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I N T E R S T A T E
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GOST
33464-2015

Global navigation satellite system

ROAD ACCIDENT EMERGENCY RESPONSE SYSTEM

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

Official Edition
English Version Approved by Interstandard

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Foreword

The purposes, main principles and basic order of work on interstate standardization are established by GOST 1.0-2015 "Interstate system for standardization. Basic principles" and GOST 1.2-2015 "Interstate System for Standardization. Interstate standards. Rules for development, taking over, renovation and cancellation"

Details

1 DEVELOPED by Non-Commercial Partnership "For Promotion of Navigation Technologies Development and Application" and Joint Stock Company "Research and Technical Centre of Advanced Navigation Technologies" "Internavigation" (JSC "Internavigation RTC")

2 INTRODUCED by Federal Agency on Technical Regulating and Metrology

3 ADOPTED by Interstate council for standardization, metrology and certification by means of correspondence (protocol No. 82-П, dated 12.11.2015)

Votes in favour:

Short name of the country according to IC (ISO 3166) 004—97	Country code according to IC (ISO 3166) 004—97	Abbreviated name of national standards body
Armenia	AM	Ministry of Economics of Republic of Armenia
Kyrgyzstan	KG	Kyrgyzstandart
Russian Federation	RU	Rosstandart
Tajikistan	TJ	Tajikstandart

4 Interstate Standard GOST 33464-2015 is introduced as a national standard of the Russian Federation by Order No. 2034-ст, dated 15.12.2016, of Federal Agency on Technical Regulating and Metrology from 01.01.2017.

5 This Standard developed on based GOST R 54620-2011*

6 INTRODUCED FOR THE FIRST TIME

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

National standard GOST R 54620-2011 withdrawn from 01.06.2017 by Order No. 2034-ст, dated 15.12.2016, of Federal Agency on Technical Regulating.

Contents

Introduction

The Road Accident Emergency Response System is meant to mitigate the consequences of road accidents and other emergencies on the roads by reducing the time required to report such accidents to emergency services. This System is called "ERA-RB" in the Republic of Belarus, "EVAK" in the Republic of Kazakhstan and "ERA-GLONASS" in the Russian Federation. The System is analogous to the European eCall System currently under development, and is harmonised with it in regard to its main functional features (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 pertaining to road accidents; uniform procedures for initiation and termination of duplex voice connection with the persons in the vehicle cabin, etc.).

According to the requirements of the Technical Regulation "On Safety of Wheeled Vehicles" (TR CU 018/2011) [1] of the Customs Union, any emergency call devices and systems intended for installation on vehicles of categories M and N shall provide for generation of the minimum set of vehicle data, its transmission to the Road Accident Emergency Response System and establishing duplex voice connection with emergency services in the case of a road accident or an emergency of other kind.

This Standard is included in the set entitled "Global Navigation Satellite System. Road Accident Emergency Response System," and constitutes one of the key standards of this set.

I N T E R S T A T E S T A N D A R D

Global navigation satellite system

ROAD ACCIDENT EMERGENCY RESPONSE SYSTEM

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

Date of Introduction — 2017—01—01

1 Scope

This Standard applies to in-vehicle emergency call devices and systems intended for installation on wheeled vehicles of Categories M and N in accordance with the requirements established in the Technical Regulation [1].

This Standard sets out general technical requirements for an in-vehicle emergency call device/system that are aimed at ensuring the conformity to the requirements of the Technical Regulation [1] and are related to the provision of the Base Service by the Road Accident Emergency Response System.

2 Normative references

The following standards are referred to in this Standard:

GOST 12.1.044-89 (ISO 4589:1984) Occupational safety standards system. Fire and explosion hazard of substances and materials. Nomenclature of indices and methods of their determination

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 radiocommunication. Requirements for mechanical and environmental resistance and test methods

GOST 16600-72 Speech transmission over the radiocommunication. Requirements for speech legibility and methods of articulation measurements

GOST 18725-83 Integrated circuits. General specifications

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 33465-2015 Global navigation satellite system. Road accident emergency response system. Data exchange protocol between In-Vehicle Emergency Call Device/System and Emergency Response System Infrastructure

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GOST 33466-2015 Global navigation satellite system. Road accident emergency response system. Compliance test methods for electromagnetic compatibility, environmental and mechanical resistance requirements of In-Vehicle Emergency Call Device/System

GOST 33468-2015 Global navigation satellite system. Road accident emergency response system. Test methods for in-vehicle emergency call device/system on compliance with requirements for speakerphone quality in a vehicle

GOST 33469-2015 Global navigation satellite system. Road accident emergency response system. Test methods for in-vehicle device/system crash detection feature

GOST 33470-2015 Global navigation satellite system. Road accident emergency response system. Test methods for wireless communication module of in-vehicle emergency call device/system

N o t e — When using this standard it is expedient to check the validation of the reference standards in the general-use information system — on official site of Federal Agency on Technical regulating and Metrology in Internet or according to the annual information index "National standards" which is published as of January, 1st, of current year, and according to releases of monthly issued information index "National standards" in the current year. If a reference standard which the dated reference is provided to is replaced, it is recommended to use a version of this standard with the above specified year of approval (acceptance). If after the approval of this standard an amendment is inserted in a reference standard which the dated reference is provided to, and this amendment regards the provision referred to, it is recommended to apply this provision without regard to this amendment. If a reference standard is cancelled without a replacement, it is recommended to apply the provision which refers to it to a part which does not engage this reference.

3 Terms, definitions and abbreviations

3.1 Terms and definitions

The following terms with their respective definitions are used for the purposes of this Standard:

3.1.1 **Base Service of System:** Result of 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).

3.1.2 **road traffic accident;** RTA: Event due to vehicle movement on the road or due to vehicle presence on it resulting in deaths or injuries, in damages of vehicles, structures or cargoes, or in property damages of other kinds.

3.1.3 **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/or 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 a standard vehicle system subject to the requirements established by the vehicle manufacturer.

3.1.4 **common number "112":** Common telephone number for emergency service calls which is defined within the framework of the National Numbering System and Plan by regulatory legal acts of the States listed as "Votes in favour" in the Foreword to this Standard[1)].

3.1.5 **potential damage index for RTA;** ASI_{15}: Indicator of potential acceleration overload effects on the persons in the vehicle subjected to the RTA.

3.1.6 **configurable parameter:** Parameter that affects the IVDS 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 IVDS manufacturer.

[1)] In the Russian Federation, the Russian Numbering System and Plan are approved and introduced by Order No. 142 dated November 17, 2006, of the Ministry of Information Technologies and Communications of the RF.

3.1.7 **minimum set of data;** MSD: Set of data transmitted by the IVDS in the 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.

3.1.8 **operator of Road Accident Emergency Response System (System Operator):** Legal entity carrying out the activities related to operation of the System, in particular, processing of data stored in its database.

3.1.9 **RTA severity assessment:** Binary indicator transferred within the MSD and 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 and/or on the criteria of automatic IVDS operation in use.

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

"0" — if the IVDS is automatically activated in the result of an RTA where the harm to life and health of people in the vehicle cabin is probably of medium severity. For example, the potential damage index ASI_{15} is within the range of $0.7 \leq ASI_{15} \leq 1.4$;

"1" — if the IVDS is automatically activated in the result of an RTA where the harm to life and health of people in the vehicle cabin is probably of high severity. For example, the potential damage index is $ASI_{15} > 1.4$, or a rollover of the vehicle has occurred.

3.1.10 **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.

3.1.11 **in-vehicle emergency call system;** IVS: System supporting the functions of an in-vehicle emergency call device and providing for automatic transmission of vehicle data messages when a road accident or an accident of other kind occurs.

N o t e s

1 In addition, an in-vehicle emergency call system may be used for manual transmission of vehicle data messages in the case of road accidents or accidents of other type.

2 Categories of vehicles that shall be equipped with in-vehicle emergency call systems are specified in [1].

3.1.12 **Road Accident Emergency Response System:** Automated geographically distributed Federal and 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 motor roads 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.

N o t e — The Road Accident Emergency Response System is called "ERA-RB" in the Republic of Belarus, "EVAK" in the Republic of Kazakhstan, and "ERA-GLONASS" in the Russian Federation. These systems are analogous to the European eCall System currently in development, and are harmonised with it in regard to the main functional features (the use of in-band modem as the main data transmission tool, unified content and format of mandatory data transmitted in the MSD for road accidents, uniform procedures for initiation and termination of duplex voice connection with the persons 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 connection established for voice communication.

3.1.15 **vehicle:** Wheeled mechanical land-based device of Category M or N intended for carrying people, cargoes and/or its installed equipment along the public automobile roads [1].

3.1.16 **narrowband IVDS:** IVDS operating with narrowband voice signals of standard quality (in the operating frequency range of 0.3—3.4 kHz and at a sampling rate not less than 8 kHz).

3.1.17 **in-vehicle emergency call device;** IVD: Device used for measurement and evaluation of vehicle coordinates, speed and direction of movement based on the signals from at least two active Global Navigation Satellite Systems, for manual transmission of vehicle data messages when a road accident or an accident of other kind occurs, and for duplex voice communication with emergency services over wireless mobile communication networks.

N o t e s

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

2 Categories of vehicles that shall be equipped with in-vehicle emergency call devices are specified in [1].

3.1.18 **wideband IVDS:** IVDS operating with wideband voice signals of improved quality (in the operating frequency range of 0.15—7.0 kHz and at a sampling rate not less than 16 kHz).

3.1.19 **emergency call:** Operations performed by an IVDS in order to make a telephone call of the common emergency number "112" from within the vehicle, using the identified emergency call indicator.

3.1.20 **emergency services:** Management bodies of authorised National executive authorities, of their regional agencies and of local authorities, as well as the forces and resources that are subordinate to them and are always ready to perform urgent actions and to ensure the safety of people and property should an emergency or an accident occur.

N o t e s

1 An emergency service includes its respective duty-dispatching service receiving citizens' calls on an abbreviated number, and its subordinate forces and resources directly responding to the received calls.

2 The list of emergency services such that their calls shall be supported round-the-clock at no charge by the National communication service providers for the service users is specified in the regulatory legal acts of the States listed as "Votes in favour" in the Foreword to this Standard[2)].

3.2 Abbreviation

The following abbreviations are used for the purposes of this standard:

AES — Advanced Encryption Standard (symmetric algorithm of block encryption);
AGC — Automatic Gain Control;
ASN.1 — Abstract System Notation One;
CRC-32 — Cyclic Redundancy Code;
DES — Data Encryption Standard (symmetric encryption algorithm);
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);
eUICC — embedded Universal Integrated Circuit Card (of advanced standard);
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);
GNSS — Global Navigation Satellite System;
GPRS — General Packet Radio Service (for packet data transmission in radio networks);
GPS — Global Positioning System (GNSS used in the United States of America);

[2)] In the Russian Federation, the list of emergency services is approved by Order No. 894 dated December 31, 2004, of the RF Government, "On approval of list of emergency services whose calls by communication service users shall be ensured round-the-clock at no charge by communication service providers, and on assignment of common number for calls of emergency services."

GSM — Global System for Mobile communications (global digital standard for cellular mobile communications);
GSM-Milenage — authentication and session key generation algorithms in GSM networks;
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;
IVDS — In-Vehicle Emergency Call Device/System;
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);
LTE — Long Term Evolution (mobile radio communication standard);
MD5 — 28-bit Hash Algorithm;
MMF2 — Machine to Machine Form Factor (conventional designation of standards defining the specifications of SIM-cards manufactured in a package);
NSC — Navigation Spacecraft;
OTA — Over-The-Air (mechanism of software updates);
PIN — Personal Identification Number;
PZ-90.11 — State Geocentric Coordinate System "Earth parameters as of the year 1990";
RAIM — Receiver Autonomous Integrity Monitoring (carried out in regard to the processed navigation data in a satellite receiver);
RLR — Receiving Loudness Rating (equivalent attenuation in receiving direction);
SHA-1 — Secure Hash Algorithm, version 1;
SIM — Subscriber Identity Module (SIM-card);
SLR — Sending Loudness Rating (equivalent attenuation in sending direction);
SMS — Short Message System;
SNR — Signal-to-Noise Ratio;
SW — Software;
TCLw — weighted Terminal Coupling Loss (weighted loss along electo-acoustic path);
TCU — Telecomm System/Terminal Control Unit;
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 (of year 1984);
XOR — Exclusive OR logics.

4 General

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

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

4.2.1 Category M: passenger vehicles with at least four 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 N3 – cargo vehicles of the maximum weight exceeding 12 tons.

4.3 The following approaches may be used for IVDS installation (configuration) on vehicles:

- standard equipment configuration, where the IVDS is installed in an assembly line of the vehicle manufacturer;
- auxiliary equipment configuration, where the IVDS 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 assembling facility.

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

5 Components of in-vehicle emergency call device/system

5.1 Each IVDS shall include the following main components.

5.1.1 Navigation receiver for GLONASS or other active Global Navigation Satellite Systems;

5.1.2 GNSS antenna;

5.1.3 GSM and UMTS communication module (modem);

5.1.4 Microphone(s) and loudspeaker(s);

5.1.5 Antenna for GSM and UMTS communication module;

5.1.6 Built-in non-removable universal multi-profile SIM/eUICC chip;

5.1.7 In-band modem;

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

5.1.9 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 on-board systems is permitted for automatic identification of RTA events, recording RTA acceleration profiles and/or RTA severity assessment.

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

N o t e — Other interface conforming to the requirements of subsection 8.8 may be used instead of the "Additional functions" button.

5.1.11 IVDS status indicator

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

5.1.12 Internal non-volatile memory and RAM

5.1.13 Master microcontroller

N o t e — Such controller may be combined with other modules (e.g., with the GSM/UMTS communication module or GNSS receiver).

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

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

For in-vehicle systems in auxiliary equipment configuration, the interface for access to diagnostic data is defined by the IVDS manufacturer.

5.1.15 Power supply

5.1.16 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 IVDS installed in standard equipment configuration where the operating condition of the IVDS 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 Possible IVDS design options (methods) for combining different IVDS components in a single case (main unit (TCU), UIM, etc.) are selected by the vehicle manufacturer (for standard IVDS) and/or by the IVDS manufacturer (for systems/devices manufactured in auxiliary equipment configuration).

5.3 The requirements for IVDS components are specified in Section 8.

5.4 An IVDS 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 of 36 V in their closed state.

N o t e — The names and values of IVDS setting parameters used here and below shall correspond to Appendix A.

6 Functions of in-vehicle emergency call device/system

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

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

N o t e — The categories of vehicles subject to equipping with emergency call systems/devices are stated in [1].

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

6.2.1 Each IVDS shall identify the following accident types: frontal collision, lateral collision, shock from behind (optionally) and rollover.

N o t e — The requirement for detection of "rollover" type accidents comes into force at the dates established in [1].

6.2.2 For IVDS installed in standard equipment configuration, the mechanism used to determine the accident instance is defined by the vehicle manufacturer taking into account the requirements of [1] (Appendix 3, clause 17.2.1).

6.2.3 For IVDS installed in auxiliary equipment configuration, the condition where the potential damage index ASI_{15} exceeds the values listed in 6.2.4 is recommended as a system activation criterion.

The method used for evaluation of the accident severity for vehicles of Categories M1 and N1 is described in Appendix B.

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

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

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

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

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

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

where $(t_2 - t_1)$ is the recording interval of parameters for assessment of the potential damage index, taken equal to 15 ms;

AS/(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 δ = 50 ms;

$\hat{a}_x$, $\hat{a}_y$, $\hat{a}_z$ are the limit values corresponding to a level such that the risk for humans becomes insignificant below it. If safety belts are used, the limit values of acceleration are usually taken equal to $\hat{a}_x$ = 12 g; $\hat{a}_y$ = 9 g; $\hat{a}_z$ = 10 g.

6.2.4 The following criteria of automatic IVDS operation are defined depending on the accident severity from the viewpoint of possible harm to life and health of people occupying the vehicle cabin when frontal and lateral collisions occur:

$ASI_{15} < 0.7$ IVDS shall not operate due to low probability of harm to life and health of humans in the vehicle cabin in the case of an RTA;

$0.7 \le ASI_{15} \le 1.4$ range of ASI_{15} values for automatic IVDS operation when medium harm to life and health of humans in the vehicle cabin is probable in the case of an RTA;

$ASI_{15} > 1.4$ - ASI_{15} values when severe harm to life and health of humans in the vehicle cabin is probable in the case of an RTA.

The method of accident severity assessment for vehicles of Categories M1 and N1 with IVDS in auxiliary equipment configuration is described in Appendix B.

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

6.4 If no reliable vehicle location data are available for the RTA detection moment, 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 IVDS 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 conform to the requirements stated in Appendix C.

6.6 The MSD shall include information on the direction of vehicle movement specified as stated in 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 IVDS manufacturer and/or by the manufacturer of the GNSS receiver.

6.7 For IVDS 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 IVDS.

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 IVDS installed in auxiliary equipment configuration if the IVDS does not support the RTA severity assessment function.

6.8.2 If an RTA event has been detected automatically, and the IVDS 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 IVDS 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 (at least 250 ms) sampled with CRASH_RECORD_RESOLUTION (at most 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 IVDS 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 (at a maximum resolution of 0.1 G);
- lengthwise: from minus 24 G to plus 24 G (at a maximum resolution of 0.1 G);
- vertical: from minus 24 G to plus 24 G (at a maximum resolution of 0.1 G).

6.8.5 If an IVDS 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 IVDS 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 IVDS constituent parts (components) required for recording and transmission of the acceleration profile.

6.8.7 If an IVDS 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 the ignition 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 IVDS installed in the auxiliary equipment configuration)

6.9.1 Once an RTA event is detected, the IVDS 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 33465.

6.9.2 The data on geographical coordinates shall cover at least a 10 s time interval after the RTA detection by the IVDS and a 60 s prehistory (up to the moment of RTA detection by the IVDS), with a time resolution not exceeding 5 s (including the last 10 s of prehistory with a time resolution not exceeding 1 s) and a limiting error of coordinate measurements not exceeding the one specified in 8.1.7.

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 IVDS and a 20 s prehistory (up to the moment of RTA detection by the IVDS), 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 IVDS 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 IVDS 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 IVDS 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 IVDS shall record both acceleration profiles in parallel if the IVDS 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 IVDS 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 IVDS in FIFO order and transferred to System Operator when the data transmission link is recovered.

6.11.6 A non-volatile memory of the IVDS 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 IVDS with a reference to vehicle run data.

6.11.8 A non-volatile memory of the IVDS shall be capable of storing up to 100 sets of data containing the MSD and up to five sets of data specified in 6.8.3 and 6.9.1.

6.11.9 If a non-volatile memory of the IVDS is filled with 100 sets of data mentioned in 6.11.8 and one more set of data needs be stored, then each new set shall be recorded to that memory in FIFO order.

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

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

6.12 IVDS 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 are muted during the emergency call.

6.13 IVDS installed in auxiliary 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 are muted during the emergency call whenever it is technically feasible.

6.14 IVDS shall enable audio input (using the microphone) and audio output in voice call mode.

6.15 IVDS shall support full-duplex loudspeaker communication.

6.16 IVDS shall display their own health state and operating mode either using an optical status indicator that emits permanent (non-blinking) red light, is visible even in daylight hours, and is located where it is directly visible for the driver and the passenger on the front seat. This indicator shall switch on for a short time (three to ten seconds) when the ignition is turned on, and shall remain on from the moment when any IVDS malfunction is detected until this malfunction is eliminated.

An optical indicator conforming to the above requirements may be missing if a working order of the IVDS may be reported by some other optical indicator at each ignition switch-on, and a text message on device malfunctions may be output to the dashboard and displayed for the whole time of malfunctioning while the ignition is on.

6.17 IVDS shall support their self-diagnostic testing.

6.17.1 An IVDS shall activate its self-test function each time the ignition is turned on.

6.17.2 The information on IVDS 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).

6.17.3 Where feasible, the following checks shall be done during IVDS self-tests:

- integrity of software image;
- proper operation of GSM/UMTS communication module interface;
- proper operation of GNSS receiver;
- data integrity (credibility) of navigation and timing parameters determined by GNSS receiver (RAIM function);
- sufficient charging level of backup battery;
- proper operation (correct connection) of external GNSS antenna (if installed);
- proper operation (correct connection) of external GSM/UMTS antenna (if installed);
- proper operation of automatic RTA detector (for vehicles of Categories M1 and N1 only);
- proper operation of UIM;
- correct connection of microphone;
- proper operation of microphone;
- proper operation of loudspeaker(s).

N o t e — Feasible checks and the requirements for self-diagnostic procedures are specified by the vehicle manufacturer for IVDS in standard equipment configuration and by the IVDS manufacturer for IVDS in auxiliary equipment configuration.

6.18 For IVDS in standard equipment configuration, the IVDS interface for other on-board systems is defined by the vehicle manufacturer.

6.19 For IVDS in auxiliary equipment configuration:

- IVDS interface for safety systems and other on-board systems is agreed with the vehicle manufacturer;
- IVDS interaction with other on-board systems may be unsupported (e.g., an automatic RTA detector (auxiliary equipment) may be directly connected to the IVDS).

7 Main operating modes of in-vehicle emergency call device/system

7.1 Types of operating modes

7.1.1 The IVDS operating modes established in this Standard are related to provision of the Base Service by the road accident response system. This implies that the IVDS communication module is not registered in a mobile operator's network until an RTA event is detected.

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

7.1.2 The following operating modes are established for IVDS in auxiliary equipment configuration:

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

7.1.3 The state diagram of IVDS installed in auxiliary equipment configuration is shown in Figure 1.

7.1.4 The following operating modes are established for IVDS in standard equipment configuration:

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

7.1.5 The state diagram of IVDS installed in standard equipment configuration is shown in Figure 2.

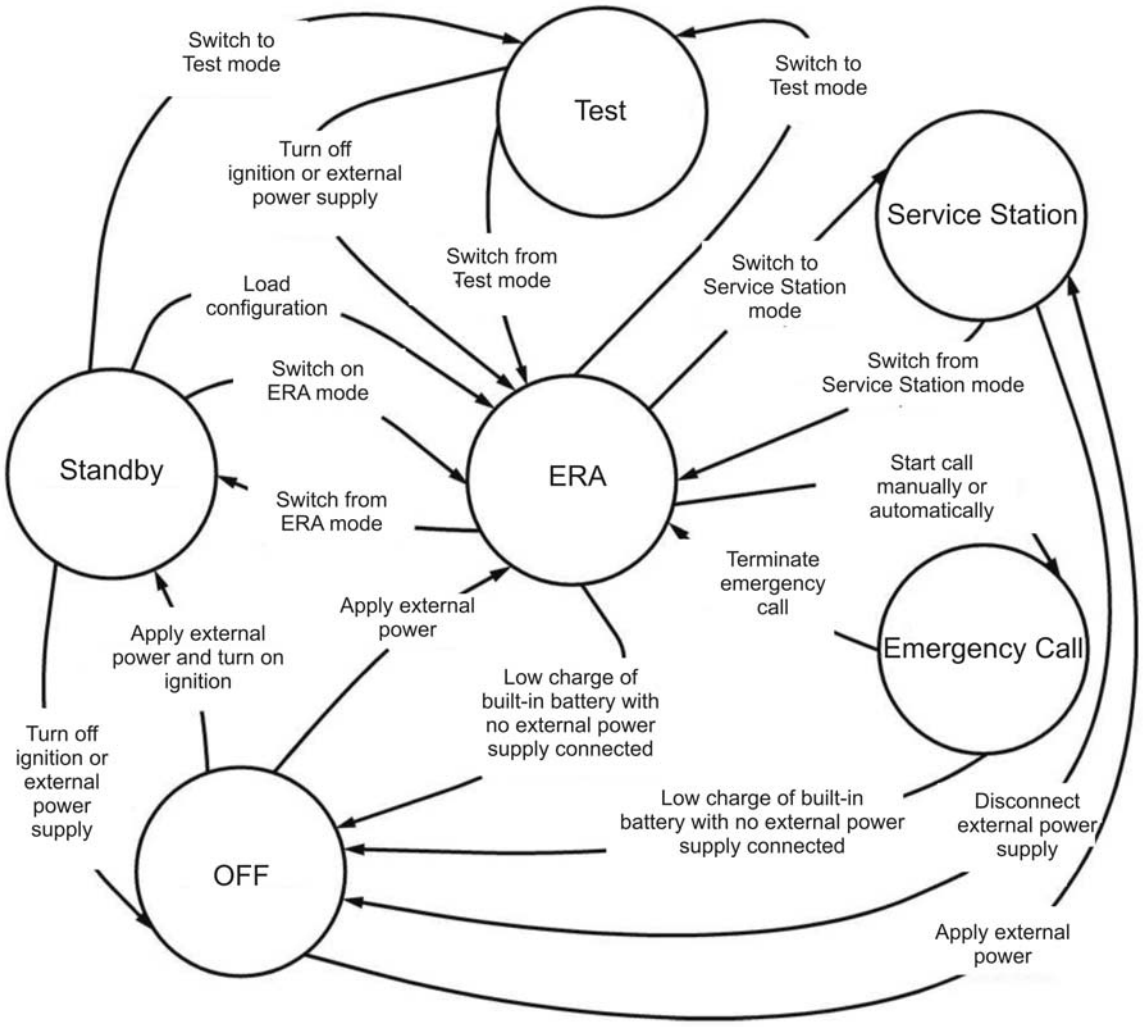


Fig. 1— State diagram of IVDS in auxiliary equipment configuration

N o t e — The Software Downloading mode is not shown in Figure 1.

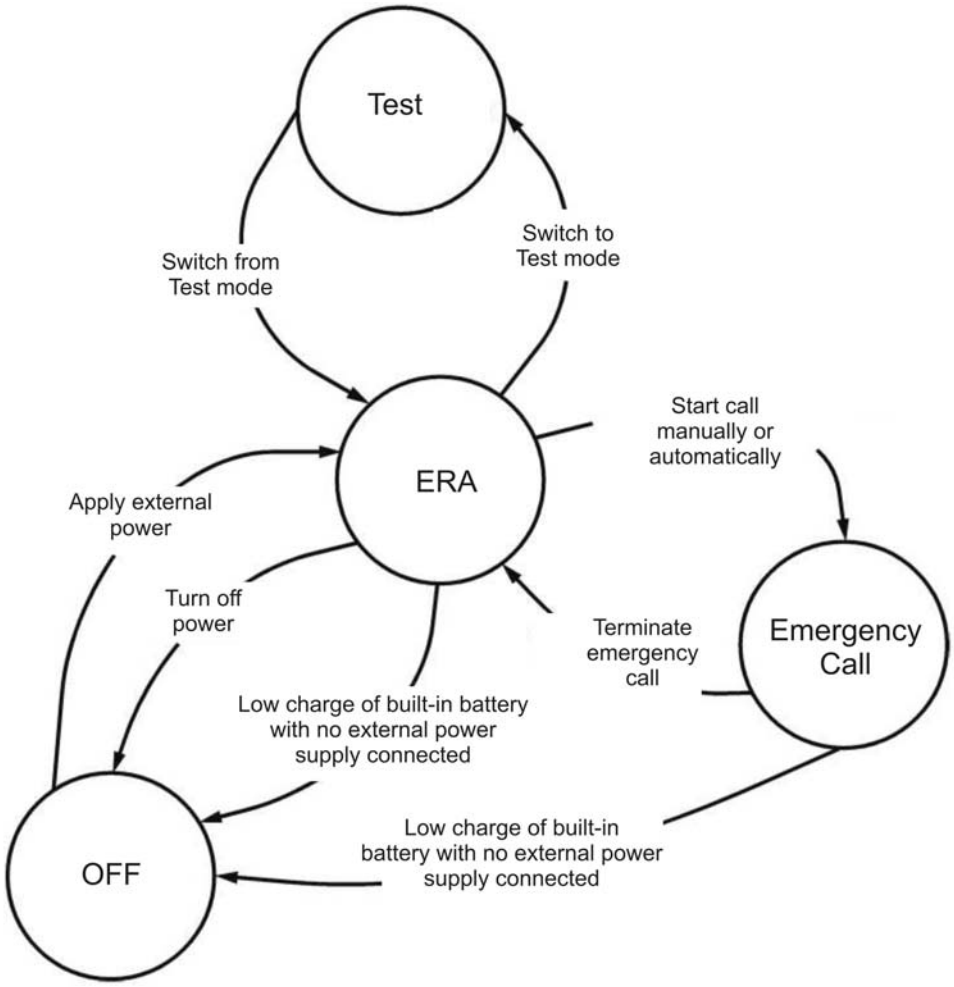


Fig. 2 — State diagram of IVDS in standard equipment configuration

N o t e — The Software Downloading mode is not shown in Figure 2.

7.2 OFF mode

7.2.1 The IVDS 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 backup battery level shall be defined by the vehicle manufacturer or the IVDS manufacturer.

7.2.2 The IVDS shall be switched from OFF mode when the external power is connected.

7.2.3 The IVDS 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 IVDS installed in auxiliary equipment configuration.

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

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

7.3.3 The IVDS shall be in Standby mode if this system has not been configured.

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

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

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

7.3.5 If the configuration start command has not been received, or the received command has been ignored, the IVDS 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 IVDS operation (e.g., unrecoverable software fault) is found in Standby mode, the IVDS shall be restarted, and shall return to Standby mode again.

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

7.3.8 The method used to switch the IVDS from Standby to Test mode is defined by the IVDS manufacturer.

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

The specification of IVDS configuration procedure is presented in GOST 33465.

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 IVDS side in order to establish IVDS voice communication with, and send the MSD to, System Operator. After the emergency call, the IVDS remains registered in the Operator's network for a time interval defined by the respective setting (Appendix A).

The time interval from the RTA event to initiation of IVDS voice communication shall be at most 20 s.

Should the telephone connection break, the IVDS 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 33465 is received by the IVDS, and before a 20 s delay assigned for MSD transmission using the in-band modem as per Table 7 expires, the IVDS 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 33465 is received by the IVDS, or after a 20 s delay assigned for MSD transmission using the in-band modem as per Table 7 expires, the IVDS 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 IVDS installed in auxiliary equipment configuration, a signal source used to initiate Emergency Call mode shall be configurable and selectable from the following options (one or both):

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

7.5.2.2 For IVDS 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 Emergency Call mode in IVDS

7.5.3.1 For IVDS 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 (configurable value) is not yet 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 IVDS installed in standard equipment configuration (for vehicles of Categories M1 and N1 only), the emergency call shall be initiated automatically when the ignition is on and an RTA alarm is received from an on-board vehicle system.

7.5.3.3 For IVDS installed in auxiliary equipment configuration, an emergency call shall be initiated regardless of the ignition line state after the "Emergency call" button (see 8.8.1.1) is pressed during a time interval exceeding SOS_BUTTON_TIME (configurable value).

7.5.3.4 For IVDS installed in standard equipment configuration, the emergency call shall be initiated with the ignition on after the "Emergency call" button is pressed during a time interval stated by the vehicle manufacturer.

7.5.3.5 While the common emergency number 112 is being dialled in Emergency Call mode, the IVDS shall notify the persons present in the vehicle cabin on such dialling, either using the IVDS 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 IVDS shall report that to the persons present in the vehicle cabin, either using the IVDS 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 IVDS shall notify the persons present in the vehicle compartment (cabin) that the voice channel connection is about to be established, by playback of a relevant sound signal or voice message.

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

7.5.3.9 In Emergency Call mode, the loudspeaker communication in the vehicle compartment (cabin) shall meet the requirements of Section 10 and ensure full-duplex voice connection with System Operator in all typical environments of vehicle operation (including but not limited to the following noise scenarios: silence, acoustic noises from road traffic passing by, vehicle parking, vehicle movement, windows open, windows closed).

7.5.3.10 Once the loudspeaker communication is switched on in Emergency Call mode, the IVDS shall automatically set the nominal receiving loudness rating regardless of both the initial position of a volume control external to the IVDS, and the previous state of automatic volume control (if such controls are present).

The nominal receiving loudness level (constant for systems with no volume controls and initial for systems with manual or automatic volume controls) described by the nominal receiving loudness rating RLR_{nom} shall ensure that the duplex voice communication with System Operator is reliable in all typical environments of vehicle operation including the presence of disturbing acoustic noise in the vehicle compartment (cabin).

The required RLR_{nom} value is specified by the IVDS or vehicle manufacturer to ensure that the receiving loudness rating is sufficient for reliable duplex loudspeaker communication at an acoustic SNR in receiving direction not less than 6 dB in "ordinary noise" environment [depending on the vehicle type (category) and the noise scenario. If the requirements for noise type and level are not specified by the vehicle manufacturer, then the minimum sound pressure level of background noises in the vehicle compartment is taken equal to minus 24 dBPa(*A*)].

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

7.5.3.11 If a manual or automatic volume control is accessible in Emergency Call mode, the IVDS user or the on-board system shall not be able to decrease the receiving loudness level below the minimum value that enables duplex voice communication at an acoustic SNR of at least 0 dB in "typical" noise environment [depending on the vehicle type (category) and the noise scenario. If the requirements for noise type and level are not specified by the vehicle manufacturer, then the minimum sound pressure level of background noises in the vehicle compartment is taken equal to minus 24 dBPa(*A*)].

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

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

7.5.3.12 In Emergency Call mode, the use of the microphone for loudspeaker communication in the vehicle compartment (cabin) shall have the highest priority, and the IVS users or an on-board system/device shall not be capable of disconnecting the microphone.

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

The recommendations regarding the connection of an IVDS in auxiliary equipment configuration to the on-board audio system of the vehicle are given in Appendix D.

7.5.3.13 After Emergency Call mode is exited, the IVDS 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 IVDS functions related to support of the Base Service by the road accident response system shall be accessible if the IVDS configuration has been completed.

7.5.3.15 Emergency Call mode and all IVDS functions related to support of the Base Service by the road accident response system (excluding configuration and setup functions) shall be inaccessible if the IVDS configuration has not been completed.

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

7.5.3.20 For IVDS 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 IVDS 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.

7.5.3.22 Once the emergency call session is over, the IVDS shall answer all incoming calls automatically for at least 20 min.

7.5.3.23 As regards the use of GSM/UMTS mobile networks, the IVDS operation shall meet the requirements of GOST 33470 (Appendices D, E and F).

7.5.3.24 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).

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

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

7.5.3.27 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.

7.5.3.28 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 IVDS installed in auxiliary equipment configuration);
- by means of respective user interface implemented for the vehicle (for IVDS installed in standard equipment configuration).

7.5.3.29 Each IVDS shall allow System Operator to initiate an emergency call by sending an SMS to the IVDS until it remains registered in the network on completion of its own emergency call. The emergency call attribute (manual or automatic call) shall be set in System Operator's request. Such call shall be enabled only after an emergency call initiated from the IVDS side is over and the IVDS remains registered in the network waiting for the response call that may possibly come from the System Operator's side.

7.5.3.30 If an attempt to send the MSD using the in-band modem fails, the IVDS shall transmit the MSD to System Operator by sending an SMS to the configurable ECALL_SMS_FALLBACK_NUMBER. The MSD transmission by SMS shall start immediately after the failed one using the in-band modem.

7.5.3.31 Upon the relevant command from System Operator, the IVDS shall send its current MSD by SMS. This being the case, receiving SMS messages from System Operator shall be possible both during and after the emergency call initiated by the IVDS side, as long as the IVDS remains registered in the network.

The current MSD shall contain the same data as those set after the RTA event detection or manual call initiation albeit that the location data (see Appendix C, MSD fields "Vehicle Location", "Recent Vehicle Location n-1", "Recent Vehicle Location n-2") and movement direction data (MSD "Vehicle Direction") shall be updated by the values determined for the vehicle state as of the moment when the System Operator's command is arrived. In addition, MessageIdentifier shall be incremented by 1 for each next request and reset to its initial value if a new call from the vehicle is initiated.

The IVDS shall send SMS messages to the configurable ECALL_SMS_FALLBACK_NUMBER. The current MSD shall be sent immediately after the respective command is received from System Operator.

7.5.3.32 Whenever the connection in Emergency Call mode breaks, the IVDS shall re-establish it.

7.5.3.33 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.

7.5.3.34 If an ignition switch-off event is detected during the emergency call session, the emergency call shall continue until terminated from the side of System Operator, regardless of the ignition line state.

7.5.3.35 The dialling in Emergency Call mode shall start not later than 1 s after the accident event is detected in automatic mode or the "Emergency call" button press is confirmed in manual mode.

7.5.4 After the RTA event occurrence, the IVDS 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 functional checks of IVDS.

N o t e — The IVDS functioning in Test mode may be checked during various IVDS tests in production or IVDS conformity tests against the requirements of [1] and of this Standard, during the maintenance of the vehicle in dealer centres of vehicle manufacturers, and during the State service inspection of the vehicle.

7.6.2 An IVDS 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 additional requirements for switching to Test mode in the case of IVDS in standard equipment configuration.

7.6.3 The IVDS switching from Test to ERA mode shall be either after the testing session is complete, or when an ignition or external power switch-off event is detected.

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

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

7.6.6 For an IVDS installed in standard equipment configuration, switching to from ERA to Test 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 IVDS 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 IVDS installed in auxiliary equipment configuration) or through the user interface implemented for the vehicle (for IVDS installed in standard equipment configuration), and the testing procedure has been started, then the IVDS shall de-register in the network after the testing procedure terminates.

7.6.8 If the IVDS 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 IVDS installed in auxiliary equipment configuration) or through the user interface implemented for the vehicle (for IVDS installed in standard equipment configuration), and the testing procedure has been started, then the IVDS behaviour in part of network registration after completion of the testing procedure shall be defined by:

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

7.6.9 If the IVDS 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 IVDS installed in auxiliary equipment configuration) or through the user interface implemented for the vehicle (for IVDS installed in standard equipment configuration), then any further registration in the network for the specified IVDS modifications shall only be possible after a time interval specified by 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 IVDS in the network.

7.6.10 If the IVDS 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 IVDS installed in auxiliary equipment configuration) or through the user interface implemented for the vehicle (for IVDS installed in standard equipment configuration), then the rules of successive registration in the network for the specified IVDS modifications shall be established by the IVDS 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 the GNSS receiver, other methods are permitted for evaluation of the distance covered by the vehicle.

7.6.12 The following tests shall be possible in Test mode:

- Microphone connection test. For example, the IVDS plays a voice message prompting the tester at the driver's seat to say a phrase of the specified duration, records the incoming sound to internal memory, reproduces the recorded sound clip and asks the tester to press the respective button(s) in order to report whether the fragment was recorded correctly at the volume level sufficient for legible perception of speech;

- Loudspeaker(s) connection test and loudness level test for receiving. For example, the IVDS outputs a voice prompt of a nominal level to the left and right loudspeakers, and asks the tester to press the respective button(s) in order to report whether the sound clip was reproduced correctly at a loudness level sufficient for legible perception of the operator's speech in transport noise conditions inside the vehicle compartment (cabin);

- Ignition turn on/turn off test for IVDS installed in auxiliary equipment configuration. For example, the IVDS plays a voice message prompting the tester to turn off and on the vehicle ignition, or the IVDS 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 the specified time interval);

- Extended test of user interface module. For example, the IVDS 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 IVDS status indicators operate as required;

- Backup battery test, if testing the backup battery status test is technically feasible (the scope of testing is defined by the vehicle manufacturer or by the IVDS manufacturer);

- Functional test of automatic detector (identification mechanism) of RTA events (for vehicles of Categories M1 and N1 only), if such 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 6.17.3.

7.6.13 After the IVDS 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 IVDS 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 IVDS test results shall be transmitted with the "Test call" attribute set in accordance with Appendix C.

7.6.15 The IVDS shall be switched from Test mode:

- after the MSD with the IVDS test results is transmitted to System Operator;
- when the external power is disconnected;
- when the vehicle (with its ignition turned on) moves away from the ignition switch-on point to a distance exceeding the total distance configurable in the TEST_MODE_END_DISTANCE setting, to an error three times the value of the location error in plan view as per 8.1.7.

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

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

The displayed test results shall contain the testing success/failure status, i.e., shall reflect whether the IVDS is in good condition or not.

7.7 Service Station mode

7.7.1 This mode is used to disable all IVDS functions while the vehicle is in the service centre.

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

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

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

7.7.4 All IVDS functions related to provision of the Base Service by the Road Accident Emergency Response System and to IVDS testing shall be disabled when the IVDS is in Service Station mode.

7.7.5 Service Station mode shall be switched off automatically when the vehicle with its ignition on moves to a distance exceeding the total distance defined by the GARAGE_MODE_END_DISTANCE setting (a configurable parameter), to an error three times the value of the location error in plan view 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 IVDS is in Service Station mode, all IVDS modules (components) shall be in a switched-off state while the ignition is off.

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

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

7.8 Software Downloading mode

7.8.1 This mode is intended for IVDS software updates.

7.8.2 Software Downloading mode is mandatory.

7.8.3 For IVDS installed in auxiliary equipment configuration, Software Downloading mode shall be supported using packet data transmission in accordance with the requirements of 7.8.4—7.8.11.

For IVDS installed in standard equipment configuration, the requirements for implementation of Software Downloading mode are specified by the vehicle manufacturer.

7.8.4 If the IVDS 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 IVDS 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 IVDS self-test terminates, during a time period defined by the POST_TEST_REGISTRATION_TIME setting.

7.8.5 If the IVDS 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 IVDS shall ignore that command and remain in the mode active before it.

7.8.6 The IVDS 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 IVDS shall download software images to IVDS RAM using the data exchange protocol defined in GOST 33465.

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

7.8.9 If the ignition is on after the software downloading is complete, the IVDS shall update the software image 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 IVDS non-volatile memory and the protection(s) against the loss of such integrity shall be ensured in order to make provisions for the following situations:

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

7.8.11 If the IVDS is in Software Downloading mode and an emergency call starts, the said mode shall be interrupted, and any downloaded data shall be ignored.

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

8 Requirements for components of in-vehicle emergency call device/system

8.1 Navigation receiver (navigation module)

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

8.1.2 A navigation module included in the IVDS package shall be capable of receiving and processing 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 IVDS package 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 IVDS package 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 in the IVDS package, 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 IVDS package shall enable evaluation of navigation parameters using the signals received from the GLONASS System only.

8.1.6 A GNSS receiver included in the IVDS package shall enable evaluation of navigation parameters either in PZ-90 or in WGS-84 coordinate systems.

N o t e — The requirement on evaluation of navigation parameters in the PZ-90 coordinate system is not mandatory until January 1, 2018.

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

- planimetric coordinates: 15 m;
- height: 15 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;
- for values of space geometric factor not exceeding 4;
- under disturbances of zero level or of a level governed by the EMC requirements listed in 13.4.

N o t e — The requirement on evaluation of height is not mandatory.

8.1.8 The minimum update interval of observation 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 up to 60 s shall not exceed 5 s after 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 IVDS package shall provide for:

- search (detection) of GNSS signals at a level of useful signals at the antenna input (antenna amplifier input) equal to minus 163 dBW;
- GNSS signal tracking and navigation solution output at a level of useful signals at the antenna input (antenna amplifier input) equal to minus 180 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 For IVDS in auxiliary equipment configuration, 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°.

8.1.15 The following functions shall be supported 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 [2];
- 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 receiver is used when the IVDS conformity is assessed in part of requirements for GNSS receivers. The technique of tests assumes the use of navigation and timing data in NMEA-0183 format.

8.1.16 For IVDS installed in auxiliary equipment configuration, the power of the GNSS receiver shall switch off after a time interval defined by the GNSS_POWER_OFF_TIME parameter expires from the moment when the ignition is turned off.

8.2 GNSS antenna

8.2.1 Each IVDS shall be equipped with an external and/or internal antenna capable of ensuring the required reception quality of GNSS signals after the IVDS is installed on the vehicle.

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

For IVDS 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 A communication module shall be capable of operating in the two GSM 900 ranges (P-GSM and E-GSM) and in the GSM 1800 range, shall support packet data transmission, and shall provide for control transfer when the range is switched.

8.3.2 An GSM 900/1800 communication module shall meet the requirements of GOST 33470.

8.3.3 A communication module shall be capable of operating in the two UMTS ranges (UMTS 900 and UMTS 2000), shall support packet data transmission, and shall provide for control transfer when the range is switched.

8.3.4 An UMTS 900/2000 communication module shall meet the requirements of GOST 33470.

8.4 Antenna for GSM/UMTS communication module

8.4.1 An antenna that is installed on the vehicle for the GSM/UMTS communication module shall ensure reliable communication over GSM 900, GSM 1800, UMTS 900 and UMTS 2000 mobile communication networks in any position of the vehicle.

N o t e — An GSM/UMTS antenna may be external and/or internal with respect to the IVDS.

8.4.2 At least one antenna (either internal or external) intended for data exchange between the IVDS 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 IVDS in auxiliary equipment configuration, the requirements for installation of external GSM and UMTS antennas are specified by the IVDS manufacturer.

8.4.4 For IVDS 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 SIM/eUICC card shall be manufactured in MFF2 form-factor in accordance with [3], and shall conform to the requirements of GOST 18725.

8.5.2 Each card shall support operation in GSM 900/GSM 1800/UMTS mobile communication networks.

8.5.3 The guaranteed service life of the SIM/eUICC card shall be at least 10 years (with possible access to any data saved on it for the specified period).

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

8.5.5 The number of read/write cycles before failure shall be at least 500000 per logical sector.

8.5.6 SIM/eUICC cards shall not include any software or hardware (counters, algorithms or scenarios) enforcing extraneous limitations on the card service life.

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

8.5.8 Each SIM/eUICC card shall be rated for d.c. supply voltages in the range from 1.62 to 3.3 V in accordance with the requirements of [3].

8.5.9 Each SIM/eUICC shall include an initiated System Operator profile required to start operation with the Road Accident Emergency Response System, and shall have a sufficient free storage space of the internal rewritable memory for one or several additional profiles of mobile network providers.

8.5.10 The following remote software update functions shall be supported by the SIM/eUICC card:
- OTA downloading of profile data;
- OTA initialisation and profile activation;
- OTA control (switchover) of operator/provider profiles.

8.5.11 The time required for switching from the System Operator profile to the profile of a mobile network provider and back shall not exceed 3 s.

N o t e — This includes the switching time for the SIM/eUICC card of the IVDS.

8.5.12 PIN-code entry queries shall be disabled on the SIM/eUICC card.

8.5.13 The following algorithms shall be supported by the SIM/eUICC card:
- authentication (GSM-Milenage, Milenage; XOR; AES);
- cryptographic (CRC-32;DES, 3DES;MD5;SHA-1).

8.5.14 No priority criteria that allow forced switching of the user to a mobile network of the specific provider shall be included in the System Operator profile on the SIM/eUICC card.

8.6 In-band modem

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

8.6.2 Each in-band modem shall correspond to the requirements established in [4].

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

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

The detector shall remain secured and operational under a 1 to 5 ms exposure to acceleration of up to 75 G at a point of its fastening.

The recommendation regarding the installation location of detectors on vehicles of Categories M1 and N1 are given in Appendix E.

8.7.2 For IVDS installed in auxiliary equipment configuration, automatic detectors of RTA events installed inside the IVDS unit shall be supplied with fastening devices ensuring that the detector may be used to measure accelerations of up to 24 G.

The IVDS unit shall remain secured and operational under exposure to accelerations of up to 75 G at a point of its fastening for a time interval from 1 to 5 ms.

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

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

8.7.5 For IVDS installed in auxiliary equipment configuration, the procedure used to check proper installation of the automatic detector of RTA events and operational condition of the IVDS shall be developed by the IVDS supplier and specified in the IVDS installation manual. If necessary, the IVDS 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 IVDS 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 IVDS manufacturer.

8.8 User interface module

8.8.1 IVDS control buttons

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

8.8.1.2 For IVDS 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 IVDS installed in standard equipment configuration, device controls implemented in the vehicle shall allow the user to start Test mode.

8.8.1.4 If the IVDS 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 IVDS 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 IVDS 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 implemented in the vehicle, then the said mode shall be started in accordance with 7.6.

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

8.8.1.8 If the IVDS 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 IVDS is in OFF or Service Station mode, then pressing the "Emergency call" button shall be ignored.

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

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

8.8.1.11 If the IVDS installed in auxiliary equipment configuration is in Test mode, the IVDS response to presses of the "Emergency call" is defined by the IVDS manufacturer.

8.8.1.12 If the IVDS installed in auxiliary equipment configuration is in Standby mode, pressing the "Emergency call" button shall be ignored.

8.8.1.13 The "Emergency call" button shall be protected from inadvertent presses.

For IVDS installed in auxiliary equipment configuration, the design of such protection and the interface for interaction between the IVDS and the UIM are defined by the IVDS manufacturer.

For IVDS installed in standard equipment configuration, the design of such protection and the interface for interaction between the IVDS and the UIM are defined by the vehicle manufacturer.

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

8.8.1.15 The "Emergency call" button shall be installed where it is directly visible from the driver and front passenger seats for 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 for them without the need to disconnect their safety belts.

8.8.1.16 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 taking into account the requirements of 8.11.3.

8.8.1.17 The "Emergency call" button shall be provided with backlighting.

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

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

8.8.3 The recommendations regarding the design and arrangement of the user interface module in the vehicle compartment for IVDS installed in auxiliary equipment configuration are given in Appendix F.

The recommendations regarding the connection of the user interface module to the main IVDS connector are given in Appendix G.

8.9 Optical status indicator of in-vehicle emergency call device/system

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

8.9.2 An in-vehicle emergency call device/system shall display its own health state and operating mode by an optical status indicator that emits permanent (non-blinking) red light, visible even in daylight hours, located where it is directly visible form the driver seat and the passenger on the front seat, and conforms to the criteria stated in 8.8.1.16. This indicator shall switch on for a short time (three to ten seconds) when the ignition is turned on, and shall remain on from the moment when any IVDS malfunction is detected until this malfunction is eliminated.

N o t e — An optical indicator conforming to the above requirements may be missing if a working order of the IVDS may be reported by some other optical indicator at each ignition switch-on, and a text message on device malfunctions may be output to the dashboard and displayed for the whole time of malfunctioning while the ignition is on.

8.9.3 The following IVDS status conditions shall be displayed using the optical status indicator(s):

- failure;
- inability to make emergency calls (to be reported only when an emergency call is attempted);
- establishing the connection 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 IVDS installed in standard equipment configuration, the optical status indicator(s) and their interface with the IVDS are implemented as specified by the vehicle manufacturer.

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

8.10 Internal non-volatile memory and RAM

8.10.1 Each IVDS shall be equipped with internal memory for storage of messages containing MSD.

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

8.10.3 Prior to initiation of an emergency call and MSD transmission using the in-band modem, the IVDS shall save the message with the respective MSD to its internal non-volatile memory.

8.10.4 The message shall be removed from the IVDS internal memory after the confirmation that the message is received successfully by System Operator in the case of transmission using the in-band modem, or after the successful sending of an SMS message with the MSD, or after the emergency call initiated manually is cancelled in accordance with 7.5.3.28.

8.10.5 If the message can not be transmitted to System Operator, then sending that message shall be suspended for a time interval equal to INT_MEM_TRANSMIT_INTERVAL.

8.10.6 If the message transmission has been suspended in accordance with the requirements stated in 8.10.5, and the time interval INT_MEM_TRANSMIT_INTERVAL has expired, then the repeated transmission of that message shall be attempted using SMS.

8.10.7 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.

8.10.8 The internal memory contents shall survive after the IVDS is turned off.

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

- by the IVDS 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 IVDS 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 IVDS operation in the tests against the requirements stated in 13.3, and no external power is available, then the IVDS manufactured in standard equipment configuration shall use the backup battery as a power supply.

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

8.11.3 After an RTA event is detected in case of IVDS 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 IVDS registration in a network, for transmission of messages required in Emergency Call mode, for 1 h of IVDS operation while waiting for a call-back, and for 10 min of voice communications at the sound volume specified in 7.5.3.9.

The compliance to the above requirements shall be tested after the backup battery charging for 24 hours. The backup battery charge, and the test of system operation time under its power supply from the backup battery, shall be carried out at a normal ambient temperature of (20 ± 5) °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 IVDS functioning in the temperature range from minus 20° C to plus 85° C with no external power. The service life of the backup battery in the specified operating conditions shall be at least three years, and shall be stated in the IVDS user manual.

8.11.4 If an external power is available when the minimum permitted level of the backup battery charge is reached, the IVDS shall report this to the user either with the help of its status indicator or by playing an audio tone/voice prompt.

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

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

8.11.7 For those IVDS 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 rechargeable backup battery is used, its charging conditions shall be specified by the IVDS or vehicle manufacturer so as to avoid premature discharging of the standard battery.

8.11.9 The service life of backup batteries and the recommended procedures of their replacement shall be presented in the IVDS 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 the service life shall be detailed in the IVDS documentation. In addition, visual or audible warnings shall be provided for the case when such replacement is necessary.

N o t e — An indication of general IVDS failure may be used if the battery replacement is necessary.

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 IVDS and System Operator shall be carried out in the voice channel using the in-band modem. Should the data transmission in the voice channel break, the IVDS shall use SMS as the redundant channel of data transmission.

9.1.2 When the data are transmitted in Emergency Call mode, the IVDS shall set the bit 6 and bit 7 in the Service Category element (which initiate either automatic or manual emergency calls) in accordance with Figure 3 and with the bit pattern detailed in Table 4.

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

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							

Fig. 3 — Service Category element

T a b l e 4 — Bit values of Service Category element

Bit number	Meaning
1	Police (militia)
2	Medical service
3	Fire service
4	Marine emergency service

Table 4 (continued)

Bit number	Meaning
5	Mountain emergency service
6	Manual call
7	Automatic call
8	Reserved (0 by default)

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

9.1.4 The MSD transmission using the IVDS in-band modem shall meet the requirements of [4].

9.1.5 The requirements on the contents and formats of data and commands transmitted between the IVDS and System Operator are specified in Table 5.

9.1.6 Should the data transmission fail in the voice channel using the in-band modem, the IVDS shall provide for voice communication with emergency services and for data transmission by making use of SMS in parallel with the voice communication.

9.1.7 A single SMS shall be sent in the case of 9.1.5. The criterion of successful SMS transfer shall be no information at the IVDS 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 IVDS side in the case of 9.1.5, the message containing the MSD shall be saved in the IVDS internal memory in accordance with 8.10.

T a b l e 5 — Requirements for contents and format of data and commands

Data, command	Sending party	Receiving party	Data transfer mechanism	Remark
MSD with RTA data	IVDS	System Operator	In-band modem	Primary transfer mechanism for RTA data in road accident response system
Command to transmit MSD with RTA data using in-band modem	System Operator	IVDS	In-band modem	
Command to transmit MSD with RTA data by SMS	System Operator	IVDS	SMS	Secondary transfer mechanism for RTA data in road accident response system. MSD transmitted by SMS from IVDS side if using in-band modem has failed, or System Operator requests so[1)]
MSD with RTA data	IVDS	System Operator	SMS	
Acceleration profile in RTA[2)], RTA severity assessment[3)], vehicle motion path in RTA	IVDS	System Operator	Packet data transmission	Data/command transmission format and rules as per GOST 33465
IVSD configuration parameters[4)]	System Operator	IVDS	Packet data transmission and SMS	

Table 5 (continued)

Data, command	Sending party	Receiving party	Data transfer mechanism	Remark
Updated software versions[5)]	System Operator	IVDS	Packet data transmission	Data/command transmission format and rules as per GOST 33465
Command to repeat emergency call	System Operator	IVDS	SMS	
MSD with IVDS testing results	IVDS	System Operator	In-band modem	Data transmission format as per Appendix C
Command to de-register in network	System Operator	IVDS	SMS	Data/command transmission format and rules as per GOST 33465

[1)] 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 IVDS side within 20 s after the start of data transmission.

[2)] 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.

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

[4)] Remote control of the IVDS configuration is not mandatory for standard in-vehicle systems. This function may be supported as agreed between the vehicle manufacturer and System Operator.

[5)] 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.

9.2 Contents of messages sent between IVDS and System Operator

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

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

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

2) for transmission of IVDS configuration parameters;

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

The message transfer protocol used for message transmission between the IVDS and System Operator shall correspond to GOST 33465.

9.2.2 IVDS in auxiliary equipment configuration shall enable changing their settings at the request of System Operator either by SMS or packet data transmission while the IVDS remains registered in the network after an emergency call is complete and the test results are transmitted.

For IVDS in standard equipment configuration, the requirements for remote control of their configuration are specified by the vehicle manufacturer.

9.3 Modes of IVDS registration in System Operator's network

9.3.1 If an IVDS supports provision of the Base Service only, then its registration in the System Operator's network in ERA and Standby modes (see section 7) shall correspond to "eCall only mobile station" mode as detailed in [5] (subsection 10.7)]:

- with ignition on;
- with ignition off, after IGNITION_OFF_FOLLOW_UP_TIME2 has elapsed since the ignition switch-off moment (for IVDS installed in auxiliary equipment configuration).

9.3.2 If an IVDS supports provision of other services in addition to the Base Service then its behaviour in part of network registration is specified:

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

9.3.3 If an IVDS supports provision of other services in addition to the Base Service, and the requirements for provision of additional services do not prescribe network registration in certain conditions, then the IVDS registration mode in the System Operator's network in such condition shall conform to the requirements of 9.3.1.

9.3.4 Regardless of the network registration state prior to Emergency Call mode (see section 7), the IVDS shall immediately register in the System Operator's network after switching to this mode.

9.3.5 After exiting Emergency Call mode, the IVDS shall remain registered in the System Operator's network until either the time defined by the NAD_DEREGISTRATION_TIME parameter expires, or a command to terminate the registration is received.

10 Requirements for quality of loudspeaker communication in vehicle cabin

10.1 After the IVDS installed and configured in the vehicle compartment (cabin), the loudspeaker communication shall correspond to the minimum performance for duplex communication detailed in Table 6 and shall meet the minimum requirements given in Appendix H.

The recommendations on selection of electro-acoustic vehicle components that ensure the required sound quality are given in Appendix I.

Table 6 — Minimum performance for duplex communication

IVDS type	Loudspeakers and microphone in use	Receiving loudness level	Minimum IVDS performance type for duplex communication
IVDS in standard equipment configuration	As specified by vehicle manufacturer	Nominal receiving loudness rating $RLR = RLR_{nom}$	2b
IVDS in auxiliary equipment configuration	Built-in (front) speakers and microphone as specified by IVDS manufacturer	Nominal receiving loudness rating $RLR = RLR_{nom}$	2b
	Additional speaker and microphone as specified by IVDS manufacturer	Nominal receiving loudness rating $RLR = RLR_{nom}$	2b
Note — The nominal receiving loudness rating RLR_{nom} is specified by the IVDS or vehicle manufacturer in accordance with 7.5.3.10; it shall be within the limits from (minus 6 ± 4) to (2 ± 4) dB. The value of (minus 6 ± 4) dB is recommended.			

10.2 Whether any automatic gain control algorithms should be used in the IVDS for receiving (sending) is decided by the IVDS manufacturer (for IVDS in auxiliary equipment configuration) or by the vehicle manufacturer (for IVDS in standard equipment configuration).

If an IVDS implements AGC algorithms for receiving (sending), then such algorithms shall conform to the minimum requirements of Appendix J in order to ensure the required quality of loudspeaker communication.

11 Requirements for electric power supply and for energy consumption

11.1 An IVDS 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.

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

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

11.4 When powered from a 12 V (24 V) power supply source, the (peak) energy consumption of IVDS in auxiliary equipment configuration shall not exceed the following values depending on the IVDS 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 (not taking into account charging current of the backup battery).

N o t e — 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 declared ones.

11.4.2 In ERA mode, within a time interval defined by the IGMTION_OFF_FOLLOW_UP_TIME1 setting after the ignition switch-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.

11.4.3 In ERA mode, after a time interval defined by the IGMTION_OFF_FOLLOW_UP_TIME1 setting expires since the ignition switch-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 IVDS manufactured in standard equipment configuration shall be specified by the vehicle manufacturer.

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

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

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

12.2 The diagram used to connect IVDS 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 of operation

13.1 General requirements for resistance to external conditions of operation

Each IVDS shall conform to the requirements for resistance to external conditions of operations specified in 13.2—13.4, and to the requirements detailed in [1] (Appendix 10, clause 118).

13.2 Requirements for resistance to climatic effects

13.2.1 An IVDS shall ensure that its parameters take the nominal values under exposure to the following normal climatic environmental factors:

- 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 IVDS shall correspond to operating conditions used for climatic modifications У or ХЛ as per GOST 15150 at a minimum operating temperature of minus 40°C.

13.2.3 The IVDS degree of protection from ingress of foreign objects (dust) and moisture as per GOST 14254 shall not be less than:

- IP 40 — for IVDS components located in the vehicle cabin (compartment);
- IP 64 — for IVDS components designed as external devices that are connected to the main IVDS unit and located outside the vehicle cabin (compartment);
- IP 67 — for external RTA detector installed outside the vehicle cabin (compartment) (for IVDS in auxiliary equipment configuration and for those installed on vehicles of Categories M1 and N1).

13.2.4 IVDS are attributed to Group B4 as per GOST 16019 (subsection 4.1).

13.2.5 In accordance with the requirements of [1] (Appendix 10, Clause 118), each IVDS 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.

The minimum temperature not higher than minus 20 °C is permitted for the backup battery.

13.2.6 If a backup power supply is used in the IVDS, the minimum operating temperature for such supply shall not be higher than minus 20 °C.

13.2.7 An IVDS shall withstand the effects of damp thermal environments for 4 days at a temperature of (40 ± 2) °C and a relative humidity of (95 ± 3) %.

13.2.8 The visual appearance of IVDS 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 IVDS 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 The requirements and parameters of IVDS tests under exposure to climatic factors are listed in Table 7.

Table 7 — Influencing climatic factors

Influencing factor	Test parameters	Influencing factor	
		Value	Permitted deviation
Resistance to decreased temperature for modification of hardness degree 1	Operating temperature, °C	–40	±3
	Time of thermal exposure, h	2	—
Durability under decreased temperature for modification of hardness degree 1	Limiting temperature, °C	–40	±3
	Time of thermal exposure, h	2	—
Resistance to increased temperature for modification of hardness degree 2	Operating temperature, °C	+85	±3
	Time of thermal exposure, h	3	—
Durability under increased temperature for modification of hardness degree 2	Operating temperature, °C	+85	±3
	Time of thermal exposure, h	3	—
Resistance to decreased temperature for modification of hardness degree 2 (IP52)	Temperature range, °C	From –40 to +85	±3

Table 7 (continued)

Influencing factor	Test parameters	Influencing factor	
		Value	Permitted deviation
Durability under temperature changes for modification of hardness degree 2	Time of exposure in chamber at each temperature value, h	3	—
	Number of cycles	3	—
Durability under and resistance to humidity at increased temperature in continuous mode for modification of hardness degree 2	Relative humidity, %	93	±3
	Temperature, °C	+40	±2
	Time of exposure, h	96	—

13.2.11 The IVDS conformity tests against the requirements of 13.2.1—13.2.10 are carried out in accordance with GOST 33466.

13.3 Requirements for resistance to mechanical impacts

13.3.1 Each IVDS shall remain functional and free of any damages and breakdowns after its exposure to vibration and shock loads listed in Table 8.

Table 8 — Vibration and shock loads

Evaluated IVDS property	Test parameters	Influencing factor	
		Value	Permitted deviation
Resistance 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 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	160	—
Resistance 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 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	—
Resistance to mechanical shocks in transportation	Peak shock acceleration, m/s^2 (g)	250 (25)	±20 %
	Shock duration, ms	6	—
	Number of shocks in each of three directions	4000	—
Durability under singular mechanical shocks[1)]	Single shock, g	75	—
	Shock duration, ms	1—5	—

[1)] Tests are carried out for IVDS in auxiliary equipment configuration.

13.3.2 In accordance with the requirements of [1] (Appendix 3, clause 17.2), the IVDS shall ensure:

a) automatic MSD transmission after airbag(s) operation or upon receiving a signal from sensor(s) installed in other components of the passive safety system or other vehicle systems that determine(s) the vehicle slow-down degree during the tests provided for in the UNECE Regulations [6] and [7] (for vehicles within the scope of these Regulations; for vehicles of Category N1, the tests as per the UNECE Regulation [8] are carried out instead of those as per the UNECE Regulation [8]);

b) retaining operational condition including duplex voice communication with emergency services after the tests indicated in item a).

13.3.3 Each IVDS shall remain secured and operational under loads that take place in dynamic tests in accordance with the UNECE Regulation [9] and are characterised by parameters conforming to [9] (see Amendment for Appendix 9).

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

13.3.5 The IVDS conformity to the requirements of Table 7 is tested in accordance with GOST 33466.

13.3.6 The IVDS conformity to the requirements of 13.3.2 is tested during the tests of a vehicle equipped with such IVDS for its conformity to the requirements of [1] (Appendix 3, Clause 17), as specified in GOST 33469 (subsection 6.6 and section 7).

13.3.7 The IVDS conformity to the requirements of 13.3.3 is tested in accordance with GOST 33466 (clause 7.2.8).

13.4 Electromagnetic compatibility requirements

13.4.1 Each IVDS shall be resistant under its exposure to interferences conducted in power circuits as described in GOST 28751. The rigidity level of test pulses and the IVDS functional condition shall conform to Table 9.

T a b l e 9 — Rigidity level of test pulses and functional condition of system

Test pulse	Rigidity level	IVDS functional condition
1	IV	A
2		
3a		
3b		
4		

13.4.2 The emission level and voltage levels of all disturbance types generated by an IVDS 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 for disturbances of type 1: minus 15(35) V;
- peak voltage for disturbances of type 2: 15(15) V;
- peak voltage for disturbances of type 3: from minus 15(25) V to plus 15(25) V.

13.4.3 An IVDS 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 IVDS functional condition are specified in Table 10.

Table 10 — Rigidity level of test pulses and functional condition of system

Test pulse	Rigidity level	IVDS functional condition
1	IV	A
2		
3a		
3b		

13.4.4 An IVDS shall be resistant under its exposure to (contact and air) electrostatic discharges as per [10] 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 IVDS power supply terminals shall not exceed the reference limit values established in [11] (clause 6.2) for device group of Class 3.

13.4.6 The reference limits of narrowband and wideband electromagnetic disturbances emitted by the IVDS in the frequency range from 30 to 1000 MHz shall not exceed the values stated in [12] (subsection 6.6).

13.4.7 An IVDS 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 [12] (subsection 6.7).

13.4.8 The IVDS conformity tests against the requirements of 13.4.1—13.4.7 shall be carried out in accordance with GOST 33466 (section 5).

14 Reliability requirements

Each IVDS shall have the following reliability indices:

- basic IVDS elements shall be suitable for round-the-clock operation;
- IVDS time between failures shall be at least 10000 hours;
- guaranteed IVDS operating life shall be at least 3 years;
- IVDS service life at least 7 years, except for the backup battery;
- guaranteed storage life shall be at lest one year provided that the IVDS is stored in its original package in heated rooms with no aggressive substances and vapours present.

15 Design requirements

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

15.2 The following shall be applied to the IVDS body:

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

Note — The information on the marking of connectors shall be included in the IVDS documentation specified in 20.2.

16 Ergonomic and industrial aesthetics requirements

The ergonomic and industrial aesthetics requirements shall be specified by:

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

17 Safety and ecological protection requirements

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

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

17.3 The use of inflammable materials, or of those producing harmful substances when burning, is forbidden in IVDS production, in accordance with the fire safety requirements of GOST 12.1.044.

18 Marking

18.1 The IVDS marking shall comply with the requirements specified in Section 15, shall be clearly visible, and shall correspond to the requirements of the IVDS assembly drawing in regard to contents, location and application method.

18.2 The IVDS marking shall be durable for the whole IVDS service life, be mechanically strong, and not subject to wear.

19 Packaging

Packaging shall correspond to the requirements of IVDS design documents.

20 Requirements for delivery package and documentation

20.1 Delivery package

20.1.1 For IVDS in auxiliary equipment configuration, each IVDS delivery package shall include:

- IVDS, and any IVDS mounting kit(s);
- IVDS user interface module and any UIM mounting kit(s);
- GNSS antenna and cable for its connection to main IVDS unit (unless the IVDS is equipped with an internal GNSS antenna);
- antenna for GSM/UMTS communication module, with cable for connection to main IVDS unit (unless the IVDS is equipped with an internal GSM/UMTS antenna);
- cable for IVDS connection to UIM;
- automatic detector of RTA events with its connecting cable, and acceleration sensor mounting kit(s) (unless such sensor is installed inside the IVDS body), for vehicles of Categories M1 and N1 only.

N o t e – The latter applies if a standard on-board system 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 IVDS connection to vehicle electronics (adapter for specific vehicle type);
- backup battery;
- loudspeaker for voice communication, its mounting kit(s) and connecting cable (optional).

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

20.1.3 The IVDS delivery package for IVDS in standard equipment configuration shall be specified by the vehicle manufacturer.

20.2 Documentation

20.2.1 The following documents shall be supplied with an IVDS in auxiliary equipment configuration:

- installation manual;

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

20.2.2 The documentation package contents for IVDS in standard equipment configuration are determined by the vehicle manufacturer.

21 Logos

21.1 The "Emergency call" button and the optical status indicator of the IVDS shall bear the "Emergency call" icon image applied in accordance with [13] and presented in Figure 4. The optical status indicator of the IVDS may be of design combined with the "Emergency call" button.

Fig. 4 — "Emergency call" icon image

21.2 The "Additional functions" button shall have the icon image shown in Figure 5.

Fig. 5 — "Additional functions" icon image

21.3 For IVDS installed in auxiliary equipment configuration, the main IVDS unit, IVDS user manual and brief booklet describing IVDS use shall be marked with the ERA-GLONASS icon shown in Figure 6.

Fig. 6 — Icon image of Road Accident Emergency Response System

Appendix A
(mandatory)

Configuration parameters of in-vehicle emergency call system/device

The IVDS configuration parameters that shall be supported when an IVDS is used for its intended purpose are listed in Table A1.

Parameter name	Unit of measurement	Parameter type or range[1)]	Initial parameter value	Parameter description	Requirement applicability[2)]	Changeable in IVDS settings[3)]
Radio mute						
RADIO_MUTE_DELAY	Milliseconds	INT	0	Delay from activation of "radio mute" signal to start of sound playback	AE	Yes
RADIO_UNMUTE_DELAY	Milliseconds	INT	0	Delay from deactivation of "radio mute" signal to stop of sound playback	AE	Yes
General purpose settings						
CALL_AUTO_ANSWER_TIME	Minutes	INT	20	Time interval wherein IVDS responds to incoming calls automatically after emergency call completion	AE, SE	Yes
POST_TEST_ REGISTRATION_TIME	Seconds	INT	120	Time interval wherein IVDS 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		Telephone number used for test calls of eCall. Determined by Operator of National Road Accident Emergency Response System	AE, SE	Yes
GARAGE_MODE_PIN		ENUM {NONE, PIN 1 - PIN 8}	NONE	Line indicating that System is in Service Station mode: - NONE – Service Station mode is not active; - PIN_X – PIN_X line is active when System is in such mode	AE	Yes

Table A.1 (continued)

Parameter name	Unit of measurement	Parameter type or range[1)]	Initial parameter value	Parameter description	Requirement applicability[2)]	Changeable in IVDS settings[3)]
INT_MEM_TRANSMIT_ INTERVAL	Minutes	INT	60	Time interval between transmission attempts of message stored in IVDS internal memory. Zero value not permitted.	AE, SE	Yes
INT_MEM_TRANSMIT_ ATTEMPTS	—	INT	10	Number of retransmission attempts for message stored in IVDS internal memory. Zero value means that no retransmission attempts are made.	AE, SE	Yes
Configuration and service configuration data						
Base Service of Road Accident Emergency Response System						
CRASH_SIGNAL_INTERNAL	—	BOOLEAN	TRUE	Vehicles of Categories M1 and N1 only: set if 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 external acceleration sensor of vehicle is used to detect RTA events	AE	Yes
ASI15_TRESHOLD	—	REAL	0,7	Vehicles of Categories M1 and N1 only: operation threshold of automatic detector of RTA events	AE	Yes
ECALL_MODE_PIN		ENUM {NONE, PIN 1 .. PIN_8}	NONE	Line indicating that System is in eCall mode: - NONE – eCall mode is not active; - PIN_X – PIN_X line is active when System is in such mode	AE	Yes
SOS_BUTTON_TIME	Milliseconds	INT	200	Time "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
NAD_DEREGISTRATION_TIME	Minutes	INT/greater/ equal 720	120	Time interval to expire before GSM and UMTS module deregisters in network	AE, SE	Yes

Table A.1 (continued)

Parameter name	Unit of measurement	Parameter type or range[1)]	Initial parameter value	Parameter description	Requirement applicability[2)]	Changeable in IVDS settings[3)]
ECALL_NO_AUTOMATIC_ TRIGGERING	—	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		Number used by IVDS to send SMS with MSD upon System Operator request. Specified by Operator of National Road Accident Emergency Response System	AE, SE	Yes
Test mode						
TEST_REGISTRATION_PERIOD	Minutes	INT	5	If IVDS has been registered in network using "Additional functions" button, then any successive network registration of IVDS after this button is pressed will not be possible until this interval expires. If set to zero, no restrictions on later network registration of IVDS are imposed.	AE, SE	Yes
Acceleration profile recording in case of RTA						
IGNITION_OFF_FOLLOW_UP_ TIME1	Minutes	INT	120	Time interval wherein acceleration profile is being recorded for RTA after ignition is switched off	AE	Yes

Table A.1 (continued)

Parameter name	Unit of measurement	Parameter type or range[1)]	Initial parameter value	Parameter description	Requirement applicability[2)]	Changeable in IVDS settings[3)]
IGNITION_OFF_FOLLOW_UP_ TIME2	Minutes	INT	240	Time interval wherein RTA event is being detected after ignition is switched off	AE	Yes
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	Duration of single frame in acceleration profile recording before RTA occurrence	AE	Yes
Miscellaneous parameters						
GNSS_POWER_OFF_TIME	Milliseconds	INT	500	Time interval to expire from ignition switching off to power disconnection of GNSS receiver	AE	Yes
GNSS_DATA_RATE	Hertzs	INT/1,2, 5, 10	1	Data output rate of GNSS receiver	AE, SE	Yes
GNSS_MIN_ELEVATION	Degrees	INT/5 - 15	5	Minimum elevation (cut-off angle) of navigation spacecrafts	AE	Yes
Vehicle parameters						
VIN	—	STRING	Defined at IVDS configuration stage	VIN to be defined in accordance with [1]	AE, SE	No
VEHICLE_TYPE	—	INT	—	Vehicle Category, bits 4-0: 00001 – passenger car (Category M1) 00010 – bus (Category M2) 00011 – bus (Category M3) 00100 – light cargo vehicle (Category N1) 00101 – heavy cargo vehicle (Category N2)	AE, SE	No

Table A.1 (continued)

Parameter name	Unit of measurement	Parameter type or range[1)]	Initial parameter value	Parameter description	Requirement applicability[2)]	Changeable in IVDS settings[3)]
VEHICLE_TYPE	—	INT	—	00110 – heavy cargo vehicle (Category N3) 00111 – motor cycle (Category L1e) 01000 – motor cycle (Category L2e) 01001 – motor cycle (Category L3e) 01010 – motor cycle (Category L4e) 01011 – motor cycle (Category L5e) 01100 – motor cycle (Category L6e) 01101 – motor cycle (Category L7e)		
VEHICLE_PROPULSION_ STORAGE_TYPE	—	INT	—	Vehicle propulsion storage type If all bits are zero, no type is set. Bit 7: unused Bit 6: unused Bit 5: 1 – hydrogen Bit 4: 1 – electricity (above 42 V and 100 A · h) Bit 3: 1 – liquid propane (LPG) Bit 2: 1 – liquefied natural gas (CNG) Bit 1: 1 – diesel Bit 0: 1 – gasoline	AE, SE	No

[1)] Parameter ranges (intervals) vs. parameter type:
- INT: 0—65535;
- BOOLEAN: TRUE, FALSE;
- STRING: 255 characters.

[2)] Requirement:
- "AE" — parameter mandatory only for IVDS installed in auxiliary equipment configuration;
- "AE, SE" — parameter mandatory for IVDS installed both in auxiliary and standard equipment configurations

[3)] Settings:
- "Yes" — initially set value of IVDS parameters may be changed after initial IVDS setup;
- "No" — initially set value may not be changed while IVDS is used.

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 IVDS 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 an 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 characteristic for events that occur during the accident (150 ms).

B.4 Compare the obtained *ASI* value with the ASI_{15}_TRESHOLD limit value listed in Appendix A. The limiting value equal to ASI_{15}_TRESHOLD defines the IVDS operation for detection of RTA event moment. Values equal to or greater than ASI_{15}_TRESHOLD correspond to RTA events that may possibly lead to high probability of life and health hazards for people present in the vehicle cabin, whereas those less than ASI_{15}_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 assess their severity in the case of IVDS installed standard equipment configuration are determined by the vehicle manufacturer.

Appendix C
(mandatory)

Minimum set of data

C.1 Representation of data

C.1.1 A minimum set of data shall be represented in terms of Abstract Syntax Notation One in accordance with [14]—[22] 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 [14]—[22] based on information stated in C.3.

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

C.2 Versions of minimum set of data

C.2.1 To provide for backwards compatibility, this Appendix defines two versions of minimum set of data: version 1 and version 2. For IVDS subject to conformity assessment before January 1, 2018, any version may be used at the discretion of the IVDS manufacturer. For IVDS subject to conformity assessment since January 1, 2018, the use of version 2 is mandatory.

C.3 Structure of minimum set of data

C.3.1 The structure of an MSD containing standard data identical to eCall is given in Table C.1 (this structure is the same for versions 1 and 2).

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

Data block number	Data block name	Type (range)	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 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
	Automatic Activation	BOOLEAN	M	Activation type: - true – automatic call; - false – manual call.
	Test Call	BOOLEAN	M	Call type - true – test call; - false – emergency call.
	Position Can Be Trusted	BOOLEAN	M	Reliability of identified vehicle position (coordinates): true if vehicle position (coordinates) has (have) been identified with an error not exceeding ±150 m at a confidence probability of 95 %; and false otherwise.
	Vehicle Type	ENUM	M	Vehicle categories (Regulation to encode vehicle types is defined in C.3): - passenger vehicle (Category M1) - buses (Category M2) - buses (Category M3) - light trucks (Category N1) - cargo vehicles (Category N2) - cargo vehicles (Category N3) - motor cycles (Category L1e) - motor cycles (Category L2e) - motor cycles (Category L3e) - motor cycles (Category L4e) - motor cycles (Category L5e) - motor cycles (Category L6e) - motor cycles (Category L7e)
4	VIN	STRING(17)	M	Vehicle identification number in accordance with [23]

Table C.1 (continued)

Data block number	Data block name	Type (range)	Status	Data block description
5	Vehicle Propulsion Storage Type	—	M	Vehicle fuel (energy source) type. Each fuel (energy source) type is encoded as follows: false – this fuel (energy source) type is not present; true – this fuel (energy source) type is present.
	Gasoline Tank Present	BOOLEAN	M	Gasoline
	Diesel Tank Present	BOOLEAN	M	Diesel
	Compressed Natural Gas	BOOLEAN	M	Compressed gas
	Liquid Propane Gas	BOOLEAN	M	Liquefied gas (propane)
	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 timestamp, i.e., number of seconds passed from January 1, 1970 UTC. Shall be set to zero should an error in evaluation of RTA event time occur.
7	Vehicle Location	—	M	Vehicle location; general rules and recommendations are: - if the latitude and longitude values are both zero, then the vehicle location shall be interpreted as unknown; - if the receiver has been unable to detect either the latitude or the longitude, interpreting both coordinate values as unknown is recommended
	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). The maximum value is: 90°00'00,000" = 90×60×60,000" = 324000,000" = 324 000 000 milliarcseconds = 0x134FD900. The minimum value is: -90°00'00,000" = -90×60×60,000" = -324000,000" = -324 000 000 milliarcseconds = 0xECB02700. Example: 48°18'1.20" N = (48×3600+18×60+1.20)" = 173881.200" = 173881200 = 0x0A5D3770. 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 0x7FFFFFFF. In either case, the parameter "Position Can Be Trusted" shall be set to false.

Table C.1 (continued)

Data block number	Data block name	Type (range)	Status	Data block description
7	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). The maximum value is: 180°00'00,000" = 180×60×60,000" = 648000,000" = 648 000 000 milliarcseconds = 0x269FB200. The minimum value is: -180°00'00,000" = -180×60×60,000" = -648000,000" = -648 000 000 milliarcseconds = 0xD9604E00. Example: 11°37'2.52" E = (11×3600+37×60+2.52)" = 41822.520" = 41822520 = 0x027E2938. 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 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 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 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 Expressed in conditional units, one unit = 0.1″, corresponding to ≈ 3 m

Table C.1 (continued)

Data block number	Data block name	Type (range)	Status	Data block description
11	Number Of Passengers	INTEGER (0...255)	O	Number of passengers
12	Optional Additional Data	—	O	Optional additional data
	oid	RELATIVE-OID	O	Identifier of the object that defines the format and purpose of the data following it. A special International standardization body is responsible for assigning unique values to this identifier. The element type is defined in accordance with [14 — 22]
	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:
- M (mandatory) — mandatory data block. Shall always be transferred;
- O (optional) — optional data block. May be omitted; its presence is determined by other parameters included in the packet.

C.4 ASN.1 representation of MSD with standard data identical to those of eCall (packed encoding), version 1

```
MSDASN1Module
DEFINITIONS
AUTOMATIC TAGS ::=
BEGIN
-- MSD specification version
CurrentId::= INTEGER (1)

-- ECallMessage is an upper level data element
-- It supports one message type only (msd)
-- Elements:
-- id: MSD data format, set to 1
-- msd: minimum set of data transmitted from IVDS side, except for ID
ECallMessage ::= SEQUENCE {
    id INTEGER(0…255),
    msd MSDMessage
}

-- Message sent from IVDS 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,
    optionalAdditionalData AdditionalData 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.5 ASN.1 representation of MSD with standard data identical to those of eCall (packed encoding), version 2

```
MSDASN1Module_V2
DEFINITIONS
AUTOMATIC TAGS ::=
BEGIN
-- MSD specification version
CurrentId::= INTEGER (2)

-- ECallMessage is an upper level data element
-- It supports one message type only (msd)
-- Elements:
-- id: MSD data format, set to 1
-- msd: minimum set of data transmitted from IVDS side, except for ID
ECallMessage ::= SEQUENCE {
    msdVersion INTEGER(0…255),
    msd OCTET STRING (CONTAINING MSDMessage)
}

-- Message sent from IVDS 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,
    optionalAdditionalData AdditionalData 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),
    ...
}
-- Vehicle Identification Number (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,
    liquidPropaneGas BOOLEAN DEFAULT FALSE,
    electricEnergyStorage BOOLEAN DEFAULT FALSE,
    hydrogenStorage BOOLEAN DEFAULT FALSE,
    otherStorage BOOLEAN DEFAULT FALSE,
    ...
}

-- VehicleLocation:
-- Current vehicle location
-- 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.6 Structure of additional MSD data introduced for Road Accident Emergency Response System and not standardised in eCall (RTA severity assessment), version 1

C.6.1 Additional data introduced into the MSD structure in the Road Accident Emergency Response 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.6.2 The contents of additional data are detailed in Table C.2.

Table C.2 — Contents of additional MSD data introduced for Road Accident Emergency Response System, version 1

Data block number	Data block name	Type (range)	Status	Data block description
12-1	Crash SeverityASI_{15}	INTEGER (0...2047)	O	Accident severity assessment basing on the ASI_{15} index value multiplied by 100. If the ASI_{15} value can not be evaluated or transmitted at IVDS vehicle side, 0 shall be transmitted for low-severity accidents or 2047 for high-severity ones.
12-2	Diagnostic Result	—	O	Results of IVDS 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

Table C.2 (continued)

Data block number	Data block name	Type (range)	Status	Data block description
	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 Failures	BOOLEAN	O	Other critical failures
	Other Not Critical Failures	BOOLEAN	O	Other non-critical failures
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
N o t e — 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.				

C.7 ASN.1 representation of second element in additional data block introduced for ERA-GLONASS System (packed encoding), version 1

```
ERAOADASN1Module
DEFINITIONS
AUTOMATIC TAGS ::=
BEGIN
      -- Format version of additional data block for ERA-GLONASS System
      -- Extends optionalAdditionalData.OID, designated by 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 IVDS 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.
```

C.8 Structure of additional MSD data introduced for Road Accident Emergency Response System and not standardised in eCall (RTA severity assessment), version 2

C.8.1 Additional data introduced into the MSD structure in the Road Accident Emergency Response 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 1.4.2.

C.8.2 The contents of additional data are detailed in Table C.3.

Table C.3 — Contents of additional MSD data introduced for Road Accident Emergency Response System, version 2

Data block number	Data block name	Type (range)	Status	Data block description
12-1	Crash Severity ASI_{15}	INTEGER (0...2047)	O	Accident severity assessment basing on the ASI_{15} index value multiplied by 100. If the ASI_{15} value can not be evaluated or transmitted at IVDS vehicle side, 0 shall be transmitted for low-severity accidents or 2047 for high-severity ones.
12-2	Diagnostic Result	—	O	Results of IVDS 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)

Table C.3 (continued)

Data block number	Data block name	Type (range)	Status	Data block description
	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 Failures	BOOLEAN	O	Other critical failures
	Other Not Critical Failures	BOOLEAN	O	Other non-critical failures
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
12-4	Coordinate System Type	ENUM	O	Type of coordinate system in use (encoding rules defined in C.9): - WGS-84; - PZ-90
N o t e — 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.				

C.9 ASN.1 representation of second element in additional data block introduced for ERA-GLONASS System (packed encoding), version 2

```
ERAOADASN1Module
DEFINITIONS
AUTOMATIC TAGS ::=
BEGIN
      -- Format version of additional data block for ERA-GLONASS System
      -- Extends optionalAdditionalData.OID, designated by CEN for ERA-GLONASS.
      -- Next versions shall be backward-compatible with the previous ones.
      ERADataFormatId::= INTEGER (2)

      -- 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,
          coordinateSystemType CoordinateSystemType DEFAULT wgs84,
          ...
      }

      -- Data block describing the IVDS 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
      }
```

```
-- Type of coordinate system in use
CoordinateSystemType ::= ENUMERATED {
    wgs64 (1),
    ps90 (2)
}

END
```

Appendix D
(recommended)

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

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

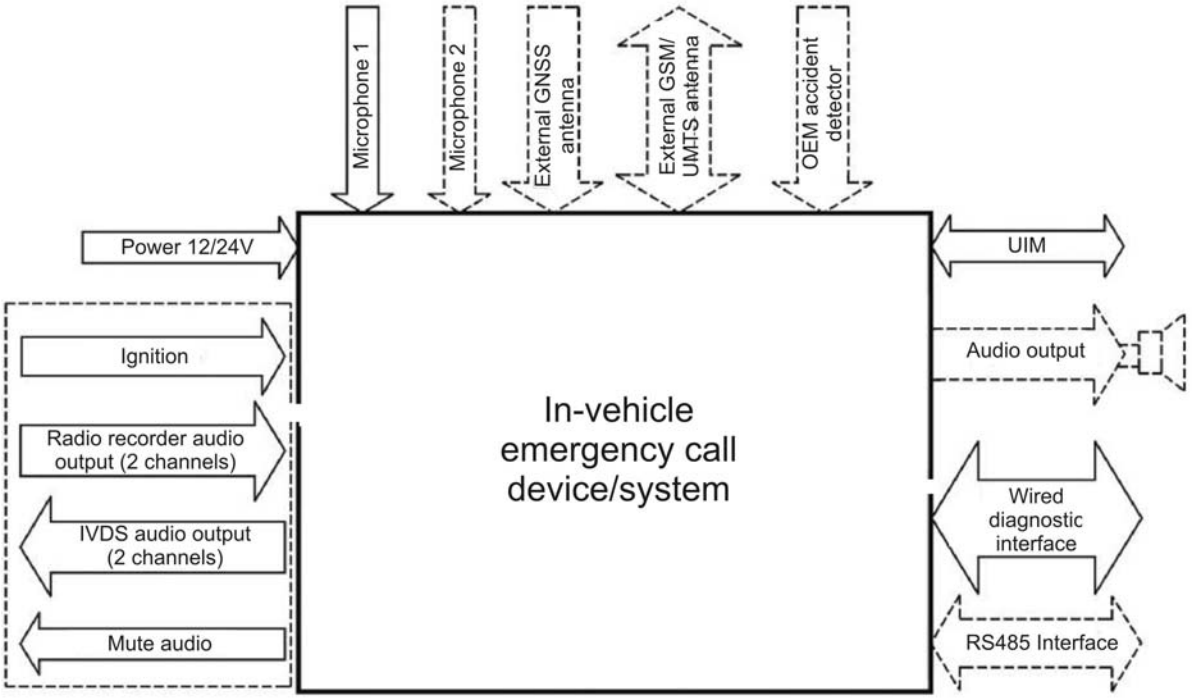


Fig. D.1 — Example IVDS connection to on-board audio system

D.2 The IVDS audio output (two 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 (two front speakers) is connected to the IVDS audio input for the purpose of signal switching inside the IVDS.

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 on IVDS connection to the on-board audio system of the vehicle depending on the design of the latter system are given in Table D.1.

Table D.1

Possible audio system design of vehicle	Recommendation for IVDS 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 IVDS. 2. Connect IVDS to audio system. 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. 2. Connect radio recorder to IVDS. 3. Connect IVDS to audio system. 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 IVDS. 2. Connect IVDS to audio system. 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 IVDS 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 IVDS. 2. Connect IVDS to audio system. 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 IVDS audio output.

Appendix E
(recommended)

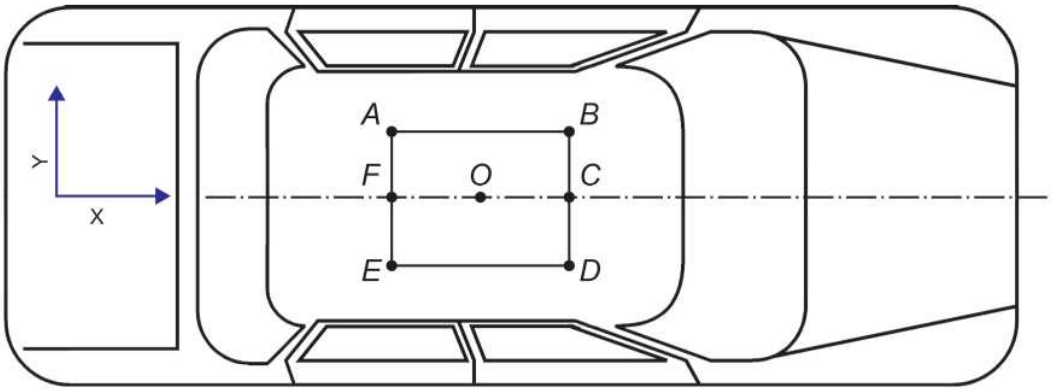
Recommended installation location of automatic detector of RTA events (for vehicles of Categories M1 and N1 only)

E.1 For IVDS 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 the 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 IVDS adjustment becomes much simpler.

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

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.



O — vehicle centre of mass point; distances *OF* and *OC* shall not exceed 70 mm; distances *AF*, *BC*, *CD* and *EF* shall not exceed 40 mm

Fig. E.1 — Recommended location of detector of RTA events

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

Appendix F
(recommended)

Recommendations on implementation of user interface module and on its arrangement in vehicle compartment (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 compartment.

F.2 Materials most close to those used for fabrication of vehicle front panels in regard to 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 Speaker(s) or electronic modules included in the IVDS package 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 compartment.

F.4 The UIM mounting on the vehicle front panel shall ensure the safety for persons present in the vehicle when an 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 device/system installed in auxiliary equipment configuration to on-board network of vehicle. Signal configuration

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

G.1.1 The signal pinout configuration recommended for such connectors is detailed in Table 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 ones) that may be used for IVDS coupling to vehicle systems.

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

For microphone connection, the connector provides the respective signals (pins 15–18).

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 IVDS)	Signal function	Signal status[1)]
1	Ground	Input	Ground pin	Yes
2	Vin+	Input	Power supply 12V or 24V	Yes
3	CAN L1	Input-output	CAN 1 (from 1.5 to 2.5 V)	Yes[2),3)]
4	uim_4	Input-output	UIM — signal 4 (e.g., ground pin 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)[4)]	No
10	gpio_1	Input-output	General purpose I/O 1[5)]	No
11	l_ine	Input-output	K-Line (OBDII) as per [24][4)]	No
12	k_line	Input-output	K-Line (OBDII) as per [24][4)]	No
13	CAN H1	Input-output	CAN 1 (from 2.5 to 3.5 V)	Yes[2),3)]
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

Table G.1 (continued)

Pin number	Signal name	Signal direction (with respect to IVDS)	Signal function	Signal status[1)]
18	Umic-	Output	Microphone power	No
19	J1850+	Input-output	J1850 (OBDII)[4)]	No
20	gpio_2	Input-output	General purpose I/O 2	No
21	Ucan/rs485+	Output	Power for autonomous smart 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 battery for backup power supply	No
25	CAN L2	Input-output	CAN 2 (from 1.5 to 2.5 VB), OBDII or FMS	No
26	Uacc+	Output	Power for acceleration sensor	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
30	Uacc-	Output	Power for acceleration sensor	No
31	Ucan/rs485-	Output	Power for autonomous smart sensors	No
32	USB d-	Input-output	USB data	No
33	gpio_4	Input-output	General purpose I/O 4	No
34	Vbat-	Input-output	External battery for backup power supply	No
35	signal_gnd	Input	Ground for J1850 (OBDII)[4)] signals	No
36	radio_mute	Output	Mute sound[2)]	Yes[2)]
37	ecall_mode	Output	"Emergency call" indicator	No
38	ignition	Input	Ignition line state[3)]	Yes[3)]
39	Ground	Input	Ground pin	No
40	NC		Unused	No

[1)] "Signal status" column indicates "Yes" if the signal implementation is mandatory and "No" otherwise.

[2)] As stated in 6.12 and 6.13, disconnection of all other sound playback devices in standard vehicle configuration is a mandatory IVDS function enabling loudspeaker communication during emergency calls.

Either signal 36 (radio_mute) or signals 3 and 13 (CAN L, CAN H) are used to implement this function.

[3)] As stated in 7.3.4, 7.5.3, 7.6.2, 7.7.5 and 7.8.8, checking the ignition line state of the vehicle is a mandatory procedure for implementation of IVDS operating modes detailed in section 7.

Either signal 38 (ignition) or signals 3 and 13 (CAN L1, CAN H1) are used to implement this procedure.

[4)] If pin 12 is present in the connector, then the protocol described in [24] is used.

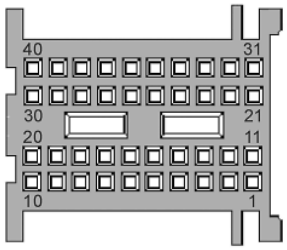
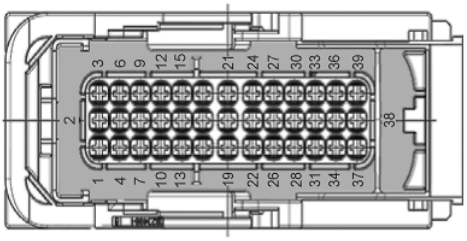
If pin 12 is not present in the connector, then the J1850 VPW (pins 19 and 35) or J1850 PWM (pins 9, 19 and 35) protocols are used in accordance with [25].

[5)] Assigning pin 10 (gpio_1) to the emergency alarm signal is recommended if such signal is used in the vehicle.

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

G.1.3 The IVDS 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 IVDS</th><th>Connector for GNSS antenna</th><th>Connector for GSM/UMTS antenna</th></tr>
<tr><td>M1/N1</td><td>953122-1[1)]
  </td><td rowspan="2">FAKRA C
  </td><td rowspan="2">FAKRA D
  </td></tr>
<tr><td>M2/M3/N2/N3</td><td>5-1718321-3[2)]
  </td></tr>
<tr><td colspan="4">[1)] The use of 953122-1 connector of MQS Tyco series is assumed.
[2)] The use of 5-1718321-3 connector of AMP MCP Tyco series is assumed.</td></tr>
</table>

G.2 Connectors used for coupling external devices to IVDS

G.2.1 Connection of external devices via RS 485 bus

G.2.1.1 The 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 5 V	Output
2	A	Data	Input-output
3	B	Data	Input-output
4	GND	Ground	Output

G.2.1.2 The four-wire USCAR 347930040 connector of Mini50 series by Molex is recommended for use; it is shown in Figure G.1.

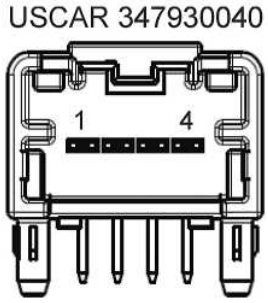


Fig. G.1— Recommended connector for coupling to RS485 bus

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 with 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 a diagnostic interface if the latter is connected to the RS485 port.

Appendix H
(mandatory)

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 narrowband and wideband IVDS;
- 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 IVDS

H.2.1 The signal processing delay in a loudspeaker IVDS in receiving direction T_R shall be at most 50 ms without considering signal encoding and decoding times, or at most 122 ms for GSM and 143 ms for UMTS communication systems taking into account signal encoding and decoding times.

H.2.2 The signal processing delay in a loudspeaker IVDS in sending direction T_S shall be at most 50 ms without considering signal encoding and decoding times, or at most 122 ms for GSM and 143 ms for UMTS communication systems taking into account signal encoding and decoding times.

H.2.3 The total signal processing delay in a loudspeaker IVDS for receiving and sending (T_R+T_S) shall be at most 70 ms without considering signal encoding and decoding times, or at most 214 ms for GSM and 256 ms for UMTS communication systems taking into account signal encoding and decoding times.

N o t e – Only an extra delay introduced by sound signal processing algorithms in the IVDS (e.g., by AGC, AEC, noise suppression, etc.) is measured excluding signal propagation delays in service provider's channels.

H.3 Sending loudness ratings

H.3.1 The sending loudness rating *SLR* measured for an IVDS 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 gain control of the IVDS is not provided for sending. Whether an automatic gain control (AGC) for sending is required to equalise the loudness rating for passengers at different distances from the IVDS microphone shall be decided by the IVDS or vehicle manufacturer for IVDS in auxiliary or standard equipment configurations, respectively.

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

N o t e — If AGC is used, its adaptive pattern of gain changes for test signals may hinder the measurements. In this case, measurements with AGC disabled and gain fixed at K_{max}, $K_{пот}$, K_{min} levels specified by the vehicle or IVDS manufacturer for IVDS in standard or auxiliary equipment configuration, respectively, are permitted.

H.4 Receiving loudness ratings

H.4.1 The nominal receiving loudness rating RLR_{nom} measured for an IVDS installed in the vehicle compartment (cabin) shall be equal to the value specified by the IVDS 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 IVDS 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 IVDS volume shall be achieved at the extreme (leftmost) position of the volume control. The required RLR_{max} value shall be specified by the IVDS 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 IVDS volume shall be achieved at the extreme (rightmost) position of the volume control. The required RLR_{min} value shall be specified by the IVDS or vehicle manufacturer based on the requirement that the receiving loudness level in the IVDS compartment (cabin) must ensure reliable duplex loudspeaker communication with an acoustic signal-to-noise ratio of at least 6 dB for receiving in the "worst" 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 IVDS shall be decided by the IVDS or vehicle manufacturer for IVDS in auxiliary and standard equipment configurations, respectively.

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

N o t e — If AGC is used, its adaptive pattern of gain changes for test signals may hinder the measurements. In this case, measurements with AGC disabled and gain fixed at K_{max}, $K_{пот}$, K_{min} levels specified by the vehicle or IVDS manufacturer for IVDS in standard or auxiliary equipment configuration, respectively, are permitted.

H.5 Frequency sensitivity response of IVDS transmitting part

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

N o t e – The frequency response of the IVDS sensitivity in sending direction shall be measured with the IVDS installed in the vehicle compartment (cabin), along the path from the IVDS 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 narrowband IVDS

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 wideband IVDS

Frequency, Hz	Upper limit, dB	Lower limit, dB
100	4	–∞
125	4	–10
200	4	–4

Table H.2 (continued)

Frequency, Hz	Upper limit, dB	Lower limit, dB
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 IVDS and from 100 Hz to 7 kHz for wideband IVDS. 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 IVDS receiving part

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

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

T a b l e H.3 – Frequency sensitivity response in receiving direction for narrowband IVDS

Frequency, Hz	Upper limit, dB	Lower limit, dB
200	0	–∞
250	0	–∞
315	0	–∞
400	0	–15
630	0	–12
3100	0	–12
4000	0	–∞

T a b l e H.4 – Frequency sensitivity response in receiving direction for wideband IVDS

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 In silence conditions when the near-end subscriber is not speaking, the maximum permitted level of the IVDS self-noise in the transmit channel measured at the electric output of the speech codec on the operator side shall not exceed minus 64 dBm0(A) for narrowband systems or for wideband systems with noise reduction in the transmit channel switched on, and minus 58 dBm0(A) for narrowband systems or for wideband systems with noise reduction in the transmit channel switched off.

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 In silence conditions when the operator is not speaking, the maximum permitted level of the IVDS self-noise in the receive channel measured at the acoustic output of the IVDS at the nominal loudness rating RLR_{nom} shall not exceed minus (51 + RLR_{nom}) dBPa(A).

H.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 IVDS and from 9 kHz to 16 kHz for wideband IVDS, the electric level of noise at the codec output measured in the base frequency band from 300 Hz to 3.4 kHz for narrowband IVDS and from (100) 200 Hz to 7 kHz for wideband IVDS 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 IVDS installed in the vehicle compartment (cabin), along the path from the IVDS 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 IVDS and from 100 Hz to 7 kHz for wideband IVDS and applied at a level of minus 12 dBm0, the acoustic level of out-of-band noise at the IVDS output measured in the frequency band from 4.6 KHz to 8 kHz for narrowband IVDS and from 8.6 kHz to 16 kHz for wideband IVDS 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 IVDS or from 100 Hz to 7 kHz for wideband IVDS.

N o t e – The measurement is carried out for an IVDS installed in the vehicle compartment (cabin), along the path from the electric input of the speech codec on the operator side to the IVDS 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 IVDS;
- 300, 500, 1000, 2000, and 3000 Hz — for wideband IVDS.

N o t e – The measurement is carried out for an IVDS installed in the vehicle compartment (cabin), along the path from the IVDS 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 IVDS volume control, for each of the following test frequencies:

- 300, 500, and 1000 Hz — for narrowband IVDS;
- 300, 500, 1000, 2000, and 3000 Hz — for wideband IVDS.

N o t e – The measurement is carried out for an IVDS installed in the vehicle compartment (cabin), along the path from the electric input of the speech codec on the operator side to the IVDS 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 46 dB (50 dB is recommended) 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 IVDS 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 IVDS receive channel, the echo signal attenuation in the IVDS 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 s :

1 The measurement is carried out for an IVDS installed in the vehicle compartment (cabin), from the electric input to the electric output of the speech codec on the operator side.

2 Controlling the level rather than attenuation of echo signals is permitted if the test signal specifics prevents from attenuation measurements.

H.15 Frequency dependence of echo signal attenuation

H.15.1 When the combined test signal of the nominal level is applied to the IVDS receive channel, the frequency dependence of the echo signal attenuation in the IVDS transmit channel shall not be below the limits specified in Table H.5 for narrowband IVDS and in Table H.6 for wideband IVDS.

N o t e – The measurement is carried out for an IVDS 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 narrowband IVDS

Frequency, Hz	Upper limit, dB	Frequency, Hz	Upper limit, dB
100	–20	1500	–33
200	–30	2600	–24
300	–38	4000	–24
800	–34		

T a b l e H.6 — Frequency dependence of echo signal suppression in wideband IVDS

Frequency, Hz	Upper limit, dB	Frequency, Hz	Upper limit, dB
100	–41	5200	–46
1300	–41	7500	–37
3450	–46	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.

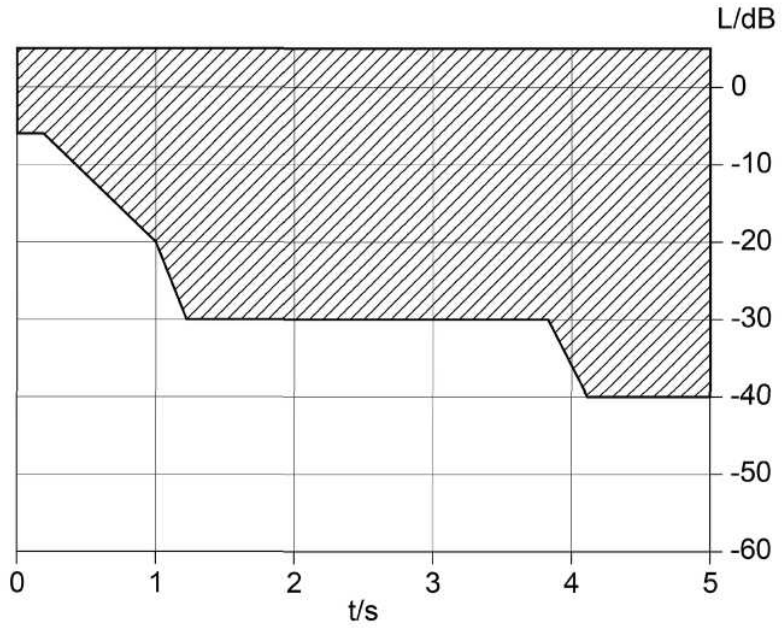
H.16 Initial convergence rate of AEC in absence of acoustic noises

H.16.1 After the combined test signal of the nominal level is applied to the IVDS receive channel, the curve of echo signal attenuation in the IVDS transmit channel versus time passed after the initial start-up of the AEC with a volume control set at its maximum level shall be below the limits shown in Figure H.1a.

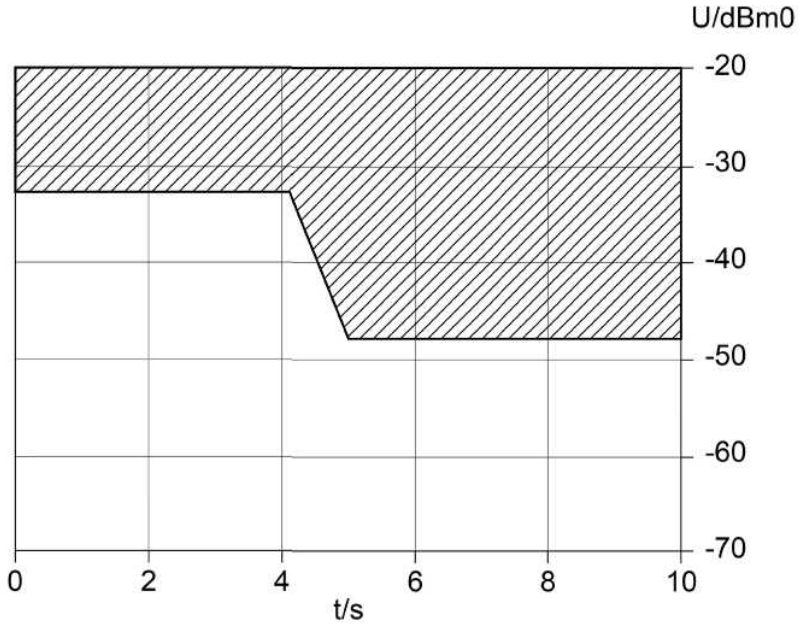
H.16.2 When the test signal of artificial voice at the nominal level is applied to the IVDS receive channel, the curve of echo signal level in the IVDS transmit channel versus time passed after the initial start-up of the AEC with a volume control set at its nominal level shall be below the limits shown in Figure H.1b.

N o t e – The measurement is carried out for an IVDS installed in the vehicle compartment (cabin), from the electric input to the electric output of the speech codec on the operator side.

H.16.3 Special attention should be given to the IVDS 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 a TCL on the electro-acoustic path of at least 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.



a)



b)

Fig H.1 — Time dependences of echo signal attenuation *L* and echo signal level *U*

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 IVDS receive channel, the curve of ratio L between the residual echo signal level in the IVDS transmit channel and the pause noise level versus time passed after the start-up of the AEC with a volume control set at its maximum position shall be below the limits shown in Figure H.2.

N o t e – The measurement is carried out for an IVDS installed in the vehicle compartment (cabin), from the electric input to the electric output of the speech codec on the operator side, with noises of different level inside the vehicle cabin.

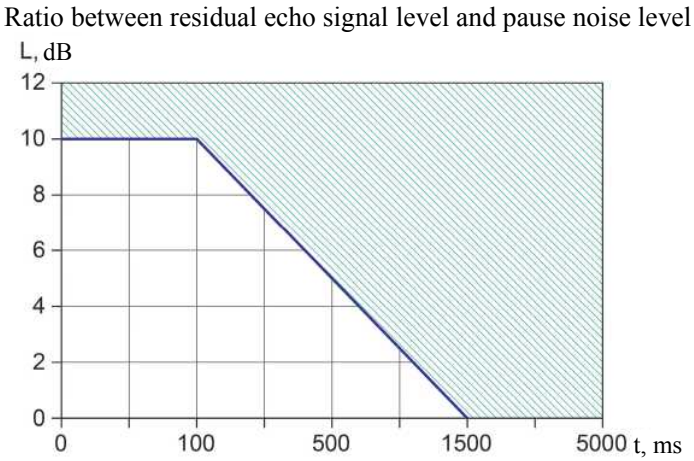


Fig. H.2 — Time dependence of ratio between residual echo signal level and pause noise level [26]

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 for a signal level of minus 16 dBm0 w.r.t. 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 level $L_{S,min}$ measured for active areas of voice signals shall not exceed minus 20 dBPa. The activation time $T_{r,S,min}$ for 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 half-duplex mode

When the subscribers are talking one at a time (in half-duplex mode), the value $A_{H,S}$ of attenuation induced by the IVDS 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 half-duplex mode

When the subscribers are talking one at a time (in half-duplex mode), the value $A_{H,R}$ of attenuation induced by the IVDS 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 duplex mode

H.23.1 When the subscribers are talking at the same time (in duplex mode), the maximum attenuation $A_{H,S,dt}$ introduced by an IVDS in the transmit channel and the maximum attenuation $A_{H,R,dt}$ introduced by it in the receive channel depend on the IVDS 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 — IVDS performance parameters for duplex 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 signal levels in sending/receiving directions and for a disbalance as stated below. Two combinations of signal levels shall be checked:

- nominal signal levels in receiving and sending directions;
- signal level in sending direction is 6 dB higher, signal level in receiving direction is 6 dB lower.

H.24 Attenuation of echo signals in duplex mode

When the subscribers are talking at the same time (in duplex mode), minimum permitted attenuation values of echo signals EL_{dt} depend on the IVDS 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 IVDS 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 An expert evaluation of the loudspeaker communication quality for an IVDS installed in the vehicle compartment is performed in transmit and receive channels. For single-talk in silence conditions, the speech quality of the IVDS loudspeaker communication at a five-grade rating scale of speech quality and intelligibility classes specified in GOST 16600 (Table 1) 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 as per GOST 16600 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 to be assessed are: good word legibility of speech, no sounding artefacts, no need for 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 narrowband IVDS and at least 3.6 for wideband IVDS when the IVDS 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 IVDS microphone position and its optimum directional properties as well as the use of additional algorithms in the IVDS (AGC in sending direction, and nose suppression).

N o t e – The measurement is carried out for an IVDS installed in the vehicle compartment (cabin), from the acoustic input of the IVDS 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 the ordinary defined in 7.5.3.10, 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 IVDS microphone position and directional properties, and the use of additional algorithms in the IVDS (AGC in receiving direction).

N o t e – The measurement is carried out for an IVDS installed in the vehicle compartment (cabin), from the electric input of the speech codec on the operator side to the electric output of the IVDS.

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 narrowband IVDS or from 150 Hz to 7.0 kHz for wideband IVDS.

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 IVDS generates an artificial comfort noise in pauses instead of transmitting real background noise while the subscribers keep silent in the vehicle compartment, then:

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 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.

Table 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[1)]	6[1)]	–6[1)]
[1)] For wideband IVDS only.		

H.29 Properties of electro-acoustic components

H.29.1 The frequency response of the IVDS microphone measured in free sound field conditions shall be within the tolerance limits listed in Table H.9 for narrowband IVDS and in Table H.10 for wideband IVDS.

Table H.9 – Frequency response of microphones for narrowband IVDS

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	–∞

Table H.10 — Frequency response of microphones for wideband IVDS

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 regarding sound pressure shall be at least 15 dB w.r.t. the nominal speech level at the mouth reference point (*MRP*) of 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 The maximum sound pressure level limited by microphone distortions equal to 3 % for 1 kHz test signals shall be at least 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 a 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 IVDS noise level performance in sending direction).

N o t e — If the microphone is included in the IVDS package submitted for certification, the requirements of this section are not mandatory.

Appendix I
(recommended)

Recommendations on 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. This being the case, the required IVDS performance parameters are directly affected by electro-acoustic properties of external devices connected to the IVDS, 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 selected speakers should be of high sensitivity and of low harmonic distortion and side tone levels within the operating frequency range for any IVDS volume level.

I.3 To provide for interchangeability of various microphones, unified levels are recommended equal to 300 mV/Pa ± 3 dB for the nominal IVDS microphone sensitivity at 1 kHz frequency and to 10 mV for the nominal sensitivity at the IVDS input (effective voltage level), with internal gain control enabled before the ADC in the ±12 dB range and the IVDS 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 IVDS 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 33468 (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.

Appendix J
(recommended)

Minimum requirements for automatic gain control algorithms

J.1 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 IVDS setup or the IVDS testing.

J.2 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 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 IVDS setup or for the IVDS testing.

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