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Road vehicles — Automotive multimedia interface —

Part 7: Physical specification

Véhicules routiers — Interface multimédia pour l'automobile —

Partie 7: Spécifications physiques

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 22902-7 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 3, *Electrical and electronic equipment*.

ISO 22902 consists of the following parts, under the general title *Road vehicles — Automotive multimedia interface*:

- *Part 1: General technical overview*

- *Part 2: Use cases*
- *Part 3: System requirements*
- *Part 4: Network protocol requirements for vehicle interface access*
- *Part 5: Common message set*
- *Part 6: Vehicle interface requirements*
- *Part 7: Physical specification*

Introduction

This part of ISO 22902 describes environmental conditions and tests to be applied to AMI-C compliant electrical and electronic equipment and some subcomponents directly mounted in or on the vehicle. It is not intended for direct application to all parts or assemblies that are part of that equipment. For example, it should not be directly applied to integrated circuits (ICs) and discrete components, printed circuit boards (PCBs), gages, displays, controls, etc. that are subassemblies of the equipment. Electrical, mechanical, climatic and chemical loads permitted for such parts and assemblies can be quite different than those described in this part of ISO 22902.

Road vehicles — Automotive multimedia interface —

Part 7:
Physical specification

1 Scope

The scope of this part of ISO 22902 is limited to conditions and testing at the equipment level; it does not include all conditions and testing necessary for complete verification and validation of the vehicle system. Environmental and reliability testing at lower and higher levels are required to ensure that vehicle quality and reliability objectives are met.

It addresses the following requirements relating to the design and manufacture of automotive components and of devices intended to be used in vehicles:

— **Environment**. The conditions in and on a vehicle that a component or device must function within. These conditions include chemical, climatic, electromagnetic and mechanical factors and stress.

— **Power management**. The requirements for power supply and delivery from a vehicle to its components and the devices used in that vehicle.

— **Interconnectivity**. The requirements for delivering data within a vehicle. These requirements differ depending on the delivery method selected by the automaker or supplier.

— **Packaging**. The standards for locating, securing, protecting, and enclosing or covering components and devices.

— **Homologation**. An overview of the legal requirements that apply to AMI-C compliant vehicles.

— **Diagnostic functional requirements**. An overview of the sensing and analysis that AMI-C compliant components and devices shall support. This section also recommends characteristics of diagnostic tools.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 11452-4, *Road vehicles — Component test methods for electrical disturbances from narrowband radiated electromagnetic energy — Part 4: Bulk current injection [BCI]*

ISO 16750-1, *Road vehicles — Environmental conditions and testing for electrical and electronic equipment — Part 1: General*

ISO 16750-2, *Road vehicles — Environmental conditions and testing for electrical and electronic equipment — Part 2: Electrical loads*

ISO 175, *Plastics — Methods of test for the determination of the effects of immersion in liquid chemicals*

ISO 1817, *Rubber, vulcanized — Determination of the effects of liquids*

ISO 6722, *Road vehicles — 60 V and 600 V single-core cables — Dimensions, test methods and requirements*

ISO 7637-1, *Road vehicles — Electrical disturbances by conduction and coupling — Part 1: Definitions and general considerations*

ISO 7637-2, *Road vehicles — Electrical disturbances by conduction and coupling — Part 2: Electrical transient conduction along supply lines only*

ISO 8092-2, *Road vehicles — Connections for on-board electrical wiring harnesses — Part 2: Definitions, test methods and general performance requirements*

ISO 16750-3, *Road vehicles — Environmental conditions and testing for electrical and electronic equipment — Part 3: Mechanical loads*

ISO 16750-4, *Road vehicles — Environmental conditions and testing for electrical and electronic equipment — Part 4: Climatic loads*

ISO 16750-5, *Road vehicles — Environmental conditions and testing for electrical and electronic equipment — Part 5: Chemical loads*

IEC 60068-2-27, *Environmental testing. Part 2: Tests — Test Ea and guidance: Shock*

IEC 60068-2-28, *Environmental testing. Part 2: Tests — Guidance for damp heat tests*

IEC 60068-2-32, *Environmental testing. Part 2: Tests — Test Ed: Free fall*

IEC 60695-11-10, *Fire hazard testing — Part 11-10: Test flames — 50 W horizontal and vertical flame test*

IEC 60793-1-40, *Optical fibres — Part 1-40: Measurement methods and test procedures — Attenuation*

IEC 60794-1-2, *Optical fibre cables — Part 1-2: Generic specification — Basic optical cable test procedures*

IEC 61280-1-1, *Fibre optic communication subsystem basic test procedures — Part 1-1: Test procedures for general communication subsystems — Transmitter output optical power measurement for single-mode optical fibre cable*

IEC 61300-3-8, *Fibre optic interconnecting devices and passive components — Basic test and measurement procedures — Part 3-8: Examinations and measurements — Ambient light susceptibility*

3 Environment

3.1 Mounting location in the vehicle

In current or future designs of road vehicles, systems, components and devices are mounted in almost any location of the vehicle. The environmental requirements for each specific application depend highly on its mounting location. Each location in the vehicle has a distinct set of environmental loads. For example, the range of temperatures in the luggage compartment differs from the range of temperatures in the passenger compartment. Devices installed in doors are exposed to a high number of mechanical shocks from door slamming.

3.2 Component or device compliance test procedure

The following tests shall be conducted as appropriate to ensure that physical components or devices comply with performance requirements. The pass/fail criteria listed for each test constitutes the performance requirements for the parameter being tested. Perform the sequences of a test in order, as indicated by the sequence number.

3.2.1 Visual and dimensional inspection

Sample size: 2 AMI-C compliant devices

Seq #	Test	Reference spec	Test criteria	Pass/fail criteria
1	Visual and dimensional	EIA 455-13A	Verify material, finish, and standards. Perform dimensional inspection for compliance with detailed drawing.	No non-conformances.

3.2.2 General inspection

The following quantities assume all tests are run.

Sample size: 54 devices

Seq #	Test	Reference spec	Test criteria	Pass/fail criteria
1	Functional, visual and parametric	EIA 455-13A	Confirm part number, condition, conformance.	No defects that would impair normal operation or deviate from dimensional tolerances

3.2.3 Combined environment

This test simulates the environment in a vehicle.

Sample size: 12 devices

Seq #	Test	Reference spec	Test criteria	Pass/fail criteria
1	Durability	EIA 455-21	Mate & un-mate connector 10 times	Functional class A as defined in ISO 16750-1
2	High temperature aging	ISO 16750-4	Temperature aging 500 hours at 85 °C	Functional class A as defined in ISO 16750-1

Seq #	Test	Reference spec	Test criteria	Pass/fail criteria
3	Vibration	ISO 16750-3	Combined temperature and vibration Max temperature Class 2: 85 °C	Functional class A as defined in ISO 16750-1
4	Thermal shock	ISO 16750-4	Rapid change of temperature Max temperature 85 °C	Functional class A as defined in ISO 16750-1
5	Humidity (cyclic)	ISO 16750-3	Para: temperature / humidity cycling	Functional class A as defined in ISO 16750-1

3.2.4 Temperature exposure

Sample size: 12 devices.

Seq #	Test	Reference spec	Test criteria	Pass/fail criteria
1	Low temperature exposure and operation	ISO 16750-4	Para - low temperature exposure with and without electrical operation. 24 hrs at −40 °C/Tmin for 24 hrs.	Functional class A as defined in ISO 16750-1 Failure mode is insufficient frost resistance/electrical malfunction.
2	High temperature exposure and operation	ISO 16750-4	Para - high temperature exposure with (6 devices) and without (6 devices) electrical operation. Dry heat @ +85 °C for 48 hrs/ Dry heat at Tmax for 96 hrs.	Functional class A as defined in ISO 16750-1 Failure mode is insufficient heat resistance/electrical malfunction.
3	Powered thermal cycle	ISO 16750-4	Para 5.3.2, varying temperatures with electrical operation	Functional class A as defined in ISO 16750-1 Failure mode is electrical malfunction.
4	Thermal shock resistance	ISO 16750-4	Para 5.3.3 Rapid change of temperature with specified transition duration – 6 cycles	Functional class A as defined in ISO 16750-1 Failure modes are mechanical cracking of materials or seal failures.
5	Powered vibration endurance/ audible noise under vibration	See *Powered vibration endurance test criteria* (4.7.11) in this document.	See *Powered vibration endurance test criteria* (4.7.11) in this document.	Functional class A as defined in ISO 16750-1
6	Medium mechanical shock	IEC 68-2-27 IEC 68-2-32	Subject component to six 50G 10msec half-sine shock pulses, one in each opposite direction of each perpendicular axis.	Functional class A as defined in ISO 16750-1

3.2.5 Water, humidity resistance

Sample size: 6 devices.

Seq #	Test	Reference spec	Test criteria	Pass/fail criteria
1	Humidity and temperature cycle	ISO 16750-4	Para - Simulate the use of the component/device under high ambient humidity.	Functional class A as defined in ISO 16750-1 Failure mode is electrical malfunction caused by moisture.
2	Water/ fluid ingress	ISO 16750-4	Para - water/fluid spills on component/device.	Functional class A as defined in ISO 16750-1 Failure mode is electrical malfunction.

3.2.6 Salt, chemical resistance

Sample size: 6 devices.

Seq #	Test	Reference spec	Test criteria	Pass/fail criteria
1	Salt mist - Atmosphere	ISO 16750-4	Para - resistance to corrosion	Functional class A as defined in ISO 16750-1 Failure mode is corrosion.
2	Chemical resistance	ISO 16750-5	Resistance to chemical agents.	Functional class A as defined in ISO 16750-1

3.2.7 Mechanical endurance

Sample size: 6 devices.

Seq #	Test	Reference spec	Test criteria	Pass/fail criteria
1	Thermal shock resistance	ISO 16750-4	Para - rapid change of temp with specified transition duration – 6 cycles	Functional class A as defined in ISO 16750-1 Failure modes are mechanical cracking of materials or seal failures.
2	Powered vibration endurance	See *Powered vibration endurance test criteria* in this document.	See *Powered vibration endurance test criteria* in this document.	Functional class A as defined in ISO 16750-1
3	Dust intrusion	ISO 16750-4	Para - resistance to dust intrusion.	Functional class A as defined in ISO 16750-1

3.2.8 Thermal shock

Sample size: 3 devices.

Seq #	Test	Reference spec	Test criteria	Pass/fail criteria
1	Thermal shock endurance	ISO 16750-4	Para - Rapid change of temp with specified transition duration – 1000 cycles	Functional class A as defined in ISO 16750-1

3.2.9 Temperature life

Sample size: 6 devices

Seq #	Test	Reference spec	Test criteria	Pass/fail criteria
1	High Temperature Endurance	IEC 68-2-2B	Cycle between modes every 10 hrs for a total test time of 1000 hrs at the test maximum operating temperature Tmax.	Functional class A as defined in ISO 16750-1

3.2.10 Mechanical shock

Sample size: 3 devices

Seq #	Test	Reference spec	Test criteria	Pass/fail criteria
1	Package drop	ISO 16750-3	Para - free fall	Functional class A as defined in ISO 16750-1 Failure mode is mechanical damage.

3.2.11 Powered vibration endurance test criteria

Sample size 3

Seq #	Test	Reference spec	Test criteria	Pass/fail criteria
1	Vibration endurance	AMI-C specified		

Table 1 — Vibration endurance test criteria

Frequency	Amplitude	Sweep	Time Sweep	Number of axes	Number of sweeps per axis	Total	
						Sweeps	Duration
5-12.2 Hz 12.2-100 Hz 101-200 Hz	10 mm peak to peak 3.0 G 0 peak 1.5 G 0 peak	log	20 min	3	18	54	18 H

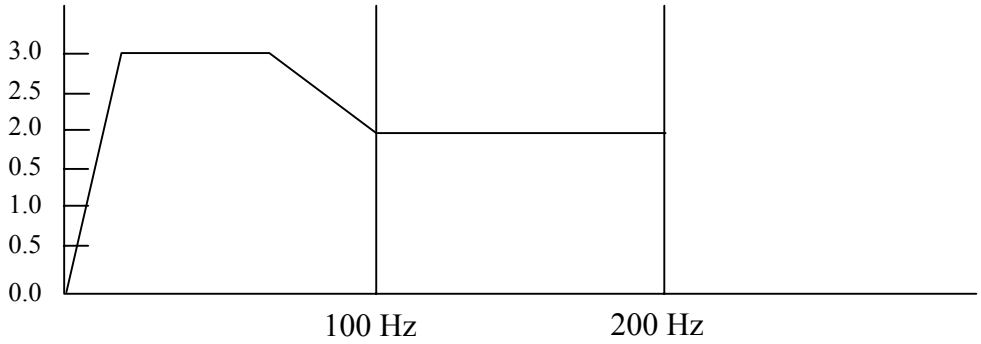

Figure 1 — Powered vibration endurance test criteria

3.2.11.1 Vibration pass/fail criteria

The following items are the requirements for measuring audible noise under vibration:

— The units shall be tested with a sinusoidal acceleration from 10 to 200 Hz.

— Acceleration amplitude shall be 1G 0 peak from 10 to 100 Hz and 0.5 0 peak from 101 to 200 Hz.

— Frequency sweep shall be linear, constant time per frequency, and have a duration of 10 minutes to cover 10 to 200 Hz range.

— Under the above vibration profile, the unit shall not emit an overall “A” weighted noise SPL greater than 70 dB using 1/3 octave analysis for the 25 Hz to 20 kHz frequency range, 1/8 second integration time per sample and peak hold mode.

— Place the microphone between 0.1 and 1 meter from the unit. Adjust reported noise measurements to reflect equivalent SPL at 0.1 meter. The above noise requirements (70 dB maximum SPL) are for the 0.1 meter placement.

3.3 Component or device electromagnetic compatibility test procedure

This standard establishes verification requirements for the control of the electromagnetic interference characteristics (emission and susceptibility) of electronic, electrical, equipment and subsystems designed or procured in compliance with this standard requirements. Such equipment and subsystems may be used independently or as an integral part of other subsystems or systems.

The following tests shall be conducted as appropriate to ensure that physical components or devices comply with this standard performance requirements. The pass/fail criteria listed for each test constitutes the performance requirements for the parameter being tested. Perform the sequences of a test in order, as indicated by the sequence number.

3.3.1 General inspection

The following quantities assume all tests are run.

Sample size: 8 devices

Seq #	Test	Reference spec	Test criteria	Pass/fail criteria
1	Functional, visual and parametric	EIA 455-13A	Confirm part number, condition, conformance.	No defects that would impair normal operation or deviate from dimensional tolerances

3.3.2 Emissions test procedure

Sample size: 2 devices

Seq #	Test	Reference spec	Test criteria	Pass / fail criteria
1	Radiated Emissions	CISPR 25	See Table 2.	Radiated emissions below requirements
2	Conducted Emissions	CISPR 25	See Table 3.	Conducted emissions below requirements

3.3.2.1 Radiated emissions test criteria

The table below shows the number of frequencies per band during emissions testing.

Table 2 — Narrowband radiated emissions specification

Frequency (MHz)	dBuV/m	Comments
0.15…30	30	Plotted in typical CISPR format up to 1000 MHz
30…400	10	Plotted in typical CISPR format up to 1000 MHz
400…1000	22…32	Plotted in typical CISPR format up to 1000 MHz
1567-1574 1574-1576 1576-1583	50-10 10 10-15	Use of high gain *(38 dB gain, 0.5 dB noise figure)* Low Noise Amplifier is required to decrease noise floor, Plotted as individual band
2308…2362	25	Use of high gain *(38 dB gain, 0.5 dB noise figure)* Low Noise Amplifier is required to decrease noise floor, Plotted as individual band

Table 3 — Narrowband conducted emissions specification

Frequency (MHz)	dBuV/m	Comments
0.15…0,.45	60	Plotted in typical CISPR format
0.45…1.75	34	
1.75…30	39	

3.3.3 Radiated and conducted immunity test procedure

Sample size: 2 devices

Seq #	Test	Reference spec	Test criteria	Pass / fail criteria
1	Direct radiation test	SAE J1113-21	See 3.3.3.1 and Table 4	Operate properly during and after exposure - according to test plan created with appendix B
2	Bulk current injection	ISO 11452-4	See - Critical vehicle functions are considered “Level 2” functions and non-critical functions are considered “Level 1” functions.	Operate properly during and after exposure - according to test plan created with appendix B
3	Parallel wire misc. noise	SAE J1113-12 Appendix B	See - Noise from the relay shall not affect the operation of the Device Under Test (DUT). This test will be performed by simulating the coupling on one unshielded twisted pair (UTP) at a time. Each UTP will be exposed to the noise for 10 seconds.	Operate properly during and after exposure - according to test plan created with appendix B

3.3.3.1 Radiated immunity – test criteria

The following table shows the requirements levels when using the direct radiation chamber to measure the immunity of components and subsystems to electromagnetic fields.

Table 4 — Radiated immunity reverberation requirement table

Freqency range	Level 2 (V/m)	Level 1 (V/m)	Modulation
400 MHz to 1 GHz	100	50	CW,
1 GHz to 2 GHz	30	15	CW, AM 80%
800 MHz to 2 GHz	70	70	Pulse PRR=50 Hz, PD=6.67 msec and Pulse PRR=217 Hz, PD=0.57 msec

Pass / fail criteria: Shall operate as designed during and after exposure.

The field strength requirements are peak levels.