INTERNATIONAL STANDARD

ISO 20860-2

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Road vehicles — 50 Ω impedance radio frequency connection system interface —

Part 2: Test procedures

Véhicules routiers — Interface de système de connexion de radiofréquence d'une impédance de 50 Ω —
Partie 2: Méthodes d'essai

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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 20860-2 was prepared by Technical Committee ISO/TC 22, *Road vehicles*.

ISO 20860 consists of the following parts, under the general title *Road vehicles — 50 Ω impedance radio frequency connection system interface*:

— *Part 1: Dimensions and electrical requirements*

— *Part 2: Test procedures*

Road vehicles — 50 Ω impedance radio frequency connection system interface —

Part 2: Test procedures

1 Scope

This part of ISO 20860 specifies the tests for male and female connectors of the 50 Ω impedance interface for radio frequency applications in road vehicles, and ensures communication to and within road vehicles.

These tests apply to all coaxial connectors for road vehicles with a 50 Ω radio frequency interface in accordance with ISO 20860-1.

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/TS 16949, *Quality management systems — Particular requirements for the application of ISO 9001:2000 for automotive production and relevant service part organizations*

ISO 20860-1, *Road vehicles — 50 Ω impedance radio frequency connection system interface — Part 1: Dimensions and electrical requirements*

IEC 60068-2-6, *Environmental testing — Part 2-6: Tests — Test Fc: Vibration (sinusoidal)*

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

IEC 60169-10, *Radio-frequency connectors — Part 10: R.F. coaxial connectors with inner diameter of outer conductor 3 mm (0,12 in) with snap-on coupling — Characteristic impedence 50 ohms (Type SMB)*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 20860-1 and the following apply.

3.1.1
adapter "Adap 1"
Adap 1
apparatus consisting of a male ISO 20860-1 connector, mateable with a female ISO 20860-1 connector and on the other side with an SMA female connector

3.1.2
adapter “Adap 2”
Adap 2
apparatus consisting of a female ISO 20860-1 connector, mateable with a male ISO 20860-1 connector and on the other side with an SMA female connector

3.2 Abbreviated terms

CT/A continuity totalizer/analyzer

NWA network analyzer

PC printed circuit

RF radio frequency

SMA subminiature version A

VSWR voltage standing wave ratio

4 Principle

Connectors in accordance with ISO 20860-1 need to be tested as one unit consisting of connector and cable. The cable itself and the quality of the application to the connector can impact the test results. Therefore, only those cables approved by the vehicle manufacturer and those tools and processes recommended by the connector manufacturer shall be used for the preparation of the test samples. These tools and processes should be as similar as possible to those used for the series production. This instruction shall be applied to PC boards as appropriate, in the case of testing board mount connectors.

The test procedures are not intended to test the samples beyond their limits of resilience. After the tests, the samples shall not show any damage due to the excessive loads applied.

The condition of the test samples shall be the same as in regular production. The test samples shall not be specially prepared for the test procedures, apart from as specified in this part of ISO 20860.

The test procedures are planned in such a way that the test samples shall pass through one test sequence. If the vehicle manufacturer so requests, the test samples may be used for several test sequences. All individual requirements shall be fulfilled in that case as well.

All test results, laboratory reports and calibration records shall be stored in a central file. Such storage shall be in accordance with established ISO/TS 16949 requirements.

5 Preparation of the test samples

5.1 Dimensional characteristics

The part construction of the test samples shall conform to the dimensions, shape and detail attributes specified in ISO 20860-1 and as defined in the latest revision of the manufacturer's applicable part drawing(s).

5.2 Material characteristics

All material used in each test sample shall conform to the specifications in ISO 20860-1 and as defined in the latest revision of the manufacturer's applicable part drawing(s).

5.3 Making of the test samples

The quantity and details relative to making the test cable assemblies are given in the corresponding test procedures. The length of the cable assembly is the distance between the two reference planes as defined in ISO 20860-1, with an accuracy of ± 3 mm. The test samples shall be marked so that they can be identified individually during and after completion of each test sequence.

5.4 Quality test of the test samples

All dimensions specified in ISO 20860-1 shall be tested by adequate means. It shall be ensured that the centre contact and the outer contact of the samples are continuously conductive.

NOTE For proof of conductivity, flexible contact parts can be touched, but it is advisable not to expose them to a mating cycle.

5.5 Documentation of the test samples

Each single test cable shall be appropriately identified with a unique label, so that test data can be recorded and retained for evidence.

6 Visual inspection

6.1 Purpose

This test shall be used to document the physical appearance of the test samples. A comparison shall then be made with other test samples. In most cases, examinations shall be carried out by a person with normal or corrected vision and normal colour sensitivity, under cool white fluorescent lighting. Conformity with RAL colours shall be proven by comparison with the RAL colour table (see Reference [1]). An identical match is not required, but there shall be clear identification with the intended colour.

6.2 Apparatus

6.2.1 Magnification apparatus 20-times (as required).

6.2.2 Camera, digital camera or **video recorder**.

6.2.3 RAL colour table or **RAL-K5 reference kit** (see Reference [1]).

6.3 Test samples

The visual inspection shall be part of all test procedures. All test samples shall be inspected before and after testing. The cables and connectors that belong to the test apparatus shall be inspected and documented.

6.4 Reference samples

An additional and appropriately identified untested sample from each test group shall be retained for post-test physical comparisons. Alternatively, photographs and/or videos are encouraged as a more complete means of documentation instead of the extra sample.

6.5 Procedure

Visually inspect each test specimen prior to testing and/or conditioning. Any manufacturing or material defects such as cracks, tarnishing, flash, etc. shall be documented. Special attention shall be paid to contact areas and locking mechanisms.

Record in detail the condition of the samples before and after the test procedures and document any differences that may occur.

6.6 Requirements

No deviations which may affect the electrical or mechanical performance of the samples, or degrade the long term performance of the samples, shall be allowed.

7 Connector electrical tests

7.1 General

Perform the tests in accordance with the corresponding test sequence plans in Clause 10. For each sequential test, the same test samples shall be used.

7.2 Contact resistance

7.2.1 Purpose

This test, which conforms to IEC 60512-2-1, determines the electrical resistance of both the outer conductor crimps and corresponding contact interface and the inner conductor crimps and corresponding contact interface.

7.2.2 Apparatus

7.2.2.1 A **micro-ohmmeter**, which limits the open circuit voltage to 20 mV and limits the current applied to 100 mA.

7.2.3 Test samples

Ten sample test cables, each 100 mm cable dielectric length, with a female connector in accordance with ISO 20860-1 on one end and a male SMA connector on the other end.

Ten sample test cables, each 100 mm cable dielectric length, with a male connector in accordance with ISO 20860-1 on one end and a male SMA connector on the other end.

7.2.4 Reference samples

Three reference cable assemblies, each 200 mm in length, minus the equivalent length of the mated ISO 20860-1 connectors, with male SMA connectors on both ends.

7.2.5 Procedure

Mate two sample cable assemblies. The SMA connectors on the remaining ends shall be connected in an adequate way to the test apparatus. The resistance of the whole cable length between the SMA connectors shall be determined for the centre conductor and for the outer conductor.

The same measurement shall be carried out for the reference sample cable assemblies in order to determine the average resistance of the SMA connectors and the cable itself. This resistance shall be deducted from the resulting resistance of the cable assemblies with the two test sample connectors.

7.2.6 Requirements

The total contact resistance of both the inner conductor and the outer conductor shall be in accordance with ISO 20860-1.

7.3 Insulation resistance

7.3.1 Purpose

This test, which conforms to IEC 60512-3-1, Method A, verifies that the electrical resistance between the centre contact and the outer contact will prevent detrimental electrical conductivity.

7.3.2 Apparatus

7.3.2.1 A **megohmmeter**, capable of detecting 25 µA or less of leakage current at 500 V d.c.

7.3.3 Test samples

Use ten test samples as described in 7.2.3.

7.3.4 Reference samples

No reference samples are required.

7.3.5 Procedure

Mate two sample cable assemblies. The SMA connectors on the remaining ends shall be connected in an adequate way to the test apparatus. Raise the voltage to 500 V d.c. and maintain for a minimum of 15 s. Perform the test at a relative humidity of between 45 % and 75 %. The resistance shall be measured and recorded. The minimum value shall be used for the requirements.

7.3.6 Requirements

The centre contact to outer contact resistance shall comply with ISO 20860-1.

7.4 Dielectric withstand voltage

7.4.1 Purpose

This test, which conforms to IEC 60512-4-1, Method A, shall be used to verify that the connection is able to withstand momentary over-potentials. It serves to determine whether insulating materials and spacing within the connector are adequate.

7.4.2 Apparatus

7.4.2.1 **Adjustable a.c. power supply**.

7.4.3 Test samples

Use ten test samples as described in 7.2.3.

7.4.4 Reference samples

No reference samples are required.

7.4.5 Procedure

Mate two test sample cable assemblies. The SMA connectors on the remaining ends shall be connected in an adequate way to the test apparatus. The a.c. voltage shall be linearly increased to 500 V and maintained for 60 s. Perform the test at a relative humidity of between 45 % and 75 %.

7.4.6 Requirements

No dielectric breakdowns or flashover are permitted.

7.5 Return loss (VSWR)

7.5.1 Purpose

This test verifies the RF electrical load corresponding to 50 Ω systems.

7.5.2 Apparatus and calibration

7.5.2.1 An **adapter "Adap 1"** with an inherent return loss of more than 34 dB[1)] to test a female connector in accordance with ISO 20860-1.

7.5.2.2 An **adapter "Adap 2"** with an inherent return loss of more than 34 dB[1)] to test a male connector in accordance with ISO 20860-1.

The tests are carried out with an NWA with a standard PC 3,5 (f) port, which shall be adjusted to "one-port" return loss measurement in the frequency range between 50 MHz and 4 000 MHz.

7.5.3 Test samples

Use ten test samples as described in 7.2.3.

7.5.4 Reference samples

Use the same reference samples as in 7.2.4.

The reference samples are verified as described below.

The measurement with the NWA shall not result in a return loss of:

— ⩽ 34 dB at frequencies ⩽ 2 000 MHz[2)];

— ⩽ 30 dB at frequencies between 2 000 MHz and 4 000 MHz[3)].

7.5.5 Procedure

The female connector shall be in accordance with ISO 20860-1.

The test sample shall be connected with the measurement port at the NWA. The adapter "Adap 1" shall be connected to the test sample and terminated with a 50 Ω load on the SMA connector side (see Figure 1).

1) This equates to a VSWR of 1,04.

2) This equates to a VSWR of more than 1,04 or a reflection factor of more than 0,02.

3) This equates to a VSWR of more than 1,06 or a reflection factor of more than 0,031 6.

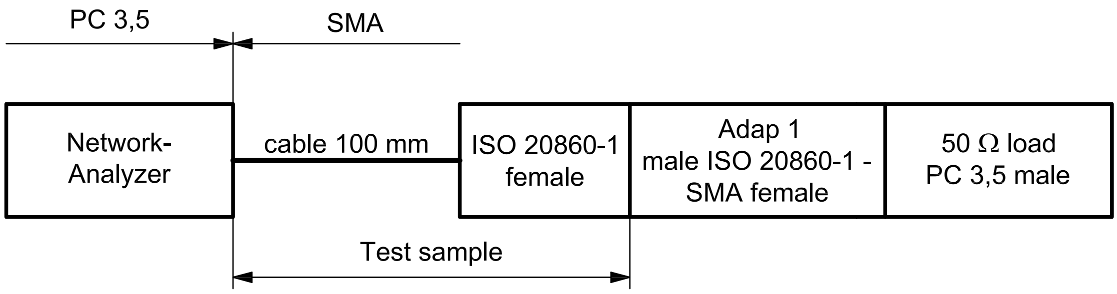

Figure 1 — Test configuration for female connector

The male connector shall be in accordance with ISO 20860-1.

The test sample shall be connected with the measurement port at the NWA. The adapter "Adap 2" shall be connected to the test sample and terminated with a 50 Ω load on the SMA connector side (see Figure 2).

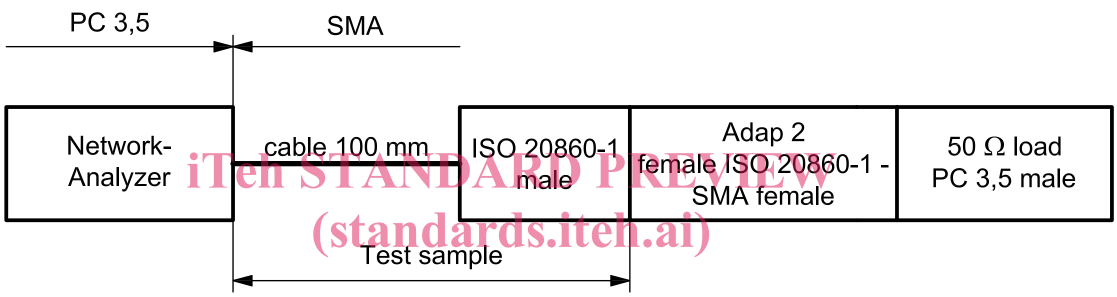

Figure 2 — Test configuration for male connector

7.5.6 Requirements

For the requirements of return loss, see ISO 20860-1.

7.6 Insertion loss

7.6.1 Purpose

This test verifies the dielectric losses of insulating materials and resistance losses of contacts.

7.6.2 Apparatus and calibration

The tests are carried out with an NWA, which shall be adjusted to "full two-port" measurement in the frequency range between 50 MHz and 4 000 MHz.

7.6.3 Test samples

Use ten test samples as described in 7.2.3. Ten additional cable assemblies are needed, as follows:

— five cables of 100 mm length, each assembled with two female connectors in accordance with ISO 20860-1;

— five cables of 100 mm length, each assembled with two male connectors in accordance with ISO 20860-1.

