

INTERNATIONAL STANDARD

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Specification for the testing of balanced and coaxial information technology cabling –

Part 2: Cords as specified in ISO/IEC 11801-1 and related standards

Spécification relative aux essais des câblages symétriques et coaxiaux des technologies de l'information –

Partie 2: Cordons tels que spécifiés dans l'ISO/IEC 11801-1 et normes associées

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Specification for the testing of balanced and coaxial information technology cabling –

Part 2: Cords as specified in ISO/IEC 11801-1 and related standards

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Spécification relative aux essais des câblages symétriques et coaxiaux des technologies de l'information – IEC 61935-2:2022

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**SPECIFICATION FOR THE TESTING OF BALANCED AND
COAXIAL INFORMATION TECHNOLOGY CABLING –****Part 2: Cords as specified in ISO/IEC 11801-1 and related standards**

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IEC 61935-2 has been prepared by IEC technical committee 46: Cables, wires, waveguides, R.F. connectors, R.F. and microwave passive components and accessories. It is an International Standard.

This fourth edition cancels and replaces the third edition published in 2010. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) inclusion of cords up to category 8.1 and category 8.2, as defined in ISO/IEC 11801-1.

The text of this International Standard is based on the following documents:

Draft	Report on voting
46/868/FDIS	46/869/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

A list of all parts of the IEC 61935 series, under the general title *Specification for the testing of balanced and coaxial information technology cabling*, can be found on the IEC website.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

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INTRODUCTION

This part of IEC 61935 covers testing of balanced and coaxial cords, for use as equipment cords, patch cords, and CP cords, as specified in ISO/IEC 11801-1 and related standards.

The test methods described in this document are suitable for any balanced or coaxial cords or cable assemblies that include connector terminations at each end.

Coaxial cords for connecting equipment are constructed using cable conforming to the IEC 61196-1 series and connectors conforming to the IEC 61169-1 series.

Balanced cords for connecting equipment are constructed using cable conforming to the IEC 61156-1 series and connectors conforming to the IEC 60603-7 series, IEC 61076-3-104, IEC 61076-3-110, IEC 61076-2-101, and IEC 61076-2-109.

Therefore, an object of this document is to provide test methods to ensure compatibility of cords to be used in cabling in accordance with ISO/IEC 11801-1 and to demonstrate their performance and reliability during their operational lifetime.

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SPECIFICATION FOR THE TESTING OF BALANCED AND COAXIAL INFORMATION TECHNOLOGY CABLING –

Part 2: Cords as specified in ISO/IEC 11801-1 and related standards

1 Scope

This part of IEC 61935 specifies test methods for balanced and coaxial cords, which are used as equipment cords, patch cords, and CP cords, within cabling systems, in accordance with ISO/IEC 11801-1. The test methods and associated requirements are provided to demonstrate performance and reliability and to ensure compatibility of these balanced and coaxial cords during their operational lifetime. This document may also be used for providing test methodology for assessing the performance of other cords.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

IEC 60068-2-61, *Environmental testing – Part 2-61: Test methods – Test Z/ABDM: Climatic sequence*

IEC 60512-26-100, *Connectors for electronic equipment – Tests and measurements – Part 26-100: Measurement setup, test and reference arrangement and measurements for connectors according to IEC 60603-7 – Tests 26a to 26g*

IEC 60512-27-100, *Connectors for electronic equipment – Tests and measurements – Part 27-100: Signal integrity tests up to 500 MHz on 60603-7 series connectors – Tests 27a to 27g*

IEC 60512-28-100, *Connectors for electronic equipment – Tests and measurements – Part 28-100: Signal integrity tests up to 2 000 MHz – Tests 28a to 28g*

IEC 60512-29-100, *Connectors for electronic equipment – Tests and measurements – Part 29-100: Signal integrity tests up to 500 MHz on M12 style connectors – Tests 29a to 29g*

IEC 60603-7, *Connectors for electronic equipment – Part 7: Detail specification for 8-way, unshielded, free and fixed connectors*

IEC 60603-7-1, *Connectors for electronic equipment – Part 7-1: Detail specification for 8-way, shielded, free and fixed connectors*

IEC 60603-7-2, *Connectors for electronic equipment – Part 7-2: Detail specification for 8-way, unshielded, free and fixed connectors, for data transmissions with frequencies up to 100 MHz*

IEC 60603-7-3, *Connectors for electronic equipment – Part 7-3: Detail specification for 8-way, shielded, free and fixed connectors, for data transmission with frequencies up to 100 MHz*

IEC 60603-7-4, *Connectors for electronic equipment – Part 7-4: Detail specification for 8-way, unshielded, free and fixed connectors, for data transmissions with frequencies up to 250 MHz*

IEC 60603-7-5, *Connectors for electronic equipment – Part 7-5: Detail specification for 8-way, shielded, free and fixed connectors, for data transmissions with frequencies up to 250 MHz*

IEC 60603-7-7, *Connectors for electronic equipment – Part 7-7: Detail specification for 8-way, shielded, free and fixed connectors for data transmission with frequencies up to 600 MHz*

IEC 60603-7-41, *Connectors for electronic equipment – Part 7-41: Detail specification for 8-way, unshielded, free and fixed connectors, for data transmissions with frequencies up to 500 MHz*

IEC 60603-7-51, *Connectors for electronic equipment – Part 7-51: Detail specification for 8-way, shielded, free and fixed connectors, for data transmissions with frequencies up to 500 MHz*

IEC 60603-7-71, *Connectors for electronic equipment – Part 7-71: Detail specification for 8-way, shielded, free and fixed connectors, for data transmission with frequencies up to 1 000 MHz*

IEC 60603-7-81, *Connectors for electronic equipment – Part 7-81: Detail specification for 8-way, shielded, free and fixed connectors, for data transmissions with frequencies up to 2 000 MHz*

IEC 60603-7-82, *Connectors for electronic equipment – Part 7-82: Detail specification for 8-way, 12 contacts, shielded, free and fixed connectors, for data transmission with frequencies up to 2 000 MHz*

IEC 60966-1, *Radio frequency and coaxial cable assemblies – Part 1: Generic specification – General requirements and test methods*

IEC 61076-2-101, *Connectors for electronic equipment – Product requirements – Part 2-101: Circular connectors – Detail specification for M12 connectors with screw-locking*

IEC 61076-2-109, *Connectors for electronic equipment – Product requirements – Part 2-109: Circular connectors – Detail specification for connectors with M 12 × 1 screw-locking, for data transmission frequencies up to 500 MHz*

IEC 61076-3-104, *Connectors for electronic equipment – Product requirements – Part 3-104: Detail specification for 8-way, shielded free and fixed connectors for data transmissions with frequencies up to 2 000 MHz*

IEC 61076-3-110, *Connectors for electronic equipment – Product requirements – Part 3-110: Detail specification for free and fixed connectors for data transmission with frequencies up to 3 000 MHz*

IEC 61156-1, *Multicore and symmetrical pair/quad cables for digital communications – Part 1: Generic specification*

IEC TR 61156-1-2, *Multicore and symmetrical pair/quad cables for digital communications – Part 1-2: Electrical transmission characteristics and test methods of symmetrical pair/quad cables*

IEC 61156-5, *Multicore and symmetrical pair/quad cables for digital communications – Part 5: Symmetrical pair/quad cables with transmission characteristics up to 1 000 MHz – Horizontal floor wiring – Sectional specification*

IEC 61156-6, *Multicore and symmetrical pair/quad cables for digital communications – Part 6: Symmetrical pair/quad cables with transmission characteristics up to 1 000 MHz – Work area wiring – Sectional specification*

IEC 61156-9, *Multicore and symmetrical pair/quad cables for digital communications – Part 9: Cables for channels with transmission characteristics up to 2 GHz – Sectional specification*

IEC 61156-10, *Multicore and symmetrical pair/quad cables for digital communications – Part 10: Cables for cords with transmission characteristics up to 2 GHz – Sectional specification*

IEC 61169-1, *Radio-frequency connectors – Part 1: Generic specification – General requirements and measuring methods*

IEC 61169-1 (all parts), *Radio-frequency connectors – Part 1*

IEC 61169-2, *Radio-frequency connectors – Part 2: Sectional specification – Radio frequency coaxial connectors of type 9,52*

IEC 61169-24, *Radio-frequency connectors – Part 24: Sectional specification – Radio frequency coaxial connectors with screw coupling, typically for use in 75 Ω cable networks (type F)*

IEC 61196-1 (all parts), *Coaxial communication cables – Part 1*

IEC 61935-1, *Specification for the testing of balanced and coaxial information technology cabling – Part 1: Installed balanced cabling as specified in ISO/IEC 11801-1 and related standards*

IEC 61935-1-1, *Specification for the testing of balanced and coaxial information technology cabling – Part 1-1: Additional requirements for the measurement of transverse conversion loss and equal level transverse conversion transfer loss*

IEC 61935-1-2, *Specification for the testing of balanced and coaxial information technology cabling – Part 1-2: Installed balanced cabling as specified in ISO/IEC 11801 – Additional requirements for measurement of resistance unbalance with field test instrumentation*

IEC 62153-4-11, *Metallic communication cable test methods – Part 4-11: Electromagnetic compatibility (EMC) – Coupling attenuation or screening attenuation of patch cords, coaxial cable assemblies, pre-connectorized cables – Absorbing clamp method*

IEC 62153-4-15, *Metallic communication cable test methods – Part 4-15: Electromagnetic compatibility (EMC) – Test method for measuring transfer impedance and screening attenuation – or coupling attenuation with triaxial cell*

ISO/IEC 11801-1, *Information technology – Generic cabling for customer premises – Part 1: General requirements*

ISO/IEC 14763-4, *Information technology – Implementation and operation of customer premises cabling – Part 4: Measurement of end-to-end (E2E) links*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.1

cable assembly

combination of cable(s) and connector(s) with specified performance, used as a single unit intended to be a part of a cabling link as defined in ISO/IEC 11801-1 (or equivalent)

3.2

consolidation point cord

cabling between the consolidation point to the telecommunications outlet(s)

3.3

cord

cable, cable unit or cable element with a minimum of one termination; a cable assembly as defined in IEC 61935-1 whatever its targeted use

3.4

equipment cord

cord connecting to equipment

3.5

patch cord

cord specifically used to establish connections on a patch panel

3.6

work area cord

cord specifically connecting to work area equipment

4 Requirements

4.1 Cord components: cable and connector

The specifications in this document cover cords used within channels in cabling systems in accordance with ISO/IEC 11801-1, e.g. equipment cords, patch cords, work area cords, and consolidation point (CP) cords.

The cabling standards specified in ISO/IEC 11801-1 comprise two basic types of electrical cords, i.e. balanced and coaxial.

Cords shall conform to the requirements given in ISO/IEC 11801-1 and in the blank detail specifications.

Balanced cord cable components shall conform to the requirements given in IEC 61156-1, IEC 61156-5, IEC 61156-6, IEC 61156-9, and IEC 61156-10, and in the blank detail specifications. Balanced cord connector components shall conform to the requirements given in the IEC 60603-7 series, IEC 61076-3-104, IEC 61076-3-110, IEC 61076-2-101, and IEC 61076-2-109, and in the blank detail specifications; IEC 60603-7 series 8-pole RJ45 connector types include IEC 60603-7-1, IEC 60603-7-2, IEC 60603-7-3, IEC 60603-7-4, IEC 60603-7-5, IEC 60603-7-7, IEC 60603-7-41, IEC 60603-7-51, IEC 60603-7-71, IEC 60603-7-81, and IEC 60603-7-82.

Coaxial cord cable components shall conform to the requirements given in the IEC 61196-1 series, and in the blank detail specifications. Coaxial cord connector components shall conform to the requirements given in the IEC 61169-1 series, including IEC 61169-2, IEC 61169-24, and in the blank detail specifications.

The component cables and connectors for cords are specified in ISO/IEC 11801-1 and in the blank detail specifications.

These test methods and procedures for cords are specified in ISO/IEC 11801-1 and in its reference ISO/IEC 14763-4, standards for cabling channel conformance and test procedures.

These test procedures for cords conform to the test procedure standards listed in Table 1.

Table 1 – Test procedure standards for cords

Cord type	Coaxial cable cords	Balanced cable cords
Test procedure	IEC 60966-1	IEC 61935-1

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4.2 Cord tests

4.2.1 General

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Cords shall be tested in accordance with the procedures specified herein.

The cord tests include two groups of tests: acceptance tests that may be performed on each cord or representative samples, and periodic tests that are only performed on representative samples.

The acceptance tests described in this document shall be performed on a minimum sample of 5 % of each lot/batch of cords. It is recommended to perform the acceptance test of this document on each cord.

The periodic tests described in this document are type tests that shall be performed in accordance with the quality system of the manufacturer.

In addition to the detail specifications, other certification test schedules for cords can refer to these tests.

Parameters specified in this document, which are not tested in accordance with a particular detail specification, are tested by design by using qualified components, which are tested accordingly.

For other cords, the cables and connectors shall be assessed separately in accordance with their respective standard unless there are no component standards. In this case, all tests are performed on the cords, including interface tests.

4.2.2 Acceptance tests

Primary, electrical transmission, compliance tests, shall be performed:

- a) visual inspection (balanced and coaxial cords);
- b) wire map (balanced cords);
- c) return loss (balanced and coaxial cords);
- d) pair-to-pair NEXT and PS NEXT (balanced cords).

Additional optional tests may be performed when the compliance of cord or assembly components to respective component standards has not been assured:

- e) insertion loss and attenuation (balanced and coaxial cords);
- f) pair-to-pair ACRF and PS ACRF (balanced cords);
- g) alien crosstalk, PS ANEXT and PS AACRF, (balanced cords);
- h) unbalance attenuation, TCL and EL TCTL, (balanced cords);
- i) coupling attenuation (screened balanced cords);
- j) screening attenuation and transfer impedance (screened balanced and coaxial cords);
- k) propagation delay (balanced and coaxial cords);
- l) delay skew (balanced cords);
- m) DC resistance (balanced and coaxial cords);
- n) DC resistance unbalance within pairs (balanced cords);
- o) DC resistance unbalance between pairs (balanced cords).

The acceptance tests are described in Clause 5.

4.2.3 Periodic tests

Secondary, mechanical and environmental, qualification tests:

- a) tensile strength;
- b) flexure;
- c) bending/twisting;
- d) crushing;
- e) dust test;
- f) climatic sequence;

The periodic tests are described in detail in Clause 6.

4.3 Cord test procedure

4.3.1 General

Acceptance tests are based directly on the results of specific electrical transmission parameters' measurements, which are described herein. The electrical transmission parameters' measurements are made using qualified test fixtures with reference test heads.

Periodic tests are based indirectly on the results of electrical transmission parameters' measurements, the same as acceptance tests, which are made before and after subjecting a sample to specific mechanical and environmental conditioning procedures, which are also described herein.