

# INTERNATIONAL STANDARD

**IEC**  
**61935-2**

First edition  
2003-05

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**Generic cabling systems –  
Specification for the testing of balanced  
communication cabling in accordance  
with ISO/IEC 11801 –**

**Part 2:  
Patch cords and work area cords**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**GENERIC CABLING SYSTEMS –  
SPECIFICATION FOR THE TESTING OF BALANCED COMMUNICATION  
CABLING IN ACCORDANCE WITH ISO/IEC 11801 –**

**Part 2: Patch cords and work area cords**

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 61935-2 has been prepared by subcommittee SC 46A:Coaxial cables, of IEC technical committee TC 46: Cables, wires, waveguides, r.f. connectors, r.f. and microwave passive components and accessories.

The text of this standard is based on the following documents:

FDIS	Report on voting
46A/532/FDIS	46A/544/RVD

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until 2004. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

A bilingual edition of this standard may be issued at a later date.

## INTRODUCTION

Modular plug cords are constructed for connecting equipment using modular connecting hardware. It is known that connecting hardware performance is subject to influence by the properties of the modular plug termination and therefore modular plug cords should be tested to determine the quality of the assembly. Moreover, the performance of modular plug cords may differ due to the performances of the involved separate components depending upon the efficiency of the manufacturing procedure. Manufacturing procedures also impact on the reliability of these cords. Therefore, the object of this standard is to provide test methods to ensure compatibility of modular plug cords to be used in cabling according to ISO/IEC 11801. Also, it provides test methods and associated requirements to demonstrate the performance and reliability of these cords during their operational lifetime.

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# GENERIC CABLING SYSTEMS – SPECIFICATION FOR THE TESTING OF BALANCED COMMUNICATION CABLING IN ACCORDANCE WITH ISO/IEC 11801 –

## Part 2: Patch cords and work area cords

### 1 Scope

This part of IEC 61935 provides methods to ensure compatibility of modular plug cords to be used in cabling according to ISO/IEC 11801 and also provides test methods and associated requirements to demonstrate the performance and reliability of these cords during their operational lifetime.

### 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.

IEC 60068-2-61:1991, *Environmental testing – Part 2-61: Test methods – Test Z/ABDM: Climatic sequence*

IEC 60603-7, *Connectors for frequencies below 3 MHz for use with printed boards*

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 (CAT 6, unshielded)*<sup>1</sup>

IEC 61156, *Multicore and symmetrical pair/quad cables for digital communications*

IEC 61935-1:2000, *Generic cabling systems – Specification for the testing of balanced communication cabling in accordance with ISO/IEC 11801 – Part 1: Installed cabling*

ISO/IEC 11801:2002, *Information technology – Generic cabling for customer premises*

### 3 Definitions

For the purposes of this document, the definitions in IEC 61935-1 apply

### 4 General requirements and test configuration

#### 4.1 Cable and connector design

The design of the cables and connectors should conform to the applicable parts of IEC 61156 and IEC 60603 respectively as referred to into the ISO/IEC 11801.

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<sup>1</sup> To be published.



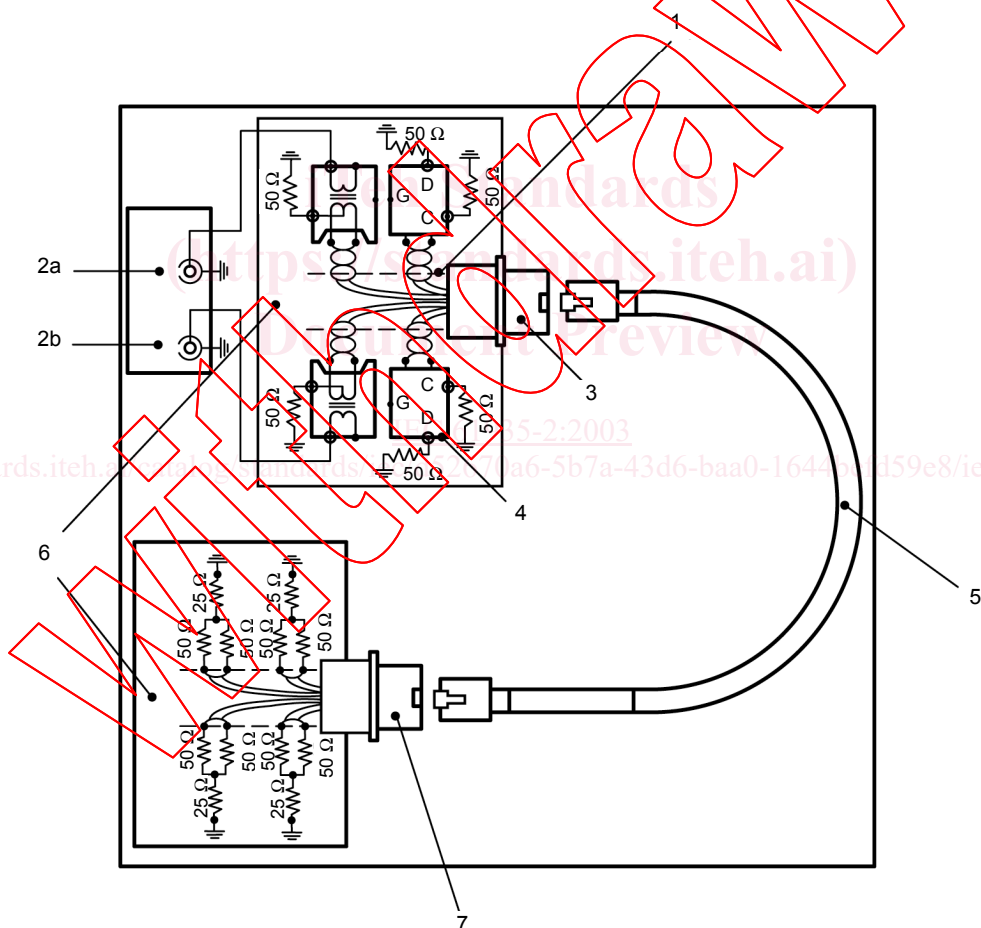
## 4.2 Cable and connector tests

Cables and connectors used in cable assemblies should be tested separately in accordance with IEC 61156-1 and 60603-7 respectively, even if they are not described in the IEC 61156-1 or the IEC 60603-7 series. These component tests do not need to be repeated on the cable assembly.

## 4.3 Test configuration and equipment

The reference measurement procedures that are described in this standard require the use of a network analyzer, r.f. transformers (baluns), twisted pair (TP) test leads and impedance matching terminations. Refer to IEC 61935-1 for requirements of test equipment. The nominal impedance for the test set-up and the terminations is 100  $\Omega$ . The same tests may be used for 120  $\Omega$  and 150  $\Omega$  patch cords, but the measurement methods have not been evaluated for these nominal impedance values.

The test configuration includes terminating test heads at each end of the patch cord as shown in Figure 1. The terminals on the test heads interface with the test equipment. Refer to IEC 61935-1 for detailed connection diagrams. All wire pairs shall be terminated with differential and common mode terminations per IEC 61935-1. Resistive type terminations are preferred.



IEC 1248/03

### Key

- |                           |                           |
|---------------------------|---------------------------|
| 1 Test interface          | 5 Modular cord under test |
| 2a Network analyzer - IN  | 6 Ground plane            |
| 2b Network analyzer - OUT | 7 Far end test head       |
| 3 Near end test head      |                           |
| 4 Balun                   |                           |

**Figure 1 – Transmission performance test configuration for patch cords**

#### 4.4 Modular plug cord tests requirements

The test methods described in this specification characterize modular plug cords. For certification purposes the test schedule refers to these tests.

The patch cord test requirements include tests that can be performed on each patch cord or representative samples produced and tests that are only performed on representative samples of patch cords. The sampling only tests (known as periodic tests) include:

- tensile strength;
- flexure;
- bending/twisting;
- crushing;
- dust test;
- climatic sequence;
- coupling attenuation.

The periodic tests are described in detail in Clause 6.

The tests that can be performed on each patch cord include (acceptance tests):

- visual inspection;
- wire map;
- pair-to-pair NEXT;
- return loss.

If the components used to assemble the patch cord are not certified to be compliant, the following additional tests should be performed:

- insertion loss (attenuation);
- ELFEXT;
- propagation delay;
- delay skew;
- d.c. resistance;
- d.c. resistance unbalance.

The requirements to be verified on each patch cord are described in detail in Clause 5.

#### 4.5 Pass/fail test limits

Pass/fail for the test procedure in this document may be affected by the measured properties of the test heads, as defined in Clause 7

### 5 Acceptance tests

#### 5.1 Visual inspection

Visual inspection of cords and work area cords is performed by observing with normal or corrected vision without any additional magnification:

- the condition, workmanship and finish are satisfactory;
- the marking, when specified in the relevant specification, is legible;
- mechanical damage is absent and there is no undesired movement or displacement of parts;

- flaking of materials or finishes is absent;
- the length as specified.

## 5.2 Wire map

A conductor map test is intended to verify correct pin termination at each end and to check for installation connectivity errors. For each of the conductors in the cable, and the screen(s), if any, the conductor map indicates:

- continuity to the remote end;
- shorts between any two or more conductors/screen(s);
- transposed pairs;
- reversed pairs;
- split pairs;
- any other connection errors.

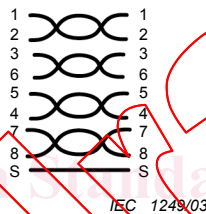


Figure 2 – Correct pairing

A reversed pair occurs when the polarity of one wire pair is reversed at one end of the link. See Figure 3a for an illustration of a reversed pair.

NOTE 1 In English, also called a tip/ring reversal.

A transposed pair occurs when the two conductors in a wire pair are connected to the position for a different pair at the remote connection. See Figure 3b for an illustration of transposed pairs.

NOTE 2 Transposed pairs are sometimes referred to as crossed pairs.

Split pairs occur when pin to pin continuity is maintained but physical pairs are separated. See Figure 3c for an illustration of split pairs.

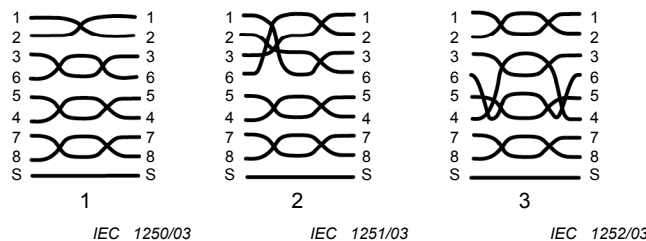


Figure 3a –  
Reversed pair

Figure 3b –  
Transposed pairs

Figure 3c – Split  
pairs

Figure 3 – Incorrect pairing

Wire map tests shall report "Pass" if cabling is determined to be correct.