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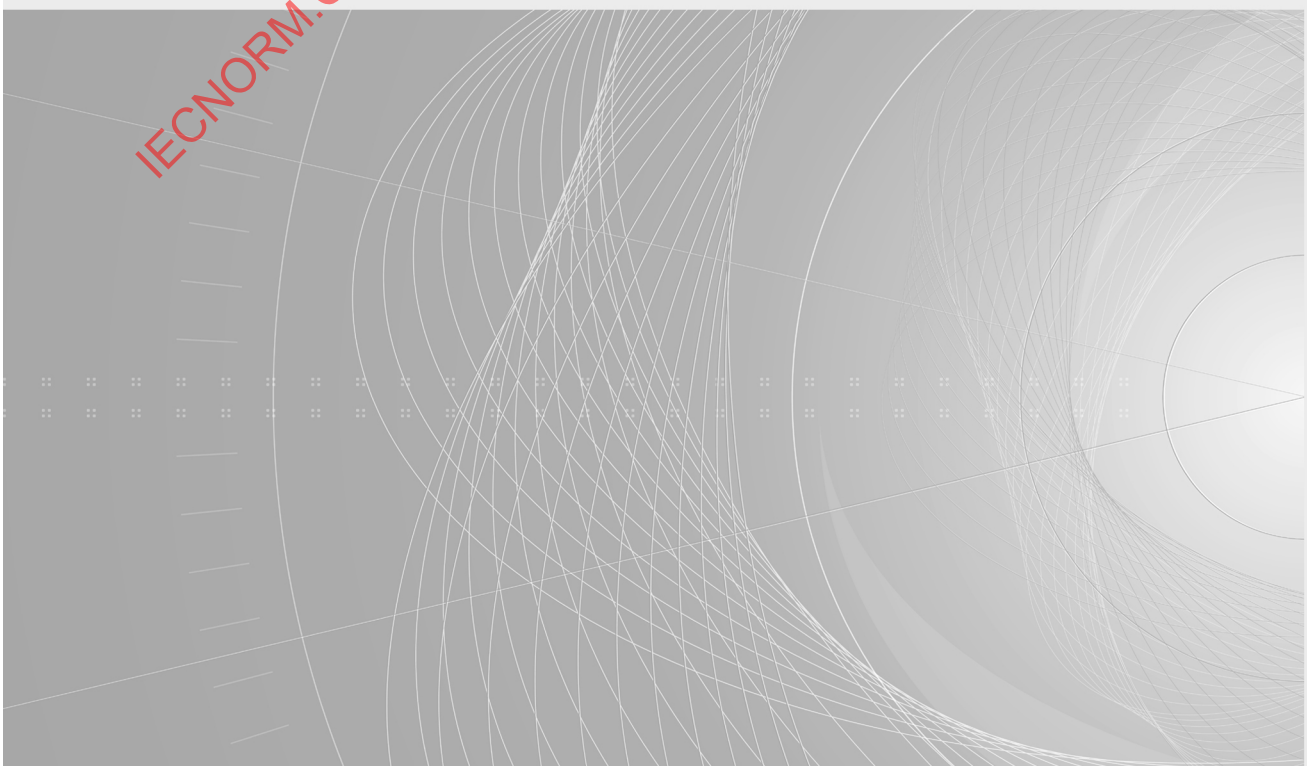
Edition 1.0 2018-02

INTERNATIONAL STANDARD

Information technology – Implementation and operation of customer premises cabling –
Part 4: Measurement of end-to-end (E2E) links



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INFORMATION TECHNOLOGY – IMPLEMENTATION AND OPERATION OF CUSTOMER PREMISES CABLING –

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FOREWORD

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International Standard ISO/IEC 14763-4 has been prepared by subcommittee SC 25: Interconnection of information technology equipment, of ISO/IEC joint technical committee 1: Information technology.

This International Standard has been approved by vote of the member bodies, and the voting results can be obtained from the address given on the second title page.

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

A list of all parts of the ISO/IEC 14763 series, published under the general title *Information technology – Implementation and operation of customer premises cabling*, can be found on the IEC and ISO websites.

INTRODUCTION

Balanced cabling is constructed for connecting equipment using free connectors. It is known that field termination in all parts of the channel has an influence on the channel performance.

Poor termination can cause problems in the channel performance and may affect reliable data transmission.

Until now, a verification of the field terminated cabling was done by measurement of the channel performance of Channel Class D or E according to ISO/IEC 11801-1. The measurement of Channel Class D or E excludes the connections at the end of the cable. The measurement of Channel Class D or E does not identify the influence to the performance caused by bad terminations of the connections at the end.

The measurement of performance of end-to-end (E2E) link includes the termination on both ends of balanced cabling.

This document describes the measurement of E2E links of two- and four-pair balanced cabling of 100 MHz of Class D and 250 MHz of Class E using laboratory and field tester measurement procedures.

The performance of E2E links is described in ISO/IEC TR 11801-9902.

INFORMATION TECHNOLOGY – IMPLEMENTATION AND OPERATION OF CUSTOMER PREMISES CABLING –

Part 4: Measurement of end-to-end (E2E) links

1 Scope

This part of ISO/IEC 14763 specifies the measurement at frequencies of E2E links of two- and four-pair balanced cabling of 100 MHz of Class D and 250 MHz of Class E including free connectors which terminate two and four pairs in both field and laboratory conditions.

The specifications for E2E links are described in ISO/IEC TR 11801-9902.

This document specifies laboratory and field measurement procedures. The requirements for accuracy to measure cabling parameters identified in ISO/IEC TR 11801-9902 are provided in IEC 61935-1 and IEC 61935-2.

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.

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

ISO/IEC TR 11801-9902:2017, *Information technology – Generic cabling for customer premises – Part 9902: End-to-end link configurations*

ISO/IEC 14763-2, *Information technology – Implementation and operation of customer premises cabling – Part 2: Planning and installation*

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 61918, *Industrial communication networks – Installation of communication networks in industrial premises*

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 and related standards*

IEC 61935-2, *Specification for the testing of balanced and coaxial information technology cabling – Part 2: Cords as specified in ISO/IEC 11801 and related standards*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 11801-1 and the following apply.

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

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

3.1.1
end-to-end link
end-to-end transmission path formed by structured cabling based on passive components including the portion of the end connection that is attached to the end equipment

3.2 Abbreviated terms

For the purposes of this document, the abbreviated terms given in ISO/IEC 11801-1 apply.

4 Conformance

For a measurement of E2E link to conform to this document, the following applies.

a) The requirements of the applicable generic cabling design standards shall be applied.

b) The configuration and structure shall conform to the requirements outlined in Clause 5.

c) The test configuration of E2E link shall meet the requirements in Clause 6 when subjected to the test of E2E link.

d) E2E link testing shall be undertaken according to Clause 7. The laboratory testing is specified in Clause 8 and the field testing is specified in Clause 9.

e) The test head shall meet the requirements of Clause 10.

This document shall apply to measurement methods of E2E link up to 100 MHz of Class D and up to 250 MHz of Class E of balanced cabling that includes the connections located at both ends.

5 Configuration and limits of performance of E2E link

E2E link measurement shall meet the following requirements:

a) The configurations and structure shall conform to the specifications outlined in ISO/IEC TR 11801-9902.

b) The test limits shall be in accordance with the outlined maximum limits described in ISO/IEC TR 11801-9902.

c) The use of compatible cabling components shall be in accordance with the requirements of ISO/IEC 11801-1.

d) If present, screens shall be handled as specified in ISO/IEC 14763-2.

e) The installation shall be performed in accordance with IEC 61918 and ISO/IEC 14763-2.

f) An E2E link shall meet the transmission limits of ISO/IEC TR 11801-9902 and, with its designated category and with appropriate test head as described in Annex A, the transmission requirements of all lower categories.

E2E link testing should be used to provide assurance of installed cabling terminated at both ends in accordance with IEC 60603-7 (all parts), IEC 61076-3-106, IEC 61076-3-117, IEC 61076-2-101 or IEC 61076-2-109.

6 Test configuration of E2E link

The E2E link includes the end connection at both ends.

Reference planes and configuration of E2E link measurement are shown in Figure 1.

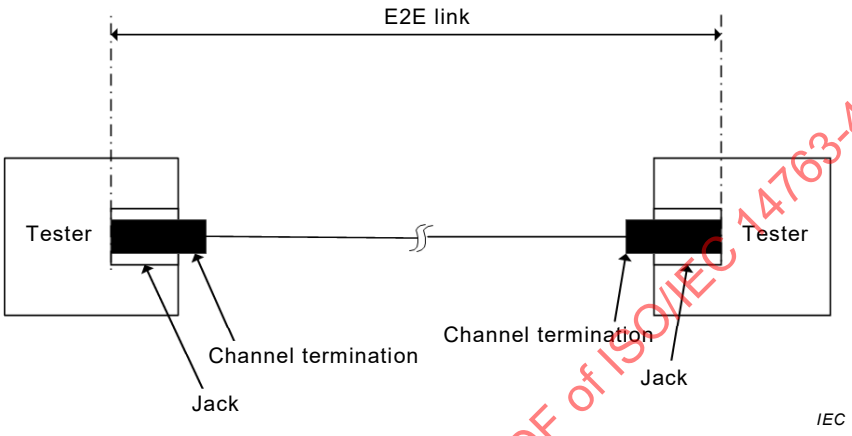

Figure 1 – Reference planes and configuration of E2E link

7 E2E link testing

Performance testing can be undertaken either in a laboratory or in the field after installation. This testing is independent from any requirements for acceptance testing contained within an installation specification, as for balanced cabling in ISO/IEC 14763-2.

There are three kinds of conformance testing:

a) Laboratory testing: This testing is performed on a sample of cabling in a laboratory where an assessment against the limits of ISO/IEC TR 11801-9902 is required.
b) Installed cabling in the field: This testing is performed on installed cabling in the field where an assessment against the conformance criteria of ISO/IEC TR 11801-9902 is required.
c) Production testing: This testing is performed in a production environment where an E2E-link assessment against the limits of ISO/IEC TR11801-9902 is required.

Testing of these kinds can be performed by independent or third party organizations in order to give greater assurance of compliance.

8 Laboratory testing of E2E link

The test configuration shall be carried out according to IEC 61935-2 for 100 Ω cabling. The test head shall conform to Clause 10.

The test regime for laboratory testing is listed in ISO/IEC TR 11801-9902:2017, Table 22 as reference conformance testing. The tests shall be applicable to Class D and E of E2E link.

The test method of the test regime of ISO/IEC TR 11801-9902:2017, Table 22 of E2E link shall be carried out and calculated according to the reference laboratory measurement procedures on cabling topologies of IEC 61935-1.

9 Field testing of E2E link

9.1 Visual inspection

Before starting measurement, first inspection shall be carried out:

a) visual inspection in accordance with the applicable installation specification, for two-pair and four-pair balanced cabling;

b) inspection of workmanship and connectivity testing according to the applicable installation specification.

9.2 Requirements of field test equipment

Cable assemblies constructed in the field can be tested for performance by field test equipment. The field test equipment is classified by performance levels. The specific performance level for field test equipment used to test E2E link cabling of class D and E shall be in accordance with IEC 61935-1.

9.3 Field test measurement parameters

Limits are provided in accordance with ISO/IEC TR 11801-9902. The field test measurements shall be according to IEC 61935-1 and include the following parameters:

a) wire map for two-pair and four-pair balanced cabling;

b) length (not a pass/fail requirement parameter per ISO/IEC 11801-1);

c) propagation delay to the maximum limits;

d) delay skew;

e) insertion loss;

f) return loss (RL) to the maximum limits;

g) near-end crosstalk (NEXT) to the maximum limits;

h) power sum near-end crosstalk (PSNEXT) to the maximum limits;

i) attenuation-to-crosstalk ratio, near end (ACR-N);

j) power sum attenuation-to-crosstalk ratio, near end (PSACR-N) to the maximum limits;

k) attenuation-to-crosstalk ratio, far end (ACR-F) in accordance to the maximum limits;

l) power sum attenuation-to-crosstalk ratio, near end (PSACR-N).

10 Test head requirements

10.1 General

The measured results of the E2E link are dependent on the required performance of the test heads used in the test setup. Compliance testing of the test head used to measure E2E links shall be carried out according the requirements of IEC 61935-2.

10.2 Test head requirements according to the IEC 60603-7 series

The test heads shall conform to the additional requirements of Annex A.

10.3 Test head requirements of IEC 61076-2-101

Test heads shall conform to the following minimum requirements:

a) NEXT = 87 − 20 log(f)
b) FEXT = 75,1 − 20 log(f)
c) RL = 60 − 20 log(f)

10.4 Test head requirements of IEC 61076-2-109

Test heads shall conform to the following minimum requirements:

a) NEXT = 94 − 20 log(f)
b) FEXT = 83,1 − 20 log(f)
c) RL = 68 − 20 log(f)

Annex A
(normative)

Additional requirements for test head designs

A.1 General

The test heads described in this document shall meet the requirements of IEC 61935-2 and the test head shall be centred within the range of test plugs which are required for the category of test.

In addition to the above requirements, test heads to be used for measurement of E2E links shall be assessed to the following requirements in order to further minimize test variation when compared to patch cord testing.

A.2 Outline of additional NEXT requirements

When evaluating an E2E test head, the procedure according to IEC 60512-29-100 shall be followed in order to confirm that the test head is compliant as mated connecting hardware. This process generates data for the de-embedded NEXT performance of the jack (fixed connector), which is in turn re-embedded with mathematical test plugs to establish compliance as mated connector, and further processed according to IEC 61935-2 to establish the centring requirements for patch cord test head compliance.

For compliance with this document, the de-embedded performance of the jack shall also comply with the requirements of A.3.1 for Category 5 and of A.3.2 for Category 6.

The application of such a small amount of permitted NEXT variation effectively controls variation on other crosstalk parameters.

An alternative test head may be used if equivalence is shown.

A.3 Additional test head requirements

A.3.1 Category 5 test head requirements

Test heads for testing E2E link composed of Category 5 components shall comply with the requirements of A.3.

The de-embedded NEXT performance of the jack shall comply with Table A.1.