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INTERNATIONAL STANDARD

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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

Spécification relative aux essais des câblages symétriques et coaxiaux des technologies de l'information –
Partie 1-2: Câblages symétriques installés tels que spécifiés dans l'ISO/IEC 11801 – Exigences supplémentaires pour le mesurage de l'asymétrie

IEC 61935-1-2:2018-12(en-fr)

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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

FOREWORD

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International Standard IEC 61935-1-2 has been prepared by IEC technical committee TC 46: Cables, wires, waveguides, RF connectors, RF and microwave passive components and accessories.

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

FDIS	Report on voting
46/695/FDIS	46/702/RVD

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

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

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

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

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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

1 Scope

This part of IEC 61935 specifies additional reference measurement procedures for measurement of resistance unbalance with field test instrumentation, and the requirements for field tester accuracy to measure resistance unbalance according to the requirements of ISO/IEC 11801-1.

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 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*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61935-1 and ISO/IEC 11801-1 apply.

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4 Reference measurement procedure for resistance unbalance

4.1 Reference measurement procedure for resistance unbalance within a pair

DC resistance unbalance within a pair shall be calculated for each pair using individual resistance measurements of each conductor within the pair according to Equation (1);

$$Resistance\_Unbalance_{\text{within\_a\_pair}} = \left(\frac{|R_1 - R_2|}{R_1 + R_2}\right) 100\ \% \quad (1)$$

where

R_1 is the resistance of conductor 1;

R_2 is the resistance of conductor 2.

4.2 Reference measurement procedure for resistance unbalance between pairs

DC resistance unbalance between pairs shall be calculated for all pair combinations using measurements of the parallel resistance of each pair according to Equation (2);

$$Resistance\_Unbalance_{\text{between\_pairs}} = \left(\frac{|R_3 - R_4|}{R_3 + R_4}\right) 100\ \% \quad (2)$$

where

R_3 is the parallel resistance of pair 1;

R_4 is the parallel resistance of pair 2.

4.3 Measurement setup for field measurement of resistance unbalance parameters

The field tester measurement setup for resistance unbalance and resistance unbalance between pairs is provided by Figure 1.

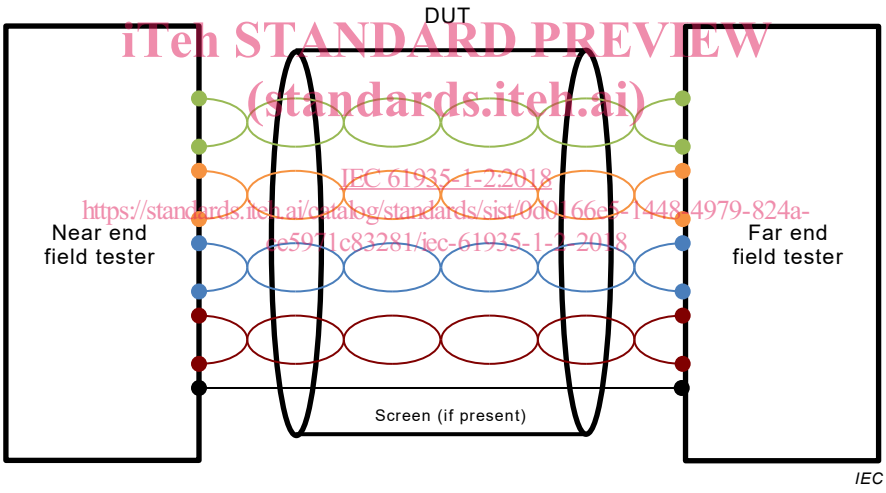

Figure 1 – Measurement setup

5 Field tester requirements for resistance unbalance measurements

5.1 General

The field tester shall comply with the requirements of the applicable level requirements of IEC 61935-1 and the requirements of Table 1. For the purposes of field measurements, calculations of limits that provide values of less than 200 mΩ shall revert to 200 mΩ.

Table 1 – Additional field test requirements for resistance unbalance measurements

Parameter	Baseline field tester	Field tester with permanent link adapter	Field tester with channel adapter	
DC loop resistance resolution	0,01			Ω
Constant error term of DC loop resistance E_{c,DC_r}	0,5			Ω
Error term proportional to the DC loop resistance E_{d,DC_r}	1			%
DC resistance unbalance resolution	0,005			%
Constant error term of DC resistance unbalance $E_{c,DC\_unbalance}$	0,025			Ω
Error term proportional to the DC resistance for resistance unbalance $E_{d,DC\_unbalance}$	0,3 DC loop resistance for resistance unbalance within a pair or Mean of DC loop resistances for resistance unbalance between pairs			%
NOTE The requirements for measurements of resistance unbalance are not based on the requirements for loop resistance measurements.				

5.2 Data reporting and accuracy

5.2.1 Detailed results

The field test equipment shall be capable of recording all connectivity information, as well as the measured values of resistance unbalance between pairs and within a pair. In addition, the detailed results shall include a PASS/FAIL result for resistance unbalance between pairs and within a pair.

5.2.2 Summary results

Detailed information may be required in certain circumstances; however, in general, summary performance information is sufficient. The field test equipment shall be capable of reporting the minimum summary information as shown in Table 2.

Table 2 – Field tester summary reporting requirements for resistance unbalance measurements

Test parameter	Measured from local or remote end (if measurement from both directions is not required)	Measured from remote end (if measurement from remote end is required)
Resistance unbalance (between pairs)	Worst case resistance unbalance between pairs margin (1 of 6 possible). Test limit at worst case resistance unbalance between pairs margin. Resistance unbalance between pairs at worst case margin. PASS/FAIL.	
Resistance unbalance (within a pair)	Worst case resistance unbalance within a pair margin (1 of 4 possible). Test limit at worst case resistance unbalance within a pair margin. Resistance unbalance within a pair at worst case margin. PASS/FAIL.	

6 Field tester accuracy performance requirements for resistance unbalance measurements

The accuracy of field tester measurements of resistance unbalance between pairs shall be given by Table 3.

Table 3 – Accuracy requirements for resistance unbalance measurements

Test parameter	Baseline accuracy at permanent link limits	Permanent link accuracy at permanent link limits	Channel accuracy at channel limits
DC loop resistance	± (0,5 Ω + 1 % DC loop resistance)		
DC resistance unbalance between pairs	± (0,025 Ω + 0,3 % mean DC loop resistance)		
DC resistance unbalance within a pair	± (0,025 Ω + 0,3 % DC loop resistance)		

NOTE The accuracy for measurements of resistance unbalance is not based on the requirements for loop resistance measurements.

7 Accuracy models

7.1 Error model for DC loop resistance

The error model for DC loop resistance is provided by the addition of the constant error term of DC loop resistance ($E_{\mathrm{c,DC\_r}}$) and the error term proportional to DC loop resistance ($E_{\mathrm{D,DC\_r}}$).

7.2 Error model for resistance unbalance

The error model for resistance unbalance, within a pair and between pairs, is provided by the addition of the constant error term of resistance unbalance ($E_{c,DC\_unbalance}$) and the error term of resistance unbalance proportional to DC resistance ($E_{D,DC\_unbalance}$).

7.3 Comparison to reference measurements

Comparison of results to the reference measurements of IEC 61935-1 shall be according to the single value test results method of IEC 61935-1.

7.4 Procedures for determining field tester parameters

7.4.1 General

Field test equipment is designed with two units that are attached to opposite ends of the cabling to be tested. Internal to these units are source and load ports that are used for measurements. The following measurements shall be used to determine compliance with the specified requirements.

7.4.2 Constant error term of DC loop resistance for loop resistance measurements

The procedure for determining the constant error term of DC loop resistance, E_{c,DC_r}, is provided by connecting a connector to the field tester with shorts across each pair. The reported DC resistance in each case shall be less than the E_{c,DC_r}.

7.4.3 Error term proportional to the DC loop resistance for loop resistance measurements

The DC resistance of cabling with a total length of approximately 30 m shall be measured using a four-terminal ohmmeter and with a specified accuracy of at least 0,01 %. The DC resistance of the same cabling, measured with the field tester, less the observed resistance value with the pair shorted (constant error term of DC loop resistance) shall be less than the error constant term proportional to the DC resistance.

$$E_{d,DC\_r} = \frac{\Omega_{Fieldtester} - E_{c,DC\_r}}{\Omega_{FourWire}} \quad (3)$$

where

E_{d,DC_r} is the error term proportional to DC loop resistance;

$\Omega_{Fieldtester}$ is the the value of the DC loop resistance as measured on the field tester;

$\Omega_{FourWire}$ is the the value of the DC loop resistance as measured on the four wire ohmmeter.

7.4.4 Constant error term of resistance unbalance for resistance unbalance measurements

The procedure for determining the constant error term of resistance unbalance, $E_{c,DC\_unbalance}$, is provided by connecting the main and remote units of the field tester at the reference plane of measurement, or with a short interconnect. The constant error term of resistance unbalance is given by the field tester's measurement of resistance unbalance less the value of resistance unbalance of the interconnect as measured with a precision four terminal ohmmeter with a specified accuracy of less than 0,01 % at the reference pane of the cabling.

The reported resistance unbalance within a pair or between pairs shall be less than the $E_{c,DC\_unbalance}$.