



SLOVENSKI STANDARD

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Komunikacijski kabli - Specifikacije za preskusne metode - 1-8. del: Električne preskusne metode - Slabljenje

Communication cables - Specifications for test methods - Part 1-8: Electrical test methods - Attenuation

Kommunikationskabel - Spezifikationen für Prüfverfahren Teil 1-8: Elektrische Prüfverfahren - Dämpfung

Câbles de communication - Spécifications des méthodes d'essai Partie 1-8: Méthodes d'essais électriques - Affaiblissement

Ta slovenski standard je istoveten z: EN 50289-1-8:2017

ICS:

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33.120.20	Žice in simetrični kabli	Wires and symmetrical cables

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EUROPEAN STANDARD

EN 50289-1-8

NORME EUROPÉENNE

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ICS 33.120.20

Supersedes EN 50289-1-8:2001

English Version

Communication cables - Specifications for test methods - Part 1-8: Electrical test methods - Attenuation

Câbles de communication - Spécifications des méthodes d'essai Partie 1-8: Méthodes d'essais électriques - Affaiblissement

Kommunikationskabel - Spezifikationen für Prüfverfahren Teil 1-8: Elektrische Prüfverfahren - Dämpfung

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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European foreword

This document [EN 50289-1-8:2017] has been prepared by CLC/TC 46X "Communication cables".

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2017-09-16
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2019-12-16

This document supersedes EN 50289-1-8:2001.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

EN 50289-1, *Communication cables — Specifications for test methods*, is currently composed with the following parts:

- Part 1-1: *Electrical test methods — General requirements*;
- Part 1-2: *Electrical test methods — DC resistance*;
- Part 1-3: *Electrical test methods — Dielectric strength*;
- Part 1-4: *Electrical test methods — Insulation resistance*;
- Part 1-5: *Electrical test methods — Capacitance*;
- Part 1-6: *Electrical test methods — Electromagnetic performance*;
- Part 1-7: *Electrical test methods — Velocity of propagation*;
- Part 1-8: *Electrical test methods — Attenuation*;
- Part 1-9: *Electrical test methods — Unbalance attenuation (longitudinal conversion loss, longitudinal conversion transfer loss)*;
- Part 1-10: *Electrical test methods — Crosstalk*;
- Part 1-11: *Electrical test methods — Characteristic impedance, input impedance, return loss*;
- Part 1-12: *Electrical test methods — Inductance*;
- Part 1-13: *Electrical test methods — Coupling attenuation or screening attenuation of patch cords / coaxial cable assemblies / pre-connectorised cables*;
- Part 1-14: *Electrical test methods — Coupling attenuation or screening attenuation of connecting hardware*;
- Part 1-15: *Electromagnetic performance — Coupling attenuation of links and channels (Laboratory conditions)*;
- Part 1-16: *Electromagnetic performance — Coupling attenuation of cable assemblies (Field conditions)*;
- Part 1-17: *Electrical test methods — Exogenous Crosstalk ExNEXT and ExFEXT*.

EN 50298-1-8:2017

1 Scope

This European Standard details the test methods to determine attenuation of finished cables used in analogue and digital communication systems.

It is bound to be read in conjunction with EN 50289-1-1, which contains essential provisions for its application.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 50289-1-1, *Communication cables - Specifications for test methods - Part 1-1: Electrical test methods - General requirements*

EN 50289-1-11, *Communication cables - Specifications for test methods - Part 1-11: Electrical test methods - Characteristic impedance, input impedance, return loss*

EN 50290-1-2, *Communication cables - Part 1-2: Definitions*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 50289-1-1 and EN 50290-1-2 and the following apply.

3.1

cable attenuation

decrease in magnitude of power of a signal that propagates along the cable

3.2

insertion loss (IL) of a network (e.g. cable or cable assembly)

ratio of power P_1 delivered to a specified load in a transmission system, before insertion of the given network, to the power P_2 delivered to the same load after insertion of the network:

$$IL = 10 \cdot \log \left(\frac{P_1}{P_2} \right) \text{ (dB)} \quad (1)$$

Note 1 to entry: The insertion loss of a network depends on the network itself as well as the transmission system in which it is inserted (including the load). The insertion loss is generally expressed in decibels.

Note 2 to entry: In a transmission system where the load and source impedances are equal, the insertion loss can be expressed by the scattering parameter S_{21} :

$$IL = -20 \cdot \log \left(|S_{21}| \right) \text{ (dB)} \quad (2)$$

Note 3 to entry: For a cable which is matched to the transmission system in which it is inserted, the insertion loss is equivalent to the cable attenuation.

Note 4 to entry: Further information on definitions of attenuation can be found in IEC/TR 62152.

4 Test method for attenuation

4.1 Method A: Balun-based test method for symmetrical cables

4.1.1 Test equipment

The test equipment consists of a vector network analyser (VNA) having at least 2 ports, and the following:

- S-parameter set-up (shall be capable of performing S_{21} measurements).
- Baluns to convert the unbalanced signal of the VNA to a balanced signal. The baluns shall have an impedance on the primary (unbalanced) side equal to the nominal impedance of the measuring devices (in general 50 Ω) and on the secondary (balanced) side equal to the nominal impedance of the cable under test (CUT) (e.g. 100 Ω). The baluns shall fulfil the requirements of Class A baluns as described in EN 50289-1-1.
- Calibration artefacts to perform the required calibration of the test equipment on the secondary side of the baluns. To perform a full 2-port calibration a short circuit, an open circuit, a reference load, and a short connection cable or similar, are required. The short circuit shall have negligible inductance and the open circuit shall have negligible capacitance. The load resistor shall have a value close (within 1%) to the nominal impedance of the CUT (e.g. 100 Ω) and with negligible inductance and capacitance. The connection cable shall be as short as possible and well matched to the nominal impedance.
- Resistor termination networks (RTN) for termination of inactive pairs. The resistor termination network shall provide the differential mode and the common mode reference termination impedances. It is recommended to use resistor termination networks in accordance with Annex C of EN 50289-1-11. Baluns may be used for termination of the inactive pairs if they provide the specified differential and common mode terminations.

As an alternative to a network analyser, a generator and vector voltmeter may be used.

Accuracy of test set-up shall be better than 1%.

4.1.2 Test sample

The CUT shall have a minimum length as specified in the relevant sectional specification. Both ends of the CUT shall be prepared, such that when connected to the terminals of the test equipment the influence to the test result is minimized. The twisting of the pairs/quads shall be maintained.

4.1.3 Calibration procedure

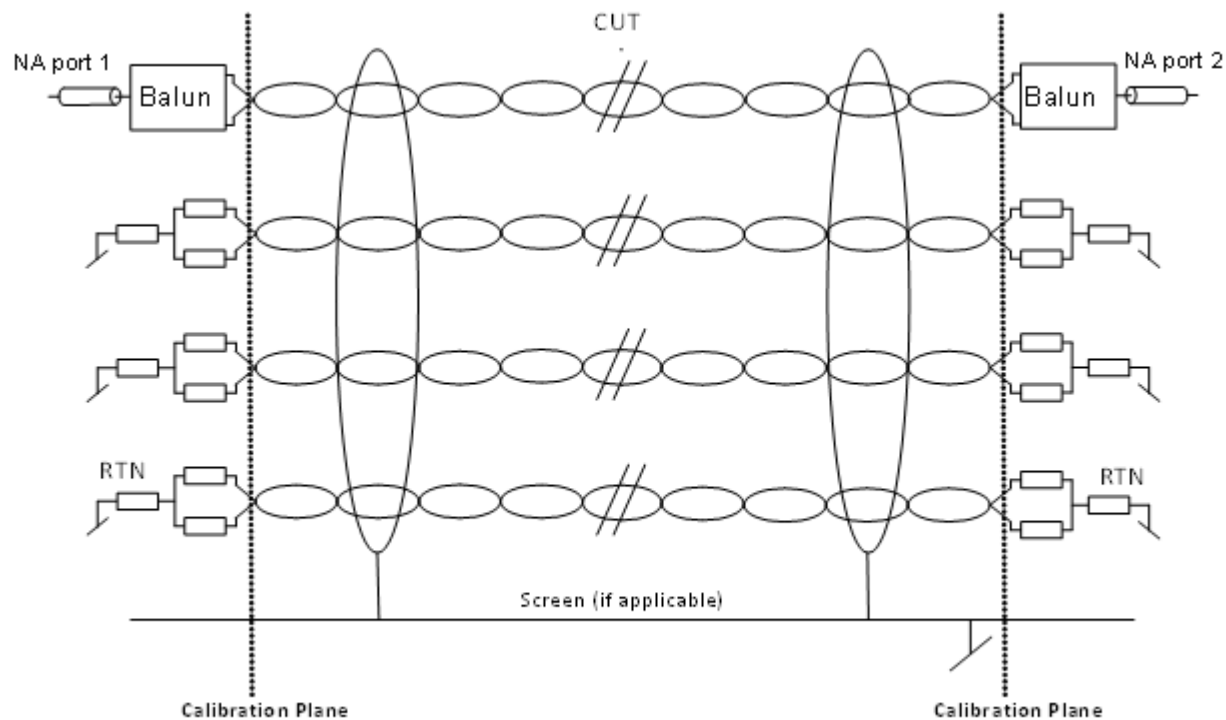
It is not the intent of the standard to detail the algorithms applied by a VNA to correct the measured results based on a calibration procedure but to detail the calibration procedure. Further information may be obtained in the manuals of the VNA supplier.

The calibration shall be performed on the secondary side of the baluns. A full two-port calibration is recommended using open, short, and load calibration artefacts at the terminals of the balun, and a short connection cable between the two baluns for the through calibration.

4.1.4 Measuring procedure

The CUT shall be connected to the terminals of the test equipment as depicted in Figure , including proper termination of the active pairs, the inactive pairs, and the screen.

The connection of the CUT to the test ports shall be optimized, such that the mismatch at the connection is minimized. For the inactive pairs, it is recommended to apply resistor termination networks as referenced in 4.1.1.



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Figure 1 — Attenuation measurement using baluns
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The scattering parameter S_{21} shall be measured over the whole specified frequency range and at the same frequency points as for the calibration procedure. All pairs/quads of the CUT shall be measured.

Under matched conditions, the attenuation a of the CUT is given by:

$$a(f) = -20 \cdot \log_{10} (|S_{21}|) \text{ (dB)} \quad (3)$$

4.2 Method B: Balun-less test method for symmetrical cables

4.2.1 Test equipment

Method B is the preferred one for balanced cables for frequencies above 1 000 MHz as it avoids the use of baluns which are often limited to 1 000 MHz. With this configuration it is possible to measure both the differential mode and the common mode attenuation of the cable.

Please refer to EN 50289-1-1 for a general description of the balun-less test method and nomenclature.

The test equipment consists of a multiport vector network analyser VNA having at least 4 ports, and the following:

- S-parameter set-up.
- A mathematical conversion from unbalanced to balanced, i.e. the mixed mode set-up which is often referred to as an unbalanced, modal decomposition or balun-less setup. This allows measurements of balanced devices without use of an RF balun in the signal path. With such a test set-up, all balanced and unbalanced parameters can be measured over the full frequency range.
- Coaxial interconnection cables in accordance with the relevant clause of EN 50289-1-1 to connect the VNA, switching matrix (if used), and the test fixture. The connection cables shall have characteristic impedance equal to the nominal impedance of the VNA, and a low transfer impedance.

- Coaxial calibration standards for calibration at the end of the coaxial interconnection cables (if applied). To perform a calibration at the end of the coaxial interconnection cable coaxial reference standards, so called calibration standards, i.e. a short circuit, an open circuit and a reference load, are required. An alternative to the before mentioned open, short and load references is the use of an electronic multiport calibration kit (E-cal module) which is supplied by the supplier of the VNA.
- Calibration artefacts in accordance with the relevant clause of EN 50289-1-1 for calibration at the test interface (if applied). To perform a calibration at the test interface, calibration artefacts, i.e. a short circuit, an open circuit and a reference load, are required.
- Resistor termination networks (RTN) for termination of inactive pairs. The resistor termination network shall provide the differential mode and the common mode reference termination impedances. It is recommended to use resistor termination networks in accordance with Annex C of EN 50289-1-11.

4.2.2 Test sample

The CUT shall have a minimum length as specified in the relevant sectional specification. Both ends of the CUT shall be prepared, such that when connected to the terminals of the test equipment the influence to the test result is minimized. The twisting of the pairs/quads shall be maintained.

4.2.3 Calibration procedure

It is not the intent of the standard to detail the algorithms applied by a VNA to correct the measured results based on a calibration procedure but to detail the calibration procedure. Further information may be obtained in the manuals of the VNA supplier

A full 4-port single ended (SE) calibration shall be performed in accordance with the relevant clause of EN 50289-1-1. The calibration shall be performed either at the ends of the coaxial interconnection cables, in which case de-embedding techniques may be required to remove the effects of the test fixture, or at the test interface.

4.2.4 Measuring procedure

The CUT shall be connected to the terminals of the test equipment as depicted in Figure , including proper termination of the active pairs, the inactive pairs, and the screen.

The connection of the CUT to the test ports shall be optimized, such that mismatching is minimized. For the inactive pairs, it is recommended to apply resistor termination networks as referenced in 4.2.1.