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INTERNATIONAL STANDARD

NORME INTERNATIONALE

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AMENDMENT 1

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Multicore and symmetrical pair/quad cables for digital communications – Part 1: Generic specification

Câbles multiconducteurs à paires symétriques et quartes pour transmissions numériques – Partie 1: Spécification générique

IEC 61156-1:2007/A1:2009

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Multicore and symmetrical pair/quad cables for digital communications – Part 1: Generic specification

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FOREWORD

This amendment has been prepared by subcommittee 46C: Wires and symmetric cables, of IEC technical committee 46: Cables, wires, waveguides, R.F. connectors, R.F. and microwave passive components and accessories.

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

FDIS	Report on voting
46C/897/FDIS	46C/899/RVD

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

The committee has decided that the contents of this amendment and the base publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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- withdrawn,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

IMPORTANT – The "colour inside" logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this publication using a colour printer.

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3 Terms and definitions

Replace definitions 3.17, 3.18, 3.19, 3.20 and 3.24 by the following:

3.17
characteristic impedance
Z_C
impedance at the input of a homogeneous line of infinite length

The impedance value is expressed in Ω, calculated, at relevant frequencies, as the square root of the product of the impedances measured at the near end (input) of a cable pair when the far end is terminated by a short-circuit load and then an open-circuit load.

NOTE 1 The asymptotic value at high frequencies is denoted as Z_∞.

NOTE 2 The characteristic impedance of a homogeneous cable pair is given by the quotient of a voltage wave and current wave which are propagating in the same direction, either forwards or backwards.

NOTE 3 For homogeneous ideal cables, this method yields a flat smooth curve over the whole frequency range. Real cables with distortions give curves with some roughness.

3.18
terminated input impedance
Z_{in}
impedance value, expressed in Ω, at relevant frequencies, measured at the near end (input) when the far end is terminated with the system nominal impedance, Z_R

(See IEC/TR 62152.)

3.19
fitted characteristic impedance
Z_m
impedance value, expressed in Ω, calculated by applying a least squares function fitting algorithm to the measured characteristic impedance values

3.20
mean characteristic impedance
Z_∞
asymptotic value at which the characteristic impedance approaches at sufficiently high frequencies (≈100 MHz) such that the imaginary part (phase angle) is insignificant

NOTE 1 Normally measured from the capacitance and time delay.

NOTE 2 Applicable for cables with frequency independence of mutual capacitance.

3.24
current carrying capacity
maximum current a cable circuit (one or several conductors) can support resulting in a specified increase of the surface temperature of the conductor beyond the ambient temperature, not exceeding the maximum allowed operating temperature of the cable

Add, after definition 3.27, the following new definitions 3.28 and 3.29:

3.28
ambient temperature
the temperature of the room or space surrounding the cable

3.29
operating temperature
the surface temperature of the conductors of a cable

The operating temperature is the sum of ambient temperature and of the temperature increase due to the carried power.

6 Characteristics and requirements

6.1 General remarks – Test configurations

Add, at the beginning of 6.1, the following new paragraph:

Unless otherwise specified, all the tests shall be performed assuming that the operating temperature is 20 °C. The temperature of the cable shall be stabilized at 20 °C and the test signal shall be low enough to avoid any temperature increase.

6.2.6 Capacitance unbalance to earth

Delete "to earth" in the heading of 6.2.6 as follows:

6.2.6 Capacitance unbalance

6.2.9 Current-carrying capacity

The correction concerns the French text only.

6.3.3.1 Attenuation at ambient temperature

Change the heading of 6.3.3.1 as follows:

6.3.3.1 Attenuation at 20 °C operating temperature

6.3.3.2 Attenuation at elevated temperatures

Change the heading of 6.3.3.2 as follows:

6.3.3.2 Attenuation at elevated ambient temperatures

6.3.3.2.3 Test procedure

Add the following text to the second paragraph of 6.3.3.2.3:

The test signal shall be low enough to avoid any temperature increase.

6.3.7 Alien (exogenous) near-end crosstalk

Replace, at the end of the subclause, the following text:

Two test cable configurations are specified as follows:

a) an assembly of six cables around one cable;
b) a helical wrap of four parallel cables onto a drum.

by

The test methods configuration involves six cables around one cable.

The cable arrangement shall be either

a) a bundle

or

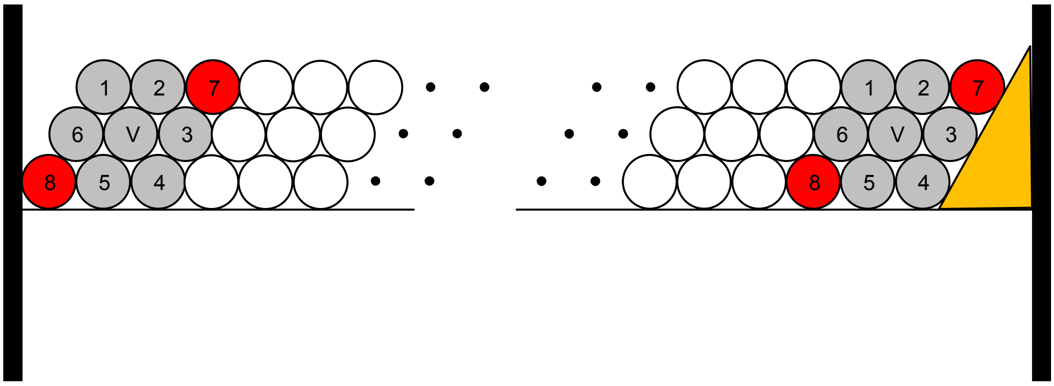
b) three layers of cables on a drum.

6.3.7.2 Four parallel cables

Replace the existing title and text of 6.3.7.2, including Figures 11 and 12, by the following:

6.3.7.2 Six cables around one cable on a drum (three layers on a drum)

The principle is to reproduce a "6 around 1" on the drum. The sample is a set of 3 specimens of cable of 100 m length. They are wound all together and side by side on a wooden drum in order to form a first layer (cables 8, 5 and 4 in Figure 18). The wooden drum shall have a minimum diameter of 1,20 m. Next, a new set of 3 cables of 100 m is wound above the first layer in order to build a second layer; the cables are put as shown in Figure 18 and described as cables 6, V and 3. Finally, a third set of 3 cables is wound to obtain a third layer described as cables 1, 2 and 7. All of the (9×100) m cables shall come from the same production batch.



IEC 1502/09

Figure 18 – Schematic diagram representing the position of the 9 cables on a wooden drum

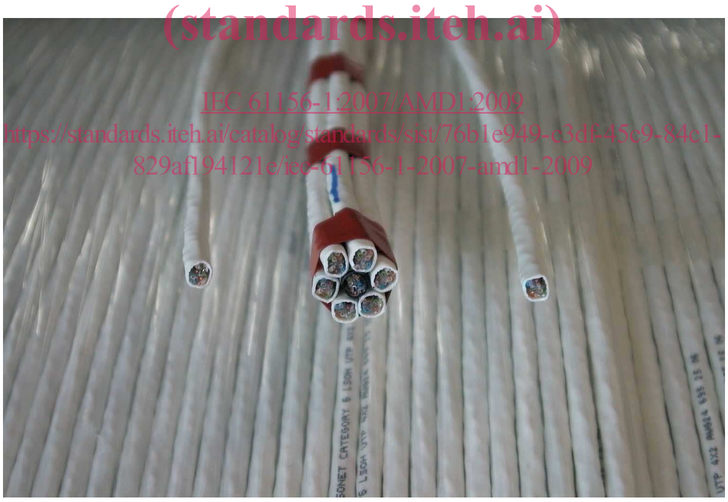
According to the "6 around 1" principle, the disturbed cable V is surrounded by 6 cables called cable 1 to cable 6 (see Figure 18).

The regularity of this construction is maintained for example by a wrapping tape around the assembly as shown in the Figure 19. At both ends, a bundle is set-up by using adhesive tapes spaced on the assembly every 10 cm.

IEC 1503/09

Figure 19 – Arrangement of the cables on the drum

Figure 20 shows the "6 around 1" construction at both ends and 2 extra cables (cable 7 and cable 8) which are here only for insuring a perfect assembly, but also for further investigation, if needed.



IEC 1504/09

Figure 20 – Preparation of one end

6.3.10 Mean characteristic impedance and input impedance

Replace the existing title and text of 6.3.10 by the following:

6.3.10 Impedance

6.3.10.1 Preparation of cable under test

The cable under test (CUT) shall be prepared so that end effects are minimized. Unscreened cables shall be suspended or laid on a non-conducting surface so that multiple traversals are separated by a minimum of 25 mm.

6.3.10.1.1 Test equipment for characteristic impedance, terminated input impedance and fitted impedance

The measurement is in a balanced configuration with a network analyser (together with an S-parameter unit) or an impedance meter. The balun shall have the relevant characteristics given in Table 1 corresponding to the measurement frequency range. The measurement schematic is given in Figure 13.

The measurement shall be done at the frequency, or in the whole frequency range, indicated in the relevant sectional specification.

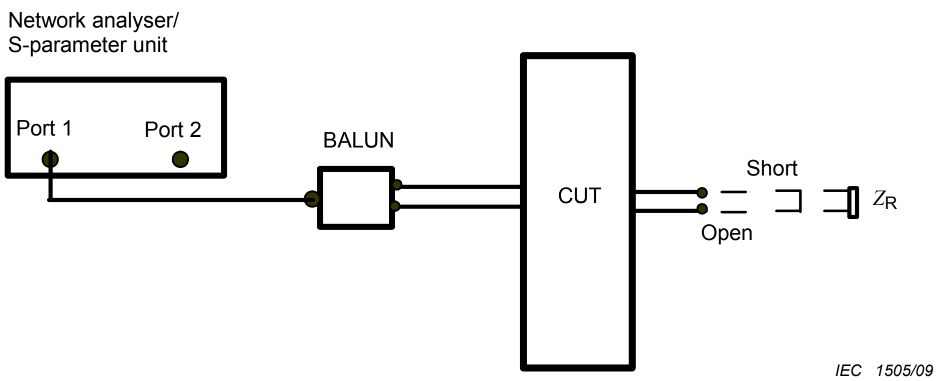


Figure 13 – Test set-up for characteristic impedance and return loss

6.3.10.1.2 Procedure

A three-step calibration procedure (using open, short and reference-load terminations) is performed at the secondary of the balun with the cable pair disconnected.

The S_{11} parameter is measured with the cable pair connected to the balun and terminated with open circuit, short circuit and reference load, Z_R. The impedance is calculated from the measured S_{11} parameters.

$$Z_{meas} = Z_R \cdot \left| \frac{1 + S_{11}}{1 - S_{11}} \right| \quad (37)$$

where

Z_{meas} is the impedance for open circuit, short circuit terminations (Ω);

Z_R is the reference load (Ω);

S_{11} is the measured wave scattering parameter for open- and short-circuit terminations.

The characteristic impedance is calculated as the square root of the product of the open and short circuit measured values and is given by

$$Z_C = \sqrt{\left| Z_{OC} \cdot Z_{SC} \right|} \quad (38)$$

where

Z_C is the characteristic impedance (Ω);

Z_{OC} is the measured open circuit impedance (Ω);

Z_{SC} is the measured short circuit impedance (Ω).

6.3.10.2 Fitted characteristic impedance

Function fitting is used for computing a smoothed characteristic impedance when the cable exhibits significant structural effects.

The fitting function is given by

$$\left| Z_m \right| = k_0 + \frac{k_1}{f^{1/2}} + \frac{k_2}{f} + \frac{k_3}{f^{3/2}} \quad (39)$$

where

Z_m is the magnitude of the fitted characteristic impedance (Ω);

k_0, k_1, k_2, k_3 are least squares coefficients;

f is the frequency (Hz).

6.3.10.3 Mean characteristic impedance

Mean characteristic impedance is calculated using the equation

$Z_\bullet = \tau / C$

where

$Z_\bullet$ is the mean characteristic impedance (Ω);

τ is the time delay (s);

C is the mutual capacitance (F).

6.3.11 Return loss

Replace the existing text of 6.3.11 by the following:

6.3.11.1 Preparation of cable under test

The cable under test shall be prepared so that end effects are minimized. Unscreened cables shall be suspended or laid on a non-conducting surface so that multiple traversals are separated by a minimum of 25 mm.

6.3.11.2 Equipment

The measurement is in a balanced configuration with a network analyser (together with a wave scattering parameter unit). The balun shall have the relevant characteristics given in Table 1 corresponding to the measurement frequency range. The measurement schematic is given in Figure 13. The load resistor shall be the nominal cable impedance.

The measurement shall done be at the frequency, or in the whole frequency range, indicated in the relevant sectional specification.

6.3.11.3 Procedure

A three-step calibration procedure (using open, short and load terminations) is performed at the secondary of the balun with the cable pair disconnected.

Return loss is given by the wave scattering parameter direct from the network analyser as follows.

$$RL = -20 \times \log_{10} |S_{11}| \qquad (40)$$

where

RL is the return loss (dB);

S_{11} is the wave scattering parameter.

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