
Večelementni kovinski kabli za analogne in digitalne komunikacije in krmiljenje - 11-2. del: Področna specifikacija za nezaslonjene kable z lastnostmi od 1 MHz do 500 MHz - Vodoravni (etažni) in stavbni hrbtenični (medetažni) kabli

Multi-element metallic cables used in analogue and digital communication and control -- Part 11-2: Sectional specification for un-screened cables, characterized from 1 MHz up to 500 MHz - Horizontal and building backbone cables

Mehradrige metallische Daten- und Kontrollkabel für analoge und digitale Übertragung -- Teil 11-2: Rahmenspezifikation für ungeschirmte Kabel von 1 MHz bis 500 MHz - Kabel für den Horizontal- und Steigbereich

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Câbles métalliques à éléments multiples utilisés pour les transmissions et les commandes analogiques et numériques -- Partie 11-2: Spécification intermédiaire pour les câbles non écrantés, caractérisés de 1 MHz à 500 MHz - Câbles horizontaux et câbles verticaux de bâtiment

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Multi-element metallic cables used in analogue and digital communication and control - Part 11-2: Sectional specification for un-screened cables, characterized from 1 MHz up to 500 MHz for work area, patch cord and data centre applications

Câbles métalliques à éléments multiples utilisés pour les transmissions et les commandes analogiques et numériques - Partie 11-2: Spécification intermédiaire pour les câbles non écartés, caractérisés de 1 MHz à 500 MHz
- Câbles horizontaux et câbles verticaux de bâtiment

Mehradrige metallische Daten- und Kontrollkabel für analoge und digitale Kommunikation - Teil 11-2: Rahmenspezifikation für ungeschirmte Kabel von 1 MHz bis 500 MHz für Geräteanschlusskabel, Schaltkabel und Anwendungen für Rechenzentren

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European foreword

This document (EN 50288-11-2:2015) has been prepared by CLC/SC 46XC "Multicore, multipair and quad data communication cables," of 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) 2015-08-03
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2018-08-03

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

This Part 11-2 is to be read in conjunction to EN 50288-1.

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association. (standards.iteh.ai)

This standard covers the Principle Elements of the Safety Objectives for Electrical Equipment Designed for Use within Certain Voltage Limits (LVD - 2006/95/EC).

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EN 50288-11-2:2015

1 Scope

This sectional specification covers un-screened cables, characterised from 1 MHz up to 500 MHz, to be used to construct cords for use in cabling specified in the EN 50173 series of standards.

The premises-specific cabling standards of the EN 50173 series reference the D1 requirements of this specification for the cable used within cords of the “reference implementations” of those standards. The alternative D2 requirements of this specification may be used to produce cords for other implementations and applications including the direct connection of equipment in data centres.

This sectional specification contains the electrical, mechanical, transmission and environmental performance characteristics and requirements of the cables when tested in accordance with the referenced test methods.

This sectional specification is to be read in conjunction with EN 50288-1, which contains the essential provisions for its application.

The cables covered in this sectional specification are intended to operate with voltages and currents normally encountered in communications systems. These cables are not intended to be used in conjunction with low impedance sources, for example the electrical power supplies of public utility mains.

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 50288-1:2013, *Multi-element metallic cables used in analogue and digital communication and control – Part 1: Generic specification*
<http://standards.iteh.ai/catalog/standards/sist/bfe3b9be-e8ab-45c7-a4dd-e5a0efeb2d18/sist-en-50288-11-2-2016>

EN 50289-3-2, *Communication cables – Specifications for test methods – Part 3-2: Mechanical test methods – Tensile strength and elongation for conductor*

EN 50289-3-4, *Communication cables – Specifications for test methods – Part 3-4: Mechanical test methods – Tensile strength, elongation and shrinkage of insulation and sheath*

EN 50289-3-5, *Communication cables – Specifications for test methods – Part 3-5: Mechanical test methods – Crush resistance of the cable*

EN 50289-3-6, *Communication cables – Specifications for test methods – Part 3-6: Mechanical test methods – Impact resistance of the cable*

EN 50289-3-8, *Communication cables – Specifications for test methods – Part 3-8: Mechanical test methods – Abrasion resistance of cable sheath markings*

EN 50289-3-9:2001, *Communication cables – Specifications for test methods – Part 3-9: Mechanical test methods – Bending tests*

EN 50289-3-16, *Communication cables – Specifications for test methods – Part 3-16: Mechanical test methods – Cable tensile performance*

EN 50289-4-6, *Communication cables – Specifications for test methods – Part 4-6: Environmental test methods – Temperature cycling*

EN 50290-2 series, *Communication cables – Part 2: Common design rules and construction*

EN 60708, *Low-frequency cables with polyolefin insulation and moisture barrier polyolefin sheath* (IEC 60708)

IEC 60189-2, *Low-frequency cables and wires with PVC insulation and PVC sheath – Part 2: Cables in pairs, triples, quads and quintuples for inside installations*

3 Terms, definitions, symbols and abbreviations

3.1 Terms and definitions

For the purposes of this document, the terms and definitions of EN 50288-1 apply.

3.2 Symbols and abbreviations

For the purposes of this document, the following abbreviations apply.

EX Exogenous (derived or originating externally)

POE Power Over Ethernet

4 Cable construction

4.1 Conductor

The conductor shall be solid or stranded annealed copper and meet the requirements of EN 50288-1:2013, 4.1

The solid conductor nominal diameter shall be $\geq 0,40$ mm and $\leq 0,80$ mm.

The stranded conductor shall consist of seven wires each with a nominal diameter of $\geq 0,10$ mm to $\leq 0,21$ mm.

NOTE Constructions with 'copper clad' conductors **do not** meet the requirements.

4.2 Insulation

The insulation shall be of a suitable material in accordance with the appropriate part of the EN 50290-2 series.

4.3 Cabling elements

The cable element shall be a pair or quad.

4.4 Identification of cabling elements

Unless otherwise specified, the colour coding for identification shall be as specified in IEC 60189-2 or EN 60708, as appropriate. The colours shall comply with the requirements of EN 50288-1:2013, 4.4.

4.5 Screening of cabling elements

Not applicable.

4.6 Cable make-up

The cable elements shall be laid up in concentric layer(s) or units to form the cable core.

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4.7 Filling compound

Not applicable.

4.8 Interstitial fillers

Where fillers are used they shall comply with the requirements of EN 50288-1:2013, 4.8.

4.9 Screening of the cable core

Not applicable.

4.10 Moisture barriers

Not applicable.

4.11 Wrapping layers

Where wrapping layers are used they shall comply with the requirements of EN 50288-1:2013, 4.11

4.12 Sheath

The sheath shall be of a suitable material and comply with the appropriate part of the EN 50290-2 series.

5 Test methods and requirements for completed cables

5.1 General

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[https://standards.iteh.ai/catalog/standards/sist/bfe3b9be-e8ab-45c7-a4dd-](https://standards.iteh.ai/catalog/standards/sist/bfe3b9be-e8ab-45c7-a4dd-e5a0efeb2d18/sist-en-50288-11-2-2016)[e5a0efeb2d18/sist-en-50288-11-2-2016](https://standards.iteh.ai/catalog/standards/sist/bfe3b9be-e8ab-45c7-a4dd-e5a0efeb2d18/sist-en-50288-11-2-2016)

The following tables specify the tests that shall be applied to the completed cable, together with the requirements to demonstrate compliance with this sectional specification.

5.2 Electrical tests

5.2.1 Low-frequency and DC electrical measurements

Table 1 – Low-frequency and DC electrical measurements

EN 50288-1:2013 Sub-clause	Parameter	Requirement
5.1.1.1	Conductor loop resistance	(D1) $\leq 28,0 \Omega/100 \text{ m}$ (D2) $\leq 34,0 \Omega/100 \text{ m}$
5.1.1.2	Conductor resistance unbalance	$\leq 2\%$
	Pair resistance unbalance	$\leq 4\%$
5.1.1.3	Dielectric strength conductor/conductor	1,0 kV DC or 0,7 kV AC for 1 min or 2,5 kV DC or 1,7 kV AC for 2 s
5.1.1.4	Insulation resistance	$\geq 5\,000 \text{ M}\Omega \cdot \text{km}$ when tested in accordance with EN 50289-1-4
5.1.1.5	Mutual capacitance	No requirement specified
5.1.1.6	Capacitance unbalance to earth	$\leq 1\,200 \text{ pF/km}$

5.2.2 High-frequency electrical and transmission measurements

Table 2 – High-frequency electrical and transmission measurements

EN 50288-1:2013 Sub-Clause	Parameter	Requirement																										
5.1.2.1	Velocity of Propagation	Phase Delay $\leq 534 + 36/\sqrt{f}$ ns/100 m, $1 \text{ MHz} \leq f \leq 500 \text{ MHz}$																										
5.1.2.2	Propagation delay difference (skew)	≤ 45 ns/100 m at 100 MHz																										
5.1.2.3	D1 Longitudinal Attenuation ^{b, c, f, g, h}	<table border="1"> <tr> <td>1</td><td>4</td><td>10</td><td>16</td><td>20</td><td>31,25</td><td>62,5</td><td>100</td><td>155</td><td>200</td><td>300</td><td>500</td><td>MHz</td> </tr> <tr> <td>2,9</td><td>5,5</td><td>8,5</td><td>10,8</td><td>12,1</td><td>15,2</td><td>21,7</td><td>27,8</td><td>35,0</td><td>40,1</td><td>49,9</td><td>66,2</td><td>dB/100 m</td> </tr> </table> $\alpha \leq 1,5 (1,82\sqrt{f} + 0,0091f + 0,25/\sqrt{f})$, $1 \text{ MHz} \leq f \leq 500 \text{ MHz}$	1	4	10	16	20	31,25	62,5	100	155	200	300	500	MHz	2,9	5,5	8,5	10,8	12,1	15,2	21,7	27,8	35,0	40,1	49,9	66,2	dB/100 m
1	4	10	16	20	31,25	62,5	100	155	200	300	500	MHz																
2,9	5,5	8,5	10,8	12,1	15,2	21,7	27,8	35,0	40,1	49,9	66,2	dB/100 m																
5.1.2.3.1	D2 Longitudinal attenuation ^{b, c, f, g, h}	<table border="1"> <tr> <td>1</td><td>4</td><td>10</td><td>16</td><td>20</td><td>31,25</td><td>62,5</td><td>100</td><td>155</td><td>200</td><td>300</td><td>500</td><td>MHz</td> </tr> <tr> <td>3,6</td><td>6,7</td><td>10,6</td><td>13,5</td><td>15,2</td><td>19,1</td><td>27,6</td><td>35,6</td><td>45,3</td><td>52,3</td><td>65,9</td><td>88,8</td><td>dB/100 m</td> </tr> </table> $\alpha \leq 3,225\sqrt{f} + 0,0333f + 0,3/\sqrt{f}$, $1 \text{ MHz} \leq f \leq 500 \text{ MHz}$	1	4	10	16	20	31,25	62,5	100	155	200	300	500	MHz	3,6	6,7	10,6	13,5	15,2	19,1	27,6	35,6	45,3	52,3	65,9	88,8	dB/100 m
1	4	10	16	20	31,25	62,5	100	155	200	300	500	MHz																
3,6	6,7	10,6	13,5	15,2	19,1	27,6	35,6	45,3	52,3	65,9	88,8	dB/100 m																
5.1.2.4	Near End Unbalance Attenuation	Level 1 $\geq 40 - 10 \log f$ dB, $1 \text{ MHz} \leq f \leq 500 \text{ MHz}$ Level 2 $\geq 50 - 10 \log f$ dB, $1 \text{ MHz} \leq f \leq 500 \text{ MHz}$																										
5.1.2.5	Near-end Crosstalk (NEXT) ^b	<table border="1"> <tr> <td>1</td><td>4</td><td>10</td><td>16</td><td>20</td><td>31,25</td><td>62,5</td><td>100</td><td>155</td><td>200</td><td>300</td><td>500</td><td>MHz</td> </tr> <tr> <td>75,3</td><td>66,3</td><td>60,3</td><td>57,2</td><td>55,8</td><td>52,9</td><td>48,4</td><td>45,3</td><td>42,4</td><td>40,8</td><td>38,1</td><td>34,8</td><td>dB</td> </tr> </table> $\geq 75,3 - 15 \log f$, $1 \text{ MHz} \leq f \leq 500 \text{ MHz}$	1	4	10	16	20	31,25	62,5	100	155	200	300	500	MHz	75,3	66,3	60,3	57,2	55,8	52,9	48,4	45,3	42,4	40,8	38,1	34,8	dB
1	4	10	16	20	31,25	62,5	100	155	200	300	500	MHz																
75,3	66,3	60,3	57,2	55,8	52,9	48,4	45,3	42,4	40,8	38,1	34,8	dB																
5.1.2.6	D1 Attenuation to crosstalk ratio at the far end ^{b, d} (ACR-F)	<table border="1"> <tr> <td>1</td><td>4</td><td>10</td><td>16</td><td>20</td><td>31,25</td><td>62,5</td><td>100</td><td>155</td><td>200</td><td>300</td><td>500</td><td>MHz</td> </tr> <tr> <td>68,0</td><td>58,0</td><td>50,0</td><td>45,9</td><td>42,0</td><td>40,1</td><td>34,1</td><td>30,0</td><td>26,2</td><td>24,0</td><td>20,5</td><td>16,0</td><td>dB</td> </tr> </table> $\geq 68 - 20 \log f$, $1 \text{ MHz} \leq f \leq 500 \text{ MHz}$, values referenced to 100 m	1	4	10	16	20	31,25	62,5	100	155	200	300	500	MHz	68,0	58,0	50,0	45,9	42,0	40,1	34,1	30,0	26,2	24,0	20,5	16,0	dB
1	4	10	16	20	31,25	62,5	100	155	200	300	500	MHz																
68,0	58,0	50,0	45,9	42,0	40,1	34,1	30,0	26,2	24,0	20,5	16,0	dB																
5.1.2.7.1	Power sum Near-end Crosstalk ^b (PSNEXT)	<table border="1"> <tr> <td>1</td><td>4</td><td>10</td><td>16</td><td>20</td><td>31,25</td><td>62,5</td><td>100</td><td>155</td><td>200</td><td>300</td><td>500</td><td>MHz</td> </tr> <tr> <td>72,3</td><td>63,3</td><td>57,3</td><td>54,2</td><td>52,8</td><td>49,9</td><td>45,4</td><td>42,3</td><td>39,4</td><td>37,8</td><td>35,1</td><td>31,8</td><td>dB</td> </tr> </table> $\geq 72,3 - 15 \log f$, $1 \text{ MHz} \leq f \leq 500 \text{ MHz}$	1	4	10	16	20	31,25	62,5	100	155	200	300	500	MHz	72,3	63,3	57,3	54,2	52,8	49,9	45,4	42,3	39,4	37,8	35,1	31,8	dB
1	4	10	16	20	31,25	62,5	100	155	200	300	500	MHz																
72,3	63,3	57,3	54,2	52,8	49,9	45,4	42,3	39,4	37,8	35,1	31,8	dB																
5.1.2.7.2	Power Sum Attenuation to crosstalk ratio at the far end ^{b, d} (PSACR-F)	<table border="1"> <tr> <td>1</td><td>4</td><td>10</td><td>16</td><td>20</td><td>31,25</td><td>62,5</td><td>100</td><td>155</td><td>200</td><td>300</td><td>500</td><td>MHz</td> </tr> <tr> <td>65,0</td><td>55,0</td><td>47,0</td><td>42,9</td><td>41,0</td><td>37,1</td><td>31,1</td><td>27,0</td><td>23,2</td><td>21,0</td><td>17,5</td><td>13,0</td><td>dB</td> </tr> </table> $\geq 65 - 20 \log f$, $1 \text{ MHz} \leq f \leq 500 \text{ MHz}$, values referenced to 100 m	1	4	10	16	20	31,25	62,5	100	155	200	300	500	MHz	65,0	55,0	47,0	42,9	41,0	37,1	31,1	27,0	23,2	21,0	17,5	13,0	dB
1	4	10	16	20	31,25	62,5	100	155	200	300	500	MHz																
65,0	55,0	47,0	42,9	41,0	37,1	31,1	27,0	23,2	21,0	17,5	13,0	dB																