SLOVENSKI STANDARD

SIST EN 50288-9-1:2013

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Večelementni kovinski kabli za analogne in digitalne komunikacije in krmiljenje - 9-1. del: Področna specifikacija za zaslonjene kable s karakteristikami do 1000 MHz - Vodoravni (etažni) in stavbni hrbtenični (medetažni) kabli

Multi-element metallic cables used in analogue and digital communications and control - Part 9-1: Sectional specification for screened cables characterised up to 1 000 MHz - Horizontal and building backbone cables

Mehradrige metallische Daten- und Kontrollkabel für analoge und digitale Übertragung - Teil 9-1: Rahmenspezifikation für geschirmte Kabel bis 1 000 MHz - Kabel für den Horizontal- und Steigbereich

Câbles métalliques à éléments multiples utilisés pour les transmissions et les commandes analogiques et numériques - Partie 9-1: Spécification intermédiaire pour câbles écrantés pour applications jusqu'à 1 000 MHz - Câbles horizontaux et verticaux de bâtiment

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Multi-element metallic cables used in analogue and digital communication and control - Part 9-1: Sectional specification for screened cables characterised up to 1 000 MHz - Horizontal and building backbone cables

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CENELEC

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

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Contents

Foreword

This document (EN 50288-9-1:2012) has been prepared by CLC/SC 46XC, "Multicore, multipair and quad data 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)	2013-11-12
• latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	2015-11-12

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

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

EN 50288 series is divided into the following parts:

– EN 50288-1, *Multi-element metallic cables used in analogue and digital communication and control — Part 1: Generic specification*;

– EN 50288-2-1, *Multi-element metallic cables used in analogue and digital communication and control — Part 2-1: Sectional specification for screened cables characterised up to 100 MHz — Horizontal and building backbone cables*;

– EN 50288-2-2, *Multi-element metallic cables used in analogue and digital communication and control — Part 2-2: Sectional specification for screened cables characterised up to 100 MHz — Work area and patch cord cables*;

– EN 50288-3-1, *Multi-element metallic cables used in analogue and digital communication and control — Part 3-1: Sectional specification for unscreened cables characterised up to 100 MHz — Horizontal and building backbone cables*;

– EN 50288-3-2, *Multi-element metallic cables used in analogue and digital communication and control — Part 3-2: Sectional specification for unscreened cables characterised up to 100 MHz — Work area and patch cord cables*;

– EN 50288-4-1, *Multi-element metallic cables used in analogue and digital communication and control — Part 4-1: Sectional specification for screened cables characterised up to 600 MHz — Horizontal and building backbone cables*;

– EN 50288-4-2, *Multi-element metallic cables used in analogue and digital communication and control — Part 4-2: Sectional specification for screened cables characterised up to 600 MHz — Work area and patch cord cables*;

– EN 50288-5-1, *Multi-element metallic cables used in analogue and digital communication and control — Part 5-1: Sectional specification for screened cables characterized up to 250 MHz — Horizontal and building backbone cables*;

– EN 50288-5-2, *Multi-element metallic cables used in analogue and digital communication and control — Part 5-2: Sectional specification for screened cables characterized up to 250 MHz — Work area and patch cord cables*;

- EN 50288-6-1, *Multi-element metallic cables used in analogue and digital communication and control — Part 6-1: Sectional specification for unscreened cables characterised up to 250 MHz — Horizontal and building backbone cables*;

- EN 50288-6-2, *Multi-element metallic cables used in analogue and digital communication and control — Part 6-2: Sectional specification for unscreened cables characterised up to 250 MHz — Work area and patch cord cables*;

- EN 50288-7, *Multi-element metallic cables used in analogue and digital communication and control — Part 7: Sectional specification for instrumentation and control cables*;

- EN 50288-8, *Multi-element metallic cables used in analogue and digital communication and control — Part 8: Specification for type 1 cables characterised up to 2 MHz*;

- EN 50288-9-1, *Multi-element metallic cables used in analogue and digital communications and control — Part 9-1: Sectional specification for screened cables characterized from 1 MHz up to 1 000 MHz — Horizontal and building backbone cables* (the present document);

- EN 50288-10-1, *Multi-element metallic cables used in analogue and digital communications and control — Part 10-1: Sectional specification for screened cables characterized from 1 MHz up to 500 MHz — Horizontal and building backbone cables*;

- EN 50288-11-1, *Multi-element metallic cables used in analogue and digital communication and control — Part 11-1: Sectional specification for un-screened cables characterised from 1 MHz up to 500 MHz — Horizontal and building backbone cables*.

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.

1 Scope

EN 50288-9-1 is a sectional specification for screened cables, characterised from 1 MHz up to 1 000 MHz, to be used in horizontal and building backbone wiring for Information technology generic-cabling systems.

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 should 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 communication systems. These cables are not intended to be used in conjunction with low impedance sources, for example, the electric 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	*Multi-element metallic cables used in analogue and digital communication and control — Part 1: Generic specification*
EN 50289-1-4	*Communication cables — Specifications for test methods — Part 1-4: Electrical test methods — Insulation resistance*
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 (all parts)	*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 given in EN 50288-1 and the following apply.

3.1.1
screening of cable
a cable is considered screened when the cable core is covered by a continuous conductive layer forming part of the shielding and grounding system. D.C. continuity has to be given and minimum shielding requirements have to be met

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 annealed copper and comply with the requirements of EN 50288-1, 4.1.

The nominal conductor diameter shall be ≥ 0,50 mm and ≤ 0,80 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 given in EN 50288-1, 4.4.

4.5 Screening of cabling elements

Where appropriate, screening of the cabling elements shall be applied in accordance with EN 50288-1, 4.5. When a braid is used the minimum braid coverage (for mechanical purposes) shall be 60 %. When a foil and braid are used the minimum braid coverage (for mechanical purposes) shall be 30 % coverage as defined in EN 50290-2-1.

4.6 Cable make-up

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

4.7 Filling compound

Not applicable.

4.8 Interstitial fillers

Where fillers are used they shall meet the requirements of EN 50288-1, 4.8.

4.9 Screening of the cable core

The screening of the cable core shall be applied in accordance with EN 50288-1, 4.9. When a braid is used the minimum braid coverage (for mechanical purposes) shall be 60 %. When a foil and braid are used, and/or where a foil is used over elements/the core, the minimum braid coverage (for mechanical purposes) shall be 30 % as defined in EN 50290-2-1.

4.10 Moisture barriers

Not applicable.

4.11 Wrapping layers

Where wrapping layers are used they shall be in accordance with EN 50288-1, 4.11.

4.12 Sheath

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

5 Test methods and requirements for completed cables

5.1 General

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 d.c. electrical measurements

Table 1 — Low-frequency and d.c. electrical measurements

EN 50288-1 Subclause	Parameter	Requirement
5.1.1.1	Conductor loop resistance	≤ 19 Ω/100 m.
5.1.1.2	Conductor resistance unbalance	≤ 2 %
5.1.1.3	Dielectric strength conductor/conductor and conductor/screen	1,0 kV d.c. or 0,7 kV a.c. for 1 min or 2,5 kV d.c. or 1,7 kV a.c. for 2 s
5.1.1.4	Insulation resistance	≥ 5 000 MΩ.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	≤ 1 200 pF/km

5.2.2 High-frequency electrical and transmission measurements and requirements

Table 2 — High-frequency electrical and transmission requirements

<table>
<tr><th>EN 50288-1 Subclause</th><th>Parameter</th><th>Requirement</th></tr>
<tr><td>5.1.2.1</td><td>Velocity of Propagation</td><td>Phase delay $\leq 534 + 36/\sqrt{f}$ ns/100 m, 1 MHz $\leq f \leq$ 1 000 MHz</td></tr>
<tr><td>5.1.2.2</td><td>Propagation delay difference (skew)</td><td>≤ 45 ns/100 m at 4 to 1 000 MHz</td></tr>
<tr><td>5.1.2.3</td><td>Longitudinal Attenuation [b, c, f]</td><td>
<table>
<tr><td>1</td><td>4</td><td>10</td><td>62,5</td><td>100</td><td>155</td><td>200</td><td>300</td><td>400</td><td>600</td><td>800</td><td>1 000</td><td>MHz</td></tr>
<tr><td>2,1</td><td>3,7</td><td>5,8</td><td>14,6</td><td>18,5</td><td>23,2</td><td>26,5</td><td>32,7</td><td>38,0</td><td>47,1</td><td>54,9</td><td>61,9</td><td>dB/100 m</td></tr>
</table>
$\alpha \leq 1{,}80\sqrt{f} + 0{,}005 f + 0{,}25/\sqrt{f}$, 1 MHz $\leq f \leq$ 1 000 MHz</td></tr>
<tr><td>5.1.2.4</td><td>Near End Unbalance Attenuation</td><td>Level 1 ≥ 40 – 10 log(f) dB, 1 MHz $\leq f \leq$ 250 MHz; 250 MHz $\leq f \leq$ 1000 MHz

Level 2 ≥ 50-10 log(f) dB, 1 MHz ≤f≤ 250 MHz : 250 MHz $\leq f \leq$ 1 000 MHz</td></tr>
<tr><td>5.1.2.5</td><td>Near-end Crosstalk (NEXT) [b]</td><td>
<table>
<tr><td>1</td><td>4</td><td>10</td><td>62,5</td><td>100</td><td>155</td><td>200</td><td>300</td><td>400</td><td>600</td><td>800</td><td>1 000</td><td>MHz</td></tr>
<tr><td>78,0</td><td>78,0</td><td>78,0</td><td>78,0</td><td>75,4</td><td>72,5</td><td>70,9</td><td>68,2</td><td>66,4</td><td>63,7</td><td>61,9</td><td>60,4</td><td>dB</td></tr>
</table>
≥ 105,4 – 15 log f, 1 MHz $\leq f \leq$ 1 000 MHz (78 dB max.)</td></tr>
<tr><td>5.1.2.6</td><td>Attenuation to crosstalk ratio at the far end [b,d,f,g] (ACR-F)</td><td>
<table>
<tr><td>1</td><td>4</td><td>10</td><td>62,5</td><td>100</td><td>155</td><td>200</td><td>300</td><td>400</td><td>600</td><td>800</td><td>1 000</td><td>MHz</td></tr>
<tr><td>78</td><td>78</td><td>78</td><td>69,4</td><td>65,3</td><td>61,5</td><td>59,3</td><td>55,8</td><td>53,3</td><td>49,7</td><td>47,2</td><td>45,3</td><td>dB/100 m</td></tr>
</table>
≥ 105,3 – 20 log f, 1 MHz $\leq f \leq$ 1 000 MHz (78 dB max.), values referenced to 100 m</td></tr>
<tr><td>5.1.2.7.1</td><td>Power sum Near-end Crosstalk [b] (PSNEXT)</td><td>
<table>
<tr><td>1</td><td>4</td><td>10</td><td>62,5</td><td>100</td><td>155</td><td>200</td><td>300</td><td>400</td><td>600</td><td>800</td><td>1 000</td><td>MHz</td></tr>
<tr><td>75,0</td><td>75,0</td><td>75,0</td><td>75,0</td><td>72,4</td><td>69,5</td><td>67,9</td><td>65,2</td><td>63,4</td><td>60,7</td><td>58,9</td><td>57,4</td><td>dB</td></tr>
</table>
≥ 102,4 – 15 log f, 1 MHz $\leq f \leq$ 1 000 MHz (75 dB max.)</td></tr>
<tr><td>5.1.2.7.2</td><td>Power Sum Attenuation to crosstalk ratio at the far end [b, d ,f] (PSACR-F)</td><td>
<table>
<tr><td>1</td><td>4</td><td>10</td><td>62,5</td><td>100</td><td>155</td><td>200</td><td>300</td><td>400</td><td>600</td><td>800</td><td>1 000</td><td>MHz</td></tr>
<tr><td>75,0</td><td>75,0</td><td>75,0</td><td>66,4</td><td>62,3</td><td>58,5</td><td>56,3</td><td>52,8</td><td>50,3</td><td>46,7</td><td>44,2</td><td>42,3</td><td>dB/100 m</td></tr>
</table>
≥ 102,3 - 20 log f, 1 MHz $\leq f \leq$ 1 000 MHz (75 dB max.), values referenced to 100 m</td></tr>
</table>

Table 2 *(continued)*

<table>
<tr><th>EN 50288-1 Subclause</th><th>Parameter</th><th>Requirement</th></tr>
<tr><td>5.1.2.7.4</td><td>Power Sum Exogenous Crosstalk PSExNEXT [b,e]</td><td>
<table>
<tr><td>1</td><td>4</td><td>10</td><td>62,5</td><td>100</td><td>155</td><td>200</td><td>300</td><td>400</td><td>600</td><td>800</td><td>1 000</td><td>MHz</td></tr>
<tr><td>67,0</td><td>67,0</td><td>67,0</td><td>67,0</td><td>67,0</td><td>67,0</td><td>67,0</td><td>67,0</td><td>67,0</td><td>65,8</td><td>64,0</td><td>62,5</td><td>dB</td></tr>
</table>
≥ 107,5 – 15 log f, 1 MHz ≤ f ≤ 1 000 MHz (67 dB max.)

NOTE ExACR-F removed as only PS is required. Cable meets requirements by design.
</td></tr>
<tr><td>5.1.2.7.6</td><td>Power Sum Attenuation to crosstalk ratio at the far end Exogenous Crosstalk PSExACR-F [b, c, d, e, f]</td><td>
<table>
<tr><td>1</td><td>4</td><td>10</td><td>62,5</td><td>100</td><td>155</td><td>200</td><td>300</td><td>400</td><td>600</td><td>800</td><td>1 000</td><td>MHz</td></tr>
<tr><td>67,0</td><td>67,0</td><td>67,0</td><td>57,3</td><td>53,2</td><td>49,4</td><td>47,2</td><td>43,7</td><td>41,2</td><td>37,6</td><td>35,1</td><td>33,2</td><td>dB</td></tr>
</table>
≥ 93,2 – 20 log f, 1 MHz ≤ f ≤ 1 000 MHz (67 dB max.)

NOTE Cable meets requirements by design.
</td></tr>
<tr><td>5.1.2.8</td><td>Mean Characteristic Impedance</td><td>(100 ± 5) Ω, at 100 MHz</td></tr>
<tr><td>5.1.2.9</td><td>Return loss [a, b, f]</td><td>
<table>
<tr><td>4</td><td>10</td><td>62,5</td><td>100</td><td>155</td><td>200</td><td>300</td><td>400</td><td>600</td><td>800</td><td>1 000</td><td>MHz</td></tr>
<tr><td>23,0</td><td>25,0</td><td>21,5</td><td>20,1</td><td>18,8</td><td>18,0</td><td>17,3</td><td>17,3</td><td>17,3</td><td>16,1</td><td>15,1</td><td>dB</td></tr>
</table>
≥ 20 + 5 log (f), 4 MHz ≤ f ≤ 10 MHz; 25 dB, 10 MHz ≤ f < 20 MHz; 25 – 7 log (f/20), 20 MHz < f ≤ 250 MHz; 17,3dB 250 MHz ≤ f < 600 MHz;17,3 – 10 log (f/600), 600 MHz < f ≤ 1 000 MHz
</td></tr>
<tr><td>5.1.2.10</td><td>Coupling attenuation</td><td>
Type I

≥ 85dB, 30 MHz ≤ f ≤ 100 MHz;
≥ 85 – 20 log (f / 100) dB, 100 MHz ≤ f ≤ 1 000 MHz

Type Ib

≥ 70dB, 30 MHz ≤ f ≤ 100 MHz;
≥ 70 – 20 log (f / 100) dB, 100 MHz ≤ f ≤ 1 000 MHz
</td></tr>
</table>