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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

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EUROPEAN STANDARD

**EN 50288-2-1**

NORME EUROPÉENNE

EUROPÄISCHE NORM

December 2003

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Supersedes EN 50288-2-1:2001

English version

**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**

Câbles métalliques à éléments multiples  
utilisés pour les transmissions  
et les commandes analogiques  
et numériques

Partie 2-1: Spécification intermédiaire  
pour les câbles blindés

pour applications jusqu'à 100 MHz

Câbles horizontaux et verticaux  
de bâtiment

Mehradrige metallische Daten-  
und Kontrollkabel für analoge  
und digitale Übertragung

Teil 2-1: Rahmenspezifikation

für geschirmte Kabel bis 100 MHz -  
Kabel für den Horizontal-

und Steigbereich

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

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Lithuania, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.

**CENELEC**

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

**Central Secretariat: rue de Stassart 35, B - 1050 Brussels**

## Foreword

This European Standard was prepared by SC 46XC, Multicore, Multipair and Quad Data communication cables, of Technical Committee CENELEC TC 46X, Communication cables.

The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as EN 50288-2-1 on 2003-10-01.

This European Standard supersedes EN 50288-2-1:2001

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2004-10-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2006-10-01

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

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**SIST EN 50288-2-1:2004**

## 1 Scope

This sectional specification covers screened cables, characterised up to 100 MHz, to be used in horizontal floor and building backbone wiring as defined in EN 50173.

The electrical, mechanical, transmission and environmental performance characteristics of the screened cables, related to their reference test methods, are detailed.

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

## 2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the cited publications are listed hereafter. For dated references, subsequent amendments to or revisions of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references, the latest edition of the cited publication applies, together with any amendments.

EN 50173		Information technology - Generic cabling systems
EN 50288-1		Multi-element metallic cables used in analogue and digital communication and control - Part 1: Generic specification
EN 50289	Series	Communication cables - Specifications for test methods
EN 50290	Series	Communication cables
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 Definitions

For the purposes of this European Standard the definitions of EN 50288-1 apply.

## 4 Cable construction

### 4.1 Conductor

The conductor shall be solid copper and meet the requirements of 4.1 of EN 50288-1.

The conductor shall be plain or metal coated.

The nominal conductor diameter shall be  $\geq 0,5$  mm and  $\leq 0,8$  mm.

### 4.2 Insulation

The insulation shall be of a suitable material according to the relevant part of EN 50290-2.

### 4.3 Cabling elements

The cable element shall be a pair or a quad.

#### 4.4 Identification of cabling elements

Unless otherwise specified, the colour coding for identification is given in IEC 60189-2. The colours shall meet the requirements of 4.4 of EN 50288-1.

#### 4.5 Screening of cabling elements

Where appropriate, screening of the cabling elements shall be applied in accordance with 4.5 of EN 50288-1. 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 is 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 4.8 of EN 50288-1.

#### 4.9 Screening of the cable core

The screening of the cable core shall be applied in accordance with 4.9 of EN 50288-1. 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 each cabling element, the minimum braid coverage (for mechanical purposes) shall be 30 %. Coverage is 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 4.11 of EN 50288-1.

#### 4.12 Sheath

The sheath shall be of a suitable material according to the relevant part of EN 50290-2.

## 5 Tests and requirements for completed cables

The following tables give the tests to be applied, together with the respective limits, in order to demonstrate compliance with this specification.

### 5.1 Electrical tests

#### 5.1.1 Low-frequency and d.c. electrical measurements

EN 50288-1 Subclause no.	Parameter	Requirement
5.1.1.1	Conductor loop resistance	$\leq 19,0 \Omega/100 \text{ m}$
5.1.1.2	Conductor resistance unbalance	$\leq 2,0 \%$
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	$\geq 500 \text{ M}\Omega \text{ km}$ using 100 V - 500 V test voltage
5.1.1.5	Mutual capacitance	No requirement specified
5.1.1.6	Capacitance unbalance to earth	$\leq 1600 \text{ pF/km}$

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#### 5.1.2 High-frequency electrical and transmission measurements

EN 50288-1 Subclause no.	Parameter	Requirement																		
5.1.2.1	Velocity of propagation	Phase delay $\leq 534+36/\sqrt{f}$ ns/100 m, 1 MHz $\leq f \leq$ 100 MHz																		
5.1.2.2	Propagation delay difference (skew)	$\leq 40 \text{ ns/100 m}$ at 100 MHz																		
5.1.2.3	Longitudinal attenuation <sup>2) 3) 4)</sup>	<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>MHz</td> </tr> <tr> <td>2,1</td><td>4,0</td><td>6,3</td><td>8,0</td><td>9,0</td><td>11,4</td><td>16,5</td><td>21,3</td><td>dB/100 m</td> </tr> </table> $\alpha \leq 1,9108\sqrt{f}+0,0222f+0,2/\sqrt{f}$ , 1 MHz $\leq f \leq$ 100 MHz	1	4	10	16	20	31,25	62,5	100	MHz	2,1	4,0	6,3	8,0	9,0	11,4	16,5	21,3	dB/100 m
1	4	10	16	20	31,25	62,5	100	MHz												
2,1	4,0	6,3	8,0	9,0	11,4	16,5	21,3	dB/100 m												
5.1.2.5	Near-end crosstalk (NEXT) <sup>1) 2)</sup>	<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>MHz</td> </tr> <tr> <td>65,3</td><td>56,3</td><td>50,3</td><td>47,2</td><td>45,8</td><td>42,9</td><td>38,4</td><td>35,3</td><td>dB</td> </tr> </table> $\geq 65,3-15\log(f)$ , 1 MHz $\leq f \leq$ 100 MHz	1	4	10	16	20	31,25	62,5	100	MHz	65,3	56,3	50,3	47,2	45,8	42,9	38,4	35,3	dB
1	4	10	16	20	31,25	62,5	100	MHz												
65,3	56,3	50,3	47,2	45,8	42,9	38,4	35,3	dB												



EN 50288-1 Subclause no.	Parameter	Requirement																		
5.1.2.7.1	Power sum near-end crosstalk <sup>2)</sup> (PSNEXT)	<table border="1" data-bbox="659 324 1465 454"> <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>MHz</td> </tr> <tr> <td>62,3</td><td>53,3</td><td>47,3</td><td>44,2</td><td>42,8</td><td>39,9</td><td>35,4</td><td>32,3</td><td>dB</td> </tr> </table> <p data-bbox="675 472 1171 504">≥ 62,3-15log(f), 1 MHz ≤ f ≤ 100 MHz</p>	1	4	10	16	20	31,25	62,5	100	MHz	62,3	53,3	47,3	44,2	42,8	39,9	35,4	32,3	dB
1	4	10	16	20	31,25	62,5	100	MHz												
62,3	53,3	47,3	44,2	42,8	39,9	35,4	32,3	dB												
5.1.2.6	Equal level far-end crosstalk <sup>2)</sup> (ELFEXT)	<table border="1" data-bbox="659 533 1465 663"> <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>MHz</td> </tr> <tr> <td>63,8</td><td>51,8</td><td>43,8</td><td>39,7</td><td>37,8</td><td>33,9</td><td>27,9</td><td>23,8</td><td>dB</td> </tr> </table> <p data-bbox="651 680 1490 712">≥ 63,8-20log(f), 1 MHz ≤ f ≤ 100 MHz; values referenced to 100 m</p>	1	4	10	16	20	31,25	62,5	100	MHz	63,8	51,8	43,8	39,7	37,8	33,9	27,9	23,8	dB
1	4	10	16	20	31,25	62,5	100	MHz												
63,8	51,8	43,8	39,7	37,8	33,9	27,9	23,8	dB												
5.1.2.7.2	Power sum equal level far-end crosstalk <sup>2)</sup> (PSELFEXT)	<table border="1" data-bbox="659 754 1465 884"> <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>MHz</td> </tr> <tr> <td>60,8</td><td>48,8</td><td>40,8</td><td>36,7</td><td>34,8</td><td>30,9</td><td>24,9</td><td>20,8</td><td>dB</td> </tr> </table> <p data-bbox="651 902 1490 934">≥ 60,8-20log(f), 1 MHz ≤ f ≤ 100 MHz; values referenced to 100 m</p>	1	4	10	16	20	31,25	62,5	100	MHz	60,8	48,8	40,8	36,7	34,8	30,9	24,9	20,8	dB
1	4	10	16	20	31,25	62,5	100	MHz												
60,8	48,8	40,8	36,7	34,8	30,9	24,9	20,8	dB												
5.1.2.8	Mean characteristic impedance	100 Ω ± 5 Ω, 120 Ω ± 5 Ω, at 100 MHz																		
5.1.2.9	Return loss <sup>2) 5)</sup>	<table border="1" data-bbox="659 1048 1465 1178"> <tr> <td>4</td><td>8</td><td>10</td><td>16</td><td>20</td><td>31,25</td><td>62,5</td><td>100</td><td>MHz</td> </tr> <tr> <td>23,0</td><td>24,5</td><td>25,0</td><td>25,0</td><td>25,0</td><td>23,6</td><td>21,5</td><td>20,1</td><td>dB</td> </tr> </table> <p data-bbox="675 1196 1490 1258">≥ 20+5log(f), 4 MHz ≤ f &lt; 10 MHz; 25 dB, 10 MHz ≤ f &lt; 20 MHz; 25-7log(f/20), 20 MHz ≤ f ≤ 100 MHz; f.f.s</p>	4	8	10	16	20	31,25	62,5	100	MHz	23,0	24,5	25,0	25,0	25,0	23,6	21,5	20,1	dB
4	8	10	16	20	31,25	62,5	100	MHz												
23,0	24,5	25,0	25,0	25,0	23,6	21,5	20,1	dB												
5.1.2.4	Near-end unbalance attenuation	≥ 40-10log(f) dB, 1 MHz ≤ f ≤ 100 MHz, f.f.s																		
5.1.2.10	Coupling attenuation	≥ 55 dB, 30 MHz ≤ f ≤ 100 MHz, f.f.s ≥ 55-20log(f/100) dB; 100 MHz < f ≤ 1 000 MHz, f.f.s																		
5.1.2.11	Transfer impedance	≤ 50 mΩ/m at 1 MHz; ≤ 100 mΩ/m at 10 MHz; ≤ 200 mΩ/m at 30 MHz																		
5.1.2.12	Screening attenuation	≥ 40 dB, 30 MHz ≤ f ≤ 100 MHz, f.f.s  NOTE Measured to 1 GHz.																		
<p data-bbox="204 1749 1445 1805">1) For hybrid and multi-unit cables and cables, PSNEXT between all non fibre recognised cable units shall be 3 dB better than the specified pair to pair NEXT at all specified frequencies.</p> <p data-bbox="204 1816 1445 1872">2) The values in the table are for information only. The formula given shall be used to determine compliance, rounded to one decimal place.</p> <p data-bbox="204 1883 1445 1939">3) The attenuation shall meet values adjusted for temperature up to 60 °C with a temperature coefficient of 0,2 % per degree rise above 20 °C.</p> <p data-bbox="204 1951 871 1984">4) Values between 1 MHz and 4 MHz are for information only.</p> <p data-bbox="204 1995 1445 2051">5) For the measurement of return loss a test sample having a round trip loss ≥ 40 dB at any measured frequency should be used.</p>																				