

Category 7A Communication Cable Requirements

as specified in ISO/IEC, IEC, CENELEC and TIA standards and draft specifications

per 14th February 2011

1. Applicable standards and draft specifications:

- 2nd edition ISO/IEC 11801
- Amendment 2 to 2nd edition ISO/IEC 11801
- 2nd edition IEC 61156-5
- 3rd edition IEC 61156-6
- CENELEC EN 50288-9-1, draft prEN 50288-9-1: January 2010
- 2nd edition CENELEC EN 50173-1
- Amendment 2 to 2nd edition EN 50173-1, draft FprAB July2010

2. Requirements for Unscreened Category 7A Horizontal Cables

Parameter	ISO/IEC	IEC	CENELEC	TIA/EIA	3P Requirements
Standards	* 2 nd edition ISO/IEC 11801 * Amendment 2 to 2 nd edition ISO/IEC 11801	2 nd edition IEC 61156-5	•2 nd edition EN 50173-1 •Amendment 2 to 2 nd edition EN 50173-1, draft FprAB July2010	ANSI/TIA 568-C.2	
Current carrying capacity	Not specified	Not specified	Not specified	Not specified	Not measured
dc resistance	Max. 95,0 Ω/km @ 20°C	Max. 95,0 Ω/km @ 20°C	Not specified	Not specified	Max. 93,8 Ω/km @ 20°C
dc loop resistance	Not specified	Not specified	Not specified	Not specified	Max. 190 Ω/km
Resistance unbalance within a pair	Max. 2 %	Max. 2 %	Not specified	Not specified	Max. 2,0 %
Resistance unbalance between pairs	Today outdated requirement is max. 4 %	Today outdated requirement is max. 4 %	Not specified	Not specified	Not measured
Mutual capacitance	Not specified	Not specified	Not specified	Not specified	Max. 56 nF /km @ 1 kHz (for information)
Capacitance unbalance	Max. 1600 pF/km @ 0,8 or 1 kHz	Max. 1600 pF/km @ 0,8 or 1 kHz	Not specified	Not specified	Max. 1200 pF/km

Insulation resistance	Min. 5000 MΩ km	Min. 5000 MΩ km	Not specified	Not specified	Min. 5000 MΩ km
Dielectric strength	Min. 1,0 kVdc or 0,7 kVdc for 1 min. or 2,5 kVdc or 1,7 kVdc for 2 secs.	Min. 1,0 kVdc or 0,7 kVdc for 1 min. or 2,5 kVdc or 1,7 kVdc for 2 secs.	Not specified	Not specified	2,5 kVdc for 2 secs.
Input impedance	For information when return loss requirements are passed. Alternatively complex equation in the 2 nd edition IEC 61156-5 standard	For information when return loss requirements are passed. Alternatively complex equation in the standard	Not specified	Not specified	<i>1-100 MHz:</i> 100+/-15 Ω <i>100-250 MHz:</i> 100+/-22 Ω <i>250-1000 MHz:</i> 100+/-25 Ω (for information)
Mean input impedance	100+/-5 Ω @ 100 MHz	100+/-5 Ω @ 100 MHz	Not specified	Not specified	100+/-5 Ω @ 100 MHz
Return loss	<i>4-20 MHz:</i> 20+5log(f) dB, max. 25,0 dB <i>20-600 MHz:</i> 25,0- 7log($\frac{f}{20}$) dB, min. 17,3 dB <i>600-1000 MHz:</i> 17,3- 10log($\frac{f}{600}$) dB for 100 m cable	<i>4-20 MHz:</i> 20+5log(f) dB, max. 25,0 dB <i>20-600 MHz:</i> 25,0- 7log($\frac{f}{20}$) dB, min. 17,3 dB <i>600-1000 MHz:</i> 17,3- 10log($\frac{f}{600}$) dB for 100 m cable	Not specified	Not specified	<i>1-20 MHz:</i> 20+5log(f) dB, max. 25,0 dB <i>20-600 MHz:</i> 25,0- 7log($\frac{f}{20}$) dB, min. 17,3 dB <i>600-1000 MHz:</i> 17,3- 10log($\frac{f}{600}$) dB for long cable
Attenuation (insertion loss) 20°C	<i>4-1000 MHz:</i> 18,00√f+ 0,05 f+ $\frac{2,5}{\sqrt{f}}$ dB/km	<i>4-1000 MHz:</i> 18,00√f+ 0,05 f+ $\frac{2,5}{\sqrt{f}}$ dB/km	Not specified	Not specified	<i>1-1000 MHz:</i> 18,00√f+ 0,05 f+ $\frac{2,5}{\sqrt{f}}$ dB/km
Attenuation (insertion loss) 40°C	<i>4-1000 MHz:</i> 19,440√f+ 0,054 f+ $\frac{2,70}{\sqrt{f}}$ dB/km	<i>4-1000 MHz:</i> 19,440√f+ 0,054 f+ $\frac{2,70}{\sqrt{f}}$ dB/km	Not specified	Not specified	<i>1-1000 MHz:</i> 19,440√f+ 0,054 f+ $\frac{2,70}{\sqrt{f}}$ dB/km
Attenuation (insertion loss) 60°C	<i>4-1000 MHz:</i> 21,600√f+ 0,060 f+ $\frac{3,00}{\sqrt{f}}$ dB/km	<i>4-1000 MHz:</i> 21,600√f+ 0,060 f+ $\frac{3,00}{\sqrt{f}}$ dB/km	Not specified	Not specified	<i>1-1000 MHz:</i> 21,600√f+ 0,060 f+ $\frac{3,00}{\sqrt{f}}$ dB/km

Temperature correction factor for attenuation	20-40°C: 0,4 %/°C 40-60°C: 0,6 %/°C	20-40°C: 0,4 %/°C 40-60°C: 0,6 %/°C	Not specified	Not specified	20-40°C: 0,4 %/°C 40-60°C: 0,6 %/°C
Near end crosstalk	4-1000 MHz: 105,4- 15log(f) dB, max. 78 dB	4-1000 MHz: 105,4- 15log(f) dB, max. 78 dB	Not specified	Not specified	1-1000 MHz: 105,4- 15log(f) dB, max. 78 dB
Power sum near end crosstalk	4-1000 MHz: 102,4- 15log(f) dB, max. 75 dB	4-1000 MHz: 102,4- 15log(f) dB, max. 75 dB	Not specified	Not specified	1-1000 MHz: 102,4- 15log(f) dB, max. 75 dB
ACR	Not specified	Not specified	Not specified	Not specified	1-1000 MHz: NEXT- attenuation dB
Power sum ACR	Not specified	Not specified	Not specified	Not specified	1-1000 MHz: Power sum NEXT- attenuation dB
ELFEXT (ACR-F)	1-1000 MHz: 105,3- 20log(f) dB, max. 75 dB, and not specified when FEXT is over 70 dB	4-1000 MHz: 95,3- 20log(f) dB, max. 78 dB, and not specified when FEXT is over 90 dB	Not specified	Not specified	1-1000 MHz: 105,3- 20log(f) dB, max. 75 dB, and not specified when FEXT is over 90 dB
Power sum ELFEXT (PSACR-F)	1-1000 MHz: 102,3- 20log(f) dB, max. 72 dB, and not specified specified when power sum FEXT is over 67 dB	4-1000 MHz: 92,3- 20log(f) dB, max. 75 dB, and not specified when FEXT is over 90 dB	Not specified	Not specified	1-1000 MHz: 102,3- 20log(f) dB, max. 72 dB, and not specified when FEXT is over 90 dB
Power sum alien near end crosstalk	1-1000 MHz: 107,5 -15log(f) dB, max. 67 dB	1-1000 MHz: 107,5 -15log(f) dB, max. 67 dB	Not specified	Not specified	1-1000 MHz: 107,5 -15log(f) dB, max. 67 dB
Average power sum alien near end crosstalk	Not specified	Not specified	Not specified	Not specified	Not specified
Power sum alien equal level far end crosstalk	1-1000 MHz: 93,2-20log(f) dB, max. 67 dB	1-1000 MHz: 93,2-20log(f) dB, max. 67 dB	Not specified	Not specified	1-1000 MHz: 93,2-20log(f) dB, max. 67 dB

Average power sum alien equal level far end crosstalk	Not specified	Not specified	Not specified	Not specified	Not specified
Near end balance (TCL)	<i>1-250 MHz:</i> 50,0-10log(f) dB	Level 1: <i>1-250 MHz:</i> 40,0-10log(f) dB Level 2: <i>1-250 MHz:</i> 50,0-10log(f) dB	Not specified	Not specified	Level 2: <i>1-1000 MHz:</i> 50,0-10log(f) dB
Far end balance (ELTCTL)	<i>1-30 MHz:</i> 35,0-20log(f) dB	<i>1-30 MHz:</i> 35,0-20log(f) dB	Not specified	Not specified	<i>1-30 MHz:</i> 35-20log(f) dB
Propagation delay	<i>4-1000 MHz:</i> 5340+ $\frac{360}{\sqrt{f}}$ ns/km	<i>4-1000 MHz:</i> 5340+ $\frac{360}{\sqrt{f}}$ ns/km	Not specified	Not specified	<i>1-1000 MHz:</i> 5340+ $\frac{360}{\sqrt{f}}$ ns/km
Velocity of propagation	Not specified	Not specified	Not specified	Not specified	Measured (for information)
Delay skew 20°C	<i>4-1000 MHz:</i> Max. 250 ns/km	<i>4-1000 MHz:</i> Max. 250 ns/km	Not specified	Not specified	<i>1-1000 MHz:</i> Max. 250 ns/km
Delay skew 40°C	Not specified	Not specified	Not specified	Not specified	<i>1-1000 MHz:</i> Max. 250 ns/km
Delay skew 60°C	Not specified	Not specified	Not specified	Not specified	<i>1-1000 MHz:</i> Max. 250 ns/km
Delay skew variation with temperature	Not specified	Not specified	Not specified	Not specified	<i>1-250 MHz:</i> Max. +/- 100 ns/km of value at 20°C when measured at 40°C and 60°C
Coupling attenuation	Not specified	Type III: <i>30- 1000 MHz:</i> 40- $20\log(\frac{f}{100})$ dB, max. 40 dB Type II: <i>30- 1000 MHz:</i> 55- $20\log(\frac{f}{100})$ dB, max. 55 dB Type I: <i>30- 1000 MHz:</i> 85- $20\log(\frac{f}{100})$ dB, max. 85 dB	Not specified	Not specified	Type III: <i>30- 1000 MHz:</i> 40- $20\log(\frac{f}{100})$ dB, max. 40 dB Type II: <i>30- 1000 MHz:</i> 55- $20\log(\frac{f}{100})$ dB, max. 55 dB Type I: <i>30- 1000 MHz:</i> 85- $20\log(\frac{f}{100})$ dB, max. 85 dB

“EMC performance”	Not specified	Type III: Min. 40 dB Type II: Min. 55 dB Type I: Min. 85 dB	Not specified	Not specified	Type III: Min. 40 dB Type II: Min. 55 dB Type I: Min. 85 dB
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3. Requirements for Unscreened Category 7A Flexible Cables

Parameter	ISO/IEC	IEC	CENELEC	TIA/EIA	3P Requirements
Standards	* 2 nd edition ISO/IEC 11801 * Amendment 2 to 2 nd edition ISO/IEC 11801	3 rd edition IEC 61156-6	•2 nd edition EN 50173-1 •Amendment 2 to 2 nd edition EN 50173-1, draft FprAB July2010	ANSI/TIA 568-C.2	
Current carrying capacity	Not specified	Not specified	Not specified	Not specified	Not measured
dc resistance	Max. 145 Ω/km @ 20°C	Max. 145 Ω/km @ 20°C	Not specified	Not specified	Max. 140 Ω/km @ 20°C
dc loop resistance	Not specified	Not specified	Not specified	Not specified	Max. 290 Ω/km
Resistance unbalance within a pair	Max. 2 %	Max. 2 %	Not specified	Not specified	Max. 2,0 %
Resistance unbalance between pairs	Today outdated requirement is max. 4 %	Today outdated requirement is max. 4 %	Not specified	Not specified	Not measured
Mutual capacitance	Not specified	Not specified	Not specified	Not specified	Max. 56 nF /km @ 1 kHz (for information)
Capacitance unbalance	Max. 1600 pF/km @ 0,8 or 1 kHz	Max. 1600 pF/km @ 0,8 or 1 kHz	Not specified	Not specified	Max. 1200 pF/km
Insulation resistance	Min. 5000 MΩ km	Min. 5000 MΩ km	Not specified	Not specified	Min. 5000 MΩ km
Dielectric strength	Min. 1,0 kVdc or 0,7 kVdc for 1 min. or 2,5 kVdc or 1,7 kVdc for 2 secs.	Min. 1,0 kVdc or 0,7 kVdc for 1 min. or 2,5 kVdc or 1,7 kVdc for 2 secs.	Not specified	Not specified	2,5 kVdc for 2 secs.
Input impedance	For information when return loss requirements are passed. Alternatively complex equation in the 2 nd edition IEC 61156-6 standard	For information when return loss requirements are passed. Alternatively complex equation in the standard	Not specified	Not specified	1-100 MHz: 100+/-15 Ω 100-250 MHz: 100+/-22 Ω 250-1000 MHz: 100+/-25 Ω (for information)

Mean input impedance	100+/-5 Ω @ 100 MHz	100+/-5 Ω @ 100 MHz	Not specified	Not specified	100+/-5 Ω @ 100 MHz
Return loss	4-20 MHz: 20+5log(f) dB, max. 25,0 dB 20-600 MHz: 25,0- 8,6log($\frac{f}{20}$) dB, min. 15,6 dB 600-1000 MHz: 15,6- 10log($\frac{f}{600}$) dB for 100 m cable	4-20 MHz: 20+5log(f) dB, max. 25,0 dB 20-600 MHz: 25,0- 8,6log($\frac{f}{20}$) dB, min. 15,6 dB 600-1000 MHz: 15,6- 10log($\frac{f}{600}$) dB for 100 m cable	Not specified	Not specified	1-20 MHz: 20+5log(f) dB, max. 25,0 dB 20-600 MHz: 25,0- 7log($\frac{f}{20}$) dB, min. 17,3 dB 600-1000 MHz: 17,3- 10log($\frac{f}{600}$) dB for long cable
Attenuation (insertion loss) 20°C	4-1000 MHz: 27,00 \sqrt{f} + 0,075 f+ $\frac{3,0}{\sqrt{f}}$ dB/km	4-1000 MHz: 27,00 \sqrt{f} + 0,075 f+ $\frac{3,0}{\sqrt{f}}$ dB/km	Not specified	Not specified	1-1000 MHz: 27,00 \sqrt{f} + 0,075 f+ $\frac{3,0}{\sqrt{f}}$ dB/km
Attenuation (insertion loss) 40°C	4-1000 MHz: 29,160 \sqrt{f} + 0,081 f+ $\frac{3,24}{\sqrt{f}}$ dB/km	4-1000 MHz: 29,160 \sqrt{f} + 0,081 f+ $\frac{3,24}{\sqrt{f}}$ dB/km	Not specified	Not specified	1-1000 MHz: 29,160 \sqrt{f} + 0,081 f+ $\frac{3,24}{\sqrt{f}}$ dB/km
Attenuation (insertion loss) 60°C	4-1000 MHz: 32,400 \sqrt{f} + 0,090 f+ $\frac{3,60}{\sqrt{f}}$ dB/km	4-1000 MHz: 32,400 \sqrt{f} + 0,090 f+ $\frac{3,60}{\sqrt{f}}$ dB/km	Not specified	Not specified	1-1000 MHz: 32,400 \sqrt{f} + 0,090 f+ $\frac{3,60}{\sqrt{f}}$ dB/km
Temperature correction factor for attenuation	20-40°C: 0,4 %/°C 40-60°C: 0,6 %/°C	20-40°C: 0,4 %/°C 40-60°C: 0,6 %/°C	Not specified	Not specified	20-40°C: 0,4 %/°C 40-60°C: 0,6 %/°C
Near end crosstalk	4-1000 MHz: 108,4- 15log(f) dB, max. 78 dB	4-1000 MHz: 108,4- 15log(f) dB, max. 78 dB	Not specified	Not specified	1-1000 MHz: 108,4- 15log(f) dB, max. 78 dB
Power sum near end crosstalk	4-1000 MHz: 105,4- 15log(f) dB, max. 75 dB	4-1000 MHz: 105,4- 15log(f) dB, max. 75 dB	Not specified	Not specified	1-1000 MHz: 105,4- 15log(f) dB, max. 75 dB
ACR	Not specified	Not specified	Not specified	Not specified	1-1000 MHz: NEXT- attenuation dB
Power sum ACR	Not specified	Not specified	Not specified	Not specified	1-1000 MHz: Power sum NEXT- attenuation dB

ELFEXT (ACR-F)	<i>1-1000 MHz:</i> 105,3- 20log(f) dB, max. 75 dB, and not specified when FEXT is over 70 dB	<i>4-1000 MHz:</i> 94,0- 20log(f) dB, max. 78 dB, and not specified when FEXT is over 70 dB	Not specified	Not specified	<i>1-1000 MHz:</i> 105,3- 20log(f) dB, max. 75 dB, and not specified when FEXT is over 90 dB
Power sum ELFEXT (PSACR-F)	<i>1-1000 MHz:</i> 102,3- 20log(f) dB, max. 72 dB, and not specified specified when power sum FEXT is over 67 dB	<i>4-1000 MHz:</i> 91,0- 20log(f) dB, max. 75 dB, and not specified when FEXT is over 70 dB	Not specified	Not specified	<i>1-1000 MHz:</i> 102,3- 20log(f) dB, max. 72 dB, and not specified when FEXT is over 90 dB
Power sum alien near end crosstalk	<i>1-1000 MHz:</i> 105-15log(f) dB, max. 67 dB	<i>1-1000 MHz:</i> 105-15log(f) dB, max. 67 dB	Not specified	Not specified	<i>1-1000 MHz:</i> 105-15log(f) dB, max. 67 dB
Average power sum alien near end crosstalk	Not specified	Not specified	Not specified	Not specified	Not specified
Power sum alien equal level far end crosstalk	<i>1-1000 MHz:</i> 92,0-20log(f) dB, max. 67 dB	<i>1-1000 MHz:</i> 92,0-20log(f) dB, max. 67 dB	Not specified	Not specified	<i>1-1000 MHz:</i> 92,0-20log(f) dB, max. 67 dB
Average power sum alien equal level far end crosstalk	Not specified	Not specified	Not specified	Not specified	Not specified
Near end balance (TCL)	<i>1-250 MHz:</i> 50,0-10log(f) dB	Level 1: <i>1-250 MHz:</i> 40,0-10log(f) dB Level 2: <i>1-250 MHz:</i> 50,0-10log(f) dB	Not specified	Not specified	Level 2: <i>1-1000 MHz:</i> 50,0-10log(f) dB
Far end balance (ELTCTL)	<i>1-30 MHz:</i> 35,0-20log(f) dB	<i>1-30 MHz:</i> 35,0-20log(f) dB	Not specified	Not specified	<i>1-30 MHz:</i> 35-20log(f) dB
Propagation delay	<i>4-1000 MHz:</i> 5340+ $\frac{360}{\sqrt{f}}$ ns/km	<i>4-1000 MHz:</i> 5340+ $\frac{360}{\sqrt{f}}$ ns/km	Not specified	Not specified	<i>1-1000 MHz:</i> 5340+ $\frac{360}{\sqrt{f}}$ ns/km
Velocity of propagation	Not specified	Not specified	Not specified	Not specified	Measured (for information)
Delay skew 20°C	<i>4-1000 MHz:</i> Max. 250 ns/km	<i>4-1000 MHz:</i> Max. 250 ns/km	Not specified	Not specified	<i>1-1000 MHz:</i> Max. 250 ns/km

Delay skew 40°C	Not specified	Not specified	Not specified	Not specified	1-1000 MHz: Max. 250 ns/km
Delay skew 60°C	Not specified	Not specified	Not specified	Not specified	1-1000 MHz: Max. 250 ns/km
Delay skew variation with temperature	Not specified	Not specified	Not specified	Not specified	1-250 MHz: Max. +/- 100 ns/km of value at 20°C when measured at 40°C and 60°C
Coupling attenuation	Not specified	<p>Type III: 30- 1000 MHz: 40- $20\log\left(\frac{f}{100}\right)$ dB, max. 40 dB</p> <p>Type II: 30- 1000 MHz: 55- $20\log\left(\frac{f}{100}\right)$ dB, max. 55 dB</p> <p>Type I: 30- 1000 MHz: 85- $20\log\left(\frac{f}{100}\right)$ dB, max. 85 dB</p>	Not specified	Not specified	<p>Type III: 30- 1000 MHz: 40- $20\log\left(\frac{f}{100}\right)$ dB, max. 40 dB</p> <p>Type II: 30- 1000 MHz: 55- $20\log\left(\frac{f}{100}\right)$ dB, max. 55 dB</p> <p>Type I: 30- 1000 MHz: 85- $20\log\left(\frac{f}{100}\right)$ dB, max. 85 dB</p>
“EMC performance”	Not specified	<p>Type III: Min. 40 dB</p> <p>Type II: Min. 55 dB</p> <p>Type I: Min. 85 dB</p>	Not specified	Not specified	<p>Type III: Min. 40 dB</p> <p>Type II: Min. 55 dB</p> <p>Type I: Min. 85 dB</p>

4. Requirements for Screened Category 7A Horizontal Cables

Parameter	ISO/IEC	IEC	CENELEC	TIA/EIA	3P Requirements
Standards	* 2 nd edition ISO/IEC 11801 * Amendment 2 to 2 nd edition ISO/IEC 11801	2 nd edition IEC 61156-5	• EN 50288-9-1, draft prEN 50288-9-1: January 2010 • 2 nd edition EN 50173-1 • Amendment 2 to 2 nd edition EN 50173-1, draft FprAB July 2010	ANSI/TIA 568-C.2	
Current carrying capacity	Not specified	Not specified	Max. 3 A/mm ²	Not specified	Not measured
dc resistance	Max. 95,0 Ω/km @ 20°C	Max. 95,0 Ω/km @ 20°C	Not specified	Not specified	Max. 93,8 Ω/km @ 20°C
dc loop resistance	Not specified	Not specified	Max. 190 Ω/km	Not specified	Max. 190 Ω/km
Resistance unbalance within a pair	Max. 2 %	Max. 2 %	Max. 2 %	Not specified	Max. 2,0 %
Resistance unbalance between pairs	Today outdated requirement is max. 4 %	Today outdated requirement is max. 4 %	Today outdated requirement is max. 4 %	Not specified	Not measured
Mutual capacitance	Not specified	Not specified	Not specified	Not specified	Max. 56 nF /km @ 1 kHz (for information)
Capacitance unbalance	Max. 1600 pF/km @ 0,8 or 1 kHz	Max. 1600 pF/km @ 0,8 or 1 kHz	Max. 1200 pF/km	Not specified	Max. 1200 pF/km
Insulation resistance	Min. 5000 MΩ km	Min. 5000 MΩ km	Min. 5000 MΩ km	Not specified	Min. 5000 MΩ km
Dielectric strength	Min. 1,0 kVdc or 0,7 kVdc for 1 min. or 2,5 kVdc or 1,7 kVdc for 2 secs.	Min. 1,0 kVdc or 0,7 kVdc for 1 min. or 2,5 kVdc or 1,7 kVdc for 2 secs.	Min. 1,0 kVdc or 0,7 kVdc for 1 min. or 2,5 kVdc or 1,7 kVdc for 2 secs.	Not specified	2,5 kVdc for 2 secs.

Input impedance	For information when return loss requirements are passed. Alternatively complex equation in the 2 nd edition IEC 61156-5 standard	For information when return loss requirements are passed. Alternatively complex equation in the standard	Not specified	Not specified	1-100 MHz: 100+/-15 Ω 100-250 MHz: 100+/-22 Ω 250-1000 MHz: 100+/-25 Ω (for information)
Mean input impedance	100+/-5 Ω @ 100 MHz	100+/-5 Ω @ 100 MHz	100+/-5 Ω @ 100 MHz	Not specified	100+/-5 Ω @ 100 MHz
Return loss	4-20 MHz: 20+5log(f) dB, max. 25,0 dB 20-600 MHz: 25,0- 7log($\frac{f}{20}$) dB, min. 17,3 dB 600-1000 MHz: 17,3- 10log($\frac{f}{600}$) dB for 100 m cable	4-20 MHz: 20+5log(f) dB, max. 25,0 dB 20-600 MHz: 25,0- 7log($\frac{f}{20}$) dB, min. 17,3 dB 600-1000 MHz: 17,3- 10log($\frac{f}{600}$) dB for 100 m cable	4-20 MHz: 20+5log(f) dB, max. 25,0 dB 20-600 MHz: 25- 7log($\frac{f}{20}$) dB, min. 17,3 dB 600-1000 MHz: 17,3- 10log($\frac{f}{600}$) dB for long cable	Not specified	4-20 MHz: 20+5log(f) dB, max. 25,0 dB 20-600 MHz: 25,0- 7log($\frac{f}{20}$) dB, min. 17,3 dB 600-1000 MHz: 17,3- 10log($\frac{f}{600}$) dB for long cable
Attenuation (insertion loss) 20°C	4-1000 MHz: 18,00√f+ 0,05 f+ $\frac{2,5}{\sqrt{f}}$ dB/km	4-1000 MHz: 18,00√f+ 0,05 f+ $\frac{2,5}{\sqrt{f}}$ dB/km	4-1000 MHz: 18,00√f+ 0,05 f+ $\frac{2,5}{\sqrt{f}}$ dB/km	Not specified	1-1000 MHz: 18,0√f+ 0,05 f+ $\frac{2,5}{\sqrt{f}}$ dB/km
Attenuation (insertion loss) 40°C	4-1000 MHz: 18,720√f+ 0,052 f+ $\frac{2,60}{\sqrt{f}}$ dB/km	4-1000 MHz: 18,720√f+ 0,052 f+ $\frac{2,60}{\sqrt{f}}$ dB/km	4-1000 MHz: 18,720√f+ 0,052 f+ $\frac{2,60}{\sqrt{f}}$ dB/km	Not specified	1-1000 MHz: 18,720√f+ 0,052 f+ $\frac{2,60}{\sqrt{f}}$ dB/km
Attenuation (insertion loss) 60°C	4-1000 MHz: 19,440√f+ 0,054 f+ $\frac{2,70}{\sqrt{f}}$ dB/km	4-1000 MHz: 19,440√f+ 0,054 f+ $\frac{2,70}{\sqrt{f}}$ dB/km	4-1000 MHz: 19,440√f+ 0,054 f+ $\frac{2,70}{\sqrt{f}}$ dB/km	Not specified	1-1000 MHz: 19,440√f+ 0,054 f+ $\frac{2,70}{\sqrt{f}}$ dB/km
Temperature correction factor for attenuation	20-60°C: Max. 0,2 %/°C	20-60°C: Max. 0,2 %/°C	20-60°C: Max. 0,2 %/°C	Not specified	20-60°C: Max. 0,2 %/°C
Near end crosstalk	4-1000 MHz: 105,4- 15log(f) dB, max. 78 dB	4-1000 MHz: 105,4- 15log(f) dB, max. 78 dB	1-1000 MHz: 102,4- 15log(f) dB, max. 66 dB	Not specified	1-1000 MHz: 105,4- 15log(f) dB, max. 78 dB
Power sum near end crosstalk	4-1000 MHz: 102,4- 15log(f) dB, max. 75 dB	4-1000 MHz: 102,4- 15log(f) dB, max. 75 dB	1-1000 MHz: 99,5- 15log(f) dB, max. 64 dB	Not specified	1-1000 MHz: 102,4- 15log(f) dB, max. 75 dB
ACR	Not specified	Not specified	Not specified	Not specified	1-1000 MHz: NEXT- attenuation dB

Power sum ACR	Not specified	Not specified	Not specified	Not specified	<i>1-1000 MHz:</i> Power sum NEXT-attenuation dB
ELFEXT (ACR-F)	<i>1-1000 MHz:</i> 105,3-20log(f) dB, max. 75 dB, and not specified when FEXT is over 70 dB	<i>4-1000 MHz:</i> 95,3-20log(f) dB, max. 78 dB, and not specified when FEXT is over 90 dB	<i>1-1000 MHz:</i> 105-20log(f) dB, max. 66 dB, and not specified when FEXT is over 70 dB	Not specified	<i>1-1000 MHz:</i> 105,3-20log(f) dB, max. 75 dB, and not specified when FEXT is over 90 dB
Power sum ELFEXT (PSACR-F)	<i>1-1000 MHz:</i> 102,3-20log(f) dB, max. 72 dB, and not specified when power sum FEXT is over 67 dB	<i>4-1000 MHz:</i> 92,3-20log(f) dB, max. 75 dB, and not specified when FEXT is over 90 dB	<i>1-1000 MHz:</i> 102-20log(f) dB, max. 66 dB, and not specified when FEXT is over 70 dB	Not specified	<i>1-1000 MHz:</i> 102,3-20log(f) dB, max. 72 dB, and not specified when FEXT is over 90 dB
Power sum alien near end crosstalk	<i>1-1000 MHz:</i> 107,5-15log(f) dB, max. 67 dB (for information)	<i>1-1000 MHz:</i> 107,5-15log(f) dB, max. 67 dB (for information)	<i>1-1000 MHz:</i> 92,5-15log(f) dB, max. 72 dB (for information)	Not specified	Not measured
Average power sum alien near end crosstalk	Not specified	Not specified	Not specified	Not specified	Not specified
Power sum alien equal level far end crosstalk	<i>1-1000 MHz:</i> 93,2-20log(f) dB, max. 67 dB (for information)	<i>1-1000 MHz:</i> 93,2-20log(f) dB, max. 67 dB (for information)	<i>1-1000 MHz:</i> 78,2-20log(f) dB, max. 67 dB, and not specified when AFEXT is over 70 dB (for information)	Not specified	Not measured
Average power sum alien equal level far end crosstalk	Not specified	Not specified	Not specified	Not specified	Not specified
Near end balance (TCL)	Level 1: <i>1-250 MHz:</i> 40,0-10log(f) dB Level 2: <i>1-250 MHz:</i> 50,0-10log(f) dB	Level 1: <i>1-250 MHz:</i> 40,0-10log(f) dB Level 2: <i>1-250 MHz:</i> 50,0-10log(f) dB	<i>1-1000 MHz:</i> 50,0-10log(f) dB	Not specified	Level 2: <i>1-1000 MHz:</i> 50,0-10log(f) dB
Far end balance (ELTCTL)	<i>1-30 MHz:</i> 35,0-20log(f) dB	<i>1-30 MHz:</i> 35,0-20log(f) dB	Not specified	Not specified	<i>1-30 MHz:</i> 35-20log(f) dB

Propagation delay	4-1000 MHz: 5340+ $\frac{360}{\sqrt{f}}$ ns/km	4-1000 MHz: 5340+ $\frac{360}{\sqrt{f}}$ ns/km	1-1000 MHz: 5340+ $\frac{360}{\sqrt{f}}$ ns/km	Not specified	1-1000 MHz: 5340+ $\frac{360}{\sqrt{f}}$ ns/km
Velocity of propagation	Not specified	Not specified	Not specified	Not specified	Measured (for information)
Delay skew 20°C	4-1000 MHz: Max. 250 ns/km	4-1000 MHz: Max. 250 ns/km	Max. 400 ns/km @ 100 MHz	Not specified	1-1000 MHz: Max. 250 ns/km
Delay skew 40°C	Not specified	Not specified	Not specified	Not specified	1-1000 MHz: Max. 250 ns/km
Delay skew 60°C	Not specified	Not specified	Not specified	Not specified	1-1000 MHz: Max. 250 ns/km
Delay skew variation with temperature	Not specified	Not specified	Not specified	Not specified	1-250 MHz: Max. +/- 100 ns/km of value at 20°C when measured at 40°C and 60°C
Coupling attenuation	30- 1000 MHz: 55- $20\log(\frac{f}{100})$ dB, max. 55 dB	Type III: 30- 1000 MHz: 40- $20\log(\frac{f}{100})$ dB, max. 40 dB Type II: 30- 1000 MHz: 55- $20\log(\frac{f}{100})$ dB, max. 55 dB Type I: 30- 1000 MHz: 85- $20\log(\frac{f}{100})$ dB, max. 85 dB	30- 1000 MHz: 85- $20\log(\frac{f}{100})$ dB, max. 85 dB	Not specified	Type I: 30- 1000 MHz: 85- $20\log(\frac{f}{100})$ dB, max. 85 dB
“EMC performance”	Type II: Min. 55 dB	Type III: Min. 40 dB Type II: Min. 55 dB Type I: Min. 85 dB	Min. 85 dB	Not specified	Type I: Min. 85 dB

Transfer impedance	Max. 50 mΩ/m @1 MHz Max. 100 mΩ/m @10 MHz Max. 200 mΩ/m @30 MHz Max. 1000 mΩ/m @100 MHz	Grade 1: Max. 10 mΩ/m @1 MHz Max. 10 mΩ/m @10 MHz Max. 30 mΩ/m @30 MHz Max. 100 mΩ/m @100 MHz Grade 2: Max. 50 mΩ/m @1 MHz Max. 100 mΩ/m @10 MHz Max. 200 mΩ/m @30 MHz Max. 1000 mΩ/m @100 MHz	Max. 15 mΩ/m @1 MHz Max. 10 mΩ/m @10 MHz Max. 30 mΩ/m @30 MHz Max. 60 mΩ/m @100 MHz	Not specified	Max. 15 mΩ/m @1 MHz Max. 10 mΩ/m @10 MHz Max. 30 mΩ/m @30 MHz Max. 60 mΩ/m @100 MHz
Screening attenuation	Not specified	Not specified	Not specified	Not specified	Not measured

5. Requirements for Screened Category 7A Flexible Cables

Parameter	ISO/IEC	IEC	CENELEC	TIA/EIA	3P Requirements
Standards	* 2 nd edition ISO/IEC 11801 * Amendment 2 to 2 nd edition ISO/IEC 11801	3 rd edition IEC 61156-6	•2 nd edition EN 50173-1 •Amendment 2 to 2 nd edition EN 50173-1, draft FprAB July2010	ANSI/TIA 568-C.2	
Current carrying capacity	Not specified	Not specified	Not specified	Not specified	Not measured
dc resistance	Max. 145 Ω/km @ 20°C	Max. 145 Ω/km @ 20°C	Not specified	Not specified	Max. 140 Ω/km @ 20°C
dc loop resistance	Not specified	Not specified	Not specified	Not specified	Max. 290 Ω/km
Resistance unbalance within a pair	Max. 2 %	Max. 2 %	Not specified	Not specified	Max. 2,0 %
Resistance unbalance between pairs	Today outdated requirement is max. 4 %	Today outdated requirement is max. 4 %	Not specified	Not specified	Not measured
Mutual capacitance	Not specified	Not specified	Not specified	Not specified	Max. 56 nF /km @ 1 kHz (for information)
Capacitance unbalance	Max. 1600 pF/km @ 0,8 or 1 kHz	Max. 1600 pF/km @ 0,8 or 1 kHz	Not specified	Not specified	Max. 1200 pF/km
Insulation resistance	Min. 5000 MΩ km	Min. 5000 MΩ km	Not specified	Not specified	Min. 5000 MΩ km
Dielectric strength	Min. 1,0 kVdc or 0,7 kVdc for 1 min. or 2,5 kVdc or 1,7 kVdc for 2 secs.	Min. 1,0 kVdc or 0,7 kVdc for 1 min. or 2,5 kVdc or 1,7 kVdc for 2 secs.	Not specified	Not specified	2,5 kVdc for 2 secs.
Input impedance	For information when return loss requirements are passed. Alternatively complex equation in the 2 nd edition IEC 61156-6 standard	For information when return loss requirements are passed. Alternatively complex equation in the standard	Not specified	Not specified	1-100 MHz: 100+/-15 Ω 100-250 MHz: 100+/-22 Ω 250-1000 MHz: 100+/-25 Ω (for information)

Mean input impedance	100+/-5 Ω @ 100 MHz	100+/-5 Ω @ 100 MHz	Not specified	Not specified	100+/-5 Ω @ 100 MHz
Return loss	4-20 MHz: 20+5log(f) dB, max. 25,0 dB 20-600 MHz: 25,0- 8,6log($\frac{f}{20}$) dB, min. 15,6 dB 600-1000 MHz: 15,6- 10log($\frac{f}{600}$) dB for 100 m cable	4-20 MHz: 20+5log(f) dB, max. 25,0 dB 20-600 MHz: 25,0- 8,6log($\frac{f}{20}$) dB, min. 15,6 dB 600-1000 MHz: 15,6- 10log($\frac{f}{600}$) dB for 100 m cable	Not specified	Not specified	4-20 MHz: 20+5log(f) dB, max. 25,0 dB 20-600 MHz: 25,0- 7log($\frac{f}{20}$) dB, min. 17,3 dB 600-1000 MHz: 17,3- 10log($\frac{f}{600}$) dB for long cable
Attenuation (insertion loss) 20°C	4-1000 MHz: 27,00 \sqrt{f} + 0,075 f+ $\frac{3,0}{\sqrt{f}}$ dB/km	4-1000 MHz: 27,00 \sqrt{f} + 0,075 f+ $\frac{3,0}{\sqrt{f}}$ dB/km	Not specified	Not specified	1-1000 MHz: 27,00 \sqrt{f} + 0,075 f+ $\frac{3,0}{\sqrt{f}}$ dB/km
Attenuation (insertion loss) 40°C	4-1000 MHz: 28,080 \sqrt{f} + 0,078 f+ $\frac{3,12}{\sqrt{f}}$ dB/km	4-1000 MHz: 28,080 \sqrt{f} + 0,078 f+ $\frac{3,12}{\sqrt{f}}$ dB/km	Not specified	Not specified	1-1000 MHz: 28,080 \sqrt{f} + 0,078 f+ $\frac{3,12}{\sqrt{f}}$ dB/km
Attenuation (insertion loss) 60°C	4-1000 MHz: 29,160 \sqrt{f} + 0,081 f+ $\frac{3,24}{\sqrt{f}}$ dB/km	4-1000 MHz: 29,160 \sqrt{f} + 0,081 f+ $\frac{3,24}{\sqrt{f}}$ dB/km	Not specified	Not specified	1-1000 MHz: 29,160 \sqrt{f} + 0,081 f+ $\frac{3,24}{\sqrt{f}}$ dB/km
Temperature correction factor for attenuation	20-60°C: 0,2 %/°C	20-60°C: 0,2 %/°C	Not specified	Not specified	20-60°C: 0,2 %/°C
Near end crosstalk	4-1000 MHz: 108,4- 15log(f) dB, max. 78 dB	4-1000 MHz: 108,4- 15log(f) dB, max. 78 dB	Not specified	Not specified	1-1000 MHz: 108,4- 15log(f) dB, max. 78 dB
Power sum near end crosstalk	4-1000 MHz: 105,4- 15log(f) dB, max. 75 dB	4-1000 MHz: 105,4- 15log(f) dB, max. 75 dB	Not specified	Not specified	1-1000 MHz: 105,4- 15log(f) dB, max. 75 dB
ACR	Not specified	Not specified	Not specified	Not specified	1-1000 MHz: NEXT- attenuation dB
Power sum ACR	Not specified	Not specified	Not specified	Not specified	1-1000 MHz: Power sum NEXT- attenuation dB

ELFEXT (ACR-F)	<i>1-1000 MHz:</i> 105,3- 20log(f) dB, max. 75 dB, and not specified when FEXT is over 70 dB	<i>4-1000 MHz:</i> 94,0- 20log(f) dB, max. 78 dB, and not specified when FEXT is over 70 dB	Not specified	Not specified	<i>1-1000 MHz:</i> 105,3- 20log(f) dB, max. 75 dB, and not specified when FEXT is over 90 dB
Power sum ELFEXT (PSACR-F)	<i>1-1000 MHz:</i> 102,3- 20log(f) dB, max. 72 dB, and not specified when power sum FEXT is over 67 dB	<i>4-1000 MHz:</i> 91,0- 20log(f) dB, max. 75 dB, and not specified when FEXT is over 70 dB	Not specified	Not specified	<i>1-1000 MHz:</i> 102,3- 20log(f) dB, max. 72 dB, and not specified when FEXT is over 90 dB
Power sum alien near end crosstalk	<i>1-1000 MHz:</i> 105-15log(f) dB, max. 67 dB	<i>1-1000 MHz:</i> 105-15log(f) dB, max. 67 dB	Not specified	Not specified	Not measured
Average power sum alien near end crosstalk	Not specified	Not specified	Not specified	Not specified	Not specified
Power sum alien equal level far end crosstalk	<i>1-1000 MHz:</i> 92,0-20log(f) dB, max. 67 dB	<i>1-1000 MHz:</i> 92,0-20log(f) dB, max. 67 dB	Not specified	Not specified	Not measured
Average power sum alien equal level far end crosstalk	Not specified	Not specified	Not specified	Not specified	Not specified
Near end balance (TCL)	Level 1: <i>1-250 MHz:</i> 40,0-10log(f) dB Level 2: <i>1-250 MHz:</i> 50,0-10log(f) dB	Level 1: <i>1-250 MHz:</i> 40,0-10log(f) dB Level 2: <i>1-250 MHz:</i> 50,0-10log(f) dB	Not specified	Not specified	Level 2: <i>1-1000 MHz:</i> 50,0-10log(f) dB
Far end balance (ELTCTL)	<i>1-30 MHz:</i> 35,0-20log(f) dB	<i>1-30 MHz:</i> 35,0-20log(f) dB	Not specified	Not specified	<i>1-30 MHz:</i> 35-20log(f) dB
Propagation delay	<i>4-1000 MHz:</i> 5340+ $\frac{360}{\sqrt{f}}$ ns/km	<i>4-1000 MHz:</i> 5340+ $\frac{360}{\sqrt{f}}$ ns/km	Not specified	Not specified	<i>1-1000 MHz:</i> 5340+ $\frac{360}{\sqrt{f}}$ ns/km
Velocity of propagation	Not specified	Not specified	Not specified	Not specified	Measured (for information)
Delay skew 20°C	<i>4-1000 MHz:</i> Max. 250 ns/km	<i>4-1000 MHz:</i> Max. 250 ns/km	Not specified	Not specified	<i>1-1000 MHz:</i> Max. 250 ns/km

Delay skew 40°C	Not specified	Not specified	Not specified	Not specified	1-1000 MHz: Max. 250 ns/km
Delay skew 60°C	Not specified	Not specified	Not specified	Not specified	1-1000 MHz: Max. 250 ns/km
Delay skew variation with temperature	Not specified	Not specified	Not specified	Not specified	1-250 MHz: Max. +/- 100 ns/km of value at 20°C when measured at 40°C and 60°C
Coupling attenuation	30- 1000 MHz: 55- $20\log\left(\frac{f}{100}\right)$ dB, min. 55 dB	Type III: 30- 1000 MHz: 40- $20\log\left(\frac{f}{100}\right)$ dB, max. 40 dB Type II: 30- 1000 MHz: 55- $20\log\left(\frac{f}{100}\right)$ dB, max. 55 dB Type I: 30- 1000 MHz: 85- $20\log\left(\frac{f}{100}\right)$ dB, max. 85 dB	Not specified	Not specified	Type I: 30- 1000 MHz: 85- $20\log\left(\frac{f}{100}\right)$ dB, max. 85 dB
“EMC performance”	Type II: Min. 55 dB	Type III: Min. 40 dB Type II: Min. 55 dB Type I: Min. 85 dB	Not specified	Not specified	Type I: Min. 85 dB
Transfer impedance	Max. 50 mΩ/m @1 MHz Max. 100 mΩ/m @10 MHz Max. 200 mΩ/m @30 MHz Max. 1000 mΩ/m @100 MHz	Grade 1: Max. 10 mΩ/m @1 MHz Max. 10 mΩ/m @10 MHz Max. 30 mΩ/m @30 MHz Max. 100 mΩ/m @100 MHz Grade 2: Max. 50 mΩ/m @1 MHz Max. 100 mΩ/m @10 MHz Max. 200 mΩ/m @30 MHz Max. 1000 mΩ/m @100 MHz	Not specified	Not specified	Grade 1: Max. 15 mΩ/m @1 MHz Max. 10 mΩ/m @10 MHz Max. 30 mΩ/m @30 MHz Max. 60 mΩ/m @100 MHz
Screening attenuation	Not specified	Not specified	Not specified	Not specified	Not measured