Separation between metallic LAN cables and power cables

Based on EN 50174-2

1. Background

The proper segregation between LAN copper cables and various sources of EMI is a complex and controversial issue for several reasons, but mainly because it is difficult to accurately assess the real effect of a certain source of EMI on the performance of the cabling system in the field. Nevertheless, designers and installers of LAN cabling systems must make justifiable decisions on a daily basis and for this purpose CENELEC EN 50174-2 may be helpful. It should be noted that there are several other related standards with different approach, but EN 50174-2 was selected being widely accepted in the EU. Local or national safety regulations take precedence whenever their required separation distances are larger than those specified in this document.

2. CENELEC EN 50174-2 guidelines

Based on the current edition of EN 50174-2:2009, including the amendments A1 (2011) and A2 (2014) the following method is proposed to calculate the minimum separation (A) between metallic LAN cables and power cables:

2.1. Select the relevant segregation classification based on the Coupling Attenuation (CA) or the TCL of the relevant LAN cable using the table below (EN 50174-2 table 3):

Information technology cable			
Screened	**Unscreened**	**Coaxial/twinaxial**	
Coupling attenuation at 30 MHz to 100 MHz dB	**TCL at 30 MHz to 100 MHz** dB	**Screening attenuation at 30 MHz to 100 MHz** dB	**Segregation classification**
≥ 80 [a]	≥ 70 − 10 × lg f	≥ 85 [d]	d
≥ 55 [b]	≥ 60 − 10 × lg f	≥ 55	c
≥ 40	≥ 50 − 10 × lg f [c]	≥ 40	b
< 40	< 50 − 10 × lg f	< 40	a

Notes:

a. The segregation classifications indicated above are not inherent properties of the cables, but merely interpretations of the coupling attenuation (CA) or the TCL (Transverse Conversion Loss, balance) values of the cable.

b. CA and TCL are measurable properties specified in both TIA-568 and IEC 61156 with clear limits. These parameters should be specified in the technical specifications of any LAN cable. Indicating only the segregation classification may be misleading and is obviously redundant when the CA and the TCL are specified.

c. The CA levels indicated above are not in line with IEC 61156-5 CA levels and they ignore the frequency range above 100MHz, which may be critically important:

These are the current IEC 61156-5 CA limits:

Type I 30 - 100 MHz : > 85 dB. 100 - 1000MHz > 85 – 20 · log10 (f /100) dB

Type Ib 30 - 100 MHz : > 70 dB. 100 - 1000MHz > 70 – 20 · log10 (f /100) dB

Type II 30 - 100 MHz : > 55 dB. 100 - 1000MHz > 55 – 20 · log10 (f /100) dB

Type III 30 - 100 MHz : > 40 dB. 100 - 1000MHz > 40 – 20 · log10 (f /100) dB

CA is specified in IEC 61156-5 up to 1000MHz for categories 5 to 7A.

CA is specified in IEC 61156-9 up to 2000MHz for categories 8.1 and 8.2.

2.2. Select the relevant separation (S) from the table below (EN 50174-2 table 4):

		Containment applied to information technology or mains power cabling		
Segregation Classification (from Table 3)	**Separation without electromagnetic barrier**	**Open metallic containment** [a]	**Perforated metallic containment** [b, c]	**Solid metallic containment** [d]
d	10 mm	8 mm	5 mm	0 mm
c	50 mm	38 mm	25 mm	0 mm
b	100 mm	75 mm	50 mm	0 mm
a	300 mm	225 mm	150 mm	0 mm

[a] Screening performance (0 MHz to 100 MHz) equivalent to welded mesh steel basket of mesh size 50 mm x 100 mm (excluding ladders). This screening performance is also achieved with steel tray (trunking without cover) of less than 1,0 mm wall thickness and more than 20 % equally distributed perforated area.

[b] Screening performance (0 MHz to 100 MHz) equivalent to steel tray (trunking without cover) of 1,0 mm wall thickness and no more than 20 % equally distributed perforated area. This screening performance is also achieved with screened power cables that do not meet the performance defined in Note [d].

[c] The upper surface of installed cables shall be at least 10 mm below the top of the barrier.

[d] Screening performance (0 MHz to 100 MHz) equivalent to a steel conduit of 1,5 mm wall thickness. Separation specified is in addition to that provided by any divider/barrier.

2.3. Select the power cabling factor (P) from the table below (EN 50174-2 table 5):

Electrical circuit type [a, b, c]	**Quantity of circuits**	**Power cabling factor** ***P***
20 A 230 V 1-phase	1 to 3	0,2
	4 to 6	0,4
	7 to 9	0,6
	10 to 12	0,8
	13 to 15	1,0
	16 to 30	2
	31 to 45	3
	46 to 60	4
	61 to 75	5
	> 75	6

[a] 3-phase cables shall be treated as 3 off 1-phase cables.

[b] More than 20 A shall be treated as multiples of 20 A.

[c] Lower voltage AC or DC power supply cables shall be treated based upon the their current ratings, i.e. a 100 A 50 V DC cable = 5 of 20 A cables (P = 0,4).

2.4. Calculate the minimum separation (A) as follows: A(min)=S·P (mm).

3. Final notes

3.1. Cables should be defined according to their CA (and their Zt, Transfer Impedance) which are objective and measurable parameters showing the true cable EMC, specified both in IEC 61156 and in TIA-568. All AT&T LAN cables specifications include these parameters. LAN cables which are not clearly specified, tested and verified with these parameters have in fact unknown EMC, regardless if their shield construction. The CA and TCL values indicated in AT&T cables specs provide precise and clear information on the EMC of the cables. The segregation class should be selected based on these values following the selected standard and calculation method.

3.2. The minimum separation from power lines can be based on the methods indicated in EN 50174-2 or in any other standard dealing with Installation planning and practices inside buildings, but they are not properties of the cable. Alternative requirements and calculation methods and safety guidelines can be found in ANSI/TIA-942, ANSI/TIA-1005, BS 6701 and NEC Article 800.52.
It should be noted that when a cable spec indicates conformance to EN 50174-2 Class d segregation it merely means that the cable has CA > 80dB at 30-100MHz, and if the IEC 61156-5 CA Type is not indicated, the cable may conform to Type Ib, Type II and even Type III at frequencies above 100MHz.

3.3. The separation between power lines and data cables as calculated in EN 50174-2 is easy to perform but may not be good enough. The standard is referencing mains power supply that may have high frequency content consistent with the switching and operation of connected equipment including non-linear loads such as fluorescent lamps and switch mode power supply devices, but other types of equipment are excluded. It should be noted that electrical appliances and devices may be added and replaced randomly, usually without taking into consideration their possible impact on the LAN cabling system, so maintaining substantial separation between all LAN cables and all power cables minimizes the chance of having unexpected disruptions in the IT system.

Question and remarks may be sent to tech.support_emea@cabling.att-mail.com

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