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Information technology - Cabling installation - Part 99-2: Mitigation and protection from electrical interference

Informationstechnik - Installation von Kommunikationsverkabelung - Teil 99-2: Abschwächung von und Schutz vor elektrischer Störung

Technologies de l'information - Installation de câblages - Partie 99-2:

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
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European foreword

This document (CLC/TR 50174-99-2:2020) was prepared by the Technical Committee CLC/TC 215, “Electrotechnical aspects of telecommunication equipment”.

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

A previous version of this document was published as informative Annex A in EN 50174-2:2009. During the revision of EN 50174-2:2009, TC 215 decided to remove the Annex, revise and then publish it as separate Technical Report.

Introduction

The EN 50174 series standards specify the specification, planning and practices applicable to installation of telecommunications cabling.

This document supports the requirements and recommendations of the EN 50174 series in relation to the mitigation and protection of telecommunications cabling from electromagnetic interference by describing:

a) coupling mechanisms and possible countermeasures;

b) assessment of the electromagnetic environment;

c) filtering, isolation and surge protections measures.

1 Scope

This document addresses the mitigation and protection of telecommunications cabling from electromagnetic interference by describing:

a) coupling mechanisms and possible countermeasures;

b) assessment of the electromagnetic environment;

c) filtering, isolation and surge protections measures.

Safety (electrical safety and protection, optical power, fire, etc.) and electromagnetic compatibility (EMC) requirements are outside the scope of this document and are covered by standards and regulations. However, information given in this document can be of assistance in meeting these standards and regulations.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 50173 (series), *Information technology – Generic cabling systems*

EN 50174 (series), *Information technology - Cabling installation*

EN 50174-2:2018, *Information technology - Cabling installation - Part 2: Installation planning and practices inside buildings*

EN 50174-3, *Information technology - Cabling installation - Part 3: Installation planning and practices outside buildings*

EN 50310:2016, *Telecommunications bonding networks for buildings and other structures*

3 Definitions, abbreviations and symbology

3.1 Definitions

For the purposes of this document, the terms and definitions given in the EN 50173 series and EN 50174 series and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1.1
common bonding network
set of interconnected conductive structures that combine the functions of a protective bonding network and a telecommunications bonding network

[SOURCE: EN 50310:2016, 3.1.6]

3.1.2
isolated bonding network
bonding network that has a single point of connection to either the common bonding network or another isolated bonding network

Note 1 to entry: All IBNs considered here will have a connection to earth through the single point of connection.

3.2 Abbreviations

For the purposes of this technical report the following abbreviations apply in addition to those of the EN 50173 series and EN 50174 series of standards.

BN	Bonding Network
CBN	Common Bonding Network
CMS	cable management system
IBN	Isolated Bonding Network
SRPP	System Reference Potential Plane

4 Coupling mechanisms and countermeasures

4.1 General

Electromagnetic interference is transferred to installed telecommunications cabling by the following coupling phenomena which can have adverse effects at different frequencies including:

— galvanic or common mode impedance coupling (see 4.2);

— capacitive coupling (see 4.3);

— inductive coupling (see 4.4);

— radiative coupling (see 4.5);

— low frequency fields (se 4.6).

4.2 Countermeasures against galvanic or common mode impedance coupling

Impedances in common mode current paths, if they cannot be avoided, should be kept as low as possible.

The main countermeasures to minimize the effects of common mode impedance coupling are the reduction of the:

a) common mode impedance;

b) amplitude of the disturbing currents.

4.3 Countermeasures against capacitive coupling

The main countermeasures to minimize the effects of capacitive coupling are:

a) Symmetrical transmission on balanced cabling

Conductors are exposed to the same electric field. Induced interfering voltages in both conductors have the same polarity and amplitude; the wanted differential mode signal remains unaffected up to a frequency dependent on the balance of the cabling. The interference appears as an unwanted common mode signal. Depending on its common mode rejection ratio, the correct operation of connected equipment is influenced by the presence of common mode voltages.

b) Screened cabling specially designed to mitigate electromagnetic interference if the cable screen is:

— of low impedance;

— of large surface area;

— continuous along the cabling channel;

— bonded as detailed in EN 50174-2 and EN 50310.

NOTE At high frequencies the method of bonding of the screen at the ends of the cable is important. Even a few centimetres of unscreened lead (pigtail) can compromise the screen effectiveness.

c) A cable management system (CMS) specially designed to mitigate electromagnetic interference if it is:

— of low impedance;

— of large surface area;

— continuous along the cabling channel;

— bonded as detailed in EN 50174-2 and EN 50310.

NOTE Since the cable management system is fixed at earth potential via the bonding network, unwanted electric charges cannot cause voltage rises.

4.4 Countermeasures against inductive coupling

The main countermeasures to minimize the effects of inductive couplings are:

a) Symmetrical transmission on balanced cabling

Conductors are twisted together making the surfaces of possible induction loops very small. Only a few magnetic field lines penetrate these loops. Adjacent twists create induced voltages in phase opposition which as a consequence cancel each other. The induced difference between the two conductors approaches zero. However, a common mode disturbance is induced in the loop formed with the (twisted) conductors and the bonding network. The influence on the equipment is reduced by the common mode rejection of the connected port.

b) Screened cabling

The degree of protection against magnetic fields over a given frequency range provided by screened cabling depends:

— upon the materials used in the screen;

— the bonding of the screen to the bonding network (BN) at the ends of the cable (see EN 50174-2:2018, 4.7).

NOTE In general, no effective protection against magnetic fields is given if the screen of the cable is not bonded in accordance with EN 50310. Exceptions to this rule exist e.g. when the unconnected cable screen is placed on the surface of or near to a system reference potential plane (SRPP).

c) Metallic or composite CMS specially designed for to mitigate electromagnetic interference

The degree of protection against magnetic fields over a given frequency range provided depends upon:

— the material used in the CMS and its thickness;

— the bonding of the elements of the CMS;

— the bonding of the CMS to the BN.

The disturbing magnetic field also induces a current in the loop built up by CMS and the BN. This current creates an opposite magnetic field which compensates the initial one.

A limited degree of protection can be obtained with a parallel earthing conductor (PEC). The PEC principle is explained in IEC/TR 61000-5-3.

Both capacitive and inductive coupling exist simultaneously, the countermeasure applied should take the effect of each contributor into account (unless one can be neglected).

4.5 Countermeasures against radiative coupling

The main countermeasures to minimize the effects of radiative coupling are:

a) Reduction of the antenna effect of the disturbed cable

Mitigation of the interference from the electric field to the cable can be achieved by:

— reducing the cable height *h* in Figure 1;

— installing the cable in CMS specially designed to mitigate electromagnetic interference;

— the use of PECs, filters or ferrite beads etc.

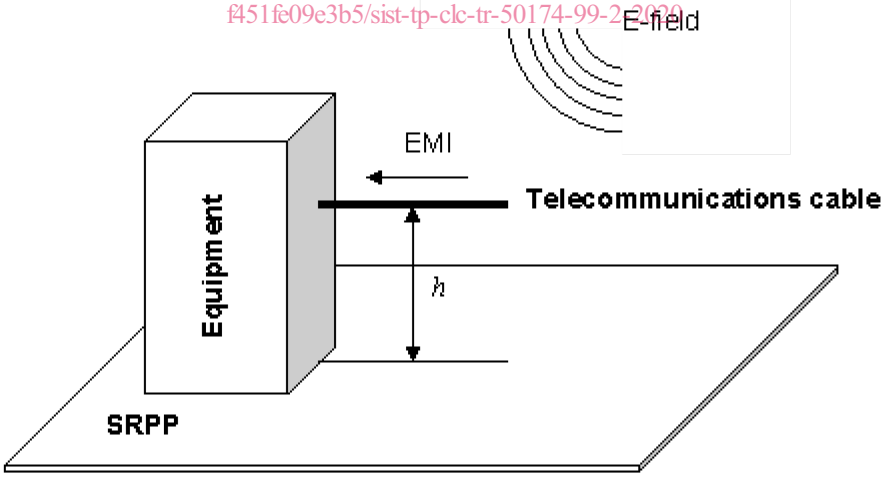

Figure 1 — Radiative coupling from the electric field

b) Reduction of the disturbed loop area

Mitigation of the interference from the field to the loop can be achieved by:

— reducing the cable height *h* in Figure 2;

— reducing the cable length *l* in Figure 2;

— installing the cable in CMS specially designed to mitigate electromagnetic interference;

— the use of PECs, filters or ferrite beads etc.

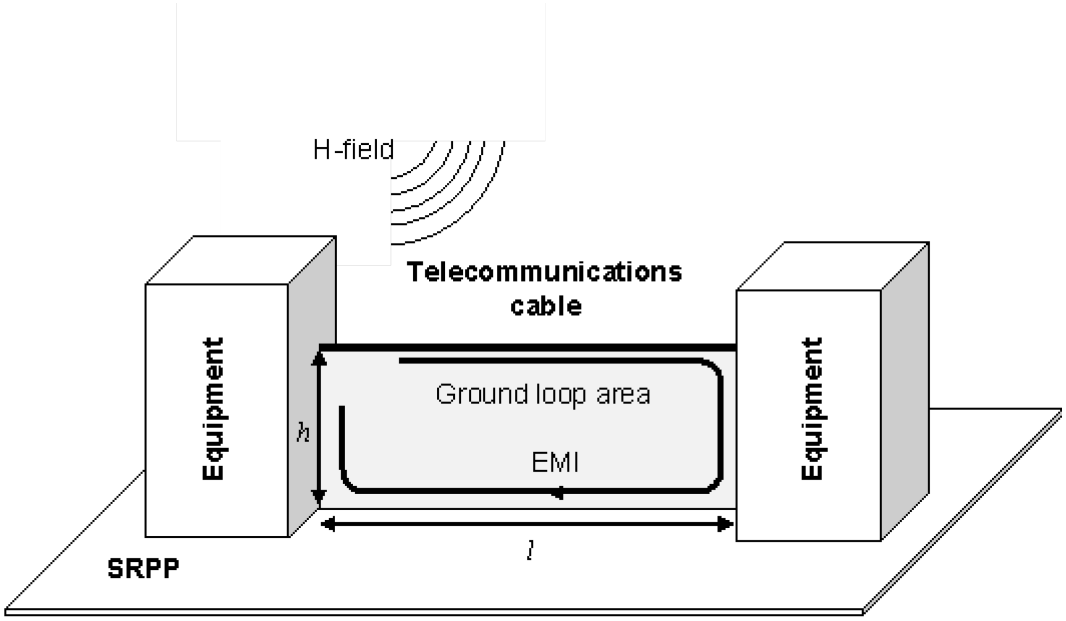

Figure 2 — Radiative coupling from the magnetic field

c) The use of the Faraday cage principle:

A screened cable connected at both ends with the screening of the equipment is a possible solution.

The equipment does not require to be bonded in order to prevent interference from high frequencies. If the equipment is bonded, current loops should be avoided or at least minimized.

4.6 Protection against very low frequency fields

See EN 50174-2.

5 Assessment of the electromagnetic environment

The questions of Table 1 should be completed to provide a determination of the electromagnetic environment. Table 2 should be used to complete the assessment based on the answers to the questions of Table 1.

Table 1 — Assessment checklist

No.	ASPECTS TO BE CONSIDERED	YES	NO	COMMENT
1	**Building**			
1a)	Existing building?	Δ	O	
1b)	New building projected?	Δ	O	
1c)	New building existing?	Δ	O	
1d)	New and existing building mixed?	Δ	O	
1e)	Hospital?	Δ	O	