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Protection against lightning electromagnetic pulses in telecommunication centres

Recommendation ITU-T K.40

ITU-T

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Protection against lightning electromagnetic pulses in telecommunication centres

Summary

Guidelines for the design of an effective protective system for a telecommunication structure against lightning electromagnetic pulse (LEMP) are proposed. The concept of lightning protection zones is introduced as a framework where specific protective measures are merged: earthing, bonding, cable routing, shielding, coordinated SPD system and isolating interfaces. Information about simulating the LEMP effects and a shopping list for the protective measures in existing and new buildings are also given.

History

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Bonding, cable routing, earthing, isolating interfaces, lightning electromagnetic pulse (LEMP), shielding, surge protective device (SPD).

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Introduction

This Recommendation is aimed at setting out the installation and testing principles necessary to protect a telecommunication structure against lightning electromagnetic pulse (LEMP). It focuses on the design of an effective protective system for the telecommunication structure environment.

The installation engineering guidelines that this Recommendation lays down are based on the following standards, produced by IEC TC 81: "Protection against lightning – Part 1: General principles" [IEC 62305-1] and "Protection against lightning – Part 4: Electrical and electronic systems within structures" [IEC 62305-4].

The basic principles for protecting a structure against LEMP, earthing, shielding and bonding, can be found in [ITU-T K.27] and [ITU-T K.35]. If after applying these principles to a structure, the result of the risk assessment as stated in [ITU-T K.39] is that additional protective measures should be taken, this Recommendation gives advice on these special measures. A telecommunication site with antennas at the top or near a telecommunication site is more at risk of damage by a direct lightning strike; special attention is given to these structures.

Recommendation ITU-T K.40

Protection against lightning electromagnetic pulses in telecommunication centres

1 Scope

This Recommendation addresses new and existing structures, such as telecommunication centres, large installations at a subscriber's premises and remote sites, and gives advice on the design and installation of protective measures against lightning electromagnetic pulses (LEMPs), in order to reduce damages to the equipment and cabling inside these structures.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

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|----------------------------|--|
| [ITU-T K.27] | Recommendation ITU-T K.27 (2015), <i>Bonding configurations and earthing inside a telecommunication building</i> . |
| [ITU-T K.35] | Recommendation ITU-T K.35 (1996), <i>Bonding configurations and earthing at remote electronic sites</i> . |
| [ITU-T K.39] | Recommendation ITU-T K.39 (1996), <i>Risk assessment of damages to telecommunication sites due to lightning discharges</i> . |
| [ITU-T Lightning Handbook] | ITU-T Lightning Handbook (1978), <i>The protection of telecommunication lines and equipment against lightning discharges</i> . |
| [IEC 60664-1] | IEC 60664-1:2007, <i>Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests</i> . |
| [IEC 62305-1] | IEC 62305-1:2010, <i>Protection against lightning – Part 1: General principles</i> . |
| [IEC 62305-4] | IEC 62305-4:2010, <i>Protection against lightning – Part 4: Electrical and electronic systems within structures</i> . |

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

All terms and definitions already defined in [IEC 62305-1] and [IEC 62305-4] are applicable for this Recommendation. These include:

3.1.1 LEMP protection measures, SPM [IEC 62305-4]: Measures taken to protect internal systems against the effects of LEMP.

NOTE – This is part of overall lightning protection.

3.1.2 surge protective device, SPD [IEC 62305-4]: Device intended to limit transient overvoltages and divert surge currents; contains at least one non-linear component.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 bonding: A measure to establish a direct or indirect (through an SPD) contact between metallic parts.

3.2.2 MCBN: The minimum common bonding network against LEMP configuration required for protection against LEMP at a telecommunication centre. Additional bonding may be installed to improve the behaviour against LEMP to reduce the risk of damage. As stated in various clauses of this Recommendation, the efficiency of these enhancements may be estimated with [ITU-T K.39].

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

BN	Bonding Network
CBN	Common Bonding Network
LEMP	Lightning Electromagnetic Pulse
LPS	Lightning Protection System
LPZ	Lightning Protection Zone
MCBN	Minimum Common Bonding Network
MOM	Method of Moments
SPD	Surge Protective Device
SPM	LEMP Protection Measures

5 Conventions

None.

6 Reference configuration

As a reference configuration, that is, to what type of telecommunication environment should the guidelines suggested in this Recommendation be considered, structures with telecommunication towers on the roof or adjacent to the structure should be taken into account.

In this configuration a direct lightning strike to the telecommunication tower is the source of the LEMP phenomena. As the lightning current flows through the tower, it creates a strong electromagnetic field; this field couples with the internal and external cabling of the equipment inside the telecommunication structure, inducing overvoltages and overcurrents that can destroy electronic components of the equipment.

A resistive coupling mechanism takes place as well due to the earth potential rise; partial lightning current will flow in the cable screens resulting in voltages between the conductors and the screen. The resistive coupling may cause also a firing of the surge protective devices (SPDs) installed at the telecommunication cables entrance, the LEMP disturbance is then propagated through the core of the telecommunication cable and may cause damage to the cable when the isolating breakdown voltage between shield and core is surpassed, not only in the telecommunication cables but to a large extent in the mains conductors, and may cause problems for mains-connected equipment if their resistibility is lower than the protective level given by the mains SPD. See Figure 1.