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SERIES K: PROTECTION AGAINST INTERFERENCE

Protection of surrounding structures of telecommunication towers against lightning

Recommendation ITU-T K.111

ITU-T

Recommendation ITU-T K.111

Protection of surrounding structures of telecommunication towers against lightning

Summary

Recommendation ITU-T K.111 considers the protection of structures in the area surrounding telecommunication towers (including masts and poles) against damage and injury derived from direct lightning flashes to the towers. The assessment and protection measures intend to reduce the possible risk derived from the erection of towers, but not to improve the overall lightning protection for every surrounding structure.

This Recommendation considers towers whose height is less than 100 m from ground level, which rarely meets the initiation condition of upward flashes, so that the presence of the tower does not significantly influence the incidence of lightning flashes.

Based on the analyses of sources of damage for an individual surrounding structure referring to IEC 62305-2, the risk components mostly include the possible influence in the close vicinity of a tower due to earth potential rise (EPR) and the transferred transients through common power feeds. For the former risk component, the hazard resulting from the occurrence of sparking and the injury to living beings are under consideration. For the latter, a series of exemption criteria and the corresponding protection (mitigation) measures are recommended. The requirements detailing the implementation of protection measures are also introduced.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
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Keywords

Earth potential rise, lightning protection, surrounding structures, telecommunication tower, transferred surge.

* To access the Recommendation, type the URL <http://handle.itu.int/> in the address field of your web browser, followed by the Recommendation's unique ID. For example, <http://handle.itu.int/11.1002/1000/11830-en>.

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Table of Contents

		Page
1	Scope.....	1
2	References.....	1
3	Definitions	2
3.1	Terms defined elsewhere	2
3.2	Terms defined in this Recommendation.....	2
4	Abbreviations and acronyms	2
5	Conventions	3
6	Reference configuration.....	3
7	Protection of tower vicinity	3
7.1	Need of protection	3
7.2	The assessment of the safety distance	5
7.3	Protection measures.....	6
7.4	Protection measures against injury to living beings due to touch and step voltages.....	8
8	Protection of local community with common power feed.....	8
8.1	Need of protection	8
8.2	Protection measures.....	9
9	Implementation of protection measures.....	10
Annex A – Influence on the lightning risk of the surrounding structures due to the presence of a tower		11
A.1	Possible lightning risk components derived from erection of a tower	11
A.2	Risk from EPR on the close vicinity of a tower	12
A.3	Risk from transferred surge through common power feed.....	13
Annex B – Determination of parameters for the assessment of safety distance		16
B.1	Lightning parameters according to LPL	16
B.2	Reference values of Esoil	16
B.3	Reference values of typical earthing impedance	17
B.4	Reference values of tower inductance	17
Appendix I – Influence of the tower on the ground flash density.....		18
I.1	Downward flash.....	18
I.2	Upward flash	18
Bibliography.....		20

Recommendation ITU-T K.111

Protection of surrounding structures of telecommunication towers against lightning

1 Scope

This Recommendation considers the protection of structures in the neighbourhood of telecommunication towers (including masts and poles) against damage and injury derived from direct lightning flashes to the towers. These protection measures intend to reduce the possible risk derived from the erection of towers, but not to improve the overall lightning protection for every surrounding structure. The systemic protection for these structures should refer to the IEC 62305-x series.

This Recommendation only considers towers whose heights are less than 100 m from ground level. Towers higher than 100 m or those situated on mountain ridges or high hills are not considered in this Recommendation.

The lightning protection of telecommunication sites attached to the tower, such as a radio base station (RBS) and a dedicated telecommunication building, is not included in this Recommendation. To this aim, the user should refer to the corresponding Recommendations, such as [b-ITU-T K.27], [b-ITU-T K.35], [b-ITU-T K.56] and [b-ITU-T K.97].

The lightning protection of service lines, such as power lines and telecommunication lines, is not included in this Recommendation. The information about telecommunication lines is given in [b-ITU-T K.46] and [b-ITU-T K.47].

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.

- | | |
|---------------|---|
| [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 K.66] | Recommendation ITU-T K.66 (2011), <i>Protection of customer premises from overvoltage.</i> |
| [IEC 62305-1] | IEC 62305-1 (2010), <i>Protection against lightning – Part 1: General principles.</i> |
| [IEC 62305-2] | IEC 62305-2 (2010), <i>Protection against lightning – Part 2: Risk management.</i> |
| [IEC 62305-3] | IEC 62305-3 (2010), <i>Protection against lightning – Part 3: Physical damage to structures and life hazard.</i> |
| [IEC 62305-4] | IEC 62305-4 (2010), <i>Protection against lightning – Part 4: Electrical and electronic systems within structures.</i> |

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3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 conventional earthing impedance [IEC 62305-1]: Ratio of the peak values of the earth-termination voltage and the earth-termination current which, in general, do not occur simultaneously.

3.1.2 coordinated SPD system [IEC 62305-1]: SPDs properly selected, coordinated and installed to form a system intended to reduce failures of electrical and electronic systems.

3.1.3 dangerous event [IEC 62305-2]: Lightning flash to or near the structure to be protected, or to or near a line connected to the structure to be protected that may cause damage.

3.1.4 downward flash [IEC 62305-1]: Lightning flash initiated by a downward leader from cloud to earth.

NOTE – A downward flash consists of a first impulse, which can be followed by subsequent impulses. One or more impulses may be followed by a long stroke.

3.1.5 lightning protection level (LPL) [IEC 62305-1]: Number related to a set of lightning current parameters values relevant to the probability that the associated maximum and minimum design values will not be exceeded in naturally occurring lightning.

NOTE – Lightning protection level is used to design protection measures according to the relevant set of lightning current parameters.

3.1.6 radio base station [b-ITU-T K.56]: Installation intended to provide access to the telecommunication system by means of radio waves.

3.1.7 surge protective device (SPD) [IEC 62305-1]: Device intended to limit transient overvoltages and divert surge currents; contains at least one non-linear component.

3.1.8 upward flash [IEC 62305-1]: Lightning flash initiated by an upward leader from an earthed structure to cloud.

NOTE – An upward flash consists of a first long stroke with or without multiple superimposed impulses. One or more impulses may be followed by a long stroke.

3.2 Terms defined in this Recommendation

This Recommendation defines the following term:

3.2.1 common power feed: A low voltage distribution system which makes the powered buildings and installations interconnected through the same low voltage line.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

EPR	Earth Potential Rise
LPL	Lightning Protection Level
LPS	Lightning Protection System
LV	Low Voltage
MV	Medium Voltage
RBS	Radio Base Station
SPD	Surge Protective Device

5 Conventions

None.

6 Reference configuration

Figure 1 shows the typical layout scenario consisting of the telecommunication tower and the affected surrounding structures (area) in the neighbourhood. In this figure, the possibly affected items are divided into two parts according to the corresponding risk components introduced in Annex A. These two parts can be classified as tower vicinity and local community and are defined as follows:

- **tower vicinity:** Includes the close vicinity around the tower within a limited distance from the edge of the telecommunication site. In this area, the current density and the voltage gradient is much larger than that of the far vicinity. There is the possible risk of injury to living beings by electric shock due to step and touch voltages and/or the hazard resulting from the occurrence of sparking between the tower and the metal parts of adjacent structures.
- **local community:** Includes the premises and installations connected with the telecommunication site through common low voltage (LV) power feeds, which suffer the influence of transferred surge from the interconnected LV power lines. If the telecommunication site is supplied by a dedicated transformer, the influence of transferred surge through medium voltage (MV) power lines can be negligible.

NOTE 1 – The earth-termination system of the tower shall comply with [IEC 62305-3] and [b-ITU-T K.56].

NOTE 2 – There may be other interconnected lines, such as telecommunication lines, and their influence is under study.

NOTE 3 – If the tower is erected on a rented building, the overall risk re-assessment and protection are needed for the rented building according to the IEC 62305-x series.

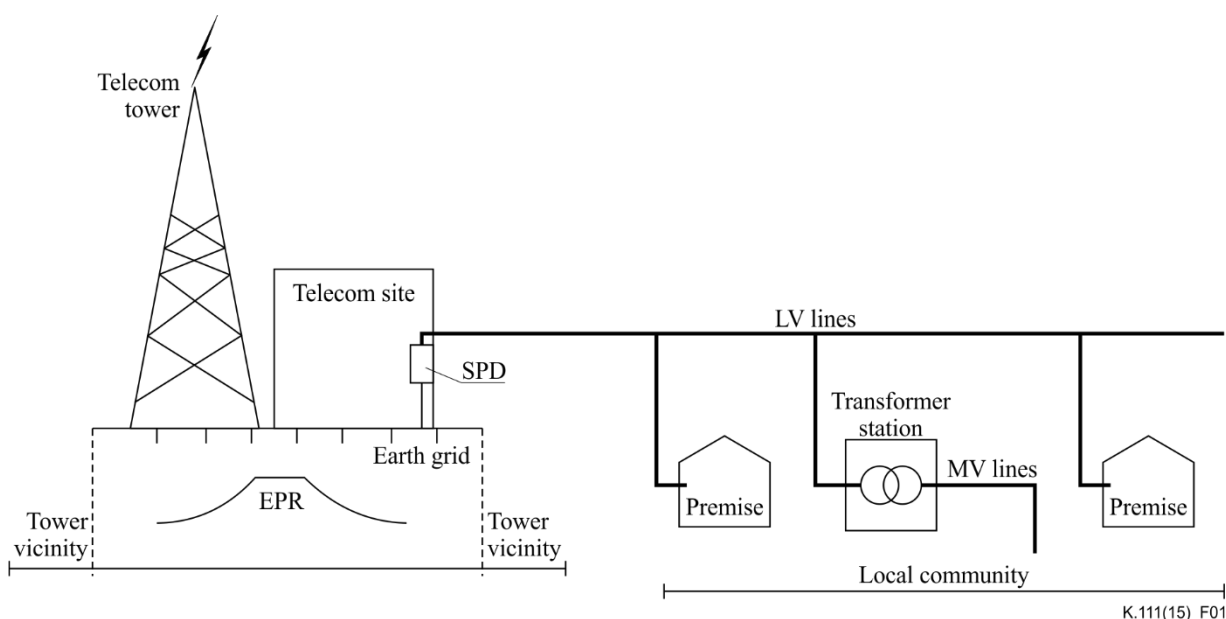


Figure 1 – Reference configuration

7 Protection of tower vicinity

7.1 Need of protection

The risk assessment shall be performed in order to determine a lightning protection level (LPL) for the determination of safety distances and the design of protection measures.