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Requirements for the mitigation of lightning effects on home networks installed in customer premises

Recommendation ITU-T K.85



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Recommendation ITU-T K.85

Requirements for the mitigation of lightning effects on home networks installed in customer premises

Summary

Recommendation ITU-T K.85 gives the requirements for home network equipment and installations in customer premises. It covers the classification of interfaces, resistibility of equipment, impact of installation practices, installation of surge protective devices (SPDs) and a risk assessment of equipment damage according to IEC 62305-2. The risk assessment of user injury will be covered by a separate Recommendation.

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T K.85	2011-11-13	5

FOREWORD

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In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

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Introduction

This Recommendation provides all requirements to minimize disruption and damage to home networks. To ensure a reliable home network service it is essential that a number of interrelated requirements are met. These include the following.

All equipment complies with the appropriate resistibility level of [ITU-T K.21].

- The equipment ports have been correctly classified in accordance with [ITU-T K.75].
- Overvoltage protection, when required, has been installed according to [ITU-T K.66]. This includes the use of both multiservice surge protective devices (MSPDs) and primary (point of entry) protection. It also includes ensuring correct earthing and bonding.
- A risk assessment of equipment damage is performed in accordance with [IEC 62305-2].

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Recommendation ITU-T K.85

Requirements for the mitigation of lightning effects on home networks installed in customer premises

1 Scope

This Recommendation applies to home networks installed in customer premises. Service to the home network can be provided by optical fibre, wireless, hybrid fibre/coaxial (HFC) cable or x digital subscriber line (xDSL). This Recommendation predicts the frequency of damage to the home network (telecommunications) equipment within the structure.

NOTE – Consideration of loss of the telecommunication service is contained in [ITU-T K.72]. Consideration of injury of the service user, within the structure, will be considered in a future ITU-T Recommendation.

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.12] Recommendation ITU-T K.12 (2010), *Characteristics of gas discharge tubes for the protection of telecommunications installations.*
- [ITU-T K.21] Recommendation ITU-T K.21 (2008), *Resistibility of telecommunication equipment installed in customer premises to overvoltages and overcurrents.*
- [ITU-T K.44] Recommendation ITU-T K.44 (2008), *Resistibility tests for telecommunication equipment exposed to overvoltages and overcurrents – Basic Recommendation.*
- [ITU-T K.65] Recommendation ITU-T K.65 (2004), *Overvoltage and overcurrent requirements for termination modules with contacts for test ports or SPDs.*
- [ITU-T K.66] Recommendation ITU-T K.66 (2004), *Protection of customer premises from overvoltages.*
- [ITU-T K.67] Recommendation ITU-T K.67 (2006), *Expected surges on telecommunications and signalling networks due to lightning.*
- [ITU-T K.71] Recommendation ITU-T K.71 (2011), *Protection of customer antenna installations.*
- [ITU-T K.72] Recommendation ITU-T K.72 (2011), *Protection of telecommunication lines using metallic conductors against lightning – Risk management.*
- [ITU-T K.75] Recommendation ITU-T K.75 (2008), *Classification of interface for application of standards on resistibility and safety of telecommunication equipment.*
- [IEC 60364-4-44] IEC 60364-4-44 ed. 2 (2007), *Low-voltage electrical installations – Part 4-44: Protection for safety – Protection against voltage disturbances and electromagnetic disturbances.*
<http://webstore.iec.ch/webstore/webstore.nsf/artnum/038219>

- [IEC 60950-1] IEC 60950-1 ed. 2 (2005), *Information technology equipment – Safety – Part 1: General requirements*.
<<http://webstore.iec.ch/webstore/webstore.nsf/artnum/035320>>
- [IEC 61643-21] IEC 61643-21 ed. 1.1 Consol. with am1 (2009), *Low-voltage surge protective devices – Part 21: Surge protective devices connected to telecommunications and signalling networks – Performance requirements and testing methods*.
<http://webstore.iec.ch/webstore/webstore.nsf/ArtNum_Popup/42865!opendocument>
- [IEC 61643-22] IEC 61643-22 ed. 1 (2004), *Low-voltage surge protective devices – Part 22: Surge protective devices connected to telecommunications and signalling networks – Selection and application principles*.
<<http://webstore.iec.ch/webstore/webstore.nsf/artnum/033373>>
- [IEC 62305-2] IEC 62305-2 ed. 2 (2010), *Protection against lightning – Part 2: Risk management*.
<<http://webstore.iec.ch>>
- [IEC 62368-1] IEC 62368-1 ed. 1 (2010), *Audio/video, information and communication technology equipment – Part 1: Safety requirements*.
<http://webstore.iec.ch/webstore/webstore.nsf/ArtNum_Popup/45465!opendocument>

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 home network [b-ISO/IEC 15044]: Internal network for digital and analogue information transport in home or business premises of similar complexity, providing defined access points and using any medium in any topology.

3.1.2 level [b-ETSI ES 201 468]: Measures on a relative scale how important it is that the equipment operates as specified.

NOTE – Two levels are defined for the purpose of the present document and are designated as level 1 and level 2.

Level 1 should be selected if the equipment has moderate failure consequences. Equipment has moderate failure consequences when:

- a failure causes limited inconvenience;
- repairs may be made without compromising the responsibilities of the network operator.

Level 2 should be selected if the equipment has severe failure consequences. Equipment has severe failure consequences when:

- failure compromises the function of vital, centralized systems, or services of a commercially sensitive or security related nature;
- repair or restoration costs are high, or the time the equipment is out of service is unacceptably long;
- corruption of charging or billing information occurs.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 multiservice surge protective device (MSPD): A surge protective device (SPD) containing both telecommunications and mains protection. It may also include port protection for video or Ethernet.

3.2.2 tracer/locate wire (optical fibre cable): Conductive wire in an optical fibre cable that allows a buried cable to be located with a metal detector.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

CLP	Cell Loss Priority
CPE	Customer Premises Equipment
GDT	Gas Discharge Tube
HFC	Hybrid Fibre/Coaxial (cable)
LEMP	Lightning ElectroMagnetic Pulse
LPS	Lightning Protection System
LT/NT	Line Termination/Network Termination
MET	Main Earth Terminal
MOV	Metal-Oxide Varistor
MSB	Main electrical Switchboard
MSPD	Multiservice Surge Protective Device
NTD	Network Termination Device
PE	Power Earth
POTS	Plain Old Telephone Service
SELV	Safety Extra-Low Voltage
SPC	Surge Protective Components
SPD	Surge Protective Device
USB	Universal Serial Bus
xDSL	Any of the various types of Digital Subscriber Lines

5 Lightning damage

Damage to equipment can occur as a result of:

- surges entering on metallic services, with respect to the local earth;
- lightning strikes to antennas;
- lightning current entering the ground at or near the building with respect to remote earth;
- induction into indoor cabling due to nearby lightning.

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6 Requirements

To limit the risk of misunderstanding by the supplier/manufacturer, it is recommended that the equipment specification for overvoltage protection and safety includes a schematic diagram showing the likely or possible applications of the equipment. This diagram should specifically address connections of the equipment within the building and especially its interconnection to any lines, or other equipment type connected to lines, that are external to the building. This should include any antenna connections.

Some conditions might come with a small increase in item cost but could significantly increase application and reduce life cycle cost.

6.1 Classification of ports

[ITU-T K.75] provides information on classifying plain old telephone service (POTS), Ethernet and video ports. A mains port is always an external port.

Correct classification of ports is important. If an internal port is subject to conducted lightning surges or a.c. surges, there will be equipment damage and human safety issues.

Please note that when specifying the above overvoltage and safety requirements it is also very important to clearly advise the vendors where the equipment is to be used and what is expected to be connected to it (for example, whether it will or will not involve any connections to cabling that exits the building). Manufacturers of customer equipment in particular assume that the equipment ports will only be connected to intra-building cabling. A problem then occurs if the network operator, or the customer, decides to extend the service to an outbuilding. Equipment designed for connection to intra-building cabling may have insufficient isolation from the point of view of safety and insufficient resistibility to overvoltages, when connected to inter-building cables. To ensure the equipment use is not limited, the best way to proceed may be to assume that the port will connect to an inter-building cable, unless it is clear that it will not. The types of ports that could be connected to inter-building cabling include:

- POTS/xDSL;
- Ethernet;
- coaxial cable ports.

For those ports that may connect to inter-building cables, classify the ports as follows:

- For [IEC 60950-1] (safety) testing, use TNV-3 for ports with a working voltage higher than the safety extra-low voltage (SELV); or TNV-1 for ports with a working voltage lower than or equal to SELV (see [IEC 60950-1] for definitions).
- For [IEC 62368-1] (safety) testing the applicable value of the transient voltage on an external circuit shall be determined using Table 15 of [IEC 62368-1]. Where more than one location or condition is applicable, the highest transient voltage applies.
- For resistibility testing, classify it as external.

NOTE – Where approved engineering practices have been implemented, a lower port classification may be used. An example involves the use of a non-removable galvanic isolator with the equivalent of double insulation between the coaxial cable and the coaxial cable port.

6.2 Resistibility

[ITU-T K.21] has two levels of resistibility: "basic" and "enhanced". [ITU-T K.44] gives advice on the selection of "basic" and "enhanced".

The required level of resistibility can be determined in Figure 1. Information on "Special requirements" is contained in [ITU-T K.44]. Non-compliance with [ITU-T K.66] could include:

- non-bonded earths;
- difficulty in installing SPDs at the building entry;
- bonding wires in excess of 10 m.

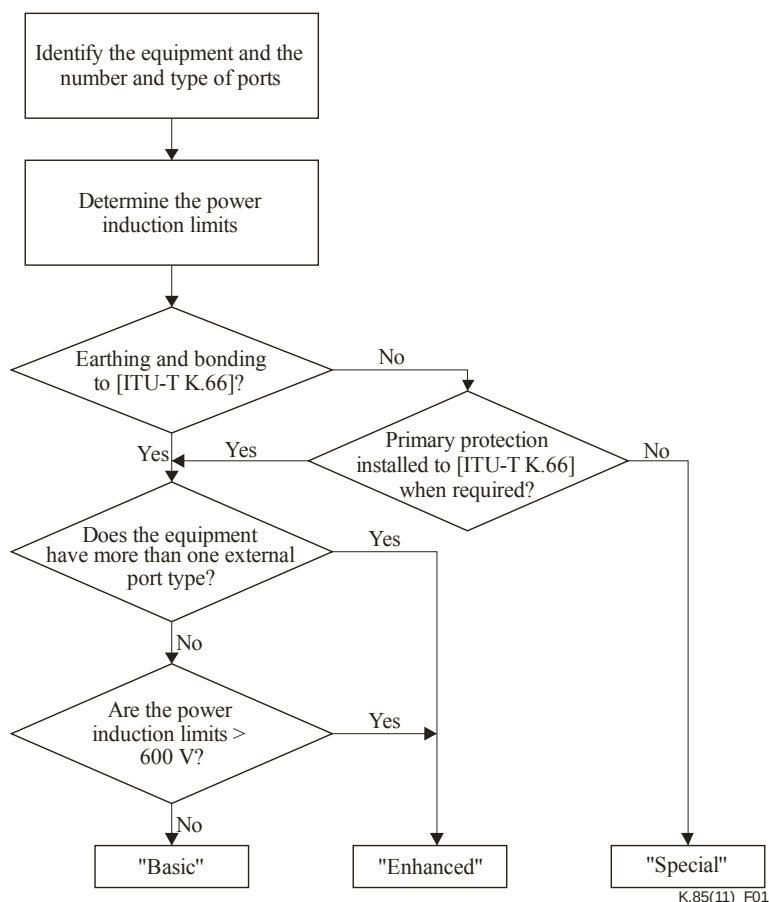


Figure 1 – Flowchart for determining required level of resistibility

The resistibility requirements of [ITU-T K.21] in conjunction with [ITU-T K.44] ensure that the equipment can be protected by the installation of an MSPD or primary protector.

It is expected that protection for ports connected to external cables will only be installed if required and therefore the "inherent" tests in Table 2 of [ITU-T K.21] are required.

It is necessary to determine the special test protector to be used when checking compliance with [ITU-T K.21]. Information on selecting the agreed primary protector, and hence the special test protector, is given in Annex C of Recommendation [ITU-T K.12]. If the product can be used within the customer premises there is a likelihood that the customer may connect it via an MSPD or may request primary protection to be installed. This sets the worst-case scenario for determining the "agreed primary protector" as per [ITU-T K.44].