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Safe limits for operating voltages and currents in telecommunication systems powered over the network

Recommendation ITU-T K.50

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Safe limits for operating voltages and currents in telecommunication systems powered over the network

Summary

Recommendation ITU-T K.50 provides guidance on voltages and currents that may safely be used to power telecommunication systems that are part of the network of telecommunications service providers. These systems use the paired-conductor cables of the network or specific power feeding cables to provide power to equipment at remote locations. This equipment and the current-carrying conductors can be accessed in the energized state by service or skilled personnel without using insulated gloves or tools. For safety reasons, system types operating at hazardous voltages are not intended to pass beyond the public network interface (PNI) between the service provider and the end customer. These hazardous voltage systems are not intended to be part of the subscriber's installation, and are not accessible to users of the network. They are located in the networks between different telecommunication centres, between a telecommunication centre and a telecommunications access facility/node, and between a telecommunication centre and PNIs. Recommendation ITU-T K.50 only covers systems that use continuous d.c. powering.

History

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FOREWORD

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The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

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.

NOTE

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Introduction

Telecommunication networks sometimes use equipment that generates voltages and currents that exceed TNV-1, TNV-2, TNV-3 (defined in [IEC 60950-1]) and ES1, ES2 (defined in [IEC 62368-1]) to provide power to remote equipment over paired-conductor network telecommunications cables. Examples of this type of equipment are x-type digital subscriber line (xDSL) powering units, xDSL remote terminating units, line power up-converters, line power down-converters, repeaters, regenerators, or other remote cabinet or enclosure equipment. The voltages and currents that power these systems differ from those of telecommunication services provided to end users or subscribers. To help ensure that service or skilled personnel can safely work on these lines or equipment without de-energizing the circuits or using insulated gloves, this Recommendation provides guidance not only on the voltage and current limits for these systems, but also the associated work practices required.

Voltages and currents that may be applied to a telecommunication network by equipment forming part of a subscriber's installation are covered in [IEC 60950-1] and [IEC 62368-1].

This Recommendation includes the operating voltages and currents defined in [b-ATIS-0600337].

Recommendation ITU-T K.50

Safe limits for operating voltages and currents in telecommunication systems powered over the network

1 Scope

This Recommendation provides guidance on voltages and currents that may safely be used to power telecommunication systems that are part of the telecommunications service provider's network. These systems use the paired-conductor cables of the network to provide power to communications-related equipment at remote locations. This equipment and the current-carrying conductors can be accessed in the energized state by service or skilled personnel without using insulated gloves or tools. These systems are not intended to extend a voltage-limited remote feeding telecommunication (RFT-V) or a current-limited RFT (RFT-C) circuit beyond the point of demarcation between the service provider and the end user or ordinary people. In addition, exposed RFT-V and RFT-C circuits are not allowed to be accessible to ordinary people or end users. The systems that use RFT-C and RFT-V are located in the network between different telecommunication centres, between a telecommunication centre and a telecommunications access facility or node, and between a telecommunication centre and public network interfaces (PNIs). This Recommendation covers only systems that use continuous direct current (d.c.) powering.

RFT circuits sometimes carry signalling or data on the conductors, as well as delivering power. However, in many cases the conductors are used to simply provide d.c. power and no signalling or data is present. This is becoming more commonplace, as fibre is used more and more to transmit broadband data and twisted pair copper cable pairs are used to power remote telecommunications equipment.

Figure 1-a shows the field of application in the network between different telecommunication centres. Figure 1-b shows the part of the access network where this Recommendation is applicable. If there is no access network equipment between the local exchange and the customer premises equipment to convert the RFT-V or RFT-C to telecommunication network voltage-1 (TNV-1), TNV-2, TNV-3, energy source class 1 (ES1) or energy source class 2 (ES2), this Recommendation does not apply.

Guidance on work practices, if these limits are exceeded, can be found in [b-ITU-T Directives Vol. VI] and [b-ITU-T Directives Vol. VII].

NOTE 1 – Limits on permissible voltages that may occur because of exposure to power or electrified railway lines are provided in [b-ITU-T Directives].

NOTE 2 – Requirements for the safety of equipment that is part of the telecommunications network infrastructure are provided in [b-ITU-T K.51], [IEC 60950-1] and [IEC 62368-1].

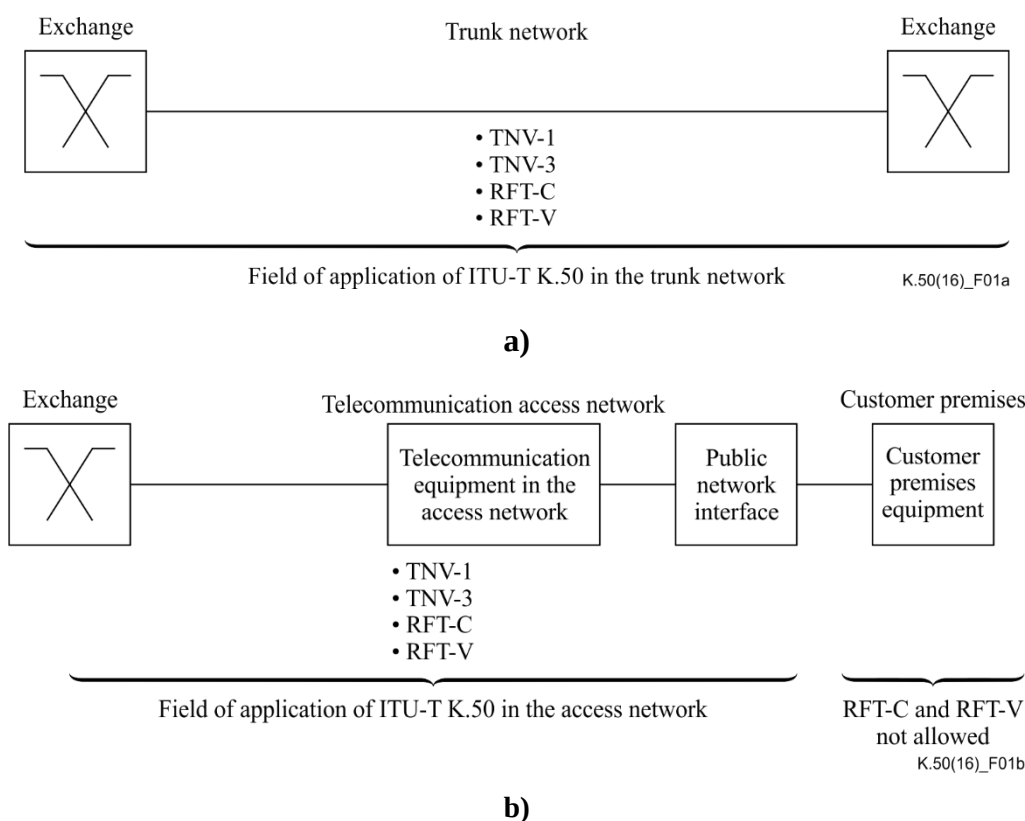


Figure 1 – Field of application of this Recommendation: a) in the trunk network; b) in the access network

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.

- [IEC 60950-1] IEC 60950-1 (2013), *Information technology equipment – Safety – Part 1: General requirements*.
- [IEC 62368-1] IEC 62368-1 (2014), *Audio/video, information and communication technology equipment – Part 1: Safety requirements*.

3 Definitions

3.1 Terms defined elsewhere

NOTE – The definition of circuits in [IEC 60950-1] is limited to circuits internal to equipment. In [IEC 62368-1] the definition of circuits is limited to circuits external to equipment, which are normally considered to be a telecommunication network. For this Recommendation, the definition of circuits is extended to include network cable conductors that carry the same voltages/currents.

This Recommendation uses the following terms defined elsewhere:

3.1.1 basic insulation [IEC 60950-1]: Insulation to provide basic protection against electric shock.

NOTE – [IEC 62368-1] refers to "basic safeguard" rather than "basic protection" and notes "This concept does not apply to insulation used exclusively for functional purposes".

3.1.2 double insulation [IEC 60950-1]: Insulation comprising both basic insulation and supplementary insulation.

3.1.3 ELV circuit [IEC 60950-1]: Secondary circuit with voltages between any two conductors of the circuit, and between any one such conductor and earth, not exceeding 42.4 V peak, or 60 V d.c., under normal operating conditions, which is separated from hazardous voltage by basic insulation, and which neither meets all of the requirements for an SELV circuit nor meets all of the requirements for a limited current circuit.

3.1.4 external circuit [IEC 62368-1]: Electrical circuit that is external to the equipment and is not mains.

NOTE – An external circuit is classified as ES1, ES2 or ES3, and PS1, PS2 or PS3.

3.1.5 functional insulation [IEC 62368-1]: Insulation between conductive parts which is necessary only for the proper functioning of the equipment.

NOTE – [IEC 60950-1] adds the informative note "functional insulation by definition does not protect against electric shock. It may, however, reduce the likelihood of ignition and fire".

3.1.6 hazardous voltage [IEC 60950-1]: Voltage exceeding 42.4 V peak, or 60 V d.c., existing in a circuit that does not meet the requirements for either a limited current circuit or a TNV circuit.

NOTE – The corresponding [IEC 62368-1] requirement would be voltages exceeding ES1.

3.1.7 instructed person [IEC 62368-1]: Person instructed or supervised by a skilled person as to energy sources and who can responsibly use equipment safeguards and precautionary safeguards with respect to those energy sources.

NOTE 1 – Supervised, as used in the definition, means having the direction and oversight of the performance of others.

NOTE 2 – In the context of this Recommendation, the term *instructed person* is synonymous with *user* [IEC 60950-1].

3.1.8 limited current circuit [IEC 60950-1]: Circuit that is so designed and protected that, under both normal operating conditions and single fault conditions, the current that can be drawn is not hazardous.

NOTE 1 – Simulated faults and abnormal conditions are defined in clause 1.4.14 of [IEC 60950-1].

NOTE 2 – The limit value of d.c. is defined as 2 mA d.c. through a 2 k Ω resistor connected between any two parts of a limited current circuit or between any such part and earth in clause 2.4 of [IEC 60950-1].

3.1.9 ordinary person [b-IEC 60050-826]: Person who is neither a skilled person nor an instructed person.

NOTE – In the context of this Recommendation, the term *ordinary person* is synonymous with *user* [IEC 60950-1].

3.1.10 overvoltage [b-IEC/TR 60664-2-1]: Any voltage having a peak value exceeding the corresponding peak value of maximum steady-state voltage at normal operating conditions.

3.1.11 primary circuit [IEC 60950-1]: Circuit that is directly connected to the a.c. mains supply.

3.1.12 prospective touch voltage [IEC 62368-1]: Voltage between simultaneously accessible conductive parts when those conductive parts are not being touched.

3.1.13 reinforced insulation [IEC 62368-1]: Single insulation system that provides a degree of protection against electric shock equivalent to double insulation.

NOTE – [IEC 60950-1] adds the informative note "The term "insulation system" does not imply that the insulation has to be in one homogeneous piece. It may comprise several layers that cannot be tested as basic insulation and supplementary insulation".