

International Telecommunication Union

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

K.20

(06/2021)

SERIES K: PROTECTION AGAINST INTERFERENCE

**Resistibility of telecommunication equipment
installed in a telecommunication centre to
overvoltages and overcurrents**

Recommendation ITU-T K.20

ITU-T

Recommendation ITU-T K.20

Resistibility of telecommunication equipment installed in a telecommunication centre to overvoltages and overcurrents

Summary

Recommendation ITU-T K.20 specifies resistibility requirements and test procedures for telecommunication equipment that is attached to or installed within a telecommunication centre.

Overvoltages and overcurrents covered by Recommendation ITU-T K.20 include surges due to lightning on or near the line plant, short-term induction from adjacent alternating current (AC) power lines or railway systems, earth potential rise due to power faults, direct contact between telecommunication lines and power lines, and electrostatic discharges (ESDs). The sources for overvoltages in internal lines, between equipment or racks, are mainly inductive coupling caused by lightning currents being conducted in nearby lightning strikes or lightning currents being conducted in nearby conductors.

Major changes compared with Recommendation ITU-T K.20 (2017) include:

- DC insulation resistance test;
- revised test exemption for internal short cables;
- renaming of some test titles for clarity;
- screened cable exemptions;
- addition of test 7.10, a twisted pair port transverse/differential test, to Table 7.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T K.20	1984-10-19		11.1002/1000/6964
2.0	ITU-T K.20	1988-11-25		11.1002/1000/1387
3.0	ITU-T K.20	1991-03-18	V	11.1002/1000/1388
4.0	ITU-T K.20	1993-03-12	V	11.1002/1000/1389
5.0	ITU-T K.20	1996-10-18	5	11.1002/1000/3880
6.0	ITU-T K.20	2000-02-25	5	11.1002/1000/4904
7.0	ITU-T K.20	2003-07-29	5	11.1002/1000/6492
7.1	ITU-T K.20 (2003) Amd. 1	2004-11-12	5	11.1002/1000/7499
8.0	ITU-T K.20	2008-04-13	5	11.1002/1000/9400
9.0	ITU-T K.20	2011-11-13	5	11.1002/1000/11420
10.0	ITU-T K.20	2015-04-22	5	11.1002/1000/12403
11.0	ITU-T K.20	2016-06-29	5	11.1002/1000/12867
12.0	ITU-T K.20	2016-12-14	5	11.1002/1000/13126
13.0	ITU-T K.20	2017-07-29	5	11.1002/1000/13272
14.0	ITU-T K.20	2018-10-22	5	11.1002/1000/13629
15.0	ITU-T K.20	2019-07-14	5	11.1002/1000/13950
16.0	ITU-T K.20	2019-11-13	5	11.1002/1000/14067
17.0	ITU-T K.20	2021-06-29	5	11.1002/1000/14723

Keywords

1.2/50-8/20, 10/700, Ethernet, external ports, internal port, overcurrent, overvoltage, power contact, power induction, power over Ethernet (PoE), resistibility, subscriber line integrated circuit (SLIC), surges, telecommunication centres, telecommunication equipment, transverse, universal serial bus (USB).

* 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>.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

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

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure, e.g., interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

INTELLECTUAL PROPERTY RIGHTS

ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents/software copyrights, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the appropriate ITU-T databases available via the ITU-T website at <http://www.itu.int/ITU-T/ipr/>.

© ITU 2021

All rights reserved. No part of this publication may be reproduced, by any means whatsoever, without the prior written permission of ITU.

Table of Contents

	Page
1 Scope	1
2 References.....	1
3 Definitions	1
3.1 Terms defined elsewhere	1
3.2 Terms defined in this Recommendation.....	2
4 Abbreviations and acronyms	2
5 Conventions	2
6 Tests.....	2
Appendix I – Floating transverse power induction and earth potential rise test for ports connected to external symmetric pair cables	27
I.1 Introduction	27
I.2 Discussion of the reason for the damage	27
I.3 Test set-up and test voltages.....	28
Bibliography.....	29

Recommendation ITU-T K.20

Resistibility of telecommunication equipment installed in a telecommunication centre to overvoltages and overcurrents

1 Scope

This Recommendation specifies resistibility requirements and test procedures for equipment installed in a telecommunication centre where the earthing, bonding and cabling between equipment or racks are in accordance with [ITU-T K.27]. This Recommendation applies to both external and internal ports. [ITU-T K.44] is an integral part of this Recommendation and should be read in conjunction with [ITU-T K.11], [ITU-T K.39] and [ITU-T K.46].

This Recommendation applies to all telecommunication equipment, whether network operator or customer owned, including telephony, routers and modems. It does not apply to equipment such as personal computers or printers.

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.11] | Recommendation ITU-T K.11 (2009), <i>Principles of protection against overvoltages and overcurrents</i> . |
| [ITU-T K.27] | Recommendation ITU-T K.27 (2015), <i>Bonding configurations and earthing inside a telecommunication building</i> . |
| [ITU-T K.39] | Recommendation ITU-T K.39 (2019), <i>Risk assessment of damages to telecommunication sites due to lightning discharges</i> . |
| [ITU-T K.44] | Recommendation ITU-T K.44 (2019), <i>Resistibility tests for telecommunication equipment exposed to overvoltages and overcurrents – Basic Recommendation</i> . |
| [ITU-T K.46] | Recommendation ITU-T K.46 (2012), <i>Protection of telecommunication lines using metallic symmetric conductors against lightning-induced surges</i> . |
| [IEC 61000-4-2] | IEC 61000-4-2:2008, <i>Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test</i> . |

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

- 3.1.1 **dedicated power feed (dpf)** [ITU-T K.44].
- 3.1.2 **IT power distribution system** [ITU-T K.44].
- 3.1.3 **TT power distribution system** [ITU-T K.44].

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AC	Alternating Current
CWG	Combination Wave Generator
DC	Direct Current
ESD	Electrostatic Discharge
PoE	Power over Ethernet
SLIC	Subscriber Line Integrated Circuit
SPD	Surge Protective Device
STP	Special Test Protector
STP _E	Shielded Twisted Pair Ethernet
USB	Universal Serial Bus
UTP _E	Unshielded Twisted Pair Ethernet

Other definitions, abbreviations, conventions and symbols used in this Recommendation are specified in [ITU-T K.44].

5 Conventions

None.

6 Tests

A summary of the tests applicable to the equipment installed in a telecommunication centre is given in Table 1. The numbers given in the "Port type" columns, e.g., 2.2.1a, refer to the "Test no." of Tables 2 to 5. The words "under study" mean that ITU-T is still studying this test. The test conditions applicable to the four ports: symmetric; coaxial; dedicated power feed; and mains power are given in Tables 2 to 5. The test conditions for electrostatic discharge (ESD) are given in Table 6. The test conditions for internal cable ports are given in Table 7. For information on the headings and terms used in the tables, refer to clause 10 of [ITU-T K.44].

Refer to clause 5.2 of [ITU-T K.44] on selecting the enhanced resistibility requirement.

NOTE 1 – For small telecommunication centres, the resistance of the earth electrode may be significantly high. When the "enhanced" requirement is specified and the centre has 250 symmetric pairs or fewer, apply the port to the external port test from [b-ITU-T K.45], but retain the inherent test voltages from this Recommendation.

NOTE 2 – The external port test applies to ports used to connect externally-attached equipment to equipment installed within the same building. The mains power contact test does not apply in this situation. Where the equipment external to the building is installed in the "inherently protected" area shown in Figure 3 of [b-ITU-T K.71], the internal port test can be applied.

NOTE 3 – The power induction test does not apply to ports used to connect to antennas installed within the scope of [b-ITU-T K.71].

NOTE 4 – Tests of Table 1b and Table 7 do not apply to equipment ports meeting all of the following requirements.

- 1) The distance between two racks/cabinets is not more than 6 m.

- 2) The length of interconnection cable does not exceed 10 m.
- 3) The equipment has a dedicated earthing point and shares the same earth. Measures to reduce the potential difference between equipment shall be taken.
- 4) The equipment has the same power distribution source.
- 5) Interconnected equipment shall use shielded cable bonded at both ends.

If the port meets the intra-system port criteria all of requirements 1 to 5, no testing is required on the port. However, other port types used on the equipment shall be tested as per this Recommendation.

Table 7 does not apply to ports connected infrequently such as maintenance ports.

NOTE 5 – Test 7.7 of Table 1b and Table 7 does not apply to shielded cable equipment ports meeting all of the following requirements.

- 1) The monitored impulse voltage of the Ethernet longitudinal/common mode withstand test 7.6 does not have any insulation breakdown or voltage limiter operation.
- 2) The unused pins of the port are not solidly earthed.
- 3) The installation environment prohibits the use of voltage limiters (surge protective devices (SPDs)) in the cabling.

NOTE 6 – Shielded cable tests 7.6, 7.7 and 7.10 do not apply when the equipment is guaranteed to be installed using a shielded cable bonded at both ends and there are no voltage limiters in the system, such as surge protective devices (SPDs) and surge protective components in the equipment port or connecting cable. (The operation of longitudinal/common-mode voltage limiters, such as surge protective devices (SPDs) and surge protective components, can produce transverse/differential surges.)

Table 1a – Applicable tests for external ports

Test type	No. of pairs simultaneously tested	Test connection	Primary protection	Port type			
				Symmetric port	Coaxial port	Dedicated power feed port	Mains power port
Lightning voltage	Single	Transverse/differential	No	2.1.1a	3.1.1	4.1.1a	5.1.1a
		Port to earth	No	2.1.1b	n/a	4.1.1b	5.1.1b
		Port to external port	No	n/a	n/a	4.1.1c	5.1.1c
		Coordination/Transverse/differential	Yes	2.1.2a	3.1.2	4.1.2a	5.1.2a
		Coordination/Port to earth	Yes	2.1.2b	n/a	4.1.2b	5.1.2b
		Coordination/Port to external port	Yes	n/a	n/a	4.1.2c	5.1.2c
	Multiple	Port to earth	No	2.1.3a	n/a	n/a	n/a
		Port to external port	No	n/a	n/a	n/a	n/a
		Port to earth	Yes	2.1.4a	n/a	n/a	n/a
		Port to external port	Yes	n/a	n/a	n/a	n/a
	Unshielded twisted pair Ethernet (UTP _E)	Port to earth	No	2.1.8	n/a	n/a	n/a
		Transverse	No	2.1.7	n/a	n/a	n/a
		Voltage impulse test	No	2.1.10		n/a	n/a
		Power over Ethernet (PoE)	No	2.1.11		n/a	n/a
	Shielded twisted pair Ethernet (STP _E)	Port to earth	No	2.1.8		n/a	n/a
		Shield to earth	No	2.1.9		n/a	n/a
Lightning current	Single	Port to earth	No	2.1.5a	n/a	4.1.5a	n/a
		Port to external port	No	n/a	n/a	n/a	n/a
		Differential	n/a	n/a	3.1.3	n/a	n/a
		Shield to earth	n/a	n/a	3.1.4	n/a	n/a
		Shield to external port	n/a	n/a	3.1.5	n/a	n/a
	Multiple	Port to earth	No	2.1.6a	n/a	n/a	n/a
		Port to external port	No	n/a	n/a	n/a	n/a

Table 1a – Applicable tests for external ports

Test type	No. of pairs simultaneously tested	Test connection	Primary protection	Port type			
				Symmetric port	Coaxial port	Dedicated power feed port	Mains power port
Power induction and earth potential rise	Single	Transverse	No	2.2.1a	Under study	4.2.1a	n/a
		Port to earth	No	2.2.1b	n/a	4.2.1b	5.2.1 under study
		Port to external port	No	2.2.1c	n/a	4.2.1c	n/a
		Coordination transverse	Yes	2.2.2a	Under study	4.2.2a	n/a
		Coordination port to earth	Yes	2.2.2b	n/a	4.2.2b	n/a
		Coordination port to external port	Yes	2.2.2c	n/a	4.2.2c	n/a
Neutral potential rise	Single	Port to earth	No	n/a	n/a	n/a	5.2.2a
		Port to external port	No	n/a	n/a	n/a	5.2.2b
Mains power contact	Single	Transverse	No	2.3.1a	n/a	4.3.1a	n/a
		Port to earth	No	2.3.1b	n/a	4.3.1b	n/a
		Port to external port	No	2.3.1c	n/a	4.3.1c	n/a

Table 1b – Lightning test conditions for ports connected to internal cables
(See clause 6, Note 4 and Note 6, for exemptions)

No. of pairs simultaneously tested	Test connection	Primary protection	Unshielded cable	Shielded cable	PoE power feed	Direct current (DC) powered equipment	DC power source
Single	Shielded cable to earth	No		7.2			
	Universal serial bus (USB) shielded cable to earth	No		7.3			
	Screen/shield connection high current test	No		7.4			
	Ethernet transverse	No	7.7	7.7			
	Twisted pair port transverse/differential	No	7.10	7.10			
	DC powered equipment port	No				7.8	
	DC power source port	No					7.9
Multiple	Unshielded cable with symmetric pairs	No	7.1				
	PoE Mode A and Mode B transverse testing	No			7.5		
	Ethernet longitudinal/common mode withstand test	No	7.6	7.6			