



INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

K.54

(12/2004)

SERIES K: PROTECTION AGAINST INTERFERENCE

**Conducted immunity test method and level at
fundamental power frequencies**

ITU-T Recommendation K.54

ITU-T Recommendation K.54

Conducted immunity test method and level at fundamental power frequencies

Summary

This Recommendation presents the simplified immunity test method, the test procedure and the immunity test level for equipment with telecommunication ports connected to external telecommunication lines against conducted disturbances which can be induced on telecommunication lines by a.c. power or electrified railway lines under normal operating conditions.

Source

ITU-T Recommendation K.54 was approved on 14 December 2004 by ITU-T Study Group 5 (2005-2008) under the ITU-T Recommendation A.8 procedure.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications. 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, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

© ITU 2005

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

CONTENTS

	Page
1 Scope	1
2 References.....	1
3 Definitions	1
4 Immunity test conditions	2
5 Performance criterion	2
6 Test method and procedure.....	2

Introduction

Disturbances at fundamental power frequencies ($16\frac{2}{3}$, 50 or 60 Hz) can be induced on telecommunication lines by a.c. power and electrified railway lines under normal operating conditions. Therefore, there is a need to define immunity requirements at these frequencies of equipment with telecommunication ports connected to external telecommunication lines.

This Recommendation presents the immunity test method, the test procedure and the immunity test levels for telecommunication equipment.

Background information on the test set-up is given in the "Handbook on interference measuring techniques" [1].

Other coupling networks are possible. (See [1].)

ITU-T Recommendation K.54

Conducted immunity test method and level at fundamental power frequencies

1 Scope

This Recommendation refers to long-term (i.e., longer than 1 second) voltages induced by a.c. power or electrified railway lines on telecommunication lines.

The Recommendation defines:

- the immunity level, which a telecommunication equipment shall comply to;
- the test method and procedure, which shall be used to verify the immunity level.

The tests are applicable to telecommunication ports connected to external metallic telecommunication lines.

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.

- [1] ITU-T Handbook (2002), *Interference measuring techniques*, Part A.
- [2] ITU-T (1989) Directives concerning the protection of telecommunication lines against harmful effects from electric power and electrified railway lines, Volume VI: *Danger and disturbance*.
- [3] ITU-T Recommendation K.43 (2003), *Immunity requirements for telecommunication equipment*.

3 Definitions

This Recommendation defines the following terms:

3.1 common mode induced disturbances: Voltage induced on telecommunication line by an a.c. power or electrified railway line under normal operating conditions between the equipment telecommunication port and a reference earth.

3.2 test frequency: The test frequency is the fundamental power frequency used in the area, where the telecommunication plant is located, i.e., $16\frac{2}{3}$, 50 or 60 Hz.

3.3 external telecommunication line: Telecommunication line which leaves a telecommunication centre or shelter or customer building.

3.4 reference earth: A point in the soil, whose electrical potential is presumed to be zero. This concept is used both in the calculation and measurement of voltages, considered as difference of the potential induced in the telecommunication plant and the potential of the soil.

Other definitions are found in ITU-T Rec. K.43 [3].

4 Immunity test conditions

The immunity level of conducted long-term disturbances at fundamental power frequencies is the r.m.s. level of the common mode voltage between telecommunication port and earth.

The immunity level shall be 60 V.

The test duration shall not be less than 1 minute and not exceed 15 minutes.

5 Performance criterion

During the test, the Equipment Under Test (EUT) shall meet its performance requirements.

6 Test method and procedure

A simplified test circuit is shown in Figure 1 for symmetrical pair ports (unshielded or shielded cable) whereas it is under study for coaxial pairs.

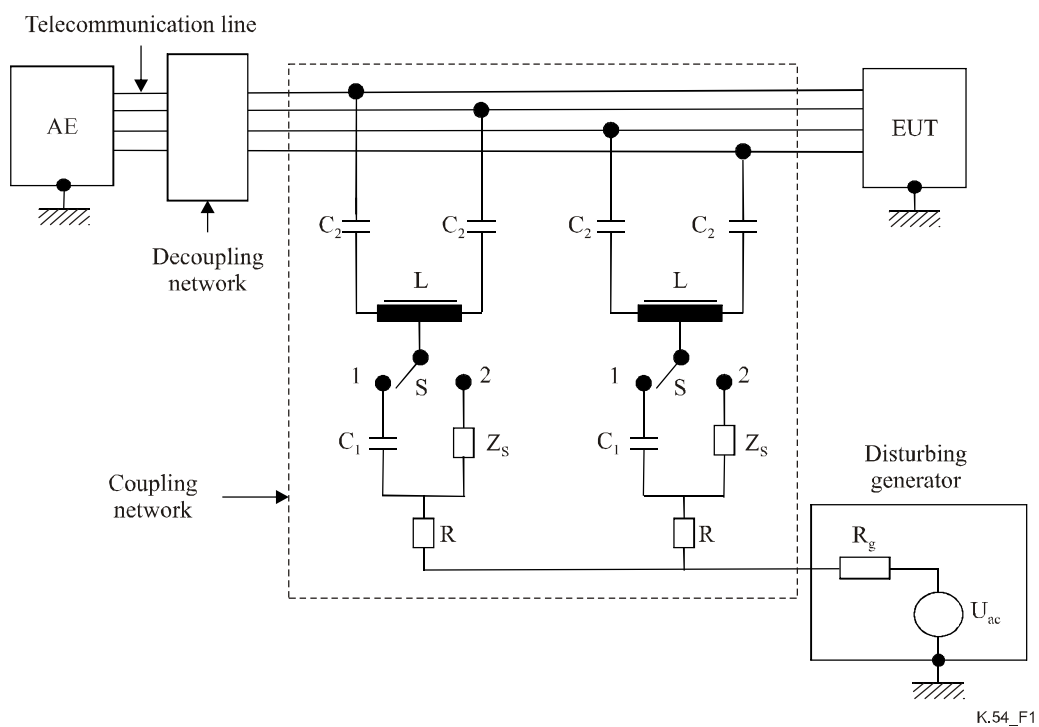


Figure 1/K.54 – Test circuit for shielded and unshielded cables

Switch S in position 1, when the associated equipment has an impedance to earth greater than 30 k Ω .

Switch S in position 2, when the associated equipment has an impedance to earth less than 30 k Ω .

In Figure 1, the open circuit voltage of the test generator, U_{ac} , is the required immunity level.

When the common mode impedance of the EUT is low, the common mode voltage occurring at the port of the EUT is significantly lower than the voltage of the test generator.

The earthing connections of the EUT shall be implemented according to the real installation conditions.

If the Auxiliary Equipment (AE) has a lower immunity level than that required of the EUT, it is necessary to use a decoupling network to isolate the AE from the common mode disturbance. For this purpose, it is possible to use common mode transformers on the telecommunication lines. In

this case, if the EUT is powered by a remote feeding circuit through the telecommunication line, the d.c. voltage generator on the line shall be used to supply the EUT.

The EUT test conditions (operating state, earthing connections, wiring, etc.) should be as close as possible to the real installation conditions. If the EUT is designed to be mounted in a rack or cabinet, it should be tested in this configuration.

The signal or control ports shall be correctly terminated either by auxiliary equipment necessary to exercise the ports or in their nominal impedance. Auxiliary equipment may be used to simulate the functional termination of the ports. Special additional equipment, e.g., a traffic simulator, and/or software, line attenuator, line simulator, may be used to simulate the operating conditions.

NOTE – The operation of the test simulator shall be verified for correct operation before applying the disturbing voltage.

In Figure 1, the following values of the components should be used:

$$R_g = 50 \Omega$$

$$R = 150 \Omega$$

$$C_1 = 120 \text{ nF}$$

$$Z_S = 100 \Omega$$

$$C_2 = 10 \mu\text{F}$$

These values take into account the worst-case conditions concerning line lengths, number of pairs and centre of exposure.

The inductance L of the coupling network for differential mode should provide a high impedance compared with the differential mode impedance of the EUT.

SERIES OF ITU-T RECOMMENDATIONS

Series A	Organization of the work of ITU-T
Series D	General tariff principles
Series E	Overall network operation, telephone service, service operation and human factors
Series F	Non-telephone telecommunication services
Series G	Transmission systems and media, digital systems and networks
Series H	Audiovisual and multimedia systems
Series I	Integrated services digital network
Series J	Cable networks and transmission of television, sound programme and other multimedia signals
Series K	Protection against interference
Series L	Construction, installation and protection of cables and other elements of outside plant
Series M	Telecommunication management, including TMN and network maintenance
Series N	Maintenance: international sound programme and television transmission circuits
Series O	Specifications of measuring equipment
Series P	Telephone transmission quality, telephone installations, local line networks
Series Q	Switching and signalling
Series R	Telegraph transmission
Series S	Telegraph services terminal equipment
Series T	Terminals for telematic services
Series U	Telegraph switching
Series V	Data communication over the telephone network
Series X	Data networks, open system communications and security
Series Y	Global information infrastructure, Internet protocol aspects and next-generation networks
Series Z	Languages and general software aspects for telecommunication systems