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PROTECTION AGAINST INTERFERENCE

IMMUNITY REQUIREMENTS AND TEST METHODS FOR ELECTROSTATIC DISCHARGE TO TELECOMMUNICATION EQUIPMENT – GENERIC EMC RECOMMENDATION

ITU-T Recommendation K.32
Superseded by a more recent version

(Previously "CCITT Recommendation")

FOREWORD

The ITU-T (Telecommunication Standardization Sector) is a permanent organ of the International Telecommunication Union (ITU). The 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 Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1 (Helsinki, March 1-12, 1993).

ITU-T Recommendation K.32 was prepared by ITU-T Study Group 5 (1993-1996) and was approved under the WTSC Resolution No. 1 procedure on the 31st of May 1995.

NOTES

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

2. The status of annexes and appendices attached to the Series K Recommendations should be interpreted as follows:

- an *annex* to a Recommendation forms an integral part of the Recommendation;
- an *appendix* to a Recommendation does not form part of the Recommendation and only provides some complementary explanation or information specific to that Recommendation.

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IMMUNITY REQUIREMENTS AND TEST METHODS FOR ELECTROSTATIC DISCHARGE TO TELECOMMUNICATION EQUIPMENT – GENERIC EMC RECOMMENDATION

(Geneva, 1995)

1 Introduction

This Recommendation defines the immunity requirement and test methods for equipment from electrostatic discharges, via users directly, and from radiated fields via discharges to adjacent objects. It is desirable to promote standardization by referring to other suitable standards where these exist. This Recommendation refers to an international standard and gives further requirements in order to meet the specific needs of telecommunications. The test methods recommended are applied to equipment which is functioning under normal conditions.

Although test levels and methods are presented here, it is recognized that the levels and test methods should be kept under review in order that they correctly emulate the actual electrostatic discharge threat.

2 Scope

The objective of the Recommendation is to establish a common reference for evaluating the degradation of the performance of telecommunication equipment when subjected to electrostatic discharges. Levels of electrostatic discharges which may occur from personnel to an object near to the equipment are found in Appendix I "Guidance for selecting test levels".

This Recommendation

- sets out performance criteria;
- refers to IEC Publication 801-2 for test levels, methods and procedures;
- refers to additional test levels necessary to meet varying levels of service priority and varying levels of each country's electrostatic discharge environment;
- is intended to encourage planning at equipment design levels or the hardening of equipment in order to meet the levels set out in this Recommendation;
- is applicable to telecommunication equipment;
- does not include:
  - limits of radiated and conducted electrostatic emission or immunity;
  - constructional details as to how equipment may be designed to meet the requirement levels.

3 References

[1] IEC 801-2: 1991, *Electromagnetic compatibility for industrial-process measurement and control equipment Part 2: Electrostatic discharge requirement*.

[2] IEC 1000-2-3: 1992, *Environment – Section 3: Description of environment – Radiated and non-network-frequency-related conducted phenomena*.

[3] IEC 1000-4-1: 1992, *Testing and measuring techniques – Section 1: Overview of immunity tests Basic EMC publication*.

[4] IEC 50(161): 1990, *International Electrotechnical Vocabulary – Chapter 161: Electromagnetic compatibility*.

4 Definitions

Defined terms are to be found in IEC Publication 801-2 (future 1000-4-2) together with those from the International Electrotechnical Vocabulary [IEV 161(50)].

5 General

The problem of protecting equipment against the discharge of static electricity has gained considerable importance for manufacturers and users. The extensive use of microelectronic components has emphasized the need to define the aspects of the problem and seek a solution in order to enhance product/system reliability. The problem of static electricity accumulation and subsequent discharges becomes more relevant for uncontrolled environments and the widespread application of equipment and systems in a wide range of industrial plants.

Equipment may also be subjected to electrostatic energy whenever discharges occur from personnel to nearby objects. Additionally, discharges can occur between metal and objects, such as chairs and tables, in the proximity of the equipment. However, based on limited experience available to date, it is considered that the tests described in this Recommendation will be adequate to simulate the effects of the latter phenomenon.

6 Test level

The test level required in any given situation shall be selected from those in IEC 801-2.

Considering the different failure consequence and electrostatic discharge environment between different countries, appropriate levels should be selected from these severity levels. A guidance for selecting test levels is given in Appendix I.

7 Performance criteria

7.1 Purpose

The purpose for setting performance criteria is to ensure that the equipment will perform satisfactorily when exposed to influence from the environment.

In order to achieve this goal and to avoid over specification, the severity of testing must be closely correlated to the severity of the environment and allowable malfunction of equipment.

The severities of testing are graded in order:

- to take account of the fact that the environmental severity varies statistically;
- to allow for malfunction of the Equipment Under Test (EUT) at some level of exposure;
- to establish the safety margin.

7.2 Equipment specific performance criteria

Specific performance criteria for each equipment category will be specified in relevant Recommendations. Generic performance criteria are given below.

Equipment may be susceptible to electrostatic discharges (ESD) effects at all stages of storage, installation, testing, operation and maintenance. Any malfunction, undesirable response, or performance degradation of the EUT, beyond the tolerances stated in the EUT's performance requirements, is considered to be a failure. The following compliance criteria are required to be met and have to be defined depending on the test level selected.

i) *Normal performance*

The EUT shall withstand the applied test without damage and shall operate correctly within its specified limits. Signal degradation shall be less than specified limits. Corruption of any software or data associated with the EUT is not permitted. This includes data stored in memory or data in process within the EUT.

ii) *Reduced performance*

The EUT shall withstand the applied test without damage. Corruption of software or data held in memory shall not occur. Reduced performance is permitted within specified relaxed limits. Resumption to normal performance shall occur at the cessation of the test, without the need for operator action.

iii) *Loss of function*

The EUT has a temporary loss of function following the application of the test. Recovery requires operator action to restore normal performance. No physical damage or corruption of system operating software is permitted.

8 Test method

8.1 General test method

This subclause specifies the test procedure to be used to analyze the system level immunity to ESD of an equipment assembly.

Electrostatic discharge tests shall be conducted in accordance with IEC Publication 801-2. The preferred test method is that of type tests performed in laboratories and this is the only accepted method of demonstrating conformance with this Recommendation. The EUT shall be arranged as closely as possible to the arrangement in the final installed conditions.

8.2 Application of discharge

Application of discharge shall be carried out in accordance with 8.3/IEC 801-2. For application to telecommunication equipment, the following additional guidance is given.

Where the EUT contains panels and doors, normal operation testing is first performed with the panels in place and the doors closed. When equipment has doors which can be opened during normal operation, the doors are then to be opened and the discharge is applied to door edges and inner door surfaces. Where user-accessible components such as control panels and cabinets of tape and disk drive units, and wrist-strap jacks are present behind door or panels, they are to be tested with the door opened or the panels removed.

Discharges are to be applied to vertical and horizontal coupling planes for the indirect discharge test in accordance with IEC 801-2.

Indirect discharge test should be carried out using the same test conditions as direct discharge.

8.3 Operation of equipment during tests

Electrostatic discharge test shall be performed on fully operational, suitably configured, and typically loaded production equipment, including hardware, software and firmware, for application in telecommunication networks. The EUT shall demonstrate its ability to perform its design intended functions before and after the tests to demonstrate its immunity to malfunction and damage. An example of switching equipment operation is shown in Appendix II.

Appendix I

Guidance for selecting test levels

The environments in which equipment may be installed are described below. Static discharge levels may vary depending on the environment and the priority of service provided by the equipment. Figures I.1 and I.2 give guidance on the levels that may be observed depending on the materials used, and the environment in which the systems are operating.

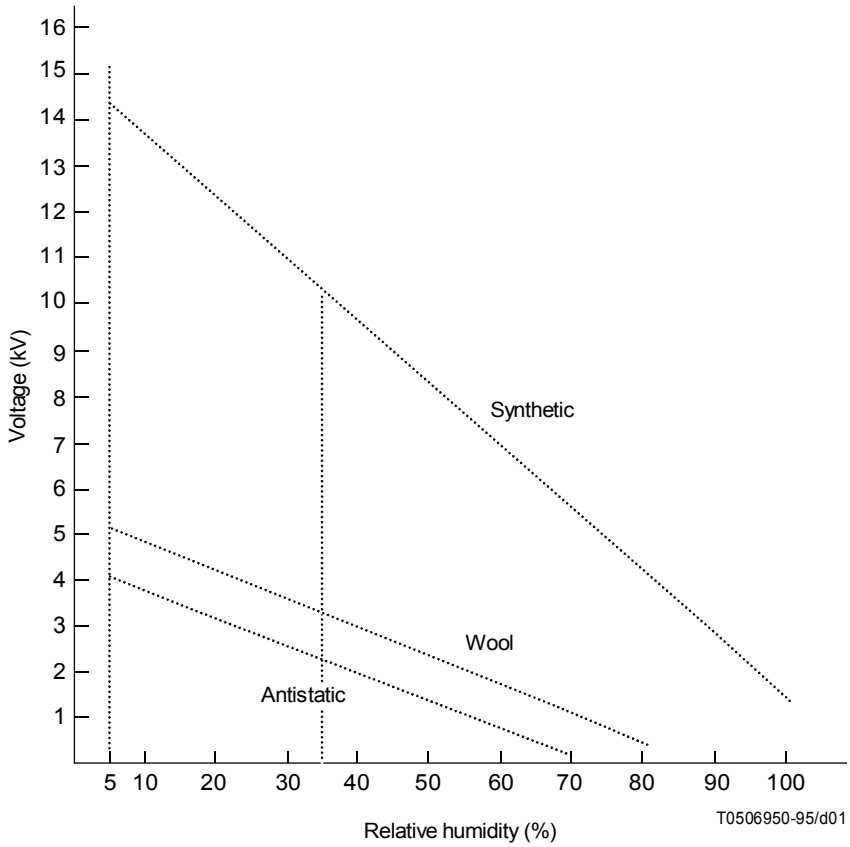

FIGURE I.1/K.32

Maximum values of electrostatic voltages to which operators may be charged while contact with materials
(Source: IEC 1000-4-2)

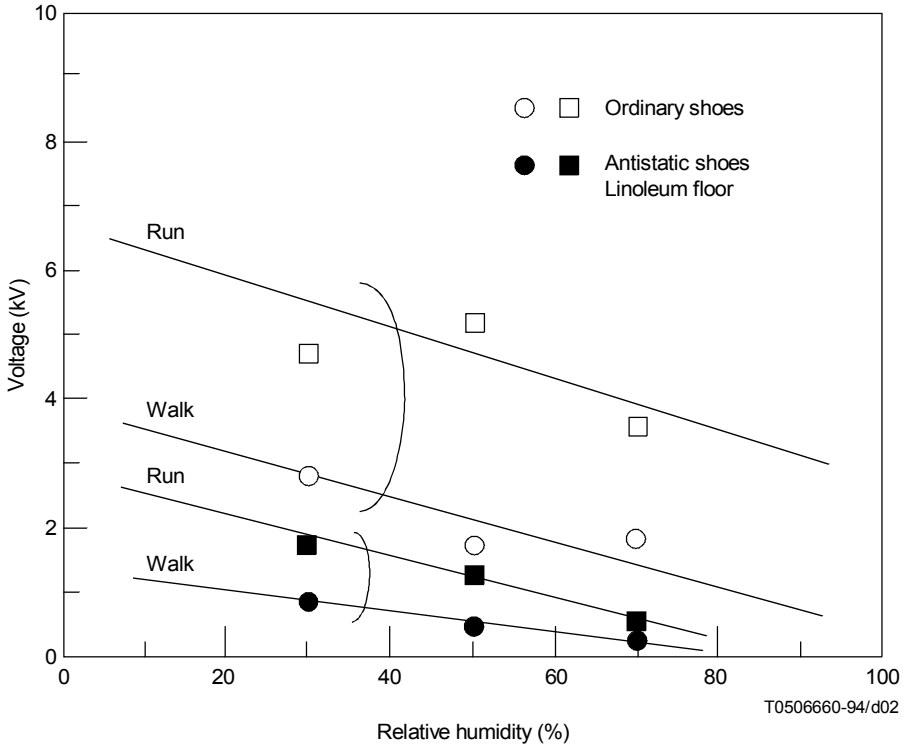

FIGURE I.2/K.32

Maximum values of electrostatic voltage to which operators may be charged in telecommunications central office
(Source: COM 5-D.35, 1990, NTT)

Appendix II

An example of switching equipment operation

For example, a switching system is loaded as follows during ESD testing. If the EUT principally performs call processing, then traffic is simulated by use of "load boxes" with the number of originating and terminating lines and trunks to generate a traffic load sufficient to exercise the rated call capacity in the range of 70% to 80%, with an appropriate call mix.

When the EUT is a distributed processing system composed of both central and peripheral processing sub-systems, the test load applies only to the portion of the EUT affected by the particular test. The portion of the EUT that is judged to be unaffected by a particular test may be operated at lower but not zero load levels for that test.

For high-capacity processing systems, it may be impractical to bring the load on the EUT up to the prescribed level solely with use of boxes. In such cases, it is acceptable to provide additional traffic using internal traffic simulation software or other artificial means to increase the call processing load to prescribed level. However, a minimum of capability to detect and report call processing errors in the artificial traffic must be comparable to that for traffic generated by the use of the load boxes.

Other switching system functions such as data transfer, maintenance routines are ongoing during the ESD testing.