

# Information technology equipment — Immunity characteristics — Limits and methods of measurement

The European Standard EN 55024:1998, with the incorporation of amendment A1:2001, has the status of a British Standard

ICS 33.100

NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW

**BSI**  
British Standards

## National foreword

This British Standard is the English language version of EN 55024:1998, including amendment A1:2001. It was derived by CENELEC from CISPR 24:1997, including amendment 1:2001.

The start and finish of text introduced or altered by amendment is indicated in the text by tags **A1** **A1**. Tags indicating changes to the IEC text carry the number of the IEC amendment. For example, text altered by IEC amendment 1 is indicated by **A1** **A1**.

The CENELEC common modification have been implemented at the appropriate places in the text. The start and finish of each common modification is indicated in the text by tags **C** **C**.

The UK participation in its preparation was entrusted by Technical Committee GEL/210, Electromagnetic compatibility, to Subcommittee GEL/210/7, Interference characteristics of ITE, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

### Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled “International Standards Correspondence Index”, or by using the “Search” facility of the *BSI Electronic Catalogue* or of British Standards Online.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

### Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 25 and a back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

This British Standard, having been prepared under the direction of the Electrotechnical Sector Committee, was published under the authority of the Standards Committee and comes into effect on 15 December 1998

© BSI 28 August 2002

ISBN 0 580 30600 3

### Amendments issued since publication

Amd. No.	Date	Comments
13564	28 August 2002	See National foreword

---

ICS 33.100

Descriptors: Data processing equipment, telecommunication terminals, facsimile equipment, photocopying machines, printers, cash registers, vending machines, local area networks, electromagnetic immunity, radio disturbances, electrostatic discharge tests, characteristics, measurements, limits

English version

## Information technology equipment — Immunity characteristics — Limits and methods of measurement

(includes amendment A1:2001)

(CISPR 24:1997 + A1:2001, modified)

Appareils de traitement de l'information —  
Caractéristiques d'immunité —  
Limites et méthodes de mesure  
(inclut l'amendement A1:2001)  
(CISPR 24:1997 + A1:2001, modifiée)

Einrichtungen der Informationstechnik —  
Störfestigkeitseigenschaften —  
Grenzwerte und Prüfverfahren  
(enthält Änderung A1:2001)  
(CISPR 24:1997 + A1:2001, modifiziert)

This European Standard was approved by CENELEC on 1998-08-01 and amendment A1 was approved by CENELEC on 2001-10-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

## CENELEC

European Committee for Electrotechnical Standardization  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B-1050 Brussels

---

© 1998 CENELEC — All rights of exploitation in any form and by any means reserved worldwide for CENELEC members.

Ref. No. EN 55024:1998 + A1:2001 E

## Foreword

The text of the International Standard CISPR 24:1997, prepared by CISPR SC G, Interference relating to information technology equipment, together with common modifications prepared by SC 210A, EMC Products, of Technical Committee CENELEC TC 210, EMC, was submitted to the Unique Acceptance Procedure and was approved by CENELEC as EN 55024 on 1998-08-01.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1999-02-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2001-07-01

Annexes designated “normative” are part of the body of the standard.

In this standard, Annex A, Annex B, Annex C, Annex D, Annex E, Annex F, Annex G and Annex ZA are normative. Annex ZA has been added by CENELEC.

## Foreword to amendment A1

The text of document CISPR/G/211/FDIS, future amendment 1 to CISPR 24:1997, prepared by CISPR SC G, Interference relating to information technology equipment, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A1 to EN 55024:1998 on 2001-10-01.

The following dates were fixed:

- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2002-07-01
- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 2004-10-01

## Contents

	Page
Foreword	2
Introduction	3
1 Scope and object	3
2 Normative references	3
3 Definitions	4
4 Immunity test requirements	6
5 Applicability	7
6 Conditions during testing	8
7 Performance criteria	8
8 Product documentation	9
Annex A (normative) Telecommunications terminal equipment	12
Annex B (normative) Data processing equipment	18
Annex C (normative) Local area networks (LAN)	20
Annex D (normative) Printers	21
Annex E (normative) Copying machines	21
Annex F (normative) Automatic teller machines (ATM)	22
Annex G (normative) Point of sale terminals (POST)	23
Annex ZA (normative) Normative references to international publications with their corresponding European publications	25
Figure 1 — Description of ports	4
Table 1 — Immunity, enclosure port	9
Table 2 — Immunity, signal ports and telecommunication ports	10
Table 3 — Immunity, input d.c. power port (excluding equipment marketed with an a.c./d.c. power converter)	10
Table 4 — Immunity, input a.c. power ports (including equipment marketed with a separate a.c./d.c. power converter)	11
Table A.1 — Maximum acoustic demodulated levels at the telecommunications port and at the acoustic receiving device (measurement method 1)	13
Table A.2 — Maximum demodulated differential mode noise levels at the telecommunications port (measurement method 2)	14
Table A.3 — Maximum demodulated differential mode noise and acoustic sound pressure levels at the telecommunications port and at the acoustic receiving device (measurement method 1)	15
Table A.4 — Maximum demodulated differential mode noise levels (measurement method 2)	16

## Introduction

This CISPR publication establishes uniform requirements for the electromagnetic immunity of information technology equipment. The test methods are given in the referenced Basic EMC Immunity Standards. This publication specifies applicable tests, test levels, product operating conditions and assessment criteria.

## 1 Scope and object

This CISPR publication applies to information technology equipment (ITE) as defined in CISPR 22.

Ⓒ Harmonized standards prepared by ETSI, which cover the immunity requirements for telecommunications network equipment take precedence over this standard. Ⓒ

Procedures are defined for the measurement of ITE and limits are specified which are developed for ITE and within the frequency range from 0 Hz to 400 GHz.

The object of this publication is to establish requirements which will provide an adequate level of intrinsic immunity so that the equipment will operate as intended in its environment.

For exceptional environmental conditions, special mitigation measures may be required.

Owing to testing and performance assessment considerations, some tests are specified in defined frequency bands or at selected frequencies. Equipment which fulfils the requirements at these frequencies is deemed to fulfil the requirements in the entire frequency range from 0 Hz to 400 GHz for electromagnetic phenomena.

The object of this publication is to define the immunity test requirements for equipment defined in the scope in relation to continuous and transient, conducted and radiated disturbances, including electrostatic discharges (ESD).

The test requirements are specified for each port considered.

NOTE 1 Safety considerations are not covered in this publication.

NOTE 2 In special cases, situations will arise where the level of disturbance may exceed the levels specified in this publication, for example where a hand-held transmitter is used in proximity to an equipment. In these instances special mitigation measures may have to be employed.

## 2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the publication referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

IEC 60050(161):1990, *International Electrotechnical Vocabulary (IEV) — Chapter 161: Electromagnetic compatibility*.

IEC 60318:1970, *An IEC artificial ear, of the wideband type, for the calibration of earphones used in audiometry*.

IEC 61000-4-2:1995, *Electromagnetic compatibility (EMC) — Part 4: Testing and measurement techniques — Section 2: Electrostatic discharge immunity test — Basic EMC Publication*.

IEC 61000-4-3:1995, *Electromagnetic compatibility (EMC) — Part 4: Testing and measurement techniques — Section 3: Radiated, radio-frequency, electromagnetic field immunity test — Basic EMC Publication*.

IEC 61000-4-4:1995, *Electromagnetic compatibility (EMC) — Part 4: Testing and measurement techniques — Section 4: Electrical fast transient/burst immunity test — Basic EMC Publication*.

IEC 61000-4-5:1995, *Electromagnetic compatibility (EMC) — Part 4: Testing and measurement techniques — Section 5: Surge immunity tests — Basic EMC Standard*.

IEC 61000-4-6:1996, *Electromagnetic compatibility (EMC) — Part 4: Testing and measurement techniques — Section 6: Immunity to conducted disturbances, induced by radio-frequency fields*.

IEC 61000-4-8:1993, *Electromagnetic compatibility (EMC) — Part 4: Testing and measurement techniques — Section 8: Power frequency magnetic field immunity test*.

IEC 61000-4-11:1994, *Electromagnetic compatibility (EMC) — Part 4: Testing and measurement techniques — Section 11: Voltage dips, short interruptions and voltage variations immunity tests.*

CISPR 22:1997, *Information technology equipment — Radio disturbance characteristics — Limits and methods of measurement.*

ISO 9241-3:1992, *Ergonomic requirements for office work with visual display terminals (VDTs) — Part 3: Visual display requirements.*

ITU-T Recommendation I.241.1, *Telephony.*

ITU-T Recommendation I.411, *Integrated service digital network (ISDN) user network interfaces.*

☐ Text deleted ☐

### 3 Definitions

For the purpose of this publication, the definitions contained in the following documents apply: ITU-T Recommendation I.411, IEC 60050 (161), International Electrotechnical Vocabulary (IEV), Chapter 161. In addition, the following specific definitions apply:

3.1  
**continuous wave (CW)**  
 electromagnetic waves, the successive oscillations of which are sinusoidal and identical under steady-state conditions, which can be interrupted or modulated to convey information

3.2  
**dcgradation**  
 the unwanted change in operational performance of an EUT due to electromagnetic disturbances  
 this does not necessarily mean malfunction or catastrophic failure

3.3  
**equipment under test (EUT)**  
 a representative ITE or functionally interactive group of ITE (that is a system) which includes one or more host units and is used for evaluation purposes

3.4  
**information technology equipment (ITE)**  
 the definition of ITE is as described in CISPR 22

3.5  
**jitter (of a cathode ray tube (CRT) monitor)**  
 peak-to-peak variation in the geometric location of picture elements on the viewing surface of the CRT monitor

3.6  
**temporal instability (flicker)**  
 the perception of unintended temporal variation in luminance

3.7  
**port**  
 particular interface of the specified equipment with the external electromagnetic environment (see Figure 1)

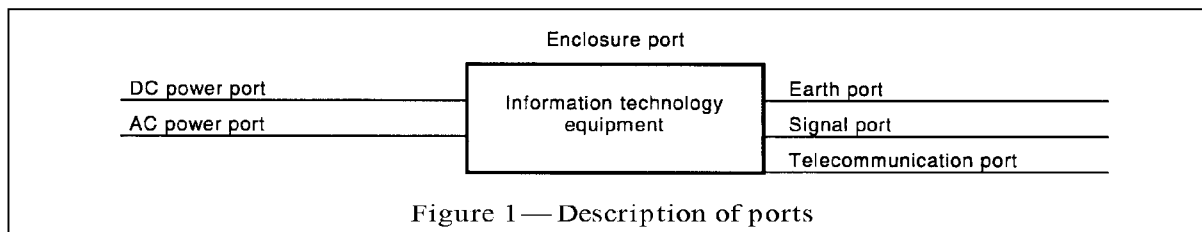


Figure 1 — Description of ports

## 3.8

## enclosure port

the physical boundary of the equipment through which electromagnetic fields may radiate or impinge for plug-in units, the physical boundary will be defined by the host unit

## 3.9

## cable port

a point at which a conductor or a cable is connected to the equipment. Examples are signal and power ports

## 3.10

## a telephony call

the process exercised in the network and the telecommunication terminal equipment (TTE) to allow interchange of information (speech, video or data) with another TTE through the network

NOTE The call shall be operated in the way specified by the manufacturer. For circuit switched services the exchange of data shall be considered to be possible when a 64 kbit/s channel or equivalent is available for both parties. For packet service the exchange of information shall be considered to be possible when a virtual path is established to the called TTE.

## 3.11

## to establish a telephony call

the operating procedure for a user or an automatic process in conjunction with the network to reach the capability to exchange information with another TTE

see note to 3.10

## 3.12

## to receive a telephony call

the operating procedure for a user or an automatic process initiated by, and in conjunction with, the network to reach the capability to exchange information with another TTE

see note to 3.10

## 3.13

## to maintain a telephony call

the capability of exchanging information without having to clear and re-establish a call

see note to 3.10

## 3.14

## to clear a telephony call

the operating procedure for a user or an automatic process in conjunction with the network (either at the initiative of the local party or the distant party) to stop the capability of exchanging information by an orderly return to a state where the establishment of a new call is possible

see note to 3.10

## 3.15

## network terminator (NT)

ancillary equipment representing the termination of the telecommunication network

## 3.16

## telephony service

a service providing users with the ability for real-time two-way speech conversation via a network (see ITU-T Recommendation I.241.1)

## 3.17

## telecommunications terminal equipment

equipment intended to be connected to a public or private telecommunications network, that is:

- a) to be connected directly to the termination of a telecommunications network in order to send, process or receive information; or
- b) to interwork with a telecommunications network being connected directly or indirectly to the termination of a telecommunications network in order to send, process or receive information

## 4 Immunity test requirements

### 4.1 General

The immunity test requirements for equipment are given on a port-by-port basis.

Tests shall be conducted in a well-defined and reproducible manner.

The tests shall be carried out as single tests in sequence. The sequence of testing is optional.

The description of the test, the test generator, the test methods and the test set-up are given in IEC basic EMC standards which are referred to in the following tables.

The contents of these IEC basic EMC standards are not repeated here; however, modifications or additional information needed for the practical application of the tests are given in this publication.

### 4.2 Particular requirements

#### 4.2.1 *Electrostatic discharges (ESD)*

Static electricity discharges shall be applied only to those points and surfaces of the EUT which are expected to be touched during usual operation, including user access, as specified in the user manual, for example for ribbon and paper roll changes.

The discharges shall be applied in two ways:

- a) contact discharges to the conductive surfaces and to coupling planes:

The EUT shall be exposed to at least 200 discharges, 100 each at negative and positive polarity, at a minimum of four test points (a minimum of 50 discharges at each point). One of the test points shall be subjected to at least 50 indirect discharges (contact) to the centre of the front edge of the horizontal coupling plane. The remaining three test points shall each receive at least 50 direct contact discharges. If no direct contact test points are available, then at least 200 indirect discharges shall be applied in the indirect mode [see IEC 61000-4-2 for use of the Vertical Conducting Plane (VCP)]. Tests shall be performed at a maximum repetition rate of one discharge per second.

- b) air discharge at slots and apertures, and insulating surfaces:

On those parts of the EUT where it is not possible to perform contact discharge testing, the equipment should be investigated to identify user accessible points where breakdown may occur; examples are openings at edges of keys, or in the covers of keyboards and telephone handsets. Such points are tested using the air discharge method. See also IEC 61000-4-2 regarding painted surfaces. This investigation should be restricted to those areas normally handled by the user. A minimum of 10 single air discharges shall be applied to the selected test point for each such area.

The application of electrostatic discharges to the contacts of open connectors is not required by this publication.

#### 4.2.2 *Electrical fast transients (EFT)*

The test method is given in IEC 61000-4-4. However, the test set-up for *in situ* measurements is not applicable for ITE.

The test procedure is as given in IEC 61000-4-4 together with the following changes and clarifications:

- if the equipment contains identical ports, only one shall be tested;
- multiconductor cables, such as a 50-pair telecommunication cable, shall be tested as a single cable. Cables shall not be split or divided into groups of conductors for this test;
- interface ports, which are intended by the manufacturer to be connected to data cables not longer than 3 m, shall not be tested.

#### 4.2.3 *Continuous radio frequency disturbances*

Ⓒ The frequency range for the radiated field test is 80 MHz to 1 000 MHz. Ⓒ

The frequency ranges are scanned as specified; however, at a limited number of selected frequencies a more comprehensive functional test may be required. The requirement to undertake this additional selected frequency test is not universally applicable to all products, but only to products which have this requirement specified in Annex A (under particular product specific requirements). The selected frequencies are given in Table 1, Table 2, Table 3 and Table 4.



The dwell time at each frequency shall not be less than the time necessary for the EUT to be exercised and to be able to respond; however, the dwell time shall not exceed 5 s at each of the frequencies during the scan.

The time to exercise the EUT shall not be interpreted as a total time of a programme or a cycle but related to the reaction time in case of failure of the EUT.

#### 4.2.3.1 *Continuous radiated disturbances*

The test procedure is in accordance with IEC 61000-4-3.

The EUT shall be positioned so that the four sides of the EUT shall be exposed to the electromagnetic field in sequence. In each position the performance of the EUT will be investigated.

In the case where the most sensitive surface side of the EUT is known throughout the frequency range (for example, via preliminary tests), testing may be restricted to that surface side only.

In cases of dispute, testing on the four surface sides shall take precedence.

If the EUT is too large to be adequately illuminated by the radiating antenna partial illumination shall be used.

Partial illumination shall be carried out using one of the following techniques:

- the EUT can be repositioned so that the front surface remains separated from the radiating antenna by the test distance (perpendicular with the axis between the calibration point and the radiating antenna) in order to illuminate those sections of the EUT outside the previous antenna beam width;
- where the EUT consists of separate modules, the modules can be tested separately within the antenna beam width.

In cases of dispute, full illumination of the EUT will take precedence.

The frequency range can be swept incrementally with a step size not exceeding 4 % of the fundamental with a test level of twice the value of the specified test level.

In cases of dispute, testing with 1 % steps will take precedence.

#### 4.2.3.2 *Continuous conducted disturbances*

Ⓒ The test procedure shall be in accordance with IEC 61000-4-6. Ⓒ

#### 4.2.4 *Power-frequency magnetic fields*

The test procedure shall be in accordance with IEC 61000-4-8.

The EUT shall be arranged and connected to satisfy its functional requirements, and shall be placed at the centre of the coil system (immersion method).

The cables supplied by the equipment manufacturer shall be used or, in their absence, suitable alternative cables of the type appropriate to the signals involved shall be used.

Physically large products need not be completely submerged in the magnetic field, only the sensitive devices (such as CRT monitors if they are the only sensitive parts). In this case, and if the CRT monitor is integral with the ITE, then the CRT monitor or sensitive device can be removed for testing.

#### 4.2.5 *Surges*

The test procedure shall be in accordance with IEC 61000-4-5 Ⓒ *Text deleted* Ⓒ.

#### 4.2.6 *Voltage dips and interruptions*

The test procedure is in accordance with IEC 61000-4-11. There shall be no deviations from that standard.

## 5 Applicability

Tests shall be applied to the relevant ports of the equipment according to Table 1, Table 2, Table 3 and Table 4. Tests shall only be carried out where the relevant port exists.

It may be determined from consideration of the electrical characteristics and usage of a particular equipment that some of the tests are inappropriate and therefore unnecessary. In such a case, it is required that both the decision and the justification not to apply any particular test to any particular port be recorded in the test report.

## 6 Conditions during testing

### 6.1 General conditions

The tests shall be made exercising all primary functions in the most representative mode consistent with typical applications. The test sample shall be configured in a manner consistent with typical installation practice.

If the equipment is part of a system or can be connected to auxiliary equipment, then the equipment shall be tested while connected to the minimum representative configuration of auxiliary equipment necessary to exercise the ports in a similar manner to that described in CISPR 22.

The configuration and mode of operating during the tests shall be precisely noted in the test report. It is not always possible to test every function of the apparatus; in such cases, the most critical mode of operation shall be selected.

If the equipment either has a large number of terminals or a large number of ports with similar connections, then a sufficient number shall be selected to simulate the actual operating conditions and to ensure that all the different types of termination are covered.

Coil cables (such as keyboard cables) shall not be intentionally stretched during testing. For such cables, the length specified in the table notes refers to unstretched conditions.

The test equipment or auxiliary equipment (for example NT or simulator) connected to the EUT shall not have any influence on the result of the testing.

In cases where a manufacturer's specification requires external protection devices or measures which are clearly specified in the user's manual, then the test requirements of this standard shall be applied with the external protection devices or measures in place.

During testing, the environmental conditions and supply voltages shall remain within the operating ranges specified for the product unless otherwise indicated in the basic standard.

If an earth connection independent of the power supply cable is provided, this earth connection shall be installed according to the specifications of the manufacturer for the tests (given in Table 1, Table 2, Table 3 and Table 4) at all other ports.

### 6.2 Particular conditions (EUT operational modes, etc.)

The particular conditions specified in the annexes take precedence over the corresponding parts of the general conditions.

Where particular conditions for specific functions are not given in this standard, then the general conditions shall apply.

## 7 Performance criteria

The manufacturer has the obligation to express the performance criteria in terms which relate to the performance of his specific product when used as intended.

The following performance criteria are applicable, and shall only be evaluated when the functions referred to are implemented.

### 7.1 General performance criteria

Examples of functions defined by the manufacturer to be evaluated during testing include, but are not limited to, the following:

- essential operational modes and states;
- tests of all peripheral access (hard disks, floppy disks, printers, keyboard, mouse, etc.);
- quality of software execution;
- quality of data display and transmission;
- quality of speech transmission.

**Performance criterion A**

The equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.

**Performance criterion B**

After the test, the equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed, after the application of the phenomena below a performance level specified by the manufacturer, when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance.

During the test, degradation of performance is allowed. However, no change of operating state or stored data is allowed to persist after the test.

If the minimum performance level (or the permissible performance loss) is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.

**Performance criterion C**

Loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls by the user in accordance with the manufacturer's instructions.

Functions, and/or information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

**7.2 Particular performance criteria**

The particular performance criteria which are specified in the normative annexes take precedence over the corresponding parts of the general performance criteria.

Where particular performance criteria for specific functions are not given, then the general performance criteria shall apply.

**8 Product documentation**

The specification used by the manufacturer to define the performance criteria for the testing required by this standard shall be made available to the user upon request.

Table 1 — Immunity, enclosure port

	Environmental phenomenon	Test specification	Units	Basic standard	Remarks	Performance criterion
1.1	Power-frequency magnetic field	Ⓒ 50 1 Ⓒ	Hz A/m (r.m.s.)	IEC 61000-4-8	See <sup>1)</sup>	A See Annex B
1.2	Radio-frequency electromagnetic field Amplitude modulated	Ⓒ 80-1 000 3 80 Ⓒ	MHz V/m (unmodulated, r.m.s) % AM (1 kHz)	IEC 61000-4-3	Ⓒ The test level specified is prior to modulation See <sup>2)</sup> Ⓒ	A
1.3	Electrostatic discharge	4 (Contact discharge) 8 (Air discharge)	kV (charge voltage) kV (charge voltage)	IEC 61000-4-2		B
<sup>1)</sup> Applicable only to equipment containing devices susceptible to magnetic fields, such as CRT monitors, Hall elements, electrodynamic microphones, magnetic field sensors, etc. <sup>2)</sup> The frequency range is scanned as specified. However, when specified in Annex A, an additional comprehensive functional test shall be carried out at a limited number of frequencies. The selected frequencies are: 80, 120, 160, 230, 434, 460, 600, 863 and 900 MHz (±1 %). Ⓒ Note deleted Ⓒ						

Ⓒ

Table 2 — Immunity, signal ports and telecommunication ports

	Environmental phenomenon	Test specification	Units	Basic standard	Remarks	Performance criterion
2.1	Radio-frequency continuous conducted	0,15–80 3 80	Mhz V (unmodulated, r.m.s) % AM (1 kHz)	IEC 61000-4-6	See <sup>1)</sup> and <sup>3)</sup>	A
2.2	Surge Line to Ground	1 1,2/50 (8/20)	kV (peak) Tr/Th µs	IEC 61000-4-5	See <sup>2)</sup> and <sup>4)</sup>	B
2.3	Fast transients	0,5 5/50 5	kV (peak) Tr/Th ns Repetition frequency kHz	IEC 61000-4-4	See <sup>3)</sup>	B

NOTE 1 The frequency range is scanned as specified. However, when specified in Annex A, an additional comprehensive functional test shall be carried out at a limited number of frequencies. The selected frequencies for conducted tests are: 0,2; 1; 7,1; 13,56; 21; 27,12 and 40,68 Mhz (±1 %).

NOTE 2 Applicable only to ports which according to the manufacturer's specification may connect directly to outdoor cables.

NOTE 3 Applicable only to cables which according to the manufacturer's specification supports communication on cable lengths greater than 3m.

NOTE 4 Where normal functioning cannot be achieved because of the impact of the CDN on the EUT, no test shall be required.

Ⓒ

Table 3 — Immunity, input d.c. power port (excluding equipment marketed with an a.c/d.c. power converter)

(if d.c. power is fed on conductors included in a signal cable, then the requirements of Table 2 only apply to this cable)

	Environmental phenomenon	Test specification	Units	Basic standard	Remarks	Performance criterion
Ⓒ 3.1	Radio-frequency continuous conducted	0,15–80 3 80	MHz V (unmodulated, r.m.s.) % AM (1 kHz)	IEC 61000-4-6	See <sup>1)</sup>	A Ⓒ
3.2	Surges	1,2/50 (8/20) 0,5	Tr/Th µs kV (peak)	IEC 61000-4-5	Test applied lines to earth (ground) See <sup>2)</sup>	B
3.3	Fast transients	0,5 5/50 5	kV (peak) Tr/Th ns Repetition frequency kHz	IEC 61000-4-4		B

<sup>1)</sup> The frequency range is scanned as specified. However, when specified in Annex A, an additional comprehensive functional test shall be carried out at a limited number of frequencies. The selected frequencies for conducted test are: 0,2; 1; 7,1; 13,56; 21; 27,12 and 40,68 MHz (±1 %).

<sup>2)</sup> Applicable only to ports which according to the manufacturer's specification may connect directly to outdoor cables.

Ⓒ Note deleted Ⓒ

Table 4 — Immunity, input a.c. power ports (including equipment marketed with a separate a.c./d.c power converter)

	Environmental phenomenon	Test specification	Units	Basic standard	Remarks	Performance criterion
4.1	Radio-frequency continuous conducted	0,15–80 3 80	MHz V (unmodulated, r.m.s) % AM (1 kHz)	IEC 61000-4-6	See <sup>1)</sup>	A
4.2	Voltage dips	>95 0,5	% reduction period	IEC 61000-4-11	See <sup>2)</sup>	B
		30 25	% reduction periods			C
4.3	Voltage interruptions	>95 250	% reduction periods	IEC 61000-4-11	See <sup>2)</sup>	C
4.4	Surges	1,2/50 (8/20) 1 line to line 2 line to earth (ground)	Tr/Th $\mu$ s kV (peak) kV (peak)	IEC 61000-4-5	See <sup>3)</sup>	B
4.5	Fast transients	1,0 5/50 5	kV (peak) Tr/Th ns Repetition frequency kHz	IEC 61000-4-4		B
<p><sup>1)</sup> The frequency range is scanned as specified. However, when specified in Annex A, an additional comprehensive functional test shall be carried out at a limited number of frequencies. The selected frequencies for conducted test are: 0,2; 1; 7,1; 13,56; 21; 27,12 and 40,68 MHz (<math>\pm 1</math> %).</p> <p><sup>2)</sup> Changes to occur at 0 degree crossover point of the voltage waveform.</p> <p><sup>3)</sup> When the manufacturer specifies protection measures and it is impractical to simulate these measures during the tests, then the applied test levels shall be reduced to 0,5 kV and 1 kV.</p> <p><del>Note deleted</del></p>						

## Annex A (normative)

### Telecommunications terminal equipment

#### A.1 Telecommunications terminal equipment (TTE) having an analogue interface

##### A.1.1 *Particular test conditions*

The telecommunications terminal equipment (TTE) shall be configured for connection to a telecommunication line (or reference line) at its nominal impedance. Auxiliary equipment may be used to simulate the telecommunications network.

##### A.1.2 *Particular performance criteria*

The following performance criteria are applicable only when the functions are implemented.

#### Performance criterion A

##### a) Swept frequency test

Testing shall be carried out in accordance with one of the two measurement methods described below.

In case of dispute, tests shall be carried out as originally performed.

##### Measurement method 1

The volume control (where it exists) shall be set as close as possible to the position which gives the nominal value as stated by the manufacturer.

The acoustic sound pressure level (spl) shall be measured using a calibrated artificial ear, as defined in IEC 60318, coupled without loss to the acoustic receiving device of the TTE. The background acoustic noise shall be less than 40 dB(spl). The audio channel shall be open and active.

The following shall be fulfilled during a sweep in the whole specified frequency range:

- the TTE shall be able to maintain an established call;
- for TTE supporting telephony service, the following also applies:  
the demodulated narrowband 1 kHz (maximum measurement bandwidth of 100 Hz) differential mode signal measured on the telecommunications port shall not be greater than the values given in Table A.1, measured at the TTE nominal impedance (as specified by the manufacturer);
- for TTE having an acoustic interface, the following also applies:  
the acoustic demodulated sound pressure level (spl) in the receive direction shall not be greater than the values given in Table A.1.

Table A.1—Maximum acoustic demodulated levels at the telecommunications port and at the acoustic receiving device (measurement method 1)

Frequency band MHz	Type of immunity test	Noise signal dBm	Acoustic sound pressure level dB(spl)
A) 0,15 to 10	Conducted	−50	55
10 to 30 (except 26,95 to 27,29)	Conducted	−50 to −30 (see Note 2)	55 to 75 (see Note 2)
26,95 to 27,29	Conducted	−40	65
30 to 80	Conducted	−20	85 A)
80 to 1 000 <sup>1)</sup> (except at 900 <sup>1)</sup> )	Radiated	−30	75
900 <sup>1)</sup>	Radiated	−50	55
A) NOTE 1 A) These tests are designed to ensure a minimum acceptable immunity to amplitude modulated radio-frequency disturbances for devices having acoustic interfaces. The demodulated disturbance levels are higher than those that will be found acceptable in practice. The levels in the tests have been chosen for their practical test convenience, having regard for the maximum allowed background acoustic noise level of 40 dB(spl) and the test levels to be applied for functional testing. The amplitude demodulated disturbances will arise, almost invariably, from semi-conductor junctions behaving as inadvertent square law detectors. This means that for every 1 dB change in the level of the applied radio-frequency signal the demodulated level will change by 2 dB. Therefore, if a radiated immunity test subjecting the EUT to a test field carrier level of 3 V/m produces a resultant demodulated acoustic 1 kHz disturbance output of 55 dB(spl) [a distinctly annoying acoustic level for most listeners with normal hearing, but conveniently above the allowed background noise level of 40 dB(spl)], the test ensures that an amplitude modulated disturbance field of 1 V/m (approximately 10 dB lower field strength) applied to the same equipment in a real world situation can produce a demodulated acoustic disturbance level of approximately 35 dB(spl), which most people in a practical listening environment do not perceive as annoying.			
A) NOTE 2 Levels in the specified range change linearly with the logarithm of the frequency. A)			
<sup>1)</sup> This requirement is not applicable for countries where no digital mobile services operating at 900 MHz exist.			

#### Measurement method 2

The volume control (where it exists) shall be set at a fixed level during calibration and shall not be changed during the test.

The following shall be fulfilled during a sweep in the whole of the specified frequency range:

- the TTE shall be able to maintain an established call;
- for TTE supporting telephony service, the following also applies:  
with the audio channel open and active, the demodulated differential mode noise on the telecommunications port measured at the TTE nominal impedance (as specified by the manufacturer), shall not be greater than the values given in Table A.1. The measurement bandwidth shall be 100 Hz maximum at 1 kHz;
- for TTE having an acoustic interface, the following also applies:  
a sinusoidal signal of 1 kHz, −40 dBm is impressed on the telecommunication line (signal level without the radio-frequency field). The resulting acoustic sound level is measured using a microphone. The measured level shall be used and recorded as the reference level. The signal used to establish the reference level is switched off during the actual test. The measurement bandwidth shall be 100 Hz maximum.

The background noise shall not exceed a level 15 dB below the reference level.

The demodulated differential mode noise in the receive direction, measured in the way described for the reference level, shall not be greater than the values given in Table A.2.

Table A.2 — Maximum demodulated differential mode noise levels at the telecommunications port (measurement method 2)

Frequency band MHz	Type of immunity test	Demodulated differential mode noise dBm
A1) 0,15 to 30	Conducted	Reference level –10 dB
10 to 30 (except 26,95 to 27,29)	Conducted	(Reference level –10 dB) to (Reference level +10 dB) (See Note 2)
26,95 to 27,29	Conducted	Reference level
30 to 80	Conducted	Reference level +20 dB A1)
80 to 1 000 (except at 900 <sup>1)</sup> )	Radiated	Reference level +10 dB
900 <sup>1)</sup>	Radiated	Reference level –10 dB
A1) NOTE 1 See Note 1 in Table A.1.		
NOTE 2 Levels in the specified range change linearly with the logarithm of the frequency. A1)		
<sup>1)</sup> This requirement is not applicable for countries where no digital mobile services operating at 900 MHz exist.		

b) *Selected frequency test*

The following shall be fulfilled at the spot frequencies specified in Table 1, Table 2, Table 3 and Table 4 (this may be shown by checking the data sent to the line, to avoid having an operator in the field):

- the TTE shall be able to establish a call with telephony service;
- the TTE shall be able to receive a call;
- the TTE shall be able to clear a call;
- where the TTE is intended to provide a data (non-telephony) service, the time required for a transmission shall not, as a consequence of the application of the test, increase beyond that defined by the manufacturer.

## Performance criterion B

The following shall be fulfilled:

A call established prior to the application of the disturbance shall be maintained.

Requirements to be checked after the application of the disturbance:

- the TTE shall be able to establish a call;
- the TTE shall be able to receive a call;
- the TTE shall be able to clear a call.

## Performance criterion C

Requirements to be checked after the application of the disturbance:

- the TTE shall be able to establish a call;
- the TTE shall be able to receive a call;
- the TTE shall be able to clear a call.

## A.2 Telecommunications terminal equipment (TTE) having a digital interface

A.2.1 *Particular test conditions*

The TTE shall be configured for connection to a telecommunication line (or reference line) at its nominal impedance. Auxiliary equipment may be used to simulate the telecommunications network.

For digital basic access, ISDN interfaces providing telephony service to the TTE shall be in idle mode as defined for the applied digital to analogue conversion.



### A.2.2 Particular performance criteria

The following performance criteria are applicable only when the functions are implemented.

#### Performance criterion A

##### a) Swept frequency test

Testing shall be carried out in accordance with one of the two measurement methods described below.

In case of dispute, tests shall be carried out as originally performed.

##### Measurement method 1

The volume control (where it exists) shall be set as close as possible to the position which gives the nominal value as stated by the manufacturer.

The acoustic sound pressure level (spl) shall be measured using a calibrated artificial ear, as defined in IEC 60318, coupled without loss to the acoustic receiving device of the TTE. The background acoustic noise shall be less than 40 dB(spl). The audio channel shall be open and active.

The following shall be fulfilled during a sweep in the whole specified frequency range:

- the TTE shall be able to maintain an established call;
- for TTE supporting telephony service, the following also applies:  
the demodulated differential mode noise and acoustic sound pressure levels in the receive direction shall not be greater than the values given in Table A.3;
- for TTE having an acoustic interface, the following also applies:  
the acoustic demodulated sound pressure level (spl) in the receive direction shall not be greater than the values given in Table A.3.

Table A.3 — Maximum demodulated differential mode noise and acoustic sound pressure levels at the telecommunications port and at the acoustic receiving device (measurement method 1)

Frequency band MHz	Type of immunity	Demodulated differential mode noise dBmO	Acoustic sound pressure level dB(spl)
A1) 0,15 to 10	Conducted	-50	55
10 to 30 (except 26,95 to 27,29)	Conducted	-50 to -30 (Note 2)	55 to 75 (Note 2)
26,95 to 27,29	Conducted	-40	65
30 to 80	Conducted	-20	85 A1)
80 to 1 000 (except at 900 <sup>1)</sup> )	Radiated	-30	75
900 <sup>1)</sup>	Radiated	-50	55
A1) NOTE 1 See Note 1 in Table A.1.			
NOTE 2 Levels in the specified range change linearly with the logarithm of the frequency. A1)			
1) This requirement is not applicable for countries where no digital mobile services operating at 900 MHz exist.			

Measurement method 2

The volume control (where it exists) shall be set at a fixed level during calibration and shall not be changed during the test.

The following shall be fulfilled during a sweep in the whole specified frequency range:

- the TTE shall be able to maintain an established call;
- for TTE supporting telephony service, the following also applies:  
with the audio channel open and active, the demodulated differential mode noise and acoustic sound pressure level from the EUT, measured in the assigned B-channel, shall not be greater than the values given in Table A.3. The measurement bandwidth shall be 100 Hz maximum at 1 kHz;
- for TTE having an acoustic interface the following also applies:  
E An A-law or  $\mu$ -law coded C digital signal representing a sinusoidal signal of 1 kHz,  $-40$  dBmO is impressed on the telecommunication line (signal level without the radio frequency disturbance). The resulting acoustic sound pressure level is measured using a microphone. The measure level shall be used and recorded as the reference level. The signal used to establish the reference level is switched off during the actual test. The measurement bandwidth shall be 100 Hz maximum. C For coded signals other than A-law or  $\mu$ -law, equivalent levels will be required or measurement method 1 shall be applied. C

During the test, the idle code shall be sent to the EUT in the assigned B-channel.

The background noise shall not exceed a level 15 dB below the reference level.

The demodulated differential mode noise in the receive direction, measured in the way described for the reference level, shall not be greater than the values given in Table A.4.

Table A.4—Maximum demodulated differential mode noise levels (measurement method 2)

Frequency band MHz	Type of immunity test	Demodulated differential mode noise dBm
<span style="border: 1px solid black; padding: 0 2px;">A</span> 0,15 to 10	Conducted	Reference level $-10$ dB
10 to 30 (except 26,95 to 27,29)	Conducted	(Reference level $-10$ dB) to (Reference level $+10$ dB (See Note 2)
26,95 to 27,29	Conducted	Reference level
30 to 80	Conducted	Reference level $+20$ dB <span style="border: 1px solid black; padding: 0 2px;">A</span>
80 to 1 000 (except at 900 <sup>1)</sup> )	Radiated	Reference level $+10$ dB
900 <sup>1)</sup>	Radiated	Reference level $-10$ dB
<span style="border: 1px solid black; padding: 0 2px;">A</span> NOTE 1 See Note 1 in Table A.1.		
NOTE 2 Levels in the specified range change linearly with the logarithm of the frequency. <span style="border: 1px solid black; padding: 0 2px;">A</span>		
<sup>1)</sup> This requirement is not applicable for countries where no digital mobile services operating at 900 MHz exist.		

b) *Selected frequency test*

The following shall be fulfilled at the spot frequencies specified in Table 1, Table 2, Table 3 and Table 4:

- the TTE shall be able to establish a call with telephony service;
- the TTE shall be able to receive a call;
- the TTE shall be able to clear a call;
- where the TTE is intended to provide a data (non-voice) service, the time required for a transmission shall not, as a consequence of the application of the test, increase beyond that defined by the manufacturer.

For ISDN equipment for primary access only the following also applies:

The number of loss of frame alignments shall be less than 10 within a test period of 10 seconds. Where it can be clearly established that a voice call is maintained throughout the test it is not then required to evaluate the loss of frame alignment.

**Performance criterion B**

The following shall be fulfilled:

A call established prior to the application of the phenomena shall be maintained.

Requirements to be checked after the application of the phenomena:

- the TTE shall be able to establish a call;
- the TTE shall be able to receive a call;
- the TTE shall be able to clear a call.

**Performance criterion C**

Requirements to be checked after the application of the phenomena:

- the TTE shall be able to establish a call;
- the TTE shall be able to receive a call;
- the TTE shall be able to clear a call.

**A.3 Facsimile****A.3.1 Particular test conditions**

The EUT shall be connected to a second EUT or simulator which permits a test pattern to be sent to and be received from the EUT. A test pattern selected from the relevant ITU-T recommendation is preferred but is not mandatory. The following requirements are in addition to the TTE performance requirements.

**A.3.2 Particular performance criteria****Performance criterion A**

The EUT shall operate normally during and after the test without:

- data transfer errors, for example no retries beyond the specified maximum;
- degradation of the printed image beyond the manufacturer's specification;
- missing text either full or partial, for example decapitated letters;
- unintended line or page feed;
- colour change beyond the manufacturer's specification;
- re-initiating a call.

**Performance criterion B**

As for performance criteria A, with the following exceptions, which are permitted during the application of the disturbance, provided that normal operation of the EUT is recoverable to the condition immediately before the application of the disturbance:

- degradation of the printed image beyond the manufacturer's specification;
- unintended line feed.

**Performance criterion C**

Any degradation of performance is permitted, provided that normal operation is self-recoverable, or can be restored after the test by the use of operator controls, and provided that:

- any interruptions in the transmission are logged and the user notified;
- the EUT can re-establish a call;
- the EUT can receive a call;
- the EUT can clear a call.

## Annex B (normative)

### Data processing equipment

The test shall be carried out using an exercising program which can repeat the sequences for functions of equipment and, in case of failure, enable an operator to recognise the nature of failure by display or by operator's operation.

The test sequences shall be selected from the following below according to the functions defined by the manufacturer of the equipment to be tested, and the performance criteria A, B or C shall be selected according to the disturbance to be tested.

#### B.1 Read, write and storage of data

##### B.1.1 *Particular test conditions*

Data read and write cycles shall be repeated with internal storage devices such as semi-conductor memories, magnetic or optical disks or magnetic tape devices, and then the copied back data shall be compared with the original.

Read-only memories (ROM) shall be read repeatedly and this data compared with the expected data.

##### B.1.2 *Particular performance criteria*

###### Performance criterion A

Storage devices shall maintain normal operation both in read/write and in stand-by conditions.

###### Performance criterion B

Failures which can be recovered by read and write retries are permissible (temporary delay in processing caused by this process is acceptable).

Normal operation of the EUT shall be restored after the test, self-recovery to the conditions immediately prior to the application of the test is accepted where this is a normal means of recovery. In these cases, operator response is permitted to re-initialise an operation.

###### Performance criterion C

Failures resulting in a delay in processing after the external disturbance is removed, but which can be recovered to normal operation by reset or reboot are permissible.

Failures resulting in a system abort, which can be recovered to normal operation by reset or reboot are permissible.

#### B.2 Data display

##### B.2.1 *Particular test conditions*

Text or graphics shall be displayed on display devices such as CRT monitors and liquid crystal, plasma or LED displays.

##### B.2.2 *Particular performance criteria*

###### Performance criterion A

When seen from the normal viewing distance, the EUT shall operate with no change beyond the manufacturer's specification, in flicker, colour, focus and jitter (except for the power frequency magnetic field test).

###### Power frequency magnetic field test

For CRT monitors, the following also applies:

The jitter shall be measured using a measuring microscope as specified in 6.6.14 of ISO 9241-3.

The jitter (in mm) shall not exceed the value  $\frac{(\text{character height in mm} + 0,3) \times 2,5}{33,3}$  when the CRT monitor is immersed in a continuous magnetic field of 1 A/m (r.m.s.) at one of the power frequencies of 50 Hz C *Text deleted* C.

Alternatively, a field of 50 A/m may be applied, and a transparent graduated mask used to assess the jitter. In that case, the jitter shall not exceed 50 times the value in the above formula.

NOTE This test level is used to simplify the measurement of jitter. Lesser values of the test level may be used if non-linearity is experienced, due to, for example, saturation of screening material.

The EUT shall be tested in two positions, both perpendicular to the magnetic field.

#### Performance criterion B

Screen disturbances during the application of the test are permissible.

#### Performance criterion C

Failures which are not self-recovered after removal of the external disturbance, but which can be recovered to normal operation by reset or reboot are permissible.

### B.3 Data input

#### B.3.1 *Particular test conditions*

Data shall be acquired with input devices such as keyboard, mouse, magnetic card reader, optical character reader, image scanner, input pen or miscellaneous sensors.

Though continuous input is preferable, testing in the stand-by condition is permitted for equipment which requires operator's attendance for operation.

When the EUT is a mass data input device, such as a character reader or scanner, then the central processing unit shall run a program which reads an appropriate test chart continuously for the duration of the test. Read data inputs are displayed, printed directly, or stored for later evaluation.

#### B.3.2 *Particular performance criteria*

##### Performance criterion A

Unintended input from input device is not allowed.

Input devices shall maintain the specified quality image data.

##### Performance criterion B

Keyboard/mouse "lock up" is not allowed.

For equipment with manually inputted data which can be confirmed by reading the display, errors which can be recognised by the operator and easily corrected are permissible.

##### Performance criterion C

Failures resulting in a delay in processing after the external disturbance is removed, but which can be recovered to normal operation by reset or reboot are permissible.

Failures resulting in a system abort which can be recovered to normal operation by reset or reboot are permissible.

### B.4 Data printing

#### B.4.1 *Particular test conditions*

Data shall be printed by printers or plotters. For equipment which has several operation modes, test shall be selected in the most typical operation mode.

#### B.4.2 *Particular performance criteria*

##### Performance criterion A

Printers shall maintain the specified printing quality and normal operation.

##### Performance criterion B

No degradation of the printing quality beyond the manufacturer's specification (such as distortion of character(s) or missing pixels) is permissible.

##### Performance criterion C

Printing errors or omission of character(s) which require reprinting are permissible.

Input/output failure which can be recovered to normal operation by reset or reboot are also permissible.

## B.5 Data processing

### B.5.1 *Particular test conditions*

Data processing, such as computation, data conversion, storage or transfer shall be performed, and the results of processing shall be compared with results in normal operation.

### B.5.2 *Particular performance criteria*

#### Performance criterion A

Failures which do not influence the specified operation within the product specification, and which do not prevent automatic recovery are permissible.

#### Performance criterion B

Failures which are recovered automatically but cause temporary delay in processing are permissible.

#### Performance criterion C

Failures resulting in a delay in processing after the external disturbance is removed, but which can be recovered to normal operation by reset or reboot are permissible.

Failures resulting in a system abort, which can be recovered to normal operation by reset or reboot are permissible.

Failures which are followed by alarms and can be recovered to normal operation by the operator's intervention are permissible.

## Annex C (normative)

### Local area networks (LAN)

#### C.1 Particular test conditions

A minimum test configuration consists of two pieces of terminal equipment interconnected with manufacturer specified physical cable. Associated equipment necessary to the function of the LAN shall be included in the test configuration. Unused ports shall be treated according to the manufacturer's instructions.

The system shall be capable of delivering and receiving data at the specified nominal transmission rate.

The LAN equipment executes a programme which exercises the LAN functions. As a minimum, the functions below shall be assessed.

#### C.2 Particular performance criteria

##### Performance criterion A

During and after the test, the EUT shall operate without:

- error rate beyond the figure defined by the manufacturer;
- requests for retry beyond the figure defined by the manufacturer;
- speed of data transmission rate beyond the figure defined by the manufacturer;
- protocol failure;
- loss of link.

##### Performance criterion B

Error rate, request for retry and speed of data transmission rate may be degraded during the application of the test.

Degradation of the performance as described in criterion A is permitted provided that the normal operation of the EUT is self-recoverable to the condition immediately before the application of the test. In these cases, operator response is permitted to re-initiate an operation.

##### Performance criterion C

Degradation of the performance as described in criteria A and B is permitted provided that the normal operation of the EUT is self-recoverable to the condition immediately before the application of the test or can be restored after the test by the operator.

## Annex D (normative)

### Printers

#### D.1 Particular test conditions

Data shall be printed with printers or plotters. No standard image is required, but the use of a text containing more than three character fonts and at least one grid of lines is recommended. Character pitch and line spacing should be small. If the dot density can be selected, the highest density shall be chosen. Tests shall be carried out with the EUT in the printing mode.

#### D.2 Particular performance criteria

##### Performance criterion A

The EUT shall operate without degradation of performance during and after the application of the disturbance. For example, there shall be no:

- loss or corruption of data during input/output operations;
- degradation of the printed image beyond the manufacturer's specification;
- change in output mode or character font;
- perceptible change in dot-pitch;
- unintended line or page feed.

##### Performance criterion B

As for performance criterion A, with the following exceptions:

- degradation of the printed image beyond the manufacturer's specification is allowed;
- misalignment of the grid lines is allowed;
- unintended line feed is allowed.

After the disturbance is removed, normal operation of the EUT is self-recoverable to the condition immediately before the application of the test; this may involve an operator response to re-initiate the operation.

##### Performance criterion C

Degradation of the performance as described in criteria A and B is permitted provided that the normal operation of the EUT is self-recoverable to the condition immediately before the application of the test or can be restored after the test by the operator.

## Annex E (normative)

### Copying machines

#### E.1 Particular test conditions

No standard image is required, but the use of a pattern consisting of a grid of lines and a scale of grey tones is recommended.

Testing shall be performed in the stand-by mode and the copying mode.

## E.2 Particular performance criteria

### Performance criterion A

The EUT shall operate without degradation of performance during and after the application of the disturbance. For example, there shall be no:

- unintended start of operation;
- change of the program or of the program setting, for example:
  - single or double sided;
  - number of copies;
  - sorting and/or stapling;
  - contrast;
  - copy size, reduction or enlargement;
  - loss of stored or transmitted data;
- interruption of copying sequence (for example, paper jam);
- false indications (for example, paper jam, low toner, low paper, control indicators);
- fall back to stand-by mode from copying mode;
- unintended operation of safety interlocks;
- degradation of copied images beyond manufacturer's specification;
- errors in billing devices.

### Performance criterion B

As for performance criterion A, with the following exception:

False indications of, for example, paper jam, low toner, low paper, control indicators are permissible during the test.

All false indications must be removed when the copier is reset to the stand-by mode after the completion of the test.

### Performance criterion C

Degradation of performance as specified under criterion A is allowed, with the following qualifications and exceptions:

- output/input failures are only allowed if normal operation can be restored by reset or reboot;
- no unintended start of copying from stand-by mode is allowed.

## Annex F (normative)

### Automatic teller machines (ATM)

#### F.1 Particular test conditions

The ATM shall be connected to each of its peripheral devices and one of each type of communication line shall be connected driven into the correct terminating equipment or a representative load. Interconnecting cables shall be of a type and length specified in the individual equipment requirements. One subassembly of each type of ITE necessary for the basic operation shall be included in the ATM to be evaluated. For a system, one of each type of ITE that can be included in the possible system configuration shall be included with the ATM.

In the case of ATMs which functionally interact with other ITE, including any ITE that is dependent on the ATM for its power interface, either the actual interfacing EUT or simulators may be used to provide representative operating conditions, provided the effects of the simulator can be isolated or identified.

The ATM shall execute a program which shall exercise each function whose integrity is to be assessed during the test. As a minimum, the functions noted below shall be assessed. Where more than one function is to be assessed, the software shall be flexible enough to permit the test operator to select certain functions if so desired. A parallel or serial execution of the test is permitted provided that the ATM can operate in that manner. To facilitate the testing, the software shall alert the operator when a failure has occurred.



The ATM shall be operated using the default settings upon start-up. The ATM shall be evaluated in all modes unless the most susceptible mode is already known from preliminary testing or previous experience, in which case the most susceptible mode shall be used.

## F.2 Particular performance criteria

### Performance criterion A

The EUT shall operate without degradation of performance during and after the application of the disturbance. For example, there shall be no:

- system response time beyond the figure defined by the manufacturer;
- memory errors;
- data corruption;
- repeated self-recoverable errors beyond a number specified by the manufacturer;
- loss of stored data;
- keyboard lock-up;
- system reset or shut down;
- system change state;
- network connections dropping;
- money or receipts inappropriately dispensed;
- I/O errors;
- I/O state change.

### Performance criterion B

There shall be no loss of stored data during the application of the disturbance. A transaction may be aborted provided that this is correctly reported. There shall be no incorrect dispensing of money or printed receipts.

Degradation of the performance as described in criterion A is permitted provided that the normal operation of the EUT is self-recoverable to the condition immediately before the application of the test. In these cases, operator response is permitted to re-initiate an operation.

### Performance criterion C

There shall be no loss of function following the restoration of the system by the operator. Loss or corruption of the contents of Random-Access Memory (RAM) and information stored on permanent storage media, such as hard drive, optical or floppy disk, is not permitted.

Degradation of the performance as described in criteria A and B is permitted provided that the normal operation of the EUT is self-recoverable, or can be restored after the test by the operator.

## Annex G (normative)

### Point of sale terminals (POST)

#### G.1 Particular test conditions

The Point of Sale Terminal (POST) shall be connected to each of its peripheral devices (such as scales, scanner, card reader) and one of each type of communication line shall be connected to the correct terminating equipment or a representative load. Interconnecting cables shall be of a type and length specified in the individual equipment requirements. One subassembly of each type of ITE necessary for the basic operation shall be included in the POST to be evaluated. For a system, one of each type of ITE that can be included in the possible system configuration shall be included in the POST.

In the case of POSTs which functionally interact with other ITE, including any ITE that is dependent on the Central Processing Unit (CPU) for its power interface, either the actual interfacing EUT or simulators may be used to provide representative operating conditions, provided the effects of the simulator can be isolated or identified.

Note that it is important that any simulator used instead of the actual interfacing ITE properly represents the electrical and, in some cases, the mechanical characteristics of the interfacing ITE, especially RF signals and impedances.

The POST shall execute a program which shall exercise each function whose integrity is to be assessed during the test. As a minimum, the functions noted below shall be assessed. Where more than one function is to be assessed the software shall be flexible enough to permit the test operator to select certain functions if so desired. A parallel or serial execution of the test is permitted provided that the POST can operate in this manner. To facilitate the testing, the software shall alert the operator when a failure has occurred.

The POST shall be operated in the condition that was found to produce the highest overall emissions or, if this is not known, the default settings upon start-up. The POST shall be evaluated in all modes, unless the most susceptible mode is already known from preliminary testing or previous experience, in which case the most susceptible mode shall be used.

## G.2 Particular performance criteria

### Performance criterion A

The EUT shall operate without degradation of performance during and after the application of the disturbance. For example, there shall be no:

- system response time beyond the figure defined by the manufacturer;
- memory errors;
- data corruption;
- repeated self-recoverable errors beyond a number specified by the manufacturer;
- loss of stored data;
- keyboard lock-up;
- system reset or shut down;
- system change state;
- network connections dropping;
- money or receipts inappropriately dispensed;
- I/O errors;
- I/O state change.

### Performance criterion B

As for performance criterion A, with the following exception:

keyboard lock-up or corruption of information of a single item within a transaction is permitted during the application of the disturbance provided that the event is recorded and the user alerted.

### Performance criterion C

There shall be no loss of function following the restoration of the system by the operator. Loss or corruption of volatile or non-volatile memory is not permitted.

Degradation of the performance as described in criteria A and B is permitted provided that the normal operation of the EUT is self-recoverable or can be restored after the test by the operator.

## Annex ZA (normative)

## Normative references to international publications with their corresponding European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 60050(161)	1990	International Electrotechnical Vocabulary (IEV)— Chapter 161: Electromagnetic compatibility	—	—
IEC 60318	1970	An IEC artificial ear, of the wide band type, for the calibration of earphones used in audiometry	—	—
IEC 61000-4-2	1995	Electromagnetic compatibility (EMC) Part 4: Testing and measurement techniques — Section 2: Electrostatic discharge immunity test	EN 61000-4-2	1995
IEC 61000-4-3 (mod)	1995	Section 3: Radiated, radio-frequency, electromagnetic field immunity test	EN 61000-4-3	1996
IEC 61000-4-4	1995	Section 4: Electrical fast transient/burst immunity test	EN 61000-4-4	1995
IEC 61000-4-5	1995	Section 5: Surge immunity test	EN 61000-4-5	1995
IEC 61000-4-6	1996	Section 6: Immunity to conducted disturbances, induced by radio-frequency fields	EN 61000-4-6	1996
IEC 61000-4-8	1993	Section 8: Power frequency magnetic field immunity test	EN 61000-4-8	1993
IEC 61000-4-11	1994	Section 11: Voltage dips, short interruptions and voltage variations immunity tests	EN 61000-4-11	1994
CISPR 22 (mod)	1997	Information technology equipment — Radio disturbance characteristics — Limits and methods of measurement	EN 55022	1998
ISO 9241-3	1992	Ergonomic requirements for office work with visual display terminals (VDTs) Part 3: Visual display requirements	—	—
ITU-T Recommendation I.241.1		Telephony	—	—
ITU-T Recommendation I.411		Integrated service digital network (ISDN) — User network interfaces	—	—

---

## BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

### Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: +44 (0)20 8996 9000. Fax: +44 (0)20 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

### Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: +44 (0)20 8996 9001. Fax: +44 (0)20 8996 7001. Email: [orders@bsi-global.com](mailto:orders@bsi-global.com). Standards are also available from the BSI website at <http://www.bsi-global.com>.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

### Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre. Tel: +44 (0)20 8996 7111. Fax: +44 (0)20 8996 7048. Email: [info@bsi-global.com](mailto:info@bsi-global.com).

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration. Tel: +44 (0)20 8996 7002. Fax: +44 (0)20 8996 7001. Email: [membership@bsi-global.com](mailto:membership@bsi-global.com).

Information regarding online access to British Standards via British Standards Online can be found at <http://www.bsi-global.com/bsonline>.

Further information about BSI is available on the BSI website at <http://www.bsi-global.com>.

### Copyright

Copyright subsists in all BSI publications. BSI also holds the copyright, in the UK, of the publications of the international standardization bodies. Except as permitted under the Copyright, Designs and Patents Act 1988 no extract may be reproduced, stored in a retrieval system or transmitted in any form or by any means – electronic, photocopying, recording or otherwise – without prior written permission from BSI.

This does not preclude the free use, in the course of implementing the standard, of necessary details such as symbols, and size, type or grade designations. If these details are to be used for any other purpose than implementation then the prior written permission of BSI must be obtained.

Details and advice can be obtained from the Copyright & Licensing Manager. Tel: +44 (0)20 8996 7070. Fax: +44 (0)20 8996 7553. Email: [copyright@bsi-global.com](mailto:copyright@bsi-global.com).