

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

ICS 33.100

## National foreword

This British Standard is the UK implementation of EN 55024:1998+A2:2003. It is derived from CISPR 24:1997, incorporating amendments 1:2001 and 2:2002.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to 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 modifications 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.

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

CENELEC Interpretation Sheet 1 (August 2007) is applicable to Annex A. The content of this interpretation sheet is reproduced in National Annex NA (informative).

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

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| Amd. No. | Date             | Comments                                                        |
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| 13564    | 28 August 2002   | See national foreword                                           |
| 14388    | 9 June 2003      | See national foreword                                           |
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|          |                  |                                                                 |

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 (CISPR 24:1997, modified)

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

Einrichtungen der Informationstechnik —  
Störfestigkeitseigenschaften —  
Grenzwerte und Prüfverfahren  
(CISPR 24:1997, modifiziert)

This European Standard was approved by CENELEC on 1998-08-01. 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.

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## CENELEC

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

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## 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:

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- 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.

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## Foreword to amendment A2

The text of document CISPR/I/42/FDIS, future amendment 2 to CISPR 24:1997, prepared by CISPR SC I, Electromagnetic compatibility of information technology equipment, multimedia equipment and receivers, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A2 to EN 55024:1998 on 2001-12-01.

The following dates were fixed:

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- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 2005-12-01

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

In this standard, Annex ZA is normative.

Annex ZA has been added by CENELEC.

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## 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*.

<sup>A2</sup> CISPR 20:2002, *Sound and television broadcast receivers and associated equipment — Immunity characteristics — Limits and methods of measurement*. <sup>A2</sup>

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

##### **degradation**

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)

#### 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

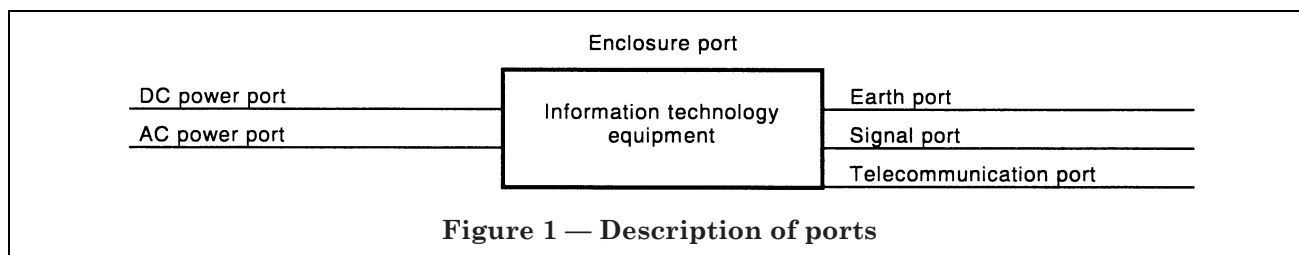


Figure 1 — Description of ports

**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

**A2 3.18****multifunction equipment**

information technology equipment in which two or more functions subject to this standard and/or to other standards are provided in the same unit

NOTE Examples of information technology equipment include:

- a personal computer provided with a telecommunication function and/or broadcast reception function;
- a personal computer provided with a measuring function, etc. **A2**

**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.

**A2** Multifunction equipment which is subjected simultaneously to different clauses of this standard and/or other standards shall be tested with each function operated in isolation, if this can be achieved without modifying the equipment internally. The equipment thus tested shall be deemed to have complied with the requirements of all clauses/standards when each function has satisfied the requirements of the relevant clause/standard. For example, a personal computer with a broadcast reception function shall be tested with the broadcast reception function inactivated according to CISPR 24 and then tested with only the broadcast reception function activated according to CISPR 20, if the equipment can operate each function in isolation under normal operation.

For equipment which it is not practical to test with each function operated in isolation, or where the isolation of a particular function would result in the equipment being unable to fulfil its primary function, or where the simultaneous operation of several functions would result in saving measurement time, the equipment shall be deemed to have complied if it meets the provisions of the relevant clause/standard with the necessary functions operated. For example, if a personal computer with a broadcast reception function cannot operate the broadcast reception function in isolation from the computing function, the personal computer may be tested with the computing function and broadcast reception function activated according to CISPR 24 and CISPR 20 with respect to these requirements.

Where an allowance is made excluding specific ports or frequencies or functions in a standard because of different test specification and/or test set-up and/or performance criterion, the allowance may be made when relevant functions within multifunction equipment are tested against a different standard (e.g. excluding of the application of Table 2 to an antenna port or excluding of the evaluation of the broadcast function during a measurement of equipment containing the broadcast reception function according to CISPR 24). **A2**

## 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.

## **A<sub>2</sub>** 6.3 Equipment set-up

There are several specific test set-ups of ITE for immunity testing, for example test set-up for measuring the demodulated sound pressure level (spl) and the demodulated differential mode signal of telecommunications terminal equipment. In those cases the EUT is recommended to be configured and set-up in accordance with Figure A.1 to Figure A.8 of Annex A.

Figure A.1 to Figure A.8 give examples of specific test set-ups appropriate for a small key telephone system. This type of system will typically consist of a main EUT (M-EUT) and a sub-EUT (S-EUT, such as a telephone terminal). The intention here is to test these two parts of the EUT sequentially. **A<sub>2</sub>**

## 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