

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE

COMITÉ INTERNATIONAL SPÉCIAL DES PERTURBATIONS RADIOÉLECTRIQUES

Information technology equipment – Immunity characteristics – Limits and  
methods of measurement

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Appareils de traitement de l'information – Caractéristiques d'immunité – Limites  
et méthodes de mesure

CISPR 24:2010

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International Standard CISPR 24 has been prepared by CISPR subcommittee I: Electromagnetic compatibility of information technology equipment, multimedia equipment and receivers.

This second edition cancels and replaces the first edition published in 1997, and its Amendments 1(2001) and 2 (2002). It is a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- dated references updated;
- option of using a 4 % step size for continuous conducted immunity test deleted;
- revision of Annex A for telephony equipment including methodology for measuring the demodulation from a speaker / hands free device;
- inclusion of new annex related to DSL equipment.

The text of this standard is based on the following documents:

FDIS	Report on voting
CIS/1/331/FDIS	CIS/1/334/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

The contents of the corrigendum of June 2011 have been included in this copy.

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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.

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# INFORMATION TECHNOLOGY EQUIPMENT – IMMUNITY CHARACTERISTICS – LIMITS AND METHODS OF MEASUREMENT

## 1 Scope and object

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

The object of this publication is to establish requirements that will provide an adequate level of intrinsic immunity so that the equipment will operate as intended in its environment. The publication defines the immunity test requirements for equipment within its scope in relation to continuous and transient conducted and radiated disturbances, including electrostatic discharges (ESD).

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

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 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 equipment. In these instances, special mitigation measures may have to be employed.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

IEC 60318-1:2009, *Electroacoustics – Simulators of human head and ear – Part 1: Ear simulator for the measurement of supra-aural and circumaural earphones*

IEC 61000-4-2:2008, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 61000-4-3:2006, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*  
Amendment 1(2007)  
Amendment 2(2010)

IEC 61000-4-4:2004, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-5:2005, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61000-4-6:2008, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-8:2009, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test*

IEC 61000-4-11:2004, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests*

CISPR 16-1-2:2003, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-2: Radio disturbance and immunity measuring apparatus – Ancillary equipment – Conducted disturbances*

Amendment 1(2004)

Amendment 2(2006)

CISPR 20:2006, *Sound and television broadcast receivers and associated equipment – Immunity characteristics – Limits and methods of measurement*

CISPR 22:2008, *Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement*

### 3 Terms and definitions

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For the purposes of this document, the terms and definitions given in IEC 60050-161, and the following apply.

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#### 3.1

##### **degradation**

unwanted change in operational performance of an EUT due to electromagnetic disturbances. This does not necessarily mean malfunction or catastrophic failure

#### 3.2

##### **equipment under test**

##### **EUT**

representative device or functionally interactive group of devices (that is a system) which includes one or more host units that is subjected to test procedures specified in this publication

#### 3.3

##### **information technology equipment**

##### **ITE**

any equipment:

- a) which has a primary function of either (or a combination of) entry, storage, display, retrieval, transmission, processing, switching, or control, of data and of telecommunication messages and which may be equipped with one or more terminal ports typically operated for information transfer;
- b) with a rated supply voltage not exceeding 600 V.

It includes, for example, data processing equipment, office machines, electronic business equipment and telecommunication equipment.

Any equipment (or part of the ITE equipment) which has a primary function of radio transmission and/or reception according to the ITU Radio Regulations are excluded from the scope of this publication.

NOTE Any equipment which has a function of radio transmission and/or reception according to the definitions of the ITU Radio Regulations should fulfil the national radio regulations, whether or not this publication is also valid.

Equipment, for which all disturbance requirements in the frequency range are explicitly formulated in other IEC or CISPR publications, are excluded from the scope of this publication.

[3.1 of CISPR 22:2008]

### 3.4

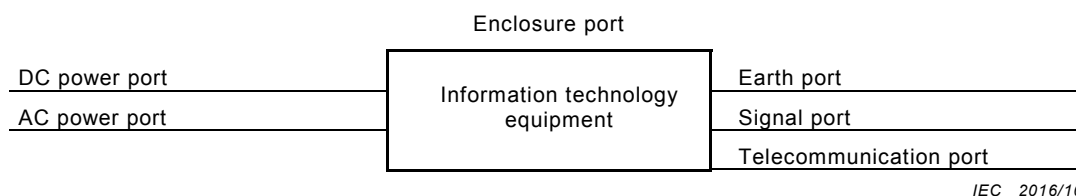
#### **jitter (of a cathode ray tube (CRT) monitor)**

peak-to-peak variation in the geometric location of picture elements on the viewing surface of the CRT monitor

### 3.5

#### **port**

particular interface of the specified EUT with the external electromagnetic environment (see Figure 1)



IEC 2016/10

**Figure 1 – Description of ports**  
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### 3.6

#### **enclosure port**

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

### 3.7

#### **telephony call**

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 should be operated in the way specified by the manufacturer. For circuit switched services, the exchange of data should 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 should be considered to be possible when a virtual path is established to the called TTE.

### 3.8

#### **establishment of 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

NOTE See Note of 3.7.

### 3.9

#### **reception of 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

NOTE See Note of 3.7.

### 3.10

#### **maintenance of a telephony call**

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

NOTE See Note of 3.7.

### 3.11

#### **clearing of 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

NOTE See Note of 3.7.

### 3.12

#### **network terminator**

##### **NT**

associated equipment representing the termination of the telecommunication network

### 3.13

#### **telephony service**

a service providing users with the ability for real-time two-way speech conversation via a network

[see ITU-T, I.241.1]

### 3.14

#### **telecommunications terminal equipment**

##### **TTE**

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 inter-work with a telecommunications network being connected directly or indirectly to the termination of a telecommunications network in order to send, process or receive information

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### 3.15

#### **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 multifunction equipment include

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

### 3.16

#### **telecommunication network port**

point of connection for voice, data and signaling transfers intended to interconnect widely dispersed systems via such means as direct connection to multi-user telecommunications networks (e.g. public switched telecommunications networks (PSTN), integrated services digital networks (ISDN), x-type digital subscriber lines (xDSL), etc.), local area networks (e.g. Ethernet, Token Ring, etc.) and similar networks

NOTE A port generally intended for interconnection of components of an ITE system under test (e.g. RS-232, IEEE Standard 1284 (parallel printer), Universal Serial Bus (USB), IEEE Standard 1394 ("Fire Wire"), etc.) and used in accordance with its functional specifications (e.g. for the maximum length of cable connected to it), is not considered to be a telecommunications/network port under this definition.

### 3.17

#### **analogue interface**

an interface that transmits and receives signals whose characteristic quantities follow continuously the variations of another physical quantity representing information

**3.18****acoustic interface**

port at which audio signals emanate and/or originate

**3.19****associated equipment****AE**

equipment needed to exercise and/or monitor the operation of the EUT in a representative way

**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.

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**4.2 Particular requirements**

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**4.2.1 Electrostatic discharges (ESD)**

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The test procedure shall be in accordance with IEC 61000-4-2, with the following modifications and clarifications.

Electrostatic 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 cleaning or adding consumables when the EUT is powered.

The number of test points is EUT dependent. The requirements of 8.3.1 and A.5 of IEC 61000-4-2 shall be taken into consideration when selecting test points. The application of discharges to the contacts of open connectors is not required.

Guidance on the selection of actual test points is given in A.5 of IEC 61000-4-2. When selecting test points particular attention shall be given to keyboards, dialing pads, power switches, mice, drive slots, card slots, around communication ports, etc.

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. For table-top equipment one of the test points shall be the centre front edge of the horizontal coupling plane, which shall be subjected to at least 50 indirect discharges (25 of each polarity). All other test points shall each receive at least 50 direct contact discharges (25 of each polarity). All areas normally touched by the user should be tested. 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)).

For contact discharge, the requirement to apply ESD discharges at lower levels, as defined in Clause 5 of IEC 61000-4-2, is not applicable.

b) Air discharge at apertures and insulating surfaces:

On those parts of the EUT where it is not possible to perform contact discharge testing, the EUT should be investigated to identify the user accessible points where breakdown may occur; examples are openings at edges of keys, or the covers of keyboards and telephone handsets. Such points are tested using the air discharge method.

#### 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 EUT contains several ports with the same particular interface, 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;
- applicable only to cables which according to the manufacturer's specification support communication on cable lengths greater than 3 m;
- the cable length between the EUT and the coupling device shall be as short as possible in the range 0,5 m to 3,0 m.

#### 4.2.3 Continuous radio frequency disturbances

##### 4.2.3.1 General

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The frequency range for the radiated field test is 80 MHz to 1 000 MHz. The frequency range for the continuous conducted test is 0,15 MHz to 80 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 Tables 1 to 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 seconds 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.

Unless required by an annex of this document, clock and other sensitive frequencies do not need to be assessed separately.

##### 4.2.3.2 Continuous radiated disturbances

The test procedure shall be 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. Where it is not possible to determine the most sensitive face with any certainty (for example where different faces are sensitive at different frequencies) all four faces shall be tested.

If the EUT is too large such that it cannot be fully illuminated by the radiating antenna, or exceeds the size of the Uniform Field Area (UFA) then partial illumination shall be used. The EUT can be repositioned so that the front surface remains within the UFA in order to illuminate those sections of the EUT that were previously outside the UFA.

#### **4.2.3.3 Continuous conducted disturbances**

There shall be no additional deviations from IEC 61000-4-6 (other than those specified in 4.2.3.1).

#### **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 EUT 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 may be removed for testing.

#### **4.2.5 Surges**

The test procedure shall be in accordance with IEC 61000-4-5.

#### **4.2.6 Voltage dips and interruptions**

The test procedure shall be in accordance with IEC 61000-4-11.

### **5 Applicability**

Tests shall be applied to the relevant ports of the EUT according to Tables 1 to 4.

It may be determined from consideration of the electrical characteristics and usage of particular EUT 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.

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 physically 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 disabled according to this standard and then tested with only the broadcast reception function activated according to CISPR 20, if it can operate each function in isolation under normal operation.