

Edition 5:2005 consolidated with amendments 1:2005 and 2:2006

INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE

**Information technology equipment –
Radio disturbance characteristics –
Limits and methods of measurement**

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

CISPR 22:2005

<https://standards.iteh.ai/en/standards/iec/6c02ddc1-1b26-4c9f-be21-682313cc455d/cispr-22-2005>

*This **English-language** version is derived from the original **bilingual** publication by leaving out all French-language pages. Missing page numbers correspond to the French-language pages.*



Consolidated editions

The IEC is now publishing consolidated versions of its publications. For example, edition numbers 1.0, 1.1 and 1.2 refer, respectively, to the base publication, the base publication incorporating amendment 1 and the base publication incorporating amendments 1 and 2.

Further information on IEC publications

The technical content of IEC publications is kept under constant review by the IEC, thus ensuring that the content reflects current technology. Information relating to this publication, including its validity, is available in the IEC Catalogue of publications (see below) in addition to new editions, amendments and corrigenda. Information on the subjects under consideration and work in progress undertaken by the technical committee which has prepared this publication, as well as the list of publications issued, is also available from the following:

- **IEC Web Site** (www.iec.ch)

- **Catalogue of IEC publications**

The on-line catalogue on the IEC web site (www.iec.ch/searchpub) enables you to search by a variety of criteria including text searches, technical committees and date of publication. On-line information is also available on recently issued publications, withdrawn and replaced publications, as well as corrigenda.

- **IEC Just Published**

This summary of recently issued publications (www.iec.ch/online_news/justpub) is also available by email. Please contact the Customer Service Centre (see below) for further information.

- **Customer Service Centre**

If you have any questions regarding this publication or need further assistance, please contact the Customer Service Centre:

Email: custserv@iec.ch
Tel: +41 22 919 02 11
Fax: +41 22 919 03 00

<https://standards.iteh.ai/catalog/standards/iec/6c02ddc1-1b26-4c9f-be21-682313cc455d/cispr-22-2005>

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

CISPR
22

Edition 5.2
2006-03

Edition 5:2005 consolidated with amendments 1:2005 and 2:2006

INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE

**Information technology equipment –
Radio disturbance characteristics –
Limits and methods of measurement**

iTech Standards
(<https://standards.iteh.ai>)
Document Preview

CISPR 22:2005

<https://standards.iteh.ai/en/standard/iec/6c02ddc1-1b26-4c9f-be21-682313cc455d/cispr-22-2005>

© IEC 2006 Copyright - all rights reserved

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

International Electrotechnical Commission, 3, rue de Varembe, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch



Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE

CR

For price, see current catalogue

CONTENTS

FOREWORD.....	9
INTRODUCTION.....	13
1 Scope and object.....	15
2 Normative references.....	15
3 Definitions.....	17
4 Classification of ITE.....	21
4.1 Class B ITE.....	21
4.2 Class A ITE.....	21
5 Limits for conducted disturbance at mains terminals and telecommunication ports.....	21
5.1 Limits of mains terminal disturbance voltage.....	23
5.2 Limits of conducted common mode (asymmetric mode) disturbance at telecommunication ports.....	23
6 Limits for radiated disturbance.....	25
6.1 Limits below 1 GHz.....	25
6.2 Limits above 1 GHz.....	27
7 Interpretation of CISPR radio disturbance limit.....	29
7.1 Significance of a CISPR limit.....	29
7.2 Application of limits in tests for conformity of equipment in series production.....	29
8 General measurement conditions.....	31
8.1 Ambient noise.....	31
8.2 General arrangement.....	31
8.3 EUT arrangement.....	37
8.4 Operation of the EUT.....	41
9 Method of measurement of conducted disturbance at mains terminals and telecommunication ports.....	43
9.1 Measurement detectors.....	43
9.2 Measuring receivers.....	45
9.3 Artificial mains network (AMN).....	45
9.4 Ground reference plane.....	45
9.5 EUT arrangement.....	45
9.6 Measurement of disturbances at telecommunication ports.....	51
9.7 Recording of measurements.....	57
10 Method of measurement of radiated disturbance.....	59
10.1 Measurement detectors.....	59
10.2 Measuring receiver below 1 GHz.....	59
10.3 Antenna below 1 GHz.....	59
10.4 Measurement site below 1 GHz.....	61
10.5 EUT arrangement below 1 GHz.....	63
10.6 Radiated emission measurements above 1 GHz.....	63
10.7 Recording of measurements.....	65
10.8 Measurement in the presence of high ambient signals.....	65
10.9 User installation testing.....	65
11 Measurement uncertainty.....	67

Annex A (normative) Site attenuation measurements of alternative test sites	87
Annex B (normative) Decision tree for peak detector measurements	99
Annex C (normative) Possible test set-ups for common mode measurements	101
Annex D (informative) Schematic diagrams of examples of impedance stabilization networks (ISN)	115
Annex E (informative) Parameters of signals at telecommunication ports	133
Annex F (informative) Rationale for disturbance measurements and methods on telecommunications ports	139
Annex G (informative) Operational modes for some types of ITE	153
 Bibliography	 155
 Figure 1 – Test site	 67
Figure 2 – Minimum alternative measurement site	69
Figure 3 – Minimum size of metal ground plane	69
Figure 4 – Example test arrangement for tabletop equipment (conducted and radiated emissions) (plan view)	71
Figure 5 – Example test arrangement for tabletop equipment (conducted emission measurement - alternative 1a)	73
Figure 6 – Example test arrangement for tabletop equipment (conducted emission measurement – alternative 1b)	73
Figure 7 – Example test arrangement for tabletop equipment (conducted emission measurement – alternative 2)	75
Figure 8 – Example test arrangement for floor-standing equipment (conducted emission measurement)	77
Figure 9 – Example test arrangement for combinations of equipment (conducted emission measurement)	79
Figure 10 – Example test arrangement for tabletop equipment (radiated emission measurement)	79
Figure 11 – Example test arrangement for floor-standing equipment (radiated emission measurement)	81
Figure 12 – Example test arrangement for floor-standing equipment with vertical riser and overhead cables (radiated and conducted emission measurement)	83
Figure 13 – Example test arrangement for combinations of equipment (radiated emission measurement)	85
Figure A.1 – Typical antenna positions for alternate site NSA measurements	93
Figure A.2 – Antenna positions for alternate site measurements for minimum recommended volume	95
Figure B.1 – Decision tree for peak detector measurements	99
Figure C.1 – Using CDNs described in IEC 61000-4-6 as CDN/ISNs	103
Figure C.2 – Using a 150 Ω load to the outside surface of the shield ("in situ CDN/ISN")	105
Figure C.3 – Using a combination of current probe and capacitive voltage probe	105
Figure C.4 – Using no shield connection to ground and no ISN	107
Figure C.5 – Calibration fixture	111
Figure C.6 – Flowchart for selecting test method	113
Figure D.1 – ISN for use with unscreened single balanced pairs	115
Figure D.2 – ISN with high longitudinal conversion loss (LCL) for use with either one or two unscreened balanced pairs	117

Figure D.3 – ISN with high longitudinal conversion loss (LCL) for use with one, two, three, or four unscreened balanced pairs	119
Figure D.4 – ISN, including a 50 Ω source matching network at the voltage measuring port, for use with two unscreened balanced pairs	121
Figure D.5 – ISN for use with two unscreened balanced pairs	123
Figure D.6 – ISN, including a 50 Ω source matching network at the voltage measuring port, for use with four unscreened balanced pairs	125
Figure D.7 – ISN for use with four unscreened balanced pairs	127
Figure D.8 – ISN for use with coaxial cables, employing an internal common mode choke created by bifilar winding an insulated centre-conductor wire and an insulated screen-conductor wire on a common magnetic core (for example, a ferrite toroid).....	127
Figure D.9 – ISN for use with coaxial cables, employing an internal common mode choke created by miniature coaxial cable (miniature semi-rigid solid copper screen or miniature double-braided screen coaxial cable) wound on ferrite toroids	129
Figure D.10 – ISN for use with multi-conductor screened cables, employing an internal common mode choke created by bifilar winding multiple insulated signal wires and an insulated screen-conductor wire on a common magnetic core (for example, a ferrite toroid).....	129
Figure D.11 – ISN for use with multi-conductor screened cables, employing an internal common mode choke created by winding a multi-conductor screened cable on ferrite toroids	131
Figure F.1 – Basic circuit for considering the limits with defined TCM impedance of 150 Ω	145
Figure F.2 – Basic circuit for the measurement with unknown TCM impedance	145
Figure F.3 – Impedance layout of the components used in Figure C.2.....	149
Figure F.4 – Basic test set-up to measure combined impedance of the 150 Ω and ferrites	151
Table 1 – Limits for conducted disturbance at the mains ports of class A ITE	23
Table 2 – Limits for conducted disturbance at the mains ports of class B ITE	23
Table 3 – Limits of conducted common mode (asymmetric mode) disturbance at telecommunication ports in the frequency range 0,15 MHz to 30 MHz for class A equipment.....	23
Table 4 – Limits of conducted common mode (asymmetric mode) disturbance at telecommunication ports in the frequency range 0,15 MHz to 30 MHz for class B equipment.....	25
Table 5 – Limits for radiated disturbance of class A ITE at a measuring distance of 10 m.....	25
Table 6 – Limits for radiated disturbance of class B ITE at a measuring distance of 10 m.....	25
Table 7 – Acronyms used in figures.....	67
Table 8 – Limits for radiated disturbance of Class A ITE at a measurement distance of 3 m	27
Table 9 – Limits for radiated disturbance of Class B ITE at a measurement distance of 3 m	27
Table A.1 – Normalized site attenuation (A_N (dB)) for recommended geometries with broadband antennas	91
Table F.1 – Summary of advantages and disadvantages of the methods described in Annex C.....	141

INTERNATIONAL ELECTROTECHNICAL COMMISSION
INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE

**INFORMATION TECHNOLOGY EQUIPMENT –
RADIO DISTURBANCE CHARACTERISTICS –
LIMITS AND METHODS OF MEASUREMENT**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard CISPR 22 has been prepared by CISPR subcommittee 1: Electromagnetic compatibility of information technology equipment, multimedia equipment and receivers.

This consolidated version of CISPR 22 consists of the fifth edition (2005) [documents CISPR/1/135A/FDIS and CISPR/1/148/RVD + CISPR/1/136/FDIS and CISPR/1/147/RVD], its amendment 1 (2005) [documents CISPR/1/151/FDIS and CISPR/1/161/RVD] and its amendment 2 (2006) [documents CISPR/1/174/FDIS and CISPR/1/182/RVD].

The technical content is therefore identical to the base edition and its amendments and has been prepared for user convenience.

It bears the edition number 5.2.

A vertical line in the margin shows where the base publication has been modified by amendments 1 and 2.

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

The committee has decided that the contents of the base publication and its amendments will remain unchanged until the maintenance result 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.

Withdawn

iTech Standards
(<https://standards.itih.ai>)
Document Preview

CISPR 22:2005

<https://standards.itih.ai/standards/iec/6c02ddc1-1b26-4c9f-be21-682313cc455d/cispr-22-2005>

INTRODUCTION

The scope is extended to the whole radio-frequency range from 9 kHz to 400 GHz, but limits are formulated only in restricted frequency bands, which is considered sufficient to reach adequate emission levels to protect radio broadcast and telecommunication services, and to allow other apparatus to operate as intended at reasonable distance.

Withheld

iTech Standards
(<https://standards.iteh.ai>)
Document Preview

CISPR 22:2005
<https://standards.iteh.ai/en/standards/iec/6c02ddc1-1b26-4c9f-be21-682313cc455d/cispr-22-2005>

INFORMATION TECHNOLOGY EQUIPMENT – RADIO DISTURBANCE CHARACTERISTICS – LIMITS AND METHODS OF MEASUREMENT

1 Scope and object

This International Standard applies to ITE as defined in 3.1.

Procedures are given for the measurement of the levels of spurious signals generated by the ITE and limits are specified for the frequency range 9 kHz to 400 GHz for both class A and class B equipment. No measurements need be performed at frequencies where no limits are specified.

The intention of this publication is to establish uniform requirements for the radio disturbance level of the equipment contained in the scope, to fix limits of disturbance, to describe methods of measurement and to standardize operating conditions and interpretation of results.

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 60083:1997, *Plugs and socket-outlets for domestic and similar general use standardized in member countries of IEC*

IEC 61000-4-6:2003, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

CISPR 11:2003, *Industrial, scientific, and medical (ISM) radio-frequency equipment – Electromagnetic disturbance characteristics – Limits and methods of measurement*

CISPR 13:2001, *Sound and television broadcast receivers and associated equipment – Radio disturbance characteristics – Limits and methods of measurement*

CISPR 16-1-1:2003, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-1: Radio disturbance and immunity measuring apparatus – Measuring apparatus*

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*¹
Amendment 1 (2004)

¹ There exists a consolidated edition 1.1 (2004) including edition 1.0 and its Amendment 1.

CISPR 16-1-4:2004, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-4: Radio disturbance and immunity measuring apparatus – Ancillary equipment – Radiated disturbances*

CISPR 16-2-3:2003, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 2-3: Methods of measurement of disturbances and immunity – Radiated disturbance measurements*
Amendment 1 (2005)

CISPR 16-4-2:2003, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainties, statistics and limit modelling – Uncertainty in EMC measurements*

3 Definitions

For the purposes of this document the following definitions apply:

3.1 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.

3.2 equipment under test (EUT)

representative ITE or functionally interactive group of ITE (system) which includes one or more host unit(s) and is used for evaluation purposes

3.3 host unit

part of an ITE system or unit that provides the mechanical housing for modules, which may contain radio-frequency sources, and may provide power distribution to other ITE. Power distribution may be a.c., d.c., or both between the host unit(s) and modules or other ITE

3.4

module

part of an ITE which provides a function and may contain radio-frequency sources

3.5

identical modules and ITE

modules and ITE produced in quantity and within normal manufacturing tolerances to a given manufacturing specification

3.6

telecommunications/network port

point of connection for voice, data and signalling 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.

3.7

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.

3.8

total common mode impedance

TCM impedance

impedance between the cable attached to the EUT port under test and the reference ground plane

NOTE The complete cable is seen as one wire of the circuit, the ground plane as the other wire of the circuit. The TCM wave is the transmission mode of electrical energy, which can lead to radiation of electrical energy if the cable is exposed in the real application. Vice versa, this is also the dominant mode, which results from exposition of the cable to external electromagnetic fields.

3.9

arrangement

physical layout of the EUT that includes connected peripherals/associated equipment within the test area

3.10

configuration

mode of operation and other operational conditions of the EUT

3.11

associated equipment

AE

apparatus needed to help exercise the EUT. The associated equipment may be physically located outside the test area

4 Classification of ITE

ITE is subdivided into two categories denoted class A ITE and class B ITE.

4.1 Class B ITE

Class B ITE is a category of apparatus which satisfies the class B ITE disturbance limits.

Class B ITE is intended primarily for use in the domestic environment and may include:

- equipment with no fixed place of use; for example, portable equipment powered by built-in batteries;
- telecommunication terminal equipment powered by a telecommunication network;
- personal computers and auxiliary connected equipment.

NOTE The domestic environment is an environment where the use of broadcast radio and television receivers may be expected within a distance of 10 m of the apparatus concerned.

4.2 Class A ITE

Class A ITE is a category of all other ITE which satisfies the class A ITE limits but not the class B ITE limits. Such equipment should not be restricted in its sale but the following warning shall be included in the instructions for use:

Warning

This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

5 Limits for conducted disturbance at mains terminals and telecommunication ports

The equipment under test (EUT) shall meet the limits in Tables 1 and 3 or 2 and 4, as applicable, including the average limit and the quasi-peak limit when using, respectively, an average detector receiver and quasi-peak detector receiver and measured in accordance with the methods described in Clause 9. Either the voltage limits or the current limits in Table 3 or 4, as applicable, shall be met except for the measurement method of C.1.3 where both limits shall be met. If the average limit is met when using a quasi-peak detector receiver, the EUT shall be deemed to meet both limits and measurement with the average detector receiver is unnecessary.

If the reading of the measuring receiver shows fluctuations close to the limit, the reading shall be observed for at least 15 s at each measurement frequency; the higher reading shall be recorded with the exception of any brief isolated high reading which shall be ignored.

5.1 Limits of mains terminal disturbance voltage

Table 1 – Limits for conducted disturbance at the mains ports of class A ITE

Frequency range MHz	Limits dB(μV)	
	Quasi-peak	Average
0,15 to 0,50	79	66
0,50 to 30	73	60

NOTE The lower limit shall apply at the transition frequency.

Table 2 – Limits for conducted disturbance at the mains ports of class B ITE

Frequency range MHz	Limits dB(μV)	
	Quasi-peak	Average
0,15 to 0,50	66 to 56	56 to 46
0,50 to 5	56	46
5 to 30	60	50

NOTE 1 The lower limit shall apply at the transition frequencies.
NOTE 2 The limit decreases linearly with the logarithm of the frequency in the range 0,15 MHz to 0,50 MHz.

5.2 Limits of conducted common mode (asymmetric mode) disturbance at telecommunication ports ²⁾

Table 3 – Limits of conducted common mode (asymmetric mode) disturbance at telecommunication ports in the frequency range 0,15 MHz to 30 MHz for class A equipment

Frequency range MHz	Voltage limits dB (μV)		Current limits dB (μA)	
	Quasi-peak	Average	Quasi-peak	Average
0,15 to 0,5	97 to 87	84 to 74	53 to 43	40 to 30
0,5 to 30	87	74	43	30

NOTE 1 The limits decrease linearly with the logarithm of the frequency in the range 0,15 MHz to 0,5 MHz.
NOTE 2 The current and voltage disturbance limits are derived for use with an impedance stabilization network (ISN) which presents a common mode (asymmetric mode) impedance of 150 Ω to the telecommunication port under test (conversion factor is $20 \log_{10} 150 / I = 44$ dB).

²⁾ See 3.6.