TECHNICAL REPORT

CISPR 16-3

First edition
2000-05

INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE

Specification for radio disturbance and immunity measuring apparatus and methods –

Part 3: Reports and recommendations of CISPR

Spécifications des méthodes et des appareils de mesure des perturbations radioélectriques et de l'immunité aux perturbations radioélectriques –

Partie 3: Rapports et recommandations du CISPR

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Terminology used in this publication

Only special terms required for the purpose of this publication are defined herein.

For general terminology, readers are referred to IEC 60050: *International Electrotechnical Vocabulary* (IEV), which is issued in the form of separate chapters each dealing with a specific field, the General Index being published as a separate booklet. Full details of the IEV will be supplied on request.

For terms on radio interference, see Chapter 902.

Graphical and letter symbols

For graphical symbols, and letter symbols and signs approved by the IEC for general use, readers are referred to:

– IEC 60027: *Letter symbols to be used in electrical technology*;

– IEC 60617: *Graphical symbols for diagrams*;

The symbols and signs contained in the present publication have either been taken from IEC 60027 or IEC 60617, or have been specifically approved for the purpose of this publication.

* IEC web site

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

SPECIFICATION FOR RADIO DISTURBANCE AND IMMUNITY MEASURING APPARATUS AND METHODS –

Part 3: Reports and recommendations of CISPR

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The 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 the 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 National Committees.
3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
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The main task of IEC technical committees is to prepare International Standards. However, a technical committee may propose the publication of a technical report when it has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

Technical reports do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

CISPR 16-3, which is a technical report, has been prepared by CISPR subcommittee A: Radio interference measurements and statistical methods.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
CISPR/A/CO/67 CISPR/A/CO/77	CISPR/A(CO)82 CISPR/A(CO)84

Full information on the voting for the approval of this technical report 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 3.

This document which is purely informative is not to be regarded as an International Standard.

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

Recommendation 2/2 – p/o CISPR. 7B, 1975; Recommendation 46/1 – p/o CISPR. 11, 1990; Report 33 – p/o CISPR 8, 1969; Report 38 – p/o CISPR 8, 1969; Report 48 – p/o CISPR 8B, 1975; Report 49 – p/o CISPR 8C, 1980; Report 61 = CISPR 23, 1987; Report 59: CIS/A(Sec)58 + CIS/A(Sec)58A, 1983; Report: CIS/A(Sec)67 + CIS/A(Sweden)29; RM 2828/CISPR/A, 1985; CIS/A(CO)32, 1985; CIS/A(Sec)58, 1983; CIS/A(Sec)58A, 1983; CIS/A(Sec)67, 1985; CIS/A(CO)67, 1992; CIS/A(CO)67A, 1993; CIS/A(CO)77A, 1993; CIS/A(CO)81, 1987; CIS/A(CO)82, 1994; CIS/A(CO)84, 1994; CIS/A(Sec)84, 1987; CIS/A(Sec)88, 1988; CIS/A(Sec)88A, 1988; CIS/A(Sec)94, 1989; CIS/A(Sec)115, 1991; CIS/A(Sec)115A, 1991; CIS/A(Sec)116, 1991; CIS/A(Sec)124, 1991; CIS/A(Sec)128, 1992; CIS/A(Sec)132, 1993; CIS/A/166/CD, 1995.

A bilingual version of this publication may be issued at a later date.

SPECIFICATION FOR RADIO DISTURBANCE AND IMMUNITY MEASURING APPARATUS AND METHODS –

Part 3: Reports and recommendations of CISPR

1 General

1.1 Scope

This part of CISPR 16 contains recommendations on statistics of disturbance complaints, on the significance of CISPR limits, on determination of CISPR limits and other specific reports.

Over the years, the CISPR prepared a number of recommendations and reports that have significant technical merit but were not generally available. Reports and recommendations were for some time published in CISPR 7 and 8.

At its meeting in Campinas, Brazil, in 1988, subcommittee A agreed on the table of contents of part 3 and to publish the reports for posterity by giving the reports a permanent place in part 3.

1.2 Reference documents

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

IEC 60364-4, *Electrical installations of buildings – Part 4: Protection for safety*

CISPR 11:1997, *Industrial, scientific and medical (ISM) radio-frequency equipment – Electromagnetic disturbance characteristics – Limits and methods of measurement*

CISPR 13:1996, *Limits and methods of measurement of radio interference characteristics of sound and television broadcast receivers and associated equipment*

CISPR 14-1, *Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission*

CISPR 16-1:1999, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1: Radio disturbance and immunity measuring apparatus*

CISPR 16-2:1996, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 2: Methods of measurement of disturbances and immunity*

ITU-R BS 468-4, *Measurement of audio-frequency noise voltage level in sound broadcasting*

1.3 Definitions

For the purpose of this part of CISPR 16, the definitions of CISPR 16-1 and IEV 60050(161) as well as the following definitions apply.

1.3.1
bandwidth (B_n)
width of the overall selectivity curve of the receiver between two points at a stated attenuation, below the midband response. The bandwidth is represented by the symbol B_n, where n is the stated attenuation in decibels

1.3.2
impulse bandwidth (B_{imp})

$$B_{imp} = A(t)_{max} / (2G_o \times IS)$$

where

$A(t)_{max}$ is the peak of the envelope at the IF output of the receiver with an impulse area IS applied at the receiver input;

G_o is the gain of the circuit at the centre frequency.

Specifically, for two critically coupled tuned transformers,

$$B_{imp} = 1{,}05 \times B_6 = 1{,}31 \times B_3$$

where B_6 and B_3 are respectively the bandwidths at the –6 dB and –3 dB points (see 1.3-A.2 in annex 1.3-A for further information)

1.3.3
impulse area (sometimes called impulse strength) (IS)
the voltage-time area of a pulse defined by the integral:

$$IS = \int_{-\infty}^{+\infty} V(t)dt \text{ (expressed in µVs or dB(µVs))}$$

NOTE Spectral density (D) is related to impulse area and expressed in µV/MHz or dB(µV)/MHz. For rectangular impulses of pulse duration T at frequencies $f << 1/T$, the relationship D (µV/MHz) = $2 \times 10^6/IS$ (µVs) applies since D is calibrated in r.m.s. values of a corresponding sine wave.

1.3.4
electrical charge time constant (T_C)
time needed after the instantaneous application of a constant sine-wave voltage to the stage immediately preceding the input of the detector for the output voltage of the detector to reach 63 % of its final value

NOTE This time constant is determined as follows. A sine-wave signal of constant amplitude and having a frequency equal to the mid-band frequency of the i.f. amplifier is applied to the input of the stage immediately preceding the detector. The indication, D, of an instrument having no inertia (for example, a cathode-ray oscilloscope) connected to a terminal in the d.c. amplifier circuit so as not to affect the behaviour of the detector, is noted. The level of the signal is chosen such that the response of the stages concerned remains within the linear operating range. A sine-wave signal of this level, applied for a limited time only and having a wave train of rectangular envelope is gated such that the deflection registered is 0,63D. The duration of this signal is equal to the charge time of the detector.

1.3.5
electrical discharge time constant (T_D)
time needed after the instantaneous removal of a constant sine-wave voltage applied to the stage immediately preceding the input of the detector for the output of the detector to fall to 37 % of its initial value

NOTE The method of measurement is analogous to that for the charge time constant, but instead of a signal being applied for a limited time, the signal is interrupted for a definite time. The time taken for the deflection to fall to 0,37D is the discharge time constant of the detector.

1.3.6
mechanical time constant (T_M) of a critically damped indicating instrument

$$T_M = T_L / 2\pi$$

where T_L is the period of free oscillation of the instrument with all damping removed.

NOTE 1 For a critically damped instrument, the equation of motion of the system may be written as

$$T_M^2(d^2\alpha / dt^2) + 2T_M(d\alpha / dt) + \alpha = ki$$

where

α is the deflection;

i is the current through the instrument;

k is a constant.

It can be deduced from this relation that this time constant is also equal to the duration of a rectangular pulse (of constant amplitude) that produces a deflection equal to 35 % of the steady deflection produced by a continuous current having the same amplitude as that of the rectangular pulse.

NOTE 2 The methods of measurement and adjustment are deduced from one of the following:

a) The period of free oscillation having been adjusted to $2\pi T_M$, damping is added so that $\alpha_{TM} = 0{,}35\ \alpha_{max}$.

b) When the period of oscillation cannot be measured, the damping is adjusted to be just below critical such that the overswing is not greater than 5 % and the moment of inertia of the movement is such that $\alpha_{TM} = 0{,}35\ \alpha_{max}$.

1.3.7
overload factor
ratio of the level that corresponds to the range of practical linear function of a circuit (or a group of circuits) to the level that corresponds to full-scale deflection of the indicating instrument.

The maximum level at which the steady-state response of a circuit (or group of circuits) does not depart by more than 1 dB from ideal linearity defines the range of practical linear function of the circuit (or group of circuits)

1.3.8
symmetric voltage
in a two-wire circuit, such as a single-phase mains supply, the symmetric voltage is the radio-frequency disturbance voltage appearing between the two wires. This is sometimes called the differential mode voltage. If *Va* is the vector voltage between one of the mains terminals and earth and *Vb* is the vector voltage between the other mains terminal and earth, the symmetric voltage is the vector difference (*Va* – *Vb*)

1.3.9
asymmetric voltage
radio-frequency disturbance voltage appearing between the electrical mid-point of the mains terminals and earth. It is sometimes called the common-mode voltage and is half the vector sum of *Va* and *Vb*, i.e. (*Va* + *Vb*)/2.

1.3.10
unsymmetric voltage
amplitude of the vector voltage, *Va* or *Vb* defined in 1.3.8 and 1.3.9. This is the voltage measured by the use of an artificial mains V-network

1.3.11
CISPR indicating range
range specified by the manufacturer which gives the maximum and the minimum meter indications within which the receiver meets the requirements of this part of CISPR 16

2 Statistics

2.1 Recommendation 2/3: Statistics of complaints and sources of interference (this recommendation replaces Recommendation 2/2 in CISPR 7B)

The CISPR,

CONSIDERING

a) that many administrations regularly publish statistics on interference complaints;

b) that it would be useful to be able to compare the figures for certain categories;

c) that, at present, varied and ambiguous presentation often renders this comparison difficult,

RECOMMENDS

1 that the statistics supplied by National Committees should be in such a form that the following information may be readily extracted:

1.1 number of complaints as a percentage of the total number of receiving licences for television, sound broadcasting and other services;

1.2 the relative aggressivity of the various sources of interference in the different frequency bands;

1.3 the comparison of the interference caused by the same source in different frequency bands;

1.4 the effectiveness of limits (CISPR or national) and other counter-measures on subclauses 1.1, 1.2 and 1.3;

2 that the terms used in publication of statistics as recommended in clause 3 should have the following meaning:

2.1 *complaint:* a request for assistance made to the interference service by a listener or a viewer who complains that his reception is degraded by interference. For the purpose of these statistics, one complaint will be recorded for each frequency band for which a confirmed complaint has been received;

2.2 *source:* a source of interference is the apparatus or installation which causes interference. Interference may be caused by a group of devices, for example, a number of fluorescent lamps on one circuit. In such cases, the number to be entered in the statistics is determined by the interference service;

NOTE To facilitate comparison of statistics, the method used to determine the number of sources should be stated.

one source may cause many complaints and one complaint may be caused by more than one source. Therefore, it is clear that the number of sources and the number of complaints against any classification code may not be related;

for the purpose of these statistics, both active generators of electrical energy and apparatus and installations which cause interference by secondary effects (secondary modulation) are included. See also Appendix II for a complete list;

2.3 *cause of complaint other than a source:* a reason for unsatisfactory reception in a case in which no source is concerned. See also Appendix II for a complete list;

3 that statistics should cover a complete calendar year; they should whenever possible be presented in the following form, without necessarily employing the finer categories listed in Appendix II. It s not intended to exclude further subdivisions; these are desirable, but they should fit into the scheme of the standard form;

the code numbers refer to the items listed in Appendices I and II;

Statistics of interference complaints

Source of interference or other cause of complaint						Number of complaints per service from each source					
Classification code				Description	Total number in each classification	Broadcasting [a]					Other services [b]
						Sound [c]		Television [c]			
						LF/ MF/ HF	II	I	III	IV/V	
A	1	1									
	2	1									
		etc. as in the appendices									
					Totals						

[a] LF = low frequency (long waves);
MF = medium frequency (medium waves);
HF = high frequency (short waves).
These three bands may either be grouped together, as shown, or dealt with separately.
II = Band II (VHF/FM)
I = Band I (VHF/television)
III = Band III (VHF/television);
IV/V = Band IV/V (UHF/television).

[b] The service and band affected should be stated.

[c] At the time of receipt of complaints of interference, i.e. before they have been investigated fully, it may not be possible to apportion the complaints accurately to the various broadcasting services. If this is so, then the number of complaints should be stated separately for sound broadcasting and television.

Appendix I to Recommendation 2/3: Classification of sources of interference and other causes of complaint

Main categories

Classification code	Description of the source
A	Industrial scientific and medical RF apparatus
A.1	Industrial and scientific RF apparatus
A.1.1	Apparatus tuned to free radiation frequency
A.1.2	Apparatus not tuned to free radiation frequencies
A.2	Medical radio-frequency apparatus
A.2.1	Apparatus tuned to free radiation frequencies
A.2.2	Apparatus not tuned to free radiation frequencies
A.3	Sparking apparatus (except ignition)
B	Electric power supply, distribution and traction
B.1	AC voltages exceeding 100 kV
B.1.1	Power lines overhead
B.1.2	Generating and switching stations
B.2	DC voltages exceeding 100 kV
B.2.1	Power lines overhead
B.2.2	Converting stations

Classification code	Description of the source
B.3	Voltages 100 kV to 1 kV (subdivision as for B.1)*
B.4	Voltages 1 kV to 450 kV (subdivision as for B.1)*
B.5	Low tension power supply and distribution (<450 V)
B.5.1	Power lines overhead
B.5.2	Generating and switching stations
B.6	Electric traction
B.6.1	Railways
B.6.2	Tramways
B.6.3	Trolley buses
C	Electricity consumers' equipment (industrial and similar)
C.1	Generators
C.2	Motors (P > 700 W)
C.2.1	Rated power P: 700 W < P ≤ 1 000 W
C.2.2	Rated power P: 1 000 W < P ≤ 2 000 W
C.2.3	Rated power P: 2 000 W < P
C.3	Contacts
C.4	Ignition
C.5	Rectifiers
C.6	Convertors
C.7	Diode thyristor and thyratron control equipment
C.8	Cattle fences
D	Low-power appliances as normally used in households, offices and small workshops
D.1	Motors (up to and including 700 W)
D.2	Contact devices
D.3	Diode, thyristor and thyratron control equipment (less than 1 000 W)
E	Gaseous discharge and other lamps
E.1	Fluorescent lamps
E.2	Neon signs
E.3	Filament lamps
F	Receiving installations
F.1	Sound broadcast receivers
F.2	Television receivers
F.3	Amplifiers and common aerial reception systems for broadcasting
F.4	Non-broadcasting receivers
G	Ignition systems of internal combustion engines
H	Identified sources other than those specified
* For convenience of analysis, the same subdivision is used for all voltage ranges. In those cases where a classification does not apply, for example, corona for low voltages, the category should remain blank	

Classification code	Description of the source
I	Other causes of complaint
I.1	Telecommunication
I.1.1	Radio communication transmitters
I.1.1.1	Fundamental radiation
I.1.1.2	Harmonic radiation
I.1.1.3	Spurious radiation
I.1.2	Telecommunication by wire
I.2	Faults of the receiving installations
I.3	Receiver characteristics
I.4	Weak or faulty signals
I.5	Atmospheric disturbances
I.6	Unidentified sources of interference
I.7	Interference not observed
J	Information technology equipment
J.1	Data processing equipment (DPE)
J.1.1	Large DPE in computer rooms
J.1.2	Smaller plugable DPE not in dedicated rooms
J.1.3	Home computers and home video games
J.2	Local area network
J.3	Commercial video games
J.4	Telephone exchanges and other digital telecommunication equipment

Appendix II to Recommendation 2/3: Classification of sources of interference and other causes of complaint

Detailed categories

Classification code	Description of the source
A	Industrial scientific and medical RF apparatus
A.1	Industrial and scientific RF apparatus
A.1.1	Apparatus tuned to free radiation frequency
A.1.1.1	Drying non-metals
A.1.1.2	Plastic pre-heaters
A.1.1.3	Plastic seam welders
A.1.1.4	Wood glue drying
A.1.1.5	Microwave heating
A.1.1.6	Microwave cooking
A.1.1.7	Ultrasonic soldering and cleaning
A.1.1.8	Food treatment heaters (for example, fish thawing)
	...
A.1.1.20	Other
A.1.2	Not tuned to free radiation frequencies
A.1.2.1 to A.1.2.20	As for A.1.1.1 to A.1.1.20
A.2	Medical radiofrequency apparatus
A.2.1	Apparatus tuned to free radiation frequencies
A.2.1.1	Diathermy
A.2.1.2	Ultrasonic medical
A.2.1.3	Cauterization
	...
A.2.1.20	Other
A.2.2	Apparatus not tuned to free radiation frequencies
A.2.2.1 to A.2.2.20	As for A.2.1.1 to A.2.1.20
A.3	Sparking apparatus (except ignition)
A.3.1	RF excited arc welder
A.3.2	Surface erosion of plastics
A.3.3	Surface erosion of metals
A.3.4	Spectrograph
A.3.5	Spark diathermy
	...
A.3.20	Other
B	Electric power supply, distribution and traction
B.1	AC voltages exceeding 100 kV
B.1.1	Power lines overhead
B.1.1.1	Corona effect
B.1.1.2	Insulators
B.1.1.3	Presence of foreign objects on line
	...
B.1.1.20	Other