

Limits and methods of measurement of radio disturbance characteristics of information technology equipment

The European Standard EN 55022:1994 has the status of a
British Standard

ICS 33.100; 35.180

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by Technical Committee GEL/110, Electromagnetic compatibility, to Subcommittee GEL/110/7, Interference characteristics of information technology equipment, upon which the following bodies were represented:

- Association of Consulting Scientists
- British Radio and Electronic Equipment Manufacturers' Association
- Federation of the Electronics Industry
- GAMBICA (BEAMA Ltd.)
- British Telecommunications plc
- ERA Technology Ltd.
- Mercury Communications Ltd.
- National Air Traffic Services
- OFTEL (Office of Telecommunications)
- Power Supply Manufacturers' Association — PSMA (BEAMA Ltd.)
- Radio Communications Agency

This British Standard, having been prepared under the direction of the Electrotechnical Sector Board, was published under the authority of the Standards Board and comes into effect on 15 April 1995

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National foreword

This British Standard has been prepared under the direction of the Electrotechnical Sector Board and is the English language version of EN 55022:1994, *Limits and methods of measurement of radio disturbance characteristics of information technology equipment*, including amendment A1:1995 and amendment A2:1997, published by the European Committee for Electrotechnical Standardization (CENELEC). It is derived from CISPR 22:1993 including Amendment 1:1995 and Amendment 2:1997, published by the International Electrotechnical Commission (IEC). The CENELEC common modifications given in EN 55022/A2:1997 have been implemented at the appropriate places in the text and are indicated by a single line in the margin.

Reference is made in the foreword of EN 55022:1994 to the fact that for products which conform to EN 55022:1987 before 31 December 1995, as shown by the manufacturer or by a certification body, the previous standard may continue to apply for production until 31 December 1998. For this reason BS 6527:1988, which is superseded by this British Standard, will be withdrawn but may still be referred to in these circumstances.

CISPR 22:1993 has now been revised as CISPR 22:1997. When it is ratified by CENELEC it will be published as a new edition of BS EN 55022.

Cross-reference

International standard	Corresponding British Standard
EN 55011 [CISPR 11 (modified)]	BS EN 55011:1991 <i>Specification for limits and methods of measurement of radio disturbance characteristics of industrial scientific and medical (ISM) radio-frequency equipment</i>

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 32, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Limits and methods of measurement of radio disturbance characteristics of information technology equipment

(includes amendments A1:1995 and A2:1997)
(CISPR 22:1993 + A1:1995 + A2:1996, modified)

Limites et méthodes de mesure des caractéristiques de perturbations radioélectriques produites par les appareils de traitement de l'information
(inclut les amendements A1:1995 et A2:1997)
(CISPR 22:1993 + A1:1995 + A2:1996, modified)

Grenzwerte und Meßverfahren für Funkstörungen von Einrichtungen der Informationstechnik
(enthält Änderungen A1:1995 und A2:1997)
(CISPR 22:1993 + A1:1995 + A2:1996, modified)

This European Standard was approved by CENELEC on 1992-12-09. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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

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

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

CENELEC

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

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

Foreword

At the request of the CENELEC sub-committee SC 110A, EMC Products, a number of Draft International Standards containing proposed amendments to CISPR Publication 22 were submitted to the CENELEC Unique Acceptance Procedure (UAP) for acceptance as amendments to the European Standard EN 55022:1987.

The CISPR Publication and the relevant DIS were combined by IEC into a new edition of CISPR 22, the text of which was approved by CENELEC as EN 55022 on 1992-12-09.

The following dates were fixed:

- latest date of publication
of an identical national
standard (dop) 1994-12-15
- latest date of withdrawal
of conflicting national
standards (dow) 1998-12-31

For products which have complied with EN 55022:1987 before 1995-12-31, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 1998-12-31.

Annexes designated “normative” are part of the body of the standard. In this standard, Annex A and Annex ZA are normative.

Foreword to amendment A1

The text of document CISPR/G(CO)36, future amendment 1 to CISPR 22:1993, 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 55022:1994 on 1995-02-15.

The following dates were fixed:

- latest date of which the
amendment has to be
implemented at national
level by publication of an
identical national standard
or by endorsement (dop) 1996-04-01
- latest date by which the
national standards
conflicting with the
amendment have to be
withdrawn (dow) 1998-12-31

Amend the text of the European Standard EN 55022:1995 in accordance with the following details.

Foreword to amendment A2

The text of amendment 2:1996 to the international Standard CISPR 22:1993, 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 formal vote and was approved by CENELEC as amendment A2 to EN 55022:1994 on 1997-03-11.

The following dates were fixed:

- latest date by which the
amendment has to be
implemeted at national level
by publication of an
identical national standard
or by endorsement (dop) 1997-12-01
- latest date by which the
national standards
conflicting with the
amendment have to be
withdrawn (dow) 1998-12-31

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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.

1 Scope and object

This 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 standard 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 standards are referred to in this publication:

IEC 83:1975, *Plugs and socket-outlets for domestic and similar general use — Standards*.

IEC 625, *An interface system for programmable measuring instruments (byte serial, bit parallel)*.

CISPR 11:1990, *Limits and methods of measurement of electromagnetic disturbance characteristics of industrial, scientific, and medical (ISM) radio-frequency equipment*.

CISPR 16:1987, *CISPR specification for radio interference measuring apparatus and measurement methods*.

CISPR 16-1:1993, *Specification for radio disturbance and immunity measuring apparatus and methods — Part 1: Radio disturbance and immunity measuring apparatus*.

CISPR 16-2:19XX, *CISPR specification for radio disturbance and immunity measuring apparatus and methods — Part 2: Methods of disturbance and immunity measurements (under consideration)*.

NOTE CISPR 16 (1987) should be used until CISPR 16-2 is available.

CCITT V.24:1993, *List of definitions for interchange circuits, between data terminal equipment (DTE) and data circuit terminating equipment (DCE)*.

3 Definitions

For the purpose of this standard 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 standard

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 CISPR 22 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 standard

3.2

equipment under test (EUT)

a representative ITE or functionally interactive group of ITE (i.e. 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

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

5.1 Limits for conducted disturbance at mains ports

The equipment under test (EUT) shall meet the limits of disturbance of Table 1 or Table 2 including the average limits and the quasi-peak limits when using, respectively, an average detector receiver and a quasi-peak detector receiver, and measured in accordance with the methods described in clause 10. If the average limit is met when using a quasi-peak detector, the EUT shall be deemed to meet both limits and measurement with the average detector 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 highest reading shall be recorded with the exception of any brief isolated high reading which shall be ignored.

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
0,5 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 for conducted disturbance at telecommunication ports

Under consideration.

6 Limits for radiated disturbance

The EUT shall meet the limits of Table 3 or Table 4 when measured at the measuring distance R in accordance with the methods described in clause 11. If the reading on the measuring receiver shows fluctuations close to the limit, the reading shall be observed for at least 15 s at each measurement frequency; the highest reading shall be recorded with the exception of any brief isolated high reading which shall be ignored.

Table 3 — Limits for radiated disturbance of Class A ITE at a measuring distance of 10 m

Frequency range MHz	Quasi-peak limits dB (µV/m)
30 to 230	40
230 to 1 000	47

NOTE 1 The lower limit shall apply at the transition frequency.

NOTE 2 Additional provisions may be required for cases where interference occurs.

Table 4 — Limits for radiated disturbance of Class B ITE at a measuring distance of 10 m

Frequency range MHz	Quasi-peak limits dB (µV/m)
30 to 230	30
230 to 1 000	37
NOTE 1 The lower limit shall apply at the transition frequency.	
NOTE 2 Additional provisions may be required for cases where interference occurs.	

7 Limits for disturbance power

The authorities in certain countries apply, in the case of Class B equipment, the measurement of and limits for disturbance power for regulatory and control purposes. In this standard, the limits for, and measurement of, disturbance power of ITE are under consideration.

NOTE Those countries which already have provision for using the absorbing clamp in their national standards may continue to include those provisions while the subject remains under consideration.

8 Interpretation of CISPR radio disturbance limit

8.1 Significance of a CISPR limit

8.1.1 A CISPR limit is a limit which is recommended to national authorities for incorporation in national standards, relevant legal regulations and official specifications. It is also recommended that international organizations use these limits.

8.1.2 The significance of the limits for equipment shall be that on a statistical basis at least 80 % of the mass-produced equipment complies with the limits with at least 80 % confidence.

8.2 Application of limits in tests for conformity of equipment in series production

8.2.1 Tests shall be made:

8.2.1.1 Either on a sample of equipment of the type using the statistical method of evaluation set out in 8.2.3.

8.2.1.2 Or, for simplicity's sake, on one equipment only.

8.2.2 Subsequent tests are necessary from time to time on equipment taken at random from production, especially in the case referred to in 8.2.1.2.

8.2.3 Statistically assessed compliance with limits shall be made as follows:

This test shall be performed on a sample of not less than five and not more than 12 items of the type but if, in exceptional circumstances, five items are not available, a sample of four or three shall be used. Compliance is judged from the following relationship:

$$\bar{x} + kS_n \leq L$$

where

$\bar{x}$ is the arithmetic mean of the measured value of n items in the sample

$$S_n^2 = \frac{1}{n-1} \sum (x_n - \bar{x})^2$$

x_n is the value of the individual item

L is the appropriate limit

k is the factor derived from tables of the non-central t -distribution which assures with 80 % confidence that 80 % of the type is below the limit; the value of k depends on the sample size n and is stated below.

The quantities x_n , $\bar{x}$, S_n and L are expressed logarithmically: dB(µV), dB(µV/m) or dB(pW).

n	3	4	5	6	7	8	9	10	11	12
k	2,04	1,69	1,52	1,42	1,35	1,30	1,27	1,24	1,21	1,20

NOTE For general information, see CISPR 16, Section 9.

8.2.4 The banning of sales, or the withdrawal of a type approval, as a result of a dispute shall be considered only after tests have been carried out using the statistical method of evaluation in accordance with 8.2.1.1.

9 General measurement conditions

A test site shall permit disturbances from the EUT to be distinguished from ambient noise. The suitability of the site in this respect can be determined by measuring the ambient noise levels with the EUT inoperative and ensuring that the noise level is at least 6 dB below the limits specified in clauses 5 and 6.

If at certain frequency bands the ambient noise is not 6 dB below the specified limit, the methods shown in 11.4 may be used to show compliance of the EUT to the specified limits.

It is not necessary that the ambient noise level be 6 dB below the specified limit where both ambient noise and source disturbance combined do not exceed the specified limit. In this case the source emanation is considered to satisfy the specified limit. Where the combined ambient noise and source disturbance exceed the specified limit, the EUT shall not be judged to fail the specified limit unless it is demonstrated that, at any measurement frequency for which the limit is exceeded, two conditions are met:

- a) the ambient noise level is at least 6 dB below the source disturbance plus ambient noise level;
- b) the ambient noise level is at least 4,8 dB below the specified limit.

9.1 EUT configuration

Where not specified herein, the EUT shall be configured, installed, arranged and operated in a manner consistent with typical applications. Interface cables/loads/devices shall be connected to at least one of each type of interface port of the EUT, and where practical, each cable shall be terminated in a device typical of actual usage.

Where there are multiple interface ports of the same type, additional interconnecting cables/loads/devices may have to be added to the EUT depending upon the results of preliminary tests.

The rationale for the selection of the configuration and loading of ports shall be included in the test report.

Interconnecting cables should be of the type and length specified in the individual equipment requirements. If the length can be varied, the length shall be selected to produce maximum disturbance.

If shielded or special cables are used during the tests to achieve compliance, then a note shall be included in the instruction manual advising of the need to use such cables.

Excess lengths of cables shall be bundled at the approximate centre of the cable with the bundles 30 cm to 40 cm in length. If it is impractical to do so because of cable bulk or stiffness, or because the testing is being done at a user installation, the disposition of the excess cable shall be precisely noted in the test report.

Where there are multiple interface ports all of the same type, connecting a cable to just one of that type of port is sufficient provided it can be shown that the additional cables would not significantly affect the results.

Any set of results shall be accompanied by a complete description of the cable and equipment orientation so that results can be repeated. If specific conditions of use are required to meet the limits, those conditions shall be specified and documented; for example cable length, cable type, shielding and grounding. These conditions shall be included in the instructions to the user.

One module of each type shall be operative in each ITE evaluated in an EUT. For a system EUT, one of each type of ITE that can be included in the possible system configuration shall be included in the EUT.

Equipment which is populated with multiple modules (drawer, plug-in card, board, etc.) shall be tested with a mix and number representative of that used in a typical installation.

The rationale used for selecting the number and type of modules should be stated in the test report.

A system that consists of a number of separate units shall be configured to form a minimum representative configuration. The number and mix of units included in the test configuration shall normally be representative of that used in a typical installation. The rationale used for selecting units should be stated in the test report.

Examples of a minimum representative configuration follow.

For a personal computer or a personal computer peripheral, the minimum configuration consists of the following device grouped and tested together.

- a) Personal computer.
- b) Keyboard.
- c) Visual display unit.
- d) External peripheral for each of two different types of available I/O protocols, e.g., serial, parallel, etc.
- e) If the EUT has a dedicated port for a special-purpose device e.g. a mouse or joystick, that device shall be part of the minimum configuration.

NOTE Items a), b) and/or c) may, in some systems, be assembled in the same chassis. In no instance may items a), b), c) mouse or joystick controls, be used as a replacement for item d).

For a point of sale terminal, the minimum system consists of the following devices (to the extent applicable) grouped and tested together.

- a) Active processor (till).
- b) Cash drawer.
- c) Keyboard(s).
- d) Display units (operator and customer).
- e) Typical peripheral (bar code scanner).
- f) Handheld device (bar code scanner).