

Information technology equipment — Radio disturbance characteristics — Limits and methods of measurement

The European Standard EN 55022:1998, with the incorporation of amendment A1:2000 and A2:2003, has the status of a British Standard

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National foreword

This British Standard was published by BSI. It is the UK implementation of EN 55022:1998, including corrigenda August 1999, April 2003, July 2003, March 2005, September 2005, September 2006 and amendments A1:2000 and A2:2003. It was derived by CENELEC from CISPR 22:1997, including amendments 1:2000 and 2:2002. It supersedes BS EN 55022:1995.

The CENELEC common modifications have been implemented at the appropriate places in the text. The start and finish of each common modification is indicated in the text by tags [C] <C].

The start and finish of text introduced or altered by amendment is indicated in the text by tags [A1] <A1]. Tags indicating changes to IEC text carry the number of the IEC amendment. For example, text altered by IEC amendment 1 is indicated by [A1] <A1].

CENELEC Corrigendum September 2005 replaces CENELEC Corrigendum April 2003 to amendment A1 and corrects the date of withdrawal in the EN foreword to amendments A1 and A2. CENELEC Corrigendum March 2005 includes and replaces the CENELEC Corrigendum July 2003, corrects the date of withdrawal in the EN foreword, replaces the last sentence in 8.2 and adds a footnote in Annex ZA.

The UK participation in its preparation was entrusted by Technical Committee GEL/210, Electromagnetic compatibility, to Subcommittee GEL/210/11, EMC Product Standards.

A list of organizations represented on GEL/210/11 can be obtained on request to its secretary.

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

Compliance with a British Standard cannot confer immunity from legal obligations.

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Information technology equipment — Radio disturbance characteristics — Limits and methods of measurement

(CISPR 22:1997, + A1:2000 + A2:2002, modified)

Appareils de traitement de l'information
Caractéristiques des perturbations
radioélectriques —
Limites et méthodes de mesure
(CISPR 22:1997, + A1:2000 + A2:2002, modifiée)

Einrichtungen der Informationstechnik
Funkstörungen —
Grenzwerte und Meßverfahren
(CISPR 22:1997, + A1:2000 + A2:2002,
modifiziert)

This European Standard was approved by CENELEC on 1998-08-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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

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, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, 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

The text of document CISPR/G/112/FDIS, future edition 3 of CISPR 22, prepared by CISPR SC G, Interference relating to information technology equipment, was submitted to the IEC-CENELEC parallel vote.

The text of document CISPR/G/121/FDIS, a further part of CISPR 22, which failed to pass the IEC-CENELEC parallel vote within CENELEC, together with the common modifications prepared by SC 210A, EMC Products, of Technical Committee CENELEC TC 210, EMC, was submitted to the Unique Acceptance Procedure.

The combined text of edition 3 of CISPR 22, the common modifications in amendment A2:1997 to EN 55022:1994 and those for CISPR/G/121/FDIS were approved by CENELEC as EN 55022 on 1998-08-01.

This European Standard supersedes
EN 55022:1994 + corrigendum
August 1997 + A1:1995 + corrigendum
August 1997 + A2:1997.

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

Annexes designated “informative” are given for information only.

In this standard, Annex A, Annex B, Annex C and Annex ZA are normative and Annex D and Annex E are informative.

Annex ZA has been added by CENELEC.

Foreword to amendment A1

The text of document CISPR/G/177/FDIS, future amendment 1 to CISPR 22:1997, prepared by CISPR SC G, Interference relating to information technology equipment, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A1 to EN 55022:1998 on 2000-08-01.

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Foreword to amendment A2

The text of document CISPR/1/41/FDIS, future amendment 2 to CISPR 22:1997, prepared by CISPR SC 1, Electromagnetic compatibility of information technology equipment, multimedia equipment and receivers, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A2 to EN 55022:1998 on 2002-12-01.

The following dates were fixed:

- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2003-09-01
- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 2009-10-01

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

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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 publication 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 normative documents contain provisions which, through reference in this text, constitute provisions of this publication. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this publication are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

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

IEC 61000-4-6:1996, *Electromagnetic compatibility (EMC) — Part 4: Testing and measurement techniques — Section 6: Immunity to conducted disturbances, induced by radio-frequency fields*

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

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

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

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

ISO/IEC 11801:1995, *Information technology — Generic cabling for customer premises*

3 Definitions

For the purpose of this publication 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)

a 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. 

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 Table 1 and Table 3 or Table 2 and Table 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 Table 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 ports¹⁾

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 $20 \log_{10} 150 / 1 = 44$ dB).

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

Frequency range MHz	Voltage limits dB(μV)		current limits dB (μA)	
	Quasi-Peak	Average	Quasi-peak	Average
0,15 to 0,5	84 to 74	74 to 64	40 to 30	30 to 20
0,5 to 30	74	64	30	20

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 $20 \log_{10} 150 / 1 = 44$ dB).

Ⓔ NOTE 3 Provisionally, a relaxation of 10 dB over the frequency range of 6 Mhz to 30 Mhz is allowed for high-speed services having significant spectral density in this band. However, this relaxation is restricted to the common mode disturbance converted by the cable from the wanted signal. The provisional relaxation of 10 dB will be reviewed no later than three years after the date of withdrawal based on the results and interference cases seen in this period. Wherever possible it is recommended to comply with the limits without the provisional relaxation. Ⓒ

6 Limits for radiated disturbance

The EUT shall meet the limits of Table 5 or Table 6 when measured at the measuring distance R in accordance with the methods described in Clause 10. 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 5 — 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.

¹⁾ See 3.6.

Table 6 — 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 Interpretation of CISPR radio disturbance limit

7.1 Significance of a CISPR limit

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

7.1.2 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.

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

7.2.1 Tests shall be made:

7.2.1.1 Either on a sample of equipment of the type using the statistical method of evaluation set out in **7.2.3**.

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

7.2.2 Subsequent tests are necessary from time to time on equipment taken at random from production, especially in the case referred to in **7.2.1.2**.

7.2.3 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. 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(μW).

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 Nine.

7.2.4 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 **7.2.1.1**.

8 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 10.4 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.

8.1 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.

☐ 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, such as serial, parallel, etc.;

e) if the EUT has a dedicated port for a special-purpose device such as 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).

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.

A unit of equipment which forms part of a system distributed over a wide area (such as data processing terminals or workstations, or private branch telecommunication exchanges, etc.), and which in itself may be a subsystem, may be tested independently of the host unit or system. Distributed networks, for example a local area network, may be simulated on the test site by lengths of cable and actual peripherals or remote network communications simulators located at a distance sufficient to ensure that they do not contribute to the measured level.

The results of an evaluation of EUTs having one of each type of module or ITE can be applied to configurations having more than one of each of those modules or ITE. This is permissible because it has been found that disturbances from identical modules or ITE (see 3.5) are generally not additive in practice.

In the case of EUTs which functionally interact with other ITE, including any ITE that is dependent on a host unit for its power interface, either the actual interfacing ITE or simulators may be used to provide representative operating conditions, provided the effects of the simulator can be isolated or identified. If an ITE is designed to be a host unit to other ITE, such ITE may have to be connected in order that the host unit shall operate under normal conditions.

It is important that any simulator used instead of an actual interfacing ITE properly represents the electrical and, in some cases, the mechanical characteristics of the interfacing ITE, especially RF signals and impedances. Following this procedure will permit the results of measurements of individual ITE to remain valid for system application and integration of the ITE with other similarly tested ITE, including ITE produced and tested by different manufacturers.

In the case of printed wiring board assemblies (PWBA), separately marketed for the enhancement of diverse host units, the PWBA (such as ISDN interface, CPU, adaptor cards, etc.) shall be tested in at least one appropriate representative host unit of the PWBA manufacturer's choice so as to ensure compliance of the PWBA with the entire population of hosts in which it is intended to be installed.

The host shall be a typical compliant production sample.

PWBA intended to be class B shall not be tested in hosts which are class A.

The accompanying documentation of the PWBA shall include information regarding the host units in which the PWBA was tested and verified, and information enabling the user to identify host units in which the PWBA will achieve compliance with the classification (A or B).

8.1.1 Determination of maximum emission configuration(s)

Initial testing shall identify the frequency that has the highest disturbance relative to the limit while operating the EUT in typical modes of operation and cable positions in a test set-up which is representative of typical system configurations. The identification of the frequency of highest disturbance with respect to the limit shall be found by investigating disturbances at a number of significant frequencies, to give confidence that the probable frequency of maximum disturbance has been found and that the associated cable, EUT configurations and mode of operation has been identified.

For initial testing, the EUT shall be set-up in accordance with Figure 4 through Figure 14. The distances between the EUT and peripherals are set according to the figures.

Final measurements shall be conducted as in Clauses 9 and 10 for terminal disturbance voltage and disturbance field strength measurements, respectively.

8.1.2 EUT configuration with ground plane

The EUT situation relative to the ground plane shall be equivalent to that occurring in use, that is floor-standing equipment is placed on a ground plane or on an isolating floor (for example wood) close to a ground plane, and portable equipment is placed on a non-metallic table. The power and signal cables shall be oriented with respect to the ground plane in a manner equivalent to actual use. The ground plane may be of metal.

NOTE Specific ground plane requirements are given in 9.3 for conducted disturbance measurements and in 10.3.4 for radiated disturbance measurements, and in Figure 4 through Figure 14 as they may relate to particular test set-ups.

8.2 Operation of the EUT

☐ The operational conditions of the EUT shall be determined by the manufacturer according to the typical use of the EUT with respect to the expected highest level of emission. The determined operational mode and the rationale for the conditions shall be stated in the test report. ☐

The EUT shall be operated within the rated (nominal) operating voltage range and typical load conditions (mechanical or electrical) for which it is designed. Actual loads should be used whenever possible. If a simulator is used, it shall represent the actual load with respect to its radio frequency and functional characteristics.

The test programmes or other means of exercising the equipment should ensure that various parts of a system are exercised in a manner that permits detection of all system disturbances. For example, in a computer system, tape and disk drives should be put through a read-write-erase sequence; and various portions of memories should be addressed. Any mechanical activities should be performed and visual display units should be operated as in normal use (e.g. control settings, random text).

☐ Text deleted ☐

A2 8.3 Operation of multifunction equipment

Multifunction equipment which is subjected simultaneously to different clauses of this standard and/or other standards shall be tested with each function operated in isolation, if this can be achieved without modifying the equipment internally. The equipment thus tested shall be deemed to have complied with the requirements of all clauses/standards when each function has satisfied the requirements of the relevant clause/standard. For example, a personal computer with a broadcast reception function shall be tested with the broadcast reception function inactivated according to CISPR 22 and then tested with only the broadcast reception function activated according to CISPR 13, if the equipment can operate each function in isolation under normal operation.

For equipment which it is not practical to test with each function operated in isolation, or where the isolation of a particular function would result in the equipment being unable to fulfil its primary function, or where the simultaneous operation of several functions would result in saving measurement time, the equipment shall be deemed to have complied if it meets the provisions of the relevant clause/standard with the necessary functions operated. For example, if a personal computer with a broadcast reception function cannot operate the broadcast reception function in isolation from the computing function, the personal computer may be tested with the computing function and broadcast reception function activated according to CISPR 22 and CISPR 13 with respect to these requirements.

Where an allowance is made excluding specific ports or frequencies in a standard, the allowance may be made when relevant functions within multifunction equipment are tested against a different standard (e.g. excluding of fundamental and harmonics frequencies of a local oscillator during a measurement of equipment containing the broadcast reception function according to CISPR 22). In the same way special terminations may be needed, e.g. during the measurements according to CISPR 22, the antenna port of a broadcast receiver shall be terminated by a non-inductive resistor equal to the value of the nominal impedance for the port.

NOTE Disturbances caused by the local oscillator can be distinguished from disturbances caused by other sources by changing the tuned reception frequency/channel. A2

A₂ Regardless of the above prescriptions,

- the measurement of disturbance voltage at the mains port according to CISPR 13 may be excluded if the EUT has complied with the relevant limits of CISPR 22;
- the measurement of disturbance power according to CISPR 13 may be excluded if the EUT has complied with the limits of radiated disturbance field strength of CISPR 22;
- the measurement of radiated disturbance field strength according to CISPR 13 may be excluded if all radiated disturbances from the EUT have complied with the relevant limits of CISPR 22. **A₂**

9 Method of measurement of conducted disturbance at mains terminals and telecommunication ports

Measurements shall be carried out using quasi-peak and average detector receivers as described in 9.1. Both detectors may be incorporated in a single receiver, and measurements may be carried out by using alternatively the quasi-peak detector and the average detector.

NOTE It is recommended that the measurement of conducted disturbances be performed in a screened enclosure.

To reduce testing time, a peak detector receiver may be used instead of a quasi-peak or an average detector receiver. In case of dispute, measurement with a quasi-peak detector receiver will take precedence when measuring to the quasi-peak limits, and measurement with an average detector receiver will take precedence when measuring to the average limits (see Annex B).

9.1 Measuring receivers

The quasi-peak measuring receiver shall be in accordance with Clause 2 of CISPR 16-1. Receivers with average detectors shall be in accordance with Clause 4 of CISPR 16-1, and shall have a 6 dB bandwidth in accordance with Clause 2 of CISPR 16-1. Receivers with peak detectors shall be in accordance with Clause 3 of CISPR 16-1, and shall have a 6 dB bandwidth in accordance with Clause 2 of CISPR 16-1.

9.2 Artificial mains network (AMN)

An AMN is required to provide a defined impedance at high frequencies across the power feed at the point of measurement of terminal voltage, and also to provide isolation of the circuit under test from the ambient noise on the power lines.

A network with a nominal impedance (50 Ω /50 μ H) as defined in CISPR 16-1, Clause 11.3, shall be utilized.

Connection of the EUT to the AMN is required. The EUT is located so that the distance between the boundary of the EUT and the closest surface of the AMN is 0,8 m.

Where a mains flexible cord is provided by the manufacturer this shall be 1 m long, or if in excess of 1 m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0,4 m in length.

Where a mains cable is specified in the manufacturer's installation instructions, a 1 m length of the type specified shall be connected between the EUT and the AMN.

Conducted disturbance is measured between the phase lead and the reference ground, and between the neutral lead and the reference ground. Both measured values shall be within the appropriate limits.

Ground connections, where required for safety purposes, shall be connected to the reference ground point of the network and, where not otherwise provided or specified by the manufacturer, shall be 1 m long and run parallel to the mains connection at a distance of not more than 0,1 m.

Other ground connections (for example for EMC purposes), either specified or supplied by the manufacturer for connection to the same ultimate terminal as the safety ground connection, shall also be connected to the reference ground of the network.

It may not be possible to measure at some frequencies because of conducted ambient noise caused by couples from local broadcast service fields. A suitable additional radio-frequency filter may be inserted between the AMN and the mains supply, or measurements may be performed in a shielded enclosure. The components forming the additional radio-frequency filter should be enclosed in a metallic screen directly connected to the reference ground of the measuring system. The requirements for the impedance of the AMN should be satisfied at the frequency of the measurement, with the additional radio-frequency filter connected.