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INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE
COMITÉ INTERNATIONAL SPÉCIAL DES PERTURBATIONS RADIOÉLECTRIQUES

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

**Compatibilité électromagnétique – Exigences pour les appareils électrodomestiques, outillages électriques et appareils analogues –
Partie 1: Emission**

WITNESS



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

CISPR 14-1 Edition 6.0 2016-08

ELECTROMAGNETIC COMPATIBILITY – REQUIREMENTS FOR HOUSEHOLD APPLIANCES, ELECTRIC TOOLS AND SIMILAR APPARATUS –

Part 1: Emission

INTERPRETATION SHEET 1

This interpretation sheet has been prepared by subcommittee CISPR F: Interference relating to household appliances tools, lighting equipment and similar apparatus, of IEC technical committee CISPR: International special committee on radio interference.

The text of this interpretation sheet is based on the following documents:

FDIS	Report on voting
CIS/F/703/FDIS	CIS/F/707/RVD

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

Interpretation Sheet 1 to CISPR 14-1: Interpretation of subclause 5.4.2.4 of CISPR 14-1:2016 on the upper quartile method for the evaluation of clicks

Introduction

The evaluation of clicks has to be performed at four frequencies while the determination of the click rate N is made only at two frequencies. The application of the upper quartile method at the frequencies 150 kHz and 500 kHz is clear, while the situation is unclear for the frequencies 1,4 MHz and 30 MHz. This interpretation sheet is intended to clarify this matter.

The click measurement procedure is under revision in CISPR/F WG1 and will be updated in the next amendment to CISPR 14-1:2016.

Question

How should the upper quartile method be applied at the frequencies 1,4 MHz and 30 MHz?

Interpretation

Each of the following two interpretations is valid.

ICS 33.100.10

Interpretation 1:

The number of clicks at 1,4 MHz and the number of clicks at 30 MHz which exceed the limit, L , for continuous disturbances during the observation time, T , are measured. The number of clicks at 1,4 MHz and the number of clicks at 30 MHz exceeding L_q are allowed to be one quarter of the number of clicks counted at each respective frequency.

Interpretation 2:

The number of clicks at 1,4 MHz and the number of clicks at 30 MHz which exceed the limit, L , for continuous disturbances during the observation time, T , are not measured but are assumed to be equal to the number of clicks counted at 500 kHz during the observation time T . The number of clicks at 1,4 MHz and the number of clicks at 30 MHz exceeding L_q are allowed to be one quarter of the number of clicks counted at 500 kHz.

In any situation where it is necessary to verify the original measurement, the assessment method (interpretation 1 or 2) originally chosen shall be used in order to ensure consistency of the results.

Withdrawn

INTERNATIONAL ELECTROTECHNICAL COMMISSION

CISPR 14-1 Edition 6.0 2016-08

ELECTROMAGNETIC COMPATIBILITY – REQUIREMENTS FOR HOUSEHOLD APPLIANCES, ELECTRIC TOOLS AND SIMILAR APPARATUS –

Part 1: Emission

INTERPRETATION SHEET 2

This interpretation sheet has been prepared by subcommittee CISPR F: Interference relating to household appliances tools, lighting equipment and similar apparatus, of IEC technical committee CISPR: International special committee on radio interference.

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Interpretation Sheet 2 to CISPR 14-1: Interpretation of subclause A.4.11 of CISPR 14-1:2016 on the assessment of irons with steam generator

Introduction

Subclause A.4.11 of CISPR 14-1:2016 defines the testing conditions for irons (dry or steam), but there are no instructions regarding the steam production.

Question

How to set the steam function of irons during CISPR 14-1 emission tests?

Interpretation

When measuring disturbances from irons, if the iron has a continuous steam function, it shall be operated in this mode only and use a sufficient amount of water to facilitate continuous steaming for the duration of the test.

Withdrawn

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INTERNATIONAL ELECTROTECHNICAL COMMISSION
INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE

**ELECTROMAGNETIC COMPATIBILITY –
REQUIREMENTS FOR HOUSEHOLD APPLIANCES,
ELECTRIC TOOLS AND SIMILAR APPARATUS –**

Part 1: Emission

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.
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This sixth edition cancels and replaces the fifth edition published in 2005, Amendment 1:2008 and Amendment 2:2011. This edition constitutes a technical revision.

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

- full editorial review of the standard, rearranging the structure of several clauses;
- improvements to the operating conditions for testing induction cooking appliances and incorporation of the limits for these appliances in the body of the standard;

- moving all specific operating conditions to Annex A;
- improvement of definitions;
- addition of general and specific test setups (e.g. vacuum cleaners and robotic cleaners) for radiated emission;
- provision for the current probe test method for conducted disturbance measurements on ports other than the AC mains port in alternative to the voltage probe method;
- clarifications about click analysis (e.g. measurements under the presence of continuous disturbances). Further clarification is being developed for future inclusion;
- clarification about the use of the artificial hand;
- introduction of testing on wired network ports of household equipment (equivalent to CISPR 32 requirements);
- clarification in the scope regarding emissions from radio transmitters (copied verbatim from CISPR 32);
- clarification about the measurement of equipment with built-in luminaries.

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

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

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

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

- reconfirmed,
- withdrawn,
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- amended

The contents of the corrigendum of October 2016 and the interpretation sheet 1 of May 2017 and 2 of May 2017 have been included in this copy.

ELECTROMAGNETIC COMPATIBILITY – REQUIREMENTS FOR HOUSEHOLD APPLIANCES, ELECTRIC TOOLS AND SIMILAR APPARATUS –

Part 1: Emission

1 Scope

This part of CISPR 14 specifies the requirements that apply to the emission of radio-frequency disturbances in the frequency range 9 kHz to 400 GHz from appliances, electric tools and similar apparatus as defined below, whether powered by AC or DC (including a battery).

Within this standard wherever the term “equipment” is used it includes the more specific terms “appliance”, “household or similar appliances”, “electric tool”, “toys” and “apparatus”.

This International Standard is applicable to the following equipment:

- household appliances or similar equipment;

NOTE 1 Examples are equipment used:

- for typical housekeeping functions in the household environment, which includes the dwelling and its associated buildings, the garden, etc.;
- for typical housekeeping functions in shops, offices, commercial and other similar working environments;
- in farms;
- by clients in hotels and other residential type environments;
- for induction cooking, either in residential or commercial environments.

- electric tools;

NOTE 2 Examples of electric tools include electric motor-operated or electromagnetically driven hand-held tools, transportable tools, lawn and garden machinery.

- similar apparatus.

NOTE 3 Examples are external power controllers using semiconductor devices, motor-driven electro-medical apparatus, electric/electronic toys, automatic goods-dispensing machines, entertainment machines, cine or slide projectors, as well as battery chargers and external power supplies for use with products under the scope of this standard.

Also included in the scope of this standard are separate parts of the above mentioned equipment such as motors and switching devices (e.g. power or protective relays); however, no emission requirements apply to such separate parts, unless otherwise stated in this standard.

Excluded from the scope of this standard are:

- equipment for which all emission requirements in the radio-frequency range are explicitly formulated in other CISPR standards;

NOTE 4 Examples are:

- luminaires, including portable luminaires for children, discharge lamps and other lighting devices under the scope of CISPR 15;
- information technology equipment, e.g. home computers, personal computers, electronic copying machines under the scope of CISPR 32;
- audio/video equipment and electronic music instruments other than toys under the scope of CISPR 32;

- mains communication devices, as well as baby surveillance systems;
 - equipment which is under the scope of CISPR 11 because of the use of radio frequency energy for heating (other than induction cooking) and therapeutic purposes, microwave ovens (but be aware of 6.5 on multifunction equipment e.g. for click measurements)
 - radio controls, walkie-talkies and other types of radio-transmitters;
 - arc welding equipment.
- equipment intended to be used only on a vehicle, ship or aircraft;
 - the effects of electromagnetic phenomena relating to the safety of the equipment.

Multifunction equipment may be required to comply with clauses in this and other standards. The details are given in 6.5.

The radiated emission requirements in this standard are not intended to be applicable to the intentional transmissions from a radio transmitter as defined by the ITU, nor to any spurious emissions related to these intentional transmissions.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

CISPR 16-1-1:2015, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-1: Radio disturbance and immunity measuring apparatus – Measuring apparatus*

CISPR 16-1-2:2014, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-2: Radio disturbance and immunity measuring apparatus – Coupling devices for conducted disturbance measurements*

CISPR 16-1-3:2004, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-3: Radio disturbance and immunity measuring apparatus – Ancillary equipment – Disturbance power*
CISPR 16-1-3:2004/AMD1:2016

CISPR 16-1-4:2010, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-4: Radio disturbance and immunity measuring apparatus – Antennas and test sites for radiated disturbance measurements*
CISPR 16-1-4:2010/AMD1:2012

CISPR 16-2-1:2014, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 2-1: Methods of measurement of disturbances and immunity – Conducted disturbance measurements*

CISPR 16-2-2:2010, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 2-2: Methods of measurement of disturbances and immunity – Measurement of disturbance power*

CISPR 16-2-3:2010, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 2-3: Methods of measurement of disturbances and immunity – Radiated disturbance measurements*

CISPR 16-2-3:2010/AMD1:2010

CISPR 16-2-3:2010/AMD2:2014

CISPR 16-4-2:2011, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainties, statistics and limit modelling*

instrumentation uncertainty
CISPR 16-4-2:2011/AMD1:2014

CISPR 32:2015, *Electromagnetic compatibility of multimedia equipment – Emission requirements*

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

IEC 60050-161:1990/AMD1:1997

IEC 60050-161:1990/AMD2:1998

IEC 60050-161:1990/AMD3:2014

IEC 60050-161:1990/AMD4:2014

IEC 60050-161:1990/AMD5:2015

IEC 60335-2-76:2002, *Household and similar electrical appliances – Safety – Part 2-76: Particular requirements for electric fence energizers*

IEC 60335-2-76:2002/AMD1:2006

IEC 60335-2-76:2002/AMD2:2013

IEC 61000-4-20:2010, *Electromagnetic compatibility (EMC) – Part 4-20: Testing and measurement techniques – Emission and immunity testing in transverse electromagnetic (TEM) waveguides*

IEC 61000-4-22:2010, *Electromagnetic compatibility (EMC) – Part 4-22: Testing and measurement techniques – Radiated emission and immunity measurements in fully anechoic rooms (FARs)*

3 Terms, definitions and abbreviated terms

3.1 General

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.2 General terms and definitions

3.2.1

equipment under test

EUT

equipment (devices, appliances and systems) subjected to EMC (emission) compliance tests

[SOURCE: CISPR 16-2-1:2014, 3.1.18]

3.2.2

reference ground

reference potential connecting point

Note 1 to entry: There can only be one reference ground in a conducted disturbance measurement system.

[SOURCE: CISPR 16-2-1:2014, 3.1.24]

3.2.3

reference ground plane

RGP

flat conductive surface that is used as a common reference and allows a defined parasitic capacitance to the surroundings of an EUT

Note 1 to entry: A reference ground plane is needed for conducted disturbance measurements, and serves as reference ground for the measurement of unsymmetric and asymmetric disturbance voltage.

[SOURCE: CISPR 16-2-1:2014, 3.1.25]

3.2.4

common mode absorption device

CMAD

device applied on cables leaving the test volume in radiated emission measurements to reduce the compliance uncertainty

[SOURCE: CISPR 16-1-4:2010, 3.1.4]

3.2.5

radio frequency

RF

frequency of the electromagnetic spectrum that is between the audio-frequency portion and the infrared portion

Note 1 to entry: The RF spectrum is generally accepted to be from 9 kHz to 3 000 GHz.

3.2.6

weighting (of e.g. impulsive disturbance)

pulse-repetition-frequency (PRF) dependent conversion (mostly reduction) of a peak-detected impulse voltage level to an indication that corresponds to the interference effect on radio reception

[SOURCE: CISPR 16-2-1:2014, 3.1.29]

3.3 Terms and definitions related to click analysis

3.3.1

switching operation

operation of opening or closing a switch or contact

Note 1 to entry: Switches can be mechanical (including electro-mechanical relays) or electronic (thyristors, transistors).

Note 2 to entry: Switching operations are used to control/enable the operation of a device/load (e.g. a motor or a heating element) and have the potential of generating discontinuous disturbances.

Note 3 to entry: Switching operations occur at a random rate (e.g. for the purpose of temperature control) or pre-determined rate (e.g. as part of automatic program controls).

Note 4 to entry: The occurrence of switching operations is not necessarily associated with the generation of disturbances classified as clicks (see 3.3.3 definition)

3.3.2

discontinuous disturbance

impulsive disturbance that appears as an abrupt and transitory increase of the disturbance level caused by switching operations

Note 1 to entry: The spectral density of discontinuous disturbances is broadband. Their subjective effect varies with repetition rate, duration and amplitude. These parameters are captured with suitable time domain instrumentation (e.g. disturbance analyser).

Note 2 to entry: Other impulsive disturbances appear as broadband (e.g. those generated by commutation in brush motors) but the repetition rate is higher than that typical of switching operations.

3.3.3

click

discontinuous disturbance, the amplitude of which exceeds the quasi-peak limit for continuous disturbance, the duration of which is not longer than 200 ms and which is separated from a subsequent disturbance by at least 200 ms, where the durations are determined from the signal which exceeds the i.f. reference level of the measuring receiver and for a click containing a number of impulses, the duration time is that from the beginning of the first to the end of the last impulse

Note 1 to entry: Examples of discontinuous disturbances which can be classified as clicks are shown in Figure 2. Examples of discontinuous disturbances which cannot be classified as clicks, are shown in Figure 3.

Note 2 to entry: Under certain conditions, some kinds of disturbances are considered as clicks even if they do not meet this definition (see 5.4.3).

3.3.4

i.f. reference level

corresponding value on the intermediate frequency output of the measuring receiver of an unmodulated sinusoidal signal which produces a quasi-peak indication equal to the limit for continuous disturbance

3.3.5

minimum observation time

T

minimum time necessary to permit the statistical interpretation of the disturbance caused by clicks or switching operations

3.3.6

click rate

N

in general the number of clicks or switching operations per minute

3.3.7

click limit

L_q

variable limit for discontinuous disturbances, which depends on the click rate N

Note 1 to entry: The click limit can be seen as a relaxation of the relevant quasi-peak limit for continuous disturbances and it is used for the assessment of discontinuous disturbances classified as clicks.

3.3.8

upper quartile method

statistical evaluation method for clicks

3.4 Terms and definitions related to types of ports

3.4.1

port

physical interface through which electromagnetic energy enters or leaves the EUT

Note 1 to entry: This standard does not define requirements for optical and wireless ports.

[SOURCE: CISPR 32:2015, 3.1.27, modified – Note 1 to entry modified]

3.4.2

mains port

port used for connection to the AC mains supply network

3.4.3

associated port

port used for connection of the EUT to an associated device

Note 1 to entry: Examples include ports for connection to loads, batteries, remote controls, EPS and other specific interfaces as RS-232, Universal Serial Bus (USB) and High-Definition Multimedia Interface (HDMI).

Note 2 to entry: These ports are used to transfer control signals, information, energy supply or a combination thereof.

Note 3 to entry: Wired network ports are not included in this definition.

3.4.4

wired network port

point of connection for voice, data and signalling transfers intended to interconnect widely dispersed systems by direct connection to a single-user or multi-user communication network

Note 1 to entry: Examples of these include CATV, PSTN, ISDN, xDSL, LAN and similar networks.

Note 2 to entry: These ports are connected to screened or unscreened cables and may carry AC or DC power where this is an integral part of the telecommunication specification

[SOURCE: CISPR 32:2015, 3.1.32, modified – Note 2 to entry modified]

3.4.5

fence port

output port of an electric fence energizer (high voltage)

3.4.6

enclosure port

physical boundary of the EUT through which electromagnetic fields may radiate

[SOURCE: CISPR 32:2015, 3.1.13]

3.5 Terms and definitions related to parts and devices connected to the EUT

3.5.1

terminal

conductive part that allows electrical connection at a port

Note 1 to entry: Terminals are fitted at the end of a cable (e.g. a plug, a connector) or directly at the enclosure of the EUT (a connector).

3.5.2

non-extendable wiring

arrangement whereby the length of electrical wire connected to a port cannot be easily increased by the user

EXAMPLE Non-extendable wiring are cables and leads that are:

- permanently attached to equipment or devices at both ends,
- attached using special tools,
- connected using couplers that are not generally available to members of the public,
- fitted with connectors specifically designed for use only with a particular model of equipment/apparatus,
- wiring whose length is established only after installation, e.g. air conditioning units.

3.5.3

associated device

apparatus part of the equipment (system) under test that is conductively connected to the EUT in order to exercise the operating functions covered by the EMC assessment

EXAMPLE Loads, controls, batteries, external power supplies and battery chargers.

Note 1 to entry: These devices can be essential or not for the operation of the EUT.

Note 2 to entry: Devices not part of the system under test are those that interface with the EUT for the purpose of transferring data and/or power (e.g. Ethernet, USB and similar devices).

3.5.4

external power controller

device or equipment which allows the user to directly control the power delivered to a load external to the EUT

EXAMPLE Controllers used to regulate the speed of motors or the movement of mechanical parts. The required settings are generally achieved by rotating knobs and/or pressing buttons. Regulation can be provided by a number of fixed or continuously adjustable settings.

3.5.5

external power supply

EPS

device having its own physical enclosure that converts power supplied by the AC mains into power at a different voltage

Note 1 to entry: The output voltage of the EPS can be either AC or DC.

3.6 Terms and definitions related to operating conditions

3.6.1

mains operated equipment

equipment which is not battery operated equipment

3.6.2

battery operated equipment

equipment which is operated only from batteries and cannot perform its intended function when connected to the AC mains supply, either directly or via an external power supply (EPS) unit

3.6.3

mains operation

condition where the equipment is powered from the AC mains supply either directly or via a dedicated external power supply to perform its intended function(s)

Note 1 to entry: Charging batteries from the AC mains supply is mains operation.

3.6.4

battery operation

condition where the equipment is powered only from batteries and there is no provision for the equipment to perform its intended function(s) when connected to the AC mains supply, either directly or via an external power supply (EPS) unit

3.6.5

operating mode

condition in which the equipment performs one or more of its intended function(s), as specified by the manufacturer

Note 1 to entry: The number of operating modes could be increased if an associated device can be used to expand the functionality of the equipment.

Note 2 to entry: A number of user selectable settings could be available within an operating mode (e.g. control of power or speed).

3.6.6

table-top EUT

equipment intended to be located on the top of a table or on a surface other than the floor

EXAMPLE Wall and ceilings are examples of surfaces other than the floor.

3.6.7

floor standing EUT

equipment that, according to its design and/or weight, usually stands on the floor while in use

3.7 Terms and definitions related to toys

3.7.1

toy

equipment designed for, or clearly intended for use in play by, children under 14 years old

Note 1 to entry: Toys can incorporate motors, heating elements, electronic circuits and their combination

Note 2 to entry: The supply voltage of a toy can be provided by a battery or by means of an adapter or a transformer connected to the AC mains supply.

Note 3 to entry: External power supplies and external chargers for toys are considered not to be part of the toy (see IEC 61558-2-7).

3.7.2

battery toy

toy which contains or uses one or more batteries as the only source of electrical energy

3.7.3

transformer toy

toy which is connected to the supply mains through a transformer for toys and using the supply mains as the only source of electrical energy

3.7.4

dual supply toy

toy which can be operated simultaneously or alternatively as a battery toy and a transformer toy

3.7.5

battery box

compartment which is separate from the toy or equipment and in which the batteries are placed

3.7.6

video toy

toy consisting of a screen and activating means by which the child can play and interact with the picture shown on the screen

Note 1 to entry: All parts necessary for the operation of the video toy, such as control box, joy stick, keyboard, monitor and connections, are considered to be part of the toy.

3.7.7

normal operation of toys

condition under which the toy, connected to the recommended power supply, is played with as intended or in a foreseeable way, bearing in mind the normal behaviour of children

3.7.8

experimental kit

collection of electric or electronic components intended to be assembled in various combinations

Note 1 to entry: The main aim of an experimental set is to facilitate the acquiring of knowledge by experiment and research. It is not intended to create a toy or equipment for practical use.

3.8 Other terms and definitions

3.8.1

clock frequency

fundamental frequency of any signal used in the EUT excluding those which are solely used inside integrated circuits (IC) and those used in radio transmitters or radio receivers

Note 1 to entry: High frequency signals are often generated inside integrated circuits (IC) by phase-locked-loop (PLL) circuits from lower clock oscillator frequencies outside the IC.

3.8.2

active electronic circuit

electronic circuit containing electronic components switching at a variable or fixed rate (switching/clock frequency)

Note 1 to entry: Active electronic circuits comprise components such as transistors, thyristors, digital ICs, microprocessors, and oscillators. An LED display circuit connected to a battery is not an active electronic circuit if the current is limited only by a resistor or by a transistor operating linearly, but it is an active electronic circuit if the current is pulsed.

Note 2 to entry: According to the switching rate and to the measurement bandwidth, the spectral distribution of the disturbance generated by active electronic circuits appears as either broadband or narrowband.

Note 3 to entry: Active electronic circuits are used to control switching operations as defined in 3.3.1 (e.g. by a microcontroller) but the two switching rates are fundamentally different.

3.8.3

robotic equipment

equipment capable of performing its intended use by changing its position or the position of its parts without human intervention

Note 1 to entry: The movements can be within a limited space, a pre-programmed space, or a space self-controlled by the equipment.

3.8.4

robotic cleaner

robotic equipment capable of performing the functions of a cleaner

EXAMPLE Robotic cleaners used to vacuum dust and dirt or to wash floors and windows.

Note 1 to entry: Robotic cleaners typically consist of two parts:

- a battery powered mobile part that performs the cleaning function (cleaning unit), and
- a stationary docking station which could, for example, provide battery charging, data processing and dust removal from the mobile cleaner.

3.9 Abbreviations

AC : Alternating current

AMN : Artificial Mains Network

DC : Direct current

EPS : External Power Supply

FAR : Fully Anechoic Room

OATS : Open Area Test Site

SAC : Semi Anechoic Chamber

RGP : Reference Ground Plane

RF : Radio Frequency
i.f.: intermediate frequency

4 Limits of disturbances

4.1 General

Radio disturbance limits are given in the frequency range 150 kHz to 1 000 MHz, with an extension down to 9 kHz for particular types of equipment.

If it is evident from the construction of the equipment that a certain measurement is not necessary, e.g. because the equipment has no source of disturbance, the equipment is deemed to comply with the requirements without testing.

4.2 Application of limits

The following Table 1 gives a reference to the limits applicable to the different types of equipment under the scope of this standard.

The table provides only a quick reference. The requirements detailed in the referenced clauses and other relevant clauses shall be applied.

Withdawn

Table 1 – Application of limits

	Disturbance voltage/current			Disturbance voltage	Disturbance Power ^c		Radiated dist.	Magnetic field	
	Continuous ^{a, f}			Clicks ^b					
Subclause	(4.3.2)	(4.3.3)		(4.4.2)	(4.3.4)		(4.3.4)	(4.3.2)	
Limits	Table 2	Table 5	Table 6	Text	Table 7	Table 8	Table 9	Table 3	Table 4
All equipment not listed below		•		•	•	•	•		
Tools			•	•	•	•	•		
Induction cooking appliances	•			•	•	•	•	•	•
Electric fence energisers ^d		•		•	•	•	•		
Toys Cat. A ^e									
Toys Cat. B							•		
Toys Cat. C							•		
Toys Cat. D		•		•	•	•	•		
Toys Cat. E		•		•	•	•	•		

^a Limits of Table 5 and Table 6 can also be applicable to discontinuous disturbances (see 4.4.2.2).

^b For exemption and exceptions see 5.4.3.

^c For mains operated equipment, if certain conditions are met, the disturbance power test may be applied in alternative to the radiated disturbance test (see 4.3.4.2 and Figure 4).

^d For electric fence energisers the disturbance voltage test is applied according to 4.3.3.5.

^e Toys of category A shall be deemed to comply with the requirements of this standard without testing.

^f For wired network ports, see 4.3.3.7.

4.3 Continuous disturbances

4.3.1 General

Continuous disturbances shall be assessed in accordance with the methods and limits of this subclause using the test equipment specified in 5.1.

NOTE Continuous disturbances can be either: broadband, caused by switching devices such as mechanical switches, commutators and semiconductor regulators; or narrowband, caused by electronic control devices such as microprocessors.

4.3.2 Frequency range 9 kHz to 30 MHz

The requirements and the tables contained in this subclause only apply to induction cooking appliances.

The measurement of disturbance voltage on the mains port of induction cooking appliances shall be made in accordance with Clause 5 and the corresponding limits are specified in Table 2.

The assessment of the radiated disturbances from induction cooking appliances in the frequency range 9 kHz to 30 MHz shall be made according to the test method and limits specified in Table 3.

In alternative the method and limits specified in Table 4 may be used for appliances having diagonal dimension up to 1.6 m.

Table 2 – Disturbance voltage limits for induction cooking appliances

Frequency range MHz	Appliances which are 100 V rated and without an earth connection		All other appliances	
	dB μ V Quasi-peak	dB μ V Average	dB μ V Quasi-peak	dB μ V Average
0,009 to 0,050	122	–	110	–
0,050 to 0,150	Decreasing linearly with logarithm of frequency from 102 to 92	–	Decreasing linearly with logarithm of frequency from 90 to 80	–
0,150 to 0,5	Decreasing linearly with logarithm of frequency from 72 to 62	62 to 52	66 to 56	56 to 46
0,5 to 5	56	46	56	46
5 to 30	60	50	60	50
The lower limit applies at the transition frequencies.				

Table 3 – Magnetic field strength limits

Frequency range MHz	Limits at 3 m distance ^{a, b} Quasi-peak dB μ A/m
0,009 to 0,070	69
0,070 to 0,150	Decreasing linearly with logarithm of frequency from 69 to 39
0,150 to 4,0	Decreasing linearly with logarithm of frequency from 39 to 3
4,0 to 30	3
^a The measurements are performed at 3 m distance with a 0,6 m loop antenna as described in 4.3.2 of CISPR 16-1-4:2010. ^b The antenna shall be installed vertically, with the lower edge of the loop at 1 m height above the floor.	

Table 4 – Limits of the magnetic field induced current

Frequency range MHz	Horizontal component ^{a,b} Quasi-peak dB μ A	Vertical component ^{a,c} Quasi-peak dB μ A
0,009 to 0,070	88	106
0,070 to 0,150	Decreasing linearly with logarithm of frequency from 88 to 58	106 to 76
0,150 to 30	Decreasing linearly with logarithm of frequency from 58 to 22	76 to 40
^a The measurement is performed using the 2 m loop antenna system (LAS) as described in 7.2 of CISPR 16-2-3:2010. ^b Current induced by the horizontal component of the magnetic field. ^c Current induced by the vertical component of the magnetic field.		

In any situation where it is necessary to verify the original measurement the measuring method originally chosen shall be used in order to ensure consistency of the results.

The test report shall state which method was used and which limits were applied.

4.3.3 Frequency range 150 kHz to 30 MHz

4.3.3.1 General

Disturbance voltages shall be measured in accordance with Clause 5 at each applicable port with respect to the reference ground. Disturbance currents shall be measured in accordance with Clause 5 on the relevant leads.

4.3.3.2 Mains port

The limits in columns 2 and 3 of Table 5 shall be met on the phase(s) and the neutral of the mains port of all equipment except for electric tools. For electric tools, see 4.3.3.4.

4.3.3.3 Associated port

On associated ports, either the disturbance voltage or the disturbance current measurement method may be selected, the limits given in columns 4 to 7 of Table 5.

However, these limits do not apply to:

- ports of equipment or associated devices that do not contain active electronic circuits or brush motors
- ports which connect to non-extendable wiring shorter than 2 m;
- ports connected to leads integrated in the suction hose of vacuum cleaners, even if the length exceeds 2 m;
- ports internal to the EUT (e.g. built-in batteries);
- ports which are not necessary for the intended functions of the EUT and which are not in operation during normal use (e.g. programming ports).

NOTE See also 5.2.3.1.

If a port can be configured to be either a mains port or another type of port, then the limits of Table 5 applicable to the type of port being tested shall be met.

4.3.3.4 Tools

For motor operated electric tools the limits for the mains port are given in Table 6.

The power ratings given in columns 2 to 7 of Table 6 relate only to the rated power P of the motor. The power taken by resistive loads of the EUT (for instance the power used by the heating elements in an electric blower for plastic welding) is disregarded for the purpose of selecting the limits.

For ports other than the mains port 4.3.3.3 shall apply.

4.3.3.5 Electric fences

For electric fence energizers the disturbance voltage limits apply to:

- a) the mains port on energizers designed for connection to the mains (columns 2 and 3 of Table 5);
- b) the battery port of battery operated energizers (columns 4 and 5 of Table 5), except that no disturbance voltage limits apply to this port if the external batteries are connected by non-extendable wiring shorter than 2 m;
- c) the fence port on all energizers (columns 4 and 5, or alternatively, columns 6 and 7 of Table 5)

Type D energizers, as defined in Clause 3 according to IEC 60335-2-76:2002/AMD1:2006/AMD2:2013, are measured as battery-operated energizers with connecting leads of at least 2 m in length between the energizer and the battery.

NOTE In practice, the fence wire can also act as an active source of disturbances, due to the high-voltage discharges, in particular to radio and telecommunication networks.

Manufacturers of electric fence energizers should instruct the users to avoid discharge points such as touching vegetation or broken fence wires.

4.3.3.6 Limits

The limits of Table 5 and Table 6 for the frequency range 150 kHz to 30 MHz apply to the conducted emissions from equipment other than induction cooking appliances.

Table 5 – General limits

Frequency range	Mains ports		Associated ports			
	Disturbance voltage		Disturbance voltage		Disturbance current	
1	2	3	4	5	6	7
MHz	Quasi-peak dB μ V	Average dB μ V	Quasi-peak dB μ V	Average dB μ V	Quasi-peak dB μ A	Average dB μ A
0,15 to 0,50	Decreasing linearly with the logarithm of the frequency from: 66 to 56		80	70	Decreasing linearly with the logarithm of the frequency from: 40 to 30	
	59 to 46				30 to 20	
0,50 to 5	56	46	74	64	30	20
5 to 30	60	50	74	64		
The lower limit applies at the transition frequencies.						
The test report shall state which test method was used and which limits were applied.						

Table 6 – Limits for mains port of tools

Frequency range	$P \leq 700 \text{ W}$		$700 \text{ W} < P \leq 1\,000 \text{ W}$		$P > 1\,000 \text{ W}$	
	2	3	4	5	6	7
MHz	Quasi-peak dB μ V	Average dB μ V	Quasi-peak dB μ V	Average dB μ V	Quasi-peak dB μ V	Average dB μ V
0,15 to 0,35	Decreasing linearly with the logarithm of the frequency from:					
	66 to 59	59 to 49	70 to 63	63 to 53	76 to 69	69 to 59
0,35 to 5	59	49	63	53	69	59
5 to 30	64	54	68	58	74	64
The lower limit applies at the transition frequencies.						
Key						
P = rated power of the motor only.						

If the quasi-peak measurements meet the average limit, the EUT shall be deemed to meet both limits and the measurements using the average detector need not be carried out.

4.3.3.7 Wired network ports

Wired network ports shall meet the requirements of CISPR 32 and the applicable disturbance limits for class B equipment in the frequency range 150 kHz to 30 MHz.

4.3.4 Frequency range 30 MHz to 1 000 MHz

4.3.4.1 General

Products and associated devices that do not contain active electronic circuits or brush motors are deemed to comply with the requirements of this standard in the frequency range 30 MHz to 1 000 MHz without testing. See also 4.1.

For mains operation, the assessment procedure of 4.3.4.2 shall be applied.

For battery operation, the assessment procedure of 4.3.4.3 shall be applied.

Equipment which is capable of both mains and battery operation shall be assessed in the mains operation mode only if all intended functions can be performed in this mode.

4.3.4.2 Mains operation

The EUT shall be assessed for emissions in the frequency range from 30 MHz to 1 000 MHz by testing in accordance with either method a) or b), see also Figure 4.

- a) The disturbance power limits in columns 2 and 3 of Table 7 for the frequency range from 30 MHz to 300 MHz shall be met by all equipment except for electric tools.

For electric tools the limits given in columns 4 to 9 of Table 7 apply. The power ratings given in columns 4 to 9 of Table 7 relate only to the rated power P of the motor. The power taken by resistive loads of the EUT (for instance the power used by the heating elements in an electric blower for plastic welding) is disregarded for the purpose of selecting the limits.

The EUT shall be also deemed to comply with the requirement of this standard in the frequency range from 300 MHz to 1 000 MHz without further testing if both conditions 1) and 2) below are fulfilled:

- 1) the disturbance power emission from the EUT is lower than the limits of Table 7 reduced by the values of Table 8;
- 2) the maximum clock frequency is less than 30 MHz

If either of the conditions 1) or 2) is not fulfilled, radiated measurements in the frequency range from 300 MHz to 1 000 MHz shall be performed and the limits of Table 9 for that range applied. In any case, the limits of Table 7 in the frequency range 30 MHz to 300 MHz shall be met.

- b) The limits for radiated disturbances in Table 9 for the selected test method shall be met.

NOTE The advantage of method b) is that the assessment in the frequency range 30 MHz to 1 000 MHz of equipment having leads in addition to the mains lead is done in one measurement only, whilst with method a) the leads, where applicable, have to be tested separately.

4.3.4.3 Battery operation

The EUT shall comply with the limits in Table 9 for the frequency range from 30 MHz to 1 000 MHz (see also Figure 5).

Battery operated remote controls used for equipment within the scope of this standard that do not use connecting cables need not be tested.

NOTE An example of the above would be a device that transmits infrared or ultrasonic signals to an air conditioning system. Such devices can be hand-held or mounted at a fixed position.

4.3.4.4 Disturbance power limits

The disturbance power limits in Table 7, and where relevant, in Table 8 shall be applied.

Table 7 – Disturbance power limits – 30 MHz to 300 MHz

Frequency range	General		Tools					
			$P \leq 700 \text{ W}$		$700 \text{ W} < P \leq 1\,000 \text{ W}$		$P > 1\,000 \text{ W}$	
1	2	3	4	5	6	7	8	9
MHz	Quasi-peak dBpW	Average dBpW	Quasi-peak dBpW	Average dBpW	Quasi-peak dBpW	Average dBpW	Quasi-peak dBpW	Average dBpW
30 to 300	Increasing linearly with the frequency from:							
	45 to 55	35 to 45	45 to 55	35 to 45	49 to 59	39 to 49	55 to 65	45 to 55
Key P = rated power of the motor only.								

If the quasi-peak measurements meet the average limit, the EUT shall be deemed to meet both limits and the measurements using the average detector need not be carried out.

Table 8 – Reduction applicable to Table 7 limits

Frequency range	General		Tools					
			$P \leq 700 \text{ W}$		$700 \text{ W} < P \leq 1\,000 \text{ W}$		$P > 1\,000 \text{ W}$	
1	2	3	4	5	6	7	8	9
MHz	Quasi-peak dBpW	Average dBpW	Quasi-peak dBpW	Average dBpW	Quasi-peak dBpW	Average dBpW	Quasi-peak dBpW	Average dBpW
200 to 300	Increasing linearly with the frequency from:							
	0 to 10	0	0 to 10	0	0 to 10	0	0 to 10	0
NOTE This table only applies if method a) specified in 4.3.4.2 is followed.								

4.3.4.5 Radiated disturbance limits – 30 MHz to 1 000 MHz

The radiated disturbances limits, as specified in Table 9, shall be applied according to the selected test method.

Table 9 – Radiated disturbance limits and testing methods – 30 MHz to 1 000 MHz

Testing method	Basic standard	Frequency range MHz	Limit ^a Quasi-peak dB μ V/m	Remarks
OATS or SAC ^b	CISPR 16-2-3	30 to 230 230 to 1 000	30 37	Measurement distance 10 m
FAR ^c	CISPR 16-2-3	30 to 230 230 to 1 000	42 to 35 ^d 42	Measurement distance 3 m
FAR ^c	IEC 61000-4-22	30 to 230 230 to 1 000	42 to 35 ^d 42	Measurement distance 3 m
TEM-Waveguide ^e	IEC 61000-4-20	30 – 230 230 – 1 000	30 37	–
^a The lower limit is applies at the transition frequency. ^b Measurements may be made at closer distance, down to 3 m. An inverse proportionality factor of 20 dB per decade shall be used to normalize the measured data to the specified distance for determining the limit. In this case the recommendations of the CISPR basic standards shall be considered when testing large EUT at frequency approaching 30 MHz, due to near field effects. ^c All equipment shall be measured within the test volume as described in 5.3.4.3 and shown in Figures 12 to 19. ^d Decreasing linearly with the logarithm of the frequency. ^e The TEM waveguide method shall be limited to battery operated EUT without cables attached and with a maximum size according to 6.2 of IEC 61000-4-20:2010 (the largest dimension of the enclosure is equal to the wavelength at the maximum measurement frequency, 300 mm at 1 GHz). The test report shall state which test method was used and which limits were applied.				

Any of the measurement methods mentioned in Table 9 may be selected by the manufacturer to assess the EUT (see Figure 4 and Figure 5).

In any situation where it is necessary to verify the original measurement, the measuring method and measuring distance originally chosen shall be used in order to ensure consistency of the results.

4.4 Discontinuous disturbances

4.4.1 General

Discontinuous disturbances shall be assessed when they exceed the limits for continuous disturbances, using the test equipment specified in 5.1. See Annex C for further guidance.

4.4.2 Limits

4.4.2.1 The limits for discontinuous disturbances identified as clicks are based on quasi-peak disturbance voltage measurements on the mains port. These limits only apply in the frequency range 150 kHz to 30 MHz.

NOTE The level of disturbances below 30 MHz is interpreted as an indication for the level above 30 MHz.

The limits for discontinuous disturbance depend on the disturbance characteristics and on the click rate N , as given in detail in 4.4.2.2 and 4.4.2.3.

4.4.2.2 The limits of Table 5 apply without relaxations to discontinuous disturbances from equipment that produces:

- disturbances other than clicks, or
- clicks with a click rate N equal to or greater than 30.

NOTE Examples of discontinuous disturbances for which the limits for continuous disturbance apply are shown in Figure 3.

4.4.2.3 The click limit L_q is calculated by increasing the relevant quasi-peak limit L for continuous disturbances (as given in Table 5 column 2) by:

$$\begin{array}{ll} 44 \text{ dB} & \text{for } N < 0,2, \text{ or} \\ 20 \lg (30/N) \text{ dB} & \text{for } 0,2 \leq N < 30 \end{array}$$

The click limit L_q applies for click rates calculated in 5.4.2.

Table B.1 contains a list of equipment for which the click rate N may be derived from counting the number of switching operations.

5 Test equipment and methods of measurement

5.1 Test equipment

5.1.1 General

The instruments and devices specified in 5.1 shall be used in accordance with the methods of measurement specified in 5.2 and 5.3.

5.1.2 Measuring receivers

Receivers with quasi-peak detectors shall be in accordance with Clause 4 of CISPR 16-1:2015; receivers with average detectors shall be in accordance with Clause 6 of CISPR 16-1:2015.

NOTE 1 Both detectors are generally incorporated in a single receiver.

NOTE 2 Some measuring receivers contain, beside the average detector according to the specification in CISPR 16-1-1, a linear average detector which can give a different indicated result.

5.1.3 Artificial Mains Network (AMN)

Where this standard specifies the use of an AMN, the artificial mains V-network $50\ \Omega/50\ \mu\text{H}$ (or $50\ \Omega/50\ \mu\text{H} + 5\ \Omega$) as defined in Clause 4 of CISPR 16-1-2:2014 shall be used.

The connection between the AMN and the measuring receiver shall be made by means of a coaxial cable with a characteristic impedance of $50\ \Omega$.

The AMN shall be bonded to the RGP by a low RF impedance connection according to CISPR 16-2-1.

During all measurements of disturbance voltage and disturbance current (on the mains port or on associated ports) the mains port of the EUT shall be connected to the EUT port of an AMN in order to provide a defined termination.

5.1.4 Voltage probe

Where this standard specifies the use of a voltage probe, the device shall be as defined in 5.2 of CISPR 16-1-2:2014. If the impedance of the probe is too low, thus affecting the operation of the EUT, more suitable values of its components shall be chosen (for example $15\ \text{k}\Omega$ in series with $500\ \text{pF}$).

The readings shall be corrected according to the voltage division factor between the probe and the measuring instrument set. For this correction factor, only the resistive parts of the impedances shall be taken into account.

5.1.5 Current probe

The current probe shall be in accordance with 5.1 of CISPR 16-1-2:2014.

5.1.6 Artificial hand

In order to simulate the influence of the user's hand, the application of the artificial hand is required for hand held equipment during the disturbance voltage and disturbance current measurement.

The artificial hand consists of metal foil connected to the reference ground through a RC element consisting of a capacitor of $(220 \pm 44)\ \text{pF}$ in series with a resistor of $(510 \pm 51)\ \Omega$ (see Figure 12 and Clause 8 of CISPR 16-1-2:2014 for constructive details). The RC element of the artificial hand may be incorporated in the housing of the AMN.

5.1.7 Disturbance analyser for discontinuous disturbance

The measuring equipment for discontinuous disturbances shall comply with Clause 9 of CISPR 16-1-1:2015. Alternative instrumentation may be used as long the test system fulfills the verification procedure according to Clause 9 of CISPR 16-1-1:2015. For example, FFT-based receivers may be suitable and the use of an intermediate frequency may not be necessary.

For the measurement of the duration of the disturbance an alternative method using an oscilloscope may be applied provided that the degree of accuracy is sufficient, (see Annex C and CISPR 16-1-1).

5.1.8 Absorbing clamp

The absorbing clamp shall be in accordance with Clause 4 of CISPR 16-1-3:2004.

The transducer factor used for measurements with the absorbing clamp shall result from a calibration according to CISPR 16-1-3:2004, B.2.1 (original method).

5.1.9 Radiated emission test sites

The measurement instrumentation, including antennas and test sites shall be compliant with the relevant requirements for the test method selected according to 4.3.4.5.

Common mode absorption devices (CMAD) shall be constructed and validated according to CISPR 16-1-4.

5.2 Conducted disturbances set-up and measurements

5.2.1 Arrangement of the EUT

5.2.1.1 EUT operated without an earth connection and not held by the hand

Table-top EUT shall be placed:

- at a distance of $(0,4 \pm 0,05)$ m from a RGP of at least $2\text{ m} \times 2\text{ m}$ in size;
- at a distance of 0,8 m from the AMN, and
- shall be kept at least 0,8 m from any other earthed conducting surface.

The RGP shall be either horizontal or vertical.

Floor standing EUT shall be:

- placed at a height of $(0,12 \pm 0,04)$ m above a horizontal RGP of at least $2\text{ m} \times 2\text{ m}$ in size,
- placed at a distance of 0,8 m from the AMN,
- kept at least 0,8 m from any other earthed conducting surface, and
- placed in a manner to ensure that the RGP extends at least 0,5 m beyond the EUT boundaries

Parts supporting the EUT and its parts at the required height shall be made of non-conductive material.

5.2.1.2 EUT without an earth connection and held by hand during operation

5.2.1.2.1 The EUT shall be arranged in accordance with 5.2.1.1, with the addition of the artificial hand described in 5.1.6 and according to the requirements provided in 5.2.1.2.

5.2.1.2.2 The artificial hand shall be applied only on the handles, grips and those parts of the EUT specified as such by the manufacturer. Where no information is provided by the manufacturer's specification, the application of the artificial hand shall follow the general principle that the foil shall be wrapped around all handles, both fixed and detachable, supplied with the EUT. The terminal M of the RC element (see Figure 7) shall be connected to any exposed non-rotating metalwork as specified in 5.2.1.2.3 to 5.2.1.2.7.

5.2.1.2.3 Metalwork that is covered with paint or lacquer is considered as exposed metalwork and shall be directly connected to the terminal M.

5.2.1.2.4 When the enclosure of the EUT is entirely made of metal, no metal foil is required and the terminal M shall be connected directly to the metal enclosure.

5.2.1.2.5 When the enclosure of the EUT is of insulating material, the metal foil shall be wrapped round the handles, e.g. in Figure 8, around handle B, and also round the second handle D, if present. Also metal foil 60 mm wide shall be wrapped round the body C at that point where the iron core of the motor stator is located, or around the gearbox if this gives a

higher disturbance level. All these pieces of metal foil, and the ring or bushing A, if present, shall be connected together and to the terminal M of the RC element.

5.2.1.2.6 When the enclosure of the EUT is partly metal and partly insulating material, and has insulating handles, metal foil shall be wrapped round the handles, as handles B and D in Figure 8. If the case is non-metallic at the location of the motor, a metal foil 60 mm wide shall be wrapped round the body C at that point where the iron core of the motor stator is located, or alternatively around the gearbox, if this is of insulating material and a higher disturbance level is obtained. The metal part of the body, the point A, the metal foil round the handles B and D and the metal foil on the body C shall be connected together and to the terminal M of the RC element.

5.2.1.2.7 When a class II EUT has two handles of insulating material A and B and a case of metal C, for example an electric saw (Figure 9), metal foil shall be wrapped round the handles A and B. The metal foil at A and B and the metal body C shall be connected together and to the terminal M of the RC element.

NOTE Classes 0, I, II and III are according to IEC 61140.

5.2.1.3 EUT with an earth connection

EUT shall be arranged in accordance with 5.2.1.1

5.2.2 Arrangement of the leads at the ports of the EUT

5.2.2.1 Mains port

The disturbance voltage measurements at the mains port are normally made at the plug end of the mains lead.

If the mains lead of the EUT is longer than necessary to be connected to the AMN, the length of this lead in excess of 0,8 m shall be folded back and forth parallel to the lead so as to form a bundle with a length between 0,3 m and 0,4 m (see Figure 10).

In the case of controversy it shall be replaced by a lead of similar type with a length of 1 m.

If the mains lead is shorter than the required distance between the EUT and the AMN, it shall be extended, or replaced, by a cable of similar type having the same number of wires and of the necessary overall length.

If the mains lead of the EUT includes an earth conductor (protective or functional earth), the plug end of the earth conductor shall be connected to the AMN reference ground.

Where an earth conductor is required, but it is not included in the lead, the connection of the earth terminal of the equipment to the AMN reference ground shall be made by a lead not longer than necessary to be connected to the AMN and running parallel to the mains lead at a distance of not more than 0,1 m from it.

If the equipment is not supplied with a lead, it is to be connected to the AMN by a lead not longer than 1 m (also in case of plug or socket-outlet).

The mains lead shall be led downward along the EUT to the level of the non-conductive support and then straight to the AMN.

5.2.2.2 Associated port

Leads attached to associated ports shall be treated in accordance with 5.2.3.2, except where otherwise stated in this standard.

5.2.2.3 Wired network port

CISPR 32 provides the measuring procedure and arrangement for leads connected to wired network ports.

5.2.3 Arrangement of EUT having associated devices

5.2.3.1 General

When the associated device is not essential to the operation of the equipment and has a separate test procedure specified elsewhere in this standard, this sub-clause does not apply. The main unit shall be tested as individual equipment.

Conducted emission measurements are not required when the connecting lead between the EUT and the associated device is non-extendable and is either shorter than 2 m, or if it has a shielding whose ends are connected to a ground layer, a metal plate or the metal enclosure on both the EUT and the associated device.

The connections of the shield mentioned above should offer low impedance to high frequency currents (e.g. a short wire or a suitable capacitor).

The measurement of the disturbance voltage or disturbance current on non-extendable leads longer than 2 m shall be started at a frequency according to the following formula, but without going below 150 kHz:

$$f_{\text{start}} = \frac{60}{L}$$

where

f_{start} is the start frequency in MHz for the measurement;

L is the length in m of the connecting lead between the EUT and the associated device.

NOTE This calculation is based on the assumption that a lead is not an efficient emitter at frequencies whose wavelength is longer than five times its length.

5.2.3.2 Measuring arrangement

The EUT shall be arranged in accordance with 5.2.1 and 5.2.2.1 with the following additional requirements:

- Associated devices shall be placed at a distance from the RGP following the same principles used for the main EUT (i.e. depending whether the device is floor standing or table top equipment).
- For associated leads delivered to the end user together with the EUT, the measurements shall be performed with the original lead;

If an associated lead is not delivered to the end user together with the EUT but the manufacturer specifies for it a length shorter than 10 m, the measurements shall be performed with a lead having the maximum specified length;

If the manufacturer gives no information about the length of the associated lead to be used or if the manufacturer specifies that the length of the associated lead may be longer than 10 m, the measurements shall be performed with a lead having a length of at least 10 m;

From the point of connection to the EUT the associated lead goes vertically down to the required height, horizontally to the associated devices and vertically to the point of connection at the associated devices;

Where bundling is required, the lead shall be folded back and forth for a length of 0,3 m to 0,4 m, as shown in Figure 10.

The associated lead should be routed in the opposite direction to the main lead.

The arrangement and operation of an associated device shall not unduly affect the disturbance level of the EUT.

- c) If an EUT having an associated device is earthed, no artificial hand shall be connected. If the EUT itself is made to be held by the hand, the artificial hand shall be connected to the EUT and not to any associated device;
- d) If the EUT is not intended to be held by the hand, the associated device which is not earthed and is intended to be held by the hand shall be connected to the artificial hand. If the associated device is not intended to be held by the hand either, it shall be placed above the RGP as described in 5.2.1.1;

When the disturbance current method is used, the probe shall clamp together the leads connected to the same port, in order to cancel out the effect of differential mode currents. Where the leads cannot fit in the current probe, they may be separated, but still aiming to clamp both the send and return currents. Each group of leads, as relevant, shall be identified in order to be tested separately according to the measurement procedure described in 5.2.3.3.

For voltage probe measurements, the associated device shall be placed at a distance of $(0,8 \pm 0,05)$ m from the EUT. If an associated lead is shorter than 0,8 m the associated device shall be placed at the furthest possible distance from the main EUT.

For current probe measurements, the current probe shall be placed at a distance of $(0,3 \pm 0,03)$ m from the port to be tested. In this case the associated device shall be placed at a distance of $(0,8 \pm 0,05)$ m from the current clamp.

NOTE When using the current clamp the distance is approximately 1,1 m between EUT and AE.

5.2.3.3 Measuring procedure

Unless specified elsewhere in this standard, in addition to the measurement on the mains port, measurements are made on each associated port to be connected to leads (e.g. control and load lines) using a probe selected between those described in 5.1.4 (see Figure 11) and 5.1.5.

The associated device is connected to allow measurements to be made under all provided operating conditions and during interactions between the main EUT and the associated device.

When using the voltage probe the above measurements are performed both on the ports of the EUT and on those of the associated device. If using the current probe measurement is used the measurement shall be done on the EUT port only.

5.3 Radiated disturbances set-up and measurements

5.3.1 General

Subclause 5.3 describes the general requirements for the measurements of radiated disturbances.

5.3.2 Magnetic field strength – 9 kHz to 30 MHz

The measurement of radiated disturbances in the frequency range 9 kHz to 30 MHz shall be made in accordance with CISPR 16-2-3.

5.3.3 Disturbance power – 30 MHz to 300 MHz

5.3.3.1 General

The disturbance power is measured on the cables attached to the ports of the EUT according to Clause 7 of CISPR 16-2-2:2010 and the methods described in this standard.

It is generally considered that for frequencies above 30 MHz radio interference energy is propagated by radiation. Experience has shown that the disturbing energy is mostly radiated by the part of the mains leads and other leads near the EUT. It is therefore agreed to define the disturbing capability of an EUT as the RF power it could supply to its leads. This power is nearly equal to that transferred by the EUT to a suitable absorbing device (absorbing clamp) placed around these leads at the position where the absorbed power is at its maximum.

5.3.3.2 Measurement procedure for the mains port

5.3.3.2.1 The distance between the clamp test set-up (the EUT, the mains lead and the absorbing clamp) and any other conductive objects (including persons, walls and ceiling, but excluding the floor) shall be at least 0,8 m. The EUT shall be placed on a non-metallic support parallel to the floor.

The height of the support (e.g. pallet) shall be $(0,12 \pm 0,04)$ m for floor standing EUT and $(0,8 \pm 0,05)$ m for table-top EUT.

The lead under test shall be placed in a straight line at a height of $(0,8 \pm 0,05)$ m from the floor for a length specified in 5.3.3.2.2.

5.3.3.2.2 The straight portion of the lead under test should be about 6 m long, this being equal to $(\lambda_{\max}/2 + 1)$ m in order to allow at any time the positioning of the absorbing clamp and a possible second clamp for additional isolation.

Mains leads that are shorter than the necessary length shall be extended and any plug or socket that cannot pass through the absorbing clamp due to its size shall be removed. In order to meet the above requirements, the lead can be replaced with one of the required length and similar type.

NOTE $\lambda_{\max}$ is the wavelength corresponding to the lowest frequency at which measurements are to be made for instance 10 m at 30 MHz.

5.3.3.2.3 The absorbing clamp shall be clamped around the lead under test and, at each test frequency, moved along the lead in order to find the position that gives the maximum indication. The maximum value is found between a position adjacent to the EUT and a distance of about a half-wavelength from it.

NOTE The maximum can occur at a distance close to the equipment.

5.3.3.2.4 If the RF isolation between mains supply and the input of the absorbing clamp on the side of the EUT appears to be insufficient, a fixed ferrite clamp should be placed along the lead at a distance of about 6 m from the EUT. This improves the stability of the loading impedance and further reduces extraneous noise coming from the mains supply. For more information see Clause 4 of CISPR 16-1-3:2004.

5.3.3.3 Measurement procedure for ports other than the mains port

5.3.3.3.1 Test set-up

The main EUT, the lead under test and the absorbing clamp shall be arranged following the principles described in 5.3.3.2.

Leads normally extendable by the user, for instance with a loose end or fitted with a easily replaceable plug or socket on one or both ends, shall be extended to a length of about 6 m in accordance with 5.3.3.2.2. Any plug or socket which will not pass through the absorbing clamp due to its size shall be removed.

If the lead connected to the port is non-extendable and:

- shorter than or equal to 0,25 m, measurement need not be made on it;

- is longer than 0,25 m but shorter than twice the length of the absorbing clamp, it shall be extended to twice the length of the absorbing clamp;
- is longer than twice the length of the absorbing clamp, measurements shall be made on it.

In order to meet the above requirements, the lead can be replaced with one of the required length and similar type.

When the associated device connected at the end of the lead is not essential for the operation of the main EUT and a separate test procedure for it is specified elsewhere in this standard, only the lead, but not the associated device, shall be connected. However, all measurements on the main EUT in accordance with 5.3.3.3.2 shall be made.

5.3.3.3.2 Measurement procedure

Measurement of the disturbance power shall be made firstly on the mains lead (if applicable) of the main EUT using the absorbing clamp in accordance with 5.3.3.2. Any lead connecting the main EUT to an associated device is disconnected, if this does not affect the operation of the main EUT; otherwise it is isolated by means of ferrite rings (e.g. an additional absorbing clamp or a CMAD) placed close to the main EUT.

Secondly, a similar measurement shall be made on each lead which is or may be connected to an associated device, whether or not it is essential for the operation of the EUT; the current transformer of the clamp pointing towards the main EUT. Isolation, or disconnection of the mains lead and other leads is made in accordance with the above paragraph.

NOTE For permanently connected short leads the movement of the clamp (as described in 5.3.3.2.2) is limited by the length of the lead.

In addition, measurements shall be made as above but with the current transformer of the clamp pointing towards any associated device, unless this device is not essential for the operation of the main EUT and a separate test procedure for it is specified elsewhere in this standard (no disconnection or RF isolation of other leads is of course necessary in this case).

5.3.4 Radiated emission – 30 MHz to 1 000 MHz

5.3.4.1 General

Except for the setup requirements specified in 5.3.4.3, the measurement methods used for measuring radiated emissions from the enclosure port of equipment shall be in conformity with the relevant requirements of one of the basic standards listed below:

- CISPR 16-2-3, if the test is made using either an open area test site (OATS), a semi anechoic absorber-lined shielded enclosure (SAC) or a fully absorber-lined shielded enclosure (FAR) validated according to CISPR 16-1-4;
- IEC 61000-4-20, if the test is made using a Transverse Electromagnetic (TEM)-Waveguide;
- IEC 61000-4-22, if the test is made in a FAR according to IEC 61000-4-22.

5.3.4.2 Measurement instrumentation

The measurement instrumentation, including antennas and test sites shall be compliant with the relevant requirements for the different methods as described in CISPR 16-1-1, CISPR 16-1-4, IEC 61000-4-20 or IEC 61000-4-22, as applicable. Common mode absorption devices (CMADs) shall be constructed and validated according to CISPR 16-1-4.

5.3.4.3 Test set-up for radiated emission measurements

5.3.4.3.1 General

The boundary of the EUT is defined by an imaginary circle encompassing the EUT. The centre of this imaginary circle shall be at the same position as the centre of the turntable (see Figure 12).

The distance from the receive antenna reference point to the boundary of the EUT shall be the measurement distance as required by the limits used (see 4.3.4.5).

If ancillary equipment is needed to operate the EUT, this ancillary equipment is not part of the EUT and its radiated emissions shall not influence the test results e.g. by placing it outside the screened room.

Table-top EUT shall be placed at $(0,8 \pm 0,05)$ m above the reference plane of the test site selected for measurement (see Figure 13 and Figure 14).

Floor standing EUT shall be placed at $(0,12 \pm 0,04)$ m above the reference plane of the test site selected for measurement (see Figure 16).

Parts supporting the EUT and its parts at the required height shall be made of non-conductive material.

Where the EUT comprises multiple parts, these shall be arranged to minimise, as far as it is reasonably practical, the test volume. A minimum distance of 0,1 m shall be maintained between these parts (see Figure 17 and Figure 18).

Where the test set-up of particular equipment is not fully covered by this standard, the set-up shall be determined by referring to the basic standard relevant to the test method selected for measurement.

5.3.4.3.2 Cables

All cables, both signal and power, are covered in this subclause.

Retractable cables on reel cords or in cable compartments shall be fully extracted and bundled as appropriate.

For cables leaving the test volume:

- Mains cables shall be routed directly from the EUT vertically to the floor (see Figure 13, Figure 14, Figure 16, Figure 17 and Figure 18 as examples).
- If more than one cable is connected to the EUT and leaves the test volume, then all other cables shall be routed together with the nearest mains cable to the floor. These cables shall be routed first down to the supporting surface and then around the periphery of the EUT using the shortest possible path to the nearest mains cable (see Figure 15 as an example).
- At the point where each cable reaches the ground plane (or leaves the test volume in the FAR) it shall be taken through a CMAD. Each cable shall be routed through a single CMAD separately (see Figure 13 to Figure 18 as example). If more than three cables are leaving the test volume only the mains cable(s) shall be routed through CMADs.
- When measuring in a FAR, at least 0,8 m of cables leaving the test volume shall be visible from the antenna reference point (see Figure 19).

For cables terminating within the test volume:

- Interconnecting cables shall be routed between EUT units in the shortest possible way. Any excess length of each cable shall be separately bundled in a serpentine fashion at the approximate centre of the cable with the bundle 0,3 m to 0,4 m in length (see Figure 17 and Figure 18 as example).

5.4 Measurement procedures and interpretation of results

5.4.1 Continuous disturbance

5.4.1.1 If the disturbance level is fluctuating, the reading shall be observed for about 15 s for each measurement and the highest readings recorded, except that any isolated spike shall be ignored. If the disturbance level is stable, it is not necessary to measure for 15 s.

5.4.1.2 If the level of the disturbance is not steady, but shows a continuing rise or fall of more than 2 dB in the 15 s period, then the disturbance measurement shall be performed in accordance with the conditions of normal use of the equipment, as follows:

- a) If in normal use the equipment may be switched on or off frequently, for instance an electric drill or a sewing-machine, then when performing tests, at each frequency of measurement the EUT shall be switched on just before each measurement, and switched off just after each measurement; the maximum level obtained during the first minute at each frequency of measurement shall be recorded;
- b) if in normal use the equipment runs for longer periods, for instance a hair-dryer, then it shall remain switched on for the entire test period, and at each frequency the level of disturbance shall be recorded only after a steady reading (subject to the provision of 5.4.1.1) has been obtained. For such equipment the starting phase, generally lasting few seconds, shall be ignored.

5.4.1.3 The disturbance voltages or disturbance currents shall be assessed throughout the frequency range for which limits are specified.

An initial survey or scanning of the complete frequency range shall be made.

Quasi-peak and average values shall be given for the significant maxima of the measured Peak envelope (i.e. above or nearer the limit).

5.4.1.4 Where disturbance power is assessed, measurements shall be made throughout the frequency range 30 MHz to 300 MHz.

The same principles as 5.4.1.3 shall be used; however the maximization procedure of the absorbing clamp method shall also be applied.

5.4.1.5 Where only the radiated emission is assessed, measurements shall be made throughout the frequency range 30 MHz to 1 000 MHz. Alternatively, in accordance with 4.3.4.2, disturbance power measurements may be made throughout the frequency range 30 MHz to 300 MHz and radiated emission measurements made throughout the frequency range 300 MHz to 1 000 MHz.

The same principles as 5.4.1.3 shall be used; however, the maximization procedure of the selected radiated measurement method shall also be applied.

5.4.1.6 When the equipment contains only commutator motors as source of disturbance, average detector measurements does not need to be carried out.

5.4.2 Discontinuous disturbance

5.4.2.1 Observation time

The minimum observation time T shall be determined at both frequencies specified for determining the click rate N and according to the equipment operation, as follows:

- a) If the EUT does not stop automatically, T is the shorter time of either:
 - the time in minutes to register 40 clicks, or, where relevant, 40 switching operations, or
 - 120 min
- b) If the EUT does stop automatically, T is:
 - the sum of the durations of the minimum number of complete programmes necessary to produce 40 clicks or, where relevant, 40 switching operations; or
 - if after 120 min from the beginning of the test 40 clicks or, where relevant, 40 switching operations have not been recorded, the sum of the durations of the minimum number of complete programmes that exceeds 120 min.

If the measurement of the clicks is carried out simultaneously at 150 kHz and 500 kHz, it is sufficient to register 40 clicks at one of the frequencies.

The interval between the end of one programme and the start of the next programme shall be excluded from the minimum observation time, except for those EUT for which an immediate re-start is inhibited. For such EUT, the minimum time required to re-start the programme shall be included in the minimum observation time.

5.4.2.2 Click rate

The click rate N shall be determined:

- a) under the operating conditions specified in Clause 6, unless specific operating conditions are given in Annex A;
- b) at 150 kHz and 500 kHz. The click rate determined at 500 kHz shall also be used for the analysis at 1,4 MHz and 30 MHz

The receiver input attenuation shall be set such that an input signal equal in amplitude to the limit L for continuous disturbance is within the dynamic range of the receiver.

It is recommended that the dynamic range of the receiver begins at least 10 dB below the limit L for continuous disturbance. See Clause 9 of CISPR 16-1-1:2015 for more details.

The click rate N is in general the number of clicks per minute determined from the formula $N = n_1/T$, where n_1 is the number of clicks during the observation time T minutes.

In alternative, for certain equipment the click rate N may be determined from the formula $N = n_2 \times f/T$, where n_2 is the number of switching operations during the observation time T and f is a factor depending on the particular equipment, as given in Annex B Table B.1.

For equipment for which Annex A and Annex B permit this alternative, the choice of the method for determining the click rate is the responsibility of the manufacturer. The factor f is only applicable when the second method is used.

5.4.2.3 Test frequencies

The measurement of disturbance generated by switching operations shall be performed with the same programme as has been chosen when determining the click rate N at the following restricted number of frequencies:

150 kHz, 500 kHz, 1,4 MHz and 30 MHz.

5.4.2.4 Upper quartile method

The EUT is assessed for compliance with the limit L_q in accordance with the upper quartile method, for a time not less than the minimum observation time T .

If the click rate N is determined from the number of clicks, the EUT shall be deemed to comply with the limit if not more than a quarter of the number of clicks registered during the observation time T exceeds the click limit L_q .

If the click rate N is determined from the number of switching operations, the EUT shall be deemed to comply with the limit if not more than a quarter of the number of switching operations registered during the observation time T produce clicks exceeding the click limit L_q .

NOTE 1 See Annex C for guidance on the measurement of discontinuous disturbance.

NOTE 2 An example of the use of the upper quartile method is given in Annex D.

5.4.3 Exceptions from the click definition

5.4.3.1 General

Under certain conditions, some kinds of discontinuous disturbances are exempted from the definition of a click and the measurement procedure shall be able to verify these occurrences.

Figure 6 is a flow chart that shows how to consider these conditions in the verification procedure.

Even if not shown in the flow chart, the verification procedure of this subclause 5.4.3 shall be followed when a second measurement is needed in order to apply the upper quartile method.

5.4.3.2 Individual switching operations

Individual switching operations are caused by infrequent operations of a switch which is part of the equipment either by direct or remote activation.

NOTE These switching operations have the potential to cause discontinuous disturbances but are disregarded because infrequent.

Examples of individual switching operations are those for:

- a) the purpose of mains connection or disconnection only;
- b) the purpose of programme selection only;
- c) the control of energy or speed by switching between a limited number of fixed positions;
- d) the changing of the manual setting of a continuously adjustable control such as a variable speed device for water extraction or electronic thermostats;

Any disturbance caused by individual switching operations shall be disregarded for the purpose of testing the EUT for compliance with the limits of radio disturbance set out in this standard.

Examples of switches covered by this subclause are the on/off switches for apparatus (including foot activated), manual switches for heat and airflow control in fan heaters and hair dryers, as well as the indirectly operated switch in a cupboard, wardrobe or refrigerator, and sensor-operated switches, etc.

Also the disturbance caused by the operation of any switching device or control which is included in an equipment for the purpose of mains disconnection for safety only is to be

disregarded for the purpose of testing the equipment for compliance with the limits of radio disturbance as described in this standard.

The requirements of this subclause 5.4.3.2 shall not be applied to switches which are intended to be repeatedly operated (e.g. for sewing machines and soldering equipment).

5.4.3.3 Combination of disturbances in a time frame less than 600 ms

A series of discontinuous disturbances within a time frame less than 600 ms, having amplitudes that exceed the limits for continuous disturbances and which do not meet the definition of click, may be considered as one click. This exception may be applied:

- once per program cycle, for program controlled equipment, or
- once per minimum observation time, for all other equipment.

The same may also be applied to thermostatically controlled three-phase switches, causing three disturbances sequentially in each of the three phases and the neutral.

5.4.3.4 Instantaneous switching

Equipment fulfilling all of the following conditions is deemed to comply with the click requirements, regardless of the amplitude of the clicks.

- the click rate is not more than 5;
- none of the caused clicks has a duration longer than 20 ms;
- 90 % of the caused clicks have a duration less than or equal to 10 ms.

These conditions shall be verified at one frequency only, 150 kHz or 500 kHz, at which the higher click rate occurs.

If any of these conditions is not satisfied then the general assessment in accordance with 5.4.2 applies.

5.4.3.5 Separation less than 200 ms

For equipment which have a click rate less than 5, any two disturbances, each having a maximum duration of 200 ms, shall be evaluated as two clicks even when the separation between the disturbances is less than 200 ms. After using this exemption, the click rate shall remain less than 5. In this case, for instance observed with refrigerators, the second example shown in Figure 3, would be evaluated as two clicks and not as continuous disturbance.

5.4.3.6 Thermostatically controlled three-phase switches

For thermostatically controlled three-phase switches, the three disturbances caused sequentially in each of the three phases and the neutral shall, independent of their spacing, be evaluated as three clicks and not as continuous disturbance if the following conditions are met:

- a) the switch does not operate more than once in any 15 min period;
- b) the duration of the disturbance caused by the opening or closing of any one of the contacts shall be 20 ms or less;
- c) not more than a quarter of the number of the clicks caused by switching operations registered during the observation time exceed the level of 44 dB above the relevant limit L for continuous disturbance.

5.4.3.7 Superposition of clicks with continuous disturbance

If clicks have to be measured under the superposition of continuous disturbance it is allowed to determine duration and spacing not from the signal which exceeds the i.f. reference value.

Instead, it is allowed to increase the reference level for the time measurements to a value just above the signals produced by the continuous disturbance at the i.f. output of the receiver. This is allowed only if the continuous disturbance is at least 2 dB below the QP limit.

The necessary offset to the i.f. reference level can alternatively be determined from the value by which the peak signal of the continuous disturbance exceeds the QP limit. See also C.3.2.

6 Operating conditions

6.1 General

The EUT shall be tested when operated from the intended power supply sources according to 6.2 and/or 6.3 as appropriate.

Unless in conflict with the manufacturer's instructions, the operating and/or load conditions for test shall be as defined in Annex A. If Annex A does not define operating modes and/or load conditions the equipment shall be tested in all the relevant operating modes. Where there is a conflict, the manufacturer's instructions shall take precedence.

Normal load conditions shall be as defined in 6.2, 6.3 and Annex A, unless these are in conflict with the manufacturer's instruction for use, which in such cases take precedence. Where the EUT is not covered by these subclauses, the manufacturer's instruction for use shall be followed.

The duration of operation is not restricted unless the manufacturer specifies limitations for the operating time of the EUT. In this case the limitations shall be complied with.

No running-in time to be specified but, prior to testing, the EUT shall be operated for a sufficient period to ensure that the conditions of operation will be typical of those during normal life of the equipment. Running-in of motors shall be carried out by the manufacturer.

The ambient temperature shall lie within the range 15 °C to 35 °C.

6.2 Mains operation

6.2.1 Voltage at the mains port

During the tests, the EUT shall be operated at the rated voltage specified for the equipment.

For single-phase equipment with a rated voltage range in the range between:

- 100 V to 127 V, test at one nominal voltage within this range;
- 200 V to 240 V, test at one nominal voltage within this range;
- 100 V to 240 V, test at two voltages within this range, one test in the range 100 V to 127 V and another test in the range 200 V to 240 V.

The recommended test voltages are 120 V for the range 100 V to 127 V; and 230 V for the range 200 V to 240 V.

NOTE The nominal voltages of mains supply networks are 100 V, 110 V, 115 V, 120 V, 127 V, 200 V, 208 V, 220 V, 230 V and 240 V.

Where applicable, EPS shall be as specified by the manufacturer and connected as from the instruction manual.

Multi-phase equipment shall be tested applying the same principles set-out above.

6.2.2 Frequency at the mains port

During the tests the EUT shall be operated at the rated frequency specified for the equipment.

If the equipment has more than one rated frequency (e.g. 50 Hz to 60 Hz), then the EUT shall be tested at one of these frequencies only.

If the equipment has a rated frequency range (e.g. 50 Hz to 60 Hz), then the EUT shall be tested at one frequency within this range.

6.3 Battery operation

For battery operation the supply source shall be as specified by the manufacturer (e.g. the batteries specified and connected as from the instruction manual).

Fully charged batteries shall be used when starting each test. During the test, the battery condition shall be adequate to maintain normal operating conditions.

The equipment shall be tested operating in each permitted mode and in accordance with the operating conditions given in Annex A.

If the battery is charged from the AC mains supply, the equipment shall be treated in this operation mode as mains operated equipment.

6.4 Speed controls

Unless specific requirements for a particular product are given elsewhere in this standard, speed controls shall be adjusted to approximately maximum speed and mid-range speed, and the highest disturbance level shall be recorded.

Once the setting of controls, which are not intended for frequent adjustment in normal use, has been pre-set by the manufacturer, it shall not be further adjusted during the test.

6.5 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 equipment for 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, the equipment shall be deemed to have complied only if it meets the provisions of each clause/standard with the necessary functions operative.

6.6 Equipment with built-in luminaires

Equipment with a lighting function shall be tested with the lighting function switched on at the highest setting during the operating conditions specified in Annex A, unless otherwise stated in this standard. If all requirements of this standard are met, 6.5 shall not be applied for the lighting function.

Alternatively, if the lighting function of such equipment can be tested separately, then the lighting function may be tested according to the requirements in CISPR 15 with the remaining equipment being tested according to this standard with the lighting function not activated.

The lighting function need not be tested if it is not intended to be continuously switched on during normal operation.

NOTE A range hood is an example of a product where the lighting function is intended to be continuously switched on during normal operation. A refrigerator is an example of a product where the lighting function is not intended to be continuously switched on during normal operation, since the light is turned off when the door is closed.

7 Interpretation of CISPR radio disturbance limits

7.1 Significance of a CISPR limit

A CISPR limit is a limit 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.

The significance of the limits for type approved 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.

In the case of discontinuous disturbance when the shortened procedure described in 7.2.2.2 is applied, compliance with the limits on the 80 % – 80 % basis is not guaranteed.

7.2 Type tests

7.2.1 Equipment producing continuous disturbance

Type tests shall be made either:

- a) on a sample of equipment of the type using the statistical method of evaluation in accordance with 7.3, or
- b) for simplicity's sake, on one unit only.

Subsequent tests are necessary from time to time on equipment taken at random from the production, especially if option b) above has been followed.

7.2.2 Equipment producing discontinuous disturbance

7.2.2.1 Type tests shall be made on one unit only.

Subsequent tests are necessary from time to time on units taken at random from the production.

7.2.2.2 In the case of controversy with regard to a type approval test, the following shortened procedure is applied:

If the first unit is tested and fails, three additional units shall be tested at the same frequency or frequencies at which the first unit failed.

The three additional units are judged according to the same requirements as applied to the first unit.

If all three additional units comply with the relevant requirements, the type is approved.

If one or more units do not comply, the type is rejected.

7.3 Compliance with limits for equipment in large-scale production

7.3.1 General

Statistically assessed compliance with the limits shall be made according to one of the three methods described below or to some other test which ensures compliance with the requirements of 7.1.

The test according to 7.3.2 or 7.3.3 should be performed on a sample of not less than 5 items of the type, but if, in exceptional circumstances, 5 items are not available, then a sample of at least 3 shall be used.

The test according to 7.3.4 should be performed on a sample of not less than 7 items.

It is recommended to start the evaluation with the method described in 7.3.2 and only in case the test has not been passed to continue with the more extensive methods described in 7.3.3 and 7.3.4.

7.3.2 Method based on a general margin to the limit

Compliance is given when the measured values from all items of the sample are under the limit and the margin to the limit is not shorter than the general margin, given in Table 10 below.

Table 10 – General margin to the limit for statistical evaluation

Sample size (n)	3	4	5	6
General margin to the limit (dB)	3,8	2,5	1,5	0,7

This method shall not be used to consider a product as non-compliant.

NOTE This method is based on CISPR TR 16-4-3, where compliance can be verified according to the formula

$$x_{\max} + k_E \sigma_{\max} < L$$

where

$x_{\max}$ is the highest (worse) value of all items in the sample;

k_E is the coefficient from the Table below, depending on the sample size;

$\sigma_{\max}$ is a conservative value for the standard deviation in a product group;

L is the limit.

Table 11 – Values of the coefficient as a function k_E of the sample size

Sample size (n)	3	4	5	6
Coefficient k_E	0,63	0,41	0,24	0,12

CISPR TR 16-4-3 recommends a value $\sigma_{\max} = 6,0$ dB for both the disturbance voltage and the disturbance power. For radiated disturbances, measured on an EUT in the scope of this standard, the same value for $\sigma_{\max}$ has been assumed. The values for the general margin to the limit in the Table 10 above are a simple multiplication of this 6,0 dB with the coefficient k_E .

In Table 10 values are given only for a sample size up to $n = 6$ because for $n = 7$ or higher the method given in 7.3.4 can be applied, where the binomial distribution without an additional margin is used.

7.3.3 Test based on the non-central t -distribution

Compliance is judged from the following relationship:

$$\bar{x} + k S_N \leq 0 \quad (1)$$

where

$\bar{x}$ is the arithmetic mean of the values x_n of n items in the sample;

S_n is the standard deviation of the sample;

S_n^2 is equal to

$$\sum (x_n - \bar{x})^2 / (n-1) \quad (2)$$

The quantities x_n , $\bar{x}$ and S_n are expressed logarithmically (dB μ V, dBpW or dB μ V/m).

k is the factor, derived from tables of the non-central t -distribution, which ensures with 80 % confidence that 80 % or more of the type is below the limit; the value of k depends on the sample size n and is given in Table 12 below.

Table 12 – Factor k for the application of the non-central t -distribution

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

x_n is determined as follows:

- for each of the frequency ranges specified below, the differences between the measured values and the limit are calculated. The difference is negative where the measured value is below the limit and positive where it is higher than the limit.

For the n^{th} individual unit, x_n is the difference value at the frequency where the difference curve shows its maximum.

NOTE 1 If all measured values are below the limit, x_n is the shortest distance to the limit. If some of the measured values are above the limit, x_n is highest value by which the limit is exceeded.

The statistical evaluation shall be carried out separately for the following frequency sub-ranges:

Disturbance voltage and disturbance current:

- 150 kHz to 500 kHz
- 500 kHz to 5 MHz
- 5 MHz to 30 MHz

Disturbance power:

- 30 MHz to 100 MHz
- 100 MHz to 200 MHz
- 200 MHz to 300 MHz

Radiated disturbances:

- 30 MHz to 230 MHz
- 230 MHz to 500 MHz
- 500 MHz to 1 000 MHz

If all measured values are under the limit and the test is failed only due to a high standard deviation, it shall be investigated whether this high standard deviation has been caused by a maximum of x_n at the borderline between two frequency sub-ranges. In this case the evaluation has to be done according to 7.3.4.

NOTE 2 Figure 1 illustrates the possible difficulties if a maximum of the measured disturbances occurs near the borderline between two frequency sub-ranges. " U " is the measured disturbance voltage; " f " is the frequency. Here two units with different characteristics out of a sample are shown. For broadband disturbances the value of the maximum as well as the frequency of the maximum can change from unit to unit, differences as between unit 1 and unit 2 in a sample are typical. An average value and standard deviation is calculated for all units (of which two are shown) for each sub-range. In this example the calculated standard deviation is much higher for subrange 1 than subrange 2 (e.g. consider how different the values of x_1 and x_2 are at the borderline). Even though the average for subrange 1 is much lower than subrange 2, after taking into consideration the high value of S_n multiplied by the factor out of Table 12, in rare cases this could lead to the sample set failing the given criteria. Since this is simply a consequence of the way in which the frequency sub-ranges have been defined, no statistically meaningful conclusion can be drawn regarding compliance.

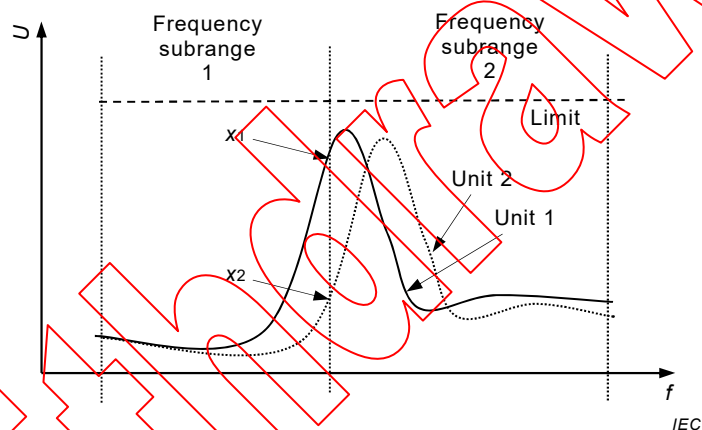


Figure 1 – Possible issue due to a high standard deviation when using method 7.3.3

7.3.4 Test based on the binomial distribution

Compliance is judged from the condition that, from a sample of size n , the number of units that generate an interference level above the applicable limit shall not exceed c , as given in Table 13.

Table 13 – Application of the binomial distribution

n	7	14	20	26	32
c	0	1	2	3	4

7.3.5 Larger sample size

Should the test on the sample result in non-compliance with the requirements, then a second sample may be tested and the result combined with those from the first sample and compliance checked for the larger sample size.

NOTE For general information, see CISPR TR 16-4-3.