BS EN 55014-2:2015

BSI Standards Publication

Electromagnetic compatibility — Requirements for household appliances, electric tools and similar apparatus

Part 2: Immunity — Product family standard

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National foreword

This British Standard is the UK implementation of EN 55014-2:2015. It is identical to CISPR 14-2:2015. It supersedes BS EN 55014-2:1997+A2:2008, which will be withdrawn on 25 March 2018.

The UK participation in its preparation was entrusted by Technical Committee GEL/210, EMC - Policy committee, to Subcommittee GEL/210/11, EMC product standards.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus - Part 2: Immunity - Product family standard (CISPR 14-2:2015)

Compatibilité électromagnétique - Exigences relatives aux appareils électrodomestiques, outillages électriques et appareils analogues - Partie 2: Immunité - Norme de famille de produits (CISPR 14-2:2015)

Elektromagnetische Verträglichkeit - Anforderungen an Haushaltgeräte, Elektrowerkzeuge und ähnliche Elektrogeräte - Teil 2: Störfestigkeit - Produktfamiliennorm (CISPR 14-2:2015)

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

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Foreword

The text of document CIS/F/652/FDIS, future CISPR 14-2, prepared by CISPR SC F “Interference relating to household appliances tools, lighting equipment and similar apparatus” of CISPR “International special committee on radio interference” was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 55014-2:2015.

The following dates are fixed:

– latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2015-12-25
– latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2018-03-25

This document supersedes EN 55014-2:1997.

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Endorsement notice

The text of the International Standard CISPR 14-2:2015 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60335 (series)	NOTE	Harmonized as EN 60335 (series).
IEC 61558-2-7	NOTE	Harmonized as EN 61558-2-7.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 60050	series	International Electrotechnical Vocabulary	-	series
IEC 61000-4-2	2008	Electromagnetic compatibility (EMC) -- Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test	EN 61000-4-2	2009
IEC 61000-4-3	2006	Electromagnetic compatibility (EMC) -- Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test	EN 61000-4-3	2006
+A1	2007		+A1	2008
+A2	2010		+A2	2010
IEC 61000-4-4	2012	Electromagnetic compatibility (EMC) -- Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test	EN 61000-4-4	2012
IEC 61000-4-5	2014	Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test	EN 61000-4-5	2014
IEC 61000-4-6	2013	Electromagnetic compatibility (EMC) -- Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields	EN 61000-4-6	2014
IEC 61000-4-11	2004	Electromagnetic compatibility (EMC) -- Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests	EN 61000-4-11	2004
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)	EN 61000-4-22	2011
CISPR 14-1	2005	Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus -- Part 1: Emission	EN 55014-1	2006
+A1	2008		+A1	2009
+A2	2011		+A2	2011

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE

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

Part 2: Immunity – Product family standard

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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International Standard CISPR 14-2 has been prepared by CISPR subcommittee F: Interference relating to household appliances tools, lighting equipment and similar apparatus.

This second edition cancels and replaces the first edition published in 1997, Amendment 1:2001 and Amendment 2:2008. This edition constitutes a technical revision.

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

a) 5.1: For ESD tests on contacts of plugs and sockets the note ("The 4 kV contact discharge shall be applied to conductive accessible parts. Metallic contacts, such as in battery compartments or in socket outlets, are excluded from this requirement.") saying that no test on contacts is necessary has been removed. The IEC 61000-4-2 includes a detailed

description how to deal with ESD on contacts and other surfaces. Also discharge on HCP and VCP is required by the basic standard IEC 61000-4-2.

b) 5.3 and 5.4: The tables for tests at d.c. power ports according IEC 61000-4-6 are aligned with the generic standards and are the same for 5.3 and 5.4.

c) 5.3 and 5.4: For EUT with single mains cable and no other cable, the test set-up as shown in Figure 2 shall be used. The set-up as described in Annex F of IEC 61000-4-6:2013 shall not be used.

d) 5.5: The IEC 61000-4-22 has been introduced as alternative method for testing radiated immunity.

e) 5.6: No line-to-earth surges are applied to products which do not have provision for connection to earth.

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

FDIS	Report on voting
CISPR/F/652/FDIS	CISPR/F/657/RVD

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.

A list of all parts in the CISPR 14 series, published under the general title *Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus*, can be found on the IEC website.

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,
- replaced by a revised edition, or
- amended.

INTRODUCTION

The intention of this standard is to establish uniform requirements for the electromagnetic immunity of the equipment mentioned in the scope, to fix test specifications of immunity, to refer to basic standards for methods of testing, and to standardize operating conditions, performance criteria and interpretation of results.

Keywords: Immunity, household appliances, electric apparatus, electromagnetic compatibility.

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

Part 2: Immunity – Product family standard

1 Scope

1.1 This part of CISPR 14 deals with the electromagnetic immunity of appliances and similar apparatus for household and similar purposes that use electricity, as well as electric toys and electric tools, the rated voltage of the apparatus being not more than 250 V for single-phase apparatus to be connected to phase and neutral, and 480 V for other apparatus.

Apparatus may incorporate motors, heating elements or their combination, may contain electric or electronic circuitry, and may be powered by the mains, by transformer, by batteries, or by any other electrical power source.

Apparatus not intended for household use, but which nevertheless may require the immunity level, such as apparatus intended to be used by laymen in shops, in light industry and on farms, are within the scope of this standard, as far as they are included in CISPR 14-1. In addition, the following are also included in the scope of this standard:

– microwave ovens for domestic use and catering;
– cooking hobs and cooking ovens, heated by means of r.f. energy;
– (single- and multiple-zone) induction cooking appliances;
– appliances for personal care equipped with radiators in the range from UV to IR, inclusive (this includes visible light);
– power supplies and battery chargers provided with or intended for apparatus within the scope of this standard.

1.2 This standard does not apply to:

– equipment for lighting purposes;
– apparatus designed exclusively for heavy industrial purposes;
– apparatus intended to be part of the fixed electrical installation of buildings (such as fuses, circuit breakers, cables and switches);
– apparatus intended to be used in locations where special electromagnetic conditions prevail, such as the presence of high electromagnetic fields (for example in the vicinity of a broadcast transmitting station), or where high pulses occur on the power network (such as in a power generator station);
– radio and television receivers, audio and video equipment, and electronic music instruments other than toys;
– medical electrical appliances;
– personal computers and similar equipment other than toys;
– radio transmitters;
– apparatus designed to be used exclusively in vehicles;
– babies surveillance systems.

1.3 Immunity requirements in the frequency range 0 Hz to 400 GHz are covered.

1.4 The effects of electromagnetic phenomena relating to the safety of apparatus are excluded from this standard and are covered by other standards, for example in the IEC 60335 series.

Abnormal operation of the apparatus (such as simulated faults in the electric circuitry for testing purposes) is not taken into consideration.

NOTE 1 Attention is drawn to the fact that additional requirements can be necessary for apparatus intended to be used on board ships or aircraft.

1.5 The object of this standard is to specify the immunity requirements for apparatus defined in the scope in relation to continuous and transient, conducted and radiated electromagnetic disturbances, including electrostatic discharges.

These requirements represent essential electromagnetic compatibility immunity requirements.

NOTE 2 In special cases, situations will arise where the level of disturbances may exceed the test values specified in this standard. In these instances special mitigation measures may have to be employed.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050 (all parts), *International Electrotechnical Vocabulary (IEV)* (available at www.electropedia.org)

IEC 61000-4-2:2008, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 61000-4-3:2006, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*
IEC 61000-4-3:2006/AMD1:2007
IEC 61000-4-3:2006/AMD2:2010

IEC 61000-4-4:2012, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-5:2014, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61000-4-6:2013, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-11:2004, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests*

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

CISPR 14-1:2005, *Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission*
CISPR 14-1:2005/AMD1:2008
CISPR 14-1:2005/AMD2:2011

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the terms and definitions related to EMC and related phenomena found in IEC 60050-161, as well as the following terms and definitions apply.

3.1.1
electromagnetic compatibility
ability of a device, unit of equipment or system to function satisfactorily in its electro-magnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment

3.1.2
port
particular interface of the specified apparatus with the external electromagnetic environment

Note 1 to entry: See Figure 1.

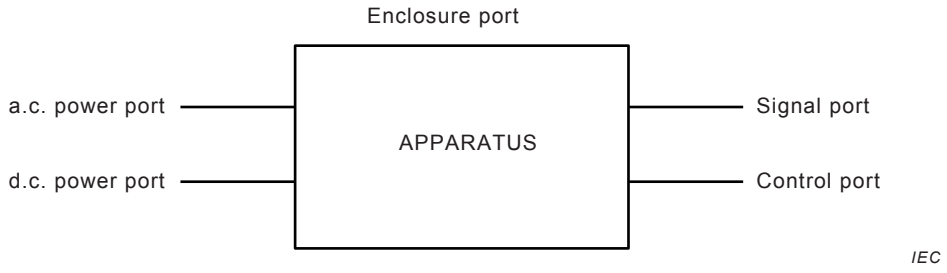


Figure 1 – Examples of ports

3.1.3
enclosure port
physical boundary of the apparatus through which electromagnetic fields may radiate or impinge

3.1.4
series production
production process in which identical apparatus are manufactured continuously or in batches (consisting of identical products)

3.1.5
safety extra-low voltage
voltage which does not exceed 50 V a.c. or 120 V ripple free d.c. between conductors, or between any conductor and earth, in a circuit which is isolated from the supply mains by such means as a safety isolating transformer

3.1.6
toy
product designed for, or clearly intended for use in play by children under 14 years old

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

Note 2 to entry: The supply voltage of a toy shall not exceed 24 V a.c. (r.m.s.) or ripple-free d.c. and may be provided by a battery or by means of an adapter or a safety transformer connected to the mains supply.

Note 3 to entry: Transformers, converters and chargers for toys are considered not to be part of the toy (see IEC 61558-2-7).

3.1.7
electric toy
toy having at least one function dependent on electricity

3.1.8
battery toy
toy which contains or uses one or more batteries as the only source of electrical energy

3.1.9
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

3.1.10
dual supply toy
toy which can be operated simultaneously or alternatively as a battery toy and a transformer toy

3.1.11
safety isolating transformer
transformer, the input winding of which is electrically separated from the output winding by an insulation at least equivalent to double insulation or reinforced insulation, and which is designed to supply an appliance or circuit at safety extra-low voltage

3.1.12
safety transformer for toys
safety isolating transformer specially designed to supply toys operating at safety extra-low voltage not exceeding 24 V

Note 1 to entry: Either a.c. or d.c. or both may be delivered from the transformer unit.

3.1.13
constructional kit
collection of electric, electronic or mechanical parts intended to be assembled as various toys

3.1.14
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.

3.1.15
functional toy
toy with a rated voltage not exceeding 24 V and which is a model of an appliance or installation used by adults

Note 1 to entry: A product with a rated voltage exceeding 24 V, intended to be used by children under the direct supervision of an adult and which is a model of an appliance or installation and used in the same way, is known as a functional product.

3.1.16
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, key board, monitor and connections, are considered to be part of the toy.

3.1.17
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

3.1.18
clock frequency
fundamental frequency of any signal used in the device, excluding those which are solely used inside integrated circuits (IC)

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

3.2 Abbreviations

ESD Electrostatic Discharge

CDN Coupling and Decoupling Network

EUT Equipment Under Test

UV Ultraviolet (Light)

IR Infrared (Light)

RF Radio Frequency

4 Classification of apparatus

4.1 The apparatus covered by this standard is subdivided into categories. For each category, specific requirements are formulated.

4.2 Category I: apparatus containing no electronic control circuitry.

All appliances having no electronic control circuitry are considered to be category I.

Electric circuits consisting of passive components (such as radio interference suppression capacitors or inductors, mains transformers, mains frequency rectifiers and heating elements) are not considered to be electronic control circuitry.

EXAMPLES Appliances operated with a motor and mechanical switch only; lighting toys with a battery and a LED or incandescent lamp without additional electronic control circuitry; track sets without electronic control circuitry; heating or cooling appliances without electronic control circuitry; tools without electronic controls and all other apparatus containing only electromechanical components (e. g. switches or thermostats).

4.3 Category II: transformer toys, dual supply toys, mains powered motor operated appliances, tools, heating appliances and similar electric apparatus (for example – UV radiators, IR radiators and microwave ovens) containing electronic control circuitry with no clock frequency higher than 15 MHz.

NOTE For toys, examples include educational computers, organs, track sets with electronic control units.

4.4 Category III: equipment which in normal use, is not connected to a power network and has no cables attached.

This category includes apparatus provided with rechargeable batteries, solar or other similar d.c. power sources which can be charged or operated by connecting the apparatus to the mains power. However, this apparatus shall also be tested as an apparatus in category II while it is connected to the mains network.

NOTE For toys, examples include musical soft toys, cord-controlled toys and motor-operated electronic toys.

4.5 Category IV: all other apparatus covered by the scope of this standard.

5 Tests

5.1 Electrostatic discharge

Electrostatic discharge tests (air discharges, contact discharges direct and indirect, as appropriate) are carried out according to basic standard IEC 61000-4-2, with test signals and conditions as given in Table 1.

Table 1 – Enclosure port

Environmental phenomenon	Test specification	Test set-up
Electrostatic discharge	8 kV air discharge 4 kV contact discharge	IEC 61000-4-2

Apply 20 discharges (10 with positive and 10 with negative polarity) to each selected discharging point. Tests with other (lower) voltages than those given in Table 1 are not required.

5.2 Fast transients

Fast transient tests are carried out according to basic standard IEC 61000-4-4, for 2 min with a positive polarity and for 2 min with a negative polarity, according to the following Tables 2, 3 and 4.

Table 2 – Ports for signal lines and control lines

Environmental phenomenon	Test specifications	Test set-up
Fast transients common mode	0,5 kV (peak) 5/50 ns T_r/T_d 5 kHz repetition frequency	IEC 61000-4-4
Applicable only to ports interfacing with cables whose total length can exceed 3 m according to the manufacturer's functional specification		

Table 3 – Input and output d.c. power ports

Environmental phenomenon	Test specifications	Test set-up
Fast transients common mode	0,5 kV (peak) 5/50 ns T_r/T_d 5 kHz repetition frequency	IEC 61000-4-4
Not applicable to input ports intended for connection to a battery or a rechargeable battery which shall be removed or disconnected from the apparatus for recharging. Apparatus with a d.c. power input port intended for use with an a.c. – d.c. power adaptor shall be tested on the a.c. power input of the a.c.- d.c. power adaptor specified by the manufacturer or, where none is so specified, using a typical a.c. – d.c. power adaptor. For d.c. input and output ports intended to be connected permanently, the test is only applicable to cables longer than 3 m.		

A coupling/decoupling network shall be applied for testing d.c. power ports.

Table 4 – Input and output a.c. power ports

Environmental phenomenon	Test specifications	Test set-up
Fast transients common mode	1 kV (peak) 5/50 ns T_r/T_d 5 kHz repetition frequency	IEC 61000-4-4
For extra low voltage a.c. ports and output a.c. ports, this testing is only applicable to ports interfacing with cables whose total length may exceed 3 m according to the manufacturer's functional specification.		

A coupling/decoupling network shall be used for testing a.c. power ports.

5.3 Injected currents, 0,15 MHz to 230 MHz

Injected current tests are carried out according to the basic standard IEC 61000-4-6, and according to the following Tables 5, 6 and 7.

For large EUT having only one mains cable and no other cable leaving the EUT and where the mains cable leaves the EUT at a height of more than 1 m from the floor the following test set-up shall be used:

– the mains cable is routed along the enclosure of the EUT straight down to 3,0 cm to 5,0 cm above the ground plane and then horizontally to the CDN or clamp;
– the CDN or clamp shall be placed at a distance not more than 30 cm from the boundary of the EUT. A distance of 20 cm is recommended;
– see Figure 2 for an example.

NOTE 1 Typical household appliance for application of this paragraph on large EUT is a refrigerator.

Test conditions and testing arrangements, especially for measurements from 80 MHz to 230 MHz, shall be clearly specified in the test report.

NOTE 2 Current injection up to 230 MHz is applied, independent of the dimensions of the equipment under test (EUT).

The unmodulated carrier of the test signal is adjusted to the indicated test value. To perform the test, the carrier is in addition modulated as specified.

Table 5 – Ports for signal lines and control lines

Environmental phenomenon	Test specifications	Test set-up
RF current common mode 1 kHz, 80 % AM	0,15 MHz to 230 MHz 1 V (r.m.s.) (unmodulated) 150 Ω source impedance	IEC 61000-4-6
Applicable only to ports interfacing with cables whose total length may exceed 3 m according to the manufacturer's functional specification.		

Table 6 – Input and output d.c. power ports

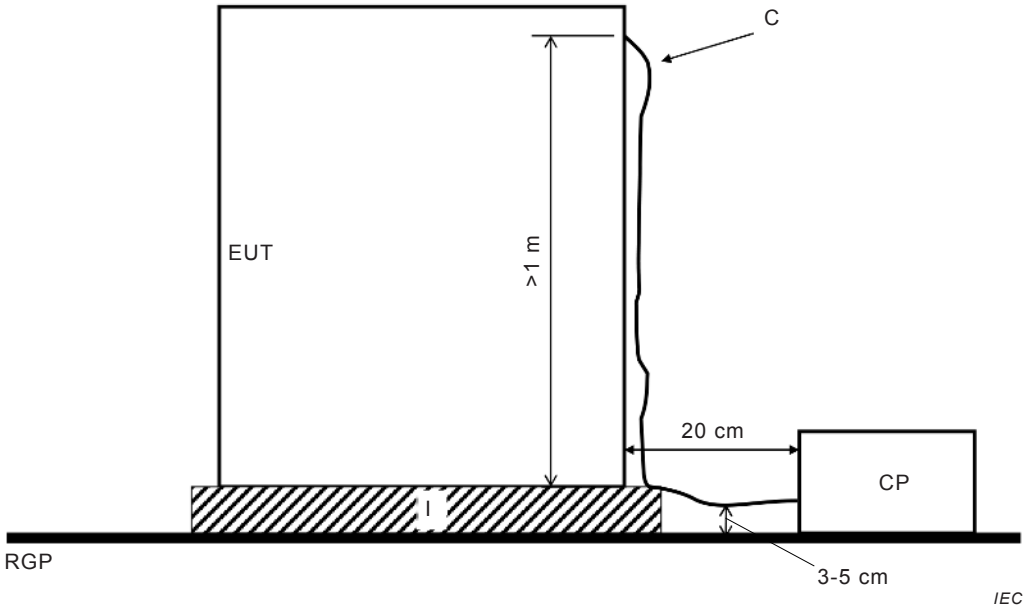
Environmental phenomenon	Test specifications	Test set-up
RF current common mode 1 kHz, 80 %AM	0,15 MHz to 230 MHz 1 V (r.m.s.) (unmodulated) 150 Ω source impedance	IEC 61000-4-6
Not applicable to battery operated appliances that cannot be connected to the mains while in use. Not applicable to input ports intended for connection to a battery or a rechargeable battery which shall be removed or disconnected from the apparatus for recharging. Apparatus with a d.c. power input port intended for use with an a.c. – d.c. power adaptor shall be tested on the a.c. power input of the a.c.- d.c. power adaptor specified by the manufacturer or, where none is so specified, using a typical a.c. – d.c. power adaptor. For d.c. input and output ports intended to be connected permanently, the test is only applicable to cables longer than 3 m.		

A coupling/decoupling network shall be applied for testing d.c. power ports

Table 7 – Input and output a.c. power ports

Environmental phenomenon	Test specifications	Test set-up
RF current common mode 1 kHz, 80 % AM	0,15 MHz to 230 MHz 3 V (r.m.s.) (unmodulated) 150 Ω source impedance	IEC 61000-4-6
For extra low voltage a.c ports and output a.c. ports, this testing is only applicable to ports interfacing with cables whose total length may exceed 3 m according to the manufacturer's functional specification.		

A coupling/decoupling network shall be applied for testing a.c. power ports.



RGP = Reference ground plane I = Insulating support as required by IEC 61000-4-6

CP = CDN or clamp EUT = Equipment under test

C = Cable (mains cable)

Figure 2 – Example for a test set-up for large EUTs (e. g. refrigerators) where the cable leaves the EUT on a height of more than 1 m above the floor

5.4 Injected currents, 0,15 MHz to 80 MHz

Injected current tests are carried out according to the basic standard IEC 61000-4-6, and according to the following Tables 8, 9 and 10.

Large EUT shall be measured in the same way as described in 5.3.

The unmodulated carrier of the test signal is adjusted to the indicated test value. To perform the test, the carrier is in addition modulated as specified.

Table 8 – Ports for signal lines and control lines

Environmental phenomenon	Test specifications	Test set-up
RF current common mode 1 kHz, 80 % AM	0,15 MHz to 80 MHz 1 V (r.m.s.) (unmodulated) 150 Ω source impedance	IEC 61000-4-6
Applicable only to ports interfacing with cables whose total length can exceed 3 m according to the manufacturer's functional specification.		

Table 9 – Input and output d.c. power ports

Environmental phenomenon	Test specifications	Test set-up
RF current common mode 1 kHz, 80 % AM	0,15 MHz to 80 MHz 1 V (r.m.s.) (unmodulated) 150 Ω source impedance	IEC 61000-4-6
Not applicable to battery operated appliances that cannot be connected to the mains while in use. Not applicable to input ports intended for connection to a battery or a rechargeable battery which shall be removed or disconnected from the apparatus for recharging. Apparatus with a d.c. power input port intended for use with an a.c. – d.c. power adaptor shall be tested on the a.c. power input of the a.c.- d.c. power adaptor specified by the manufacturer or, where none is so specified, using a typical a.c. – d.c. power adaptor. For d.c. input and output power ports intended to be connected permanently, the test is not applicable provided the instructions require external cables not to be longer than 3 m.		

A coupling/decoupling network shall be applied for testing d.c. power ports.

Table 10 – Input and output a.c. power ports

Environmental phenomenon	Test specifications	Test set-up
RF current common mode 1 kHz, 80 % AM	0,15 MHz to 80 MHz 3 V (r.m.s.) (unmodulated) 150 Ω source impedance	IEC 61000-4-6
For extra low voltage a.c ports and output a.c. ports, this testing is only applicable to ports interfacing with cables whose total length may exceed 3 m according to the manufacturer's functional specification.		

A coupling/decoupling network shall be applied for testing a.c. power ports.

5.5 Radio frequency electromagnetic fields, 80 MHz to 1 000 MHz

Radio frequency electromagnetic field tests are carried out according to basic standard IEC 61000-4-3 or IEC 61000-4-22, and according to Table 11.

The unmodulated carrier of the test signal is adjusted to the indicated test value. To perform the test, the carrier is in addition modulated as specified.

Table 11 – Enclosure port

Environmental phenomenon	Test specifications	Test set-up
Radio-frequency electromagnetic field, 1 kHz, 80% AM	80 MHz to 1 000 MHz 3 V/m (r.m.s.) (unmodulated)	IEC 61000-4-3 or IEC 61000-4-22

5.6 Surges

Surge immunity tests are carried out according to basic standard IEC 61000-4-5, and according to Table 12.

Table 12 – Input a.c. power ports

Environmental phenomenon	Test specifications	Test set-up
Surge	1,2/50 (8/20) μs T_r/T_d 2 kV line-to-earth with 12 Ω Impedance 1 kV line-to-line with 2 Ω Impedance	IEC 61000-4-5

Five positive and five negative pulses shall be applied as far as applicable, successively:

– between phase and phase: 1 kV;
– between phase and neutral: 1 kV;
– between phase and earth: 2 kV;
– and between neutral and earth: 2 kV.

The positive pulses are applied 90° relative to the phase angle of the a.c. line voltage to the equipment under test, and the negative pulses are applied 270° relative to the phase angle of the a.c. line voltage to the equipment under test. Tests with other (lower) voltages than those given in Table 12 are not required.

No line-to-earth surges are applied to products which do not have provision for connection to earth.

NOTE The shield of a cable does not provide a dedicated connection to earth.

5.7 Voltage dips

Tests concerning voltage dips are carried out according to basic standard IEC 61000-4-11, and according to the following Table 13. The voltage interruption tests according to IEC 61000-4-11 are not performed.

Table 13 – Input a.c. power ports

Environmental phenomena		Test level in % U_T	Durations for voltage dips		Test set-up
			50 Hz	60 Hz	
Voltage dips in % U_T	100	0	0,5 cycle	0,5 cycle	IEC 61000-4-11
	60	40	10 cycles	12 cycles	Voltage change shall occur at zero crossing
	30	70	25 cycles	30 cycles	
U_T is the rated voltage of the equipment under test.					

6 Performance criteria

A functional description and a definition of performance criteria, during or as a consequence of the EMC testing, shall be provided by the manufacturer and noted in the test report, based on the following criteria.

Performance criterion A: The apparatus shall continue to operate as intended during the test. No degradation of performance or loss of function is allowed below a performance level (or permissible loss of performance) specified by the manufacturer, when the apparatus is used as intended. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product

description and documentation, and from what the user may reasonably expect from the apparatus if used as intended.

Performance criterion B: The apparatus shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level (or permissible loss of performance) specified by the manufacturer, when the apparatus is used as intended. During the test, degradation of performance is allowed, however no change of actual operating state or stored data is allowed to persist after the test. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and from what the user may reasonably expect from the apparatus if used as intended.

Performance criterion C: Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls, or by any operation specified in the instructions for use.

The selection, the specification of functions, and the permissible degradation is left to the responsibility of the manufacturer.

Annex A serves as a guide to formulate the permissible degradation of the equipment under test (EUT) caused by electromagnetic phenomena.

7 Applicability of immunity tests

7.1 General

7.1.1 The immunity tests for apparatus covered by this standard are given in Clause 5 on a port by port basis. The tests are specified for each port concerned.

Tests are applied to the relevant ports of the apparatus according to Tables 1 to 13 (if applicable).

Tests shall be carried out on those ports that can be subjected to disturbances during normal operation of the equipment.

The tests shall be carried out as single tests in sequence. Any testing sequence is acceptable.

The description of the test, the test generator, the test methods, and the test set-up are given in basic standards which are referred to in the tables. The content of these basic standards are not repeated here; however, modifications or additional information needed for the practical application of the tests are given in this standard.

7.1.2 It may be determined from consideration of the electrical characteristics and usage of a particular apparatus that some of the tests are inappropriate, and therefore unnecessary. In such cases it is required that the decision not to test be recorded in the test report.

7.1.3 Regardless of their category, experimental kits intended for education and play are deemed to fulfill the immunity requirements, and are not tested.

7.2 Application of tests for the different categories of apparatus

7.2.1 Category I

Category I apparatus is deemed to fulfill the relevant immunity requirements without testing.

7.2.2 Category II

Category II apparatus shall fulfill the following requirements:

– electrostatic discharge with performance criterion B (5.1);
– fast transients with performance criterion B (5.2);
– injected currents up to 230 MHz with performance criterion A (5.3);
– surges with performance criterion B (5.6);
– voltage dips with performance criterion C (5.7).

7.2.3 Category III

Category III apparatus shall fulfill the following requirements:

– electrostatic discharge with performance criterion B (5.1);

  A performance criterion C could be applied to toys not using score or data entered by the user. Examples are musical soft toys, sounding toys, etc.

– radio frequency electromagnetic fields with performance criterion A (5.5).

  For toys, the radio frequency electromagnetic fields test is only applicable for ride on toys.

7.2.4 Category IV

Category IV apparatus shall fulfill the following requirements (if applicable):

– electrostatic discharge with performance criterion B (5.1);
– fast transients with performance criterion B (5.2);
– injected currents up to 80 MHz with performance criterion A (5.4);
– radiofrequency electromagnetic fields with performance criterion A (5.5);
– surges with performance criterion B (5.6);
– voltage dips with performance criterion C (5.7).

8 Conditions during testing

8.1 Unless otherwise specified, the tests shall be made while the apparatus is operated as intended by the manufacturer, in the most susceptible operating mode consistent with normal use.

Tests shall be carried out under the conditions specified in CISPR 14-1 where applicable. The tests shall be carried out within the specified or typical environmental range for the apparatus, and at its rated supply voltage and frequency. If the apparatus can be set at different levels (for example speed, temperature), a setting below maximum shall be used, preferably at approximately 50 % level.

Appliances with a microwave oven function shall be tested, loaded with 1 l ± 0,5 l tapwater; long lasting tests may be interrupted to refill the load.

During the tests, toys are operated under normal operation. Transformer toys are tested with the transformer supplied with the toy. If the toy is supplied without a transformer, it shall be tested with an appropriate transformer.

In case of associated devices (for example, video toy cartridges) sold separately to be used with different appliances, the associated device shall be tested with at least one appropriate representative hosting appliance, selected by the manufacturer of the associated device, in order to check conformity of the associated device for all appliances with which it is intended

to operate. The hosting appliance shall be representative of series produced appliances and shall be typical.

However, the manufacturer's specification of test configuration, conditions and performances takes precedence.

8.2 Where applicable, the configuration of the EUT shall be varied to achieve maximum susceptibility. If the apparatus can be connected to auxiliary apparatus, then the apparatus shall be tested while connected to the minimum configuration of auxiliary apparatus necessary to exercise all existing ports.

8.3 The tests concerning ESD, transients, surges and voltage dips are carried out during each mode of operation of the EUT (or phase as part of the mode of operation) selected for the test.

8.4 The tests concerning electromagnetic fields and current injection are carried out during the scan time while, at random, the selected modes of the EUT are set into operation.

8.5 For manual selection of the mode of operation, the test may be interrupted, or care should be taken that the operator does not influence the test results.

8.6 In case of an EUT with an automatic cycling program, the scan time shall be started at random. Where a single cycle lasts longer than the scan time, the test shall be repeated until the cycle is finished.

8.7 The configuration and mode of operation during the tests shall be precisely noted in the test report.

NOTE Care is taken that changes in the environment, such as power supply, do not influence the test results.

9 Assessment of conformity

9.1 Single product evaluation

Apparatus manufactured in series production shall be verified by performing a type-test on one representative model, or on one series-produced apparatus.

The manufacturer's or supplier's quality system shall ensure that the tested model or apparatus is representative of the series-produced apparatus concerned.

For apparatus not produced in series, the test procedures shall ensure that each individual apparatus meets the requirements when tested by the methods specified.

Results obtained for an apparatus tested when installed in its place of use (and not on a test site) relates to that installation only, and shall not be considered representative for any other installation.

9.2 Statistical evaluation

The significance of the requirements for compliance of the apparatus with the standard shall be that, on a statistical basis, at least 80 % of the series produced apparatus complies with the requirements with at least 80 % confidence.

When type-testing is carried out on a single piece of apparatus, compliance with the requirements on the 80 %/80 % basis is not guaranteed.

Compliance is judged from the condition that the number of apparatus which do not fulfil the requirements may not exceed c in a sample of size n.

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

If the tests on the sample result in non-compliance with the requirements, then a second sample may be tested, and the results combined with those from the first sample. Compliance is then checked for the combined sample.

NOTE For general information on the statistical consideration in the determination of EMC compliance, see CISPR TR 16-4-3.

9.3 In case of dispute

In case of dispute, assessment of conformity with this standard shall be based on the statistical method of evaluation.

Annex A
(informative)

Guidance for permissible degradation

Table A.1 serves as a guide to formulate the permissible degradation of the equipment under test (EUT) caused by electromagnetic phenomena.

Not all functions of the apparatus need to be tested. The selection of functions to be monitored during the tests and the permissible degradation is the responsibility of the manufacturer.

Table A.1 – Examples of degradations

Functions (non-exhaustive)	Criteria			
	A	B [b]	C1 [c]	C2 [c]
Motor speed	10 % [a]	–	+	–
Torque	10 % [a]	–	+	–
Movement	10 % [a]	–	+	–
Power (consumption, input)	10 % [a]	–	+	–
Switching (change of state)	–	–	+	–
Heating	10 % [a]	–	+	–
Timing (programme, delay, duty cycle)	10% [a]	–	+	–
Stand-by	–	–	[d]	–
Data storage	–	–	[e]	[e]
Sensor functions (signal transmission)	[f]	–	[g]	–
Indicators (visual and acoustic)	[f]	–	[g]	–
Audio function	[f]	–	[g]	–
Illumination	[f]	–	[g]	–

– No change allowed.

\+ Change allowed.

[a] Values are exclusive of the measurement accuracy.

[b] For criterion B, measurement or verification is performed during the stable operations of the Equipment Under Test before and after the application of the specified phenomenon.

[c] For criterion C, distinction is made between
C1: before resetting and
C2: after resetting.

[d] Switching-off is allowed, switching-on is not allowed.

[e] Loss or change of data is allowed.

[f] Lower performance as specified by the manufacturer is allowed, but no loss of correct function.

[g] Loss of correct functions allowed.

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IEC 61558-2-7, *Safety of power transformers, power supplies, reactors and similar products – Part 2-7: Particular requirements and tests for transformers and power supplies for toys*

CISPR TR 16-4-3, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-3: Uncertainties, statistics and limit modelling – Statistical considerations in the determination of EMC compliance of mass-produced products* (only available in English)

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