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*Incorporating
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and 2 (Amendment
No. 1 renumbered
BS EN 55014 as
BS EN 55014-1)*

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

**Part 1: Emission —
Product family standard**

The European Standard EN 55014-1:1993 with the inclusion of amendments A1:1997 and A2:1999 has the status of a British Standard

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Cooperating organizations

The European Committee for Electrotechnical Standardization (CENELEC), under whose supervision this European Standard was prepared, comprises the national committees of the following countries:

Austria	Italy
Belgium	Luxembourg
Denmark	Netherlands
Finland	Norway
France	Portugal
Germany	Spain
Greece	Sweden
Iceland	Switzerland
Ireland	United Kingdom

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National foreword

This British Standard has been prepared under the direction of the General Electrotechnical Standards Policy Committee and is the English language version of EN 55014-1:1993 *Electromagnetic compatibility — Requirements for household appliances, electric tools and similar apparatus — Part 1: Emission — Product family standard*, including amendments A1:1997 and A2:1999, published by the European Committee for Electrotechnical Standardization (CENELEC). It is identical with CISPR Publication 14-1:1993, including amendment 1:1996, corrigendum January 1997 and amendment 2:1998, published by the International Electrotechnical Commission (IEC).

This standard is one of a number of standards related to European Council Directive 89/336/EEC, dated 3 May 1989 [referred to as the Electromagnetic Compatibility (EMC) Directive] as amended on 28 April 1992 by Council Directive 92/31/EEC. This amendment provides for a transitional period lasting until 31 December 1995 during which a manufacturer can choose between the following two options when marketing his products in the Single Market:

- a) to manufacture in accordance with the requirements of the EMC Directive, making a declaration of conformity and affixing the CE mark. This route provides access to the markets of all member states in the Single Market.
- b) to manufacture in accordance with the National Regulations existing on 30 June 1992 in the country or countries in which the product is to be marketed. This route provides access only to those EC markets in which the apparatus is in compliance with the National Regulations of those member states.

As far as products covered by this standard are concerned, the options for compliance in the UK are given in the table overleaf.

The foreword of the EN makes references to the “date of withdrawal” (dow) of the relevant conflicting national standard. In this case the relevant national standard is BS 800:1988 and withdrawal will not take place until the end of the transitional period on 31 December 1995 when Statutory Instrument 1989 No. 562 will also be withdrawn.

Options for compliance in the UK						
Manufacturer's option	EC Directive	UK regulations	Standards for compliance			
			Emission			Immunity
			Harmonics	Voltage fluctuations	Radio interference	All aspects
a	89/336/EEC	SI 1992 No. 2372 ^a	BS 5406-2: 1988	BS 5406-3: 1988	BS EN 55014-1: 1997	BS EN 50082-1: 1992
					[EN 55014: 1993] ^c	[EN 50082-1: 1992]
b	76/889/EEC ^b	SI 1989 No. 562	—	—	BS 800: 1988 ^d [EN 55014: 1987]	—
^a UK Regulations implementing Directive 89/336/EEC, as amended by 92/31/EEC, came into force on 28 October 1992. ^b As amended by Commission Directive 82/449/EEC and adapted to technical progress by Commission Directive 87/308/EEC. ^c Until an announcement of the title of this standard has appeared in the Official Journal of the European Communities, which should take place during 1993, BS 800:1988 will be valid for this aspect of compliance with Directive 89/336/EEC. ^d BS 800:1988 includes Amendment No. 2 which incorporates Amendment No. 1.						

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Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, the EN title page, pages 2 to 45 and a back cover.

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Sidelining in this document indicates the most recent changes by amendment.

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English version

Electromagnetic compatibility — Requirements for household appliances, electric tools and similar apparatus Part 1: Emission — Product family standard

(Includes amendments A1:1997 and A2:1999)

(CISPR 14-1:1993/A1:1996 + corrigendum 1997 + A2:1998)

Compatibilité électromagnétique — Exigences pour les appareils électrodomestiques, outillages électriques et appareils analogues
Partie 1: Emission — Norme de famille de produits
(Inclut les amendements A1:1997 et A2:1999)
(CISPR 14-1:1993/A1:1996 + corrigendum 1997 + A2:1998)

Elektromagnetische Verträglichkeit Anforderungen an Haushaltgeräte, Elektrowerkzeuge und ähnliche Elektrogeräte
Teil 1: Störaussendung Produktfamiliennorm
(Enthält Änderungen A1:1997 und A2:1999)
(CISPR 14-1:1993/A1:1996 + Corrigendum 1997 + A2:1998)

This European Standard was approved by CENELEC on 1993-03-09; amendment A1 was approved by CENELEC on 1996-10-01 and amendment A2 on 1999-01-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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

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

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

CENELEC

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

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

Foreword

The text of documents CISPR/F(CO)70 and 71, as prepared by CISPR, Subcommittee F: Interference relating to household appliances, tools, lighting equipment and similar apparatus, was submitted to the IEC-CENELEC parallel vote in April 1991.

The text of document CISPR/F(CO)84, prepared by the same subcommittee, was submitted to the IEC-CENELEC parallel vote in May 1992.

The reference documents were approved by CENELEC as EN 55014 on 9 March 1993.

The following dates were fixed:

- latest date of publication of an identical national standard (dop) 1993-11-01
- latest date of withdrawal of conflicting national standards (dow) 1995-12-31

Foreword to amendment A1

The texts of CISPR/F180/CDV and CISPR/F/182/FDIS, future amendment 1 to CISPR 14-1:1993, prepared by CISPR SC F, Interference relating to household appliances, tools, lighting equipment and similar apparatus, were submitted to the Unique Acceptance Procedure and were approved by CENELEC as amendment A1 to EN 55014-1:1993 on 1996-10-01.

NOTE With this amendment the European Standard is renumbered EN 55014-1 and the title adapted accordingly.

The following dates were fixed:

- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1997-10-01
- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) —

Foreword to amendment A2

The text of document CISPR/F/253/FDIS, future amendment 2 to CISPR 14-1:1993, prepared by CISPR SC F, Interference relating to household appliances, tools, lighting equipment and similar apparatus, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A2 to EN 55014-1:1993 on 1999-01-01.

The following dates were fixed:

- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1999-10-01
- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 2001-10-01

Annexes designated “normative” are part of the body of the standard. In this standard, annex ZA is normative. Annex ZA has been added by CENELEC.

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Introduction

The intention of this standard is to establish uniform requirements for the radio disturbance level of the equipment contained in the scope, to fix limits of disturbance, to describe methods of measurement and to standardize operating conditions and interpretation of results.

1 Scope

1.1 This standard applies to the conduction and the radiation of radio-frequency disturbances from appliances whose main functions are performed by motors and switching or regulating devices, unless the r.f. energy is intentionally generated or intended for illumination.

It includes such equipment as: household electrical appliances, electric tools, regulating controls using semiconductor devices, motor-driven electro-medical apparatus, electric toys, automatic dispensing machines as well as cine or slide projectors.

Also included in the scope of this standard are:

- separate parts of the above mentioned equipment such as motors, switching devices e.g. (power or protective) relays, however no emission requirements apply unless formulated in this standard.

This standard gives for the time being no requirements for apparatus that cannot be measured on a test site; requirements for *in situ* measurements are under consideration.

Requirements concerning immunity are under consideration.

Excluded from the scope of this standard are:

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

NOTE Examples are:

- *Luminaires, discharge lamps and other lighting devices*: CISPR 15;
- *Audio and video equipment and electronic music instruments*: CISPR 13 and 20 (see also 7.3.5.4.2);
- *Mains communication devices*: IEC XX (to be published);
- *Equipment for generating and use of radio frequency energy for heating and therapeutic purposes*: CISPR 11;
- *Microwave ovens*: CISPR 11 (but be aware of subclause 1.3 on multifunction equipment);
- *Information technology equipment, e.g. home computers, personal computers*: CISPR 22;
- *Electric equipment to be used on motor vehicles*: CISPR 12.
- regulating controls and equipment with regulating controls incorporating semiconductor devices with a rated input current of more than 25 A per phase;
- stand-alone power supplies.

1.2 The frequency range covered is 9 kHz to 400 GHz.

1.3 Multifunction equipment which is subjected simultaneously to different clauses of this standard and/or other standards shall meet the provisions of each clause/standard with the relevant functions in operation; details are given in 7.2.1.

1.4 The limits in this standard have been determined on a probabilistic basis, to keep the suppression of disturbances economically feasible while still achieving an adequate radio protection. In exceptional cases radio frequency interference may occur, in spite of compliance with the limits. In such a case, additional provisions may be required.

2 Normative references

The following standards are referred to in this publication:

IEC 50(161):1989, *International Electrotechnical Vocabulary — Chapter 161: Electromagnetic Compatibility*.

IEC 60335-2-76:1997, *Safety of household and similar electrical appliances — Part 2: Particular requirements for electric fence energizers*.

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

CISPR 16-1, *Specification for radio interference and immunity measuring equipment, Part 1 (Draft 1989)*.

CISPR 16-2, *Methods of interference and Immunity measurements, Part 2 (Draft 1989)*.

NOTE CISPR 16 (1987) shall be used until CISPR 16-1 and CISPR 16-2 are available.

3 Definitions

3.1.1 For the purpose of this standard, the definitions contained in IEC 50(161):1989, *International Electrotechnical Vocabulary (IEV) — Chapter 161: Electromagnetic Compatibility*, apply extended with the specific definitions in the field of discontinuous disturbance given in 3.2, 3.3, 3.4, 3.5, 3.6 and 3.7.

3.1.2 Definitions of the following terms are specified in CISPR 16, Part 1 and Part 2 (Draft 1989):

Asymmetric voltage	Reference ground
Electrical charge time constant	RFD current
Electrical discharge time constant	RFD power on conductors
Equipment under test (EUT)	RFD voltage
Level	Type testing
Radio frequency disturbance source	Weighting

3.2 click

a disturbance which exceeds the limit of continuous disturbance not longer than 200 ms and which is separated from a subsequent disturbance by at least 200 ms. Both intervals are related to the level of the limit of continuous disturbance

a click may contain a number of impulses; in which case the relevant time is that from the beginning of the first to the end of the last impulse (see Figure 3)

3.3 switching operation

one opening or one closing of a switch or contact

NOTE Independent of whether clicks are observed or not.

3.4 minimum observation time T

the minimum time necessary when counting clicks (or where relevant counting switching operations) to provide sufficiently firm evidence for the statistical interpretation of the number of clicks (or switching operations) per time unit (see also 7.4.2.1).

3.5 click rate N

in general the number of clicks or switching operations within one minute; this figure is being used to determine the click limit (see also 7.4.2.3)

3.6 click limit L_q

the relevant limit L for continuous disturbance, as given in 4.1.1 for the measurement with the quasi-peak detector, increased by a certain value determined from the click rate N (see also 4.2.2.2)

the click limit applies to the disturbance assessed according to the upper quartile method

3.7 upper quartile method

a quarter of the number of the clicks registered during the observation time T is allowed to exceed the click limit L_q

in the case of switching operations a quarter of the number of the switching operations registered during the observation time is allowed to produce clicks exceeding the click limit L_q (see also 7.4.2.6)

4 Limits of disturbance

Radio disturbance measurements below 148,5 kHz and above 300 MHz need not to be carried out, unless otherwise specified in this standard for specific appliances.

4.1 Continuous disturbance

Commutator motors, as well as other devices incorporated in household appliances, electric tools and similar electrical apparatus may cause continuous disturbance.

Continuous disturbance may be either broadband, caused by switching devices such as mechanical switches, commutators and semiconductor regulators, or may be narrowband, caused by electronic control devices such as microprocessors.

NOTE Instead of the concept of "broadband" and "narrowband" disturbances, in this standard a distinction is made between two related kinds of disturbance, defined by the type of the applied detector. For this purpose limits have been defined with respect to the measurement with the quasi-peak detector and with the average detector (see 5.1.1 and 6.1.1).

4.1.1 Frequency range 148,5 kHz to 30 MHz (terminal voltages)

NOTE The World Administrative Radiocommunications Conference (WARC) has in 1979 reduced the lower frequency limit in Region 1 to 148,5 kHz; for applications falling in the scope of this standard, tests at 150 kHz are considered adequate, since 148,5 kHz falls within the receiver bandwidth.

The limits of the terminal disturbance voltages are given in Table 1. Terminal voltages are measured, in accordance with clause 5, on each terminal with respect to ground.

Terminals are defined as conductive parts, suitable for re-usable electrical connection to external circuits.

4.1.1.1 The limits in columns 2 and 3 shall be met on the phase(s) and the neutral of the mains terminals of all appliances except those of electric tools.

4.1.1.2 On additional terminals of appliances as well as on load and additional terminals of regulating controls incorporating semiconductor devices the relaxed limits given for "additional terminals" in columns 4 and 5 apply.

Terminals which may be used as either mains terminals or load/additional terminals are subject to the limits for mains terminals.

No terminal voltage limits apply for non-rewirable leads shorter than 2 m, connecting separate semiconductor speed controls with apparatus such as sewing machines, dental drills, etc. The semiconductor device may be either incorporated in the separate control unit or in the apparatus.

NOTE For the measurement at the load terminals and additional terminals of regulating controls incorporating semiconductor devices see 5.2.4, for additional terminals of other appliances see 5.2.3.

Table 1 — Terminal voltage limits for the frequency range 148,5 kHz to 30 MHz
(see Figure 1 and Figure 2)

HOUSEHOLD APPLIANCES AND EQUIPMENT CAUSING SIMILAR DISTURBANCES AND REGULATING CONTROLS INCORPORATING SEMICONDUCTOR DEVICES						
Frequency range	At mains terminals		At load terminals and at additional terminals			
1	2	3	4	5		
(MHz)	dB (μV) Quasi-peak	dB (μV) Average ^a	dB (μV) Quasi-peak	dB (μV) Average ^a		
0,15 to 0,50	Decreasing linearly with the logarithm of the frequency from: 66 to 56		80	70		
		59 to 46				
0,50 to 5	56	46	74	64		
5 to 30	60	50	74	64		
MAINS TERMINALS OF TOOLS						
1	6	7	8	9	10	11
Frequency range	Rated motor power not exceeding 700 W		Rated motor power above 700 W and not exceeding 1 000 W		Rated motor power above 1 000 W	
(MHz)	dB (μV) Quasi-peak	dB (μV) Average ^a	dB (μV) Quasi-peak	dB (μV) Average ^a	dB (μV) Quasi-peak	dB (μV) Average ^a
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
NOTE The limits for the measurement with the average detector are tentative and may be modified after a period of experience.						
^a If the limit for the measurement with the average detector is met when using a receiver with a quasi-peak detector, the equipment under test shall be deemed to meet both limits and the measurement using the receiver with an average detector need not to be carried out.						

4.1.1.3 For the mains terminals of electric tools the particular limits given in columns 6 to 11 apply according to the rated power of the motor, the power of any heating device is to be excluded (for instance heating power in a blower for plastic welding). For the load terminals and additional terminals of electric tools, columns 4 and 5 apply without further relaxation.

4.1.1.4 Limits for electric fence energizers apply to:

- the fence terminals on all energizers (columns 4 and 5 of Table 1);
- the mains terminals on energizers designed for connection to the mains (columns 2 and 3 of Table 1);
- the battery terminals on energizers designed for operation from a battery (columns 4 and 5 of Table 1).

However, no limits apply to the battery terminals of energizers with built-in batteries which cannot be connected to the mains supply, or energizers with external batteries if the connecting lead between the energizer and the battery is shorter with 2 m and is not capable of being easily extended by the user without special tools.

Type D energizers, according to IEC 60335-2-76, are measured as battery operated energizers with connecting leads between the energizer and the battery greater than 2 m in length.

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 eliminate discharge points such as touching vegetation or a broken fence wire.

Table 2 — Disturbance power limits for the frequency range 30 MHz to 300 MHz

Household and Similar appliances		Tools						
1	2	3	4	5	6	7	8	9
Frequency range			Rated motor power not exceeding 700 W		Rated motor power above 700 W and not exceeding 1 000 W		Rated motor power above 1 000 W	
(MHz)	dB (pW) Quasi-peak	dB (pW) Average ^a	dB (pW) Quasi-peak	dB (pW) Average ^a	dB (pW) Quasi-peak	dB (pW) Average ^a	dB (pW) Quasi-peak	dB (pW) Average ^a
30 to 300	Increasing linearly with the frequency from 45 to 55		Increasing linearly with the frequency from 45 to 55		Increasing linearly with the frequency from 49 to 59		Increasing linearly with the frequency from 55 to 65	
		35 to 45		35 to 45		39 to 49		45 to 55

NOTE The limits for the measurement with the average detector are tentative and may be modified after a period of experience.

^a If the limit for the measurement with the average detector is met when using a receiver with a quasi-peak detector, the equipment under test shall be deemed to meet both limits and the measurement with the receiver with average detector need not be carried out.

4.1.1.5 For battery operated appliances (with built-in batteries, as well as with external batteries) which can be connected to the mains the limits of columns 2 and 3 of Table 1 apply to the mains terminals.

No radio disturbance limits apply to appliances with built-in batteries, which cannot be connected to the mains supply.

No radio disturbance limits apply to appliances with external batteries, if the connecting lead between appliance and battery is shorter than 2 m. If the connecting lead is longer than 2 m or easily extendable by the user without special tools, then the limits of columns 4 and 5 of Table 1 apply to these leads.

4.1.2 Frequency range 30 MHz to 300 MHz (disturbance power)

The limits of the disturbance power are given in Table 2.

Disturbance power is measured in accordance with clause 6, at all terminals.

4.1.2.1 The limits in columns 2 and 3 of Table 2 shall be met by all appliances except those mentioned in 4.1.2.2, second paragraph, to 4.1.2.4.

4.1.2.2 For battery operated appliances (with built-in batteries as well as with external batteries) which can be connected to the mains the limits of columns 2 and 3 of Table 2 apply, together with 4.1.2.3 and 4.1.2.4.

For battery operated appliances (with built-in batteries) which cannot be connected to the mains, no disturbance power limits apply;

4.1.2.3 For electric tools the particular limits given in columns 4 to 9 of Table 2 apply according to the rated power of the motor, the power of any heating device is to be excluded (for instance heating power in a blower for plastic welding).

4.1.2.4 Regulating controls which incorporate semiconductor devices, electric fence energizers, rectifiers, battery chargers and convertors which do not contain any internal frequency or clock generator operating at frequencies higher than 9 kHz are not subject to the disturbance power requirements in the frequency range 30 MHz to 300 MHz.

4.2 Discontinuous disturbance

Switching operations in thermostatically controlled appliances, automatic programme controlled machines and other electrically controlled or operated appliances generate discontinuous disturbance. The subjective effect of discontinuous disturbance varies with repetition rate and amplitude in audio and video presentation. Therefore distinction is made between various kinds of discontinuous disturbance.

The discontinuous disturbance is only measured with a measuring receiver including a quasi-peak detector as mentioned in 5.1.1 and specified in clause 2 of CISPR 16, Part 1 (Draft 1989).

See Annex C for guidance.

4.2.1 The limits for discontinuous disturbance depend mainly on the character of the disturbance and on the click rate N as given in detail in 4.2.2 and 4.2.3.

No discontinuous disturbance limits apply in the frequency range 30 MHz to 300 MHz.

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

4.2.2 Frequency range 148,5 kHz to 30 MHz (terminal voltages)

4.2.2.1 The limits of Table 1 apply also to discontinuous disturbances from all equipment which produce:

a) disturbances other than clicks, or

- b) clicks occurring more frequently than twice in any 2 s period, or
- c) clicks with a click rate N equal to or greater than 30.

Appliances as described in 4.2.3 are exempted.

NOTE Examples of discontinuous disturbances for which the limits for continuous disturbance apply are shown in Figure 4a, Figure 4b, and Figure 4c.

4.2.2.2 The click limit L_q is the relevant limit L for continuous disturbance, as given in 4.1.1, increased by:

44 dB	for $N < 0,2$, or
20 lg (30/ N) dB	for $0,2 \leq N < 30$

NOTE Examples of discontinuous disturbances which are classified as clicks are shown in Figure 3a, Figure 3b and Figure 3c.

See also Annex A, Table A.1 and Table A.2.

4.2.2.3 The click limit L_q applies for click rates N determined under operating conditions and interpretation of results as specified in clause 7.

4.2.3 The following exceptions apply:

4.2.3.1 Thermostats for, or integrated in room heating equipment (such as convectors, fan heaters, fluid filled heaters, oil burners and similar) which are intended for stationary use shall be in conformity with the click limit L_q for which in the calculation a click rate N shall be used, which is five times the click rate N determined for a single room-heater in accordance with 7.2.4.

Subclause 4.2.3.4 does not apply.

4.2.3.2 When clicks from programme-controlled appliances are evaluated applying the method of assessment of discontinuous disturbance, some discontinuous disturbance may be registered that does not satisfy the conditions given in 4.2.2.1 necessary in order to be classified as clicks.

If the total duration of this discontinuous disturbance does not exceed 600 ms during the minimum observation time (see 3.4), it is considered as one click and is not subject to the limits for continuous disturbance laid down in 4.1.1.

4.2.3.3 The disturbance from individual switching operations, caused directly or indirectly, manually or by similar activities on a switch or a control which is included in an appliance or otherwise to be used for:

- 1) the purpose of mains connection or disconnection only,
- 2) the purpose of programme selection only,
- 3) the control of energy or speed by switching between a limited number of fixed positions,
- 4) the changing of the manual setting of a continuously adjustable control such as a variable speed device for water extraction or electronic thermostats, is to be disregarded for the purpose of testing the appliance for compliance with the limits of radio disturbance set out in this standard.

Examples of switches included in this subclause are the switch for a lamp (including foot activated), the switch for an electric typewriter, manual switches for heat and air flow control in fan heaters and hair-dryers, as well as the indirectly operated switch in a cupboard, wardrobe or refrigerator, and sensor-operated switches for front door lamps, etc.

Switches which usually will be repeatedly operated are not included in this subclause, e.g. for sewing machines, calculating machines, soldering equipment, etc. see 7.2.3 and 7.3.2.4 c).

Also the disturbance caused by the operation of any switching device or control which is included in an appliance for the purpose of mains disconnection for safety only, is to be disregarded for the purpose of testing the appliance for compliance with the limits of radio disturbance as described in this standard.

4.2.3.4 Appliances which have a click rate N of not more than five and which have instantaneous switching (i.e. the duration of each click is less than 10 ms) shall be deemed to comply with the limits, independent of the amplitude of the clicks (see for Table A.1 and Table A.2 of Annex A).

If either condition is not satisfied then the limits in accordance with 4.2.2 apply.

4.2.3.5 For appliances which have a click rate N of less than five, any two disturbances caused by the sequential operation of two or more separate switches, and each disturbance having a maximum duration of 200 ms, and neither preceded nor followed within 2 s by any other disturbance, shall be evaluated as two clicks even when the separation between the disturbances is less than 200 ms.

For this class of equipment, for instance refrigerators, the example shown in Figure 4c, would be evaluated as two clicks and not as continuous disturbance.

4.2.3.6 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 and subject to the following conditions, be evaluated as three clicks and not as continuous disturbance:

- a) the switch operates not more than once in any 15 min period and the three disturbances are neither preceded nor followed within 2 s by any other disturbance;
- b) the duration of the disturbance caused by the opening or the closing of any one of the contacts shall be 10 ms or less and not more than a quarter of the number of the clicks caused by switching operations registered during the observation time is allowed to exceed the level 44 dB above the relevant limit L for continuous disturbance.

4.2.3.7 For appliances listed in Table A.2 of Annex A, the click rate $N = n_2 \times f/T$, where n_2 is the number of switching operations (see 3.3) during the observation time T minutes, and f is a factor given in Annex A, Table A.2.

4.2.3.8 The limits for electric fence supply units apply to the mains terminals and to the output terminal of the supply unit. A correction factor of 16 dB has to be added to the measured values on the output terminals according to the voltage division resulting from the use of the fence equivalent circuit from the 250 Ω resistor in series with the 50 Ω impedance of the artificial mains V-network (see also item 5 of the legend of Figure 6).

4.2.4 The limits for specific appliances for various conditions in accordance with the preceding 4.2.2 and 4.2.3 are summarized in Annex A.

Limits for appliances not shown in Annex A shall be calculated in accordance with the principles laid down in 4.2.2 and 4.2.3, using the examples shown in Annex A for guidance.

5 Methods of measurement of terminal disturbance voltages (148,5 kHz to 30 MHz)

This clause lays down the general requirements for the measurement of disturbance voltage produced at the terminals of apparatus.

The operating conditions are given in clause 7 of this standard.

5.1 Measuring devices

The measuring devices given below are to be used:

5.1.1 Measuring receivers

Receivers with quasi-peak detectors shall be in accordance with clause 2 of CISPR 16, Part 1 (Draft 1989); receivers with average detectors shall be in accordance with clause 4 of CISPR 16, Part 1 (Draft 1989).

NOTE Both detectors may be incorporated in a single receiver and measurements carried out either using the quasi-peak detector or the average detector.

5.1.2 Artificial mains network

The artificial mains V-network is required to provide a defined impedance at high frequencies between the terminals of the equipment under test and reference ground, and also to isolate the test circuit from unwanted radio-frequency signals on the supply mains.

The artificial mains V-network 50 Ω /50 μH (or 50 Ω /50 μH + 5 Ω) as defined in clause 11 of CISPR 16, Part 1 (Draft 1989) shall be used.

To ensure that, at the frequency of measurement, the impedance of the mains does not materially affect the impedance of the artificial mains V-network, a suitable radio-frequency impedance shall be inserted between the artificial mains V-network and the supply mains. This impedance will also reduce the effect of unwanted signals which occur on the supply mains (see also 5.3).

The connection between the artificial mains V-network and the measuring receiver shall be made by means of a coaxial cable with a characteristic impedance of 50 Ω .

5.1.3 Voltage probe

The voltage probe shall be used when measuring on terminals other than mains terminals (see 5.2.3.2) e.g. load and control terminals (5.2.4.4). The voltage probe shall also be used on mains terminals when the artificial mains V-network cannot be used without unduly influencing the equipment under test or the test equipment, e.g. while measuring motors and heating devices operating at more than 25 A per phase.

The voltage probe contains a resistor having a resistance value of at least 1 500 Ω in series with a capacitor with a reactive value negligible to the resistance (in the range 150 kHz to 30 MHz) (see clause 12 of CISPR 16, Part 1, Draft 1989).

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