II

(Acts whose publication is not obligatory)

COMMISSION

COMMISSION DIRECTIVE

of 7 June 1982

adapting to technical progress Council Directive 76/889/EEC on the approximation of the laws of the Member States relating to radio interference caused by electrical household appliances, portable tools and similar equipment

(82/499/EEC)

THE COMMISSION OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community,

Having regard to Council Directive 76/889/EEC of 4 November 1976 on the approximation of the laws of the Member States relating to radio interference caused by electrical household appliances, portable tools and similar equipment (1), and in particular Article 7 (3) thereof,

Whereas, in view of experience gained and of the state of the art, it is now possible to match the requirements of the Annex to the abovementioned Directive more closely to actual test conditions;

Whereas the measures provided for in this Directive are in accordance with the opinion of the Committee on the Adaptation to Technical Progress of the Directives for the elimination of Technical Barriers to Trade in the Sector of Apparatus Producing Radio Interference,

HAS ADOPTED THIS DIRECTIVE:

Article 1

The Annex to Directive 76/889/EEC is replaced by the Annex to this Directive.

Article 2

The Member States shall, by 1 December 1983, adopt and publish the provisions required to comply with this Directive and shall forthwith inform the Commission thereof.

They shall apply these provisions as from the same date as regards the freedom to market and use the equipment, provided for in Article 4 of Directive 76/889/EEC, and as from 1 December 1984 as regards the ban on marketing referred to in Article 2 thereof.

Article 3

This Directive is addressed to the Member States.

Done at Brussels, 7 June 1982.

For the Commission

Karl-Heinz NARJES

Member of the Commission

(1) OJ No L 336, 4. 12. 1976, p. 1.

ANNEX

1. (1) SCOPE

1.1. These provisions shall apply to electrical household appliances, portable tools and other electrical equipment causing similar types of interference, continuous or discontinuous, such as office machines, cine or slide projectors, record players, milking machines, motor-operated electromedical apparatus, regulating controls incorporating semi-conductors, electric fences, vending machines and slot-machines, etc., excluding appliances using in-built batteries.

1.2. Procedures are given for the measurement of interference and limits are laid down within the frequency range 0·15 to 300 MHz. There must be 80 % confidence that at least 80 % of the series-produced appliances comply with these limits.

1.3. Portable tools with a rated power exceeding 2 kW and regulating controls incorporating semiconductors with a rated input current exceeding 16 A are excluded from the scope of this Directive.

1.4. Unattached motors, sold as such, are also excluded from the provisions of Items 4 *et seq.* They shall carry a label drawing the attention of the user to the fact that he is responsible for any action necessary to ensure that his equipment complies with the requirements laid down.

(2.)

3. DEFINITIONS

For the purpose of this Directive the following definitions shall apply.

3.1. **Continuous interference**

Continuous interference may arise from either impulsive or random noise or may be a superposition of these, the disturbance lasting for more than 200 ms.

3.2. **Discontinuous interference**

Interference which is not continuous. In the calculation of limits and the measurement of discontinuous interference the following definitions are used.

3.2.1. *Click*

A disturbance which lasts not more than 200 ms, and which is separated from a subsequent disturbance by at least 200 ms. A click may contain a number of impulses. Examples of discontinuous interference which are classified as clicks are shown in Figures 1a, 1b and 1c.

3.2.2. *Counted click*

Click which exceeds the limit of continuous interference.

3.2.3. *Switching operation*

One opening or one closing of a switch or contact.

(1) Point 1 of the Annex to Council Directive 76/889/EEC.

3.2.4. *Minimum observation time*

In general, the time taken to register 40 counted clicks or, for appliances listed in Table II, Appendix A, to count 40 switching operations. For appliances which do not stop automatically, the time to register 40 counted clicks or, where relevant, 40 switching operations. For appliances which stop automatically, the operating time of the minimum number of complete programmes required to produce at least 40 counted clicks or, where relevant, 40 switching operations. The interval between the end of one programme and the start of the next programme shall be excluded from the minimum observation time, except (a) where specified (e.g. Item 5.3.5.13), or (b) in the case of appliances in which an immediate restart is inhibited; in both cases the minimum time required to restart the programme shall be included in the minimum observation time.

The minimum observation time shall not exceed 120 minutes.

3.2.5. *Click rate N*

The figure which is used to determine the permitted limit for discontinuous interference (Item 3.2.6). In general N is the number of counted clicks per minute determined from the formula $N = n_1/T$; n_1 being the number of counted clicks during the observation time T minutes.

For certain appliances (see Item 4.2.4.6) the click rate N is determined from the formula $N = fn_2/T$, where n_2 is the number of switching operations during the observation time T and f is a factor given in Table II of Appendix A.

3.2.6. *Permitted limit L_q (for counted clicks)*

The relevant limit for continuous interference increased by a specified amount (given in Items 4.2.3.3 and 4.2.4).

3.2.7. *Typical value*

The typical value of clicks is that allocated to the appliance according to the upper quartile method, the appliance being tested for a time T not less than the minimum observation time. If the click rate N is determined from the number of counted clicks, the appliance under test shall be deemed to comply with the limit if not more than a quarter of the number of counted clicks registered during the observation time are higher than the permitted limit (see Item 3.2.6).

If the click rate N is determined from the number of switching operations (see Item 3.2.5), the appliance under test shall be deemed to comply with the limit if the number of clicks exceeding the permitted limit is not more than a quarter of the number of switching operations.

Note: An example of the application of the upper quartile method is given in Apppendix B.

3.3. **Duty cycle**

The duty cycle is the ratio of the time during which the contacts are closed to the total time expressed as a percentage.

4. INTERFERENCE LIMITS

4.1. Continuous interference

4.1.1. *Frequency range: 0·15 to 30 MHz (terminal voltages)*

The measuring equipment shall comply with CISPR Publication 16 (1977), 'CISPR Specification for Radio Interference Measuring Apparatus and Measurement Methods'. The operating condi-

tions and methods of measurement are given in Item 5 and 6, respectively, of this Annex. The limits of the terminal voltages measured with the 50 Ω artificial mains V-network (see Item 6.1.2) are given in Table I.

TABLE I

Terminal voltage limits for the frequency range 0·15 to 30 MHz

Frequency range	Electrical household appliances and appliances causing similar interference	Regulating controls not incorporated within an appliance		
		At mains terminals	At load terminals	At additional terminals
(MHz)	dB (μV)	dB (μV)	dB (μV)	dB (μV)
0·15 to 0·50	Decreasing linearly with the logarithm of the frequency from 66 to 56	Decreasing linearly with the logarithm of the frequency from 66 to 56	80	80
0·50 to 5	56	56	74	74
5 to 30	60	60	80	80

Frequency range	Portable tools		
	Rated power of motor		
	Not exceeding 700 W	Above 700 W and not exceeding 1 000 W	Above 1 000 W and not exceeding 2 000 W
(MHz)	dB (μV)	dB (μV)	dB (μV)
0·15 to 0·35	Decreasing linearly with the logarithm of the frequency from 66 to 59	Decreasing linearly with the logarithm of the frequency from 70 to 63	Decreasing linearly with the logarithm of the frequency from 76 to 69
0·35 to 5	59	63	69
5 to 30	64	68	74

4.1.2. *Frequency range 30 MHz to 300 MHz (interference power)*

The measuring equipment shall comply with CISPR Publication 16 (1977), 'CISPR Specification for Radio Interference Measuring Apparatus and Measurement Methods'.

The operating conditions and methods of measurement are given in Items 5 and 7 respectively, of this Annex.

The limits of interference power, measured with the absorbing clamp (see Item 7) are given in Tables II and III below:

TABLE II

Interference power limits for the frequency range 30 to 300 MHz

Frequency range	Electrical household appliances and appliances causing similar interference	Portable tools		
		Rated power of motor		
		Not exceeding 700 W	Above 700 W and not exceeding 1 000 W	Above 1 000 W and not exceeding 2 000 W
MHz	dB (pW)	dB (pW)	dB (pW)	dB (pW)
30 to 300	45 increasing linearly with frequency to 55	45 increasing linearly with frequency to 55	49 increasing linearly with frequency to 59	55 increasing linearly with frequency to 65

TABLE III

Interference power limits at the preferred frequencies

Preferred frequencies	Electrical household appliances and appliances causing similar interference	Portable tools		
		Rated power of motor		
		Not exceeding 700 W	Above 700 W and not exceeding 1 000 W	Above 1 000 W and not exceeding 2 000 W
MHz	dB (pW)	dB (pW)	dB (pW)	dB (pW)
30	45	45	49	55
45	46	46	50	56
65	46	46	50	56
90	47	47	51	57
150	49	49	53	59
180	51	51	55	61
220	52	52	56	62
300	55	55	59	65

4.2. **Discontinuous interference**

4.2.1. Switching operations in thermostatically controlled appliances, automatic programme-controlled appliances and other electrically controlled or operated appliances generate discontinuous interference. The subjective effect of discontinuous interference varies with repetition rate and amplitude. For that reason, a distinction is made between various kinds of discontinuous interference. The measuring equipment used is specified in CISPR Publication 16 (1977), 'CISPR Specification for Radio Interference Measuring Apparatus and Measurement Methods'.

(4.2.2.)

4.2.3. The following limits and conditions shall apply (except as detailed in Item 4.2.4).

4.2.3.1. When switching operations produce:

(a) counted clicks occurring more than twice in any 2-s period, or

(b) interference other than clicks,

the interference shall, with the exception of that caused by appliances as detailed in Items 4.2.3.5, 4.2.4.3 and 4.2.4.4, be subject to the limits for continuous interference laid down in Item 4.1.

Examples of discontinuous interference to which the limits for continuous interference apply are shown in Figures 2a, 2b and 2c.

4.2.3.2. In the case of counted clicks not occurring more than twice in any 2-s period for all classes of appliances, except those detailed in Item 4.2.4, the permitted limit shall be as defined in Item 4.2.3.3 and as shown in Appendix A.

4.2.3.3. The permitted limit L_q applying to counted clicks in relation to the limit L for continuous interference, is obtained from the formulae:

$$L_q = (L + 44)\ (*) \qquad [N < 0{\cdot}2]$$

$$L_q = \left(L + 20 \log_{10} \frac{30}{N}\right)^{(*)} \qquad [0{\cdot}2 \leqslant N \leqslant 30]$$

$$L_q = L\ (*) \qquad [N > 30]$$

(*) dB (μV) for the frequency range 0·15 to 30 MHz,
dB (pW) for the frequency range 30 to 300 MHz.

The value of N shall be determined at 160 kHz, 550 kHz and 45 MHz for the frequency ranges 150 to 500 kHz, 0·5 to 30 MHz and 30 to 300 MHz respectively.

4.2.3.4. The limits apply for click rates N under the operating conditions specified in Items 5.1.1 and 5.3 or, when not specified,under the most onerous conditions of normal use (maximum click rate N).

4.2.3.5. When programme-controlled appliances are assessed, some discontinuous interference which is caused by one or more disturbances and which does not satisfy the conditions necessary in order to be classified as clicks, may be registered. If, during the observation time the total duration of this discontinuous interference does not exceed 600 ms then it is considered as one click and is not subject to the limits for continuous interference laid down in Item 4.1.

In the case of appliances which produce fewer than 10 clicks per minute ($N < 10$) the occurrence of more than two clicks caused by the successive functioning of several contacts in less than two seconds is acceptable if this phenomenon represents less than 2 % of the clicks caused by the appliance during the execution of a typical cycle and the number of these successive clicks does not exceed four.

For this category of appliance, e.g. certain washing machines and their typical washing cycle, the example given in Figure 2 on page 36 would be rated as three clicks and not as interference.

4.2.4. For certain appliances listed in the following items, the limits and operating conditions laid down in Item 4.2.3 shall apply with the exceptions detailed.

4.2.4.1. The interference caused by the manual operation of a switch which is included in the appliance for:

(a) the purpose of mains connection and/or disconnection only,

(b) the purpose of programme selection only, or

(c) the control of energy by switching between a limited number of fixed positions

is to be disregarded for the purposes of testing the appliance for compliance with the limits of radio interference set out in this Technical Annex. Examples of switches included in the above definition are the switch for a lamp, the switch for an electric typewriter, the switch for heat and air-flow control in fan heaters. Switches which are not included in the above definitions are those designed to give a continuously variable output. For interference caused by switches which are subject to repeated manual operation during normal use, no amplitude limits apply if the click duration is less than 10 ms; failing this, a click rate of N = 4 applies, unless otherwise specified (e.g. Item 5.3.7.2) or unless a click rate of N = 4 cannot be attained, in which case the highest value of N obtainable in practice shall be used. Examples of appliances with switches which are operated repeatedly during normal use are fruit-juice squeezers and hot-air hand driers for public use.

4.2.4.2. Specific appliances marked with ** in the Tables of Appendix A, which have instantaneous switching (i.e. the duration of each click is less than 10 ms) and a click rate N of not more than five shall be deemed to comply with the limit independently of the amplitude of the clicks. Both conditions must be satisfied for this relaxation to be applied.

4.2.4.3. For appliances which have a click rate N of less than five, any two disturbances separated by less than 200 ms shall be evaluated as two separate clicks only if all the following conditions are satisfied:

(a) the first disturbance is caused by an intended operation within the appliance being tested;

(b) the second disturbance is caused by an intended operation within the appliance being tested, this second operation being the direct consequence of the first operation referred to in (a);

(c) each disturbance has a maximum duration of 200 ms;

(d) there is no other disturbance within the 2-s period preceding the first disturbance mentioned in (a);

(e) there is no other disturbance within the 2-s period following the second disturbance mentioned in (b).

For this class of equipment, e.g. refrigerators, the interference in the example shown in Figure 2c shall be evaluated as two clicks and not as continuous interference.

4.2.4.4. For thermostatically controlled three-phase switches, the three disturbances caused sequentially in each of the three phases and the neutral shall, independently of their spacing and subject to the following conditions, be evaluated as three clicks and not as continuous interference.

Conditions:

(a) Under normal conditions of use the switch cannot operate more frequently than once in any 15-minute period, and the three disturbances are neither preceded nor followed within 2-s by any other disturbance.

(b) The duration of the disturbances caused by the opening or the closing of any one of the contacts shall be 10 ms or less and the typical value shall be not more than 44 dB above the limit for continuous interference.

4.2.4.5. For room heaters having built-in thermostats and intended for permanent installation, the click rate N used to calculate the permitted limit shall be five times the click rate determined for one room heater as defined in Item 3.2.5 and determined in accordance with Item 5.3.5.11.

4.2.4.6. For appliances listed in Table II of Appendix A, the click rate $N = fn_2/T$, where n_2 is the number of switching operations (see Item 3.2.3) during the observation time T minutes, and f is a factor given in Appendix A, Table II.

4.2.4.7. Limits for power supply devices for electric fences are applicable to the terminals of the power supply device (see Figure 4) and are applicable only up to 30 MHz.

4.2.5. The limits for specific appliances for various conditions in accordance with the preceding Items 4.2.3 and 4.2.4 are summarized in Appendix A.

Limits for appliances not shown in Appendix A shall be calculated in accordance with Items 4.2.3 and 4.2.4, using as guidance the examples shown in Appendix A.

4.3. **Interference produced by regulating controls incorporating semi-conductor devices**

The limits are applicable only to regulating controls of rated input currents not exceeding 16 A and which incorporate semi-conductor devices. The limits are given in Table I. Regulating controls which incorporate semi-conductor devices are not subject to the interference power limits in the frequency range 30 to 300 MHz.

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

4.3.1. *Appliances containing several individually adjustable regulating controls*

The following measurement procedure is applied to appliances containing several individually adjustable regulating controls. It shall be applied both to appliances where several regulating controls are connected to the same phase of the mains and to appliances where the regulating controls are connected to separate phases of the mains.

(a) Each individual regulating control is tested separately. Measurements are made on all terminals of the appliance. If separate switches are provided for the individual controls, the unused ones shall be in the 'off' position during the tests.

(b) As many individual regulating controls as possible shall be connected to their loads and each control set to its maximum rated input current. If it is not possible to connect all individual controls, those controls are used which gave the highest interference values when tested according to (a) (the controls may be different for different frequencies or for different terminals). The settings of the individual controls shall be the same as those giving maximum interference during the measurements according to (a). In addition, a simple check shall be made to ensure that no other setting will give more interference. Measurements are made on the mains terminals (all phases and neutral), on the terminals to the loads and on additional terminals of the appliance.

5. OPERATING CONDITIONS AND INTERPRETATION OF RESULTS

5.1. **General**

When measurements of interference are being made, the appliance shall be operated under the following conditions.

5.1.1. *Operating conditions*

5.1.1.1. Normal load conditions as defined in Item 5.3 shall be adopted. Appliances not covered by Item 5.3 are to be operated so as to maximize the interference generated whilst still conforming with normal operating procedure.

5.1.1.2. The time of operation shall be the operating time marked on the appliance; where an operating time is not indicated, there is no restriction on the time of operation.

5.1.1.3. No running-in time is to be specified but, prior to testing, the appliance shall be operated for a sufficient period to ensure that the conditions of operation will be typical of those obtaining during the normal life of the appliance. For type-approval testing and production-control testing, the testing authority may require that running-in shall be carried out by the manufacturer.

5.1.1.4. The appliances shall be operated from a supply having the rated voltage of the appliance. If the level of interference varies considerably with the supply voltage, a test at a frequency in each frequency range for supply voltages from 0·9 to 1·1 times the rated voltage shall be made. Appliances with more than one rated voltage shall be tested at the rated voltage which causes maximum interference.

5.1.1.5. Appliances which are subject simultaneously to the provisions of different items of this Technical Annex and/or other Directives relating to radio interference shall be tested as follows:

(a) The appliance shall be operated so that only that part which is subject to a particular item is operational while it is being tested as specified in that item, provided that this can be achieved without modifying it internally.

The appliance shall be tested as specified in each item to which it is subject.

The appliance shall be deemed to comply only if it satisfies the requirements of all items to which it is subject when tested as specified above.

(b) Appliances which, for practical reasons, cannot be tested as specified in (a), or appliances in which non-operation of the relevant part(s) would prevent the appliance from operating normally shall be tested as specified in the relevant items with all necessary parts operational. The appliance shall be deemed to comply only if the interference generated by all the operational parts satisfies the provisions of every relevant item.

5.1.1.6. When an appliance is listed in Item 5.2 or 5.3 and also incorporates a control, the control shall be set, at each preferred frequency (see Item 5.1.2.1), so as to maximize the radio interference generated. The scanning of the frequency range between two preferred frequencies shall be done at the control setting for the lower preferred frequency.

5.1.2. *Interpretation of results*

5.1.2.1. Continuous interference

(a) The reading on the measuring receiver shall be observed for at least 15 s at each measurement frequency; the highest readings shall be recorded with the exception of any isolated spike which shall be ignored;

(b) If the general level of the interference is not steady, but shows a continuing rise or fall of more than 2 dB in the 15-s period, the interference levels shall be observed for a further period and the levels shall be interpreted according to the conditions of normal use of the appliance, as follows:

1. If the appliance is one which may be switched on and off frequently, e.g. an electric drill or a sewing-machine motor, then at each measurement frequency the appliance shall be switched on immediately 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.

2. If the appliance is one which normally runs for longer periods without interruption, e.g. a hair drier, it shall remain switched on for the period of the complete measurement, and at each measurement frequency the level of interference shall be recorded only after a steady reading (subject to the provisions of paragraph (a)) has been obtained.

(c) If the pattern of the interference from an appliance changes from being steady to being random part way through a test, then that appliance shall be tested in accordance with paragraph (b).

(d) The limits apply throughout the frequency range 0·15 to 30 MHz and therefore the interference characteristics shall be assessed throughout this frequency range.

Note:

An initial survey or scanning of the complete range shall be made and the registered values shall be given at least at the following preferred frequencies and at all frequencies at which

there is a maximum which exceeds the limits: 0·16 MHz, 0·24 MHz, 0·55 MHz, 1 MHz, 1·4 MHz, 2 MHz, 3·5 MHz, 6 MHz, 10 MHz, 22 MHz, 30 MHz.

These frequencies are subject to a tolerance of ± 10 %.

(e) The limits apply throughout the frequency range 30 to 300 MHz and therefore the interference characteristics shall be assessed throughout this frequency range.

Note:

An initial survey or scanning of the complete range shall be made and the registered values shall be given at least at the following preferred frequencies and at all frequencies at which there is a maximum which exceeds the limits: 30 MHz, 45 MHz, 65 MHz, 90 MHz, 150 MHz, 180 MHz, 220 MHz, 300 MHz.

These frequencies are subject to a tolerance of ± 5 MHz.

The measurements shall be repeated at at least one frequency close to each of the following frequencies: 45, 90, 220 MHz. If differences of not more than 2 dB are observed between the levels of interference measured, the first results obtained shall be adopted. If, in any case, the difference is greater than 2 dB, the measurement shall be repeated for this frequency range and the highest level measured at each frequency shall be adopted.

5.1.2.2. Discontinuous interference

(a) Measurements of interference generated by switching operations shall be made at the following restricted number of frequencies: 160 kHz, 550 kHz, 1·4 MHz, 10 MHz, 45 MHz, 90 MHz and 220 MHz. A tolerance of ± 10 % is permitted for the first four frequencies, and of ± 5 MHz for the other three. Further restriction, to the following three frequencies, is permitted for prolonged tests: 160 kHz, 550 kHz, and 45 MHz.

(b) The minimum observation time and the click rate N are obtained in accordance with Items 3.2.4 and 3.2.5.

(c) The value of the click rate N shall be determined at the frequencies specified in Item 4.2.3.3.

5.1.3. *Measurement of the duration of disturbances*

Discontinuous interference measuring apparatus shall comply with Clause 30 and Appendix R of CISPR publication 16, first edition (1977).

An alternative method using an oscilloscope may be employed if it yields the same results with the same degree of accuracy.

See Appendix D for guidance.

5.1.4. *Appliances having auxiliary apparatus connected at the end of a lead other than the mains lead*

The appliance under test shall be disposed as indicated in Item 6.2.2.1, with the following additional requirements:

(a) the auxiliary lead shall be folded to form a horizontal bundle with a length of between 30 and 40 cm. If, for practical reasons, this is not possible, the shortest practical length shall be used. When the auxiliary apparatus is a control, the arrangements for its operation must not affect the level of interference;

(b) if an appliance having auxiliary apparatus is earthed, no artificial hand shall be connected. If the appliance itself is made to be held in the hand, the artificial hand shall be connected to the appliance and not to any auxiliary apparatus;

(c) if the appliance having auxiliary apparatus is not made to be held in the hand, auxiliary apparatus which is not earthed and is made to be held in the hand shall be connected to the artificial hand.

5.2. **Interference produced by regulating controls incorporating semi-conductor devices**

5.2.1. *General*

The requirements of this Technical Annex are limited to the regulating controls of rated input currents not exceeding 16 A using semi-conductors. Semi-conductor switched-mode power supplies operating at less than 10 kHz, except those incorporated in telecommunications equipment, are subject to the requirements of this Technical Annex.

5.2.2. *Measurements*

The measurement of interference from regulating controls incorporating semi-conductor devices (see Item 4.3) shall be made in accordance with CISPR publication 16 (1977) and as described in the following paragraphs:

(a) The regulating control shall be connected as shown in Figures 3 or 3a and measured in accordance with the provisions of Items 6.2.2.1 or 6.2.2.3.

(b) The output terminals of the control shall be connected to a load of the correct rated value by leads 1 m in length.

(c) Unless otherwise specified by the manufacturer, the load shall consist of incandescent lamps.

(d) Measurement shall also be made on the interference appearing at the load terminals by using a probe consisting of a capacitor and a resistance with a minimum value of 1 500 Ω in series with the input of the measuring receiver. Due allowance shall be made for the impedance of the probe and the resultant voltage division between the probe and the measuring receiver.

(e) For regulating controls having additional terminals for connection to a separate sensing or control component, the separation between the regulating control unit and the separate component shall be 1 m. The following further provisions apply:

1. These additional terminals shall be connected to the separate component by leads 1 m in length. If a special lead is provided, any length of this lead in excess of 80 cm shall be folded back and forth so as to form a horizontal bundle with a length between 30 and 40 cm.

2. Measurement of the interference at these additional terminals shall be made in the same way as described in Item 5.2.2 (d).

Note:

The probe impedance may have to be raised to avoid extra loading which causes improper operation of the regulating control (e.g. 15 kΩ in series with 500 pF).

(f) During each measurement the regulating control shall be adjusted so as to generate maximum interference at each measurement frequency.

(g) For sewing machines, dental drills and similar appliances using semi-conductor controls with non-rewirable separate control units (for example a cable with moulded plugs) connected to the appliance by a lead not longer than 2 m, only the interference at the mains terminals of the complete appliance shall be measured.

Note:

When the semi-conductor unit or its separate sensing or control components are incorporated in the equipment which is controlled, there is no need to measure the interference at those terminals which are connected to the corresponding incorporated unit or component and are not available for external connection.

5.3. **Definition of normalized loads and standardized operating conditions**

5.3.1. *Electric motor-operated appliances for household and similar purposes*

5.3.1.1. Vacuum cleaners shall be operated continuously without accessories but with the dust-bag in place.

5.3.1.2. Floor polishers shall be operated continuously without mechanical load on the polishing brushes.

5.3.1.3. Sewing machines.

5.3.1.3.1. Continuous interference caused by the motor: the motor shall be operated continuously with the sewing mechanism in operation, but without thread or material.

5.3.1.3.2. Switch interference: see Item 5.3.7.

5.3.1.4. Liquidizers: as in Item 5.3.1.7.

5.3.1.5. Clocks shall be operated continuously.

5.3.1.6. Fans shall be operated continuously with and without heating, if this is provided. For switch interference, see Item 5.3.5.11.

5.3.1.7. Food mixers (kitchen machines) shall be operated continuously without load.

5.3.1.8. Liquid-mixers/blenders: as in Item 5.3.1.7.

5.3.1.9. Refrigerators shall be operated continuously with the door closed. The thermostat shall be adjusted to the mean value of its range. The cabinet shall be empty and not heated. After reaching a steady operating state, the interference generated by the refrigerator shall be measured.

The click rate N is determined from half the number of switching operations. (Owing to ice deposition on the cooling element, the number of switching operations during normal functioning is about half the number occurring when the refrigerator is empty.)

Note:

Item 4.2.4.3 may apply.

5.3.1.10. Washing machines shall be operated with water only and the temperature of the incoming water shall be in accordance with the manufacturer's instructions. The thermostat, if any, shall be adjusted to the maximum setting for the programme chosen or to 90 °C, whichever is lower. The control programme giving the highest click rate N shall be selected.

Note:

For appliances where the drying function forms part of the programme see Item 5.3.1.21.

5.3.1.11. Centrifugal driers shall be operated continuously without load.

5.3.1.12. Dish-washing machines: as in Item 5.3.1.10.

5.3.1.13. Hair driers: as in Item 5.3.1.6; for switch interference, see Item 5.3.5.12.

5.3.1.14. Razors and hair clippers shall be operated continuously for not more than 10 minutes.

5.3.1.15. Massage apparatus shall be operated continuously without load.

5.3.1.16. Business machines

5.3.1.16.1. Typewriters shall be operated continuously.

5.3.1.16.2. Adding machines, calculating machines and cash registers

5.3.1.16.2.1. Motor interference: if possible, the motor shall be operated so as to give steady readings on the meter which are unaffected by switch interference.

5.3.1.16.2.2. Switch interference: see Item 5.3.7.

5.3.1.17. Projectors

5.3.1.17.1. Cine-projectors shall be operated continuously with a film, the lamp being switched on.

5.3.1.17.2. Slide projectors shall be operated continuously with the lamp switched on, but without slides unless these are necessary for the operation of the appliance (e.g. projectors with an autofocus facility). To determine the click rate N, operate with four picture changes per minute.

5.3.1.18. Coffee grinders shall be operated empty.

5.3.1.19. Lawn mowers shall be operated continuously without load.

5.3.1.20. Milking machines shall be operated continuously without vacuum.

5.3.1.21. Tumble dryers shall be operated with textile material in the form of pre-washed, double-hemmed cotton sheets having dimensions of approximately 70 cm × 70 cm and a weight of between 140 g/m² and 175 g/m² in the dry condition. Control devices shall be set to the lowest and the highest position. The position that gives the higher click rate N shall be taken.

Separate tumble dryers shall be operated with half the maximum dry weight of cotton textile material recommended in the manufacturers' operating instructions. The specified dry weight of material shall be saturated with an equal weight of water at 25 ± 5 °C.

Tumble dryers combined with washing machines where the washing, spinning and drying operations are performed sequentially in a single container shall be tested with half the maximum dry weight of cotton textile material recommended for the tumble dryer sequence in the manufacturer's operating instructions. The water content at the start of the drying operation shall be that obtained at the end of the previous spinning operation after a preceding washing operation.

5.3.1.22. Auxiliary power nozzles of vacuum cleaners connected by a non-rewirable mains supply lead longer than 0·4 m shall be measured as separate appliances, operating continuously without mechanical load on the brushes. If necessary, cooling shall be provided by a non-metallic hose.

5.3.2. *Portable motor-operated tools*

Hand-held electric power-operated tools which incorporate vibrating or swinging masses shall, where possible, be measured with these masses removed or disconnected.

Such tools, which have an inadmissible increase of their r/min (revolutions per minute) when operating without their vibrating or swinging masses, can be operated at lower voltages so that their nominal operating r/min is reached.

For portable tools designed to operate via a transformer intended to be connected to the mains supply, the following measurement procedure shall be used:

Terminal voltage: 0·15 to 30 MHz

(a) If the tool is sold together with a transformer, the interference shall be assessed by measurements made on the power-supply side of the transformer.

The power-supply lead from the portable tool to the transformer shall be 40 cm in length or, if longer, folded to form a horizontal bundle with a length between 30 and 40 cm.

(b) If the tool is sold as a 110 V device for example, but is intended to be used with a transformer, the interference shall be assessed by measurements made on the power-supply side of a transformer recommended for use with the power tool.

Note:

If a 'sample' transformer is not supplied with the tool at the time of test, the interference shall be assessed by measurements made at the tool's power input connections whilst it is being supplied at its rated voltage.

Interference power: 30 to 300 MHz

The interference shall be assessed by measurements made on the tool's power-input connections whilst being supplied at its rated voltage. During measurement the portable tool shall be equipped with a power-supply lead with a length suitable for measurements with the absorbing clamp as described in CISPR Publication 16 (1977), sub-clause 11.2.

5.3.2.1. Drills shall be operated continuously without load.

5.3.2.2. Screwdrivers and impact wrenches: as for Item 5.3.2.1. If two rotating directions can be used

(a) after running-in for a period of 15 minutes in one direction, measure the interference generated throughout the frequency ranges;

(b) after running-in for a further period of 15 minutes in the other direction, measure the interference generated throughout the frequency ranges.

The higher of the two interference levels shall comply with the permissible limit.

5.3.2.3. Grinders, disc-type sanders and polishers: as for Item 5.3.2.1.

5.3.2.4. Sanders, other than disc-type: as for Item 5.3.2.1.

5.3.2.5. Saws and knives: as for Item 5.3.2.1.

5.3.2.6. Hammers: as for Item 5.3.2.1.

5.3.2.7. Spray guns shall be operated continuously with the container empty and without accessories.

5.3.2.8. Shears: as for Item 5.3.2.1.

5.3.2.9. Thread-cutting machines: as for Item 5.3.2.1.

5.3.2.10. Compass saws for wood and similar material: as for Item 5.3.2.1.

5.3.2.11. Liquid agitators (internal vibrators) shall be operated continuously in the centre of a round steel-plate container filled with water, the volume of the water being 50 times the volume of the vibrator.

5.3.2.12. Impact drills: as for Item 5.3.2.1.

5.3.2.13. Planing machines: as for Item 5.3.2.1.

5.3.3. *Sound recording and reproduction equipment*

5.3.3.1. Gramophones shall be operated continuously without a disc.

5.3.3.2. Magnetic recorders shall be operated continuously using a magnetic recording medium.

5.3.3.3. Sound-film projectors shall be operated continuously with a film, the lamp being switched on.

5.3.4. *Motor-operated electromedical apparatus*

5.3.4.1. Dental drills

5.3.4.1.1. Continuous interference caused by the motor: the motor shall be operated continuously with the drilling gear fitted but not functioning.

5.3.4.1.2. Switch interference: see Item 5.3.7.

5.3.4.2. Saws and knives shall be operated continuously without load.

5.3.4.3. Electrocardiographs and similar recorders shall be operated continuously with a tape.

5.3.4.4. Pumps shall be operated continuously with a liquid.

5.3.5. *Electrical thermal appliances*

Before making measurements the appliances shall reach steady-state conditions. If the duty cycle specified below cannot be attained, the highest possible one shall be applied instead.

5.3.5.1. Cooking ranges with automatic plates; appliances with one or more boiling plates (or grills) controlled by thermostats or energy regulators shall be operated under conditions of adequate heat discharge; an aluminium pan filled with water is placed on the boiling plate and heated until the water boils. The click rate N is defined as half the number of switching operations per minute when the duty cycle of the control device (e.g. a thermostat) is (50 ± 10) %.

The exemption applicable to instantaneous switching (see Item 4.2.4.2) also covers these appliances.

Note:

Appliances incorporating cooking ovens and components associated with the operation of the oven shall be tested according to Item 5.3.5.2.

5.3.5.2. Cooking ovens shall be operated without conditions of adequate heat discharge, the oven door being closed. The click rate N shall be determined as the number of switching operations per minute when the duty cycle of the control device is (50 ± 10) %. The requirements for instantaneous switching (see Item 4.2.4.2) are applicable to these appliances.

5.3.5.3. Warming plates, boiling tables, heating drawers, heating cabinets, etc. shall be operated without conditions of adequate heat discharge. The click rate N shall be determined when the duty cycle of the control device is (50 ± 10) %.

5.3.5.4. Steam generators for indirect heating of appliances used in the hotel industry and open water-baths shall be operated under conditions of adequate heat discharge and using the normal quantity of water. The click rate N shall be determined when the duty cycle of the control device is (50 ± 10) %.

5.3.5.5. Frying pans, table-type roasters, deep-fat fryers, etc. shall be operated under conditions of adequate heat discharge. The quantity of oil above the highest point of the heating surface shall be approximately:

30 mm for frying pans (sauté pans),

10 mm for table-type roasters,

10 mm for deep-fat fryers, unless a minimum oil level is specified.

The click rate N shall be determined when the duty cycle of the control device is (50 ± 10) %.

5.3.5.6. Waffle irons shall be operated without conditions of adequate heat discharge, the appliance being closed. The click rate N shall be determined when the duty cycle of the control device is (50 ± 10) %.

5.3.5.7. Feed boilers, cauldrons, casseroles, water boilers, cooking pots, kettles, percolators, milk boilers, feeding-bottle heaters, glue pots, sterilizers, wash boilers, etc.

shall be operated under conditions of adequate heat discharge, half-filled with water and without the lid. In the case of a variable control device having a range between 20 °C and 100 °C the click rate N shall be determined with a medium setting (60 °C).

(5.3.5.8.)

5.3.5.9. Ironing machines (ironing machines for table use, rotating ironing machines, ironing presses):

The click rate N of the control device shall be determined without conditions of adequate heat discharge, the heating surface being in the open position and the control devices at the highest temperature setting.

The click rate N of the motor switch shall be determined under conditions of adequate heat discharge of the heating elements when two damp hand-towels (approximately 1 m × 0·5 m) are ironed per minute. The sum of the two click rates shall be used to determine the limit.

5.3.5.10. Irons

shall be operated under conditions of adequate heat discharge, using air, water or oil cooling. The click rate N is defined as the product of the factor 0·66 and the number of switching operations per minute when the duty cycle of the control device at a high temperature setting is 50 ± 10 %.

5.3.5.11. Appliances for heating rooms (fan heaters, convectors, oil-filled heaters, etc.)

shall be operated under conditions of adequate heat discharge. The click rate N shall be determined when the duty cycle of the control device is 50 ± 10 % or the maximum stated by the manufacturer.

The amplitude and duration of the interference shall be measured for the lowest position of the power range switch, if any. In addition, the same measurements shall be performed with the switch in the zero position for those appliances which have their thermostat and a resistor still connected to the mains.

5.3.5.12. Hair driers: see Item 5.3.5.11.

5.3.5.13. Toasters:

If the duration of each click is less than 10 ms and click rate N ≤ 5, no limit is applicable to the amplitude of the clicks.

5.3.5.13.1. Simple toasters

Simple toasters are toasters which:

(a) incorporate a manually operated switch for switching on the heating element at the start of the toasting cycle and automatically switching off the heating element at the end of a predetermined period, and

(b) incorporate no automatic control device to regulate the heating element during the toasting operation.

For simple toasters the click rate N shall be determined and the level of interference generated assessed as follows:

(a) Determination of click rate N

Using white bread about 24 hours old (dimensions approximately 10 cm × 9 cm × 1 cm) the manual control shall be set to give golden-brown toast. With the appliance in a warm condition, the average 'on' time (t_1 seconds) of the heating element shall be determined from three toasting operations. A rest period of 30 seconds shall be allowed when determining t_1. The time for a complete toasting cycle is (t_1 + 30) seconds. Thus the click rate $N = 120/(t_1 + 30)$.

(b) Assessment of interference levels

The click rate N, established as described above shall be used to calculate the permitted limit, L_q, using the formula given in Item 4.2.3.3.

The toaster shall be tested applying the calculated permitted limit and its conformity assessed using the upper quartile method given in Item 3.2.7. The toaster shall be operated for 20 heating cycles without load at the golden-brown setting specified in (a). Each heating cycle shall comprise a period of operation and a period of rest of sufficient duration to ensure that the appliance is cooled to approximately room temperature at the beginning of the next cycle. Forced-air cooling may be used.

5.3.5.13.2. Other toasters shall be operated under conditions of adequate heat discharge, using slices of white bread about 24 hours old (dimensions: about 10 cm × 9 cm × 1 cm): Each cycle shall consist of an operating period and a rest period, the latter having a duration of 30 seconds. The click rate N shall be determined at a setting at which the bread becomes golden brown.

5.3.5.14. Instantaneous water heaters, storage and non-storage water heaters

shall be operated in the normal position of use, filled with a normal quantity of water. No water shall be drawn off during the test. The click rate N shall be determined with the highest setting of all control devices fitted.

5.3.5.15. Flexible electrical heating appliances (warming pads, electric blankets, bedwarmers, heating mattresses)

shall be spread between two flexible covers, extending beyond the heating surface by at least 10 cm. The thickness and the heat conductivity shall be selected in such a way that the click rate N can be determined when the duty cycle of the control device is (50 ± 10) %.

5.3.5.16. Thermostats for the control of electric room or water heaters, oil and gas burners and the like: as for Item 5.3.5.11.

When the thermostat may be used together with a relay or contactor, all measurements shall be performed using such a device as a load; this device shall have the highest coil inductance used in practice. In order to obtain a satisfactory measurement, the contacts shall be operated for a sufficient number of times with a suitable load to ensure that the levels of interference are representative of those encountered in normal operation.

5.3.6. *Electric fence supply units*

These shall be operated by replacing the fence wire by an RC circuit having a 300 Ω resistance and a 10 nF capacitor (nominal voltage of 10 kV d.c.) in series as follows: in the normal position of the appliance with a maximum inclination of 15° from the vertical position, the controls accessible without tools shall be set to the positions of maximum interference.

Electric fences designed to be operated with a.c. or d.c. shall be tested with both kinds of supply.

If the connecting device of the current source does not provide a fixed polarity, tests shall be made with both polarities.

The earth terminal of the fence circuit shall be connected to the earth terminal of the artificial mains V-network. If the terminals of the fence circuit are not clearly marked, they shall each be earthed in turn. The interference voltage shall be measured on the terminals A, B and C in accordance with Figure 4.

Note:

This procedure only applies for measurements up to 30 MHz (see Item 4.2.4.7).

5.3.7. *Speed controls, starting switches, etc.*

For appliances in this category, the click rate $N = n_2/T$, where n_2 is the sum of the switching operations during the observation time T minutes.

5.3.7.1. Starters and speed control to sewing machines and dental drills

Interference generated during starting and stopping; the speed of the motor shall be increased to the maximum over a 5-s period. For stopping, the control is to be reset quickly to its 'off' position. To determine the click rate N, the period between two starts shall be 15 s.

5.3.7.2. Starting switches in adding machines, calculating machines and cash registers

Intermittent operation with at least 30 starts per minute. If 30 starts per minute cannot be attained, intermittent operation with as many starts per minute as possible in practice must be used.

5.3.7.3. Picture change devices of slide projectors

shall be operated continuously with the lamp switched on, but without slides, unless slides are necessary for the operation of the appliance (e.g. projectors which have an autofocus facility). To determine the click rate N, operate with four picture changes per minute.

5.3.8. *Domestic appliances incorporating gas-discharge lamps for therapeutic purposes*

5.3.8.1. Ultraviolet and ozone lamps. The lamps shall be operated for three minutes before measurements are made.

5.3.8.2. Solarium loungers of the wall-mounted or ceiling-mounted type

If equipped with starters the luminaires shall be measured according to the requirements of Directive 76/890/EEC.

5.3.9. *Automatic goods dispensing machines, entertainment machines and similar appliances*

Continuous interference shall be assessed while the appliance is operated according to the manufacturer's instructions. If the appliance is capable of producing more than two clicks within any 2-s period, all discontinuous interference must meet the continuous interference limits.

In the case of automatic machines, where individual switching processes are (directly or indirectly) manually operated, and in which no more than two counted clicks per cycle are produced, Item 4.2.4.1 is applicable.

5.3.9.1. Automatic goods-dispensing machines

Three sales operations shall be carried out, each subsequent operation being initiated once the machine has returned to a quiescent rest state. If the number of counted clicks produced by each of the sales operations is the same, the click rate N is numerically equal to one-sixth of the

number of counted clicks produced in a single sales operation. If the number of counted clicks varies from operation to operation a further seven sales operations shall be carried out and the click rate N determined from at least 40 counted clicks on the assumption that the rest period between each sales operation was such that the 10 sales operations were uniformly distributed over a period of one hour. The rest period shall be included in the observation time.

5.3.9.2. Juke boxes

An operating cycle is initiated by inserting the smallest coins with the minimum value necessary to start the machine, followed by the selection and playing of the corresponding number of pieces of music. This operating cycle shall be repeated as often as necessary to produce a minimum of 40 counted clicks. The click rate N shall be half the number of counted clicks per minute. (Taking account of the normal frequency of use and combination of coins, the number of clicks is taken as half that observed during the test.)

5.3.9.3. Automatic entertainment machines incorporating a winnings-payout mechanism

Electro-mechanical devices incorporated in the machine for storing and paying out winnings shall be disconnected where possible from the operating system to allow the entertainment function to be operated independently.

The entertainment cycle is initiated by inserting the smallest coins with the minimum value necessary to start the machine. The entertainment cycle shall be repeated as often as is necessary to produce a minimum of 40 counted clicks. Taking account of the normal frequency of use and combination of coins, the number of clicks used to determine the click rate N_1, of the entertainment cycle is taken as half that observed during the measurement period.

The average frequency and value of the winnings-payout shall be supplied by the manufacturer. The click rate N_2 of the devices for storing and paying out winnings shall be assessed by simulating a win of the average value specified by the manufacturer rounded up to the nearest payout value. The simulation of this win is to be repeated as often as is necessary to produce a minimum of 40 counted clicks. The winnings-payout mechanism click rate N_2 is thus determined. To allow for the frequency of paying out, the number of entertainment cycles used to determine N_1 is multiplied by the average frequency of paying out. This number of payouts per entertainment cycle is multiplied by N_2 to produce an effective winnings-payout mechanism click rate, N_3.

The click rate for the appliance is the sum of the two click rates, i.e. $N_1 + N_3$.

5.3.9.4. Automatic entertainment machines with no winnings-payout mechanism

5.3.9.4.1. Pinball machines

The appliance shall be operated by an average player (that is one with at least 30 minutes experience of operating this or similar machines). The game shall be that obtained by inserting the smallest coins with the minimum value necessary to start the machine. The operating cycle shall be repeated as often as is necessary to produce a minimum of 400 counted clicks.

5.3.9.4.2. Video machines and all other appliances shall be operated in accordance with the manufacturer's instructions.

The operating cycle shall be the programme obtained after inserting the smallest coins with the minimum value necessary to start the appliance. In the case of appliances with several programmes, the programme giving the maximum click rate shall be selected. Should the duration of the programme be less than one minute, the following programme is not to be started within one minute of the start of the previous programme so as to reflect normal use. This rest period is to be included in the observation time. The programme shall be repeated as often as is necessary to produce the minimum of 40 counted clicks.

5.3.10. *Electrostatic air cleaners*

shall be operated under normal working conditions, surrounded by a sufficient volume of air.

Note:

This specification does not apply to electro-static air cleaners incorporating radio-frequency generators operating at frequencies greater than 10 kHz.

5.3.11. *Appliances incorporating oscillators*

Some appliances incorporating oscillators fall within the scope of this Directive. For many such appliances there are no explicit requirements in this Annex concerning the interference caused by these oscillators and Item 5.1.1.5 therefore applies.

Note:

There are no explicit requirements in this Annex concerning the interference caused by oscillators which have a fundamental frequency greater than 10 kHz.

5.3.11.1. Cookers incorporating r.f. sources for heating purposes with an oscillator fundamental frequency not exceeding 10 kHz shall be tested under conditions of adequate heat discharge; a pan filled with water shall be heated until the water boils.

Note:

Those r.f. sources with an oscillator fundamental frequency greater than 10 kHz are not within the scope of this Annex.

5.3.11.2. Clock frequency oscillators operating with fundamental frequencies not exceeding 10 kHz shall be measured under normal operating conditions (see Item 5.1.1.1).

Note:

Clock frequency oscillators operating at fundamental frequencies greater than 10 kHz are not within the scope of this Annex.

5.3.12. *Spark devices*

5.3.12.1. Electronic gas ignitors

Under Item 4.2.4.1, manually operated single-spark-on-demand electronic gas ignitors, the switches of which are included in the equipment for the purpose of mains connection or disconnection only (e.g. central-heating boilers, gas fires, but not cooking equipment), are exempt from the provisions of this Annex. Other equipment incorporating electronic gas ignitors shall be tested without gas being applied to the equipment as follows:

5.3.12.1.1. Single-spark-on-demand ignitors

Determine whether interference is continuous or discontinuous as follows:

Produce 10 single sparks with not less than two seconds between sparks. If any click exceeds 200 ms, the continuous interference limits of Tables I and II apply.

If all clicks are less than 10 ms, no amplitude limit shall apply.

If any click is greater than 10 ms and if all clicks are less than 200 ms, the permitted limit shall be calculated as in Item 4.2.3.3 using an empirical click rate N = 2. This click rate is an assumed practical value, which gives a permitted limit 24 dB above the continuous limit.

The ignitor shall be tested for 40 sparks with a minimum of two seconds between each spark applying the calculated permitted limit, and shall be assessed by the upper quartile method (see Item 3.2.7).

5.3.12.1.2. Repetitive ignitors

Determine whether interference is continuous or discontinuous as follows:

Operate the ignitor to produce 10 sparks.

If either (a) any click exceeds 200 ms, or (b) any click is not separated from a subsequent click by at least 200 ms, or (c) more than two clicks occur within any 2-s period, the continuous interference limits of Tables I and II shall apply.

If (a) all clicks are less than 10 ms and (b) are at intervals of at least 200 ms and (c) not more than two clicks occur within any 2-s period, no amplitude limit shall apply.

If (a) any clicks are greater than 10 ms and (b) if all clicks are less than 200 ms at intervals of at least 200 ms and (c) no more than two clicks occur within any 2-s period, then the permitted limit shall be calculated as in Item 4.2.3.3 using an empirical click rate N = 2. This click rate is an assumed practical value which gives a permitted limit 24 dB above the continuous limit.

The ignitor shall be tested for 40 sparks at intervals of at least two seconds using the calculated permitted limit, and assessed by the upper quartile method (see Item 3.2.7).

5.3.13. *Electric toys running on tracks*

5.3.13.1. Electric toy systems

5.3.13.1.1. An electric toy system includes both the moving component, the control device and the track, sold as a package.

5.3.13.1.2. The system shall be assembled to the instructions given in the sales package. The layout of the track shall be such as to maximize the area. Other components shall be arranged as indicated in Figure 9.

5.3.13.1.3. Each moving component shall be tested separately while running on the track, and all components in the sales package shall be tested.

5.3.13.1.4. The tests shall be carried out as described in Item 5.3.13.3.

5.3.13.2. Individual components

5.3.13.2.1. Individual components which, although being sold separately, also form part of a set which meets the limits shall require no further testing.

5.3.13.2.2. Individual moving components, e.g. locomotives and cars

Individual moving components shall be tested on an oval track measuring 2 m × 1 m (see Figure 9). The necessary track, leads and control device are to be supplied by the manufacturer or supplier of the individual moving component. If such ancillary equipment is not supplied, tests shall be carried out on such ancillary equipment as is convenient for the testing organization to use. The track, leads and control device are to be arranged as shown in Figure 9. The tests are to be carried out as described in Item 5.3.13.3. The test results shall describe the ancillary equipment used.

5.3.13.3. Method of measurement

5.3.13.3.1. Terminal voltages on the mains supply (0·15 to 30 MHz)

Non-earthed equipment: the electric toy system shall be arranged in accordance with Items 5.3.13.1 or 5.3.13.2, whichever applies.

The electric toy system shall be tested at a height of 40 cm above a metal earth plate or above the metal floor of a screened room. The metal plate shall extend at least 10 cm beyond the edge of the electric toy system.

Measurements shall be made on the power side of the transformer/control device using the CISPR 50 Ω artificial mains V-network. The limits set out in Table I for electrical household appliances shall apply.

5.3.13.3.2. Terminal voltages on the mains supply (0·15 to 30 MHz)

Earthed equipment: the electric toy system shall be arranged in accordance with Items 5.3.13.1 or 5.3.13.2, whichever applies.

Measurements shall be made on the power side of the transformer/control device, using the CISPR 50 Ω artificial mains V-network. The limits set out in Table I for electrical household appliances shall apply.

5.3.13.3.3. Interference power on the mains supply (30 to 300 MHz)

The electric toy system shall be arranged in accordance with Items 5.3.13.1 to 5.3.13.2, whichever applies.

Measurements shall be made on the power supply side of the transformer/control device, using the absorbent clamp. The limits set out in Table II shall apply.

6. METHODS OF MEASUREMENT OF TERMINAL VOLTAGES (0·15 to 30 MHz)

This item lays down the general requirements for the measurement of terminal voltages. Special conditions for the measurement of terminal voltages are specified in Item 5 for various types of apparatus.

6.1. **Artificial mains network**

6.1.1. *General*

An artificial mains V-network is required to provide a defined impedance at radio frequencies across the terminals of the appliance under test, and also to isolate the test circuit from unwanted radio-frequency signals on the supply mains.

6.1.2. *Impedances*

The artificial mains V-network shall have a resistance of 50 Ω, an inductance of 50 μH and an impedance characteristic as defined in CISPR publication 16 (1977), Figure 5.

6.1.3. *Decoupling*

To ensure that, at the measurement frequencies 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 existing on the supply mains (see also Item 6.2.1).

The components forming this impedance shall be enclosed in a metallic screen directly connected to the reference earth of the measuring system.

The requirements for the impedances of the artificial mains network shall be satisfied at the measurement frequency, with the isolating network connected.

6.1.4. *Connection between the artificial mains V-network and the measuring receiver*

The requirements of Items 6.1.2 and 6.1.3 shall be satisfied when the measuring receiver is connected to the artificial mains V-network.

6.2. **Measurement procedure**

6.2.1. *Reduction of interference not produced by the appliance under test*

Interference not produced by the appliance under test (arising from the supply mains or produced by extraneous fields) shall give an indication on the measuring receiver at least 20 dB below the lowest interference which it is desired to measure, or shall not be measurable.

The interference not produced by the appliance being tested is measured when the appliance under test is connected but not operated.

Notes:

1. Realization of this condition may require the addition of a supplementary filter in the supply mains and the measurements may have to be made in a screened enclosure.

2. When testing appliances having a continuous rating in excess of 6 A, or a short-term rating in excess of 10 A, this condition may be difficult to achieve. Should the residual interference be greater than that specified above, it should be quoted in the results of the measurement.

6.2.2. *Disposition of appliances and their connection to the artificial mains network*

6.2.2.1. Appliances normally operated without an earth connection but not held in the hand

The appliance shall be placed 40 cm above an earthed conducting surface at least 2 m × 2 m in size, which shall be kept at least 80 cm from any other earthed conducting surface. If the measurement is made in a screened enclosure one of the walls of the enclosure may be used in place of the earthed conducting surface.

If the appliance is supplied without a flexible lead, it shall be placed at a distance of 80 cm from the artificial mains network and connected thereto by a lead not more than 1 m in length.

If the appliance is supplied with a flexible lead, the voltages shall be measured at the plug end of the lead. The length of the lead in excess of 80 cm shall be folded back and forth so as to form a horizontal bundle with a length of between 30 cm and 40 cm.

6.2.2.2. Appliances normally operated without an earth connector and held in the hand

Measurements shall first be made in accordance with Item 6.2.2.1. Additional measurements shall then be made using an 'artificial hand', intended to reproduce the effect of the user's hand.

The artificial hand shall consist of metal foil wrapped round the case, or part thereof, as specified below. The foil shall be connected to one terminal (terminal M) of an RC element (see Figure 5a), consisting of a 200 pF capacitor in series with a 500 Ω resistor; the other terminal of the RC element shall be connected to the reference earth of the measuring system.

The general principle to be followed in the application of the 'artificial hand' is that terminal M of the RC element shall be connected to any exposed non-rotating metalwork and to metal foil wrapped around all handles, both fixed and detachable, supplied with the appliance.

The following paragraphs (a) to (d) specify the detailed application of the 'artificial hand'.

(a) When the case of the appliance is entirely of metal, no metal foil is needed, but the terminal M of the RC element shall be connected directly to the body of the appliance.

(b) When the case of the appliance is of insulating material, metal foil shall be wrapped round the handle B (Figure 5b), and also round the second handle D, if present. Metal foil 60 mm wide, C, shall also be wrapped round the body at a point in front of the iron core of the motor stator. All these pieces of metal foil, and the metal ring or bushing A, if present, shall be connected together and to the terminal M of the RC element.

(c) When the case of the appliance is partly metal and partly insulating material, and has insulating handles, metal foil shall be wrapped round the handles B and D (Figure 5b) and on the non-metallic part of the body C. The metal part of the body, 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.

(d) When a double-insulated appliance, for example an electric saw, has two handles of insulating material and a case of metal C (Figure 5c), 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 terminal M of the RC element.

6.2.2.3. Appliance normally required to be operated with an earth connection

The measurements shall be made with the body of the appliance connected to the reference earth of the measuring system.

If the appliance is supplied without a flexible lead, it shall be placed at a distance of 80 cm from the artificial mains network and connected thereto by a lead not more than 1 m in length. The connection of the appliance case or frame to the reference earth of the measuring system shall be made by a lead running parallel to the mains lead and of the same length, at a distance of not more than 10 cm from the mains lead.

If the appliance is supplied with a flexible lead, the interference shall be measured at the plug end of the lead. The length of lead in excess of the 80 cm shall be folded back and forth so as to form a horizontal bundle with a length of between 30 cm and 40 cm.

If this lead includes the earthing conductor, the plug end of the earthing conductor shall be connected to the reference earth of the measuring system. If an earthing conductor is not included in the flexible lead, the connection to the reference earth of the measuring system shall be made by a lead 80 cm to 1 m in length in a manner analogous to that specified above for appliances supplied without a flexible lead.

7. METHODS OF MEASUREMENT OF INTERFERENCE POWER (30 to 300 MHz)

7.1. Measuring device

The absorbing clamp described in CISPR Publication 16 (1977) shall be used.

7.2. Measurement procedure

The appliance to be tested is placed on a non-metallic table at least 40 cm from other metallic objects and the mains lead is stretched in a straight line for a distance sufficient to accommodate the measuring device, and to permit the necessary measuring adjustment of position for tuning.

In use, the position of the measuring device shall be adjusted at each test frequency to obtain the maximum indicated output.

The measured power is derived by reference to the calibration curve of the measuring device.

(8.)

9. APPLICATION OF LIMITS IN TESTS FOR CONFORMITY OF APPLIANCES IN SERIES PRODUCTION

9.1. Tests shall be made:

9.1.1. Either on a sample of appliances of the type using the statistical method of evaluation set out in Item 9.3,

9.1.2. or, for simplicity's sake, on one appliance only.

9.2. Subsequent tests are necessary from time to time on appliances taken at random from production, especially in the case referred to in Item 9.1.2. The banning of sales, as a result of a dispute, shall be considered only after tests have been carried out in accordance with Item 9.1.1.

9.3. Statistical assessment of compliance shall be made as follows:

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

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

where:

$\bar{x}$ = the arithmetic mean value of the interference levels of n appliances in the sample;

S_n = the standard deviation of the sample, where:

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

x = the interference level of an individual appliance;

L = the permitted limit;

k = the factor derived from tables of the non-central t-distribution which ensures with 80 % confidence that 80 % or more of the production is below the limit. Values of k as a function of n are given in Table IV.

TABLE IV

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

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

APPENDIX A

LIMITS OF DISCONTINUOUS INTERFERENCE FOR SPECIFIC APPLIANCES WHEN THE FORMULA 20 $LOG_{10}\frac{30}{N}$ IS APPLICABLE

TABLE I

Examples of appliances for which the click rate N is derived from the number of counted clicks and the application of limits

Type of appliance	Operating conditions (Item)	Frequency range (MHz)	Permitted limit
Washing machines	5.3.1.10		
Dishwashing machines	5.3.1.12		
Warming plates	5.3.5.3		
Steam generators	5.3.5.4		
Deep-fat fryers	5.3.5.5		
Table-type roasters	5.3.5.5		
Waffle irons	5.3.5.6		
Boilers — Water heaters	5.3.5.7		
Coffee percolators	5.3.5.7		
Cooking pans	5.3.5.7		The value as stated in Table I enlarged with:
Feeding-bottle heaters	5.3.5.7		
Glue pots	5.3.5.7		
Immersion heaters	5.3.5.7	0·15 to 0·5	$20 \log_{10}\frac{30}{N}$ dB (μV)
Kettles	5.3.5.7		
Milk boilers	5.3.5.7		
Sterilizers	5.3.5.7	0·5 to 5	$20 \log_{10}\frac{30}{N}$ dB (μV)
Ironing presses	5.3.5.9		
Rotating ironing machines	5.3.5.9	5 to 30	$20 \log_{10}\frac{30}{N}$ dB (μV)
Table and free-standing ironing machines	5.3.5.9		
Convectors	5.3.5.11		
Fan heaters	5.3.5.11		
Forced-air heaters	5.3.5.11		
Oil-filled heaters	5.3.5.11		
Space heaters	5.3.5.11		
Hair driers	5.3.5.12		The value as stated in Table II enlarged with:
Instantaneous water heaters	5.3.5.14		
Storage and non-storage water heaters	5.3.5.14	30 to 300	$20 \log_{10}\frac{30}{N}$ dB (pW)
Bedwarmers	5.3.5.15		
Blankets	5.3.5.15		
Heating mattresses	5.3.5.15		
Warming pads	5.3.5.15		
Separate thermostats for control of room or water heaters and oil burners	5.3.5.16		
Electric fence supply units	5.3.6		
Frying pans (**)	5.3.5.5		
Stewing pans (**)	5.3.5.5		
Toasters (**)	5.3.5.13		

(**) When the conditions click $\leq$ 10 ms and N $\leq$ 5 are fulfilled, there is no limit on amplitude. See Item 4.2.4.2.

TABLE II

Appliances for which the click rate N is derived from the number of switching operations, the factor f as mentioned in the relevant operating conditions and the application of limits

Type of appliance	Operating conditions (Item)	Factor f	Permitted limit
Refrigerators	5.3.1.9	0·5	
Cooking ranges with automatic plates (**)	5.3.5.1	0·5	
Cooking ovens (**)	5.3.5.2	1·0	
Appliances with one or more boiling (**) plates (or grills) controlled by thermostats or energy regulators	5.3.5.1	0·5	As for Table I
Irons (**)	5.3.5.10	0·66	
Sewing-machine speed controls and starting switches	5.3.7.1	1	
Dental-drill speed controls and starting switches	5.3.7.1	1	
Adding-machine starter switches	5.3.7.2	1	
Calculating-machine starter switches	5.3.7.2	1	
Cash-register starter switches	5.3.7.2	1	
Slide-projector picture change devices	5.3.7.3	1	

(**) When the conditions click duration $\leqslant$ 10 ms and N $\leqslant$ 5 are fulfilled, there is no limit on amplitude. See Item 4.2.4.2.

TABLE III

Application of limits when the mean intervals between the successive clicks is greater than five minutes

Type of appliance	Special conditions	Frequency range (MHz)	Permitted limit
All appliances	For values of N < 0·2	0·15 to 0·5	Decreasing linearly with the logarithm of the frequency from 110 dB (μV) to 100 dB (μV)
		0·5 to 5	100 dB (μV)
		5 to 30	104 dB (μV)
		30 to 300	Increasing linearly with frequency from 89 dB (pW) to 99 dB (pW)

APPENDIX B

EXAMPLES OF THE USE OF THE UPPER QUARTILE METHOD TO DETERMINE COMPLIANCE WITH INTERFERENCE LIMITS

Example (Tumble-dryer)

The appliance has a program which stops automatically, therefore the observation time is defined and contains more than 40 counted clicks.

First test run

Click No:	1	2	3	4	5	6	7	8	9	10
* = counted click	*	*	*	—	*	—	*	*	—	*
— = click	11	12	13	14	15	16	17	18	19	20
Frequency 550 kHz	*	*	*	*	*	*	*	*	*	*
Limit for continuous interference level 56 dB (μV)	21	22	23	24	25	26	27	28	29	30
	*	*	*	*	*	*	*	*	*	*
	31	32	33	34	35	36	37	38	39	40
	*	—	*	*	—	*	*	*	*	*
	41	42	43	44	45	46	47	48	49	50
	*	*	—	*	*	*	*	*	*	—
	51	52	53	54	55	56				
	—	*	*	*	—	*				

Total time of run (T) = 35 minutes.

Total number of counted clicks (n_1) = 47.

$$N = \frac{47}{35} = 1{\cdot}3$$

$$20 \log_{10} \frac{30}{N} = 20 \log_{10} \frac{30}{1{\cdot}3} = 27{\cdot}5 \text{ dB}$$

Permitted limit for 550 kHz = 56 + 27·5 = 83·5 dB (μV).

The number of clicks allowed above the permitted limit = $\frac{47}{4}$ = 11·75, which means that only 11 such clicks are allowed. A second test run is made to determine how many clicks exceed the permitted limit. The time for this second run is the same as the time taken for the first run.

Second test run

Click No:	1	2	3	4	5	6	7	8	9	10
* = clicks above permitted limit	*	—	*	—	—	*	*	—	—	*
— = clicks not exceeding permitted limit	11	12	13	14	15	16	17	18	19	20
	—	—	—	—	—	—	—	*	*	*
Frequency 550 kHz	21	22	23	24	25	26	27	28	29	30
Permitted limit = 83·5 dB (μV)	—	*	—	*	—	—	—	—	—	—
	31	32	33	34	35	36	37	38	39	40
	—	—	—	—	—	*	—	*	—	—
	41	42	43	44	45	46	47	48	49	50
	*	*	—	—	—	—	—	—	—	—
	51	52	53	54	55	56				
	—	—	—	—	—	—				

Total time of run (T) = 35 minutes (identical to first run).

Number of clicks greater than permitted limit = 14.

Allowed number of clicks = 11: therefore, APPLIANCE FAILS!

(APPENDIX C)

APPENDIX D

GUIDANCE NOTES FOR THE MEASUREMENT OF DISCONTINUOUS INTERFERENCE

D1. GENERAL

D1.1. These guidance notes do not purport to interpret the provisions of this Directive but are intended to guide the user through the rather complex procedures, thereby facilitating the measurement of discontinuous interference.

D1.1.1. For the purposes of this measurement, appliances may be divided into two broad categories as follows:

(a) those which generate discontinuous interference but do not generate continuous interference;

(b) those which generate both types of interference.

The two broad classifications may be further divided as follows:

(a) appliances in which the assessment of discontinuous interference may be made without the use of a measuring receiver, e.g. by the use of an oscilloscope connected to an artificial mains V-network (see Item D2.3);

(b) appliances for which the use of the CISPR measuring receiver with its weighted response is necessary;

(c) appliances for which relaxation of the limits are specified under certain conditions (see Items 3.2.6, 4.2.3 and 4.2.4).

D1.1.2. The flow diagram shown in Figure 10 gives a simplified guide to the measurement of discontinuous interference.

Discontinuous interference is subjectively less disturbing in the audio output of sound-broadcast receivers and in the video and audio outputs of television receivers compared with continuous interference, since it generally occurs in bursts. Thus, the subjective effect is dependent on the spacing of these bursts, which is related to the click rate N (see Item 3.2.5). There are, therefore, a number of relaxations on the limits applied to household appliances for discontinuous interference.

During the measurements the appliance shall be operated as specified in Item 5.

To determine the click rate N (see Item 3.2.5) by the method of counted clicks set the receiver attenuators so that an input signal equal in amplitude to the limit for continuous interference produces a mid-scale deflection on the meter and count the number of disturbances (of duration less than 200 ms) which cause a greater deflection during the observation time (see Item 3.2.4).

For certain appliances (see Item 4.2.4.6), the click rate N is determined from the number of switching operations (see Item 3.2.3) of the contacts which are causing the interference.

The application of the formula $20 \log_{10} \frac{30}{N}$, (where N is the click rate) allows a relaxation in the limit of 6 dB for each octave reduction of N (see Item 3.2.6). Further relaxations for specific appliances are detailed in Item 4.2.4.

The value of N determined is to be used in the formula $20 \log_{10} \frac{30}{N}$ to calculate the permitted (relaxed) limits (see Item 3.2.6). The receiver attenuators shall then be set for the permitted (relaxed) limit in a manner similar to that already described and the number of disturbances (duration less than 200 ms) which exceed the permitted (relaxed) limit during the same observation time shall be counted.

The upper quartile method shall then be applied to the results to determine compliance (see Appendix B).

In general the measurement of discontinuous interference requires the determination of its amplitude and duration characteristics as well as the spacing between various bursts of discontinuous interference. Moreover, in order to determine whether equipment satisfies the appropriate interference limits it is necessary to classify the discontinuous interference in accordance with the following basic parameters:

(a) Relative amplitude of discontinuous interference — is it above the limit of continuous interference and, subsequently, is it above the permitted limit of discontinuous interference?

(b) Duration of discontinuous interference — is it less than 10 ms, is it greater than 10 ms but less than 200 ms, is it greater than 200 ms?

(c) Spacing between bursts of discontinuous interference (e.g. counted clicks) — is it less than 200 ms, is it greater than 200 ms, is it such that more than two bursts occur in any 2-s period?

(d) Rate of discontinuous interference (click rate N) — what is the number of bursts of discontinuous interference per minute? Is it greater than 30, is it less than 30 but greater than five, is it less than five but greater than 0·2, is it less than 0·2?

The measurement of these basic parameters is described in Item D2.

Special precautions have to be taken when discontinuous interference has to be measured in the presence of continuous interference as the latter may influence the discontinuous interference measurements to a limited extent. In such circumstances the IF reference level (see Item D2.1) has to be increased by an appropriate amount. In practice, this may be achieved in any convenient manner provided that the required result is obtained, e.g. by connecting an attenuator at the IF output of the measuring receiver.

Interference measurements are performed using the measuring receiver specified in Section 1 of CISPR publication 16 (1977) and the artificial mains V-network and absorbing clamp specified in Section 2 of publication 16 in conjunction with a (storage) oscilloscope or the disturbance analyzer for the automatic measurement and assessment of the measuring results in accordance with Clause 30 and Appendix R of CISPR publication 16 (1977).

D2. MEASUREMENT OF THE BASIC PARAMETERS

D2.1. **Level setting of r.f input attenuator**

For the measurement and evaluation of discontinuous interference the r.f input attenuator of the measuring receiver is adjusted to the position which causes a zero dB meter indication when a sinusoidal signal with a level equal to the relevant interference level for continuous interference is applied to the r.f input of the measuring receiver.

Note:

Other calibration sources may be used (e.g. 100 Hz pulses). However, due account shall be taken of the CISPR weighting factor.

The IF signal level corresponding with the abovementioned zero dB meter indication is defined as the IF reference signal level.

D2.2. **Amplitude**

The amplitude of the discontinuous interference is the weighted reading of the receiver according to Section 1 of CISPR publication 16 (1977).

The amplitude can also be measured with an analogue circuit connected to the IF output of the measuring receiver simulating the electrical and mechanical properties of the detector and indicating instrument respectively.

In the case of close successive bursts of discontinuous interference the indicating instrument may show only one deflection exceeding the zero dB reference indication. It is then considered that each single burst exceeds the zero dB indication. The durations of those different bursts are investigated according to the procedure given in Item D2.3.

D2.3. **Duration and spacing**

The duration and spacing of the interference is measured at the IF output of the measuring receiver either with a (storage) oscilloscope or the disturbance analyzer. For the determination of the duration and spacing of counted clicks only that part of the discontinuous interference exceeding the IF reference signal level (see Item D2.1) and exceeding the relevant weighted response of the CISPR receiver (see Item D2.2) is considered.

Duration measurements may also be performed on the mains supply current circuit of the device under test by connecting the oscilloscope to the artificial mains V-network provided that this will lead to the same results as obtained from measurements performed at the IF output of the measuring receiver. In this case the voltage at the mains frequency shall be attenuated sufficiently.

Note:

Owing to the limited bandwidth of the measuring receiver the shape and, possibly, the duration of the discontinuous interference may be changed. It is therefore recommended that the simple oscilloscope/artificial mains V-network measuring combination be used only when the 'no amplitude limit' relaxation applies (see Item 4.2.4.2), i.e. the duration of each counted click is less than 10 ms and the click rate N is not more than five. Whenever the amplitude and the duration of a disturbance has to be taken into account it is recommended that a CISPR receiver be used.

D2.4. **Rate**

The rate of discontinuous interference is called the click rate N, where N is either the number of counted clicks per minute or the number of switching operations per minute multiplied by a factor 'f'. (See Item 3.2.5 and Table II of Appendix A.) N is determined during the observation time T (see Item 3.2.4).

D3. MEASUREMENT OF DISCONTINUOUS INTERFERENCE

D3.1. **Applying an oscilloscope**

The appliance to be tested is connected to an artificial mains V-network for the frequency range 0·15 to 30 MHz or an absorbing clamp is inserted for the frequency range 30 to 300 MHz. The measuring receiver is connected to the artificial mains V-network or the absorbing clamp, as appropriate, and an oscilloscope is connected to the IF output of the measuring receiver. The cut-off frequency of the oscilloscope shall not be lower than the intermediate frequency of the measuring receiver.

The triggering of the oscilloscope shall be adjusted to the IF reference signal level (see Item D2.1).

Only those disturbances causing the meter of the measuring receiver to exceed the zero dB value (with the attenuators set as specified in Item D2.1) shall be evaluated.

It is recommended that for initial measurement of the duration and spacing of discontinuous interference, the time base of the oscilloscope be set such that the whole display width is no less than 2 s.

If, at the end of a 2-s interval or at the beginning of the next 2-s interval, more than one click is observed (see Item 4.2.3.2) it is recommended that in order to check the requirement 'not occurring more frequently than twice in any 2-s period' the measurement be repeated at a lower or higher time-base frequency. In this way, closely spaced successive clicks can be analyzed.

The following time bases shall be used for further evaluation of the duration and spacing of discontinuous interference:

— for disturbances < 10 ms: 1 to 5 ms/cm,

— for disturbances $\geqslant 10$ ms, < 200 ms: 20 to 100 ms/cm,

— for disturbances spaced $\geqslant 200$ ms: 100 ms/cm.

Notes:

1. Such time bases make possible visual evaluation with an accuracy of approximately 5 %, which is in conformity with the 5 % accuracy specified for the disturbance analyzer (see CISPR publication 16 (1977) Clause 30).

2. For assessment of each of the criteria mentioned above it is recommended that observations be carried out for at least 40 counted clicks or switching operations. It should be appreciated that if a particular criterion is assessed only once, it must be assumed that the appliance always displays the same characteristics.

When storage oscilloscopes are used, care shall be taken to apply the correct writing speed, otherwise the peaks of the pulses may not be completely displayed.

All conditions allowing the application of the discontinuous interference limits shall be met before the discontinuous interference limits can be applied using the formula specified in Item 3.2.6, i.e. the limit for continuous interference is increased by an amount $= 20 \log_{10} \frac{30}{N}$ ($0{\cdot}2 \leqslant N \leqslant 30$). N is the click rate mentioned in Item D2.4.

D3.2. **Applying a disturbance analyzer**

The analyzer shall be connected to the IF output of the measuring receiver. The analyzer/receiver combination shall be adjusted in accordance with the instructions supplied and the performance checks specified in Clause 30 of CISPR publication 16 (1977) shall be carried out.

The appliance to be tested is connected to an artificial mains V-network for the frequency range 0·15-30 MHz or an absorbing clamp is inserted for the frequency range 30-300 MHz. The measuring receiver is connected to the artificial mains V-network or the absorbing clamp, as appropriate. The analyzer thus set up automatically evaluates the discontinuous interference generated by the appliance. The analyzer will automatically indicate whether, during evaluation, the appliance generates continuous interference above the continuous interference limit or whether the conditions allowing application of the discontinuous interference limits are met.

Where the special conditions referred to in Items 4.2.3.5, 4.2.4.3 and 4.2.4.4 apply, care shall be taken to determine whether any non-compliance indicated by the analyzer is valid.

If the discontinuous interference limits are to be applied to the appliance, the formula specified in Item 3.2.6 is used, i.e. the limit for continuous interference is increased by an amount $= 20 \log_{10} \frac{30}{N}$ ($0{\cdot}2 \leqslant N \leqslant 30$). N is the click rate mentioned in Item D2.4.

D3.3. **Evaluation of results**

Compliance with the permitted limit (calculated above) is assessed using the upper quartile method as specified in Item 3.2.7, i.e. the appliance under test shall be deemed to comply with the limit if not more than a quarter of the counted clicks or disturbances produced by switching operations are higher than the permitted limit.

Figure 1

Examples of discontinuous interference classified as clicks as observed at the intermediate frequency output of the measuring receiver (see Item 3.2.1)

Figure 1a

One click

Disturbance not longer than 200 ms, consisting of a continuous series of impulses

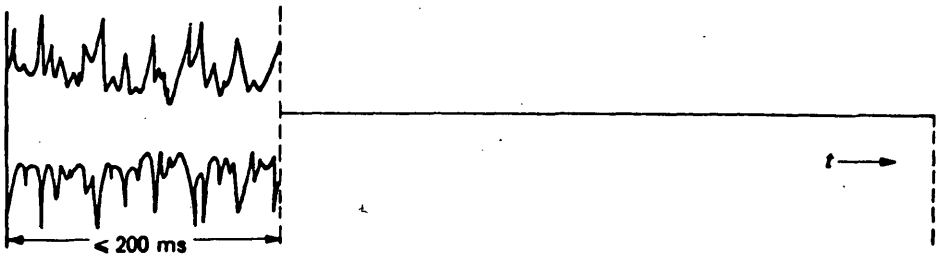


Figure 1b

One click

Individual impulses shorter than 200 ms, spaced closer than 200 ms and not continuing for more than 200 ms.

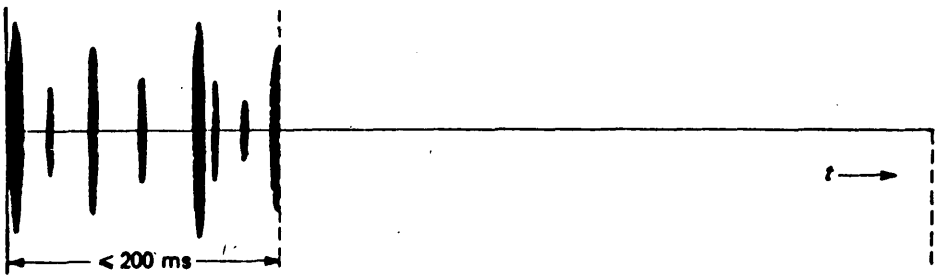


Figure 1c

Two clicks

Two disturbances neither exceeding 200 ms, spaced by a minimum of 200 ms.

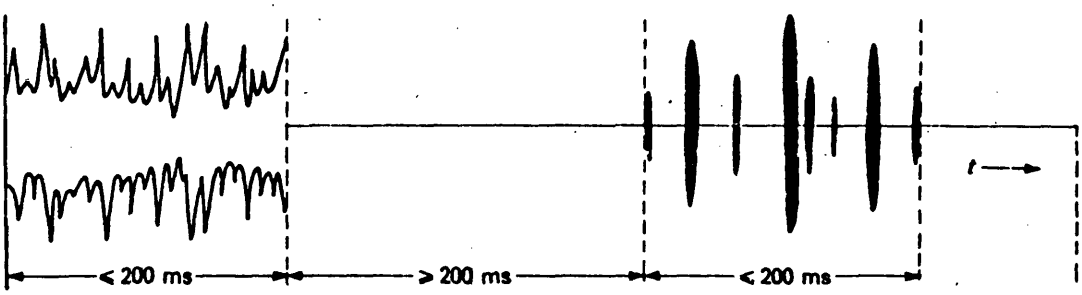


Figure 2

Examples of discontinuous interference as observed at the intermediate frequency output of the measuring receiver for which the limits of continuous interference apply (see Item 4.2.3.1)

Figure 2a

More than two clicks in a 2-s period

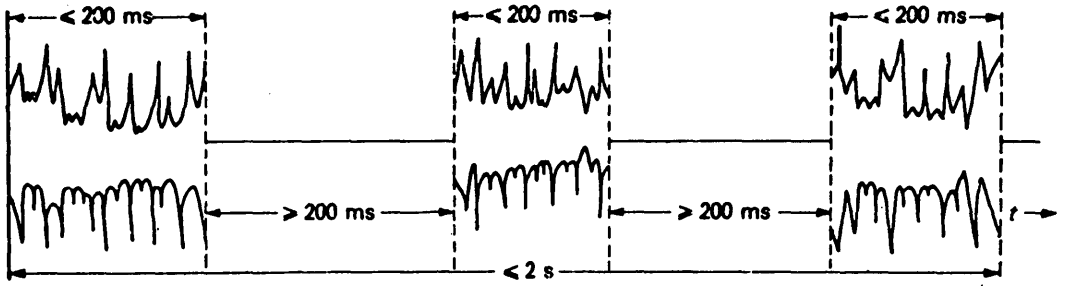


Figure 2b

Individual impulses shorter than 200 ms, spaced closer than 200 ms and continuing for more than 200 ms.

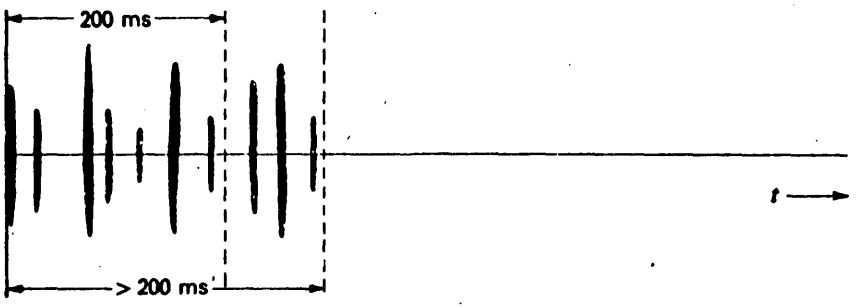


Figure 2c

Two disturbances spaced by less than 200 ms, having a total duration of more than 200 ms.

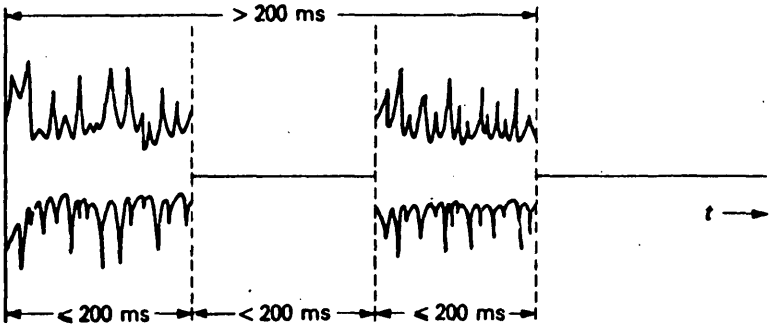
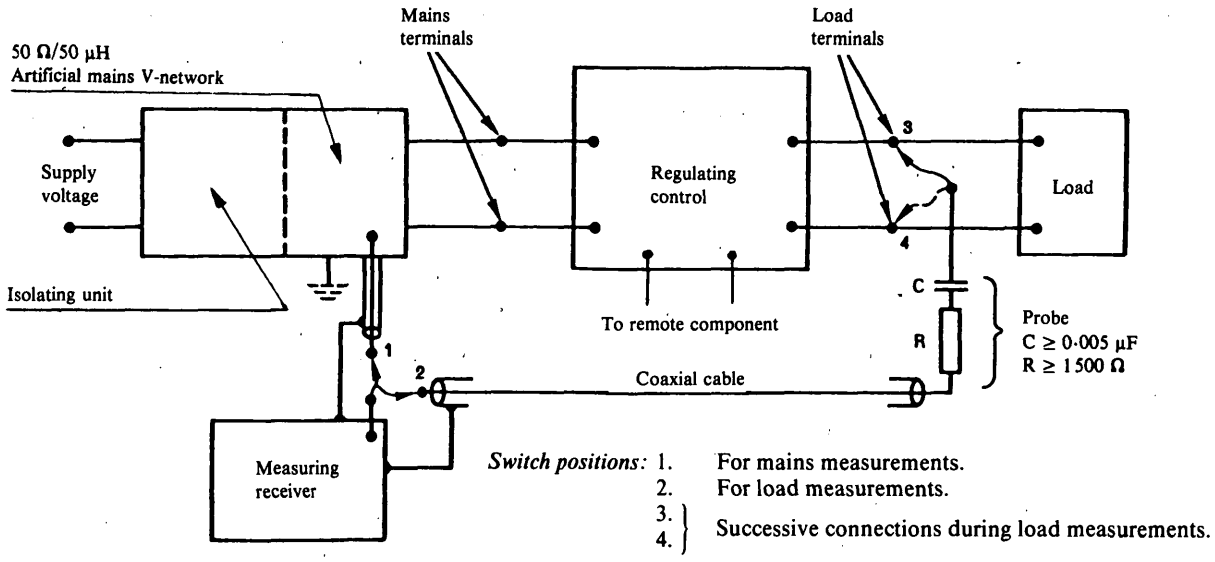


Figure 3

Measuring arrangement for regulating controls (see Item 5.2)



Notes:

1. The earth of the measuring receiver shall be connected to the artificial mains V-network.
2. The length of the coaxial cable from the probe shall not exceed 2 m.
3. When the switch is in position 2, the output of the artificial mains V-network at terminal 1 shall be terminated by an impedance equivalent to that of the measuring receiver.
4. Where a two-terminal regulating control is inserted in one lead only of the supply, measurements shall be made by connecting the second supply lead as indicated in Figure 3a.

Figure 3a

Layout for measurement of two-terminal regulating controls (see Figure 3)

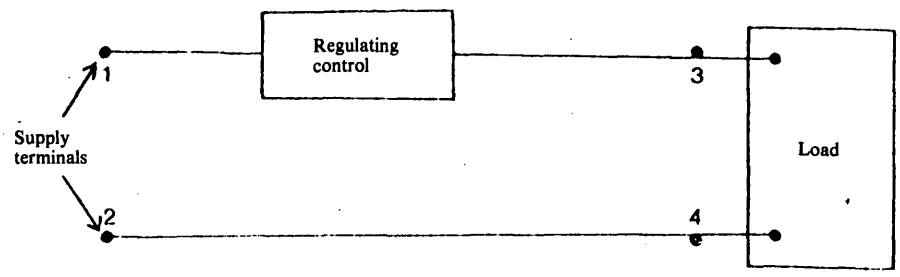
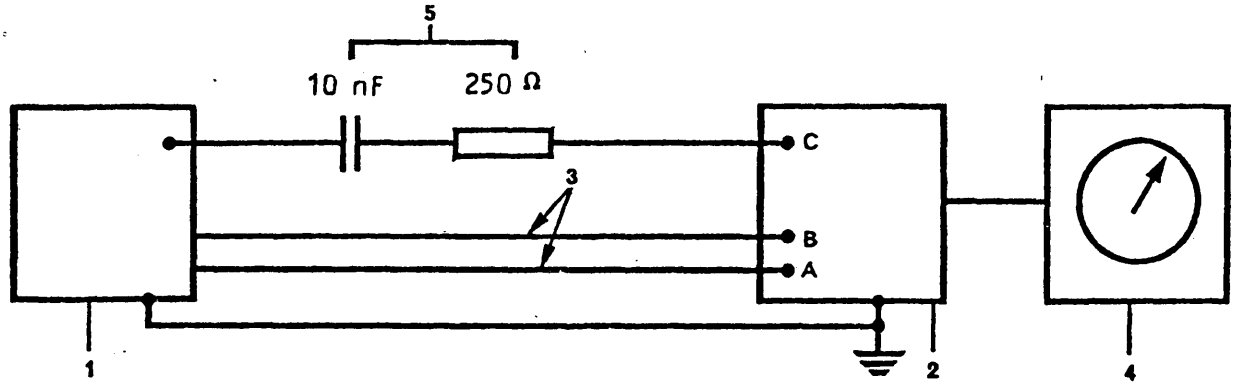


Figure 4

Arrangement for measurement of interference voltage produced by supply units of electric fences (see Item 5.3.6)



1. Supply unit of electric fence.
2. Artificial mains V-network conforming to Item 6.1.2.
3. Mains lead to supply unit for the electric fence.
4. Measuring receiver.
5. Elements of the equivalent circuit to replace the fence (the specified resistance of 300 Ω is provided by the 250 Ω resistor in series with the 50 Ω resistance of the artificial mains V-network.
6. The limits apply to the interference at the terminals of the supply unit and therefore account shall be taken of the voltage division resulting from the 250 Ω resistor in series with 50 Ω (equivalent to − 16 dB) when measuring at terminal C.

Figure 5

Application of the artificial hand (see Item 6.2.2.2)

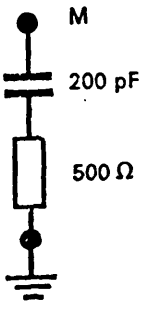


Figure 5a

RC element

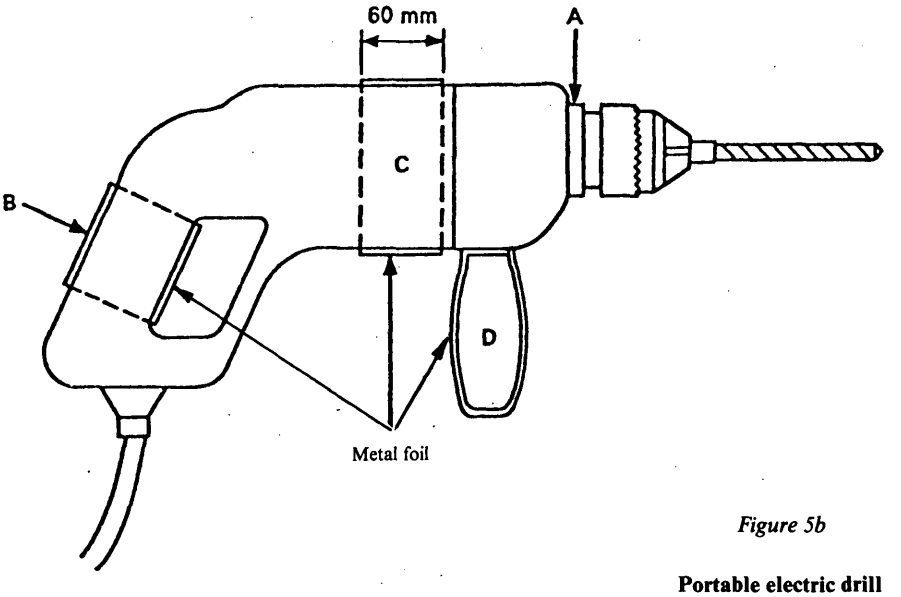
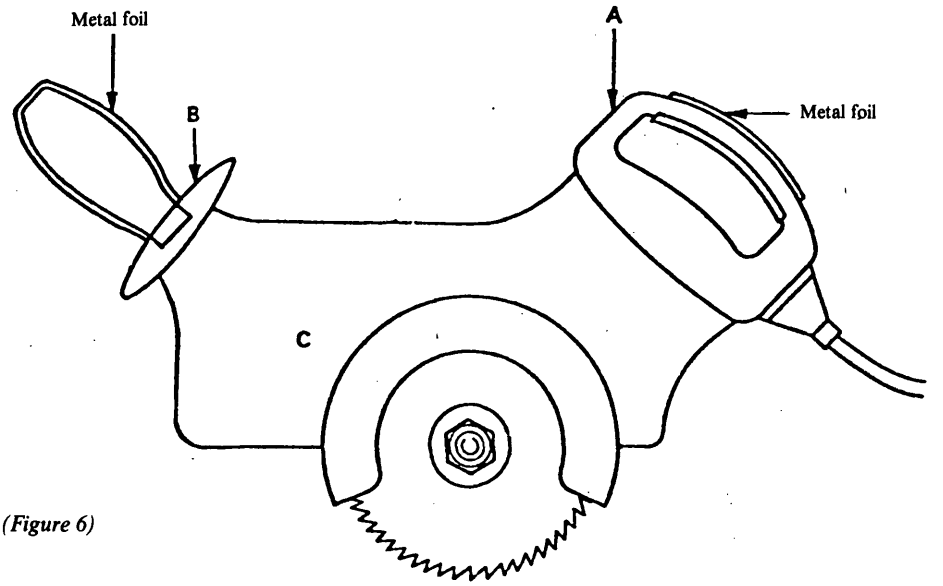


Figure 5b

Portable electric drill

Figure 5c

Portable electric saw



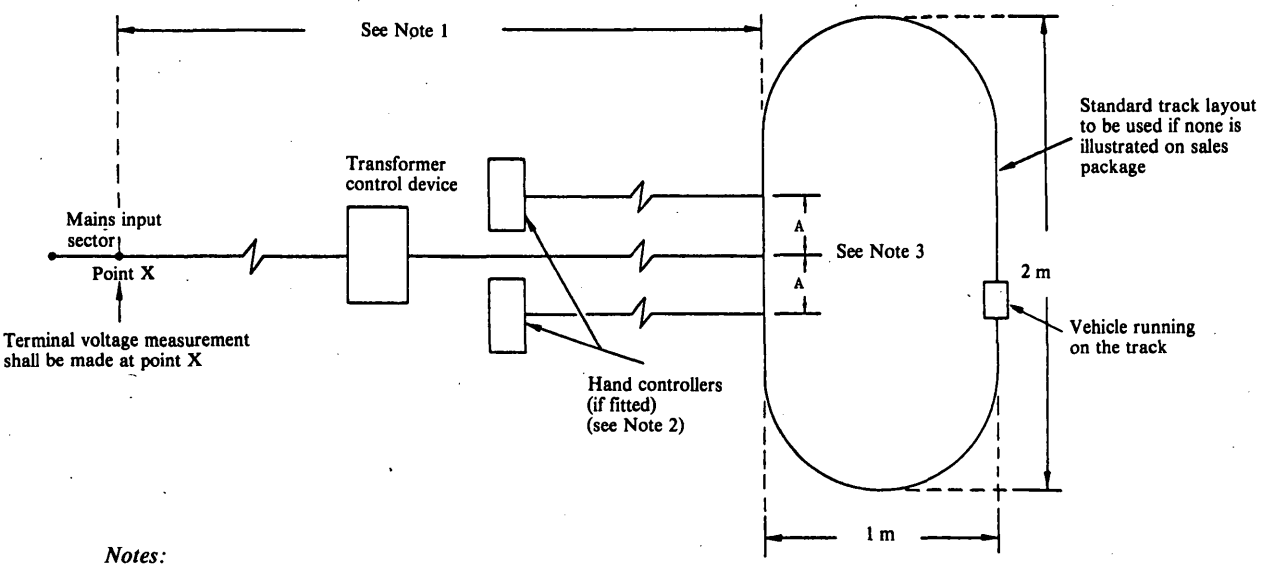
(Figure 6)

(Figure 7)

(Figure 8)

Figure 9

Measuring arrangement for toys running on tracks (see Item 5.3.13)



Notes:

1. For terminal voltage measurements (0·15 to 30 MHz) the nearest part of the track shall not be farther then 1 m from point X.

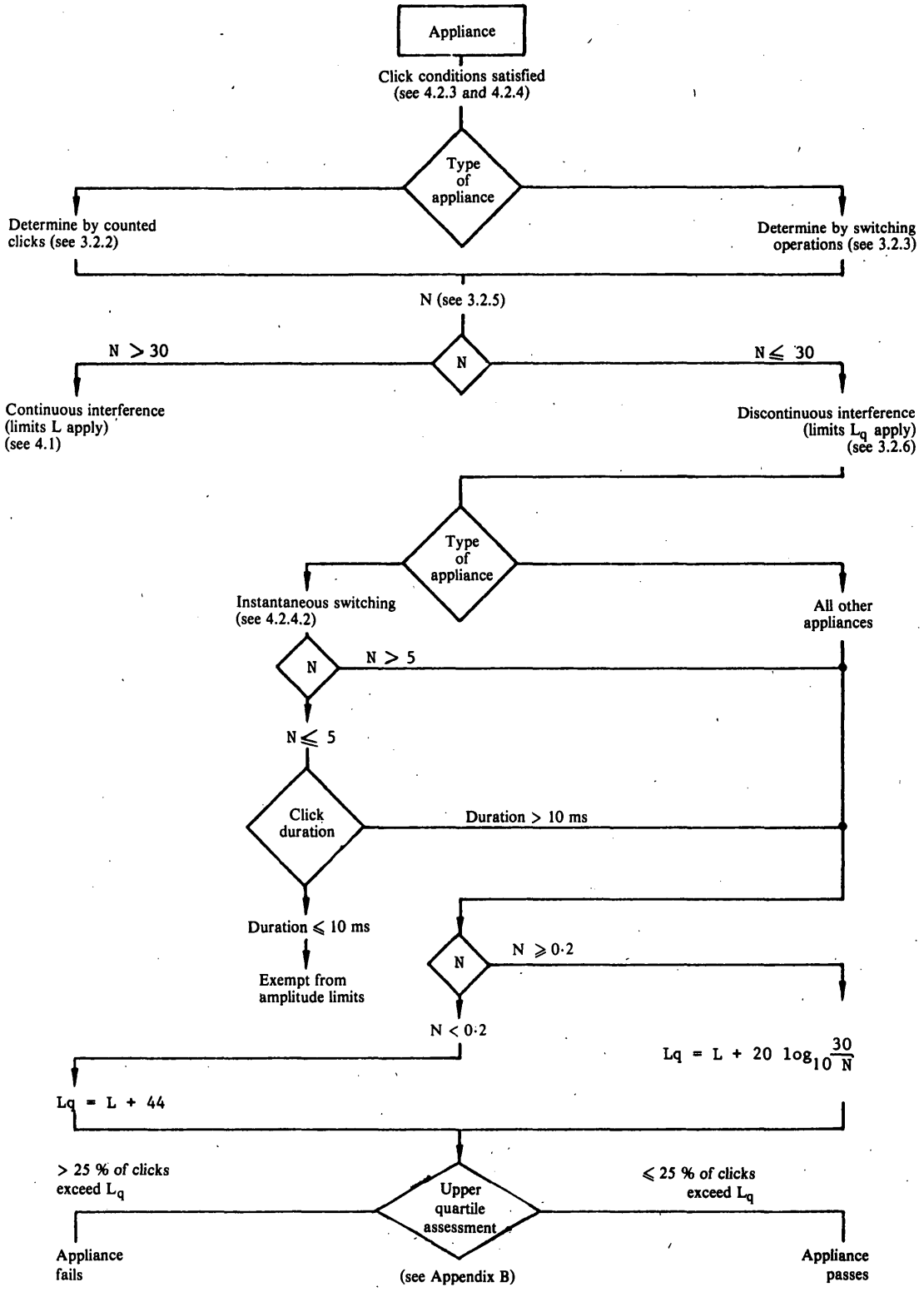
   For power measurements (30 to 300 MHz) the distance from point X to the nearest part of the track shall be extended (to 6 m) to accommodate the use of the absorbing clamp between point X and the transformer and control device.

2. Excess length of connecting leads shall be folded back and forth to form a horizontal bundle with a length of between 30 and 40 cm.

3. Dimension A shall be adjusted to 10 cm where possible.

Figure 10

Flow diagram for measurement of discontinuous interference (see Appendix D)



NOTE

This Annex is based on CISPR publication 14, first edition 1975 and Amendment No 1 (October 1980) of the International Special Committee on Radio Interference (CISPR) of the International Electrotechnical Commission (CEI-IEC), 'Limits and methods of measurement of radio interference characteristics of household electrical appliances, portable tools and similar electrical apparatus', as amended by Documents CISPR/F (SEC) Nos 42, 43, 44, 45, 46, 47, 48 and 49.

This Annex is also based on the harmonization document of the European Committee for Electrotechnical Standardization (Cenelec) Hd 20 S2 (1979).