

## II

*(Acts whose publication is not obligatory)*

## COUNCIL

## COUNCIL DIRECTIVE

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

(76/889/EEC)

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community, and in particular Article 100 thereof,

Having regard to the proposal from the Commission,

Having regard to the opinion of the European Parliament <sup>(1)</sup>,

Having regard to the opinion of the Economic and Social Committee <sup>(2)</sup>,

Whereas in most Member States electrical household appliances, portable tools and similar equipment which cause radio interference are subject to mandatory provisions relating to such possible interference; whereas such provisions differ from one Member State to another;

Whereas the differences between such national provisions are a barrier to trade in electrical household appliances, portable tools and similar equipment likely to cause radio interference; whereas for that reason they directly affect the establishment and functioning of the common market;

Whereas it is therefore necessary to lay down at Community level the rules to be observed with regard to the permissible upper limits of the radio interference caused by the appliances covered by this Directive, together with the methods for measuring such interference;

Whereas, as a general rule, when applying interference limits it is necessary to distinguish between interference heard as a continuous sound or a 'buzz' as distinct from interference heard as a 'click';

Whereas in order to measure the interference produced by the appliances covered by this Directive, it is necessary to operate the appliance under specified conditions, to interpret in a uniform manner the values given by the measuring apparatus and to carry out the measurement in accordance with a defined statistical procedure based on uniform rules of evaluation, to ensure that the results conform with the limits laid down;

Whereas technical progress necessitates frequent adaptation of the technical requirements contained in this Directive and in subsequent Directives in the field of radio interference; whereas in order to facilitate implementation of the necessary measures, a procedure should be set up for establishing close cooperation between Member States and the Commission in the Committee responsible for adapting to technical progress Directives for eliminating technical barriers to trade in equipment likely to cause radio interference,

<sup>(1)</sup> OJ No C 37, 4. 6. 1973, p. 8.

<sup>(2)</sup> OJ No C 52, 5. 7. 1973, p. 23.

HAS ADOPTED THIS DIRECTIVE:

#### *Article 1*

1. The purpose of this Directive is the approximation of the laws, regulations and administrative provisions of the Member States relating to radio interference caused by electrical household appliances, portable tools and similar equipment which cause a similar type of continuous or discontinuous radio interference, by fixing the permissible upper limits for the interference caused by such equipment and the methods for measuring such interference.

2. The scope of this Directive is specified in section 1 of the Annex.

3. 'Continuous' radio interference means the interference defined in section 2.1 and 'discontinuous' radio interference the interference defined in section 2.2 of the Annex.

#### *Article 2*

The equipment referred to in Article 1 may not be placed on the market unless it meets the requirements of this Directive with regard to the radio interference which it is likely to cause.

#### *Article 3*

1. The conformity of the equipment with the requirements of this Directive shall be certified by the manufacturer, assembler or importer, on his own responsibility, in a statement to be included in the instructions for use, the guarantee certificate or on the equipment itself.

2. The statement provided for in paragraph 1 shall be unnecessary where use is made of marks or certificates issued by the bodies notified by each Member State to the other Member States and to the Commission.

3. For a period of five and a half years from the time this Directive is notified, Member States may require that compliance by equipment with the requirements of this Directive shall be attested by marks or certificates issued on behalf of the competent authorities on the basis of prior type testing.

In the light of experience gained and the results obtained within the Community, all appropriate measures shall be taken in accordance with the procedure laid down in Article 8, within this period of five and a half years.

#### *Article 4*

Member States may not prohibit or prevent the placing on the market or use of equipment on grounds relating to radio interference, if such equipment meets the requirements of this Directive.

#### *Article 5*

Member States shall take the necessary steps to ensure that the methods of measurement used in official tests for verifying compliance with the permissible limits specified for each type of appliance, are in accordance with those specified in the Annex.

#### *Article 6*

1. The requirements of this Directive shall not prevent, with regard to the use of the equipment referred to in Article 1, the application in any Member State of the following measures to protect reception:

- (a) special measures, in the case of receiving stations used for public utility or safety purposes;
- (b) additional suppression measures, in isolated cases, where individual appliances, even though complying with the requirements of this Directive, have caused interference.

2. Member States shall inform the Commission of the special measures taken pursuant to paragraph 1 (a) and each year forward a brief summary of action taken in individual cases.

#### *Article 7*

1. A committee, hereinafter called 'the Committee', is hereby set up to adjust to technical progress the Directives on the elimination of technical barriers to trade in appliances causing radio interference. It shall consist of representatives of the Member States and be chaired by a Commission representative.

2. The Committee shall adopt its own rules of procedure.

3. Any amendments required to adapt the requirements of the Annex (excluding section 1) to technical progress shall be adopted in accordance with the procedure laid down in Article 8. However, such amendments must not result in a decrease in the

quality of radioelectric communications, including sound radio and TV reception, in the frequency range covered by this Directive.

#### *Article 8*

1. In the event of the procedure laid down in this Article being invoked, the matter shall be referred to the Committee by its chairman, either on his own initiative, or at the request of the representative of a Member State.

2. The Commission representative shall submit to the Committee a draft of the measures to be adopted. The Committee shall give its view on this draft within a period to be fixed by the chairman having regard to the urgency of the matter.

The Committee shall take its decisions by a majority of 41 votes, the votes of the Member States being weighted as provided for in Article 148 (2) of the Treaty. The chairman shall not vote.

3. (a) The Commission shall adopt the proposed measures where they are in accordance with the opinion of the Committee.

(b) Where the proposed measures are not in accordance with the opinion of the Committee, or if no view is given, the Commission shall without delay propose to the Council the measures to be adopted. The Council shall decide by a qualified majority.

(c) If, within three months of the matter being submitted to it, the Council has not taken a decision, the proposed measures shall be adopted by the Commission.

#### *Article 9*

1. Member States shall bring into force the provisions necessary in order to comply with this Directive within 18 months of its notification and shall forthwith inform the Commission thereof. Within the United Kingdom the 18-month period shall be extended to 30 months for the class of semi-conductor devices rated up to 1 000 W and intended for use as lighting dimmers.

2. Member States shall ensure that the texts of the provisions of national law which they adopt in the field covered by this Directive are communicated to the Commission.

#### *Article 10*

This Directive is addressed to the Member States.

Done at Brussels, 4 November 1976.

*For the Council*

*The President*

Th. E. WESTERTERP

## ANNEX

## 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 semi-conductors 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 section 3 *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. DEFINITIONS

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

## 2.1. Continuous interference

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

## 2.2. Discontinuous interference

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

## 2.2.1. 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.

## 2.2.2. Counted clicks

Clicks which exceed the limit of continuous interference.

## 2.2.3. Switching operation

One opening or one closing of a switch or contact.

## 2.2.4. The minimum observation time T

In general, the time taken to register 40 counted clicks and to count 40 switching operations (see 6.1.1.5 for details).

## 2.2.5. Click rate N

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 3.2.6.4) 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 Annex 1, Table D.

2.2.6. *Permitted limit  $L_q$  (for counted clicks)*

The relevant limit for continuous interference increased by a specified amount (given in 3.2.3 and 3.2.6).

2.2.7. *Typical value (of counted clicks)*

The value allocated to the equipment or appliance according to the upper-quartile method. That is, the equipment or appliance under test shall be deemed to comply with the limits if not more than a quarter of the counted clicks are higher than the permitted limit. Examples of application of the upper-quartile method are shown in Annex 2.

2.3. **Duty cycle**

Over a number of cycles of openings and closings the duty cycle is the sum of the times during which the contacts are closed expressed as a ratio of the total time.

3. **INTERFERENCE LIMITS**3.1. **Continuous interference**3.1.1. *Frequency range 0.15 to 30 MHz (terminal voltage)*

Limits of interference voltage produced in the frequency range 0.15 to 30 MHz are given in Table I.

TABLE I

Frequency range	Limits for the frequency range 0.15 to 30 MHz					
	Electrical household appliances and similar equipment	Portable tools			Regulating controls not incorporated	
		Rated power of motor				
		Up to and including 700 W	Above 700 W up to and including 1 000 W	Above 1 000 W up to and including 2 000 W	At mains terminals	At load terminals
(MHz)	dB (μV) mV	dB (μV) mV	dB (μV) mV	dB (μV) mV	dB (μV) mV	dB (μV) mV
0.15 to 0.50	66 2	66 2	70 3	76 6	66 2	80 10
0.50 to 5	60 1	60 1	64 1.5	70 3	60 1	74 5
5 to 30	66 2	66 2	70 3	76 6	66 2	80 10

*Note:* The limits apply across the whole frequency range but, for practical reasons, measurements may be made at the following preferred frequencies: 0.16; 0.24; 0.55; 1.0; 1.4; 2.0; 3.5; 6.0; 10 and 22 MHz; all of which have the permitted tolerance of  $\pm 10\%$ .

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

Tables II and III show the limits of interference power.

TABLE II

Frequency range	Limits for the frequency range 30 to 300 MHz			
	Electrical household appliances and similar equipment	Portable tools		
		Rated power of motor		
		Up to and including 700 W	Above 700 W up to and including 1 000 W	Above 1 000 W up to and including 2 000 W
(MHz)	dB (pW)	dB (pW)	dB (pW)	dB (pW)
30 to 300	45 to 55	45 to 55	49 to 59	55 to 65
increasing linearly with frequency				

*Note:* The limits indicated apply across the whole frequency range but, for practical reasons, measurements may be made at the six preferred frequencies, the limits for which are indicated in Table III. Each test frequency may be selected within a tolerance of  $\pm 5$  MHz.

TABLE III

## Limits at preferred frequencies

Frequencies MHz	Limits dB (pW)			
	Electrical household appliances and similar equipment	Rated power of motors of portable tools		
		Up to and including 700 W	Above 700 W up to and including 1 000 W	Above 1 000 W up to and including 2 000 W
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

## 3.2. Discontinuous interference

For household appliances, portable tools, electric fence supply units and similar equipment, which produce discontinuous interference as defined in 2.2, limits shall be determined in accordance with 3.2.1 to 3.2.6. Annex 1 summarizes the limits for certain appliances for specified operating conditions. Limits for appliances not shown in Annex 1 shall be calculated in accordance with the principles laid down in 3.2.1 to 3.2.6 using as a guide the examples shown in Annex 1.

- 3.2.1. When switching operations produce more than two clicks in any two-second period, or interference other than clicks, the resulting interference shall, with the exception of that caused by appliances as detailed in 3.2.6.3, be subject to the limits for continuous interference laid down in 3.1.

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

- 3.2.2. In the case of counted clicks not occurring more frequently than twice in any two-second period for all classes of equipment and appliances except those detailed in 3.2.6, the permitted limit  $L_q$  is as defined in 2.2.6 and set out in 3.2.3. Specific examples of formulae are shown in Annex 1, Tables A 1, B and C.

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

$$L_q = (L + 44) (*) \quad [N < 0.2]$$

$$L_q = \left( L + 20 \log_{10} \frac{30}{N} \right) (*) \quad [0.2 \leq N \leq 30]$$

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

(\*) dB ( $\mu$ V) 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.

- 3.2.4. Measurements of radio noise 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  $\pm 10\%$  is permitted for the first four frequencies, and  $\pm 5\%$  for the other three. Further restriction to the following three frequencies is permitted for prolonged tests: 160 kHz, 550 kHz and 45 MHz.

- 3.2.5. The click rate  $N$  shall be determined under the operating conditions specified in section 6. The appliances shall therefore be operated under these conditions for the measurement of discontinuous interference.

- 3.2.6. For certain appliances, listed in the subsidiary points below, limits and conditions laid down in 3.2.1 to 3.2.5 shall apply with the exceptions specified.

- 3.2.6.1. Manually operated switches which are included in an appliance for the purpose only of mains isolation or programme selection (e.g. the switch for a lamp or an electric typewriter, but not stop-start switches of sewing machines and calculating machines) are exempted from the provisions of this Directive.

- 3.2.6.2. For appliances listed in Annex 1, Table B and the like, the limit in the frequency range 0.15 to 0.2 MHz shall be:

$$L_q = 70 + 20 \log_{10} \frac{30}{N} \text{ dB } (\mu\text{V}).$$

In addition, appliances listed in Annex 1, Table B and marked with a double asterisk, which have instantaneous switching (i.e. the duration of each click is less than 10 ms), and a click rate of not more than five shall be deemed to comply with the limit independently of the amplitude of the clicks.

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

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

- 3.2.6.4. For appliances listed in Annex 1, Table D the click rate  $N = f n_2 / T$ , where  $n_2$  is the sum of the switching operations during the observation time  $T$  minutes, and  $f$  is a factor given in Annex 1, Table D.

- 3.2.6.5. Limits for electric fence supply units are applicable only up to 30 MHz.

#### 4. APPLICATION OF LIMITS IN TESTS FOR CONFORMITY OF APPLIANCES IN SERIES PRODUCTION

##### 4.1. Tests shall be made:

4.1.1. either on a sample of appliances of the type using the statistical method of evaluation set out in 4.3,

4.1.2. or for simplicity's sake on one item only. The value measured must in this case be at least 2 dB less than the limit value.

4.2. Subsequent tests are necessary from time to time on items taken at random from the production especially in the case of 4.1.2. In the case of any dispute which could lead to a ban on sales, such a ban shall be considered only after tests have been carried out in accordance with 4.1.1.

##### 4.3. 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 items of the type, but if in exceptional circumstances five items are not available, then a sample of three or four shall be used. Compliance is achieved when the following relationship is met:

$$\bar{x} + kS_n \leq L,$$

where

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

$S_n^2$  = the standard deviation of the sample, where

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

$x$  = the interference level of an individual item;

$k$  = 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 the table below;

$L$  = the limit;

$x$ ,  $\bar{x}$ ,  $S_n$  and  $L$  are expressed logarithmically [dB ( $\mu$ V) or dB (pW)].

$n$	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

#### 5. MEASURING APPARATUS AND METHODS

##### 5.1. Frequency range 0.15 to 30 MHz

— The measuring apparatus shall comply with the CISPR Publication 1 'Specification of CISPR radio interference measuring apparatus for the frequency range 0.15 MHz to 30 MHz' (1972), second edition.

— Measurements are made of the interference voltages produced by the apparatus at the terminals of an artificial mains V-network of 150 ohms impedance in accordance with that publication.

##### 5.1.1. *Specific measures for regulating controls incorporating semi-conductor devices*

In the case of regulating controls incorporated within appliances, measurement shall be made in accordance with 5.1.

For such regulating controls as are not incorporated within an appliance the apparatus shall be arranged as shown in Figure 3, or in the case of two-terminal apparatus in accordance with the outline in Figure 3a. The load shall be of the correct rated value and unless otherwise stated by the manufacturer shall consist of incandescent lamps. Measurement of interference voltages at the mains terminals shall be made in accordance with the provisions of 5.1 above. Measurement of interference voltages at the load terminals shall be made using a probe consisting of a



capacitor and a resistor having a resistance of a minimum value of 1 500 ohms in series with the input of the measuring receiver. Due allowance shall be made for the voltage division between the probe and the measuring set.

During all such measurement, the regulating control shall be adjusted to give maximum indication on the measuring apparatus at each frequency.

5.1.2. *Electric fence supply units*

The unit under test shall be set up in accordance with Figure 4, the fence being replaced by a circuit having a 300 ohms resistance in series with a 10 nF capacitance (rated voltage 10 kV dc.).

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.

Electric fence supply units designed to operate on ac or dc shall be tested with both kinds of current.

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

The interference voltage shall be measured at terminals a, b and c of the circuit shown in figure 4, the appliance being in its normal position, with a maximum inclination of 15° from the vertical, and the controls accessible without tools set to the positions of maximum interference.

5.2. **Frequency range 30 to 300 MHz**

The measuring apparatus shall comply with CISPR Publication 2 'Specification for CISPR radio interference measuring apparatus for the frequency range 25 MHz to 300 MHz' (1961) and Amendment No 1 (1969).

5.3. Discontinuous interference measuring apparatus shall comply with CISPR Recommendation 41 (1970) 'Automatic Assessment of Interference produced by Switching Operations'.

Other methods shall be allowed if they yield the same results with the same degree of accuracy.

5.4. **Measurement of the duration of disturbances shorter than 10 ms**

It is necessary to determine the duration of the disturbances caused by the thermostats of appliances referred to in 3.2.6.2 having instantaneous switching. This duration may be determined in the following manner: the appliance to be tested is connected to a CISPR artificial mains V-network. If a CISPR meter is available, it is connected to the V-network and a cathode-ray oscilloscope is connected to the i.f. output of the CISPR meter. If a CISPR meter is not available, the oscilloscope is connected directly to the V-network. The time base of the oscilloscope can be started by the disturbances to be tested; the velocity of the time base is set to a value of 1-10 ms/cm. The phenomena can either be recorded on the screen of a storage oscilloscope or a photograph can be made, thus enabling the time duration to be measured.

6. **OPERATING CONDITIONS FOR APPLIANCES DURING TESTS**

6.1. **Conditions and duration of operations and interpretation of results**

6.1.1. The appliance is to be operated under the following conditions:

6.1.1.1. the load shall be as defined in 6.2, and 6.3 or, for appliances not covered by these paragraphs, under normal operating conditions as indicated in the manufacturer's instructions;

6.1.1.2. where an appliance is marked with an indication of the normal period of operation, the operating period shall be of that length; in all other cases no limit is set as to the operating period; it is recommended that the appliance be kept in operation while measurements are effected at various frequencies;

- 6.1.1.3. no running-in period is laid down, but prior to testing the appliance must have been used sufficiently for its operating condition to be representative of the operating condition during the normal life of the appliance; running-in shall be carried out by the manufacturer;
- 6.1.1.4. operation shall be from a supply having the rated voltage of the appliance. If the level of interference varies considerably with supply voltage, a test shall be conducted at frequencies for which the results are closest to the limits and at supply voltages between 0.9 and 1.1 times the rated voltage of the appliance. Appliances with more than one rated voltage must be tested at the rated voltage which causes maximum interference;
- 6.1.1.5. the minimum observation time  $T$  mentioned in 2.2.4 shall be, for equipment with automatic stop, a complete programme if this produces 40 or more counted clicks. If the programme does not produce 40 counted clicks, it shall be repeated in full as often as necessary to produce a minimum of 40 clicks, but with a two hour limit in the case of equipment without automatic stop if 40 clicks are not produced within such a period. The interval between the end of one programme and the start of the next programme shall be excluded from the observation time.
- 6.1.1.6. When determining  $N$  (but not when determining the typical value of counted clicks) the time  $T$  may be restricted to two hours for appliances which are not programme-controlled.
- 6.1.1.7. For programmed appliances and appliances with automatic stop, the programme which produces the greatest number of clicks shall be chosen for determining the click rate  $N$ .
- 6.1.2. For interpretation of the readings on the measuring set the following procedure shall be adopted:
  - 6.1.2.1. the readings on the measuring receiver shall be observed for at least 15 seconds at each measuring frequency, the highest reading being recorded;
  - 6.1.2.2. within the range 30 to 300 MHz, the tests must be carried out as follows.
    - 6.1.2.2.1. The entire spectrum shall be measured;  
*Note:* For this purpose it is sufficient to measure at the following preferred frequencies: 45, 65, 90, 150, 180, 220 MHz, with a tolerance of  $\pm 5$  MHz.
    - 6.1.2.2.2. The measurements shall be repeated on at least one frequency close to each the following: 45, 90, 220 MHz.
    - 6.1.2.2.3. If differences of not more than 2 dB are observed between the levels of interference as measured in 6.1.2.2.1 and 6.1.2.2.2, for the frequencies concerned, the curve obtained under 6.1.2.2.1 shall be adopted. If the differences are greater than 2 dB, the measurement shall be repeated for the entire spectrum and the highest level of all measurements at each frequency shall be adopted.
- 6.2. **Standardized loads for electric motor-operated appliances**
  - 6.2.1. *Electric motor-operated appliances for household and similar purposes*
    - 6.2.1.1. Vacuum cleaners: to be operated continuously without accessories and with maximum air flow, but with dust bag in place.
    - 6.2.1.2. Floor polishers: to be operated continuously without mechanical load on the polishing brushes.
    - 6.2.1.3. Sewing machines:
      - (a) continuous interference from the motor: the motor to be operated continuously with sewing mechanism *in situ* but not sewing a fabric. The regulator must be set in the position for maximum speed.
      - (b) interference during starting and stopping: the speed of the motor to be increased to maximum speed over a five-second period. For stopping, the regulator is to be reset quickly. To determine the click rate  $N$ , the period between two starts shall be 15 seconds.

- 6.2.1.4. Juice extractors: as in 6.2.1.7.
- 6.2.1.5. Clocks: continuous operation.
- 6.2.1.6. Fans: continuous operation with maximum air flow: if heating is incorporated, the fan should be tested both with and without heating.
- 6.2.1.7. Food mixers (kitchen type): to be operated without load and set first at half speed, then at maximum speed.
- 6.2.1.8. Liquid mixers: as in 6.2.1.7.
- 6.2.1.9. Refrigerators: to be operated continuously with door closed. The thermostat to be set to the middle of the range. The cabinet shall be empty and not heated. Measurement is made when the steady state has been reached.  
The click rate N is calculated on the basis of half the number of switching operations per hour.
- 6.2.1.10. Washing machines: to be operated with water but without washing. When a thermostat is fitted it must be adjusted to the maximum setting or to 90 °C whichever is lower. The programme should be set to produce the highest value for N.
- 6.2.1.11. Spin dryers: to be tested in continuous operation without load.
- 6.2.1.12. Dish-washing machines: as in 6.2.1.10.
- 6.2.1.13. Hair dryers: as in 6.2.1.6.
- 6.2.1.14. Shavers and hair clippers: to be tested in continuous operation without load for not more than 10 minutes.
- 6.2.1.15. Massage appliances: to be tested in continuous operation without load.
- 6.2.1.16. Office machines, vending machines and amusement machines
  - 6.2.1.16.1. Typewriters: continuous operation.
  - 6.2.1.16.2. Adding and calculating machines and cash registers:
    - (a) Interference from motors: if possible, the motor should operate for a sufficient period of time to give steady readings unaffected by switching disturbances.
    - (b) Interference from switches: intermittent operation with at least 30 starts per minute. If 30 starts per minute cannot be attained, then intermittent operation with as many starts per minute as possible in practice must be used.
  - 6.2.1.16.3. Vending machines and amusement machines: as in 6.1.1.7.
- 6.2.1.17. Projectors
  - 6.2.1.17.1. Cinema projectors: to be tested in continuous operation with film and with the lamp switched on.
  - 6.2.1.17.2. Slide projectors: to be tested in continuous operation without slides but with lamp switched on. The click rate N is determined on a basis of four picture-changes per minute, but without slides.
- 6.2.1.18. Coffee grinders: to be operated without grinding charge.
- 6.2.1.19. Lawn mowers: to be operated continuously without load.

- 6.2.1.20. Milking machines: to be operated continuously without vacuum.
- 6.2.2. *Portable tools with electric motors*  
Hand-held tools which incorporate vibrating or swinging masses shall where possible be measured with these masses removed or disconnected unless otherwise stated.
- 6.2.2.1. Drills: to be operated continuously without load.
- 6.2.2.2. Screwdrivers and impact wrenches: as in 6.2.2.1.
- 6.2.2.3. Grinders, disc type sanders and polishers: as in 6.2.2.1.
- 6.2.2.4. Sanders, other than disc sanders: as in 6.2.2.1.
- 6.2.2.5. Saws and cutters: as in 6.2.2.1.
- 6.2.2.6. Hammers: as in 6.2.2.1.
- 6.2.2.7. Spray guns: to be operated continuously without accessories and with empty reservoir.
- 6.2.2.8. Shears: as in 6.2.2.1.
- 6.2.2.9. Thread cutting machines: as in 6.2.2.1.
- 6.2.2.10. Compass saws for wood and similar material: as in 6.2.2.1.
- 6.2.2.11. Liquid agitators (internal vibrators) with agitators fitted: to be operated continuously in the centre of a round steel-plate container filled with water, the volume of water being equal to 50 times that of the agitator (vibrator).
- 6.2.2.12. Impact drills: as in 6.2.2.1.
- 6.2.2.13. Planing machines: as in 6.2.2.1.
- 6.2.3. *Sound recording and reproduction equipment*
- 6.2.3.1. Record players: to be operated continuously without record.
- 6.2.3.2. Magnetic recorders: to be operated continuously using a magnetic recording medium.
- 6.2.3.3. Sound-film projectors: to be operated continuously with film, the lamp being switched on.
- 6.2.4. *Electro-medical equipment with motor*  
Paragraph 6.2.4 is under revision to take account of current techniques.
- 6.2.4.1. Dental drills:  
(a) continuous interference from the motor: the motor to be operated continuously with the drilling gear but not drilling a material. The speed control shall be set to the position for maximum speed.  
(b) interference during starting and stopping: as in 6.2.1.3.
- 6.2.4.2. Saws and scalpels: to be operated continuously without a load.
- 6.2.4.3. Electro-cardiographs and similar recorders: to be operated continuously with a recording tape.

6.2.4.4. **P u m p s** : to be operated continuously with liquid.

6.3. **Supplementary conditions for household electrical and similar appliances without a motor**

Before measurement, the appliances should reach a state of thermal equilibrium.

If the specified duty cycle (see 2.3) cannot be achieved the switching rate applied should be the highest possible.

6.3.1. *Cookers, appliances with one or more hot plates controlled by thermostats or energy regulators*

To be tested under conditions of adequate heat discharge; an aluminium saucepan filled with water is placed on the hot plate and brought to the boil. The click rate N is equal to half the number per minute of the switching operations for a 50 % duty cycle.

6.3.2. *Cooking ovens*

To be operated without utilization of the heat developed, the door being closed. N is determined with the control set for a 50 % duty cycle.

6.3.3. *Plate warmers, heated tables, heated drawers, hot-presses*

To be operated without utilization of the heat developed. N is determined with the control set for a 50 % duty cycle.

6.3.4. *Steam generators for indirect heating of appliances in the hotel industry, open water-baths*

To be operated under conditions of adequate heat discharge and using the normal quantity of water. N is determined with the control set for a 50 % duty cycle.

6.3.5. *Frying pans, table-type spit-roasters, deep-fryers*

To be operated under conditions of adequate heat discharge. The quantity of oil above the hottest point of the heated surface should be:

30 mm for frying pans (sauté pans)

10 mm for table-type spit-roasters

10 mm for deep fryers (unless a minimum oil level is specified).

N is determined with the control set for a 50 % duty cycle.

6.3.6. *Waffle irons, grills*

To be operated without utilization of the heat developed, the lid being closed. N is determined with the control set for a 50 % duty cycle.

6.3.7. *Cauldrons, cooking pots, fixed water boilers, casseroles, kettles, percolators, milk-warmers, feeding-bottle warmers, glue boilers, sterilizers, wash-boilers*

To be operated under conditions of adequate heat discharge, half-filled with water and with the lid off. If it is possible to regulate the temperature, the click rate N shall be determined with a medium setting.

6.3.8. *Absorption refrigerators*

As in 6.2.1.9.

6.3.9. *Ironing machines (table, roller, pressing machines)*

The repetition rate N for the clicks caused by the thermostat shall be determined without utilization of the heat developed, the heated surface being in the open position and the thermostat set to a high temperature. The repetition rate N for any motor control contacts shall be determined under such conditions that the heat discharged permits the ironing of two damp hand-towels (of approximately 1 m × 0.5 m) per minute. To establish the permitted limit of interference, the two values of N should be added.

6.3.10. *Smoothing irons*

To be tested with suitable heat discharge, using air, oil, or water cooling. N is taken as 0.66 times the number of switching operations for a duty cycle of 50 % and a high temperature setting.

6.3.11. *Room heaters* (convection radiators, oil-filled heaters etc.)

To be operated under conditions of adequate heat discharge. N is determined with the control set for a duty cycle of 50 %.

6.3.12. *Hair dryers*

As in 6.3.11.

6.3.13. *Toasters*

To be tested under conditions of adequate heat discharge with slices of bread about 24 hours old (dimensions approximately 10 cm x 9 cm x 1 cm), each cycle comprising a period of operation and a period of rest. The rest period should last 30 seconds. N should be determined for a setting giving golden-brown toast.

6.3.14. *Instantaneous water heaters, storage heaters, non-storage heaters*

To be tested under conditions of adequate heat discharge, the temperature of the water entering not exceeding 35 °C. N shall be determined with the control mechanism set for a duty cycle of 50 %.

6.3.15. *Flexible electrical heating appliances* (pillows, blankets, bed-warmers, heating mattresses)

Should be stretched out between two soft coverings (for example, insulating mats) extending beyond the heating surface by at least 10 cm. The thickness and the thermal conductivity must be chosen so that N can be determined with the control set for a duty cycle of 50 %.

6.3.16. *Thermostats for controlling electric room heaters or water heaters, oil or gas burners and the like* (as in 6.3.11)

Where the thermostat can in practice be connected to a relay or contactor, all measurements should be taken using as a load such a device, having the highest coil inductance used in practice. In order to effect satisfactory measurement, the contacts must be operated a sufficient number of times at a suitable load in order to ensure that interference levels are representative of those registered in normal operation.

Figure 1: Examples of discontinuous interference classified as clicks (see 2.2.1)

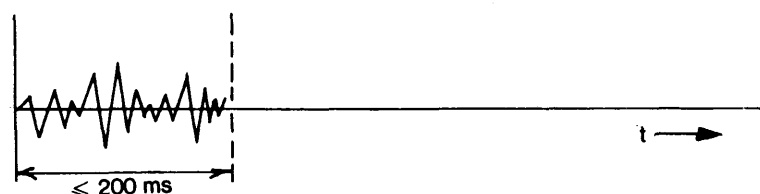


Figure 1a

*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

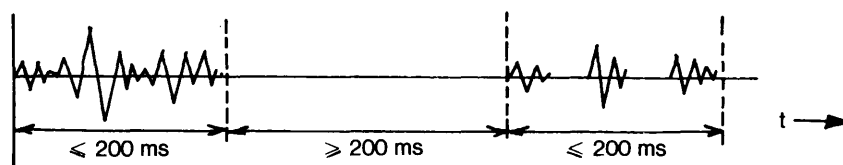


Figure 1c

*Two clicks*

Two disturbances, neither exceeding 200 ms, and spaced by minimum of 200 ms

Figure 2: Examples of discontinuous interference for which the limits of continuous interference apply (see 3.2.1)

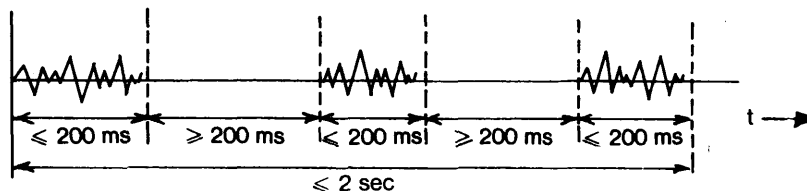


Figure 2a

More than two disturbances of duration less than 200 ms spaced by 200 ms or more, in a period of two seconds

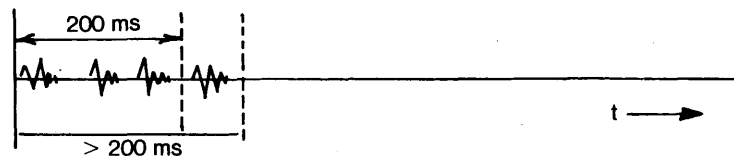


Figure 2b

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

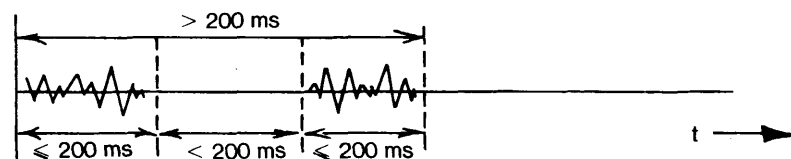
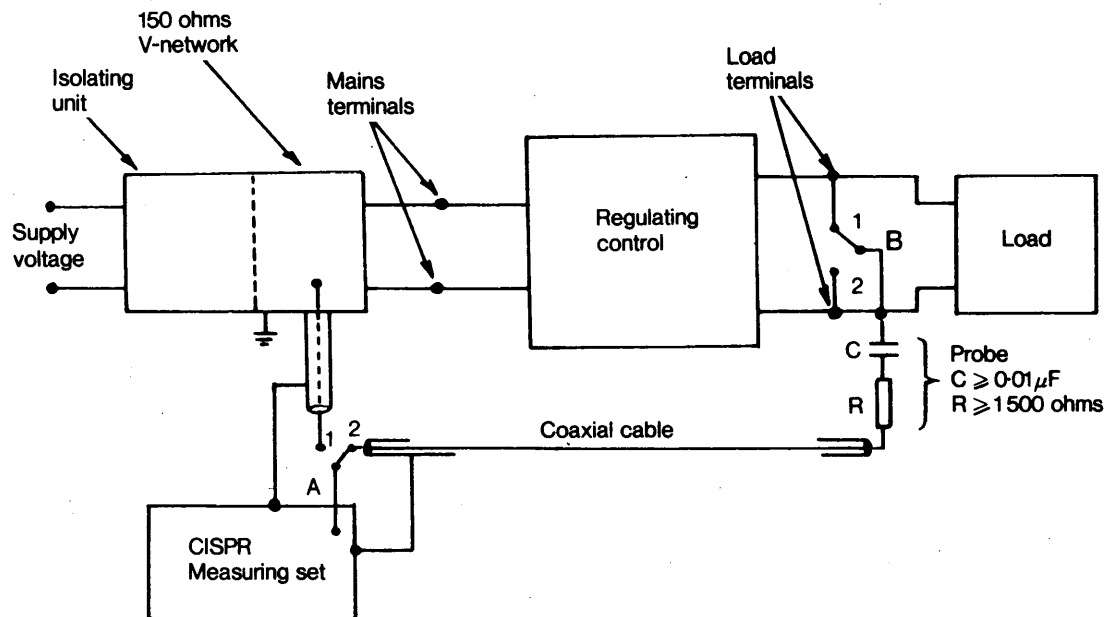


Figure 2c

Two disturbances spaced by less than 200 ms and continuing for more than 200 ms.

Figure 3: Measuring arrangement for regulating controls (see 5.1.1)

*Switch positions*

- A 1 — For mains measurements  
 A 2 — For load measurements  
 B 1 } Successive connections during load measurement  
 B 2 }

- Notes: 1. The earth of the measuring set shall be permanently connected to the V-network.  
 2. The length of the coaxial cable from the probe shall not exceed 2 m.  
 3. When the switch A is in position 2 the output of the V-network at terminal 1 shall be closed by an impedance equivalent to the input impedance of the CISPR measuring set.  
 4. The leads connecting the load to the output terminal shall be from 0.5 to 1 m in length.  
 5. Where a two-terminal regulating control is inserted in one leg only of the supply, measurements shall be made in associating the second leg of the supply as follows:

Figure 3a: Layout for measurement of two-terminal regulating controls (see 5.1.1)

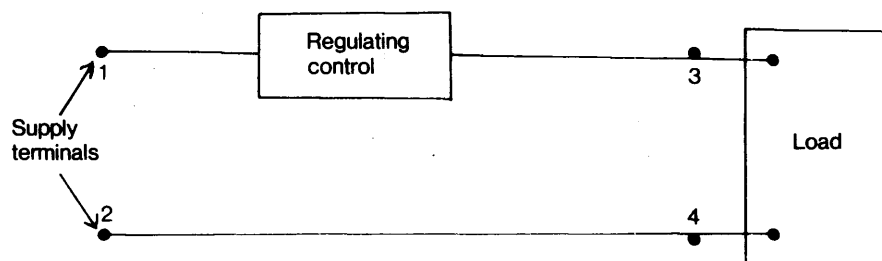
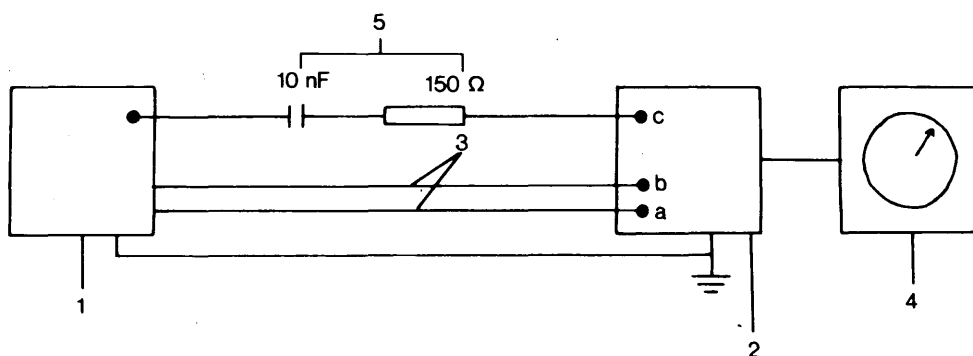




Figure 4: Arrangement for measurement of interference voltage produced by an electric fence supply unit (see 5.1.2)



1. Supply unit of electric fence.
2. V-network conforming to Figure 9, Appendix D of CISPR Publication 1 (the network presents an impedance of 150 ohms between each of the terminals a, b and c and earth).
3. Mains lead to supply unit for the electric fence.
4. CISPR receiver, in accordance with CISPR Publication 1.
5. Elements of the equivalent circuit to replace the fence (the specified resistance of 300 ohms is provided by the 150 ohm resistance in series with the resistances of the V-network).

## Annex 1

Limits of radio noise produced by the switching operations of specific appliances when the formula  $20 \log_{10} 30/N$  is applicable

TABLE A 1

Type of appliance	Special conditions	Frequency range (MHz)	Limit
Steam generators	None	0.15 — 0.5	$66 + 20 \log_{10} \frac{30}{N}$ dB ( $\mu$ V)
Sauté pans			
Table spit-roasters			
Waffle grills			
Feeding bottle heaters		0.5 — 5.0	$60 + 20 \log_{10} \frac{30}{N}$ dB ( $\mu$ V)
Glue pots			
Rotating ironing machines		5.0 — 30	$66 + 20 \log_{10} \frac{30}{N}$ dB ( $\mu$ V)
Fan heaters			
Oil-filled heaters and the like		30 — 300	$(45-55) + 20 \log_{10} \frac{30}{N}$ dB (pW) (increasing linearly)
Hair dryers			
Thermal and non-thermal storage water-heaters			
Heating mattresses			
Electric fences			3.2.1 to 3.2.5 apply
Washing machines			
Dishwashing machines			

TABLE A 2

Type of appliance	Special conditions	Frequency range (MHz)	Limit
Sewing machine starter switches			As for Table A 1, but values of N are derived according to 6.2 (see also Table D)
Dental drill starter switches			
Table and free standing ironing machines			
Ironing presses			
Sewing machine speed controls			
Dental drill speed controls			
Adding machine starter switches			
Calculating machine starter switches			
Cash register starter switches			
Slide projector picture change devices			

TABLE B

Type of appliance	Special conditions	Frequency range (MHz)	Limit
Warming plates	None	0.15 — 0.2	$70 + 20 \log_{10} \frac{30}{N}$ dB ( $\mu$ V)
Cooking ovens			
Deep fat fryers			
Space heaters			
Fan heaters			
Convectors			
Refrigerators (*)		0.2 — 0.5	$66 + 20 \log_{10} \frac{30}{N}$ dB ( $\mu$ V)
Immersion heaters			
Water baths		0.5 — 5	$60 + 20 \log_{10} \frac{30}{N}$ dB ( $\mu$ V)
Instantaneous water heaters			
Waffle irons		5 — 30	$66 + 20 \log_{10} \frac{30}{N}$ dB ( $\mu$ V)
Kettles			
Coffee percolators		30 — 300	$(45-55) + 20 \log_{10} \frac{30}{N}$ dB(pW) (increasing linearly)
Milk warmers			
Sterilizers		3.2.6.2 applies	3.2.6.2 applies
Warming pads			
Blankets			
Bedwarmers			
Separate thermostats for control of room or water heaters and oil burners			
Irons (**)			
Frying pans (**)			
Automatic toasters (**)			
Cooking ranges with automatic plates (**)			
Stewing pans (**)			

(\*) See also 3.2.6.3.

(\*\*) When the conditions  $< 10$  ms click,  $N \leq 5$  are fulfilled, there is no amplitude limit.

TABLE C

Type of appliance	Special conditions	Frequency range (MHz)	Limit
All appliances except those appearing in Table B for which the limit is 114 dB ( $\mu$ V) in the frequency range 0.15—0.2 MHz	For values of $N < 0.2$	0.15 — 0.5	110 dB ( $\mu$ V)
		0.5 — 5	104 dB ( $\mu$ V)
		5 — 30	110 dB ( $\mu$ V)
		30 — 300	89—99 dB (pW)
			3.2.3 applies

TABLE D

Click rate  $N = \frac{fn_2}{T}$  where  $n_2$  is the sum of the openings and closings (switching operations) during the observation time T minutes

Type of appliance	Factor f	Special conditions see points below	Limit
Cooking ranges	0.5	6.3.1	See Tables A 1, A 2, B and C
Appliances with one or more boiling flames controlled by thermostats or energy regulators	0.5	6.3.1	
Refrigerators	0.5	6.2.1.9	
Irons	0.66	6.3.10	
Speed controls and starting switches for sewing machines	1.0	6.2.1.3	
Dental drills	1.0	6.2.4.1	
Starting switches for adding machines	1.0	6.2.1.16.2	
Calculating machines	1.0	6.2.1.16.2	
Cash registers	1.0	6.2.1.16.2	
Slide projectors	1.0	6.2.1.17.2	

## Annex 2

## Examples of use of the upper quartile method to determine compliance with reference limits

(see 2.2.7)

Click No Level db ( $\mu$ V)	Test record No									
	1	2	3	4	5	6	7	8	9	10
	94	100	98	102	97	90	98	99	96	94
	11	12	13	14	15	16	17	18	19	20
	94	90	97	94	100	94	99	80	96	91
	21	22	23	24	25	26	27	28	29	30
	87	88	98	88	86	80	94	90	92	83
	31	32	33	34	35	36	37	38	39	40
	96	86	96	86	98	92	97	90	97	90
	41	42	43	44	45					
	98	93	97	99	100					

*Example I:* Deep fat fryer (appliance rejected)

Total time of the record (T) = 35 min.

Total number of clicks ( $n_1$ ) = 45.

$$N = \frac{45}{35} = 1.3$$

$$20 \log_{10} \frac{30}{N} = 20 \log_{10} \frac{30}{1.3} = 27.5 \text{ dB}$$

Admissible level for 160 kHz = 70 + 27.5 = 97.5 dB ( $\mu$ V).In this example 12 clicks (Nos 2, 3, 4, 7, 8, 15, 17, 23, 35, 41, 44 and 45) are above the limit of 97.5 dB ( $\mu$ V).As only  $\frac{45}{4} = 11$  such clicks are allowed, the appliance has to be rejected.*Example II:* Oil heater (appliance accepted)

Total time of record (T) = 135 min.

Total number of clicks ( $n_1$ ) = 45.

$$N = \frac{45}{135} = \frac{1}{3}$$

$$20 \log_{10} \frac{30}{N} = 20 \log_{10} 90 = 39.2 \text{ dB}$$

Admissible level for 160 kHz = 66 + 39.2 = 105.2 dB ( $\mu$ V).In this example no clicks are above the limit of 105.2 dB ( $\mu$ V) and the appliance is accepted.