STATUTORY INSTRUMENTS

1963 No. 1895

TELEGRAPHS

The Wireless Telegraphy (Control of Interference from Electro-Medical Apparatus) Regulations 1963

Made - - - -	*22nd November* 1963
Laid before Parliament	*29th November* 1963
Coming into Operation	*29th November* 1964

I, The Right Honourable John Reginald Bevins, M.P., Her Majesty's Postmaster General, by virtue of the powers vested in me by section 10 of the Wireless Telegraphy Act 1949(a), by the said section as extended to the Channel Islands by the Wireless Telegraphy (Channel Islands) Order 1952(b), and by the said section as extended to the Isle of Man by the Wireless Telegraphy (Isle of Man) Order 1952(c), and of every other power enabling me in this behalf, and after consultation with the advisory committee referred to in section 9 of the Wireless Telegraphy Act 1949, do hereby make the following regulations, that is to say:

1.—(1) In these regulations, except so far as the contrary is provided or the context otherwise requires, the following expressions have the meanings hereby respectively assigned to them:

"the Act" means the Wireless Telegraphy Act 1949;

"the British Islands" means the area comprised by the United Kingdom, the Channel Islands, and the Isle of Man;

"electric supply lines" means electric lines for transmitting electric power to an electro-medical apparatus;

"electric supply line terminals" in relation to an electro-medical apparatus means the terminals or other points of connection on or in the electro-medical apparatus which are designed to connect it with a source of electric power, or, in relation to electro-medical apparatus which is installed in a metallically screened and filtered enclosure, means those terminals or other points of connection on the electric supply lines which are nearest to the enclosure, being on the supply side of the enclosure and of any filter associated with the enclosure;

"electro-medical apparatus" means apparatus, not being surgical diathermy apparatus, used or designed to be used for the purpose of giving radio-frequency or ultrasonic medical or epilation treatment which, or any part of which, generates or is liable to generate fortuitously electro-magnetic energy at frequencies of three million megacycles or less per second when it is in operation, and includes any switchgear or controlling apparatus forming part of or directly associated with that apparatus, and any induction cables, attachments, electrodes and connecting leads used or designed to be used with that apparatus;

(a) 12, 13 & 14 Geo. 6. c. 54. (b) S.I. 1952/1900 (1952 III, p. 3414).
(c) S.I. 1952/1899 (1952 III, p. 3418).

"surgical diathermy apparatus" means apparatus used or designed to be used solely for cauterisation or cutting in surgery;

"terminal voltage" means the radio-frequency voltage present between each electric supply line terminal of an electro-medical apparatus and the screening of the measuring apparatus referred to in regulation 4;

expressions used in Schedule 3 have the meanings respectively assigned to them in Part 1 of Schedule 3;

and other expressions have the same meaning as they have in the Act.

(2) The Interpretation Act 1889(a) applies for the interpretation of these regulations as it applies for the interpretation of an Act of Parliament.

Manufacturers, Assemblers and Importers

2.—(1) Subject to paragraph (3), if after the commencement of these regulations any electro-medical apparatus is to be sold otherwise than for export, or offered or advertised for sale otherwise than for export, or let on hire or offered or advertised for letting on hire, by any person who in the British Islands in the course of business manufactures or assembles electro-medical apparatus, or who in the course of business imports electro-medical apparatus into the British Islands, it shall comply with the following requirement for the purposes of section 10 of the Act.

(2) The said requirement is that the electro-medical apparatus shall be so designed, constructed and assembled, and that such precautions shall be taken in relation to it, as to ensure that when the apparatus is used the following conditions are satisfied:

(*a*) the field strength of electro-magnetic energy radiated in any direction from the apparatus, as measured and computed in accordance with regulation 4, shall not exceed the limits specified in columns 1 and 2 of Schedule 1 at any frequency within the range from 150 kilocycles per second to 223 megacycles per second, and

(*b*) the terminal voltage, as measured and computed in accordance with regulation 4, shall not exceed the limits specified in columns 1 and 3 of Schedule 1 at any frequency within the said range.

(3) Where the Postmaster General is satisfied that any apparatus is to be sold or let on hire for the purpose of being used only in a metallically screened or filtered enclosure, he may by consent in writing to the manufacturer, assembler or importer (as the case may be) waive compliance with the conditions set out in paragraph (2) in the case of such apparatus. Any such consent may relate either to specified apparatus or to apparatus of any specified class or description, and may be given subject to such conditions as the Postmaster General may think fit, and shall be revocable at any time.

Users

3. When any electro-medical apparatus is used in the British Islands, it shall comply with the following requirements for the purposes of section 10 of the Act:

(*a*) the field strength of electro-magnetic energy radiated in any direction from the apparatus, as measured and computed in accordance with regulation 4, shall not exceed the limits specified in columns 1 and 2 of Schedule 2 at any frequency within the range from 150 kilocycles per second to 223 megacycles per second, and

(a) 52 & 53 Vict. c. 63.

(*b*) the terminal voltage, as measured and computed in accordance with regulation 4, shall not exceed the limits specified in columns 1 and 3 of Schedule 2 at any frequency within the said range.

Field strength and terminal voltage measurement

4.—(1) For the purpose of measuring and computing the field strength of electro-magnetic energy and the terminal voltage at frequencies exceeding 150 kilocycles per second but not exceeding 30 megacycles per second, the electro-medical apparatus shall be tested by means of measuring apparatus of the description and having the physical and electrical characteristics and performance set out in Part 2 of Schedule 3.

(2) For the purpose of measuring and computing the field strength of electro-magnetic energy and the terminal voltage at frequencies exceeding 30 megacycles per second but not exceeding 223 megacycles per second, the electro-medical apparatus shall be tested by means of measuring apparatus of the description and having the physical and electrical characteristics and performance set out in Part 3 of Schedule 3.

(3) The tests for field strength shall be made by the method and under the conditions set out in Part 4 of Schedule 3, and the tests for terminal voltage shall be made by the method and under the conditions set out in Part 5 of Schedule 3.

(4) The said field strength and terminal voltage shall be computed as provided in Part 4 or Part 5 (as the case may be) of Schedule 3 from the readings afforded by the measuring apparatus while the electro-medical apparatus is operating.

Citation and commencement

5.—(1) These regulations may be cited as "the Wireless Telegraphy (Control of Interference from Electro-Medical Apparatus) Regulations 1963."

(2) These regulations shall come into operation on 29th November 1964.

Dated 22nd November 1963.

J. R. Bevins,
Her Majesty's Postmaster General.

Reg. 2(2)

SCHEDULE 1

Manufacturers, Assemblers and Importers

The limits of field strength and terminal voltage shall be as follows:

Col. 1 Frequency range		Col. 2 Maximum radiated field strength in microvolts per metre	Col. 3 Maximum terminal voltage in microvolts
Exceeding	Not exceeding		
13533 kc/s	13553 kc/s	1,000,000	5,000,000
13553 „	13567 „	unlimited	unlimited
13567 „	13587 „	1,000,000	5,000,000
26957 „	27283 „	unlimited	unlimited
40·599 Mc/s	40·761 Mc/s		
53·915 „	54·565 „		
67·766 „	67·834 „	150	7,500
80·872 „	81·848 „		
94·873 „	94·967 „	50	2,250
107·829 „	109·131 „		
121·980 „	122·100 „		
134·786 „	136·414 „	150	7,500
149·085 „	149·235 „		
161·744 „	163·696 „		
176·193 „	176·367 „	50	2,250
188·701 „	190·979 „		
203·298 „	203·502 „	150	7,500
215·658 „	218·262 „		

For all other frequencies in the ranges specified below the limits of field strength and terminal voltage shall be as follows:

Col. 1 Frequency range		Col. 2 Maximum radiated field strength in microvolts per metre	Col. 3 Maximum terminal voltage in microvolts
Exceeding	Not exceeding		
150 kc/s	40 Mc/s	30	1,500
40 Mc/s	118 Mc/s	15	750
118 Mc/s	223 Mc/s	30	1,500

Reg. 3

SCHEDULE 2

Users

The limits of field strength and terminal voltage shall be as follows:

Col. 1 Frequency range		Col. 2 Maximum radiated field strength in microvolts per metre	Col. 3 Maximum terminal voltage in microvolts
Exceeding	Not exceeding		
13533 kc/s	13553 kc/s	1,000,000	5,000,000
13553 „	13567 „	unlimited	unlimited
13567 „	13587 „	1,000,000	5,000,000
26957 „	27283 „	unlimited	unlimited

For all other frequencies in the ranges specified below the limits of field strength and terminal voltage shall be as follows:

Col. 1 Frequency range		Col. 2 Maximum radiated field strength in microvolts per metre	Col. 3 Maximum terminal voltage in microvolts
Exceeding	Not exceeding		
150 kc/s	40 Mc/s	30	1,500
40 Mc/s	118 Mc/s	15	750
118 Mc/s	223 Mc/s	30	1,500

Reg. 4

SCHEDULE 3

PART 1

Definition of expressions used in the Schedule

Voltage and e.m.f.

References to the voltage or e.m.f. of a sinewave are references to its effective or root mean square value.

Decibel (abbreviated db)

A unit of transmission giving the ratio of two powers.

If P_1 and P_2 represent two values of power, and n the number of decibels representing their ratio:

$$n = 10 \log_{10} \left\{ \frac{P_1}{P_2} \right\}$$

If the two powers are dissipated in equal resistive impedances, their ratio in decibels may be expressed by:

$$n = 20 \log_{10} \left\{ \frac{V_1}{V_2} \right\}$$

where V_1, V_2 are the voltages across the two resistive impedances.

Applied voltage

The voltage applied to the input terminals of the measuring apparatus.

Reference deflection

The deflection of the needle of the indicating meter of the valve-voltmeter to a mark at the middle of the scale of the meter.

Tuned frequency

The mid-frequency of the band of frequencies for which the measuring apparatus is tuned to accept the applied voltage.

Image frequency

The frequency, not being the tuned frequency, which combines with the fundamental frequency of the beating oscillator to produce the intermediate frequency.

Terminal voltage calibration constant

The number of decibels that must be added to the reading of the measuring apparatus, when a measurement of terminal voltage is made as prescribed, to give the terminal voltage in decibels above 1 microvolt.

Field-strength calibration constant

The number of decibels that must be added to the reading of the measuring apparatus, when a measurement of field-strength is made as prescribed, to give the value of field-strength in decibels above 1 microvolt per metre.

PART 2

Description and specification of characteristics and performance of measuring apparatus for use in the frequency range 150 kc/s to 30 Mc/s

1. *General description*

(1) The measuring apparatus shall be a calibrated radio receiver, designed for the measurement of radio frequency noise voltages, and the field strength of radio frequency noise. For this latter purpose the input terminal of that receiver shall be connected directly to a vertical rod aerial. The receiver shall be of the super-heterodyne type with an intermediate frequency of 450 kc/s, and shall incorporate a radio-frequency (R.F.) amplifier, a frequency-changer with its oscillator operating at a frequency higher than the frequency to which the receiver is tuned, and an output valve-voltmeter. One or more stepped or continuously-variable attenuators, calibrated in decibels (db), shall be provided, either wholly in the input circuit of the R.F. amplifier or distributed between the input circuits of the R.F. and I.F. amplifiers. If any of the attenuators are continuously-variable, the indicating meter of the valve-voltmeter shall have a scale provided with zero and full-scale marks and a reference deflection mark at mid scale. If none of the attenuators is continuously-variable, the indicating meter of the valve-voltmeter shall have a scale provided with zero and full-scale marks and calibrated in steps of 1 db, covering a range at least equal to the smallest step on the attenuator(s). The measuring apparatus shall be calibrated in terms of a known sinewave voltage applied across the 75 ohm resistive network mentioned in the next sub-paragraph and the input circuit of the measuring apparatus (the two being connected in series), and in terms of a known intensity of a continuous wave field in which the associated aerial system is placed. Facilities shall be provided so that whenever a measurement is to be made, the gain of the receiver of the measuring apparatus may be set to the gain used when it was calibrated.

(2) Resistive networks, each having a resistance of 150 ohms (±30 ohms) and a phase angle not exceeding 30°, shall be provided for connection between each electric supply line terminal of the electro-medical apparatus (other than that to which the measuring apparatus is to be connected for the purpose of a terminal voltage test) and the screening of the measuring apparatus, via an isolating capacitor. For the purpose of a terminal voltage test a resistive network having a resistance of 75 ohms (±15 ohms) and a phase angle not exceeding 30° shall be provided for connection between the electric supply line terminal to be tested and one terminal of the input circuit of the measuring apparatus, via an isolating capacitor. In both cases the isolating capacitor shall be inserted between the

electric supply line terminal and the resistive network. Each isolating capacitor shall have an impedance of less than 10 ohms at the frequencies at which measurements are to be made.

(3) Reactors having an impedance of not less than 1000 ohms at the frequencies at which measurements are to be made shall be provided for insertion between the electric supply line terminals of the electro-medical apparatus and the electric supply lines. Filters may be inserted between the reactors and the supply lines if required for reducing noise voltages present on the supply lines.

2. *Performance characteristics*

(1) *Frequency tuning and calibration accuracy*

The receiver shall be capable of being tuned continuously over its frequency range, and the calibration of the frequency scale shall be accurate to within ±1 per cent.

(2) *Voltage accuracy*

At any frequency within the range of the measuring apparatus, values of sinewave voltage shall be measurable to an accuracy of ±1 db.

(3) *Field-strength accuracy*

At any frequency within the range of the measuring apparatus, values of field-strength shall be measurable to an accuracy of ±3 db.

(4) *Attenuators*

The attenuators shall be so constructed and disposed that no performance characteristic of the set, apart from gain, is significantly affected by variations in their settings.

(5) *Overload characteristic*

With the measuring apparatus adjusted to give full scale deflection of the meter for an applied sinewave voltage of any value between 4 microvolts and 40 millivolts, the sinewave voltage measured at the input of the valve-voltmeter shall be proportional to the applied voltage within ± 1 db up to a voltage 20 db above that producing full scale deflection of the meter.

(6) *Overall frequency characteristic*

The variation with frequency of an applied sinewave voltage to produce a constant voltage at the input to the valve-voltmeter, when no alteration is made to the tuning of the measuring apparatus, shall not exceed the limits of the marked area of Figure 1.

(7) *Frequency characteristic of the input circuit*

The acceptance bandwidth of the input circuit prior to the first valve when measured at the input terminals shall be not greater than the tuned frequency for an attenuation of 20 db relative to the response at the tuned frequency.

(8) *Frequency characteristic of the radio frequency amplifier*

The acceptance bandwidth of the signal frequency circuits prior to the frequency changer valve when measured at the input terminals shall be not greater than the intermediate frequency for an attentuation of 20 db relative to the response at the tuned frequency.

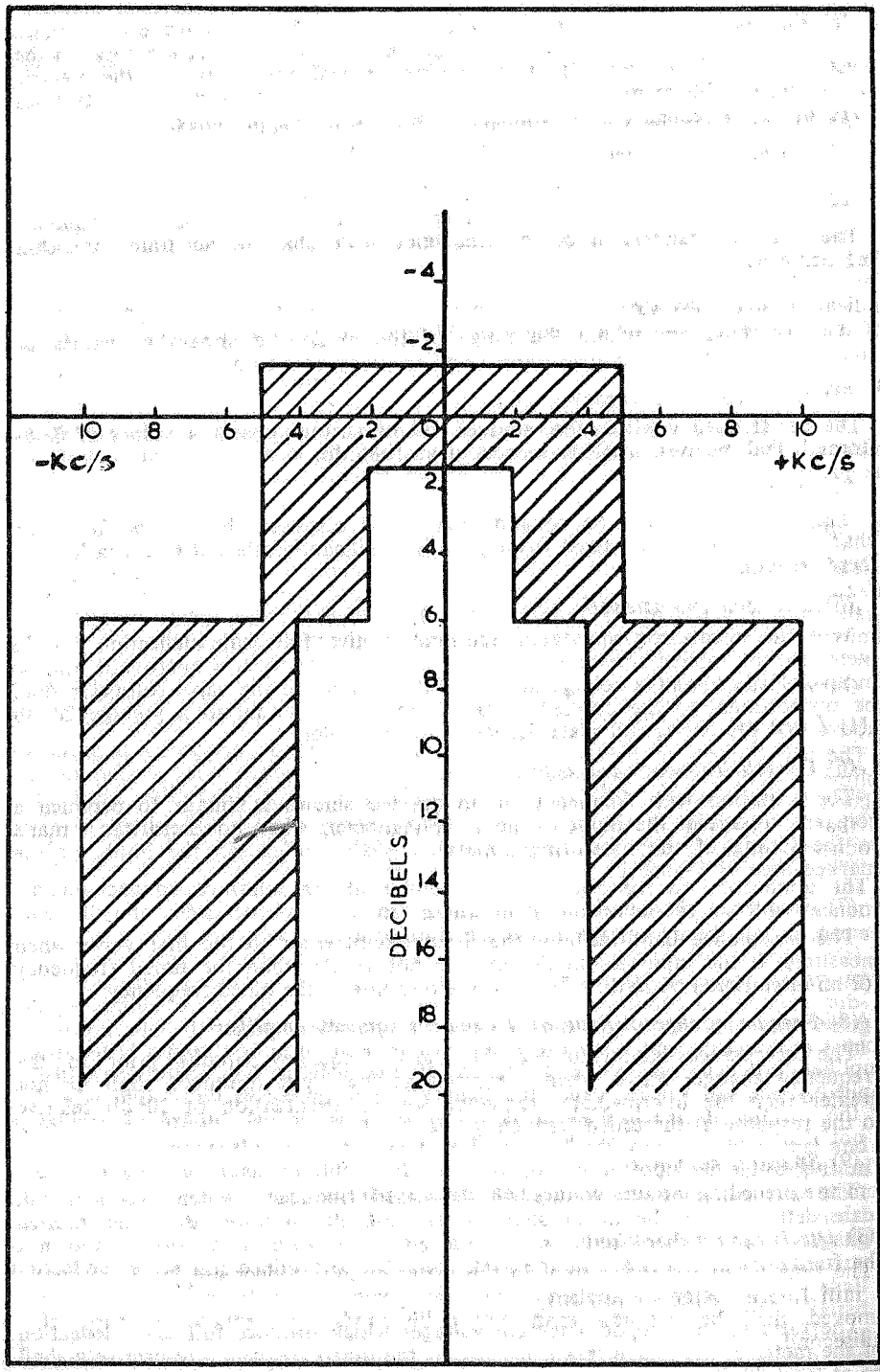
(9) *Spurious responses*

The applied sinewave voltage of the tuned frequency which produces full scale deflection of the meter shall be at least 80 db lower than the applied voltage at any other frequency which combines with a harmonic and not the fundamental frequency of the local oscillator to produce full scale deflection

(10) *Image frequency response*

The ratio of the applied sinewave voltages which produce full scale deflection of the meter at the image frequency and at the tuned frequency respectively shall be at least 40 db.

Fig. 1 Overall Frequency characteristic of measuring apparatus. (Schedule 3 Part 2, Para. 2 (6)).



(11) *Intermediate frequency response*

The ratio of the applied sinewave voltages which produce full scale deflection of the meter at the intermediate frequency and at the tuned frequency respectively shall be at least:

(*a*) 40 db where the tuned frequency differs from the intermediate frequency by more than 250 kc/s,

(*b*) 20 db where the tuned frequency differs from the intermediate frequency by more than 150 kc/s, but not more than 250 kc/s.

(12) *Screening*

The overall screening shall be such that, with the receiver tuned to any frequency within its range and the gain of the receiver adjusted to that used for that frequency when the measuring apparatus was calibrated, the meter indication shall not vary by more than 1 db when an electro-magnetic field of that frequency and of a strength of 30 millivolts per metre is switched on.

3. *Aerial*

The aerial shall consist of a vertical rod of a total length not exceeding 2 metres. The receiver shall be supported so that the base of the aerial is at a height of between 0·8 and 1·2 metres above ground level.

4. *Input circuit*

The measuring apparatus shall have an unbalanced input termination for making terminal voltage measurements. The impedance at the input terminals shall have a value of 75 ohms ± 15 ohms and a phase angle within the limits ± 10° at any frequency within the range of the measuring apparatus.

5. *Output circuit (valve-voltmeter)*

(1) *Linearity*

The performance of the rectifier and of any associated circuits of the valve-voltmeter shall be such that the current through the indicating meter is linearly related to the sinewave voltage input to the rectifier, to within ± 10 per cent. of that voltage for all values of input voltage from 0·3 to 4 times the value producing full scale deflection of the meter.

The application to the input of the rectifier of the sinewave voltage which produces full scale deflection shall cause an increase of 5·5 volts ± 10 per cent. in the steady voltage across the rectifier load.

(2) *Charge time-constant*

A sinusoidal voltage of frequency equal to the intermediate frequency, which when continuously applied to the input terminals of the intermediate frequency amplifier produces full scale deflection of the meter, shall, when suddenly applied at the same point, cause the change of voltage across the output circuit of the rectifier to reach 0·63 times the final value of the change of voltage in not less than 0·8 milliseconds and not more than 1·2 milliseconds.

In this test, the input terminals of the I.F. amplifier shall be disconnected from the preceding circuits of the measuring apparatus.

(3) *Discharge time-constant*

The time taken for the current in the meter circuit to decrease by 0·63 times its initial value after an applied voltage as specified in 5(2) above is suddenly removed shall be not less than 450 milliseconds and not more than 550 milliseconds.

(4) *Indicating meter*

The indicating meter shall be of the permanent magnet moving coil type in which the deflection of the needle is directly proportional to the current passing through the meter. Under the conditions of use of the measuring apparatus the damping of the meter shall be such that, when a current of a value which produces a final steady full scale deflection is suddenly applied to the meter, the time of rise to 80 per cent. of full scale deflection is not less than 240 milliseconds and not more than 360 milliseconds and the overswing is less than 5 per cent. of the full scale deflection.

6. *General requirements*

(1) *Gain setting*

The accuracy of adjustment of the measuring apparatus shall be such that two successive measurements of any given input voltage (having a value within the range of measurement of the apparatus), between which any adjustments of the operating controls may be made, shall not differ by more than 1 db.

(2) *Monitoring*

Provision shall be made for the aural presentation of the receiver output for monitoring purposes.

PART 3

Description and specification of characteristics and performance of measuring apparatus for use in the frequency range exceeding 30 Mc/s but not exceeding 223 Mc/s.

1. *General description*

(1) The measuring apparatus shall be a calibrated radio receiver, designed for the measurement of radio frequency noise voltages and the field strength of radio frequency noise. For this latter purpose the input terminals of the receiver shall be connected to a dipole aerial by either a balanced screened feeder or a coaxial feeder. If a coaxial feeder is used, a balance/unbalance transformer shall be connected between the dipole aerial and the coaxial feeder. The receiver shall be of the superheterodyne type with an intermediate frequency of 10 Mc/s, and shall incorporate a radio-frequency (R.F.) amplifier, a frequency changer, with its oscillator operating at a frequency higher than the frequency to which the receiver is tuned, and an output valve-voltmeter. Attenuators, calibrated in decibels (db), shall be provided in the input circuits of both R.F. and I.F. amplifiers. The indicating meter of the valve-voltmeter shall have a scale provided with zero and full-scale marks and a reference deflection mark at mid-scale. The measuring apparatus shall be calibrated in terms of a known sinewave voltage at its input terminals and in terms of a known intensity of a continuous wave field in which the associated aerial system is placed. Facilities shall be provided so that, whenever a measurement is to be made, the gain of the receiver of the measuring apparatus may be set to the gain used when it was calibrated.

(2) Resistive networks, each having a resistance of 75 ohms (± 15 ohms) and a phase angle not exceeding 30°, shall be provided for connection between each electric supply line terminal of the electro-medical apparatus (other than that to which the measuring apparatus is to be connected for the purpose of a terminal voltage test) and the screening of the measuring apparatus, via an isolating capacitor, which shall be inserted between the electric supply line terminal and the resistive network. An isolating capacitor shall also be provided for connection between the measuring apparatus and the electric supply line terminal to which a terminal voltage test is to be applied. Each isolating capacitor shall have an impedance of less than 5 ohms at the frequencies at which the measurements are to be made. An unbalance/balance transformer may be inserted in the connection between the appropriate isolating capacitor and the measuring apparatus, and if so any loss caused by it shall be included in the calibration of the measuring apparatus.

(3) Reactors having an impedance of not less than 500 ohms at the frequencies at which the measurements are to be made shall be provided for insertion between the electric supply line terminals of the electro-medical apparatus and the electric supply lines. Filters may be inserted between the reactors and the supply lines if required for reducing noise voltages present on the supply lines.

2. *Performance characteristics*

(1) *Frequency tuning and calibration accuracy*

The receiver shall be capable of being tuned continuously over its frequency range, and the calibration of the frequency scale shall be accurate to within ± 1 per cent.

(2) *Voltage accuracy*

At any frequency within the range of the measuring apparatus, values of sinewave voltage shall be measurable to an accuracy of ± 1 db.

(3) *Field strength accuracy*

At any frequency within the range of the measuring apparatus, values of field-strength shall be measurable to an accuracy of ± 3 db.

(4) *Attenuators*

The attenuators shall be so constructed and disposed that no performance characteristic of the set, apart from gain, is significantly affected by variations in their settings.

(5) *Overload characteristic*

With the measuring apparatus adjusted to give reference deflection of the meter for an applied sinewave voltage of any value between 20 microvolts and 100 millivolts the sinewave voltage measured at the input of the valve-voltmeter shall be proportional to the applied voltage within ± 1 db up to a voltage 40 db above that producing reference deflection.

(6) *Overall frequency characteristic*

The variation with frequency of an applied sinewave voltage to produce a constant voltage at the input to the valve-voltmeter, when no alteration is made to the tuning of the measuring apparatus, shall not exceed the limits of the marked area of Figure 2.

(7) *Frequency characteristic of the radio-frequency amplifier*

The increase of an applied sinewave voltage needed to produce a constant voltage at the control grid of the frequency changer valve shall not be less than 6 db when the frequency of the applied voltage is varied from the tuned frequency by ± 2·5 Mc/s.

(8) *Spurious responses*

The applied sinewave voltage of the tuned frequency which produces reference deflection of the meter shall be at least 80 db lower than the applied voltage at any other frequency which combines with a harmonic and not the fundamental frequency of the local oscillator to produce reference deflection.

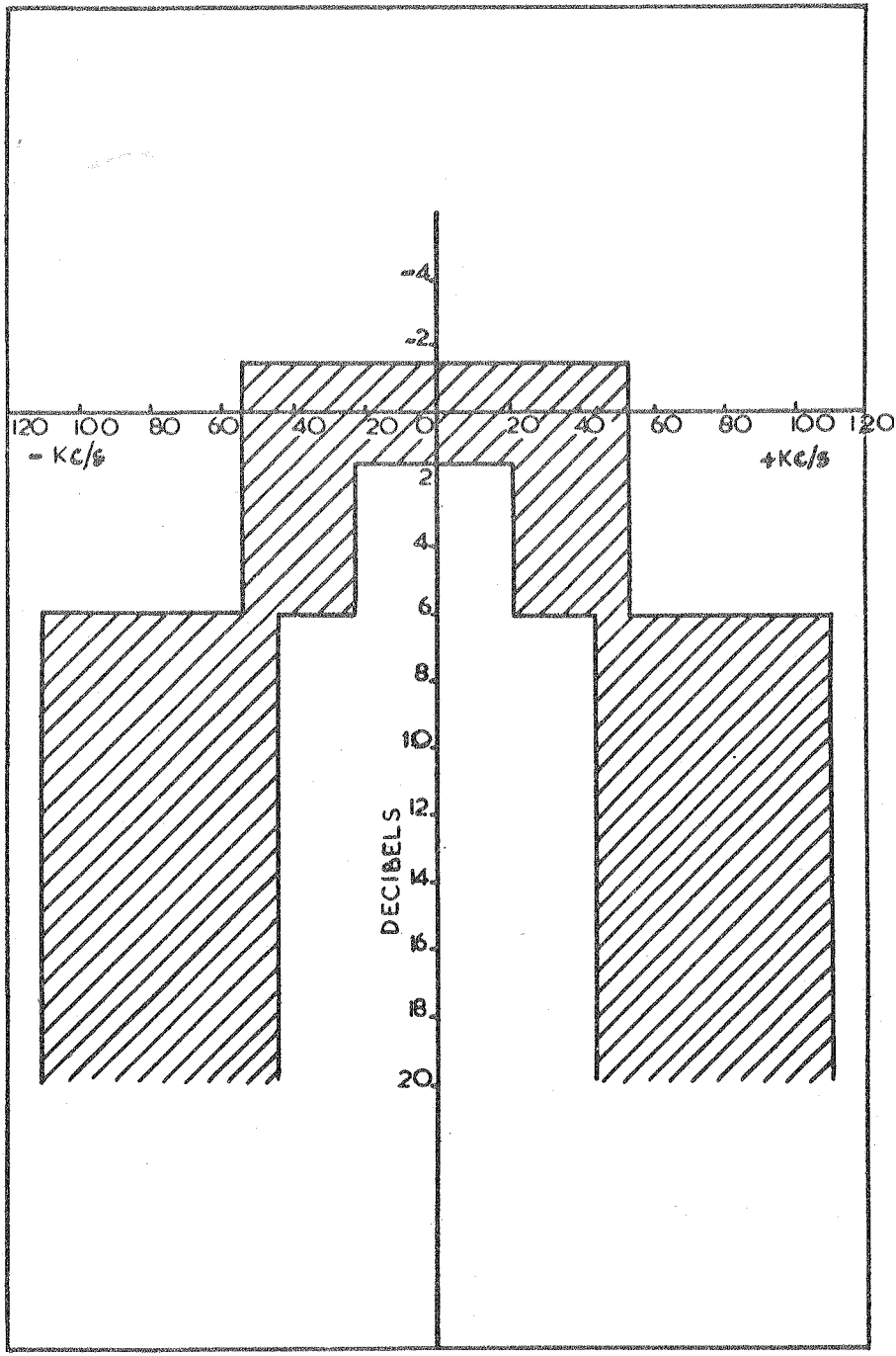
(9) *Image frequency response*

The ratio of the applied sinewave voltages which produce reference deflection at the image frequency and at the tuned frequency respectively shall be at least 40 db.

(10) *Intermediate frequency response*

The ratio of the applied sinewave voltages which produce reference deflection at the intermediate frequency and at the tuned frequency respectively shall be at least 40 db.

Fig. 2 Overall frequency characteristic of measuring apparatus. (Schedule 3 Part 3, Para. 2 (6)).



(11) *Screening*

The overall screening shall be such that, with the receiver tuned to any frequency within its range and the gain of the receiver adjusted to that used for that frequency when the measuring apparatus was calibrated, the change in the I.F. attenuator setting required to return the meter to reference deflection when an external electro-magnetic field of that frequency and of a strength of 86 db above 1 microvolt per metre is switched on shall not exceed 1 db. This requirement shall be met for all orientations of the measuring apparatus. For this test screening covers may be placed over the input terminals.

3. *Input circuit*

The impedance at the input terminals of the measuring apparatus shall be balanced and shall have a value of 75 ohms ± 15 ohms and a phase angle within the limits ± 20° at any frequency within the range of the measuring apparatus.

4. *Aerial and feeder*

(1) *Aerial*

The aerial shall consist of a dipole of a length not greater than 3 metres nor less than 2 metres. The centre of the aerial shall be supported at a height of between 2 and 4 metres above ground level.

(2) *Feeder*

The aerial shall be connected to the aerial input terminals of the measuring apparatus by either a twin balanced and screened feeder or a balance/unbalance transformer and a coaxial feeder. In the latter case the balance/unbalance transformer shall be mounted at the centre of the dipole aerial. In both cases the feeder shall be led away from the dipole at right angles for a distance of at least 1 metre, and shall have a nominal characteristic impedance of 75 ohms.

(3) *Balance/Unbalance ratio*

(i) If a balanced screened feeder is used, the balance/unbalance ratio at the aerial end of the feeder shall be not less than 20 db when measured as follows:

A generator of internal impedance R, where R is not greater than 5 ohms, shall be connected through resistances to the feeder and measuring apparatus as shown in Figure 3(*a*) and as shown in Figure 3(*b*) in turn. The ratio $\frac{e_1}{e_2}$ of the generator e.m.f.'s which produce reference deflection of the meter in the unbalanced connection, (e_1 figure 3(*a*)) and the balanced connection (e_2 figure 3(*b*)) respectively shall be taken as the balance/unbalance ratio.

(ii) If a coaxial feeder and balance/unbalance transformer is used, the balance/unbalance ratio at the aerial terminals of the said balance/unbalance transformer shall be not less than 20 db when measured as follows:

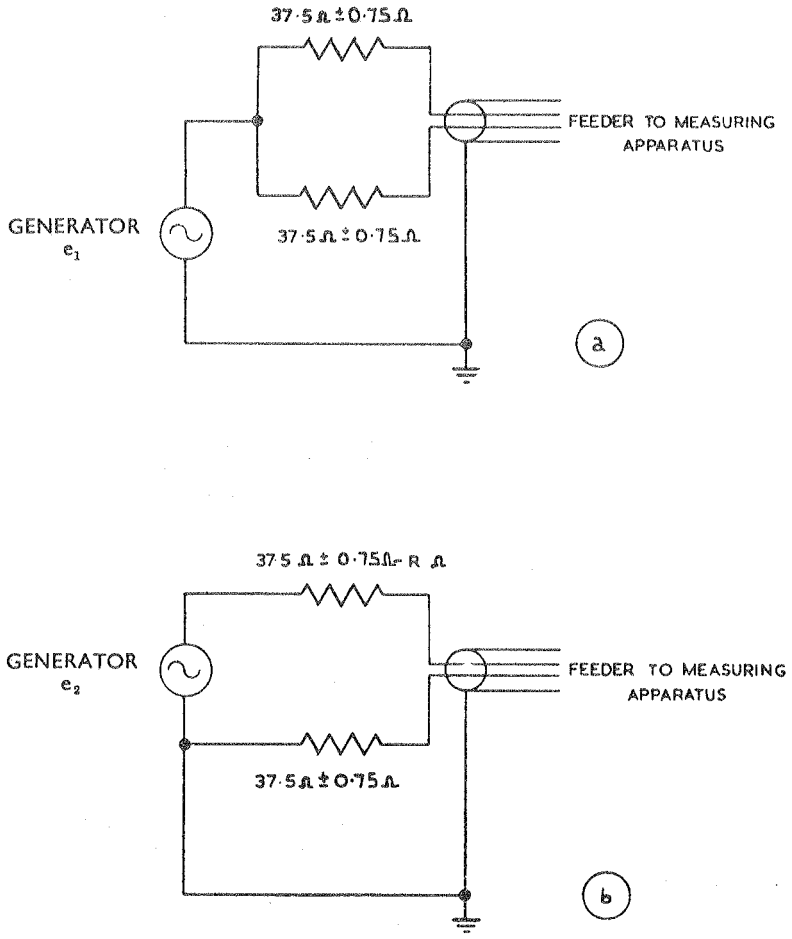
A generator of internal impedance R, where R is not greater than 5 ohms, shall be connected through resistances to the aerial terminals of the balance/unbalance transformer, the latter being connected to the feeder and measuring apparatus, as shown in Figure 4(*a*) and as shown in Figure 4(*b*) in turn. The ratio $\frac{e_1}{e_2}$ of the generator e.m.f.'s which produce reference deflection of the meter in the unbalanced connection, (e_1 figure 4(*a*)) and the balanced connection (e_2 figure 4(*b*)) respectively shall be taken as the balance/unbalanced ratio.

5. *Output circuit (valve-voltmeter)*

(1) *Linearity*

The performance of the rectifier and of any associated circuits of the valve-voltmeter shall be such that the current through the indicating meter is linearly related to the sinewave voltage input to the rectifier, to within ±10 per cent. of

Fig. 3
Schedule 3 Part 3 Paragraph 4 (3) (i)



that voltage, for all values of input voltage from 0·5 to 2·5 times the value producing reference deflection.

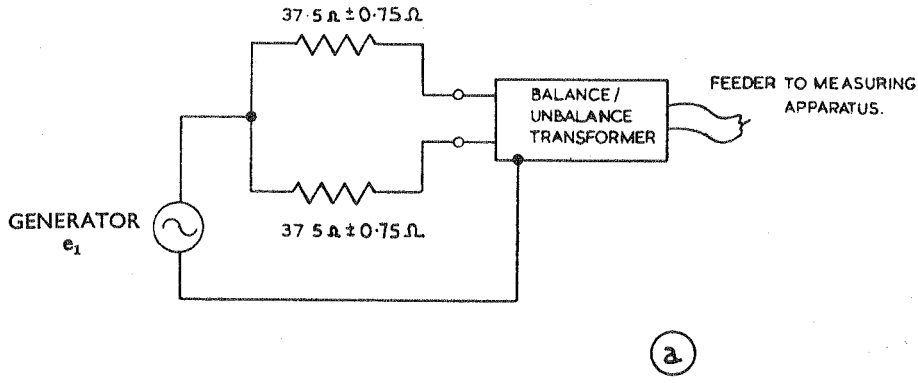
The application to the input of the rectifier of the sinewave voltage which produces reference deflection shall cause an increase of 1·75 volts ±10 per cent. in the steady voltage across the rectifier load.

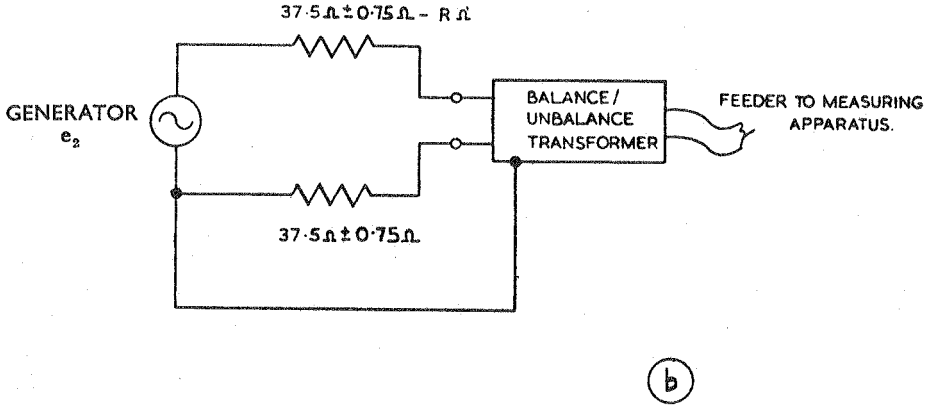
The increase in the sinewave voltage at the input of the rectifier required to increase the meter reading from reference deflection to full-scale deflection shall be not less than 5·5 db nor more than 6·5 db.

(2) *Charge time-constant*

A sinusoidal voltage of frequency equal to the intermediate frequency, which when continuously applied to the input terminals of the intermediate frequency amplifier produces reference deflection, shall, when suddenly applied at the same point, cause the change of voltage across the output circuit of the rectifier to reach 0·63 times the final value of the change of voltage in not less than 0·8 milliseconds and not more than 1·2 milliseconds.

Fig 4.
Schedule 3 Part 3 Paragraph 4 (3) (ii)





In this test, the input terminals of the I.F. amplifier shall be disconnected from the preceding circuits of the measuring apparatus.

(3) *Discharge time-constant*

The time taken for the current in the meter circuit to decrease by 0·63 times its initial value after an applied voltage as specified in 5(2) above is suddenly removed shall be not less than 450 milliseconds and not more than 550 milliseconds.

(4) *Indicating meter*

The indicating meter shall be of the permanent magnet moving-coil type in which the deflection of the needle is directly proportional to the current passing through the meter. Under the conditions of use of the measuring apparatus the damping of the meter shall be such that, when a current of a value which produces a final steady full-scale deflection is suddenly applied to the meter, the time of rise to 80 per cent. of full-scale deflection is not less than 240 milliseconds and not more than 360 milliseconds and the overswing is less than 5 per cent. of the full-scale deflection.

6. *General requirements*

(1) *Gain setting*

The accuracy of adjustment of the measuring apparatus shall be such that two successive measurements of any given input voltage (having a value within the range of measurement of the apparatus), between which any adjustment of the operating controls may be made, shall not differ by more than 1 db.

(2) *Monitoring*

Provisions shall be made for aural presentation of the receiver output for monitoring purposes.

PART 4

Method and conditions of measuring field strength

1. *General*

(1) Where an electro-medical apparatus is being tested for the purposes of regulation 2 it shall be connected with an appropriate source of electric power.

(2) Where an electro-medical apparatus is being tested for the purposes of regulation 3 it shall, so far as is consistent with the following provisions of this Part of this Schedule, be tested under its normal conditions of installation.

2. *Connections to be made to the electric supply line terminals of the electro-medical apparatus.*

(1) *Frequency range 150 kc/s to 30 Mc/s*

The following connections shall be made:

(*a*) All the electric supply line terminals of the electro-medical apparatus shall be connected to the earth continuity conductor of the electric supply line through the isolating capacitors and 150 ohms resistive networks mentioned in paragraph 1(2) of Part 2 of this Schedule.

(*b*) All the electric supply line terminals of the electro-medical apparatus shall be connected, through the reactors and (if required) the filters mentioned in paragraph 1(3) of Part 2 of this Schedule, with the electric supply lines.

(2) *Frequency range exceeding 30 Mc/s but not exceeding 223 Mc/s*

The following connections shall be made:

(*a*) All the electric supply line terminals of the electro-medical apparatus shall be connected to the earth continuity conductor of the electric supply line through the isolating capacitors and resistive networks mentioned in paragraph 1(2) of Part 3 of this Schedule.

(*b*) All the electric supply line terminals of the electro-medical apparatus shall be connected, through the reactors and (if required) the filters mentioned in paragraph 1(3) of Part 3 of this Schedule, with the electric supply lines.

(3) All connecting leads used for the purposes of the said connections shall be as short as is practicable and unscreened, and the layout and wiring of the electro-medical apparatus shall not be altered more than is necessary to comply with this Part of this Schedule.

3. *Dummy load*

When an electro-medical apparatus being tested uses capacitor electrodes for delivering its output, a dummy load shall be used for the purpose of the tests. It shall be substantially resistive and shall be capable of absorbing the rated output power of the electro-medical apparatus to be tested. The two terminals

of the dummy load shall be at opposite ends of the load and each terminal shall be directly joined to a circular flat plate electrode having a diameter of not more than 18 centimetres and not less than 16 centimetres.

(*Note.* A conveninent form of dummy load consists of one or more lamps between 25 and 32 cms. long, of tubular double-ended construction with straight filaments and of suitable wattage rating connected in parallel. A calibrated luxmeter can then be used to determine the power being absorbed by the lamps.)

4. *Output attachments*

The electrodes or induction cable or other attachment used or designed to be used for delivering the output of the electro-medical apparatus, with their connecting leads, shall be connected to it. Where the attachment with which the apparatus is being tested consists of capacitor electrodes, they shall be placed parallel to and not more than 2·75 centimetres or less than 2·25 centimetres from the circular flat plate electrodes connected to the dummy load as mentioned in paragraph 3 of this Part of this Schedule.

5. *Other electrical apparatus to be disconnected*

All other electrical apparatus which is installed in proximity to the electro-medical apparatus, and which in operation could appreciably affect the result of the test, shall be switched off or otherwise prevented from being energised by complete or partial electrical disconnection.

6. *Preliminary adjustment of measuring apparatus*

The receiver of the measuring apparatus shall be connected with an appropriate source of electric power, the attenuator(s) shall be set at maximum loss, and the zero control of the valve-voltmeter shall be adjusted to bring the needle of the indicating meter to the zero mark. The receiver shall be tuned to the frequency, as indicated by the main tuning dial calibrations, at which it is desired to test, and its gain shall be set to that used when the measuring apparatus was calibrated.

7. *Input connection of measuring apparatus, and distance of aerial*

(1) The receiver shall be connected to the aerial mentioned in paragraph 3 of Part 2 of this Schedule, or the aerial and feeder mentioned in paragraph 4 of Part 3 of this Schedule (as the case may be).

(2) Where an electro-medical apparatus is being tested for the purposes of regulation 2, the distance between the aerial of the measuring apparatus and the nearest point on the electro-medical apparatus (including its dummy load where provided) shall be not less than 30 metres.

(3) Where an electro-medical apparatus is being tested for the purposes of regulation 3, the distance between the aerial of the measuring apparatus and the nearest point on the electro-medical apparatus (including its dummy load where provided) or, where the electro-medical apparatus is installed inside a metallically screened and filtered enclosure, the distance between the aerial of the measuring apparatus and nearest point on the outside of the metallic screen, shall be not less than 30 metres.

8. *Adjustment of electro-medical apparatus*

For the purpose of the main test mentioned in paragraph 10 of this Part of this Schedule, the electro-medical apparatus being at the temperature of the surrounding air shall be switched on, and where the output circuit can be tuned it shall be tuned to resonance with the fundamental frequency of the apparatus. Where a dummy load is required under paragraph 3 of this Part of this Schedule, the apparatus shall be adjusted to deliver its rated output power into the dummy load.

9. *Making the measurement*

(1) The R.F. amplifier tuning of the receiver shall be trimmed to give maximum deflection of the meter needle.

(2) Where the measuring apparatus being used is that described in Part 2 of this Schedule, the attenuator(s) shall be adjusted to bring the needle of the indicating meter of the valve-voltmeter to the reference deflection mark if a continuously-variable attenuator is fitted, or otherwise on to the calibrated part of the scale.

(3) Where the measuring apparatus being used is that described in Part 3 of this Schedule, the attenuators shall be adjusted to bring the needle of the indicating meter of the valve-voltmeter to the reference deflection mark, the R.F. attenuator being adjusted so that the I.F. attenuator is set to the lowest possible value in excess of 10 db.

(4) The frequency at which a test is being made shall be measured by means of a frequency meter incorporating a crystal-controlled frequency standard. This measurement shall be made simultaneously with or immediately after the adjustments referred to in paragraph 9(2) or 9(3), before the electro-medical apparatus is switched off.

10. *Tests*

A set of tests shall be made in each case as follows:

(*a*) A check test made while the electro-medical apparatus is not operating;

(*b*) A main test;

(*c*) A further check test as mentioned in (*a*).

A separate set of tests as aforesaid may be made with each separate attachment used or designed to be used for delivering the output of the electro-medical apparatus.

11. If a click (as opposed to a buzz of appreciable duration) is heard in the monitoring loudspeaker or earphones at any time when any switchgear or controlling apparatus of the electro-medical apparatus is operating, then provided that not more than one further click is heard during the period of two seconds immediately following the first, the readings of the measuring apparatus appearing within that period of two seconds shall be disregarded for the purpose of these regulations.

12. *Interpretation of results*

The field strength expressed in decibels above 1 microvolt per metre will be given by the sum of: (*a*) the reading(s) of the attenuator(s), (*b*) the field-strength calibration constant (if any) appropriate to the frequency at which the measurement is being made, and (*c*) the reading of the indicating meter of the valve-voltmeter, if calibrated in decibels. If the result obtained is x decibels, the field strength expressed in microvolts per metre is given by the antilog to the base 10 of $\frac{x}{20}$.

13. If the maximum reading obtained on any main test exceeds the maximum reading obtained on either of the check tests made next before or next after that main test by at least 10 db, the readings obtained on that main test are to be regarded as not materially affected by extraneous noise or signals. Otherwise the readings obtained on that main test are to be regarded as materially affected by extraneous noise or signals, and the results of that main test shall be disregarded for the purpose of these regulations.

PART 5

Method and conditions of measuring terminal voltage

1. *General*

(1) Where an electro-medical apparatus is being tested for the purposes of regulation 2, it shall be connected with an appropriate source of electric power.

(2) Where an electro-medical apparatus is being tested for the purposes of regulation 3, it shall, so far as is consistent with the following paragraphs of this Part of this Schedule, be tested under its normal conditions of installation.

2. *Connections to be made to the electric supply line terminals of the electro-medical apparatus and the input terminals of the measuring apparatus*

(1) *Frequency range 150 kc/s to 30 Mc/s*

The following connections shall be made:

(*a*) The electric supply line terminal of the electro-medical apparatus which is the terminal being tested shall be connected, through the isolating capacitor and the 75 ohms resistive network mentioned in paragraph 1(2) of Part 2 of this Schedule, with one of the receiver input terminals of the measuring apparatus.

(*b*) The other receiver input terminal of the measuring apparatus shall be connected to the screening of the measuring apparatus.

(*c*) Each of the other electric supply line terminals of the electro-medical apparatus shall be connected to the screening of the measuring apparatus through the isolating capacitor and 150 ohms resistive network mentioned in paragraph 1(2) of Part 2 of this Schedule.

(*d*) All the electric supply line terminals of the electro-medical apparatus shall be connected, through the reactors and (if required) the filters mentioned in paragraph 1(3) of Part 2 of this Schedule, with the electric supply lines.

(2) *Frequency range exceeding 30 Mc/s but not exceeding 223 Mc/s*

The following connections shall be made:

(*a*) The electric supply line terminal of the electro-medical apparatus which is the terminal being tested shall be connected with one of the receiver input terminals of the measuring apparatus, through the isolating capacitor and (where used) the unbalance/balance transformer mentioned in paragraph 1(2) of Part 3 of this Schedule.

(*b*) The other receiver input terminal of the measuring apparatus shall be connected to the screening of the measuring apparatus.

(*c*) Each of the other electric supply line terminals of the electro-medical apparatus shall be connected to the screening of the measuring apparatus through the isolating capacitor and resistive network mentioned in paragraph 1(2) of Part 3 of this Schedule.

(*d*) All the electric supply line terminals of the electro-medical apparatus shall be connected, through the reactors and (if required) the filters mentioned in paragraph 1(3) of Part 3 of this Schedule, with the electric supply lines.

(3) All connecting leads used for the purposes of the said connections shall be as short as is practicable and unscreened, and the layout and wiring of the electro-medical apparatus shall not be altered more than is necessary to comply with this Part of this Schedule.

3. *Dummy load*

Where appropriate, the dummy load mentioned in paragraph 3 of Part 4 of this Schedule shall be used for the purpose of the tests.

4. *Output attachments*

Paragraph 4 of Part 4 of this Schedule shall apply.

5. *Preliminary adjustment of measuring apparatus*

Paragraph 6 of Part 4 of this Schedule shall apply.

6. *Adjustment of electro-medical apparatus*

For the purpose of the main test mentioned in paragraph 8 of this Part of this Schedule, paragraph 8 of Part 4 of this Schedule shall apply.

7. *Making the measurement*

Paragraph 9 of Part 4 of this Schedule shall apply.

8. *Tests*

A set of tests as mentioned in sub-paragraphs (*a*), (*b*) and (*c*) of paragraph 10 of Part 4 of this Schedule shall be made in each case with the receiver of the testing apparatus connected with one of the electric supply line terminals of the electro-medical apparatus, and another set or other sets of tests as mentioned in those sub-paragraphs shall be made with the receiver of the testing apparatus connected with the other or each of the others of such terminals. A separate series of tests as aforesaid may be made with each separate attachment used or designed to be used for delivering the output of the electro-medical apparatus.

9. Paragraph 11 of Part 4 of this Schedule shall apply.

10. *Interpretation of results*

The terminal voltage, expressed in decibels above 1 microvolt, will be given by the sum of: (*a*) the reading(s) of the attenuator(s), (*b*) the calibration constant (if any) appropriate to the frequency at which the measurement is being made, and (*c*) the reading of the indicating meter of the valve-voltmeter, if calibrated in decibels.

If the result obtained is x decibels, the voltage expressed in microvolts is given by the antilog to the base 10 of $\frac{x}{20}$.

11. Paragraph 13 of Part 4 of this Schedule shall apply.

EXPLANATORY NOTE

(This Note is not part of the regulations, but is intended to indicate their general purport.)

These regulations prescribe the requirements to be complied with in relation to certain electro-medical apparatus, for the purpose of ensuring that it will not cause undue interference with wireless telegraphy.

The requirements are prescribed in terms of the maximum permitted field strength of the electro-magnetic energy radiated from the apparatus, and the maximum permitted radio-frequency voltage at the supply line terminals of the apparatus, at specified frequencies.

The limits set out in Schedule 1 apply to manufacturers, assemblers and importers of electro-medical apparatus which, on or after 29th November 1964, they sell or offer or advertise for sale (except for export) or let on hire or offer or advertise for letting on hire in the course of their business within the British Islands. The limits set out in Schedule 2 apply to users of electro-medical apparatus on or after that date.

Non-compliance with the limits is not an offence, but is a ground on which the Postmaster General may serve an enforcement notice under section 11 or section 12 of the Wireless Telegraphy Act 1949.