THE SCHEDULE

PART 1

Description and specification of characteristics and performance of measuring apparatus

Definitions of expressions used in this Schedule

1. *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

The term "decibel" (abbreviated db) expresses the logarithmic ratio of two voltages or e.m.f.'s. The ratio of two voltages V_1 and V_2 expressed in decibels is 20 times the logarithm to the base 10 of V_1/V_2 i.e. $20 \log_{10} V_1/V_2$.

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.

Intermediate frequency

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

Image frequency

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

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 one microvolt per metre.

General description of measuring apparatus

2. The measuring apparatus shall be a calibrated radio receiver, covering the frequency range 40 Mc/s–70 Mc/s, designed for the measurement of the field-strength of radio frequency noise. For this measurement the input terminals of the receiver shall be connected to a dipole aerial by a balanced screened feeder. The receiver shall be of the superheterodyne type and comprise a radio-frequency (R.F.) amplifier, a frequency changer, an intermediate-frequency (I.F.) amplifier 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 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.

Performance characteristics

3.—(1) *Frequency range*

The measuring apparatus shall be suitable for use at any frequency in the range 40 Mc/s to 70 Mc/s. The receiver shall be capable of being set, to an accuracy of ± 1 per cent., to receive any desired frequency within its range.

(2) *Field-strength sensitivity and accuracy*

Values of field-strength, greater than 20 microvolts per metre at any frequency throughout the range of frequencies from 40 Mc/s to 70 Mc/s, shall be measurable to an accuracy of ±3 db.

(3) *Attenuators*

The calibrated 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.

(4) *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 value-voltmeter shall be proportional to the applied voltage within ± 1 db up to a voltage 40 db above that producing reference deflection.

(5) *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 apparatus, shall not exceed the limits of the marked area of Figure 1.

(6) *Frequency characteristic of 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 be not less than 6 db when the frequency of the applied voltage is varied from the tuned frequency by ±2.5 Mc/s.

(7) *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.

(8) *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.

(9) *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.

(10) *Screening*

The overall screening of the measuring apparatus shall be such that when the measuring apparatus is in a field of a strength requiring a setting of 40 db for the R.F. attenuator and at least 30 db for the I.F. attenuator to produce reference deflection, the following requirements shall be met for all orientations of the measuring apparatus excluding the aerial:—

(a) The decrease in the setting of the I.F. attenuator required to increase the meter reading from reference deflection to full-scale deflection shall not exceed 6.5 db.

(b) The decrease in the setting of the I.F. attenuator required to return the meter to reference deflection when the setting of the R.F. attenuator is increased from 40 db to 60 db shall be at least 19 db.

The overall screening shall also be such that, with the receiver tuned to any frequency within its range and with the aerial disconnected 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 electromagnetic 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 aerial input and voltage input terminals.

Aerial and feeder

4.—(1) *Aerial*

The aerial shall consist of a dipole of a length not greater than 3 metres nor less than 2 metres, which shall be supported so that its centre is not less than 2 metres above the base of the support when a measurement of field-strength is made.

(2) *Feeder*

The aerial shall be connected to the aerial input terminals of the apparatus by a twin balanced and screened feeder of a nominal characteristic impedance of 75 ohms. The feeder shall be led at right angles from the dipole for a distance of at least 1 metre.

(3) *Balance/Unbalance ratio*

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 to the feeder and measuring apparatus as shown in Figure 2(a) and as shown in Figure 2(b) in turn. The ratio 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 2(a)) and the balanced connection (e_2 figure 2(b)) respectively, shall be taken as the balance/unbalance ratio.

Input circuit

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

Output circuit (Value-voltmeter)

6.—(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 0.5 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.

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 6 (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.

General requirements

7.—(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*

Provision shall be made for aural presentation of the receiver output for monitoring purposes.
FIGURE 1.
FIGURE 2

PART 2

Method of measurement

(1) With the aerial and feeder disconnected from the receiver of the measuring apparatus and the I.F. attenuator set at maximum loss, the zero control of the valve-voltmeter shall be adjusted to bring the needle of the indicating meter to the zero mark.

(2) 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.

(3) The feeder and a dipole aerial of length approximating as closely as practicable to that used for the calibration of the measuring apparatus shall be connected to the receiver. The aerial may be set vertically or horizontally or in any intermediate position, as desired for the test. The R.F. amplifier tuning of the receiver shall be trimmed to give maximum deflection of the meter needle.

(4) The attenuators shall then be adjusted to bring the meter needle 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 10db.

(5) The field-strength in decibels above 1 microvolt per metre will be given by the sum of the readings of the two attenuators plus the field-strength calibration constant appropriate to the frequency at which the measurement is being made. If this value is X decibels, the field-strength in microvolts per metre is given by the antilog to the base 10 of X/20

PART 3

Conditions of testing

1. Where ignition apparatus is being tested for the purpose of regulation 2, it shall be tested as installed in the engine. If the engine is to form part of a vehicle or vessel which is to be sold or let on hire by the assembler or importer, the test shall be made with the engine installed in the vehicle or vessel.

2. Where ignition apparatus is being tested for the purpose of regulation 3, it shall be tested under normal conditions of installation. Where apparatus mentioned in regulation 3(1)(b) is being tested for the purpose of that regulation, it shall be tested under normal conditions of installation and use.

3. All electrical apparatus, other than the apparatus under test, which forms part of the vehicle, vessel or engine (if any) 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.

4. The distance between the aerial of the measuring apparatus and the nearest point on the apparatus under test shall be not less than 33 feet.

5. Where the apparatus under test is part of an engine, the engine shall be rapidly accelerated from idling speed during the course of the test.

6. To ensure that no extraneous noise or signal of sufficient magnitude materially to affect the measurement is present, readings of the measuring apparatus shall be taken, both before and after the main test, without the apparatus under test being energised. If the maximum reading obtained on the main test exceeds the maximum reading obtained on either of these checks tests by at least 10 decibels, the maximum reading obtained on the main test is to be regarded as not materially affected by extraneous noise or signals. Otherwise, the readings obtained on the main test are to be regarded as materially affected by extraneous noise or signals, and the result of the main test shall be disregarded for the purpose of these regulations.