

RECEIVER, RADIO, No. 27A  
Description, Operation and Maintenance

**1. Introduction.**—The Receiver, Radio, No. 27A is a light, portable, interference tracing and measuring set covering the long and medium wave broadcast bands and intended to supersede Receiver, Radio, No. 11. This Instruction describes the receiver, its operation and maintenance.

**2.** The equipment is fully transistorized and consists of a superheterodyne receiver with measuring facilities for continuous waves and for r.f. noise voltages and fields. A built-in reference oscillator provides a voltage source for calibration purposes.

The equipment has not been designed primarily as a noise measuring set and whilst it is quite satisfactory for the measurement of commutator-type noise its performance falls short in the measurement of pulses at low repetition rates. Where noise measurements of high standard are required, Measuring-set, R.I., No. 1 should be used.

**3. Facilities.**—The equipment works off a self-contained battery unit and enables the following work to be carried out:—

(a) The tracing and location of interference sources including the direction finding of distant sources.

(b) The measurement of radio frequency voltages at high and low impedance levels including r.f. voltages appearing on mains supply cables.

(c) The measurement of electric and magnetic field strengths.

(d) Normal broadcast reception for demonstration purposes using either the built-in ferrite aerial or an external aerial. Connexion of a mains supply to the chassis enables the effect of mains conducted interference to be assessed. A mains lead is provided for this purpose.

DESCRIPTION

**4.** The complete equipment consists of:—

(a) Receiver, Radio, No. 27A including a telescopic aerial rod one metre in length (Aerial No. 24).

(b) Unit, Isolating, R.F., No. 9A for making mains-borne voltage measurements.

(c) Cords, Test, No. 2/36R for connecting the Unit, Isolating, R.F., No. 9A to the Receiver, Radio, No. 27A.

(d) Receivers, Headgear, No. 16T, Double with Plug No. 316 and Cord, Instrument, No. 2/144AB, Grebe, 72 in.

**5. Circuit arrangement.**—A functional block diagram of the equipment is given in Fig. 1 and a schematic diagram is given in Fig. 9.

A choice of three input signal circuit arrangements is provided:—

(a) A low impedance 75-ohm input so that the r.f. signal is applied via an attenuator to a signal frequency tuned circuit in the base circuit of the frequency-changer transistor.

(b) A high impedance input feeding into the 75-ohm attenuator via a step-down transformer.

(c) Internal aerial using a ferrite rod. The secondary winding on the tuned ferrite rod aerial is connected in the frequency-changer base circuit.

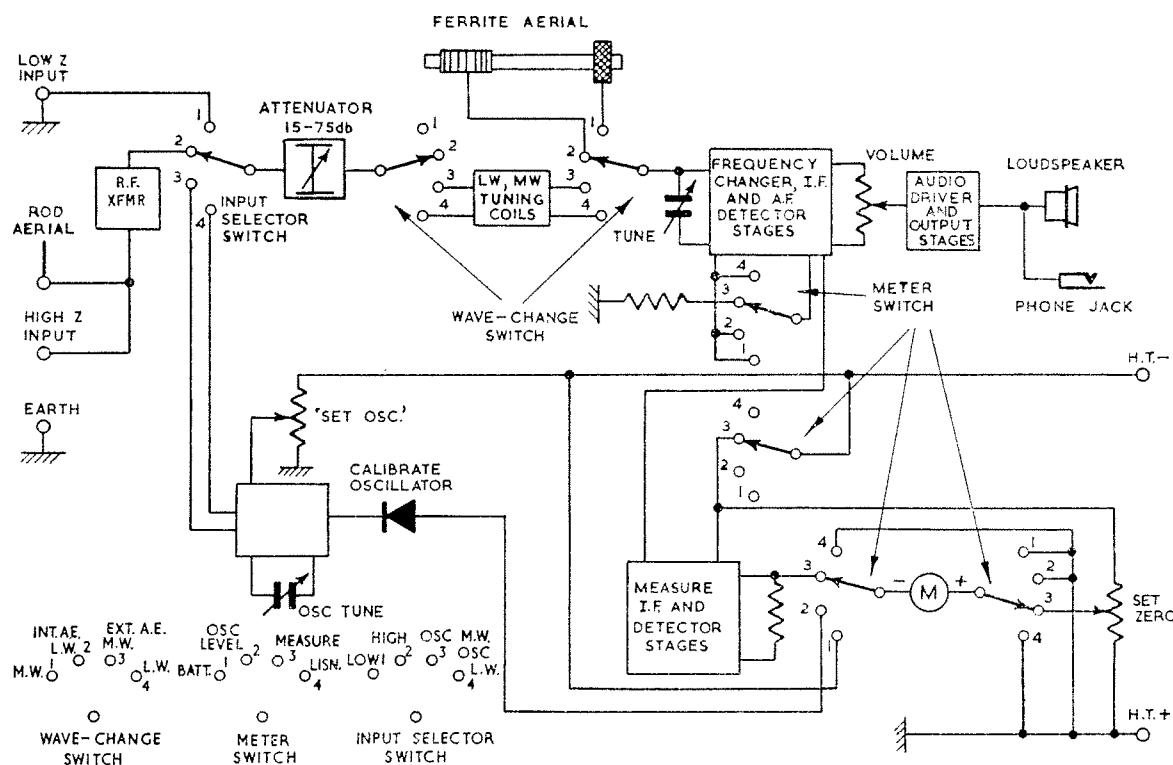
The attenuator is out of circuit under this condition.

The frequency-changer is followed by a two-stage 470 kc/s intermediate frequency amplifier which, for aural reproduction, feeds a detector circuit and a two-stage audio frequency amplifier employing a class B push-pull output stage. For measurement and visual indication an additional stage of i.f. amplification is provided to feed another detector circuit giving a performance approximating to that specified in B.S. 727 for the time constants at the detector of 1 ms charge and 500 ms discharge. The rectified signal develops a d.c. voltage across the detector load resistors R38, R39. This voltage is compared via the meter M1 with a d.c. voltage obtained from potentiometer RV6 (the SET ZERO control) connected across the battery supply, the difference between the two voltages causing a current to flow through the meter. The device thus acts as a signal indicator.

To minimize loading on the preceding stages when measurements are being made a null method of measurement is employed. The potentiometer voltage is made equal to the rectified signal voltage so that the measurement criterion is zero meter deflexion. The equipment is first standardized by injecting a known signal level from the calibrating oscillator with the input attenuator set to 75 db, and adjusting the SET ZERO potentiometer to give zero deflexion. The signal to be measured is then injected and the input attenuator adjusted to restore the zero condition. The change in attenuator setting is the difference between the signal input and the calibrating voltage levels. The amplitude of the latter has been selected so that the attenuator setting gives the signal level directly in db rel. 1  $\mu$ V for the low impedance input terminal. Provision is made for the calibrating oscillator output to be checked against a reference deflexion on the meter scale.

**6. Input facilities.**—

(a) *Low impedance input.*—A Socket, Coaxial, No. 4 on the front of the receiver provides a 75-ohm input terminal for use in conjunction with the Unit, Isolating, R.F., No. 9A for the measurement of mains-borne radio frequency voltages in conformity with B.S. 727 'Characteristics and Performance of Apparatus for Measurement of Radio Interference'.



AJGJJ

FIG. 1.—FUNCTIONAL BLOCK DIAGRAM

(b) *High impedance input.*—A step-down auto-transformer connected internally to the low impedance terminal gives a 15000-ohm input which is available at the socket marked A on the rear of the receiver for use with an external aerial. A screwed metal boss on the front of the receiver is also connected to the high impedance terminal and accommodates the metre-long telescopic rod aerial used for electric field strength measurements.

(c) *Ferrite rod aerial.*—A ferrite rod aerial built into the receiver provides a sensitive directional aerial for general listening, direction finding, and interference tracing. Magnetic field-strength measurements are made by using this aerial.

**7. Output facilities.**—An elliptical loudspeaker under the top of the cabinet is normally connected to the audio output stage. A parallel-connected jack provides an optical low impedance headphone output should it be required. The loudspeaker is disconnected from the output stage on the insertion of the jack plug.

**8. Mains lead.**—A mains lead which is normally accommodated in a recess at the rear of the cabinet is connected via a suitable blocking capacitor to the receiver chassis. By connecting this lead to a complainants' supply mains the degree of interference injected via the mains can be assessed. A small neon light mounted immediately above the receiver tuning register indicates when the cable is energized. In view of the numerous types of socket-outlet in use in this country no plug has been fitted to the cable.

**9. Controls.**—The controls are separated into two functional groups (see Fig. 2).

(a) Those which are required to operate the equipment as a normal broadcast receiver. These comprise the tuning, volume and wave-change controls. They are situated in the lower part of the front panel and remain uncovered when the lid of the receiver is closed.

(b) Those which are restricted in use to measuring and tracing operations. These are mounted, together with the meter, on the top half of the front panel, and are covered by the receiver lid when it is closed.

The controls are as follows:—

(a) *The tuning control* is situated at the bottom right of the front panel. The frequency to which the receiver is tuned is indicated by the tuning register in the lower centre of the front panel.

(b) *The audio volume control* is situated beneath the tuning register and incorporates the on/off switch. A white painted sector appears on the knob when the receiver is switched off.

(c) *The wavechange switch* situated on the lower left of the receiver front panel is a four-position switch giving long and medium wave ranges for the ferrite rod aerial (INT. AE.) and high impedance external aerial (EXT. AE.) conditions respectively. The EXT. AE. positions are also used in conjunction with the input selector switch to connect the 75-ohm input socket to the receiver.

(d) *The meter selector switch* is situated at the top centre of the receiver and has four positions which enable the meter to perform the following functions:—

(i) The supply voltage is indicated when in the position marked BATTERY.

(ii) The output voltage of the reference oscillator is indicated in the OSC. LEVEL position.

(iii) In the MEASURE position the meter is connected between the measuring diode and the measuring potentiometer as described in par. 5. Auxiliary contacts remove the a.g.c. voltage from the controlled

stages and connect the h.t. supply to the measuring i.f. stage.

(iv) In the LISTEN position the a.g.c. voltage is restored to the first i.f. stage and the supply voltage is removed from the measuring i.f. stage.

(e) *The set zero control* is situated adjacent to the meter and varies the potentiometer setting used to zero the meter when a measurement is made.

(f) *The attenuator* is a continuously variable type 5-65 db with a 10 db pad giving an attenuation range of 15-75 db. The dial is calibrated in 2 db steps from 15 to 75 db. In conjunction with the reference oscillator it provides the means of making measurements. All signals, including the calibration voltage, applied to the voltage input terminals pass through this component.

(g) *The oscillator tuning control* which is situated to the right of the centre of the receiver panel adjusts the frequency of the reference oscillator. Its dial is approximately calibrated in terms of frequency (Mc/s) for the two ranges.

(h) *The oscillator level control* varies the supply voltage to the reference oscillator thus enabling the oscillator output to be set to the required standard calibration level as indicated by the meter.

(j) *The input selector switch* situated at the top right of the panel has four positions:—

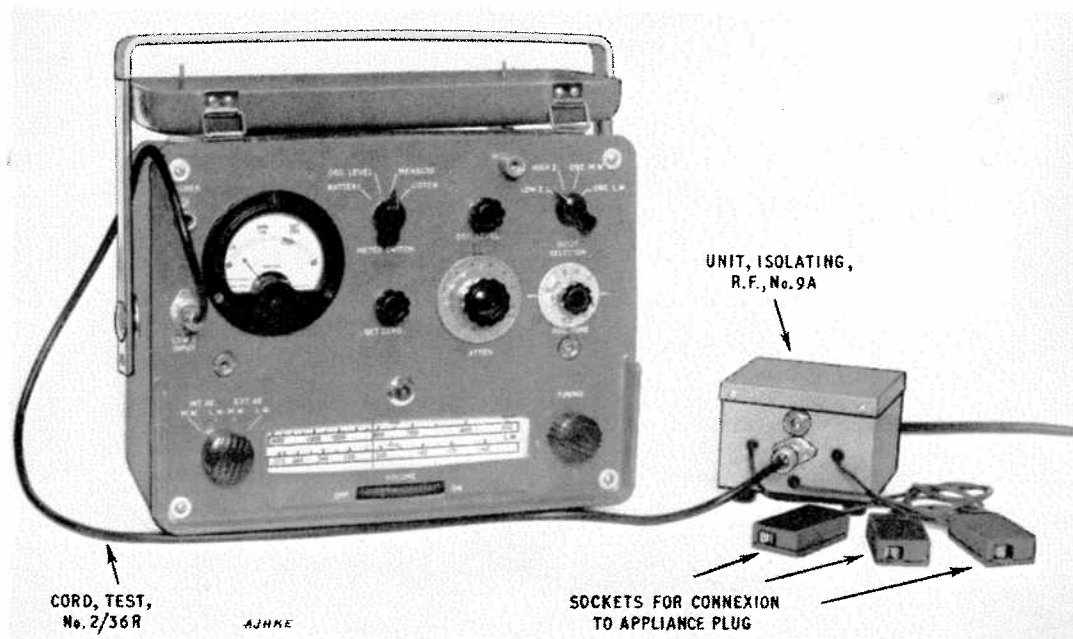


FIG. 2.—GENERAL VIEW OF RECEIVER, RADIO, NO. 27A AND UNIT, ISOLATING, R.F., NO. 9A

(i) In the LOW Z position the coaxial input socket is connected to the receiver circuits.

(ii) In the HIGH Z position the high impedance aerial sockets are connected in circuit and the LOW Z socket is disconnected.

(iii) In the OSC.M.W. position the reference oscillator h.t. supply is switched on and the oscillator output is applied to the attenuator input terminal. The external aerial sockets are disconnected from the receiver input.

(iv) A similar condition for the long wave range is given in the OSC.L.W. position.

**10. Meter and meter dial.**—The meter movement has a full-scale deflexion of 50  $\mu$ A. The scale is divided into 50 divisions with the mechanical and electrical zeros coinciding five divisions from the left to simplify zeroing when measurements are made. A green coloured sector indicates the battery supply voltage limits for satisfactory operation. The reference oscillator output is adjusted to the SET OSC. mark when electric field and voltage measurements are to be made. For magnetic field-strength measurements only, the reference oscillator level is set to the MAG. CAL. mark.

**11. Power supplies.**—The receiver is energized by a pack of four Batteries, Dry, No. 20 connected in

series to give a nominal 6V and mounted at the rear of the chassis. A cardboard box houses the battery mounting frame (see Fig. 3). Two non-reversible press stud connectors link the battery to the receiver circuits. The battery unit is secured to the chassis by two nylon straps.

**12. Mechanical construction.**—The receiver comprises three main sub-assemblies: the main chassis which carries the signal, i.f. and audio frequency circuits, the reference oscillator unit, and the ferrite aerial loudspeaker unit. These units are mounted together on the front panel which also has the meter selector switch and attenuator mounted upon it. To minimize interaction and feedback, especially when the ferrite aerial is used, extensive screening of the various circuits has been necessary. Figs. 3 and 4 give a general idea of the layout. The front panel is mounted vertically in the fibre-glass cabinet to which it is secured by four screws, one in each corner at the front and two at the top rear. The hinged lid which covers the meter and measurement controls holds the telescopic rod aerial in two rubber clips when not in use. Brief operating instructions and field-strength calibration charts are secured to the inner surface of the lid, which can be folded back to lie on top of the cabinet when access to the controls is required.

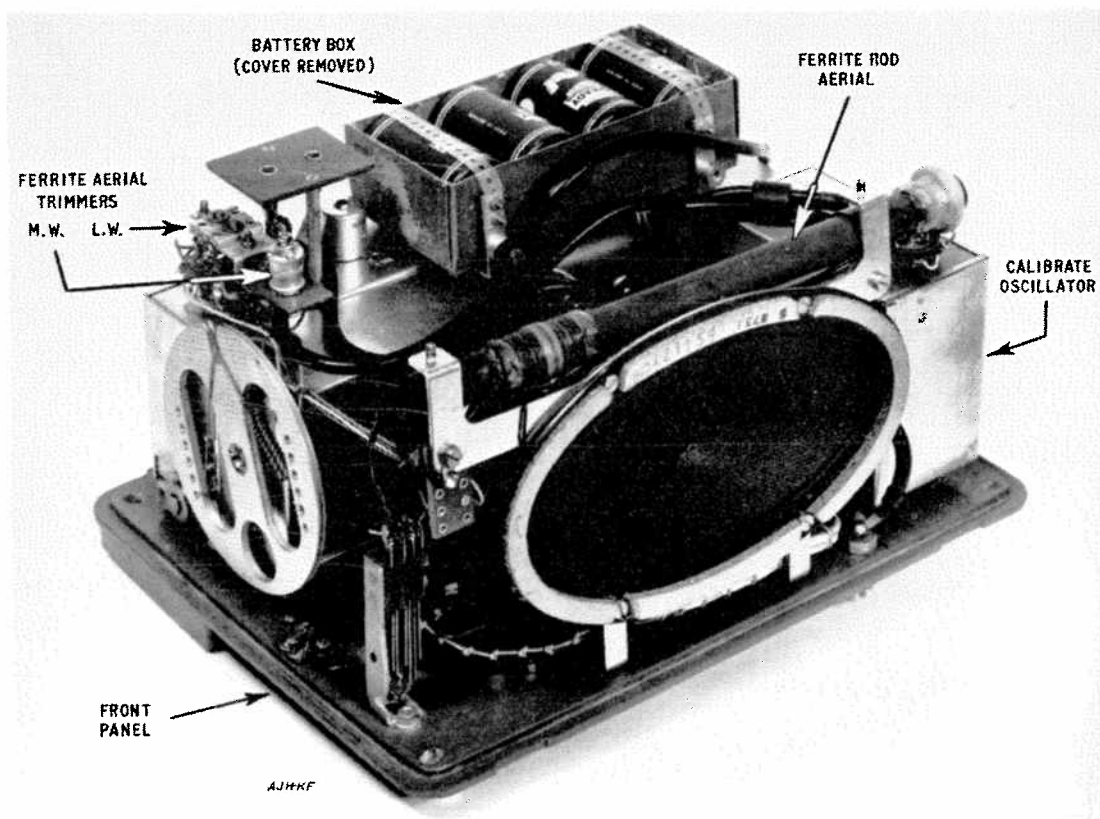


FIG. 3.—INSIDE VIEW OF RECEIVER, RADIO, No. 27A WITH BATTERY BOX COVER REMOVED

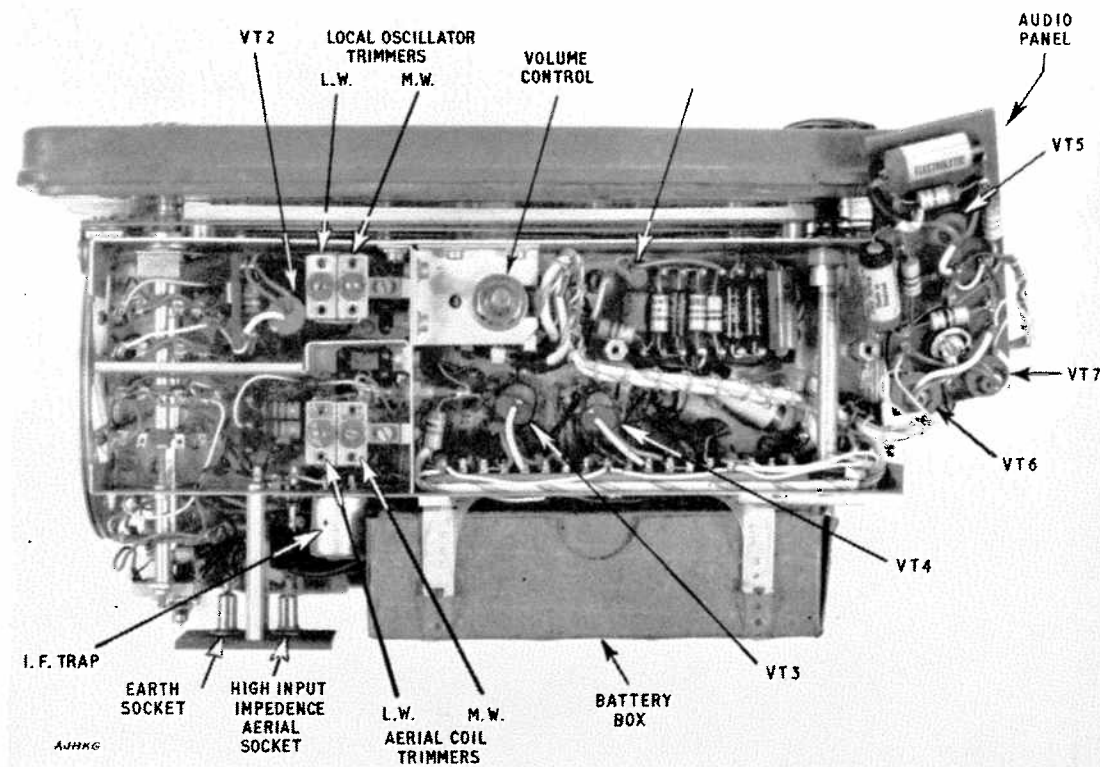


FIG. 4.—UNDERSIDE VIEW OF RECEIVER, RADIO, NO. 27A CHASSIS WITH SCREEN REMOVED (AUDIO PANEL MOVED TO ONE SIDE)

The loudspeaker opening in the top of the receiver is covered with closely woven fabric to prevent the ingress of moisture and is protected by a plastic grille. The metal carrying handle is pivoted around the approximate centre of balance and has two locked positions at right angles so that the receiver can be carried with the front panel either vertical or horizontal.

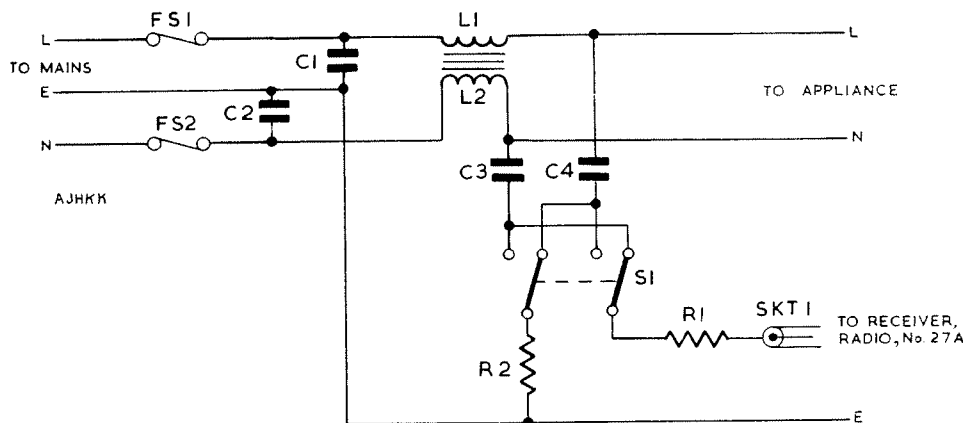
**13. Size and weight.**—The external dimensions of the receiver are  $11\frac{3}{8}$  in. by  $8\frac{5}{8}$  in. by 7 in. The weight including batteries is approximately 15 lb.

#### UNIT, ISOLATING, R.F., NO. 9A

**14. General.**—The Unit, Isolating, R.F., No. 9A is designed to provide a connecting network between the Receiver, Radio, No. 27A and the mains supply leads so that noise voltages appearing on the leads from an appliance under test can be measured in a consistent manner. The circuit details are such that measurements so made are in general conformity with B.S. 727.

**15. Circuit arrangement.**—The circuit is shown in Fig. 5, and Fig. 6 shows a block diagram of the complete measuring arrangements. The mains plug of the appliance under test is connected to the three push-on spring sockets and the three-core cable from the unit is connected to the supply mains. A Cord, Test, No. 2/36R connects the unit to the Receiver, Radio, No. 27A. Capacitors C3 and C4 isolate the equipment from the supply whilst allowing radio frequency currents to flow. Inductors L1 and L2 fulfil a two-fold purpose: they ensure that the impedance (R1 in series with the 75-ohm input resistance of the radio receiver) across which the noise voltages from the appliance are developed is not affected by the impedance of the supply mains, and also prevent any noise voltages present on the supply mains from giving misleading measurements. The change-over switch S enables the noise voltage appearing between either the live line and earth or the neutral line and earth to be measured.

**16.** The unit is rated at 3 amps and is fused accordingly. This, however, is a conservative rating and currents up to 5 amps are permissible for short periods if suitable 5 amp fuses are fitted.



R1	Resistor, $75\Omega \pm 20\%$ , $\frac{1}{4}$ W, Erie
R2	„ $75\Omega \pm 20\%$ , $\frac{3}{4}$ W, Erie
C1	Capacitor, $0.005\ \mu\text{F} \pm 25\%$ , T.C.C. type CP 45W
C2	„ $0.005\ \mu\text{F} \pm 25\%$ , T.C.C. type CP 45W
C3	„ $0.1\ \mu\text{F} \pm 25\%$ , T.C.C. type CP 47W
C4	„ $0.1\ \mu\text{F} \pm 25\%$ , T.C.C. type CP 47W
L1, L2	Filter, Suppression, No. 32A
S1	Switch, Snap type CD 825
FS1, FS2	Fuse, 3 A, Belling and Lee
SK1	Socket, Coaxial, No. 4

FIG. 5.—SCHEMATIC DIAGRAM OF UNIT, ISOLATING, R.F., No. 9A

### OPERATION

**17. General listening.**—*Ferrite rod aerial*—The following operations should be carried out:—

- (a) The meter selector switch is turned to LISTEN to provide an a.g.c. voltage.
- (b) The wavechange switch is turned to the required INT. AE. wave range.
- (c) The receiver is switched on.
- (d) The required transmission is tuned in.
- (e) The receiver is orientated for optimum reception.
- (f) The volume control is set as required.

Once operation (a) has been carried out the receiver lid may be closed if desired.

### 18. High impedance external aerial.

- (a) The input selector switch is set to HIGH Z.
- (b) The meter selector switch is turned to LISTEN.
- (c) The attenuator is set to minimum attenuation (15 db on scale).
- (d) The wavechange switch is turned to the required EXT. AE. wave range.
- (e) The high impedance external aerial is plugged into the aerial socket at the rear of the receiver.

**NOTE:**—The metre rod aerial supplied with the receiver can be screwed into the boss at the front of

the receiver and used as a high impedance aerial. It is, however, rather insensitive and will only give satisfactory reception in areas of very strong field strength.

(f) An earth connexion to the earth socket at the rear of the receiver may be necessary.

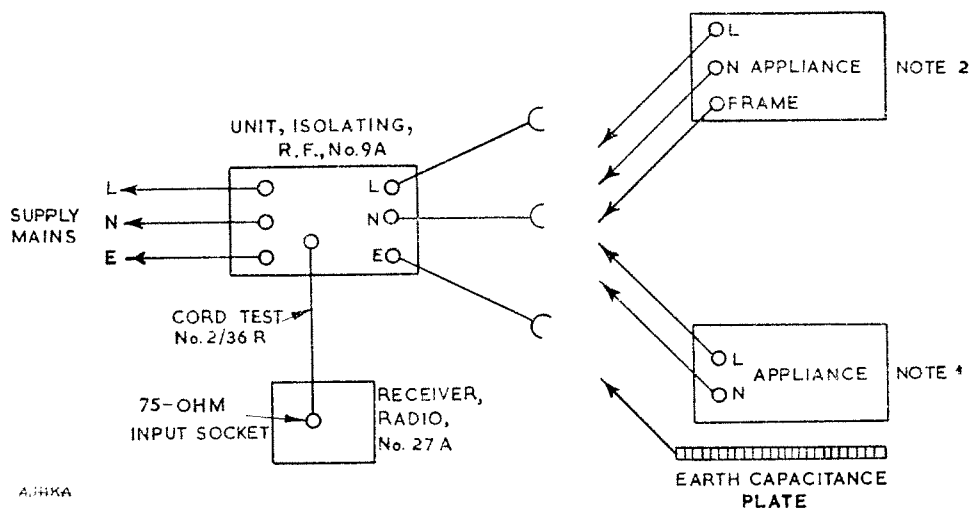
The procedure given in par. 17 (c), (d) and (f) should then be followed. The attenuator is now in circuit and provides a radio frequency gain control.

**19. Low impedance source.**—If a low impedance external signal source is used the procedure outlined in par. 18 is followed except that the input selector switch is first turned to LOW Z. Connexion is made to the receiver via the coaxial input socket on the front panel.

### 20. Radio frequency voltage measurements—low impedance input.

The measurements are made by comparing the unknown voltage with a known locally generated one. In order that the measurements can be made accurately the following procedure should be followed:—

- (a) The signal voltage is applied to the coaxial input socket.
- (b) The wavechange switch is set to the required EXT. AE. position.
- (c) The input selector switch is turned to LOW Z.



*NOTE 1*:—Connexions for non-earthed appliances. The earth plate should extend at least 12 in. beyond the appliance.

*NOTE 2*:—Connexions for earthed appliances.

FIG. 6.—ARRANGEMENTS FOR MAINS-BORNE NOISE VOLTAGE MEASUREMENTS

(d) The meter switch is turned to MEASURE.

(e) The signal is tuned in the usual way using the meter as a tuning indicator. A convenient meter deflexion is obtained by adjustment of the SET ZERO and ATTENUATOR controls. Once the signal is tuned in the tuning control should not be altered.

The receiver is then calibrated as follows:—

(f) The reference oscillator is switched on and its output injected into the receiver by turning the input selector switch to OSC. M.W. or OSC. L.W. as required.

(g) The frequency is adjusted by means of the OSC. TUNE control to give maximum meter deflexion. The SET ZERO and ATEN. controls should again be set to give a convenient deflexion.

(h) Reference level is obtained by turning the meter selector switch to OSC. LEVEL and setting the meter needle to the SET OSC. mark by means of the osc. LEVEL control. The meter switch is then returned to MEASURE and the attenuator set to the 75 db point.

(j) The meter circuit is zeroed by adjusting the SET ZERO control to give zero meter indication (0 on dial).

The signal is now re-introduced and measured:—

(k) The input selector switch is turned back to LOW Z and the attenuator adjusted until the signal just causes zero meter deflexion.

(l) Then the level of signal equals the attenuator setting in db rel. 1  $\mu$ V. A db/microvolt or microvolt/

metre conversion chart is shown in Table 1.

*NOTE*:—In this and the following paragraphs very full instructions for using the Receiver, Radio, No. 27A for measurement purposes especially of time base interference have been given. This information has been included for completeness and does not imply that measurements are required as the general rule in the investigation of interference cases.

**21. Mains-borne noise measurement.**—In order to make a measurement of the voltages injected into the mains by an appliance, the Receiver, Radio, No. 27A and the Unit, Isolating, R.F., No. 9A are connected as shown in Fig. 6. The measurement procedure is then identical with that described in par. 20. Switch S is operated to give the noise voltage on each mains line. Since there is a loss of 6 db in the isolating unit the noise voltage levels equal the setting of the radio receiver attenuator + 6 db.

**22. Radio frequency voltage measurements—high impedance input.**—Voltages injected into the high impedance terminal at the rear of the receiver are measured in a similar manner to voltages at the low impedance terminal. The input selector switch should however be set to HIGH Z instead of LOW Z for operations (k) and (j) of par. 20. Since the step-down input auto-transformer used in this condition introduces a loss of 23 db, the level of the signal measured equals the setting of the attenuator +23 db.



**23. Electric field-strength measurement.—**

The receiver is positioned with its base 2 ft. 6 in. above the ground and the 1-metre-long telescopic aerial extended and screwed into the aerial boss on the front of the receiver. The aerial should be vertical, although the set can be used in either a vertical or horizontal position by using the appropriate tapped hole for holding the aerial. A measurement of the required radiation is then made as given in par. 22. The field strength is equal to the attenuator setting plus the appropriate constant obtained from the electric field-strength curves (marked MWES and LWES) mounted in the receiver lid and is given in db above 1 microvolt/metre.

*NOTE:*—The 23 db loss in the input transformer which is referred to in par. 22 is incorporated in the calibration constant shown by these curves and should not be added additionally.

**24. Electric radiation—time base measurements.—**

The limit for electrostatic radiation from television receiver time bases is specified in B.S. 905 'Interference Characteristics and Performance of Radio Receiving Equipment for Aural and Visual Reproduction' in terms of the voltage developed across a resistance of 15000 ohms connected in the base of a metre-long vertical rod aerial immersed in the radiation field. To make this measurement with the Receiver, Radio, No. 27A, it is connected to the television receiver as shown in Fig. 7 with the metre-

long rod aerial in position. A high impedance voltage measurement is then made as described in par. 22. The measured voltage is equal to the attenuator setting + 23 db. A summary of all the relevant limits specified in British Standards Specifications is given in Table 2.

**25. Magnetic field-strength measurement.—**

This facility has been provided principally to enable magnetic radiation from television receiver time bases to be measured. Since the attenuator is not in circuit when the internal ferrite rod aerial is used a somewhat different measuring technique has to be used. The Receiver, Radio, No. 27A should be orientated for maximum pick-up of signal. The following procedure is then adopted:—

- (a) The wavechange switch is turned to the required INT. AE. position.
- (b) The meter selector switch is turned to MEASURE.
- (c) The required signal is tuned in using the SET ZERO control to give a convenient meter deflexion.
- (d) The meter is then set to zero using the SET ZERO control.

*NOTE:*—This control must not then be altered until the measurement is completed.

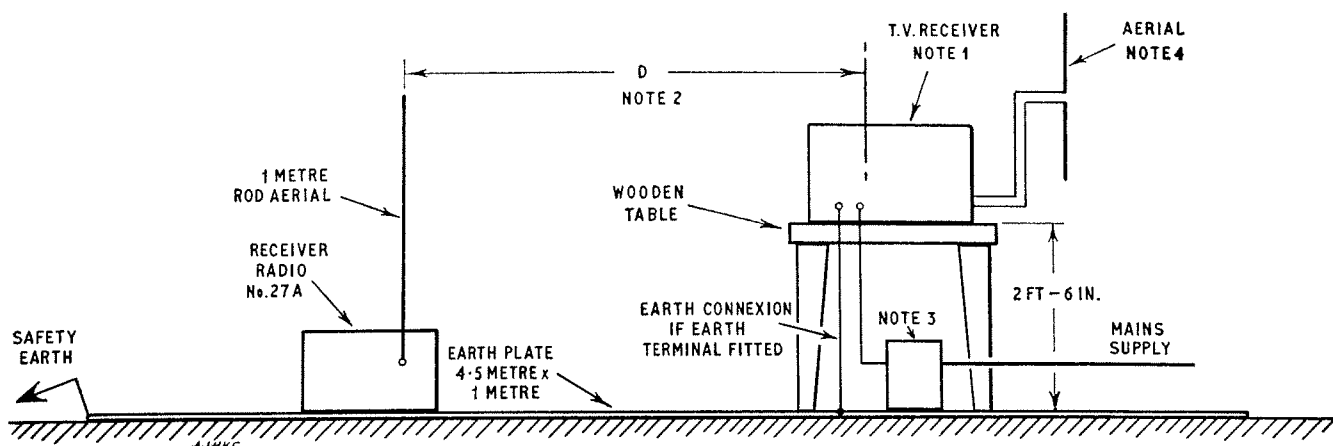
- (e) The wavechange switch is turned to the appropriate EXT. AE. position and the input selector switch to the corresponding osc. position.

TABLE 2.—NOISE VOLTAGE AND RADIATION LIMITS SPECIFIED IN BRITISH STANDARDS SPECIFICATIONS

B.S. Specn.	Type of measurement	Limit (db rel. 1 $\mu$ V or 1 $\mu$ V/m)
B.S. 800	Mains-borne noise voltages from appliances 200 kc/s - 1605 kc/s	63.5 db (1500 $\mu$ V)
B.S. 905	Mains-borne noise voltages from television receivers due to time bases 200 kc/s - 550 kc/s 550 kc/s - 1605 kc/s	46 db (200 $\mu$ V) 40 db (100 $\mu$ V)
B.S. 905	Electric radiation from television receiver time bases. Voltage induced in a metre-long aerial. See Fig. 7 for method of measurement	40 db (100 $\mu$ V)
B.S. 905	Magnetic radiation from television receiver time bases. See Fig. 8 for method of measurement	52 db (400 $\mu$ V/m)

B.S. 800: 1954 Limits of Radio Interference

B.S. 905: 1959 Interference Characteristics and Performance of Radio Receiving Equipment for Aural and Visual Reproduction



NOTE 1:—A table model is shown. Console models should be stood on the ground.

NOTE 2:—The value of D is as follows:—

Location of receiver aerial with respect to television receiver	Distance from centre of back of the receiver
In front of the receiver	12 ft. (3.6 metres)
At the back of the receiver	6 ft. (1.8 metres)
At the top, bottom and both sides of the receiver, in turn	8 ft. 6 in. (2.5 metres)

NOTE 3:—Mains voltage isolating network.

NOTE 4:—A signal is required to synchronize the time base.

FIG. 7.—METHOD OF MEASURING ELECTRIC RADIATION FROM A TELEVISION RECEIVER TIME BASE

(f) The reference oscillator is then tuned in using the attenuator to give a convenient meter deflexion.

(g) The oscillator output is standardized by turning the meter selector switch to OSC. LEVEL and adjusting the meter deflexion to the MAG. CAL. mark by means of the oscillator level control.

(h) The meter switch is returned to MEASURE, the meter zeroed by means of the attenuator, and the attenuator setting noted.

(j) The required calibration constant is obtained from the curves (M.W.E.M. or L.W.E.M.) contained in the lid of the receiver.

(k) The magnetic field strength is then given by (calibration constant—attenuator setting) db above 400 microvolt/metre.

NOTE:—If the attenuator setting is numerically greater than the calibration constant the result is in db below 400 microvolt/metre.

**26. Measurement of magnetic radiation for time bases in accordance with B.S. 905.**—The arrangement shown in Fig. 8 should be adopted and the measurement made as outlined in par. 25.

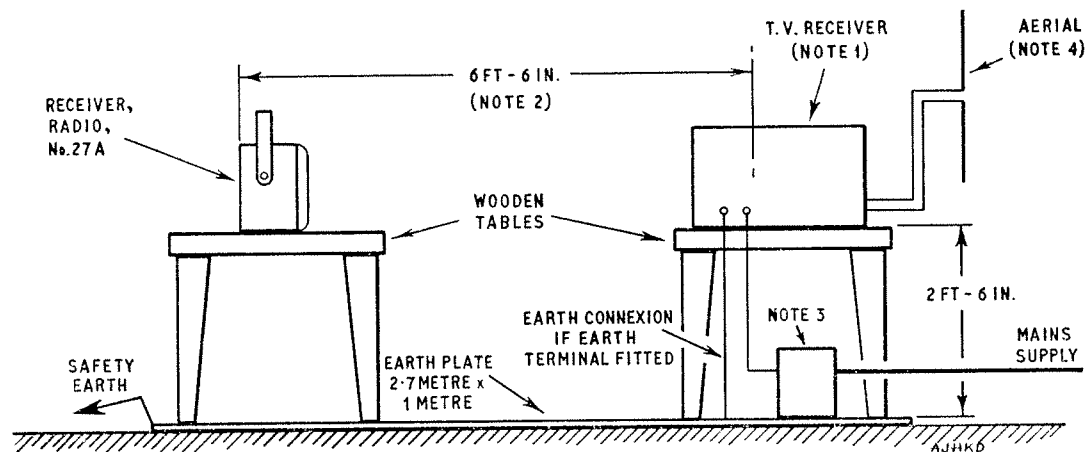
**27. Direction finding.**—The receiver can be used for direction finding as follows:—

(a) The meter switch is set to MEASURE.

(b) The wavechange switch is set to the required INT. AE. position.

(c) The wanted signal is tuned in and the receiver orientated for minimum meter deflexion. Then the direction of the required transmission will lie along the length of the receiver.

NOTE:—The above procedure gives results better than  $\pm 15^\circ$  for distant stations. At near distances where the induction field predominates (distance less than  $\frac{1}{4}$  wavelength) unreliable results may be obtained and tracing on an intensity basis may be necessary.



**NOTE 1:**—The television receiver and the Receiver, Radio, No. 27A are orientated for maximum pick-up.

**NOTE 2:**—This distance is measured between the back of the Receiver, Radio, No. 27A and the centre of the C.R.T. deflexion coils.

**NOTE 3:**—Mains isolating network.

**NOTE 4:**—A signal is required to synchronize the time base.

FIG. 8.—METHOD OF MEASURING MAGNETIC RADIATION FROM A TELEVISION RECEIVER TIME BASE

Since the a.g.c. voltage is absent and the radio frequency attenuator is not in circuit in the above operating condition there may be some overloading when strong signals are received and the meter deflexion tends to remain constant regardless of the orientation of the receiver. This difficulty can be overcome by detuning the receiver slightly, so that the meter deflexion varies as the direction of the receiver is changed. Such a procedure does not materially affect the accuracy of the bearing obtained.

**28. Interference tracing.**—The receiver is adjusted as for direction finding (see par. 27) and tracing carried out on a signal intensity basis by noticing the directions of movement required to give a signal increase. Headphones can be used with advantage for this operation. The SET ZERO control should be used to give a convenient meter deflexion.

**29. Use of mains lead.**—The mains lead incorporated in the receiver provides a radio-frequency connexion between the mains and the receiver chassis. Should it be suspected that a complainant is experiencing interference injected into his receiver via the mains supply a check can be made by operating the Receiver, Radio, No. 27A with the mains lead connected and then disconnected from the supply.

## MAINTENANCE

**30. Repairs.**—Local arrangements should be made to clear simple faults. Transistors should not be replaced since re-alignment of the circuits may be necessary. No attempt should be made to re-align the receiver. It is especially important that the trimmer capacitors C3A and C3B associated with the ferrite rod aerial are not adjusted since the setting of these controls the magnetic field-strength calibration constant.

**31 Attenuators.**—Since the attenuators have been individually calibrated the dials should not be interchanged. Corresponding dials and attenuators are stamped with the same serial number.

**32. Typical voltage readings.**—The voltages shown in Table 3 are typical values under no signal conditions obtained with a voltmeter of at least 20000 ohms/volt sensitivity. The readings are with respect to the chassis, which is positive.

**33. Removal of chassis from cabinet.**—The front panel assembly can be withdrawn from the cabinet by undoing the screw in each corner of the front panel and the two screws above the mains lead

compartment in the rear of the case. The mains lead should be fed through the hole in the cabinet.

It is not recommended that the front panel be removed from the rest of the equipment. Access to the various stages is obtained by removing the screening cover on the underside of the main chassis which is secured by two screws at each end. The volume control knob has first to be removed by loosening the set screw and easing the boss from the spindle.

**34. Maintenance exchange.**—Should other than

a simple fault develop or an overhaul be necessary the receiver should be replaced under maintenance exchange procedure (see STORES, Workmen's Procedure, I 0011). Batteries should be removed from the receiver when this procedure is used and the receiver should be dispatched to the Supplies Dept., Birmingham, by passenger train.

**35. Re-calibration procedure.**—Should it be felt that re-calibration of the measuring circuits is necessary, the normal maintenance exchange procedure as outlined in par. 34 should be used.

TABLE 3.—TYPICAL OPERATING VOLTAGES

Transistor	Emitter	Base	Collector	Supply
VT2	-0.68	0.51	-4.8	6.0
VT3	-0.76	0.7	-5.7	
VT4	-0.36	0.5	-5.0	
VT5	-0.6	0.7	-5.2	
VT6	0	0.18	-5.7	
VT7	0	0.18	-5.7	
VT8	-0.35	0.46	-3.3	

[Fig. 9 follows]

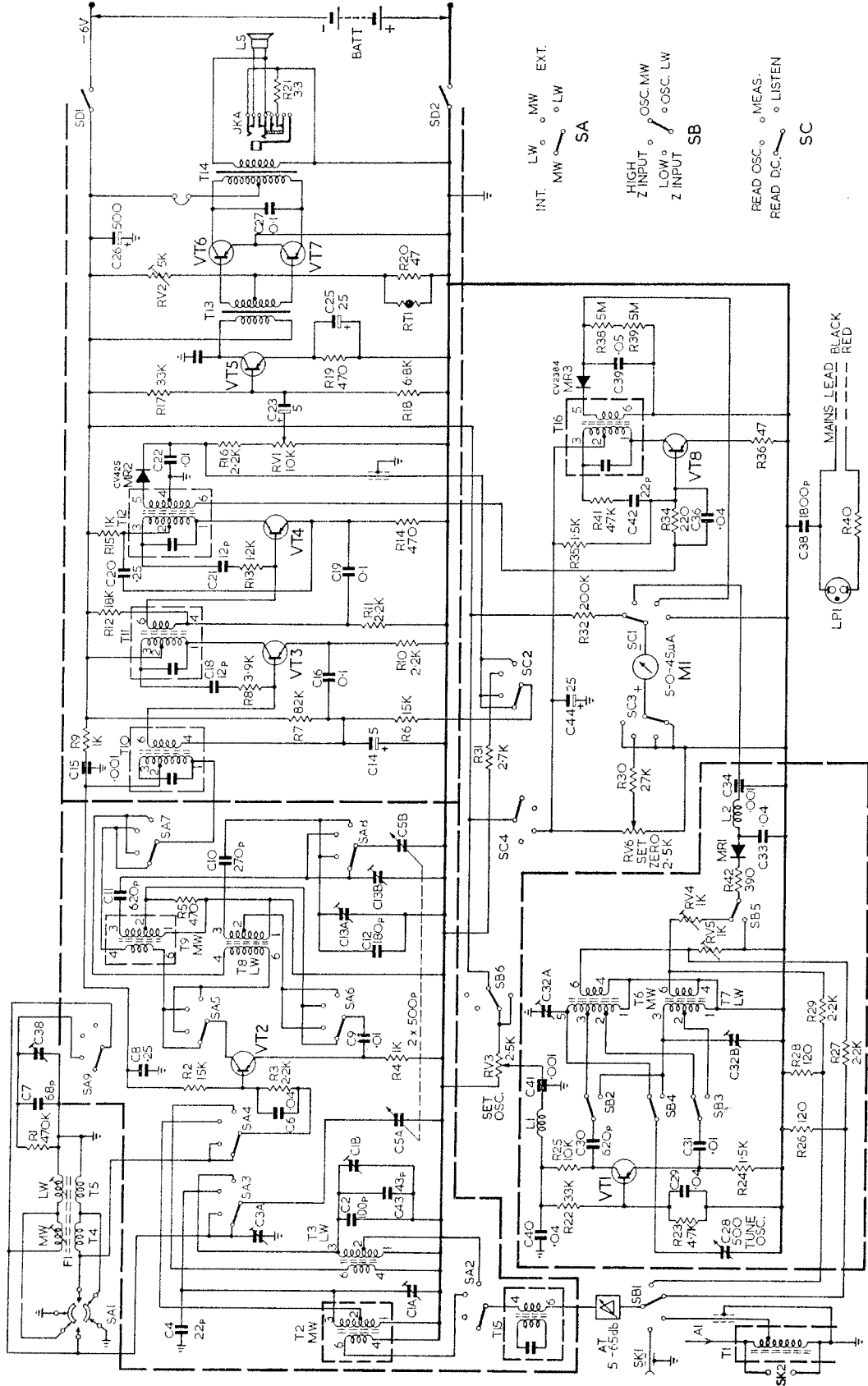


FIG. 9.—SCHEMATIC DIAGRAM OF RECEIVER, RADIO, No. 27A  
(For components see Table 4)

TABLE 4.—LIST OF COMPONENTS FOR RECEIVER, RADIO, NO. 27A

(See Fig. 9)

<i>Cct. ref.</i>	<i>Description</i>	<i>Cct. ref.</i>	<i>Description</i>
R1	Resistor, 470K $\Omega \pm 10\%$ , $\frac{1}{4}$ W	C9	Capacitor 0.01 $\mu$ F $\pm 20\%$ , 400V
R2	" 15K $\Omega \pm 10\%$ , $\frac{1}{4}$ W	C10	" 270 pF $\pm 2\%$ , 350V
R3	" 2.2K $\Omega \pm 10\%$ , $\frac{1}{4}$ W	C11	" 620 pF $\pm 2\%$ , 125V
R4	" 1K $\Omega \pm 10\%$ , $\frac{1}{4}$ W	C12	" 180 pF $\pm 2\%$ , 350V
R5	" 470 $\Omega \pm 10\%$ , $\frac{1}{4}$ W	C13	" pre-set, $2 \times 40$ pF $\pm 2\%$ , 250V
R6	" 15K $\Omega \pm 10\%$ , $\frac{1}{4}$ W	C14	" 5 $\mu$ F $\pm 25\%$ , 25V
R7	" 82K $\Omega \pm 10\%$ , $\frac{1}{4}$ W	C15	" 0.001 $\mu$ F $\pm 20\%$ , 500V
R8	" 3.9K $\Omega \pm 10\%$ , $\frac{1}{4}$ W	C16	" 0.1 $\mu$ F $\pm 25\%$ , 150V
R9	" 1K $\Omega \pm 10\%$ , $\frac{1}{4}$ W	C18	" 12 pF $\pm 10\%$ , 350V
R10	" 2.2K $\Omega \pm 10\%$ , $\frac{1}{4}$ W	C19	" 0.1 $\mu$ F $\pm 25\%$ , 150V
R11	" 2.2K $\Omega \pm 10\%$ , $\frac{1}{4}$ W	C20	" 0.25 $\mu$ F $\pm 25\%$ , 150V
R12	" 18K $\Omega \pm 10\%$ , $\frac{1}{4}$ W	C21	" 12 pF $\pm 10\%$ , 350V
R13	" 1.2K $\Omega \pm 10\%$ , $\frac{1}{4}$ W	C22	" 0.01 $\mu$ F $\pm 20\%$ , 400V
R14	" 470 $\Omega \pm 10\%$ , $\frac{1}{4}$ W	C23	" 5 $\mu$ F $\pm 25\%$ , 25V
R15	" 1K $\Omega \pm 10\%$ , $\frac{1}{4}$ W	C24	" 0.01 $\mu$ F $\pm 20\%$ , 400V
R16	" 2.2K $\Omega \pm 10\%$ , $\frac{1}{4}$ W	C25	" 25 $\mu$ F $\pm 100\% - 20\%$ , 25V
R17	" 33K $\Omega \pm 10\%$ , $\frac{1}{4}$ W	C26	" 500 $\mu$ F $\pm 100\% - 20\%$ , 12V
R18	" 6.8K $\Omega \pm 10\%$ , $\frac{1}{4}$ W	C27	" 0.1 $\mu$ F $\pm 25\%$ , 150V
R19	" 470 $\Omega \pm 10\%$ , $\frac{1}{4}$ W	C28	" 0.500 pF, 350V
R20	" 47 $\Omega \pm 10\%$ , $\frac{1}{4}$ W	C29	" 0.04 $\mu$ F $\pm 20\%$ , 150V
R21	" 3.3 $\Omega \pm 10\%$ , 1 $\frac{1}{2}$ W	C30	" 620 pF $\pm 2\%$ , 125V
R22	" 33K $\Omega \pm 10\%$ , $\frac{1}{4}$ W	C31	" 0.01 $\mu$ F $\pm 20\%$ , 400V
R23	" 4.7K $\Omega \pm 10\%$ , $\frac{1}{4}$ W	C32	" pre-set, $2 \times 40$ pF $\pm 2\%$ , 250V
R24	" 1.5K $\Omega \pm 10\%$ , $\frac{1}{4}$ W	C33	" 0.04 $\mu$ F $\pm 20\%$ , 150V
R25	" 10K $\Omega \pm 10\%$ , $\frac{1}{4}$ W	C34	" 0.001 $\mu$ F $\pm 20\%$ , 500V
R26	" 120 $\Omega \pm 5\%$ , $\frac{1}{4}$ W	C36	" 0.04 $\mu$ F $\pm 20\%$ , 150V
R27	" 2.2K $\Omega \pm 5\%$ , $\frac{1}{4}$ W	C38	" 1800 pF $\pm 80\% - 20\%$ , 1250V
R28	" 120 $\Omega \pm 5\%$ , $\frac{1}{4}$ W	C39	" 0.05 $\mu$ F $\pm 10\%$ , 200V
R29	" 2.2K $\Omega \pm 5\%$ , $\frac{1}{4}$ W	C40	" 0.04 $\mu$ F $\pm 20\%$ , 150V
R30	" 27K $\Omega \pm 10\%$ , $\frac{1}{4}$ W	C41	" 0.001 $\mu$ F $\pm 20\%$ , 500V
R31	" 2.7K $\Omega \pm 10\%$ , $\frac{1}{4}$ W	C42	" 22 pF $\pm 1\%$ , 350V
R32	" 200K $\Omega \pm 1\%$ , $\frac{1}{8}$ W	C43	" 43 pF $\pm 2\%$
R34	" 220 $\Omega \pm 10\%$ , $\frac{1}{4}$ W	C44	" 25 $\mu$ F $\pm 100\% - 20\%$ , 25V
R35	" 1.5K $\Omega \pm 10\%$ , $\frac{1}{4}$ W	VT1	Transistor, XA102 or CV 7003
R36	" 47 $\Omega \pm 10\%$ , $\frac{1}{4}$ W	VT2	" XA102 or CV 7003
R38	" 5M $\Omega \pm 2\%$ , $\frac{1}{2}$ W	VT3	" XA101 or CV 7004
R39	" 5M $\Omega \pm 2\%$ , $\frac{1}{2}$ W	VT4	" XA101 or CV 7004
R40	Part of LPI	VT5	" CV 2389
R41	Resistor, 4.7K $\Omega \pm 10\%$ , $\frac{1}{4}$ W	VT6	" CV 2389
R42	" 390 $\Omega \pm 10\%$ , $\frac{1}{4}$ W	VT7	" CV 2389 } matched pair
RV1	" variable, 10K $\Omega \pm 20\%$ , $\frac{1}{2}$ W	VT8	" CV 7001
RV2	" " 5K $\Omega \pm 20\%$ , $\frac{1}{4}$ W	MR1	Diode, CV 2310
RV3	" " 2.5K $\Omega \pm 20\%$ , $\frac{1}{2}$ W	MR2	" CV 425
RV4	" " 1K $\Omega \pm 20\%$ , $\frac{1}{4}$ W	MR3	" CV 2384
RV5	" " 1K $\Omega \pm 20\%$ , $\frac{1}{4}$ W	SA	Switch, Wavechange, 4-position, 8-pole
RV6	" " 2.5K $\Omega \pm 20\%$ , $\frac{1}{2}$ W	SB	" Input selector, 4-position, 6-pole
C1	Capacitor, $2 \times 40$ pF $\pm 2\%$ , 250V	SC	" Meter, 4-position, 4-pole
C2	" 100 pF $\pm 2\%$ , 350V	SD	" part of RV5, 2-pole on/off
C3A	" 3-30 pF	T1	Transformer, aerial auto.
C3B	" pre-set, $2 \times 40$ pF $\pm 2\%$ , 250V	T2	" m.w. aerial
C4	" 22 pF $\pm 1\%$ , 350V	T3	" l.w. aerial
C5	" variable, $2 \times 500$ pF, 350V	T4	" m.w. aerial ferrite
C6	" 0.04 $\mu$ F $\pm 20\%$ , 150V	T5	" l.w. ferrite frame aerial
C7	" 68 pF $\pm 2\%$ , 350V	T6	" signal generator m.w.
C8	" 0.25 $\mu$ F $\pm 25\%$ , 150V	T7	" signal generator l.w.

TABLE 4.—(contd.)

<i>Cct. ref.</i>	<i>Description</i>	<i>Cct. ref.</i>	<i>Description</i>
T8	Transformer, oscillator l.w.	M1	Meter, 0–50 $\mu$ A, Weston 5500
T9	„ oscillator m.w.	JKA	Jack, Socket
T10	„ I.F.T. 1	LS	Loudspeaker
T11	„ I.F.T. 2	F1	Ferrite rod, 9½ in. by ½ in.
T12	„ I.F.T. 3	A1	Aerial whip, Aerial No. 24
T13	„ a.f. driver	SK1	Coaxial socket, Socket Coaxial No. 4
T14	„ a.f. output	SK2	Aerial and earth socket
T15	„ i.f. trap	LP1	Neon indicator, 240V
T16	„ I.F.T. 4	RT1	Thermistor, Mullard VA1040
L1	Inductor, r.f. choke	AT	Attenuator, 5–65 db, 75 $\Omega$ $\pm$ 10%, 0.2 W
L2	„ r.f. choke		

Reference:—STORES, Workmen's Procedure, I 0011  
(WI3/3)

END