AIR PUBLICATION
2563 J
Volume I
SECOND EDITION
MARCH, 1946

TEST SETS
TYPE 210 and TYPE 253
and ATTENUATOR UNIT
TYPE 70

Prepared by direction of the
Minister of AVIATION

Henry Hardman

Promulgated by order of the
Air Council

M. J. Dean

UNCLASSIFIED

AIR MINISTRY

REPRINTED 1961

TEST SETS TYPE 210 AND TYPE 253 AND ATTENUATOR UNIT TYPE 70

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

Introduction

1. The test sets type 210 and type 253 are essentially similar in function and design, the main difference between them being in the fact that test set 210 operates from an 80 volts (or 115 volts), 1500 c/s supply, while test set 253 operates off a 230 volts, 50 c/s supply. This difference entails a few divergencies in the layout and in the components making up the power pack, but nothing more. Only test set type 210 will be described fully in this publication, while information relating to test set type 253 in so far as it diverges from test set type 210 will be found in the latter part of the text.

2. Both test sets are signal generators designed primarily for the alignment of the RF units and for a sensitivity check of the receivers employed in the following radar installations :—

Gee Mk II — ARI.5083 and its tropicalised version—ARI.5718.

-H " I — ARI.5525

" " II — ARI.5597 and its tropicalised version—ARI.5696.

Mobile Gee — MGRI.5528

Transportable " — TGRI.5615 and its tropicalised version ATGRI.5690.

AMES Type 100.

AMES Type 7000 stations.

In addition, the test sets may be used as a means of calibrating the wavemeters type W1615 and type W1616 (employed for measuring the transmitter frequency in ARI.5525), and also for calibrating the test set type 238 (the wavemeter for ARI.5597, MGRI.5528 and TGRI.5615).

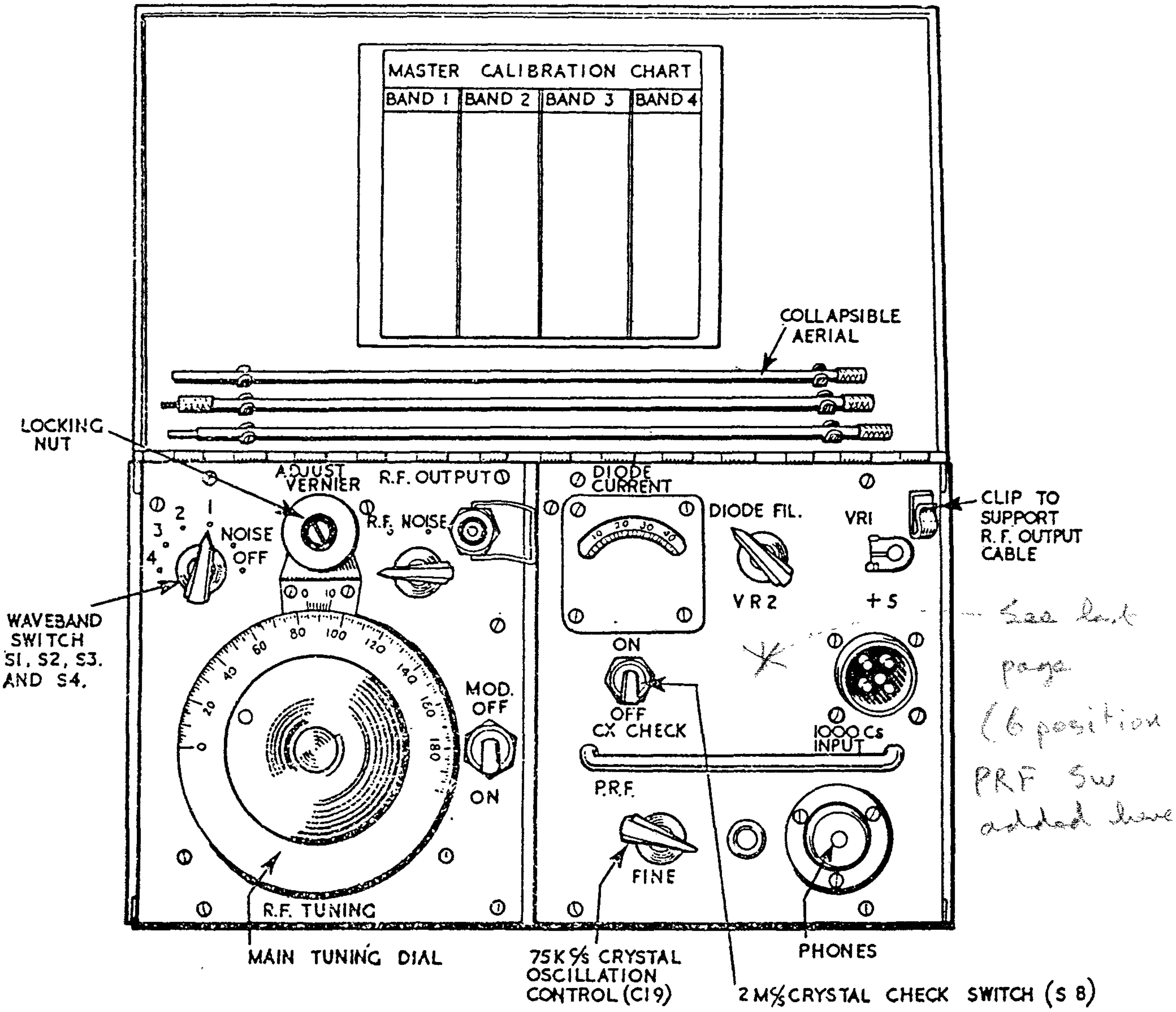
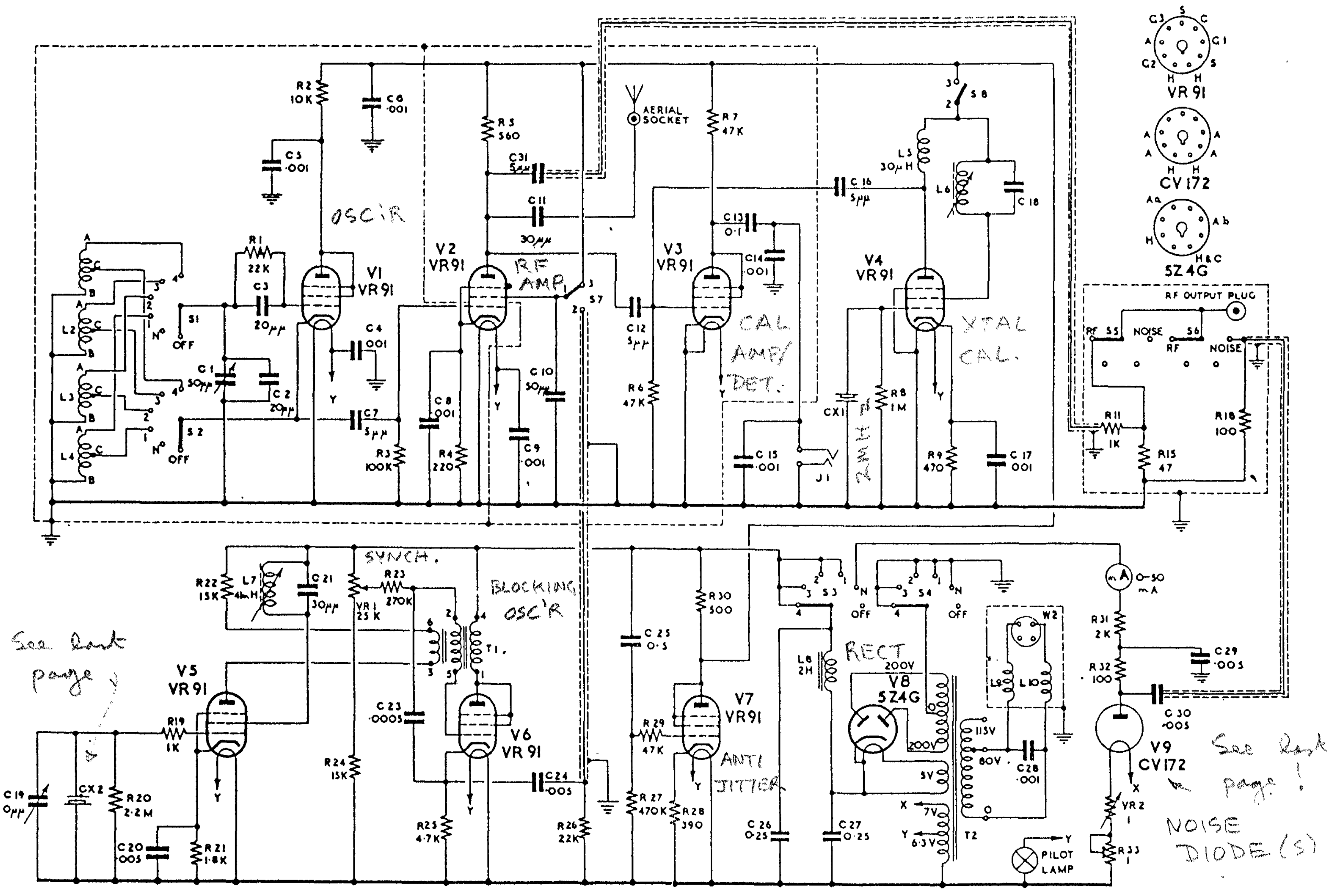


Fig. 1—Test set type 210 — front panel



R2 10K
C6 ·001
C5 ·001
R5 560
C31 5μμ
C11 30μμ
AERIAL SOCKET
R7 47K
C16 5μμ
L5 30μH
L6
C18
S8
OSC'R
V1 VR91
V2 VR91
RF AMP
V3 VR91
V4 VR91
R1 22K
C3 20μμ
C4 ·001
C13 0·1
C14 ·001
S7
S1 OFF
S2 OFF
L2
L3
L4
C1 50μμ
C2 20μμ
C7 5μμ
C12 5μμ
CAL AMP/ DET.
XTAL CAL.
R3 100K
C8 ·001
R4 220
C9 ·001
C10 50μμ
R6 47K
C15 ·001
J1
CX1
R8 1M
R9 470
C17 ·001
VR91
CV172
5Z4G
RF OUTPUT PLUG
S5
S6
RF
NOISE
R11 1K
R15 47
R18 100
SYNCH.
BLOCKING OSC'R
R22 15K
L7 4mH
C21 30μμ
R23 270K
VR1 25K
T1.
V5 VR91
V6 VR91
R19 1K
C19 0μμ
CX2
R20 2·2M
C20 ·005
R21 1·8K
C23 ·0005
R24 15K
R25 4·7K
C24 ·005
R26 22K
C25 0·5
R30 500
V7 VR91
R29 47K
R27 470K
R28 390
ANTI JITTER
S3
S4
OFF
RECT
L8 2H
V8 5Z4G
200V
115V
80V
5V
7V
6·3V
C26 0·25
C27 0·25
T2
W2
L9
L10
C28 ·001
PILOT LAMP
mA 0-50 mA
R31 2K
R32 100
C29 ·005
C30 ·005
V9 CV172
VR2
R33
See last page
See last page !
NOISE DIODE (S)

TEST SET TYPE 210

General description

3. The test set type 210 is contained in a steel case measuring 13in. × $8\frac{3}{4}$in. × $8\frac{1}{4}$in. (excluding handles) and weighs 25 lb. The normal power supply for the test set is 80 volts at nominally 1500 c/s, but provision is made by means of an alternative tapping point on the input transformer for a 115 volts supply to be used. Care should be taken, when connecting up the test set, to ensure that the correct tapping of the transformer is used for the voltage supply available.

4. Three outputs are provided:

(i) RF. pulse with a P.R.F. of 15 Kc/s and a 2 to 3 μsec. pulse-width.
(ii) RF., unmodulated.
(iii) " Noise " untuned.

The frequency range of (i) and (ii) is from 20 to 88 Mc/s and is covered in four bands any one of which may be selected by the wave-band switch.

Range 1	20 to 29 Mc/s.
Range 2	29 to 42 Mc/s.
Range 3	42 to 60 Mc/s.
Range 4	60 to 88 Mc/s.

5. The outputs (i) and (ii) referred to in para. 4 are normally radiated from the collapsible aerial supplied with the test set, but may, if desired, be fed *via* an internal attenuator to a Pye plug located on the front panel of the unit, and thence directly to the receiver by means of the appropriate connector.

6. The output levels at the Pye plug are as follows :—

(i) RF. pulses (ii) RF. unmodulated	10 mV. (approx.) decreasing in level with an increase of frequency.
(iii) Noise	5 microvolts at 30 mA. anode current.

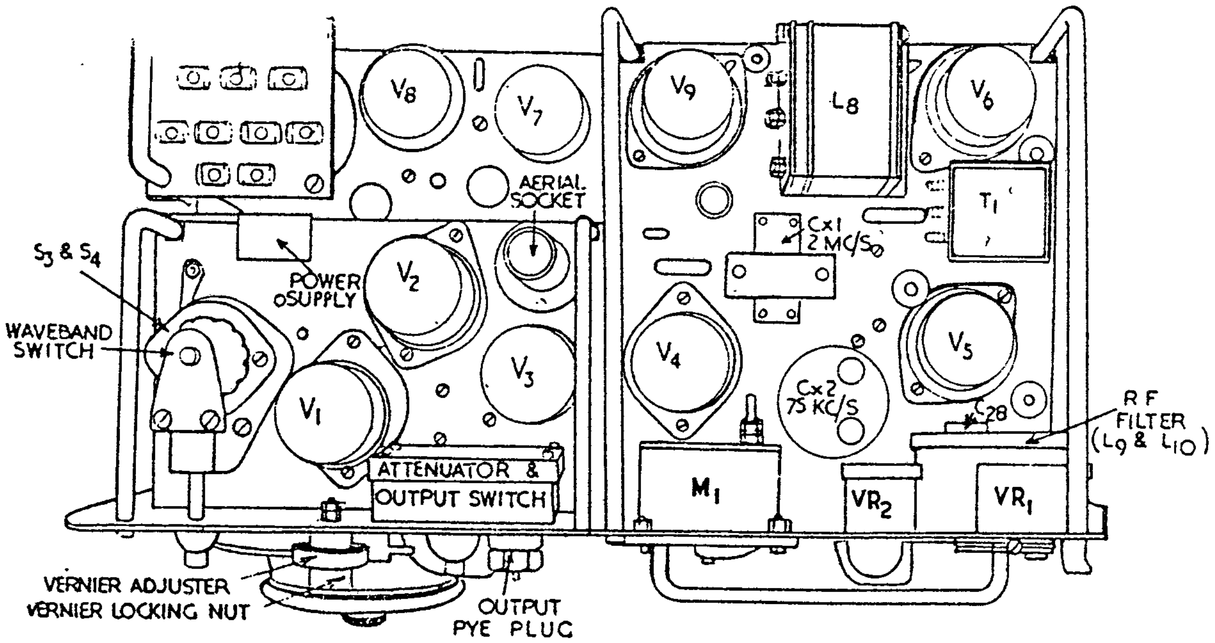


Fig. 3—Test set type 210 — chassis, top view

The particular output required may be selected by operation of the RF. output switch. It should be noted that the " Noise " output, when selected, is independent of frequency and may only be obtained *via* the Pye output plug on the front panel.

Note :—The input to a receiver connected to a standard whip aerial located 12 feet away from the test set radiating from its full aerial extension is approximately 500 μV.

Circuit description

7. In the following paragraphs, the individual functions of each valve in the test set are described. Reference should be made to the circuit diagram, fig. 2.

Oscillator valve (V1)

8. The valve V1 functions as an RF. oscillator in a cathode tap circuit and generates the carrier frequency over the complete range of 20 to 88 Mc/s. Four tuning coils are provided, and the one required is selected by the wave-band switch contacts S1 and S2. The tuning condenser C1 is provided with an adjustable vernier control the purpose of which is described later. The oscillator, together with the amplifier valve V2 and the detector V3, is mounted in a removable RF. unit.

Buffer amplifier (V2)

9. The valve V2 functions as an aperiodic buffer stage between the oscillator valve and the aerial. Consequently the oscillator carrier frequency may be modulated by the application of 15 Kc/s pulses to the screen of the buffer stage. The modulator switch S7 in the screen circuit of V2 has two positions marked ON and OFF. In the OFF position, the screen of V2 is connected to the HT. supply, while in the ON position the screen is connected to the cathode of the divider-modulator valve V6 from which positive pulses are obtained which modulate the buffer stage output. During the intervals between successive positive pulses, the screen of V2 is approximately at earth potential rendering the valve non-conducting.

10. By reference to fig. 2, it will be seen that the output from V2 is fed to :—
   (i) The aerial socket.
   (ii) The output Pye plug, *via* S5 and attenuator R11 and R15.
   (iii) The control grid of V3 *via* C12.

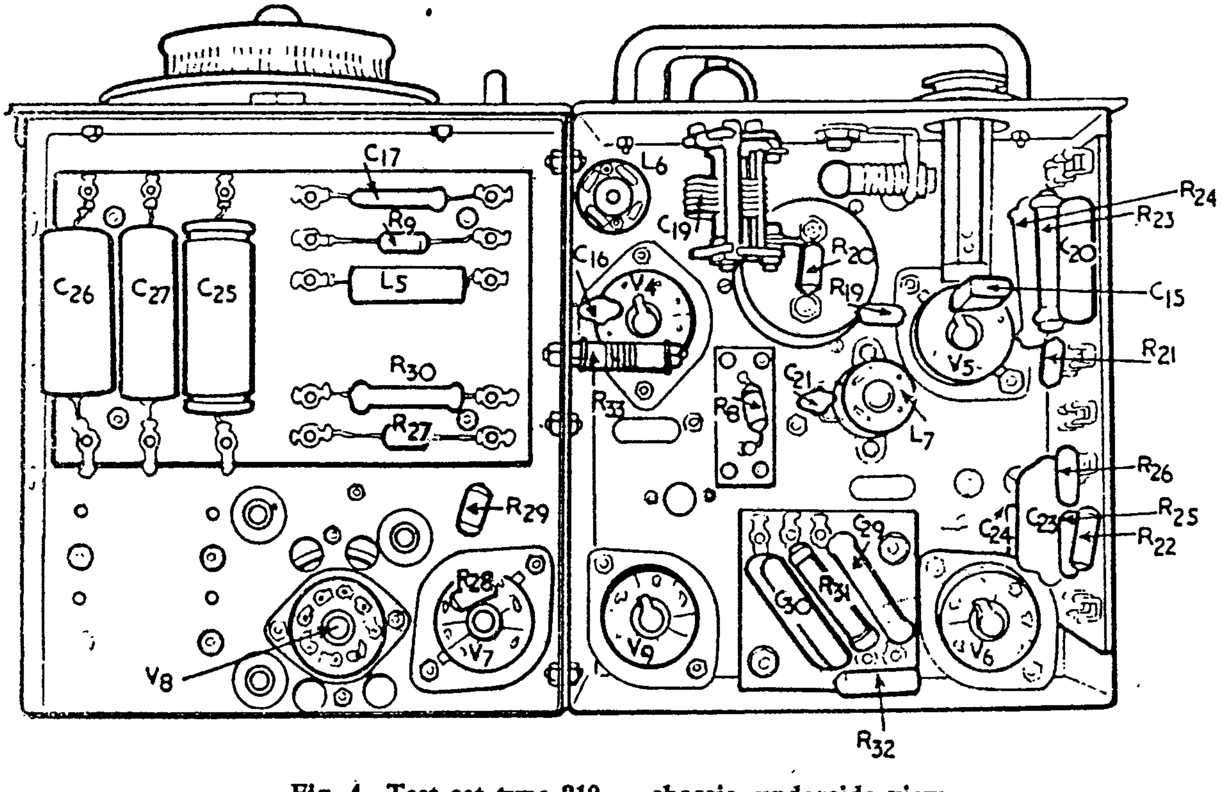


Fig. 4—Test set type 210 — chassis, underside view

Calibration valve (V4)

11. The valve V4 has a 2 Mc/s crystal included in its control grid circuit and functions as a crystal-controlled oscillator by means of which the calibration of the tuning dial may be checked and adjusted. Oscillations occur between screen and grid, the tuned circuit L6—C18 resonating at 2 Mc/s. The output from V4 is taken from the anode, *via* C16, to the control grid of the detector valve V3. The switch S3 is the crystal check ON-OFF switch.

Detector valve (V3)

12. In order to check the tuning dial calibration, the RF. output from the amplifier V2 is mixed with the 2 Mc/s crystal-controlled output from V4, and the resultant composite signal is rectified by the valve V3 which functions as a leaky-grid detector. The rectified output from V3 contains audio-beat frequencies produced by the heterodyne action of the RF. carrier with harmonics of the 2 Mc/s crystal controlled oscillator output. The jack J1 is provided in order that telephones may be plugged in whilst carrying out calibration checks.

Crystal oscillator valve (V5) → (See back page – 6 xtals now)

13. The valve V5 functions as a crystal controlled oscillator with a tuned screen circuit L7—C21 and operates at a frequency of 75 Kc/s. The output from the anode circuit of V5 is used to synchronise the divider-modulator stage (V6). A variable condenser C19, connected in parallel with the crystal in the grid circuit of V5, permits the modulation frequency to be adjusted in order that the signal may be kept stationary on the time base of the indicator unit in the installation under test. → C3c

Divider-modulator valve (V6)

14. The valve V6 is a squegging oscillator, whose squegging frequency may be adjusted by means of the potentiometer VR1 to 15 Kc/s synchronous with the 75 Kc/s input from V5. The circuit in which V6 functions is very similar to the divider stages used in the indicator type 62. The output from V6, consisting of positive 15 Kc/s pips of approximately 150 volts amplitude and 3 μseconds duration is obtained from the cathode. This is applied to the screen of the buffer valve V2 *via* the condenser C24 when the switch S7 is in the ON position.

Anti-jitter valve (V7)

15. In order to provide a steady HT. supply without fluctuations and also to assist in the removal of ripple characteristic of aircraft generators, an anti-jitter valve V7 is included in the power pack. The HT. supply for the RF. valves V1 to V4 is obtained from the anode of V7. Due to the constant drain on the HT. supply imposed by V7, a proportional voltage is developed across the resistor R30. Any positive surge occurring in the HT. supply is applied to the control grid of V7 *via* the condenser C25; thus the anode current flow is increased and the voltage drop across R30 increases. Similarly, a sudden drop in HT. voltage will reduce the anode current of V7, thus reducing the voltage drop across R30. By this means, the anode voltage of V7 remains substantially free from ripple.

Noise diode (V9)

16. The valve V9 functions as a noise generator and is used as a means of checking the sensitivity of receiver units. With the RF. switch set to NOISE, the anode of V9 is connected to the Pye output plug *via* C30. The wave-band switch should also be set to NOISE thus connecting the HT. supply to V9 *via* the contacts of S3. The variable resistor VR2 should be adjusted until the diode current, indicated in the meter M1, is 30 mA, when a noise output of approximately 5 micro-volts will be available at the output plug when it is used with the specified connector (45 ohms).

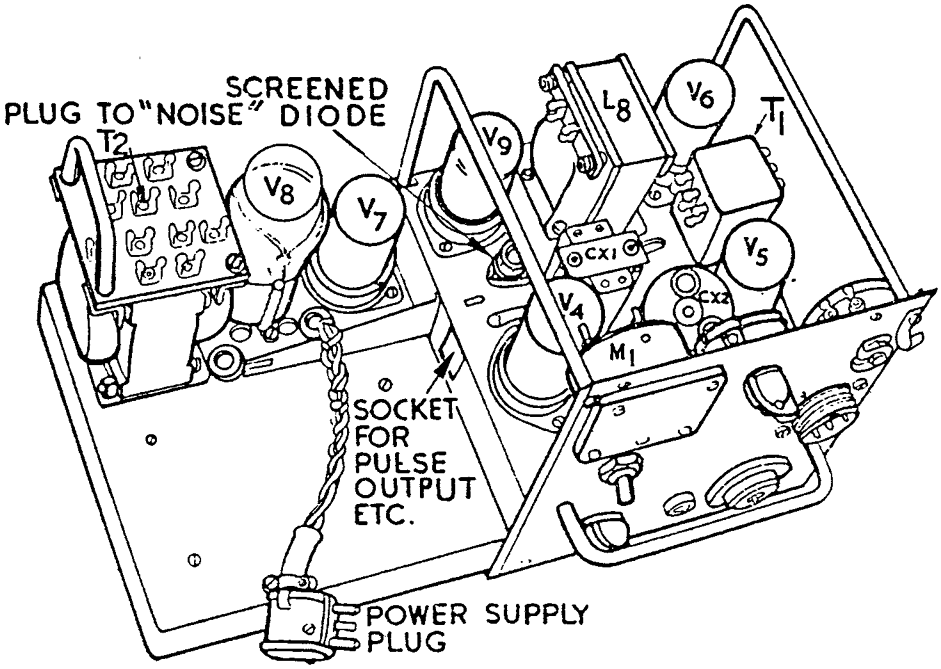


Fig. 5—Test set type 210 ; — chassis, less RF. unit

Power pack

17. The power pack is of conventional design. When a 115 volts supply is used, the input will have to be fed to the 115 volts tap before switching on the test set. The input W socket is a four pin socket. The chokes L9 and L10 and the condenser C28 comprise an RF. filter circuit. The switch contacts S3 and S4 are ganged to the wave-band switch S1 and S2. In the NOISE position,

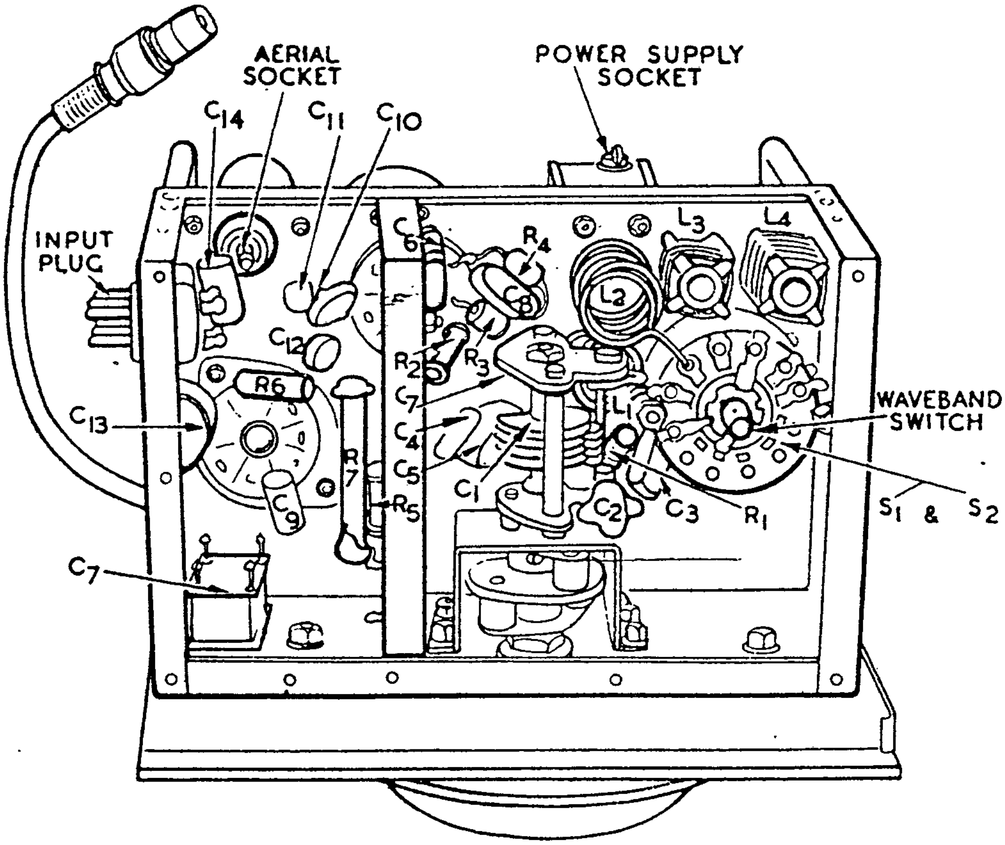


Fig. 6—Test set type 210 — RF. unit ; underside view of chassis

S3 removes the HT. supply from valves V1 to V7 and connects it to the noise diode V9. In the OFF position, S4 disconnects the HT. supply altogether. A pilot lamp is connected across the 6·3 volts LT. winding of the transformer T2.

Calibration

18. As supplied, each test set contains a Master Calibration Chart, for the particular test set in question, located inside the lid. This master calibration chart is prepared by the manufacturers and a specimen example is shown in fig. 10, Table I. This is required for the preparation of spot frequency calibrations, after which it should be removed and retained by the responsible technical authority concerned for reference when required.

19. Referring again to the specimen, Table I, it will be seen that the dial readings for the main crystal check points are given for the complete frequency range covered by the test set. The spot frequency readings may be found by interpolation as described in para. 20.

Note :—The 1 Mc/s points must be used for interpolation.

20. *Example.* Suppose that the dial readings for a spot frequency of 42·7 Mc/s is required. Then, by referring to Table I (fig. 10), it will be seen that the two nearest crystal check frequencies are 43 Mc/s and 42 Mc/s in Band 3, corresponding to dial readings of 47·0 and 35·0 respectively.

Hence by interpolating :—	Reading for 43 Mc/s	=47·0 degrees
	Reading for 42 Mc/s	=35·0 degrees
	Difference for 1 Mc/s	=12·0 degrees

Therefore, if the difference for 0·1 Mc/s is 1·2 degrees, the difference for 0·7 Mc/s will be :—

$$1{\cdot}2 \times 7 = 8{\cdot}4 \text{ degrees.}$$

By adding this result to the reading for 42 Mc/s :—

$$35{\cdot}0 + 8{\cdot}4 = 43{\cdot}4 \text{ degrees, which is therefore the reading for } 42{\cdot}7 \text{ Mc/s.}$$

The crystal check point to be noted in the table for the above example would be 42 Mc/s at 35 degrees. By following a similar procedure, the spot frequency calibration for any other required frequency may be determined.

21. The procedure described in the example given must be observed for all the spot frequencies in general use at the Service Unit concerned, and a new table must be prepared by the responsible technical authority. A specimen of such a table is given in fig. 10, Table II. This table, when completed, should be affixed inside the lid of the particular test set concerned in place of Table I. Table II should also contain certain 2 Mc/s crystal check points for use when checking the test set calibration as described in para. 23 to 25.

22. The 1 Mc/s check points (i.e. " odd " frequencies) should *not* be included in this table, as some of these points are difficult to identify without the aid of a calibrated receiver. The 2 Mc/s check points (i.e. " even " frequencies) are quite distinct. Where continuously tunable RF. units, such as units type 31 or 32, are in service, the table should be constructed in the form shown in *fig.* 10, Table III.

Calibration check

23. It is important that the dial calibration should be checked every day before using the test set. The reading of the nearest 2 Mc/s crystal check point must be checked each time the test set is set up to a spot frequency and each time the wave-band switch is operated and/or every time the test set is moved.

Note :—As the maximum adjustment of the vernier block is ± 1 degree, it is essential that, if the vernier is displaced by more than 0·7 of a degree, the test set should be recalibrated.

24. In the following paragraphs the method of checking the calibration is described :—

(i) Set the modulation switch to OFF.
(ii) Set the crystal check switch to ON.
(iii) Plug in the telephones to J1.
(iv) By means of the table ascertain that the correct dial readings of two of the 2 Mc/s check points near the opposite ends of the frequency band in use (i.e. around 50 and 130 degrees on the dial).
(v) Put on the headphones and turn the main tuning dial to approximately the reading of the first crystal check point chosen.

Note :—The 2 Mc/s crystal check points are easily identifiable, since the heterodyne beat notes at these points are much louder than the other beat notes which are also audible.

25. (i) When the required 2 Mc/s check point has been identified, tune as closely as possible to the " silent point," on either side of which the beat note will be heard, and note the dial reading, using the vernier.
(ii) If the dial reading obtained does not correspond exactly to the reading given in Table I, slacken the locking nut on the vernier adjustment (see fig. 1) and move the vernier by means of the larger milled nut until the correct dial reading is obtained.
(iii) Tighten the locking nut making sure that the above reading is maintained since the vernier has a tendency to shift as the locking nut is being secured.
(iv) If both dial readings are satisfactory, the readings obtained for the spot frequencies given in Table II should be correct over the whole wave-band range.
(v) If there is an error of more than about 0·5 of a scale division in the second check point, the test set must be re-calibrated.

Before proceeding any further, it should first be established that the error referred to in para. 25 (v), if present, is not caused through poor switch contacts or faulty tuning condensers.

26. If there is an additional test set type 210 of known accuracy available at the Unit concerned, the recalibration and the preparation of a fresh Table I may be carried out in the following manner.

27. (i) Set the wave-band switch of the faulty test set to Band 1 and the main tuning dial to the lower end of the scale with the vernier adjuster locked in the centre position.
(ii) Tune in the first loud crystal check point obtained; this should be the 20 Mc/s point.
(iii) If the new dial reading is within a few degrees of the old reading, and is quite stable, the new crystal check points can probably be identified by reference to the original Table I. If this is doubtful, the points may be checked by reference to another test set type 210 as follows :—

28. (i) Set up the second test set to the frequency required by means of its crystal check oscillator.
(ii) Switch off the crystal check oscillators on both test sets.
(iii) Listen on the faulty test set for a beat note, tune to the " silent point " and note the dial reading.
(iv) Switch off the second test set completely and re-check the dial reading obtained on the faulty test set by means of its own crystal oscillator.
(v) Now tune the faulty test set to the next loud check point on this band, which should be 22 Mc/s and check as before if in doubt.
(vi) The approximate dial reading for the 21 Mc/s point may be found by interpolation or by reference to the original Table I.
(vii) Repeat as described throughout the whole wave-band for all crystal check points required.

29. The following instructions should be observed, whilst recalibrating, in order to ensure accurate and reliable results.

(i) Do not adjust the vernier block during the initial calibration without re-checking some of the crystal check points already noted.

(ii) Always start the calibration from the lower frequency end of the scale (i.e. 0 degrees) towards the high frequency end (180 degrees).

(iii) Before starting the calibration, ensure that the oscillator is in a stable condition and that there is no intermittent frequency drift.

(iv) After calibrating all four wave-bands, re-check in the way described in para. 24 and 25. If the oscillator valve is changed, calibration on all bands must be checked as described in paragraphs 23 to 25 and a new master calibration chart prepared if necessary.

(v) If the calibration at any crystal check point at the lower end of any wave-band has moved by more than 5 degrees, or if the coverage given in para. 4 is not obtainable, the test set should be returned to Stores for servicing.

Note :—In all calibration checks, it is important that the modulation switch in the test set is set to OFF.

Method of use

30. In the following paragraphs, some examples are given of the procedure to be adopted when using the test set type 210 for daily inspections of aircraft installations.

(i) First ensure that the mains transformer tapping in the test set is correctly set for the supply voltage available. The test set type 210 is normally despatched with this tapping set for an 80 volts supply.

(ii) Place the test set on the test bench and connect up the power supply.

(iii) Allow at least five minutes for the set to warm up and thus avoid the possibility of frequency drift.

(iv) Remove the aerial sections from clips and insert the first section in the aerial socket located on the top of the test set.

(v) Set the modulation switch to ON, the crystal check switch to OFF and the wave band switch to the correct range for the RF. unit in the receiver under test.

(vi) Swing the main tuning control of the test set until the 15 Kc/s pulse signals are visible on the indicator (see fig. 10), turning the gain of the receiver up as required.

(vii) If a large enough signal cannot be obtained when using the first aerial section only, the second, and if necessary the third, section should be added.

Receiver tuning check for ARI.5083, etc.

31. (i) Connect up, and switch on the test set as previously described in para. 30.

(ii) Set the RF. unit stud switch (for RF. units type 24 and 25) or tuning dial (for RF. Units type 26 and 27) to the appropriate position.

(iii) Set the wave-band switch on the test set to the correct range and check the dial calibrations as described in para. 23. Correct the vernier, if necessary, as described in para. 25 (ii).

(iv) Move the tuning dial to the correct setting.

(v) With the modulator switch on the test set in the ON position, rotate the main tuning control until a maximum amplitude of pulse is displayed on the indicator.

32. If the dial reading is correct to within about 100 Kc/s, the RF. unit tuning may be considered satisfactory for most purposes. Where continuously tunable RF. units are under test, it is of minor importance whether the tuning is exactly correct at the spot frequency readings or not, provided that the tracking is correct over the band as, in practice, the final tuning for maximum signal is carried out whilst in the air.

33. Should the RF. unit be found off tune, it should be set up in the following manner :—

(i) For the RF. units type 24 and 25, set the main tuning dial of the test set to the required spot frequency.

(ii) Set the modulation switch to ON and adjust the RF. unit trimmers, with the trimming tool provided, through the appropriate holes in the side of the receiver. Reference may be made to A.P.2557A (ARI.5083) and to A.P.2557E (ARI.5525) for details and illustrations.

(iii) The trimmers should be adjusted in the following order :—

(*a*) Oscillator.

(*b*) Mixer.

(*c*) Amplifier.

(iv) Adjust the trimmers for maximum pulse amplitude with the receiver gain reduced to avoid overloading (it will be found convenient to observe the pulses in the strobe time-base position).

(v) When the trimmers have been adjusted in the order shown above, the settings should be re-checked as they may be slightly interdependent. This should be repeated for each stud number where necessary.

34. The tuning controls on RF. units type 26 and 27 have a single dial and are continuously variable. The tuning should be checked in the following manner :—

(i) Set the wave-band switch in the test set and the tuning control to the required spot frequency.

(ii) Adjust the RF. tuning control (large knob) and the aerial trimmer (small knob) for maximum signal amplitude on the indicator and note the approximate readings for the various spot frequencies on the RF. tuning dial.

(iii) If the RF. unit requires adjustment to the trimming and tracking condensers, this should be carried out as described in the appropriate A.P. or Maintenance Manual.

Receiver tuning check for MGRI.5528 TGRI. 5615, etc.

35. Receivers using the continuously tunable 20 to 30 and 40 to 50 Mc/s RF. units type 31, 32, etc., should be tuned as described in para. 31, but as on these there is a separate tuning dial for each stage, the approximate readings at the spot frequencies should be noted on each of these tuning dials.

Receiver sensitivity check

36. (i) Connect the aerial plug on the RF. unit of the receiver under test to the Pye output plug of the test set using the appropriate connector (type 5942).

(ii) Set the test set wave-band switch to OFF and the modulation switch to OFF.

(iii) Set the test set RF. output switch to NOISE.

(iv) Increase the receiver gain until a convenient amount of " grass " is seen on the indicator, say about 1/10 of an inch.

(v) Set the test set wave-band switch to NOISE and adjust the noise control (VR2) until the test set meter M1 reads 30 mA.

(vi) The " grass " on the indicator should now increase to approximately twice its former height if the receiver sensitivity is normal.

Note :—It is most important that the test set wave-band switch be set to the appropriate range when testing. Test set type 210 possesses a considerable harmonic content and one of these harmonics may be easily mistaken for the required signal if the wave-band switch is incorrectly set.

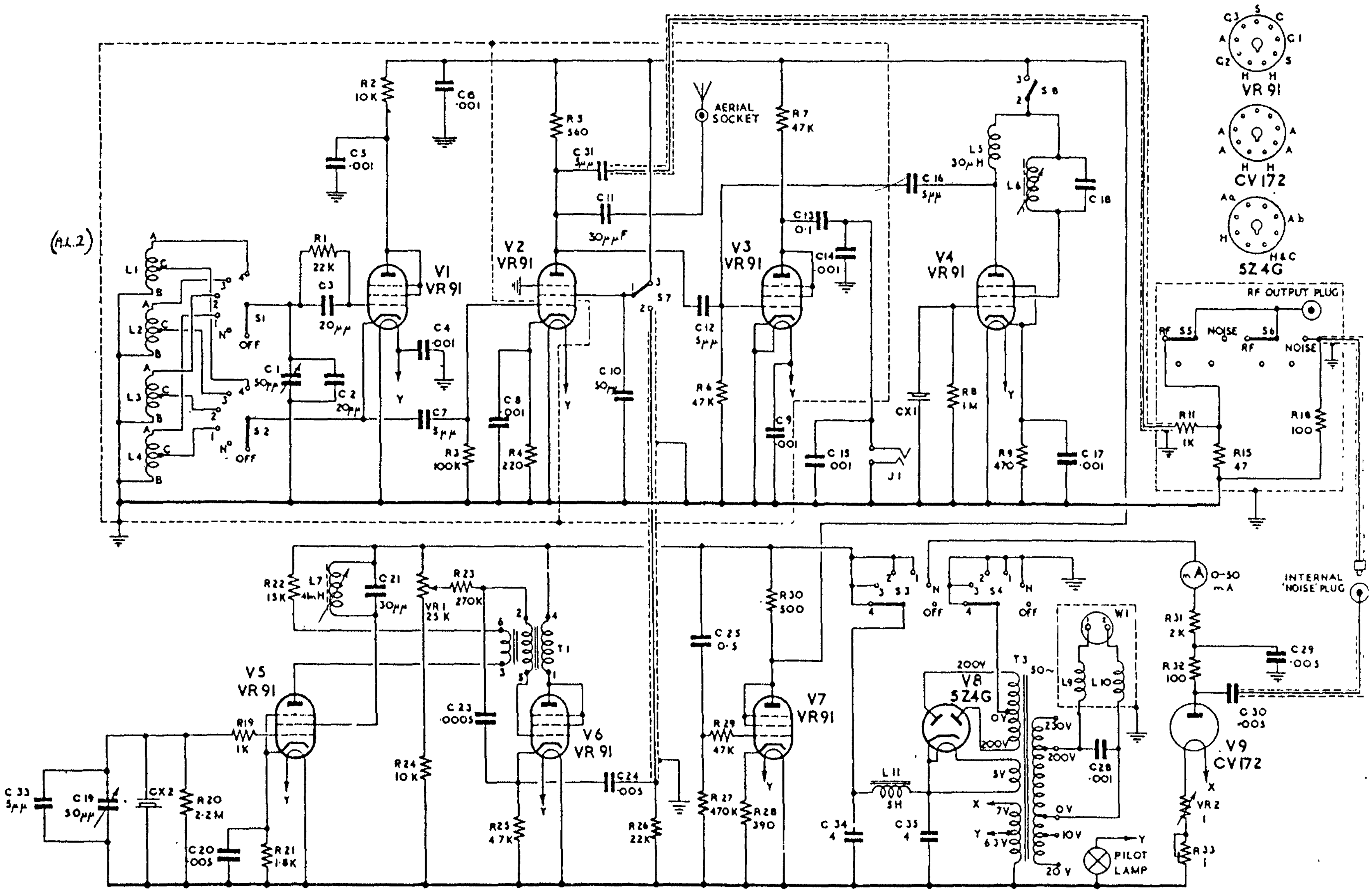


FIG. 7.—TEST SET TYPE 253, CIRCUIT

NOT THIS!

Method of checking wavemeter W1615, W1616

37. (i) Connect up the test set type 210 as described in para. 30, (i) to (iv). Connect the wavemeter under test to its appropriate power supply, and switch on.

(ii) Connect the aerial of the test set to the aerial terminal on the wavemeter by means of a length of wire.

(iii) Check the calibration of the test set as described in para. 23 and 24.

(iv) Set the modulation switch to CW. and the crystal check switch to OFF.

(v) Tune the test set to the spot frequency required, and then tune the wavemeter for maximum indication in the " Magic Eye."

(vi) Note the wavemeter dial reading, taking care to avoid harmonics (see Note at the end of para. 36).

Servicing

38. To remove the test set from its case, undo and remove the screws located along the top and bottom of the front panel. Remove the aerial socket bush by unscrewing the large nut on the top of the test set. Views of the test set are shown in fig. 3, 4, 5 and 6.

39. When the test set has been removed from its case, the RF. unit containing the valves V1, V2 and V3, and all the components in that portion of the circuit enclosed by a dotted line in the circuit diagram (see fig. 2), may be detached by unscrewing the two nuts and bolts on the same level with the bottom of the main tuning dial on the front panel. The two flexible leads should now be removed from their sockets and the remaining connections are automatically broken as the RF. unit is withdrawn. The RF. unit can now be slid out horizontally to the left.

40. To obtain access to the interior of the RF. unit, the 16 small countersunk screws securing the cover plate must be removed.

Note :—It is important that, when the RF. unit cover is removed, great care is exercised to avoid disturbing the coils, the wiring or the tuning condensers, as any such disturbance will necessitate recalibration.

TEST SET TYPE 253

41. Test set type 253 is contained in a steel case measuring 14in. × 8½in. × 11¼in. (excluding handles) and weighs 36 lb. The power supply for test set type 253 is 230 volts at 50 c/s. The test set can however be adapted to receive inputs ranging from 200 to 250 volts in 10 volt steps by modifying the wiring on the primary of the mains transformer in the power pack. Care should be taken when connecting up the test set to ensure that the correct tapping of the transformer is used.

42. The test set type 253 differs from test set type 210 only in its power pack, as can be ascertained by referring to fig. 7 which gives the circuit diagram of test set 253. In test set 253, the smoothing and the reservoir condensers (C34 and C35) are of 4μF. each, while the smoothing choke L11 has a value of 5 henries. The chokes L9 and L10 and the condenser C28 comprise an RF. filter circuit. Top and

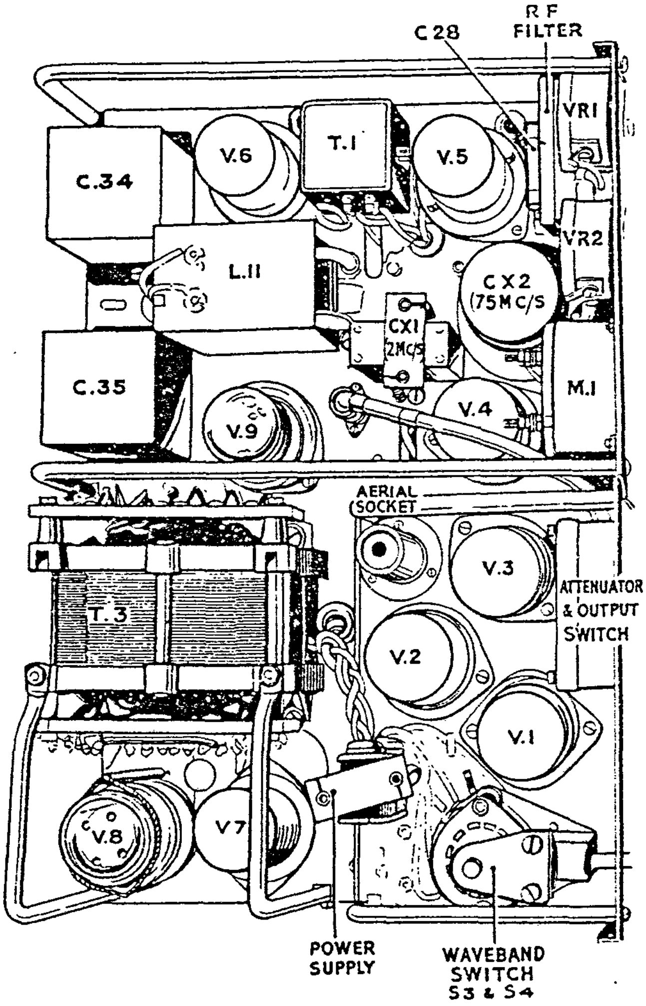


Fig. 8—Test set type 253 — chassis, top view

underside views of the chassis of test set 253 are shown in fig. 8 and 9. The front panel is similar in almost every respect to the front panel of test set 210, with the exception that the power input plug is a two-pin W-plug and is labelled : 50 C/S INPUT.

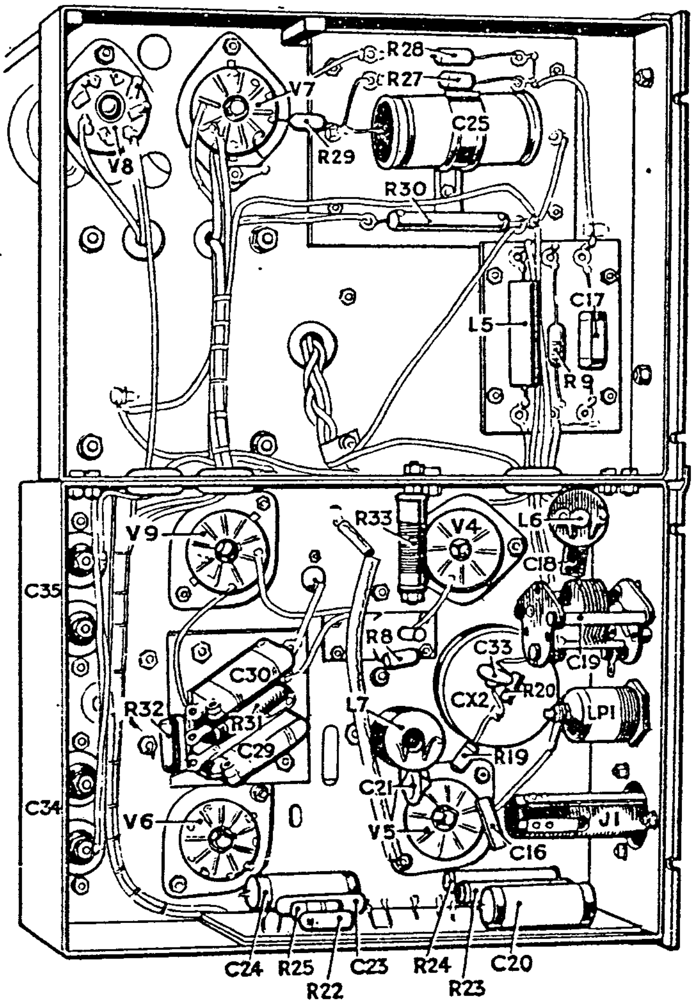


Fig. 9—Test set type 253 — chassis, underside view

ATTENUATOR UNIT TYPE 70

43. Attenuator unit type 70 (Ref. 10A/16129) is a calibrated attenuator used in conjunction with test sets type 210 and type 253. A dissected view of the attenuator is shown in fig. 11. It consists merely of a metal cylinder with movable piston mounted on a board which can be secured on to the top of the test set by means of four small metal spring clips. The movement of the piston in the cylinder can be measured on a scale engraved on the piston shaft.

44. The piston consists of an empty metal cylinder which fits closely around the fixed part of the attenuator—a probe projecting inside the left-hand part of the cylinder—thus giving a condenser action to the attenuator when the piston is pushed all the way into the cylinder—i.e when very little attenuation is required.

TYPICAL TABLE I READINGS ARE FOR EXAMPLE ONLY

BAND 1		BAND 2		BAND 3		BAND 4	
FREQ. OF CRYSTAL CHECK	DIAL READING	FREQ. OF CRYSTAL CHECK	DIAL READING	FREQ. OF CRYSTAL CHECK	DIAL READING	FREQ. OF CRYSTAL CHECK	DIAL READING
20 MC/S	21·1	28 MC/S	8·5	41 MC/S	21·6	60 MC/S	7·7
21	48·3	29	28·2	42	35·0	61	17·5
22	71·3	30	46·5	43	47·0	62	26·0
23	91·8	31	62·6	44	58·0	63	34·3

TYPICAL TABLE II READINGS ARE FOR EXAMPLE ONLY

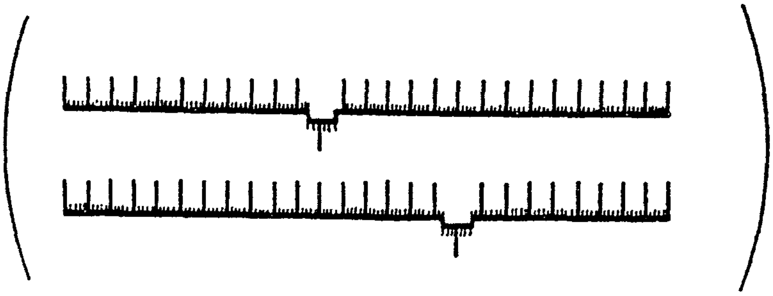
R.F. UNIT Nº 24				R.F. UNIT Nº 25			
STUD # NUMBER	FREQUENCY (MC/S)	TEST SET 210 DIAL R'D'G	TEST SET 210 BAND Nº	STUD # NUMBER	FREQUENCY (MC/S)	TEST SET 210 DIAL R'D'G	TEST SET 210 BAND Nº
CHECK POINT	22·0	71·3	1	CHECK POINT	40·0	155·9	2
1	21·9	69·0	1	1	43·0	47·0	3
2	22·9	89·8	1	CHECK POINT	44·0	58·0	3
3	25·3	128·4	1	2	44·9	67·5	3
CHECK POINT	26·0	137·4	1	3	46·8	86·1	3
4	27·3	151·7	1	4	48·0	97·0	3
5	29·7	41·0	2	5	50·5	116·4	3
CHECK POINT	30·0	46·5	2				

DIAL READING IN THE CASE OF R.F. UNITS 26&27

SIMILAR TABLE FOR R.F. UNITS 26 AND 27
SPOT FREQUENCY READINGS OBTAINED BY INTERPOLATION
FROM TABLE I AS DESCRIBED IN PARAS 18 TO 20

TYPICAL TABLE III FOR R.F. UNIT TYPE 31

FREQUENCY (MC/S)	TEST SET 210		R.F. UNIT TYPE 31		
	DIAL R'D'G	BAND Nº	OSC.	MIXER	AERIAL



15 KC/S PULSE SIGNALS FROM TEST SET SEEN ON MAIN TIME BASE OF INDICATOR

Fig. 10—Tables

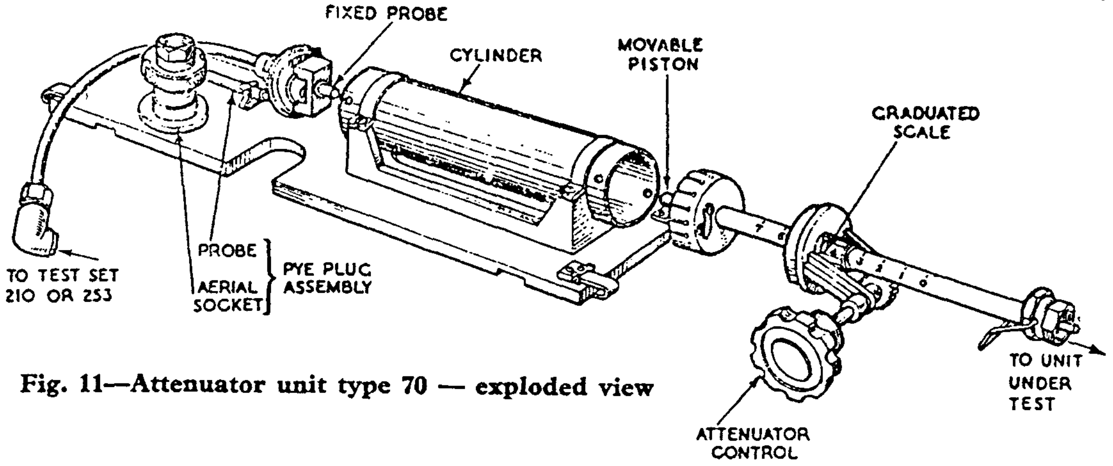
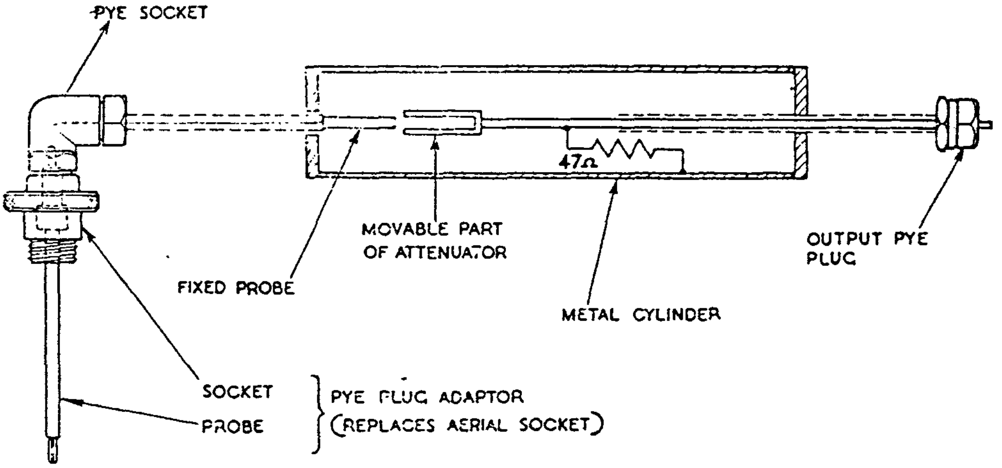


Fig. 11—Attenuator unit type 70 — exploded view



(A.L.2.)

Fig. 12—Attenuator unit type 70 — schematic diagram

45. The probe is connected electrically to the test set by means of a Pye plug assembly which, when mounted, fits into the aerial socket of the test set. The Pye plug assembly consists of a probe which is clipped to the attenuator mounting board when not in use, and of a threaded socket which fits closely around and secures the probe to the test set. This threaded socket replaces the aerial socket when in use and, when not in use, is screwed to an appropriate mounting on the attenuator mounting board.

46. The attenuator is also supplied with a length of cable which feeds the attenuated output of the test set concerned to the unit undergoing tests. Diagrams showing the mode of action of the test set are given in fig. 12, and 13.

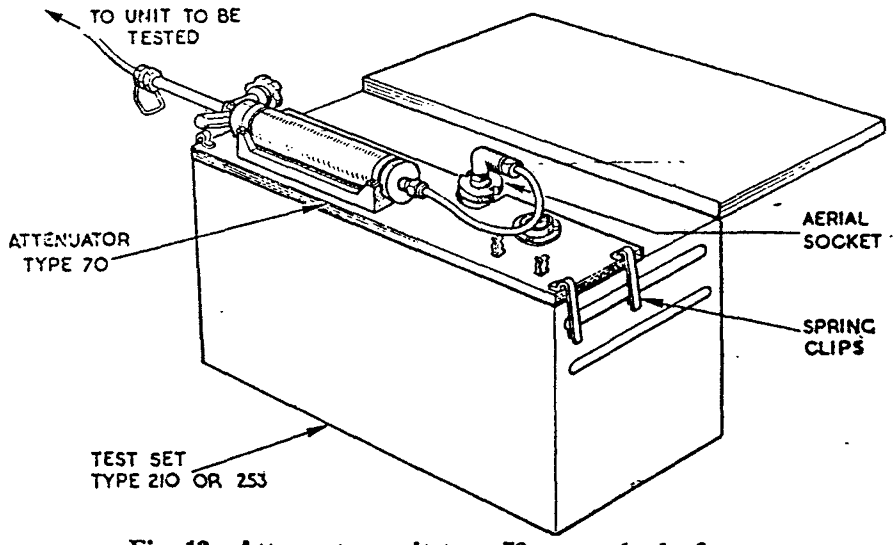


Fig. 13—Attenuator unit type 70 — method of use

APPENDIX I

TEST SET TYPE 210

LIST OF PARTS

The following list of parts is given for reference only. When ordering spares reference should be made to Vol. III of this publication, if available, or to A.P.1086.

Circuit Ref.	*Stores Ref.*	*Description*	*Quantity*
	10S/16002	Test Set Type 210	1
	Consisting of :—		
	10B/16102	Aerial Element (Top section)	1
	10B/16103	Aerial Element (Middle section)	1
	10B/16104	Aerial Element (Base section)	1
C1, C19	10C/13847	Condenser Type 4544 : 4-50μμF. variable	2
C2, C3	10C/3200	Condenser Type 1555 : 20μμF. ±10%, 350V.	2
C4, C5, C6, C8, C9, C14, C15	10C/3396	Condenser Type 1660 : ·001μF. ± 10%, 350V.	7
C7, C11, C12, C16	10C/5454	Condenser Type 2956 : 5μμF. ± 10%, 500V.	4
C10	10C/3612	Condenser Type 1819 : 50μμF. ± 10%, 500V.	1
C13	10C/11126	Condenser Type 3362 : ·1μF. ± 20%, 350V.	1
C17, C28	10C/14	Condenser Type 570 : ·001 μF. ± 15%, 350V.	2
C18, C21	10C/2920	Condenser Type 1397 : 30 μμF. ± 10%, 500V. DC.	2
C20, C24	10C/11120	Condenser Type 3358 : ·005 μF. ± 25%, 1000V. DC.	2
C23	10C/5144	Condenser Type 2736 : 500 μμF. ± 10%, 350V.	1
C25	10C/11131	Condenser Type 3367 : ·5μF. ± 20%, 500V. DC.	1
C26	10C/11128	Condenser Type 3364 : ·25μF. ± 20%, 350V.	1
C27	10C/11129	Condenser Type 3365 : ·25μF. ± 20%, 500V.	1
C29, C30	10C/3788	Condenser Type 1918 : ·005μF. ± 10%, 350V. DC.	2
VR1	10W/8573	Resistance Type 2081 : 25K ± 5%, 3W. Variable	1
VR2	10W/15783	Resistance Type 4467 : 1 ohm. ± 5%, 3W., Variable	1
R1, R26	10W/1879	Resistance Type 9/21 : 22K. ± 20%, ¼W.	2
R2	10W/6079	Resistance Type 6076 : 10K. ± 20%, ½W.	1
R3	10W/6840	Resistance Type 6840 : 100K. ± 20%, ½W.	1
R4	10W/8327	Resistance Type 8327 : 220 ohms. ± 20%, ¼W.	1
R5	10W/689	Resistance Type 873 : 560 ohms. ± 10%, ¼W.	1
R6	10W/6847	Resistance Type 6847 : 47K. ± 20%, 1W.	1
R7, R29	10W/1882	Resistance Type 9/23 : 47K. ± 20%, ¼W.	2
R8	10W/1889	Resistance Type 9/31 : 1M. ± 20%, ¼W.	1
R9	10W/9507	Resistance Type 2760 : 470 ohms. ± 20%, ¼W.	1
R11, R19	10W/1867	Resistance Type 9/13 : 1K. ± 20%, ¼W.	2
R15	10W/8297	Resistance Type 8297 : 47 ohms. ± 20%, 1/10W.	1
R18	10W/8684	Resistance Type 2158 : 100 ohms. ± 20%, 1/10W.	1
R20	10W/996	Resistance Type 996 : 2·2M. ± 20%, ¼W.	1
R21	10W/6911	Resistance Type 6911 : 1·8K. ± 10%, ¼W.	1
R22	10W/8424	Resistance Type 8424 : 15K. ± 20%, ½W.	1
R23	10W/1802	Resistance Type 1802 : 270K. ± 10%, 1W.	1
R24	10W/8425	Resistance Type 8425 : 15K. ± 20%, 1W.	1
R25	10W/1850	Resistance Type 8/17 : 4·7K. ± 20%, ½W.	1
R27	10W/1884	Resistance Type 9/29 : 470K. ± 20%, ¼W.	1
R28	10W/1462	Resistance Type 1462 : 390 ohms. ± 10%, ¼W.	1
R30	10W/7445	Resistance Type 7445 : 500 ohms. ± 10%, 6W.	1
R31	10W/1217	Resistance Type 1217 : 2K. ± 10%, 6W.	1
R32	10W/1954	Resistance Type 1954 : 100 ohms. ± 20%, ½W.	1
R33		0·5 ohms. (special)	1
L3	10C/14316	Inductance Type 1121	1
L4	10C/14315	Inductance Type 1120	1
L5	10C/13774	Choke HF. Type 597 : 30μH.	1
L6	10C/14322	Coil assembly	1
L7	10C/14321	Coil assembly	1
L8	10C/13775	Choke L.F. Type 498 : 2H.	1
L9, L10	10P/16013	Filte Unit Type 183	1
V1, V2, V3, V4, V5, V6, V7	10E/92	Valve Type VR91, Screened pentode	7

Circuit Reference	*Stores Ref.*	*Description*	*Quantity*
V8	10E/598	Valve Type 5Z4G Full wave rectifier	1
V9	10E/CV172	Valve Type CV172, Noise diode	1
LP1	5L/6	Lamp Filament, 6V., ·36W.	1
	10A/14203	Lampholder Type 94	1
	10A/13153	Retainer Valve Type 28	3
	10A/2937	Retainer Valve Type 100	5
	10A/3568	Retainer Valve Type 130	1
CX1	10X/2000	Crystal	1
CX2	10XC/2	Crystal	1
T2	10K/1672	Transformer Type 1770 (Mains)	1
T1	10K/1518	Transformer Type 1556 (Divider)	1
M1	10A/11278	Milliammeter Type G	1
	10H/4175	Plug Type 582	1
W2	10H/391	Plug Type W198	1
W1	10H/528	Plug type 229	1
	10H/18804	Plug Type	1
	10H/18686	Plug Type 678	1
	10H/18811	Socket Type	1
	10H/18687	Socket Type 638	1
	10H/1123	Socket Type W244	1
J1	10H/8241	Socket Type 33	1
S1, S2, S3, S4	10FB/1274	Switch Type 1523	1
S5, S6	10FB/1275	Switch Type 1524	1
S7	10F/747	Switch, Type 576	1
S8	10F/10338	Switch, Type 152	1
	10A/19009	Tag Board, Type 506	1
	10A/19010	Tag Board, Type 507	1
	10A/19011	Tag Board, Type 508	1
	10AB/2492	Tag Board, Type 166	1
	10A/19015	Tag Board, Type 509	1
	10S/16069	Attenuator Box	1
	10S/16067	Spindles, Condenser	1
	10H/4176	Connector, Type 1405/1	1
	10A/14534	Couplings, Type 58	1
	10S/16066	Drive Anchor Block	1
	10A/14749	Dials, Slow Motion Type 23	1
	10A/12745	Knob, Type 67	2
	10S/16068	Receptacle, single pole	1
	10HA/1155	Connector, Type 5941 (Power Supply)	1
	10HA/1156	Connector, Type 5942 (RF. Output)	1

APPENDIX II

TEST SET TYPE 253

LIST OF PARTS

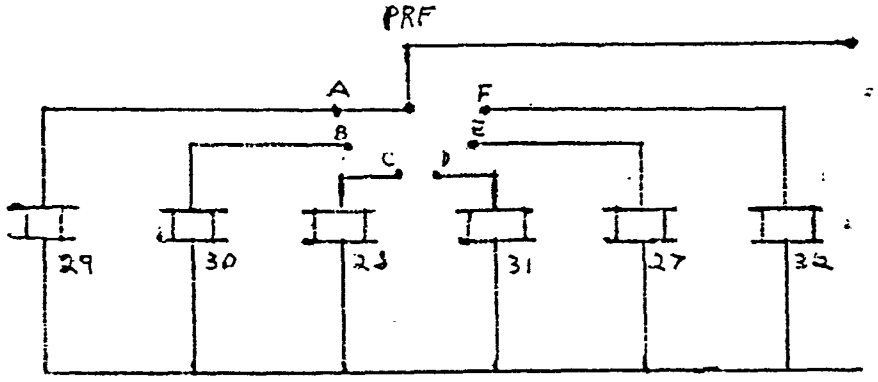
The following list of parts is given for reference only. When ordering spares reference should be made to Vol. III of this publication, if available or to A.P.1086.

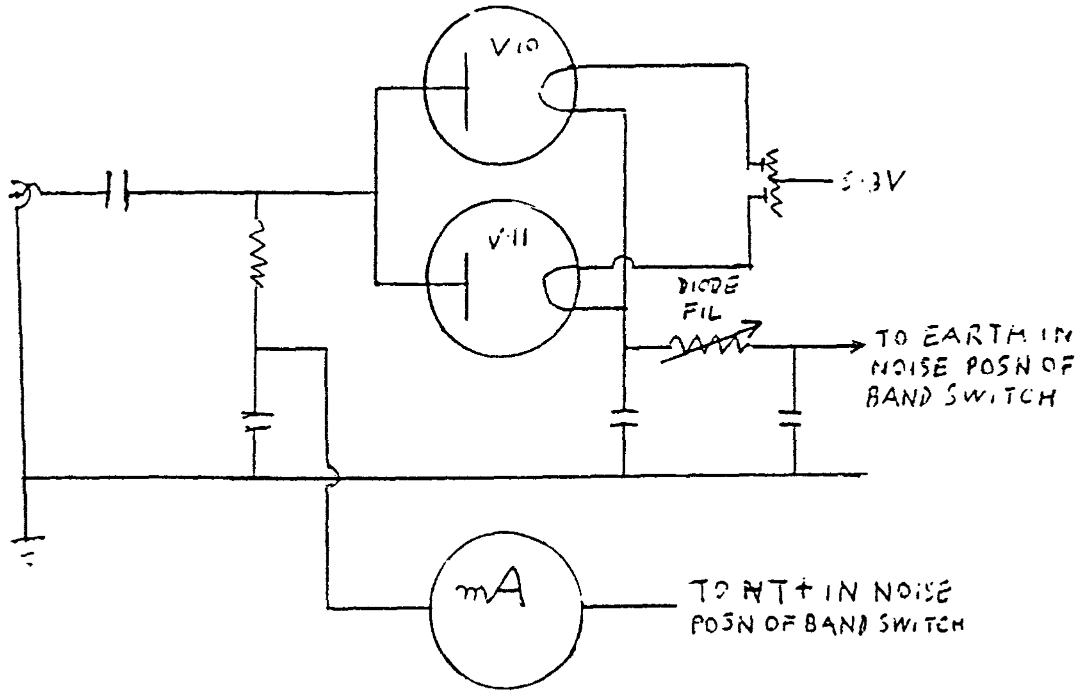
Circuit Reference	*Stores Ref.*	*Description*	*Quantity*
	10S/16049	Test Set, Type 253	1
	Consisting of :—		
	10B/16102	Aerial Element (Top section)	1
	10B/16103	Aerial Element (Middle section)	1
	10B/16104	Aerial Element (Base section)	1
C1, C19	10C/4870	Condenser, Type 2562 : 4-50$\mu\mu$F., Variable	2
C2	10C/15215	Condenser, Type 5197 : 18$\mu\mu$F. ± 5%, 500V.	1
C3, C11	10C/3200	Condenser, Type 1555 : 20$\mu\mu$F. ± 10%, 350V., DC.	2
C4, C5, C6, C8, C9, C14, C15, C17, C28	10C/14	Condenser, Type 570 : ·001μF. ± 15%, 350V., DC.	9
C7, C12, C16, C31 & C33	10C/5454	Condenser, Type 2956 : 5$\mu\mu$F. ± 10%, 500V., DC.	5
C10	10C/3612	Condenser, Type 1819 : 50$\mu\mu$F. ± 10%, 500V., DC.	1
C13	10C/11126	Condenser, Type 3362 : ·1μF. ± 20%, 550V., DC.	1
C18, C21	10C/2920	Condenser, Type 1397 : 30$\mu\mu$F. ± 10%, 500V., DC.	2
C20, C24	10C/11122	Condenser, Type 3358 : ·005μF. ± 25%, 1000V., DC.	2
C23	10C/5144	Condenser, Type 2736 : 500$\mu\mu$F. ± 10%, 350V., DC.	1
C25	10C/11131	Condenser, Type 3367 : ·5μF. ± 20%, 500V., DC.	1
C29, C30	10C/3788	Condenser, Type 1918 : ·005μF. ± 10%, 350V., DC.	2
C34, C35	10C/12946	Condenser, Type 4138 : 4 μF. ± 20%, 250V., DC.	2
VR1	10W/8573	Resistance, Type 2081 : 25K. ± 10%, 3W., Variable	1
VR2	10W/15783	Resistance, Type 4467 : 1 ohm. ± 5%, 3W., Variable	1
R1, R26	10W/1879	Resistance, Type 9/21 : 22K. ± 20%, ¼W.	2
R2	10W/6079	Resistance, Type 6079 : 10K ± 20%, ½W.	1
R3	10W/6840	Resistance, Type 6840 : 100K. ± 20%, ½W.	1
R4	10W/8327	Resistance, Type 8327 : 220 ohms. ± 20%, ¼W.	1
R5	10W/689	Resistance, Type 873 : 560 ohms. ± 10%, ¼W.	1
R6, R29	10W/1882	Resistance, Type 9/23 : 47K. ± 20%, ¼W.	2
R7	10W/6847	Resistance, Type 6847 : 47K. ± 20%, 1W.	1
R8	10W/1889	Resistance, Type 9/31 : 1M. ± 20%, ¼W.	1
R9	10W/9507	Resistance, Type 2760 : 470 ohms. ± 20%, ¼W.	1
R11	10W/6654	Resistance, Type 6654 : 1K. ± 20%, 1/10W.	1
R15	10W/8297	Resistance, Type 8297 : 47 ohms. ± 20%, 1/10W.	1
R18	10W/8684	Resistance, Type 2158 : 100 ohms. ± 20%, 1/10W.	1
R19	10W/1867	Resistance, Type 9/13 : 1K. ± 20%, ¼W.	1
R20	10W/996	Resistance, Type 996 : 2·2M. ± 20%, ¼W.	1
R21	10W/6911	Resistance, Type 6911 : 1·8K. ± 10%, ¼W.	1
R22	10W/8424	Resistance, Type 8424 : 15K. ± 20%, ½W.	1
R23	10W/1802	Resistance, Type 1802 : 270K. ± 10%, 1W.	1
R24	10W/1830	Resistance, Type 2/19 : 10K. ± 20%, 1W.	1
R25	10W/1850	Resistance, Type 8/17 : 4·7K. ± 20%, ½W.	
R27	10W/1884	Resistance, Type 9/29 : 470K. ± 20%, ¼W.	1
R28	10W/1462	Resistance, Type 1462 : 390 ohms. ± 10%, ¼W.	1
R30	10W/7445	Resistance, Type 7445 : 500 ohms. ± 10%, 6W.	1
R31	10W/1217	Resistance, Type 1217 : 2K. ± 10%, 6W.	1
R32	10W/1954	Resistance, Type 1954 : 100 ohms. ± 20%, ¼W.	1
or R32	10W/1858	Resistance, Type 9/7 : 100 ohms. ± 20%, ¼W.	1
R33	10W/15783	Resistance, Type : 1 ohm., 6W., w.-wound preset	1
L3	10C/14316	Inductance, Type 1121	1
L4	10C/14315	Inductance, Type 1120	1
L5	10C/13774	Choke, H.F., Type 597 : 50 μH	1
L6	10C/14322	Coil Assembly	1
L7	10C/14321	Coil Assembly	1
L9, L10	10P/16013	Filter Unit, Type 183	1
L11	10C/15214	Choke, L.F., Type 610 : 5H.	1

Circuit Reference	*Stores Ref.*	*Description*	*Quantity*
V1, V2, V3, V4, V5, V6, V7	10E/92	Valve, Type VR91 : Screened pentode	7
V8	10E/598	Valve, Type 5Z4G : Full-wave rectifier	1
V9	10E/CV172	Valve, Type CV172 : Noise diode	1
LP1	5L/6	Lamp, Filament, 6V., ·36W.	1
	10A/14203	Lampholder, Type 94	1
	10A/13153	Retainer, Valve, Type 28	3
	10A/2937	Retainer, Valve, Type 100	5
	10A/3568	Retainer, Valve, Type 130	1
	10H/3237	Holder, Valve, Type 238	3
	10H/5043	Holder, Valve, Type 286	5
	10H/493	Holder, Valve, Type 73	1
CX1	10X/2000	Crystal	1
CX2	10XC/1	Crystal	1
or CX2	10XC/2	Crystal	1
T1	10K/1518	Transformer, Type 1556 (Divider)	1
T3	10K/2153	Transformer, Type 1968 (Mains)	1
M1	10A/11278	Milliammeter, Type G.	1
W1	10H/528	Plug, Type 229	1
W3	10H/389	Plug, Type W196	1
	10H/4175	Plug, Type 582	1
	10H/18686	Plug, Type 678	1
	10H/18804	Plug, Type	1
V1	10H/8241	Socket, Type 33	1
	10H/18687	Socket, Type 638	1
	10H/18811	Socket, Type	1
S1, S2, S3, S4	10FB/1274	Switch, Type 1523	1
S5, S6	10FB/1275	Switch, Type 1524	1
S7	10F/747	Switch, Type 576	1
S8	10F/10338	Switch, Type 152	1
	10H/19009	Tag Board, Type 506	1
	10A/19010	Tag Board, Type 507	1
	10A/19011	Tag Board, Type 508	1
	10AB/2492	Tag Board, Type 166	1
	10A/19015	Tag Board, Type 509	1
	10S/16069	Attenuator Box	1
	10S/16067	Spindles, Condenser	1
	10H/4176	Connector, Type 1405/1	1
	10A/14534	Couplings, Type 58	1
	10S/16066	Drive Anchor Block	1
	10A/14749	Dial, Slow Motion, Type 23	1
	10A/12745	Knob, Type 67	2
	10S/16068	Receptacle, Single pole	1
	10S/16109	Cases, Transit, for Test Set Type 253	1

GOVT. MODIFICATION TO TEST SET 253 SER Nº 99

THIS CIRCUIT REPLACES
CX2 IN ORIGINAL EQUIPMENT
SEE AP2563J Vol I





V10+11 CV2171 (A2087)

GOVT MODIFICATION TO TEST SET 253 SER Nº 99

THE ABOVE CIRCUIT REPLACES NOISE GENERATOR
V9 IN ORIGINAL EQUIPMENT. SEE AP2563J Vol I