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AIR PUBLICATION
2531A&C, D&E
VOLUME 6
PART 2

UHF MULTI AND SINGLE -CHANNEL TRANSMITTERS TYPE T.7096 AND T.7355

AND

AMPLIFIERS (RF POWER) TYPE A.7349 AND A.9365

REPAIR AND RECONDITIONING INSTRUCTIONS

(ADVANCE INFORMATION)

Prepared by direction of the Minister of Supply

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Promulgated by Command of the Air Council

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AIR MINISTRY

NOTE TO READERS

The subject matter of this publication may be affected by Admiralty Fleet Orders, or Air Ministry Orders, or by General Orders and Modifications" leaflets in this A.P., in the associated publications listed below, or even in some others. If possible, Amendment Lists are issued to correct this publication accordingly, but it is not always practicable to do so. When an Order, or leaflet contradicts any portion of this publication, the Order or leaflet is to be taken as the overriding authority.

The inclusion of references to items of equipment does not constitute authority for demanding the items.

Each leaf, except the original issue of preliminaries, bears the date of issue and the number of the Amendment List with which it was issued. New or amended technical information on new leaves which are inserted when this publication is amended will be indicated by a vertical line in the margin. This line merely denotes a change and is not a mark or emphasis. When a Part, Section, or Chapter is issued in a completely revised form, the line will not appear.

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LIST OF ASSOCIATED PUBLICATIONS

	A.P.
U.H.F. Multi-channel receiver Type R.7109, Naval receiver outfit CUJ	2531B
U.H.F. Single-channel receiver Type R.7351, Naval receiver outfit CUK	2531F
12-24 Channel remote control equipment - ground	2529G

The Air Publications describing the test equipment are given in the Tables in Sect. 1, Chap. 1

CONTENTS

PRELIMINARIES

SECTION 1

INTRODUCTION

SECTION 2

SINGLE-CHANNEL TRANSMITTER TYPE T.7355 AND AMPLIFIER (RF) POWER TYPE A.9365

SECTION 3

MULTI-CHANNEL TRANSMITTER TYPE T.7096 AND AMPLIFIER (RF) POWER TYPE A.9365

Transmitter Type T.7096 - overall tests
Transmitter unit assembly
Transmitter unit Type 7703
Amplifying and drive unit radio
Oscillator unit Type 7106
Mixer unit Type 7100
Comparator unit Type 7101
Relay unit Type 7346
Selector unit Type 7102
Selector unit Type 9008 and 9008A
Chassis assembly Type 9226
Fan assembly Type 9239
Cable assembly Type 9206
Probe assembly Type 9242
Power unit Type 7097
Power unit assembly
Chassis assembly Type 9250
Relay unit Type 9230
Cable assembly Type 9207
Amplifier (r.f.) power Type A.9365
Amplifier unit assembly

The following items which form part of the multi-channel equipment as well as the single-channel equipment are described in Section 2.

Modulator unit Type 7099	Chap. 3
Monitoring unit Type 7107	Chap. 5
Amplifying unit Type 9201 and power unit Type 9202 with their sub-assemblies	Chap.13 to Chap.22

SECTION 4

ANCILLARY EQUIPMENT

Blower, air, Type 7344
Test set Type 7618

SECTION 1

INTRODUCTION

Chapter 1

GENERAL INFORMATION AND TEST EQUIPMENT

LIST OF CONTENTS

LIST OF TABLES

INTRODUCTION

1. This Volume is issued as an interim measure to meet the needs of units engaged in third line servicing of the following u.h.f. equipments:-

(1) Multi-channel transmitter Type T.7096 and amplifier (r.f.) power Type A.7349.

(2) Single-channel transmitter Type T.7355 and amplifier (r.f.) power Type A.9365.

(3) Associated ancillary equipment.

2. The information in this Volume is based upon the production test specifications prepared by the manufacturer. It is possible that the performance figures given for certain of the tests may have to be relaxed slightly to allow for ageing of the components.

3. The equipment is of sub-unit construction and a specification has been prepared for each sub-unit. Therefore, a separate chapter is to be written for individual sub-units. The various chapters are listed in the Contents Sheet at the front of the book.

4. Where the test equipment used by the Servicing unit is not a direct equivalent of that used by the manufacturer, due regard must be made for this and the associated test figures co-related.

5. General and technical information, including circuits, construction, installation, servicing and fault finding is given in A.P.2531A and C, Vol. 1 for the multi-channel equipment and in A.P.2531D and E, Vol. 1 for single-channel equipment. Each circuit is available as a miniature air diagram, the number of which is to be found on the appropriate circuit.

TEST EQUIPMENT

6. The approved test equipment includes a number of items which are for use with both the multi channel and the single channel equipments. The equipment can be divided into three main categories:-

(1) Equipment which is obtainable from Service stores. This is tabulated as follows:-

(a) Table 1. This contains items which are for use with both the multi and the single-channel equipments.

(b) Table 2. This contains additional items which are for use with the multi-channel equipment.

(c) Table 3. This contains additional items for use with the single-channel equipment.

(2) Commercial test equipment used by the manufacturer. These items and their Service equivalents (if known) are given at the beginning of the appropriate servicing chapter.

(3) Test units built by the manufacturer to facilitate production tests viz., load units, switch units and other similar devices. The circuit diagram and a list of the components required to construct a required test unit are given in the appropriate servicing chapter. In some instances the components can be used as individual items in a given test and in others it will be advantageous to assemble them as a complete test unit.

Note...

In Table 1 the quantities given are those required for servicing either a multi-channel or a single-channel equipment independently.

TABLE 1

Test equipment for multi and single-channel equipments (para. 1)

Item	Ref. No.	Description	Qty	Remarks
1	1H/100	Tool, valve extracting	1	
2	1C/6339	Spanner, double ended, open jaw ½ in. x 9/16 in. a.f.	1	For use with the bolts which secure major units together in a stack.
3	1H/47	Adjuster, armature No. 2	1	Tools for G.P.O. relays K.3000
4	1H/51	Adjuster, spring No. 1	1	
5	1H/52	Adjuster, spring No. 2	1	
6	1H/6	Cleaner, contact No. 1	1	
7	1H/6	Gauge, feeler No. 1	1	
8	1H/57	Gauge, tension No. 1	1	
9	1H/58	Gauge, tension No. 2	1	
10	1H/61	Insulator, contact	1	
11	1B/4487	Mirror, inspection	1	
12	1H/64	Plier, adjusting No. 2	1	
13	1C/2176	Screwdriver, instrument No. 1	1	
14	1H/13	Screwdriver, instrument No. 2	1	
15	1H/16	Screwdriver, instrument No. 5	1	

16	4G/5421	Cleaner, vacuum large	1	A.M.S.E.C. scale 105
17	10AH/9	Headset low impedance, consisting of:-	1	
17A	10AH/7376	Cord, instrument Type E	1	
17B	10A/12160	Headband, Type C	1	
17C	10AD/13466	Receiver, telephone head Type 32	2	
17D	10H/488	Plug Type 1	1	
18	10A/12052	Microphone, Type 23	1	
19	10H/242	Plug Type 170	1	Substitute for microphone and press to talk switch to permit c.w. signal to be radiated (A.P.2531A/C and D/E, Vol. 1)
20	10H/16830	Test set Type 7618	1	Special to type test set A.P.2531A/C and D/E, Vol. 1
21	10S/17001	Multimeter Type 9980	1	A.P.2536C
		OR		
21A	10S/16441	Multimeter Type 1	1	
22	10T/16	Frequency meter Type SCR211	1	A.P.2284A
		OR		
22A		Any of the BC 221 series	1	
23	10K/19450	Power unit Type 7262	1	For use with item 22
24	5G/1621	Tester insulation Type A	1	A.P.4343
		OR		
24A	5G/203	Tester insulation Type D	1	
25	10S/16308	Multimeter CT38	1	A. .2879AG
26	10S/AP63729	R.F. power and modulation meter CT214	1	A.P.2879AQ
		AND		
26A	10S/AP64009	Matching transformer 70 to 50 ohms		
27	10S/647	Signal generator Type 56	1	A.P.2879D
		OR		
27A	10S/16822	Signal generator Type 56A	1	
		OR		
27B	10S/16780	Signal generator CT218	1	A.P.2536CF
28	10S/831	Oscilloscope Type 13A	1	A.P.2879AF
29	10S/16400	Test set Type 193A	1	(Crystal activity tester A.P.2536C

30	10K/17631	Transformer Type 3236	1	For use with item 31
31	10S/16499	Signal generator Type 65B	1	A.P.2879AD
		OR		
31A	10S/16446	Signal generator Type 65A	1	
		OR		
31B	10S/16344	Signal generator Type 65	1	
		OR		
31C	10S/72	Test set Type 37	1	A.P.2579H
32	10AG/78	Alignment tool, electronic equipment Type 2	1	Slug adjuster
33	10AG/79	Alignment tool, electronic equipment Type 3	1	Lock nut spanner
34	10AG/83	Alignment tool, electronic equipment Type 4	1	Trimmer screwdriver
				A.P. 2531A/C and A.P. 2531D/E
35	10AG/96	Alignment tool electronic equipment Type 6	1	R.F. trimmer tools for amplifiers (R.F. power Type A.7349 and A.9365
36	10AG/97	Alginment tool, electronic equipment Type 7	1	
37	10S/16460	Test set Type 373A	1	L.C.R. bridge A.P.2536C
38	10W/0221207	Resistor 560 ohm	1	For use with Plug Type 170 item 19
39	10AG/111	Wand, alignment 3/16 in. diameter, 6 in. long	1	
40	10H/0560044	Socket r.f. free	1	For local manufacture of connector for use with CT214 item 26. A.P.2531D/E Vol. 5
41	10H/0970145	Sleeves inner	1	
42	10H/0970146	Sleeve outer	1	
43	10H/0970113	Nuts union	1	
44	5E/3267	Cable r.f. uniradio Type 67 (approx. 5 ft)	1	

TABLE 2

Test equipment (additional to Table 1) for use with multi-channel equipment (para. 1)

Item	Ref. No.	Description	Qty	Remarks
1	10HG/93	Connector B14/20C/R5	1	
2	10HG/94	Connector B14/20C/R6	1	Power unit Type 7096 to transmitter unit Type 7703 also Power unit Type 7096 to mounting plinth
3	10HG/91	Connector B12/20B/R9	1	
4	10HG/90	Connector B4/50F/R8	1	
5	10HG/100	Connector B23/40E/R2	1	
6	10HG/109	Connector B23/20A/R3	1	
7	10HG/111	Connector B14/30B/R2	1	For use when testing remote control
8	10HG/115	Connector B14/10B/R3	1	
9	10HG/116	Connector BE4/50A/R1	1	
10	ZDH or ZDM 15166.666	Crystal unit quartz	1	For use with test set Type 193A. Table 1, item 29
11	ZDH or ZDM 6333.333	" " "	1	
12	ZDH or ZDM 18333.333	" " "	1	
13	ZDM/12500.00	" " "	2	
14	ZDM/15833.333	" " "	1	
15	ZDM/15166.666	" " "	1	
16	ZDM/17500.00	" " "	1	
17	ZDM/12777.777	" " "	1	
18	ZDM/13888.888	" " "	1	
19	ZDM/15000.00	" " "	1	See Note
20	ZDM/16111.111	" " "	1	
21	ZDM/12166.666	" " "	1	
22	ZDM/12833.333	" " "	1	
23	ZDM/13166.666	" " "	1	
24	ZDM/13500.00	" " "	1	
25	ZDM/13833.333	" " "	1	

(A.L.1, Feb. '59)

26	ZDM/14166.666	Crystal unit quartz	2)	
27	ZDM/14500.00	" " "	1)	
28	ZDM/14833.333	" " "	1)	
29	ZDM/6033.333	" " "	1)	
30	ZDM/6066.666	" " "	1)	
31	ZDM/6100.00	" " "	1)	
32	ZDM/6133.333	" " "	1)	
33	ZDM/6166.666	" " "	1)	
34	ZDM/6200.00	" " "	1)	See Note
35	ZDM/6233.333	" " "	1)	
36	ZDM/6266.666	" " "	1)	
37	ZDM/6300.00	" " "	1)	
38	ZDM/6333.333	" " "	1)	
39	ZDM/2500.00	" " "	1)	
40	ZDJ/2516.666	" " "	1)	
41	10XCG/17222.222	" " "	1)	
42	10XCG/18333.333	" " "	1)	

Note...

Items 12 to 42 constitute one complete set of crystals.

43	10HG/108	Connector Type B23/20A/R2	1)	Amplifier Type A.7349 and remote control
44	10HG/112	" " B14/30B/R3	1)	
45	10HG/114	" " B14/10B/R2	1)	
46	10W/0221089	Resistor 68 ohm	1)	For use with comparator unit Type 7101 and drive unit radio Type 7098
47	5K/400856	Clips crocodile	2)	
48	10W/0219378	Resistor 47 ohm	1	For use with oscillator Type 7106
49	10C/0115623	Capacitor 1000 pF 350V	1	Fpr use with mixer unit Type 7100

TABLE 3

Test equipment (additional to Table 1) for use with single-channel equipment (para. 1)

Item	Ref. No.	Description	Qty	Remarks
1	10HG/73	Connector Type B4/50E/R4	1	Mains and line
2	10HG/74	Connector Type B23/40F/R1	1	
3	ZDH/16700	Crystal unit quartz	1	Oscillator frequency adjustment
4	ZDM/12500	" " "	1	Limit ganging for use with test set Type 193A. Table 1, Item 29.
5	10XCG/16662.5	" " "	1	
6	NIV	Non-metallic screwdriver 3/16 in. diameter	1	
7	NIV	Test jig	1	For drive unit radio Type 7358

Chapter 1

TRANSMITTER TYPE T.7355 - OVERALL TESTS

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

TEST EQUIPMENT

1. To perform the tests described in subsequent paragraphs the following categories of equipment are required:-

(1) Service stores held items (para. 2). Further information regarding these items is given in Sect. 1, Chap. 1, Table 1.

(2) Commercial items of equipment. Where possible the Service equivalent is given (para. 3).

(3) Locally manufactured items of equipment (para. 4).

Service stores held items

2. The stores held items are as follows:-

(1) Multimeter Type 1 or Type 9980.

(2) R.F. power and modulation meter CT214 and a matching transformer 70 ohms to 50 ohms.

(3) Signal generator Type 65, 65A or 65B and the balance to unbalance transformer Type 3236 to provide a balanced source impedance of 600 ohms.

(4) Crystals quartz ZDM/12500.000 kc/s and 10XCG/16662.5 kc/s. These two crystals are included in the approved list of test equipment and they permit the lowest and the highest frequencies of the range of the transmitter to be tested.

(5) To test the transmitter at spot frequencies within the lower and upper limits, the following crystals (not included in the approved test of test equipment) will also be required:-

(a) ZDM/13888.888

(b) 10XCG/13541.666

(c) ZDM/15277.777

(d) 10XCG/12500.000

(e) 10XCG/14583.333

(f) 10XCG/15624.999

(6) Connectors:-

(a) Ref. No. 10HG/73, Type B4/50E/R4, for the mains supply.

(b) Ref. No. 10HG/74, Type B23/40F/R1 for the a.f. input and remote control line.

(c) Ref. No. 10HG/44, Type 8267/1203/R1, r.f. connector

(7) Plug Type 170 and a 560 ohm resistor. (A.P.2531D/E, Vol. 1, Part 2, Sect. 1, Chap. 1). These items take the place of the microphone and the press to talk switch to permit a c.w. signal to be radiated.

Commercial items

3. The following commercial items of test equipment are used by the manufacturer:-

(1) A variable transformer to provide an a.c. 60 c/s supply of 230V r.m.s. ± 2 per cent.

Example:- Zenith variac transformer 200 CUH.

(2) A.F. oscillator at a frequency of 0 c/s to 10 000 c/s at an impedance of 600 ohms.

Example:- Marconi b.f.o. TF195L.

(3) A.F. attenuator for use with the a.f. oscillator, calibrated in millivolts from 0 to 100 mV. The input impedance is 600 ohms and the output impedance is balanced 600 ohms.

Locally manufactured items

4. The items to be manufactured locally consist of:-

(1) A.F. lead (para. 5)

(2) Test plug (para. 6)

(3) Output load (para. 7)

(4) Test unit (para. 8)

(5) Test jack (para. 9)

Note...

Subsequent references to the signal generator Type 65B should be interpreted as any one of the r.f. signal generators listed in the approved test equipment in Sect. 1, Chap. 1.

A.F. lead

5. The purpose of the a.f. lead is to connect the output from the l.f. signal generator Type 65B via transformer Type 3236 to the microphone input socket of the transmitter. The lead consists of the following:-

(1) Two core screened lead cut to the required length.

(2) At one end of the lead, one of the inner cores is connected to the tip of a G.P.O. jack plug Type 301, while the other core is connected to the ring of the plug. The screen of the lead is to be connected to the sleeve of the plug.

(3) The opposite ends of the two cores are to be connected to the primary winding of a 1 : 1 transformer, the secondary winding of which shall be capable of carrying a current of 48 mA. The secondary winding should be terminated to permit its connection to the output of the a.f. source. This transformer is necessary to isolate the attenuator from the d.c. current of the line relay flowing in the microphone transformer of the modulator unit Type 7099.

Test plug

6. The test plug is used to permit the circuits associated with the amplifier (R.F.) power Type A.9365 to be tested. The test plug is made up as follows:-

(1) A 25-pole breeze plug, 5935-99-0560300, orientation 0.

(2) Connect a short-circuiting link across poles S and T of the plug.

(3) Connect a 6.3V 0.3A lamp between pole U, a 6.3V supply and pole W of the plug.

(4) Connect suitable terminations to poles P and V to provide voltage test points.

Output load (a.f.)

7. The output load is to provide facilities for measuring the a.f. power from the transmitter Type T.7355 to the amplifier (RF) power Type A.9365. The load is made up as follows:-

(1) A six-pole breeze plug, 5935-99-0560300 - orientation 0.

(2) A resistor of 4000 ohms, 30 watts connected across poles A and B. of the plug.

Test unit

8. The test unit is to provide facilities for testing the remote control facilities of the transmitter. The unit should be connected as shown in fig. 1 at the end of this chapter. The unit consists of:-

(1) A twenty-five pole breeze socket 5935-0560220 - orientation normal.

(2) Two single-pole, single throw switches S1 and S2.

(3) One lamp, 6.3V 0.3A LP1.

(4) Power supply of 6.3V.

Test jack

9. The test jack is used with the test unit (para. 7) when testing the remote control circuits. It consists of a six-pole breeze plug, 5935-99-0560301, (orientation 1) with a six-pole jack socket Type 214 Ref. No. 10H/20966) connected between the poles A and B. The frame of the socket is connected to the chassis.

MECHANICAL EXAMINATION

10. Carefully adjust the equipment to ensure that it is not damaged.

11. Ensure that the transmitter unit Type 9231 moves smoothly on the runners and that, with the unit pushed home into the cover assembly, the runner latches engage when the front panel is tight against the gasket.

12. Ensure that when the transmitter unit is withdrawn or pushed back into its cover assembly, the cables of the cable assembly Type 9232 always lie flat, on the floor of the cover assembly and also that they do not rise, cross over or move incorrectly in any other way.

13. Fit the front cover Type 1068 over the front panel of the transmitter unit Type 9231 and engage the four latches. Ensure that the front cover is held securely to the cover assembly and that the latches can be operated by hand. After this release the latches and remove the cover.

FUNCTIONAL TESTS

Note...

In the subsequent tests, where a.f. voltages are quoted, the values refer to the terminated voltages.

Gate switch adjustment

14. Adjust the gate switch as follows:-

(1) Withdraw the transmitter unit Type 9231 from its cover assembly.

(2) Operate and lock manually the gate switch 7S1 of the cover assembly.

(3) From the outside of the front panel turn the operating screw of the gate switch in a counter-clockwise direction until it reaches the fullest extent of its travel.

(4) Return the transmitter unit into its cover assembly and ensure that the withdrawal handles are in the "locked position".

(5) Engage the latches of the cover assembly firmly with the latch plates on the front panel of the transmitter unit.

(6) Slowly turn the gate switch operating screw in a clockwise direction until the manual locking device is heard to release. Give the screw a further turn of 360 deg. in a clockwise direction.

(7) Withdraw the transmitter unit Type 9231 from its cover assembly and tighten the operating screw of the gate switch 7S1.

(8) Operate and lock manually the gate switch, return the transmitter unit into its cover assembly until the runner latches engage.

(9) Examine the operation of the gate switch by withdrawing the transmitter unit and ensure that the gate switch has released to the "off" position.

R.F. power output

15. The procedure for measuring r.f. power output is as follows:-

(1) Connect the mains lead 10HG/73 to plug 7PL16 of the cable assembly Type 9232.

(2) Insert the plug Type 170 with its 560-ohm resistor (para. 2) in the MIC jack 9JK1 on the transmitter unit.

(3) Operate and lock manually the gate switch 7S1.

(4) Via the variable transformer (para. 3) connect 230V a.c. ± 2 per cent to the mains lead (sub-para. (1)) and ensure that the gate switch indicator lamp 7ILP1 and the MAINS lamp 9ILP3 on the front panel of the transmitter unit are illuminated.

(5) Connect the r.f. wattmeter CT214 and the associated transformer (para. 2, sub-para. (2)) via the r.f. connector 10HG/44 to the plug 7PL8 of the cable assembly Type 9232.

(6) Ensure that the metering test plug 9PL23 is fitted in the 5SKT23 on the drive unit radio Type 7358.

(7) Release the crystal oven cover retaining clip and remove the oven cover, oven and crystal retaining clip from the drive unit radio Type 7358.

(8) Fit the 16662.499 kc/s crystal (para. 2) corresponding with the final frequency of 399.9 Mc/s, into the working socket of the oven base of the drive unit radio Type 7358. Fit the crystal retaining clip, oven, oven cover and oven retaining clip.

(9) On the transmitter unit Type 9231, set each of the three tuning dials, HG, TREBLER TUNE and PA TUNE to 400 Mc/s approximately.

(10) Set the MAINS switch 9S3 and H.T. switch 9S2 to their ON positions.

(11) Set the TUNE REMOTE LOCAL key 9KTRL to the TUNE position.

(12) After operation (10) ensure that the H.T. lamp 9ILP1 is illuminated after a delay of 50 seconds ± 40 per cent.

(13) Set the METER SWITCH 9S1 to position 7 and adjust the HG TUNE control for maximum reading on the meter 9M1.

(14) Set the METER SWITCH 9S1 to position 8 and adjust the TREBLER TUNE control for a maximum reading on the meter 9M1.

(15) Adjust the PA TUNE control for maximum reading on the r.f. wattmeter CT214.

(16) Set TUNE REMOTE LOCAL key 9KTRL to the LOCAL position. Adjust the HG TUNE, TREBLER TUNE and PA TUNE control for maximum reading on the r.f. wattmeter CT214.

(17) Ensure that the reading obtained in operation (16) is not less than 10 watts.

Amplifying unit Type 7105 - tuning

16. The preset control of 2C8 of the power amplifier circuit of the amplifying unit Type 7105 is adjusted as follows:-

(1) Repeat the operation described in para. 15, sub-para. (16). The test equipment and connections remain the same as those described in para. 15.

(2) Adjust the capacitor 2C8 of the amplifying unit Type 7105 for the maximum reading on the wattmeter CT214.

(3) Adjust the TREBLER TUNE and PA TUNE control for maximum reading on the CT214.

(4) Repeat the operations described in sub-para. (2) and (3) until the highest possible reading is obtained on the r.f. wattmeter CT214.

(5) Remove the plug Type 170 and the associated resistor (para. 16 sub-para. (2)) from the MIC jack 9JK1 on the transmitter unit Type 9231.

A.F. output

17. The additional equipment (to that remaining in use at the end of para. 16) used by the manufacturer for making the a.f. output test is given in para. 3, sub-para. (2) and (3).

18. The approved test equipment for the a.f. output measurement is the signal generator Type 65B, the balance to unbalance transformer Type 3236 and the a.f. lead (para. 5). Appropriate arrangements will have to be made for terminating the balanced output of the transformer with a 600-ohm load and for measuring the a.f. voltage across this load. The procedure is as follows:-

(1) Connect the output of the signal generator Type 65B via the transformer Type 3236 (balanced 600-ohm output) and the a.f. load to the MIC jack on the transmitter unit Type 9231.

(2) Fit the metering test plug 9PL23 into 1SKT44 of the link modulator unit Type 7099. Ensure that the UNCLIP/CLIP/1LKB is in the UNCLIP position.

(3) Set the signal generator at a frequency of 1000 c/s.

(4) Set the METER SWITCH 9S1 on the transmitter unit to position 2.

(5) Set the a.f. output of the signal generator Type 65B to give a level of 10mV at the output of the transformer Type 3236.

(6) Set the TUNE REMOTE LOCAL key to LOCAL. Adjust the HG. TREBLER and PA TUNE controls to obtain a maximum reading on the wattmeter CT214.

(7) Slowly increase the output from the signal generator Type 65B until a dip occurs in the reading on the meter 9M1 on the transmitter unit.

(8) Set the h.t. switch on the transmitter unit to the OFF position and connect the test plug (para. 6) to 7SKT4 of the cable assembly type 9232.

(9) Connect the a.f. output load (para. 7) to 7SKT6 of the cable assembly.

(10) Transfer the LOW POWER/HIGH POWER link, 9LKA on chassis assembly Type 7357, to the HIGH POWER position. Set the h.t. switch on the transmitter unit to the ON position. Ensure that the lamp on the test plug (sub-para. (8)) is illuminated.

(11) Repeat the tuning operations given in sub-para. (6).

(12) Using the multimeter Type 1 set to its 0 to 1000V d.c. range, measure the r.m.s. voltage across the a.f. output load. The reading should be 270V ± 30V.

(13) Set the h.t. switch 9S2 of the transmitter unit to its OFF position. Disconnect the output load from 7SKT6 of the cable assembly Type 9232.

(14) Set the h.t. switch of the transmitter unit to the ON position and using the multimeter Type 1 make the following measurements:-

(a) Between pole P of the test plug (sub-para. (8)) and chassis measure the -150V bias supply. With the meter set to its 250V d.c. range, the reading should be -157V ± 9.5V.

(b) Between pole V of the test plug and chassis measure the -48V d.c. supply. With the meter set to its 100V d.c. range, the reading should be -48V ± 10V.

(15) Set the h.t. switch of the transmitter unit to its OFF position and disconnect the test plug from 7SKT4.

(16) Transfer the LOW POWER/HIGH POWER link of the chassis assembly Type 7357 to the LOW POWER position.

(17) Remove the a.f. lead (sub-para. (1) from the MIC jack of the transmitter unit.

Remote control circuitry test

19. The procedure for testing the remote control circuitry is as follows:-

(1) Connect the test unit (para. 8) to 7PL2 of the cable assembly Type 9232 and the test jack (para. 9) to 7SKT32. Insert the plug Type 170, with its associate resistor of 560 ohms, into the socket Type 214 of the test jack.

(2) Close switch S2 of the test unit and set the TUNE REMOTE LOCAL key to the REMOTE position.

(3) Set the h.t. switch of the transmitter unit to the ON position and ensure that the h.t. lamp 9ILP1 on the transmitter and also the lamp LP1 on the test unit are both illuminated.

(4) Close the switch S1 on the test unit. Set the TUNE REMOTE LOCAL key to LOCAL. Adjust the HG, TREBLER and PA TUNE controls to obtain maximum reading on the wattmeter CT214.

(5) Open switch S2 on the test unit and remove the plug Type 170 from the test jack (sub-para. (1)). Ensure that the lamp 9ILP1 on the transmitter unit is extinguished.

(6) Put the plug Type 170 back into the test jack and close the switch S2 of the test unit.

(7) Set the h.t. switch of the transmitter unit to the OFF position and transfer the E.V.O.S. OUT/IN link 6LKB on the power unit Type 7356 to the IN position.

(8) Set the h.t. switch on the transmitter unit to the ON position and open the switch S1 on the test unit. Ensure that the reading on the r.f. wattmeter CT214 falls to zero.

(9) Using the multimeter Type 1 connected between pole Y of the 25-pole socket of the test unit and the chassis (fig. 1), measure the -48V supply. With the meter set to the 100V d.c. range the reading should be -48V $\pm$ 10V.

(10) Set the h.t. switch of the transmitter unit to the ON position and the EVOS link on the power unit Type 7356 to the OUT position.

(11) Remove the plug Type 170 from the test jack and insert it into the MIC jack of the transmitter unit.

(12) Disconnect the test unit from 7PL2 of the cable assembly Type 9232 and the test jack from 7SKT32 (sub-para. (1)).

Final r.f. power output tests

20. The r.f. power output should be measured at the following frequencies:-

Crystal kc/s (para. 5)	Final frequency Mc/s
12500.000	225
13888.888	250
15277.777	275
12500.000	300
13541.666	325
14583.333	350
15624.999	375
16662.499	399.9

21. The following procedure should be adopted for r.f. power output tests at the frequencies given in para. 20:-

(1) Insert the appropriate crystal in the working crystal socket of the transmitter unit (para. 15, sub-para. (7) and (8)).

(2) Ensure that the CT214 remains connected to 7PL8 of the cable assembly Type 9232 (para. 15, sub-para. (5)).

(3) Set the HG, TREBLER and PA TUNE controls to 400 Mc/s approximately.

(4) Set the TUNE REMOTE LOCAL key to TUNE and ensure that the MAINS and the HT switches are set to ON.

(5) Set the METER switch to position 7 and adjust the HG TUNE control for maximum reading on the meter 9M1.

(6) Set the TUNE REMOTE LOCAL CONTROL to LOCAL and adjust the HG, TREBLER TUNE controls for maximum reading on the r.f. wattmeter CT214.

(7) Ensure that at each frequency given in para. 20, the r.f. output is not less than 10 watts.

(8) If any of the r.f. output measurements are below 10 watts, the following procedure should be adopted:-

(a) Tune the transmitter unit at the frequency which gave the lowest r.f. power output, using the procedure described in sub-para. (1) to (5).

(b) Adjust the preset capacitor 2C8 in the amplifying unit Type 7105, the TREBLER and PA TUNE controls of the transmitter unit for maximum reading on the wattmeter CT214. This tuning procedure should be repeated as necessary until an r.f. power output of not less than 10 watts is obtained.

(9) Repeat the instructions given in sub-para. (1) to (7) (a) and (b) until the minimum r.f. power output of 10 watts is obtained at all frequencies given in para. 20.

Completion of tests

22. When all the tests described in this chapter have been completed, proceed as follows:-

(1) Set all the switches of the transmitter unit to their OFF positions.

(2) Disconnect all the test equipment and connectors.

(3) Remove the crystal from the crystal oven in the drive unit radio Type 7358. Refit the crystal retaining clip, oven, oven cover and secure the cover in position with the appropriate retaining clip.

(4) Push the transmitter unit back into its cover assembly and secure the four latches.

(5) Fit the cover Type 1068 on front of the cover assembly and secure it in position by the four latches.

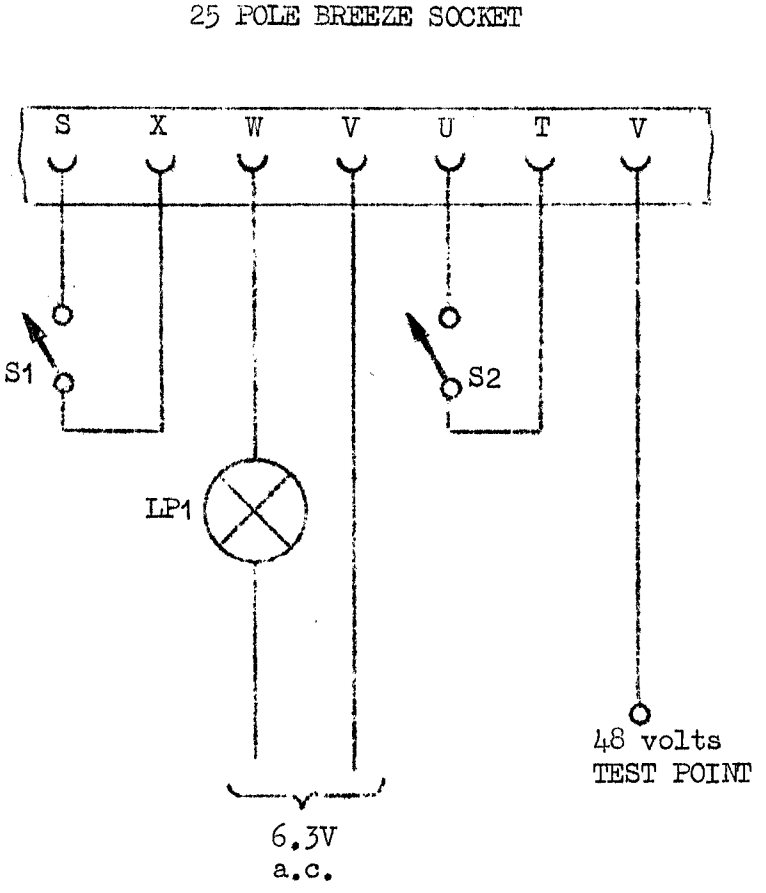


Fig. 1 Test unit for remote control circuitry tests.

Chapter 3

MODULATOR UNIT TYPE 7099

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

TEST EQUIPMENT

Introduction

1. To perform the tests described in subsequent paragraphs the categories of test equipment are the same as thosegiven in Sect. 2, Chap. 1, para. 1. Service equivalents to those used by the manufacturer (para. 3) are quoted wherever possible in the subsequent servicing instruction.

Service stores held items

2. The Service stores held items are as follows:-

(1) Multimeter Type 1 or Type 9980

(2) Insulation tester Type A or D

(3) Signal generator Type 65, 65A or 65B or test set Type 37

(4) Balance to unbalance transformer Type 3236. This is for use with the signal generator (sub-para. (3)) to provide facilities for a balanced a.f. source of 600 ohms impedance.

(5) Multimeter CT38

(6) Test set Type 7618

Commercial items

3. The following commercial items of test equipment have been used by the manufacturer:-

(1) Distortion factor meter capable of measuring from 0 to 50 per cent distortion over a range of 0 to 8000 c/s at an input impedance of 600 ohms.

Example:- Marconi distortion factor meter TF132E

(2) Double beam oscillograph

Example: A.C. Cossor oscillograph model 1035

(3) A.F. oscillator operating at a frequency of 0 to 10 000 c/s at an output impedance of 600 ohms.

Example:- Marconi b.f.o. TF195L

(4) A.F. attenuator for use with the a.f. oscillator, input impedance 600 ohms, output impedance balanced 600 ohms.

(5) Valve voltmeter including a range covering 0 to 5V r.m.s. and an input impedance not less than 1 megohm at 1 Mc/s.

Example:- Marconi valve-voltmeter TF426B

Locally manufactured items

4. The items to be manufactured locally are as follows:-

(1) Power units (two) (para. 5 and 6)

(2) Test unit (para. 7)

(3) Output load unit (para. 8)

L.T. and h.t. power unit

5. The l.t. and h.t. power unit is required to provide the following:-

(1) L.T. supply of 6.3V a.c. r.m.s. $\pm$ 0.3V at 4.5A.

(2) H.T. supply of 300V d.c. $\pm$ 6V at 300 mA.

Bias power unit

6. The bias power unit is required to provide 150V d.c. ± 3V at 15 mA.

Test unit

7. The test unit, the connections of which are shown in fig. 1, is to provide facilities for connecting the power supplies described in para. 5 and 6 to the modulator unit Type 7099. The test unit consists of the following:-

(1) 18-pole socket 5935-99-056-2509 (SKT1)

(2) Milliammeter, moving coil, 300 mA full scale deflection (M1).

Output load unit

8. The output load is required for loading the output transformer 1T3 of the modulator unit Type 7099. The wiring for this unit is given in fig. 1. The components are as follows:-

(1) Resistors, wire wound, 4000 ohms, 30 watt.

(2) Resistor, 150K, $\frac{3}{4}$ watt, 5905-99-022-3309

(3) Unitor socket 5935-99-056-2506 (SKT1)

MECHANICAL EXAMINATION

9. Carefully examine the modulator unit to ensure that it is undamaged.

10. Ensure that the UNCLIP/CLIP link (1LKB) is tested in both the CLIP and UNCLIP positions to ensure that it fits correctly in each socket.

11. Ensure that the locking devices of the potentiometers 1RV4 and 1RV56 are satisfactory, then release them and ensure that both the potentiometers operate freely and smoothly.

Wiring

12. The wiring should be tested for continuity and correctness in accordance with the relevant circuit in A.P.2531D and E, Vol. 1, Sect. 2, Chap. 2, fig. 3. This should consist of a point to point test or such electrical test as will confirm the accuracy of the soldering, the absence of dry joints, an adequate clearance between adjacent terminals and the general satisfactory condition of the wiring and its insulation.

Insulation

13. Before making any insulation tests it is recommended that the various valves should be removed. The tests should be made with a 500V d.c. insulation tester such as the Type A or D. The insulation resistance between all parts not intended to be connected electrically should be not less than 40 megohms.

FUNCTIONAL TESTS

Note...

The a.f. voltages quoted in the subsequent tests are terminated values.

Preliminary tests

14. The modulator unit Type 7099 should be prepared for functional testing as follows:-

(1) Connect the terminals of the h.t. and l.t. power unit (para. 5) and the 150V power unit (para. 6) to the test unit (para. 7) in accordance with the details given in fig. 1 at the end of this chapter.

(2) Connect SKT1 of the test unit to 1PL15 of the modulator unit Type 7099 and also SKT1 of the output load unit (para. 8) to 1PL45 of the modulator unit.

(3) Switch on the h.t./l.t. and the 150V power units and make the following measurements to ensure that they are within the tolerances quoted:-

Test point	Range of Multimeter	Voltage limits
Pin 3 to pin 4 of 1V1	10V a.c.	6.3V r.m.s. ± 0.3V
Junction of 1R23 and 1R35 to chassis	500V d.c.	300V d.c. ± 6V
Junction of 1R1 and pole 4 of 1PL15 to chassis	250V d.c.	-150V d.c. ± 3V

Note...

When making the measurement at the junction of 1R1 and 1PL15 ensure that the positive of the multimeter is connected to the chassis and the negative to the junction.

(4) Ensure that the UNCLIP/CLIP link 1LKB is in the UNCLIP position and also that short circuiting links are not connected across the VOGAD AND ENABLER tags of the VOGAD/ENABLER link 1LKA.

Soak test

15. The following are the details of the soak test:-

(1) Switch on the power supplies to the modulator unit and leave the power switched on for six hours without interruption.

(2) Switch off the l.t./h.t. and the 150V power units (para. 5 and 6).

(3) Examine the modulator unit visually and ensure that there are no signs of overheating nor damage to the components.

Voltage and current tests

16. Voltage and current tests should be made as follows:-

(1) Unlock the potentiometers 1RV4 and 1RV56 of the modulator unit and rotate them both to their fully clockwise positions to give maximum output. Then lock both potentiometers.

(2) Switch on the l.t./h.t. and the 150V d.c. power units and allow a warming up period of approximately 15 minutes to elapse before making any further tests.

(3) Using the multimeter Type 1 set to the 10V a.c. range make the following measurements:-

Valves	Between pins	Limits
1V1, 1V2, 1V3) 1V4 and 1V5)	3 and 4	6.3V a.c. ± 0.3V
1V6	4 and 5	6.3V a.c. ± 0.3V
1V7 and 1V8	1 and 8	6.3V a.c. ± 0.3V

(4) Using the multimeter Type 1 measure the d.c. voltages between the chassis and following points:-

Test point	Multimeter range	Voltage limits	
1V1 anode, pin 5	100V	72V	± 7.2V
1V1 screen, pin 7	250V	98V	± 9.8V
1V1 cathode, pin 2	2.5V	1.3V	± 0.13V
1V2 anode, pin 5	250V	165V	± 16.5V
1V2 screen, pin 7	250V	170V	± 17V
1V2 cathode, pin 2	2.5V	1.7V	± 0.25V
1V4 anode, pin 5	100V	-78V	± 7.8V
1V4 cathode, pin 2	100V	-80V	± 8V
1V5 anode, pin 5	1000V	300V	± 15V
1V5 screen, pin 7	1000V	300V	± 15V
1V5 cathode, pin 2	25V	0 (in the absence of speech)	
1V6 anode, pin 6	100V	88V	± 8.8V
1V6 cathodes, pins 3 and 8	100V	26V	± 2.6V
1V7 anode, pin 2	1000V	290V	± 14.5V
1V7 screen, pin 3	1000V	290V	± 14.5V
1V8 anode, pin 2	1000V	290V	± 14.5V
1V8 screen, pin 3	1000V	290V	± 14.5V

Junction of 1R41, 1R42	25V	-17.4V	± 1.7V
Junction of 1R43, 1R44	100V	82V	± 4.1V

(5) Observe the h.t. current reading on the meter M1 of the test unit (fig. 1). The reading should be 225 mA ± 25 mA.

VOGAD test

17. The operation of the VOGAD system can be tested immediately following the voltage and current measurements (para. 16) with the same power supplies connected via the test unit to the modulator unit. The VOGAD test requires an l.f. signal generator with a balanced 600 ohm output. For this test the manufacturer uses the oscillator and attenuator described in para. 2 (sub-para. (3) and (4)). The approved test equipment is the signal generator Type 65B and the balance to unbalance transformer Type 3236. Provision must be made to terminate the transformer with a balanced load of 600 ohms and also to measure the a.f. voltage across this load. The procedure for making the VOGAD test is as follows:-

(1) Connect the metering test plug of the test set Type 7618 to the socket 1SKT44 of the modulator unit. Set the METER SWITCH of the test set to position 2.

(2) Connect the signal generator Type 65B via the transformer Type 3236 to the appropriate leads of the test unit (fig. 1).

(3) Set the frequency of the signal generator Type 65B to a frequency of 1000 c/s at an output level of 10 mV as measured across the output of the transformer Type 3236.

(4) Slowly increase the output from the signal generator until a dip occurs on the meter of the test set Type 7618. When the dip occurs, the output voltage at the transformer should be 20 mV ± 25 per cent. Make a note of the output voltage.

(5) Ensure that the output at the transformer remains constant at the value obtained in sub-para. (4). Set the multimeter Type 1 to a range of 1000V a.c. and connect the meter across points B and C of the output load (fig. 1). The reading should be not less than 280V r.m.s.

Distortion over the VOGAD controlled range

18. The test for distortion over the VOGAD controlled range is made using the same requirement as the VOGAD test in para. 17. With the addition of a distortion factor meter. The procedure is as follows:-

(1) Connect the distortion factor meter (para. 3) across points A and C of the output load (fig. 1).

(2) Set the signal generator Type 65B to a frequency of 1000 c/s to give an output level of 15 mV, as measured at the output of the transformer Type 3236.

(3) Measure the distortion level with the distortion factor meter. The distortion level should not exceed 10 per cent.

(4) Disconnect the distortion factor meter from points A and C of the output load (fig. 1).

(5) With the multimeter Type 1 set to a range of 1000V a.c. measure the r.m.s. voltage across points B and C of the output load and record the reading.

(6) Reconnect the distortion factor meter across points A and C of the output load (fig. 1).

(7) Repeat the operations described in sub-para. (3) to (6) at the following a.f. output levels from the signal generator Type 65B (as measured at the transformer) and in each case record the voltage measurement obtained on the multimeter Type 1:-

20 mV, 25 mV, 30 mV, 40 mV, 50 mV, 75 mV, 100 mV, 125 mV, 150 mV, 175 mV, 200 mV, 225 mV, 250 mV, 280 mV

(8) The outputs obtained in making the measurements described in sub-para. (5) and (7) should be constant within -1 dB of the highest output obtained over the whole of the VOGAD controlled range from 15 mV to 280 mV.

(9) Disconnect the distortion factor meter from the output load (fig. 1).

Frequency response

19. The frequency response measurement of the modulator unit is made with the test equipment remaining connected when the procedure described in para. 18 was completed. The procedure is as follows:-

(1) Ensure that the signal generator Type 65B is set to a frequency of 1000 c/s.

(2) Ensure that the output of the signal generator is set to a level obtained by following the procedure described in para. 17 (sub-para. (3) and (4). Record this level and during the subsequent tests in this paragraph, ensure that this level remains constant.

(3) Connect a short circuiting link across the VOGAD tags of the VOGAD/ENABLER link panel 1LKA of the modulator unit.

(4) Set the frequency of the signal generator Type 65B to a frequency of 500 c/s, ensure the output level of the generator (as measured at the output of the transformer Type 3236) is the same as that obtained in sub-para. (2).

(5) With the multimeter Type 1 set to the 1000V a.c. range measure the r.m.s. voltage across points B and C of the output load (fig. 1). Record the output voltage.

(6) Repeat the operation described in sub-para. (5) with the signal generator Type 65B operating at the following frequencies and at the output level obtained in sub-para. (2). 1000 c/s, 2000 c/s, 3000 c/s and 3500 c/s.

(7) The output obtained at frequencies within 500 c/s and 3500 c/s should be constant within -3 dB with reference to the highest output obtained in sub-para. (5) and (6).

Clipper operation

20. The operation of the clipper circuit is tested using the same test equipment as that used in para. 19 with the addition of a double beam oscillograph (para. 3). The procedure is as follows:-

(1) Transfer the UNCLIP/CLIP link 1LKB to the CLIP position and remove the short circuit link across the tags of the VOGAD position of the VOGAD/ENABLER panel 1LKB.

(2) Ensure that the test plug connector from the test set Type 7618 is connected to 1SKT44 of the modulator unit.

(3) Connect the oscillograph (para. 3, sub-para. (2)) between the control grids of 1V7 and 1V8 (pins 5 or 6 on each valve).

(4) Set the signal generator Type 65B to a frequency of 1000 c/s.

(5) Adjust the output of the signal generator to find the operating point of the VOGAD bias as described in para. 17, sub-para. (3) and (4). Make a record of the a.f. output voltage V1 at the transformer Type 3236.

(6) Adjust the output of the signal generator to produce 2.5 mV at the output of the transformer.

(7) Adjust the oscillograph until a waveform of suitable amplitude is obtained and then lock the waveform.

(8) Slowly increase the output of the signal generator Type 65B until the peaks of the waveform displayed on the oscillograph bear evidence of starting to clip and make a record of the a.f. voltage V2 at the output of the transformer.

(9) Using the oscillograph measure the peak-to-peak voltage of the waveform obtained in sub-para. (8) and make a record of this peak-to-peak voltage V3.

(10) Increase the output from the signal generator by 15 dB and using the oscillograph measure the peak-to-peak voltage of the waveform displayed. Make a record of this voltage V4.

(11) Calculate the degree of clipping in dB using the following formula:-

$$\text{Degree of clipping} = 20 \log \left(\frac{V_1}{V_2} \times \frac{V_3}{V_4}\right) \text{ dB}$$

(12) The degree of clipping calculated in sub-para. (11) should be within the limits of -12 dB and -15 dB.

(13) Disconnect the oscillograph.

Enabler operation

21. The operation of the enabler circuit is tested using the same equipment as that used in para. 18. The procedure is as follows:-

(1) Transfer the UNCLIP/CLIP link of the modulator unit to the UNCLIP position.

(2) Connect the oscillograph (para. 3, sub-para. (2)) across the points B and C of the output load (fig. 1).

(3) Ensure that the signal generator Type 65B is set to a frequency of 1000 c/s.

(4) Adjust the level of the output of the signal generator to produce a level of 1 mV at the output of the transformer Type 3236. Adjust the Y amplifier of the oscillograph to a sensitivity of 15 volts.

(5) Slowly increase the output from the signal generator until a waveform of fairly low amplitude is obtained on the oscillograph. The output at the transformer Type 3236 at this point must be not less than 1.5 mV and not greater than 3.0 mV.

(6) Disconnect the oscillograph from the output load (fig. 1).

Frequency response and distortion

22. The frequency response and distortion measurements are made using the equipment remaining connected after completing para. 21 with the addition of the distortion factor meter (para. 3, sub-para. (1)). The procedure is as follows:-

(1) Ensure that the signal generator Type 65B is set to a frequency of 1000 c/s, then adjust the level of the output at the transformer Type 3236 to correspond with the threshold of the VOGAD as described in para. 17, sub-para. (3) and (4).

(2) Connect the distortion factor meter across points A and C of the output load unit (fig. 1).

(3) Set the signal generator Type 65B to a frequency of 250 c/s.

(4) Using the distortion factor meter, measure the distortion factor. The distortion level should be not greater than 10 per cent.

(5) Disconnect the distortion factor meter from the output load unit.

(6) Set the multimeter Type 1 to its a.c. range of 1000V and connect it across points B and C of the output load unit (fig. 1). Measure the voltage at these points and make a record of the reading.

(7) Repeat the procedure described in sub-para. (2) to (6) at the following frequencies:-

500 c/s, 1000 c/s, 2000 c/s, 3000 c/s and 3500 c/s

(8) The output obtained at frequencies between 500 c/s and 3000 c/s should be attenuated by not more than 3.0 dB with reference to highest output measured in sub-para. (6) and (7).

(9) Set the frequency of the signal generator Type 65B to 150 c/s.

(10) Connect a short circuiting link across the ENABLER tags of the VOGAD/ENABLER link 1LKA in the modulator unit Type 7099.

(11) Ensure that the multimeter Type 1 is connected across points B and C of the output load unit. Set it to its a.c. range of 100V, measure the voltage across these points and make a record of the measurement.

(12) The attenuation at 150 c/s (sub-para. (11) should be not less than 20 dB when compared with the output obtained at a frequency of 1000 c/s (sub-para. (7)).

(13) Disconnect the short circuit link from the tags of the ENABLER position of the VOGAD/ENABLER panel 1LKA.

(14) Set the signal generator Type 65B to a frequency of 7000 c/s.

(15) Repeat the measurement described in sub-para. (11) at 7000 c/s and make a record of the result.

(16) The attenuation at 7000 c/s (sub-para. (15)) should be not less than 6 dB when compared with the output obtained at 3500 c/s (sub-para. (7)).

(17) At the test unit (fig. 1) disconnect the a.f. input from transformer Type 3236 and the signal generator Type 65B.

Hum level

23. The hum level is measured using the test equipment left connected to the modulator unit Type 7099 at the end of para. 22, with the addition of a valve-voltmeter having a range not less than 0 to 5V and an input impedance of not less than 1 megohm at a frequency of 1 Mc/s. The approved meter is the CT38. The manufacturer uses the item listed in para. 4, sub-para. (5). The procedure is as follows:-

(1) Short circuit the two leads which normally connect the a.f. input to SKT1 (poles 7 and 16) of the test unit (fig. 1).

(2) Connect a short circuiting link across the ENABLER position of the VOGAD/ENABLER panel 1LKA.

(3) Connect the valve voltmeter CT38 across points B and C of the output load unit (fig. 1). Set the CT38 to the 10V a.c. range.

(4) The hum level should not exceed 2.5V r.m.s.

(5) Transfer the UNCLIP/CLIP link of 1LKB of the modulator unit to the CLIP position and ensure that the hum level does not exceed 2.5V r.m.s.

(6) Disconnect the short circuiting link from the ENABLER position of the VOGAD/ENABLER panel 1LKA of the modulator unit. Disconnect the CT38 from the output load unit (fig. 1).

Metering test

24. Using the test set Type 7618 make the following metering test:-

(1) Ensure that the test plug from the test set Type 7618 is connected to the test socket 1SKT44 of the modulator unit Type 7099.

(2) Using the METER SWITCH of the test set make the following measurements:-

METER SWITCH position	Meter reading on test set
1	20 to 34
2	Greater than 60
3	45 to 70
4	0
5	40 to 80

(3) Connect the signal generator Type 65B via the transformer Type 3236 to the a.f. input leads on the test unit (fig. 1).

(4) Set the signal generator to a frequency of 1000 c/s and adjust the output level to 20 mV as measured at the output terminals of the transformer.

(5) Using the test set Type 7618 make the following metering tests:-

METER SWITCH position	Meter reading on test set
1	0
4	60 to 80

Completion of tests

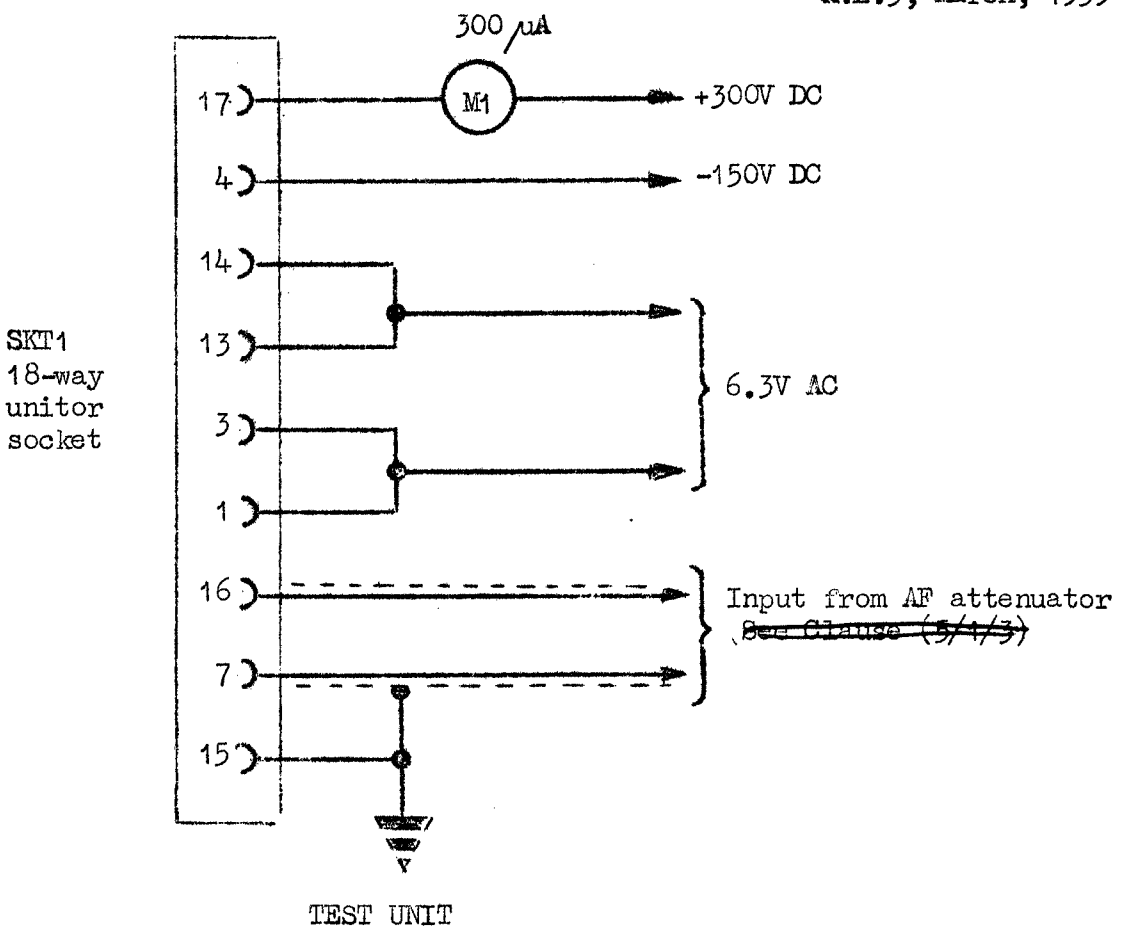
25. When all the tests described in this chapter have been completed, proceed as follows:-

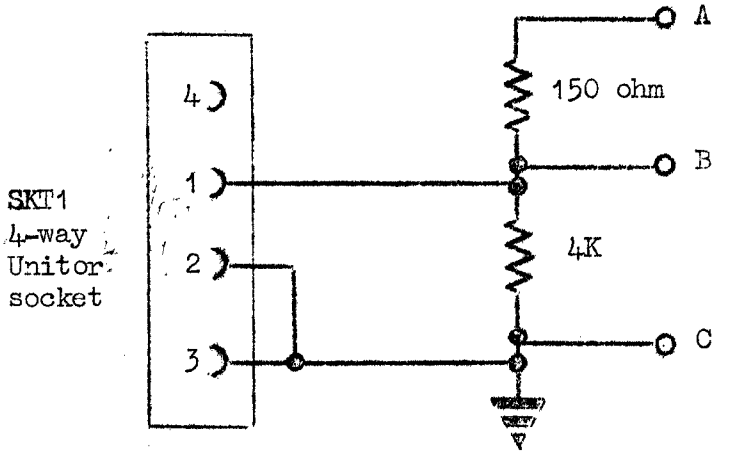
(1) Switch off all the power supplies and disconnect all the test equipment from the modulator unit.

(2) Ensure that the UNCLIP/CLIP link 1LKB in the modulator unit is in the UNCLIP position.

(3) Ensure that there are no short circuiting links across the tags of the VOGAD and the ENABLER positions on the VOGAD/ENABLER panel 1LKA of the modulator unit.

(4) Ensure that the potentiometer 1RV56 of the modulator unit is turned full clockwise to provide for maximum output.





Note...

Connect voltmeter across B and C
Connect oscillograph across B and C
Connect distortion factor meter across A and C

LOAD UNIT

Fig. 1 Test unit and output load unit

Chapter 5

MONITORING UNIT TYPE 7107

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

TEST EQUIPMENT

Introduction

1. To perform the tests described in this chapter, the test equipment can be divided into two categories:-

(1) Service stores held items

(2) Locally manufactured items

Service stores held items

2. The Service stores held items are as follows:-

(1) R.F. power and modulation meter CT214

(2) Matching transformer 70 to 50 ohms (10S/AP.64009) for use with the CT214.

Locally manufactured items

3. The test equipment items which are to be manufactured locally are as follows:-

(1) Probe socket

(2) Test meter

(3) Test socket

Probe socket

4. The probe socket is to provide facilities for coupling the r.f. power output of the transmitter Type T.7355 to the monitoring unit Type 7107 and for testing the metering system of the monitoring unit. The wiring of the probe socket is given in fig. 1. The probe socket consists of the following items:-

(1) SKT1. Eight-pole unitor socket 5935-99-056-2507

(2) M1. Microammeter, moving coil, 100 microamperes f.s.d., internal resistance 500 ohms.

(3) Probe assembly Type 9241, Ref. No. 10AE/400.

Test meter

5. The test meter is required for testing the aural monitoring facility. The wiring diagram for the test meter is given in fig. 2, while the items constituting the test meter are as follows:-

(1) Jack plug GPO Type 301

(2) M1. Moving coil meter, 100 microamperes f.s.d., internal resistance 500 ohms.

(3) MR1 and MR2. Germanium diode valves Type CV442 (quantity two).

(4) C1. Capacitor, ceramicon, 100 pF.

(5) R1. Resistor, 750 ohms $\pm$ 1per cent $\frac{1}{4}$ watt

(6) R2. Resistor, 1.5K $\pm$ 1per cent $\frac{1}{4}$ watt

(7) R3. Resistor, 620 ohms $\pm$ 1per cent $\frac{1}{4}$ watt

(8) S1. Switch, single-pole single throw

Test socket

6. The test socket is required for testing the operation of the reflection coefficient circuits of the monitoring unit Type 7107. The wiring diagram is given in fig. 2, while the items constituting the test socket are as follows:-

(1) SKT1. Eight-pole unitor socket 5935-99-056-2508

(2) M1. Moving coil meter, 100 microamperes f.s.d., internal resistance 500 ohms.

(3) S1. Switch, single pole, double throw.

(4) RV1 Variable resistor, wire wound, 100 ohms $\frac{1}{2}$ watt

(5) Cell 2V.

MECHANICAL EXAMINATION

7. Carefully examine the monitoring unit Type 7107 to ensure that it is undamaged.

Wiring

8. The wiring should be tested for continuity and correctness in accordance with the circuit in A.P.2531D and E, Vol. 1, Sect. 2, Chap. 2, fig. 6. This should consist of a point to point test or such electrical test as will confirm the accuracy of the wiring. The equipment should be examined for the neatness of the soldering, the absence of dry joints, adequate clearance between adjacent terminals and the general satisfactory condition of the wiring and its insulation.

FUNCTIONAL TESTS

Preliminary

9. Prepare the monitoring unit Type 7107 for testing by connecting the socket SKT1 of the probe socket (para. 4 and fig. 1) to 3PL14 of the monitoring unit.

Power test

10. The power test procedure is as follows:-

(1) Connect the r.f. output at 9PL1 at the rear of the transmitter Type T.7355 to the input socket PL1 of the probe socket (fig. 1). Connect the r.f. wattmeter CT214 to output plug PL2 of the probe socket.

(2) Set the transmitter Type T.7355 to a frequency of 225 Mc/s and r.f. power output of 10 watts (Sect. 2, Chap. 1).

(3) Set the MON SWITCH of the monitoring unit Type 7107 to the POWER position.

(4) Make a record of the reading obtained on the meter M1 of the probe socket (fig. 1).

(5) Repeat the procedure described in sub-para. (2) to (4) at the following frequencies:-

250 Mc/s, 275 Mc/s, 300 Mc/s, 325 Mc/s, 350 Mc/s, 375 Mc/s, and 399.9 Mc/s.

(6) The readings obtained in sub-para. (4) and (5) should be within the following limits:-

Frequency in Mc/s	Limits in microamperes
225	25.5 to 34.5
250	28 to 38
275	30.5 to 41.5
300	34 to 46
325	38 to 52
350	43 to 58
375	43.5 to 58.5
399.9	42.5 to 57.5

Calibration test

11. The calibration test is made using the same test equipment and connections as those used in the power test (para. 10). The procedure is as follows:-

(1) Set the frequency of the transmitter Type T.7355 to 300 Mc/s and the r.f. power output to 10 watts.

(2) Modulate the carrier of the transmitter Type T.7355 to a depth of 80 per cent at a frequency of 1000 c/s and measure the modulation percentage as follows:-

(a) Set the function switch of the wattmeter CT214 to position 3. Then adjust the knurled wheel of the probe depth control (just below the front panel of the CT214) so that the reading on the meter of the CT214 corresponds with 100 per cent modulation, i.e., f.s.d. (the last graduation on the right-hand end of the % MODULATION scale).

(b) Set the function switch of the CT214 to position 4 and read the modulation percentage directly from the % MODULATION scale. The modulation should be of sine wave form and the distortion content should not be greater than 10 per cent.

(3) Set the MON SWITCH of the monitoring unit Type 7107 to the CAL position and adjust the CALIBRATE potentiometer 3RV2 on the monitor unit so that a reading of 100 is obtained on the meter M1 of the probe socket (fig. 1).

Modulation percentage test

12. The procedure for testing the modulation percentage follows immediately after completing the test described in para. 11 and it is as follows:-

(1) Set the MON SWITCH of the monitoring unit Type 7107 to the MOD % position.

(2) The reading on the meter M1 of the probe socket (fig. 1) should be 80 μA $\pm$ 9 μA. This corresponds with a modulation depth of 80 per cent. Make a record of this reading.

Aural monitoring test

13. The test equipment for the aural monitoring test is that used for the previous tests (para. 10 to 12) with the addition of the test meter described in para. 5. The procedure for the aural monitoring test is as follows:-

(1) Connect jack plug of the test meter (fig. 2) to the MON socket 3JK1 of the monitoring unit Type 7107. Ensure that the switch S1 of the test meter is on open circuit and also that the reading of the meter M1 on the probe socket (fig. 1) falls to zero.

(2) Set the MON switch of the monitoring unit to the MON position and observe the reading on the test meter (fig. 1). This reading should be within ± 10 per cent of that obtained in para. 12 sub-para. (2).

(3) Close the switch S1 of the test meter (fig. 2). Rotate the CALIBRATE control 3RV2 of the monitor unit Type 7107 and ensure that the reading on the test meter is variable over its entire range in a smooth and regular manner.

(4) Disconnect the transmitter T.7355, the r.f. wattmeter CT214, the probe socket and the test meter (fig. 1 and 2) from the monitoring unit Type 7107.

Reflection coefficient test

14. The procedure for making the reflection coefficient test is as follows:-

(1) Connect SKT1 of the test socket (para. 6 and fig. 2) to 3PL14 of the monitoring unit Type 7107.

(2) Set the switch S1 of the test socket (fig. 2) and the MON switch of the monitoring unit Type 7107 to the CAL position.

(3) Set the CALIBRATE potentiometer 3RV2 to its half-way position approximately. Then adjust RV1 of test socket (fig. 2) so that a reading of 90 is obtained on the meter M1 of the test socket.

(3) Set the MON switch of the monitoring unit to the reflection coefficient (R. COEFF) position and the switch S1 of the test socket (fig. 2) to position 2.

(4) Ensure that the reading on the meter M1 of the test socket remains unchanged at 90 (sub-para. (2)).

(5) Disconnect the test socket from the monitoring unit.

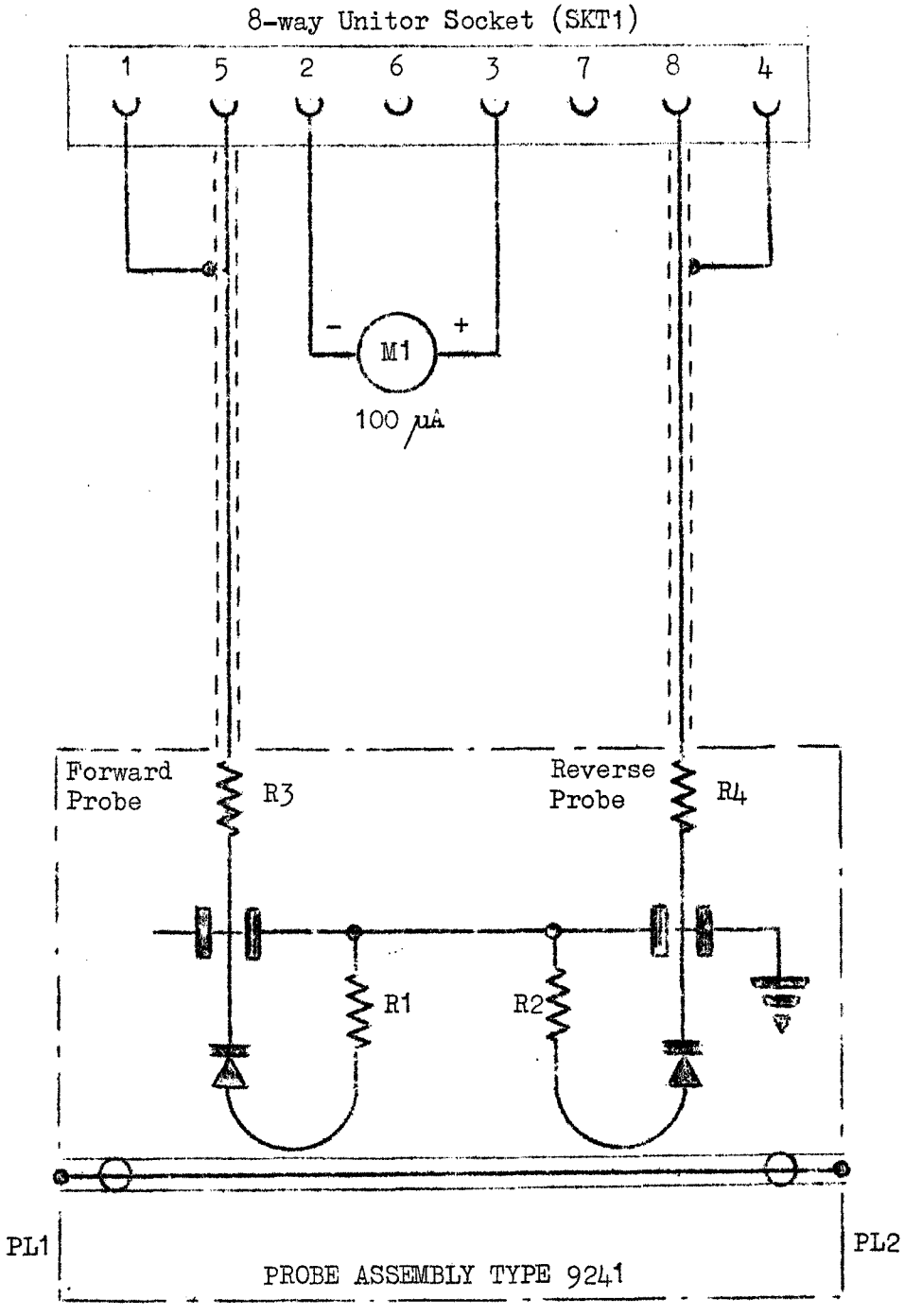
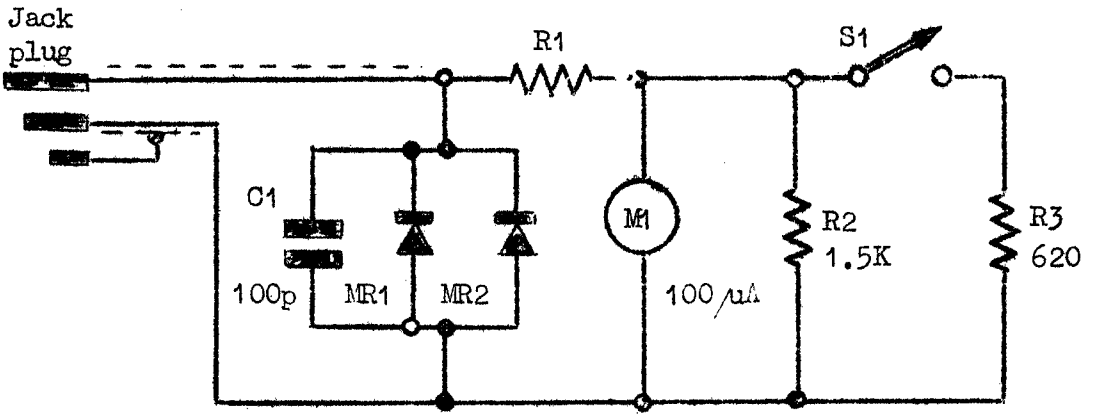
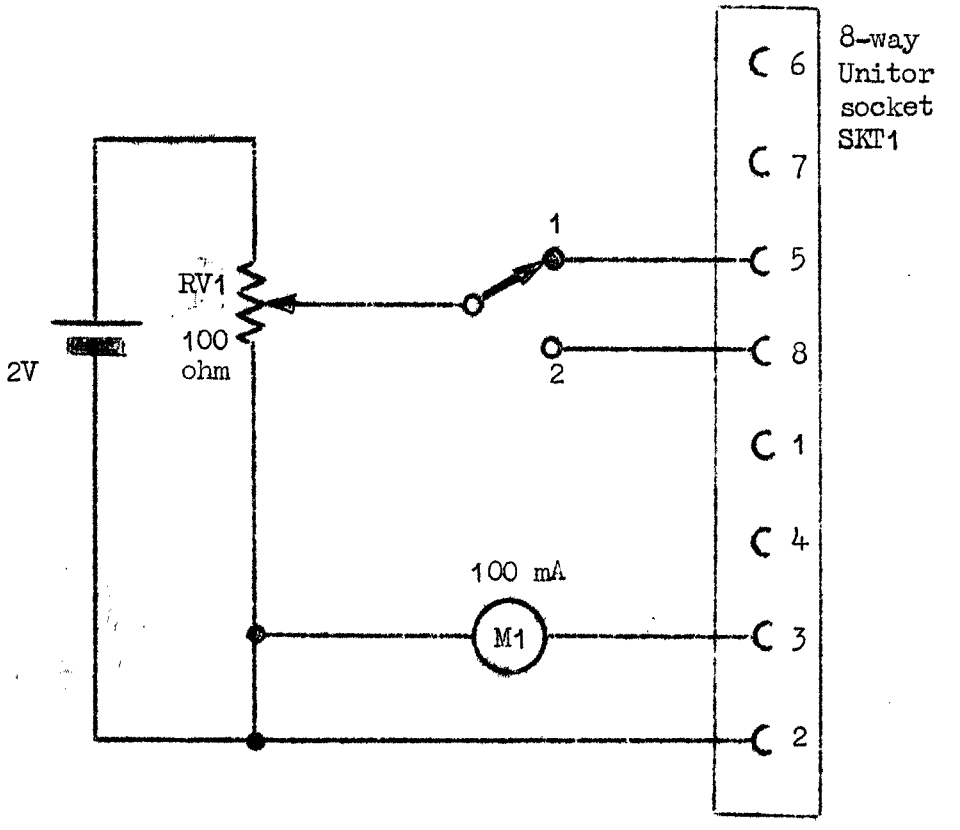


Fig.2 Probe Socket



TEST METER



TEST SOCKET

Fig. 2 Test meter and test socket

Chapter 6

PROBE ASSEMBLY TYPE 9241

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

TEST EQUIPMENT

Introduction

1. To perform the tests described in this chapter the test equipment can be divided into two categories:-

(1) Service stores held items

(2) Locally manufactured items

Service stores held items

2. The Service stores held items are as follows:-

(1) Insulation tester Type C 250V d.c. (Ref. No. 5G/152)

(2) Test set Type 373A (LCR bridge)

(3) Transmitter Type T.7355

(4) Probe assembly Type 9241. This assembly must have been standardized by comparison with a slotted line to enable the voltage standing wave ratio of the test circuitry to be measured accurately.

(5) Coaxial connector Type 8267/120B/R1 (Ref. No. 10HG/44).

(6) R.F. power and modulation meter CT214

(7) Matching transformer 70 to 50 ohms (Ref. No. 10S/AP.64009) for use with the CT214.

Note...

The manufacturer used a Doran d.c. potentiometer as a resistance measuring device and the Marconi capacitance bridge TF868 for capacitance measurements up to 45 pF at 1000 c/s. The test set Type 373A is the Service item used for these measurements.

Locally manufactured test unit

3. A test unit for assessing the sensitivity of the probe assembly Type 9241 should be constructed of the following items and connected together in accordance with fig. 1.

(1) R1. Resistor 4.7K ± 1 per cent

(2) R2. Resistor 680 ohms ± 1 per cent

(3) R3. Resistor 130 ohms ± 1 per cent

(4) C1. Capacitor, ceramicon, 100 pF.

(5) MR1 and MR2 Germanium diodes Type CV442

(6) M1. Meter, moving coil, 100 μA, f.s.d. internal resistance 500 ohms (Ref. No. 5Q/16147)

(7) One crocodile clip.

4. The test unit should be enclosed in a metal box measuring 4 in. long, 4 in. wide and 3 in. deep as shown in fig. 2. On the side of the box, a metal platform should be mounted. The platform should be fitted with two retaining springs in such a position that the main body of the probe assembly under test is held securely and also that a good earth contact is established.

MECHANICAL EXAMINATION

5. Carefully examine the probe assembly Type 9241 to ensure that it is undamaged.

Wiring

6. The wiring of the probe assembly Type 9241 should be tested for continuity and correctness with the circuit in A.P.2531D & E, Vol. 1, Sect. 2, Chap. 2, fig. 6 and 7. This should consist of a point to point test or such electrical test as will confirm the accuracy of the wiring. The equipment should be examined for the neatness of the soldering, the absence of dry joints, adequate clearance between adjacent terminals and the general satisfactory condition of the wiring and its insulation.

COMPONENT TESTING

Pre-assembly

7. Before the probe assembly Type 9241 is assembled the following components tests are made by the manufacturer:-

(1) The insulation between the two capacitor plates of 4C1 and of 4C2 is measured with a 250V d.c. insulation tester (para. 2). The insulation resistance should be not less than 40 megohms.

(2) The capacitances between the two plates of 4C1 and of 4C2 are measured with a capacitance bridge (para. 2). The capacitance in each case should be not less than 45 pF.

(3) The resistances of 4R4 and of 4R5 are measured as described in para. 2 note and they should each have a resistance of 51 ohms ± 1 per cent.

FUNCTIONAL TESTING

Sensitivity test

8. Prior to making the sensitivity test of the probe assembly Type 9241 it is essential to measure the voltage standing wave ratio (V.S.W.R.) of the r.f. power source, i.e., the transmitter Type T.7355. This test should also be made whenever any coaxial leads are changed. The procedure is as follows:-

(1) Connect the r.f. output of the transmitter Type T.7355 to one end of the standard probe assembly Type 9241 (para. 2, sub-para. (4)). Connect the other end of the standard probe assembly via the coaxial connector (para. 2, sub-para. (5)) to the r.f. power meter CT214.

(2) Remove the screw caps and ferrules from the top of each tower of the standard probe assembly so as to expose the solder tags. Place the standard probe assembly in the retaining clips of the test unit (fig. 2) and ensure that the clips hold the main body of the probe assembly securely to make a good earth connection.

(3) Connect the fly lead of the test unit (fig. 1) to the solder tag on that tower of the standard probe assembly which is nearer to the r.f. output connection of the transmitter Type T.7355.

(4) Set up the transmitter Type T.7355 at a frequency of 225 Mc/s and adjust the r.f. power output level until it is 10 watts exactly, as indicated on the CT214. Make a record of the reading (A) on the meter M1 of the test unit (fig. 1).

(5) Transfer the fly lead of the test unit to the solder tag on the tower which is nearer the input connection of the CT214. Make a record of the reading (B) on the meter M1 of the test unit.

(6) The voltage standing wave ratio can be calculated using the following formula:-

$$\text{V.S.W.R.} = \frac{(A + B)}{(A - B)} \quad : \quad 1$$

The V.S.W.R. should not be greater than 1·2 : 1

(7) Switch off the r.f. power from the transmitter Type T.7355, disconnect the test unit from the standard probe assembly Type 9241 and remove the probe assembly from the clips of the test unit. Fit the ferrules and screw caps on to the standard probe assembly.

9. After ensuring that the conditions of para. 8 have been satisfied, the procedure for assessing the sensitivity of the probe assembly Type 9241 being serviced is as follows:-

(1) The probe assembly Type 9241 to be tested should be connected to the test equipment as described in para. 8, sub-para. (1) to (3).

(2) Set up the transmitter Type T.7355 at a frequency of 225 Mc/s and adjust the r.f. power output so that a reading of 10 watts exactly is obtained on the r.f. power meter CT214.

(3) The reading on the meter M1 of the test unit (fig. 1) should be not less than 20 μA.

(4) Transfer the fly lead of the test unit to the tower which is nearer to the r.f. power meter CT214. The reading on the meter M1 of the test unit should not exceed 10 μA.

(5) Disconnect and remove the probe assembly Type 9241 from the test unit (fig. 1 and 2). Then using the procedure described in para. 8, sub-para. (1) to (3) fit the probe assembly the opposite way round in the clips of the test unit and reverse the r.f. input and output connections from the test equipment to the probe assembly as follows:-

(a) Connect the r.f. output from the transmitter Type T.7355 to the plug which was originally connected to the CT214.

(b) Connect the CT214 to the plug which was originally connected to the r.f. output of the transmitter.

(6) Connect the fly lead of the test unit (fig. 1) to the solder tag of the tower which is nearer the r.f. output connection of the transmitter T.7355. The reading of the meter M1 of the test unit should be not less than 20 μA.

(7) Transfer the fly lead of the test unit to the solder tag of the tower which is nearer the input connection of the CT214. The reading of the meter M1 of the test unit should not exceed 10 μA.

(8) Switch off the transmitter Type T.7355, disconnect all the test equipment from the probe assembly Type 9241. Fit the ferrules and screw caps back on to the probe assembly Type 9241.

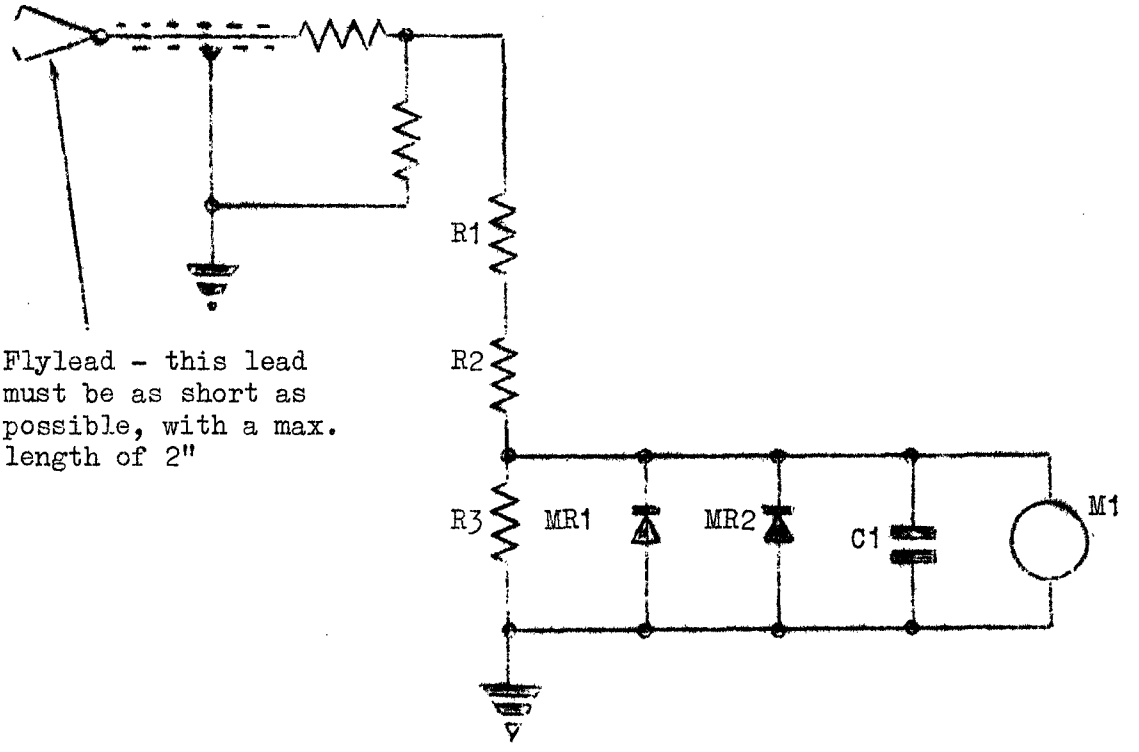


Fig.1 Test Unit Circuit