TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
000	(a)	INT. CON.	-	-	Depress "Press to Test" button.
	(b)	UUT	-	-	Set UUT mode switch to CW(W) and frequency to 2.5 MHz.
NOTE:	Ensure when selecting frequency that the UUT FREQUENCY RANGE switch is in the correct position for the selected frequency.				
	(c)	DVM	100V	-	Set DVM to 100 volt range.
	(d)	AVO	10A	-	Set AVO to 10A dc range.
	(e)	RF GEN.	-	-	Set RF Gen for minimum output.
	(f)	RMS VM	1V	-	Set RMS VM to 1 volt range.
LINE VOLTAGE					
002	(a)	INT. CON.	-	-	Depress "Press to Test" button.
	(b)	DVM	100V	23.92V to 24.08V	Adjust PSU to give a DVM reading of 24V.
Rx CURRENT CONSUMPTION					
011	(a)	RF GEN.	-	25.0 MHz ± 8 Hz	Set RF Gen to 25.0 MHz and 1 mV emf.
	(b)	UUT	-	-	Set UUT to 25.0 MHz.
	(c)	INT. CON.	-	-	Depress "Press to Test" button.
	(d)	DVM	100V	23.92V to 24.08V	Adjust PSU to give a DVM indication of 24V.
	(e)	AVO	1A	NGT 160 mA	Check the 24 volt line current for the UUT power switch positions HP, LP and ANT.
	(f)	UUT	-	-	Remove Hypertac SIG GEN lead from UUT T/R socket. Connect power meter input to T/R socket, connect power meter to RF load.
LINE VOLTAGE					
012	(a)	INT. CON.	-	-	Depress "Press to Test" button.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
012 (cont)	(b)	DVM	100V	23.92V to 24.08V	Adjust PSU to give a DVM indication of 24V.
Tx SIDETONE OUTPUT LEVEL (AM)					
004	(a)	AF GEN.	-	885 mV emf at 2.0 kHz	Set output of AF Gen to 885 mV emf at a frequency of 2.0 kHz (12 mV at UUT).
	(b)	UUT	-	-	Set UUT mode switch to AM, power switch to LP and frequency to 2.5 MHz.
	(c)	INT. CON.	-	-	Depress "Press to Test" button.
	(d)	RMS VM.	1V	300 to 440 mV	Check the reading on the RMS VM.
Tx SIDETONE OUTPUT LEVEL (CW)					
004	(e)	UUT	-	-	Set UUT function switch to CW(W).
	(f)	RMS VM	100 mV	50 to 97 mV	Check the reading on the RMS VM.
TRANSMITTER OUTPUT POWER					
036	(a)	UUT	-	-	Set UUT mode switch to CW(W), power switch OFF and frequency to 25.0 MHz.
	(b)	INT. CON.	-	-	Depress "Press to Test" button.
	(c)	PM	50W	8.4 to 13.4W	Set UUT power switch to HP and, allowing a 5 second delay, check the power meter reading.
	(d)	UUT	-	-	Disconnect power meter assembly from T/R socket. Connect RF mV via 30 dB attenuator to T/R socket.
	(e)	RF mV	3000 mV	0 dB REF	Note RF mV reading as 0 dB reference level.
	(f)	RF mV	1000 mV	9.3 to 12 12.7 dB DOWN ON 036 (e)	Set UUT power switch to LP and, allowing a 5 sec delay, check the RF mV reading with respect to level noted in 036(e).
	(g)	UUT	-	-	Reconnect power meter assembly to T/R socket in place of RF mV assembly.
	(h)	-	-	-	Repeat 036(c) only for UUT frequency of 2.5, 4.0, 6.5, 10.0 and 16.0 MHz.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
000	(a)	INT. CON.	-	-	Depress "Press to Test" button.
	(b)	UUT	-	-	Set UUT mode switch to CW(W) and frequency to 2.5 MHz.
NOTE: Ensure when selecting frequency that the UUT FREQUENCY RANGE switch is in the correct position for the selected frequency.					
	(c)	DVM	100V	-	Set DVM to 100 volt range.
	(d)	AVO	10A	-	Set AVO to 10A dc range.
	(e)	RF GEN.	-	-	Set RF Gen for minimum output.
	(f)	RMS VM	1V	-	Set RMS VM to 1 volt range.
LINE VOLTAGE					
002	(a)	INT. CON.	-	-	Depress "Press to Test" button.
	(b)	DVM	100V	23.92V to 24.08V	Adjust PSU to give a DVM reading of 24V.
Rx CURRENT CONSUMPTION					
011	(a)	RF GEN.	-	25.0 MHz ± 8 Hz	Set RF Gen to 25.0 MHz and 1 mV emf.
	(b)	UUT	-	-	Set UUT to 25.0 MHz.
	(c)	INT. CON.	-	-	Depress "Press to Test" button.
	(d)	DVM	100V	23.92V to 24.08V	Adjust PSU to give a DVM indication of 24V.
	(e)	AVO	1A	NGT 160 mA	Check the 24 volt line current for the UUT power switch positions HP, LP and ANT.
	(f)	UUT	-	-	Remove Hypertac SIG GEN lead from UUT T/R socket. Connect power meter input to T/R socket, connect power meter to RF load.
LINE VOLTAGE					
012	(a)	INT. CON.	-	-	Depress "Press to Test" button.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
UUT METER INDICATION (Tx POWER)					
038	(a)	INT. CON.	-	-	Depress "Press to Test" button.
	(b)	UUT	-	-	Set UUT to 2 MHz, mode switch to CW(W).
	(c)	UUT METER	-	30 to 100% of fsd	Set UUT power switch to HP, allow a 5 second delay, and check the reading indicated on the UUT output meter as a percentage of fsd.
	(d)	UUT METER	-	30 to 100% of fsd	Repeat 038(c) but with UUT power switch set to LP.
	(e)	UUT METER	-	60 to 100% of fsd	Repeat 038(c) but with UUT power switch set to ANT.
	(f)	UUT	-	-	Set UUT power switch OFF and disconnect power meter assy. from UUT T/R socket (i.e. open circuit termination).
	(g)	UUT METER	-	NGT 20% fsd	Repeat 038(c) and check the output power meter indication as a percentage of fsd.
	(h)	UUT	-	-	Set UUT power switch OFF. Connect a short circuit BNC connector to the UUT T/R socket.
	(i)	UUT	-	NGT 20% fsd	Repeat 038(c) in ANT mode only. Check the output power meter indication as a percentage of fsd.
	(j)	UUT	-	-	Set UUT power switch OFF. Reconnect power meter assy. in place of short circuit BNC connector at T/R socket.
Tx CURRENT CONSUMPTION (HP)					
040	(a)	UUT	-	-	Set UUT frequency to 2.5 MHz.
	(b)	INT. CON.	-	-	Depress "Press to Test" button.
	(c)	UUT	-	-	Set UUT power switch to HP.
	(d)	DVM	100V	23.92V to 24.08V	Adjust PSU to give a DVM indication of 24V.
	(e)	AVO	10A	NGT 2.5A	After an interval of at least 5 seconds from switch-on.
	(f)	UUT	-	-	Set UUT power switch OFF.
	(g)	-	-	-	REPEAT 040(c) to (f) at UUT frequencies of:- 4.0, 6.5, 10.0, 16.0 and 25.0 MHz.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
Tx CURRENT CONSUMPTION (LP)					
042	(a)	UUT	-	-	Set UUT frequency to 25.0 MHz.
	(b)	INT. CON.	-	-	Depress "Press to Test" button.
	(c)	UUT	-	-	Set UUT power switch to LP.
	(d)	DVM	100V	23.92V to 24.08V	Adjust PSU to give a DVM indication of 24V.
	(e)	AVO	10A	NGT 1.1A	After an interval of at least 5 seconds from switch-on, check the 24 volt line current.
	(f)	UUT	-	-	Set UUT power switch OFF.
LINE VOLTAGE					
044	(a)	INT. CON.	-	-	Depress "Press to Test" button.
	(b)	DVM	100V	23.92V to 24.08V	Adjust PSU to give a DVM reading of 24V.
NOTE: In tests 046 to 050 the Tx output is fed via the ATU to a dummy load.					
ATU OPERATION					
046	(a)	UUT	-	-	Connect the BNC link provided between T/R and INT TUNER sockets at the rear of the UUT. Connect the special 35 pF capacitor box to the top socket on the l.h.s. of the UUT ensuring also that the box earth tag is attached to the UUT at the adjacent earth connection. Terminate the open end of the capacitor box with the 50 ohm load. Set UUT frequency to 2 MHz, LOAD switch to 5 and ATU range to A.
	(b)	INT. CON.	-	-	Depress "Press to Test" button.
	(c)	UUT METER	-	NLT 60% of fsd	Switch UUT power switch to ANT and adjust TUNE and load controls for a maximum deflection on the UUT meter. Check meter deflection with reference to full scale deflection

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
046 (cont)	(d)	UUT	-	-	Set UUT power switch OFF and set frequency to 29.9999 MHz.
	(e)	UUT METER	-	NLT 60% of fsd	Repeat 046(c) at ATU band E.
	(f)	UUT	-	-	Set UUT power switch OFF.
048	(a)	UUT	-	-	Replace 50 ohm load on 35 pF capacitor box with 10 ohm load.
	(b)	INT. CON.	-	-	Depress "Press to Test" button.
	(c)	UUT METER	-	NLT 60% of fsd	Switch UUT power switch to ANT and adjust TUNE and load controls for a maximum deflection on the UUT meter. Check meter deflection with reference to full scale deflection.
	(d)	UUT	-	-	Set UUT power switch OFF and set frequency to 2 MHz.
	(e)	UUT METER	-	NLT 60% of fsd	Repeat 048(c) at ATU band A.
	(f)	UUT	-	-	Set UUT power switch OFF.
050	(a)	UUT	-	-	Replace 10 ohm load on 35 pF capacitor box with 100 ohm load.
	(b)	INT. CON.	-	-	Depress "Press to Test" button.
	(c)	UUT METER	-	NLT 60% of fsd	Switch UUT power switch to ANT and adjust TUNE control for a maximum deflection on the UUT meter. Check meter deflection with reference to full scale deflection.
	(d)	UUT	-	-	Set UUT power switch OFF and set frequency to 29.9999 MHz.
	(e)	UUT METER	-	NLT 60% of fsd	Repeat 050(c) at ATU band E.
	(f)	UUT	-	-	Set UUT power switch OFF.
VHF FILTER ATTENUATION					
052	(a)	INT. CON.	-	-	Depress "Press to Test" button.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
052 (cont)	(b)	UUT	-	-	At the UUT:- 1) Remove the coaxial link between T/R and INT TUNER sockets. 2) Connect the lead from the hypertac plug at the Test Interface labelled SIG GEN to the UUT INT TUNER socket. 3) Remove the 100 ohm load from the 35 pF capacitor box. 4) Connect the Power Meter Assembly, via a T-piece to the output of 35 pF capacitor box. 5) Connect the Spectrum Analyser directly to the Power Meter Assembly via the T-piece.
NOTE: The above connections provide for supply of the RF Gen output to the VHF filter and monitoring the resulting signal after it has passed through the ATU. The remainder of the receiver/transmitter is switched off.					
054	(a)	INT. CON.	-	-	Depress "Press to Test" button.
	(b)	RF GEN.	-	-	Adjust RF Gen O/P to 1V emf at 29.9999 MHz.
	(c)	SPEC ANAL	-	0 dB REF. LEVEL	Tune UUT for a peak on the Spectrum Analyser and set to 'Log Ref Level' on screen.
	(d)	SPEC ANAL	-	-	Adjust the Spectrum Analyser to sweep from 0 to 110 MHz.
				NLT 26 dB DOWN ON 054(c)	Maintaining the 1 volt output emf, sweep the RF Gen over the frequency range of 33 to 100 MHz. Check that any output on the Spectrum Analyser over this frequency range is NLT 26 dB down on the reference level set in 054(c).
	(e)	UUT	-	-	Remove SIG GEN lead from UUT INT TUNER socket. Remove Power Meter Assembly from the 35 pF capacitor box. Remove the 35 pF capacitor box from the ATU output. Connect link to T/R socket.

TEST No.	STEP	UNIT	RANGE	UNITS	INSTRUCTIONS
VOLTAGE BREAKDOWN (TRANSMIT)					
058	(a)	UUT	-	-	Set UUT frequency to 2.8 MHz and ATU range switch to A.
	(b)	INT. CON.	-	-	Depress "Press to Test" button.
	(c)	UUT METER	-	MAXIMUM STEADY READING	Set UUT power switch to AND and adjust TUNE and LOAD controls for a maximum steady reading on UUT meter.
	(d)	UUT	-	-	Set UUT power switch to HP.
	(e)	UUT METER	-	MAINTAINS STEADY STATE READING	Check that the UUT meter maintains a steady state reading. N.B. An intermittent reading on the UUT meter indicates a voltage breakdown.
	(f)	UUT	-	-	Set UUT power switch OFF. Remove link from INT TUNER and T/R SOCKETS. Connect lead from hypertac plug at Test Interface marked SIG GEN to T/R socket at UUT.
RECEIVER SIGNAL TO NOISE MEASUREMENTS					
060	(a)	UUT	-	-	Set UUT to 2 MHz and SSB.
	(b)	INT. CON.	-	-	Depress "Press to Test" button.
	(c)	RF GEN. & SYNC	-	0.8 μV at 1.998 MHz $\pm$ 8 Hz	Set RF Gen to give an output emf od 0.8 μV at 1.998 MHz $\pm$ 8 Hz. Ensure CARRIER is switched ON.
	(d)	RMS VM	1V	0 dB REF.	Set UUT power switch to LP and vary GAIN to set AF output to 320 mV on the RMS VM. Note the dB reading.
	(e)	RF GEN.	-	-	Switch the carrier of the RF Gen OFF.
	(f)	RMS VM	-	NLT 10.5 dB DOWN ON 060(d)	Check the reading of the AF output as indicated on RMS VM is NLT 10.5 dB down on value noted in 060(d).
	(g)	UUT	-	-	Set UUT power switch to OFF.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
060 (cont)	(h)	-	-	-	REPEAT TEST 060 AT UUT FREQUENCIES:- 2.5 AND 3.1 MHz (BAND 1) 3.1, 4.0 and 4.9 MHz (BAND 2) 4.9, 6.5 AND 7.7 MHz (BAND 3) 7.7, 10.0 AND 12.2 MHz (BAND 4) 12.2, 16.0 AND 19.1 MHz (BAND 5) 19.1, 25.0 AND 29.9 MHz (BAND 6) AND SIGNAL GENERATOR FREQUENCIES:- 2.498 AND 3.098 MHz (BAND 1) 3.098, 3.998 AND 4.898 MHz (BAND 2) 4.898, 6.498 AND 7.698 MHz (BAND 3) 7.698; 9.998 AND 12.198 MHz (BAND 4) 12.198, 15.998 AND 19.098 MHz (BAND 5) 19.098, 24.998 AND 29.898 MHz (BAND 6)
	(i)	SIG GEN & SYNC	-	1 μV at 1.998 MHz $\pm$ 8 Hz	Set RF Gen to give an output emf of 1 μV at 1.998 MHz $\pm$ 8 Hz and Synchroniser at 1.998 MHz phase lock.
OVERALL GAIN					
062	(a)	AF VM	3V	-	Set AF VM to 3V range.
	(b)	UUT	-	-	Set UUT to LP, SSB and 2.0 MHz. Set GAIN control fully clockwise.
	(c)	INT. CON.	-	-	Depress "Press to Test" button.
	(d)	AF VM	3V	NLT 0.89V	Check the AF output level.
	(e)	SIG GEN UUT	-	1 μV at 1.999 MHz $\pm$ 8 Hz	Set RF Gen for a phase locked frequency of 1.999 MHz $\pm$ 8 Hz. Set UUT mode switch to CW(N).
	(f)	AF VM	3V	NLT 0.89V	Check the AF output level.
	(g)	UUT	-	-	Set UUT mode switch to AM.
	(h)	RF GEN & SYNC	-	5 μV at 2.0 MHz AM 85%	With RF Gen frequency set to 2.0 MHz set up an AM output emf of 5 μV. Set mod. depth to 85% 1 kHz.
	(i)	AF VM	3V	NLT 0.89V	Check the AF output level.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
062 (cont)	(j)	UUT	-	-	Switch UUT to FREQ. CHECK, turn GAIN control to minimum. Disconnect lead from T/R socket.
	(k)	AF VM	300 mV 1V	115 to 400 mV	Check the reading on the AF VM.
	(l)	UUT	-	-	Switch UUT to CW(W). Switch the turret to Range 6.
	(m)	AF VM	300 mV 1V	115 to 400 mV	Check the reading on the AF VM.
PRESSEL CHARACTERISTICS					
065	(a)	UUT	-	-	Switch the turret to Range 1.
	(b)	INT. CON.	-	-	Depress "Press to Test" button.
	(c)	DVM	10V	1.802V to 2.398V	Check the SK A voltage reading on the DVM.
	(d)	-	-	-	Disconnect plug from SK A and connect to SK B.
066	(a)	INT. CON.	-	-	Depress "Press to Test" button.
	(b)	DVM	100 mV	NGT 29 mV (NGT 0.29 mA)	Check the voltage reading on the DVM (as current equivalent 0.01 mA/mV).
067	(a)	INT. CON.	-	-	Depress "Press to Test" button.
	(b)	DVM	100V	32V	Adjust PSU to obtain an indication of 32 volts on the DVM.
	(c)	DVM	100V	23.92V to 24.08V	Readjust PSU to obtain an indication of 24 volts on the DVM.
	(d)	DVM	100 mV	NGT 29 mV (NGT 0.29 mA)	Reselect Test 066. Check the voltage on the DVM (ensuring 32V input has caused no damage).
REMOTE SUPPLY					
069	(a)	INT. CON.	-	-	Depress "Press to Test" button.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
069 (cont)	(b)	DVM	100V	NLT 23.52V	Check the voltage on the DVM (remote supply at SK B pin C).
070	(a)	INT. CON.	-	-	Depress "Press to Test" button. (Placing 1 ohm between SK B pins C and E).
	(b)	DVM	1V	NGT 198 mV (NGT 198 mA)	Wait for reading to stabilise and check the voltage reading on the DVM. (Check of current through 1 ohm load across remote supply).
BATTERY CHECK					
034	(a)	UUT	-	-	Switch UUT power switch to BATT. CHK.
	(b)	INT. CON.	-	-	Depress "Press to Test" button.
	(c)	DVM	100V	19.92V to 20.08V	Adjust PSU to give a DVM indication of 20 volts.
	(d)	UUT	-	19 to 21% fsd	Check the front panel meter reading as a percentage of fsd.
	(e)	DVM	100V	31.92V to 32.08V	Adjust PSU to give a DVM indication of 32 volts.
	(f)	UUT	-	NLT 70% fsd	Check the front panel meter reading as a percentage of fsd.
	(g)	DVM	100V	23.92V to 24.08V	Adjust PSU to give a DVM indication of 24 volts.
	(h)	UUT	-	30 to 50% fsd	Check the front panel meter reading as a percentage of fsd.
138	(a)	INT. CON.	-	-	Depress "Press to Test" button.
	(b)	UUT	-	-	Set UUT power switch to OFF. Disconnect UUT from Test Interface.
XXX		UUT	-	-	UUT should now be tested for sealing and leakage by raising the internal pressure of the unit to 35 kN/m^2 and checking for any leaks (procedure as given for second line servicing).

THIRD LINE SERVICING
OF
FRONT PANEL & CHASSIS ASSEMBLY 630/1/37601
(UNIT 1)

CONTENTS

ILLUSTRATIONS

GENERAL

1. The front panel and chassis assembly (Unit 1) is a component part of the receiver transmitter unit and has the following sub-assemblies located on it:

(1)	Turret assembly	Unit 3
(2)	Tuner RF (ATU)	Unit 4
(3)	Power supply	Unit 5
(4)	Mother panel	Unit 6
(5)	Screen and can assemblies	(Units 6a, 6b, 6c/d, 6e)

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sine-waveform is effectively removed when pin 3 of the unit is taken from 0V to a positive potential of between +0.6V and +2.0V.

POLICY

6. The tests in this section include instructions to adjust internal potentiometers, wire links, etc. These instructions must be used with discretion as follows:

(1) Such an instruction should initially be interpreted as an instruction to check that the required result is obtained without any adjustments.

(2) Such an instruction should be obeyed in full only after a check as in (1) has not provided a result within limits and only if a repair has been carried out on the associated circuits. For example, receiver AGC adjustments are not necessary if the transmitter circuits have been repaired.

7. Within the constraints indicated in para.6, all tests will be carried out after repair.

8. Within the constrainst indicated in para.6, the tests can be used as an aid to trouble shooting. Failure to obtain a result within limits must be assumed as due to a fault condition and attempts to rectify this condition by adjustements should not be made.

9. There will be many, instances where a fault can be rectified by replacement of a component part of a unit without complete removal of the unit from the Front Panel and Chassis Assembly. This should be done with discretion, the test procedures given in this section only provide for re-alignment adjustments of Units 1a, 6 and 6a to 6e, any other unit which requires re-alignment adjustments should be removed and aligned in accordance with the test procedures given in the section which covers that unit. In any case, a unit which is removed for repair must satisfy all the tests given in the section which covers that unit before it is fitted to the Front Panel and Chassis Assembly.

NOTES: 1. It is preferred that a suspect synthesiser (Unit 9) be removed from Unit 1 before any attempt is made to diagnose which of its sub-assemblies may be at fault.

2. The ATU (Unit 4) is not checked by the procedures given in this section. However the procedures given in the section which covers this unit can be carried out without removing the unit from the Front Panel and Chassis Assembly.

TESTING

Test equipment

10. The following items of special-to-purpose test equipment are required:

(1) Manual Interface Controller. Plessey Type TD4924A.

(2) Test Interface. Plessey Type TD50562A.

(3) Test Jig. Plessey Type TJ841A.

(4) Junction Box (Plessey TD50575A) to switch output of an AF Generator between the test interface and an AF voltmeter.

11. The following items of proprietary test equipment are required:

Item	Description
Avo	A dc milliammeter for measuring currents in the ranges 100 to 170 mA to an accuracy of ± 1% fsd. Suitable instrument: Avo Model 8X
DVM	A digital voltmeter for measuring voltages in the range 0 to 0.5V, 20 to 33V with an accuracy of ± 0.02% of reading or 0.005% fsd. Suitable instrument: Solartron A203/204
RF VM	An RF millivoltmeter having the following essential characteristics: Frequency range: 2 to 30 MHz Voltage range: 10 mV to 1V Accuracy: ± 2% fsd Suitable instrument: Marconi TF2604
RMS VM	A true rms millivoltmeter having the following essential characteristics: Frequency range: 100 Hz to 5 kHz Voltage range: 10 mV to 1V Accuracy: ± 1% of fsd Suitable instrument: Hewlett Packard 3400A

Item	Description
AF VM	An audio frequency millivoltmeter having the following essential characteristics:

Frequency	2 kHz
Voltage range	10 to 100 mV
Accuracy	± 1% of fsd

Suitable instrument: Hewlett Packard 400E

CRO — An oscilloscope having the following essential characteristics:

Voltage range	0.1 to 10 V/cm to an accuracy of ± 5% of reading
Timebase range	0.1 to 100 mS/cm to an accuracy of ± 5% of reading and 0.5 S/cm to an accuracy of ± 10% of reading

The oscilloscope must have a long persistence trace and facilities for external triggering.

Suitable instrument: Solartron A100

COUNTER — A frequency counter for measuring frequencies in the range 2 to 32 MHz to an accuracy of ± 1 count ± 1 part in 10^7 and having a facility for taking average readings over 10 seconds.

Suitable instrument: Racal 9024 Counter

AF Gen. — An AF signal generator having the following essential characteristics:

Frequency	2 kHz with a setting accuracy of ± 2% ± 1 Hz
Output voltage	50 to 100 mV (setting accuracy as for AF millivoltmeter)
Outputs	600 ohms balanced and 1 ohm unbalanced

Suitable instrument: Advance J3

RF Gen. — An RF signal generator having the following essential characteristics:

Frequency range	2 to 30 MHz with a setting accuracy of ± 10 Hz
Modulation frequency range	70 Hz to 5 kHz with a setting accuracy of ± 10%
Modulation depth	continuously variable to 100% with a depth setting accuracy of ± 5%
Carrier output accuracy	± 1 dB with 50 ohms load

Suitable instrument: Marconi TF2002B with
Marconi TF2170B synchronizer

PSU — A power supply unit to give 20 ± 0.1V, 24 ± 0.1V and 33 ± 0.1V with current limiting at 300 mA.

Suitable instrument: Farnell TSV70

Preliminary

12. Connect the Test Jig (harness) to the test interface.

13. Connect the test interface to the manual interface controller.

14. At the manual interface controller:

(1) Set the DC MONITOR switch to EXT.

(2) Set the test selection switches to COO.

(3) Connect the AVO to the socket marked Avo.

(4) Connect the DVM to the socket marked DVM.

(5) Connect the RMS VM to the socket marked RMS V/V.

(6) Connect the CRO signal input to the socket marked CRO AMP A.

(7) Connect the CRO trigger input to the socket marked CRO AMP TRIG.

(8) Connect the COUNTER to the socket marked COUNTER.

(9) Connect the junction box 1 ohm emf output to the socket marked AUDIO GEN.

(10) Connect the junction box 300 ohm emf balanced outputs to the sockets marked 2 and 5 respectively.

(11) Connect the RF GEN to the socket marked SG1.

15. At the junction box inputs, connect the AF GEN outputs to the inputs of the junction box. Connect the AF VM to the junction box socket marked AF V/V.

16. Connect the RF VM to the special socket on the side of the test interface.

17. Connect the PSU to the manual interface controller EXT B connector.

18. At the unit under test (UUT), mount the mother panel in the servicing position (refer to assembly/disassembly procedures). Disconnect the link between TPG and TPH on Unit 6.

19. Load the UUT into the test jig and connect:

(1) Harness multiway connectors to 1SK1, 1SK2 and 1SK3 on UUT.

(2) Harness probes to TPG, TPH and pin 24, all on UUT Unit 6.

20. Switch on the mains supply to all test instruments where appropriate.

Test procedures

21. Carry out the test procedures given on the following pages.

Notes relating to test procedures

1. For each test of transmitter circuits, the UUT is set to transmit condition by an interface connection to the UUT pressel line.

2. The test interface includes a circuit which oscillates the speech input from the AF GEN to the transmitter between a high level and a low level. This is to test the VOGAD device; the CRO trigger is taken from the pulsing circuit.

3. The AF GEN output is routed to the transmitter speech input at the UUT 1SK3 pins 4 and 5 when the junction box switch is set to NORMAL OUTPUT. If this switch is set to 300 OHM EMF, the AF VM is connected to the AF GEN output.

4. For the majority of tests, the title of the test, as given in the procedures, together with the UUT switch settings, indicates the nature of the test. Clarifying comments are included at various points and various general comments are given in note 5 below. In respect of particular tests:

(1) Test 016/018. This is to check that switch from Rx to Tx mode will not occur if the unit is set to FREQ.CHECK. The DVM is connected to the +6V Tx rail for this test.

(2) Test 021. This is to check the pressel delay circuit. The +24V Tx rail is displayed at the CRO and the delay between releasing the pressel and switching off this rail is checked on CW mode and or AM mode.

5. The general employment of the test instruments is as follows:

(1) Avo and DVM. To measure 24V line current and voltage respectively.

(2) Counter. To measure VFO output frequency (at pin 24 of Unit 6).

(3) RF VM. Is used to measure either:

(a) Receiver IF level (at Unit 6 TPh) on receiver tests or

(b) Transmitter RF output level (at UUT 1SK2/A1) on transmitter tests.

(4) RMS VM. Is used to measure the UUT audio output (at UUT 1SK3 pin 2).

(5) RF GEN. Is used to provide the receiver RF input (at UUT 1SK1/A1).

6. All loading units for the UUT and test instruments are built into the test interface.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
000	(a)	INT. CON.	-	-	Depress "Press to Test" button.
	(b)	UUT	-	-	Set frequency to 2.2222 MHz (see note below) and mode to AM. Set to LP and turn GAIN fully anticlockwise.
	(c)	AVO	250 mA	-	Set AVO to 250 mA dc range.
	(d)	DVM	100V dc	-	Set DVM to 100V dc range.
	(e)	RMS VM	1V	-	Set RMS VM to 1V range.
	(f)	COUNTER	-	-	Set counter to take average over 10 sec on MHz range.
	(g)	RF VM	100 mV	-	Set RF VM to 100 mV range.
	(h)	CRO	-	-	Set CRO to maximum voltage range.
	(i)	AF GEN.	-	-	Set AF Gen to minimum output level.
	(j)	PSU	-	-	Set PSU to minimum output.
	(k)	RF GEN.	-	-	Set RF Gen to minimum output level.
	(l)	-	-	-	Set switch on junction box to NORMAL OUTPUT.
NOTE: All instructions to set the UUT frequency must be taken to include setting the FREQUENCY RANGE switch to the appropriate band.					
SET SUPPLY VOLTAGE					
002	(a)	INT. CON.	-	-	Depress "Press to Test" button.
	(b)	PSU	-	23.78V to	Increase PSU output to give 24V on DVM.
		DVM	100V	24.22V	
	(c)	AVO	1A	110 to 160 mA	Check 24V line current.
004	(a)	INT. CON.	-	-	Depress "Press to Test" button.
	(b)	DVM	-	23.78V to 24.22V	Readjust PSU for 24V on DVM.
SYNTHESISER LOGIC (VFO OUTPUT)					
008	(a)	INT. CON.	-	-	Depress "Press to Test" button.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
008 (cont)	(b)	-	-	-	Refer to table 1 and for each of check Nos. 1 to 11: (i) Set UUT frequency, range and mode switches as given. (ii) Check that the counter reading, when averaged over 10 sec, is within the limits given. (iii) Set the gate time on counter to 1 sec and check that the difference between successive readings is NGT ± 8 Hz.

Table 1

Check	UUT switch settings			Counter reading Limits (MHz)
	Frequency MHz	Range	Mode	
1	02.2222	1	AM	3.972202 to 3.972198
2	03.3333	2	AM	5.083303 to 5.08329
3	05.5555	3	AM	7.305505 to 7.305495
4	10.0000	4	AM	11.750010 to 11.749990
5	11.1111	4	AM	12.861111 to 12.861089
6	14.4444	5	AM	16.194414 to 16.194386
7	26.6666	6	AM	28.416626 to 28.41657
8	27.7777	6	AM	29.527728 to 29.527672
9	28.8888	6	AM	30.638828 to 30.638772
10	29.9999	6	AM	31.749929 to 31.749871
11	29.9999	6	CW(W)	31.749929 to 31.749871

A	UUT	-	-	Set UUT to SSB, 2.0000 MHz.
B	RMS VM	1V	-	Set RMS VM to 1V range.
C	RFG1	-	-	Set RFG1 to 2 μV emf at 1.998 MHz.
D	RMS VM	1V	314 to 326 mV (0 dB ref)	Adjust UUT GAIN control to give 320 mV on RMS VM. Note RMS VM dB reading.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
008 (cont	E	RFG1 RMS VM	- 10V	- NGT 4.8 dB than 008D	Increase RFG1 output to 100 mV emf and check that the RMS VM dB reading is NGT 4.8 dB different from that noted in 008D.
	F	RFG1	-	-	Set RFG1 output to 5 µV emf at 2.0000 MHz modulated at 1 kHz to 85%.
	G	-	-	-	Repeat 008D and E.
NOTE: The remainder of test 008 will be carried out only if incorrect results are obtained in 008A-G and only if a repair has been carried out.					
AGC PRELIMINARY SETTING UP					
	(x)	UUT	-	-	Remove links on Unit 6a (see table 2). Set R2 and R4 on Unit 6b both fully anticlockwise. Set UUT to AM and set frequency controls to 2.0000 MHz. Set GAIN control fully clockwise. Connect RF VM to TPH.
	(y)	RF GEN.	-	-	Set RF Gen to 2.0000 MHz at 1.0 µV emf.
	(z)	UUT RF VM	- 100 mV	- 27 to 48 mV	Adjust L2 and L3 in Unit 6a for maximum output on RF VM. Fit links to Unit 6a (table 2) according to RF VM reading. Then check that reading is within limits of 27 to 48 mV.

Table 2 - Unit 6a links

RF VM reading	Link Unit 6a pins
3.4 to 6.0 mV	6 to 7
6.4 to 8.6 mV	6 to 8
9.4 to 11.4 mV	6 to 9
12.6 to 19.4 mV	7 to 10
20.6 to 24.4 mV	6 to 10
27 to 48 mV	None

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
AGC LEVEL SSB					
008 (cont)	(aa)	RMS VM	1V	-	Set RMS VM to 1V range.
	(ab)	UUT	-	-	Set UUT to SSB.
	(ac)	RF GEN.	-	-	Set RF Gen to 1 μV emf at 1.998 MHz.
	(ad)	RMS VM	1V	1.00V	Adjust R5 on Unit 6b to give 1V on the RMS VM.
	(ae)	RF GEN.	-	-	Set RF Gen to 2 μV emf at 1.998 MHz.
	(af)	UUT	-	314 to 326 mV (0 dB ref)	Adjust GAIN control on UUT to give 320 mV on RMS VM.
		RMS VM	1V		
	(ag)	UUT	-	-	Adjust R4 on Unit 6b to reduce RMS VM reading by 3 dB. Adjust UUT GAIN control to reset level to 0 dB ref.
		RMS VM	1V	-3 dB 0 dB	
	(ah)	RF GEN.	-	-	Increase RF Gen output to 100 mV emf and check the difference between the reading on the dB scale and the reference taken in (af) on RMS VM.
		RMS VM	10V	NGT 4.8 dB	
AGC LEVEL AM					
	(ai)	RF GEN.	-	-	Reduce RF Gen output to 5 μV emf at 2.0000 MHz modulated at 1 kHz to 85%.
	(aj)	UUT	-	-	Switch UUT to AM and set GAIN to maximum.
		RMS VM	1V	1.00V	Adjust R11 on Unit 6b to give 1V on RMS VM.
	(ak)	RF GEN.	-	-	Increase RF Gen output to 10 μV emf.
	(al)	UUT	1V	314 to 326 mV (0 dB ref)	Adjust GAIN control on UUT to give 320 mV on RMS VM.
		RMS VM	1V		
	(am)	UUT	--	-	Adjust R2 on Unit 6b to reduce RMS VM reading by 3 dB. Adjust UUT GAIN control to reset level to 0 dB ref.
		RMS VM	1V	-3 dB	
	(an)	RF GEN.	-	-	Set RF Gen to 10 μV emf and 1 kHz modulation depth to 30%.
	(ao)	UUT	-	-	Adjust GAIN control on UUT to give 0 dB on RMS VM.
		RMS VM	1V	0 dB	

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
008 (cont)	(ap)	RF GEN.	-	-	Increase RF Gen output to 100 mV.
	(aq)	RMS VM	10V	NGT 4.8 dB	Check the reading on RMS VM is NGT 4.8 dB above 008(ao).
RECEIVER SENSITIVITY AND GAIN CONTROL					
012	(a)	RF GEN.	-	-	Set RF Gen to 24.998 MHz at 1 μV emf.
	(b)	UUT	-	-	Switch UUT to SSB, frequency to 25 MHz and GAIN to maximum.
	(c)	INT. CON.	-	-	Depress "Press to Test" button.
	(d)	RMS VM	1V	NLT 850 mV (0 dB ref)	Check reading on RMS VM. Note the reading on the dB scale as a reference.
	(e)	UUT	-	-	Turn GAIN control on UUT and ensure that it will continuously vary the output as read on the RMS VM. Turn GAIN fully anticlockwise.
		RMS VM	1V	-	
	(f)	RMS VM	-	42.5 to 57.5 dB Below 012 (d)	By changing down the range switch of the RMS VM (10 dB steps) check that the reading is between 43 and 57 dB below the reference taken in (d).
SIGNAL TO NOISE RATIO CW(W)					
	(g)	RF GEN.	-	-	Set RF Gen to 24.998 MHz at 0.8 μV emf.
	(h)	UUT	-	-	Set UUT to 25 MHz and CW(W).
	(i)	RMS VM	1V	-	Switch RMS VM to 1V range.
	(j)	UUT	-	-	Adjust GAIN on UUT to set the RMS VM indicator to the nearest dB marker to 320 mV. Note the dB reading.
		RMS VM	1V	314 to 326 mV (0 dB ref)	
	(k)	RF GEN.	-	-	Switch off the carrier on RF Gen.
	(l)	RMS VM	0.1V	NLT 10.5 dB Below 012 (j)	Check that the reading on the RMS VM is more than 10.5 dB below the reference taken in (j).
SIGNAL TO NOISE RATIO CW(N)					
	(m)	RF GEN.	-	-	Switch on carrier at RF Gen (setting 0.8 μV emf at 24.999 MHz).

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
012 (cont)	(n)	UUT	-	-	Switch UUT to CW(N). Adjust GAIN on UUT to set the RMS VM indicator to the nearest dB marker to 320 mV. Note dB reading.
		RMS VM	1V	314 to 326 mV (0 dB ref)	
	(o)	RF GEN.	-	-	Switch off carrier at RF Gen.
	(p)	RMS VM	0.1V	NLT 17.5 dB Below 012 (n)	Check that the reading on the RMS VM is more than 17.5 dB below the reference taken in (n). (If necessary change range on RMS VM).
SIGNAL TO NOISE RATIO AM					
	(q)	RF GEN.	-	-	Switch on carrier at RF Gen (frequency set to 25.000 MHz). Set RF Gen output to 3.3 μV emf, modulated at 1 kHz to a depth of 30%.
	(r)	UUT	-	-	Switch UUT to AM mode and frequency to 25 MHz. Adjust UUT GAIN to set the RMS VM indicator to the nearest dB marker to 320 mV.
		RMS VM	1V	314 to 326 mV (0 dB ref)	
	(s)	RF GEN.	-	-	Switch off modulation at RF Gen.
	(t)	RMS VM	-	NLT 10.5 dB Below 012 (r)	Check that the reading on the RMS VM is more than 10.5 dB below the reference taken in (r).
FREQUENCY LOCK INDICATION					
	(u)	UUT	-	-	Set GAIN on UUT fully anticlockwise. Switch UUT to a frequency outside the limits of the FREQUENCY RANGE switch. Check that the phase lock alarm sounds.
	(v)	RMS VM	1V	110 mV to 440 mV	Check reading on RMS VM.
FREQUENCY CHECK FACILITY					
	(w)	RF GEN.	-	-	Set RF Gen to 1.999 MHz at 25 mV emf.
	(x)	UUT	-	-	Switch UUT to FREQ.CHK. Adjust GAIN control fully anticlockwise.
	(y)	RMS VM	1V	110 mV to 440 mV	Note reading on RMS VM. Set UUT to 2.0 MHz and CW(N).
	(z)	RMS VM	1V	-	Adjust GAIN control to give same reading as at 012(v).

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
012 (cont)	(aa)	UUT	-	-	Switch UUT to FREQ. CHECK.
	(ab)	RMS VM	1V	-	Check that there is a low frequency beat note causing the RMS VM needle to fluctuate. Adjust Freq. of RF Gen a small amount if necessary.
BATTERY VOLTAGE INDICATION					
013	(a)	UUT	-	-	Switch UUT to BATTERY CHECK.
	(b)	INT. CON.	-	-	Depress "Press to Test" button.
	(c)	DVM	100V	19.92 to 20.08V	Adjust PSU to give 20V on DVM.
	(d)	UUT	-	20% fsd	Adjust R4 on mother panel (Unit 6) to set the front panel meter indicator exactly on the first calibration point from zero. (20% fsd).
	(e)	DVM	100V	23.92 to 24.08V	Adjust power supply to give 24V on DVM.
	(f)	UUT	-	30% to 60% fsd	Check that the front panel meter indicates between 30% and 60% of full scale.
	(g)	DVM	100V	31.92 to 32.08V	Adjust power supply to give 32V on DVM.
	(h)	UUT	-	70% to 100% fsd	Check that the front panel meter indicates between 70 and 100% of full scale.
	(i)	DVM	100V	23.78 to 24.22V	Adjust power supply to give 24V on DVM.
SSB DRIVE LEVEL					
014	(a)	UUT	-	-	Switch UUT to SSB, LP, 2.000 MHz.
	(b)	RF VM	100 mV	-	Set RF VM to 100 mV range and refit to side of INTERFACE. Remove probe from pin 24 of UUT Unit 6.
	(c)	INT. CON.	-	-	Depress "Press to Test" button.
	(d)	-	-	-	Set switch on Junction Box to '300 OHM EMF' position.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
014 (cont)	(e)	AF GEN AF VM	-	2.000 kHz	Set AF Gen to 2 kHz and level to 29 mV on AF VM.
	(f)	-	-	-	Set switch on Junction Box to NORMAL OUTPUT position.
	(g)	RF VM	100 mV	42 to 58 mV (0 dB ref)	If RF VM indication is outside limits, then at Unit 6e, replace links with links to pin 9 to 11 and pin 10 to 12. Note RF VM reading, refer to table 3 and adjust Unit 6 links accordingly. Check and note final reading on RF VM.

Table 3 - Unit 6e links

RF VM reading	Link Unit 6e pins
19.6 to 26.4 mV	8 to 10 and 10 to 12
29 to 38 mV	9 to 10 and 11 to 13
42 to 58 mV	No change
62 to 82 mV	9 to 11, 8 to 10 and 10 to 12
86 to 104 mV	9 to 11, 8 to 10 and 10 to 12

CW (W) DRIVE LEVEL					
	(h)	UUT	-	-	Switch UUT to CW(W), LP.
	(i)	RF VM	100 mV	-1.6 to -1.9 dB Below 014 (g)	Adjust R15 on Unit 1a to give RF VM reading -1.6 to -1.9 dB below 014(g).
CW (N) DRIVE LEVEL					
	(j)	UUT	-	-	Switch UUT to CW(N), LP.
	(k)	RF VM	100 mV	Within 3.2 dB of 014 (i)	Check RF VM reading with respect to result at 014(i).
AM DRIVE LEVEL					
	(l)	UUT	-	-	Switch UUT to AM. Set h5 on Unit 6d fully anticlockwise.
	(m)	CRO	-	-	Set CRO timebase to 1 mS/cm and voltage range to 50 mV/cm. Set to internal trigger, AC.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
014 (cont)	(n)	UUT	-	-	Adjust R3 on Unit 6d for a modulation depth of 85% by adjusting the Y expansion control on the CRO, so that the waveform covers the full 8 cm of screen height, and setting the trough amplitude using R3 to less than 0.64 cm. (Note that R3 will have two apparent correct settings. The first of these from fully anticlockwise is the correct setting). Set UUT to SSB.
	(o)	CRO	-	-	Set the Y expansion to CAL and note the peak-to-peak amplitude of the waveform.
	(p)	UUT	-	-	Switch UUT to AM and adjust R8 on Unit 6d to set the peak-to-peak amplitude to the same level as in (o).
FREQUENCY CHECK Tx LOW LEVEL					
016	(a)	INT. CON.	-	-	Depress "Press to Test" button.
	(b)	UUT	-	-	Switch UUT to FREQ. CHK.
018	(a)	DVM	1V	-	Set DVM to 1V range.
	(b)	UUT	-	-	Set UUT to Transmit.
	(c)	INT. CON.	-	-	Depress "Press to Test" button.
	(d)	DVM	1V	NGT 0.499V	Check DVM reading (6V Tx line at Unit 6 pin 11).
SIDETONE LEVEL AM					
020	(a)	-	-	-	Set switch on junction box to 300 ohm EMF position. Switch UUT to AM.
	(b)	AF GEN	-	-	Set AF Gen to 2 kHz and set output to 17.5
		AF VM	30 mV	-	mV as read on the AF VM.
	(c)	-	-	-	Set switch on junction box to NORMAL OUTPUT position.
	(d)	RMS VM	1V	-	Switch RMS VM to 1V range.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
020 (cont)	(e)	INT. CON.	-	-	Depress "Press to Test" button.
	(f)	RMS VM	1V	280 mV to 460 mV	Check reading on RMS VM.
SIDETONE LEVEL CW(W)					
	(g)	UUT	-	-	Switch UUT to CW(W).
	(h)	RMS VM	100 mV	46 to 100 mV	Switch RMS VM to 100 mV range and check reading.
CW BREAK IN					
021	(a)	CRO	100 mS/cm 10V/cm	-	Set CRO to external trigger, dc, +ve, and set timebase to 100 mS/cm. Set voltage range to 10V/cm dc.
	(b)	UUT	-	-	Switch UUT to CW(W).
	(c)	INT. CON.	-	-	Depress "Press to Test" button.
	(d)	CRO	-	263 to 712 mS	Check the time taken before the 24V dc level switches off on CRO.
	(e)	INT. CON. CRO	-	- c	Set the Int Controller to TEST 020 and set the CRO timebase to 5 mS/cm.
	(f)	UUT	-	-	Switch UUT to AM.
	(g)	INT. CON.	-	-	Set the Int Controller to TEST 021 and press the "Press to Test" button.
	(h)	CRO	-	NGT 23.7 mS	Check the time taken before the 24V dc level switches off on CRO.
022	(a)	INT. CON.	-	-	Depress "Press to Test" button. Unload UUT from test jig. Replace link between TPG and TPH on Unit 6. Replace Unit 6 in normal operating position.

Calibration of temperature controlled reference oscillator (Unit 8)

22. It is suggested that calibration of Unit 8 be carried out at specified intervals. The following are recommended:

(1) Six monthly intervals (Unit 8 assembled into Unit 1).

(2) Upon assembly into Unit 1 if interval since last calibration exceeds three months.

23. For the calibration, the front panel and chassis assembly should be connected to a 24V supply, be operated in the transmit mode and have a counter connected to monitor the RF output at 1SK2 pin A1. This can be done either by:

(a) Making the indicated connections, (including pressel switch between 1SK3 pins 3 and 7) or

(b) By calibrating as part of Unit 1 testing, in which case, it is only necessary to connect the counter to the special socket on the side of the test interface (in place of the RF VM), and, at the manual interface controller, select test number 014 and depress the Press to Test button.

24. Whichever connections are employed, proceed as follows:

(1) Carry out the calibration at normal room temperature ($20^{o}C \pm 5^{o}C$).

(2) Set UUT to CW(W), frequency to 10.00000 MHz and wait at least 20 minutes.

(3) Set the counter to gating time 10 secs and check that the counter reading is within 10 Hz of 10.00000 MHz, allowing for the calibration information given on Unit 8 and the Front Panel labels (see note).

NOTES: 1. The Unit 8 and Front Panel labels record the last three digits of the counter reading appropriate to three separate temperatures. Hence, the counter reading required at the ambient temperature can be extrapolated.

2. When Unit 8 is replaced, the label on the front panel must be changed to agree with the calibration data given on Unit 8 label.

(4) If the counter reading is not within limits, remove the screw plug on Unit 8 and adjust the trimmer resistor to obtain the correct frequency. Replace the screw plug and strike off the appropriate section of the recalibration label on the front panel casting to indicate date of re-calibration.

COMPONENTS LIST FOR
PANEL, ELECTRONIC CIRCUIT (Unit 6)
419/1/24982 (see Figure 3)

Cct.Ref.	Description	Reference No.
	Resistors	
R1	10 kohm ± 5%	403/4/78126/073
R2	10 kohm ± 5%	403/4/78126/073
R3	3.9 kohm ± 5%	403/4/78126/063
R4	2 kohm ± 10% variable 0.5w	404/9/05032/004
R5	3.9 kohm ± 5%	403/4/78126/029
R6	150 ohm ± 5%	403/4/78126/029
R7	180 ohm ± 5%	403/4/78126/031
R8	Not used	
R9	100 ohm ± 5%	403/4/78126/025
R10	1 kohm ± 5%	403/4/78126/049
R11	510 kohm ± 5%	403/4/78127/114
R12	10 kohm ± 5%	403/4/78126/073
R13	5.6 kohm ± 5%	403/4/78126/067
R14	4.7 kohm ± 5%	403/4/78126/065
R15	1 kohm ± 5%	403/4/78126/049
	Capacitors	
C1	180uF ± 10% 6v	402/4/98049/006
C2,C3	68nF +80% -20% 50v	400/9/19084/098
C4	180uF ± 10% 6v electrolytic	402/4/98049/006
C5	68nF +80% -20% 50v	400/9/19084/098
	Inductors	
L1	Inductor 180uH	406/8/08470/027
	Semi-conductor devices	
D4	Not used	
D1,2,3,5,6	Diode, CV7367	990/4/00107/367
ML1	Integrated circuit CN497T	446/4/00429
	Miscellaneous	
RLA	Relay	507/9/05095 (or 507/9/38041)
FS1	Indicator, elapsed time (E.T.I.)	434/9/94315

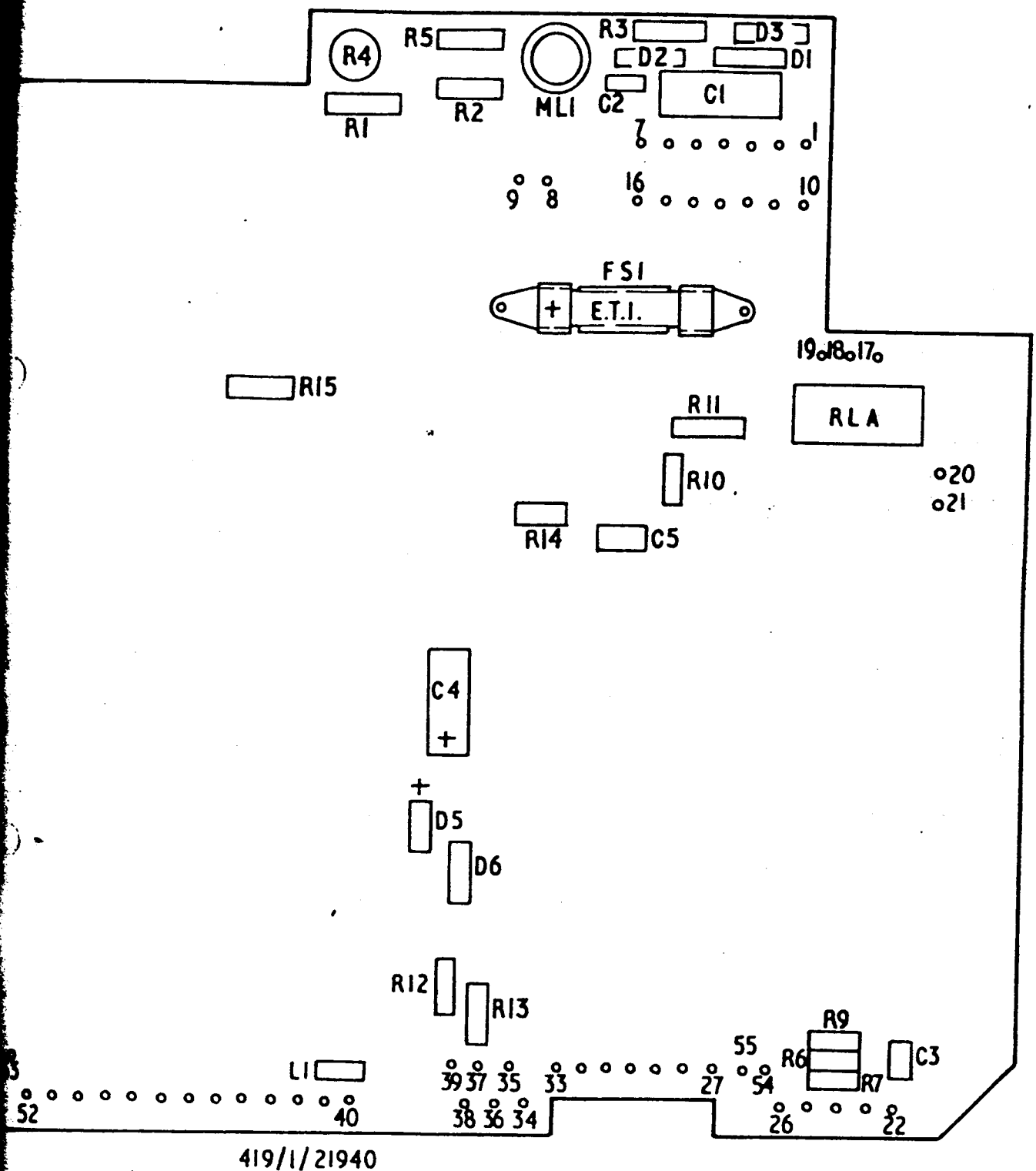


Fig. 3 Unit 6 – component layout

THIRD LINE SERVICING OF FILTER UNIT 419/1/24970 (UNIT 1a)

CONTENTS

ILLUSTRATIONS

DESCRIPTION

1. The Filter Unit (unit 1a) is a panel, electronic circuit (pec), which is a component part of the transmitter receiver and is normally located on the Front Panel and Chassis Assembly (Unit 1).

2. With reference to the circuit diagram in fig.1., Unit 1a provides the following:

(1) TR4, TR5, TR2 and associated components function as a filter which accepts a 1 k Hz input square wave of 100 mV peak-to-peak and shapes this waveform to provide two 1 k Hz sine wave outputs, one 50 mV peak-to-peak and the other variable up to 50 mV peak-to-peak.

(2) Surge protection of an external relay is provided by transistor TR3 (in parallel with the relay coil) and transistor TR1 (in parallel with the relay contacts). The relay drive signal operates TR3, thereby switching TR1. Since the transistors operate more rapidly than the relay, TR1 takes the initial surge and thereby protects the relay contacts. The maximum surge current is 4.5 mA.

(3) L2/C2 provides decoupling of the +6V supply for the VFO and L1 provides suppression for the +6V supply to certain Rx and Tx circuits.

TESTING

Test equipment

3. The following items of test equipment are required:

Item	Description
Sig. Gen	Square wave generator with frequency output 1 k Hz ± 10%, output impedance less than 100 ohm and output emf 100 mV peak-to-peak. Suitable instrument: Advance Type H1 or AF generator with pulse forming network.
Avo	To measure dc current up to 5A with an accuracy of ± 5%. Suitable instrument: Avometer Model 8X.
CRO	Oscilloscope to measure 1 k Hz of amplitude 50 mV p-p Suitable instrument: Solartron A100.
PSU A	DC supply to provide +2.9V ± 0.1V up to 10 mA Suitable instrument: Farnell L30B
PSU B	DC supply to provide +24V ± 0.5V up to 5A. Suitable instrument: Farnell T5V 70.

4. The following components are required:

(1) Resistor 1 k ohm ± 2% ½W (Qty 2)

(2) Resistor 1.2 k ohm ± 2% ½W

(3) Resistor 5.3 ohm ± 1% 120W

(4) Capacitor 470 nF ± 20% (Qty 2)

(5) Single pole switch (24V, 5A)

NOTE: Filter unit under test is termed UUT

1 k Hz filter

Connect the PSU A across UUT pins 5(+ve) and 7 (-ve)

6. Connect Sig Gen output to UUT pin 6 (cable screen to pin 4 of UUT)

7. Connect 1 k ohm resistor and 470nF capacitor (in series) between UUT pins 3 and 4 (capacitor to pin 3). Similarly connect second 1 k ohm resistor and 47CnF capacitor between UUT pins 14 and 4 (capacitor to pin 14).

Switch on supplies to test instruments and

(1) Set PSU A output to 2.9V ± 0.1V

(2) Set Sig. Gen output to 1 k Hz ± 100 Hz at 100 mV p-p.

(3) Connect CRO to monitor waveform across 1 kohm load resistor connected via capacitor to pin 3.

(4) Check that the displayed waveform is sinusoidal, of frequency 1 k Hz ± 100 Hz and 50mV ± 2mV p-p.

(5) Connect CRO to monitor waveform across 1 k ohm load resistor connected via capacitor to pin 14.

(6) Repeat (4) but verify that the waveform amplitude is adjustable by R15 on UUT from a maximum of 50 mV ± 2 mV p-p to approx. OV.

Relay protection circuit

9. Connect PSU B +ve rail to UUT pins 11 and 13.

10. Connect AVO -ve terminal to PSU B -ve rail.

11. Connect 5.3 ohm resistor between AVO +ve terminal and pin 10 of UUT.

12. Connect pin 12 of UUT via 1.2 k ohm resistor and test switch to PSU B -ve rail. Open the switch.

13. Switch on PSU B and set its output to 24V ± 0.5V with current limit 5A.

14. Close the test switch and check that the AVO reading is between 4.0A and 4.5A.

15. Open the test switch and check that the AVO reading is less than 1 mA.

COMPONENTS LIST

16. The principal component parts of the 1 k Hz filter are listed below and the component layout is given on Fig.2.

Cct Ref.	Description	Ref. No.
	Resistors	
R1	3.3 kohm ± 5%	403/4/78126/061
R2	3.9 kohm ± 5%	403/4/78126/063
R3	7.5 kohm ± 5%	403/4/78126/070
R4	16 kohm ± 5%	403/4/78126/078
R5	10 kohm ± 5%	403/4/78126/073
R6	33 kohm ± 5%	403/4/78126/085
R7	68 ohm ± 5%	403/4/78126/021
R8	2.2 kohm ± 5%	403/4/78126/057
R9	10 kohm ± 5%	403/4/78126/073
R10	470 ohm ± 5%	403/4/78126/041
R11	1 kohm ± 5%	403/4/78126/049
R12	3.3 kohm ± 5%	403/4/78126/061
R13, 14	10 kohm ± 5%	403/4/78126/073
R15	10 kohm ± 10% variable	408/9/05033/404

Cct Ref.	Description	Ref. No.
	Capacitors	
C1	82nF ± 10% 100v	400/9/19083/065
C2	47uF ± 20% 6v electro-lytic	402/4/98049/010
C3, C4	39nF ± 10% 100v	400/9/19083/061
C5	10nF + 80% -20% 100v	400/9/19084/078
C6	68nF + 80% -20% 50v	400/9/19084/098
C7	4.7nF ± 10% 100v	400/9/19083/041
	Inductors	
L1	Inductor R.F.	406/8/11032/004
L2	Inductor R.F.	406/9/08490/033
	Semi-conductors	
TR1	Transistor	417/4/00247
TR2	Transistor	417/4/02027/003
TR3, TR4	Transistor	417/4/00240
TR5	Transistor CV7648	417/4/98681/000
D1	Diode BAX 12	415/4/05451

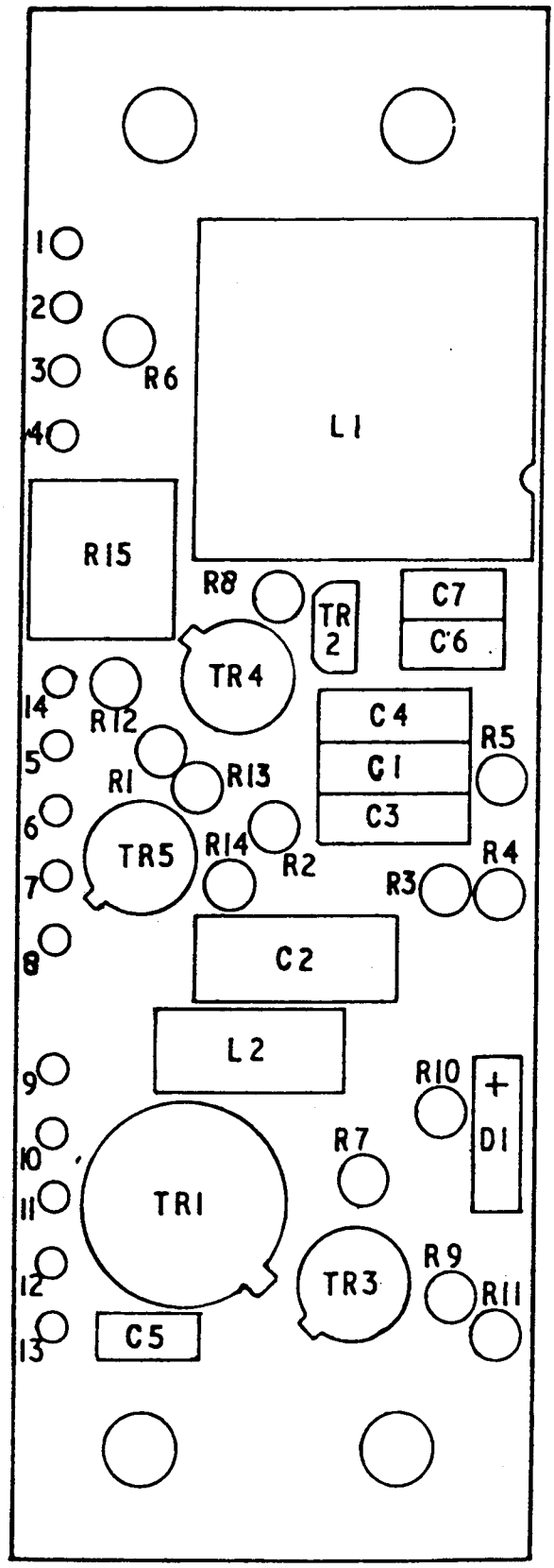


Fig.2 1kHz filter (Unit 1a) – component layout

THIRD LINE SERVICING
OF
REAR PANEL ASSEMBLY 630/1/37608
(UNIT 2)

CONTENTS

ILLUSTRATIONS

:RODUCTION

The rear panel assembly (Unit 2) is a component part of the transmitter :eiver unit and comprises a number of sub-assemblies which are all attached the rear panel casting.

The principal sub-assemblies of the rear panel assembly are:

(1) Power Amplifier — Unit 2a

(2) PA Switch and Filter Assembly which contains:

(a) Reflectometer — Unit 2b

(b) PA Filter Assembly — Units 2c-2f

(3) RF Decoupling Unit — Unit 2g

(4) VHF Filter — Unit 2h

This section of the manual provides information for the servicing of rd line of the rear panel assembly as a whole. Only Unit 2a is detailed this section, the remaining sub-assemblies (items 2(a), 2(b), 3 and 4 in a.2 above) can each be independently tested at third line and are each ailed in their own sections in this part of the manual.

CTIONAL DESCRIPTION

The functions of the sub-assemblies are:

(1) Power amplifier (Unit 2a)

Provides power amplification of the transmitter RF signal, with an automatic level control (ALC) which maintains the transmitter output power at the correct level to suit the conditions of load VSWR, battery voltage, operating mode and demanded power. Information concerning load VSWR and output power is provided by the reflectometer.

(2) Reflectometer (Unit 2b)

This contains monitors which provide information concerning load VSWR and output power.

(3) PA filters (Units 2c to 2f)

The filters provide reduction of the harmonic content of the transmitter output to below -40 dB with respect to the wanted signal.

(4) RF decoupling unit (Unit 2g)

This unit is connected in series with the wiring to the two audio sockets. It decouples spurious RF from the audio signal lines.

(5) VHF filter (Unit 2h)

The unit is connected in circuit when the antenna tuning unit (Unit 4) is in use; it provides reduction in the level of broadband noise and spurious outputs in the range 33 MHz to 75 MHz by at least 25 dB.

DETAILED DESCRIPTION

General

5. The units, and various plug and socket connectors on the rear panel assembly are interconnected as shown in fig.1. Connectors 2PL1, 2PL2 and 2PL3 engage with corresponding connectors on the Front Panel and Chassis Assembly (Unit 1) and provide all electrical connections between Units 1 and 2. Sockets 2SK5 and 2SK6 are located on the rear of Unit 2 and provide connections to external audio equipment. Sockets 2SK7 and 2SK8 are also located on the rear of the unit, a 50 ohm RF source or load can be connected directly to 2SK7, otherwise the antenna tuning unit (Unit 4) is required and the two sockets are connected by external link.

NOTES: 1. Refer to figs.1 and 2 in the section for second line servicing of the receiver/transmitter (Part 2 of this manual) for block diagram and interconnection data relating to Unit 2.

2. Refer to the separate sections in this part of the manual for detailed descriptions of Units 2b-2h.

Unit 2a

6. The power amplifier sub-assembly consists of a panel, electronic circuit together with a connector (2PL2). Wire leads connect 2PL2 to the panel, which contains RF power amplifiers, ALC generator and bias regulator circuits.

7. With reference to the circuit diagram in figure 2. The power amplifiers consist of a class AB output stage (TR12/13), a class AB driver (TR6/7) and three class A pre-amplifier stages (ML2, TR2 and TR3/4).

8. ML2, the first pre-amplifier stage, is a silicon integrated circuit. The RF input at pin 5 of ML2 is the main signal path and this same input at pin 6 controls the bias level of the internal amplifier. A gain control signal is applied from pin 11 of the ALC generator ML1 to pin 7 of ML2. The amplified RF is taken from pin 3 of ML2 to the second pre-amplifier, TR2.

9. Bias for the driver stage is derived from the +6V supply by a "ring-of-two" regulator circuit (TR5/TR8). The bias level is set by resistor R34. Similarly, bias for the output stage is provided by the regulator TR9, TR10, TR11 and the bias level is set by resistor R43.

NOTE: Transistors TR11, 12 and 13 are located on a heat sink which is attached to the panel, electronic circuit.

10. The ALC generator ML1 compares an ALC control signal, supplied to pin 22 of ML1 from Unit 2b, with a standing reference voltage developed across an internal resistor chain and set by resistor R2. Since the control voltage is derived from the RF output and the ALC generator output controls the gain of the first RF pre-amplifier, a loop is formed which automatically maintains the peak-envelope-power at the appropriate level. The standing reference voltage within ML1 is modified, and the RF power level consequently reduced, when OV is applied either to pin 2 or pin 4 of the panel.

11. The ALC system has a fast attack time constant and a slow decay time constant to provide suitable control of peak-envelope-power without introducing excessive intermodulation. These time constants are provided by various components connected to ML2 and by TR1. The inputs OV LP, OV LP/HP and OV ANT TUNE are normally controlled by the power switch on the front panel of the radio and select the time constants appropriate to the required power level.

12. A delayed mean control limits the power output under single tone conditions to approx. 4 dB below peak-envelope-power to avoid excessive heat dissipation and power consumption.

13. Overload protection is provided by a control voltage applied to pins 16 and 17 of ML1. This voltage is provided by two sources, TR14 emitter in Unit 2a or via the panel pin 15 from Unit 2b. If either source causes the control voltage to exceed a level of 4.5V, a gating circuit within ML1 overrides the normal ALC control and the control voltage applied from ML1 to ML2 renders the first RF pre-amplifier inoperative.

14. The overload sensing circuit within Unit 2a operates as follows. The voltage developed across R45 is the resultant of two anti-phase voltages, one is derived from the RF output current flowing through the primary of current transformer T5 and the other is derived from the RF output voltage at transformer T4. When the load is correctly matched, the two voltages are equal, the resultant across R45 is zero and a minimum output is obtained from the emitter follower TR14. A mismatched load will result in an imbalance of the two voltages, giving a resultant which increases with the degree of mismatch.

TESTING

Test equipment

15. The following items of special-to-purpose test equipment are required:

(1) Manual Interface Controller. Plessey Type TD4924A.

(2) Test Interface. Plessey Type TD50563A.

(3) Test Jig. Plessey Type TJ840A.

16. The following items of proprietary test equipment are required:

Item	Description
Avo	A dc milliammeter for measuring currents in the range 10 milliamps to 2 amps to an accuracy of ± 1% of fsd. Suitable instrument: Avo Universal Model 8
Counter	An electronic counter for measuring frequencies in the range 2 to 30 MHz to an accuracy of ± 2 Hz. Suitable instrument: Racal 9024 Counter

Item	Description

RF Gen. An RF signal generator with the following essential characteristics:

Frequency to include	2 MHz to 30 MHz
Frequency setting accuracy	± 10 kHz
Output voltage	20 uV to 200 mV
Output voltage accuracy	± 1.2 dB
Output impedance	50 ohms

Suitable instrument: Marconi TF144H/4

DVM A digital voltmeter with the following essential characteristics:

Range and accuracy	10V, 0.02% reading ± 0.005% fsd 100V, ± 0.025% reading ± 0.005% fsd
Input impedance	10 kMohms on 0-10V scale 10 Mohms on 0-100V scale

Suitable instrument: Solartron A203/204

PM A power meter with the following essential characteristics:

Frequency to include	2 MHz to 30 MHz
Range	0-50 watts
Accuracy	± 5%
VSWR	1.05 maximum

Suitable instrument: Bird Thruline Type 43 with plug-in Type 50H and Load Type 8080

RF mV An RF millivoltmeter having the following essential characteristics:

Voltage and dB ranges	1V (+10 dBm) 3V (+20 dBm)
Frequency range	to include 2.5 MHz to 30 MHz
Accuracy	± 1% of reading ± 2% of fsd
Input impedance	50 ohms

Suitable instrument: Marconi TF2604

Attenuator A fixed value attenuator having the following essential characteristics:

Attenuation	30 dB ± 1.2 dB
Power rating	30 watt
Input/output impedance	50 ohms

Suitable instrument: Ottowa Electronique OTT.70-1120-14

24V PSU A power supply with the following essential characteristics:

Stabilised voltage	24V ± 0.1V
Current limit	500 mA to 5A

Suitable instrument: Farnell TSV70-Mk2

Item	Description
6V PSU	A power supply with the following essential characteristics: Stabilised voltage 6V ± 0.1V Current limit 220 mA Suitable instrument: Farnell L30B:L30DT

Preliminary

17. Connect the test jig to the test interface and connect the test interface to the manual interface controller.

18. At the manual interface controller:

(1) Ensure that the DC MONITOR switch is set to EXT and that the test selection switches are set to 000.

(2) Connect the Avo to the socket marked AVO.

(3) Connect the DVM to the socket marked DVM.

(4) Connect the RF Gen to the socket marked SG1.

19. Connect the counter to RF Gen normal output via a 10 dB attenuator.

20. Load the UUT (unit under test) into the jig and secure by means of the clamps. Fit the two multiway connectors to 2PL1 and 2PL2 of the UUT. Connect the power meter to socket T/R of the UUT.

21. At the UUT, remove the reflectometer cover. Adjust R43 and R34 on Unit 2a fully anti-clockwise.

22. Fit the special wheel provided so that it fits over the end of the spindle projecting from the PA Filter casting. The range number selected appears opposite to the connector 2PL1. Select Range 1.

23. At the manual interface controller:

(1) Connect the 6V supply to the socket marked EXT A.

(2) Connect the 24V supply to the socket marked EXT B. Connect the sense terminals on the 24V supply unit to the sense leads and remove any shorting links on the power supply terminals.

24. Switch on mains power to all test instruments where applicable.

Notes relating to test connections

The above connections provide the following at the UUT:

24V supply + rail to 2PL1 pins 6, 10, 11
6V supply + rail to 2PL1 pin 7 and 2PL2 pin 10

24V & 6V supply - rail to 2PL1 pins 5, 8
2PL2 pins 2, 3
2PL1 pin 3 (HP modes only)
2PL2 pin 5 (LP modes only)

RF Gen to 2PL2/A1

Avo in series with either 24V + rail or 6V + rail according to test.

Test procedures

CAUTIONS: 1. DAMAGE TO THE POWER AMPLIFIER MAY RESULT IF THE RF GENERATOR OUTPUT IS NOT SET TO LESS THAN 1 mV BEFORE EITHER:
(1) CHANGING PA FILTER RANGE.
(2) CHANGING SIGNAL GENERATOR OUTPUT FREQUENCY.

2. DAMAGE TO THE POWER AMPLIFIERS WILL RESULT IF THE POWER TRANSISTORS ARE NOT KEPT IN PHYSICAL CONTACT WITH THE ASSOCIATED HEAT SINK.

25. Carry out the procedures given on the following pages, in each case strictly observe the indicated sequence.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
000	(a)	INT. CON.	-	-	Depress "Press to Test" button.
SET CURRENT LIMIT					
001	(a)	PSU	-	-	Set 24V power supply to zero volts output and current limit to a minimum. Set 6V power supply to 6V output.
	(b)	INT. CON.	-	-	Depress "Press to Test" button.
	(c)	AVO	1A	485 mA to 515 mA	Increase 24V Power Supply output voltage a small amount and set current limit control to indicate on AVO a reading of 500 mA.
	(d)	PSU	-	-	Set 6V Power Supply to zero volts output and set current limit to a minimum. Fit a shorting link across 6V Power Supply Terminals. Switch Power Supply to read current on meter.
	(e)	PSU	1A	245 mA to 255 mA	Increase output voltage a small amount and set current limit control to indicate a reading of 250 mA on meter. Remove shorting link.
002	(a)	INT. CON.	-	-	Depress "Press to Test" button.
	(b)	DVM	10V	5.901V to 6.099V	Adjust 6.0V Power Supply to indicate on DVM a reading of 6.0 volts.
004	(a)	DVM	100V	-	Set DVM to 100V range.
	(b)	INT. CON.	-	-	Depress "Press to Test" button.
	(c)	DVM	100V	23.91V to 24.09V	Adjust 24V Power Supply to indicate on DVM reading of 24.0 volts.
SET PA BIAS AND DRIVER BIAS					
006	(a)	INT. CON.	-	-	Depress "Press to Test" button.

Notes relating to tests 000 - 022

The aim of these procedures is to ensure the correct settings of potentiometers in Unit 2a. However, a fault condition in the UUT (e.g. open circuit or short circuit connection etc) could result in damage to the PA transistors if precautions were not taken.

Accordingly, the tests proceed in a sequence commencing at the lowest power condition (2aR43 and 2aR34 set in para.21, and in LP mode) and finishing at the highest power condition; before each adjustment, the PSU current limits are set so that any tendency of the UUT to draw current in excess of that anticipated will trip the PSU before damage will occur. At each step, the actual current drain is checked - if the current is outside limits, of if the PSU trips, abandon the test and repair the fault.

The majority of these test procedures are the current limit setting, the remainder are the actual adjustments thus:

Test 008 2aR43 and 2aR34 bias controls are set to give specified 24V line current levels on LP mode.

Test 016 2aR2 is initially set to give max. PA gain on HP mode and a very low level RF input applied, this level being advanced until a specified mean power output on HP mode is obtained. With this RF input level, 2aR2 is adjusted to reduce the PA gain to an appropriate level - making it safe to proceed.

Test 022 - Final adjustment of 2aR2 to provide the correct peak-emitted-power (PEP) with a 100 mV RF input.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
006 (cont)	(b)	AVO	1A	0.18A to 0.221A	Check the 6 volt line current.
008	(a)	INT. CON.	-	-	Depress "Press to Test" button.
	(b)	AVO	100 mA	18.4 mA to 32.4 mA	Note the 24 volt line current.
	(c)	AVO	100 mA	30.4 mA to 48.4 mA	Adjust 2aR34 on UUT to give an increase of 14 mA on 008(b). Note the Avo reading.
	(d)	AVO	100 mA or 1A	82 to 107 mA	Adjust 2aR43 on UUT to give an increase of 55 mA on 008(c). Check Avo reading is within limits.
ALC ADJUSTMENT					
010	(a)	PSU	-	-	Set 24V Power Supply to zero volts output and current limit to a minimum.
	(b)	AVO	10A	-	Set Avo to 10 amps dc range.
	(c)	INT. CON.	-	-	Depress "Press to Test" button.
	(d)	AVO	10A	2.5A	Increase 24V Power Supply output voltage a small increment and set current limit control to indicate on Avo a reading of 2.5 Amps.
012	(a)	INT. CON.	-	-	Depress "Press to Test" button.
	(b)	DVM	10V	5.901V to 6.099V	Set DVM to 10V range. Adjust 6V Power Supply to indicate on DVM a reading of 6.0 volts.
014	(a)	DVM	100V	-	Set DVM to 100V range.
	(b)	INT. CON.	-	-	Depress "Press to Test" button.
	(c)	DVM	100V	23.91V to 24.09V	Adjust 24V Power Supply to indicate on DVM a reading of 24.0 volts.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
C16	(a)	INT. CON.	-	-	Depress "Press to Test" button.
	(b)	COUNTER	-	2.499998 to 2.500998 MHz	Set RF Gen to indicate on Counter a frequency of 2.5 MHz.
	(c)	RF GEN.	-	Set 20 μV	Set RF Gen output controls to 2.5 and 20 μV output.
	(d)	UUT	-	-	Set 2aR2 on UUT to the fully clockwise position. Set PA Filter to range 1.
	(e)	PM	10W	14.25 to 15.75 watts	Increase RF Gen output voltage to give an indication on Power Meter of 15 watts.
	(f)	AVO	10A	1.4A to 1.8A	Check 24 volt line current.
	(g)	PM	50W	9.5 to 10.5 watts	Adjust 2aR2 on UUT to give PM reading of 10W.
C18	(a)	PSU	-	-	Set 24V Power Supply to zero volts output and current limit to a minimum.
	(b)	INT. CON.	-	-	Depress "Press to Test" button.
	(c)	AVO	10A	5A	Increase 24V Power Supply output voltage a small increment and set current limit control to indicate on Avo a reading of 5A.
C20	(a)	INT. CON.	-	-	Depress "Press to Test" button.
	(b)	DVM	100V	23.91 to 24.09V	Adjust 24V Power Supply to indicate on DVM a reading of 24 volts.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
022	(a)	INT. CON.	-	-	Depress "Press to Test" button.
	(b)	PM	50W	28.75W to 29.25W	Set RF Gen output voltage to 100 mV, switch off carrier and wait for at least 10 secs. Switch on carrier and note the 'steady peak value' on the Power Meter. Repeat this operation a number of times and adjust 2aR2 on the UUT each time until the Power Meter reading is 29 watts.
NOTES:					'Steady peak value'. At carrier switch on the power rapidly rises to the steady peak value in approx. 0.1 to 1 sec. The power then falls to the 'steady rms value'. Tests 022(c)-(j), 024, 026, 028 check the PEP at various frequency levels on HP and LP modes. The reduction of RF Gen output level before changing frequency and PA Filter range is essential if damage to the UUT is to be avoided.
HP OUTPUT AT 10 MHz					
	(c)	RF GEN.	-	-	Reduce output voltage of RF Gen to below 1 mV.
	(d)	UUT	-	-	Set PA Filter to range 4.
	(e)	COUNTER	-,	9.990002 to 10.009998 MHz	Set RF Gen to indicate on Counter a frequency of 10 MHz.
	(f)	PM	50W	22.5W to 30.5W	Set output voltages of RF Gen to 100 mV, switch off carrier and wait at least 10 secs. Switch on carrier and check the 'steady peak value' as indicated on Power Meter.
HP OUTPUT AT 30 MHz					
	(g)	RF GEN.	-	-	Reduce output voltage of RF Gen to below 1 mV.
	(h)	UUT	-	-	Change PA Filter to range 6.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
022 (cont)	(i)	COUNTER	-	29.990002 to 30.009998 MHz	Set RF Gen to indicate on Counter a frequency of 30 MHz.
	(j)	PM	50W	22.5W to 30.5W	Repeat 022(f).
LP OUTPUT AT 30 MHz					
024	(a)	RF GEN.	-	-	Reduce the output voltage of the RF Gen to below 1 mV.
	(b)	-	-	-	Disconnect the Power Meter from the UUT. Connect the RF millivoltmeter via the 30 dB Attenuator to the T/R socket of the UUT.
	(c)	RF mV	+20 dBm (3V)	-	Set the RF millivoltmeter to the +20 dBm (3V) range.
	(d)	INT. CON.	-	-	At the Interface Controller, select TEST 022 and depress the "Press to Test" button.
	(e)	RF mV	+20 dBm (3V)	REF	Set output of RF Gen to 100 mV and switch carrier off for at least 10 seconds. Switch carrier on and note the dB reading of the RF mV as a reference.
	(f)	INT. CON.	-	-	At the Interface Controller, select TEST 024 and depress the "Press to Test" button.
	(g)	RF mV	+10 dBm (1V)	-	Subtract the RF mV dB reading from REF ((e) above) and check the difference is between 9.3 dB and 12.7 dB.
LP OUTPUT AT 10 MHz					
026	(a)	RF GEN.	-	-	Reduce the output voltage of the RF Gen to below 1 mV.
	(b)	UUT	-	-	Set the PA Filter to range 4.
	(c)	COUNTER	-	9.99002 to 10.009998 MHz	Set the RF Gen to indicate a frequency of 10 MHz on the Counter.
	(d)	RF mV	-	REF	Repeat operation 024(c) to 024(e) inclusive.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
026 (cont)	(e)	INT. CON.	-	-	At the Interface Controller, select TEST 026 and depress the "Press to Test" button.
	(f)	RF mV	+10 dBm (1V)	-	Subtract the RF mV dB reading from REF ((d) above) and check the difference is between 9.3 dB and 12.7 dB.
LP OUTPUT AT 2.5 MHz					
028	(a)	RF GEN.	-	-	Reduce the output voltage of the RF Gen to below 1 mV.
	(b)	UUT	-	-	Set the PA Filter to range 1.
	(c)	COUNTER	-	2.490002 to 2.50998 MHz	Set the RF Gen to indicate a frequency of 2.5 MHz on the Counter.
	(d)	RF mV	-	REF	Repeat operations 024(c) to 024(e) inclusive.
	(e)	INT. CON.	-	-	At the Interface Controller, select TEST 028 and depress the "Press to Test" button.
	(f)	RF mV	+10 dBm (1V)	-	Subtract the RF mV dB reading from REF ((d) above) and check the difference is between 9.3 dB and 12.7 dB.
	(g)	RF GEN.	-	-	Reduce the RF Gen output to less than 1 mV. Disconnect the RF mV and 30 dB attenuator from the RF socket of the UUT. Connect the Power Meter to the T/R socket on UUT.
ALC CONTROL AND SENSITIVITY					
030	(a)	COUNTER	-	1.990002 to 2.009998 MHz	Set RF Gen to 20 μV output voltage and 2 MHz as indicated on Counter.
	(b)	INT. CON.	-	-	Depress "Press to Test" button.
	(c)	RF GEN.	-	9.2 mV to 28.8 mV	Note the RF Gen output voltage setting required to indicate on Power Meter a reading of 7.5 watts.
		PM	-	7.2W to 7.8W	
	(d)	AVO	10A	NGT 1.7A	Check 24V line current.

Notes relating to tests 030 - 040

These tests check the response of the ALC. Tests 030 - 034 are carried out with a 2 MHz carrier input and tests 036 - 040 are similar tests carried out with a 25 MHz carrier input.

Test 030 (036) Preparatory procedure to determine RF input level required to obtain a specified mean power output on HP mode.

Test 032 (038) Check of response of ALC to the switching on of a carrier input level 10 dB greater than the reference level determined in test 030 (036).

Test 034 (040) Check that, with the carrier input level used in 032 (038), the mean power output, and current drain, on LP mode is within limits.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
032	(a)	INT. CON.	-	-	Remove AVO plug from side of Interface Controller.
	(b)	INT. CON.	-	-	Depress "Press to Test" button.
	(c)	DVM	100V	NGT 14.191V	With RF Gen output voltage set as 030(c), interrupt the carrier and increase the RF level by 10 dB. Restore carrier and check the maximum DVM reading.
	(d)	PM	50W	8.8W to 13.2W	With RF Gen output condition as in 032(c), check the Power Meter reading 5 secs after carrier switch-on.
	(e)	RF GEN.	-	-	Switch off the RF carrier at the RF Gen (do NOT alter the Sig. Gen. output setting). Disconnect the Power meter from the UUT and connect the RF millivoltmeter via the 30 dB Attenuator to the T/R socket of the UUT.
	(f)	RF mV	+20 dBm (3V)	-	Set the RF mV to the +20 dBm (3V) range.
	(g)	RF mV	-	REF	Switch on the RF carrier and note the dB reading of the RF mV after 5 seconds from carrier switch-on.
034	(a)	AVO	1A	-	Set Avo to dc 1A range.
	(b)	INT. CON.	-	-	Connect Avo to Interface Controller.
	(c)	INT. CON.	-	-	Depress "Press to Test" button.
	(d)	RF mV	-	-	With RF Gen condition as in 032(c), note RF mV reading 10 secs after carrier switch-on. Check that the value is between 9.5 and 12.3 dB down on noted value of 032(g).
	(e)	AVO	1A	0.31A to 0.79A	Check 24V line current.
	(f)	RF GEN.	-	-	Reduce the RF Gen output to less than 1 mV. Disconnect the RF mV and 30 dB attenuator from the T/R socket of UUT. Connect the Power Meter to the T/R socket.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
036	(a)	AVO	10A	-	Set AVO to dc 10A range.
	(b)	RF GEN.	-	Set 20 μV	Set RF Gen output voltage to 20 μV.
	(c)	UUT	-	-	Set PA Filter to range 6.
	(d)	COUNTER	-	24.990002 to 25.009998 MHz	Set RF Gen to indicate on Counter a frequency of 25 MHz.
	(e)	INT. CON.	-	-	Depress "Press to Test" button.
	(f)	RF GEN.	-	9.2 mV to 28.8 mV	Note the RF Gen output voltage setting to give an indication of 7.5 watt on Power Meter.
		PM	-	7.2W to 7.8W	
	(g)	AVO	10A	NGT 1.7A	Check 24V line current.
038	(a)	INT. CON.	-	-	Remove AVO plug from side of Interface Controller.
	(b)	INT. CON.	-	-	Depress "Press to Test" button.
	(c)	DVM	100V	NGT 14.191V	With RF Gen output voltage set as 036(f), interrupt the carrier and increase the RF level by 10 dB. Restore carrier and record DVM maximum reading.
	(d)	PM	50W	8.8W to 13.2W	With RF Gen output conditions as 038(c), check the Power Meter reading 5 secs after carrier switch-on.
	(e)	RF GEN.	-	-	Switch off the RF carrier at the RF Gen (do NOT alter the Sig. Gen. output setting). Disconnect the Power Meter from the UUT and connect the RF millivoltmeter via the 30 dB Attenuator to the T/R socket of the UUT.
	(f)	RF mV	+20 dBm (3V)	-	Set the RF mV to the +20 dBm (3V) range.
	(g)	RF mV	-	REF	Switch on the RF carrier and note the dB reading of the RF mV after 5 seconds from carrier switch-on.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
040	(a)	AVO	1A	-	Set AVO to dc 1A range.
	(b)	INT. CON.	-	-	Connect AVO to Interface Controller.
	(c)	INT. CON.	-	-	Depress "Press to Test" button.
	(d)	RF mV	-	-	With RF Gen condition as in 038(c) note RF mV dB reading 10 secs after carrier switch-on. Check that the value is between 9.5 and 12.3 dB down on the value noted in 038(g).
	(e)	AVO	1A	0.31A to 0.79A	Check 24V line current.
	(f)	RF GEN.	-	-	Set RF Gen otuput to minimum.
	(g)	-	-	-	Disconnect the RF mV and 30 dB attenuator from the T/R socket. Connect the Power Meter to the T/R socket.

Repeat tests 036, 038, 040 for each of the following carrier frequencies, in each case setting the PA Filter to the appropriate range thus:

Frequency	Range
3.990002 to 4.009998 MHz	2
6.490002 to 6.509998 MHz	3
9.990002 to 10.010002 MHz	4
15.990002 to 16.010002 MHz	5
29.890002 to 29.909998 MHz	6

042	(a)	INT. CON.	-	-	Depress "Press to Test" button.
	(b)	UUT	-	-	Remove Unit Under Test from Test Jig. Replace Reflectometer cover on UUT.

REPAIR POLICY

26. The tests given in this section must be carried out in full after assembly of any of the power amplifier, reflectometer and PA filters to the rear panel. The tests can also be used as an aid to locating a faulty component on the power amplifier unit; any unit other than the power amplifier can be diagnosed as faulty when testing the complete radio, removed from the rear panel and separately tested as given in the relevant section of this part of the manual.

NOTE: The RF decoupling unit (Unit 2g) can be tested without removal from the rear panel.

27. The tests given in this section do not check either the VHF filter (Unit 2h) or the RF decoupling unit (Unit 2g). They are independent of each other and the other circuits on the rear panel, since they are functionally checked when testing the complete radio and fully checked after repair by the separate test facilities, there is no requirement to perform any test on these items when the rear panel is separated from the radio.

28. Any sub-assembly which can be separately tested should not be removed for a routine check of the sub-assembly.

ASSEMBLY/DISASSEMBLY

29. For assembly/disassembly of the Rear Panel Assembly refer to the Assembly/Disassembly procedures for the Receiver/Transmitter given in Part 2 of this manual.

COMPONENTS LIST

30. For location of the principal sub-assemblies of the Rear Panel Assembly, and the associated components list, refer to the section relating to the second line servicing of the Receiver/Transmitter (Part 2 of this manual).

31. For detailed breakdown of Unit 2a, refer to the following pages. For detailed breakdown of sub-assemblies other than Unit 2a, refer to the relevant sections of this part of the manual.

COMPONENTS LIST FOR
POWER AMPLIFIER - PEC (Unit 2a)
419/1/11820 (refer to Fig.3 and 4)

Cct Ref	Description	Reference No.
	Resistors	
R1	4.7 kohm ± 5%	403/4/78126/065
R2	2 kohm ± 10% 0.5w variable	404/9/05032/004
R3	220 ohm ± 5%	403/4/78126/033
R4	100 ohm ± 5%	403/4/78126/025
R5	27 kohm ± 1%	403/4/78126/283
R6	2.7 kohm ± 1%	403/4/78126/259
R7	1 kohm ± 5%	403/4/78126/049
R8	47 ohm ± 5%	403/4/78126/017
R9	75 ohm ± 5%	403/4/78126/022
R10	220 ohm ± 5%	403/4/78126/033
R11	2.7 kohm ± 5%	403/4/78126/059
R12	680 ohm ± 5%	403/4/78126/045
R13	68 ohm ± 5%	403/4/78126/021
R14	390 ohm ± 5%	403/4/78126/039
R15	33 ohm ± 5%	403/4/78126/013
R16	12 ohm ± 5%	403/4/78126/003
R17	12 ohm ± 5%	403/4/78126/003
R18	6.2 ohm ± 2%	403/9/05026/001
R19	18 ohm ± 5%	403/4/78126/007
R20	18 ohm ± 5%	403/4/78126/007
R21	6.2 ohm ± 2%	403/9/05026/001
R22	47 ohm ± 5%	403/4/78126/017
R23	47 ohm ± 5%	403/4/78126/017
R24	1 kohm ± 5%	403/4/78127/049
R25	1.5 kohm ± 5%	403/4/78126/053
R26	390 ohm ± 5%	403/4/78126/039
R27	68 ohm ± 5%	403/4/78126/021
R28	1.8 kohm ± 5%	403/4/78126/055
R29	4.7 ohm ± 5% 0.5w	403/9/03540/002
R30	4.7 ohm ± 5% 0.5w	403/9/03540/002
R31	4.7 kohm ± 5%	403/4/78126/065
R32	68 ohm ± 5%	403/4/78126/021
R33	3.3 kohm ± 5%	403/4/78126/061
R34	2 kohm ± 10% 0.5w variable	404/9/05032/004
R35	4.7 ohm ± 5% 0.5w	403/9/03540/002
R36	1.0 ohm ± 10% 0.5w	403/9/03540/001
R37	68 ohm ± 5% 6w wirewound	403/4/78265/029
R38	680 ohm ± 5%	403/4/78126/045
R39	330 ohm ± 5%	403/4/78126/037
R40	2.2 kohm ± 5%	403/4/78126/057

Cct Ref	Description	Reference No.
R41	4.7 kohm ± 5%	403/4/78126/065
R42	3.3 kohm ± 5%	403/4/78126/061
R43	2 kohm ± 10% 0.5w variable	404/9/05032/004
R44	220 ohm ± 5%	403/4/78126/033
R45	47 ohm ± 5%	403/4/78126/017
	Capacitors	
C1	150uF ± 10% 6v electrolytic	402/4/98049/005
C2	100uF ± 10% 10v electrolytic	402/4/98049/019
C3	150uF ± 10% 6v electrolytic	402/4/98049/005
C4	100nF ± 20% 100v	400/9/19083/136
C5	6.8uF ± 20% 6v electrolytic	402/4/98049/009
C6	2.2nF ± 10% 100v	400/9/19083/030
C7	10nF ± 20% 100v	400/9/19083/121
C8	10nF ± 20% 100v	400/9/19083/121
C9	470nF +80% -20% 50v	400/9/19084/109
C10	4.7nF +80% -20% 100v	400/9/19084/070
C11	10nF +80% -20% 100v	400/9/19084/078
C12	10nF +80% -20% 100v	400/9/19084/078
C13	4.7nF +80% -20% 100v	400/9/19084/070
C14	68nF +80% -20% 50v	400/9/19084/098
C15	10nF +80% -20% 100v	400/9/19084/078
C16	560pF ± 10% 100v	400/9/19082/099
C17 to C20	68nF +80% -20% 50v	400/9/19084/098
C21, C22	10nF +80% -20% 100v	400/9/19084/078
C23	68nF +80% -20% 50v	400/9/19084/098
C24	10nF +80% -20% 100v	400/9/19084/078
C25, C26	68nF +80% -20% 50v	400/9/19084/098
C27	10nF +80% -20% 100v	400/9/19084/078
C28, C29	10nF ± 20% 100v	400/9/19083/121
C30, C31	68nF +80% -20% 50v	400/9/19084/098
C32	10nF +80% -20% 100v	400/9/19084/078
C33	68nF +80% -20% 50v	400/9/19084/098
C34, C35	47pF ± 5% 100v	400/9/19082/018
C36	10nF +80% -20% 100v	400/9/19084/078
C37	not used	
C38, C39	470nF +80% -20% 50v	400/9/19084/109
C40	4.7uF ± 20% 35v electrolytic	402/4/98049/088
C41	10pF ± 5% 100v	400/9/19082/002
C42	56pF ± 10% 350v silver mica	438/9/30100/016
C43	4.7nF +80% -20% 100v	400/9/19084/070
C44, C45	220pF ± 5% 100v	400/9/19082/032
C46, C47	68pF ∓10% 100v	400/9/19082/82
	Inductors	
L1, L2	Inductor 18uH ± 10%	406/9/08470/027
L3	Inductor 56uH ± 10%	406/9/08490/030
L4, L5	Inductor4.7uH ± 10%	406/9/08470/020

Cct Ref	Description	Reference
L6,L7	Inductor 56uH ± 10%	406/9/08490/030
L8	Inductor 33uH ± 10%	406/9/26031
L9,L10	Inductor 4.7uH ± 10%	406/9/08470/020
L11	Inductor 6.2uH ± 10%	406/8/11123
L12	Inductor 18uH	406/9/08450/022
	Semi-conductor devices	
TR1	Transistor CV 7648	990/4/00107/648
TR2 to TR4	Transistor CV 7555	990/4/00107/555
TR5	Transistor CV 7644	990/4/00107/644
TR6, TR7	Transistor 2N 3553	417/4/02078
TR8, TR9	Transistor CV 7723	990/4/00107/723
TR10, TR11	Transistor CV 7644	990/4/00107/644
TR12, TR13	Transistor 2N 5070	417/4/00246
TR14	Transistor CV 7648	990/4/00107/648
D1 to D4	Diode CV 7367	990/4/00107/367
ML1	Integrated circuit CN 595 D.P.	446/4/00452
ML2	Integrated circuit CN 599T	446/4/00421
	Transformers	
T1	Transformer	406/8/11031/004
T2	Transformer	406/8/11031/005
T3	Transformer	406/8/11031/006
T4	Transformer	406/8/11032/00[illegible]
T5	Transformer	406/8/11099
	Miscellaneous	
2PL2	Plug, electrical	508/9/21629
	Heat sink assembly	640/1/14919
	Heat sink adaptor TO-5	418/9/37021/002
	Heat sink adaptor TO-18	418/9/37022/002
	Nut 10-32 UNF st. st.	991/4/00474/014

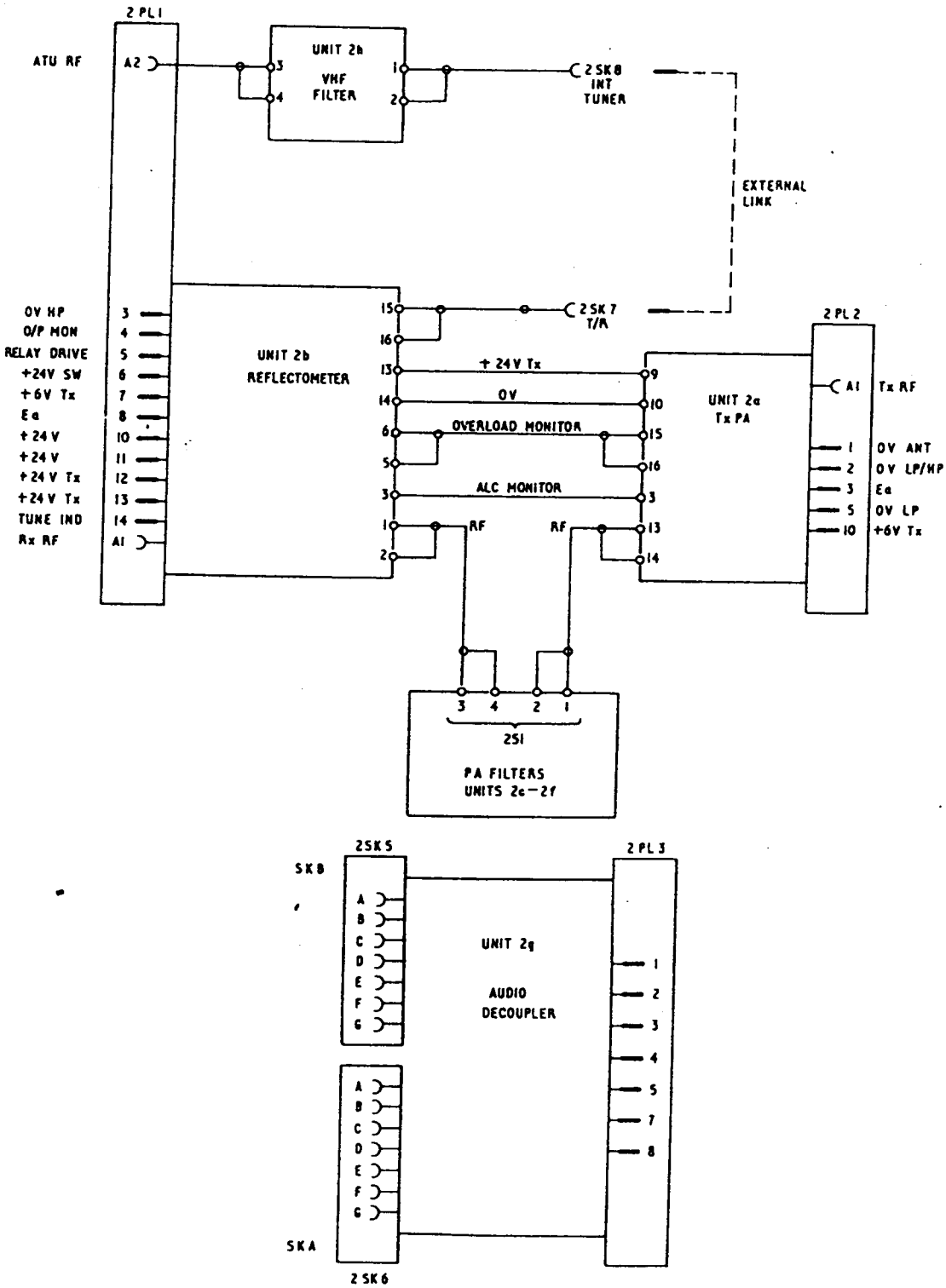


Fig.1 Unit 2 — Circuit diagram

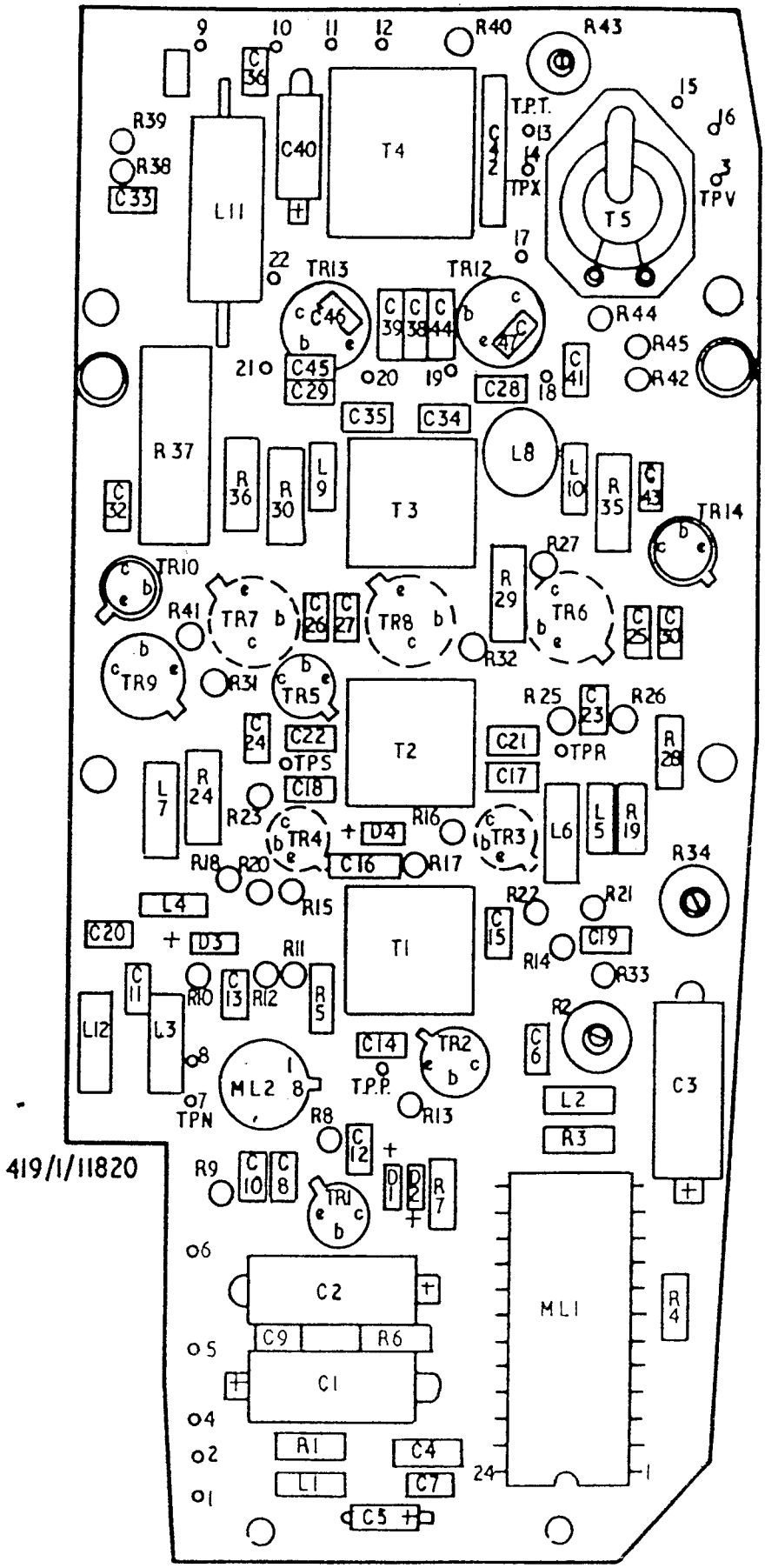
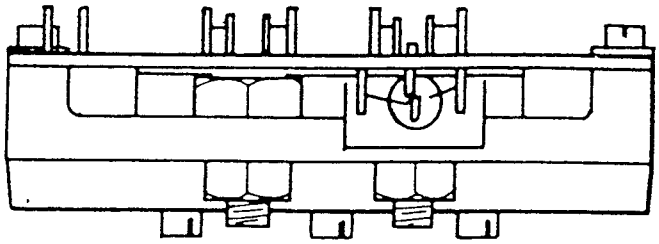


Fig. 3 Power amplifier pec (unit 2a)
component layout



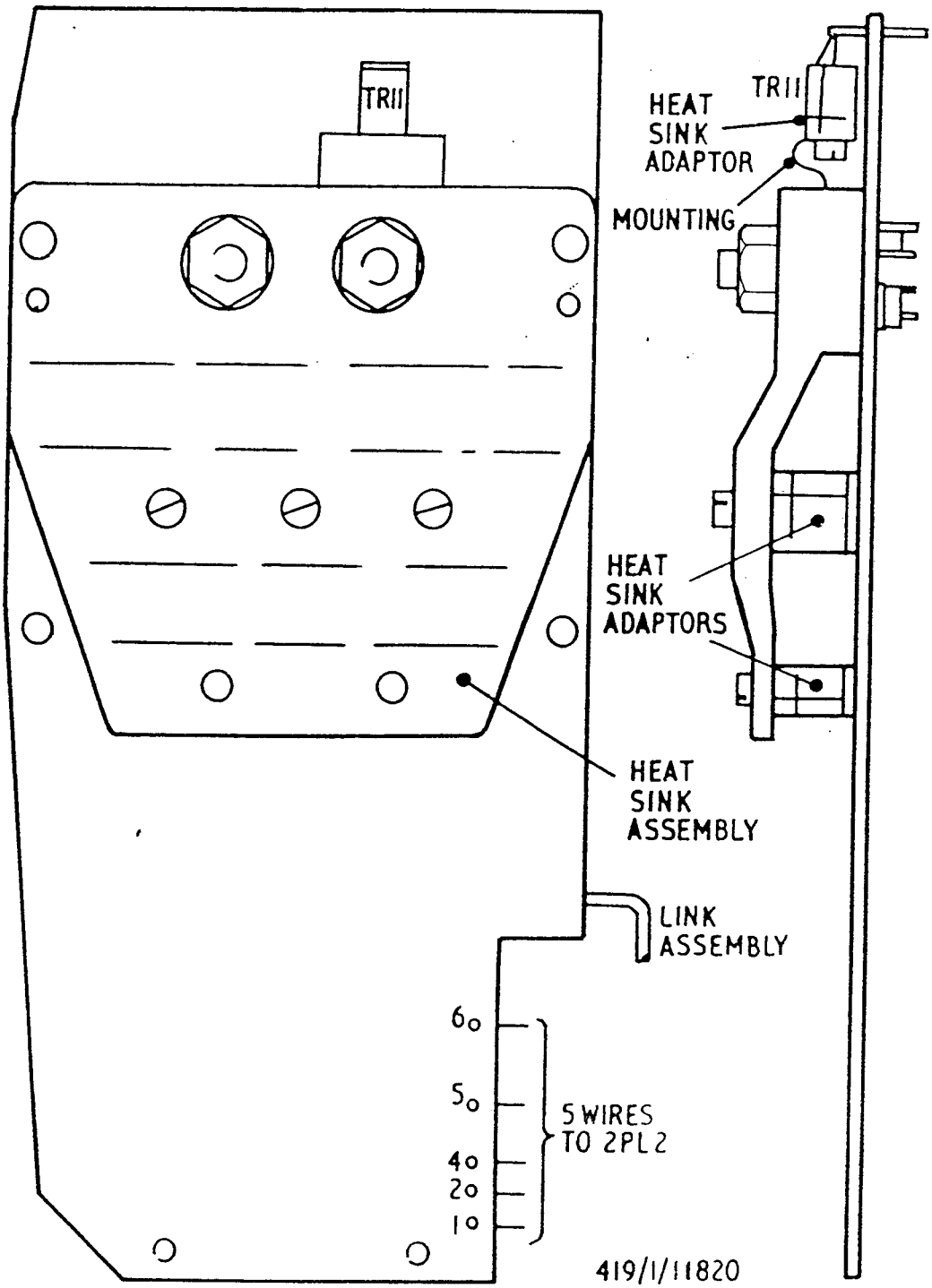


Fig.4 Power amplifier-position of heat sinks

THIRD LINE SERVICING OF REFLECTOMETER 419/1/11830 (UNIT 2b)

CONTENTS

ILLUSTRATIONS

INTRODUCTION

1. The reflectometer (Unit 2b) is a component part of the receiver-transmitter and is normally located on the Rear Panel Assembly (Unit 2). It consists of a panel, electronic circuit together with a connector (2PL1). Wire leads connect 2PL1 to the panel, which provides the following circuits:

(1) A reflectometer that produces voltages which indicate whether the transmitter power amplifier is correctly terminated with a 50 ohm impedance or not. Two voltages are produced:

(a) Tune indicator. This is for supply to a small indicating meter and is maximum when the PA is correctly terminated.

(b) Overload monitor. This is for supply to the PA protection circuits and is minimum when the PA is correctly terminated.

(2) An RF output monitor that produced a voltage suitable for supply to a small indicating meter and which is proportional to the transmitter antenna current.

(3) An output monitor (ALC drive) which produces a voltage proportional to the transmitter RF output voltage. Any audio modulation present in the Tx output is reflected to the output of the monitor.

(4) A relay for Tx/Rx switching.

DETAILED DESCRIPTION (refer to fig.1)

Tx/Rx relay RLA

2. The relay is operated from the 24V supply, its contacts provide switching of the +24 Tx supply, and switching of RF path to or from socket 2SK7.

Reflectometer

3. Two opposing voltages developed across resistor R3 are respectively proportional to the RF input voltage and current; these voltages are provided by the auto transformer AUT1 and the secondary of the current transformer CT1. The resultant RF voltage is applied to the rectifier D4 and, reduced in level by auto transformer AUT2, to the rectifier D5. When the

RF load is 50 ohms, the voltages across R3 balance and the resultant (and the rectifier outputs) approaches OV. A mismatched load will result in an imbalance of the voltages, giving a resultant which increases with the degree of mismatch.

4. The RF rectified by D4 provides a negative bias potential to the base of transistor TR1, the emitter current of which provides the tune indicator output via pin 10 (2PL1/14). When the RF load is 50 ohms, the negative bias applied to TR1 from D4 is minimum (OV nominal) and the resulting output from pin 10 (2PL1/14) is maximum (0.85V dc nominal).

5. The RF rectified by D5 provides a positive potential at the overload monitor output from pin 6; this output is minimum (OV nominal) when the RF load is 50 ohms.

ALC drive

6. One transistor in ML1, in conjunction with capacitor C7, provides an RF level detector that produces a dc output at pin 3 which is proportional to the RF input voltage level. This output has a standing level of +2V dc, due to the second transistor in ML1, and is increased by the detector output.

7. There is no audio decoupling in this circuit and any audio modulation in the transmitter output will pass to the output.

Antenna current monitor

8. The RF at transformer AUT1 secondary is rectified by diode D1, to provide the output monitor voltage which is taken to an external meter via pin 7 (2PL1/14).

9. The sensitivity of the circuit is reduced when the radio is operating in the high power mode by connecting pin 8 (2PL1/3) to OV.

TESTING

Test equipment

10. The following items of special-to-purpose test equipment are required:

(1) Manual Interface Controller. Plessey Type TD4924A.

(2) Test Interface. Plessey Type TD50564A.

(3) Test Jig. Plessey Type TJ839A.

11. The following items of proprietary test equipment are required:

Item	Description	
Avo	A dc millivoltmeter with the following essential characteristics:	
	Range	0 to 10 mA
	Accuracy	± 1% of fsd
	Suitable instrument: Avo Universal Model 8	
DVM	A digital voltmeter with the following essential characteristics:	
	Range	100 mV, 1V and 10V
	Accuracy	± 0.02% reading ± 0.005% of fsd on 100 mV, 1V and 10V ranges
	Input impedance	10 kMohms on the above ranges
	Suitable instrument: Solartron A203/204	
Counter	An electronic counter with the following essential characteristics:	
	Range	To include 2 MHz
	Accuracy	± 2 Hz
	Suitable instrument: Racal 9024	
RF Gen.	An RF signal generator with the following essential characteristics:	
	Range	To include 2 MHz
	Overall frequency accuracy	± 10%
	Output voltage	2 µV to 2.0V
	Output meter accuracy	± 0.5 dB
	Output impedance	50 ohms with a VSWR of better than 1.25:1
	Suitable instrument: Marconi TF144H/4	
RF VV	An RF valve voltmeter with the following essential characteristics:	
	Voltage range	1V
	Frequency range	To include 2 MHz
	Voltage accuracy on 10V range	± 2%
	Input impedance	10 Mohms shunted by 25 pF.
	Suitable instrument: Hewlett Packard 400E	
PSU	A power supply with the following essential characteristics:	
	Output voltage	6.0V ± 5%
	Current capacity	10 mA
	Suitable instrument: Farnell L30B:L30DT	

Preliminary

12. Connect the test jig to the test interface and connect the test interface to the manual interface controller.

13. At the manual interface controller:

(1) Ensure that the DC monitor switch is set to EXT and that the test selection switches are set to 000.

(2) Connect the Avo to the socket marked AVO.

(3) Connect the DVM to the socket marked DVM.

(4) Connect the RF Gen to the socket marked SG1.

14. Connect the counter to the RF Gen normal output via a 10 dB attenuator.

15. Connect the RF voltmeter to the BNC socket on the test interface.

NOTE: Due to attenuation within the interface, the RF voltmeter reading will be a factor of 10:1 lower than the RF output of the UUT.

16. Ensure that any wire leads are removed from the UUT (unit under test) and load it into the jig.

17. At the manual interface controller, connect the PSU output to the socket marked EXT A.

NOTE: A +24V supply to the UUT is provided by the test interface.

18. Switch on mains supplies to all test instruments where applicable.

Notes relating to test connections

The above connections provide the following at the UUT:

24V supply + rail to pin 17
6V supply + rail to pin 9
Supply - rail to pins 17, 20. To pin 8 on test 026
50, 25 or 100 ohm RF load across pins 15/16 according to test

RF VV to pin 16

RF Gen to pin 1 (screen to pin 2)

VV across pins 5/6 (OVERLOAD MONITOR)

or pins 3/20 (ALC MONITOR)

or pins 7/20 (O/P MON)

or pins 10/20 (TUNE INDICATOR)

Avo in series with 6V supply + rail.

Test procedures

19. Carry out the procedures given on the following pages.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
000	(a)	INT. CON.	-	-	Depress "Press to Test" button.
	(b)	AVO	10 mA	-	Set Avo to 10 mA dc range.
	(c)	DVM	10V	-	Set DVM to 10V dc range.
	(d)	RF VV	10V	-	Set the RF VV to 1V range.
POWER CONSUMPTION					
002	(a)	INT. CON.	-	-	Depress "Press to Test" button.
	(b)	DVM	10V	5.701V to 6.299V	Adjust external power supply to indicate on DVM a reading of 6.0 volts.
	(c)	AVO	10 mA	2.6 mA to 3.4 mA	Check the 6V line current.
REFLECTOMETER SENSITIVITY					
003	(a)	INT. CON.	-	-	Depress "Press to Test" button.
	(b)	DVM	10V	5.701V to 6.299V	Adjust external power supply to indicate on DVM a reading of 6.0 volts.
004	(a)	RF GEN.	-	2 MHz Min O/P	Set RF Gen to a frequency of 2 MHz with minimum output voltage.
	(b)	COUNTER	-	1.999902 to 2.000098 MHz	Adjust RF Gen to give a counter indication of 2 MHz.
	(c)	INT. CON.	-	-	Depress "Press to Test" button.
	(d)	RF VV	-	Set 0.7V	Adjust RF Gen output level to give an indication on RF VV of 700 mV rms (7.0V at UUT).
	(e)	DVM	1V	0.7001V to 0.9998V	Set DVM to 1 volt range. Check DVM reading.
006	(a)	INT. CON.	-	-	Depress "Press to Test" button.
	(b)	DVM	100 mV	LT 49.99 mV	Set DVM to 100 mV range. Check DVM reading.
008	(a)	INT. CON.	-	-	Depress "Press to Test" button.

Notes relating to tests 000 - 014

Test 002 — Check of 6V line current with no RF input.

Test 003 — For setting 6V supply level.

Tests 004 - 014 — With an RF input of 2 MHz and input level set to give 7V rms across a load connected across UUT RF output (pins 15/16), the TUNE INDICATOR output (at pin 10) and OVERLOAD MONITOR output (at pin 6) of the UUT is checked at various RF load conditions thus:

50 ohm load : Pin 10 (test 004)
Pin 6 (test 006)

25 ohm load : Pin 10 (test 008)
Pin 6 (test 010)

100 ohm load : Pin 10 (test 012)
Pin 6 (test 014)

NOTE: Failure to obtain an RF output could be due to a faulty relay RLA on the UUT. This relay should be operated by 24V from the test interface and its contact connect the RF to the UUT output (pin 15).

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
008 (cont)	(b)	RF VV	-	Set 0.7V	Adjust RF Gen output level to give an indication on RF VV of 700 mV.
	(c)	DVM	100 mV	LT 199.96 mV	Check DVM reading.
010	(a)	DVM	1V	-	Set DVM to 1V range.
	(b)	INT. CON.	-	-	Depress "Press to Test" button.
	(c)	DVM	1V	0.7502V to 1.1498V	Check DVM reading.
012	(a)	RF GEN.	-	Min. O/P level	Decrease RF Gen output level to a minimum.
	(b)	INT. CON.	-	-	Depress "Press to Test" button.
	(c)	RF VV	1.0V	Set 0.7V	Increase RF Gen output level to give a 700 mV indication on RF VV.
	(d)	DVM	1V	0.4001V to 0.5999V	Check DVM reading.
014	(a)	INT. CON.	-	-	Depress "Press to Test" button.
	(b)	DVM	1V	LT 0.2499V	Check DVM reading.
ALC MONITOR SENSITIVITY					
016	(a)	RF GEN.	-	Min. O/P level	Decrease RF Gen output level to a minimum.
	(b)	DVM	10V	-	Set DVM to 10V range.
	(c)	INT. CON.	-	-	Depress "Press to Test" button.
	(d)	DVM	10V	1.901V to 2.099V	Check DVM reading.
018	(a)	INT. CON.	-	-	Depress "Press to Test" button.
	(b)	RF VV	1.0V	Set 0.7V	Increase RF Gen output level to give a 700 700 mV indication on RF VV.

Notes relating to tests 016/018

The ALC MONITOR output (pin 3 of UUT) is checked with a zero RF input (test 016) and with an RF input of 2 MHz at a level set to give 7.0V rms across the UUT RF output (pins 15/16) terminated with a 50 ohm load (test 018).

The output being monitored at the DVM and RF output being monitored at the RF VV.

Notes relating to tests 021 - 026

Tests 022 and 024 check the O/P MON output (pin 7 of UUT) under similar RF input and load conditions to tests 016 and 018 respectively.

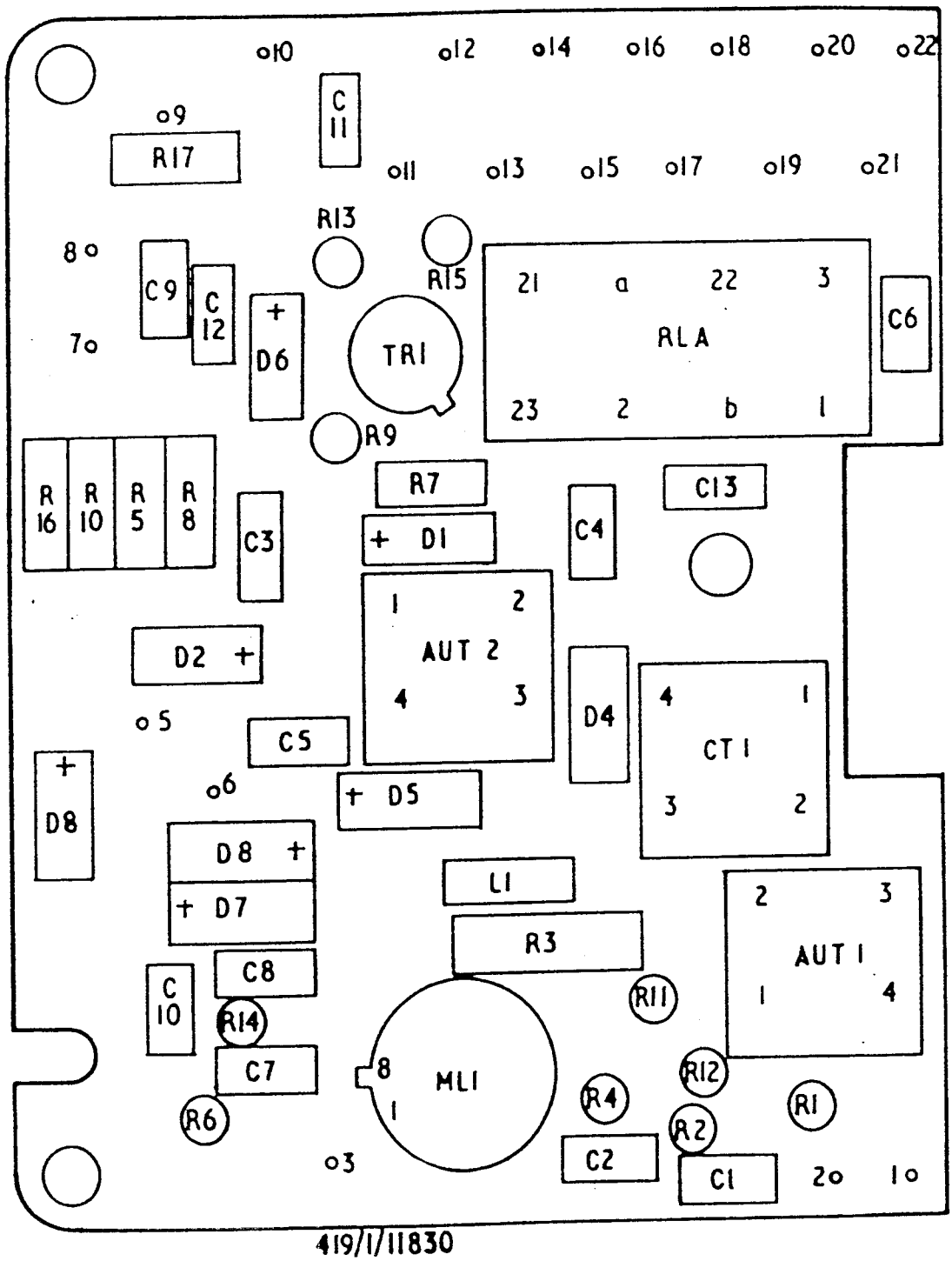
In test 026, the test conditions are similar to those for test 024, but the test checks the effect on the O/P MON output when the OV HP input line (pin 8) is connected to OV.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
018 (cont)	(c)	DVM	10V	2.301V to 2.399V	Check DVM reading.
ANTENNA CURRENT MONITOR					
021	(a)	INT. CON.	-	-	Depress "Press to Test" button.
	(b)	DVM	10V	5.701V to 6.299V	Set external power supply to indicate on DVM a reading of 6 volts.
022	(a)	RF GEN.	-	Min. O/P level	Decrease RF Gen output level to a minimum.
	(b)	INT. CON.	-	-	Depress "Press to Test" button.
	(c)	DVM	1V	0 volts	Set DVM to 1V range. Check DVM reading.
024	(a)	INT. CON.	-	-	Depress "Press to Test" button.
	(b)	RF VV	1.0V	Set 0.7V	Increase RF Gen output level to give a 700 mV indication on RF VV.
	(c)	DVM	1V	0.6001V to 0.7998V	Check DVM reading.
026	(a)	INT. CON.	-	-	Depress "Press to Test" button.
	(b)	DVM	1V	0.4001V to 0.4999V	Check DVM reading.
028	(a)	INT. CON.	-	-	Depress "Press to Test" button.
	(b)	UUT	-	-	Remove UUT from Test Jig.

COMPONENTS LIST FOR REFLECTOMETER (Unit 2b) 419/1/11830 (refer to Fig.2)

Cct Ref	Description	Reference No.
	Resistors	
R1	3 kohm ± 1%	403/4/78126/260
R2	560 ohm ± 1%	403/4/78126/243
R3	150 ohm ± 1%	403/4/78127/229
R4	150 ohm ± 5%	403/4/78126/029
R5	510 ohm ± 5%	403/4/78126/042
R6	2.7 kohm ± 5%	403/4/78126/059
R7	5.6 kohm ± 5%	403/4/78126/067
R8	30 ohm ± 5%	403/3/78126/012
R9	18 kohm ± 5%	403/4/78126/079
R10	510 ohm ± 5%	403/4/78126/042
R11	2.4 kohm ± 1%	403/4/78126/258
R12	5.6 kohm ± 1%	403/4/78126/267
R13	3.9 kohm ± 5%	403/4/78126/063
R14	1.8 kohm ± 1%	403/4/78126/255
R15	100 ohm ± 5%	403/4/78126/025
R16	10 ohm ± 5%	403/4/78126/001
R17	100 ohm ± 5%	403/4/78126/025
	Capacitors	
C1	22pF ± 5% 100v	400/9/19082/010
C2	10nF +80% -20% 100v	400/9/19084/078
C3	4.7nF ± 20% 100v	400/9/19084/070
C4	68nF +80% -20% 100v	400/9/19084/098
C5	10nF +80% -20% 100v	400/9/19084/078
C6	10pF ± 5% 100v	400/9/19082/002
C7	10nF +80% -20% 100v	400/9/19084/078
C8,C9	4.7nF ± 20% 100v	400/9/19084/070
C10	470nF +80% -20% 50v	400/9/19084/109
C11	4.7nF ± 20% 100v	400/9/19084/070
C12,C13	10nF +80% -20% 100v	400/9/19084/078
	Inductors	
L1	Inductor, 0.12uH	406/9/08470/001
	Semi-conductor devices	
ML1	Integrated circuit CN 497T	446/4/00429
TR1	Transistor CV7648	990/4/00107/648
D1 to D8	Diode CV7367	990/4/00107/367

Cct Ref	Description	Reference No.
	Miscellaneous	507/9/05095 or 507/9/38041
RLA	Relay	508/9/21630
2PL1	Plug, electrical	406/8/11030/003
CT1	Transformer	406/8/11030/004
AUT1	Transformer	406/8/11030/006
AUT2	Transformer	406 8/11030



Note: Plug 2PL1 is part of this item and connects to it by flying leads

Fig 2 Reflectometer pec (unit 2b) component layout

THIRD LINE SERVICING OF RF DECOUPLING UNIT 419/1/24973 (UNIT 2g)

CONTENTS

ILLUSTRATIONS

DESCRIPTION

1. The RF Decoupling Unit (Unit 2g) is a component part of the transmitter receiver and is normally located on the Rear Panel Assembly (Unit 2). It consists of a panel electronic circuit (pec), two 7-way audio sockets (2SK5, 2SK6) which are connected to the pec by flexible connectors, and a 9-way plug (2PL3) which is connected to the pec by flying leads.

2. The unit provides decoupling of spurious RF signals from the microphone, earphone and pressel lines. It also provides two thermistors which protect the 24V dc supply from the radio to external equipment by limiting the current drain to less than 200 mA when the supply outlet is shorted to ground.

3. A circuit diagram of the unit is given in Fig.1.

TESTING

Test equipment

4. The following items of proprietary test equipment are required:

Item	Description
AF Gen.	Audio frequency signal generator which will provide 2 kHz at 100 mV emf. Suitable instrument: Advance J3
AF VM	AF millivoltmeter to read 2 kHz ac voltages up to 100 mV. Suitable instrument: Hewlett Packard 3400A
Avo	To read D.C. current 10A with an accuracy of ± 1%. Suitable instrument: Avo Model 8X
PSU	Power supply to provide 24V ± 0.1V dc with a current limit of 1.5A. Suitable instrument: Farnell TSV70-Mk2

Test procedures

NOTE: All the following tests can be carried out while the unit is fitted to the Rear Panel Assembly.

5. To test the audio lines, refer to the list of checks given below and for each check:

(1) Connect the AF Gen to the specified pins of 2PL3. Set the AF Gen output to 2 kHz at a level of 100 mV ± 1 mV.

(2) Using the AFV, check that the output at the indicated pins of both audio sockets, 2SK5 and 2SK6, is greater than 95 mV.

Check	AF Gen to 2PL3 pins	RFV to Audio socket pins
1	4/5	A/B
2	2/7	D/E
3	2/7	G/E
4	3/7	F/E

6. To test the 24V supply protection:

(1) Set the 24V supply to 24V ± 0.1V.

(2) Connect the 24V supply, +ve rail to 2PL3 pin 1, -ve rail to 2PL3 pin 7.

(3) Connect the Avo, set to 10A dc range, between pins C and E of 2SK5.

(4) Switch on the 24V supply, and check that the Avo reading is less than 200 mA after an initial surge.

COMPONENTS LIST FOR
RF DECOUPLER (Unit 2g)
419/1/24973 (refer to fig.2)

Cct Ref	Description	Reference No.
	Resistors	
R1, R2	Thermistors P.T.C.	403/9/03552
	Capacitors	
C1	22uF ± 20% 35v electrolytic	402/4/98049/092
C2, C3	10nF +80% -20% 100v	400/9/19084/078
C4 to C6	68nF +80% -20% 50v	400/9/19084/098
C7, C8	4.7uF ± 20% electrolytic 35v	402/9/98049/088
C9	68nF +80% -20% 50v	400/9/19084/098
C10	10nF +80% -20% 100v	400/9/19084/078
	Inductors	
L1, L2	Inductor 18uH	406/9/08470/027
	Miscellaneous	
2PL3	Plug, electrical, 9-way	508/4/28210/001
2SK5,2SK6	Socket, electrical, fixed	508/9/20411/003
	Insulator	640/2/09855
	Spacer	640/2/09858
	Saddle (for securing R1, R2)	640/2/14912
	Panel, printed circuit flexible to 2SK5	419/1/24988
	Panel, printed circuit flexible to 2SK6	419/1/24977
	Bracket (adjacent to L1)	640/2/09853
	Bracket assembly (adjacent to C1)	640/2/09584
	Screw, slotted pan hd., M2.5 x 8mm. st.st.	991/4/01737/004
	Washer, crinkle M2.5 Ber.Cu	991/4/02000/036
	Nut, hex. M2.5 st.st.	991/4/01495/003

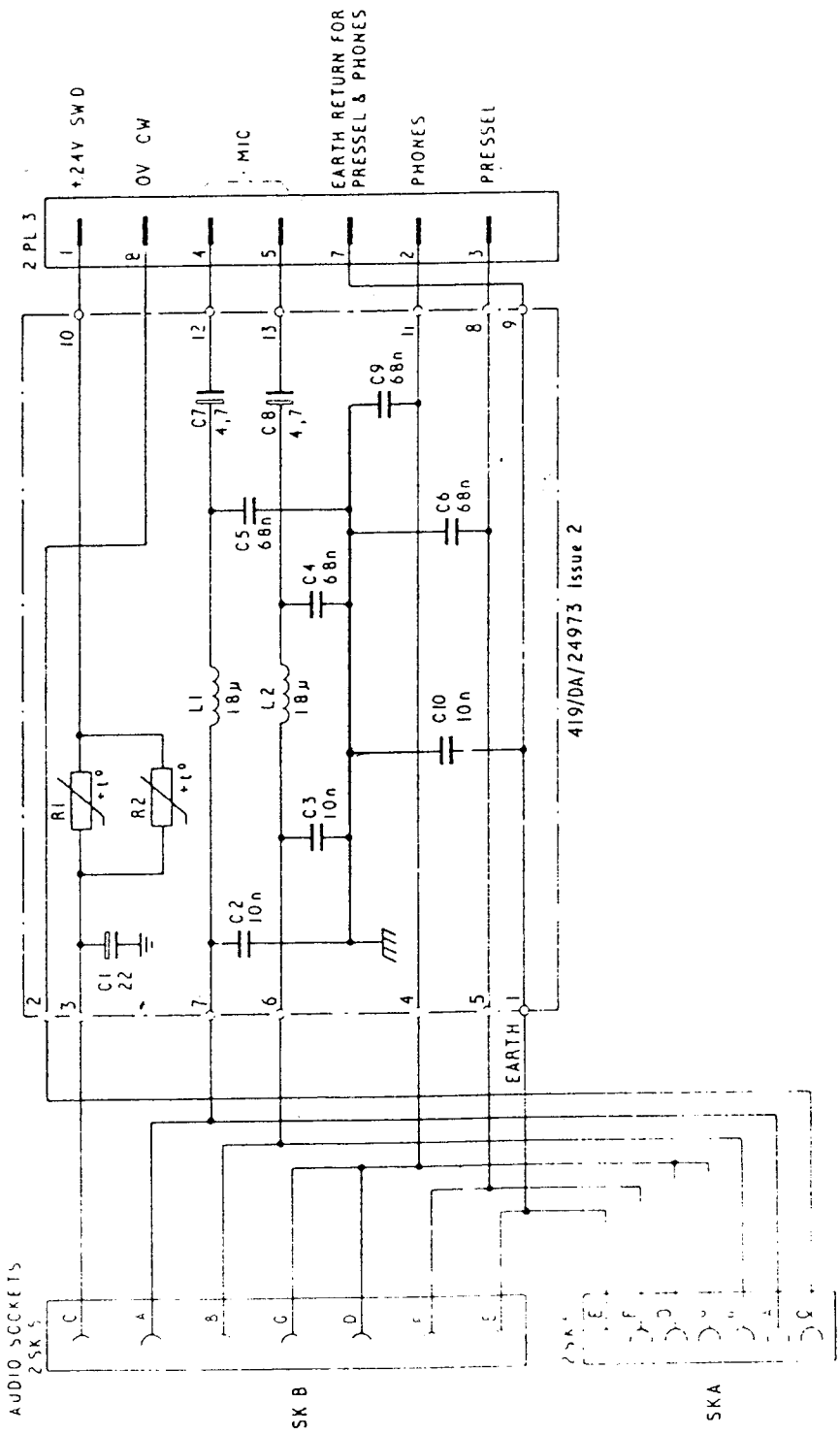


Fig 1 Unit 2g RF decoupler - circuit

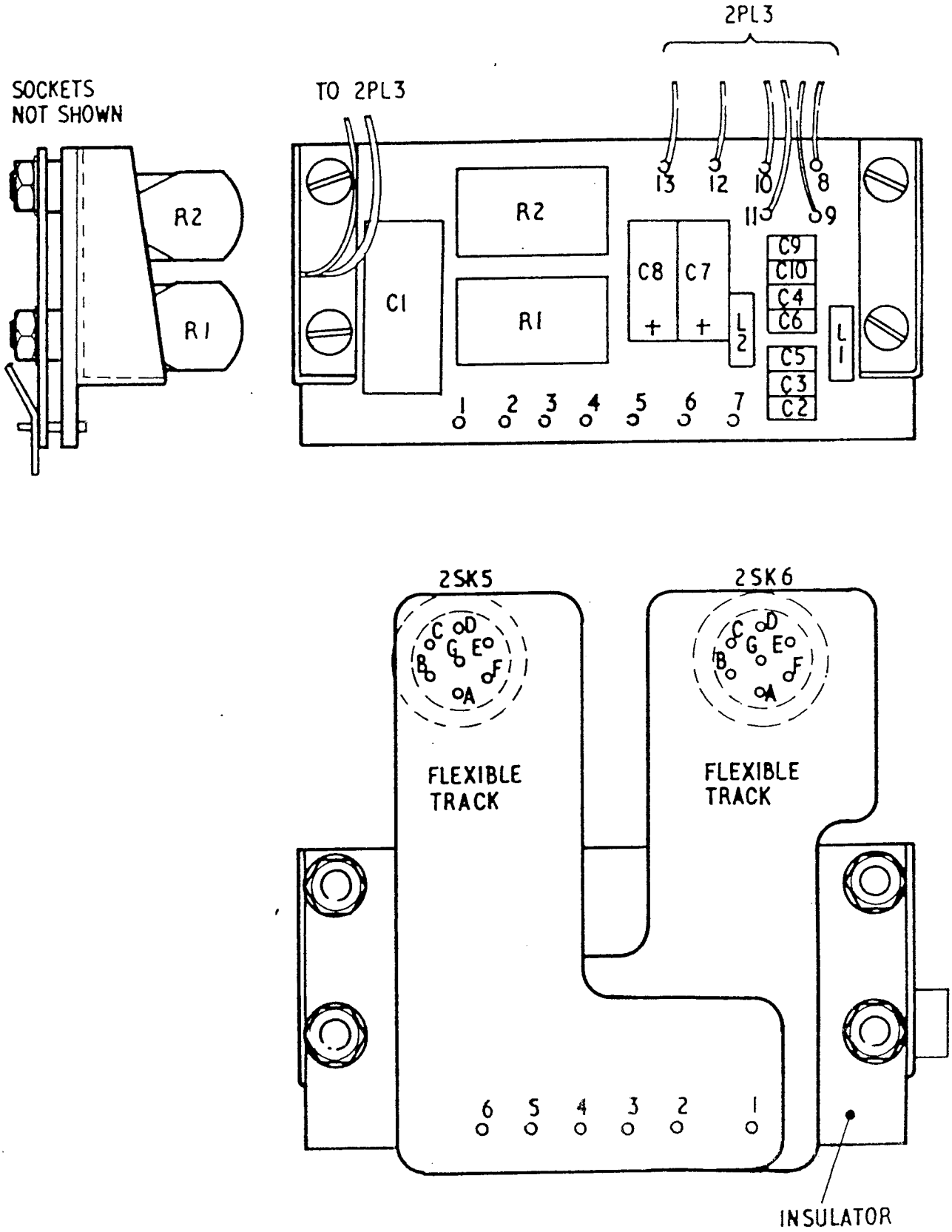


Fig.2 RF decoupler pec (unit 2g) — component layout

THIRD LINE SERVICING
OF
PA FILTER SUB-ASSEMBLY 640/1/09734
(UNITS 2c-2f)

CONTENTS

ILLUSTRATIONS

INTRODUCTION

1. The PA filter assembly consists of a switch and four panels, electronic circuit (Units 2c-2f). It is a component part of the receiver transmitter and is normally located on the Rear Panel Assembly (Unit 2).

NOTE: Literally, the PA filter assembly is a component part of the PA switch and filter assembly (630/1/09631). For convenience, a breakdown of this assembly is included in the components list at the rear of this section.

2. The assembly is connected in series with the transmitter output, the harmonic content of which is reduced by one of six filters, selected according to the frequency range.

DETAILED DESCRIPTION

3. The four panels respectively contain one filter on each of Units 2c and 2e and two filters on each of Units 2d and 2f. The panels are fixed in the form of a rectangular block, with six position printed circuit switches placed at the ends. A shaft links the switches. Two coaxial flying leads connect the assembly to the external circuits.

4. A circuit diagram of the assembly is given in fig.1. Each filter (fig.2) is a two-section, low pass, Darlington type configuration. The value of components differ in each filter to provide the following characteristics:

	Pass-band	Stop-band edge frequency
Range 1 filter	2 - 3.1 MHz	4.0 MHz
Range 2 filter	3.1 - 4.9 MHz	6.2 MHz
Range 3 filter	4.9 - 7.7 MHz	9.8 MHz
Range 4 filter	7.7 - 12.2 MHz	15.4 MHz
Range 5 filter	12.2 - 19.1 MHz	24.4 MHz
Range 6 filter	19.1 - 30.0 MHz	38.2 MHz

5. In each case, the rejection band attenuation is greater than 25 dB with a pass-band insertion loss of less than 0.05 dB.

TESTING

Test equipment

6. The following item of special-to-purpose test equipment is required:

Test Jig. Plessey Type TJ843A.

7. The following items of proprietary test equipment are required:

Item	Description
RF Gen.	An RF Signal Generator capable of supplying an output emf of between 2 microvolts and 2 volts over a frequency range of 2 to 70 MHz with an output impedance of 50 ohms. Suitable instrument: Marconi RF Signal Generator Type TF144H/4

Item	Description
RF mV	An RF Voltmeter for measuring between 50 millivolts and 1 volt over a frequency range of 2 to 70 MHz to an accuracy of ± 3% of indicated value. Suitable instrument: Marconi RF Millivoltmeter Type TF2603 with adaptors TM7950 and 'N' to 'BNC' connector.
Counter	An Electronic Counter with the facility for measuring frequencies in the range 2 to 70 MHz to an accuracy of ± 2 Hz. Suitable instrument: Racal 9024.
Load	A resistive load of 50 ohms ± 2%. (Suitable 50 ohm pad).

Preliminary

NOTE: Part of the jig is a housing rouchly similar to the PA filter housing used in the radio - but with holes drilled to give access to the filter inductor core adjusters.

8. Fit the UUT (unit under test) to the jig as follows:

(1) Fit the top cover plate to the UUT.

(2) Hold the UUT by the top of its spindle and position above the jig. Pass the lower flying lead through the side hole inside the base of the jig casting. Pass the upper flying lead into the cut-out in the top of the jig casting and gently lower the UUT until the cover plate locates on the two pins on top of the casting.

(3) Clamp the cover plate into position.

(4) Check that all 12 inductor slug slots are accessible through their associated holes in the jig casting.

(5) Connect the lower flying lead (filter input) into the strip-line connector (side of housing nearest cover clamp lever) so that the inner conductor is in contact with the printed copper strip and the outer conductor is in contact with the ground plane. Tighten the clamp screw to hold both conductors in position.

(6) Connect the upper flying lead (filter output) into the strip-line connector (on opposite side of housing to the first strip-line). Make the connections in a similar manner.

(7) Fit the range selection wheel (number on wheel adjacent to engraved locating line on housing gives range selected). Check that the switch can be turned but do not use force.

Alignment of filters

9. Proceed as follows:

(1) Connect the RF Gen output to the filter input at the Test Jig. Connect the counter to the RF Gen normal output via a 10 dB attenuator.

(2) Connect the 50 ohm load to the filter output at the test jig. Connect the RF voltmeter to measure the voltage across the load.

(3) Switch on mains supplies to test instruments.

(4) With reference to the table below, carry out checks 1 to 18 in that order and, for each check:

(a) Set the UUT range as given.

(b) Set RF Gen frequency as indicated, at 2V emf.

(c) Adjust given inductor for minimum reading at RV voltmeter.

NOTE: The location of the inductors is given in terms of upper/lower part of Face A, B, C, D. Face B is the one with the engraved locating line, face C is nearest the cover clamp. Face A is opposite C, face D is opposite B.

CHECK NO.	RANGE SWITCH 'P' & FILTER NO.	FACE	CORE TO BE ADJUSTED	SIGNAL GENERATOR FREQUENCY (MHz) NOMINAL VALUE AND LIMITS
1	1	B	L2 (TOP)	4.21 (4.205002 AND 4.214998)
2			L1 (BOTTOM)	5.74 (5.735002 AND 5.744998)
3			L2 (TOP)	4.21 (4.205002 AND 4.214998)
4	2	A	L3 (TOP)	6.40 (6.395002 AND 6.404998)
5			L1 (BOTTOM)	9.38 (9.375002 AND 9.384998)
6			L3 (TOP)	6.40 (6.395002 AND 6.404998)
7	3	A	L4 (TOP)	9.94 (9.935002 AND 9.944998)
8			L2 (BOTTOM)	15.15 (15.145002 AND 15.154998)
9			L4 (TOP)	9.94 (9.935002 AND 9.944998)
10	4	D	L2 (TOP)	15.95 (15.945002 AND 15.954998)
11			L1 (BOTTOM)	22.50 (22.495002 AND 22.504998)
12			L2 (TOP)	15.95 (15.945002 AND 15.954998)
13	5	C	L3 (TOP)	25.60 (25.595002 AND 25.604998)
14			L1 (BOTTOM)	36.24 (36.235002 AND 36.244998)
15			L3 (TOP)	25.60 (25.595002 AND 25.604998)
16	6	C	L4 (TOP)	39.60 (39.595002 AND 39.604998)
17			L2 (BOTTOM)	57.25 (57.245002 AND 57.254998)
18			L4 (TOP)	39.60 (39.595002 AND 39.604998)

Insertion losses

10. With test equipment connected as specified for tests in para.9, carry out each of checks 1 to 18 in the table below and, for each check:

(1) Set UUT range switch as given.

(2) Set RF Gen output to indicated frequency at 2V emf.

(3) Check that RF Voltmeter reading is within the indicated limits.

CHECK NO.	RANGE SWITCH 'P' & FILTER NO.	SIGNAL GENERATOR FREQUENCY (MHz) NOMINAL VALUE AND LIMITS	OUTPUT LEVEL (mV)
1	1	2.50 (2.450002 TO 2.549998)	GT 950
2		4.00 (3.995002 TO 4.004998)	LT 56
3		4.73 (4.725002 TO 4.734998)	LT 56
4	2	4.00 (3.950002 TO 4.049998)	GT 950
5		6.20 (6.195002 TO 6.204998)	LT 56
6		7.05 (7.045002 TO 7.054998)	LT 56
7	3	6.30 (6.250002 TO 6.349998)	GT 950
8		9.80 (9.795002 TO 9.804998)	LT 56
9		11.37 (11.365002 TO 11.374998)	LT 56
10	4	10.00 (9.950002 TO 10.049998)	GT 950
11		15.40 (15.395002 TO 15.404998)	LT 56
12		17.82 (17.815002 TO 17.824998)	LT 56
13	5	15.70 (15.650002 TO 15.749998)	GT 950
14		24.40 (24.395002 TO 24.404998)	LT 56
15		28.17 (28.165002 TO 28.174998)	LT 56
16	6	24.50 (24.450002 TO 24.549998)	GT 950
17		38.20 (38.195002 TO 38.204998)	LT 56
18		45.60 (45.550002 TO 45.649998)	LT 56

COMPONENTS LIST

11. The PA Switch and Filter Assembly 640/1/09631 comprises:

Panel, electronic circuit (Unit 2b)	419/1/11830
Housing assembly	640/1/09735
Cover (over Unit 2b)	640/1/09733
PA Filter sub-assembly	640/1/09734
Cover (over filters)	640/2/09729
Shaft	640/2/09845
Circlip	999/4/01348/009

12. The Filter sub-assembly 640/1/09734 comprises:

Switch 2S1BF	408/8/23235
Switch 2S1AF	408/8/23234
Panel, electronic circuit (Unit 2c)	419/1/11835
Panel, electronic circuit (Unit 2d)	419/1/11840
Panel, electronic circuit (Unit 2e)	419/1/11845
Panel, electronic circuit (Unit 2f)	419/1/11850

Component layout diagrams of Units 2c to 2f are given in fig.3 and associated component lists in paras.13-16 inc.

13. The component parts of Unit 2c, 419/1/11835 are:

Cct.ref.	Description	Ref.No.
	Capacitors, silver mica	
C1	890 pF ± ½% 350V	438/9/30100/138
C2	264 pF ± ½% 350V	438/9/30100/129
C3	1497 pF ± ½% 350V	438/9/30100/140
C4	854 pF ± ½% 350V	438/9/30100/137
C5	641 pF ± ½% 350V	438/9/30100/136
	Inductors, r.f.	
L1	2.04 - 2.38 µH min.	406/8/11037/001
L2	1.37 - 1.61 µH min.	406/8/11037/002

14. The component parts of Unit 2d, 419/1/11840 are:

Cct.ref.	Description	Ref.No.
	Capacitors, silver mica	
C1	614 pF ± ½% 350V	438/9/30100/135
C2	394 pF ± ½% 350V	438/9/30100/132
C3	175 pF ± ½% 350V	438/9/30100/124
C4	106 pF ± ½% 350V	438/9/30100/119
C5	936 pF ± ½% 350V	438/9/30100/139
C6	603 pF ± ½% 350V	438/9/30100/134
C7	573 pF ± ½% 350V	438/9/30100/133
C8	344 pF ± ½% 350V	438/9/30100/130
C9	392 pF ± ½% 350V	438/9/30100/143
C10	258 pF ± ½% 350V	438/9/30100/128

Cct.ref.	Description	Ref.No.
	Inductors, r.f.	
L1	1.29 - 1.51 µH min.	406/8/11037/003
L2	0.94 - 1.10 µH min.	406/8/11037/004
L3	0.80 - 0.94 µH min.	406/8/11037/005
L4	0.53 - 0.62 µH min.	406/8/11037/006

15. The component parts of Unit 2e, 419/1/11845 are:

Cct.ref.	Description	Ref.No.
	Capacitors, silver mica	
C1	247 pF ± ½% 350V	438/9/30100/127
C2	70 pF ± ½ pF 350V	438/9/30100/116
C3	376 pF ± ½% 350V	438/9/30100/131
C4	230 pF ± ½% 350V	438/9/30100/125
C5	158 pF ± ½% 350V	438/9/30100/123
	Inductors, r.f.	
L1	0.505 - 0.595 µH min.	406/8/11037/007
L2	0.353 - 0.384 µH min.	406/8/11037/008

16. The component parts of Unit 2f, 419/1/11850 are:

Cct.ref.	Description	Ref.No.
	Capacitors, silver mica	
C1	157 pF ± ½% 350V	438/9/30100/122
C2	100 pF ± ½% 350V	438/9/30100/142
C3	45 pF ± ½ pF 350V	438/9/30100/114
C4	29 pF ± ½ pF 350V	438/9/30100/141
C5	240 pF ± ½% 350V	438/9/30100/126
C6	153 pF ± ½% 350V	438/9/30100/121
C7	147 pF ± ½% 350V	438/9/30100/120
C8	94 pF ± ½ pF 350V	438/9/30100/117
C9	101 pF ± ½% 350V	438/9/30100/118
C10	64 pF ± ½ pF 350V	438/9/30100/115
	Inductors, r.f.	
L1	0.313 - 0.368 µH min.	406/8/11037/009
L2	0.254 - 0.286 µH min.	406/8/11037/010
L3	0.220 - 0.260 µH min.	406/8/11037/011
L4	0.151 - 0.177 µH min.	406/8/11037/012

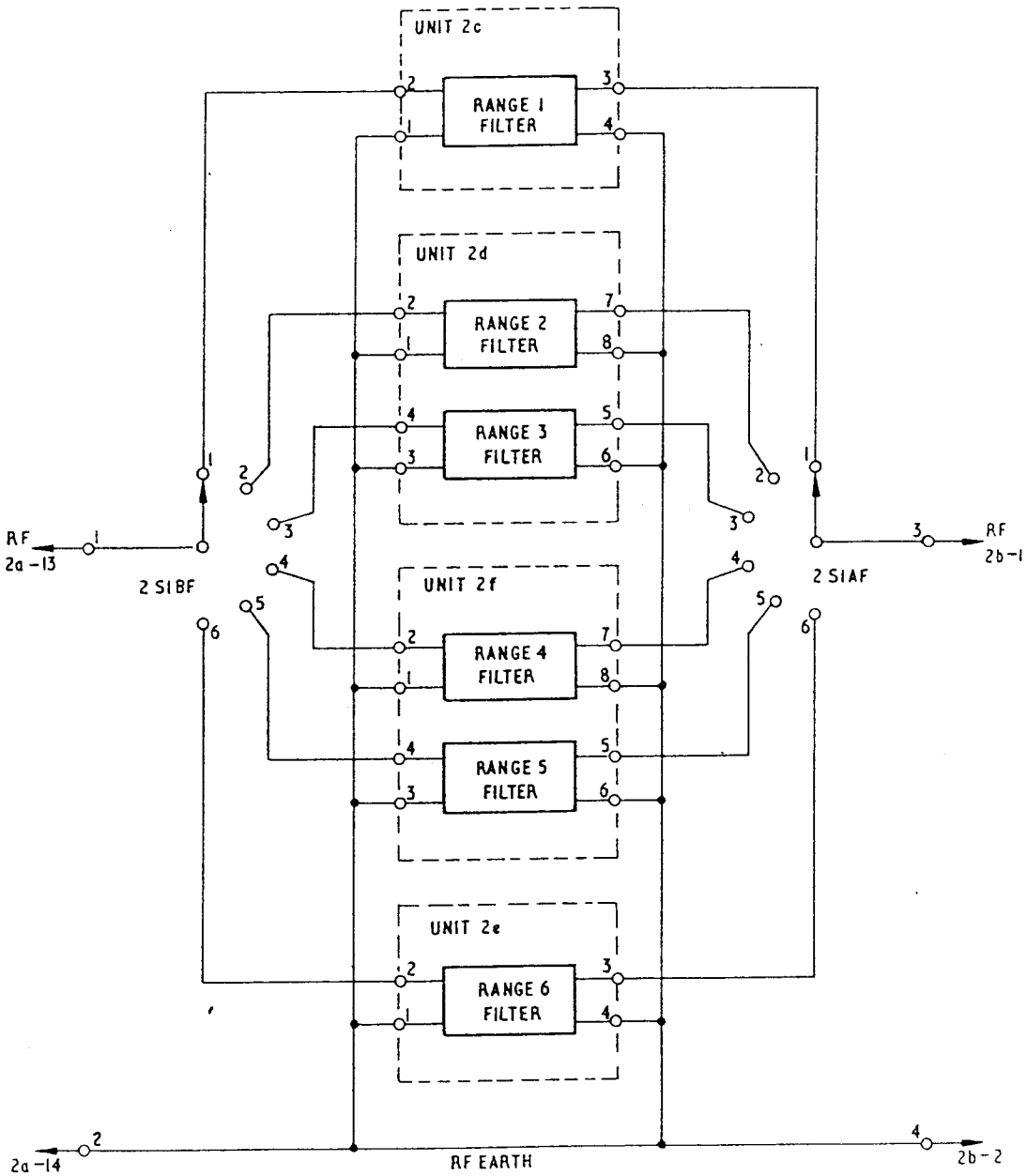
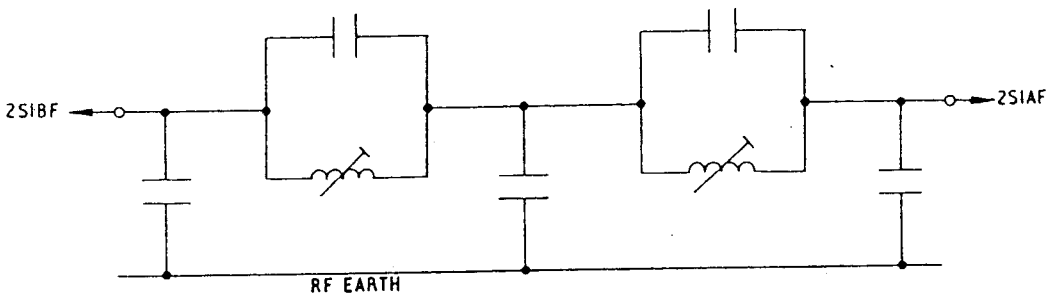


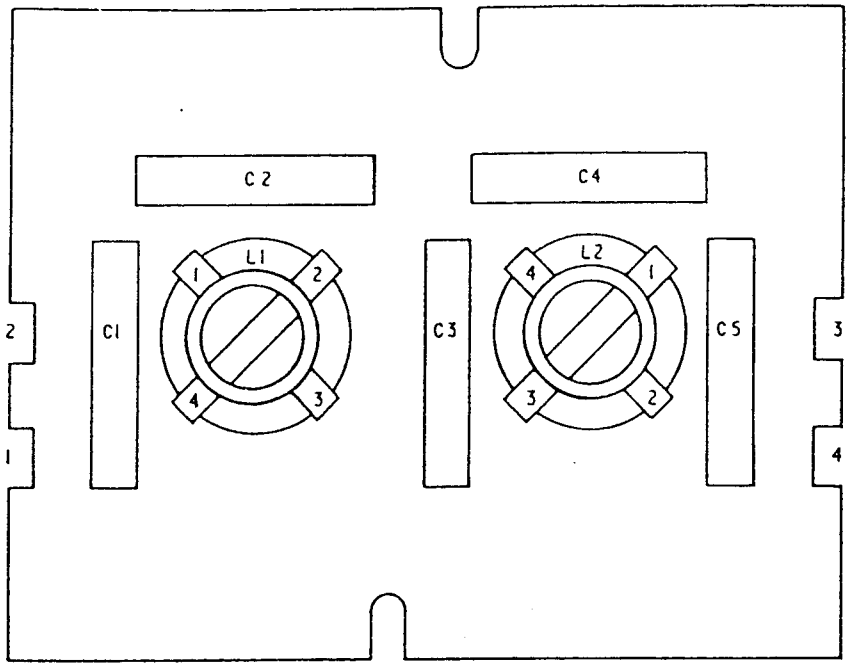
Fig. 1 PA Switch & filter - circuit diagram



RANGE	COMPONENT REFERENCES					UNIT
1	C1	C2 / L1	C3	C4 / L2	C5	2c
2	C1	C3 / L1	C5	C7 / L3	C9	2d
3	C2	C4 / L2	C6	C8 / L4	C10	2d
4	C1	C3 / L1	C5	C7 / L3	C9	2f
5	C2	C4 / L2	C6	C8 / L3	C10	2f
6	C1	C2 / L1	C3	C4 / L2	C5	2e

FOR COMPONENT VALUES REFER TO COMPONENT LISTS

Fig. 2 PA Filter - circuit diagram



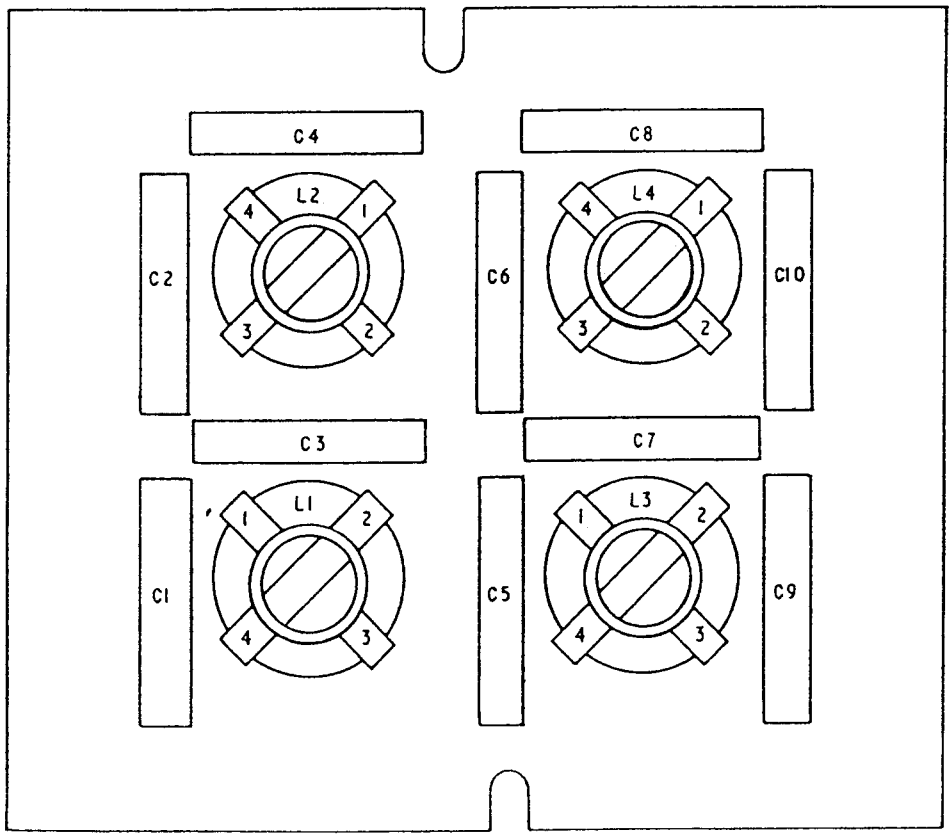


Fig. 3 Units 2c – 2f component layout

THIRD LINE SERVICING OF VHF FILTER 640/1/09648 (UNIT 2h)

CONTENTS

ILLUSTRATIONS

INTRODUCTION

1. The VHF Filter Assembly (Unit 2h) is a component part of the transmitter receiver and is normally located on the Rear Panel Assembly (Unit 2). It consists of a screening can and a panel electronic circuit. Two coaxial flying leads connect the unit to the associated external circuits.

2. The unit is a low pass filter which reduces the level of broadband noise and spurious outputs at frequencies above 33 MHz by at least 25 dB.

DETAILED DESCRIPTION

3. The filter (refer to fig.1) consists of a three-section, low pass, Darlington-type filter comprising ten fixed capacitors and three variable inductors.

4. The filter has the following characteristics:

Pass-band	2 - 30 MHz
Pass-band ripple	less than 1 dB
Stop-band edge	32.8 MHz
Stop-band rejection	greater than 25 dB

TESTING

Test equipment

5. The following item of special-to-purpose test equipment is required:

Test Jig. Plessey Type TJS45A.

6. The following items of proprietary test equipment are required:

Item	Description
RF Gen.	RF signal generator with the following essential characteristics: Range: 2 to 100 MHz Overall frequency accuracy: ± 10% Output voltage: 3 µV to 3V Output impedance: 50 ohms Suitable instrument: Marconi TF144H/4
RFV	An RF millivoltmeter with the following essential characteristcis: Frequency to include: 2 to 100 MHz Range: 0.3 mV to 3V Accuracy: ± 3% of fsd Suitable instrument: Marconi Type 2603 with adaptor Type TM7950 with adaptor N to BNC
Counter	An electronic counter for measuring frequencies in the range 2 to 100 MHz with an accuracy of 1 part in 10^4. Suitable instrument: Racal Type 9024
Load	A BNC 50 ohm by-pass termination, a suitable one being the Radiall 405 005.

Preliminary

7. At the test jig:

(1) Load the UUT (unit under test) onto the jig and clamp it into position.

nsertion loss measurement

Proceed as follows:

(1) Set the RF Gen output level to 2V emf.

(2) Set the RF Gen to each of the frequencies listed below and at each step check that the reading of the RFV is as given:

Check	RF Gen frequency MHz between	RFV reading
1	19.91792 and 20.00208	GT 930 mV
2	33.79792 and 33.80208	LT 53 mV
3	39.99792 and 40.00208	LT 53 mV
4	50.0 approx.	LT 53 mV
5	60.0 approx.	LT 53 mV
6	70.0 approx.	LT 53 mV
7	80.0 approx.	LT 53 mV
8	90.0 approx.	LT 53 mV
9	100.0 approx.	LT 53 mV

PONENTS LIST

. The principal component parts of the VHF filter assembly 640/1/09648 e:

Panel, electronic circuit	419/1/11825
Screen can assembly	640/1/09620

.. The component parts of the panel, electronic circuit 419/1/11825 (refer fig.1) are:

Cct.ref.	Description	Ref.No.
	Capacitors, silver mica	
C1	4.7 pF ± 0.25 pF 100V	400/9/19080/004
C2,3	134 pF ± 0.5% 350V	438/9/30100/111
C4	135 pF ± 0.5% 350V	438/9/30100/112
C5	96 pF ± 0.5 pF 350V	438/9/30100/109
C6,7	55 pF ± 0.5 pF 350V	438/9/30100/107
C8	132 pF ± 0.5% 350V	438/9/30100/110
C9	34 pF ± 0.5 pF 350V	438/9/30100/106
C10	92 pF ± 0.5 pF 350V	438/9/30100/108

(2) Fit the coaxial insert on one flying lead into the multi-way connector.

(3) Connect the other flying lead into the strip-line connector so that the inner conductor is in contact with the printed copper strip and the outer conductor is in contact with the ground plane. Tighten the clamp screw to hold both conductors in position.

(4) Connect the RF Gen to the input socket on the jig.

(5) Connect the counter to the RF Gen normal output via a 10 dB attenuator.

(6) Connect the 50 ohm by-pass termination to the output socket on the jig and connect the termination to the RFV.

(7) Switch on the test equipment mains supplies where applicable.

Alignment procedure

8. Proceed as follows:

(1) Set the RF Gen output level to 2V emf.

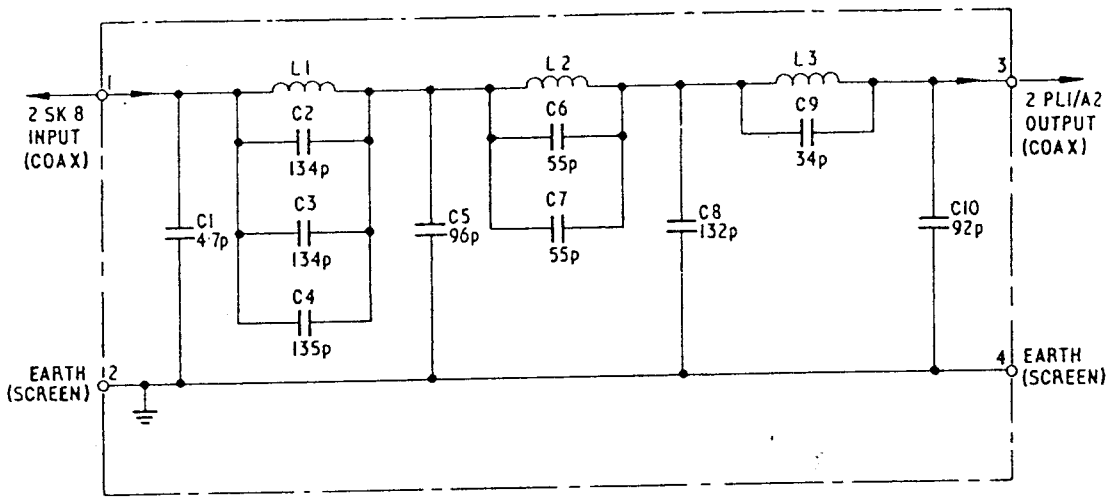
(2) Set the RF Gen frequency (indicated at counter) as given below for check 1.

(3) At the UUT, adjust the inductor core given below for check 1 to obtain a minimum reading at the RFV.

(4) Repeat (2) and (3) for each of checks 2 to 6 inc. in that order.

Check	RF Gen frequency (MHz) between	Adjust core
1	51.49792 and 51.50208	L3
2	35.619792 and 35.620208	L2
3	32.859792 and 32.860208	L1
4	35.619792 and 35.620208	L2
5	32.859792 and 32.860208	L1
6	51.49792 and 51.50208	L3

Cct.ref.	Description	Ref.No.
	Inductors, r.f.	
L1	0.056 to 0.060 μH min.	406/8/11037/013
L2	0.190 to 0.220 μH min.	406/8/11038
L3	0.27 to 0.29 μH min.	406/8/11037/014



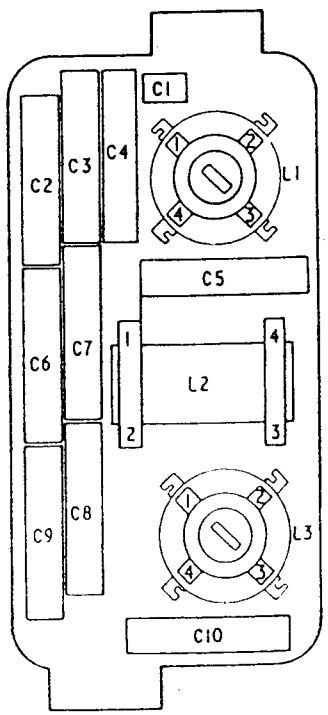


Fig. 1 VHF Filter (unit 2h) – circuit diagram and pec component layout

THIRD LINE SERVICING
OF
TURRET ASSEMBLY 640/1/09591
(UNIT 3)

CONTENTS

ILLUSTRATIONS

INTRODUCTION

1. The turret assembly (Unit 3) is a component part of the transmitter receiver and is normally located on the Front Panel and Chassis Assembly

(Unit 1). It provides the following:

(1) A variable frequency oscillator (VFO).

(2) The receiver RF amplifier (single tuned input circuit).

(3) The receiver RF/IF mixer.

(4) A receiver IF stage.

(5) A double tuned filter.

2. Coarse tuning (i.e. frequency range) for items (1), (2) and (5) is selected by a six position switch and, within each range, fine tuning is provided by varactor diodes which respond to a control voltage from a frequency synthesiser (Unit 9).

3. The double tuned filter is employed in either the transmit path or the receive path, selection being made by a relay.

DESCRIPTION

4. The turret is a six position manually controlled switch. Each position utilises a different pair of plug-in panels, electronic circuit (pec), which rotate with the switch mechanism. A small plate on the turret casting covers a port that gives access to whichever pair of pec has been selected.

5. Six of the pec (Units 3b-3g inc.) provide the single/double circuit tuning for ranges 1 to 6 respectively, the other six pec (Units 3j-3p inc.) provide the VFO tuning for ranges 1 to 6 respectively.

6. Two other pec (Units 3a and 3h) are mounted in the turret casting, beneath a large cover plate. Unit 3h contains the VFO circuits and Unit 3a contains the remainder of the RF circuits listed in para.1.

DETAILED DESCRIPTION

RF circuits (see fig.1)

7. The RF signal applied to pin 11 is fed to a single tuned circuit selected by the range switch and then to ML2. The integrated circuit ML2 is a

variable gain broadband RF amplifier controlled by the receiver AGC voltage fed to pin 9 of Unit 3a.

8. When relay RL1/2 is not operated, its contacts connect ML2 output to ML1 via the double tuned circuit selected by the range switch.

9. Both the single and double tuned circuits are tuned by varactor diodes controlled by a dc voltage in the range 5 to 80V supplied to pin 12 of Unit 3a. The control voltage is used to set the centre of the response curve of the tuned circuits at the frequency of operation.

10. The integrated circuit ML1 is a double balanced modulator. The output at ML1 pin 5 is a complex waveform containing the sum and difference frequencies of the inputs to ML1 pins 7 and 3 (RF from ML2 and RF from the VFO), the original frequencies are effectively suppressed. Ignoring any audio component in the receiver RF signal, the difference between the two frequencies is normally 1.75 MHz. The circuit L2/C4/C5 is tuned to 1.75 MHz and has a bandwidth covering the upper and lower sideband components (i.e. audio components). Thus, the difference frequency is selected and is amplified by TR1/TR2 before being passed to the Rx IF output at pin 7 of Unit 3a.

11. Relay RL1/2 is operated when +24V is applied to pin 1 of Unit 3a; its contacts disconnect the double tuned circuit from the receiver RF path and connect the circuit in the transmitter RF path (between pins 13 and 12 of Unit 3a).

VFO (see fig.2)

12. ML1 on Unit 3h is an oscillator, the frequency of which is determined by the tuned circuit connected between pins 2 and 10 of ML1. This tuned circuit is selected by the range switch and is tuned by varactor diodes controlled by a dc voltage in the range 5 to 80V supplied to pin 8 of Unit 3h. (In practice, this and the similar input to Unit 3a, are connected to a common source, the synthesiser).

13. ML1 provides three sine-wave outputs, two of these outputs are used to supply the transmitter and receiver modulators respectively and are between 200 and 400 mV peak-to-peak. The third output is between 1000 and 1700 mV peak-to-peak and is used to supply the synthesiser control loop.

TESTING

Test equipment

14. The following items of special-to-purpose test equipment are required:

(1) HF Turret Test Set. Plessey Type TD50572B.

(2) Test Jig. Plessey Type TJ844B.

15. The following items of proprietary test equipment are required:-

Item	Description
RF Gen.	A RF signal generator capable of providing spot frequencies in the range 2 - 30 MHz to an accuracy of ± 2 Hz. The output emf should be adjustable between 6 μV and 500 mV ± 1.2 dB from an output impedance of 50 ohms. Suitable instrument: Marconi TF2002B with TF2170B synchroniser
RF VM	A selective RF millivoltmeter capable of measuring voltages in the range 50 μV to 50 mV with an accuracy of ± 1.75 MHz. Suitable instrument: Bruel & Kjoer Type 2006.
DVM	Digital voltmeter to measure dc voltages in the range 0V to 62V with an accuracy of ± 5 mV. Input impedance 10 Mohm or better. Suitable instrument: Solartron A203/204
Counter	To measure frequency in the range 2 to 30 MHz with an accuracy of ± 2 MHz. Suitable instrument: Racal 9024
Pad	A 20 dB 75 ohm pad.
Tool	A trimming tool such as the Siemens 9 mm tool. (The tool blade dimensions must be correct in order to protect pot cores from damage).

NOTE: The test set TD50572 contains a reference oscillator and synthesiser that, in conjunction with the turret, provide a "phase locked loop". A lamp on the test set is extinguished when the phase lock condition is present.

Preliminary

16. Connect the turret test set to the jig, using the 6-way Plessey and BNC connectors.

17. Connect the DVM to the VARICAP connections on the jig, observing the correct polarity.

18. On the UUT (unit under test) remove the two cover plates. Lift the UUT onto the jig, ensure that it is seated correctly and, without using undue force, secure it in position by means of the clamp.

19. By means of the lever on the jig, carefully slide the plunger carriage in until the lever attains its maximum amount of movement - this will cause the plungers on the carriage to locate against the UUT test points.

20. Fit the selection switch wheel to the turret mechanism. Three locating pins, one on UUT and two on wheel ensure that the engraved marker on the wheel correctly indicates the range selected (i.e. the pec requiring alignment is accessible through the access port).

21. On the plunger carriage, set the damping switch (top of carriage) to off.

22. Connect and switch on the mains supplies to the Turret test set and DVM. Set the 6V switch to ON.

Current consumption check

23. Check that the meter on the turret test set indicates that the UUT drain on the 6V supply is between 36 and 62.5 mA.

Oscillator tracking

24. Set the turret to each of the range 1 to 6 in turn, and at each step, refer to the list below and carry out the following procedure.

(1) Set the test set frequency to the upper tracking frequency given and adjust the indicated capacitor for the specified varicap voltage (displayed at DVM). The phase lock lamp on the test set should go out.

(2) Set the test set frequency to the lower tracking frequency and adjust the indicated inductor for the specified varicap voltage. The phase lock lamp on the test set should go out.

(3) Using the counter connected to pin 4 of Unit 3a (VFO output) of the UUT, check that the counter indicates a frequency 1.75 MHz above the tracking frequency.

RANGE	TRACKING FREQUENCY MHz	ADJUST	VARICAP DIODE VOLTAGE
1	2.99 2.11	3jC1 3jL1	61.30V ± 500 mV 9.67V ± 50 mV
2	4.72 3.28	3kC1 3kL1	60.80V ± 500 mV 8.86V ± 50 mV
3	7.42 5.18	3lC1 3lL1	61.00V ± 500 mV 9.10V ± 50 mV
4	11.75 8.15	3mC1 3mL1	60.80V ± 500 mV 8.77V ± 50 mV
5	18.41 12.89	3nC1 3nL1	61.00V ± 500 mV 9.25V ± 50 mV
6	28.91 20.19	3pC1 3pL1	61.00V ± 500 mV 9.12V ± 50 mV

RF tuned circuit alignment

25. Retain the test connections used in the preceding tests.

26. Connect the RF VM probe to the mV MET socket on the test jig. Connect the 20 dB 75 ohm pad between the RF VM and its probe. Calibrate the RF VM to the reference level of 2.5 mV at 30 MHz as described in the manufacturers handbook. Set the RF VM to 1.75 MHz.

27. Set the AGC and 24V switches on the test set to OFF. Set the damping switch on the jig to ON.

28. Connect the RF Gen output to the SG1 terminal on the test jig. Switch on the RF Gen and set its output level to 1 mV.

NOTE: UUT is operated in Rx mode with RF Gen supplying signal and RF VM showing RF output at pin 7 of panel 3a of UUT.

29. Set the turret to each of ranges 1 to 6 in turn and, at each step, refer to the list below and carry out the following procedure:

(1) Set the test set and RF Gen frequency to the upper tracking frequency given.

(2) At the given unit, adjust C3, C2, C1 in that order, for maximum reading at the RF VM.

(3) Set the test set and RF Gen frequency to the lower tracking frequency given.

(4) At the given unit, adjust L3, L2, L1 in that order, for maximum reading at the RF VM.

RANGE	TRACKING FREQUENCY MHz	ADJUST AT UNIT
1	2.99 2.11	3b
2	4.72 3.28	3c
3	7.42 5.18	3d
4	11.75 8.15	3e
5	18.41 12.89	3f
6	28.91 20.19	3g

30. Select 28.91 MHz at test set and RF Gen. Adjust 3aL2 for maximum reading at the RF VM.

31. At the jig, set the damping resistor switch to OFF.

Turret gain

32. Retain the test connections used in the RF tuned circuit alignment and proceed as follows:

(1) Set UUT range switch to 1.

(2) Set test set AGC and 24V switches to OFF, set frequency to 2 MHz.

(3) Set RF Gen to 2 MHz at 1 mV emf.

(4) Adjust RF VM frequency control for maximum response in region of 1.75 MHz.

(5) Check that RF VM reading is between 1.9 mV and 9.8 mV (19 mV and 98 mV at UUT).

(6) Set test set frequency to 2.5 MHz.

(7) Set RF Gen to 2.5 MHz at 50 μV emf.

(8) Adjust RF VM frequency for maximum response in region of 1.75 MHz with narrow bandwidth selected. Note the reading.

(9) Set the test set AGC switch to ON and check that the RF VM reading is more than 40 dB down on the reading obtained in (8).

Signal + noise/noise ratio

33. Retain the test connections used in the turret gain test and proceed as follows:

(1) At the test set, set the AGC and 24V switches to off.

(2) With reference to the list given below, carry out checks 1 to 12 and for each check:

(a) Set UUT range switch as given.

(b) Set test set frequency as given. Switch on RF Gen carrier and set to same frequency at 0.8 mV emf.

(c) Adjust RF VM frequency control for max. response in region of 1.75 MHz with narrow band selected. Note RF VM reading in dB.

(d) Switch off RF Gen carrier. Check that the RF VM reading is greater than 16 dB below that noted in (c).

Check	Range	Frequency (MHz)
1	1	2.11
2	1	22.99
3	2	3.28
4	2	4.72
5	3	5.18
6	3	7.42
7	4	8.15
8	4	11.75
9	5	12.89
10	5	18.41
11	6	20.19
12	6	28.41

COMPONENTS LIST

34. For details of the component parts of Unit 3, refer to table 1. For detailed breakdown of these parts, refer to tables 2 to 15.

Table 1

TURRET ASSEMBLY (UNIT 3)
640/1/09591 (see Figure 3)

Unit	Description	Reference No.
	Filter, low pass	422/9/07510
	Screen	640/2/09664
	Housing and rotor assembly, consists of:-	640/1/09661
	Housing assembly	640/1/09762
	Rotor, D.T.C.T. assembly, including:-	640/1/09765
	Cheek assembly (right hand)	640/1/09860
	Cheek assembly (left hand)	640/1/09861
	Clip retaining	640/2/09862
	Screen	640/2/09684
	Rotor, oscillator assembly, including:-	640/1/09764
	Cheek assembly (right hand)	640/1/09860
	Cheek assembly (left hand)	640/1/09861
	Clip retaining	640/2/09862
	Back plate assembly	640/1/09766
	End plate, front assembly	640/1/09767
	Coupling assembly	640/1/09768
	Shaft assembly	640/1/09856
	Spring	640/1/14902
	Spring	640/1/14904
	Ring, retaining clip, external 4.8mm.	999/4/01303/003
	Circlip, external, 6mm. shaft	999/4/00451/008
3a	Panel, electronic circuit, D.T.C.T. static block	See table 2
3b	R.F. tuning coil, range 1	See table 3
3c	R.F. tuning coil, range 2	See table 4
3d	R.F. tuning coil, range 3	See table 5
3e	R.F. tuning coil, range 4	See table 6
3f	R.F. tuning coil, range 5	See table 7
3g	R.F. tuning coil, range 6	See table 8
3h	Panel, electronic circuit, oscillator, static block	See table 9
3j	Oscillator coil, range 1	See table 10
3k	Oscillator coil, range 2	See table 11
3l	Oscillator coil, range 3	See table 12
3m	Oscillator coil, range 4	See table 13
3n	Oscillator coil, range 5	See table 14
3p	Oscillator coil, range 6	See table 15

Table 2

DOUBLE TUNED CIRCUIT (STATIC BLOCK) WITH RECEIVER RF AMPLIFIER AND MODULATOR PEC (UNIT 3a)
419/1/11860 (See Figure 4)

Cct Ref	Description	Reference No.
	Resistors	
R1	620 ohm ± 5%	403/4/78126/044
R2	10 kohm ± 5%	403/4/78126/073
R3	150 ohm ± 5%	403/4/78126/029
R4	1.2 kohm ± 5%	403/4/78126/051
R5	200 ohm ± 5%	403/4/78126/032
R6	75 ohm ± 5%	403/4/78126/022
R7	10 kohm ± 5%	403/4/78126/073
R8	100 ohm ± 5%	403/4/78126/025
R9	100 kohm ± 5%	403/4/78126/097
R10	100 kohm ± 5%	403/4/78126/097
R11	75 ohm ± 5%	403/4/78126/022
R12	1 kohm ± 5%	403/4/78126/049
R13	100 kohm ± 5%	403/4/78126/097
	Capacitors	
C1	68nF + 80% - 20% 50v	400/9/19084/098
C2	68nF + 80% - 20% 50v	400/9/19084/098
C3	10nF + 80% - 20% 50v	400/9/19084/078
C4	100pF ± 5% 100v	400/9/19081/085
C5	300pF ± 1% 350v, silver mica	438/9/30100/105
C6	10nF + 80% - 20% 50v	400/9/19084/078
C7	6.8uF ± 20% 6v, electolytic	402/4/98049/009
C8	68nF + 80% - 20% 50v	400/9/19084/098
C9	10nF + 80% - 20% 50v	400/9/19084/078
C10	68nF + 80% - 20% 50v	400/9/19084/098
C11	10nF + 80% - 20% 50v	400/9/19084/078
C12	6.8uF ± 20% 6v, electrolytic	402/4/98049/009
C13	10nF + 80% - 20% 50v	400/9/19084/078
	Inductors	
L1	Inductor 18uH	406/8/08470/027
L2	Inductor	406/8/11030/002
	Semi-conductor devices	
TR1	Transistor CV7648	990/4/00107/648
TR2	Transistor CV7648	990/4/00107/648
D1 to D4	Diode, varactor, DB 4299	415/4/05441
D5, D6	Diode CV7367	990/4/00107/367
D7, D8	Diode, varactor, DB 4299	415/4/05441
ML1	Integrated circuit CN 615T	446/4/00427
ML2	Integrated circuit CN 599T	446/4/00421

Cct Ref	Description	Reference No.
	Miscellaneous	
RL1	Relay	507/9/05095 (or 507/9/38041)
	Contact block assembly	640/1/09668
	Screw, ch.hd. slotted M2 x 5mm st.st.	991/4/02030/054

Table 3

R.F. TUNING COIL, RANGE 1 (UNIT 3b)
406/8/11102/001 (see Figure 5a)

Cct Ref	Description	Reference No.
	Capacitors	
C1 to C3	5.5 to 18pF variable	401/9/32185
C4	1.6pF ± 0.1pF 500v	400/9/18825/004
C5	10nF ± 10% 100v	400/9/19083/051
	Miscellaneous	
	Contact block	640/2/09670
	Spring	640/2/09778
	Inductors	
L1	Printed spiral coil	419/2/11876
L2,L3	Printed spiral coil	419/2/11871

Table 4

R.F. TUNING COIL, RANGE 2 (UNIT 3c)
406/8/11102/002 (see Figure 5a)

Cct Ref	Description	Reference No.
	Capacitors	
C1 to C3	5.5 to 18pF variable	401/9/32185
C4	1.8pF ± 0.1pF 500v	400/9/18825/005
C5	10nF ± 10% 100v	400/9/19083/051
	Miscellaneous	
	Contact block	640/2/09670
	Spring	640/2/09778
	Inductors	
L1	Printed spiral coil	419/2/11891
L2,L3	Printed spiral coil	419/2/11886

Table 5

R.F. TUNING COIL, RANGE 3 (UNIT 3d)
406/8/11102/003 (see Figure 5a)

Cct Ref	Description	Reference No.
	Capacitors	
C1 to C3	5.5 to 18pF variable	401/9/32185
C4	1.0pF ± 0.1pF 500v	400/9/18825/001
C5	10nF ± 10% 100v	400/9/19083/051
	Miscellaneous	
	Contact block	640/2/09670
	Spring	640/2/09778
	Inductors	
L1	Printed spiral coil	419/2/11906
L2,L3	Printed spiral coil	419/2/11901

Table 6

R.F. TUNING COIL, RANGE 4 (UNIT 3e)
406/8/11102/004 (see Figure 5a)

Cct Ref	Description	Reference No.
	Capacitors	
C1 to C3	5.5 to 18pF variable	401/9/32185
C4	2.0pF ± 0.1pF 500v	400/9/18825/006
C5	10nF ± 10%	400/9/19083/051
	Miscellaneous	
	Contact block	640/2/09670
	Spring	640/2/09778
	Inductors	
L1	Printed spiral coil	419/2/11921
L2,L3	Printed spiral coil	419/2/11916

Table 7

R.F. TUNING COIL, RANGE 5 (UNIT 3f)
406/8/11102/005 (see Figure 5b)

Cct Ref	Description	Reference No.
	Resistors	
R1	10 kohm ± 5%	403/9/03547/001
	Capacitors	
C1 to C3	5.5 to 18pF variable	401/9/32185
C4	2.0pF ± 0.1pF 500v	400/9/18825/006
C5	6.8nF ± 10% 100v	400/9/19033/047
	Miscellaneous	
	Contact block	640/2/09670
	Spring	640/2/09778
	Note ... L1, L2, L3 are printed spiral coils	

Table 8

R.F. TUNING COIL, RANGE 6 (UNIT 3g)
406/8/11102/006 (see Figure 5c)

Cct Ref	Description	Reference No
	Resistors	
R1	10 kohm ± 5%	403/9/03547/001
	Capacitors	
C1 to C3	5.5 to 18pF variable	401/9/32185
	Inductors	
L1 to L3	Printed spiral coils	
L4	Inductor	406/8/11108/001
	Miscellaneous	
	Contact block	640/2/09670
	Spring	640/2/09778

Table 9

OSCILLATOR STATIC BLOCK P.E.C. (UNIT 3h)
419/1/11960 (see Figure 6)

Cct Ref	Description	Reference No.
	Resistors	
R1	47 kohm ± 5%	403/4/78126/089
R2	47 kohm ± 5%	403/4/78126/089
R3	39 kohm ± 5%	403/4/78126/087
R4	39 kohm ± 5%	403/4/78126/087
	Capacitors	
C1, C2	10nF +80% -20% 100v	400/9/19084/078
C3	470nF ± 20% 50v	400/9/19084/049
C4	3pF ± ½pF 500v	400/9/18825/009
C5, C6	10nF +80% -20% 100v	400/9/19084/078
C7	10nF ± 20% 100v	400/9/19083/121
C8 to C10	10nF +80% -20% 100v	400/9/19084/078
C11, C12	100nF ± 10% 100v	400/9/19083/066
C13	68nF +80% -20% 50v	400/9/19084/098
C14, C15	100nF ± 10% 100v	400/9/19083/066
C16	68nF +80% -20% 50v	400/9/19084/098
	Semi-conductor devices	
D1, D2	Diode, varactor DB 4299	415/4/05441
D3	Diode, BAX-16 High conductance 150v. P.I.V.	415/4/05449
ML1	Integrated circuit CN 597T	446/4/00420
	Miscellaneous	
	Block assembly, oscillator	640/1/09671
	Earth connection	640/1/09672
	Screw, cH.hd. slotted, M2 x 5mm. st.st.	991/4/02030/054

Table 10

OSCILLATOR COIL, RANGE 1 (UNIT 3j)
406/8/11101/001 (see Figure 7a)

Cct Ref	Description	Reference No.
	Capacitors	
C1	5.5 to 18pF variable	401/9/32185
C2	200pF ± 10% 350v, silver mica	438/9/30100/083
C3	10pF ± 5% 100v	400/9/19080/075
	Inductors	
L1	Printed spiral coil	419/2/11971
L2	Inductor 100uH	406/9/08490/033
	Miscellaneous	
	Spring	640/2/09778
	Contact block	640/2/09673

Table 11

OSCILLATOR COIL, RANGE 2 (UNIT 3k)
406/8/11101/002 (see Figure 7a)

Cct Ref	Description	Reference No.
	Capacitors	
C1	5.5 to 18pF variable	401/9/32185
C2	308pF ± 1% 350v, silver mica	438/9/30100/099
C3	10pF ± 5% 100v	400/9/19080/075
	Inductors	
L1	Printed spiral coil	419/2/11981
L2	Inductor 47uH	406/9/08490/029
	Miscellaneous	
	Spring	640/2/09778
	Contact block	640/2/09673

Table 12

OSCILLATOR COIL, RANGE 3 (UNIT 31)
406/8/11101/003 (see Figure 7a)

Cct Ref	Description	Reference No.
	Capacitors	
C1	5.5 to 18pF variable	401/9/32185
C2	470pF ± 1% 350v, silver mica	438/9/30100/055
C3	6.8pF ± 5% 100v	400/9/19080/072
	Inductors	
L1	Printed spiral coil	419/2/11991
L2	Inductor 33uH	406/9/08390/027
	Miscellaneous	
	Spring	640/2/09778
	Contact block	640/2/09673

Table 13

OSCILLATOR COIL, RANGE 4 (UNIT 3m)
406/8/11101/004 (see Figure 7a)

Cct Ref	Description	Reference No.
	Capacitors	
C1	5.5 to 18pF variable	401/9/32185
C2	732pF ± 1% 350v, silver mica	438/9/30100/098
C3	6.8pF ± 5% 100v	400/9/19080/072
	Inductors	
L1	Printed spiral coil	419/1/12001
L2	Inductor 12uH	406/9/08470/025
	Miscellaneous	
	Spring	640/2/09778
	Contact block	640/2/09673

Table 14

OSCILLATOR COIL, RANGE 5 (UNIT 3n)
406/8/11101/005 (see Figure 7b)

Cct Ref	Description	Reference No.
	Capacitors	
C1	5.5 to 18uF variable	401/9/32185
C2	1124pF ± 1% 350v, silver mica	438/9/30100/104
C3	6.8pF ± 5% 100v	400/9/19080/072
C4	6.8pF ± 5% 100v	400/9/18799/102
	Inductors	
L1	Printed spiral coil	419/2/12011
L2	Inductor, 5.6uH	406/9/08470/021
	Miscellaneous	
	Spring	640/2/09778
	Contact block	640/2/09673

Table 15

OSCILLATOR COIL, RANGE 6 (UNIT 3p)
406/8/11101/006 (see Figure 7c)

Cct Ref	Description	Reference No.
	Capacitors	
C1	5.5 to 18uF variable	401/9/32185
C2	1750pF ± 1% 200v d.c., mica	400/9/19295/001
C3	10uF ± 5% 100v	400/9/19080/075
C4	15pF ± 5% 100v	400/9/19080/077
	Miscellaneous	
	Spring	640/2/09778
	Contact block	640/2/09673
L1	Printed spiral coil	419/2/12021

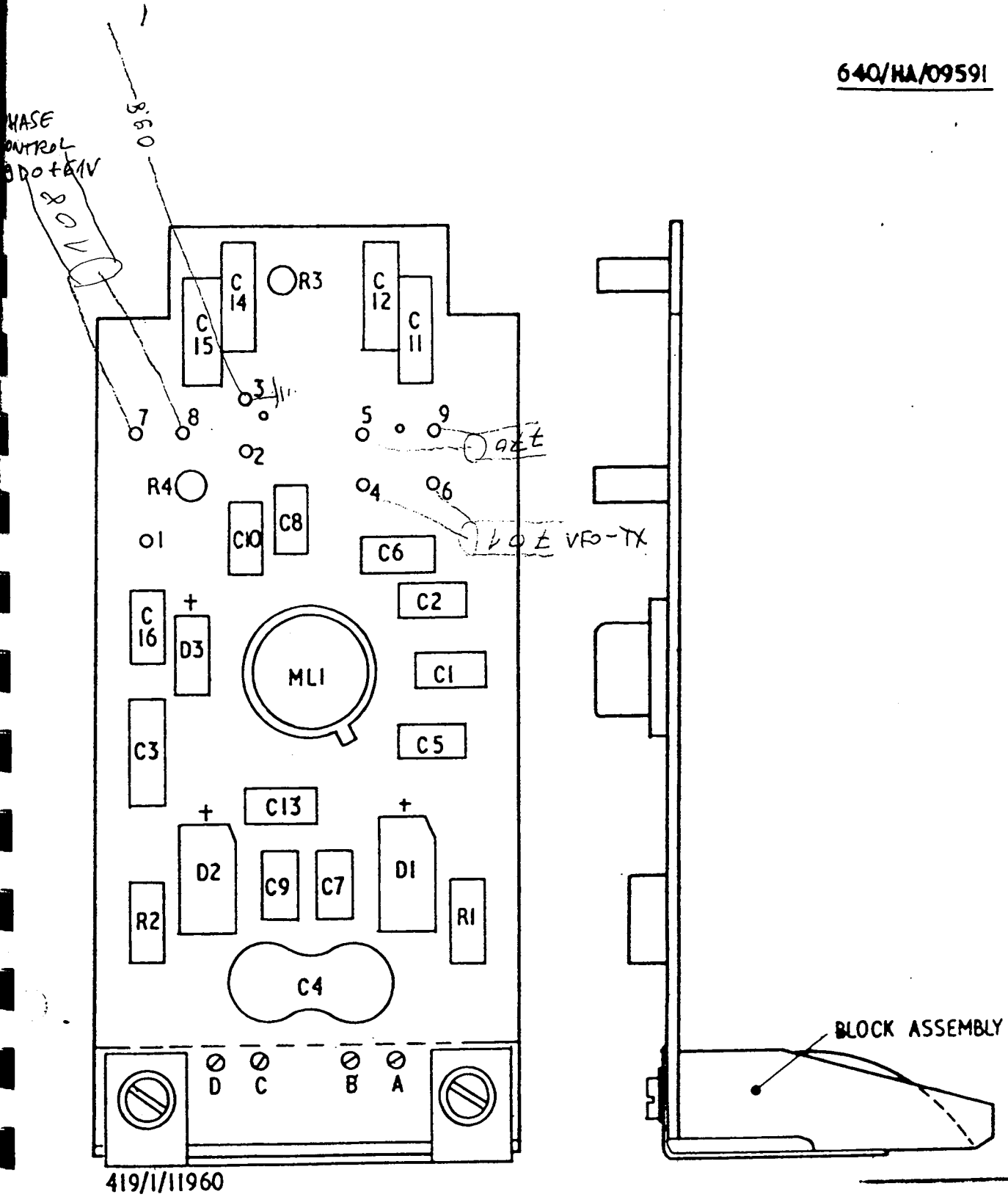
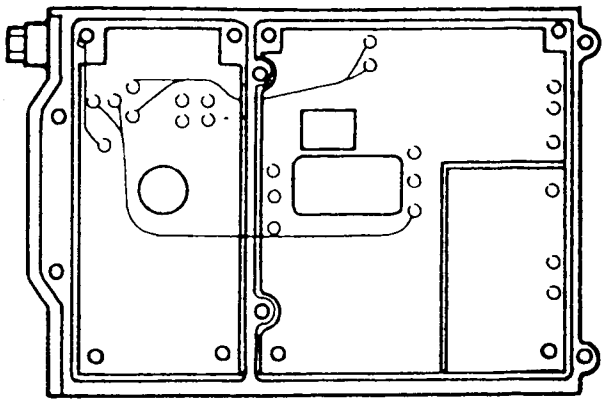
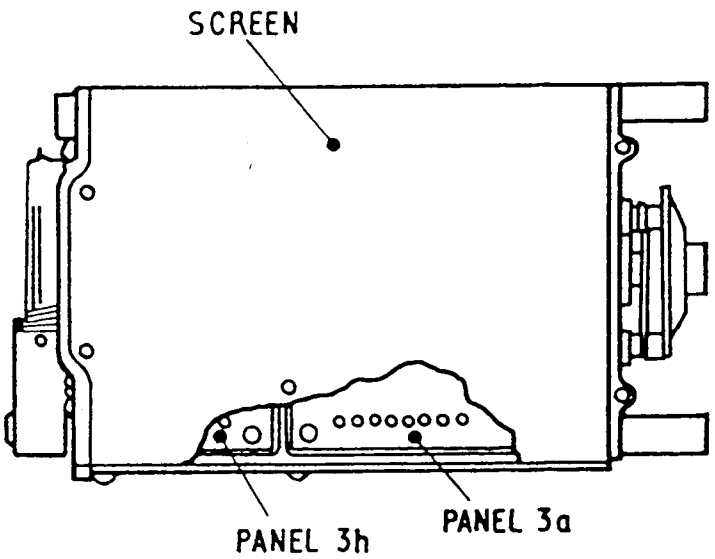
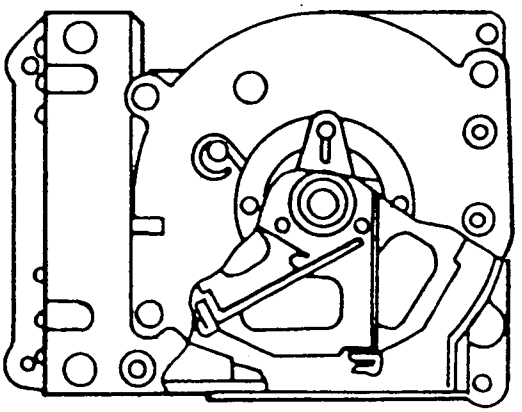


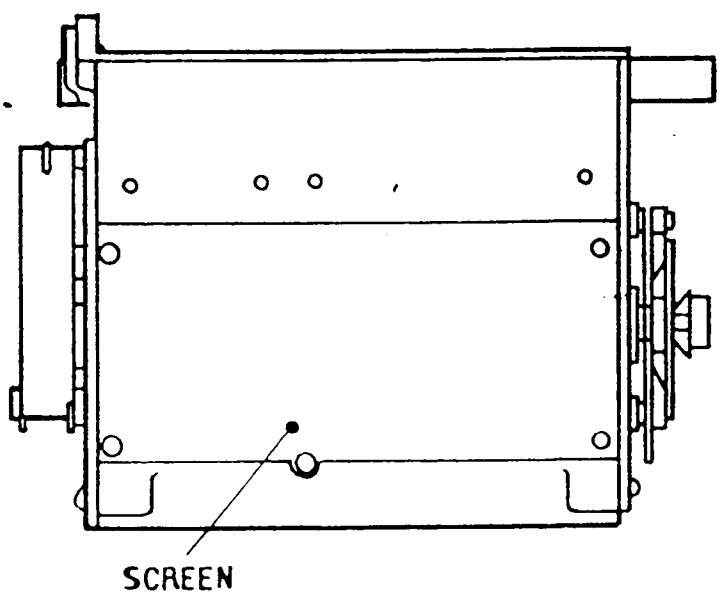
Fig.6 Oscillator static block
(unit 3h)

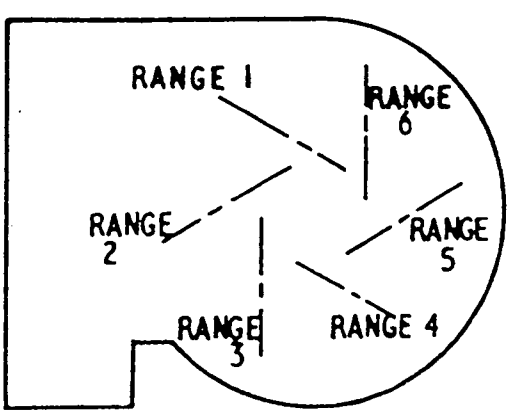


VIEW SHOWING PANEL WIRING





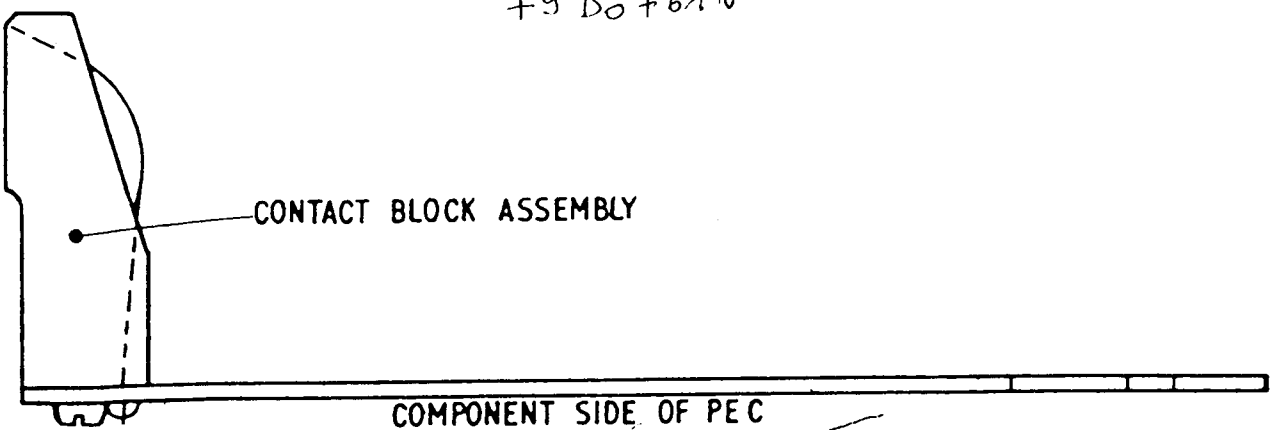




VIEW FROM FRONT SHOWING POSITION OF COILS

Fig.3 Turret assembly — component layout

12V OD 12' = PHASE CONTROL
" +9 Do +6,1 V



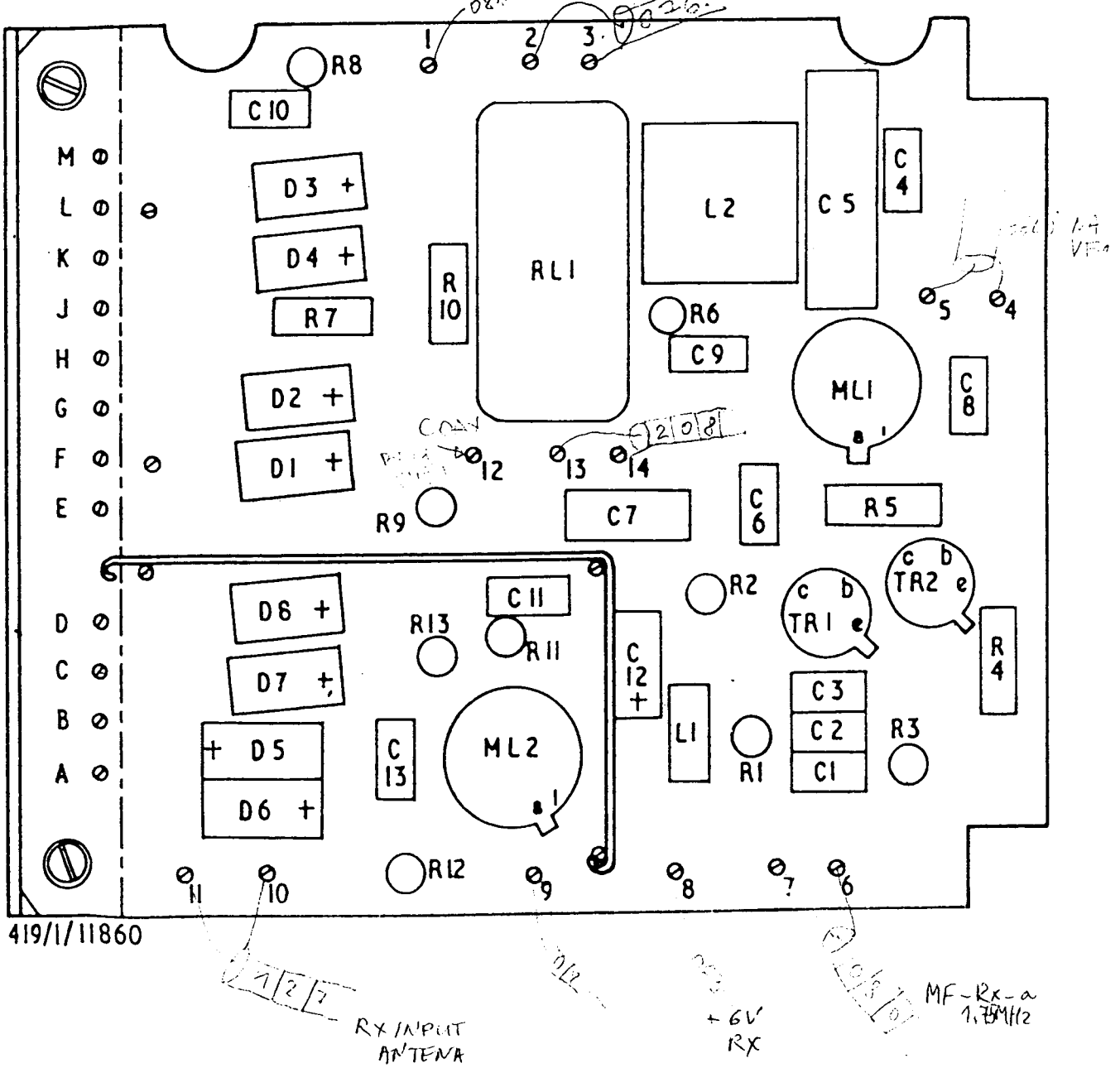


Fig. 4 Double tuned circuit static block (unit 3a)

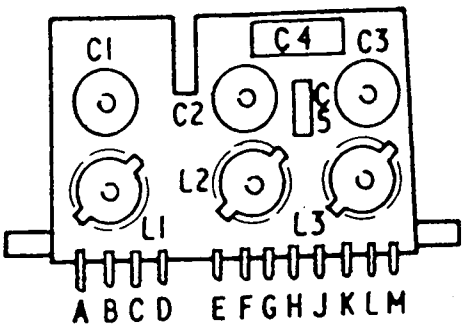


Fig.5a R.F. TUNING COIL
RANGES 1 TO 4

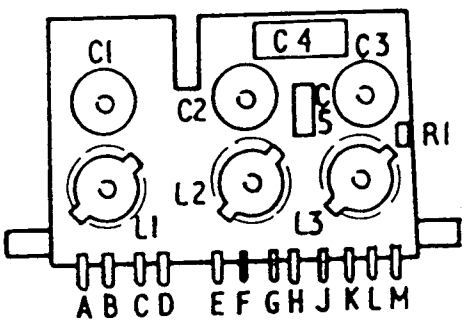


Fig.5b R.F. TUNING COIL
RANGE 5

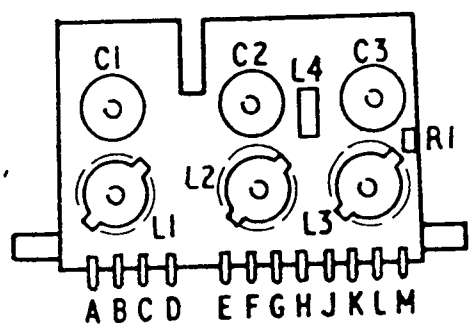


Fig.5c R.F. TUNING COIL
RANGE 6

Fig.5 Turret coils, RF tuning

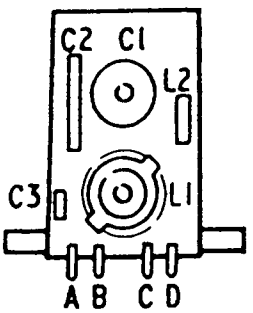


Fig.7a OSCILLATOR COIL, RANGES 1 TO 4

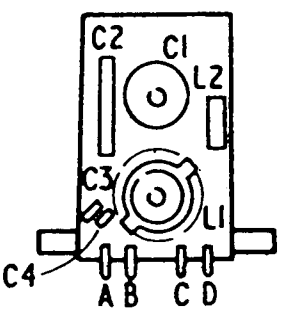


Fig.7b OSCILLATOR COIL, RANGE 5

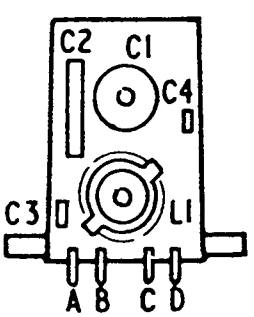


Fig.7c OSCILLATOR COIL RANGE 6

Fig. 7 Turret coils, oscillator

THIRD LINE SERVICING OF FILTER UNIT 419/1/24970 (UNIT 1a)

CONTENTS

ILLUSTRATIONS

DESCRIPTION

1. The Filter Unit (unit 1a) is a panel, electronic circuit (pec), which is a component part of the transmitter receiver and is normally located on the Front Panel and Chassis Assembly (Unit 1).

2. With reference to the circuit diagram in fig.1., Unit 1a provides the following:

(1) TR4, TR5, TR2 and associated components function as a filter which accepts a 1 k Hz input square wave of 100 mV peak-to-peak and shapes this waveform to provide two 1 k Hz sine wave outputs, one 50 mV peak-to-peak and the other variable up to 50 mV peak-to-peak.

TESTING

Test equipment

4. The following items of proprietary test equipment are required:

Item	Description
RF Gen.	An RF signal generator with the following essential characteristics:
	Frequency range: 1.8 MHz to 30 MHz Output emf: 2V Source impedance: 50 ohms
	Suitable instrument: Marconi TF144H
RF VM	An RF millivoltmeter with the following essential characteristics:
	Voltage range: 0-1000 mV Frequency range: 1.8 MHz to 30 MHz Impedance: GT 10 Mohm
	Suitable instrument: Marconi TF2604

5. The following loading components are required:

(1) Resistors:

(a) 50 ohms ± 2% ¼W

(b) 10 ohms ± 2% ¼W

(c) 100 ohms ± 2% ¼W

(2) Capacitors:

(a) 35 pF ± 10% 6V

(b) 150 pF ± 10% 6V

Preliminary

6. Connect a 50 ohm load to the ATU ground. Connect a 35 pF capacitor to terminal 8 on the ATU front drive assembly. Join the free ends of the capacitor and resistor, and connect the RF millivoltmeter to this junction (using screened cable with screen linked to unit earth).

6. At the ATU, connect RF Gen output to pin 6 of S1AB, using screened cable with screen linked to transformer T1 earth.

Test procedures

7. Set the ATU RANGE switch to each of positions A to E in turn. At each step:

(1) Set the RF Gen to the lower frequency given, at 2V emf.

(2) Adjust the ATU TUNE and LOAD controls for peak reading on the RF VM, check that this peak is GT 590 mV.

(3) Repeat at the upper frequency given.

Range Range	Lower frequency MHz	Upper frequency MHz
A	1.8	3.0
B	2.8	9.0
C	8.0	20.0
D	18.5	30.0
E	18.5	30.0

8. Fit 100 ohm load resistor in place of the 50 ohm load and:

(1) Set RF Gen to 2 MHz at 2V emf.

(2) Set RANGE A at ATU.

(3) Repeat para.6(2).

(4) Set RF Gen to 30 MHz at 2V emf.

(5) Set RANGE E at UUT.

(6) Repeat para.7(2).

9. Fit 10 ohm load resistor in place of 100 ohm load and repeat para.8.

10. Replace 50 ohm load resistor. Fit 150 pF capacitor in place of 35 pF and repeat para.8(4), (5) and (6).

COMPONENTS LIST FOR
TUNER UNIT RF
640/1/09592

Cct Ref.	Description	Reference No.
	Drive plate assembly	640/1/09676
	including:	
	HF core (short) (for L1, L2)	640/1/09799
	HF core (for L3)	905/9/02366
	Plate and bush assembly	640/1/09797
	Rear mounting assembly	640/1/09677
	including:	
	Plunger contact	640/2/09806
	Spring	640/2/09807
	Front drive assembly	640/1/09675
	including:	
L1	ATU tuning inductor coil	406/8/11035/001
L2	ATU tuning inductor coil	406/8/11035/002
L3	ATU tuning inductor coil	406/8/11035/003
C1	Capacitor 22pF ± 10% 750v	400/9/19076/001
C2	Capacitor 30pF ± 10% 750v	
C3	Capacitor 33pF ± 2% 750v	
	Gear assembly	640/1/14819
T1+S1	ATU Loading transformer (with switch)	406/8/11032/007
S2	Switch rotary wafer	408/9/00036/193
	Bracket	640/2/09698

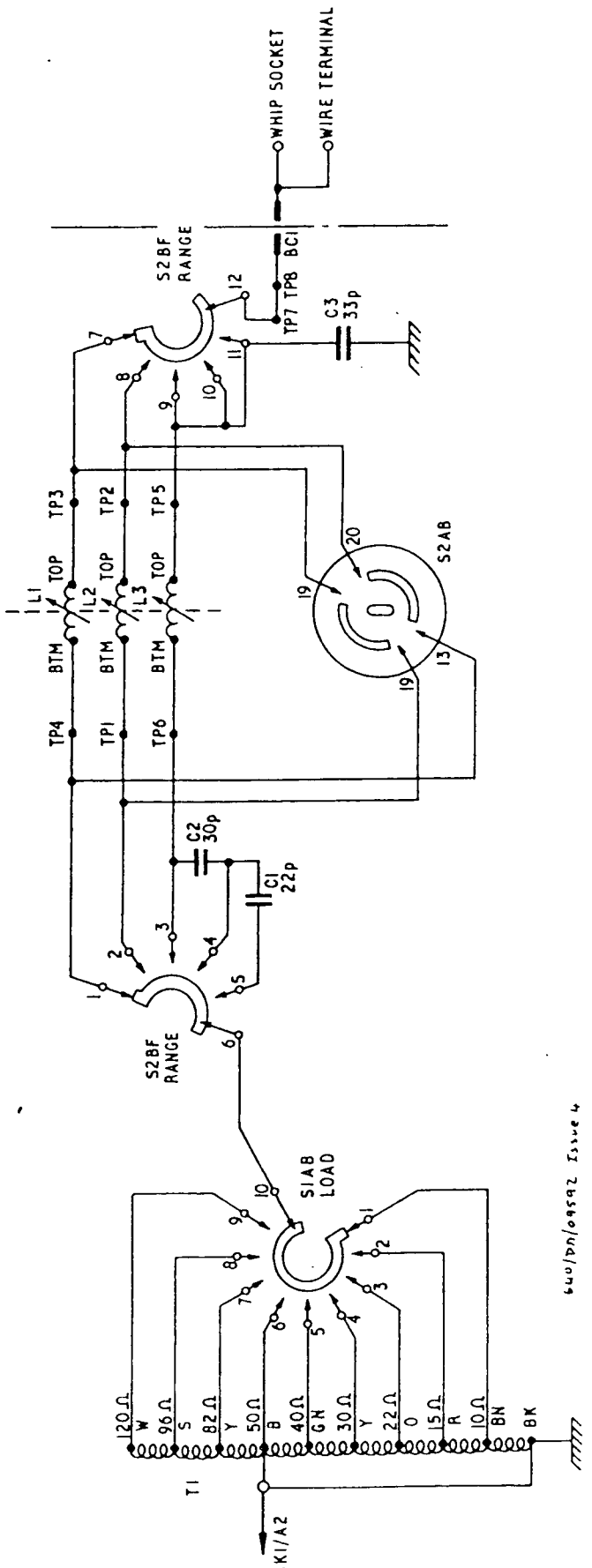


Fig 1 ATU Circuit

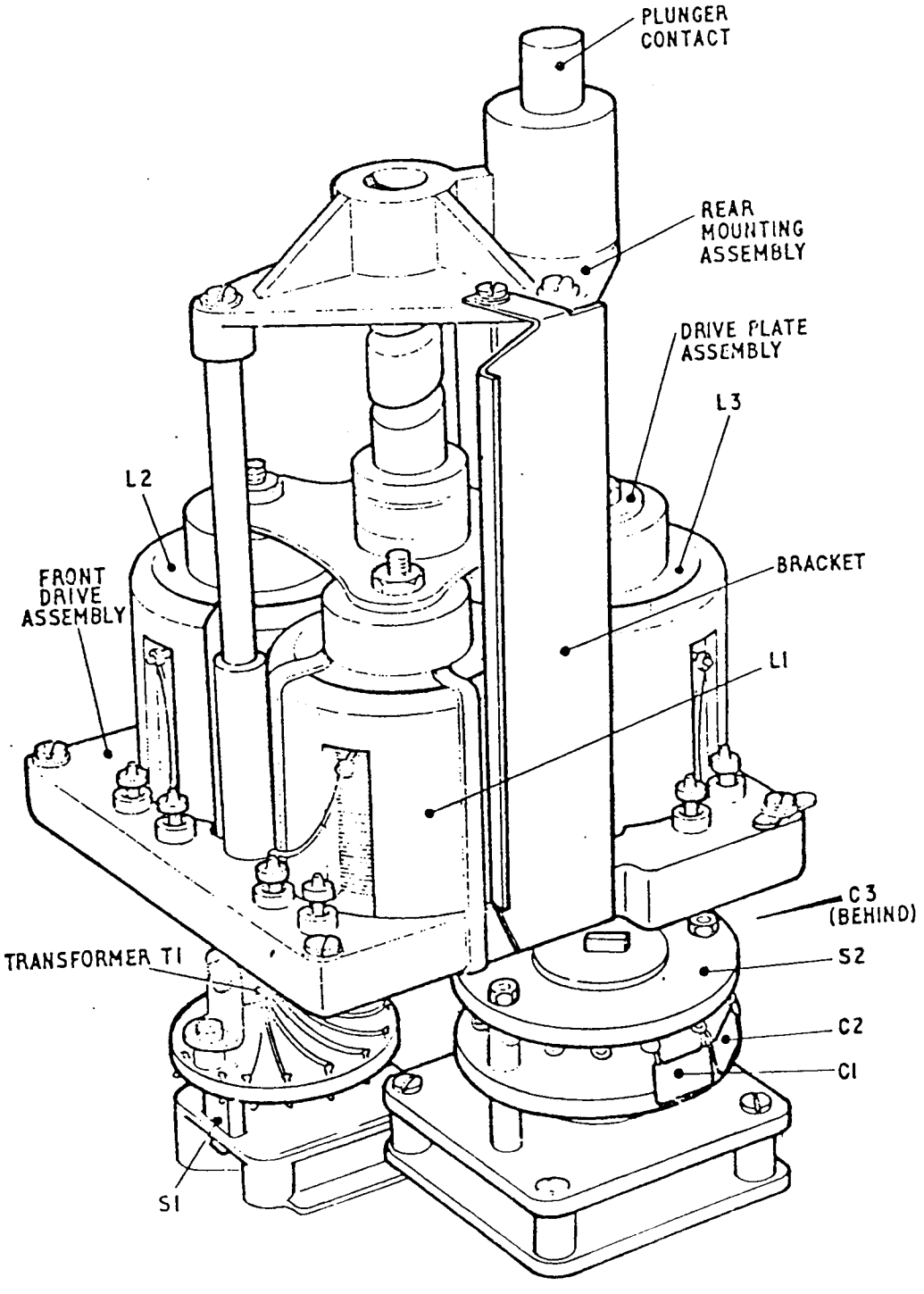


Fig. 2 ATU Assembly

THIRD LINE SERVICING
OF
POWER SUPPLY UNIT 640/1/09593
(UNIT 5)

CONTENTS

ILLUSTRATIONS

INTRODUCTION

1. The Power Supply Unit (Unit 5) is a component part of the transmitter/receiver and is normally located on the Front Panel and Chassis Assembly (Unit 1). It provides five regulated dc outputs with nominal values of +3V, +6V, +6V compensated (for VFO), +12V, and +110V all derived from a nominal supply of 24V dc (limits 20 to 32V).

DESCRIPTION

General

2. The unit consists of an assembly of pec (panel, electronic circuit), a base plate and a cover. The pec assembly consists of two pec, one (Unit 5b) is secured by circlips to pillars located on the other (Unit 5a). Connections to external equipment are provided by a multi-way socket on Unit 5a.

+12V regulator

3. At Unit 5a, TR1/TR2, ML1 and auto-transformer T1 provide a switching regulator.

4. ML1 provides a 40 kHz astable multivibrator; the mark-to-space ratio of the output is determined by comparison, within ML1, of a reference voltage derived from the 24V supply voltage at pin 6 and a control voltage at pin 1. The control voltage is obtained from a potentiometer chain connected to the regulator output. Thus, a change in output potential adjusts the multivibrator mark-to-space ratio to oppose the output change. The output mean level is set by resistor R3.

5. Capacitor C2 produces a ramp at ML1 pin 8 at initial switch on. This affects the reference voltage and thereby affects to mark-to-space ratio so that the regulator output gradually rises to the correct level over the first 100 ms after switch on.

6. Overload protection is provided by D3. A short circuit at the regulator output will pull down ML1 reference level far enough to switch off the multivibrator and thereby switch off TR1/TR2.

+3V regulator

7. The switching regulator TR3/TR4, ML2 and T2 at Unit 5a functions in a similar manner to the 12V regulator and derives a +3V regulated supply from the +12V regulator output. The following particular differences exist:

(1) The reference voltage circuits within ML2 are temperature compensated.

(2) Part of the control voltage potentiometer chain is within ML2.

(3) There is no overload protection diode because adequate protection is provided in the +12V regulator.

+6V regulator (see fig.2)

8. The +6V regulator, ML1, TR1/TR2, T1, in Unit 5b, functions in a similar manner to the +3V regulator and derives a +6V supply from the +12V regulator output.

9. Since the VFO frequency is sensitive to supply voltage variation and since switching transmit mode to receive or vice versa causes a slight change in the +6V level at pin 4 of Unit 5a, a second +6V output is provided for the VFO at pin 3 of Unit 5b and separated from the first by resistor R5. This resistor is in the control voltage potentiometer chain and provides a compensating variation in the control voltage level to maintain the VFO supply at a constant level.

+110V regulator (see fig.2)

10. The primary of transformer T1 is the output choke of the 6V regulator. Hence, a switching voltage will be applied to TR3; this will be at a low current level and has little effect on the 6V regulator.

11. The switching of TR3 base causes 40 kHz pulses of current to be drawn through T2 primary from the +12V supply rail. T2 is a 10:1 step up transformer which supplies a full wave rectifier (D3-6). A dc voltage of approximately 120V is applied from the rectifier to the 110V regulator

12. In the regulator, TR6 is the series element controlled by the drive transistor TR7. A reference voltage to TR7 is derived using one transistor in ML2 as a reverse biased diode having a breakdown voltage of approximately 5.6V at a low current level through R9. TR4 and TR5 provide a constant current supply source to TR7. The second transistor in ML2 provides a measure of temperature compensation to the control voltage taken to TR7 base from the slider of R11.

TESTING

Test equipment

13. The following items of special-to-purpose test equipment are required:

(1) Manual Interface Controller. Plessey Type TD4924A.

(2) Test Interface. Plessey Type TD50566A.

(3) Test Jig. Plessey Type TJ838A.

14. The following items of proprietary test equipment are required:

Item	Description
DVM	A digital voltmeter for measuring voltages in the range 100 mV to 125V with an accuracy of 0.05% and having an input impedance greater than 100 kohms. Two are required. Suitable instrument: Solartron A203/A204
CRO	An oscilloscope to display ac signals in the amplitude range 10 to 100 mV peak-to-peak at 2.0 MHz. Suitable instrument: Solartron A100
PSU	To supply 20V ± 0.02V, 24V ± 0.02V and 30V ± 0.02V with current limiting at 400 mA. Suitable instrument: Farnell TSV70

Preliminary

15. Proceed as follows:

(1) Connect the Test Jig to the Test Interface.

(2) Connect the Test Interface to the Manual Interface Controller.

(3) At the Interface Controller set:

(a) Test selection switches to 000.

(b) DC monitor switch to EXT.

(4) At the Interface Controller connect:

(a) DVM (DVM1) to socket marked DVM.

(b) DVM (DVM2) to socket marked AVO.

(c) CRO to socket marked CRO & AMP.

(d) PSU to terminals marked EXT B.

(5) Switch on the mains supply to all instruments where applicable.

(6) Adjust PSU voltage and current controls for zero output. Set meter switch to read current. Connect an external short circuit directly across the PSU output terminals. Increase output voltage a small amount and adjust current control until meter reads 400 mA. Remove short circuit.

Test procedures

16. Carry out the tests given in the following pages.

Notes relating to tests

1. Unit under test is referred to as UUT.

2. Tests 000 - 030 are normally performed with the screening can of the UUT removed. This can must be fitted for tests 031 - 070.

3. DVM2 monitors the voltage developed across a load connected in series with the supply current to the UUT. The DVM reading multiplied by 10 gives current level.

4. DVM1 is connected to measure input voltage or selected output voltage as appropriate.

5. Each output rail is connected to a suitable load, the +6V supply load is switched from simulated receive mode to simulated transmit mode on indicated tests.

6. The CRO is connected to monitor ripple on selected output rail.

7. Tests 000 - 016 set or check the various output voltage levels at the nominal supply voltage level.

8. Tests 018 - 028 check, under transmit mode load conditions, the current drain for various supply voltage levels.

9. Tests 031 - 036 check the output ripple.

10. Tests 038 - 070 check the regulation by monitoring the change of each output for a change of input level from 20 to 24V and from 24V to 30V. DVM2 is used to monitor supply voltage on these tests.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
000	(a)	-	-	-	Depress "Press to Test" button.
	(b)	UUT	-	-	Load UUT in test jig. Connect miniature socket to UUT and connect probe to TP2 on UUT. Turn all four pots fully anti-clockwise.
	(c)	DVM2	1V	-	Set DVM2 to 1V range.
	(d)	DVM1	100V	-	Set DVM1 to 100V range.
	(e)	CRO	5 mV/cm	-	Set CRO to 5 mV/cm range.
	(f)	PSU	-	-	Set PSU to minimum output.
SET SUPPLY VOLTAGE					
002	(a)	-	-	-	Depress "Press to Test" button.
	(b)	DVM1	100V	23.95V to 24.05V	Inorease PSU output to give 24V on DVM1.
SET 121V OUTPUT					
004	(a)	-	-	-	Depress "Press to Test" button.
	(b)	DVM1	100V	121.37V to 120.63V	Adjust 5aR3 to give 121V on DVM1. (Reading at TP2).
12 VOLTS OUTPUT					
006	(a)	-	-	-	Depress "Press to Test" button.
	(b)	DVM1	100V	13.13V to 12.07V	Check DVM1 reading.
SET 6V OUTPUT					
008	(a)	DVM1	10V	-	Set DVM1 to 10V range.
	(b)	-	-	-	Depress "Press to Test" button.
	(c)	DVM1	10V	6.019V to 5.981V	Adjust 5bR4 to give 6V on DVM1.
6V OSC. OUTPUT					
009	(a)	-	-	WITHIN ± 0.01V of 008	Depress "Press to Test" button.
	(b)	DVM1	10V		Check reading on DVM1.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
SET 2.9V OUTPUT					
010	(a)	-	-	-	Depress "Press to Test" button.
	(b)	DVM1	10V	2.901V to 2.898V	Adjust 5aR7 to give 2.9V on DVM1.
SET 110V OUTPUT					
012	(a)	DVM1	200V	-	Set DVM1 to 200V range.
	(b)	-	-	-	Depress "Press to Test" button.
	(c)	DVM1	200V	110.17V to 109.83V	Adjust 5bR11 to give 110V on DVM1.
RE-SET 121V OUTPUT					
014	(a)	-	-	-	Depress "Press to Test" button.
	(b)	DVM1	200V	121.37V to 120.63V	Adjust 5aR3 to give 121V on DVM1. (Reading at TP2).
121V OUTPUT (6V LOADED FOR TX)					
016	(a)	-	-	-	Depress "Press to Test" button.
	(b)	DVM1	200V	122.93V to 120.56	Check reading on DVM1.
SET SUPPLY VOLTAGE (Lo)					
018	(a)	-	-	-	Depress "Press to Test" button.
	(b)	DVM1	100V	19.95V to 20.05V	Adjust PSU to give 20V on DVM1.
LOAD CURRENT (SUPPLY V Lo)					
020	(a)	-	-	-	Depress "Press to Test" button.
	(b)	DVM2	100 mV	24.9 mV to 26.1 mV	Check DVM2 reading.
SET SUPPLY VOLTAGE					
022	(a)	-	-	-	Depress "Press to Test" button.
	(b)	DVM1	100V	23.95V to 24.05V	Adjust PSU to give 24V on DVM1.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
LOAD CURRENT					
024	(a)	-	-	-	Depress "Press to Test" button.
	(b)	DVM2	100 mV	21.1 mV to 22.1 mV	Check DVM2 reading.
SET SUPPLY VOLTAGE (Hi)					
026	(a)	-	-	-	Depress "Press to Test" button.
	(b)	DVM1	100V	29.95V to 30.05V	Adjust PSU to give 30V on DVM1.
LOAD CURRENT (SUPPLY V Hi)					
028	(a)	-	-	-	Depress "Press to Test" button.
	(b)	DVM2	100 mV	17.1 mV to 17.9 mV	Check DVM2 reading.
RESET SUPPLY VOLTAGE					
029	(a)	-	-	-	Depress "Press to Test" button.
	(b)	DVM1	100V	23.95V to 24.05V	Adjust PSU to give 24V on DVM1.
030	(a)	-	-	-	Depress "Press to Test" button.
	(b)	TJ.	-	-	Disconnect probe from UUT. Replace screening can.
12V OUTPUT RIPPLE					
031	(a)	-	-	-	Depress "Press to Test" button.
	(b)	CRO	5 mV/cm	NGT 19 mV	Check the peak-to-peak ripple voltage on CRO.
6V OUTPUT RIPPLE					
032	(a)	-	-	-	Depress "Press to Test" button.
	(b)	CRO	5 mV/cm	NGT 28.5 mV	Check the peak-to-peak ripple voltage on CRO.
3V OUTPUT RIPPLE					
034	(a)	-	-	-	Depress "Press to Test" button.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
034 (cont)	(b)	CRO	5 mV/ cm	NGT 19 mV	Check the peak-to-peak ripple voltage on CRO.
110V OUTPUT RIPPLE					
036	(a)	-	-	-	Depress "Press to Test" button.
	(b)	CRO	5 mV/ cm	NGT 47.5 mV	Check the peak-to-peak ripple voltage on CRO.
12V REGULATION					
038	(a)	-	-	-	Depress "Press-to-Test" button.
	(b)	DVM2	100V	19.95V to 20.05V	Adjust PSU to give 20V on DVM2.
040	(a)	-	-	-	Depress "Press to Test" button.
	(b)	DVM1	10V	12.52V to 12.98V	Note reading on DVM1.
042	(a)	-	-	-	Depress "Press to Test" button.
	(b)	DVM2	100V	23.95V to 24.05V	Adjust PSU to give 24V on DVM2; then, within 30 seconds, note reading on DVM1.
		DVM1	10V	NGT 040 + 0.08V	This must not exceed Result 040 by more than 0.08V.
044	(a)	-	-	-	Depress "Press to Test" button.
	(b)	DVM2	100V	29.95V to 30.05V	Adjust PSU to give 30V on DVM2; then, within 30 seconds, check reading on DVM1.
		DVM1	10V	NGT 042 + 0.12V	This must not exceed Result 042 by more than 0.12V.
6V REGULATION					
046	(a)	-	-	-	Depress "Press to Test" button.
	(b)	DVM2	100V	19.95V to 20.05V	Adjust PSU to give 20V on DVM2.
048	(a)	-	-	-	Depress "Press to Test" button.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
048 (cont)	(b)	DVM1	10V	5.980V to 6.019V	Note reading on DVM1.
050	(a)	-	-	-	Depress "Press to Test" button.
	(b)	DVM2	100V	23.95V to 24.05V	Adjust PSU to give 24V on DVM2; then, within 30 seconds, note reading on DVM1.
		DVM1	10V	NGT 048 + 0.002V	This must not exceed Result 048 by more than 0.002V.
052	(a)	-	-	-	Depress "Press to Test" button.
	(b)	DVM2	100V	29.95V to 30.05V	Adjust PSU to give 30V on DVM2; then, within 30 seconds, check reading on DVM1.
		DVM1	10V	NGT 050 + 0.002V	This must not exceed Result 050 by more than 0.002V.
3V REGULATION					
054	(a)	-	-	-	Depress "Press to Test" button.
	(b)	DVM2	100V	19.95V to 20.05V	Adjust PSU to give 20V on DVM2.
056	(a)	-	-	-	Depress "Press to Test" button.
	(b)	DVM1	10V	2.881V to 2.919V	Note reading on DVM1.
058	(a)	-	-	-	Depress "Press to Test" button.
	(b)	DVM2	100V	23.95V to 24.05V	Adjust PSU to give 24V on DVM2; then, within 30 seconds, note reading on DVM1.
		DVM1	10V	NGT 056 + 0.002V	This must not exceed Result 056 by more than 0.002V.
060	(a)	-	-	-	Depress "Press to Test" button.
	(b)	DVM2	100V	29.95V to 30.05V	Adjust PSU to give 30V on DVM2; then, within 30 seconds, check reading on DVM1.
		DVM1	10V	NGT 058 + 0.002V	This must not exceed Result 058 by more than 0.002V.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
034 (cont)	(b)	CRO	5 mV/ cm	NGT 19 mV	Check the peak-to-peak ripple voltage on CRO.
110V OUTPUT RIPPLE					
036	(a)	-	-	-	Depress "Press to Test" button.
	(b)	CRO	5 mV/ cm	NGT 47.5 mV	Check the peak-to-peak ripple voltage on CRO.
12V REGULATION					
038	(a)	-	-	-	Depress "Press-to-Test" button.
	(b)	DVM2	100V	19.95V to 20.05V	Adjust PSU to give 20V on DVM2.
040	(a)	-	-	-	Depress "Press to Test" button.
	(b)	DVM1	10V	12.52V to 12.98V	Note reading on DVM1.
042	(a)	-	-	-	Depress "Press to Test" button.
	(b)	DVM2	100V	23.95V to 24.05V	Adjust PSU to give 24V on DVM2; then, within 30 seconds, note reading on DVM1.
		DVM1	10V	NGT 040 + 0.08V	This must not exceed Result 040 by more than 0.08V.
044	(a)	-	-	-	Depress "Press to Test" button.
	(b)	DVM2	100V	29.95V to 30.05V	Adjust PSU to give 30V on DVM2; then, within 30 seconds, check reading on DVM1.
		DVM1	10V	NGT 042 + 0.12V	This must not exceed Result 042 by more than 0.12V.
6V REGULATION					
046	(a)	-	-	-	Depress "Press to Test" button.
	(b)	DVM2	100V	19.95V to 20.05V	Adjust PSU to give 20V on DVM2.
048	(a)	-	-	-	Depress "Press to Test" button.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
110V REGULATION					
062	(a)	-	-	-	Depress "Press to Test" button.
	(b)	DVM2	100V	19.95V to 20.05V	Adjust PSU to give 20V on DVM2.
064	(a)	-	-	-	Depress "Press to Test" button.
	(b)	DVM1	100V	109.83V to 110.17V	Note reading on DVM1.
066	(a)	-	-	-	Depress "Press to Test" button.
	(b)	DVM2	100V	23.95V to 24.05V	Adjust PSU to give 24V on DVM2; then, within 30 seconds, note reading on DVM1.
		DVM1	100V	NGT 064 + 0.01V	This must not exceed Result 064 by more than 0.01V.
068	(a)	-	-	-	Depress "Press to Test" button.
	(b)	DVM2	100V	29.95V to 30.05V	Adjust PSU to give 30V on DVM2: then, within 30 seconds, check reading on DVM1.
		DVM1	100V	NGT 066 + 0.01V	This must not exceed Result 066 by more than 0.01V.
070	(a)	-	-	-	Depress "Press to Test" button.
	(b)	-	-	-	Remove module from test jig.

COMPONENTS LIST

17. The principal component parts of the Power Supply Unit 640/1/09593 (see fig.3) are:

Base	640/1/09701
Cover assembly	640/1/10088
Assembly of PEC	640/1/14895

18. The principal component parts of the Assembly of PEC 640/1/14895 (see fig.3) are:

Panel, Electronic Circuit (Unit 5a)	419/1/12025
Panel, Electronic Circuit (Unit 5b)	419/1/12030
Ring retaining	994/4/00467/002

A detailed breakdown of Units 5a and 5b are given on the following pages.

COMPONENTS LIST

17. The principal component parts of the Power Supply Unit 640/1/09593 (see fig.3) are:

Base	640/1/09701
Cover assembly	640/1/10088
Assembly of PEC	640/1/14895

18. The principal component parts of the Assembly of PEC 640/1/14895 (see fig.3) are:

Panel, Electronic Circuit (Unit 5a)	419/1/12025
Panel, Electronic Circuit (Unit 5b)	419/1/12030
Ring retaining	994/4/00467/002

A detailed breakdown of Units 5a and 5b are given on the following pages.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
110V REGULATION					
062	(a)	-	-	-	Depress "Press to Test" button.
	(b)	DVM2	100V	19.95V to 20.05V	Adjust PSU to give 20V on DVM2.
064	(a)	-	-	-	Depress "Press to Test" button.
	(b)	DVM1	100V	109.83V to 110.17V	Note reading on DVM1.
066	(a)	-	-	-	Depress "Press to Test" button.
	(b)	DVM2	100V	23.95V to 24.05V	Adjust PSU to give 24V on DVM2; then, within 30 seconds, note reading on DVM1.
		DVM1	100V	NGT 064 + 0.01V	This must not exceed Result 064 by more than 0.01V.
068	(a)	-	-	-	Depress "Press to Test" button.
	(b)	DVM2	100V	29.95V to 30.05V	Adjust PSU to give 30V on DVM2: then, within 30 seconds, check reading on DVM1.
		DVM1	100V	NGT 066 + 0.01V	This must not exceed Result 066 by more than 0.01V.
070	(a)	-	-	-	Depress "Press to Test" button.
	(b)	-	-	-	Remove module from test jig.

COMPONENTS LIST

17. The principal component parts of the Power Supply Unit 640/1/09593 (see fig.3) are:

Base	640/1/09701
Cover assembly	640/1/10088
Assembly of PEC	640/1/14895

18. The principal component parts of the Assembly of PEC 640/1/14895 (see fig.3) are:

Panel, Electronic Circuit (Unit 5a)	419/1/12025
Panel, Electronic Circuit (Unit 5b)	419/1/12030
Ring retaining	994/4/00467/002

A detailed breakdown of Units 5a and 5b are given on the following pages.

Cct Ref	Description	Reference No.

19. The principal component parts of the Panel, electronic circuit 419/1/12025 (Unit 5a) (see fig.5) are:

	Resistors	
R1	620 ohm ± 5%	403/4/78126/044
R2	2 kohm ± 5%	403/4/78126/056
R3	500 ohm ± 10% 0.5w variable	404/9/05033/001
R4	82 ohm ± 5%	403/4/78126/023
R5	2.7 kohm ± 5%	403/4/78126/059
R6	620 ohm ± 5%	403/4/78126/044
R7	2 kohm ± 10% 0.5w variable	404/9/05033/003
R8	100 ohm ± 5%	403/4/78126/025
	Capacitors	
C1	22uF ± 20% 35v electrolytic	402/4/98049/092
C2	56uF ± 10% 6v electrolytic	402/4/98049/004
C3	1uF ± 20% 35v electrolytic	402/4/98049/085
C4	4.7nF ± 10% 100v	400/9/19083/041
C5	68uF ± 20% 15v electrolytic	402/4/98049/037
C6	22uF ± 20% 15v electrolytic	402/4/98049/036
C7	22uF ± 20% 15v electrolytic	402/4/98049/036
C8	1uF ± 20% 35v electrolytic	402/4/98049/085
C9	4.7nF ± 10% 100v	400/9/19083/041
C10	330uF ± 20% 6v electrolytic	402/4/98049/012
C11	47uF ± 20% 6v electrolytic	402/4/98049/010
	Inductors	
L1 to L4	Inductor 150uH	406/8/11040
	Semi-conductor devices	
TR1	Transistor 2N3720	417/4/00241
TR2	Transistor BCY70	417/4/00240
TR3	Transistor BFS97K	417/4/00256
TR4	Transistor BCY72	417/4/00254
D1	Diode BAX12	415/4/05451
D2	Diode BAX12	415/4/05451

Cct Ref	Description	Reference No.
D3	Diode CV7367	990/4/00107/367
D4	Diode BAX12	415/4/05451
ML1	Integrated circuit CN 587T	446/4/00416
ML2	Integrated circuit CN 585T	446/4/00415
	Miscellaneous	
T1	Transformer	406/8/11033/001
T2	Transformer	406/8/11033/003
SK	Socket, receptacle, electrical	508/9/21650
	Screw, slotted ch.hd. M2 x 10mm.cad plate st.	991/4/01547/059
	Washer, crinkle. 8BA, Ber.Cu.	991/4/01269/020
	Washer, bright, small, 8BA.cad plate. st.	991/4/00413/001
	Nut, hex, M2, st.st.	991/4/01495/002

20. The principal component parts of the Panel, electronic circuit 419/1/12030 (Unit 5b) (see fig.4) are:

	Resistors	
R1	620 ohm ± 5%	403/4/78126/044
R2	91 ohm ± 5%	403/4/78126/024
R3	1 kohm ± 5%	403/4/78126/049
R4	1 kohm ± 5% 0.5w variable	404/9/05033/002
R5	Part of printed circuit	
R6	82 ohm ± 5%	403/4/78126/023
R7	470 kohm ± 5%	403/4/78127/113
R8	22 kohm ± 5%	403/4/78126/081
R9	470 kohm ± 5%	403/4/78127/113
R10	1 Mohm ± 2%	403/4/78127/521
R11	20 kohm ± 10% 0.5w variable	404/9/05033/005
R12	43 kohm ± 5%	403/4/78126/088
	Capacitors	
C1	22uF ± 20% 15v electrolytic	402/4/98049/036
C2	4.7uF ± 20% 10v electrolytic	402/4/98049/023
C3	1uF ± 20% 35v electrolytic	402/4/98049/085
C4	4.7nF ± 10% 100v	400/9/19083/041
C5	330uF ± 20% 6v electrolytic	402/4/98049/012
C6	3.6uF ± 20% 125v electrolytic	402/9/98190/075
C7	47nF +80% -20% 50v	400/9/19084/094
C8	1.7uF ± 20% 125v electrolytic	402/9/98190/074
C9	220nF ± 20% 250v	435/4/90410/220
	Inductors	
L1	Inductor 150uH	406/8/11040

Cct Ref	Description	Reference No.
	Semi-conductor devices	
TR1	Transistor BFS 97K	417/4/00256
TR2	Transistor BCY 72	417/4/00254
TR3	Transistor CV 7644	990/4/00107/644
TR4	Transistor CV 7648	990/4/00107/648
TR5	Transistor U14906/4	417/4/05089
TR6	Transistor FRB 700	417/4/00255
TR7	Transistor FRB 700	417/4/00255
D1	Diode CV 7367	990/4/00107/367
D2	Diode BAX 12, controlled avalanche	415/4/05451
D3 to D6	Diode BAX 16, high conductance, 150v P.I.V.	415/4/05449
D7	Diode BAX 12, controlled avalanche	415/4/05451
ML1	Integrated circuit CN 587T	446/4/00416
ML2	Integrated circuit CN 497T	446/4/00429
	Transformers	
T1	Transformers	406/8/11033/002
T2	Transformer	406/8/11032/003

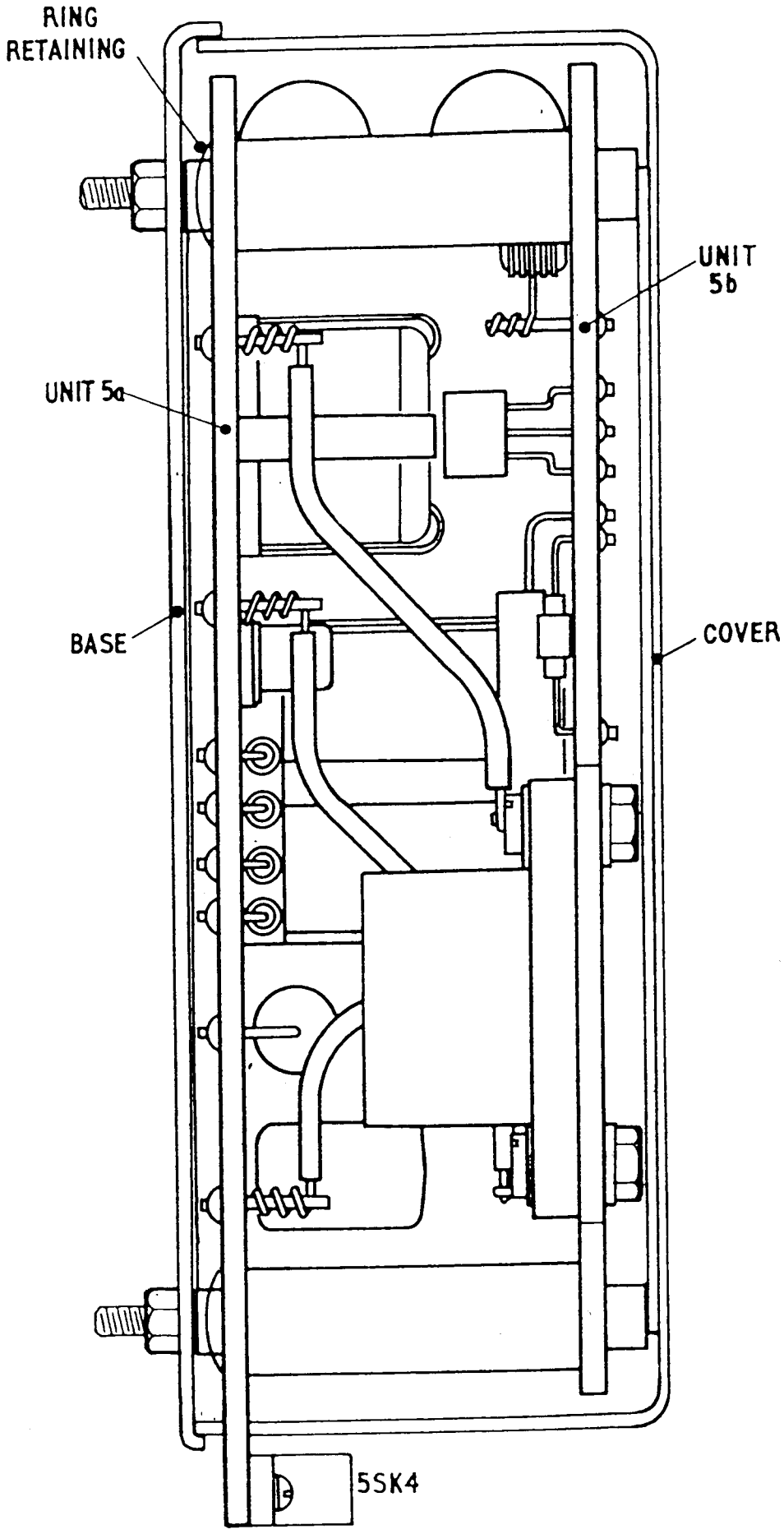


Fig. 3 Power supply unit assembly (unit 5)

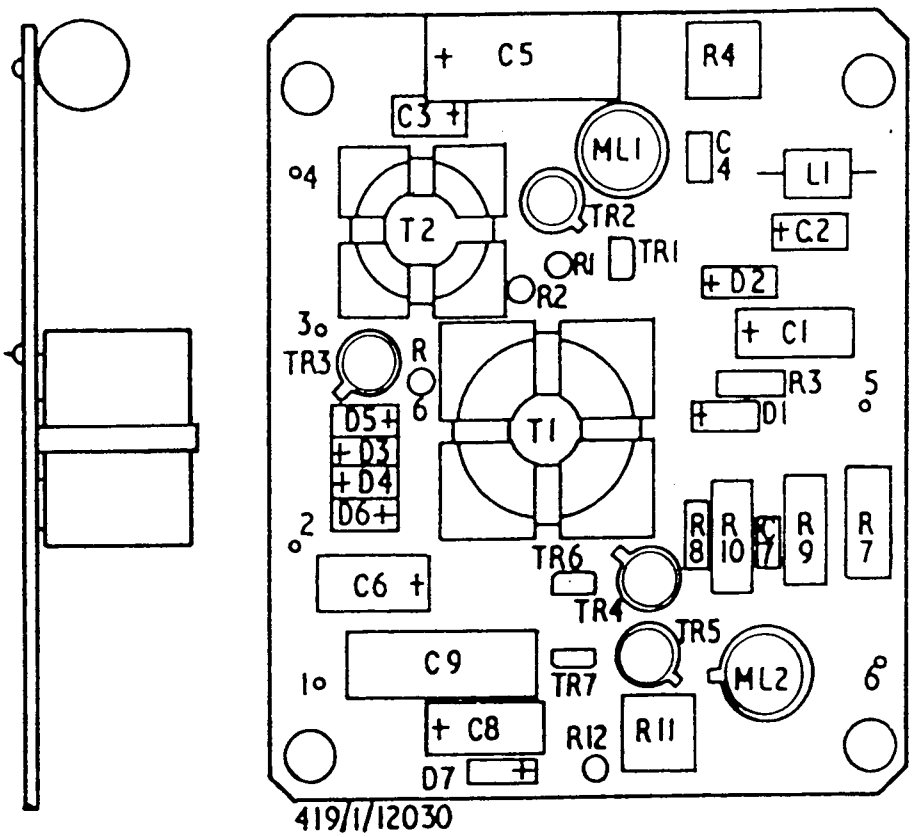


Fig. 4 Panel, electronic circuit, (unit 5b) – component layout

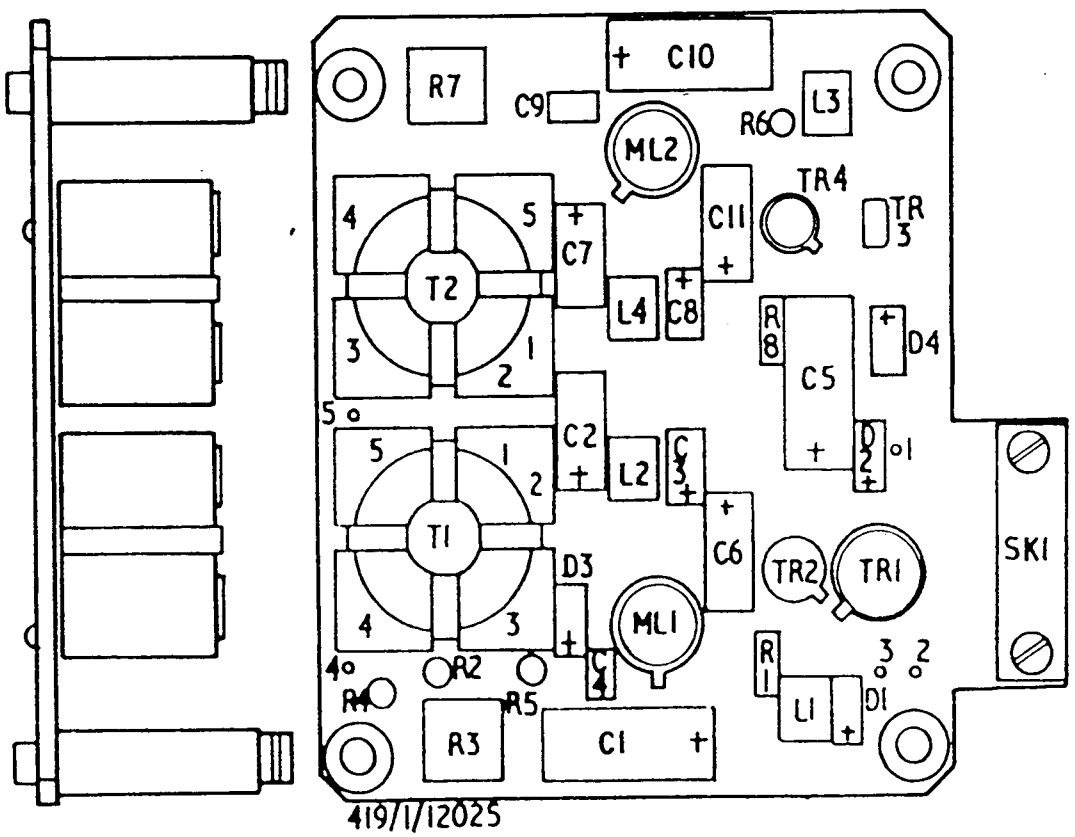


Fig. 5 Panel, electronic circuit. (unit 5a) –

THIRD LINE SERVICING
OF
SCREEN & CAN ASSEMBLY 640/1/09705
(UNIT 6a)

CONTENTS

ILLUSTRATIONS

DESCRIPTION

1. The screen and can assembly (unit 6a) is a component part of the transmitter receiver and provides receiver IF stages. The unit is normally located on a mother panel (unit 6).

2. The unit consists of a screening can and a panel, electronic circuit (pec). All the circuit components are located on the pec. Holes are drilled in the screening can to allow access for adjustment of tuning.

3. A circuit diagram of the unit is given in Fig.1. A pre-amplifier TR1 and two integrated circuit amplifiers, ML1, ML2, are connected in cascade. ML1 and ML2 are each followed by a tuned circuit. Provision is made for AGC, the control voltage being routed to ML2 pin 7.

4. The gain of TR1 is set by means of a wire link connection to select the appropriate emitter load; this selection is carried out when setting up the complete receiver.

5. The IF is 1.75 MHz with an effective bandwidth of 23 kHz. The maximum gain (AGC input OV) is greater than 70 dB.

TESTING

Test equipment

6. The following items of special-to-purpose test equipment are required:

(1) Manual Interface Controller. Plessey Type TD4924A.

(2) Test Interface. Plessey Type TD50567A.

(3) Test Jig. Plessey Type TJ834A.

7. The following items of proprietary test equipment are required:

Item	Description
Avo	A dc milliameter capable of reading currents in the range 0 - 10 mA with an accuracy of ± 1% of fsd. Suitable instrument: Avo Model 8X.
DVM	A digital voltmeter having the following essential characteristics: Range: 0 - 10V Accuracy: ± 0.015% of reading ± 0.005% of fsd Suitable instrument: Solartron A203/204
RFVM	An RF millivoltmeter having the following essential characteristics: Frequency range: 1.6 MHz to 1.8 MHz Voltage range: 1V and 100 mV. Input impedance: GT 150 kohms at 1 MHz, LT 2.5 pF at 1 MHz Accuracy: ± 3% of fsd on 10 mV range Suitable instrument: Marconi TF 2603 with coaxial adaptor TM 7950 and N to BNC adaptor

em	Description
unter	An electronic counter capable of measuring frequency 1.75 MHz with accuracy of ± 2Hz Suitable instrument: Racal 9024
Gen.	An RF signal generator having the following essential characteristics: Frequency range: 1.4 MHz to 2.1 MHz Frequency accuracy: ± 2 kHz Output emf: 40µV to 50 mV Source impedance: 50 ohms Suitable instrument: Marconi TF 144H/4
SU	A power supply capable of supplying 6V ± 3%. Suitable instrument: Farnell L30B

reliminary

. Proceed as follows:

(1) Connect the Test Interface to the Manual Interface Controller and to the Test Jig.

(2) At the Manual Interface Controller

(a) Ensure that the DC monitor switch is set to EXT

(b) Set the test selection switches to 000

(c) Connect AVO to socket marked AVO

(d) Connect DVM to socket marked DVM

(e) Connect RF Gen. to socket marked SG1

(f) Connect the PSU output to the EXT A connector

(3) At the test interface, connect RFVM to socket marked RFVM.

(4) Connect counter to RF Gen. normal output via a 10 dB attenuator.

(5) Switch on mains power to all test instruments where applicable.

(6) Ensure that all links are removed from pins 6, 7, 8, 9 and 10 of the UUT (unit under test).

Test procedures

9. Carry out the procedures given on the following pages.

NOTES RELATING TO TESTS

1. The unit under test is referred to as UUT.

2. For the majority of tests, the RF Gen. output is injected into pin 11 of the UUT and the resulting output at pin 3 is displayed at the RFVM. In tests 008/010, + 4.65V is applied to the AGC line of the UUT, for all other tests, AGC is not applied.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
000	(a)	INT CON	-	-	Depress "PRESS TO TEST" button.
	(b)	UUT	-	-	Locate UUT in test jig. Ensure that links are not fitted to any of pins 6 to 10 of the UUT.
	(c)	AVO	10mA	-	Set Avo to 10 mA dc range.
	(d)	DVM	10V	-	Set DVM to 10V range.
	(e)	RF VM	1V	-	Set RFVM to the 1V range.
6.0V SUPPLY LINE ADJUSTMENT					
002	(a)	INT CON	-	-	Depress "PRESS TO TEST" button.
	(b)	DVM	10V	5.902V to 6.098V	Adjust PSU to indicate on DVM a value of 6.0 Volts.
6.0V LINE CURRENT MEASUREMENT					
004	(a)	INT CON	-	-	Depress "PRESS TO TEST" button.
	(b)	AVO	10mA	NGT 9.0mA	Ensure that the 6V line current is not greater than 9.0 mA.
6.0V SUPPLY LINE ADJUSTMENT					
005	(a)	INT CON	-	-	Depress "PRESS TO TEST" button.
	(b)	DVM	10V	5.902V to 6.098V	Adjust PSU to indicate on DVM a value of 6.0 Volts.
IF ALIGNMENT AND GAIN					
006	(a)	INT CON	-	-	Depress "PRESS TO TEST" button.
	(b)	COUN-TER		1.748002 to 1.751998MHz	Set RF Gen. frequency to indicate on Counter 1.75 MHz.
	(c)	RF GEN	-	Set 500 µV	Set RF Gen. output level to 500 µV.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
006 cont'd	(d)	RF VM	1V	MAX. OUTPUT LEVEL	Adjust L1, L2 on the UUT for a maximum indication on the RFVM Voltmeter.
	(e)	RF VM	1V	169V to 470mV	Check the reading indicated on the RFVM.
	(f)	RF GEN		ZERO OUTPUT	Set output signal of RF Gen. to zero.
	(g)	RF VM	100mV	55 mV to 65 mV	Set RFVM to 100 vM scale. Increase output level of RF Gen. to indicate on RFVM a reading of 60 mV. Note the setting of the output level dial on the RF Gen. in dB's.
AGC VOLTS					
008	(a)	INT CON	-	-	Depress "PRESS TO TEST" button.
	(b)	DVM	10V	4.601V to 4.699V	Check AGC line voltage.
I/P LEVEL INCREASE WITH AGC					
010	(a)	INT CON	-	-	Depress "PRESS TO TEST" button.
	(b)	RF GEN			Increase RF Gen. output level to indicate on RFVM a reading of 60 mV. Note the setting of the output dial on the RF Gen. in dB's.
	(c)			NLT 61.2 dB greater	Check that reading noted in 010 b is NLT 61.2 dB above that noted in 006 g.
012	(a)	INT CON	-	-	Depress "PRESS TO TEST" button.
	(b)	UUT			Remove UUT.

COMPONENTS LIST

10. The component parts of the screen and can assembly (unit 6a) 640/1/09705 are:

Screen can	640/1/09824
Panel electronic circuit	419/1/12035
Spacer	640/2/15412

11. A detailed breakdown of the panel electronic circuit 419/1/12035 is given on the following page.

COMPONENTS LIST FOR RECEIVER IF PEC (Unit 6a) 419/1/12035

Cct Ref	Description	Reference No.
	Resistors	
R1	13 kohm ± 5%	403/4/78126/076
R2	4.3 kohm ± 5%	403/4/78126/064
R3,R9	1 kohm ± 5%	403/4/78126/049
R4	130 ohm ± 5%	403/4/78126/028
R5	75 ohm ± 5%	403/4/78126/022
R6	110 ohm ± 5%	403/4/78126/026
R7	470 kohm ± 5%	403/4/78126/041
R8	390 ohm ± 5%	403/4/78126/039
	Capacitors	
C1	10nF +80% -20% 100v	400/9/19084/078
C2	68nF +80% -20% 50v	400/9/19084/098
C3	68nF +80% -20% 50v	400/9/19084/098
C4	10nF +80% -20% 100v	400/9/19084/078
C5	68nF +80% -20% 50v	400/9/19084/098
C6	27pF ± 5% 100v	400/9/19080/080
C7	100pF ± 5% 100v	400/9/19081/085
C8	330pF ± 1% 350v	438/9/30100/105
C9	10nF +80% -20% 100v	400/9/19084/078
C10	Not used	
C11	27pF ± 5% 100v	400/9/19080/080
C12	100pF ± 5% 100v	400/9/19081/085
C13	330pF ± 1% 350v	438/9/30100/105
C14	10nF +80% -20% 100v	400/9/19084/078
C15	6.8uF ± 20% 6v CET 30A	402/4/98049/009
	Inductors	
L1	Inductor, R.F.	406/9/08470/027
L2	Inductor, R.F.	406/8/11030/001
L3	Inductor, R.F.	406/8/11030/001
	Semi-conductor devices	
TR1	Transistor ZTX109L	990/4/02027/003
ML1	Integrated circuit CN603T	446/4/00423
ML2	Integrated circuit CN603T	446/4/00423

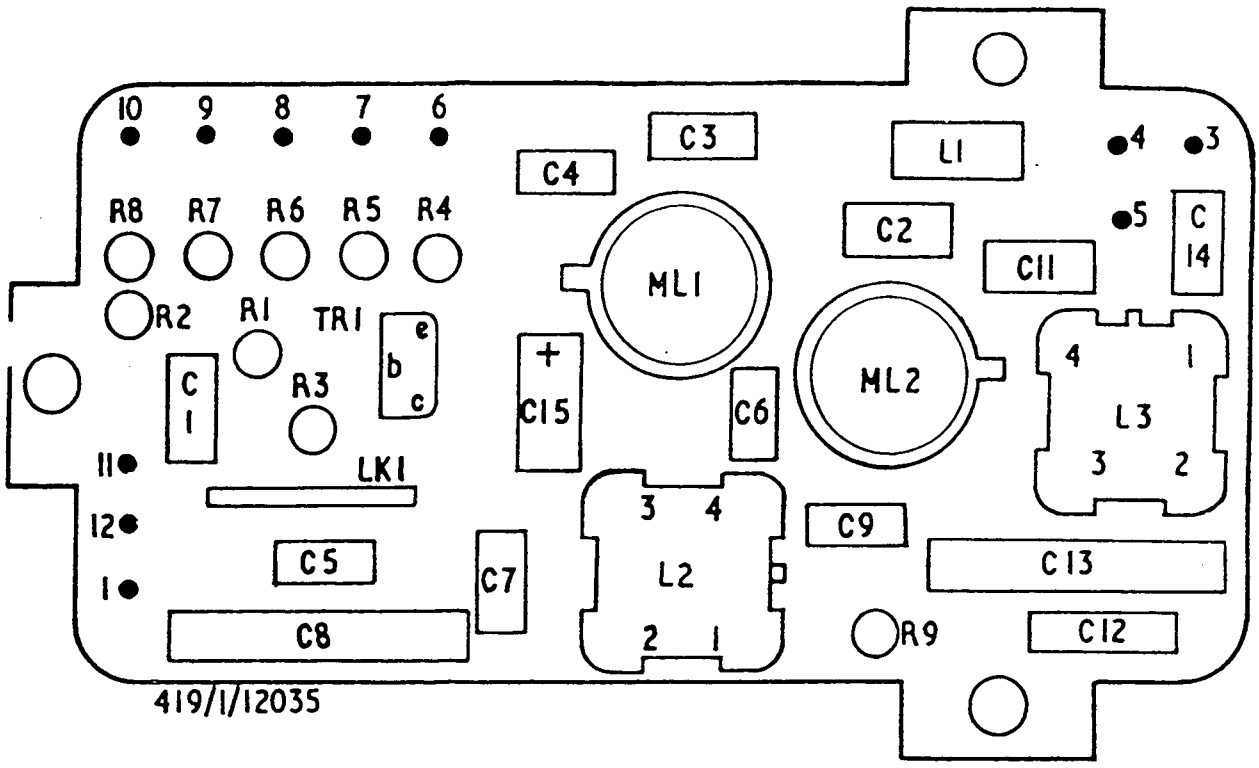


Fig.2 Receiver IF pec (unit 6a) – component layout

THIRD LINE SERVICING OF SCREEN & CAN ASSEMBLY 640/HA/09706 (UNIT 6b)

CONTENTS

ILLUSTRATIONS

SCRIPTION

Introduction

1. The screen and can assembly (unit 6b) is a component part of the transmitter receiver and provides the receiver AF and AGC unit. The unit is normally located on a mother panel (unit 6).

2. The unit consists of a screening can and a panel, electronic circuit (pec). All the circuit components are located on the pec. The circuit diagram is given in Fig. 1.

3. The unit provides the following functions:

(1) SSB demodulation and AGC generation.

(2) AM demodulation and AGC generation.

(3) Amplification of selected demodulator AF output.

(4) Injection of a tone to audio amplifier input under external control.

(5) Injection of audio (Tx sidetone) into audio amplifier input.

Demodulation and AGC generation

4. SSB demodulation is provided by integrated circuit, ML1, which also provides AM demodulation and AM AGC generation. A second integrated circuit, ML2, provides SSB AGC generation.

5. SSB IF signals applied to ML1 pin 6 beat with a 1.75 MHz carrier reinsertion signal applied to ML1 pin 9. The difference frequency at ML1 pin 8 is the AF component of the SSB signal and is routed via the emitter follower TR1 to:

(1) Integrated circuit ML2, which produces the SSB AGC voltage at ML2 pin 2. The SSB AGC threshold level, is set by R4.

(2) gate TR3 (see para. 8)

6. AM IF signals applied to ML1 pin 6 are rectified to provide an AF output at ML1 pin 1. This output is routed via the emitter follower TR2 to the gate TR4 (see para. 8). The AM AGC voltage is produced at ML1 pin 4 and is derived from the AM AF. The AM AGC threshold level is set by resistor R2, connected between ML1 pins 2 and 5.

AF amplifiers

7. Either the demodulated SSB or the demodulated AM, as selected by a gate circuit, is routed via preamplifier to the external gain control and

thence to a class AB audio amplifier. Other signals to this amplifier are provided by a tone gate and the sidetone input.

8. TR3/TR4 form a gate to select either the demodulated SSB applied to TR3 base or the demodulated AM applied to TR4 base. When the +6V(AM) input to pin 6 of unit 6b is open circuit, the bias conditions are such that TR3 passes the demodulated SSB to TR5 and TR4 is switched off. If the +6V(AM) input is at +6V, TR4 is switched on to pass the demodulated AM to to TR5 and TR4 emitter current causes TR3 to be biased beyond cut-off. Resistors R5 and R11 provide independent adjustment of the AF input levels to TR3 and TR4.

9. The +6V at the +6V (AM) input is taken via the isolating diode D3 to pin 16 of the unit where it is externally used to inhibit the carrier insertion signal (i.e. SSB demodulation is inhibited when the AM demodulator output is selected).

10. The AF signal selected by TR3/TR4 is amplified by TR5 and TR6 and passed via an external gain control to TR8. Other AF inputs to TR8 are provided by the tone gate TR7 and the sidetone input to pin 4 of unit 6b.

11. TR8/TR9 are driver stages for the class AB audio amplifier TR10/TR11.

12. The amplitude of sidetone input at TR8 base is reduced when the 0V CW input to pin 3 of unit 6b is connected to 0V.

Tone gate

13. The tone gate is provided to facillitate the transmitter-receiver frequency check and loss of phase lock warning functions. The gate passes a tone to the audio amplifier input when either one of two control signals is applied.

14. The tone (normally 1 kHz or 2 kHz) applied to pin 15 of unit 6b is passed to the base of TR7 which is normally biased beyond cut-off. If +6V is applied either to pin 6 (Rx Freq Check) or to pin 2 (Phase Lock) of unit 6b, TR7 is switched on and the tone is passed to the audio amplifier input.

15. +6V applied to the phase lock input is routed via the isolating diode D4 to pin 16 of unit 6b where it is externally used to inhibit the Tx and Rx IF carrier.

TESTING

Test equipment

16. The following items of special-to-purpose test equipment are required:

(1)	Manual interface controller.	Plessey Type TD4924A
(2)	Test interface.	Plessey Type TD50568A
(3)	Test jig.	Plessey Type TJ835A

17. The following items of proprietary test equipment are required:

Item	Description
Avo	A dc milliammeter having the following essential characteristics: Range 100 mA Accuracy ± 1% of fsd Suitable instrument: Avo Universal Model 8
DVM	A digital voltmeter having the following essential characteristics: Range 10V and 1V Accuracy ± 0.015% of reading ± 0.005% of fsd Suitable instrument: Solartron A203 or Solartron LM 1619 or Fluke 8100A
AF VM	An AF voltmeter having the following essential characteristics: Operating Frequency 100Hz to 5KHz Voltage range 0.5mV to 1V Measurement Accuracy ± 1% over above frequency range Input Impedance 150 ohms Suitable instrument: Hewlett Packard 400E

Item	Description	
RF Gen. A	An RF signal generator with the following essential characteristics:	
	Operating frequency	1.75 MHz
	CW output emf	200 mV, 125 mV, 45 mV, 25 mV, and 4.5 mV.
	Output emf accuracy	± 1 dB at 1.75 MHz
	Source Impedance	50 ohms
	Amplitude Modulation level	85% at 1 KHz, emf of 125 mV ± 2%
	Suitable instrument:	Marconi Type 2002B with Synchroniser Type 2170B
RF Gen. B	An RF signal generator with the following essential characteristics:	
	Operating frequency	Different from RF Gen. A by 100 Hz ± 10 Hz, or 1 kHz ± 10 Hz or 5 kHz ± 10 Hz
	CW output emf	100 mV
	Output emf accuracy	± 1 dB at 1.75 MHz
	Source impedance	50 ohms
	Accuracy of difference frequencies	± 10 Hz
	Suitable instrument:	Marconi Type 2002B with Synchroniser Type 2170B
AF Gen.	An AF signal generator with the following essential characteristics:	
	Operating frequency	1 KHz and 2 KHz
	Frequency accuracy	± 2% of indicated value
	Output emf	250 mV and 50 mV
	Output accuracy	± 1 dB
	Source impedance	less than 100 ohms
	Suitable instrument:	Advance J3
PSU	A power supply capable of supplying 6.0V ± 2% at 100 mA maximum.	
	Suitable power supply:	Farnell L30B

Preliminary

18. Connect the test interface to the test jig and to the manual interface controller.

19. At the manual interface controller:

(1) Set the DC monitor switch to EXT

(2) Set the test selection switches to 000

(3) Connect DVM to socket marked DVM

(4) Connect RF Gen. A to socket marked SG1

(5) Connect RF Gen. B to socket marked SG2

(6) Connect AF Gen. to socket marked AUDIO GEN

(7) Connect AF VM to socket marked AF V/V

(8) Connect PSU to socket marked EXT A

20. Connect a synchroniser to each RF Gen.

21. Switch on the mains supplies to all test instruments where applicable.

Test procedures

22. Carry out the test procedures given on the following pages.

NOTES RELATING TO TESTS

(1) The unit under test is referred to as UUT.

(2) Potentiometers R2, R4, R5 and R11 on UUT are adjusted to the requisite operational settings after unit 6b is fitted to the radio. The resistors are set to give maximum gain and AGC voltages for the purposes of the tests herein.

(3) For all tests the load normally presented by the external gain control is synthesised by a suitable resistor connected between pins 17 and 18 of the UUT, pin 17 is linked to pin 13 (max gain).

(4) Tests 000 - 005 are to set the 6V supply and check the 6V line current.

(5) For the AM circuit checks (tests 006 and 008) the UUT is set to AM mode by applying +6V to the +6V Rx AM input (pin 6) of the UUT (the resulting carrier inhibit output at pin 16 of the UUT is checked). RF Gen. A is used to supply an amplitude modulated 1.75 MHz carrier to the detector input (pin 10) of the UUT. The resulting AF and AM AGC output voltages are checked.

(6) For the SSB circuit checks (tests 010 and 012) the UUT is set to SSB mode by open circuit of the +6V Rx AM input (pin 6) of UUT. RF Gen. A is used to supply 1.75 MHz CW to the detector input (pin 10) of UUT and RF Gen. B is used to supply 1.75 MHz + 1 kHz to the carrier input (pin 8) of UUT. The resulting 1 kHz AF and SSB AGC outputs are checked.

(7) For tests 014 to 018, a 2 kHz audio signal is applied to the tone gate of the UUT and the effect of the control inputs on the routeing of this audio signal to the AF output of the UUT are checked thus:

(a) Phase lock input (pin 2) at +6V - test 014

(b) Phase lock input (pin 2) at 0V - test 016

(c) Phase lock input (pin 2) at 0V and 6V Rx freq. check input (pin 17) at +6V - test 018

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
000	(a)	INT CON	-	-	Depress "PRESS TO TEST" button.
	(b)	UUT	-	-	Locate UUT in the Test Jig.
	(c)	AVO	100mA	-	Set Avo to 100 mA dc range.
	(d)	DVM	10V	-	Set DVM to 10V range.
	(e)	AF VM	1V	-	Set AF voltmeter to 1V range.
	(f)	UUT			Set R2, R4, R5 and R11 controls on UUT fully clockwise.
6.0V SUPPLY LINE ADJUSTMENT					
002	(a)	INT CON	-	-	Depress "PRESS TO TEST" button.
	(b)	DVM	10V	5.881V to 6.119V	Adjust external power supply to indicate on DVM a value of 6.0V.
6.0V LINE CURRENT					
004	(a)	INT CON	-	-	Depress "PRESS TO TEST" button.
	(b)	AVO	100mA	NGT 34.0mA	Check 6V line current.
6.0V SUPPLY LINE READJUSTMENT					
005	(a)	INT CON	-	-	Depress "PRESS TO TEST" button.
	(b)	DVM	10V	5.881V to 6.119V	Adjust external power supply to indicate on DVM a value of 6.0V.
AF OUTPUT AM CIRCUIT					
006	(a)	SYNC 'A'		1.74001 to 1.75999MHz	Set Synchroniser to 1.75000 MHz and tune RF Gen. to 1.75 MHz.
		RF GEN A		Set 125mV MOD. at 1K Hz Depth 85%	Set an output level of 125 mV, amp. modulated at 1 K Hz, depth of modulation 85%, on the RF Gen.
	(b)	INT CON	-	-	Depress "PRESS TO TEST" button.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
006 (contd)	(c)	AF VM	3V	NLT 1.03V	Check the AF output on AF VM.
	(d)	DVM	10V	NLT 4.001V	Check the carrier inhibit output on DVM.
AM AGC CIRCUIT					
008	(a)	RF GEN A		SET ZERO OUTPUT	Set RF Gen. output voltage to a minimum.
	(b)	INT CON	-	-	Depress "PRESS TO TEST" button.
	(c)	DVM	1V	NGT 0.999V	Check AM AGC output on DVM.
	(d)	DVM	10V	-	Set DVM to 10V range.
	(e)	RF GEN A		Set 220mV	Set the RF Gen. output voltage to 220 mV.
	(f)	DVM	10V	NLT 4.601V	Check AM AGC output on DVM.
AF OUTPUT SSB CIRCUIT					
010	(a)	RF GEN A		Set 25mV CW	With frequency as in 006 (a) set a CW output voltage of 25 mV on RF Gen. A.
	(b)	SYNC 'B'		1.75097 to 1.75103MHz	Set Synchroniser B to 1.75100 and tune RF Gen. B to 1.751 MHz.
		RF GEN B		Set 100 mV CW	Set an output level of 100 mV CW, on RF Gen. B.
	(c)	INT CON	-	-	Depress "PRESS TO TEST" button.
	(d)	AF VM	3V	NLT 1.03V	Check the AF output on AF VM.
AGC SSB CIRCUIT					
012	(a)	RF GEN A		Set 45 mV CW	Increase CW output voltage to 45 mV on the RF Gen.
	(b)	INT CON	-	-	Depress "PRESS TO TEST" button.
	(c)	DVM	10V	NLT 4.601V	Check the SSB AGC output on DVM.
	(d)	INT CON	-	-	Remove the two RF Gen. output leads.
	(e)	DVM	1V	NGT 0.999V	Check the SSB AGC output on DVM.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
TONE GATE CHARACTERISTICS					
014	(a)	AF GEN		Set 50 mV Set 2 K Hz	Set the AF signal generator to a frequency of 2 KHz and output level of 50 mV.
	(b)	INT CON	-	-	Depress "PRESS TO TEST" button.
	(c)	AF VM	300mV	153mV to 297 mV	Note AF output on AF VM
	(d)	DC VM	10V	NLT 3.001V	Check the carrier inhibit output on DVM.
016	(a)	INT CON	-	-	Depress "PRESS TO TEST" button.
	(b)	AF VM	1mV	NLT 52dB down on 014 (c) value	Check that the AF output on the AF VM is greater than 52 dB down on the indicated value of 014(c). NOTE:- AF VM dB range switch reduction facility used.
018	(a)	AF VM	300mV	-	Set AF VM to 300 mV range.
	(b)	INT CON	-	-	Depress "PRESS TO TEST" button.
	(c)	AF VM	300mV	014(c) recorded value.	Check that AF output on AF VM is the value noted in 014(c).
CONCLUSION OF TESTS					
020	(a)	INT CON	-	-	Depress "PRESS TO TEST" button.
	(b)	UUT	-	-	Remove UUT from test jig.

COMPONENTS LIST

23. The component parts of the screen and can assembly (unit 6b) 640/1/09706 are:

Screen can	640/1/09825
Panel electronic circuit	419/1/12040
Spacer	640/2/15412

24. A detailed breakdown of the panel electronic circuit 419/1/12040 is given on the following pages.

COMPONENTS LIST FOR RECEIVER AF AND AGC PEC (Unit 6b) 419/1/12040

Cct Ref	Description	Reference No.
	Resistors	
R1	10 ohm ± 5%	403/4/78126/001
R2	10 kohm ± 10% 0.5w variable	404/9/05033/004
R3	1 kohm ± 5%	403/4/78126/049
R4	1 kohm ± 10% 0.5w variable	404/9/05033/002
R5	10 kohm ± 10% 0.5w variable	404/9/05033/004
R6	390 ohm ± 5%	403/4/78126/039
R7	10 kohm ± 5%	403/4/78126/073
R8	4.7 kohm ± 5%	403/4/78126/065
R9	2 kohm ± 5%	403/4/78126/056
R10	47 ohm ± 5%	403/4/78126/017
R11	10 kohm ± 10% 0.5w variable	404/9/05033/004
R12	47 kohm ± 5%	403/4/78126/089
R13	390 ohm ± 5%	403/4/78126/039
R14	10 kohm ± 5%	403/4/78126/073
R15	1 kohm ± 5%	403/4/78126/049
R16	2 kohm ± 5%	403/4/78126/056
R17	22 kohm ± 5%	403/4/78126/081
R18	2 kohm ± 5%	403/4/78126/056
R19	1.5 kohm ± 5%	403/4/78126/053
R20	390 ohm ± 5%	403/4/78126/039
R21	33 ohm ± 5%	403/4/78126/013
R22	1.2 kohm ± 5%	403/4/78126/051
R23	10 ohm ± 5%	403/4/78126/001
R24	910 ohm ± 5%	403/4/78126/048
R25	160 ohm ± 5%	403/4/78126/030
R26	2.2 kohm ± 5%	403/4/78126/057
R27	2.4 kohm ± 5%	403/4/78126/058
R28	1 kohm ± 5%	403/4/78126/049
R29	2.7 kohm ± 5%	403/4/78126/059
R30	2.2 kohm ± 5%	403/4/78126/057
R31	100 kohm ± 5%	403/4/78126/097
R32	2.7 kohm ± 5%	403/4/78126/059
R33	5.6 kohm ± 5%	403/4/78126/067
R34	6.8 kohm ± 5%	403/4/78126/069
R35	15 kohm ± 5%	403/4/78126/077
R36	7.5 kohm ± 5%	403/4/78126/070
R37	10 kohm ± 5%	403/4/78126/073
R38	10 ohm ± 5%	403/4/78126/001
R39	10 ohm ± 5%	403/4/78126/001
R40	10 kohm ± 5%	403/4/78126/073
R41	10 kohm ± 5%	403/4/78126/073

Cct Ref	Description	Reference No.
	Capacitors	
C1	47uF ± 20% 6v electrolytic	402/4/98049/010
C2	10nF +80% -20% 100v	400/9/19084/078
C3	68nF +80% -20% 50v	400/9/19084/098
C4	47uF ± 20% 6v electrolytic	402/4/98049/010
C5	1uF ± 20% 35v electrolytic	402/4/98049/085
C6	10nF +80% -20% 100v	400/9/19084/078
C7	68nF +80% -20% 50v	400/9/19084/098
C8	4.7nF +80% -20% 100v	400/9/19083/041
C9	6.8uF ± 20% 6v electrolytic	402/4/98049/009
C10	22nF ± 10% 100v	400/9/19083/058
C11	330nF ± 20% 35v electrolytic	402/4/98049/082
C12	6.8uF ± 20% 6v electrolytic	402/4/98049/009
C13	47uF ± 20% 6v electrolytic	402/4/98049/010
C14	100uF ± 10% 10v electrolytic	402/4/98049/019
C15	6.8uF ± 20% 6v electrolytic	402/4/98049/009
C16	47uF ± 10% 6v electrolytic	402/4/98049/003
C17	10nF +80% -20% 100v	400/9/19084/078
C18	100uF ± 10% 10v electrolytic	402/4/98049/019
C19	6.8uF ± 20% 6v electrolytic	402/4/98049/009
C20	6.8uF ± 20% 6v electrolytic	402/4/98049/009
C21	1uF ± 20% 35v electrolytic	402/4/98049/085
C22	470nF +80% -20% 50v	400/9/19084/109
C23	6.8uF ± 20% 6v electrolytic	402/4/98049/009
C24	68nF +80% -20% 50v	400/9/19084/098
C25	10nF +80% -20% 100v	400/9/19084/078
C26	47uF ± 20% 6v electrolytic	402/4/98049/010
C27	47uF ± 20% 6v electrolytic	402/4/98049/010
C28	22uF ± 20% 35v electrolytic	402/4/98049/092
C29	1uF ± 2% 35v electrolytic	402/4/98049/085
C30	10nF +80% -20% 100v	400/9/19084/078
C31	10nF ± 10% 100v	400/9/19083/051
C32,C33	10nF +80% -20% 100v	400/9/19084/078
C34	4.7nF +80% -20% 100v	400/9/19083/041
	Inductors	
L1	Inductor 18uH	406/9/08470/027
	Semi-conductor devices	
TR1 to TR 10	Transistor CV 7648	990/4/00107/648
TR 11	Transistor BCY 70	417/4/00240
D1 to D4	Diode CV 7367	990/4/00107/367
ML1	Integrated circuit CN 589T	446/4/00417
ML2	Integrated circuit CN 605T	446/4/00424

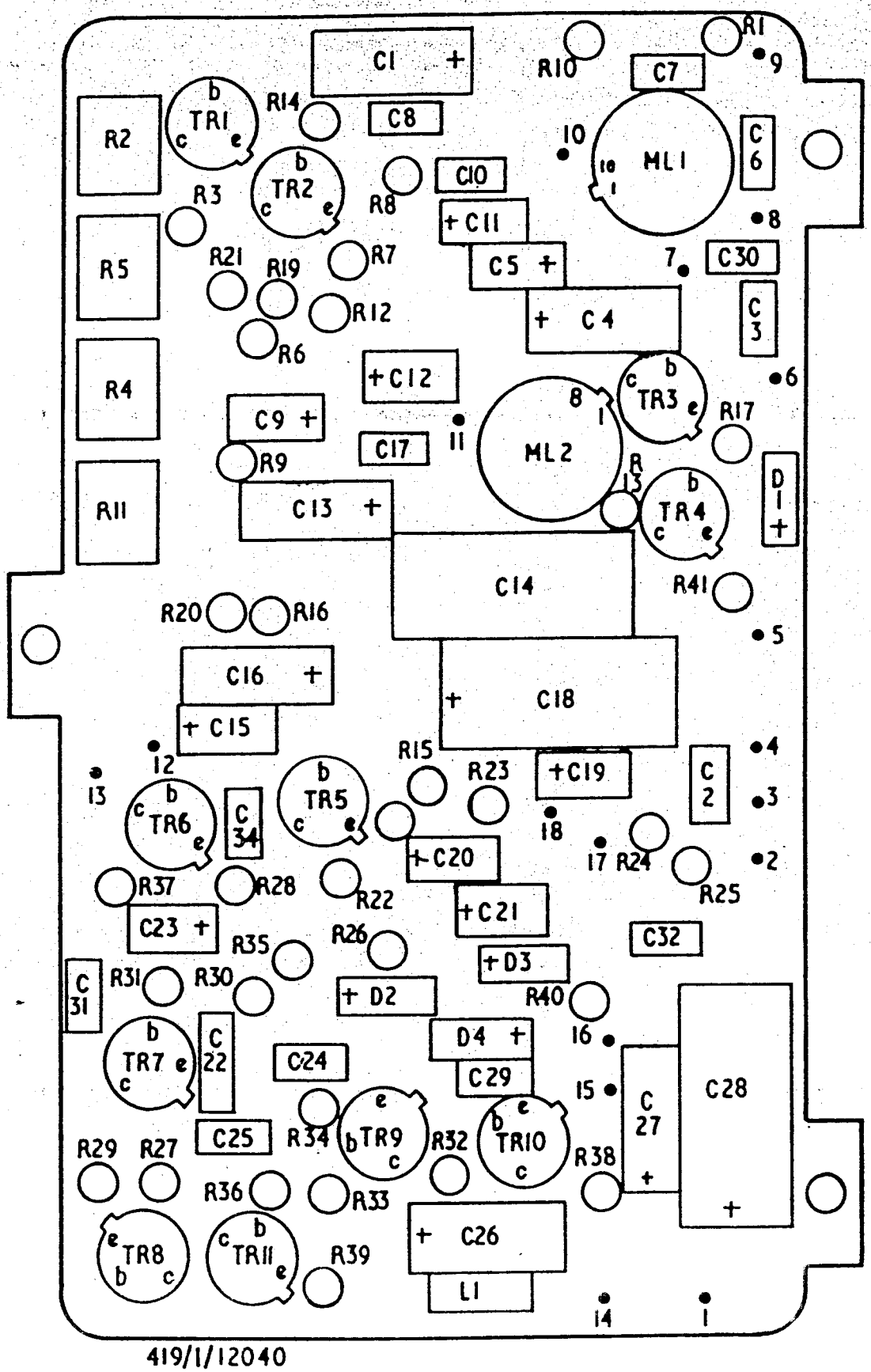


Fig. 2 Receiver AF and AGC pcb (unit 6b) — component layout

THIRD LINE SERVICING
OF
SCREEN & CAN ASSEMBLY 630/1/37605
(UNITS 6c/d)

CONTENTS

ILLUSTRATIONS

DESCRIPTION

Introduction

1. The screen and can assembly (unit 6c/d) is a component part of the transmitter receiver; it provides the transmitter audio circuits, AF/IF mixer and pressel circuits. The unit is normally located on a mother panel (unit 6).

2. The unit consists of a panel electronic circuit (pec) assembly and screening can. The pec assembly comprises two pec (units 6c and 6d), secured to each other at separating spacers. All external connections

are via unit 6c; connections to unit 6d are by wire leads to terminals on unit 6c.

3. Circuit diagrams of unit 6c and unit 6d are given in Figs 1 and 2 respectively.

Audio circuits (refer to Fig.1.)

4. Unit 6c provides a 300 ohm balanced input impedance for speech signals from a microphone. These signals are applied to an integrated circuit, ML1, which provides two audio amplifiers, one for a main signal path and one for a sidetone path.

5. The sidetone path amplifier in ML1 has a constant gain of approx. 30 dB. The main path amplifier in ML1 incorporates a VOGAD (voice operated gain adjusting device) which provides a constant output level (90 mV rms nominal) for input signals in the range 100 μV to 100 mV peak-to-peak.

6. Main path speech signals are routed from ML1 pin 9 to ML3 pin 6. Sidetone path speech is routed from ML1 pin 4 to ML2 pin 6.

7. Integrated circuits ML2 and ML3 are identical controlled gates which incorporate a fixed gain clipping amplifier. ML2 output provides the Tx sidetone (normally passed to Rx audio circuits in unit 6b) and ML3 output provides the audio signal to the modulator circuits in unit 6d. Both gates operate in the following manner:

(1) ML2 and ML3 will not pass audio signals when there is 0V at pin 12 of unit 6c.

(2) ML2 and ML3 will pass speech signals from ML1 when pins 12, 15 and 16 of unit 6c are all open circuit.

(3) ML2 and ML3 will pass an audio tone (normally 1 kHz or 2kz) applied to pins 17 and 20 of unit 6c when pin 12 of the unit is open circuit and either of pins 15, 16 is at +6V.

8. The control input to pin 12 of unit 6c is provided by unit 6d and is determined by the pressel input to that unit (para. 16); when the pressel is set to transmit, audio is passed by ML2 and ML3. The control of inputs to pins 15 and 16 of unit 6c is from external switches.

9. Two separate tone inputs are provided so that each input can be externally set to a level appropriate to the respective output path, main or sidetone.

Modulator circuits (see fig.2)

10. Audio from unit 6c and a 1.7MHz carrier from an external oscillator are applied to a double balanced modulator in ML1 of unit 6d. The output oduced at ML1 pin 6 is a complex waveform which contains the sum and difference frequencies of these signals, the original frequencies are effectively suppressed within ML1.

11. The modulator output is routed via a clipping stage and a switched gain amplifier, both in the integrated circuit ML3. The signal is routed out of ML3 at pin 7 and back again at pin 2. At this link, a connection is made to transistor TR4. This transistor is operated by the pressel and provides keying of the transmitter IF signal (para. 17)

12. The clipping of audio signals in ML3 of unit 6c, together with the clipping of peaks of the modulator output signal within ML3 is to ensure that the peak-to-mean ratio of the transmitter IF signal enables the transmitter power amplifiers to give maximum power output. Switching of ML3 gain enables the output signal to be approximately the same on all modes of operation; selection of gain is by external control applying the following to pins of unit 6d:

(1) +6V to pin 2 for SSB modes

(2) +6V to pin 3 and 4 for CW modes (note that clipping will not occur in this instance).

(3) Open circuit at pins 2, 3 and 4 for AM modes.

Fine setting of the gain for AM signals is provided by R8.

13. For reinsertion of 1.75 MHz carrier into the IF signal on AM modes, a gate in ML3 is operated for AM mode and passes the 1.75 MHz carrier from pin 5 to pin 3 of ML3 where, according to the setting of the link, LK, is either inserted into the IF signal at ML3 or is passed out of unit 6d for insertion at a later point in the IF signal path. Potentiometer R9 provides setting of the carrier level and thereby sets the modulation depth of the resulting AM signal.

Pressel circuits

14. The pressel circuits, in conjunction with an external pressel switch, provide switching of the radio from transmit to receive and vice versa.

15. The pressel is connected to pin 8 of unit 6d. When this input is open circuit (Rx), transistors TR2 and TR3 conduct. When this input is OV (Tx), transistors TR2 and TR3 are switched off.

16. The audio outputs from unit 6c are keyed by the control input to pin 12 of that unit (para. 7/8). This control input is provided by TR3 in unit 6d, the control is open circuit when TR3 is switched off (Tx), thereby switching on the audio outputs; the control is at OV when TR3 is switched on (Rx), thereby switching off the audio output.

17. Keying of transmitter IF signal by TR4 (para. 11) is controlled by the voltage at TR2 emitter. When TR2 is switched on (Rx), its output causes TR4 to switch on, thereby switching off the transmitter IF; when TR2 is switched off (Tx), its output causes TR4 to switch off, thereby switching on the transmitter IF.

18. Changing over of the radio from transmit mode to receive mode and vice versa is provided by external circuits which respond to a relay drive provided by ML3 in unit 6d. This integrated circuit is controlled by the collector voltage at transistor TR2. When TR2 is switched off (Tx), approx. +6V is applied to pin 5 of ML2, causing a heavy current to be supplied by ML2 to any relay circuits connected to pin 10 of unit 6d. This drive is removed when ML2 pin 5 is set to approx. 1V by conduction of TR2 (Rx).

19. Keying of the sidetone and the transmitter IF provides the marks and spaces of the morse message. Reversion of the radio to receive condition on CW modes when the pressel is released for the formation of a space is prevented by a delay (0.25 - 0.75 sec) between release of pressel and removal of drive. This delay is provided by capacitor C2 when pin 12 of unit 6d is connected to OV.

TESTING

Test equipment

20. The following items of special-to-purpose test equipment are required:

(1)	Manual interface controller.	Plessey Type TD4924A
(2)	Test interface.	Plessey Type TD50569A
(3)	Test jig.	Plessey Type TJ836B

21. The following items of proprietary test equipment are required:

Item	Description
Avo	A dc milliammeter for measuring current in the range 50 to 100 mA to an accuracy of ± 1% of fsd. Suitable instrument: AVO Universal Model 8 or 9.
DVM	A digital voltmeter for measuring 6 volts to an accuracy of ± 0.1% ± 1 digit. Suitable instrument: Solartron A203/204
RF VV	An RF millivoltmeter having the following essential characteristics: Frequency: 1.75 MHz Input impedance: NLT 1M ohms Voltage range: 1 mV to 500 mV to an accuracy of ± 5% Suitable instrument: Hewlett Packard 400E.

Item	Description	
AF VV	An AF voltmeter having the following essential characteristics:	
	Frequency	2 KHz
	Input impedance	10M ohms 20 pf.
	Voltage range	1 mV to 3 volts to an accuracy of ± 3% of fsd
	Suitable instrument:	Advance VM 77D
AFG 'A'	An AF signal generator having the following essential characteristics:	
	Frequency range	2 KHz ± 2%
	Output impedance	600 ohms balanced 60 to 110 mV ± 1 dB ± 1.5% of fsd
	Suitable instrument:	Advance J3.
AFG 'B'	An AF signal generator having the following essential characteristics:	
	Frequency range	2 KHz ± 10%
	Output impedance	NGT 50 ohms
	Output EMF	90 mV to 1.7 volts ± 1 dB ± 1.5% of fsd
	Suitable instrument:	Advance J3.
RF Gen.	An RF signal generator having the following essential characteristics:	
	Frequency range	1.75 MHz ± 2 KHz
	Output impedance	50 ohms
	Output EMF	100 mV ± 5%
	Suitable instrument:	Marconi TF 144H/4
Counter	A frequency counter for measuring 1.75 MHz to an accuracy of ± 1 count ± 1 part in 10^{0}.	
	Suitable instrument:	Racal 9024

Item	Description	
CRO	An oscilloscope having the following essential characteristics:	
	Frequency	500 Hz to 10 KHz
	Amplitude	400 mV to 550 mV to ± 5%
	Time	1.0 mS to 1.4 sec to ± 10%
	Suitable instrument:	Solartron A100. (Long persistence trace).
PSU	A dc power supply to provide 6V ± 0.1V with limiting above 150 mA.	
	Suitable instrument:	Farnell L30B

Preliminary

22. Connect the test interface to the test jig and to the manual interface controller.

23. At the manual interface controller:

(1) Set the DC MONITOR switch to EXT

(2) Set the test selection switches to 000

(3) Connect the AVO to the socket marked AVO

(4) Connect the DVM to the socket marked DVM

(5) Connect the AF Gen. A (600 ohms balanced output), one side to socket marked INPUT 2 and other side to socket marked INPUT 5 using coaxial cables.

(6) Connect AF Gen. B (low level output) to socket marked AUDIO GEN

(7) Connect RF Gen. to socket marked SG1

(8) Connect CRO input to socket marked CRO AMP A

(9) Connect CRO sync input to socket marked CRO AMP TRIG

(10) Connect AF VV to socket marked AF VV

(11) Connect PSU to terminals marked EXT A

24. Connect counter to monitor the output of the RF Gen.

25. Set switch on test jig to 320L

26. Connect the RF VV to socket on side of interface.

27. Switch on the mains power supply to all instruments where applicable.

Test procedures

28. Carry out the test procedures given on the following pages.

NOTES RELATING TO TESTS

1. Unit under test is referred to as UUT
2. For the majority of tests, the UUT:

(1) Is set to the Tx mode (all tests other than 020).

(2) Is set to the CW, AM or SSB mode by application of relevant control signals to the UUT (mode is indicated in sub-headings within test procedures).

(3) Carrier input is supplied by RF Gen.

(4) Tone input is supplied by AFG 'B'.

(5) Speech input is supplied by AFG 'A' (see notes 3 and 4).

The resulting output, sidetone or IF, is measured.

(9) Connect CRO sync input to socket marked CRO AMP TRIG

(10) Connect AF VV to socket marked AF VV

(11) Connect PSU to terminals marked EXT A

24. Connect counter to monitor the output of the RF Gen.

25. Set switch on test jig to 320L

26. Connect the RF VV to socket on side of interface.

27. Switch on the mains power supply to all instruments where applicable.

Test procedures

28. Carry out the test procedures given on the following pages.

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(3) Carrier input is supplied by RF Gen.

(4) Tone input is supplied by AFG 'B'.

(5) Speech input is supplied by AFG 'A' (see notes 3 and 4).

The resulting output, sidetone or IF, is measured.

3. The test interface includes a circuit which pulses the speech signal input to the UUT. This is to test the VOGAD device; the CRO Trigger is taken from the pulsing circuit.

4. For adjustment of 6cR6, a variable level of AF is required at TPH. The action of the VOGAD would prevent this. The link between TPG and TPH is broken before the tests and maintained via the interface for the tests in which AF is to be fed via the VOGAD. For tests 032/034, this connection is broken and AF is fed to TPH.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
000	(a)				Depress "Press-to-test" button.
	(b)				Load UUT into test jig.
	(c)	AVO	100mA		Set AVO to 100mA d.c. range.
	(d)	DVM	20V		Set DVM to 20 V
	(e)	PSU			Set PSU to min. O/P voltage.
	(f)	AFG 'A'			Set AFG 'A' to min. O/P level.
	(g)	AFG 'B'			Set AFG 'B' to min. O/P level.
	(h)	RF Gen			Set RF Gen. to min. O/P level.
	(j)	RFVV			Set RFVV to max. range.
	(k)	AFVV			Set AFVV to max. range.
	(l)	CRO			Set CRO volts/CM to max. range.
	(m)	PSU			Set PSU current limit for 150 mA.
	(n)	UUT			Remove link between TPG and TPH on Unit 6c.
	(p)	UUT			Ensure that a link is fitted between pins 17 and 18 of unit 6d.
SET SUPPLY VOLTAGE					
002	(a)				Depress "Press-to-test" button.
	(b)	PSU DVM	 20V	5.907 to 6.094V	Increase PSU O/P to give 6 volts on DVM.
SET AF AND RF GEN OUTPUTS					
004	(a)				Depress "Press-to-test" button.
	(b)	AFG 'A'		1.837 KHz to 2.155 KHz	Set AFG 'A' to 2 kHz.
	(c)	AFVV	30mV	17.5 mV	Adjust AFG 'A' O/P level until AFVV indicates 17.5 mV.
006	(a)				Depress "Press-to-test" button.
	(b)	AFG 'B'		1.837 KHz to 2.155 KHz	Set AFG 'B' to a frequency of 2 KHz.
	(c)	AFVV	100mV	50mV	Adjust AFG 'B' O/P level until AFVV indicates 50 mV.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
006 (cont'd)	(d)	RFGen		1.748011MHz to 1.751989MHz	Set RFGen. to a frequency of 1.75 MHz indicated by the frequency counter.
	(e)	RFGen		95mV to 104mV	Set RF Gen. O/P level to 100 mV.
SIDETONE OUTPUT LEVEL (AM)					
08	(a)	CRO	0.1v/ /cm		Set CRO to 0.1v/cm range.
	(b)				Depress "Press-to-test" button.
	(c)	CRO	0.1v/ /cm	430 mV to 500 mV pk-pk	Check amplitude of the non-sinusoidal waveform.
SIDETONE OUTPUT LEVEL (CW)					
010	(a)				Depress "Press-to-test" button.
	(b)	CRO	0.1v/ /cm	430 mV to 500 mV pk-pk	Check amplitude of the non-sinusoidal waveform.
IF OUTPUT LEVEL (SSB)					
012	(a)	AFVV	30mV		Set AFVV to 30 mV range.
	(b)				Depress "Press-to-test" button.
	(c)	AFG 'A'			Adjust AFG 'A' O/P level until AFVV indicates 17.5 mV at a frequency of 2 kHz.
014	(a)	CRO	0.2v/ /cm		Set CRO to 0.2v/cm range.
	(b)				Depress "Press-to-test" button.
	(c)	CRO	0.2V/ /cm	368mV to 807mV pk-pk	Check amplitude of the displayed waveform. Note result.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
IF OUTPUT LEVEL (CW)					
016	(a)				Depress "Press-to-test" button.
	(b)	CRO	0.5V/cm	1.03 to 2.28V pk-pk	Check amplitude of the displayed waveform.
RELAY DRIVE					
018	(a)				Depress "Press-to-test" button.
	(b)	DVM	20V	NGT 2.496V	Check the DVM indication (relay drive with pressel on).
020	(a)				Depress "Press-to-test" button.
	(b)	DVM	20V	5.887V to 6.112V	Check the DVM indication (relay drive with pressel off).
CURRENT CONSUMPTION (PRESSEL ON)					
022	(a)				Depress "Press-to-test" button.
	(b)	DVM	20V	5.887V to 6.112V	Adjust PSU O/P voltage until DVM indicates 6V.
	(c)	AVO	100mA	51mA to 89mA	Check 6V line current.
024	(a)				Depress "Press-to-test" button.
	(b)	DVM	20V	5.887V to 6.112V	Adjust PSU O/P voltage until DVM indicates 6V.
SPEECH CLIPPING THRESHOLD (SSB)					
026	(a)	AFVV	30mV		Set AFVV to the 30 mV range.
	(b)				Depress "Press-to-test" button.
	(c)	AFG 'A'			Adjust AFG 'A' O/P level until AFVV indicates 17.5 mV at 2 kHz.
028	(a)	UUT			Adjust 6cR6 fully counter clockwise.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
028 (cont'd)	(b)				Depress "Press-to-test" button.
	(c)	CRO			Adjust the CRO variable amp. control until the peak to peak displayed waveform
				5 cm	is 5 cm high.
030	(a)	RFVV	300mV		Set RFVV to the 300 mV range.
	(b)				Depress "Press-to-test" button.
	(c)	RFVV		50 - 150mV	Note output level at the RF VV.
032	(a)	AFG 'B'		2 KHz	Set AFG 'B' to min O/P level.
	(b)				Depress "Press-to-test" button.
	(c)	AFVV	30mV		Adjust AFG 'B' O/P level for an indication of 20 dB down on the level measured in test 030 (c).
034	(a)				Depress "Press-to-test" button.
	(b)	UUT			Adjust 6cR6 until the displayed waveform on the CRO is 3.5 cm, Pk - Pk in amplitude, using the unaltered display set in test 028 (c).
					NB The setting of 3.5 cm represents a 3 dB reduction of level from the reference set in test 028 (c).
036	(a)				Depress "Press-to-test" button.
	(b)				Remove UUT. Replace link between TPG and TPH on Unit 6c.

COMPONENTS LISTS

29. The principal component parts of the screen and can assembly 630/1/37605 (unit 6c/d) are:

Pec assembly	630/1/37606
Spacer	640/2/15412
Screen can	630/1/37607

30. The principal component parts of the pec assembly 630/1/37606 are:

Panel electronic circuit (unit 6c)	419/1/24978
Panel electronic circuit (unit 6d)	419/1/24981
Spacer	640/2/09898

A breakdown of the two pec is given on the following pages.

COMPONENTS LIST FOR TRANSMITTER AF & GATING PEC (Unit 6c) 419/1/24978

Cct Ref	Description	Reference No.
	Resistors	
R1	1 Mohm ± 5%	403/4/78127/121
R2	not used	
R3 to R5	4.7 kohm ± 5%	403/4/78126/065
R7, R8	1 kohm ± 5%	403/4/78126/049
R6	5 kohm ± 10% 0.5w variable	404/9/05032/005
	Capacitors	
C1	10nF +80% -20% 100v	400/9/19084/078
C2	47uF ± 10% 6v electrolytic	402/4/98049/003
C3	68nF +80% -20% 50v	400/9/19084/098
C4	10nF +80% -20% 100v	400/9/19084/078
C5	47uF ± 10% 6v electrolytic	402/4/98049/003
C6	330nF ± 20% 35v electrolytic	402/4/98049/082
C7	4.7nF ± 10% 100v	400/9/19083/041
C8	2.2uF ± 20% 20v electrolytic	402/4/98049/053
C9	680nF ± 20% 50v	400/9/19296/001
C10	10nF +80% -20% 100v	400/9/19084/078
C11	470nF +80% -20% 50v	400/9/19084/109
C12	10nF +80% -20% 100v	400/9/19084/078
C13	470nF +80% -20% 50v	400/9/19084/109
C14	4.7uF ± 20% 10v electrolytic	402/4/98049/023
C15	4.7uF ± 20% 10v electrolytic	402/4/98049/023
C16	10nF +80% -20% 100v	400/9/19084/078
C17	10nF +80% -20% 100v	400/9/19084/078
	Inductors	
L1	Inductor 18uH	406/9/08470/027
L2	Inductor 18uH	406/9/08470/027
	Semi-conductor devices	
ML1	Integrated circuit CN 617T	446/4/00428
ML2	Integrated circuit CN 591T	446/4/00418
ML3	Integrated circuit CN 591T	446/4/00418

COMPONENTS LIST FOR
TRANSMITTER AF TO IF PEC (Unit 6d)
419/1/24981

Cct Ref	Description	Reference No.
	Resistors	
R1	15 kohm ± 5%	403/4/78126/077
R2	10 kohm ± 5%	403/4/78126/073
R3	5 kohm ± 10% 0.5w variable	404/9/05032/005
R4	4.7 kohm ± 5%	403/4/78126/065
R5	22 kohm ± 5%	403/4/78126/081
R6	1.5 kohm ± 5%	403/4/78126/053
R7	10 kohm ± 5%	403/4/78126/073
R8	1 kohm ± 10% 0.5w variable	404/9/05032/003
R9	Not used	
R10	750 ohm ± 5%	403/4/78126/046
R11	22 kohm ± 5%	403/4/78126/081
	Capacitors	
C1	4.7uF ± 20% 10v electrolytic	402/4/98049/023
C2	47uF ± 10% 6v electrolytic	402/4/98049/003
C3	10nF +80% -20% 100v	400/9/19084/078
C4 to C6	68nF +80% -20% 50v	400/9/19084/098
C7 to C10	10nF +80% -20% 100v	400/9/19084/078
C11	68nF +80% -20% 50v	400/9/19084/098
	Semi-conductors	
TR1 to TR4	Transistor CV 7648	990/4/00107/648
D1	Diode CV 7367	990/4/00107/367
D2	Diode LR 360C, zener 33v	415/4/05442
D3	Diode CV 7367	990/4/00107/367
ML1	Integrated circuit CN 609T	446/4/00426
ML2	Integrated circuit CN 581T	446/4/00413
ML3	Integrated circuit CN 593F	446/4/00412

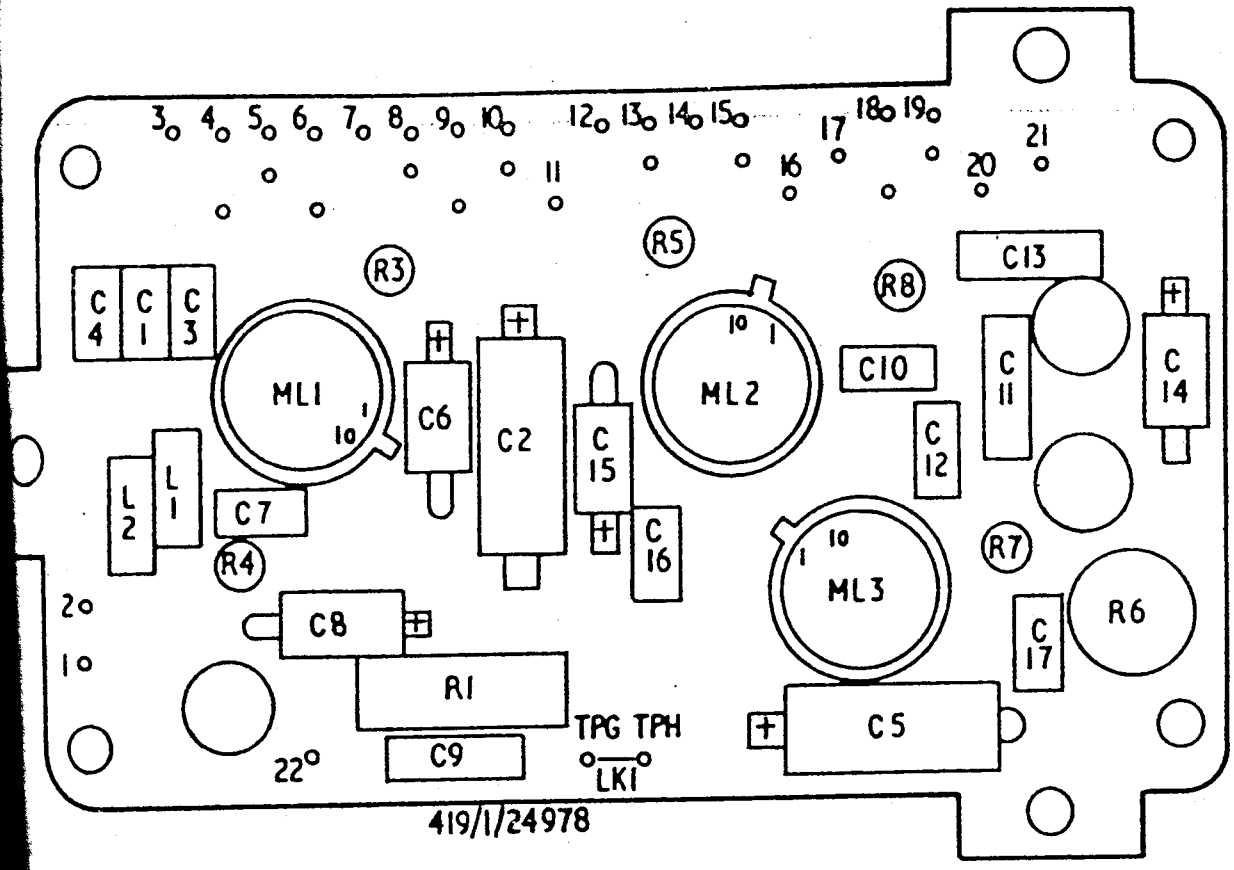

Fig.3 Transmitter AF and gating pec (unit 6c)- component layout

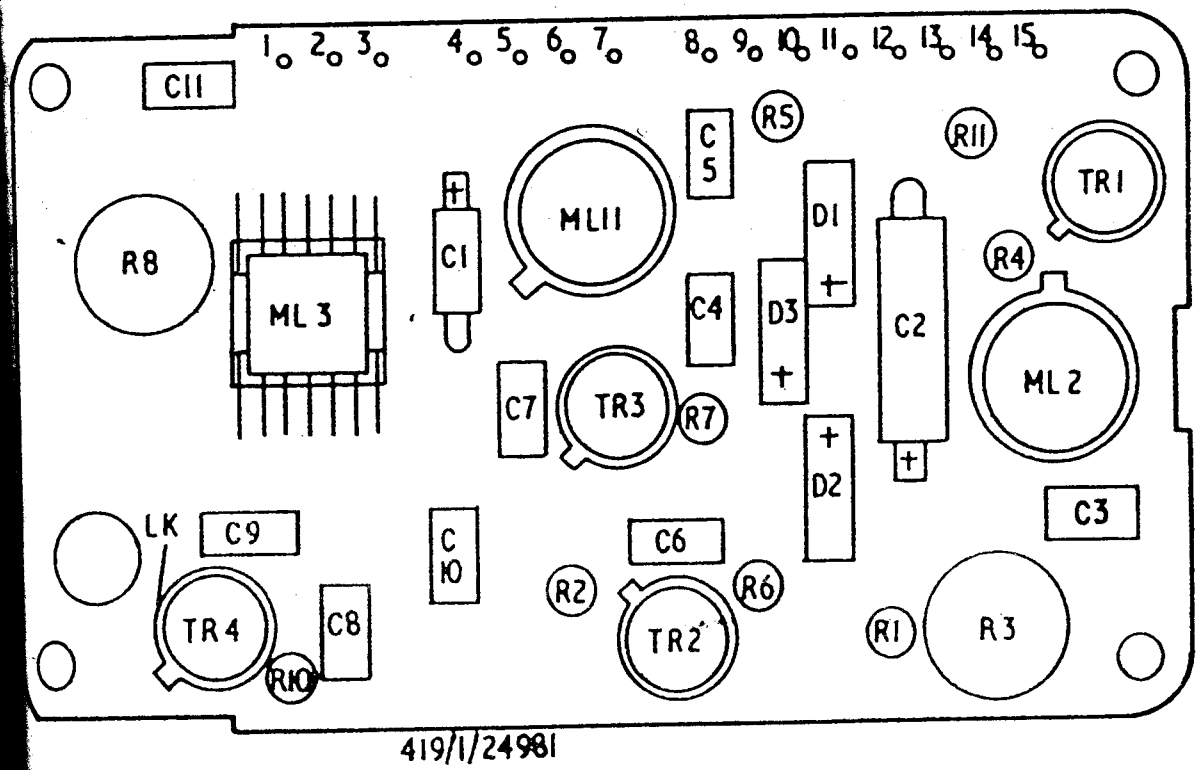

Fig.4 Transmitter AF to IF pec (unit 6d)- component layout

THIRD LINE SERVICING
OF
SCREEN & CAN ASSEMBLY 640/1/09708
(UNIT 6e)

CONTENTS

ILLUSTRATIONS

IPTION

he screen and can assembly (unit 6e) is a component part of the trans- receiver and provides the transmitter IF/RF mixer. The unit is ly located on a mother panel (unit 6).

he unit consists of a screening can and a panel, electronic circuit . All the circuit components are located on the pec. The circuit m is given in Fig. 1.

he input to pin 7 is an IF signal which can be one or other of:

(1) Amplitude modulated 1.75 MHz carrier.

(2) One or both sidebands of a suppressed 1.75 MHz carrier.

he input to pin 5 provides for reinsertion of carrier when required.

4. The IF signal is amplified by TR1 and routed to integrated circuit ML1 via emitter follower TR2. The gain of TR1 is set by means of a wire link connection to select the amount of negative feedback between TR2 emitter and TR1 base; this selection is carried out when setting up the complete transmitter.

5. The integrated circuit ML1 is a double balanced modulator which performs the function of IF/RF mixer. The IF from TR2 is mixed in ML1 with an RF in the range 3.75 MHz to 31.75 MHz supplied to pin 3 of the unit.

6. ML1 output is taken from the unit via TR5. This output is a complex waveform which contains the sum and difference frequencies of the inputs; the original frequencies are suppressed in ML1. Only the difference frequency component of the output is significant, the sum frequencies are rejected at later stages of the transmitter.

TESTING

Test equipment

7. The following items of special-to-purpose test equipment are required:

(1) Manual interface controller. Plessey Type TD4924A.

(2) Test interface. Plessey Type TD50565A.

(3) Test jig. Plessey Type TJ837A.

8. The following items of proprietary test equipment are required:

Item	Description
Avo	A dc milliammeter for measuring current in the range 28 to 48 mA with an accuracy of ± 1% fsd. Suitable instrument: Avo Model 8X
RF Gen.	An RF signal generator to supply an output of 31.75 MHz at 100 mV emf ± 2% and an output impedance of not greater than 100 ohms. Suitable instrument: Marconi TF2002B with TF2170B. Synchronising unit.

RF VM — A selective RF millivoltmeter with the following essential characteristics:

Voltage range	5 mV to 500 mV to accuracy of 5%
Frequency range	Spot frequencies of 1.75 MHz, 30 MHz and 31.75 MHz.
Bandwidth	± 200 kHz at -3dB and ± 1.75 MHz at -60dB
Input impedance	75 ohms ± 5%

Suitable instrument: Bruel and Kjoer Type 2006 with high Z probe fitted with 50 ohm input load.

DVM — A digital voltmeter for measuring 6V to an accuracy of ± 2%
Suitable instrument: Solartron A203/204

PSU — Power supply unit to provide 6.0V ± 20% at 50 mA.
Suitable supply: Farnell L30B

Pad — A 20dB 75 ohm pad.

Preliminary

9. Connect the test interface to the test jig and the manual interface controller.

10. At the manual interface controller:

(1) Set the DC monitor switch to EXT.

(2) Set the test selection switches to 000.

(3) Connect the Avo to the socket marked AVO.

(4) Connect the RF Gen. to the socket marked SG2.

(5) Connect the DVM to the socket marked DVM.

11. Connect synchronising unit to the RF Gen.

12. Connect the RF VM to the manual interface controller socket marked SEL V/M via the 20dB 75 ohm pad in series with the high impedance probe fitted with a 50 ohm load.

13. Connect the PSU to the manual interface controller sockets marked EXT A.

14. Switch on the mains power to all units where applicable.

Test procedures

15. Before proceeding with the tests, calibrate the RF VM to the reference level of 2.5 mV at 30 MHz as described in the manufacturers handbook.

16. Carry out the procedures given on the following pages.

NOTES RELATING TO TESTS

(1) Unit under test is referred to as UUT.

(2) The RF Gen is connected to supply the RF input (pin 3) of the UUT (unit under test). A 1.75 MHz oscillator within the test interface supplies the IF input (pin 7) of the UUT.

(3) The mixer output (pin 1) of the UUT is measured at the RF VM.

(4) Tests 000 to 006 set the supply voltage and check the current drain on the supply.

(5) Test 008 checks the conversion gain by ensuring that particular levels of inputs at 31.75 MHz and 1.75 MHz result in a specific level of output at the difference frequency (30 MHz).

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
000	(a)	INT. CONT.	-	-	Depress "Press to Test" button. Load UUT into jig.
	(b)	AVO	100mA	-	Set AVO to 100mA d.c. range.
	(c)	DVM	10V	-	Set DVM to 10V range.
	(d)	RF GEN		-	Set the RF GEN. to minimum output level.
	(e)	PSU		-	Set the PSU to minimum output voltage.
	(f)	RF VM	50mV	-	Set RF VM to maximum voltage range (check Ref. level).
	(g)	UUT			Ensure that links are fitted between pins 9 and 11 and between pins 10 and 12.
D.C. SUPPLY CURRENT					
002	(a)		-	-	Depress "Press to Test" button.
	(b)	DVM	10V	5.882V to 6.118V	Increase power supply voltage to give 6V on DVM.
004	(a)		-	-	Depress "Press to Test" button.
	(b)	AVO	100mA	29 to 47mA	Check supply current.
006	(a)	-	-	-	Depress "Press to Test" button.
	(b)	DVM	10V	5.882V to 6.118V	Adjust PSU for 6V on DVM.
CONVERSION GAIN					
008	(a)	RF GEN	G	-	Set RF Gen. to 31.75 MHz.
	(b)	SYNC		31.75100MHz to 31.74900MHz	Set Synchronizer to 31.75 MHz.
	(c)	RF GEN	-	100mV	Set RF Gen. output level to 100mV. EMF (50mV on dial).
	(d)	-	-		Depress "Press to Test" button.
	(e)	RF VM	50mV		Set RF VM to the 50mV range, and tune to a peak response at 30 MHz.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
008	(f)	RF VM	50mV	56.4 to 104 mV	Check mixer output at RF VM.
010	(a)	-	-	-	Depress "Press to Test" button.
	(b)				Unload UUT.

COMPONENTS LISTS

17. The principal component parts of the Screen and Can Assembly (Unit 6e) 640/1/09708 are:

Screen can	640/1/09826
Panel electronic circuit	419/1/12055
Spacer	640/2/15412

18. The component parts of the panel elctronic circuit 419/1/12055 are detailed on the following page.

COMPONENTS LIST

FOR

TRANSMITTER IF/RF MIXER PEC (unit 6e)

419/1/12055

Cct Ref	Description	Reference No.
	Resistors	
R1	910 ohm ± 5%	403/4/78126/048
R2	1.8 kohm ± 5%	403/4/78126/055
R3	4.7 kohm ± 5%	403/4/78126/065
R4	3.3 kohm ± 5%	403/4/78126/061
R5	1.6 kohm ± 5%	403/4/78126/054
R6	750 ohm ± 5%	403/4/78126/046
R7	470 ohm ± 5%	403/4/78126/041
R8	1.8 kohm ± 5%	403/4/78126/055
R9	12 ohm ± 5%	403/4/78126/003
R10	22 ohm ± 5%	403/4/78126/009
R11	75 ohm ± 5%	403/4/78126/022
	Capacitors	
C1	10nF +80% -20% 100v	400/9/19084/078
C2	10nF +80% -20% 100v	400/9/19084/078
C3	68nF +80% -20% 100v	400/9/19084/098
C4	10nF +80% -20% 100v	400/9/19084/078
C5	10nF +80% -20% 100v	400/9/19084/078
C6	68nF +80% -20% 100v	400/9/19084/098
C7	220nF +80% -20% 50v	400/9/19084/105
C8	68nF +80% -20% 100v	400/9/19084/098
	Inductors	
L1	Inductor 18uH	406/9/08470/027
	Semi-conductor devices	
TR1	Transistor CV 7648	990/4/00107/648
TR2	Transistor CV 7648	990/4/00107/648
TR3	Transistor BCY 70	417/4/00240
ML1	Integrated circuit CN 609T	446/4/00426

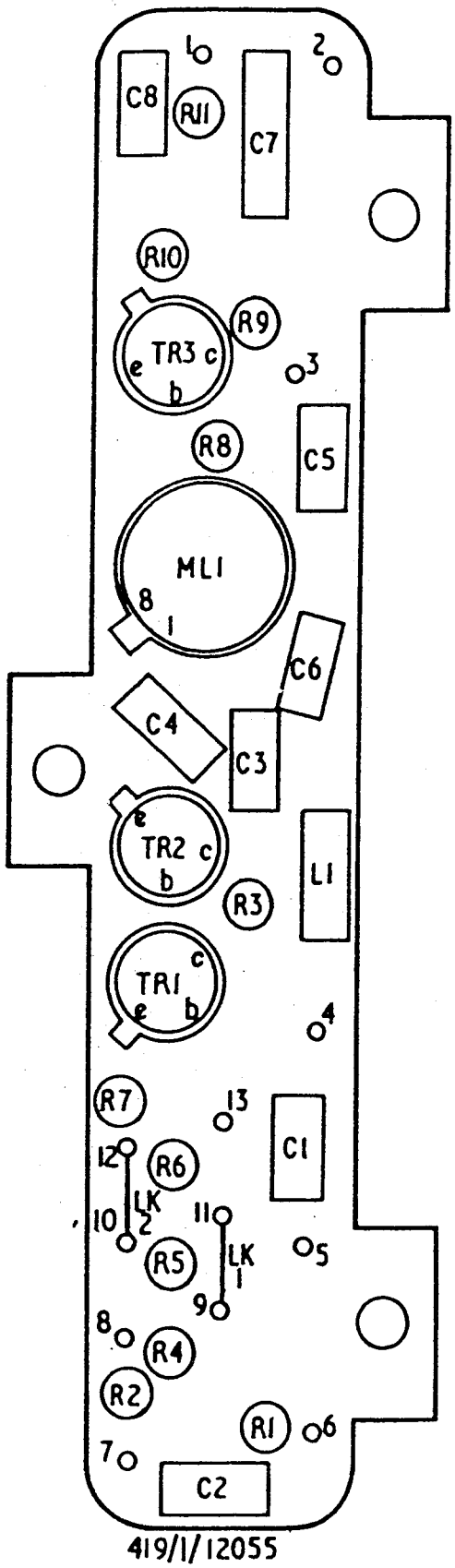

Fig.2 Transmitter IF/RF mixer pec (unit 6e)—
component layout

THIRD [illegible] SERVICING OF SYNTHESISER 682/1/01775 (UNIT 9)

CONTENTS

ILLUSTRATIONS

ILLUSTRATIONS

INTRODUCTION

1. The Synthesiser (Unit 9) is a component part of the receiver transmitter and is normally located on the Front Panel and Chassis Assembly (Unit 1).

2. Unit 9 is a module which, together with a voltage controlled variable frequency oscillator (VFO), a reference oscillator and decade switches, forms a loop that automatically sets and maintains the VFO output to any frequency in the range 3.75 MHz to 31.7499 MHz in 100 Hz increments. A facility is provided whereby the VFO output frequency can be sidestepped by -2 kHz.

3. The module consists of six panels, electronic circuit (pec), termed units 9a to 9f, together with an upper baseplate, lower baseplate and a cover. These items are mounted in a stack on four studs attached to the upper base and sealed by a gasket. Unit 9a is located between the upper and lower baseplates and is thereby fully screened. Pins and filter connectors in the lower baseplate provide terminals for external connections. Apart from printed wiring on the pec, all internal interconnections are by soldered wire leads.

DESCRIPTION

General

4. A functional description of the synthesiser unit, together with supporting block and interconnection diagram is given in Part 2 of this manual (section covering second line servicing of the transmitter receiver). This

information, together with that given in Table 2 (pp 19/20) in this section will normally be sufficient to facilitate location of a faulty p.e.c.

5. The following description is intended to supplement the functional description given in Part 2 of this manual; each pec is covered separately.

Unit 9a (see fig.2)

6. The VFO output signal is applied via buffer amplifier ML1 to a divide-by-four circuit in ML2. The resulting output is a square waveform, at $\frac{1}{4}$ the input frequency, for supply to the variable divider in Unit 9b.

Unit 9b (see fig.3)

7. Unit 9b contains two divider chains, one fixed and one variable.

8. The fixed divider provided by ML1 (÷ 5), ML2 (÷ 5), and ML3 (÷ 7), has an overall division factor of 175. The input to ML1 is a 1.75 MHz square waveform from the reference oscillator and the resulting output is a 10 kHz square waveform for supply to Unit 9c.

9. The variable divider is provided by ML4 to ML8 inc. The overall division factor is determined by binary coded signals from external decade switches (refer to Table 1). The input signal at Unit 9c pin 45 is a variable frequency square waveform derived from the VFO output by Unit 9a; the output signal, at Unit 9b pin 41, comprises positive going pulses with an average prf of 250 Hz when the VFO is operating at the correct frequency.

10. The overall operation of the synthesiser is such that if the decade switches are set to indicate a frequency fi MHz, the VFO output will be:

(1) 1.75 MHz above fi if the command sidestep input (Unit 9b pin 2) is at a potential of between +1.1 and +3V.

(2) 1.7498 MHz above fi if the command sidestep input is open circuit.

NOTE: If the command sidestep facility is not required, the command input line is externally linked to the +3V rail.

Table 1

Frequency setting switch code

Unit 9b Pin	Signals applied in Switch Position										Switch
	0	1	2	3	4	5	6	7	8	9	
9	+	0	+								10MHz
23	0	+	+								
25	0	+	0	+	0	+	0	+	0	+	1MHz
24	0	0	0	0	+	+	0	0	+	+	
7	0	0	0	0	0	0	+	+	+	+	
8	0	0	+	+	+	+	+	+	+	+	
28	+	0	+	0	+	0	+	0	+	0	100kHz
27	0	+	+	0	0	0	0	+	+	0	
5	+	+	+	0	0	0	0	0	0	+	
6	+	+	+	0	0	+	+	+	+	+	
26	0	0	+	+	+	+	+	+	+	+	
31	0	+	0	+	0	+	0	+	0	+	10kHz
30	+	+	0	0	+	+	0	0	0	0	
3	0	0	+	+	+	+	0	0	0	0	
4	+	+	+	+	+	+	0	0	+	+	
29	0	0	0	0	0	+	+	+	+	+	
33	+	0	+	0	+	0	+	0	+	0	1kHz
32	+	0	0	0	0	+	+	0	0	+	
37	+	0	0	0	0	0	0	+	+	+	
1	+	0	0	+	+	+	+	+	+	+	
22	0	+	0	+	0	+	0	+	0	+	100Hz
10	0	+	+	+	+	0	+	+	+	+	
12	+	0	0	+	+	+	+	+	0	0	
21	0	+	+	+	0	0	+	0	0	0	
11	0	+	+	+	+	+	+	+	+	+	
2	+ (Zero sidestep) 0 (-2 kHz sidestep)										

\+ indicates +3V nominal

0 indicates open circuit

Unit 9c (see fig.4)

11. The 10 kHz square waveform derived by Unit 9b from the reference oscillator output is applied to divider stages ML1 and ML2 in Unit 9c to provide:

(1) A 1 kHz square waveform which is taken via TR1 to provide the 1 kHz output from the synthesiser unit.

(2) A 250 Hz square waveform.

12. ML3 in Unit 9c contains two monostable elements, termed ramp mono and sample mono respectively and each producing a train of 30 μs duration pulses. The ramp monostable is triggered by the "250 Hz" output of the variable divider in Unit 9b and the sample monostable is triggered by the 250 Hz output of ML2 in Unit 9c.

13. The outputs of both monostable elements are applied to ML4. The ramp monostable output is also taken to Unit 9f and the sample monostable output is also taken to Unit 9e.

14. ML4 contains two pulse frequency comparator circuits, one produces an output at pin 2 when the ramp mono output frequency is greater than that of the sample mono, the other produces an output at pin 9 when the converse is true; neither output will occur if the two frequencies are within 1 Hz. The outputs consist of a pulse train at the difference frequency and operate the reversible counter in ML5, causing a forward count if a pulse train is applied from ML4 pin 2 and a backwards count if a pulse train is applied from ML4 pin 9. The counter outputs B, C and D are taken to a decoder in Unit 9d.

15. In order to prevent the counter being recycled at the top of the count (i.e. stepping from 15 to 0), the decoder (Unit 9d) output applied to ML4 pin 4, together with the counter output applied to ML4 pin 3, inhibit the forwards count pulse train when the count reaches 15. Similarly, inputs to ML4 pins 10 and 11 inhibit the backwards count pulse train when the count reaches 0, thereby preventing the counter being recycled at the bottom of the count.

16. The output from pin 8 of ML4 is taken via TR2 to provide the phase lock output from the synthesiser, the output at TR2 collector is high when ML4 detects a frequency difference in the two input pulse trains.

NOTE: The collectors of each of TR1 and TR2 must be suitably externally connected to a suitable supply rail via a resistive load. Similarly, for the phase angle output from ML4 pin 1.

17. The phase angle output from ML4 pin 1 is provided for test purposes and is taken to pin 20 of Unit 9, it consists of a pulse train (250 Hz when the VFO is operating at the correct frequency).

18. The LS bit of the counter output, together with the frequency comparator error output pulse trains are taken to Unit 9e.

Unit 9d (see fig.5)

19. The control voltage for supply to the VFO is generated in Unit 9e and taken via the emitter follower TR9 in Unit 9d. The input to the emitter follower contains switched attenuators which are controlled by the decoder ML1.

20. ML1 decodes the 3 most significant bits of the four-bit output of the counter in Unit 9c. The decoder produces a high level at one of its outputs, according to the binary input, and thereby operates one of the transistor switches to select the attenuation at TR9 input.

21. The output from ML1 pins 8 and 3 (decoding a count of 0 or 1, 14 or 15 respectively) are taken to Unit 9c for prevention of counter recycling (para.15).

Unit 9e (see fig.6)

22. The output of a ramp generator in Unit 9f is applied to the emitter of TR1 in Unit 9e.

23. The outputs of the sample mono operate switch TR1 via TR2 and switch TR4 via TR3.

24. Since the negative going ramp is triggered by the ramp mono, that portion of the ramp which is sampled by the switch TR1 will be a function of the difference in phase between the ramp and sample mono outputs. This sample is transferred to capacitor C1. Successive sampling pulses cause C1 to be charged to a mean dc level with a small superimposed ripple. This is passed through the emitter follower TR8/TR9 to a switched attenuator controlled by the least significant bit from the counter in Unit 9c. The level at the attenuator is passed via the emitter follower TR11/12 and Unit 9d to provide the VFO control voltage.

25. Thus, when there is phase lock, a fall in VFO frequency causes the prf of the pulse train from the ramp mono to change such that the ramp occurs later relative to the sample mono pulse. Hence, the voltage level at C1 becomes more positive, increasing the VFO control voltage and thereby increasing the VFO frequency. The reverse will be true if the VFO frequency rises.

26. The control voltage output attenuators in Units 9d and 9e are switched in steps when there is loss of lock. The attenuator switching causes a voltage overlap to occur and, in Unit 6e, either a fast pull up circuit (TR6/TR7) or a fast pull down circuit (TR5) is operated by the appropriate frequency error pulse from Unit 9c to rapidly bring the voltage to an appropriate level.

Unit 9f (see fig.7)

27. This unit provides a ramp generator which is triggered by the ramp mono output.

28. Transistor TR1 is normally switched off. At the positive going leading edge of a 30 μs pulse from the ramp mono, TR1 switches on, causing TR2 to conduct, thereby rapidly charging C2 towards +102V.

29. At the end of the monostable pulse, TR1 and TR2 switch off and C2 discharges through R6 to provide a ramp which is taken via the emitter follower TR3/TR4 to Unit 9e.

TESTING

Test equipment

30. The following items of special-to-purpose test equipment are required:

(1) Manual interface controller. Plessey Type TD4924A.

(2) Test interface. Plessey Type TD50141A.

(3) Test jig. Plessey Type TJ754A.

(4) Frequency controller. Plessey Type TD50150A.

31. The following items of proprietary test equipment are required:

Item	Description
Avo	A dc milliammeter for measuring currents in the range 4 to 400 mA to an accuracy of ± 1% fsd. Suitable instrument: Avo Universal Model 8X
Counter	An electronic counter for measuring frequencies in the range 3 MHz to an accuracy of ± 2 Hz. Suitable instrument: Racal Type 9024
DVM	A digital voltmeter for measuring dc voltages in the range 0 to 115V, having an input impedance of more than 10,000 Megohms and accuracy as follows 10 mV, 100 mV and 1V ranges: ± 0.02% of reading, ± 0.005% of full scale 10V range: ± 0.015% of reading, ± 0.005% of full scale 100V range: ± 0.03% of reading, ± 0.005% of full scale Suitable instrument: Solartron LM1604/05
CRO	Cathode ray oscilloscope having the following essential characteristics: Input: 1 Mohm Input capacitance: 47 pF Rise and fall times: less than 1 μs Vertical deflection: 0.01 V/cm to 10 V/cm to accuracy ± 3% of indicated value

Item		Description
CRO (cont)	Timebase speed	0.5 μs/cm to 1 sec/cm to accuracy ± 3% of indicated value

Suitable instrument: Tektronix 561B with Type 3A6 amplifier and Type 3B3 plug-in unit. A probe unit P6012 (X10 attenuation)

Preliminary

32. Connect the test interface to the test jig and to the manual interface controller.

33. At the test interface:

(1) Set the SLAVE OSCILLATOR RANGE switch to 2.

(2) Connect frequency controller to the socket provided. Set the controller to 12.2000 MHz, sidestep function off.

34. At the manual interface controller:

(1) Set the DC MONITOR switch to EXT.

(2) Set the test selection switches to 000.

(3) Connect AVO to socket marked AVO.

(4) Connect DVM Hi to socket marked DVM and DVM Lo to socket marked DVM floating input.

(5) Connect counter to socket marked COUNTER, set counter for frequency measurement Channel B. 0.01V sensitivity.

(6) Connect a 50 ohm termination to socket marked CRO AMP A TRIG.

NOTE: If using a CRO other than that recommended in para.31, interpret para.35 accordingly.

35. Fit plug-in unit 3A6 and 3B3 to CRO type 561B. Ensure probe P6012 has been correctly compensated to match input impedance of channel 1 of 3A6

amplifier. Connect probe between Channel 1 input of the 3A6 amplifier and the SCOPE socket on the test interface.

36. Switch on the mains power to all test instruments where applicable.

Test procedures

37. Carry out the test procedures given on the following pages.

Notes relating to test procedures

1. The synthesiser under test is referred to as UUT.

2. +3V, +6V, +12.2V and +106 to 115V (varactor) supplies for the UUT are provided by the test interface and the Manual interface controller (see note 6 below).

3. The UUT is connected to a reference oscillator and a slave oscillator (VFO) within the test interface. The UUT therefore operates in a similar manner to its normal working environment.

4. The slave oscillator frequency ranges are the same as the VFO in the radio but are numbered in reverse sequence (i.e. slave oscillator range 1 is the highest frequency range).

5. The parameters measured by the test instruments are readily determined from the test procedures. The following points should be noted:

Tests 008 - 016	check that the UUT causes the correct slave oscillator output frequency at either end of each of ranges 6 to 2. The 30 sec wait before taking readings is to ensure the UUT has regained lock after the switch operation.
Tests 018 - 020	check that the UUT causes the correct slave oscillator output frequency throughout range 1 and includes exercising the decade switch inputs not already exercised. The final check (test 020) verifies that sidestep command is effective.
Test 022	checks the stability of the UUT output.

Test 024/026	check the phase control voltage upper and lower limits by verifying that the correct slave oscillator output frequency is achieved when the selected frequency is slightly outside the range (above range on test 024 and below range on test 026).
Test 027/028	check phase lock output voltage under test conditions which ensure loss of lock (test 027) and lock (test 028).
Test 030	checks the phase angle output under test conditions which give lock (i.e. ensure a waveform with 250 Hz prf).

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
NOTE: Before commencing tests, ensure that the test interface has been switched on for at least 4 minutes to allow stabilisation of reference oscillator frequency.					
000	(a)	INT. CON.	-	-	Depress "Press to Test" button.
	(b)	AVO	1 Amp	-	Set AVO to 1A dc range.
	(c)	DVM	10V	-	Set DVM to 10V range.
	(d)	TEST INT.	-	-	Load UUT into test jig.
	(e)	INT. CON.	-	Set 110.0V	Set varactor supply voltage to 110.0V and set slave oscillator to range 2.
+3 VOLT LINE CURRENT (PIN 19)					
002	(a)	INT. CON.	-	-	Depress "Press to Test" button.
	(b)	AVO	1 AMP	NGT 355 mA	Check +3V line current.
+6 VOLT LINE CURRENT (PIN 36)					
004	(a)	AVO	100 mA	-	Set AVO to 100 mA range.
	(b)	INT. CON.	-	-	Depress "Press to Test" button.
	(c)	AVO	100 mA	NGT 29.5 mA	Check +6V line current.
+110 VOLT LINE CURRENT (PIN 15)					
006	(a)	AVO	10 mA	-	Set AVO to 10 mA range.
	(b)	INT. CON.	-	-	Depress "Press to Test" button.
	(c)	AVO	10 mA	5.3 mA to 4.2 mA	Check +110V line current.
SLAVE OSCILLATOR FREQUENCY ACCURACY					
008	(a)	AVO	1 AMP	-	Set AVO to 1A dc range.
	(b)	INT. CON.	-	Set 106.7V	Set varactor supply voltage to 106.7V. Set slave osc to range 6.
	(c)	FREQ. CON.	-	Set 2.0000 MHz	Set Freq Cont to 2.0000 MHz and set sidestep switch to OFF.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
008 (cont)	(d)	INT. CON.	-	-	Depress "Press to Test" button.
	(e)	COUNTER	-	3.750,003 3.749,997 MHz	Wait 30 sec and check slave osc freq.
	(f)	FREQ. CON.	-	Set 3.1000 MHz	Set Freq Cont to 3.1000 MHz (sidestep off).
	(g)	COUNTER	-	4.850,004 4.849,996 MHz	Wait 30 sec and check slave osc freq.
010	(a)	INT. CON.	-	-	Depress "Press to Test" button. Set slave osc to range 5.
	(b)	COUNTER	-	4.850,004 4.849,996 MHz	Wait 30 sec and check slave osc freq.
	(c)	FREQ. CON.	-	Set 4.9000 MHz	Set Freq Cont to 4.9000 MHz (sidestep off).
	(d)	COUNTER	-	6.650,007 6.649,993 MHz	Wait 30 sec and check slave osc freq.
012	(a)	INT. CON.	-	-	Depress "Press to Test" button. Set slave osc to range 4.
	(b)	COUNTER	-	6.650,007 6.649,993 MHz	Wait 30 sec and check slave osc freq.
	(c)	FREQ. CON.	-	Set 7.7000 MHz	Set Freq Cont to 7.7000 MHz (sidestep off).
	(d)	COUNTER	-	9.450,011 9.449,989 MHz	Wait 30 sec and check slave osc freq.
014	(a)	INT. CON.	-	-	Depress "Press to Test" button. Set slave osc to range 3.
	(b)	COUNTER	-	9.450,011 9.449,989 MHz	Wait 30 sec and check slave osc freq.
	(c)	FREQ. CON.	-	Set 12.2000 MHz	Set Freq Cont to 12.2000 MHz (sidestep off).

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
014 (cont)	(d)	COUNTER	-	13.950,017 13.949,983 MHz	Wait 30 sec and check slave osc freq.
016	(a)	INT. CON.	-	-	Depress "Press to Test" button. Set slave osc to range 2.
	(b)	COUNTER	-	13.950,017 13.949,983 MHz	Wait 30 sec and check slave osc freq.
	(c)	FREQ. CON.	-	Set 19.1000 MHz	Set Freq Cont to 19.1000 MHz (sidestep off).
	(d)	COUNTER	-	20.850,027 20.849,973 MHz	Wait 30 sec and check slave osc freq.
018	(a)	INT. CON.	-	-	Depress "Press to Test" button. Set slave osc to range 1.
	(b)	COUNTER	-	20.850,027 20.849,973 MHz	Wait 30 sec and check slave osc freq.
	(c1)	FREQ. CON.	-	Set 20.1000 MHz	Set Freq Cont to 20.1000 MHz (sidestep off).
	(c2)	COUNTER	-	21.850,028 21.849,972 MHz	Wait 5 sec and check slave osc freq.
	(d1)	FREQ. CON.	-	Set 21.1000 MHz	Set Freq Cont to 21.1000 MHz (sidestep off).
	(d2)	COUNTER	-	22.850,030 22.849,970 MHz	Wait 5 sec and check slave osc freq.
	(e1)	FREQ. CON.	-	Set 25.1000 MHz	Set Freq Cont to 25.1000 MHz (sidestep off).
	(e2)	COUNTER	-	26.850,035 26.849,965 MHz	Wait 5 sec and check slave osc freq.
	(f1)	FREQ. CON.	-	Set 26.1000 MHz	Set Freq Cont to 26.1000 MHz (sidestep off).
	(f2)	COUNTER	-	27.850,037 27.849,963 MHz	Wait 5 sec and check slave osc freq.
	(g1)	FREQ. CON.	-	Set 28.1000 MHz	Set Freq Cont to 28.1000 MHz (sidestep off).

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
018 (cont)	(g2)	COUNTER	-	29.850,039 29.849,961 MHz	Wait 5 sec and check slave osc freq.
	(h1)	FREQ. CON.	-	Set 29.1111 MHz	Set Freq Cont to 29.1111 MHz (sidestep off).
	(h2)	COUNTER	-	30.861,141 30.861,059 MHz	Wait 5 sec and check slave osc freq.
	(i1)	FREQ. CON.	-	Set 29.2222 MHz	Set Freq Cont to 29.2222 MHz (sidestep off).
	(i2)	COUNTER	-	30.972,241 30.972,159 MHz	Wait 5 sec and check slave osc freq.
	(j1)	FREQ. CON.	-	Set 29.3333 MHz	Set Freq Cont to 29.3333 MHz (sidestep off).
	(j2)	COUNTER	-	31.083,342 31.083,258 MHz	Wait 5 sec and check slave osc freq.
	(k1)	FREQ. CON.	-	Set 29.4444 MHz	Set Freq Cont to 29.4444 MHz (sidestep off).
	(k2)	COUNTER	-	31.194,442 31.194,358 MHz	Wait 5 sec and check slave osc freq.
	(l1)	FREQ. CON.	-	Set 29.5555 MHz	Set Freq Cont to 29.5555 MHz (sidestep off).
	(l2)	COUNTER	-	31.305,542 31.305,458 MHz	Wait 5 sec and check slave osc freq.
	(m1)	FREQ. CON.	-	Set 29.6666 MHz	Set Freq Cont to 29.6666 MHz (sidestep off).
	(m2)	COUNTER	-	31.416,642 31.416,558 MHz	Wait 5 sec and check slave osc freq.
	(n1)	FREQ. CON.	-	Set 29.7777 MHz	Set Freq Cont to 29.7777 MHz (sidestep off).
	(n2)	COUNTER	-	31.527,742 31.527,658 MHz	Wait 5 sec and check slave osc freq.
	(o1)	FREQ. CON.	-	Set 29.8888 MHz	Set Freq Cont to 29.8888 MHz (sidestep off).
	(o2)	COUNTER	-	31.638,842 31.638,758 MHz	Wait 5 sec and check slave osc freq.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
018 (cont)	(p1)	FREQ. CON.	-	Set 29.9999 MHz	Set Freq Cont to 29.9999 MHz (sidestep off)
	(p2)	COUNTER	-	31.749,942 31.749,858 MHz	Wait 5 sec and check slave osc freq.
020	(a)	INT. CON.	-	-	Depress "Press to Test" button.
	(b)	FREQ. CON.	-	29.9999 MHz	Check that Freq Cont is set to 29.9999 MHz. Set sidestep ON.
	(c)	COUNTER	-	31.747,942 31.747,958 MHz	Wait 5 sec and check slave osc freq.
022	(a)	INT. CON.	-	Set 113.3V	Set varactor supply voltage to 113.3V.
	(b)	FREQ. CON.	-	29.9999 MHz	Check that Freq Cont is set to 29.9999 MHz (sidestep on).
	(c)	INT. CON.	-	-	Depress "Press to Test" button.
	(d)	COUNTER	-	31.747,934 31.747,866 MHz	Wait 5 sec and not slave osc freq.
	(e)	COUNTER	-	Within +18 Hz	Check that the frequency drift over a period of 20 secs does not exceed +18 Hz.
PHASE CONTROL VOLTAGE LIMITS					
024	(a)	INT. CON.	-	Set 106.7V	Set varactor supply voltage to 106.7V.
	(b)	INT. CON.	-	-	Depress "Press to Test" button. Set slave osc to range 6.
	(c)	FREQ. CON.	-	Set 3.17 MHz	Set Freq Cont to 3.17 MHz. Set sidestep to OFF.
	(d)	COUNTER	-	4.920,005 4.919,995 MHz.	Wait 30 sec and check slave osc freq.
026	(a)	INT. CON.	-	Set 113.3V	Set varactor supply voltage to 106.7V.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
026 (cont)	(b)	INT. CON.	-	-	Depress "Press to Test" button. Set slave osc to range 3.
	(c)	FREQ. CON.	-	Set 7.55 MHz	Set Freq Cont to 7.55 MHz (sidestep off).
	(d)	COUNTER	-	9.300,010 9.299,990 MHz	Wait 30 sec and check slave osc freq.
PHASE LOCK OUTPUT (PIN 14)					
027	(a)	INT. CON.	-	Set 110.0V	Set varactor supply voltage to 110.0V.
	(b)	INT. CON.	-	-	Depress "Press to Test" button. Set slave osc to range 2.
	(c)	FREQ. CON.	-	Set 22.2000 MHz	Set Freq Cont to 22.2000 MHz (sidestep off).
	(d)	DVM	1V	NGT 0.0398V	Check phase lock output.
028	(a)	INT. CON.	-	-	Depress "Press to Test" button. Set slave osc to range 3.
	(b)	FREQ. CON.	-	Set 12.2000 MHz	Set Freq Cont to 12.2000 MHz (sidestep off).
	(c)	DVM	1V	NGT 0.398V	Check phase lock output.
PHASE ANGLE OUTPUT (PIN 20)					
030	(a)	FREQ. CON.	-	Set 12.2000 MHz	Ensure Freq Cont is set to 12.2000 MHz (sidestep off).
	(b)	INT. CON.	-	-	Depress "Press to Test" button. Ensure varactor supply voltage is 110V.
	(c)	CRO	0.2V/cm 0.5mS/cm	NLT 7.2V	Check upper level of displayed waveform, commencing at a point 180 µs after leading edge. The real value should be NLT 7.2V wrt 0V.
	NOTE: Real value is measured value with allowance for probe attenuation.				
	(d)	CRO	0.02V/cm 0.5mS/cm	NGT 90 mV	Check that the real value of the lower level of displayed waveform wrt 0V is NGT 90 mV.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
1 kHz FIXED FREQUENCY OUTPUT (PIN 13)					
032	(a)	INT. CON.	-	-	Depress "Press to Test" button. Ensure varactor supply voltage is 110V.
	(b)	COUNTER	1.0V	0.999 to 1.001 kHz	Check 1 kHz output frequency.
	(c)	CRO	0.2mS/cm 0.2V/cm	-	Examine 1 kHz output waveform.
	(d)	CRO	50 µs/cm 0.2V/cm	NLT 11.4V	Check upper level of displayed waveform, commencing at a point 180 µs after the positive going edge. The real value should be NLT 11.4V wrt OV.
	(e)	CRO	0.2V/cm 50 µs/cm	NGT 388 mV	Check that real value of lower level of displayed waveform is NLT 388 mV wrt OV.
034	(a)	INT. CON.	-	-	Depress "Press to Test" button. Set varactor voltage to zero.
	(b)	TEST INT.	-	-	Remote UUT.

Table 2

Typical signal levels

NOTE: This table is to assist in the location of possible faults and is not to be used for inspection purposes.

Unit	Pin	Function	Pulse width	Typical Amplitude	Remarks
9a	38	RF input		1.4V p-p	3.748 MHz - 31.7499 MHz
9b	45	Clock	Variable	0.7V p-p	937 kHz - 8 MHz
9b	8	Ref input	Mark space 2.2:1 to 1:2.2	1.1 to 3V p-p	1.75 MHz
9b	41	Count output	125 ns to 1.1 µs	1.1V p-p	250 Hz prf nominal
9b	40	10 kHz output	Mark space 4:3	1.1V p-p	
9c	5	1 kHz output	Mark space 2:3	11.5V p-p	
9c	6	Phase lock	dc dc	0-400 mV* 11.5V*	In lock Out of lock
9c	11	Phase angle output	Variable	7.5V p-p	If output connected via 8K to +8V supply
9c	12	Ramp mono	30 µs	1.1V p-p	250 Hz prf nominal
9c	3	Sample mono	30 µs	1.1V p-p	250 Hz prf nominal
9c	1	Counter D	Variable	1.0V p-p	To see these waveforms the synthesiser must be out of lock with pins 4 and 15 of Unit 9c disconnected
9c	2	Counter C			
9c	17	Counter B			
9c	18	Counter A			
9d	12	Limit state	dc	1.0V	VFO at range 1 & 3.1 MHz selected

* When output connected via 12K to +12V supply.

Table 2 continued

Unit	Pin	Function	Pulse width	Typical Amplitude	Remarks
9d	2	Limit state	dc	1.0V	VFO at range 2 3.1 MHz selected
9c	8	Range control	dc	6 to 88V	level depends on channel frequency selected
9f	2	Ramp output	4 ms	22V p-p	4 ms period if phase lock (Sweep from +98V to +75V approx)
9e	10	Phase output	dc	50-102V	level depends on channel frequency selected

REPAIR POLICY

38. It is recommended that repair of the synthesiser at third line be limited to replacement of faulty pec. Replacement of component parts on pec should be carried out only if locally authorised.

39. Following repair and assembly, the tests given in this section must be carried out in full.

40. A faulty unit returned to third line for repair should have the cover removed and be subjected to the test given in this section. If an incorrect result is obtained, maintain the test conditions and, with the aid of the data given in Table 2, attempt to diagnose which pec is at fault.

CAUTION: The synthesiser is employed, and tested, as part of a loop. Hence a fault condition could give rise to incorrect signal conditions at all, or most, points in the loop. The indiscriminate exchanging of pec as a means of locating the faulty pec should be avoided because excessive soldering/unsoldering of wire link interconnections can damage a pec.

ASSEMBLY/DISASSEMBLY

NOTE: Refer to fig.8 for component location and to fig.9 for interconnecting wire link data.

Cover

41. To remove the cover, proceed as follows:

(1) Remove the four nuts and washers securing the cover.

(2) Remove the fixing bracket (if still fitted after removal of Unit 9 from Unit 1).

(3) Remove the cover.

(4) Discard the exposed gasket.

42. To replace the cover, fit a new gasket (para.43), fit the cover and fixing bracket (if available). Secure with the four nuts and washers, tightening the nuts to a torque of 2.25 $\pm$ 0.25 lb. inches.

43. To fit a new gasket, it is necessary to trim the replacement to the required length - the join should be positioned approx. midway along any one side and the ends sealed using a silicone rubber sealant approx. 0.25 in. either side of joint.

Units 9c to 9f

NOTE: All orientation given below assumes that the synthesiser is positioned with its base lower most. The component sides of the pec are then:

Units 9d and 9f - component side facing down
Units 9e and 9c - component side facing up.

44. To replace any one of Units 9c, 9d, 9e or 9f, proceed as follows:

(1) Remove the cover (para.41).

(2) Locate and unsolder the wire links connected to the edge slots of the unit to be replaced. Any link that provides a through connection

should also be unsoldered at all units above, or all units below, whichever involves the fewest edge slots.

(3) If removing Unit 9c, unsolder the fixed pin from terminal 22 on Unit 9c.

(4) At the top of the synthesiser, remove the four nuts and washers from the studs which pass through the spacer pillars of all units.

(5) Withdraw, as a block, all units above that which is to be replaced.

(6) Remove the unit which is to be replaced.

(7) Position the replacement unit with its pillars over the four fixing studs and with its component side correctly oriented (see note above). In the case of positioning Unit 9c, ensure that the fixed pin locates with, and moves freely into, terminal 22 of the unit.

(8) Position the block of units (withdrawn in (4) above), with their pillars over the four fixing studs.

(9) Secure the units in place with four nuts and washers.

(10) Solder the fixed pin to terminal 22 of Unit 9c (only if this unit replaced).

(11) Solder all wire links disconnected in (2) above. If necessary, renew links using 22 swg tinned copper wire.

(12) Fit the cover (para.42).

Unit 9a

45. To replace Unit 9a, proceed as follows:

(1) Remove the cover (para.41).

(2) At the top of the synthesiser, remove the four nuts and washers from the studs which pass through the spacer pillars on all units.

(3) At the bottom of the synthesiser, withdraw the lower base and the four studs.

(4) The printed circuit side of Unit 9a is now exposed. Unsolder the joints at terminals 1, 2, 3 and 4.

(5) Remove the two screws and washers which secure Unit 9a to the upper base and remove the unit.

(6) Place the replacement Unit 9a in position, ensuring that the fixed pins locate correctly to terminals 1, 2, 3 and 4 on the unit.

(7) Secure Unit 9a in position using two screws and washers.

(8) Solder terminals 1, 2, 3 and 4.

(9) Replace the lower base and the four studs.

(10) Secure the units with four nuts and washers.

(11) Fit the cover (para.42).

Unit 9b and upper base

46. Special soldering techniques are employed during construction and no attempt should be made to spearate Unit 9b from the upper base or to replace filter connectors on the base. However, discrete components on Unit 9b can be replaced and are accessible after Units 9b - 9f have been removed.

47. To replace Unit 9b/upper base, proceed as follows:

(1) Remove Units 9b - 9f as a block, employing the procedure given in para.44(1) to (5).

(2) At the bottom of the synthesiser, withdraw the lower base and the four studs.

(3) The replacement upper base assembly is supplied complete with Units 9a and 9b. Fit the lower base and the four studs to this

assembly and then fit Units 9b - 9f, employing the procedures given in para.44(7) to (12).

COMPONENTS LIST

48. The principal component parts of the Synthesiser Unit 682/1/01775 are:

Description	Reference No.
Base lower	682/2/01777
Base, upper assembly including:-	682/1/00409
Panel, electronic circuit (Unit 9a)	682/1/00450
Panel, electronic circuit (Unit 9b)	682/1/00460
Panel, electronic circuit (Unit 9c)	419/1/24984
Panel, electronic circuit (Unit 9d)	682/1/00480
Panel, electronic circuit (Unit 9e)	682/1/00490
Panel, electronic circuit (Unit 9f)	682/1/00500
Gasket	682/2/00241
Cover	682/2/01776

49. Components list for each of Units 9a to 9f are given on the following pages.

COMPONENTS LIST FOR UNIT 9a 682/1/00450

Cct Ref	Description	Reference No.
	Resistors	
R1	12 kohm ± 5%	403/4/78126/075
R2	39 ohm ± 5%	403/4/78126/015
R3	560 ohm ± 5%	403/4/78126/043
R4	56 kohm ± 5%	403/4/78126/091
	Capacitors	
C1 to C6	4.7nF ± 10% 100v	400/9/18794/036
	Inductors	
L1	Inductor R.F.	406/9/08470/024
	Semi-conductor devices	
ML1	Integrated circuit CN 295F	446/4/00236
ML2	Integrated circuit CN 303F	446/4/00240

COMPONENTS LIST FOR UNIT 9b 682/1/00460

Cct Ref	Description	Reference No.
	Resistors	
R1	3.3 kohm ± 5%	403/4/78126/061
	Capacitors	
C1	6.8nF ± 10% 100v	400/9/18794/038
	Inductors	
L1	Inductor, R.F.	406/9/08470/016
	Semi-conductor devices	
ML1	Integrated circuit CN 333F	446/4/00244
ML2	Integrated circuit CN 333F	446/4/00244
ML3	Integrated circuit CN 333F	446/4/00244
ML4	Integrated circuit CN 311F	446/4/00223
ML5	Integrated circuit CN 317F	446/4/00226
ML6	Integrated circuit CN 317F	446/4/00226
ML7	Integrated circuit CN 321F	446/4/00229
ML8	Integrated circuit CN 325F	446/4/00230

COMPONENTS LIST FOR
UNIT 9c 419/1/24984

Cct Ref	Description	Reference NO.
	Resistors	
R1	1.5 kohm ± 5%	403/4/78126/053
R2, R3	10 kohm ± 5%	403/4/78126/073
R4 to R7	3.3 kohm ± 5%	403/4/78126/061
R8	33 kohm ± 5%	403/4/78126/085
R9	33 ohm ± 5%	403/4/78126/013
	Capacitors	
C1	6.8nF ± 10% 100v	400/9/18794/038
C2, C3	4.7nF ± 10% 100v	400/9/18794/036
C4	22uF ± 10% 15v electrolytic	402/4/98049/030
	Inductors	
L1	Inductor, R.F.	406/9/08470/020
	Semi-conductor devices	
TR1, TR2	Transistor CV 7555	990/4/00107/555
ML1, ML2	Integrated circuit CN 333F	446/4/00244
ML3	Integrated circuit CN 309F	446/4/00234
ML4	Integrated circuit CN 337F	446/4/00247
ML5	Integrated circuit CN 339F	446/4/00232

COMPONENTS LIST FOR
UNIT 9d 682/1/00480

Cct Ref	Description	Reference No.
	Resistors	
R1	115 kohm ± 1%	403/9/03511/008
R2	47.5 kohm ± 1%	403/9/03511/007
R3	26.1 kohm ± 1%	403/9/03511/005
R4	16 kohm ± 1%	403/9/03511/004
R5	10.5 kohm ± 1%	403/9/03511/003
R6	6.98 kohm ± 1%	403/9/03511/002
R7	4.75 kohm ± 1%	403/9/03511/001
R8	680 ohm ± 5%	403/4/78126/045
R9	100 kohm ± 5%	403/4/78126/097
R10	39 kohm ± 1%	403/4/78126/287
	Capacitors	
C1	220nF ± 5% 160v plastics	400/9/18791/028
	Semi-conductor devices	
TR1 to TR7	Transistor SGS - U14 909/4	417/4/05086
TR8	Transistor SGS - U14 906/4	417/4/05089
TR9	Transistor SGS - U14 908/4	417/4/05087
ML1	Integrated circuit CN 341F	446/4/00233

COMPONENTS LIST FOR
UNIT 9e 682/1/00490

Cct Ref	Description	Reference No.
	Resistors	
R1	1.5 kohm ± 5%	403/4/78126/053
R2	33 kohm ± 5%	403/4/78126/085
R3	15 kohm ± 5%	403/4/78126/077
R4	1.5 kohm ± 5%	403/4/78126/053
R5	1.5 kohm ± 5%	403/4/78126/053
R6	4.7 kohm ± 5%	403/4/78127/065
R7	330 ohm ± 5%	403/4/78127/037
R8	1.5 kohm ± 5%	403/4/78126/053
R9	27 kohm ± 5%	403/4/78127/083
R10	1.5 kohm ± 5%	403/4/78126/053
R11	2.2 kohm ± 5%	403/4/78126/057
R12	120 kohm ± 5%	403/4/78126/099
R13	100 kohm ± 5%	403/4/78126/097
R14	47 kohm ± 1%	403/4/78126/289
R15	1.5 kohm ± 5%	403/4/78126/053
R16	261 kohm ± 1%	403/9/03511/009
R17	150 kohm ± 5%	403/4/78126/101
R18	47 kohm ± 1%	403/9/03511/006
	Capacitors	
C1	470nF ± 5% 160v plastics	400/9/18791/029
	Semi-conductor devices	
TR1	Transistor SGS -U14 906/4	417/4/05089
TR2	Transistor SGS -U14 909/4	417/4/05086
TR3	Transistor CV 7555	990/4/00107/555
TR4, 5, 6.	Transistor SGS -U14 909/4	417/4/05086
TR7	Transistor SGS -U14 906/4	417/4/05089
TR8, 9.	Transistor SGS -U14 908/4	417/4/05087
TR10	Transistor SGS -U14 909/4	417/4/05086
TR11, 12	Transistor SGS -U14 908/4	417/4/05087
D1	Diode 1N3070	415/4/05440

COMPONENTS LIST FOR
UNIT 9f 682/1/00500

Cct Ref	Description	Reference No.
	Resistors	
R1	1.5 kohm ± 5%	403/4/78126/053
R2	12 kohm ± 1%	403/4/78126/275
R3	150 kohm ± 1%	403/4/78126/301
R4	2.2 kohm ± 5%	403/4/78126/057
R5	27 kohm ± 5%	403/4/78126/083
R6	680 kohm ± 1%	403/9/03511/012
R7	150 kohm ± 5%	403/4/78126/101
R8	220 kohm ± 5%	403/4/78127/105
R9	4.7 kohm ± 5%	403/4/78126/065
R10	100 kohm ± 5%	403/4/78126/097
	Capacitors	
C1	9uF ± 20% 125v electrolytic	402/4/98190/076
C2	22nF ± 5% 160v plastic	400/9/18791/027
C3	9uF ± 20% 125v electrolytic	402/4/98190/076
	Semi-conductor devices	
TR1	Transistor SGS -U14 909/4	417/4/05086
TR2	Transistor SGS -U14 906/4	417/4/05089
TR3	Transistor SGS -U14 908/4	417/4/05087
TR4	Transistor SGS -U14 907/4	417/4/05088
D1	Diode 1N3070	415/4/05440

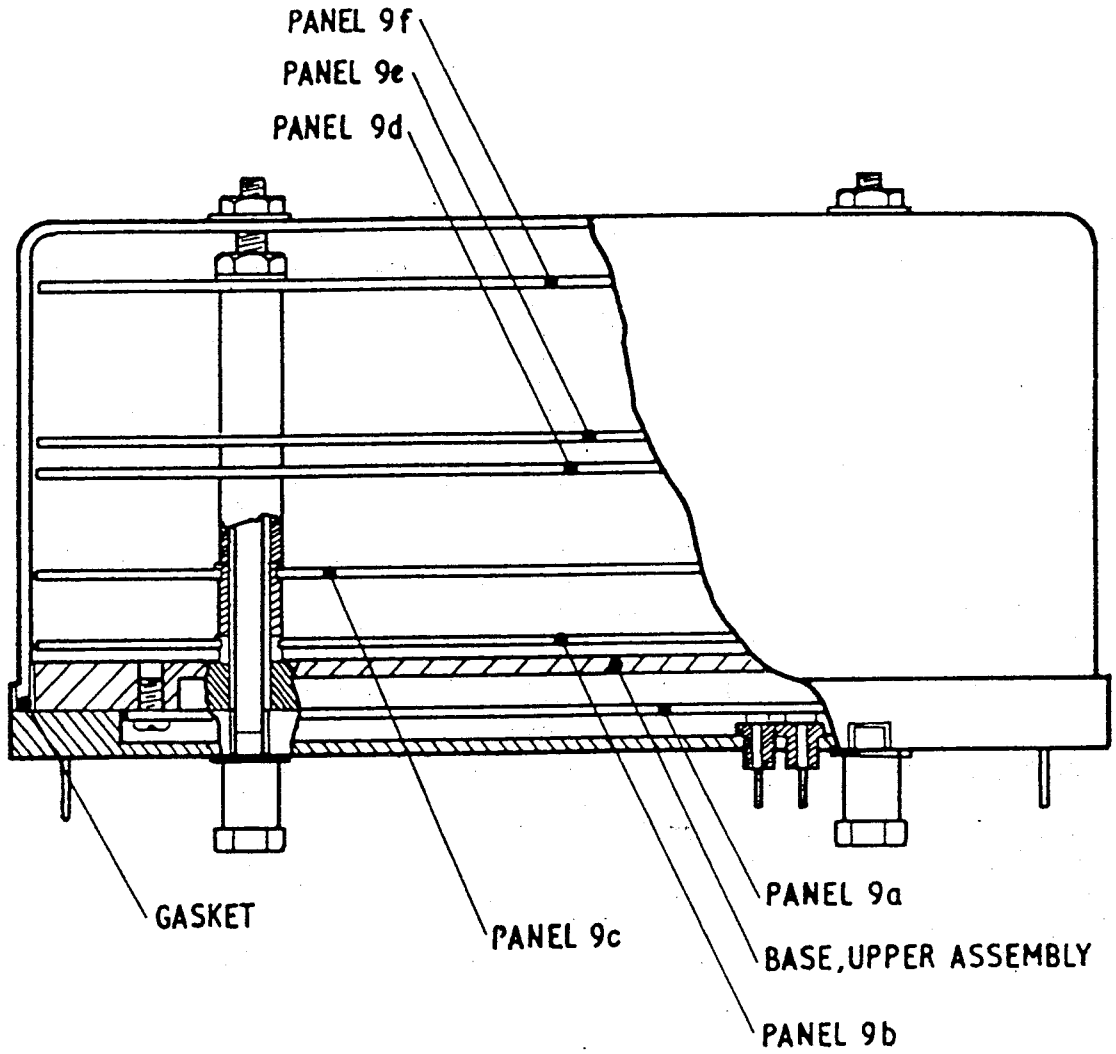

Fig.8 Synthesizer assembly

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
STATE OF CHARGE INDICATION					
22	(a)	LOAD SWITCH	27V	-	Switch the load switch to the 27V position.
	(b)	VOLT-METER	VR1 VOLTS	-	Switch the voltmeter to the VR1 VOLTS mode and range to 199.9 mV.
	(c)	VOLT-METER	199.9 mV	20.1 mV to 21.9 mV	Adjust VR1 on the test set to obtain a reading of 21 mV.
23	(a)	UUT	-	1L1 illuminated	Check the amber lamp 1L1.
24	(a)	UUT	-	1L2 extinguished	Check the green lamp 1L2.
25	(a)	CUR METER	OUTPUT CURRENT	-	Switch the current meter to the OUTPUT CURRENT mode and range to 199.9 mA. (Divide button not selected).
	(b)	CUR METER	199.9 mA	NGT 9.98 mA	Adjust VR1 on test set to obtain a reading of NGT 9.98 mA.
26	(a)	VOLT-METER	VR1 VOLTS	-	Switch the voltmeter to the VR1 VOLTS mode and range to 199.9 mV.
	(b)	VOLT-METER	199.9 mV	22.1 mV to 37.9 mV	Check the reading.
27	(a)	UUT	-	1L1 extinguished	Check the amber lamp 1L1.
28	(a)	UUT	-	1L2 illuminated	Check the green lamp 1L2.
29	(a)	VOLT-METER	VR1 VOLTS	-	Switch the voltmeter to the VR1 VOLTS mode and range to 199.9 mV.
	(b)	VOLT-METER	199.9 mV	40 mV	Adjust VR1 on test set to obtain a reading of 40 mV.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
30	(a)	CUR METER	OUTPUT CURRENT	-	Switch the current meter to the OUTPUT CURRENT mode and range to 1.999A.
	(b)	CUR METER	1.999A	0.904A to 1.288A	Adjust VR1 on test set to set the current meter reading.
31	(a)	VOLT-METER	199.9 mV	15.1 mV to 31.9 mV	Check the reading.
32	(a)	UUT	-	1L1 illuminated	Check the amber lamp 1L1.
33	(a)	UUT	-	1L2 extinguished	Check the green lamp 1L2.
34	(a)	VOLT-METER	199.9 mV	NGT 0.45 mV	Operate VR1 S/C switch on test set to obtain a reading of NGT 0.45 mV.
OVERVOLTAGE PROTECTION					
35	(a)	VOLT-METER	INPUT VOLTS	-	Switch the voltmeter to the INPUT VOLTS mode and range to 199.9V.
	(b)	VOLT-METER	199.9V	19.5V to 20.5V	Adjust the external power supply output voltages to obtain a reading of 20V.
36	(a)	CUR METER	OUTPUT CURRENT	-	Switch the current meter to the OUTPUT CURRENT mode and range to 199.9 mA.
	(b)	CUR METER	199.9 mA	NGT 9.98 mA	Check the reading.
	(c)	UUT	-	-	Disconnect UUT from test set.
NOTE: Test the UUT for sealing and leakage as in Part 3, para.38.					
HIGH INPUT VOLTAGE					
37	(a)	LOAD SWITCH	330 ohm	-	Switch the load switch to the 330 ohm position.
	(b)	UUT	-	-	Switch S1 and S2 to ON.
	(c)	VOLT-METER	INPUT VOLTS	-	Switch the voltmeter to the INPUT VOLTS mode and range to 199.9V.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
37 (cont)	(d)	VOLT-METER	199.9V	15.5V to 16.5V	Adjust the external power supply output voltage to obtain a reading of 16V on the voltmeter.
38	(a)	VOLT-METER	VR1 VOLTS	-	Switch the voltmeter to the VR1 VOLTS mode and range to 199.9 mV.
	(b)	VOLT-METER	199.9 mV	LT 0.45 mV	Operate VR1 S/C on test set to obtain a reading of not less than 0.45 mV on the voltmeter.
CURRENT REGULATION CHECK (HIGH INPUT VOLTAGE)					
39	(a)	LOAD SWITCH	27V	-	Switch the load switch to the 27V position.
	(b)	UUT	-	Amber lamp only illuminated	Check the lamps.
40	(a)	UUT	-	Amber lamp extinguished by S1	Check the amber lamp when switch S1 is operated.
41	(a)	CUR METER	OUTPUT CURRENT	-	Switch the current meter to the OUTPUT CURRENT mode and range to 1.999A only i.e. divide buttons not selected.
	(b)	CUR METER	1.999A	0.902A to 1.288A	Check the reading.
42	(a)	LOAD SWITCH	S/C	-	Switch the load switch to the S/C position.
	(b)	CUR METER	OUTPUT CURRENT	-	Switch the current meter to the OUTPUT CURRENT ÷ 2 mode and range to 1.999A.
	(c)	CUR METER	1.999A	0.402A to 0.748A	Check the reading. (Actual current is twice reading).
STATE OF CHARGE INDICATION (HIGH I/P VOLTAGE)					
43	(a)	LOAD SWITCH	27V	-	Set the load switch to the 27V position.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
43 (cont	(b)	VOLT-METER	VR1 VOLTS	-	Switch the voltmeter to the VR1 VOLTS mode and range to 199.9 mV.
	(c)	VOLT-METER	199.9 mV	20.1 mV 21.9 mV	Adjust VR1 on the test set to obtain a reading of 21 mV.
44	(a)	UUT	-	1L1 illu-minated	Check the amber lamp 1L1.
45	(a)	UUT	-	1L2 extin-guished	Check the green lamp 1L2.
46	(a)	CUR METER	199.9 mA	NGT 9.98 mA	Adjust VR1 on test set to obtain a reading of NGT 9.98 mA.
47	(a)	VOLT-METER	VR1 VOLTS	-	Switch voltmeter to VR1 VOLTS mode and range to 199.9 mV.
	(b)	VOLT-METER	199.9 mV	22.1 mV to 37.9 mV	Check the reading.
48	(a)	UUT	-	1L1 extin-guished	Check the amber lamp 1L1.
49	(a)	UUT	-	1L2 illu-minated	Check the green lamp 1L2.
50	(a)	VOLT-METER	VR1 VOLTS	-	Switch the voltmeter to VR1 VOLTS mode and range to 199.9 mV.
	(b)	VOLT-METER	199.9 mV	40 mV	Adjust VR1 on test set to obtain a reading of 40 mV.
51	(a)	CUR METER	OUTPUT CURRENT	-	Switch current meter to OUTPUT CURRENT mode and range to 1.999A.
	(b)	CUR METER	1.999A	0.904A to 1.288A	Adjust VR1 on test set to set the current meter reading.
52	(a)	VOLT-METER	199.9 mV	15.1 mV to 31.9 mV	Check the reading.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
53	(a)	UUT	-	1L1 illuminated	Check the amber lamp 1L1.
54	(a)	UUT	-	1L2 extinguished	Check the green lamp 1L2.
55	(a)	VOLTMETER	199.9 mV	NGT 0.45 mV	Operate VR1 S/C switch to obtain NGT 0.45 mV.
LOW INPUT VOLTAGE					
56	(a)	LOAD SWITCH	330 ohm	-	Switch the load switch to the 330 ohm position.
	(b)	UUT	-	-	Switch S1 and S2 on UUT to ON.
	(c)	VOLTMETER	199.9V	9.5V to 10.5V	Adjust the external power supply output voltage to obtain a reading of 10V.
57	(a)	VOLTMETER	VR1 VOLTS	-	Switch the voltmeter to VR1 VOLTS mode and range to 199.9 mV.
	(b)	VOLTMETER	199.9 mV	NGT 0.45 mV	Operate VR1 S/C switch to obtain a reading of NGT 0.45 mV.
CURRENT REGULATION CHECK (LOW INPUT VOLTAGE)					
58	(a)	LOAD SWITCH	27V	-	Set load switch to 27V position.
	(b)	UUT	-	Amber lamp only illuminated	Check the amber lamp.
59	(a)	UUT	-	Amber lamp extinguished by S1	Operate switch S1.
60	(a)	CUR METER	OUTPUT CURRENT	-	Switch the current meter to the OUTPUT CURRENT mode and range to 1.999A. divide buttons not operating.
	(b)	CUR METER	1.999A	0.902A to 1.288A	Check the reading.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
61	(a)	LOAD SWITCH	S/C	-	Set the load switch to the S/C position.
	(b)	CUR METER	OUTPUT CURRENT	-	Switch the current meter to the OUTPUT CURRENT ÷ 2 mode and range to 1.999A.
	(c)	CUR METER	1.999A ÷ 2	0.402A to	Check the reading. (Actual current is twice reading).
STATE OF CHARGE INDICATION (LOW I/P VOLTAGE)					
62	(a)	LOAD SWITCH	27V	-	Set the load switch to the 27V position.
	(b)	VOLT-METER	VR1 VOLTS	-	Switch voltmeter to VR1 VOLTS mode and range to 199.9 mV.
	(c)	VOLT-METER	199.9 mV	20.1 mV to 21.9 mV	Adjust VR1 on the test set to obtain a reading of 21 mV.
63	(a)	UUT	-	1L1 illu-minated	Check the amber lamp 1L1.
64	(a)	UUT	-	1L2 extin-guished	Check the green lamp 1L2.
65	(a)	CUR METER	199.9 mA	NGT 9.98 mA	Adjust VR1 on test set to obtain a reading of NGT 9.98 mA.
66	(a)	VOLT-METER	VR1 VOLTS	-	Switch voltmeter to VR1 VOLTS mode and range to 199.9 mV.
	(b)	VOLT-METER	199.9 mV	22.1 mV to 37.9 mV	Check the reading.
67	(a)	UUT	-	1L1 extin-guished	Check the amber lamp 1L1.
68	(a)	UUT	-	1L2 illu-minated	Check the green lamp 1L2.
69	(a)	VOLT-METER	VR1 VOLTS	-	Switch the voltmeter to VR1 VOLTS mode and range to 199.9 mV.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
69 (cont	(b)	VOLT-METER	199.9 mV	40 mV	Adjust VR1 on test set to obtain a reading of 40 mV on the voltmeter.
70	(a)	CUR METER	OUTPUT CURRENT	-	Switch current meter to OUTPUT CURRENT mode and range to 1.999A.
	(b)	CUR METER	1.999A	0.904A to 1.288A	Adjust VR1 on test set to set the current meter reading.
71	(a)	VOLT-METER	199.9 mV	15.5 mV to 31.9 mV	Check the reading.
72	(a)	UUT	-	1L1 illuminated	Check the amber lamp 1L1.
73	(a)	UUT	-	1L2 extinguished	Check the green lamp 1L2.
74	(a)	VOLT-METER	199.9 mV	NGT 0.45 mV	Operate VR1 S/C switch to obtain a reading of NGT 0.45 mV.
REVERSE POLARITY					
75	(a)	VOLT-METER	199.9V	-	Set voltmeter to INPUT VOLT mode 199.9V range.
	(b)	VOLT-METER	199.9V	13.5V to 14.5V	Adjust the external power supply to obtain a reading of 14V.
	(c)	CUR METER	OFF	-	Set current meter to OFF.
	(d)	LOAD SWITCH	33 ohm	-	Set to 33 ohm position.
	(e)	-	-	-	Depress REVERSE VOLTAGE switch.
76	(a)	VOLT-METER	199.9 mV	-	Set to OUTPUT VOLTAGE mode 199.9 mV.
	(b)	VOLT-METER	199.9	NGT 10 mV	Check the reading.
	(c)	-	-	-	Depress REVERSE VOLTAGE switch.

TEST No.	STEP	UNIT	RANGE	LIMITS	INSTRUCTIONS
REVERSE CURRENT					
77	(a)	UUT	-	-	Remove SKT1 from UUT.
	(b)	VOLT-METER	199.9V	-	Set voltmeter switch to INPUT VOLTS mode 199.9V range.
	(c)	VOLT-METER	199.9V	23.5V to 24.5V	Adjust an external supply connected to UUT output to 24V.
	(d)	CUR METER	199.9 mA	-	Set current meter to INPUT CURRENT mode 199.9 mA range.
	(e)	REV CURRENT	-	-	Depress REVERSE CURRENT switch.
78	(a)	CUR METER	199.9 mA	NGT 9.98 mA	Check the reading.

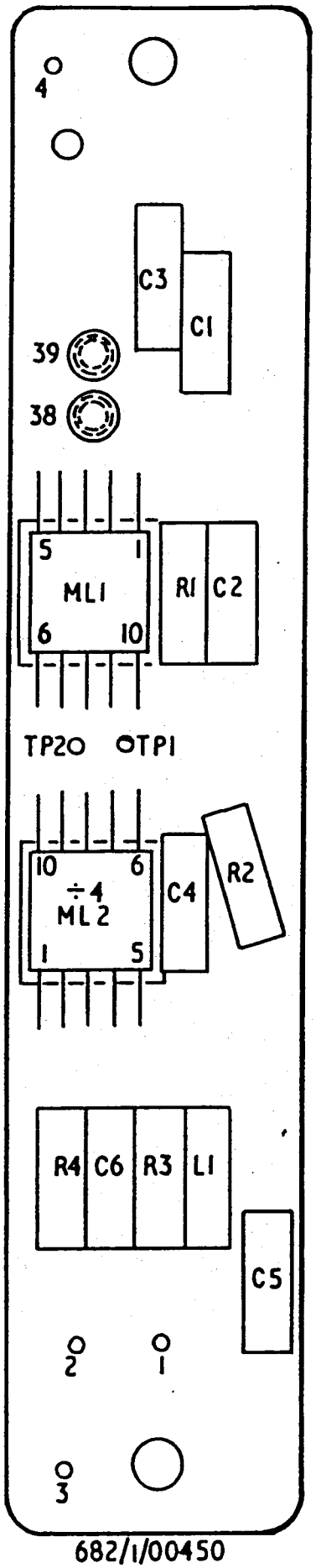

Fig. 10
Unit 9a component layout

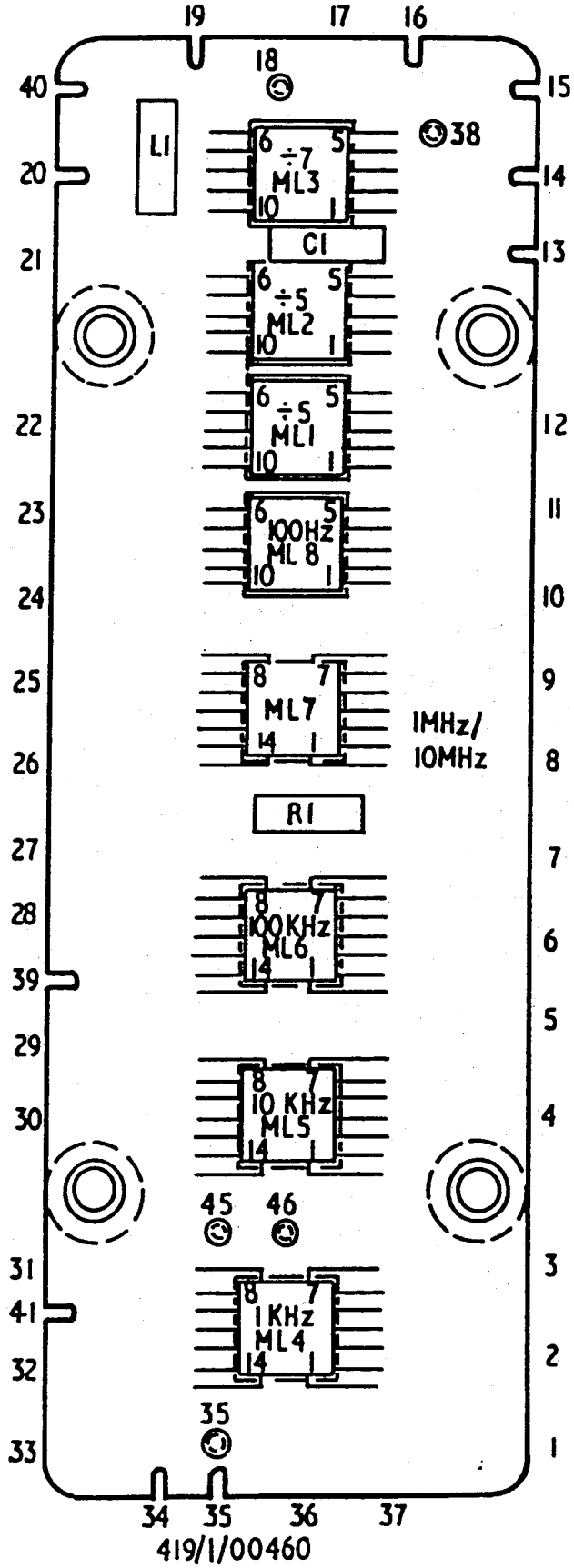

Fig. 11
Unit 9b component layout

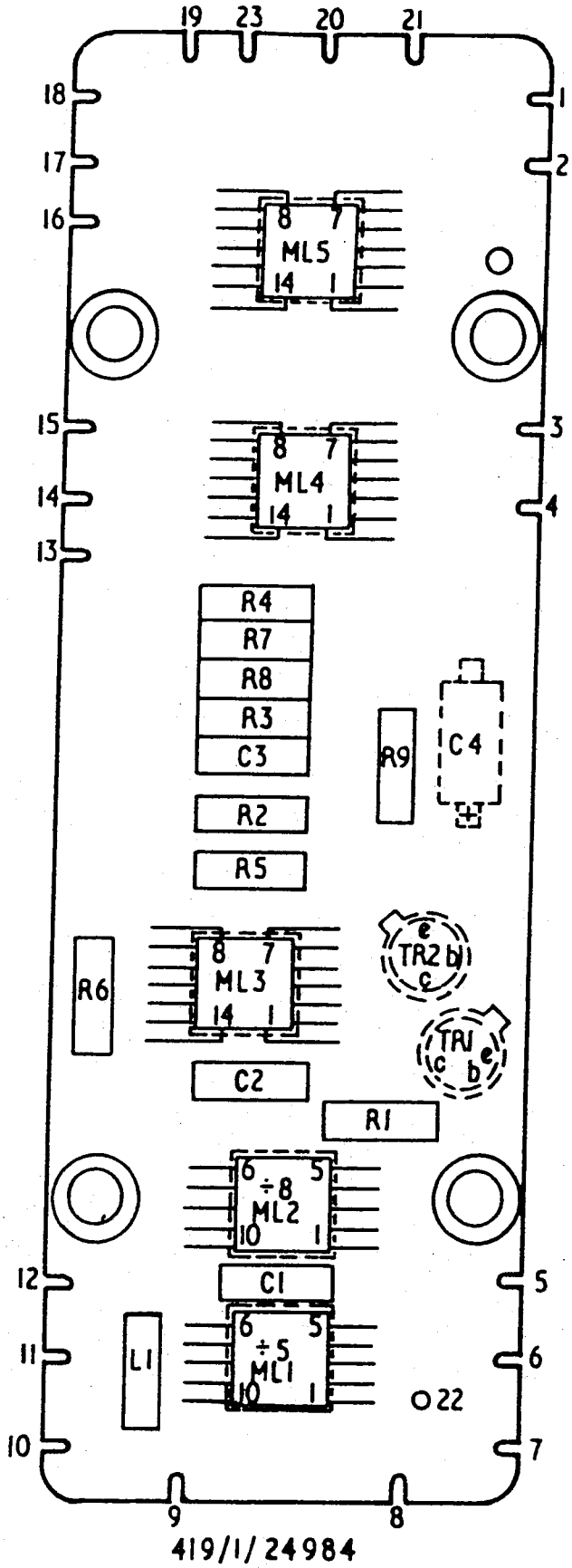

Fig.12 Unit 9c – component layout

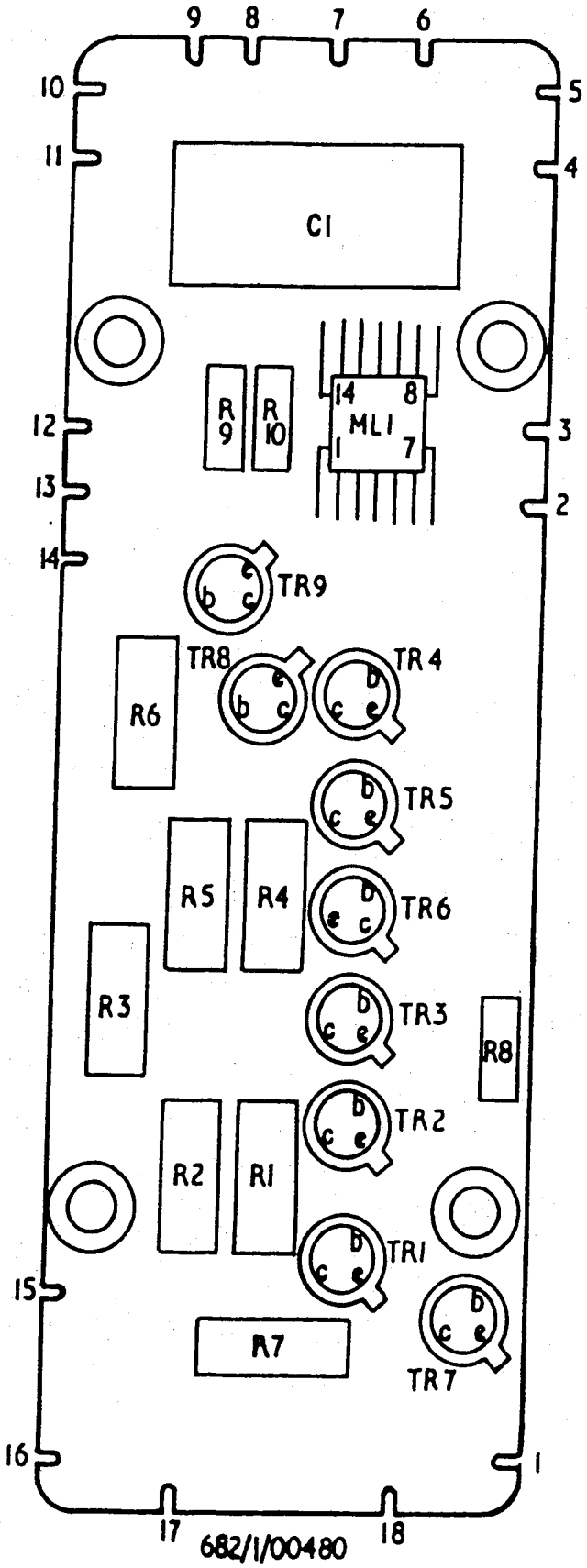

Fig.13 Unit 9d - component layout

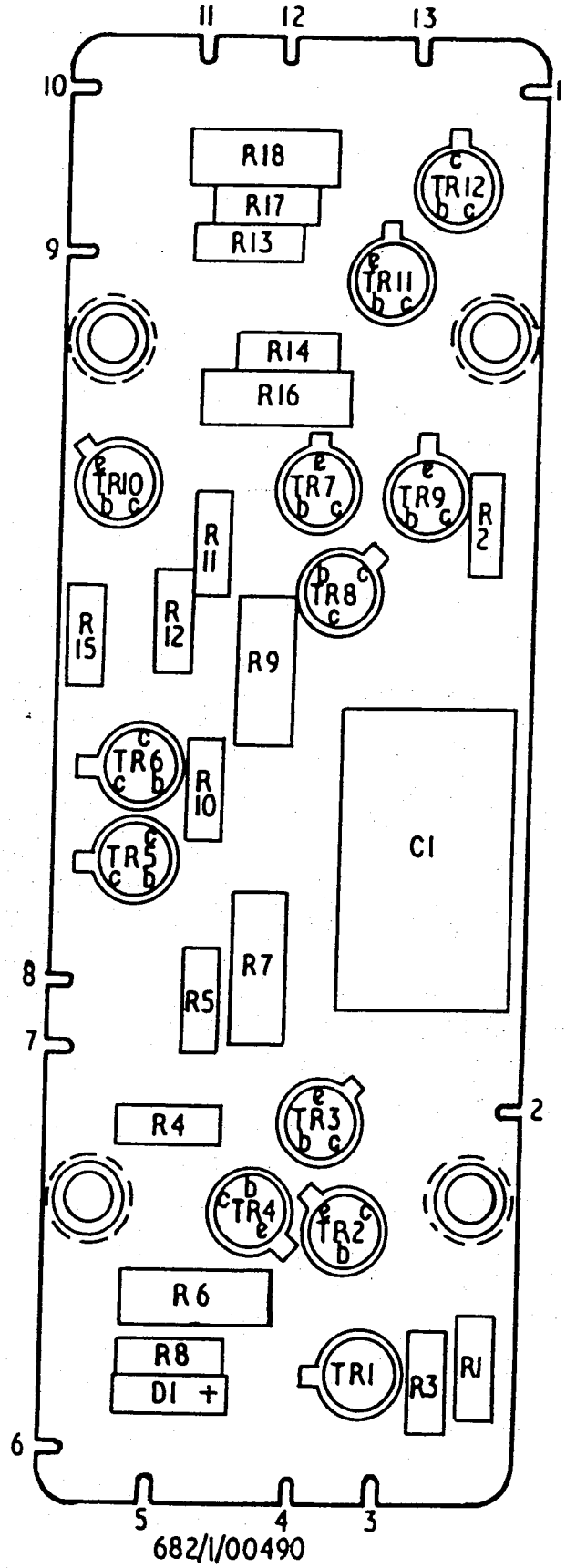

Fig.14 Unit 9e – component layout

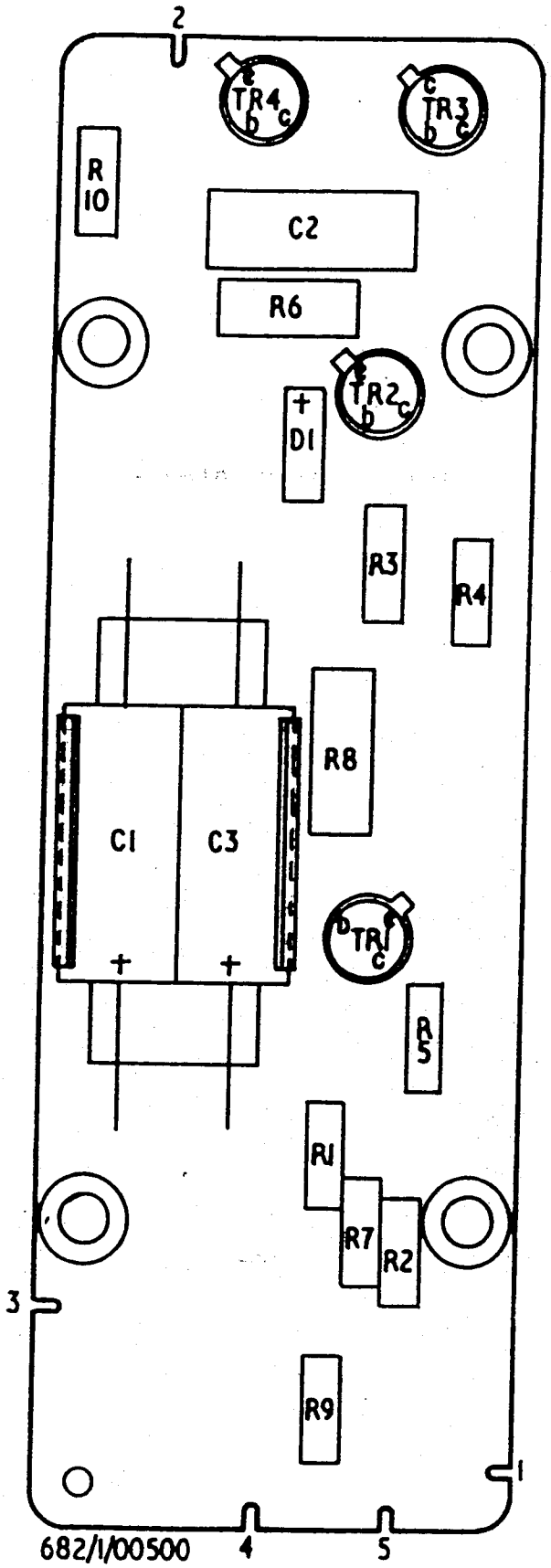

Fig. 15 Unit 9f - component layout