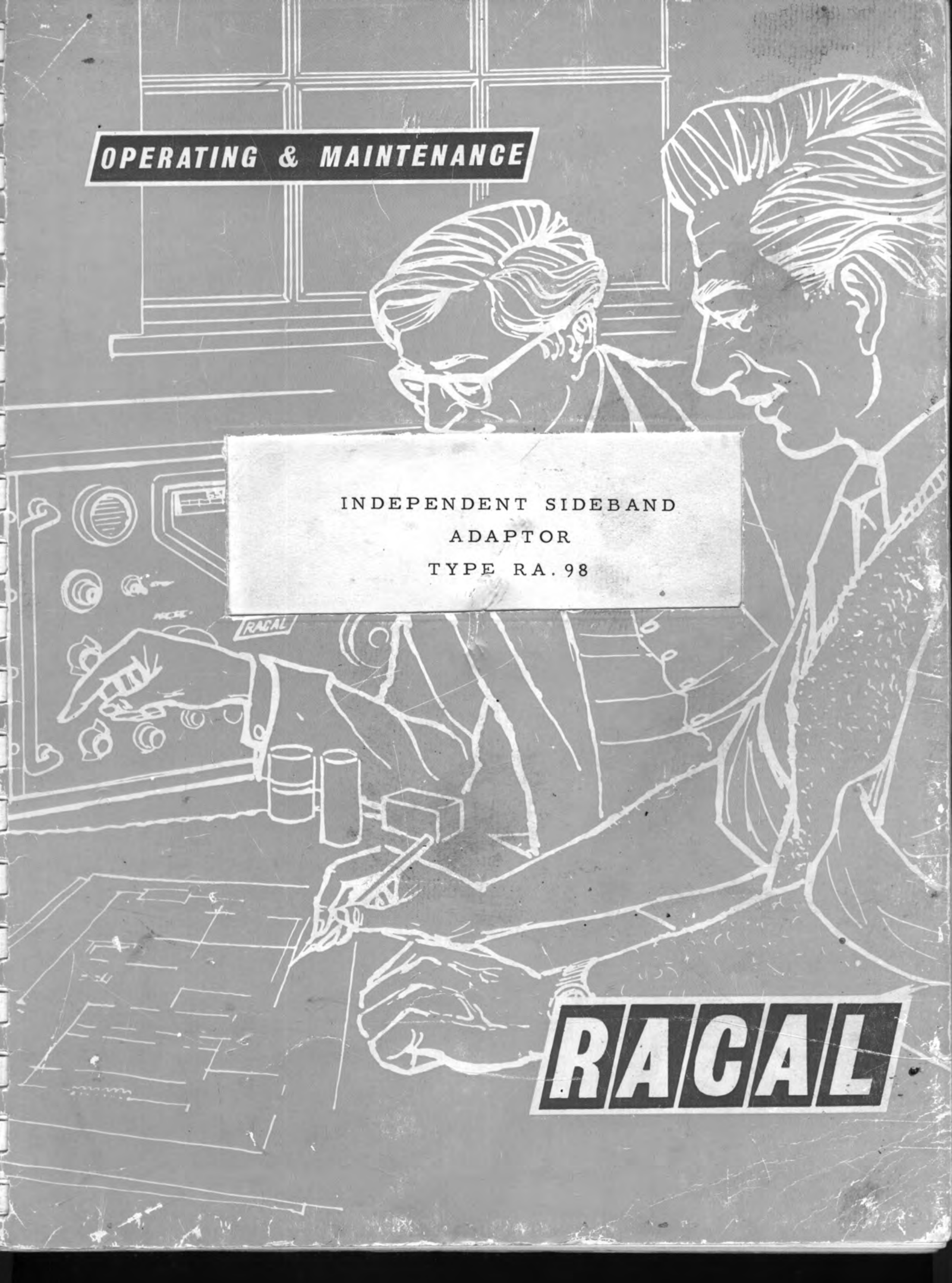
OPERATING & MAINTENANCE



INDEPENDENT SIDEBAND ADAPTOR TYPE RA. 98

RACAL

INDEPENDENT SIDEBAND ADAPTOR TYPE RA.98

Operating and Maintenance Manual

Technical Handbooks Department

RACAL ELECTRONICS LIMITED
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THE NEXT TWO PAGES

concern
all users of
electrical equipment
from a different
point of
view

●

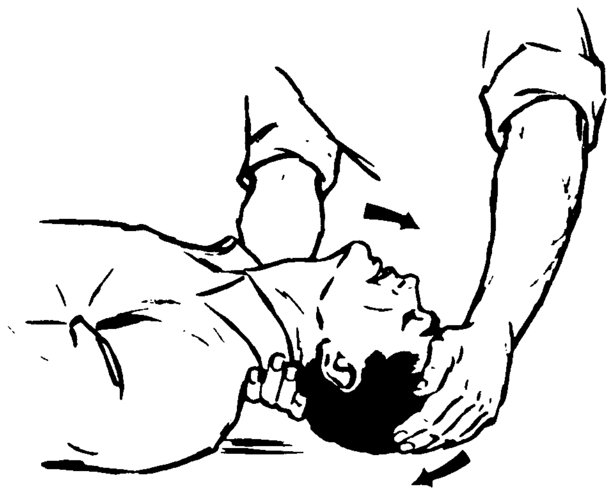
read

carefully

. . . . it

COULD AFFECT YOU

FIRST AID in case of Electric Shock



ON BACK : TILT HEAD BACK AS FAR AS POSSIBLE : RAISE THE JAW.

PINCH VICTIM'S NOSE : KEEP HEAD BACK : BLOW UNTIL THE CHEST RISES.

RESCUE BREATHING

1. LAY VICTIM ON HIS BACK.
2. CLEAR HIS MOUTH AND THROAT.
3. TILT HIS HEAD BACK AS FAR AS POSSIBLE AND RAISE HIS JAW.
4. PINCH HIS NOSTRILS.
5. TAKE A DEEP BREATH.
6. COVER HIS MOUTH WITH YOURS AND BLOW, WATCHING HIS CHEST RISE. (FORCEFULLY INTO ADULTS AND GENTLY INTO CHILDREN).
7. MOVE YOUR FACE AWAY FOR HIM TO BREATHE OUT, WATCH HIS CHEST FALL.
8. REPEAT YOUR FIRST FIVE TO TEN BREATHS AT A RAPID RATE. THEREAFTER TAKE ONE BREATH EVERY THREE TO FIVE SECONDS.
9. KEEP HIS HEAD BACK AS FAR AS POSSIBLE ALL THE TIME.

Have someone else send for a Doctor

Keep patient warm and loosen his clothing

DO NOT Give liquids until patient is conscious

now . . .

proceed

with

CAUTION

DANGER HIGH VOLTAGES

ADJUSTMENTS

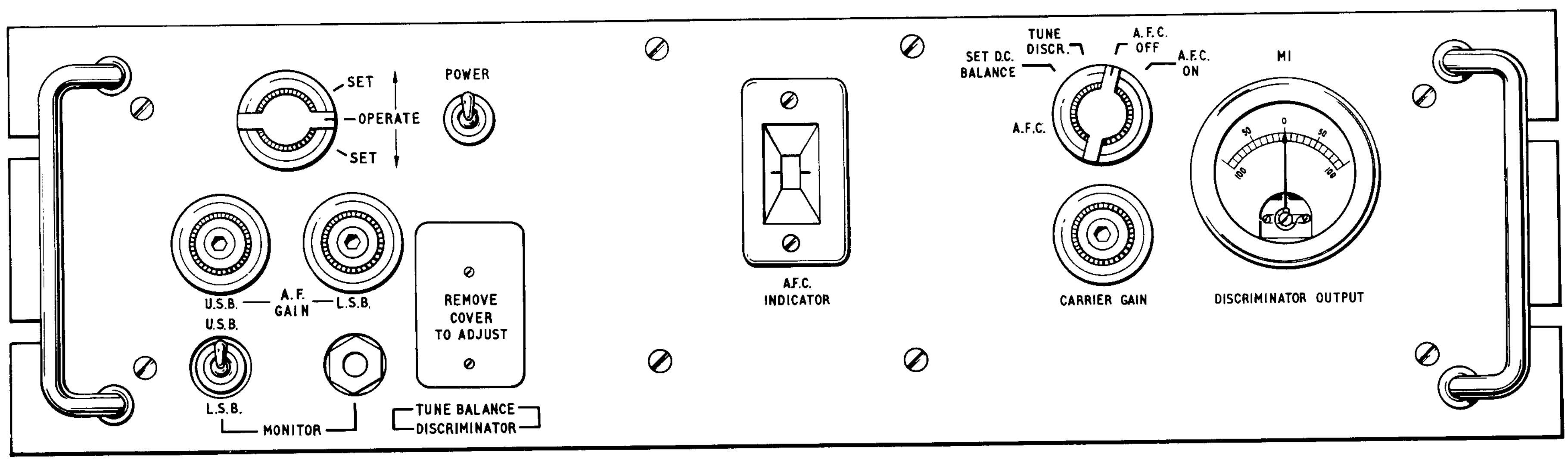
EXERCISE GREAT CARE

SERVICING

SWITCH OFF

Although every reasonable precaution has been observed in design to safeguard operating personnel this warning is . . .

VITAL !



134/3

I.S.B Adaptor Type R A.98

INDEPENDENT SIDEBAND ADAPTOR

TYPE RA.98

CONTENTS

ILLUSTRATIONS

TECHNICAL SPECIFICATION

Types of reception:	S.S.B.) pilot carrier -26 dB I.S.B.) S.S.B.) suppressed carrier with I.S.B.) external frequency standard. D.S.B. both sidebands, separately.
Input frequency:	100 kc/s ±1 kc/s.
Sensitivity:	50 mV input for 40 mW audio output.
Sideband rejection:	Not less than -50 dB between 500 and 5000 c/s in the unwanted sideband; above 5000 c/s, -40 dB.
Pass-band response:	3 dB from 300 c/s to 6000 c/s.
Intermodulation products:	Better than -40 dB.
Cross-talk:	Better than -50 dB.
Harmonic distortion:	Better than 5%.
Input:	50 mV to 0.5V r.m.s. at 75 ohms.
A.F. Output:	One balanced output, 40 mW at 600 ohms for each sideband channel and an attenuated output, switchable to each channel, for monitoring purposes.
Carrier rejection:	(On signal channels.) Better than -35 dB.
Automatic gain control:	A delayed a.g.c. voltage is produced from the carrier of the input signal which is applied to the receiver a.g.c. line to control its gain. The combined receiver and adaptor a.g.c. characteristic is then as follows: an increase of input, 60 dB above 1 μV results in an increase in audio output not exceeding 6 dB.

Automatic frequency control:	Electro-mechanical and operates from a pilot carrier of any value from 0 to -26 dB relative to peak sideband power. Maximum correction rate is ±50 c/s per second over a range of ±1 kc/s. Residual error is less than ±1 c/s. Capture range ±50 c/s. Once the a.f.c. has made the necessary correction, the appearance of interference in the carrier i.f. band does not capture the a.f.c. at ±100 c/s from the a.f.c. centre frequency (18 kc/s). There is a 'memory' property, so that the fading of the carrier below usable level does not affect the correction made. Should the distant transmitter go off the air the 'memory' will hold the last correction made.
Frequency locking: (for suppressed carrier operation).	A 118 kc/s signal of 1V at 52 ohms impedance from a high stability external source is required to lock the adaptor tuning over a range of ±330 c/s.

Dimensions:

Height	Width	Depth	
$5\frac{1}{4}$	19	14	in.
13.3	48	35.5	cm.

Power supply:	100-125V and 200-250V a.c., 45-64 c/s. Consumption: 65 watts.

SECTION 1

OPERATION AND TECHNICAL DESCRIPTION

CONTENTS

CHAPTER 1

GENERAL DESCRIPTION

Technical Details

1. These units are designed to enable the Racal RA.17 and RA.117 Receivers, or other suitable communication receivers having a 100 kc/s i.f. output, to be used for the reception of independent sideband and single sideband signals, with the carrier 0 to -26 dB relative to sideband power. Provision is made for the unit to be locked to an external high stability frequency source for suppressed carrier applications. It can also be used for the single sideband reception of double sideband transmissions with the advantages of reducing the effects of selective fading and, by the choice of either sideband, avoiding adjacent channel interference in most cases.

2. A very accurate crystal-controlled a.f.c. system is used to compensate for drift in the adaptor, receiver or distant transmitter; the tuning frequency is held to within ±3 c/s over a drift range of ±1 kc/s. This provides the tuning stability necessary for satisfactory and reliable independent or single sideband communication systems.

3. A carrier derived a.g.c. output (d.c.) is available from the adaptor for the purpose of controlling the receiver gain, both to counteract fading and to keep the input level to the adaptor within the optimum working range.

4. The RA.98A and B adaptors are self-contained and are designed to operate from the 100 Kc/s i.f. output of the receiver. The only differences between the A and B models are in the types of coaxial connectors and phone jacks used and the power switch operation.

Mechanical Details

5. The adaptor is designed for rack mounting or for fitting in a suitable cabinet above the RA.17 or RA.117 receiver. All electrical connections with the exception of the headphones are made at the rear of the unit.

6. A dust cover is fitted which provides adequate ventilation and at the same time ensures ample protection from dust and dirt.

CHAPTER 2

INSTALLATION

1. After carefully unpacking the equipment, check that all valves and screening cans are firmly in place. Ensure that all chassis and power supplies are completely clear of fluff and shavings.

Supply

2. Adjust the voltage taps on the mains transformer for the required supply voltage.

Fuses

3. Ensure that the fuse ratings are correct:

Power Fuse	2A
H.T. (B+) Fuse	250 mA (anti surge)

Installation of RA.17 or RA.117

4. The RA.17 or RA.117 should be installed as detailed in the relevant handbook.

Connection to RA.17 or RA.117

5. A suitable length of 75-ohms coaxial cable should be made up with the plugs supplied and connected between the input socket of the unit and one of the 100 kc/s output sockets of the RA.17 or RA.117 receiver.

6. Connect the a.g.c. and earth leads between the terminal block on the adaptor and the terminal strip on the receiver; an earthing terminal is fitted on the rear of the chassis of N.American receivers but with British receivers, the earthing connection is made through the braiding of the coaxial signal cable.

CHAPTER 3

OPERATION

Controls

1. A.F.C. MOTOR: SET ↑ /OPERATE/SET ↓

   POWER

   A.F. GAIN: U.S.B.

   A.F. GAIN: L.S.B.

   MONITOR (jack socket and switch) U.S.B./L.S.B.

   Behind cover (preset)
   D.C. BALANCE
   DISCRIMINATOR - TUNE and BALANCE

   A.F.C. INDICATOR: centre of green band is the electrical centre for tuning, to give a maximum 'drift following range' of slightly over ±1 kc/s.

   A.F.C. switch:
   SET D.C. BALANCE/TUNE DISCR./A.F.C. OFF/A.F.C. ON

   CARRIER GAIN

   M1 - DISCRIMINATOR OUTPUT meter

Rear of Chassis Items

2. POWER fuse FS2 2A

   Earth terminal

   H.T. (B+) fuse FS1, 250 mA (anti surge)

Terminal block: Earth, A.G.C., L.S.B., U.S.B., and Monitor; the L.S.B. and U.S.B. outputs are balanced.

R.F. GAIN control (preset)

R.F. INPUT plug (socket - N.A.)

118 kc/s OSC. LOCK (1V, 52 ohms) (socket)
RA.17/RA.117 switch, housed between V12 and V14 on chassis top.

etting-Up Instructions

. When the adaptor is installed for the first time, the following procedure must be performed. After some period of use, it may be necessary to echeck the settings.

(1) Check that the mains transformer tap settings are connected to suit the available supply voltage; a connection diagram is fitted to the side of the transformer can.

(2) Connect the supply, switch on and allow five minutes for both units to warm-up.

(3) Set the RA.17/RA.117 switch to the required position.

(4) Set the receiver System switch to STANDBY.

(5) Set the a.f.c. switch on the adaptor to SET D.C. BALANCE.

(6) Ensure that the A.F.C. MOTOR switch is set to OPERATE.

(7) Remove the small cover on the front panel and adjust the D.C. BALANCE preset control to give a centre (zero) indication on meter M1.

(8) Observe the A.F.C. INDICATOR drum through the aperture on the front panel. If an arrow is showing, set the A.F.C. MOTOR switch to the SET position which has an arrow pointing in the same direction until the centre of the green band on the drum coincides approximately with the cursor line; as soon as this is apparent, return the A.F.C. MOTOR switch to the OPERATE position.

(9) Set the A.F.C. switch to TUNE DISCR.

(10) Adjust the preset DISCRIMINATOR TUNE control to give a precise centre (zero) reading on M1.

(11) Set the A.F.C. switch to A.F.C. OFF.

(12) Set the preset R.F. GAIN control, on the rear of the adaptor, to the maximum counter-clockwise position; now rotate this control in a clockwise direction to that position which is approximately one-quarter of full rotational travel.

NOTE: When the receiver has been tuned into a signal, as described below, this setting of the R.F. GAIN control on the adaptor will provide approximately 50 mV on the control grid of the mixer stage V1 (see circuit diagram); it is necessary that this voltage should not exceed approximately 50 mV which represents approximately 40 mW output from the adaptor.

(13) Set the receiver System switch to MAN. Set the CARRIER GAIN control on the adaptor to the maximum clockwise position.

(14) Set the METER switch on the receiver to R.F. LEVEL.

(15) Tune the receiver (see RA.17 or RA.117 handbook) to the carrier of the required station and adjust the I.F. GAIN control to produce a meter deflection of approximately 100 μA; this represents an output of approximately 300 mV at the 100 kc/s OUTPUT socket of the receiver.

NOTE: It is very important to ensure that the receiver is tuned to the carrier frequency and NOT to one of the sideband frequencies.

(16) Exact tuning of the receiver is achieved by observing the meter (M1) deflection on the adaptor; as the signal is tuned in, the meter deflects slowly to the left or right (depending on the direction of the tuning action), reaches a peak and deflects rapidly to the other end of the scale, finally returning slowly to the zero position. A satisfactory tuning position is anywhere within this range of movement, although the centre position, which is difficult to obtain, is the most satisfactory.

(17) Set the receiver System switch to A.V.C.

(18) Set the A.F.C. switch on the adaptor to A.F.C. ON. The a.f.c. should now lock-on and hold, as indicated by a movement towards centre (zero) deflection of meter M1. Satisfactory functioning of the a.f.c. is indicated by a random oscillation of the meter pointer.

(19) Adjust the CARRIER GAIN control on the adaptor to give a receiver meter deflection of approximately 50 μA; this adjustment should provide optimum performance from the adaptor.

(20) Output connections are made to the terminal block on the rear, and either sideband can be monitored at a jack socket on the front panel.

OPERATING INSTRUCTIONS

4. When it is required to tune the receiver to any station the following procedure is carried out; it has been assumed that the receiver and adaptor have been set up according to the above instructions.

Signals with Carrier 0 to -26 dB relative to Sideband Power

5. (1) Switch on and allow five minutes for both units to warm-up.

(2) Set the receiver System switch to STANDBY.

(3) Set the A.F.C. switch on the adaptor to SET D.C. BALANCE.

(4) Observe the A.F.C. INDICATOR drum through the aperture on the front panel. If an arrow is showing, set the A.F.C. MOTOR switch to the SET position which has an arrow pointing in the same direction, until the centre of the green band on the drum coincides approximately with the cursor line; as soon as this is apparent, return the A.F.C. MOTOR switch to the OPERATE position.

(5) Set the receiver System switch to A.V.C.

(6) Set the A.F.C. switch to A.F.C. OFF.

(7) Set the CARRIER GAIN control to the maximum clockwise position.

(8) Tune the receiver (see RA. 17 or RA. 117 handbook) to the carrier of the required station. This will be indicated by a sharp dip in the meter indication on the receiver which corresponds to the required tuning conditions in (11) below.

NOTE: It is very important to ensure that the receiver is tuned to the carrier frequency and NOT to one of the sideband frequencies.

(9) Exact tuning of the receiver is achieved by observing the meter (M1) deflection on the adaptor; as the signal is tuned in, the meter deflects slowly to the left or right (depending on the direction of the tuning action), reaches a peak and deflects rapidly to the other end of the scale, finally returning slowly to the zero position. A satisfactory tuning position is anywhere within this range of movement, although the centre position, which is difficult to obtain, is the most satisfactory.

(10) Set the A.F.C. switch on the adaptor to A.F.C. ON. The a.f.c. should now lock-on and hold, as indicated by a movement towards centre (zero) deflection of meter M1. Satisfactory functioning of the a.f.c. is indicated by a random oscillation of the meter pointer.

(11) Adjust the CARRIER GAIN control on the adaptor to give a receiver meter deflection of approximately 50 μA; this adjustment should provide optimum performance from the adaptor.

Signals with completely Suppressed Carrier

6. No simple method of tuning these signals is known. No pilot carrier is available to operate the a.f.c., so these signals must be tuned by ear.

(1) Switch on and allow five minutes for both units to warm-up.

(2) Set the receiver System switch to STANDBY.

(3) Set the A.F.C. switch on the adaptor to SET D.C. BALANCE.

(4) Observe the A.F.C. INDICATOR drum through the aperture on the front panel. If an arrow is showing, set the A.F.C. MOTOR switch to the SET position which has an arrow pointing in the same direction, until the centre of the green band on the drum coincides approximately with the cursor line; as soon as this is apparent, return the A.F.C. MOTOR switch to the OPERATE position.

(5) Set the A.F.C. switch to A.F.C. OFF.

(6) Set the receiver System switch to A.V.C.

(7) Monitoring the receiver output, tune the receiver (see RA.17 or RA.117 handbook) until the signal appears to be centred on the pass-band, judged by loudness.

(8) Monitoring the adaptor output, tune the adaptor by setting the A.F.C. MOTOR switch alternatively to the two SET positions, until the signal becomes intelligible. If it is not known whether the signal is of the l.s.b. or u.s.b. variety it will be necessary to listen to each output channel in turn. With a little practice it is possible to recognise the characteristic sound of this type of emission and tuning will not present too much difficulty. If the signal is of the i.s.b. type, the tuning is carried out precisely as above, except that intelligence will be obtained from both sideband output channels.

CHAPTER 4

BRIEF TECHNICAL DESCRIPTION

1. This chapter briefly describes, with the aid of the block diagram in figure 1, the basic theory of operation. For a fully detailed explanation of the adaptor, Chapter 5 (DETAILED CIRCUIT DESCRIPTION) should be read.

Mixer and Oscillator

2. An input signal at 100 kc/s, fed via a preset potentiometer, is mixed with the output of a stable variable oscillator operating at a nominal frequency of 118 kc/s.

Band-pass Filter

3. The mixer output centred on 18 kc/s is fed to a band-pass filter having a flat response of at least 6 kc/s each side to accommodate the sidebands. There are two outputs from this filter, one feeding the signal channel and the other the a.f.c. and a.g.c. stages.

Signal Channel

4. Carrier Rejection Bridge and Filters

The band-pass filter output is applied to a carrier rejection beidge which produces a sharp notch at the carrier frequency of 18 kc/s (-40 dB). The double sideband output is then amplified and applied to upper and lower sideband filters. The filters provide a high degree of rejection to all signals other than the wanted sideband.

5. Product Detectors and Carrier Re-insertion Oscillator

Each sideband filter output is mixed in a product detector with a signal at 18 kc/s from a fixed frequency oscillator, giving products including an audio frequency component. Unwanted signal frequencies are subsequently removed by means of a further filter network. The resultant output therefore consists of audio frequencies.

6. Audio Stages

The audio frequency on each channel is fed via a gain control to an a.f. output stage and thence to output terminals at the rear. Either channel may be monitored by switching its output, via an attenuator, to the front panel jack socket and rear chassis monitor terminals.

A F.C. and A.G.C. Channel

7. Carrier Amplifier

The output of the band-pass filter is applied to a two stage amplifier and filter. The filter eliminates the sidebands and prevents the a.f.c. locking onto adjacent interferences. The amplifier has two outputs, one feeding the a.g.c. diode and the other the a.f.c. discriminator.

8. A.G.C.

The a.g.c. is delayed and has a time constant correction diode provided. The d.c. output is brought out at terminals on the rear for connection to the receiver a.g.c. line.

9. Discriminator and A.F.C. Motor

The discriminator is of the crystal-controlled bridge type which has a very stable zero setting. The 18 kc/s carrier input is multiplied by 5 to 90 kc/s to give increased accuracy. It has a polarised d.c. output which is fed through a cathode-follower to drive the motor for correcting the 118 kc/s oscillator tuning.

CHAPTER 5

DETAILED CIRCUIT DESCRIPTION

1. Reference should be made to the circuit diagram figure 7.

Mixer Stage

2. A 75Ω (unbalanced) source of signal at 100 kc/s is connected via socket SK1 and an input potentiometer RV1 to the signal grid of V1. R3 provides a suitable impedance match. The output of a 118 kc/s oscillator V3 is applied via C5 to the suppressor grid of V1. The resultant output centred on 18 kc/s is taken from the anode.

118 kc/s Oscillator

3. V3 is a cathode-coupled Colpitts circuit operating at a nominal frequency of 118 kc/s. Accurate tuning is effected by C89 which is driven by the a.f.c. motor. The oscillator can be locked to an external 118 kc/s source, which is coupled in via C10 and R10.

Band-pass Filter

4. This filter is a single section constant k having a sensibly flat response from 12-24 kc/s and a characteristic impedance of 10 000 Ω.

Carrier Rejection Bridge

5. V5 together with R19, L7, C31, R21 and RV4 form a bridge. The tuned circuit L7, C31 is resonant at 10 kc/s and its dynamic impedance balances the bridge so that there is no output. At the sideband frequencies L7, C31 is no longer resonant, its impedance therefore unbalances the bridge and an output is available.

6. RV4 is a preset control which ensures an accurate balance at 18 kc/s.

7. The 40 dB rejection provided prevents the carrier from producing an audio beat note with the carrier re-insertion oscillator, at a later stage. This could occur if the carrier level was at, or near, the sideband level.

Sideband Amplifier

8. This comprises a double triode V8 with the grids and cathodes connected in parallel. Equal anode loads R41 and R42 give equal outputs to the upper and lower sideband filters.

Sideband Filters

9. These are six section m derived L-C filters having a very sharp cut-off. They provide over 50 dB rejection to the unwanted sideband. As a result of the sideband inversion introduced by the additional mixer and i.f. stages in the RA.117 receiver, switch SE (RA.17/RA.117) has been inserted in the outputs of the high and low pass filters to reverse the position of these when operating with the RA.117 receiver.

Product Detectors

10. The outputs of the sideband filters are applied to the control grids of the product detectors V12 and V14 and are mixed with the output of the 18 kc/s oscillator. The product detectors employed are linear heterodyne mixers in which the signal level and the re-inserted carrier levels are adjusted so as to preserve the linearity of mixing and to reduce distortion and intermodulation products.

11. The audio outputs are taken from the anodes to low-pass audio filters arranged to cut-off at 6 kc/s. Further filtering is provided to prevent any 18 kc/s breakthrough from the oscillator.

Audio Outputs

12. The audio output stages use pentode valves (V15, V16) with un-bypassed cathode resistors to provide negative feedback, and each stage feeds balanced output terminals at 600Ω, 40 mW, on the rear. The output from either channel may be selected by the U.S.B./L.S.B. switch and applied via an attenuator (R100) to the front panel jack socket and rear chassis terminals for monitoring purposes.

Carrier Re-insertion Oscillator and Cathode-Followers

13. This oscillator is crystal-controlled and operates at 18 kc/s. The preset variable capacitor C70 compensates for any crystal inaccuracies up to ±3 c/s (approx.).

14. The output is taken via the a.f.c. switch to two cathode-followers V13, which feed the product detectors.

15. A further output is taken via the a.f.c. switch to V11 the carrier amplifier to provide an 18 kc/s carrier for discriminator tuning.

1st 18 kc/s Carrier Amplifier

16. The output of the band-pass filter is applied to the grid of V5. This stage has a variable resistor (CARRIER GAIN) in the cathode circuit giving a gain control of over 26 dB.

18 kc/s Carrier Filter

17. The output of V6 is applied to a 4-section carrier filter centred on 18 kc/s with a response of ±50 c/s at -6 dB and ±100 c/s at -26 dB. This eliminates the sidebands.

2nd 18 kc/s Amplifier

18. This stage V11 is a fixed gain, tuned amplifier. The a.g.c. diode is fed from the anode via C49 and the discriminator circuit from the junction of C46, C48 via C35.

A.G.C.

19. A delay of approximately 25 volts is provided for the a.g.c. diode V10 (b) by the potential divider R59, R61 and R66. V10 (a) is a time constant correcting diode which shunts the a.f.c. feed resistor R57 during charge, but is non-conducting during discharge.

Discriminator

20. This comprises a frequency multiplying amplifier and crystal-controlled discriminator. The amplifier V7 has an r.f. transformer anode load

tuned to the fifth harmonic of the input signal, i.e. 90 kc/s. The output is applied via C22 to R15, C85 and C50 in parallel which are in series with XL1. When the input frequency decreases towards the series resonance of XL1, the input voltage appears across R15, C85 and C50. The diode V4 (a) conducts on the positive half cycles producing a d.c. component across R15, the polarity of which gives a negative output. When the input frequency increases towards parallel resonance in XL1 the input voltage appears across XL1 and the conduction of V4 (b) produces a d.c. component across R16, the polarity of which gives a positive output. When the input frequency is mid-way between the series and parallel resonance of XL1, equal voltages appear across R15, C85, C50 and XL1, producing equal currents through V4 (a) and (b). The d.c. components developed across R15 and R16 are equal and opposite, giving a zero output.

Cathode-Follower and A.F.C. Motor

21. V2 (b) is a cathode-follower whose output is connected to one side of the a.f.c. motor. The other side of the motor is held at the fixed d.c. potential on the cathode of V2 (a). With zero input voltage the cathode potentials of V2 (a) and V2 (b) are equal so that no potential difference appears across the motor. V2 (a) and (b) are balanced by RV2, balance being indicated by M1.

Power Supply

22. This is provided by a silicon diode full-wave bridge rectifier (MR2, MR3, MR4 and MR5) with suitable filtering provided by L9, C73, C74.

SECTION 2

MAINTENANCE

CONTENTS

CHAPTER 1

TEST EQUIPMENT REQUIRED FOR MAINTENANCE

1. The following items of test gear are required to carry out the maintenance described in this part of the handbook:-

   (a) Multi-range meter (20 000Ω/volt) measuring a.c. and d.c. up to 500 volts.

   (b) Signal Generator operating up to 120 kc/s with matching device to provide 75Ω source impedance.

   (c) Valve Voltmeter, low capacity input type.

   (d) Digital Frequency Meter (maximum frequency 120 kc/s).

   (e) Output Power Meter.

   (f) 10 kΩ, $\frac{1}{4}$W resistor.

   (g) Low Pass Filter with an input impedance of 600Ω, cutting-off between 6 kc/s and 9 kc/s.

CHAPTER 2

VALVE DATA

1. Details of valves used in the Adaptor are shown below. Valve base pin connections are provided in the circuit diagram.

Base Connections

2.

Type	6AU6	6AS6	12AT7	12AX7	12AU7	6BA6	EB91	EF91
	CV2524	CV2522	CV455	CV492	CV491	CV454	CV140	CV138
Base	B7G	B7G	B9A	B9A	B9A	B7G	B7G	B7G
Pin No.								
1	G1	G1	A''	A''	A''	G1	K'	G1
2	G3	K	G''	G''	G''	G3	A''	K
3	H	H	K''	K''	K''	H	H	H
4	H	H	H	H	H	H	H	H
5	A	A	H	H	H	A	K''	A
6	G2	G2	A'	A'	A'	G2	S	G3
7	K	G3	G'	G'	G'	K	A'	G2
8			K'	K'	K'			
9			H c.t.	H c.t.	H c.t.			

Valve Complement and Typical Voltages

3. The following voltage-to-chassis measurements (d.c.) are approximate to within ±10% and are measured with a 20 000Ω/volt meter. Valve pin numbers are indicated in brackets.

Cct. Ref.	Type	Anode	Anode''	Screen	Cathode	Cathode''
V1	6AS6	250V(5)		132V(6)	2.9V(2)	
V2	12AU7	260V(6)	260V(1)		8.8V(8)	8.8V(3)
V3	6AU6	133V(5)			20V(7)	

Cct. Ref.	Type	Anode	Anode''	Screen	Cathode	Cathode''
V4	EB91	0V(7)	0V(2)		0.5V(1)	0.5V(5)
V5	12AX7	224V(6)	215V(1)		34V(8)	34V(3)
V6	6BA6	255V(5)		213V(6)	24V(7)	
(carrier gain at minimum)						
V6	6BA6	232V(5)		115V(6)	1.3V(7)	
(carrier gain at maximum)						
V7	6BA6	260V(5)		8V(6)	0.1V(7)	
V8	12AT7	145V(6)	142V(1)		1.3V(8)	1.3V(3)
V9	6AU6	73V(5)			55V(6)	0.2V(7) Cathode
(junction of R48 and R51 = 93V)						
V10	EB91	-0.2V(7)	0V(2)		0V(1)	25.5V(5)
V11	6AU6	255V(5)			150V(6)	1.8V(7)
V12	6AS6	168V(5)			135V(6)	2.9V(2)
V13	12AT7	260V(6)	260V(6)		42.5V(8)	39.5V(3)
V14	6AS6	162V(5)		127V(6)	3.1V(2)	
V15	EF91	218V(5)		224V(7)	1.9V(2)	
V16	EF91	218V(5)		224V(7)	1.9V(2)	

CHAPTER 3

ALIGNMENT AND TEST PROCEDURE

Oscillators

1. The following equipment is required:-

   Standard Signal Generator
   Digital Frequency Meter
   Valve Voltmeter

2. 118 kc/s Oscillator and Tuning Motor

   (1) Remove the cover plate on the front panel below the power switch.

   (2) Switch A.F.C. MOTOR to OPERATE.

   (3) Turn the service switch to SET D.C. BALANCE.

   (4) Adjust the D.C. BALANCE preset control to give 0 on the meter M1.

3. The operation of the motor is checked by switching to A.F.C. ON and then turning the A.F.C. MOTOR switch to the position in which the arrow is in the same direction as the arrow visible in the A.F.C. INDICATOR aperture. This should turn the motor in the correct direction to make the green section of the indicator visible in the aperture. Continue this condition until the arrow pointing in the opposite direction appears on the indicator. Turn the A.F.C. MOTOR switch to the position having the corresponding arrow direction when the green section should again appear on the indicator.

4. When the black line across the green section reaches the centre line of the aperture turn the A.F.C. MOTOR switch to the OPERATE position. There should be no further movement of the indicator. Switch to A.F.C. OFF.

   (1) Check that the cover is on the motor assembly (rear of front panel).

(2) Set the Signal Generator to exactly 100 kc/s by means of the Frequency Meter and adjust the output to 80 mV.

(3) Connect the Signal Generator to the R.F. INPUT socket on the rear panel (PL1 or SK1).

(4) Turn the R.F. GAIN preset control RV1 to maximum, i.e. fully clockwise.

(5) Connect the Frequency Meter to the output of the 12-24 kc/s band-pass filter (junction of R22 and C17, C18).

(6) Adjust C91 which is located on the top of the chassis between V3 and the front panel until the Frequency Meter registers exactly 18 kc/s. If this is unobtainable adjust L3 which is immediately to the right of C91 until 18 kc/s is obtained.

(7) Turn the A.F.C. switch to A.F.C. ON.

(8) Turn the A.F.C. MOTOR switch to the 'SET ↑' position and wait until the indicator stops moving, then switch back to OPERATE. The Frequency Meter should now register between 19.1 kc/s and 19.3 kc/s.

(9) Turn the A.F.C. MOTOR switch to the 'SET ↓' position and wait until the indicator stops moving, then switch back to the OPERATE position. The Frequency Meter should now register between 16.7 kc/s and 16.9 kc/s.

(10) Turn the A.F.C. MOTOR switch to the 'SET ↑' position. When the indicator reaches the centre of the green section, switch to OPERATE.

(11) With the valve voltmeter measure the injection voltage on the suppressor grid (pin 7) of V1. This should be 4 volts or greater.

(12) Turn A.F.C. switch to A.F.C. OFF.

5. <u>18 kc/s Carrier Re-insertion Oscillator</u>

(1) Connect the Frequency Meter to the output of the 18 kc/s oscillator (V9) on the switch side of C63.

(2) Check that the frequency is 18 kc/s ±1 c/s.

(3) If incorrect adjust C70.

(4) Measure the output voltage with the valve voltmeter. This should be greater than 4 volts.

18 kc/s Carrier Amplifiers

6. 1st 18 kc/s Carrier Amplifier

The following equipment is required:-

Standard Signal Generator
Digital Frequency Meter
Valve Voltmeter

(1) Turn the CARRIER GAIN control to the minimum position (fully anti-clockwise).

(2) Connect the valve voltmeter to the grid of V11 (pin 1).

(3) Connect the Signal Generator to the INPUT socket and set the frequency to 100 kc/s with an output of 80 mV.

(4) Connect the Frequency Meter to the output of the 12-24 kc/s band-pass filter as in para. 2 and check that the output is exactly 18 kc/s. If not, re-adjust the Signal Generator slightly to give this frequency.

(5) Adjust the cores of coils L1, L2 and L4 in the 18 kc/s carrier filter (on top of chassis between V6 and V11) for maximum output on the valve voltmeter.

(6) Repeat the adjustments until no further increase can be obtained.

(7) Note the reading on the dB scale of the valve voltmeter and take this as an 0 dB reference.

(8) Increase the frequency of the signal generator until the reading drops by 6 dB. The Frequency Meter should now register between 17.945 kc/s and 17.955 kc/s.

(9) Decrease the frequency of the Signal Generator until -6 dB on the other side of the peak response is reached. The Frequency Meter should now register between 18.045 kc/s and 18.055 kc/s.

(10) Continue decreasing the frequency of the Signal Generator until the valve voltmeter reading falls by a further 20 dB (making 26 dB in all). The Frequency Meter should now register 18.1 kc/s ±20 c/s.

(11) Increase the Signal Generator frequency to the -26 dB point on the other side of the response. The Frequency Meter should now register 17.9 kc/s ±20 c/s.

(12) If this response cannot be obtained repeak the filter at a frequency slightly above or below 18 kc/s by approximately the number of cycles at which the response is in error at -6 dB on the opposite side. This will centralise the response curve.

7. 2nd 18 kc/s Carrier Amplifier

(1) Connect the Signal Generator and Frequency Meter as in para.6.

(2) Connect the valve voltmeter to the grid of V7 (pin 1).

(3) Adjust the Signal Generator to give 18 kc/s on the Frequency Meter.

(4) Adjust the core of L8 to give a peak reading on the valve voltmeter. The tuning will be flat because this tuned circuit is damped, but a peak should be indicated.

(5) Re-check the response at -6 dB and -26 dB each side of 18 kc/s by varying the Signal Generator frequency and ensure that it remains within the limits given in para.6.

(6) Set the Signal Generator output to 80 mV and measure the level obtained at 18 kc/s. This should be greater than 5 volts.

Discriminator

8. The following equipment is required:-

Standard Signal Generator
Digital Frequency Meter

(1) Connect the Signal Generator and Frequency Meter as in para. 6.

(2) Switch the Signal Generator output off.

(3) Switch to TUNE DISCRIMINATOR and adjust the TUNE DISCRIMINATOR preset control to give zero on the meter M1. If this is not possible adjust the preset BALANCE DISCRIMINATOR control half a turn and re-adjust the TUNE DISCRIMINATOR control.

(4) Switch to A.F.C. OFF.

(5) Switch on the Signal Generator output and adjust the frequency to give maximum deflection in one direction on the meter M1.

(6) Adjust the trimmer nearest the front panel on the top of the discriminator transformer (L6), to increase this deflection to the maximum possible.

(7) Adjust the Signal Generator frequency slowly in the opposite direction, to obtain maximum deflection in the opposite direction.

(8) Adjust the rear trimmer on the discriminator transformer to increase this deflection to the maximum possible.

(9) Repeat these adjustments until the deflections in both directions exceed 50 micro-amperes and are approximately equal.

(10) Tune the Signal Generator off frequency and very slowly return until there is a slight deflection on M1 (approximately 10 μA). Note the frequency indicated by the frequency meter.

(11) Switch to A.F.C. ON and wait a few seconds observing if the a.f.c. 'locks-on'. This will be indicated by a slow increase in the deflection to maximum followed by a fast swing to zero and then a short period of slight oscillation.

(12) If no 'lock-on' occurs, switch to A.F.C. OFF and adjust the Signal Generator frequency to increase the deflection by approximately 5 μA.

(13) Switch to A.F.C. ON and repeat the above procedure until the frequency at which 'lock-on' just commences is found.

(14) Repeat the same procedure for deflection in the opposite direction.

(15) The frequencies at which 'lock-on' commences should be between 18.045 kc/s and 18.055 kc/s in one direction and 17.945 kc/s and 17.955 kc/s in the other direction.

(16) If there is unbalance outside these limits note which side locks-on at a frequency further from 18 kc/s. Turn the A.F.C. switch to TUNE DISCRIMINATOR and adjust the preset BALANCE DISCRIMINATOR control slightly to reduce the meter deflection on the side which locked-on furthest from 18 kc/s.

(17) Re-adjust the preset TUNE DISCRIMINATOR control to zero on M1 and re-check 'lock-on' balance as detailed above.

(18) Repeat this procedure until correct balance is obtained and then re-check that the maximum deflection levels on M1 exceed 50 µA and are approximately equal.

A.G.C. Output

9. The following equipment is required:-

Standard Signal Generator
Multi-range Meter

(1) Connect the Signal Generator to the R.F. INPUT socket and adjust the frequency to 100 kc/s.

(2) Connect the multi-range meter between the A.G.C. terminal at the rear and chassis with the meter on the 10-volt d.c. range (negative).

(3) 'Lock-on' the a.f.c.

(4) With the GARRIER GAIN control at minimum, increase the Signal Generator output voltage to 70-90 mV when a reading should begin to appear on the multi-range meter. With the CARRIER GAIN control at maximum a reading should begin to appear when the Signal Generator output is between 3.5 mV and 4.5 mV.

Carrier Rejection Bridge

10. The following equipment is required:-

Standard Signal Generator
Digital Frequency Meter
Valve Voltmeter
Multi-range Meter

(1) Remove the 18 kc/s crystal and set the RA.17/RA.117 switch to RA.17.

(2) Connect the Signal Generator to the R.F. INPUT socket and set the output voltage to 80 mV.

(3) Connect the Frequency Meter to the band-pass filter as in para. 2.

(4) Tune the Signal Generator frequency around 100 kc/s until the a.f.c. 'locks-on' and check the frequency on the Frequency Meter; this should be 18 kc/s ±1 c/s.

(5) Remove the Frequency Meter and connect the valve voltmeter between the grid of V12 and chassis and adjust the range until a reading is obtained.

(6) Adjust L7 and RV4, which are located between the sideband filters and are adjusted from the top, alternately to obtain minimum reading on the valve voltmeter. Continue this procedure until no further reduction can be obtained.

(7) Note this level on the valve voltmeter.

(8) Increase the range of the valve voltmeter by about 40 dB and increase the Signal Generator frequency by approximately 2 kc/s.

(9) Note the new reading on the valve voltmeter which should have increased by more than 40 dB.

(10) Replace the 18 kc/s crystal.

Sideband Filters

11. The following test equipment is required:-

Audio Signal Generator
Digital Frequency Meter
Valve Voltmeter

(1) These filters must be adjusted and tested outside the main unit and must therefore be removed.

(2) Unsolder the screened connecting leads which come out of the filters at their terminating points so that the leads remain attached to the filters.

(3) Unscrew the four 6BA screws holding each filter to the chassis.

(4) Lift the filters clear.

NOTE: Adjust the low-pass filter first as it is required for the adjustments and tests on the high-pass filter. The frequency meter must be dis-connected when actually tuning the stages also when testing the stop band response.

12. Low-pass Filter

(1) Connect the test equipment and filter as shown in figure 2.

(2) Connect the leads A and B across each section in turn and adjust the coil of that section for minimum response on the valve voltmeter with the Signal Generator frequency set according to the following table.

L1 - 18.685 kc/s
L2 - 20.770 kc/s
L3 - 19.685 kc/s
L4 - 21.125 kc/s
L5 - 18.625 kc/s
L6 - 23 kc/s

(3) Repeat these adjustments until no further reduction can be obtained.

(4) Connect the leads A and B to the remote ends of the input and output screened leads.

(5) Adjust the Signal Generator to 17 kc/s and take the valve voltmeter reading as a reference.

(6) Check the response down to 12 kc/s and up to 17.7 kc/s. This should not vary by more than 3 dB.

(7) Check the response continuously from 18.5 kc/s to 24 kc/s. The attenuation should be greater than -55 dB.

13. High-pass Filter

(1) Connect the test equipment, the previously aligned low-pass filter and the high-pass filter as shown in figure 2.

(2) Connect lead A to point C.

(3) Connect the remote ends of leads D and E together.

(4) Connect lead B to the remote end of the capacitor which couples the inductor being tuned to the next inductor, i.e. to tune L1 connect lead B to the junction of C2 and L2. Tune each inductor in turn for minimum response on the valve voltmeter with the signal generator set according to the following table.

L1 - 17.685 kc/s
L2 - 16.140 kc/s
L3 - 16.750 kc/s
L4 - 15.3 kc/s
L5 - 17.5 kc/s
L6 - 12.66 kc/s

(5) Repeat these adjustments until no further reduction can be obtained. If difficulty is experienced in tuning L4, set the core to approximately $4\frac{1}{2}$ turns from the flush position and carry out the final adjustment to correct the passband if necessary at 18.3 kc/s.

(6) Disconnect D and E.

(7) Connect lead A to point E.

(8) Connect lead B to point F.

(9) Adjust the signal generator to 19 kc/s and take the valve voltmeter reading as a reference.

(10) Check the response from 18.3 kc/s to 24 kc/s. This should not vary by more than 3 dB.

(11) If the response is not correct slightly re-adjust L4 and re-check the reference level and passband.

(12) Remove lead A from point E.

(13) Connect D and E together.

(14) Connect lead A to point C.

(15) Check the response continuously from 17.5 kc/s to 12 kc/s. The attenuation should be greater than -55 dB. If this is not achieved near 12 kc/s, slightly re-adjust L6.

Product Detectors

14. The valve voltmeter is required to measure the 18 kc/s injection level on the suppressor grids of these valves (V12 and V14, pin 7). The level should not be less than 4 volts.

Output Stages

15. The following equipment is required:-

Standard Signal Generator
Digital Frequency Meter
Valve Voltmeter
Output Power Meter
Low-pass Filter

(1) Connect the output power meter at 600Ω impedance to the U.S.B. output terminals at the rear.

(2) Connect the valve voltmeter to the same output.

(3) Turn both A.F. GAIN controls fully clockwise and set the RA.17/RA.117 switch to RA.17.

(4) With no input to the unit adjust the core of L11 (rear top of chassis) for minimum reading on the valve voltmeter.

(5) Connect the output power meter and valve voltmeter to the L.S.B. output and adjust L12 for minimum reading on the valve voltmeter.

(6) Connect the signal generator set at 100 kc/s to the input and 'lock-on' the a.f.c.

(7) Connect the frequency meter to the L.S.B. output together with the output meter and valve voltmeter.

(8) Switch the a.f.c. off.

(9) Reduce the signal generator frequency to give a reading of 1 kc/s on the frequency meter and the signal generator output voltage to give a reading of 40 mW on the output power meter.

(10) Note the signal generator output (should be less than 100 mV) and the valve voltmeter readings.

(11) Check the overall response from 300 c/s to 6000 c/s using the frequency meter and valve voltmeter and ensure that it does not vary by more than 3 dB.

(12) Connect the frequency meter to the U.S.B. output and connect the low-pass filter between the L.S.B. output and the valve voltmeter. Increase the signal generator frequency to obtain a reading of 500 c/s on the frequency meter.

(13) Note the valve voltmeter reading which should be less than -50 dB relative to the reading obtained for a 40 mW output.

(14) Continue increasing the signal generator frequency whilst watching the valve voltmeter until the frequency meter indicates 6 kc/s. The level should remain below -50 dB up to 5 kc/s and below -40 dB from 5 kc/s to 6 kc/s.

(15) Repeat the above procedure for the U.S.B. output by changing the connections over and reversing the tuning of the signal generator.

(16) Check the operation of the monitor output jack on the front panel by plugging in low impedance telephones and tuning the signal generator either side of the 'lock-on' position. There should be a note of rising frequency when tuning away from 'lock-on', on one side, whilst the signal produced when tuning on the other side should be almost inaudible.

CHAPTER 4

COMPONENTS LIST

Cct. Ref.	Value	Description	Rat.	Tol. %	N. A. T. O. No.	Manufacturer
Resistors					5905-99-	
R1	47kΩ	carbon	$\frac{1}{2}$W	10	022-2216	Erie 8
R2	10kΩ	carbon	$\frac{1}{2}$W	10	022-2132	Erie 8
R3	68Ω	carbon	$\frac{1}{4}$W	10	022-1088	Dubilier B.T.T.
R4	680Ω	carbon	$\frac{1}{4}$W	10	022-1214	Dubilier B.T.T.
R5	1MΩ	carbon	$\frac{1}{4}$W	10	022-3163	Dubilier B.T.T.
R6	1kΩ	carbon	$\frac{1}{4}$W	10	022-2004	Dubilier B.T.T.
R7	33kΩ	carbon	$\frac{1}{4}$W	10	022-2193	Dubilier B.T.T.
R8	1kΩ	carbon	$\frac{1}{4}$W	10	022-2004	Dubilier B.T.T.
R9	68kΩ	carbon	$\frac{1}{2}$W	10	022-3018	Erie 8
R10	5.6kΩ	carbon	$\frac{1}{4}$W	10	022-2100	Dubilier B.T.T.
R11	2.2kΩ	carbon	$\frac{1}{4}$W	10	022-2046	Dubilier B.T.T.
R12	680kΩ	carbon	$\frac{1}{4}$W	10	022-3142	Dubilier B.T.T.
R13	10kΩ	carbon	$\frac{1}{4}$W	10	022-2130	Dubilier B.T.T.
R14	91kΩ	carbon	$\frac{1}{4}$W	5	021-9254	Erie 108
R15	1MΩ	carbon	$\frac{1}{4}$W	10	022-3163	Dubilier B.T.T.
R16	1MΩ	carbon	$\frac{1}{4}$W	10	022-3163	Dubilier B.T.T.
R17	100kΩ	carbon	$\frac{1}{2}$W	10	022-3039	Erie 8
R18	100kΩ	carbon	$\frac{1}{2}$W	10	022-3039	Erie 8
R19	47kΩ	carbon	$\frac{1}{4}$W	10	022-2214	Dubilier B.T.T.
R20	1kΩ	carbon	$\frac{1}{4}$W	10	022-2004	Dubilier B.T.T.
R21	100kΩ	carbon	$\frac{1}{4}$W	10	022-3037	Dubilier B.T.T.
R22	10kΩ	carbon	$\frac{1}{4}$W	10	022-2130	Dubilier B.T.T.
R23	470kΩ	carbon	$\frac{1}{4}$W	10	022-3121	Dubilier B.T.T.
R24	2.7kΩ	carbon	$\frac{1}{2}$W	10	022-2060	Erie 8
R25	470kΩ	carbon	$\frac{1}{4}$W	10	022-3121	Dubilier B.T.T.
R26	47kΩ	carbon	$\frac{1}{2}$W	10	022-2216	Erie 8
R27	2.2kΩ	wirewound	3W	10	011-3328	Painton 306A
R28	4.7kΩ	carbon	$\frac{1}{4}$W	5	022-2088	Dubilier B.T.T.
R29	1kΩ	carbon	$\frac{1}{4}$W	10	022-2004	Dubilier B.T.T.
R30	DELETED					
R31	22kΩ	carbon	$\frac{1}{2}$W	10	022-2174	Erie 8
R32	56kΩ	carbon	$\frac{1}{2}$W	10	022-3009	Erie 8
R33	68Ω	carbon	$\frac{1}{4}$W	10	022-1088	Dubilier B.T.T.
R34	220kΩ	carbon	$\frac{1}{4}$W	10	022-3079	Dubilier B.T.T.
R35	1.5kΩ	carbon	$\frac{1}{2}$W	10	022-2027	Erie 8

Cct. Ref.	Value	Description	Rat.	Tol. %	N.A.T.O. No.	Manufacturer
Resistors - continued					5905-99-	
R36	560kΩ	carbon	¼W	10	022-3133	Dubilier B.T.T.
R37	3.3MΩ	carbon	¼W	10	022-3226	Dubilier B.T.T.
R38	68Ω	carbon	¼W	10	022-1088	Dubilier B.T.T.
R39	470kΩ	carbon	¼W	10	022-3121	Dubilier B.T.T.
R40	DELETED					
R41	22kΩ	carbon	½W	10	022-2174	Erie 8
R42	22kΩ	carbon	½W	10	022-2174	Erie 8
R43	680kΩ	carbon	¼W	10	022-3142	Dubilier B.T.T.
R44	3.3kΩ	carbon	¼W	10	022-2067	Dubilier B.T.T.
R45	3.3kΩ	carbon	¼W	10	022-2067	Dubilier B.T.T.
R46	180Ω	carbon	¼W	10	022-1142	Dubilier B.T.T.
R47	4.7kΩ	carbon	¼W	10	022-2088	Dubilier B.T.T.
R48	1MΩ	carbon	¼W	10	022-3163	Dubilier B.T.T.
R49	220kΩ	carbon	½W	10	022-3081	Erie 8
R50	DELETED					
R51	100kΩ	carbon	½W	10	022-3039	Erie 8
R52	47kΩ	carbon	¼W	10	022-2214	Dubilier B.T.T.
R53	1.5kΩ	carbon	½W	10	022-2027	Erie 8
R54	DELETED					
R55	DELETED					
R56	DELETED					
R57	2.2MΩ	carbon	¼W	10	022-3205	Dubilier B.T.T.
R58	470kΩ	carbon	¼W	10	022-3121	Dubilier B.T.T.
R59	470kΩ	carbon	¼W	10	022-3121	Dubilier B.T.T.
R60	DELETED					
R61	470kΩ	carbon	¼W	10	022-3121	Dubilier B.T.T.
R62	33kΩ	carbon	½W	10	022-2195	Erie 8
R63	1kΩ	carbon	½W	10	022-2006	Erie 8
R64	47kΩ	carbon	¼W	10	022-2214	Dubilier B.T.T.
R65	10kΩ	carbon	¼W	10	022-2130	Dubilier B.T.T.
R66	27kΩ	carbon	¼W	10	022-2184	Dubilier B.T.T.
R67	100kΩ	carbon	¼W	10	022-3037	Dubilier B.T.T.
R68	220Ω	carbon	¼W	10	022-1151	Dubilier B.T.T.
R69	4.7kΩ	carbon	½W	10	022-2090	Erie 8
R70	DELETED					
R71	47kΩ	carbon	½W	10	022-2216	Erie 8

Cct. Ref.	Value	Description	Rat.	Tol. %	N. A. T. O. No.	Manufacturer
Resistors - continued					5905-99-	
R72	33kΩ	carbon	½W	10	022-2195	Erie 8
R73	10kΩ	carbon	¼W	10	022-2130	Dubilier B.T.T.
R74	680Ω	carbon	¼W	10	022-1214	Dubilier B.T.T.
R75	1MΩ	carbon	¼W	10	022-3163	Dubilier B.T.T.
R76	100kΩ	carbon	¼W	10	022-3037	Dubilier B.T.T.
R77	1MΩ	carbon	¼W	10	022-3163	Dubilier B.T.T.
R78	1kΩ	carbon	¼W	10	022-2004	Dubilier B.T.T.
R79	1kΩ	carbon	¼W	10	022-2004	Dubilier B.T.T.
R80	DELETED					
R81	1MΩ	carbon	¼W	10	022-3163	Dubilier B.T.T.
R82	12kΩ	carbon	¼W	10	022-2142	Dubilier B.T.T.
R83	12kΩ	carbon	¼W	10	022-2142	Dubilier B.T.T.
R84	4.7kΩ	carbon	½W	10	022-2090	Erie 8
R85	47kΩ	carbon	½W	10	022-2216	Erie 8
R86	33kΩ	carbon	½W	10	022-2195	Erie 8
R87	100kΩ	carbon	¼W	10	022-3037	Dubilier B.T.T.
R88	10kΩ	carbon	¼W	10	022-2130	Dubilier B.T.T.
R89	680Ω	carbon	¼W	10	022-1214	Dubilier B.T.T.
R90	6.8kΩ	carbon	½W	10	022-2111	Erie 8
R91	1MΩ	carbon	¼W	10	022-3163	Dubilier B.T.T.
R92	180Ω	wirewound	6W	5	011-3379	Painton 302A
R93	6.8kΩ	carbon	½W	10	022-2111	Erie 8
R94	DELETED					
R95	100kΩ	carbon	¼W	10	022-3037	Dubilier B.T.T.
R96	220Ω	carbon	½W	10	022-1153	Erie 8
R97	DELETED					
R98	100kΩ	carbon	¼W	10	022-3037	Dubilier B.T.T.
R99	220Ω	carbon	½W	10	022-1153	Erie 8
R100	2.2kΩ	carbon	¼W	10	022-2046	Dubilier B.T.T.
R101	100kΩ	carbon	½W	10	022-3039	Erie 8
R102	100kΩ	carbon	½W	10	022-3039	Erie 8
Potentiometers						
RV1	5kΩ	linear				Racal DA15774-49
RV2	1kΩ	wirewound linear				Racal DA15774-53

Cct. Ref.	Value	Description	Rat.	Tol. %	N.A.T.O. No.	Manufacturer
Potentiometers - continued						
RV3	5kΩ	linear				Racal DA15774-52
RV4	50kΩ	linear				Racal DA15774-51
RV5	1MΩ	Log.				Racal DA15774-50
RV6	1MΩ	Log.				Racal DA15774-50
Capacitors					5910-99-	
C1	820pF	silv'd mica	350V	2		Lemco 1106S
C2	82pF	silv'd mica	350V	2		Lemco 1106S
C3	0.005μF	tubular paper	500V	20	012-0122	Hunts W97/BM6KV
C4	0.04μF	tubular paper	250V	20	012-0116	Hunts W97/BM6KV
C5	100pF	silv'd mica	350V	5		Lemco 1106S
C6	470pF	silv'd mica	350V	5		Lemco 1106S
C7	100pF	silv'd mica	350V	5		Lemco 1106S
C8	2200pF	silv'd mica	200V	2		Lemco 1106S
C9	330pF	silv'd mica	350V	5		Lemco 1106S
C10	0.01μF	tubular paper	200V	20	011-5627	T.C.C. CP112H
C11	68pF	silv'd mica	350V	2		Lemco 1106S
C12	3300pF	silv'd mica	200V	2		Lemco 1106S
C13	0.1μF	paper	150V	20	011-5560	Hunts W49/8500LP
C14	0.1μF	paper	150V	20	011-5560	Hunts W49/8500LP
C15	150pF	silv'd mica	350V	2		Lemco 1106S
C16	2200pF	silv'd mica	350V	2		Lemco 1106S
C17	820pF	silv'd mica	350V	2		Lemco 1106S
C18	82pF	silv'd mica	350V	2		Lemco 1106S
C19	0.005μF	paper	500V	20	012-0122	Hunts W97/BM20KV
C20	120pF	silv'd mica	350V	5		Lemco 1106S
C21	100pF	silv'd mica	350V	5		Lemco 1106S
C22	0.01μF	paper	200V	20	011-5627	T.C.C. CP112H
C23	1000pF	silv'd mica	350V	5		Lemco 1106S
C24	0.1μF	paper	350V	20	011-5506	T.C.C. CP37N
C25	0.1μF	paper	350V	20	011-5562	Hunts W49/B512
C26	1μF	electrolytic	450V			T.C.C. CE132PE
C27	150pF	silv'd mica	350V	5		Lemco 1106S
C28	0.01μF	paper	200V	20	011-5627	T.C.C. CP112H
C29	0.01μF	paper	500V	20	012-0123	Hunts W97/BM21KV
C30	70pF	variable				Oxley 464

Cct. Ref.	Value	Description	Rat.	Tol. %	N.A.T.O. No.	Manufacturer
Capacitors - continued					5910-99-	
C31	0.022µF	silv'd mica	350V	1		J. & M. C33S
C32	1000pF	silv'd mica	350V	5		Lemco 1106S
C33	1000pF	silv'd mica	350V	5		Lemco 1106S
C34	0.01µF	paper	350V	20	011-5625	T.C.C. CP3N
C35	120pF	silv'd mica	350V	5		Lemco 1106S
C36	0.01µF	paper	200V	20	011-5627	T.C.C. CP112H
C37	0.005µF	paper	500V	20	012-0122	Hunts W97/BM20
C38	0.005µF	paper	500V	20	012-0122	Hunts W97/BM20
C39	1µF	electrolytic	450V			T.C.C. CE132PE
C40	33pF	variable				Wingrove & Rogers C31-11/1
C41	0.1µF	paper	350V	20	011-5506	T.C.C. CP37N
C42	DELETED					
C43	0.1µF	paper	150V	20	011-5560	Hunts W49/B500LP
C44	DELETED					
C45	DELETED					
C46	2700pF	silv'd mica	200V	2		Lemco 1106S
C47	3300pF	silv'd mica	200V	2		Lemco 1106S
C48	2700pF	silv'd mica	200V	2		Lemco 1106S
C49	220pF	silv'd mica	350V	5		Lemco 1106S
C50	33pf	variable				Wingrove & Rogers C31-11/1
C51	0.1µF	paper	150V	20	011-5560	Hunts W49/B500LP
C52	0.1µF	paper	350V	20	011-5506	T.C.C. CP37N
C53	1µF	electrolytic	450V			T.C.C. CE132PE
C54	16µF+ 16µF	electrolytic	350V			Plessey CE504
C55	0.1µF	paper	350V	20	011-5506	T.C.C. CP37N
C56	56pF	silv'd mica	350V	2		Lemco 1106S
C57	1000pF	silv'd mica	350V	2		Lemco 1106S
C58	10µF	electrolytic	25V			T.C.C. CE30C
C59	270pF	silv'd mica	350V	2		J. & M. CX.22S
C60	70pF	variable				Oxley 464
C61	100pF	silv'd mica	350V	2		J. & M. CX-22S
C62	18pF	silv'd mica	350V	5		Lemco 1106S
C63	0.001µF	paper	500V	20	012-0119	Hunts W97/BM6KV

Cct. Ref.	Value	Description	Rat.	Tol. %	N.A.T.O. No.	Manufacturer
Capacitors - continued					5910-99-	
C64	100pF	silv'd mica	350V	2		J. & M. CX-22S
C65	0.1μF	paper	350V	20	011-5506	T.C.C. CP37N
C66	SEE C54					
C67	0.1μF	paper	350V	20	011-5506	T.C.C. CP37N
C68	270pF	silv'd mica	350V	2		J. & M. CX-22S
C69	1000pF	silv'd mica	350V	2		Lemco 1106S
C70	50pF	variable				Wingrove & Rogers C8-03
C71	56pF	silv'd mica	350V	2		Lemco 1106S
C72	10μF	electrolytic	25V			T.C.C. CE30C
C73)	32μF+	electrolytic	350V			Plessey CE818/1
C74)	32μF					
C75	0.01μF	paper	500V	20	012-0123	Hunts W97/BM21K
C76	0.01μF	paper	500V	20	012-0123	Hunts W97/BM21K
C77	1000pF	silv'd mica	350V	2		Lemco 1106S
C78	100pF	silv'd mica	350V	5		Lemco 1106S
C79	270pF	silv'd mica	350V	2		Lemco 1106S
C80	22pF	silv'd mica	350V	5		Lemco 1106S
C81	DELETED					
C82	0.01μF	paper	500V	20	012-0123	Hunts W97/BM21K
C83	1000pF	silv'd mica	350V	2		Lemco 1106S
C84	100pF	silv'd mica	350V	5		Lemco 1106S
C85	39pF	ceramic	750V	5	011-8362	Erie P100C
C86	DELETED					
C87	0.01μF	paper	500V	20	012-0123	Hunts W97/BM21KV
C88	0.01μF	paper	500V	20	012-0123	Hunts W97/BM21KV
C89	5-100pF	variable				Racal AD15570
C90	820pF	silv'd mica	350V	5		Lemco 1106S
C91	50pF	variable				Wingrove & Rogers C8-03
C92	4μF	electrolytic	450V			Plessey CE1632/1
C93	4μF	electrolytic	450V			Plessey CE1632/1
C94	0.001μF	paper	750V	20	012-0133	Hunts W97/BM32KV
C95	0.001μF	paper	750V	20	012-0133	Hunts W97/BM32KV
C96	270pF	silv'd mica	350V	2		J. & M. CX-22S
C97	270pF	silv'd mica	350V	2		J. & M. CX-22S

Cct. Ref.	Value	Description	Rat.	Tol. %	N.A.T.O. No.	Manufacturer
Low-Pass Filter Assembly Type BA13480						
Capacitors						
C1	4700pF	silv'd mica	200V	2		Lemco 1106S
C1A	22pF	silv'd mica	350V	±1pF		Lemco 1106S
C2	560pF	silv'd mica	350V	2		Lemco 1106S
C3	1000pF	silv'd mica	350V	2		Lemco 1106S
C3A	56pF	silv'd mica	350V	2		Lemco 1106S
C4	470pF	silv'd mica	350V	2		Lemco 1106S
C4A	82pF	silv'd mica	350V	2		Lemco 1106S
C5	1800pF	silv'd mica	200V	2		Lemco 1106S
C5A	330pF	silv'd mica	350V	2		Lemco 1106S
C6	820pF	silv'd mica	350V	2		Lemco 1106S
C6A	56pF	silv'd mica	350V	2		Lemco 1106S
C7	560pF	silv'd mica	350V	2		Lemco 1106S
C7A	68pF	silv'd mica	350V	2		Lemco 1106S
C8	680pF	silv'd mica	350V	2		Lemco 1106S
C8A	120pF	silv'd mica	350V	2		Lemco 1106S
C9	820pF	silv'd mica	350V	2		Lemco 1106S
C10	680pF	silv'd mica	350V	2		Lemco 1106S
C10A	15pF	silv'd mica	350V	2		Lemco 1106S
C11	470pF	silv'd mica	350V	2		Lemco 1106S
C11A	82pF	silv'd mica	350V	2		Lemco 1106S
Inductors						
L1	16.2mH					Racal BA13667
L2	93.5mH					Racal BA13668
L3	64mH					Racal BA13669
L4	103mH					Racal BA13670
L5	35mH					Racal BA13671
L6	55mH					Racal BA14338
High-Pass Filter Assembly Type BA13481						
Capacitors						
C1	100pF	silv'd mica	350V	2		Lemco 1106S
C1A	47pF	silv'd mica	350V	1		Lemco 1106S

Cct. Ref.	Value	Description	Rat.	Tol. %	N.A.T.O. No.	Manufacturer
Capacitors - continued						
C2	1200pF	silv'd mica	350V	2		Lemco 1106S
C2A	120pF	silv'd mica	350V	2		Lemco 1106S
C3	1000pF	silv'd mica	350V	2		Lemco 1106S
C3A	150pF	silv'd mica	350V	2		Lemco 1106S
C4	1000pF	silv'd mica	350V	2		Lemco 1106S
C4A	56pF	silv'd mica	350V	2		Lemco 1106S
C5	680pF	silv'd mica	350V	2		Lemco 1106S
C5A	47pF	silv'd mica	350V	2		Lemco 1106S
C6	1000pF	silv'd mica	350V	2		Lemco 1106S
C6A	27pF	silv'd mica	350V	±1pF		Lemco 1106S
C7	1200pF	silv'd mica	350V	2		Lemco 1106S
C7A	82pF	silv'd mica	350V	2		Lemco 1106S
C8	1000pF	silv'd mica	350V	2		Lemco 1106S
C9	270pF	silv'd mica	350V	2		Lemco 1106S
C9A	33pF	silv'd mica	350V	2		Lemco 1106S
C10	1000pF	silv'd mica	350V	2		Lemco 1106S
C10A	270pF	silv'd mica	350V	2		Lemco 1106S
C11	1000pF	silv'd mica	350V	2		Lemco 1106S
C11A	220pF	silv'd mica	350V	2		Lemco 1106S
Inductors						
L1	484mH					Racal BA13672
L2	88mH					Racal BA13673
L3	122mH					Racal BA13674
L4	82.8mH					Racal BA13675
L5	251mH					Racal BA13676
L6	127mH					Racal BA13679
18 kc/s Carrier Filter Type BC15599						
Capacitors						
C1	133pF	polystrene	125V	2		Salford Elec. Inst.
C2	220pF	polystrene	350V	1		G.E.C. P.F.
C3	5820pF	polystrene	125V	2		Salford Elec. Inst.
C4	220pF	polystrene	125V	1		Salford Elec. Inst.

Cct. Ref.	Value	Description	Rat.	Tol. %	N.A.T.O. No.	Manufacturer
Capacitors - continued						
C5	5820pF	polystrene	125V	2		Salford Elec. Inst.
C6	220pF	polystrene	125V	1		Salford Elec. Inst.
C7	1336pF	polystrene	125V	2		Salford Elec. Inst.
Inductors						
L1	58.2mH					Racal BA15630/A
L2	13.4mH					Racal BA15630/B
L3	13.4mH					Racal BA15630/B
L4	58.2mH					Racal BA15630/A
Valves						
V1		Mixer				6AS6 (CV2522)
V2		Cathode follower				12AU7 (CV491)
V3		18 kc/s oscillator				6AU6 (CV2524)
V4		Discriminator				EB91 (CV140)
V5		18 kc/s rejection				12AX7 (CV492)
V6		18 kc/s carrier amplifier				6BA6 (CV454)
V7		Discriminator amplifier				6BA6 (CV454)
V8		Sideband amplifier				12AT7 (CV455)
V9		18 kc/s oscillator				6AU6 (CV2524)
V10		A.G.C.				EB91 (CV140)
V11		18 kc/s carrier amplifier				6AU6 (CV2524)
V12		U.S.B. detector				6AS6 (CV2522)
V13		Cathode follower				12AT7 (CV455)
V14		L.S.B. detector				6AS6 (CV2522)
V15		U.S.B. output				EF91 (CV138)
V16		L.S.B. output				EF91 (CV138)
Inductors						
L1	133mH	Band-Pass Filter				Racal BA13665
L2	32.2mH	Band-Pass Filter				Racal BA13666
L3	1.13mH	118 kc/s oscillator				Racal BA13664/B
L4	133mH	Band-Pass Filter				Racal BA13665
L5	DELETED					

Cct. Ref.	Value	Description	Rat.	Tol. %	N.A.T.O. No.	Manufacturer
Inductors - continued						
L6		Discriminator				Racal BA15632
L7	3.65mH	Carrier rejection				Racal BA15678
L8	15.6mH	Carrier amplifier				Racal AA15905
L9	5H	Smoothing choke				Racal T1081
L10	DELETED					
L11	1000mH	A.F. Filter				Racal BA13677
L12	1000mH	A.F. Filter				Racal BA13677
Transformers						
T1		Mains (Power) transformer				Racal BT11670
T2		Output transformer				Racal T1080
T3		Output transformer				Racal T1080
Crystals						
XL1		89.96 kc/s				Racal BD16066
XL2		18 kc/s				Racal BD16065
Switches						
SA		A.F.C. switch				Racal BSW15942
SB		Service switch				Racal BSW15943
SC		Power switch				Arrow 81058/BT33
SD		Sideband selector switch				Arrow 81058/BT33
SE		RA.17/RA.117 switch				Racal BSW23421
Plugs and Sockets						
PL1+		100 kc/s input				Film & Equipment Z.54010
PL2+		118 kc/s oscillator lock				Magnetic Devices Z540151
SK1*		100 kc/s input				Film & Equipment SP.239
SK2*		118 kc/s oscillator lock				Amphenol UG.1094/U

Cct. Ref.	Value	Description	Rat.	Tol. %	N.A.T.O. No.	Manufacturer
JK1+		Monitor				Shipton AP61492A
JK1*		Monitor				Igranic P71

Items marked + are fitted to A version.

Items marked * are fitted to B version.

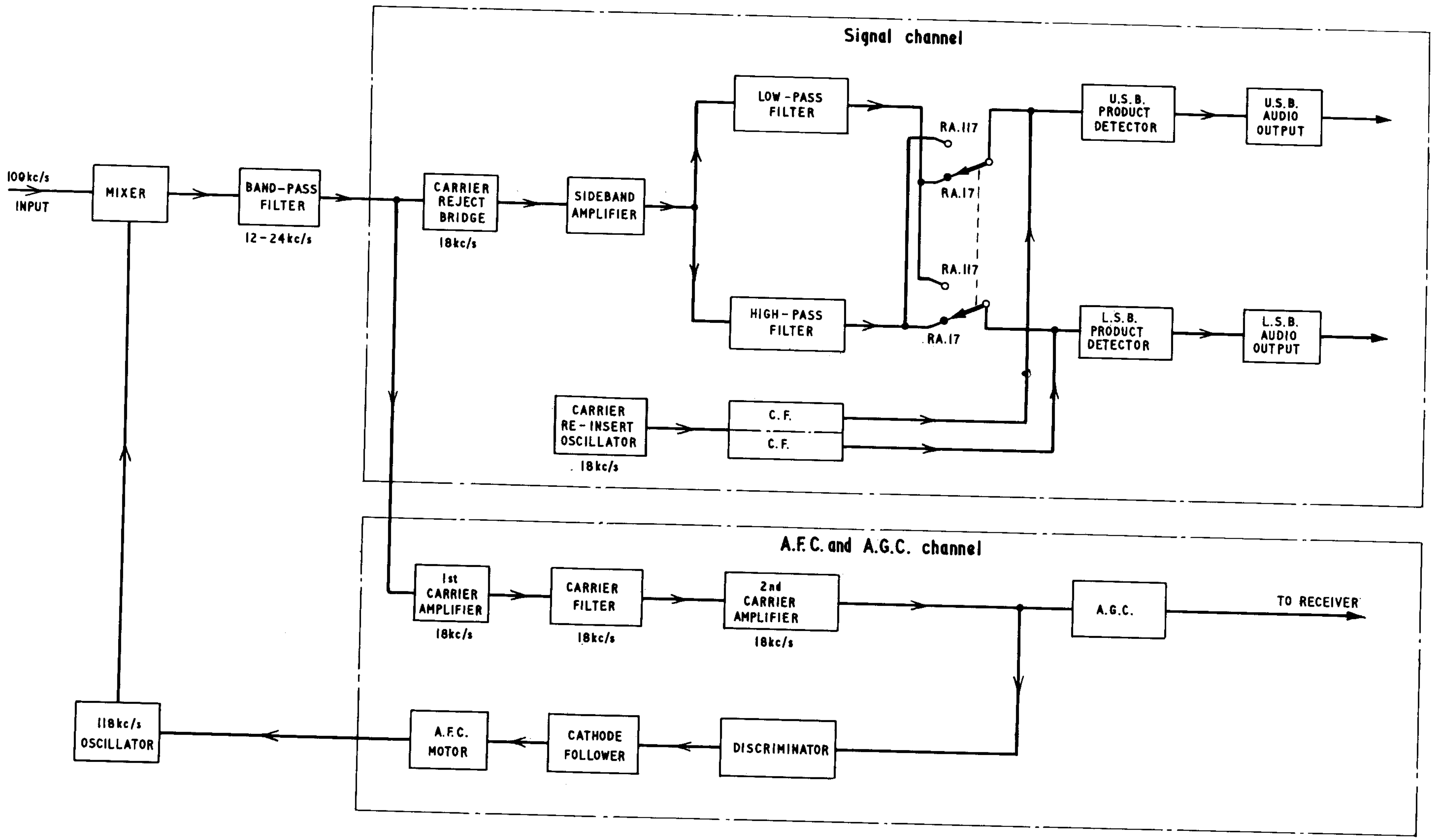


Fig. 1

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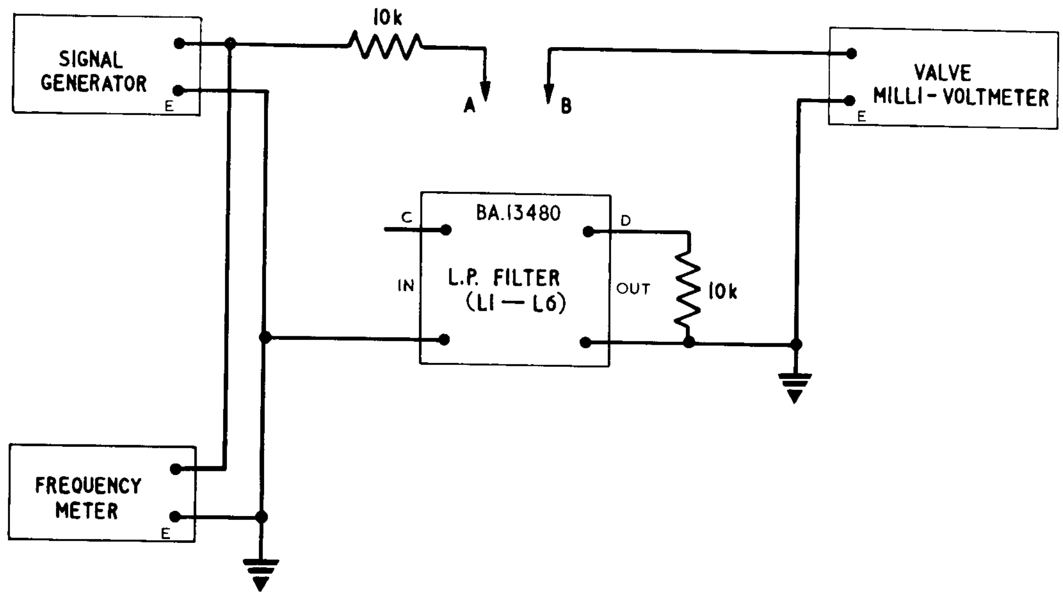
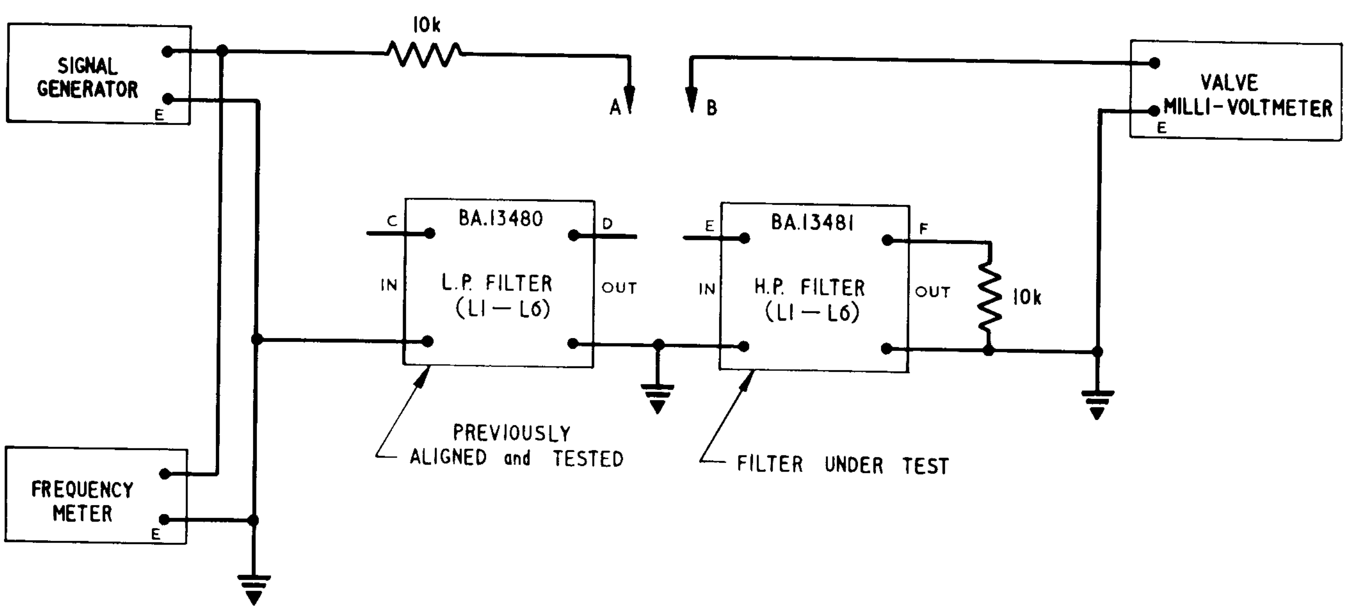
Block Diagram: I.S.B. Adaptors Type RA.98A & B



L.P. Filter alignment



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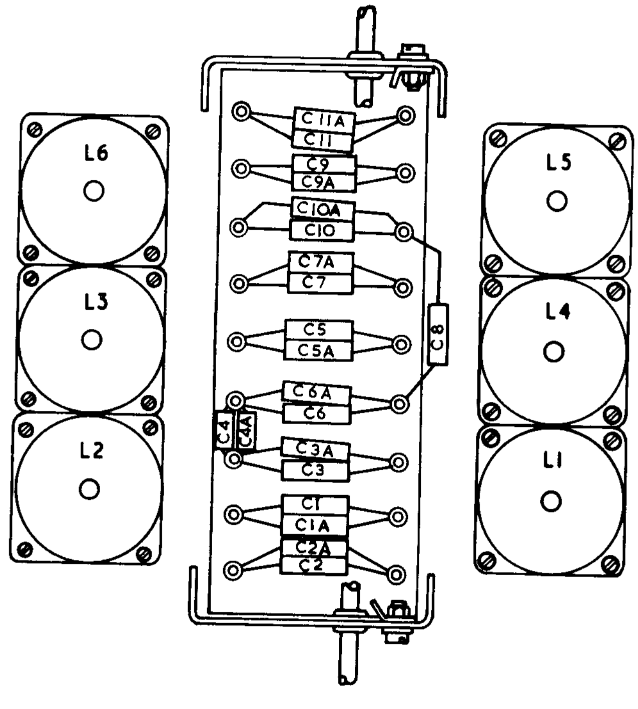
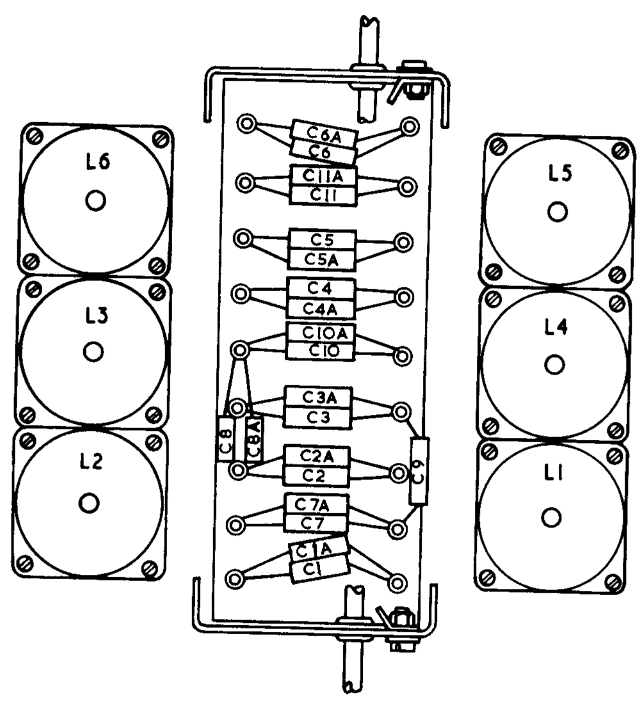
H.P. Filter alignment

Fig. 2

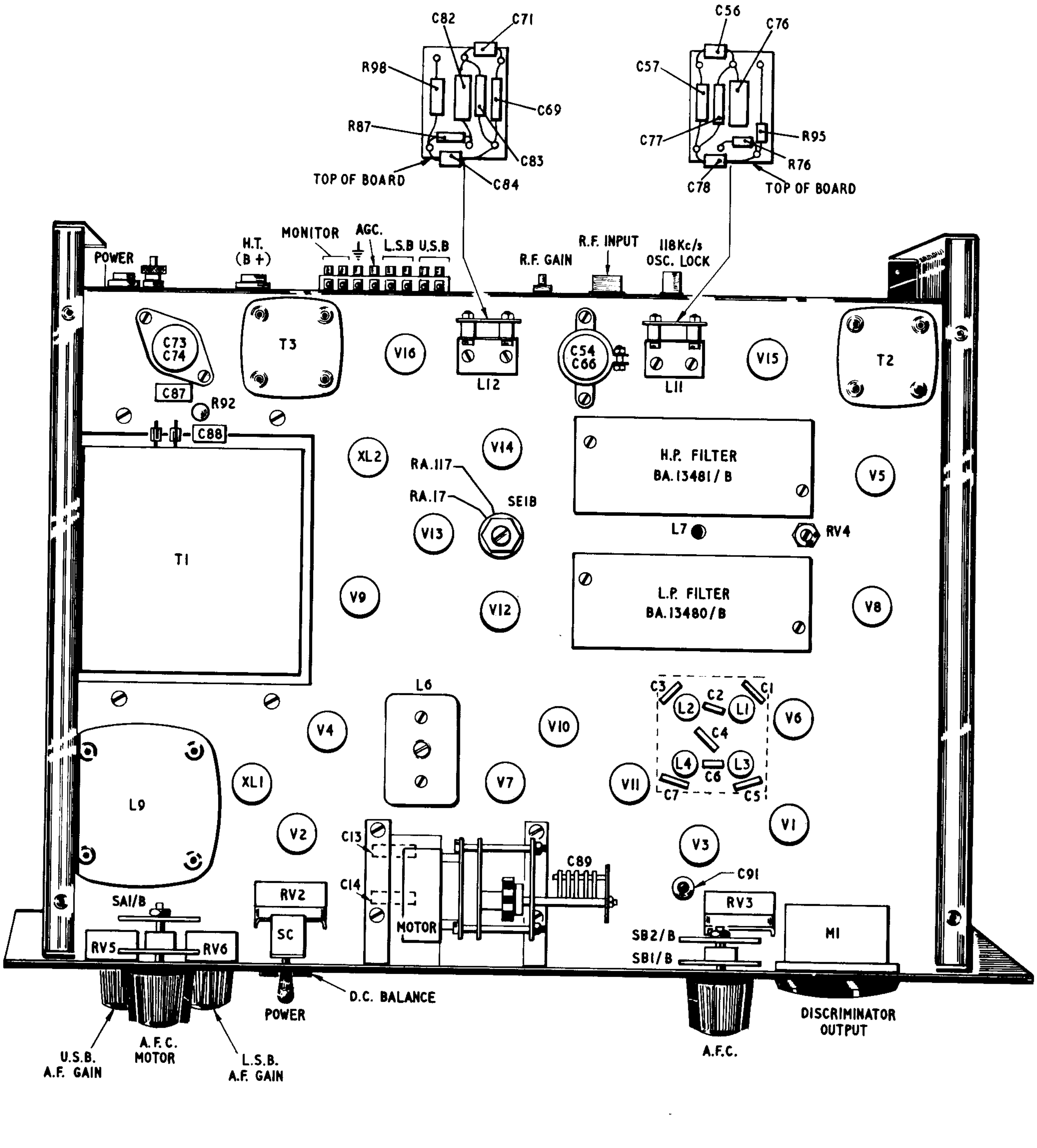


HIGH-PASS FILTER



LOW-PASS FILTER

Component Location : Sideband Filters Fig.3



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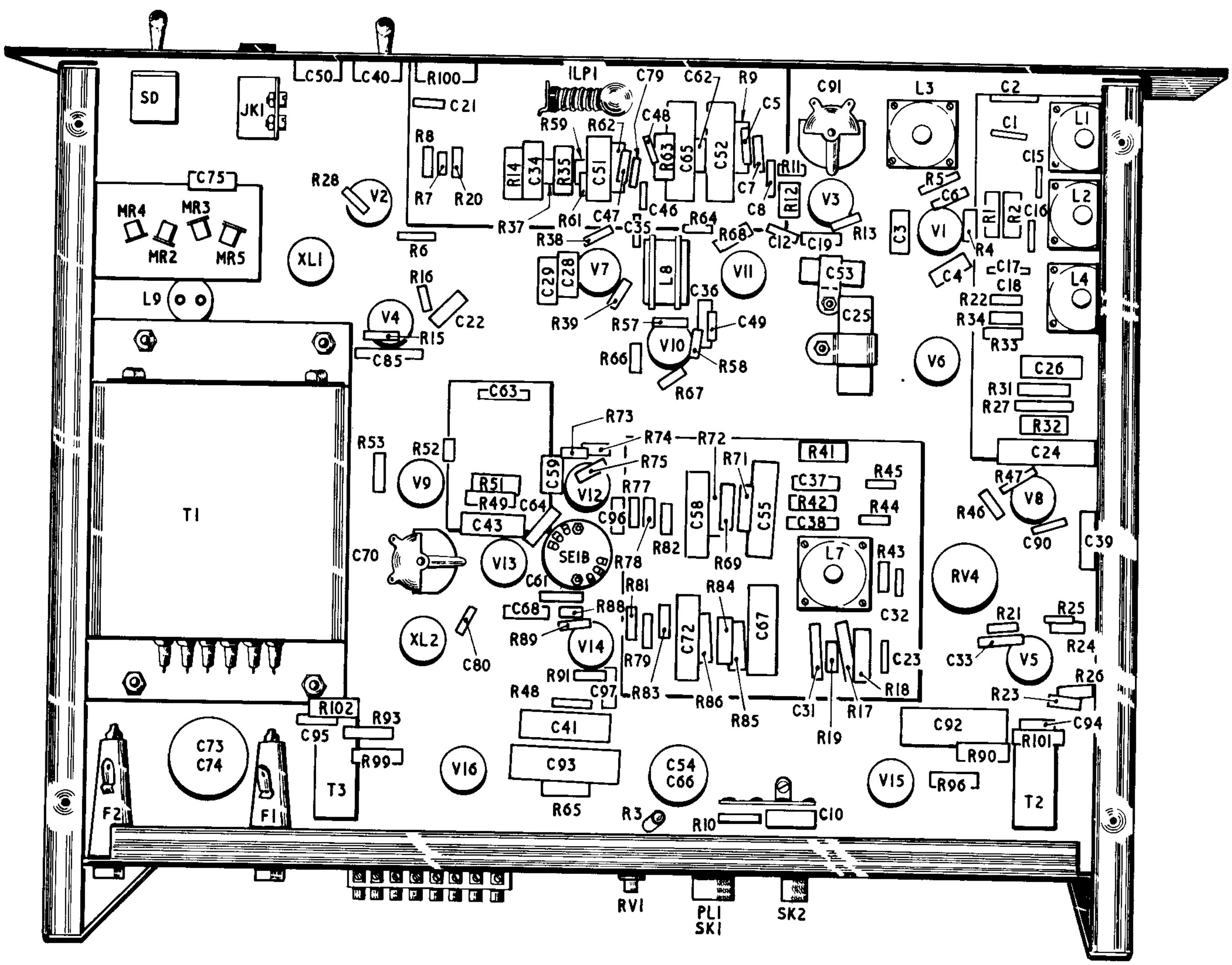
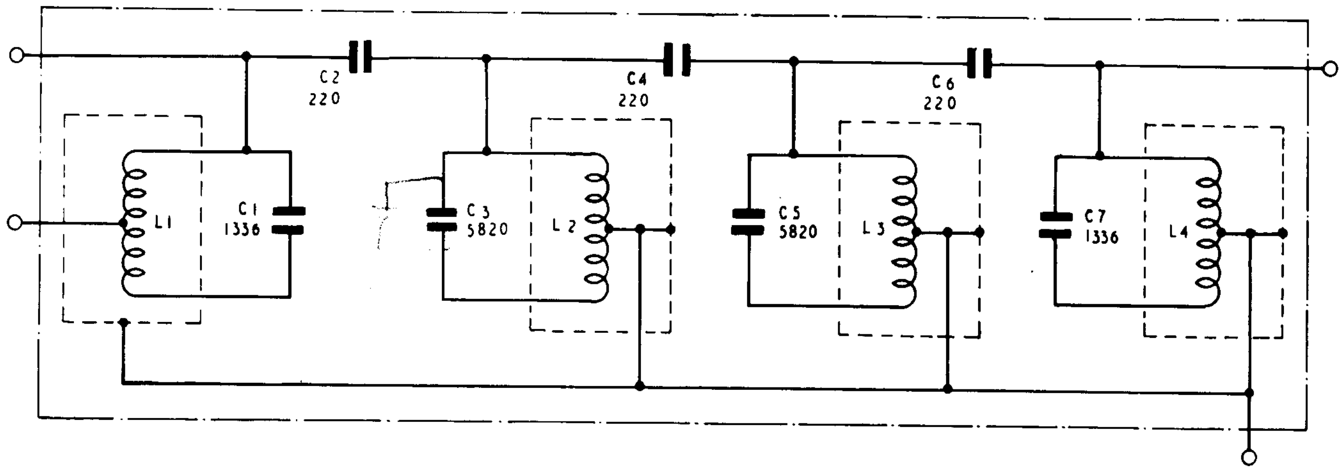
Component Layout : Chassis Top-RA.98A & B

Fig.4

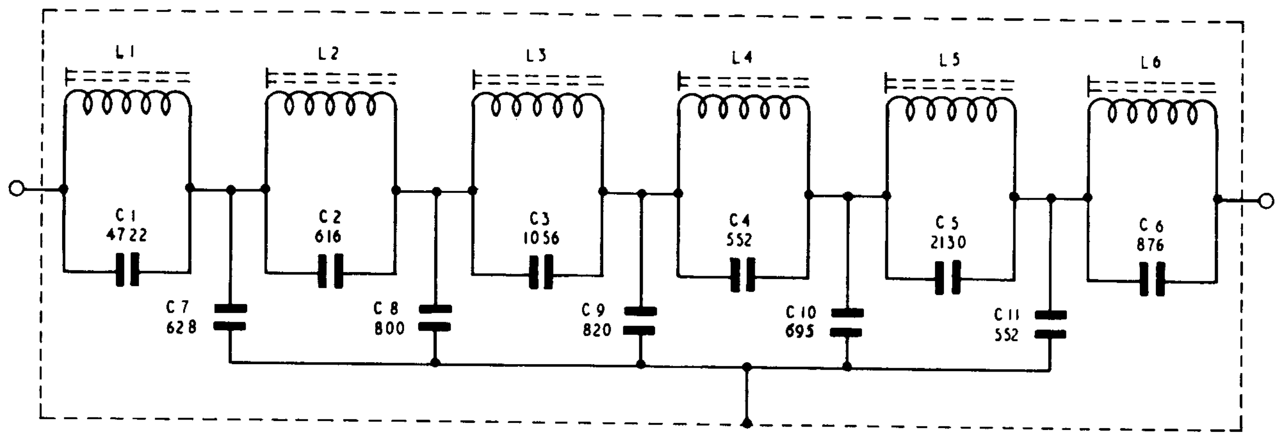


134/1/2 Component Layout : Chassis Underside RA.98A & B Fig.5

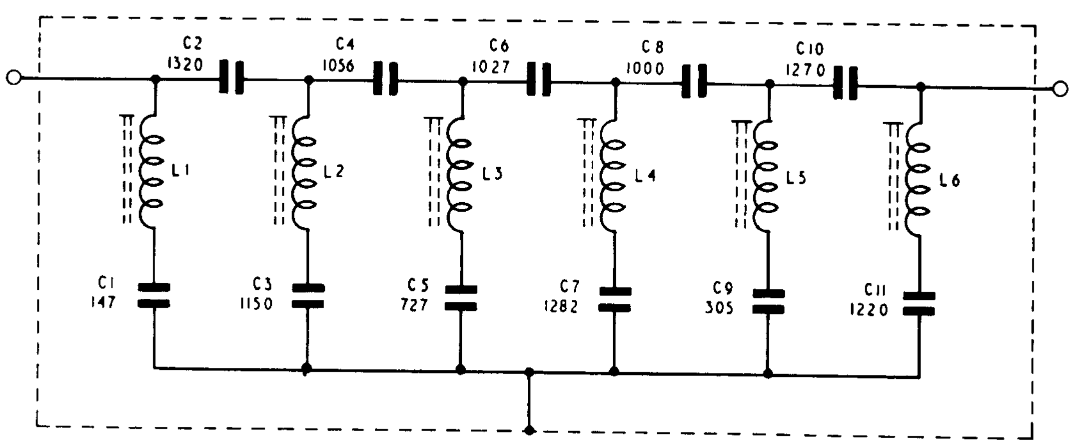
18 kc/s. CARRIER FILTER



LOW PASS FILTER



HIGH PASS FILTER



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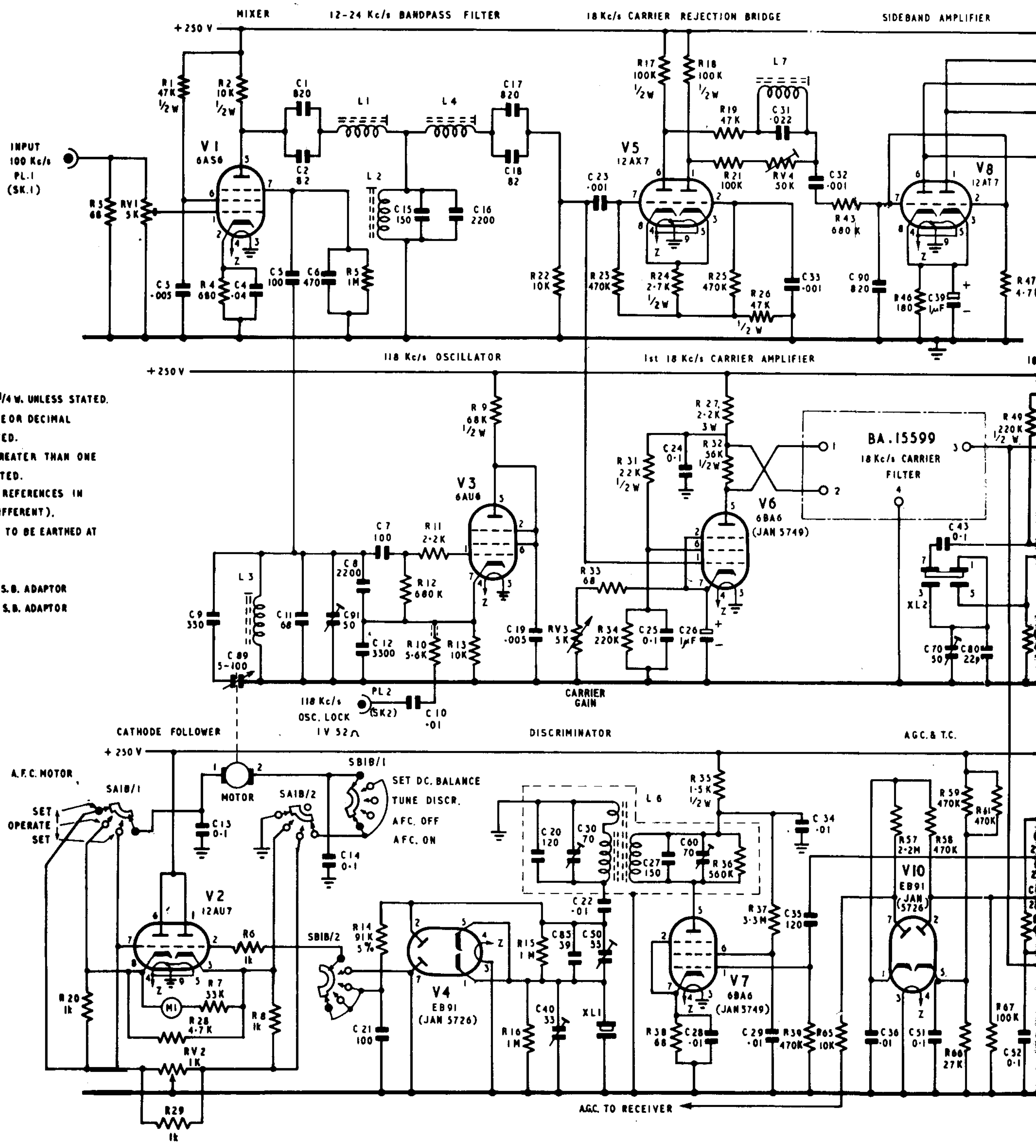
Filters: RA.98A&B

FIG.6



NOTE:-

1. ALL RESISTORS ARE ¼ W. UNLESS STATED.
2. CAPACITOR VALUES ONE OR DECIMAL ARE μF UNLESS STATED.
3. CAPACITOR VALUES GREATER THAN ONE ARE pF UNLESS STATED.
4. (AMERICAN CIRCUIT REFERENCES IN BRACKETS WHERE DIFFERENT).
5. ALL SCREENED LEADS TO BE EARTHED AT BOTH ENDS.

RA. 98A. (BRITISH) I.S.B. ADAPTOR
RA. 98B. (AMERICAN) I.S.B. ADAPTOR

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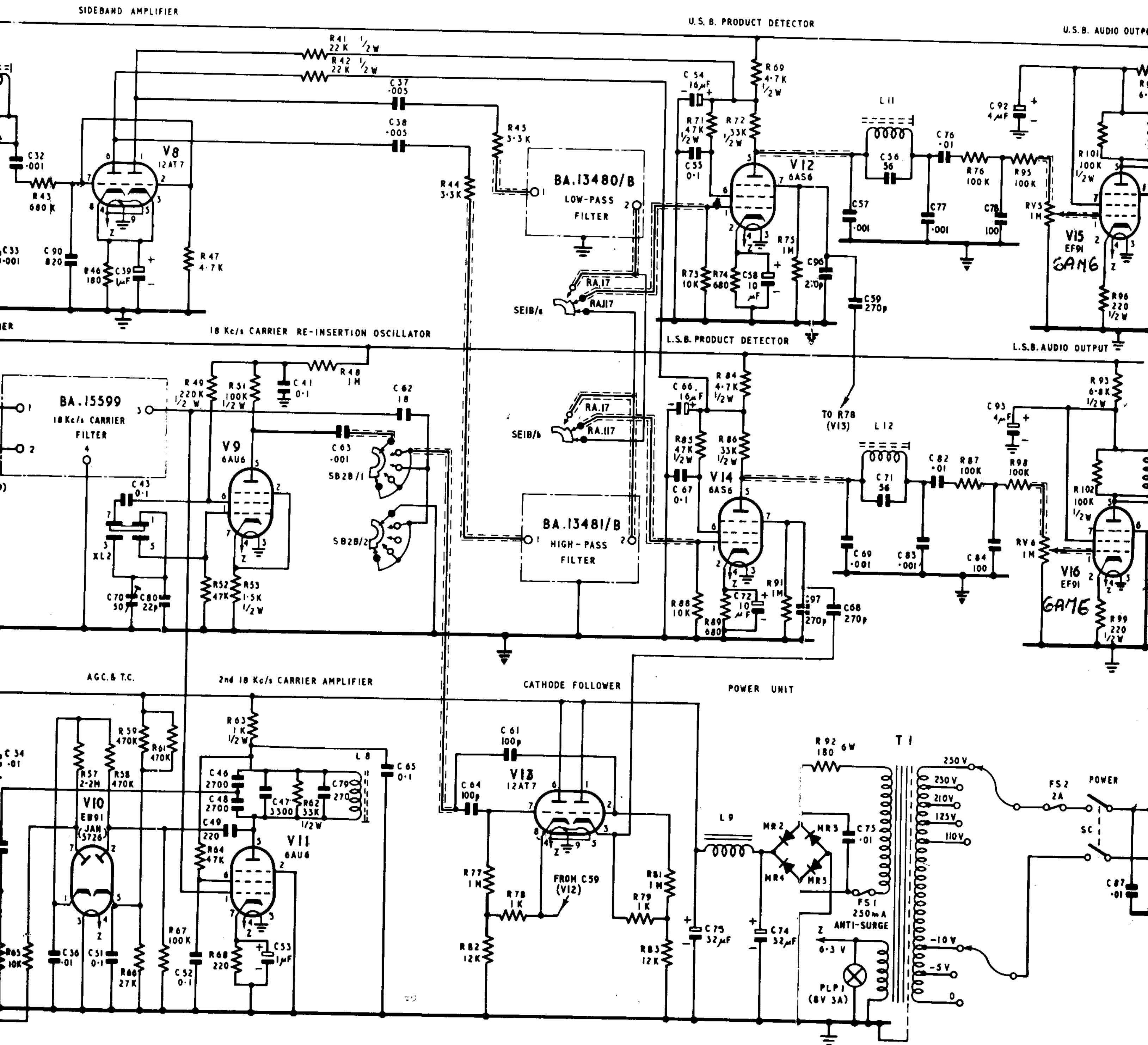
Circuit : Independant Sideband Adapto



dant Sideband Adaptor Type RA.98A&B

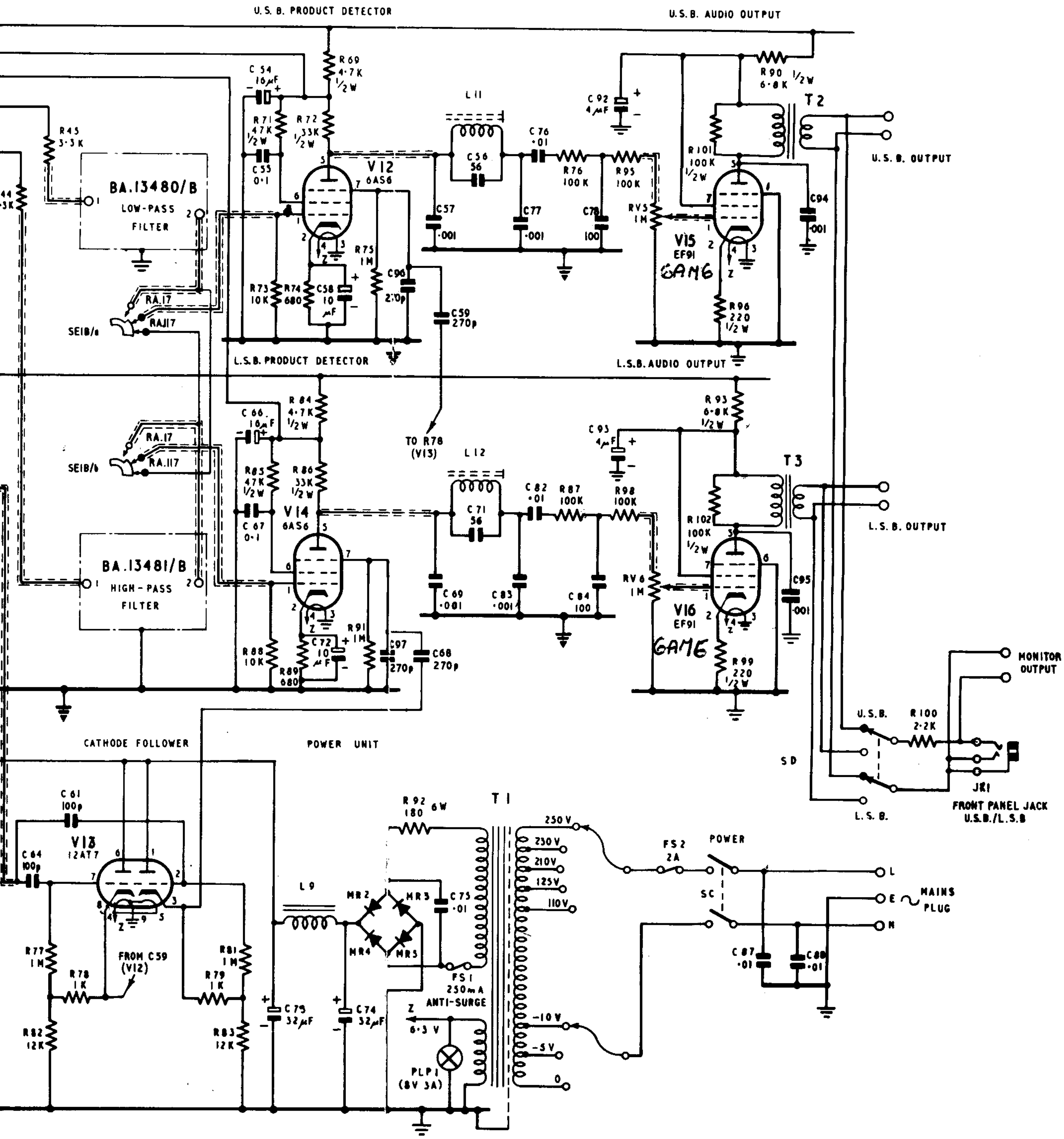
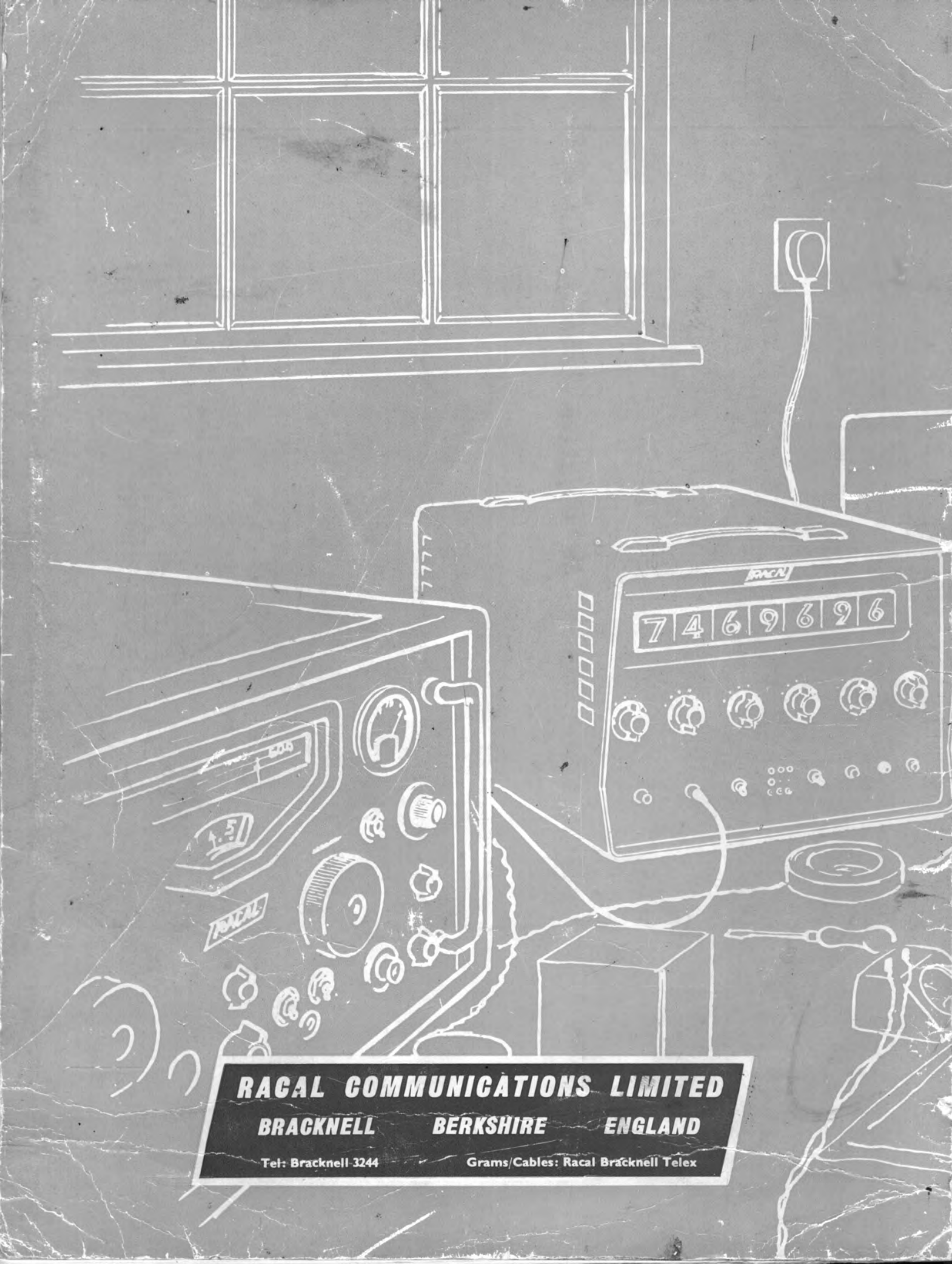

U.S.B. PRODUCT DETECTOR
U.S.B. AUDIO OUTPUT
L.S.B. PRODUCT DETECTOR
L.S.B. AUDIO OUTPUT
BA.13480/B
LOW-PASS
FILTER
BA.13481/B
HIGH-PASS
FILTER
SEIB/a
SEIB/b
RA.17
RA.117
V12
6AS6
V14
6AS6
V15
EF91
V16
EF91
GANG
GANG
V13
12AT7
T2
T3
T1
L11
L12
L9
U.S.B. OUTPUT
L.S.B. OUTPUT
MONITOR
OUTPUT
JK1
FRONT PANEL JACK
U.S.B./L.S.B
U.S.B.
L.S.B.
SD
R100
2.2K
TO R78
(V13)
FROM C59
(V12)
CATHODE FOLLOWER
POWER UNIT
R92
180 6W
MR2
MR3
MR4
MR5
FS1
250mA
ANTI-SURGE
PLP1
(8V 3A)
6.3 V
250 V
230 V
210V
125V
110V
-10 V
-5 V
0
FS2
2A
POWER
SC
L
E
N
MAINS
PLUG
C87
·01
C88
·01
C73
32μF
C74
32μF
C75
·01
R69
4.7K
½W
R72
33K
½W
R71
47K
½W
C54
16μF
C55
0.1
R73
10K
R74
680
C58
10
μF
R75
1M
C96
270p
C59
270p
R43
3.3K
C56
56
C57
·001
C76
·01
R76
100K
C77
·001
C78
100
R95
100K
RV5
1M
C92
4μF
R90
6.8K
½W
R101
100K
½W
C94
·001
R96
220
½W
R84
4.7K
½W
C66
16μF
R85
47K
½W
R86
33K
½W
C67
0.1
R88
10K
R89
680
C72
10
μF
R91
1M
C97
270p
C68
270p
C71
56
C69
·001
C82
·01
R87
100K
C83
·001
R98
100K
C84
100
RV6
1M
C93
4μF
R93
6.8K
½W
R102
100K
½W
C95
·001
R99
220
½W
C61
100p
C64
100p
R77
1M
R78
1K
R82
12K
R81
1M
R79
1K
R83
12K

FIG. 7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