

PLESSEY ELECTRONICS



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PR155G MF/HF Communications Receiver

Service Manual Publication No.061 Vol.1 Issue 10
Equipment Serial No.

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Technical Summary

Frequency Range:

60 kHz to 30.1 MHz continuous coverage (will operate down to 30 kHz with slight degradation of performance). CW, MCW, DSB (A1, A2, A3)
Two spare switch positions for additional modes.

Modes of Reception:

After 5 hour warm up at steady ambient, less than 30 Hz drift per hour.
Short term stability; less than 5 Hz variation per minute.
From 1 minute after switch on; less than 800 Hz in 60 minutes.
2nd hour; less than 100 Hz. 3 to 5 hours; less than 100 Hz.
Less than 40 Hz per °C after 5 hour warm-up.

Frequency Stability:

Spread of Drift:

6 dB - greater than 150 Hz	60 dB - less than 1.8 kHz
" " " 300 Hz	" " " 3 kHz
" " " 1.4 kHz	" " " 5.5 kHz
" " " 3.5 kHz	" " " 12 kHz
" " " 6 kHz	" " " 18 kHz
" " " 12 kHz	" " " 36 kHz

Drift with change of ambient:

Bandwidths:

CW; 300 Hz bandwidth; 2 microvolt E.M.F. for a 26dB signal/noise ratio.
AM; 30% mod., kHz bandwidth; 4 microvolts for 10 dB signal/noise ratio.

Sensitivity:
(up to 30.1 MHz)

Noise Figure:

Not worse than 10 dB up to 20 MHz and not worse than 13 dB above 20 MHz.
Thirty bands of 1 MHz each with an 84 inch scale-length for each band.
There is an overlap of 100 kHz at both ends of each band.
It is possible to set the tuning control to within plus and minus 10 Hz of a required frequency.

Tuning:

Tuning Accuracy:

Scale Reading Accuracy:

Calibration:

A.C.:

A.C. Time Constant:

Not worse than plus and minus 600 Hz at any point in the 1 MHz band, when correctly calibrated at mid-band.
Marker at 100 kHz points provided from the master 1 MHz oscillator.
Output shall not change more than 4 dB from 120 dB change in input from A.G.C. threshold. Threshold variation 1 - 4 μV E.M.F.

Short Rise set at 10 m/sec (adjustable 5-20 m/s)
Long Rise same as short.
Short hand 45 m/s ± 15 m/s. Long hand 750 m/s ± 250 m/s.
Short Decay not more than 120 m/s. Long Decay, as short.

Variable ± 8 kHz with slow motion tuning and calibration facility.
Nominal 75 ohms. Can accept, without damage, either signals up to 30v E.M.F. of 15 mins. duration with less than 1 dB degradation in noise factor and 6v E.M.F. continuously.

I.F. Output: 100 Hz, 50mV into 75 ohms. Following I.F. selectivity.

B.F.O./I.F. Breakthrough: Better than 60dB relative to 5mV.

Audio Output: Internal Loudspeaker.
Two 600 ohm headphone outputs. 150 or 600 ohm external line balanced or unbalanced.

Audio Output Level: 150 ohm line - 30 mW; 600 ohm line - 10mW
Loudspeaker - 400 mW; Headphones - 6mW

Audio Frequency Response: Within 4 dB from 300 Hz to 8 kHz.

Aerial Conduction: With the aerial input socket terminated in 75 ohms less than 2 microvolts at any frequency up to 30 MHz.

Meter Indication: May be switched to 'S' or audio level to line.

I.F. Rejection: Greater than 70 dB for any of the I.F. frequencies.

Image Rejection: Not less than 70 dB.

Internally Generated Spurious Responses : Less than equivalent 0.2 μ V E.M.F. all responses except 1 MHz + 21.4 MHz which is less than 2 μ V E.M.F. equivalent between 400 kHz - 30.1 MHz. The 1 MHz positions between 22 - 30 MHz are less than 0.25 μ V E.M.F. equivalent.

Desensitization: With the receiver tuned to any frequency, and with a 3 kHz bandwidth, a 1 μ V CW signal will have its S/N ratio reduced by 3dB. by an interfering signal spaced 10 kHz away and of amplitude not less than 200 microvolts. For 50 kHz signal spacing the interfering signal shall be not less than 2 millivolts and for 500 kHz signal spacing not less than 30mV.

Cross Modulation: With a bandwidth of 3 kHz, a 1mV wanted signal will suffer 3% cross modulation from an interfering signal with 30% modulation, spaced 10 kHz away, and of amplitude not less than 20mV.

Inband Intermod. 2nd and 3rd order - 26 dB at audio output.

Out of Band Intermod. 3rd order; 2 signals of 5mV each to give 20dB S/N ratio with reference to a 10dB noise factor receiver.

Power Requirements: 100V to 125V, or 200V to 250V, 48 to 520 Hz single phase or 24V D.C. floating supply or positive earth.
Power consumption 22W at 24V D.C. approx.

Environment: Operation - 20 $^{\circ}$ C to + 50 $^{\circ}$ C, 95% R.H.
Storage - 40 $^{\circ}$ C to + 70 $^{\circ}$ C, 95% R.H.

Dimensions and Weight: Width : Suitable for rack mounting
Height : 7 in. Depth: 17 in. Weight: 30 lbs.

1. INTRODUCTION

1.1 GENERAL

The FR155B MF/HF Receiver is an all transistor receiver designed for the reception of CW, MCW, DSB or signals in the frequency range 60 kHz to 30 MHz. Facilities can be provided to receive other types of transmissions, if required.

The receiver is of modular construction and is contained in a metal case which may be fitted with feet for desk use, or with brackets for mounting in a standard 19 inch rack or cabinet assembly. Brackets and feet are provided with the equipment together with the requisite securing screws and washers.

Protection circuits are incorporated in the receiver which will enable an RF input signal of up to 6V R.F. to be accepted without causing damage. The input circuit is arranged to match to a 75 ohm, unbalanced aerial system. The audio outputs available are two 600 ohm outputs suitable for operation of headphones and a 150 ohm and 600 ohm, balanced or unbalanced, external line output. An internal loudspeaker is fitted.

The a.c. version of the equipment is designed to operate from a 100 to 125V or 200 to 250V, 48 to 420 Hz single phase supply or an unearthed d.c. supply of 24V. Its power consumption is approximately 18W at 24V or 35VA at 240V, 50 Hz. A d.c. version, for operation on a 24V d.c., earthed, supply, is available.

1.2 MECHANICAL DESCRIPTION

1.2.1 General

Modular construction is employed, the receiver comprising sixteen standard modules assembled together on a main chassis assembly. Apart from RF connections, which are made with individual coaxial connectors, all connections between the modules and the chassis are made via the chassis wiring.

1.2.2 Main Chassis

The main chassis, with modules and subassemblies in position is illustrated in fig. 1.

Twelve of the modules are located in screened compartments above the main member of the chassis and connect with the chassis wiring via soldered contacts on the underside of the chassis. Pin contacts on the modules are soldered to contacts which are made to slide freely in their locating block in order that each may be individually unsoldered to facilitate module removal. Of the other four, the BFO, interpolating oscillator and turret modules are mounted above the main chassis member, the turret module protruding through from the underside, on which the isolating amplifier is mounted. Apart from coaxial connectors all interconnecting wiring is contained in a cableform below the chassis and behind the front panel.

All operational controls are mounted on the front panel. The MEGAHERTZ and tuning controls are coupled to the turret and interpolating oscillator respectively via Oldham couplers. On the rear panel are located the mains fuseholders, three link panels and the provisions for external connections to the receiver in the form of a plug, sockets and a terminal block.

A list of the modules contained within the receiver is given below. Twelve of these are of similar construction consisting of one or two printed circuit component boards and designed to fit into screened compartments on the main chassis, the screening being completed by an end plate which also serves as a handle for removal of the module. To aid identification, each of the modules is given a number as indicated in the list.

Item	Module No.	Part No.
RF Amplifier	1	630/1/17780
1st Mixer	2	630/1/14111 /001
1st Local Oscillator	3	630/1/14112
Amplifier/2nd Mixer	4	630/1/14117
10.7 MHz Amplifier/3rd Mixer	5	630/1/14113
100 kHz Amplifier	7A	630/1/25150
100 kHz Detector	7B	630/1/25152
AGC Amplifier and Detector	8	630/1/14114
Audio Amplifiers	9	630/1/14119
Spectrum Generators	10	630/1/14120
10.6/10.8 MHz Oscillators	11	630/1/14115
100 kHz Divider and calibrate	12	630/1/25153 /002
Interpolating Oscillator	-	630/1/14000/001
Isolating Amplifier	-	630/1/14541 d 001
BFO	-	630/1/25154 longer
Turret Assembly	-	630/1/14300 best
Regulator Assembly	-	630/1/14608 no

The turret assembly has three separate screened compartments containing the RF filter unit, MHz selector and phase lock circuits. The RF filter and MHz Selector Compartments (compartments 1 and 2) consist basically of rotary switch assemblies which are coupled to the MEGAHERTZ control. The components of their associated circuits are mounted on boards in the compartments or on the switch assemblies. Compartment 3, containing the phase lock circuits is on the underside of the module and contains three printed circuit boards. (Boards G, H and J).

The interpolating oscillator, BFO and isolating Amplifier modules each consist of a screened box containing a printed circuit board. Tuning of the BFO is effected by means of a variable capacitor located inside one end of the module; the capacitor spindle protrudes through the front panel as the BFO TUNE Control. The drive to the interpolating oscillator tuning protrudes through one end of the module and is coupled via an Oldham coupler to the KILOHERTZ film scale drive.

Final IF amplification and detection takes place in modules 7A and 7B. A product detector is used for CALIBRATE and CW operation and an envelope detector for AM. The 100 kHz signal for carrier reinsertion on CALIBRATE is obtained from module 12 and a BFO with slow motion drive is provided for CW operation.

An AF output from the detectors is applied to the audio amplifiers in module 9 which provide the receiver outputs.

AGC is applied to all IF amplifiers, it is obtained from the AGC detector (module 8).

For calibration purposes, marker pips at 100 kHz intervals, derived in module 12 from the 1 MHz output of module 10, may be injected into the 1st mixer.

All stages of the receiver operate on a -15V d.c. supply. On mains operation, the a.c. supply is stepped down to 22V and then rectified by a bridge rectifier, the resultant d.c. being applied to the receiver circuits via a regulator circuit which maintains a -15V supply. For d.c. operation, the 24V d.c. (unearthed) is applied to the regulator circuit via the bridge rectifier; this method of connection protects all circuits against damage due to reverse polarity, since the rectifiers ensure that correct polarity is always observed.

1.5 CONTROLS AND INDICATORS

All functional controls and the monitoring meter are mounted on the receiver front panel. Selector links are located on the rear panel. The controls and their functions are detailed below :-

- Control switch, S1 : A four position switch, used to switch the receiver into one of the conditions OFF, STANDBY, ON or CALIBRATE.
- Mode selector switch S2 : The required mode of operation is selected by the setting of S2. Three modes are provided, CAL, CW and AM. Extra switch positions are provided to accommodate other modes, if required.
- MEGAHERTZ control : This control is used to set the turret to operate at the 'megahertz' appropriate to the frequency of the received signal. Indication of the selected frequency is given on a MEGAHERTZ film scale.
- Tuning control (kHz) : Used to tune the interpolating oscillator and drive the KILOHERTZ film scale to indicate the tuning setting. Fast or slow motion drive is available dependent upon the setting of the SLOW/FAST/SLOW control below the tuning control.
- BANDWIDTH switch S3 : The appropriate bandwidth is selected by this switch (i.e. 12 kHz, 6 kHz, 3.5 kHz, 1.4 kHz, 300 Hz, 150 Hz.)

AGC switch S4 :

The receiver IF gain is controlled by the IF gain control when S4 is set to OFF and by AGC when S4 is set to F or S. (i.e. Fast or Slow time constant).

BFO control :

A slow motion drive is used to tune the BFO by ± 8 kHz about its nominal frequency.

AUDIO GAIN control (RV2) :

Used to adjust the gain of the audio amplifier.

RF/IF GAIN control (RV1) :

- (1) AGC off: manual gain control
- (2) AGC on : AGC threshold control.

Loudspeaker ON/OFF switch, S5 :

Used to switch the internal loudspeaker on or off.

Meter switch, S6 (AF/RF) :

Used in conjunction with the meter (M1) to monitor the audio output or as an 'S' meter for tuning.

Selector links :

A link is provided on the rear panel for selection of either a 150 ohm or a 600 ohm line output. Further links enable the internal oscillator to be disabled when external oscillators are to be used.

Indicator lamp ILP1 :

This lamp is lit when the control switch is turned from the OFF position. (Located in M1).

2. INSTALLATION, SETTING UP AND OPERATION

2.1 INSTALLATION

2.1.1 General

When received, the PR155 should be inspected for signs of damage, with particular attention to the front panel meter and the correct mechanical operation of switches and controls. Remove the top and bottom covers by first removing the four securing screws and pushing the cover forward from the back of the receiver, and ensure that all coaxial connectors are mated correctly.

If the receiver is to be used on a desk, fit the four feet to the case, or, if it is to be mounted in a rack or cabinet, fit the mounting brackets. Suitable screws, with washers, are provided for both methods of mounting. When feet are to be fitted, the screws securing the bottom cover are removed and the cover then secured in position by the feet securing screws. Extension pillars are also provided to enable the receiver to be raised at the front if desired.

2.1.2 Supply connections

For mains operation, the supply is connected into the receiver at PL1 on the rear panel, using the mains socket provided. The connections to the socket are :-

Pole A - neutral

Pole B - line

Pole C - earth

For d.c. operation, a floating 24V supply should be connected to the appropriately coded terminals of the terminal strip on the rear panel.

2.1.3 Receiver terminations

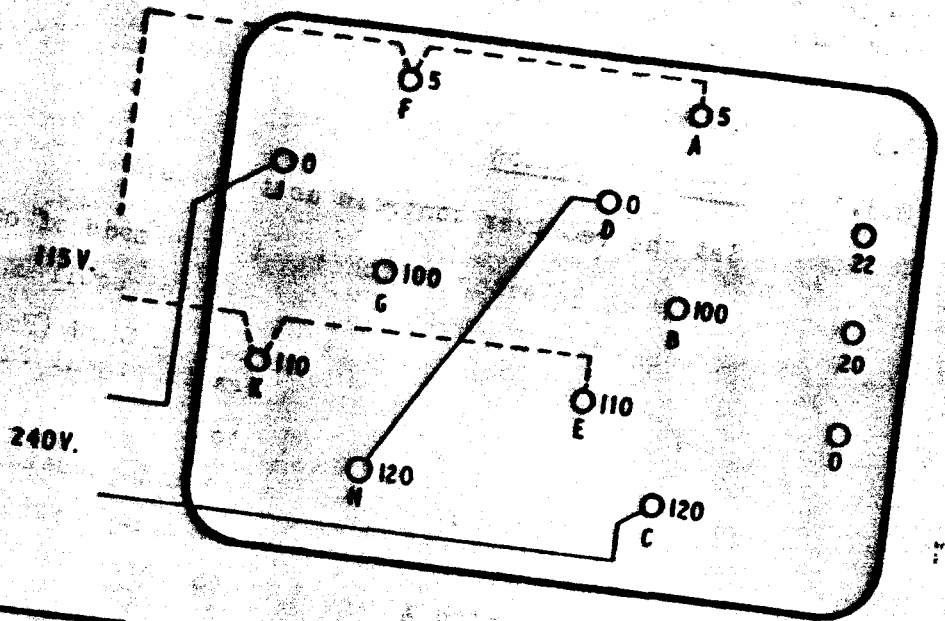
Apart from the PHONES jacks on the front panel, other connections can be made at the sockets or the terminal strip on the rear panel, these are all coded according to their use.

2.2 SETTING UP

2.2.1 Power Supply

The equipment is normally despatched from the manufacturers with the mains transformer tapplings wired for operation on 240V mains. Should any other mains supply voltage be used, change the connections and links to the transformer primary as shown below. Ensure that terminals 5 and 6 (D.C. + and -) on the terminal strip on the rear panel are linked and that the mains and 22V fuses are of the correct rating (1A for 200 to 250V operation and 2A for 100 to 125V operation).

MAINS TRANSFORMER TAPPINGS



Voltage	Input to	Link
100	J & G	J to D and G to B
105	F & G	F to A and G to B
110	J & K	J to D and E to K
115	F & K	F to A and E to K
120	J & H	J to D and C to H
125	F & H	F to A and C to H

Voltage	Input to	Link
200	J & B	G to D
205	F & B	G to D
210	J & E	G to D
215	F & E	G to D
220	J & E	K to D
225	F & E	K to D

Voltage	Input to	Link
230	J & E	H to D
235	F & E	H to D
240	J & C	H to D
245	J & C	H to A
250	F & C	H to A

To operate on a 24V d.c. (unearthed) supply, connect this supply between terminals 5 and 6 of the terminal strip, having removed the link. If the panel lamp is required to be used (A.C. or D.C. operation) link the terminals 2 and 3 (PANEL LAMP).

2.2.2 Link connections

If the internal 1 MHz oscillator and VFO (interpolating oscillator) are to be used, set the INT. 1 MHz and INT. VFO links to the ON position, but, if either or both is to be replaced with external oscillators, set the relevant link to OFF and inject the external oscillator output to the relevant socket on the rear panel. Make the appropriate coaxial connections, at the panel above the mains transformer, as follows:-

Internal oscillators in use :

External 1 MHz oscillator in use:

External VFO in use

cable 7 to cable 26
cable 28 to termination.

cable 28 to cable 24
cable 7 to cable 25

Set the LINE OUTPUT IMPEDANCE link to the position appropriate to the impedance required.

2.2.3 External connections

Connect the aerial to the AERIAL socket and, if external oscillators are to be used, they should be similarly connected to the sockets provided on the rear panel. Make the necessary line output connections at the terminal block on the rear panel.

2.3 OPERATION

2.3.1 Normal operation

Set the receiver controls as follows:-

Mode selector switch :	to the mode of operation required
BANDWIDTH switch :	to the required bandwidth
AGC :	Set to SLOW (Fast position to be used when rapid signal fading is experienced).
BFO :	to 0
AUDIO GAIN :	to mid-position
RF/IF GAIN :	to mid-position
Meter switch :	to RF

Set the control switch to STANDBY and allow 10 minutes for the oscillators to stabilize. Switch to ON. Turn the MEGAHERTZ control until the "megahertz" of the frequency of the signal it is required to receive is indicated by the MEGAHERTZ film scale. Manually set the KILOHERTZ cursor to its mid-position with the SLOW/FAST/SLOW control at FAST, turn the main tuning control until the KILOHERTZ film scale indicates the "kilohertz", of the required frequency approximately below the cursor. If required, set the SLOW/FAST/SLOW control to SLOW and tune for maximum indication of the signal to be received using the tuning meter.

Adjust the AUDIO GAIN control for optimum level in the phones or loudspeaker.

If operating on CW, adjust the BFO control to obtain the tone required.

2.3.2 Calibration

To calibrate the KILOHERTZ film scale, first select CALIBRATE on the mode selector switch and then set the control switch to CALIBRATE. Calibration pips will be heard at every 100 kHz when the receiver is tuned over the range of the tuning control, and the adjustable cursor can then be set to the appropriate scale marking at zero beat condition of the pips. Interpolation can be made between the 100 kHz markings on the scale to obtain accurate indication of the frequency of received signals.

Note: This calibration is valid for all modes but calibration pips are not obtainable on AM.

To calibrate the BFO set both the mode selector switch and the control switch to CALIBRATE and tune for zero beat with a calibration marker. Change the mode selector switch to the CW position and adjust the BFO to obtain zero beat. The BFO tuning control should indicate 0.

3. CIRCUIT DESCRIPTION

3.1 RF FILTER UNIT (Fig. 4)

The received signal is connected directly into the RF filter unit (compartment 1 of the turret assembly). The filter unit contains eight band-pass filters with pass bands as follows :-

FL1 - 0 to 2 MHz	FL5 - 6 to 9 MHz
FL2 - 2 to 3 MHz	FL6 - 9 to 14 MHz
FL3 - 3 to 4 MHz	FL7 - 14 to 21 MHz
FL4 - 4 to 6 MHz	FL8 - 21 to 30 MHz

When the MEGAHERTZ control is set to the MHz of the required frequency, the filter appropriate to that frequency is automatically selected, the filters being located between the turret wafers C and D which serve as selector switches. The filter inputs are connected to wafer D and their outputs to wafer C. From wafer C the signal is fed via the filter C2, L1 and SKT3/PL3 to the RF amplifier, module 1. The filter C2, L1 functions as an image rejector.

3.2 RF AMPLIFIER MODULE 1 (Fig. 5)

The RF amplifier comprises one stage of amplification, which is preceded and followed by a variable attenuator in which the degree of attenuation is controlled by an AGC system driven from the output of its associated amplifier. The first attenuator controls the input to the first amplifier stages at a level compatible with optimum operation despite wide variations in input signal strength. It thereby protects the amplifier against damage due to very high signal strength and eliminates the necessity for a manual RF gain control. The second attenuator, controls the output from the module at the level for ideal operation of the second mixer.

The signal input to module 1 is at PL3. From PL3, the signal is routed to the base of the first amplifier stage VT1, via C1, C3 and R3. The first amplifier stages comprise VT1 and three succeeding emitter followers, VT2, VT3 and VT4. Negative feedback is provided via C7, R7.

The input attenuator comprises two shunt arms, with variable elements in the form of diodes D1 and D2. The impedance of the diodes D1 and D2 is controlled by VT9. A voltage for operation of the control transistor is produced by VT10, which operates as a detector, with the signal from VT3 emitter applied to its base via C10, R16.

Under no-signal, or very low signal, conditions, VT9 is held non-conducting since its base and emitter is returned to -15V line; the base via R36. Thus D1 and D2 cannot conduct and offer minimum attenuation to the input signal.

As the signal level increases, the detector action of VT10 drives VT9 base less negative with the result that VT9 conducts, drawing current via D1 and D2, decreasing its impedance and thus applying some attenuation to the signal input. With further increases in signal strength VT9 draws increasing current via D1 and D2, increasing the attenuation.

The control circuit is prevented from responding to transient changes in signal level by capacitor C24.

The output from VT4 is applied via R19 to the second variable attenuator circuit and via C13 to the first mixer.

Two variable shunt arms are used in the second attenuator utilising diodes D3 and D4. The attenuation introduced by D3 and D4 is controlled by VT6 in the same manner as D1 and D2 are controlled by VT9 in the first attenuator circuit. VT6 is controlled by the AGC voltage from the AGC Detector, module 8, via amplifier stage VT5. RV1 is preset to maintain the output from VT4 at approximately 40mV, and is held at this level to prevent overloading of the first mixer.

3.3. FIRST MIXER, MODULE 2 (Fig. 6)

The signal input to module 2 is applied via a 30 MHz low pass filter (C1 to C7 and L1 to L3) to transformer T1 and the first local oscillator signal is applied to transformer T2. Transformers T1 and T2 are connected with diodes D1 to D4 in a differential mixer configuration, the output from which, at the first IF of 37.3 MHz is filtered by the 37.3 MHz bandpass filter FL1 and applied to the first IF amplifier in module 4. When the control switch, S1 on the front panel, is set to CALIBRATE, markers at 100 kHz intervals throughout the frequency range are applied in place of the signal input for calibration of the receiver. Under these conditions the -15V supply to module 1 is switched off at S1.

3.4 FIRST LOCAL OSCILLATOR, MODULE 3 (Fig. 7)

The first local oscillator is a free-running oscillator employing VT1 in a Hartley type circuit. Tuning of the oscillator is effected by the preset capacitor C5 and the varactor diodes D1 and D2 in conjunction with the saturable reactor L1. The reactor current is controlled by the d.c. amplifier in the phase lock loop circuit (3.8) to provide a coarse adjustment of oscillator frequency and a finer, faster adjustment is provided by D1 and D2 under similar control.

The oscillator output is coupled via C4 to emitter follower VT2 which provides drive to two further emitter followers VT3 and VT4. VT3 provides an output to the phase lock loop circuits and VT4 to the first mixer.

3.5 SPECTRUM GENERATOR, MODULE 10 (Fig. 8)

This module contains a 1 MHz oscillator, a spectrum generator, generating signals at 1 MHz intervals in the spectrum 35 MHz to 64 MHz, and a 48 MHz selector circuit which selects the 48 MHz output from the spectrum generator for use at the second stage of frequency conversion.

The 1 MHz oscillator employs transistor VT1, on board A, in a circuit which is crystal controlled by XL1. The signal from VT1 emitter is coupled to the base of emitter follower VT2 which provides a 1 MHz output to the spectrum generator circuits and the 100 kHz divider (module 12).

A 1 MHz signal from VT2, or from an external 1 MHz oscillator if one is in use, is applied at VT3 base. It is amplified in VT3, VT4 and VT5 stages, but the output from VT5 is differentiated to produce harmonics at each 1 MHz interval throughout the spectrum 35 MHz to 64 MHz. These harmonics are coupled via emitter follower VT6 to the 48 MHz selector (board B) and to another emitter follower VT7 which provides the spectrum output to compartment 2 of the turret assembly (3.7) via the high pass filter C20, L1, C21.

The spectrum output from board A is injected at the emitter of VT2, the first of two transistors in a 48 MHz selector circuit on board B. The collector circuit of VT1 is tuned to 48 MHz by L1 and coupled to VT2 base. The feedback capacitor C2 improves the Q of the circuit such that it would oscillate freely at very nearly 48 MHz, thus the 48 MHz of the input signal is amplified and reproduced relatively free of all unwanted frequencies at VT2 emitter. From VT2 the 48 MHz output is filtered in L2 (tuned to 48 MHz), C4 and C5 and applied via VT3, an emitter follower, to a further selector circuit in module 4 (3.9). The d.c. supply to VT1, VT2 and VT3 is locally stabilised by zener diode D2.

The 15V d.c. supplied to the 1 MHz oscillator, the spectrum generator and the 48 MHz selector circuits are each independently filtered in filter circuits contained on board B. The supply to the 1 MHz oscillator is not applied when an external 1 MHz oscillator is used.

3.6 INTERPOLATING OSCILLATOR (Fig. 9)

The interpolating oscillator provides an output which is mixed with the selected output from module 10 to make up the first local oscillator frequency in order to control the first local oscillator at this frequency. It is tunable over the range 2.2 MHz to 3.4 MHz and the tuning is linear.

Transistor VT1 operates in a tunable oscillator circuit in which L1 is the variable component. Linearity of tuning is achieved in manufacturing by adjustment of individual turns of L1 coil and final trimming is provided by L2 and C7. The output from VT1 emitter is coupled via an emitter to follower buffer stage VT2 to an amplifying stage VT3 and the amplified output is fed out to turret compartment 3 (3.8) via a second emitter follower VT4. Output amplitude is adjusted by RV1 to a nominal 400 mV r.m.s. The d.c. supply to the oscillator and buffer stage is stabilised at -10V by zener diode D1.

3.7 MHz SELECTOR, TURRET COMPARTMENT 2 (Fig. 10)

The MHz selector circuit selects the required "megahertz" output from the spectrum generator (module 10) for mixing with the output of the interpolating oscillator. The circuit employed is identical in operation to that of the 48 MHz selector in module 10 (3.5) but the tuning coils (L1 and L2 in module 10) are selected in pairs from 30 pairs, according to the setting of the MEGAHERTZ control, to enable each megahertz output (from 35 to 64 MHz) from the spectrum generator to be selected. The output from this compartment of the turret is applied to the phase lock loop circuits in compartment 3. The d.c. supply is locally stabilised at -10V by zener diode D2.

3.8 PHASE LOCK CIRCUITS, TURRET COMPARTMENT 3

3.8.1 General

In the phase lock loop circuits, contained in compartment 3 of the turret, the outputs of the MHz selector and the interpolating oscillator are mixed to obtain an output at the sum of these frequencies, and the phase relation between this synthesized signal and the output of the first local oscillator is detected to provide a control voltage to lock the first local oscillator accurately to the required frequency. A sweep voltage to tune the local oscillator within the range of control of the phase lock circuits is generated in a multivibrator circuit.

Three boards (G, H and J) are contained in compartment 3, the circuits contained on each are described in 3.8.2, 3.8.3 and 3.8.4.

3.8.2 Phase splitters and modulator, board G (Fig. 11)

The output from the MHz selector (3.7) is applied via a matching network to the base of VT5. Phase shift networks R23, C15 and R22, C13, C14 are connected between emitter and collector of VT5 and the component values are such that two outputs differing in phase by 90 degrees are obtained. One of these outputs is amplified in VT4 and applied to T2 and the other is amplified in VT6 and applied to T4. The output of the interpolating oscillator is applied to a circuit similar in operation to that to which the MHz selector output is applied. This circuit employs VT1, VT2 and VT3 and drives T1 and T3.

Transformers T1 to T4 and diodes D1 to D8 form two ring modulator circuits whose outputs are connected together via RV1. Due to the 90 degree phase difference between the modulator inputs, the difference frequency element of their outputs is cancelled out when they are connected together whilst the sum frequency elements are added. Thus a signal whose frequency is the sum of the two input frequencies is obtained at RV1 slider. Adjustment of RV1 enables any difference frequency, resulting from inequality of the difference frequency outputs from the modulators, to be cancelled out. The sum frequency output from RV1 is applied as a synthesized local oscillator frequency via emitter follower VT8 to board H.

3.8.3 Phase detector, Board H (Fig. 12)

The first local oscillator signal from the isolating amplifier is transformer coupled via T1 to the base of VT1 and thence via VT2 and T2 to VT3 base. Transformers T1 and T2 are connected to provide 2 to 1 step-up ratio. VT3 drives transformer T3 to provide a reference signal, at the local oscillator frequency, to the phase detector diodes D1 to D4 to turn the diodes on and off on alternate half cycles.

3.9 FIRST IF AMPLIFIER AND SECOND MIXER, MODULE 4 (Fig.14)

The 37.3 MHz first IF output from the first mixer in module 2 is applied via C3, D1 and C5 to the base of the first of two IF amplifiers VT1 and VT2 on board A of the module. Diode D1 has the AGC reference voltage (3.12) applied to its cathode and the AGC voltage (3.13) applied to its anode; it therefore introduces increasing impedance into the input circuits as the signal strength increases. The AGC and reference lines are isolated from the first IF by L1 and L2. The overall gain of the two IF amplifiers is controlled by the preset potentiometer RV1, which is adjusted on test for optimum output level. The output from the second stage VT2 is coupled into the second mixer via a 37.3 MHz low pass filter. Links are provided in the filter circuit to facilitate alignment.

The output of the 48 MHz selector circuit in module 10 is injected at the emitter of VT5 on board B. This transistor, in conjunction with VT6, operates in a similar circuit to that of VT1 and VT2 of the 48 MHz selector circuit, except that the output from VT5 is directly coupled to the next stage, to provide a 48 MHz output which has extremely low spurious content. The signal developed at VT6 emitter is coupled via emitter follower VT7, C30 and R34 to the second mixer on board A.

The second mixer employs transistors VT3 and VT4 in a conventional balanced mixer configuration. The first IF signal, at 37.3 MHz is applied to VT3 base and VT4 emitter and the 48 MHz signal from VT7 is applied to VT3 emitter and VT4 base. Consequently, the signals are mixed and appear across the common collector load R23. The required second IF of 10.7 MHz is selected in the crystal bandpass filter FL1 and coupled via C25, R28 to the second IF amplifier in module 5.

3.10 SECOND IF AMPLIFIER AND THIRD MIXER, MODULE 5 (Fig.15)

The first stage (VT1) of the second IF amplifier in module 5 is similar to the first stage of the first IF amplifier (3.9). It is AGC controlled in the same manner, but no preset gain control is used. Coupling to a second amplifying stage, VT3, is via C6 and this stage feeds the third mixer.

The third mixer, VT4 and VT5, is similar in operation to the second mixer in module 4 (3.9), with the 10.7 MHz second IF signal applied to VT4 base and VT5 emitter and the signal from the 10.6/10.8 MHz generator, module 11 applied to VT5 base and VT4 emitter. The 100 kHz output from the common collector circuit is coupled, via C15, emitter follower VT6 and the bandwidth filter selected by the setting of S3, to the 100 kHz amplifier in module 7.

3.11 10.6/10.8 MHz GENERATOR, MODULE 11 (Fig.16)

Two oscillators with similar circuits are contained in this module. One, VT1, is crystal controlled by XL1 at a frequency of 10.8 MHz, it is energised when the mode selector switch, S2, is set to USB, to produce the input to the third mixer necessary for USB operation. The other, VT2, is crystal controlled by XL2 at 10.6 MHz and energised in other positions of S2 to produce the input to the third mixer for other modes of operation. The output from the selected oscillator is coupled to the third mixer, (module 5) via an emitter follower VT3.

NOTE: In the PR155G version the 10.8 MHz oscillator is not used.

3.12 THIRD IF AMPLIFIER AND DETECTORS, MODULES 7A and 7B (Fig. 17)

The input circuit of VT1, the first stage of the third IF amplifier, module 7A, includes an AGC controlled diode similar to the input circuits of modules 4 (3.9) and 5, but in this case the gain of the first stage is also controlled by AGC. Since the emitter load of VT1 is considerably greater than the collector load, the gain of the stage would approach unity, however, diode D2 is included in the circuit to control this gain. It is connected between the reference and AGC lines such that it is open during reception of weak signals but its impedance increases with increase in signal strength. Thus, during reception of weak signals, VT1 emitter load impedance is reduced by the parallel path C4, D3, R10 and the gain of the stage is greater than when the diode impedance is increased by AGC action. Zener diode D3, connected between -15V and earth in series with R10 provides the AGC reference voltage of 4.7V with respect to earth.

The output from VT1 is amplified in three similar stages, VT2, VT3 and VT4 and applied to emitter follower VT5. This stage provides an output via C20, R46 to the AGC amplifier, module 8, and also drives a second emitter follower VT10 which provides outputs to the detectors and the 100 kHz OUTPUT socket on the receiver rear panel. The gain of the amplifier is controlled by RV1 placed between VT2 and VT3.

Two detectors are contained in module 7B, a product detector for CW operation and an envelope detector for AM operation. The product detector, employs transistors VT6 and VT7 together with transformers T1 and T2 in a conventional detector circuit. The -15V d.c. supply is connected to the circuit when CALIBRATE or CW are selected at S2, while the 200 kHz signal from module 11 (3.14) is, after division by 2 of the flip-flop circuit (SN7472), injected into the transistor emitter circuits for carrier reinsertion on CALIBRATE operation and the BFO (3.15) output is similarly injected on CW operation. The detector output is coupled via R44, C34 to the base of amplifier VT9. A conventional detector circuit is also used for AM operation; it is energised when AM is selected at S2. The output from VT10 is amplified in VT8, detected by D4 and the resulting audio frequency signal filtered and applied to VT9 base. VT9 is energised under all operating conditions to provide the AF signal output to the emitter followers VT10 and VT11 and hence to the audio amplifiers in the module 9 (3.14) and to the AUDIO GAIN control, RV2 on the main chassis.

3.13 AGC AMPLIFIER AND DETECTOR, MODULE 8 (Fig. 18)

A 100 kHz output from VT5 in module 7 is connected into this module and applied across RV1 and R1. RV1 acts as a threshold control to set the signal level at which AGC action starts to be effective. The signal from RV1 slider is fed via the emitter follower VT1 to the base of the amplifier VT2. Transformer T1 is the collector load of VT2; its secondary winding provides outputs to VT3 and VT8, such that the signal applied to VT8 is greater than that applied to VT3. These signals are detected in VT3 and VT8 and the resulting d.c. output used to drive the next pair of transistors VT4 and VT9. Thus the capacitors C9 and C10 in the emitter circuits of VT4 and VT9 charge negatively to a potential proportional to the signal strength, but the charge on C10 is greater than that on C9 because of the greater signal applied to VT8 from T1. The negative potential across C9 is fed to the first of three emitter followers which finally provide the output necessary for operation of the AGC controlled diodes in the IF amplifier modules. The potentials at VT4 and VT9 emitters are

also applied to emitter and base respectively of VT10, which is held cut off since its base potential is the more negative. Thus, there is no discharge path for C9, and, should the signal strength be reduced abruptly, the output from the module is maintained until C10 discharges sufficiently via R12 to reduce VT10 base potential below that of its emitter. The time taken for this to occur is the "hang" time of the circuit; it is designed to be approximately 800 milliseconds on long and 45 milliseconds on short. When VT10 starts to conduct, discharging C9, its emitter, and therefore the base of VT11, is driven more negative, with the result that VT11 also conducts, discharging C10 more quickly. The cycle continues until both capacitors are fully discharged and AGC is returned to the no signal, or weak signal conditions. RV2 is provided to enable the attack time of the AGC to be adjusted.

3.14 AUDIO AMPLIFIERS, MODULE 9 (Fig. 19)

Two audio amplifiers are contained in module 9; one, feeding the PHONES jacks and the internal speaker, is on board A, and the other, providing the line outputs, is on board B. Both boards are supplied with -15V and are separately decoupled to prevent interaction.

The input to board A is from the slider of the AUDIO GAIN control on the main chassis of the receiver, it is applied to the base of VT1 via C1, E1. Negative feedback is applied to VT1 base, via C3. Two signals are obtained from VT1 collector circuit to drive VT2 and VT3, the first two transistors in a complementary, single-ended push-pull configuration of which VT4 and VT5 are the output transistors. In order to obtain the anti-phase signals for application to VT4 and VT5, a PNP transistor is used for VT2 and an NPN for VT3. The correct bias for Class AB operation of the push-pull drivers is obtained by adjustment of RV2, while RV1 is adjusted to equalise the supply voltages across the two push-pull sections. Temperature compensation is provided by D1 and D2 in the collector load of VT1.

The input to board B is direct from module 7; it is coupled to the base of VT1 via R1, C1. VT1 operates as an amplifier, with negative feedback introduced by R5, to provide an output at the slider of a preset gain control RV1 to drive the phase splitter VT2. One output, from VT2 emitter, is coupled via R10, C6 to the base of VT3 and another, from the collector of VT2, is coupled via C7 to VT4 base. Transistors VT3 and VT4 operate in a single-ended, Class A, push-pull circuit to drive the line output transformer T1, on the main chassis, via C8. Balance of the output stages is achieved by the setting of RV2 in VT3 base circuit.

3.15 100 kHz DIVIDER AND CALIBRATE CIRCUIT, MODULE 12 (Fig.20)

Module 12 contains the circuits which, from a 1 MHz input from module 10 or an external oscillator, produce the 200 kHz required for carrier reinsertion on CALIBRATE and the 100 kHz markers used for receiver calibration.

The 200 kHz output required is derived from a closed loop circuit employing VT2 and VT3. Transformer T1 and its associated components form an 800 kHz resonant circuit. This circuit is triggered by noise and the 1 MHz input is coupled to it via VT1 and C2 to produce a difference frequency component at 200 kHz which is fed to the base of VT3. Transformer T2, in VT3 collector circuit provides a 200 kHz output to VT2 base to trigger the resonant circuit of T1 and thereby maintain oscillation. The 200 kHz output from T2 secondary is fed

to the 200 kHz output to module 7B and also to VT4 via T3, which is tuned to resonate at 100 kHz. This circuit operates as a divider, the oscillation being controlled and locked by the 200 kHz signal, thus locking the 100 kHz output to the 1 MHz standard. The 100 kHz signal developed at terminal 5 of T3 is fed via C13 to the base of the calibrate amplifier VT5. Following amplification in VT5, the signal is clipped by the limiting diodes D1 and D2, differentiated, and then injected into the first local oscillator (when CALIBRATE is selected at S1), for calibration purposes.

3.16 BFO (Fig. 21)

The BFO is energised when the mode selector switch, S2, is set to CW. It consists of an oscillator stage VT1 followed by an emitter follower VT2 which feeds the oscillator output to the product detector in module 7, via S2, for CW operation. The oscillator operates at a nominal 200 kHz and is tunable by ± 8 kHz about 200 kHz by means of the front panel BFO control, C9. The output amplitude is adjustable by means of the preset control RV1.

3.17 ISOLATING AMPLIFIER (Fig. 22)

The isolating amplifier is provided as a buffer stage between the first local oscillator and the phase lock loop circuits to isolate the oscillator from spurious oscillation. It consists of an amplifier stage, VT1 and an emitter follower, VT2. The local oscillator signal is injected at VT1 emitter and the signal from VT2 emitter is coupled to the phase lock circuits via C5, R8.

3.18 MAIN CHASSIS (Fig. 1)

3.18.1 Power Supply

On mains operation, the primary power supply is routed to the mains transformer, T2, via FS1 and the double pole toggle switch section of the control switch S1. The primary of T2 is in two sections, each with tapings to permit operation on any of the prescribed mains voltages. The 22V output from T2 secondary is applied via FS2 to the bridge rectifier MR1. The DC output is smoothed by C2 and applied to the receiver circuits via a voltage regulator. A conventional regulator circuit is used, employing VT4 with a reference voltage obtained from zener diode D1 (5.6V). Transistor VT4 is followed by two emitter followers VT3 and VT2 which drive the series regulator transistor VT1.

On d.c. operation, a floating d.c. supply is connected at terminals 5 and 6 on the terminal strip on the receiver rear panel and is thus connected into the regulator circuit via T2 primary, F2 and MR1. This method of connection provides protection by F2 and avoids the possibility of damage in the event of reversed polarity of the input, since correct polarity of the input to the regulator is ensured by MR1.

The output from the regulator, at -15V d.c. is connected to the common pole of Slaf.

3.18.2 Switching circuits

Control Switch S1

When S1 is set to STANDBY, -15V is connected via S1AF to the 1 MHz oscillator in module 10 and to the interpolating oscillator only; at the same time the output of the calibrate circuit in module 12 is earthed. In the ON position of S1, the receiver is operational and all circuits, with the exception of the calibrate circuit in module 12 are supplied with -15V. When S1 is moved to CALIBRATE, the -15V supply to module 1 is broken at S1AB the output from module 12 calibrate circuit is applied via S1AB to module 2 and the calibrate circuit is supplied with -15V via S1AF.

Mode selector switch, S2

Wafer S2AF switches the -15V supply to the oscillators in module 11. Module 12 is supplied with -15V via S2AB on CALIBRATE operation and the BFO is similarly supplied on CW operation. The -15V supply is switched to the relevant detector circuit in module 7B via S2BF. The fourth wafer, S2BB, is used to switch either the 200 kHz output from module 12, or the BFO output, to module 7B on CALIBRATE or CW operation respectively.

BANDWIDTH switch S3

This switch is used to select the filter appropriate to the bandwidth required.

AGC switch, S4

With the a.g.c. switch (S4) set to the OFF position the 15V supply to the a.g.c. amplifier (Module 8) is broken. The receiver gain is controlled by RV1 which is connected in parallel with R11 across the -15V supply via R5 and R10.

With the a.g.c. switch set to SLOW the a.g.c. is controlled by Module 8 which now has 15V applied to it via S4. In the FAST position of S4 pin 2 of Module 8 is earthed, placing R21/L3 effectively in parallel with R12, thus reducing the time constant of the "hang time" circuit.

Other switches

The loudspeaker ON/OFF switch, S5, is used to isolate the loudspeaker when it is not required. A dummy load, R6, is connected in place of the loudspeaker when S5 is at OFF to maintain the loading of the audio amplifier and prevent the level at the PHONES jacks from rising.

For metering purposes, the AGC line and the audio output are connected via a resistor and a rectifier diode to poles of the meter switch S6, the required rectified signal is selected by S6 and applied to the meter M1.

3.18.3 Selector links

Selector links on the receiver rear panel are provided to enable the required line output impedance to be selected and in order that the internal oscillators may be disabled when external oscillators are to be used. The line output impedance selector link is used to connect an appropriate resistor (R1 or R2) in series with the line output transformer (balanced line) or the unbalanced line output terminal.

4. SERVICING

4.1 GENERAL

The information provided in this section is designed to assist in location of a fault to a particular module or sub-assembly and enable adjustment of certain preset controls using items of standard commercial test equipment. For further overall receiver tests, individual module tests and adjustment of other preset controls reference should be made to Volume 2 of this Manual. Volume 2 contains complete test specifications for the receiver and its constituent modules and sub-assemblies. To implement the specification tests, certain special test equipment, detailed in the individual specifications in Volume 2, is required.

4.2 TEST EQUIPMENT

Test equipment, as detailed below, is required for the tests detailed in this volume:

- (a) Voltmeter to measure up to 20V D.C.
- (b) 75 ohm resistive loads, 0.25W - 2 off
- (c) Valve voltmeter to measure up to 80mV at 100 kHz to 67 MHz.
- (d) Signal generator to provide an output of 2 μ V to 100mV EMF from a 75 ohm source at frequencies in the range 100 kHz to 67.3 MHz and capable of being modulated to a depth of up to 90% by frequencies of 200 Hz to 3 kHz.
- (e) Valve millivoltmeter to measure 70mV to 1.6V at 200 Hz to 3 kHz.
- (f) 600 ohm resistive load, 0.25W.
- (g) 60 ohm resistive load, 0.25W.
- (h) 560 ohm resistive load, 0.25W.
- (j) Frequency counter to measure frequencies from 35 to 64.3 MHz.
- (k) Low frequency signal source suitable for external modulation of item (d).
- (l) D.C. oscilloscope, with sweep speeds down to 0.2 sec/cm. and y sensitivity of 0.5V/cm., preferably with storage facility.

4.3 POWER SUPPLY

The D.C. supply to the receiver circuits should be -15V to -16V with the control switch set at STANDBY and at ON. This can be measured at pin 4 or pin 6 of most of the modules.

4.4 OVERALL RECEIVER GAIN

The overall gain of the receiver may be tested in the following manner:-

- (a) Set AGC to ON, BANDWIDTH to 6 kHz and the mode selector switch to AM. Switch on the receiver and, with no input signal, measure and note the voltage on the AGC line (pin 3 on module 4, 5 and 7). Set AGC to OFF and adjust the IF GAIN control to obtain the same voltage, as noted, on the AGC line.
- (b) Terminate the 100 kHz OUTPUT socket with a 75 ohm resistive load and connect a valve voltmeter across the load. Connect the output of a signal generator to the 75 ohm AERIAL socket.
- (c) Adjust the signal generator for an output of $2\mu\text{V}$ EMF at 60 kHz and tune the receiver for maximum indication on the valve voltmeter. An indication between 60mV and 120mV r.m.s. should be obtained.
- (d) Repeat (c) with an input signal of $5\mu\text{V}$ at 29.9 MHz. An indication between 60mV and 120mV r.m.s. should be obtained.
- (e) Repeat (c) with an input signal of $2\mu\text{V}$ at 1.1 MHz. A reading between 80 and 140mV should be obtained.
- (f) If satisfactory results are obtained, proceed to 4.6.

4.5 STAGE GAIN

4.5.1 Measurement and adjustment

Should the overall receiver gain as measured in 4.4 not be satisfactory, the stage gain may be verified, and if necessary adjusted as detailed below, without change of the test conditions.

(a) Module 7A

Break coaxial cable 16, joining module 7A to the composite filter, and inject an unmodulated 100 kHz signal at an EMF of $300\mu\text{V}$ into the cable attached to module 7A. Set RV1 on module 7A (accessible through the module handle) fully clockwise and tune the signal generator for maximum indication on the valve voltmeter. An indication of not less than 40mV should be obtained. Failure to obtain this output would indicate a fault in module 7A. If a satisfactory result is obtained, reconnect cable 16 and proceed.

(b) Modules 4 and 10

Break cable 11, joining modules 2 and 4, and inject an unmodulated 37.3 MHz signal at an EMF of $6\mu\text{V}$ into module 4. Tune the input signal for maximum indication on the valve voltmeter. By adjustment of RV1 on module 4 (through the module handle), set the output to 38 to 43mV r.m.s.

(i) If a 15mV output is not obtainable, a fault is indicated in module 2 or the first local oscillator circuits (see 4.11.1).

(ii) If a satisfactory result is obtained, reconnect cable 11 and proceed.

(d) Module 1

Terminate cable 10 from module 1 with a 75 ohm resistive load and connect a valve voltmeter across the load. Break cable 3, connecting module 1 to the turret, and inject an unmodulated 1 MHz signal, at an EMF of 1mV into module 1. Tune the input for maximum indication on the valve voltmeter; this indication should be not less than 5mV. Unsatisfactory results indicate a fault in module 1.

4.5.2 Final Test

If satisfactory results are obtained in all of the stage gain tests, repeat 4.4.

- (a) Should the overall gain still be unsatisfactory, a fault in the RF filter (turret compartment 1) or the aerial input circuit is indicated.
- (b) If the overall gain is slightly high, adjust RV1 on module 4 to obtain the correct overall gain when the receiver is tuned to 15 MHz.

4.6 PRODUCT DETECTOR AND LINE AMPLIFIER

Test the product detector and line amplifier gain in the manner detailed below:-

- (a) With conditions as for overall gain testing (4.4) connect a 600 ohm load between the 600 ohm output terminals on the rear panel and connect a valve millivoltmeter across the load. Set the selector link on the rear panel for 600 ohms output.
- (b) Select CW and switch the AGC to OFF. Set Bandwidth to 150 Hz and the IF Gain as adjusted in 4.4 (a). Apply an input signal of 2 μ V e.m.f. at 15 MHz at the AERIAL socket and tune the receiver to give a maximum output at 100 kHz. Adjust the B.F.O. to give an audio output of approximately 1 kHz (using the internal loudspeaker as a monitor). Set RV1 on Module 9 (accessible through the handle) to the fully clockwise position, and measure the audio output voltage obtained, which should not be less than 2.45V r.m.s.
- (c) Repeat (b) with the AM mode selected and the BANDWIDTH set to 6 kHz, using a signal modulated at 1000 Hz, 30% modulation depth at 3 μ V e.m.f.

4.7 AGC TESTS

Verify correct AGC operation as follows:-

- (a) With conditions as for overall gain testing (4.4) select the AM mode and inject a 15 MHz signal at an EMF of $2\mu\text{V}$.
- (b) Tune the receiver for maximum 100 kHz output. Set AGC to ON and RV1 on module 8 (through handle) fully counter-clockwise.
- (c) Monitor the AGC voltage and turn RV1 clockwise until the AGC voltage just changes. Lock RV1.
- (d) Modulate the input signal to 30% at 1 kHz and adjust RV1 on module 9 for a convenient reading on the millivoltmeter connected across the 600 ohm line.
- (e) Raise the input signal level in 10dB steps by 120dB. The audio output level should not vary by more than 4dB above the reading obtained in (d).
- (f) Set the meter switch to RF and the input signal level to $500\mu\text{V}$. Adjust RV3 on the meter tagboard to obtain an indication at the 9 inch mark. Lock RV3.

4.8

SIGNAL/NOISE PERFORMANCE

Measure the signal/noise performance of the receiver as follows:-

- (a) Set AGC to OFF, BANDWIDTH to 6 kHz and select the AM mode. Turn both gain controls fully clockwise.
- (b) Inject a 150 kHz unmodulated signal at a level of $3\mu\text{V}$ at the 75 ohm aerial socket. Tune the receiver at 150 kHz for maximum noise output. Adjust the AUDIO GAIN control for a convenient output level on the millivoltmeter connected across the 600 ohm line output and note this level. Apply modulation at 1000 Hz and to a depth of 30% to the input signal. The audio output should increase by at least 10dB.

4.9

AUDIO PERFORMANCE

4.9.1

Output levels

To measure the audio output levels, apply a 15 MHz signal at $3\mu\text{V}$ at the 75 ohm aerial socket, modulate the input signal with 1 kHz to a depth of 30%, select AM mode and, with AGC ON, tune the receiver to the input signal; then proceed as follows:-

- (a) Set the loudspeaker switch to OFF. Connect a valve voltmeter across load resistor R6 (15 ohms). Set AUDIO GAIN to maximum; the valve voltmeter should indicate not less than 2.45V r.m.s. (400mV in 15 ohms). Remove the meter.
- (b) Load each phone jack in turn with 600 ohms and measure the voltage across the load; it should be not less than 2.0V r.m.s. (6.7mW in 600 ohms).
- (c) Load the balanced line output with 600 ohms and measure the voltage across the resistor; it should be not less than 2.45V r.m.s. (10mW in 600 ohms).
- (d) Remove the 600 ohm load and set the links for 150 ohms line output. Load the line output with 150 ohms and measure the voltage across the load; it should be at least 2.45V r.m.s. (40mW in 150 ohms).

4.9.2

Frequency response

Audio frequency response should be checked as follows:-

- (a) With the conditions as for 4.9.1 (c) adjust RV1 on module 9 for an audio output of 0.7V r.m.s. on the millivoltmeter.
- (b) Amplitude modulate the input signal to a depth of 30% at 1 kHz. Measure and note the audio output level to line.

- (c) Change the modulation frequency to 300 Hz and then to 3 kHz, noting the output level in each case; this should be not less than 4dB down on the level at 1 kHz.

4.9.3 Output adjustment

With conditions as in 4.9.2 (b) set RV1 on module 9 to give 0.775V r.m.s. on the millivoltmeter. Check that the front panel meter indicates to $1\text{mW} \pm 1/16$ in. when the meter switch is set to AF.

4.10 CALIBRATION

4.10.1 Interpolating oscillator

Check that the KILOHERTZ film scale can be calibrated as detailed in 2.3.2.

4.10.2 BFO

Connect an unmodulated 15 MHz signal source, at any convenient level, to the 75 ohm aerial socket. Switch on the receiver, with AGC ON, and USB and the 6 kHz bandwidth selected. Tune the receiver to the signal for zero beat in the phones or loudspeaker. Set BFO to 0 and select CW; zero beat should be maintained. If no, L1 on the BFO sub-unit may be adjusted to obtain this condition. (The unit side cover must be removed for access to L1).

4.11 OSCILLATORS

If a fault is suspected in either the 1 MHz oscillator in module 10 or the interpolating oscillator, it can be verified by substituting the suspect oscillator with suitable external oscillators as detailed in 2.2.2. The activity of other oscillators should be verified as detailed in the following paragraphs.

4.11.1 First local oscillator (module 3)

Test the first local oscillator as follows:-

- (a) Set the INT. 1 MHz and INT. VFO links on the rear panel of the receiver to OFF. Unsolder the connections to pins 2 and 3 of module 3.
- (b) Break cable 8 and terminate the cable from module 3 with a 75 ohm resistive load. Connect a valve voltmeter across the load. The meter should indicate approximately 625mV r.m.s. Reconnect cable 8.
- (c) Repeat (b) at cable 9. A similar reading should be obtained.
- (d) With the load and meter still connected at cable 9, break cable 8 and measure, on a frequency counter, the frequency of the RF output at cable 8 termination. It should be not more than 37,000 MHz.

4.11.4 Megahertz selector (turret compartment 2)

Verify correct operation of the megahertz selector circuit as follows:-

- (a) Remove the bottom cover of the turret. Locate the MHz input connection on board G in compartment 3 (fig. 1) and connect it to the input of the frequency counter via a coaxial connector.
- (b) Switch on the PR155 and set the MEGAHERTZ control to 0. Verify that the frequency indicated is 35 MHz. (See Note in 4.11.3).
- (c) Repeat (b) for each turret position, verifying that the output frequency increases by 1 MHz at each successive setting of the MEGAHERTZ control to 64 MHz at the 29 MHz setting.
- (d) Remove the frequency counter and connect a valve voltmeter in its place. The meter should indicate not less than 250mV r.m.s. at each setting of the MEGAHERTZ control.

4.12 PHASE LOCK CIRCUITS (TURRET COMPARTMENT 3)

Correct operation of the phase lock circuits should be verified as detailed below :-

- (a) Break cable 7, connecting the turret to the interpolating oscillator. Terminate the cable from the oscillator with a 75 ohm resistive load and connect a frequency counter across the load. Switch on the PR155 and adjust the KILOHERTZ tuning to obtain a frequency of 2.5 MHz on the counter. The control must remain in this position throughout the following tests. Switch off, remove the counter and load and reconnect cable 7.
- (b) Disconnect pin 2 of module 3 and reconnect to pin 2 via a 100k ohms resistor. Connect the D.C. input of an oscilloscope between pin 3 and earth. Break cable 9, connecting modules 2 and 3, terminate the cable from module 3 with a 75 ohm resistive load and connect the frequency counter across the load.
- (c) Connect oscilloscope between the reactor control lead on board J, turret compartment 3 and earth. (Fig. 13 refers).
- (d) Set receiver to 28 MHz. Adjust RV3 on board J to give the following waveform on the oscilloscope. (Diagram (a)).



Diagram (a)

- (e) Set the internal oscillator links on the rear panel to ON. Reconnect pins 2 and 3 of module 3. Set the MEGAHERTZ control to indicate 1 MHz on the scale and verify, by use of the frequency counter, that the frequency at cable 8 is tunable by means of the receiver tuning over the range 38.2 to 39.4 MHz.
- (f) Set the MEGAHERTZ control to 29 MHz and verify that the output frequency is capable of being tuned over the range 66.2 to 67.4 MHz.

Failure to obtain satisfactory results in (b), (c) or (d) would indicate that module 3 is unserviceable, but failure in (e) or (f) may indicate a faulty module 3 or a fault in phase lock circuit testing as detailed in 4.12.

4.11.2 10.6/10.8 MHz oscillator (module 11)

To test the 10.6/10.8 MHz oscillator, proceed as follows:-

- (a) Break cable 15 (module 11 to module 5) and terminate the cable from module 11 with a 75 ohm resistive load. Connect a frequency counter across the load.
- (b) Calibrate the mode selector switch. The frequency as measured on the counter should be 10.800000 MHz.
- (c) Replace the counter with a valve voltmeter. The meter should indicate not less than 100mV r.m.s.
- (d) Select CW and repeat (d) and (c). The frequency should be 10.600 MHz and the meter indication, 100mV r.m.s.

4.11.3 Spectrum generator (module 10) and MHz selector

The 1 MHz oscillator in module 10 can best be eliminated as faulty by using an external 1 MHz oscillator (see 2.2.2). However, if a suitable oscillator is not available, break cable 23 (module 10 to module 12) and measure the frequency on a counter at the cable from module 10; it should be 1.000000 MHz. C19 may be adjusted for this condition. Replace the counter with a 75 ohm resistive load and measure the output across the load; it should be not less than 400mV.

The 48 MHz output from module 10 can be measured across a 75 ohm resistive load connected across cable 12 from the module; an output of not less than 400mV at 48 MHz should be obtained.

Note: In making this test it may be found that the high 1 MHz content of the output may affect the operation of the frequency counter. It is therefore advisable to use a 75 ohm stepped attenuator as the resistive load and to set the attenuator to give minimum operative input to the counter.

Operation of the spectrum generator at all other frequencies can best be checked in conjunction with the MHz selector circuits in turret compartment 2 as detailed in 4.11.4.

- (e) Reset MHz selector to 21 and 22 MHz in turn, adjusting RV1 on wafer E, turret compartment 2, (Fig.10 refers) to place the locking response as near as possible to the centre of the sweep, i.e. compromise. (RV1 to 4 on wafer E are so positioned that only the one to be adjusted can be reached).

Reset MHz selector to 13 and 14 in turn, adjusting RV2 on wafer E for optimum.

- (f) Reset MHz selector to 5 and 6 MHz in turn, adjusting RV3 on wafer E for optimum waveform ($t_1 = t_2$). (Diagram (b)).

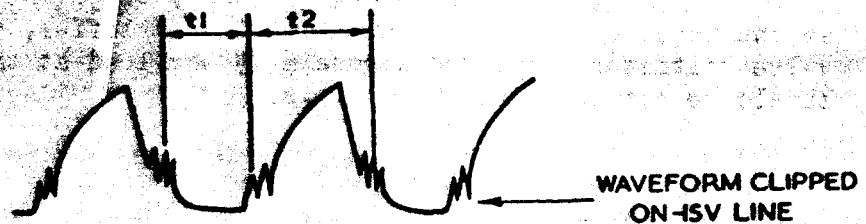


Diagram (b)

- (g) Reset MHz selector to 2 MHz and adjust RV4 on wafer E for optimum waveform. (Diagram (c)).
Lock RV1 to 4 on wafer E and RV3 on board 'J'.

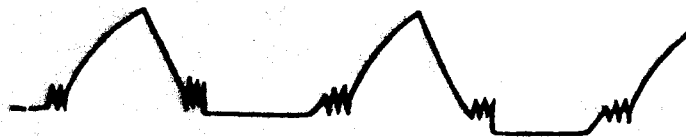


Diagram (c)

- (h) Reset receiver to 29 MHz and observe sweep waveform and ensure that it is symmetrical about the locking response. Set the receiver to each megahertz in turn down to 0, checking that the sweep waveform goes either side of the locking response by a satisfactory margin.
- (i) Reconnect pin 2 on modules 3. Set the MEGAHERTZ control to 0; the oscilloscope trace should be a horizontal line and the frequency measured on the counter should be 37.500 MHz.

- (j) Rotate the MEGAHERTZ control to each of its other positions in turn and at each position verify that the frequency is 1 MHz higher than at the previous position. If the local oscillator does not lock at a particular position, RV3 on board J may be slightly re-adjusted to make it lock. Should it be necessary to adjust RV3, verify that the oscillator locks satisfactorily at all positions previously tested. If satisfactory results are obtained, remove the test equipment and reconnect the coaxial cables.

4.13 ISOLATING AMPLIFIER

With a signal at a frequency of 50 MHz and an e.m.f. of 1V applied at the input (cable 8) to the isolating amplifier, the voltage measured on a valve voltmeter connected across a 75 ohm load at the output connector (Cable 9) should be not less than 0.5V r.m.s.

5. COMPONENT INFORMATION

Note: When ordering spares it is advisable to quote the serial number of the receiver module number and part number as quoted in this handbook. An operational spares kit is available (fuses, indicator lamp) under part number 630/LF/23448. A maintenance spares kit (resistors, capacitors, transistors, etc.) is available under part number 630/LG/23448.

5.1 MAIN CHASSIS

Resistors

R. No.	Value ohms	Tol. ± %	Rating Watts	Maker and Type	Part No.
2	150	10	1/4	Erie 16	403/A/78168/06
11	560	10	1/4	Erie 16	403/A/78168/06
3	560	5	1/4	Erie 16	403/A/78168/09
5	680	10	1/4	Erie 16	403/A/78168/09
6	15	5	1/4	Erie 108	999/A/00245/2
10	120	10	1/4	Erie 16	403/A/78168/06
14	120	10	1/4	Erie 16	403/A/78168/06
15	75	5	.1	Erie 16	999/A/00428/0
16	56	10	1/4	Erie 16	403/A/78168/06

Capacitors

C. No.	Value μF	Tol. ± %	V. Wkg.	Maker and Type	Part No.
1, 6	1000		25	Plessey Electrolytic	402/4/01205/00
3, 4	50		25	Plessey Electrolytic	402/4/01201/0
2	1700		50	Electrolytic, T.C.C.	402/4/98038/02
5	500		25	Plessey Electrolytic	402/4/01246/00
7, 8	.01		1000	Dubilier 660M	400/4/98474/0
9	2		70	Plessey Electrolytic	402/1/01223/0

Miscellaneous

Circuit Ref.	Description	Part No.
RV1	Potentiometer, 1k ohm	404/1/02650/15
RV2	Potentiometer, 5k ohm ± 20%	404/1/02650/
RV3	Potentiometer, 1k ohm, G, MK. 5A	404/1/00405/
VT1	Transistor, OC35 Mullard	417/4/98108/00
D1	Diode HG1012, Hughes International	415/4/98149
D2	Diode, Zener, 4.7V ± 5%	415/4/98167/
FLT1	Filter, composite	422/8/00100/00
S1	Switch	408/1/00004/00
S2	Switch	408/1/00002/
S4	Switch	408/8/00010/03

S5	Switch S.P.D.T.	408/4/98084/006
S6	Switch D.P.D.T.	408/4/98084/010
T1	Transformer	407/8/22047
T2	Transformer	407/4/98035
MR1	Rectifier, bridge. 1B20 KO5 Texas Insts.	415/4/98164
FS1	Fuse Link, Size 00, L754, 1A (230V)	518/4/98000/006
FS1	Fuse Link, Size 00, L754, 2A (115V)	518/4/98000/007
FS2	Fuse Link, Size 00, L562, 2.5A	518/4/98004/001
	Box spanner 5242 Buck and Hickman	630/4/17437
PL1	Plug, electrical, fixed 3-pin 5A, Mk.4	CZ48993
JK1, JK2	Socket, jack, with black facia nut	511/4/97001/001
M1	Instrument, indicating	682/4/99011
L2	Choke	407/8/21965
L1	Choke	407/8/21959
	Plug, elect. free, (BNC) Belling Lee L1637/CS	
	Socket, elect. fixed, (BNC) Belling Lee L1637/FP	
	Socket, elect. free, Mk.4	CZ49015
	Belling Lee Min. Twin Socket Type L1391/S	508/4/28002
	Belling Lee Min. Free Plug L1465/FP/AG/N1	508/4/28041/001
	Belling Lee Min. Free Socket L1465/FS/AG/N1	508/4/28382
	Belling Lee Min. Fixed Socket L1465/CS/AG/N1	508/4/28075/001

5.2 INTERPOLATING OSCILLATOR (630/1/14000/001)

Resistors

R. No.	Value ohms	Tol. \pm %	Rating Watts	Maker and Type	Part No.
1	22k	10	$\frac{1}{4}$	Erie 16	403/4/77006/041
2	39k	10	$\frac{1}{4}$	Erie 16	403/4/77006/044
3,7,10	2.2k	10	$\frac{1}{4}$	Erie 16	403/4/77006/029
4	1k	10	$\frac{1}{4}$	Erie 16	403/4/77006/025
5	10k	10	$\frac{1}{4}$	Erie 16	403/4/77006/037
6	15k	10	$\frac{1}{4}$	Erie 16	403/4/77006/039
8	180	10	$\frac{1}{4}$	Erie 16	403/4/77006/016
9	5.6k	10	$\frac{1}{4}$	Erie 16	403/4/77006/034
11	470	10	$\frac{1}{4}$	Erie 16	403/4/77006/021
12,13,15	560	10	$\frac{1}{4}$	Erie 16	403/4/77006/022
14	4.7k	10	$\frac{1}{4}$	Erie 16	403/4/77006/033
16,17	56	10	$\frac{1}{4}$	Erie 16	403/4/77006/010

Capacitors

C. No.	Value ohms	Tol. \pm %	V. Wkg.	Maker and Type	Part No.
1,9,14,15 16,19	0.1	20	250	Miniature foil	400/4/98268/001
2,5,6,10	1000p	1	125	Mullard C.295A	400/4/98245/001

3	3000p	1	125	Mullard C.295A	400/4/98245/008
4	1000p	5	350	Mica, moulded	424/4/98070/001
8	33p	5		Trimmer	401/8/20006
11	68p	5	125	Erie NPO/BD	400/4/97004/023
12	220p	5	125	Polystyrene	400/4/97001/011
13	330p	5	125	Polystyrene	400/4/97001/019

Miscellaneous

Circuit Ref.	Description	Part No.
BV1	Potentiometer, 10k ohms	404/1/00405/013
L1	Coil Assembly	406/1/08379
L2	Trimmer Coil	406/8/08327
L3	RF Choke, miniature, 6.8 μ H \pm 10%	406/4/98012/002
L4, L5	RF Choke, miniature, 1000 μ H \pm 10%	406/4/98012/005
VT1-VT4	Transistor, 2S512, Texas Insts.	417/4/98138
D1	Diode, Zener, 10V \pm 5%	415/4/98167/003
	Component Board Assembly	630/1/14020

5.3 B.F.O. ASSEMBLY (630/1/25154)

Resistors

R. No.	Value ohms	Tol. \pm %	Rating Watts	Maker and Type	Part No.
3	8.2k	10	$\frac{1}{4}$	Erie 16	403/4/78168/149
2	15k	10	$\frac{1}{4}$	Erie 16	403/4/78168/16
1	12k	10	$\frac{1}{4}$	Erie 16	403/4/78168/157
4	2.2k	10	$\frac{1}{4}$	Erie 16	403/4/78168/121
5,7,8	270	10	$\frac{1}{4}$	Erie 16	403/4/78168/07
6	18k	10	$\frac{1}{4}$	Erie 16	403/4/78168/16
9	12	10	$\frac{1}{4}$	Erie 16	403/4/78168/005

Capacitors

C. No.	Value μ F	Tol. \pm %	V. Mkg.	Maker and Type	Part No.
1	.047	20	250	Mullard C280	400/4/98268/00
2	3300p	1	125	Mullard C295A	400/4/98245/010
3	1000p	1	125	Mullard C295A	400/4/98245/001
4	470p	5	125	Polystyrene	400/4/97001/02
5,6,7	0.1	20	250	Mullard C280	400/4/98268/00
8	220p	5	125	Suflex HS7E	400/4/98366/018
9				Variable	401/4/98026/00

Miscellaneous

Circuit Ref.	Description	Part No.
RV1	Potentiometer, 5k ohms	404/1/00405/012
L1	Inductor Assembly	406/8/08323/006
L2	RF Choke, miniature, 1000 μ H \pm 10%	406/4/98012/005
VT1, VT2	Transistor, BSY95A	417/4/98138
	Board Component	630/1/25164

5.4 REGULATOR ASSEMBLY (630/1/14608)

Refer to sub-section 5.18.

5.5 TURRET ASSEMBLY (630/1/14300)

5.5.1 Compartment 1 Contact Board (630/1/15293)

Circuit Ref.	Description	Part No.
C1	Capacitor, 18pF \pm 0.1 pF. Erie NPO/AD	400/4/97004/017
L1	Choke, 0.22 μ H	406/4/98012/006

5.5.2 Filter Assembly (630/1/14289)

Circuit Ref.	Description	Part No.
FL1	Filter 0 - 2 MHz	630/1/14057
FL2	Filter 2 - 3 MHz	630/1/14058
FL3	Filter 3 - 4 MHz	630/1/14059
FL4	Filter 4 - 6 MHz	630/1/14060
FL5	Filter 6 - 9 MHz	630/1/14061
FL6	Filter 9 - 14 MHz	630/1/14062
FL7	Filter 14 - 21 MHz	630/1/14063
FL8	Filter 21 - 30 MHz	630/1/14064

5.5.3 Compartment 2 Contact Board (630/1/14292)

Resistors

R. No.	Value ohms	Tol. \pm %	Rating Watts	Maker and Type	Part No.
1	68	10	$\frac{1}{4}$	Erie 16	403/4/77006/011
2	1k	10	$\frac{1}{4}$	Erie 16	403/4/77006/025
3	1.8k	10	$\frac{1}{4}$	Erie 16	403/4/77006/028
4	39k	10	$\frac{1}{4}$	Erie 16	403/4/77006/044
5	470	10	$\frac{1}{4}$	Erie 16	403/4/77006/021
6	15k	10	$\frac{1}{4}$	Erie 16	403/4/77006/039
7	1.5k	10	$\frac{1}{4}$	Erie 16	403/4/77006/027
8	270	10	$\frac{1}{4}$	Erie 16	403/4/77006/018

9 10	47 1.2k	10 10	$\frac{1}{2}$	Erie 16 Erie 16	403/4/77006/009 403/4/77006/026
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Capacitors

C. No.	Value μ F	Tol. \pm %	V. Wkg.	Maker and Type	Part No.
1	27p	5		Erie NPO/BD	400/4/97004/021
2	8.2p	\pm 0.5pf		Erie NPO/AD	400/4/97004/010
3	47p	5		Polystyrene	400/4/97901/009
4	12p	5		Erie NPO/AD	400/4/97004/013
5	10p	5		Erie NPO/AD	400/4/97004/011
6	100p	5		Polystyrene	400/4/98001/013
7	0.1	20	250	Mullard C280	400/4/98268/007

Miscellaneous

Circuit Ref.	Description	Part No.
D1 D2 VT1, VT2, VT3	Diode, BAY36, STC Diode, Zener, 10V \pm 5% Transistor, BSY 95A STC	415/4/98141 415/4/98167/003 417/4/98148

5.5.4 Wafer Assembly (E) (630/1/14290)

Circuit Ref.	Description	Part No.
R4 R1, 2, 3 RV1 RV2, RV3, RV4	Resistor, 120 ohms \pm 10% $\frac{1}{4}$ W, Erie 16 Resistor, 180 ohms \pm 10% $\frac{1}{4}$ W, Erie 16 Potentiometer 1.5k ohms Potentiometer 1k ohms	403/4/77006/014 403/4/77006/016 403/1/00405/069 403/1/00405/005

5.5.5 Wafer Assembly (F1) (F2) (630/1/14291)

Circuit Ref.	Description	Part No.
L1 : L31	Inductor Assembly 14 turns	406/8/08325/002
L2 : L32	Inductor Assembly 14 turns	406/8/08324/002
L3 : L33	Inductor Assembly 13 turns	406/8/08325/003
L4 : L34	Inductor Assembly 13 turns	406/8/08324/003
L5, L7 : L35, L37	Inductor Assembly 12 turns	406/8/08325/004
L6, : L36	Inductor Assembly 12 turns	406/8/08324/004
L8, L10 : L38, L40	Inductor Assembly 11 turns	406/8/08324/005
L9, L11 : L39, L41	Inductor Assembly 11 turns	406/8/08325/005
L12, L14, L16: L42, L44, L46	Inductor Assembly 9 turns	406/8/08324/006
L13, L15, L17: L43, L45, L47	Inductor Assembly 9 turns	406/8/08325/006
L18, L20, L22: L48, L50, L52	Inductor Assembly 8 turns	406/8/08324/007
L19, L21, L23: L49, L51, L53	Inductor Assembly 8 turns	406/8/08325/007
L24, L26, L28: L54, L56, L58	Inductor Assembly 7 turns	406/8/08324/008
L25, L27, L29: L55, L57, L59	Inductor Assembly 7 turns	406/8/08325/008

Resistors

R. No.	Value ohms	Tol. ± %	Rating Watts	Maker and Type	Part No.
1, 11, 16, 28	82	10	$\frac{1}{4}$	Erie 16	403/4/77006/012
2, 26	5.6k	10	$\frac{1}{4}$	Erie 16	403/4/77006/034
3, 9, 14, } 21, 27, 33 }	10k	10	$\frac{1}{4}$	Erie 16	403/4/77006/037
4, 5, 6, 10, } 15, 18, 24, 25 } 30 }	470	10	$\frac{1}{4}$	Erie 16	403/4/77006/021
7, 12, 17, 34	1.2k	10	$\frac{1}{4}$	Erie 16	403/4/77006/026
8, 13, 20, 32	2.7k	10	$\frac{1}{4}$	Erie 16	403/4/77006/030
19, 22, 31, 39	47	10	$\frac{1}{4}$	Erie 16	403/4/77006/009
23	270	10	$\frac{1}{4}$	Erie 16	403/4/77006/018
29, 41	27	10	$\frac{1}{4}$	Erie 16	403/4/77006/006
35	4.7k	10	$\frac{1}{4}$	Erie 16	403/4/77006/033
36, 37, 38, } 42, 43 }	560	10	$\frac{1}{4}$	Erie 16	403/4/77006/022
40	100	10	$\frac{1}{4}$	Erie 16	403/4/77006/013

Capacitors

C. No.	Value ohms	Tol. ± %	V. Wkg.	Maker and Type	Part No.
1, 4, 6, 8, 17	.01	20	250	Mullard C280	400/4/98268/001
2	56p	5		Erie N750/AD	400/4/97005/029
3	100p	5		Erie N750/BD	400/4/97005/035
5, 7, 9	.047	20	250	Mullard C280	400/4/98268/005
10, 11, 12, 16) 18, 19, 20)	.001	-20+40		Ceramic Hi-k	400/4/97008/005
13	1.5-18p			Variable	401/4/98023/002
14	27p	5		Erie N750/AD	400/4/97005/021
15	47p	5		Erie N750/AD	400/4/97005/027

Miscellaneous

Circuit Ref.	Description	Part No.
RV1	Potentiometer, 100 ohms	404/1/00405/001
L1	RF Choke, miniature 6.8μH ± 10%	406/4/98012/002
L2	Ferrite Beads (3 off)	905/4/98052
T1 - T4	Transformer	406/8/08329/003
VT1-VT3, VT8	Transistor, 2S512, Texas Insts.	417/4/98138
VT4-VT6	Transistor, TI407, Texas Insts.	417/4/98135
D1 - D8	Diode, HG1012, Hughes International	415/4/98149

5.5.7 Compartment 3 Board H (630/1/14107)

Resistors

R. No.	Value ohms	Tol. ± %	Rating Watts	Maker and Type	Part No.
1,2,19,26	5.6	10	½	Erie 16	403/4/77006/034
3,12,17	560	10	½	Erie 16	403/4/77006/022
20,24					
4, 5	270	10	½	Erie 16	403/4/77006/018
6, 7	27	10	½	Erie 16	403/4/77006/006
8, 10	1k	10	½	Erie 16	403/4/77006/025
11, 15, 2	220	10	½	Erie 16	403/4/77006/017
13,21,27	100	10	½	Erie 16	403/4/77006/013
15,23,9	47	10	½	Erie 16	403/4/77006/006
16, 29	10k	10	½	Erie 16	403/4/77006/037
18, 25	1.5k	10	½	Erie 16	403/4/77006/027
28	470	10	½	Erie 16	403/4/77006/021

Capacitors

C. No.	Value ohms	Tol. ± %	V. Wkg.	Maker and Type	Part No.
1-4,6,8,21,) 9,10,12,13,) 14,16,17,20)	.001	20		Lemco Ceramic Hi-k	400/4/98260/007
7	.0047	-20+40		Lemco Ceramic Hi-k	400/4/98113/010
11	33p	5		Erie N750/AD	999/4/00353/106
18, 19	68p	5		Erie N750/AD	999/4/00353/114
22	12p	10		Erie NPO/AD	400/4/97005/013
31	560p	5	125	Lemco Polystyrene	400/4/98179/012
5	11	20	6	Kemet, K11N6 N5	402/4/98096/012

Miscellaneous

Circuit Ref.	Description	Part No.
L1	Inductor, 5 turns	406/8/08324/009
L2, L3	Ferroxcube beads (6 off)	905/4/98052
TR1, TR2, TR3	Transformer	406/8/08328
D1,D2,D3,D4,D7,D8	Diode, HG 1012, Hughes International	415/4/98149
D5, D6	Diode, BAY 36, STC	415/4/98141
VT1, VT6, VT8	Transistor, TI407, Texas Insts.	417/4/98135
VT2-VT5, VT7	Transistor, 2S512, Texas Insts.	417/4/98138

5.5.8 Compartment 3 Board J (630/1/14109)

Resistors

R. No.	Value ohms	Tol. ± %	Rating Watts	Maker and Type	Part No.
1, 11	1.5k	10	$\frac{1}{4}$	Erie 16	403/4/77006/027
4, 5	8.2k	10	$\frac{1}{4}$	Erie 16	403/4/77006/036
6	6.8k	10	$\frac{1}{4}$	Erie 16	403/4/77006/035
7	470	10	$\frac{1}{4}$	Erie 16	403/4/78168/089
8	2.2k	10	$\frac{1}{4}$	Erie 16	403/4/78168/121
9	1k	10	$\frac{1}{4}$	Erie 16	403/1/77006/025
10, 21, 22	10k	10	$\frac{1}{4}$	Erie 16	403/1/77006/037
12, 15, 2, 3	150	10	$\frac{1}{4}$	Erie 16	403/1/77006/015
13	330	10	$\frac{1}{4}$	Erie 16	403/1/77006/019
14	820	10	$\frac{1}{4}$	Erie 16	403/1/77006/024
16, 18, 19	4.7k	10	$\frac{1}{4}$	Erie 16	403/1/77006/033
17, 20	47k	10	$\frac{1}{4}$	Erie 16	403/1/77006/045

Capacitors

C. No.	Value ohms	Tol. ± %	V. Wkg.	Maker and Type	Part No.
1	0.1	20	250	Mullard C280	400/4/98268/007
2, 3	12		25	Plessey Electrolytic	402/1/01375/001
4	25		25	Plessey Electrolytic	402/1/01200/015
5	.047	20	250	Mullard C280	400/4/98268/005

Miscellaneous

Circuit Ref.	Description	Part No.
RV1	Potentiometer, 250 ohms	404/8/00405/008
RV2	Potentiometer, 5k ohms	404/8/00405/012
RV3	Potentiometer, 1.5k ohms	404/8/00405/069
RV4	Potentiometer, 25k	404/8/00405/014
D1	Diode, Zener, 10V ± 5%	415/4/98167/003
VT1-4, VT8, VT9	Transistor, 2S512, Texas Insts.	417/4/98138
VT5, VT6	Transistor, 2S3030, Texas Insts.	417/4/98136
VT7	Transistor, 2N1507, Texas Insts.	417/4/98139

5.6 Module 1 - RF Amplifier (630/1/17780)

Resistors

R. No.	Value ohms	Tol. ± %	Rating Watts	Maker and Type	Part No.
1a, b, c, d	33	10	1	Erie 8	403/4/78229/154
2, 21	10	10	1	Erie 16	403/4/78168/001
3, 19	39	10	1	Erie 16	403/4/78168/033
4, 11	820	10	1	Erie 16	403/4/78168/101
5	6.8k	10	1	Erie 16	403/4/78168/145
6	2.2k	10	1	Erie 16	403/4/78168/121
7	2.7k	10	1	Erie 16	403/4/78168/125
8	470	10	1	Erie 16	403/4/78168/089
9, 16	1.5k	10	1	Erie 16	403/4/78168/113
10	1.2k	10	1	Erie 16	403/4/78168/109
12	680	10	1	Erie 16	403/4/78168/097
13	390	10	1	Erie 16	403/4/78168/085
14	220	10	1	Erie 16	403/4/78168/073
15	330	10	1	Erie 16	403/4/78168/081
17, 20, 22	82	10	1	Erie 16	403/4/78168/053
18, 25	150	10	1	Erie 16	403/4/78168/065
26	4.7k	10	1	Erie 16	403/4/78168/137
40	10k	10	1	Erie 16	403/4/78168/153
23, 27, 28	560	10	1	Erie 16	403/4/78168/093
36	56k	10	1	Erie 16	403/4/78168/191
35, 24	1k	10	1	Erie 16	403/4/78168/105
37	22k	10	1	Erie 16	403/4/78168/169

Capacitors

C. No.	Value ohms	Tol. ± %	V. Wkg.	Maker and Type	Part No.
1-14, 25	0.1	20	250	Mullard C280	400/4/98268/007
15	82pf	5		Lemco 1106-S	414/4/98042/129
18	12		25	Lemco SM	402/4/98009/032
16, 17	50		25	Lemco SM	402/4/98009/039
24	68	10	15	S.T.C. Tantalum	402/4/98022/027

Miscellaneous

Circuit Ref.	Description	Part No.
L1, L5, L6, L7	RF miniature choke 1000 μ H	406/4/98012/005
L2	RF miniature choke 150 μ H	406/4/98012/004
VT1	Transistor, GM378, Texas Insts.	417/4/98137
VT2, VT3, VT4, VT6)	Transistor, BSY95A, S.T.C.	417/4/98138
VT9		
VT5	Transistor, BCY70, Texas Insts.	417/4/98267/001
VT10	Transistor, D986, Texas Insts.	417/4/98153
D1, D2, D4, D3	Diode, 21AG, (Plessey Semiconductor)	
D5	Zener Diode 6.8V \pm 5%	415/4/98167/009
D6, D7	Diode BAY36	415/4/98141
	Board Component Unit 1	630/1/17779

5.7 Module 2 (630/1/14111)

Capacitors

C. No.	Value pF	Tol. \pm %	V. Wkg.	Maker and Type	Part No.
1	94	1pf	125	L.C.R.Ltd.Polystyrene	400/4/98263/026
2	11	1pf	125	L.C.R.Ltd.Polystyrene	400/4/98263/022
3	119	2%	125	L.C.R.Ltd.Polystyrene	400/4/98263/010
4	58	1pf	125	L.C.R.Ltd.Polystyrene	400/4/98263/024
5	103	2%	125	L.C.R.Ltd.Polystyrene	400/4/98263/016
6	40	1pf	125	L.C.R.Ltd.Polystyrene	400/4/98263/023
7	63	1pf	125	L.C.R.Ltd.Polystyrene	400/4/98263/025

Miscellaneous

Circuit Ref.	Description	Part No.
L1	Inductor, 9T	406/8/08324/006
L2, L3	Inductor, 8T	406/8/08324/007
T1, T2	Transformer	406/8/08329/002
FL1	Filter, 37.3MHz + bracket assy.	
D1, D2)	Diode, CV7076	990/4/00107/076
D3, D4)	Board, Component, Unit 2	630/1/14367

5.8 Module 3 - 1st Local Oscillator (630/1/14112)

Resistors

R. No.	Value ohms	Tol. \pm %	Rating Watts	Maker and Type	Part No.
3	68k	10	1/4	Erie 16	403/4/78168/195
4	820	10	1/4	Erie 16	403/4/78168/101
5	1.8k	10	1/4	Erie 16	403/4/78168/117
6	1.5k	10	1/4	Erie 16	403/4/78168/113
7, 8	270	10	1/4	Erie 16	403/4/78168/071
9, 10	5.6k	10	1/4	Erie 16	403/4/78168/141
11	560	10	1/4	Erie 16	403/4/78168/093
12	330	10	1/4	Erie 16	403/4/78168/081
14	100	10	1/4	Erie 16	403/4/78168/057
18, 19	47	10	1/4	Erie 16	403/4/78168/039
13, 16	56	10	1/4	Erie 16	403/4/78168/045

Capacitors

Circuit Ref.	Value μ F	Tol. \pm %	V. Wkg.	Maker and Type	Part No.
C1, C2, C4, C6, C7, C8, C9	.001	-20+40	125	Lenco Ceramic Hi-k	400/4/98260/007
C3	56p	5	300	Ceramic	999/4/00353/112
C5	0.8-12p			Trimmer, tubular ceramic	400/4/98023/003

Miscellaneous

Circuit Ref.	Description	Part No.
Z1	Saturable reactor	407/1/21963
VT1, VT2	Transistor, TI407, Texas Insts.	417/4/98135
VT3, VT4	Transistor, 2S512, Texas Insts.	417/4/98138
D1, D2	Diode, BA110, STC	415/4/98148
D3	Diode, BAY36, STC	415/4/98141
F1, F2, F3, F4	UHF min. feed-thro' Ceramicon Erie CFT 3000 Board Component	400/4/98166 630/1/14443

5.9 MODULE 4 (630/1/14117)

5.9.1 Unit 4A (630/1/14093)

Resistors

R. No.	Value ohms	Tol. ± %	Rating Watts	Maker and Type	Part No.
1	180	10	$\frac{1}{4}$	Erie 16	403/4/77006/016
2, 4	100	10	$\frac{1}{4}$	Erie 16	403/4/77006/013
3, 16	75	5	$\frac{1}{4}$	Erie 16	999/4/00241/022
5	47k	10	$\frac{1}{4}$	Erie 16	403/4/77006/045
6, 14, 19, 24	10k	10	$\frac{1}{4}$	Erie 16	403/4/77006/037
8, 15	1k	10	$\frac{1}{4}$	Erie 16	403/4/77006/025
13, 18, 20 21, 22	4.7k	10	$\frac{1}{4}$	Erie 16	403/4/77006/033
17	390	10	$\frac{1}{4}$	Erie 16	403/4/77006/025
23	3.3k	10	$\frac{1}{4}$	Erie 16	403/4/77006/031
25	18	10	$\frac{1}{4}$	Erie 16	403/4/77006/004
26	27	10	$\frac{1}{4}$	Erie 16	403/4/77006/006
28	82	10	$\frac{1}{4}$	Erie 16	403/4/77006/012

Capacitors

C. No.	Value μ F	Tol. ± %	V. Wkg.	Maker and Type	Part No.
1-9, 12,) 13, 19-24)	.01	20%	30	Mullard C280	400/4/98213/001
14	59	1pf	125	L.C.R.Ltd. Polystyrene	400/4/98263/005
15	24	1pf	125	L.C.R.Ltd. Polystyrene	400/4/98263/030
16	80	1pf	125	L.C.R.Ltd. Polystyrene	400/4/98263/031
17	88	1pf	125	L.C.R.Ltd. Polystyrene	400/4/98263/032
18	27	1pf	125	L.C.R.Ltd. Polystyrene	400/4/98263/002
25	27	5%	125	L.C.R.Ltd. Ceramic NPO	400/4/97004/021

Miscellaneous

Circuit Ref.	Description	Part No.
RV1	Potentiometer 1k ohms	404/1/00405/010
L1, L2, L5	Miniature RF Choke 6.8 μ H ± 10%	406/4/98012/002
L3	Inductor 7T	406/8/08324/008
L4	Inductor 4T	406/8/08324/010
F1, F2, F3, F4	UHF min. feed thro' Ceramicon, Eire CTF 3000	400/4/98266
VT1	Transistor, GM378 Texas Insts.	417/4/98137
VT2	Transistor, TI407 Texas Insts.	417/8/98135
VT3, VT4	Transistor, 2S512, Texas Insts.	417/4/98138
D1	Diode BAY36 S.T.C.	415/4/98141

5.9.2. UNIT 4B (630/1/14095)

Resistors

R. No.	Value ohms	Tol. ± %	Rating Watts	Maker and Type	Part No.
29	1k	10	1/4	Erie 16	403/4/77006/025
30	150	10	1/4	Erie 16	403/4/77006/015
31	10k	10	1/4	Erie 16	403/4/77006/037
32	470	10	1/4	Erie 16	403/4/77006/021
33	1.5k	10	1/4	Erie 16	403/4/77006/027
34	47	10	1/4	Erie 16	403/4/77006/009
35	270	10	1/4	Erie 16	403/4/77006/018

Capacitors

C. No.	Value μF	Tol.	V. Wkg.	Maker and Type	Part No.
26	27	+10%		Ceramic	400/4/97004/021
27	18	± 5%		Erie N750/AD	400/4/97005/017
32	3.3	+0.5pF		Ceramic	400/4/97004/005
29	10	+0.5pF		Ceramic	400/4/97004/011
30, 31	.01μF	+20%	30	Mullard C280	400/4/98268/001

Miscellaneous

Circuit Ref.	Description	Part No.
L6	Inductor, 9T	406/8/08324/006
F1, F2	UHF min. feed thro' Ceramicon Erie CFT 3000	400/4/98266
FL1	Crystal Filter 10.7 MHz	428/4/98030
VT5, VT6, VT7	Transistor 2S512, Texas Insts.	417/4/98138

5.10 Module 5 (630/1/14113)

Resistors

R. No.	Value ohms	Tol. ± %	Rating Watts	Maker and Type	Part No.
1	82	10	1/4	Erie 16	403/4/77006/012
2, 5	470	10	1/4	Erie 16	403/4/77006/021
3	15k	10	1/4	Erie 16	403/4/77006/039
4, 15, 18 } 24, 26 }	10k	10	1/4	Erie 16	403/4/77006/037
6	220	10	1/4	Erie 16	403/4/77006/017
7, 14, 17, 19 } 22, 23, 25 }	4.7k	10	1/4	Erie 16	403/4/77006/033

16, 27	560	10	$\frac{1}{4}$	Erie 16	403/4/77006/022
28	68	10	$\frac{1}{4}$	Erie 16	403/4/77006/011
29	100	10	$\frac{1}{4}$	Erie 16	403/4/77006/013

Capacitors

C. No.	Value μ F	Tol. \pm %	V. Wkg.	Maker and Type	Part No.
1 to 7	.022	20	30	Mullard C280	400/4/98213/002
12, 13, 14, 15)	0.1	20	30	Mullard C280	400/4/98213/004
16, 18, 19)					
17	220p	5	125	Polystyrene	400/4/97007/017

Miscellaneous

Circuit Ref.	Description	Part No.
VT1	Transistor GM378 Texas Insts.	417/4/98137
VT3, VT4, VT5,	Transistor 2S512 Texas Insts.	417/4/98138
VT6	Diode BAY36 S.T.C.	415/4/98141
D1	UHF min. feed thro' Ceramicon	
F1, F2, F3, F4	Erie CPT3000	400/4/98266
L1	RF Choke 1000 μ H	406/4/98012/005
	Board, Component, Unit 5	630/1/14438
RV1	1.5k Potentiometer	404/1/00405/069

5.11 Module 7A (630/1/25150)

5.11.1

Resistors

R. No.	Value ohms	Tol. \pm %	Rating Watts	Maker and Type	Part No.
1, 48	75	10	$\frac{1}{4}$	Erie 16	403/4/78168/052
2, 9, 14, 29	1k	10	$\frac{1}{4}$	Erie 16	403/4/78168/105
3	27k	10	$\frac{1}{4}$	Erie 16	403/4/77006/042
4	100k	10	$\frac{1}{4}$	Erie 16	403/4/77006/049
5, 10, 24	470	10	$\frac{1}{4}$	Erie 16	403/4/77006/021
6	4.7k	10	$\frac{1}{4}$	Erie 16	403/4/77006/033
7, 19	1.5k	10	$\frac{1}{4}$	Erie 16	403/4/77006/027
11, 16, 23	100	10	$\frac{1}{4}$	Erie 16	403/4/77006/013

22	180	10	.1	Erie 15	403/4/78257/161
27	1.5k	10	.1	Erie 15	403/4/78257/172
12, 17	10k	10	+	Erie 16	403/4/77006/042
13	68k	10	+	Erie 16	403/4/77006/047
15, 25	3.9k	10	+	Erie 16	403/4/77006/032
18	47k	10	+	Erie 16	403/4/77006/045
20	33	10	+	Erie 16	403/4/77006/007
21	680	10	+	Erie 16	403/4/77006/023
26	180	10	+	Erie 16	403/4/77006/016
28	560	10	+	Erie 16	403/4/77006/022
46	220	10	+	Erie 16	403/4/77006/017
47	330	10	+	Erie 16	403/4/77006/019

Capacitors

C. No.	Value μF	Tol. ± %	V. Wkg.	Maker and Type	Part No.
1, 2, 5, 8, 9 } 13, 14, 39 }	.047	20	250	Mullard C280	400/4/98268/005
4, 6, 7, 11, 15 } 16, 20, 35, 36 } 37, 38 }	0.1	20	250	Mullard C280	400/4/98268/007
10	.005	1		Mullard C295A	400/4/98245/006
12, 40	2		70	Electrolytic	402/1/01223/001
18	.002	1		Mullard 295A	400/4/98245/003
19	47		20	Electrolytic	402/4/50833/029

Miscellaneous

Circuit Ref.	Description	Part No.
RV1	Potentiometer 10k ohms ± 20%	404/1/00405/013
L1, L2, L3, L4	RF Choke, miniature 1000μH ± 10%	406/4/98012/005
VT1-VT5, VT10	Transistor, 2S512, Texas Insts.	417/4/98138
D1, D2	Diode, BAY36, S.T.C.	415/4/98141
D3	Zener diode 4.7V ± 5%	415/4/98167/001
	Board Component, Unit 7A	630/1/25179

Resistors

R. No.	Value ohms	Tol. \pm %	Rating Watts	Maker and Type	Part No.
30	1.8k	10	1/4	Erie 16	403/4/77006/028
31,35,44	10k	10	1/4	Erie 16	403/4/77006/037
32,33,43,42	1k	10	1/4	Erie 16	403/4/77006/025
34	2.7k	10	1/4	Erie 16	403/4/77006/030
36, 51	220	10	1/4	Erie 16	403/4/77006/017
37	470	10	1/4	Erie 16	403/4/77006/021
38	22k	10	1/4	Erie 16	403/4/78168/169
39	15k	10	1/4	Erie 16	403/4/77006/039
40, 61	4.7k	10	1/4	Erie 16	403/4/78168/137
41	33k	10	1/4	Erie 16	403/4/78168/177
49	3.3k	10	1/4	Erie 16	403/4/78168/129
50	1.5k	10	1/4	Erie 16	403/4/77006/027
52	6.8k	10	1/4	Erie 16	403/4/78168/145
60	820	10	1/4	Erie 16	403/4/78168/101
62	560	10	1/4	Erie 16	403/4/78168/093
63	330	10	1/4	Erie 16	403/4/78168/081

Capacitors

C. No.	Value μ F	Tol. \pm %	V. Wkg.	Maker and Type	Part No.
17	.0024	1		Mullard C295A	400/4/98245/004
21	25		25	Electrolytic	402/1/01200/015
22,23,31	50		25	Electrolytic	402/1/01201/001
24,25,26,32	0.1	20	250	Mullard C280	400/4/98268/007
27	.002	5		Mullard C295A	400/4/98245/003
28	.01	20	250	Mullard C280	400/4/98268/001
30, 34	6.4	-10+50	25	Mullard C426	402/4/98031/032
33	47	20	20	Electrolytic	402/4/50833/029
60	50		6.4	Mullard C426	402/4/98031/015

Miscellaneous

Circuit Ref.	Description	Part No.
VT6 - VT11	Transistor, BSY 95A	417/4/98138
D4	Diode, BAY 36, S.T.C.	415/4/98141
D5	Diode Zener 5.1V	415/4/98167/010
L5, L6	RF Choke, Miniature 1000 μ H	406/4/98012/005
T1	Transformer (14MM)	406/8/08326/002
T2	Transformer (26MM)	406/8/08220/009
X1	Semiconductor Network SN7472N Texas Insts.	445/4/98008/011
	Board Component (Flip Flop network)	630/1/25155

Resistors

R. No.	Value ohms	Tol. \pm %	Rating Watts	Maker and Type	Part No.
1	2.2k	10	$\frac{1}{4}$	Erie 16	403/4/77006/029
3, 14	10k	10	$\frac{1}{4}$	Erie 16	403/4/77006/037
4, 8, 18	560	10	$\frac{1}{4}$	Erie 16	403/4/77006/022
9	3.9k	10	$\frac{1}{4}$	Erie 16	403/4/77006/032
10, 11, 2	4.7k	10	$\frac{1}{4}$	Erie 16	403/4/77006/033
15	27k	10	$\frac{1}{4}$	Erie 16	403/4/77006/042
13	3.3k	10	$\frac{1}{4}$	Erie 16	403/4/77006/031
16, 21	1k	10	$\frac{1}{4}$	Erie 16	403/4/77006/025
17	180	10	$\frac{1}{4}$	Erie 16	403/4/77006/016
19	390k	10	$\frac{1}{4}$	Erie 16	403/4/77006/056
12	15k	10	$\frac{1}{4}$	Erie 16	403/4/78168/161

Capacitors

C. No.	Value μ F	Tol. \pm %	V. Wkg.	Maker and Type	Part No.
1,5,7,8	0.1	20	250	Miniature foil	400/4/98268/007
6	.0022	5	125	Mullard C295A	400/4/98245/009
9, 10	68	10	15	Tant. Electrolytic	402/4/98022/027
11	47		20	Electrolytic	402/4/50833/029
12	2		70	Plessey Electrolytic	402/1/01223/001.

Miscellaneous

Circuit Ref.	Description	Part No.
T1	Transformer	406/8/08225/012
L1, L2, L3	RF Choke, miniature, 1000 μ H \pm 10%	406/4/98012/005
VT1, VT2, VT10	Transistor 2S512 Texas Insts.	417/4/98138
VT3 to VT9, VT11	Transistor 2S3030 Texas Insts.	417/4/98136
RV1	Potentiometer, 10k ohms	404/1/00405/009
RV2	Potentiometer, 100k ohms	404/1/00405/016

5.13 Module 9 (630/1/14119)

5.13.1 Unit 9A (630/1/14188)

Resistors

R. No.	Value ohms	Tol. ± %	Rating Watts	Maker and Type	Part No.
1	1.8k	10	1/4	Erie 16	403/4/77006/028
2	5.6k	10		Erie 16	403/4/77006/034
3	100	10		Erie 16	403/4/77006/013
4, 6	220	10		Erie 16	403/4/77006/017
5	12k	10		Erie 16	403/4/77006/038
7	2.2k	10		Erie 16	403/4/77006/029
8	330	10		Erie 16	403/4/77006/019
9, 10, 11	10	10		Erie 16	403/4/77006/001

Capacitors

C. No.	Value µF	Tol. ± %	V. Wkg.	Maker and Type	Part No.
1	1		150	Electrolytic	CE1319/1
2, 4, 5	50		25	Electrolytic	402/1/01201/001
3	560p	5	125	Polystyrene	400/4/97001/022
6	250		25	Electrolytic	402/1/01297/001
7	25		25	Electrolytic	402/1/01200/015
8, 9	0.1	20	250	Mullard C280	400/4/98268/007
10	220p	10		Synthetic Resin	424/4/98042/192

Miscellaneous

Circuit Ref.	Description	Part No.
VT1, VT3	Transistor, 2S512, Texas Insts.	417/4/98138
VT2	Transistor, ASY26 S.T.C.	417/4/98039/001
VT4, VT5	Transistor, 2N1507 Texas Insts.	417/4/98139
D1, D2	Diode, OA200 Mullard	415/4/98011
RV1	Potentiometer, 100k ohms	404/1/00405/016
RV2	Potentiometer, 1k ohms	404/1/00405/010

5.13.2 Unit 9B (630/1/14084)

Resistors

R. No.	Value ohms	Tol. \pm %	Rating Watts	Maker and Type	Part No.
1	1.2k	10	↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑	Erie 16	403/4/78168/109
6	2.2k	10		Erie 16	403/4/78168/121
2, 10	1k	10		Erie 16	403/4/78168/105
3	10k	10		Erie 16	403/4/78168/153
4, 8	470	10		Erie 16	403/4/78168/089
5	82	10		Erie 16	403/4/78168/053
7	15k	10		Erie 16	403/4/78168/161
9	2.7k	10		Erie 16	403/4/78168/125
11	33k	10		Erie 16	403/4/78168/177
12	27k	10		Erie 16	403/4/78168/173
13	22	10		Erie 16	403/4/78168/017
14	4.7k	10		Erie 16	403/4/78168/137

Capacitors

C. No.	Value μ F	Tol. \pm %	V. Wkg.	Maker and Type	Part No.
1, 6, 7	2		70	Plessey Electrolytic	402/1/01223/001
2, 8	47		20	Electrolytic	402/4/50833/029
3	.0033	-20+40	500	Lemco Ceramic, Hi-k	400/4/98113/006
4	.0047	-20+40	500	Lemco Ceramic, Hi-k	400/4/98113/010
5	25		25	Plessey Electrolytic	402/1/01200/015

Miscellaneous

Circuit Ref.	Description	Part No.
RV1	Potentiometer 5k ohms	404/1/00405/012
RV2	Potentiometer 100k ohms	404/1/00405/016
VT1 to VT4	Transistor 2S512, Texas Insts.	417/4/98138

5.14 Module 10 (630/1/14120)

5.14.1 Unit 10A (630/1/14224)

Resistors

R. No.	Value ohms	Tol. ± %	Rating Watts	Maker and Type	Part No.
1	220k	10	†	Erie 16	403/4/77006/053
2	3.3k	10	†	Erie 16	403/4/77006/031
3	180	10	†	Erie 16	403/4/77006/016
5	150k	10	†	Erie 16	403/4/77006/051
4, 7	560	10	†	Erie 16	403/4/77006/022
6	68k	10	†	Erie 16	403/4/77006/047
8	2.2k	10	†	Erie 16	403/4/77006/029
9	8.2k	10	†	Erie 16	403/4/77006/036
10	1.5k	10	†	Erie 16	403/4/77006/027
11, 19, 24	1k	10	†	Erie 16	403/4/77006/025
12	4.7k	10	†	Erie 16	403/4/77006/033
13	10k	10	†	Erie 16	403/4/77006/037
14, 18, 22	470	10	†	Erie 16	403/4/77006/021
15	270	10	†	Erie 16	403/4/77006/018
17	120	10	†	Erie 16	403/4/77006/014
20	680	10	†	Erie 16	403/4/73006/023
23, 25	150	10	†	Erie 16	403/4/77006/015

Capacitors

C. No.	Value μF	Tol. ± %	V. Wkg.	Maker and Type	Part No.
1	10p	10		Erie NPO-AD	400/4/98425/118
4	220p	5	125	Polystyrene	400/4/97001/017
5, 6, 7, 8,) 10, 11, 12,) 13, 14, 22)	0.1	20	250	Mullard C280	400/4/98268/007
9, 15, 16, 17	82p	5	125	Polysyrene	400/4/97001/012
19	1.5p-45p			Trimmer	640/8/09051
20, 21	68p	5		Ceramic	400/4/97005/031

Miscellaneous

Circuit Ref.	Description	Part No.
L1	RF Choke, miniature, 0.22μH	406/4/98012/006
L2	RF Choke, miniature, 4.7μH	406/4/98012/001
VT1-VT4 } VT6, VT8 }	Transistor, 2S512, Texas Insts.	417/4/98138
VT5	Transistor, TI407, Texas Insts.	417/4/98135
XL1	Crystal, 1 MHz	428/4/98034
D1	Diode BAY36 S.T.C.	415/4/98141

5.14.2 Unit 10B (630/1/14271)

Resistors

R. No.	Value ohms	Tol. ± %	Rating Watts	Maker and Type	Part No.
1	68	10	$\frac{1}{4}$	Erie 16	403/4/77006/011
2	1k	10	$\frac{1}{4}$	Erie 16	403/4/77006/025
3	1.8k	10	$\frac{1}{4}$	Erie 16	403/4/77006/028
4	39k	10	$\frac{1}{4}$	Erie 16	403/4/77006/044
5	470	10	$\frac{1}{4}$	Erie 16	403/4/77006/021
6	15k	10	$\frac{1}{4}$	Erie 16	403/4/77006/039
7	1.5k	10	$\frac{1}{4}$	Erie 16	403/4/77006/027
8	150	10	$\frac{1}{4}$	Erie 16	403/4/77006/015
9	47	10	$\frac{1}{4}$	Erie 16	403/4/77006/009

Capacitors

C. No.	Value μF	Tol. ± %	V. Wkg.	Maker and Type	Part No.
1	27p	5		Ceramic	400/4/98322/049
2	8.2p	±0.5p		Ceramic	400/4/97004/010
3	47p	5	125	Polystyrene	400/4/97007/009
4	12p	5		Ceramic	400/4/97005/013
5	10p			Ceramic	400/4/97004/011
6, 10, 11	.01	20	250	Mullard C280	400/4/98268/001
7, 9, 14	0.1	20	250	Mullard C280	400/4/98268/007
12, 13	.001	-20+40		Ceramic	400/4/97008/005
8	50		25	Lemco SM	400/4/98009/039

Miscellaneous

Circuit Ref.	Description	Part No.
L1, L2	Inductor	406/4/08324/005
L4, L5	Miniature Choke 1000 μ H	406/4/98012/005
L6, L7	Miniature Choke 100 μ H	406/4/98012/003
L8, L9	Ferroxcube beads (6 off)	905/4/98052
D1	Diode BAY36 S.T.C.	415/4/98141
D2	Diode Zener, 10V + 5%	415/4/98167/003
VT1, VT2, VT3	Transistor, 2S512, Texas Insts.	417/4/98138

5.15 Module 11 (630/1/14115)

Resistors

R. No.	Value ohms	Tol. \pm %	Rating Watts	Maker and Type	Part No.
1, 3	10k	10	$\frac{1}{4}$	Erie 16	403/4/77006/037
2, 4	22k	10	$\frac{1}{4}$	Erie 16	403/4/77006/041
5, 6	470	10	$\frac{1}{4}$	Erie 16, Moulded	403/4/78184/168
7	5.6k	10	$\frac{1}{4}$	Erie 16	403/4/77006/034
8	8.2k	10	$\frac{1}{4}$	Erie 16	403/4/77006/036
9	560	10	$\frac{1}{4}$	Erie 16	403/4/77006/022
10	68	10	$\frac{1}{4}$	Erie 16	403/4/77006/011
12, 13	2.7k	10	$\frac{1}{4}$	Erie 16, Moulded	403/4/78184/177

Capacitors

C. No.	Value μ F	Tol. \pm %	V. Wkg.	Maker and Type	Part No.
1,5,7,11	330p	5		Polystyrene	400/4/97001/019
2, 8	56p	5		Polystyrene	400/4/97001/010
3, 9	1-18p			Variable	401/4/98023/004
4,10,13	.01	20	250	Miniature foil	400/4/98268/001
6, 12	10p	± 0.5 pF		Erie N750/AD	400/4/97005/011
15,16,17	0.1	20	250	Miniature foil	400/4/98268/007

Miscellaneous

Circuit Ref.	Description	Part No.
L1, L2	RF Choke, miniature, 15 μ H	406/4/98012/007
L3	RF Choke, miniature, 1000 μ H	406/4/98012/005
XL1	Crystal, 10.8 MHz	428/4/98061
XL2	Crystal, 10.6 MHz	428/4/98062
VT1, VT2, VT3	Transistor, 2S512 Texas Insts.	417/4/98138
	Board Assembly Unit 11	630/1/14440

5.16 Module 12 (630/1/25153)

Resistors

R. No.	Value ohms	Tol. \pm %	Rating Watts	Maker and Type	Part No.
1	5.6k	10	$\frac{1}{4}$	Erie 16	403/4/77006/034
2, 7	8.2k	10	$\frac{1}{4}$	Erie 16	403/4/77006/036
3	1k	10	$\frac{1}{4}$	Erie 16	403/4/77006/025
4, 10	2.2k	10	$\frac{1}{4}$	Erie 16	403/4/77006/029
5, 16, 17	4.7k	10	$\frac{1}{4}$	Erie 16	403/4/77006/033
6	39k	10	$\frac{1}{4}$	Erie 16	403/4/77006/044
8, 11	27k	10	$\frac{1}{4}$	Erie 16	403/4/77006/042
9	1.2k	10	$\frac{1}{4}$	Erie 16	403/4/77006/026
13	470	10	$\frac{1}{4}$	Erie 16	403/4/77006/021
14	100	10	$\frac{1}{4}$	Erie 16	403/4/77006/012
15, 12	10k	10	$\frac{1}{4}$	Erie 16	403/4/77006/037
18	1.5k	10	$\frac{1}{4}$	Erie 16	403/4/77006/027
19	82	10	$\frac{1}{4}$	Erie 16	403/4/77006/012
20	150	10	$\frac{1}{4}$	Erie 16	403/4/77006/015
21	56	10	$\frac{1}{4}$	Erie 16	403/4/77006/010
22	15k	10	$\frac{1}{4}$	Erie 16	403/4/77006/039
23	56k	10	$\frac{1}{4}$	Erie 16	999/4/00241/193

Capacitors

C. No.	Value μ F	Tol. \pm %	V. Wkg.	Maker and Type	Part No.
1, 2, 3, 5) 6, 8, 9, 10) 12-16, 18)	0.1	20	250	Mullard C280	400/4/98268/007
4, 7	1000p	1		Mullard C295A	400/4/98245/001
11	3900p	1		Mullard C295A	400/4/98245/005
17	82p	5	125	Lemco Type 7	400/4/98179/011

Miscellaneous

Circuit Ref.	Description	Part No.
T1	Transformer	406/8/08225/013
T2	Transformer	406/8/08225/014
T3	Transformer	406/8/08326/001
VT1 - VT5	Transistor, 2S512, Texas Insts.	417/4/98138
D1, D2, D3	Diode, BAY36, S.T.C.	415/4/98141
	Board, Component, Unit 12	630/1/25173

17 Isolating Amplifier (630/1/14541)

Resistors

R. No.	Value ohms	Tol. + %	Rating Watts	Maker and Type	Part No.
1	330	10	1/4	Erie 16	403/4/77006/019
2	4.7k	10	1/4	Erie 16	403/4/77006/033
3	10k	10	1/4	Erie 16	403/4/77006/037
4, 7	470	10	1/4	Erie 16	403/4/77006/021
5, 6	5.6k	10	1/4	Erie 16	403/4/77006/034
8	220	10	1/4	Erie 16	403/4/77006/017

Miscellaneous

Circuit Ref.	Description	Part No.
C1, C4, C5	Capacitor, .001 μ F, -20% +40%, Ceramic, Hi-k	400/4/97008/005
VT1, VT2	Transistor, 2S512, Texas Insts.	417/4/98138
F1, F2, F3	UHF min. feed-thru Ceramic Erie CFT3000	400/4/98266
	Board, Component	630/1/14540

5.18 Regulator (630/1/14608)

Resistors

R. No.	Value ohms	Tol. ± %	Rating Watts	Maker and Type	Part No.
1,3,4	4.7k	10	1/4	Erie 16	403/4/78168/137
2	10k	10	1/4	Erie 16	403/4/78168/153
5	1.2k	10	1/4	Erie 16	403/4/78168/109
6	1.8k	10	1/4	Erie 16	403/4/78168/117
7	820	10	1/4	Erie 16	403/4/78168/101
8	200	5	1/4	Erie 16	999/4/20039/044

Capacitors

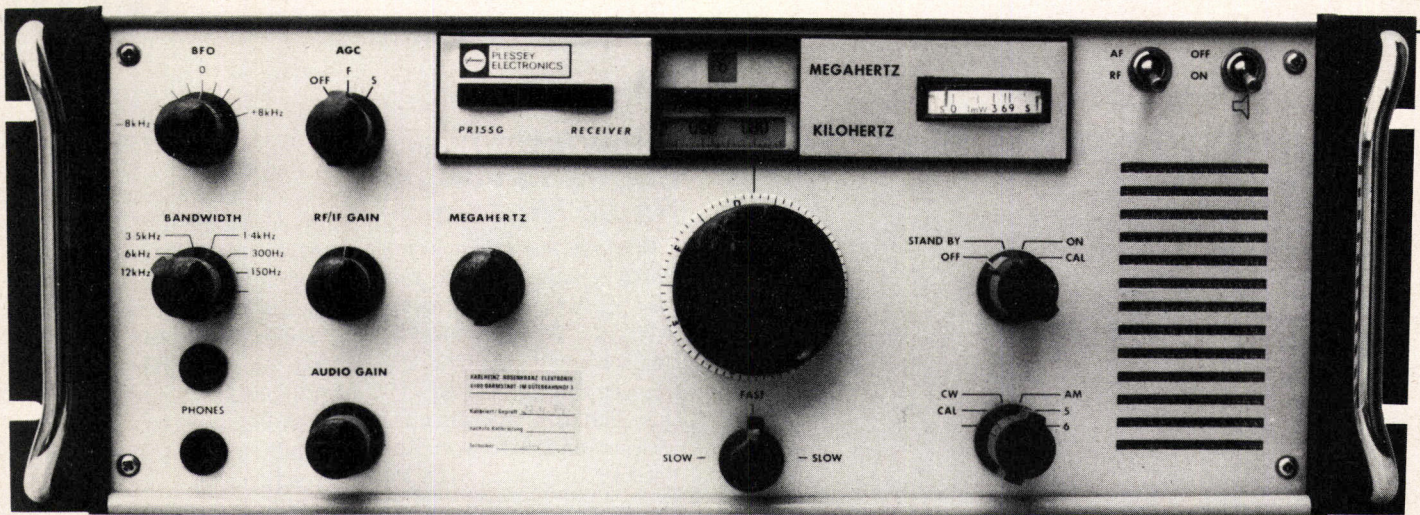
C. No.	Value µF	Tol. ± %	V. Wkg.	Maker and Type	Part No.
1, 5	50		25	Plessey Electrolytic	CE1201/1
2, 3	100		20	Tantalum	402/8/50834/017
4	.05		250	Hunts W97	999/4/20010/008

Miscellaneous

Circuit Ref.	Description	Part No.
RV1	Potentiometer 1k ohms	404/1/00405/010
D1	Diode, Zener, BZY88/C5V6	415/4/98328
MR1	Bridge, diode	415/4/98164
VT2	Transistor, OC35, Mullard	417/4/98108/002
VT3	Transistor, ACY19, Mullard	999/4/00999
VT4	Transistor, OC200, Mullard	999/4/00108/007

6. DRAWINGS AND ILLUSTRATIONS

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- Fig. 2 PR155 Schematic Diagram
- Fig. 3 PR155 RF Turret
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- Fig. 20 Module 12: 100 kHz Divider/Calibrator
- Fig. 21 Beat Frequency Osc.
- Fig. 22 Isolating Amplifier
- Fig. 23 Power Supply Regulator



Junggebliebene Technik

Irgend etwas muß dran sein an dem PR-155 von Plessey, wenn sich die meisten Besitzer nach 15 Jahren noch nicht von ihm trennen wollen...

Erste Überraschung beim Auspacken: Was aus der Verpackung kommt, ist blitzblank und sieht aus wie nagelneu. Dennoch ist es ein PR-155 von Plessey aus dem Jahre 1969. Beim ersten Ausprobieren bestätigt sich der gute Eindruck: Die Bedienungsknöpfe lassen sich leicht und spielfrei drehen.

Plessey hat weltweit den gleichen Klang wie Rohde & Schwarz in Deutschland. Klingt nach Qualität, immer Stand der Technik und ein

klein wenig darüber hinaus. Ende der sechziger Jahre kam der PR-155 mit seinen Abkömmlingen vom PR-1550 bis zum PR-1553 und dem PRV-527 mit eingebautem Funkfernsehmodulator und schließlich dem für Militärszwecke bestimmten PR-1552.

Eine stolze Reihe, die bei vielen Berufsfunkern in Betrieb war oder augenscheinlich noch in Betrieb ist. Denn Ausmusterungen größeren Maßes konnten bislang nicht entdeckt werden. Und selbst

in England zählt ein Plessey zu den Raritäten.

Über die Besonderheiten dieses Empfängers und gleichzeitig über den Stand der Technik von 1969 informiert das Schaltbild.

Besonders herausgehoben wurde von Plessey die Art der Frequenzerzeugung. Kein Wunder in einer Zeit, wo Digitalanzeigen noch so richtig ins Geld gingen und es eben nicht einfach war, eine auf 500 Hz genaue Linearskala zu fertigen. Die gewünschte Frequenz wählt man zunächst mit dem „MHz-Schalter“. Damit werden gleichzeitig die entsprechenden harmonischen eines Quarzoszillators der Grundfrequenz 1 MHz geschaltet. Die Feineinstellung geschieht durch den eigentlichen VFO, der zwischen 2,2 MHz und 3,4 MHz schwingt. Mit diesem werden dann die Kilohertz eingestellt.

Die umständlich scheinende Einstellung hat ihre Vorzüge:

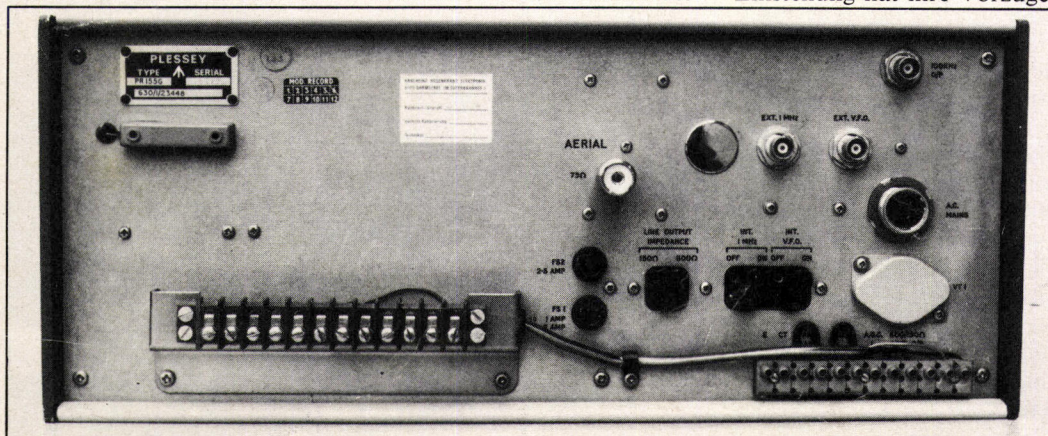
statt mehrerer Quarzoszillatoren – wie bei einigen Collins-Oldies – kommt man mit einem Quarzoszillator aus. Das spart nicht nur Geld, sondern auch Serviceaufwand. Denn jeder Quarzoszillator kann durch Alterserscheinungen unterschiedliche Frequenzabweichungen aufweisen.

Eine Überholung und ein Abgleich kann dadurch teuer werden. Bei Plessey dagegen genügt der Abgleich eines Oszillators, damit alle anderen Megahertz-Stellen stimmen. Diese werden in einem kleinen Fensterchen über der kHz-Anzeige angezeigt.

Für die kHz-Anzeige wurde eine Filmskala verwendet, auf der der 1-MHz-Bereich sich auf eine Länge von fast zwei Meter – genau: 1778 mm – ausdehnt.

Mit diesem Aufwand ist eine Auflösung auf wenige 100 Hz möglich. Die eingestellte Frequenz wird über eine Phasenregelschleife an den Mutteroszillator gebunden. So ergibt sich für den freilaufenden VFO eine erstaunlich geringe Frequenzdrift: nach der Anwärmszeit wandert der PR-155 bei gleichbleibender Zimmertemperatur um nicht mehr als 30 Hz!

Aber – ein Oszillator allein macht noch keinen Empfänger. Mit der Einstellung der MHz-Stellen wird gleichzeitig eines der insgesamt acht Hf-Filter in den Empfangsweg geschaltet. Das verringert



Die Rückseite bietet alle Anschlüsse für professionellen Betrieb

Fotos: Nils Schiffhauer

Großsignalprobleme und Schwierigkeiten mit Spiegel- frequenzen. Die Dämpfung dieser Filter wird in einem Breitbandverstärker mehr als ausgeglichen. Der Verstärker hat eine besondere automatische Regelung, die selbst Signale von 1 Volt verarbeiten kann und damit den ersten Mischer weitgehend vor Kreuz- und Intermodulationen schützt.

Darauf folgen die Zf-Stufen mit 37,3 MHz, 10,7 MHz und 100 kHz. Gefiltert wird schon recht weit vorne in der ersten Zf mit 12 kHz Bandbreite. Das darauffolgende 10,7-MHz-Quarzfilter ist 30 kHz breit. In der dritten Zf sind Durchlaßbereiche von 150 Hz, 300 Hz, 1,4 kHz, 3,5 kHz, 6 kHz, 12 kHz sowie 3 kHz für SSB schaltbar.

Die automatische Verstärkungsregelung hält ab 0,5 μV Eingangsspannung den Ausgangspegel selbst dann konstant, wenn das Eingangssignal Spannungsunterschiede von 3 dB bis 130 dB aufweist. Die Abfallzeit der AVR

(AGC) ist zwischen 100 ms, 1 Sekunde und 10 Sekunden einstellbar; zur Regelung von Hand läßt sie sich abschalten. Der Hf-Regler kann bei eingeschalteter AVR dazu benutzt werden, den Einsatz der Regelung erst ab einer bestimmten Spannung festzulegen.

In Kurzform noch ein paar wichtige Daten: Der Empfangsbereich geht von 15 kHz bis 30,1 MHz. Die Empfindlichkeit ist angegeben in SSB mit 0,5 μV und in AM mit 2,5 μV bei 10 dB Rauschabstand. Der BFO für CW ist im Bereich von ± 8 kHz regelbar. Die Formfaktoren der Zf-Filter (= Bandbreite bei -6 dB geteilt durch Bandbreite bei -6 dB) betragen bei 150 Hz etwa 10, um sich in Richtung größerer Bandbreiten auf bis zu 3 zu verbessern.

Doch nun zur Empfangspraxis mit dem PR 155. Der „Kalt-Test“ zeigte: die griffigen Knöpfe lassen sich wirklich gut bewegen. Die Abstimmung geht butterweich und doch genau. Mit dem MHz-Rastschalter wird per Trom-

meltuner das 6-MHz-Band eingestellt. Die Hauptabstimmung arbeitet in zwei Geschwindigkeiten. Im Schnellgang werden mit einer Umdrehung 60 kHz überstrichen, bei „langsam“ sind es 7 kHz. Bei Rundfunkempfang kommt man mit dem Schnellgang problemlos aus. Für SSB und besonders CW mit niedrigen Bandbreiten empfiehlt sich die Stellung „langsam“ gewissermaßen von selbst.

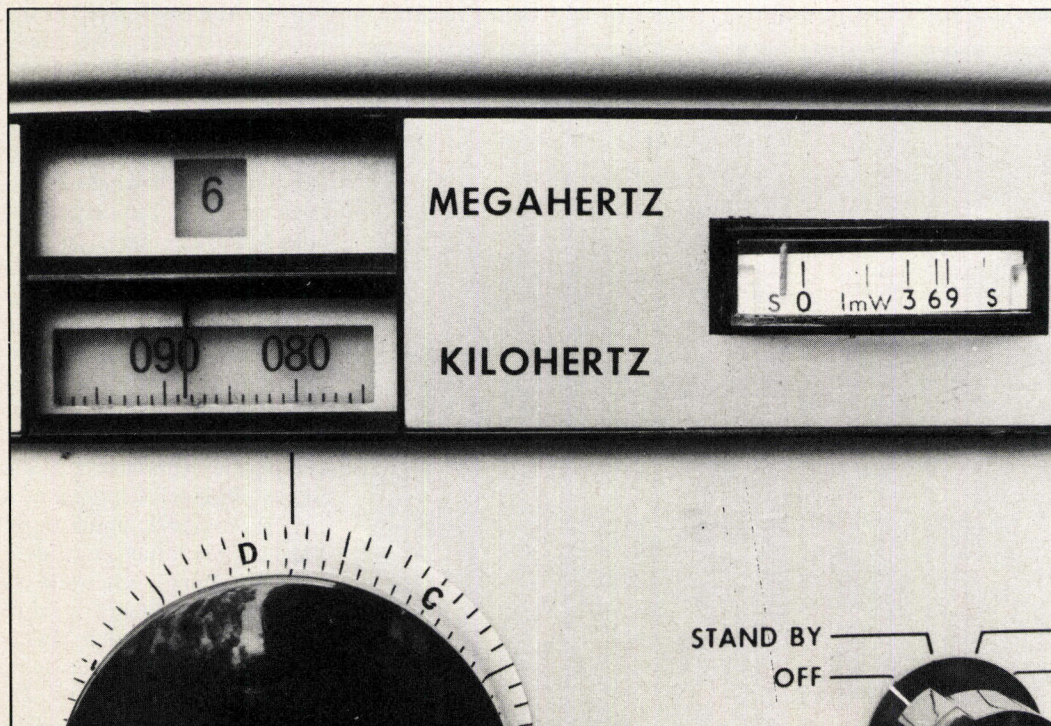
Schon bei den ersten Stationen fiel der klare, verzerrungsarme Klang des Empfängers auf. In jeder Hinsicht hervorragende Ergebnisse wurden schon bei 6 kHz Bandbreite erreicht, Rundfunksender mit 5-kHz-Raster einwandfrei getrennt. Auch der Test zwischen Radio Luxemburg und dem bayerischen Rundfunk auf 6090 kHz beziehungsweise 6085 kHz war hier keine Ausnahme. Als überraschend gut erwies sich die Empfindlichkeit auf Kurzwelle: Signale ab 0,5 μV kamen sehr verständlich herein. Zu sehen beispielsweise

se an dem Amateurfunkbaken auf 14 100 kHz mit ihren im festen Rhythmus bis auf 100 mW wechselnden Leistungen. Das 150-Hz-Filter für CW machte sich dabei vorteilhaft bemerkbar.

SSB war leider bei dem uns zur Verfügung stehenden Gerät nicht eingebaut. Man konnte aber Sender in dieser Betriebsart leicht durch den regelbaren BFO einfangen, zumal dieser mit seiner Unter- setzung noch eine zusätzliche Feineinstellung bietet. Die Frequenzanzeige arbeitet auf 1 kHz genau; 500 Hz können bei der guten Linearität noch zuverlässig geschätzt werden. Alle 100 kHz steht ein sehr genaues Quarzsignal zum einfachen Eichen (= Verschieben des Skalenstriches) zur Verfügung. Durch seine guten Regeleigenschaften ist der Empfänger wenig anfällig für Großsignaleffekte. Das machte sich beispielsweise in den Tropenbändern günstig bemerkbar. Hier wurde die Bandbreite 3,5 kHz zur ständigen Einstellung und nur in wirklich schwierigen Fällen durch 1,4 kHz ersetzt. Bei beiden Bandbreiten war der Klang noch recht gut.

Die Lang- und Mittelwelle allerdings litt etwas durch den benachbarten 100-kW-Orts-Sender. Diese Schwierigkeiten aber waren mit einer MW-Rahmenantenne (selektiv!) schnell behoben. Der Längswellenbereich wird mit herabgesetzter Empfindlichkeit erfaßt, so daß lediglich die stärkeren Zeitzeichensender gehört werden können. Der PR-155 kann von seiner Empfangsleistung her durchaus noch mit heutigen Geräten mithalten. Neuere Geräte weisen etwas mehr Komfort hinsichtlich der Bedienbarkeit (Frequenzastatur) auf, dürften aber wegen ihres eingegengten Klangumfangs bei stärkeren Sendern etwas ins Hintertreffen geraten.

Nils Schiffhauer



Ungewöhnlich ist die Frequenzeinstellung (MHz-Band oben, kHz-Wert auf der Filmskala): 6088,5 kHz ist die eingestellte Frequenz. Rechts das S-Meter, das wahlweise auch den Nf-Pegel überwacht



PR155G MF/HF Communications Receiver

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Equipment Serial No.

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12	4	27	4	42	4	57	5	12	5		
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14	6	29	4	44	5	59	4	14	4		
15	4	30	4	45	5	60	-	15	4		
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Technical enquiries should be addressed to: 'THE CHIEF ENGINEER'

Radio Systems Division,
Electronics Group,
The Plessey Company Limited,
Ilford, Essex, England.

Telephone: 01-478-3040
Telex: 23166

Enquiries concerning equipment or spare parts should be addressed to: 'THE SALES OFFICE MANAGER'

Technical Summary

Frequency Range: 60 kHz to 30.1 MHz continuous coverage (will operate down to 30 kHz with slight degradation of performance).

Modes of Reception: CW, MCW, DSB (A1, A2, A3)
Two spare switch positions for additional modes.

Frequency Stability: After 5 hour warm up at steady ambient, less than 30 Hz drift per hour.
Short term stability; less than 5 Hz variation per minute.

Spread of Drift: From 1 minute after switch on; less than 800 Hz in 60 minutes.
2nd hour; less than 100 Hz. 3 to 5 hours; less than 100 Hz.

Drift with change of ambient: Less than 40 Hz per °C after 5 hour warm-up.

Bandwidths:

6 dB - greater than 150 Hz	60 dB - less than 1.8 kHz
" " " 300 Hz	" " " 3 kHz
" " " 1.4 kHz	" " " 5.5 kHz
" " " 3.5 kHz	" " " 12 kHz
" " " 6 kHz	" " " 18 kHz
" " " 12 kHz	" " " 36 kHz

Sensitivity:
(up to 30.1 MHz)
CW; 300 Hz bandwidth; 2 microvolt E.M.F. for a 26dB signal/noise ratio.
AM; 30% mod., kHz bandwidth; 4 microvolts for 10 dB signal/noise ratio.

Noise Figure: Not worse than 10 dB up to 20 MHz and not worse than 13 dB above 20 MHz.

Tuning: Thirty bands of 1 MHz each with an 84 inch scale-length for each band.
There is an overlap of 100 kHz at both ends of each band.

Tuning Accuracy: It is possible to set the tuning control to within plus and minus 10 Hz of a required frequency.

Scale Reading Accuracy: Not worse than plus and minus 600 Hz at any point in the 1 MHz band, when correctly calibrated at mid-band.

Calibration: Marker at 100 kHz points provided from the master 1 MHz oscillator.

A.G.C.: Output shall not change more than 4 dB from 120 dB change in input from A.G.C. threshold. Threshold variation 1 - 4 μV E.M.F.

A.G.C. Time Constant: Short Rise set at 10 m/sec (adjustable 5-20 m/s)
Long Rise same as short.
Short hand 45 m/s ± 15 m/s. Long hand 750 m/s ± 250 m/s.
Short Decay not more than 120 m/s. Long Decay, as short.

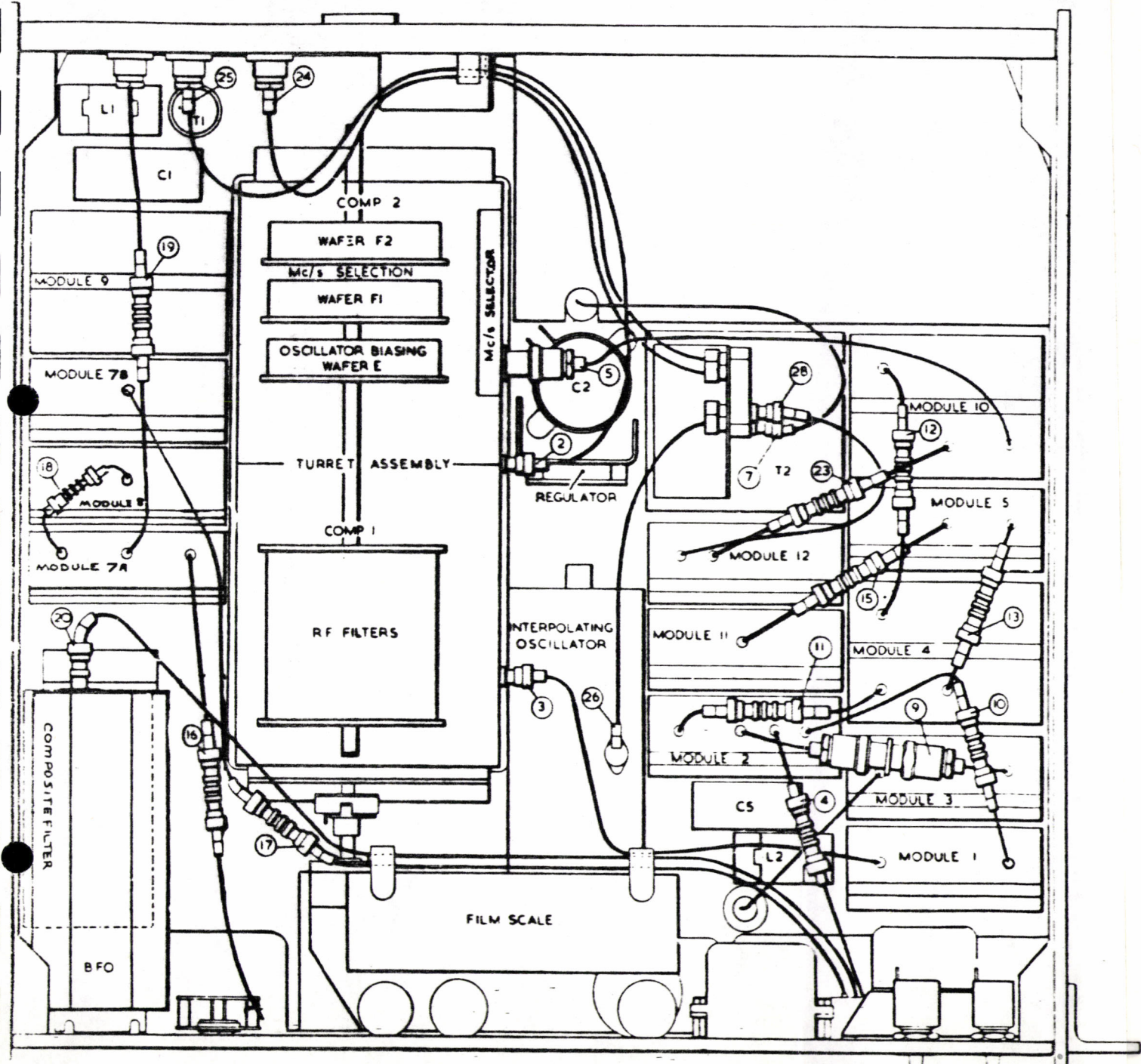
B.F.O.: Variable ± 8 kHz with slow motion tuning and calibration facility.

RF Input: Nominal 75 ohms. Can accept, without damage, either signals up to 30v E.M.F. of 15 mins. duration with less than 1 dB degradation in noise factor and 6v E.M.F. continuously.

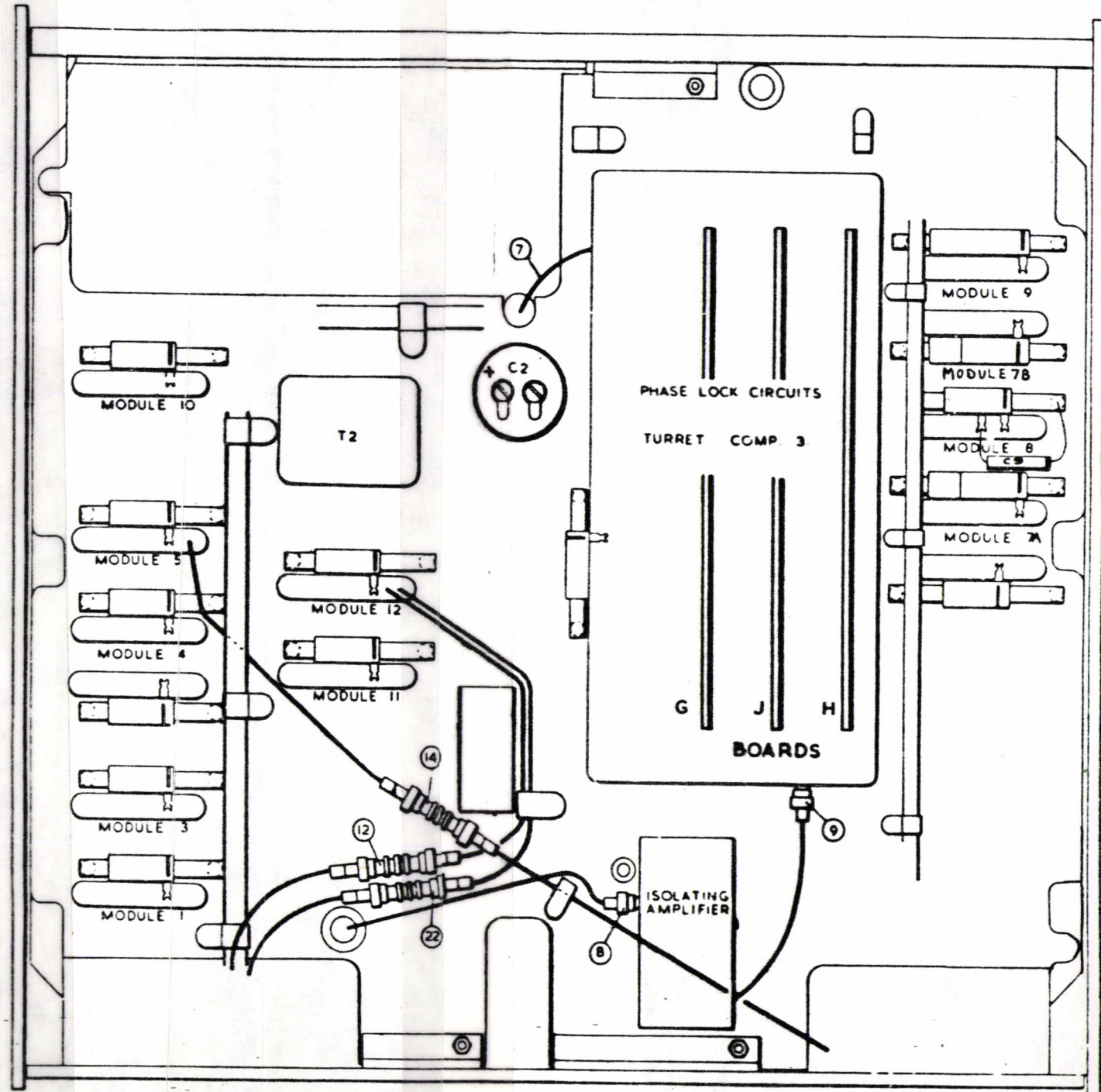
I.F. Output: 100 Hz, 50mV into 75 ohms. Following I.F. selectivity.
B.F.O./I.F. Breakthrough: Better than 60dB relative to 50mV.
Audio Output: Internal Loudspeaker.
Two 600 ohm headphone outputs. 150 or 600 ohm external line balanced or unbalanced.
Audio Output Level: 150 ohm line - 30 mW; 600 ohm line - 10mW
Loudspeaker - 400 mW; Headphones - 6mW
Audio Frequency Response: Within 4 dB from 300 Hz to 8 kHz.
Aerial Conduction: With the aerial input socket terminated in 75 ohms less than 2 microvolts at any frequency up to 30 MHz.
Meter Indication: May be switched to 'S' or audio level to line.
I.F. Rejection: Greater than 70 dB for any of the I.F. frequencies.
Image Rejection: Not less than 70 dB.
Internally Generated Spurious Responses : Less than equivalent 0.2 μ V E.M.F. all responses except 1 MHz + 21.4 MHz which is less than 2 μ V E.M.F. equivalent between 400 kHz - 30.1 MHz. The 1 MHz positions between 22 - 30 MHz are less than 0.25 μ V E.M.F. equivalent.
Desensitization: With the receiver tuned to any frequency, and with a 3 kHz bandwidth, a 1 μ V CW signal will have its S/N ratio reduced by 3dB. by an interfering signal spaced 10 kHz away and of amplitude not less than 200 microvolts. For 50 kHz signal spacing the interfering signal shall be not less than 2 millivolts and for 500 kHz signal spacing not less than 30mV.
Cross Modulation: With a bandwidth of 3 kHz, a 1mV wanted signal will suffer 3% cross modulation from an interfering signal with 30% modulation, spaced 10 kHz away, and of amplitude not less than 20mV.
Inband Intermod. 2nd and 3rd order - 26 dB at audio output.
Out of Band Intermod. 3rd order; 2 signals of 5mV each to give 20dB S/N ratio with reference to a 10dB noise factor receiver.
Power Requirements: 100V to 125V, or 200V to 250V, 48 to 520 Hz single phase or 24V D.C. floating supply or positive earth.
Power consumption 22W at 24V D.C. approx.
Environment: Operation - 20 $^{\circ}$ C to + 50 $^{\circ}$ C, 95% R.H.
Storage - 40 $^{\circ}$ C to + 70 $^{\circ}$ C, 95% R.H.
Dimensions and Weight: Width : Suitable for rack mounting
Height : 7 in. Depth: 17 in. Weight: 30 lbs.

6. DRAWINGS AND ILLUSTRATIONS

- Fig. 1 PR155 Chassis Layout
- Fig. 2 PR155 Schematic Diagram
- Fig. 3 PR155 RF Turret
- Fig. 4 Turret Comp. 1: RF Filters
- Fig. 5 Module 1: RF Amplifier
- Fig. 6 Module 2: First Mixer
- Fig. 7 Module 3: First local osc.
- Fig. 8 Module 10: Spectrum Generator
- Fig. 9 Interpolating Osc.
- Fig. 10 Turret Comp. 2: MHz Selector
- Fig. 11 Turret Board G: Phase Splitters and Modulator
- Fig. 12 Comp. Board H: Phase Detector
- Fig. 13 3 Board J: DC Amp./Reactor Sweep Gen.
- Fig. 14 Module 4: First IF Amplifier/2nd Mixer
- Fig. 15 Module 5: 2nd IF Amplifier/3rd Mixer
- Fig. 16 Module 11: 10.6/10.8 MHz Generator Mixer
- Fig. 17 Modules 7A & 7B: 3rd IF Amplifier and Detector
- Fig. 18 Module 8: AGC Amplifier/Detector
- Fig. 19 Module 9: Audio Amplifier
- Fig. 20 Module 12: 100 kHz Divider/Calibrator
- Fig. 21 Beat Frequency Osc.
- Fig. 22 Isolating Amplifier
- Fig. 23 Power Supply Regulator



a) TOP



b) BOTTOM

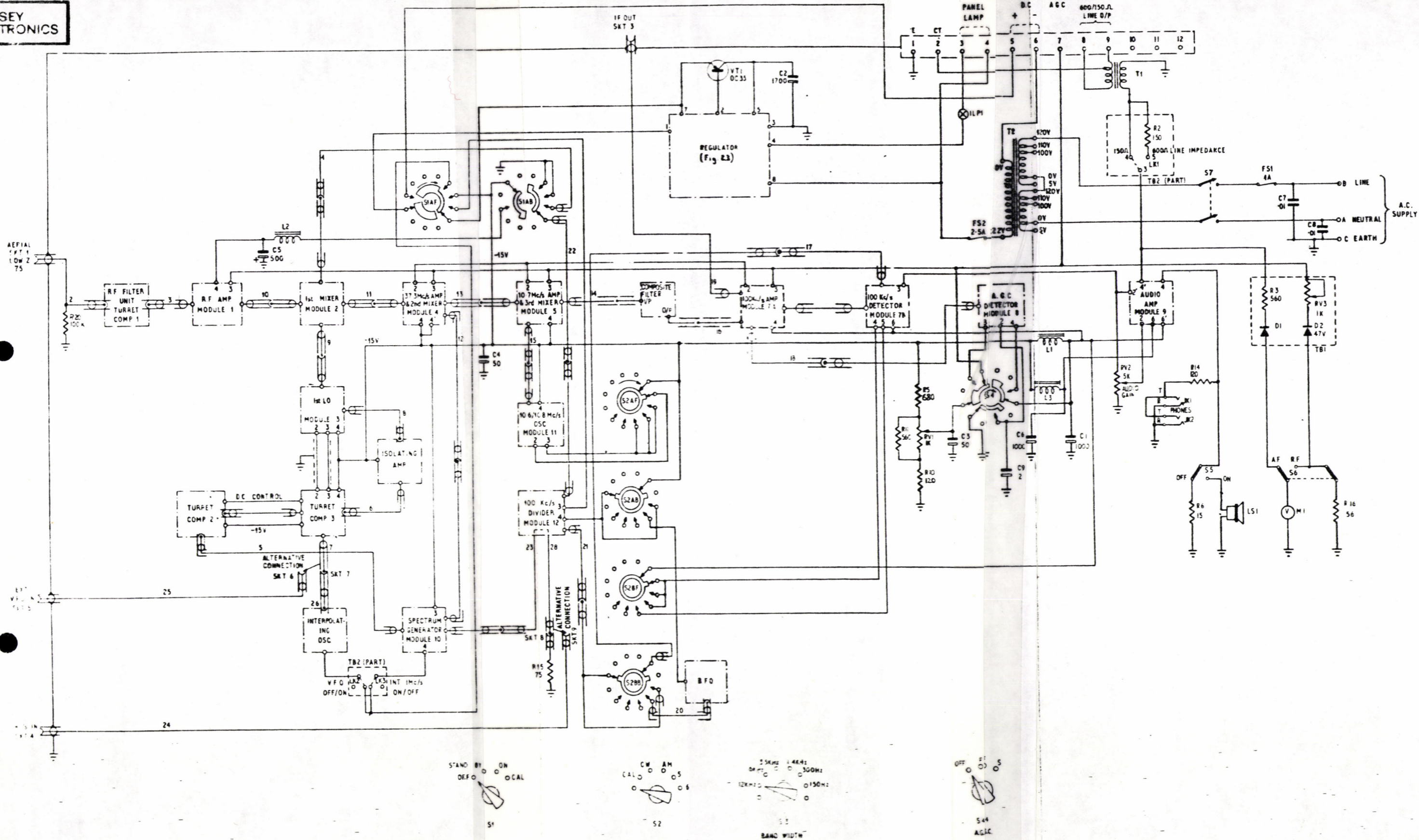
Chassis											
Revisions	Fig. 1	Issue 8									
5	6	7	8	9	10	11	12				

Turret Assembly											
Modifications											
1	2	3	4	5	6	7	8	9	10	11	12

FIG. 1. PR155 CHASSIS LAYOUT

DWG NO 630/1/23440

FIG. I. CHASSIS

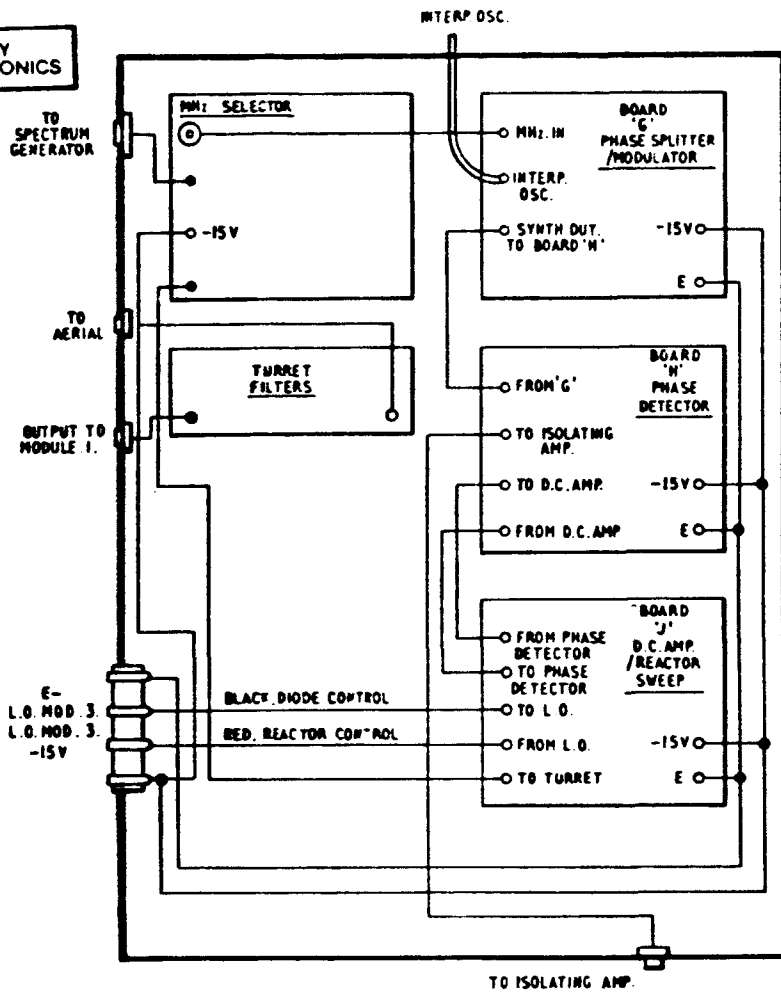


Modifications Fig. 2 Issue B
See Fig. 1

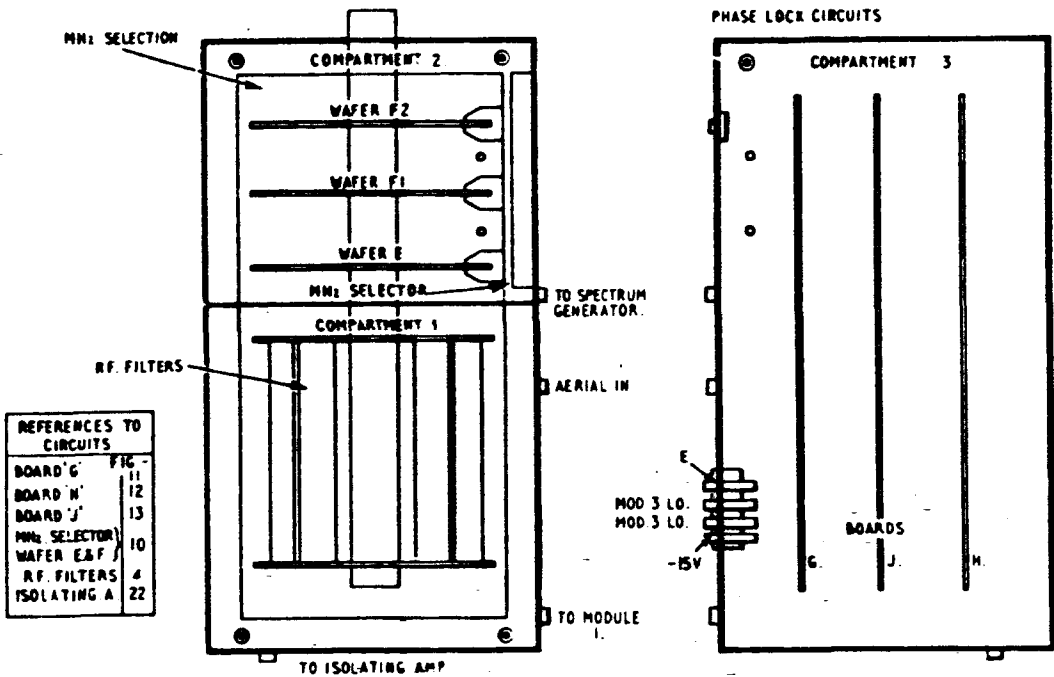
FIG. 2. PR155 SCHEMATIC BLOCK DIAGRAM

FIG. 2. SCHEMATIC

SWITCHES SHOWN IN FULLY-COUNTER CLOCKWISE POSITION.



a. TURRET INTERCONNECTIONS



b. COMPONENT BOARD POSITIONS

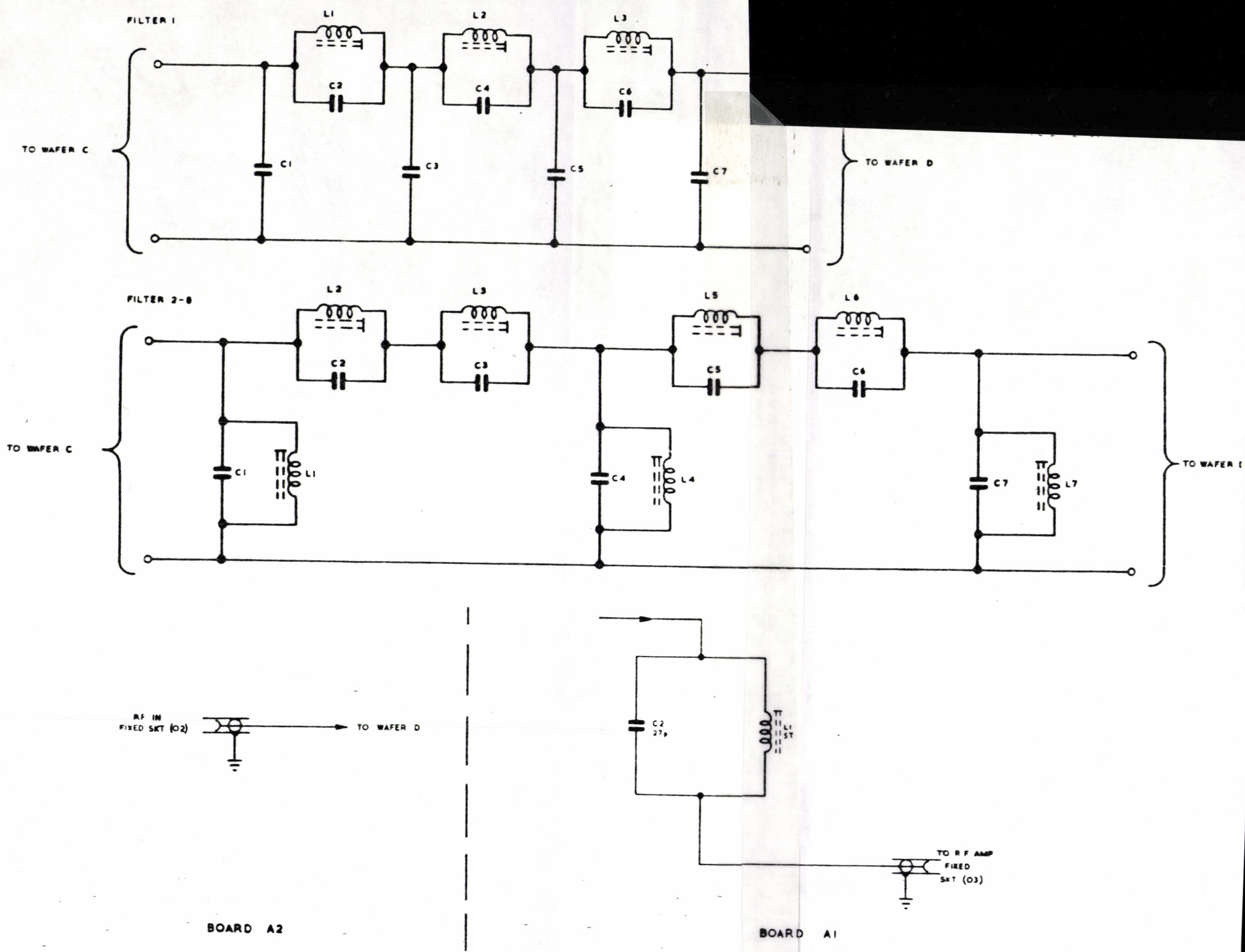


FIG. 4. TURRET COMPARTMENT I ; CIRCUIT

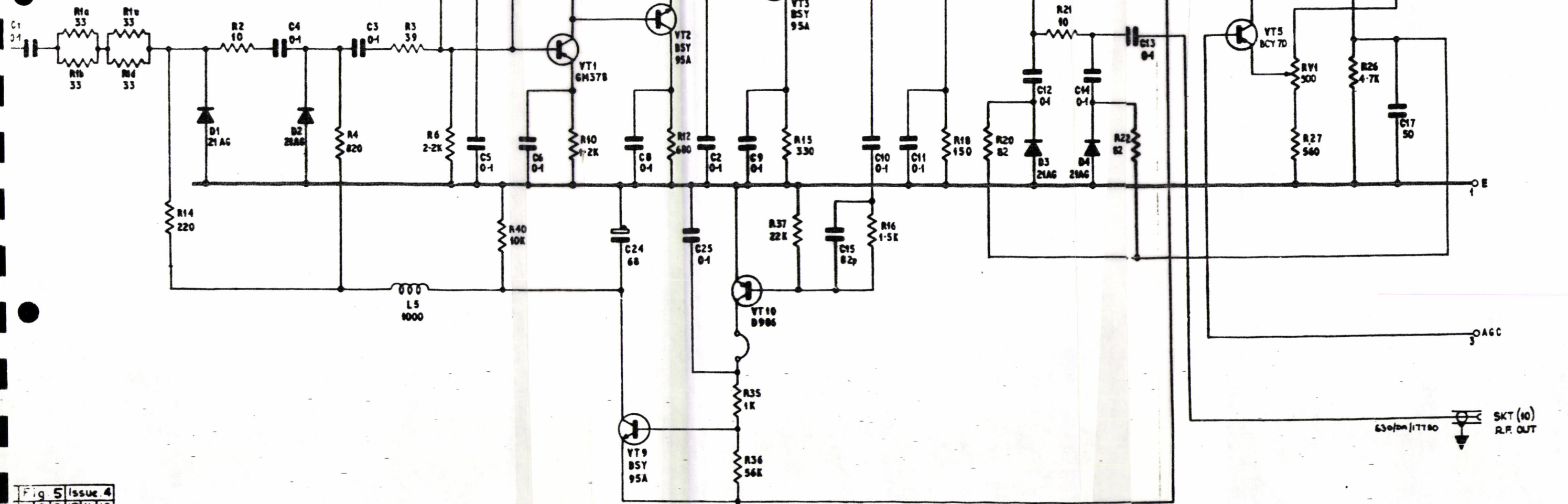
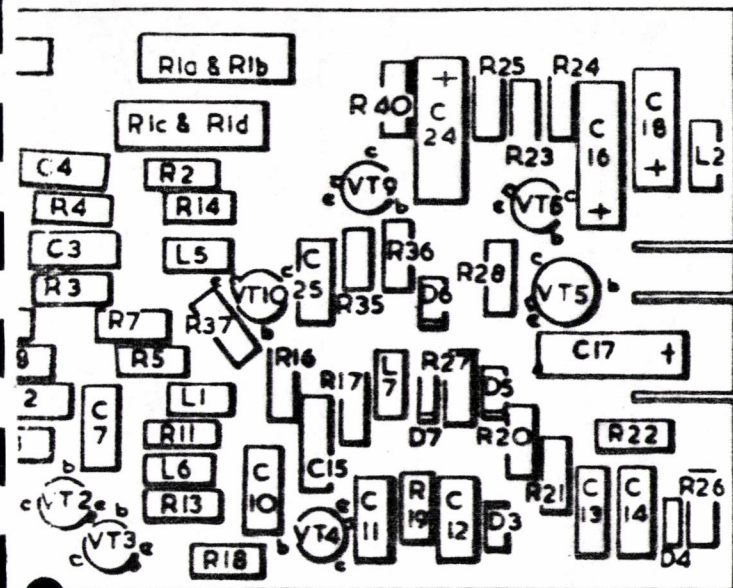
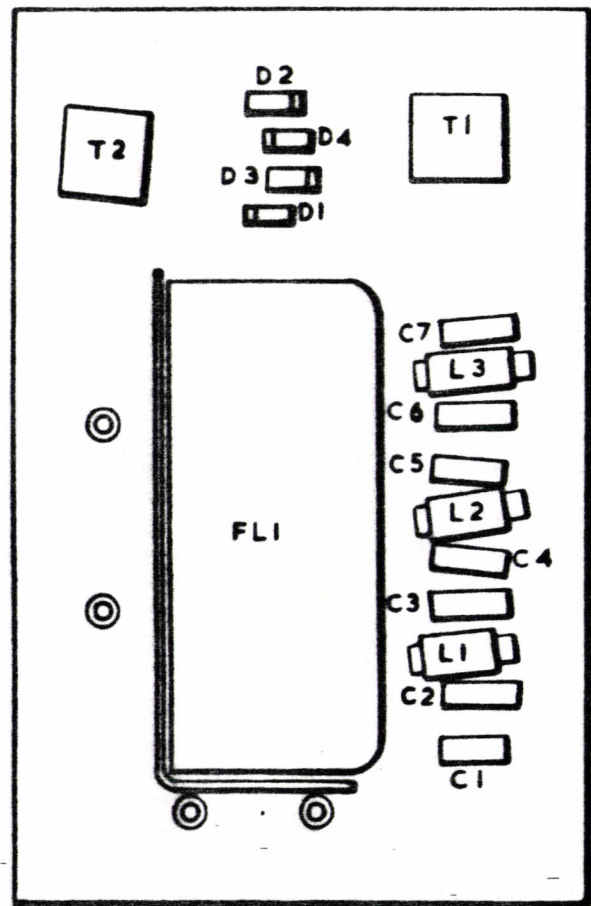
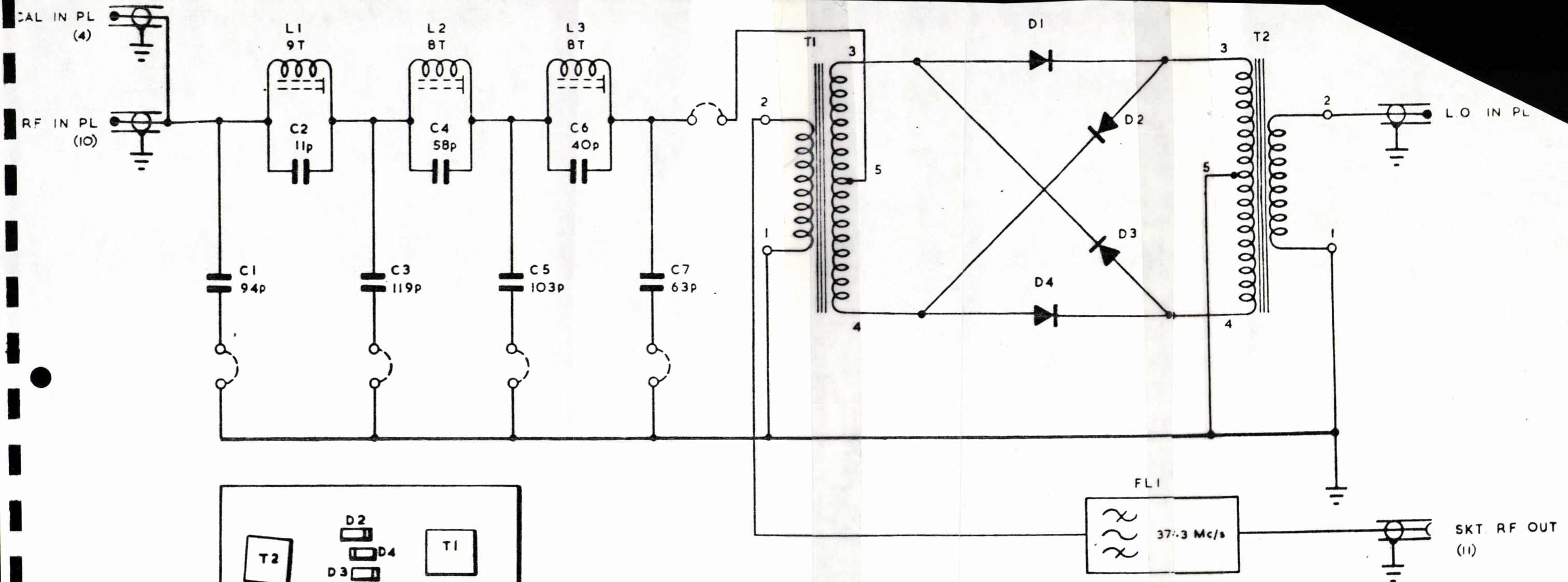


Fig 5 Issue 4
 8 9 11 12

FIG. 5 R.F. AMPLIFIER: MODULE-I: CIRCUIT AND BOARD LAYOUT

FIG. 5
 MODULE I



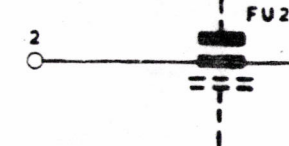
DWG. No. 630/4/1411

DWG. No. 630/DA/1411

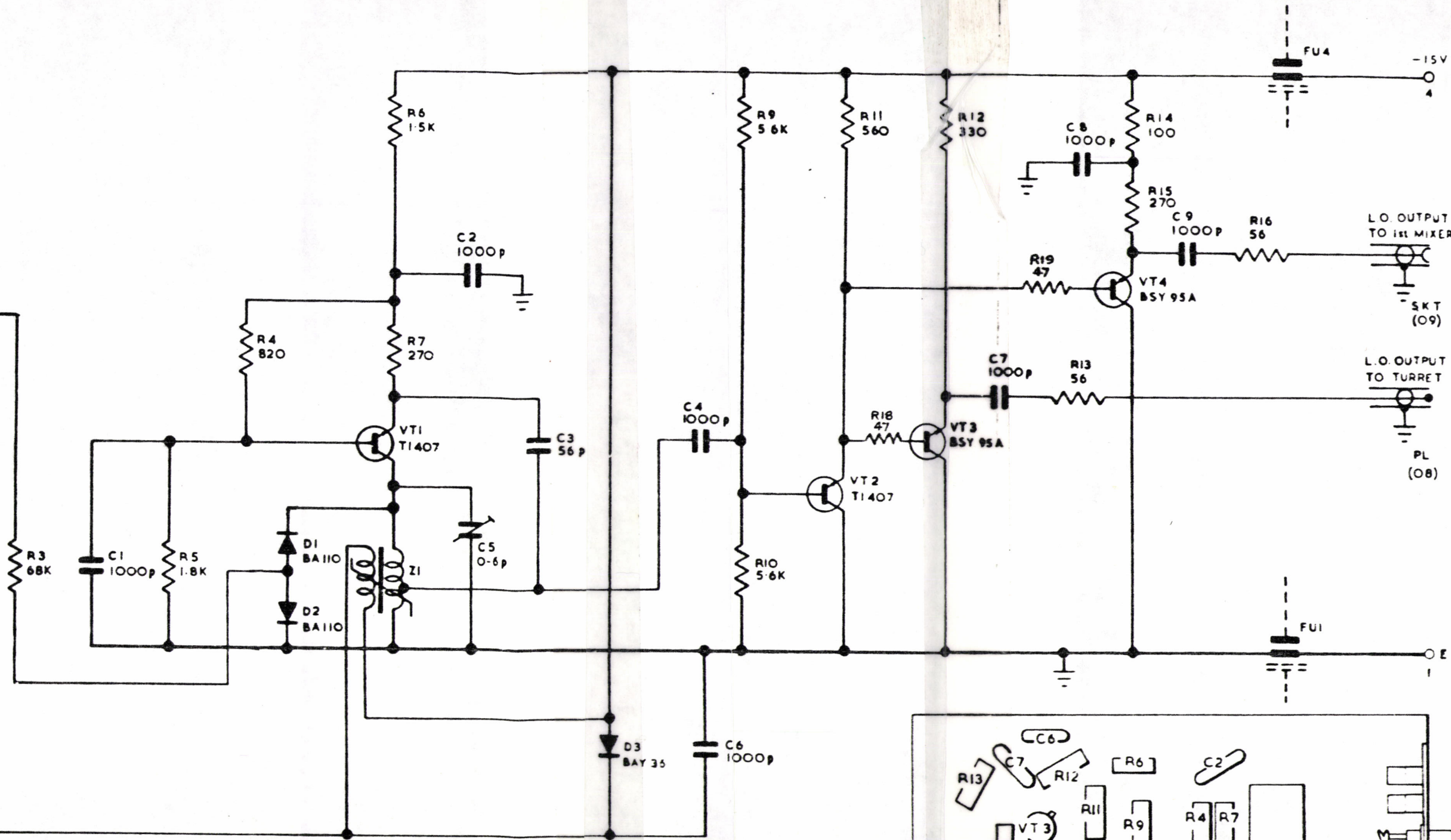
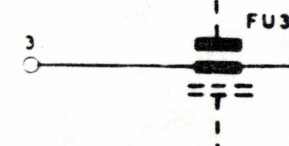
Modifications	Fig. 6	Issue. 4
2	3	4
5	6	7
8	9	10
11	12	

FIG. 6. FIRST MIXER : MODULE 2 : CIRCUIT AND BOARD LAYOUT

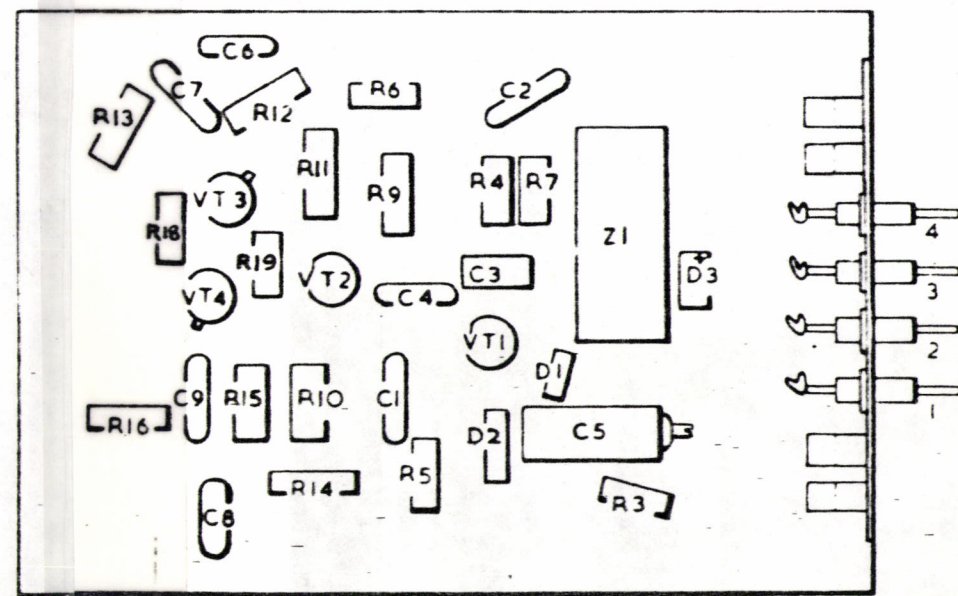
FROM TURRET CONTROL 2



FROM TURRET CONTROL 1



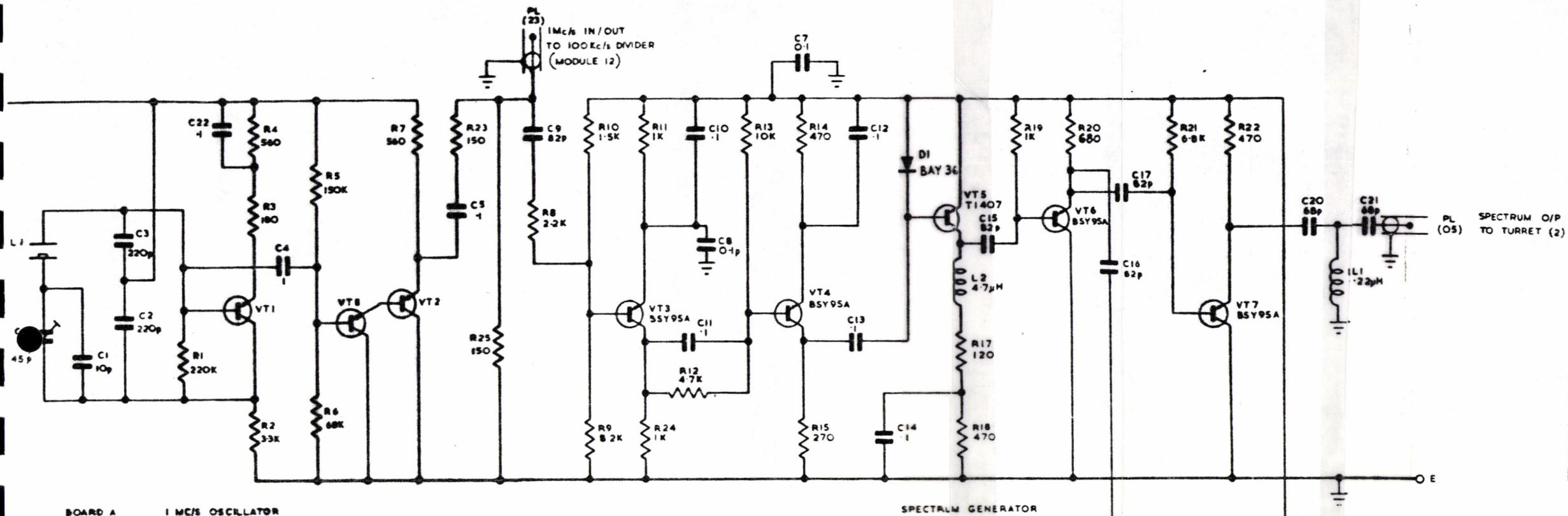
DWG. NO. 630/DA/14112



DWC NO. 630/1/14443

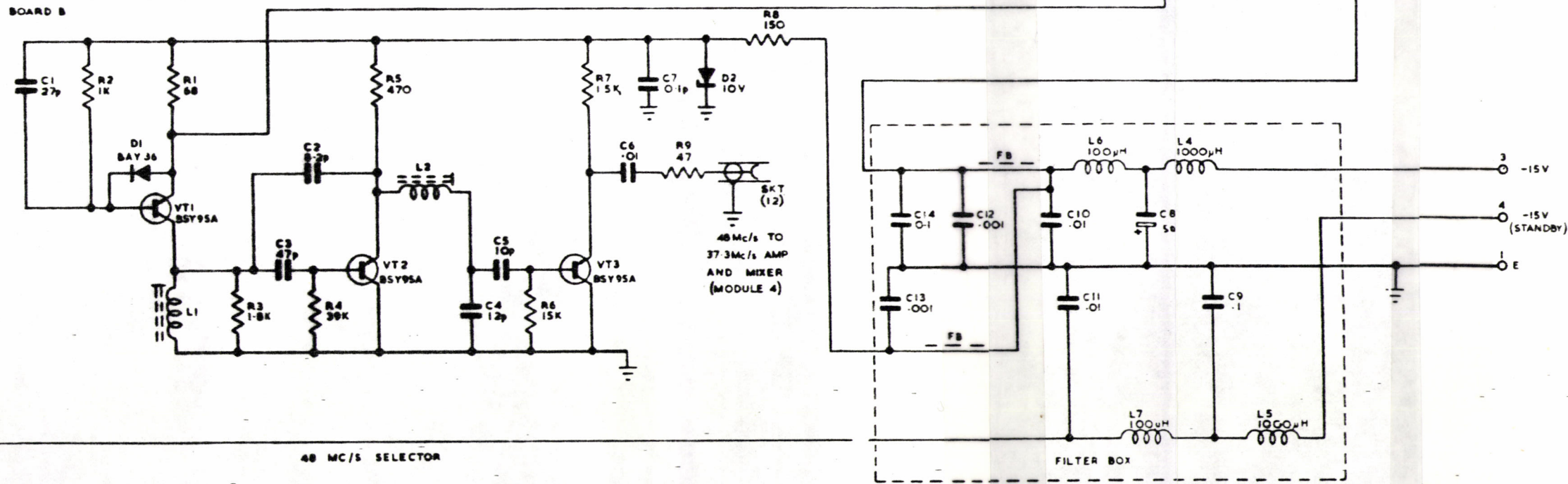
Modifications	Fig. 7	Issue 4
1	2	3
4	5	6
7	8	9
10	11	12

FIG. 7. PRI55 FIRST LOCAL OSCILLATOR : MODULE 3 : CIRCUIT AND BOARD LAYOUT



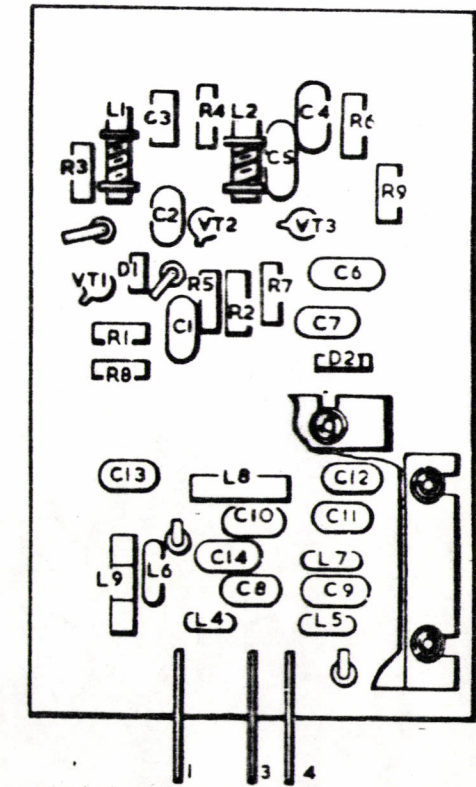
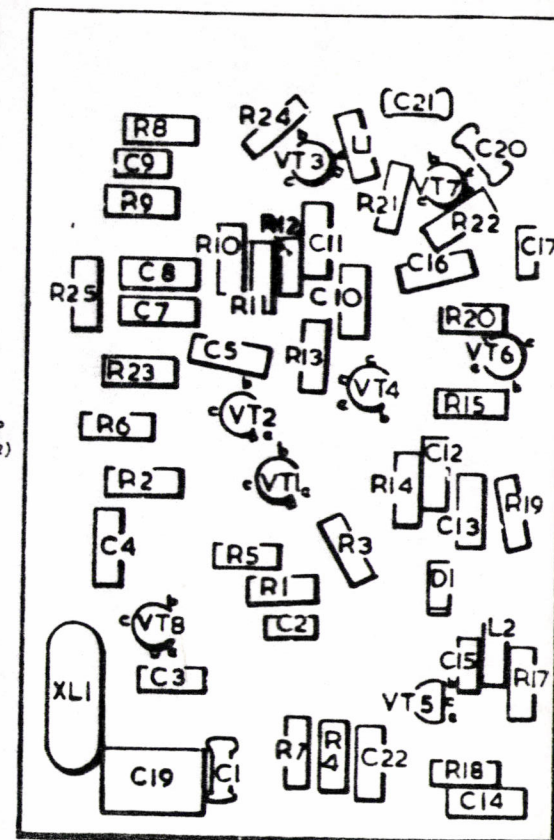
BOARD A 1 MC/S OSCILLATOR

SPECTRUM GENERATOR



48 MC/S SELECTOR

FILTER BOX

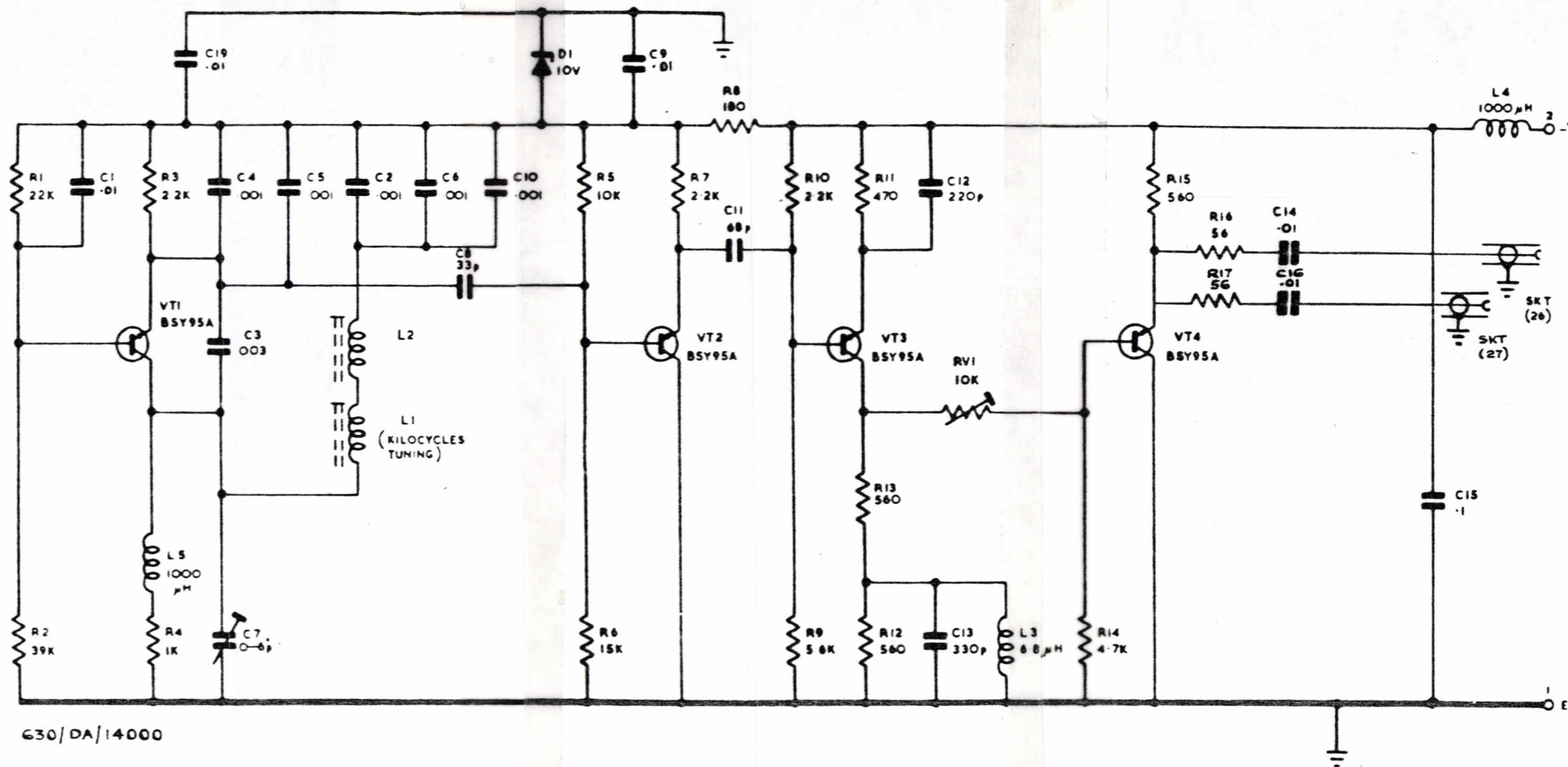


ifications	Fig. 8	Issue 6
2	4	5
6	7	8
9	10	11
12		

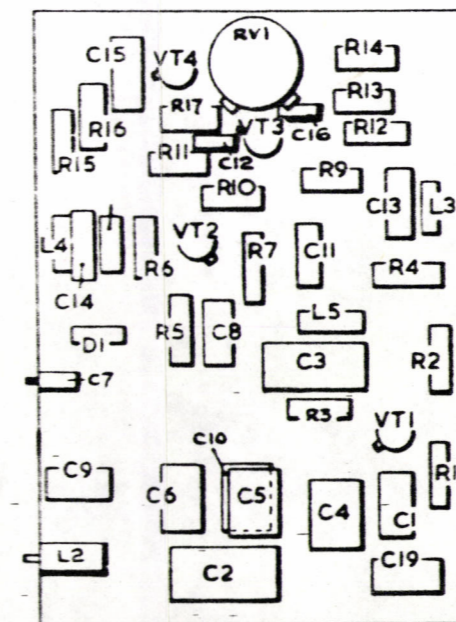
FIG. 8. PRI55. SPECTRUM GENERATOR: MODULE 10: CIRCUIT AND BOARD LAYOUT.

630/1/14271

FIG. 8. MODULE 10



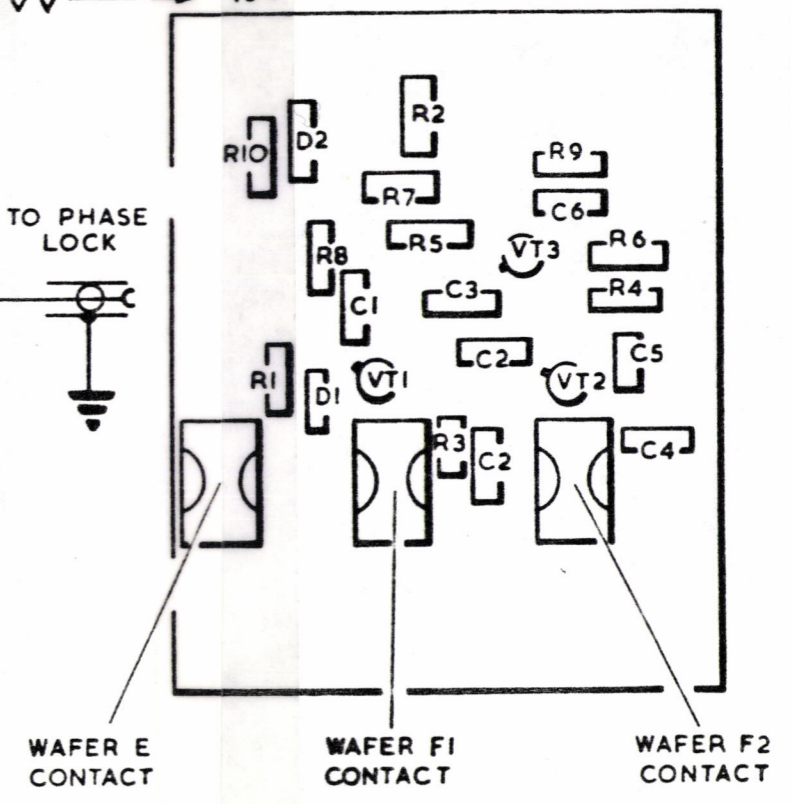
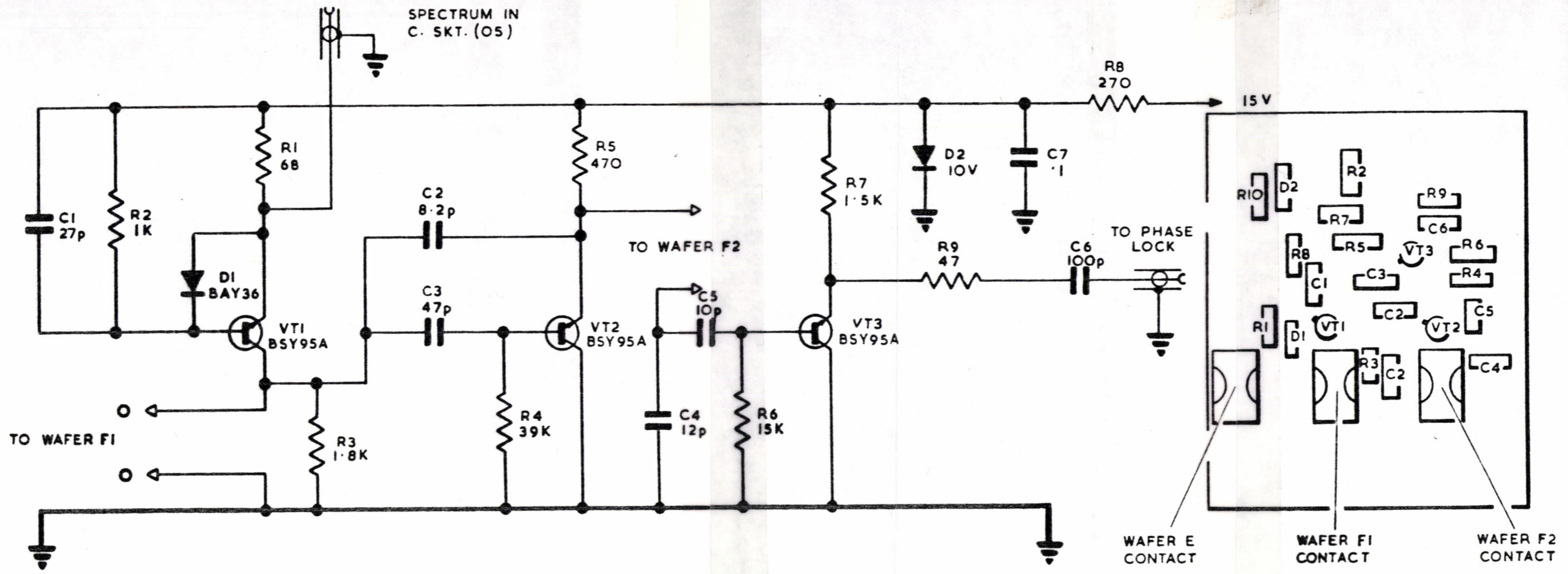
630/DA/14000



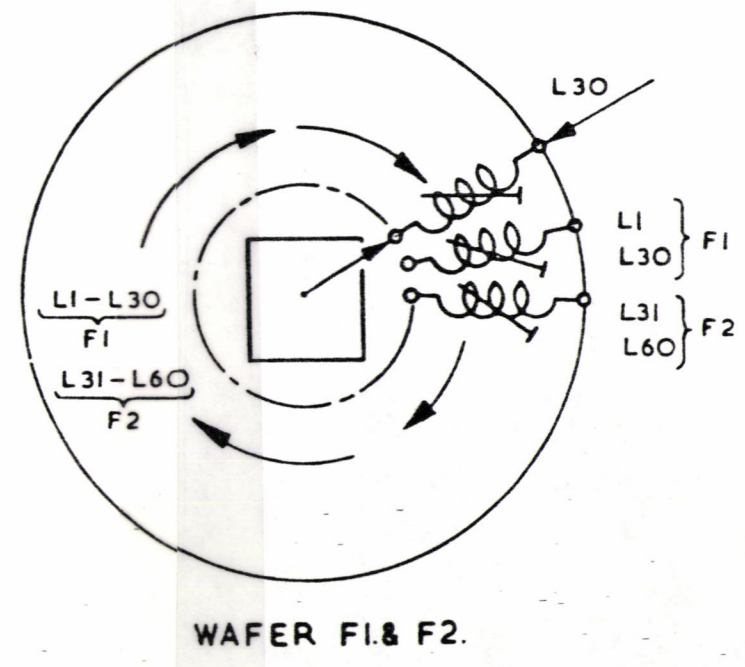
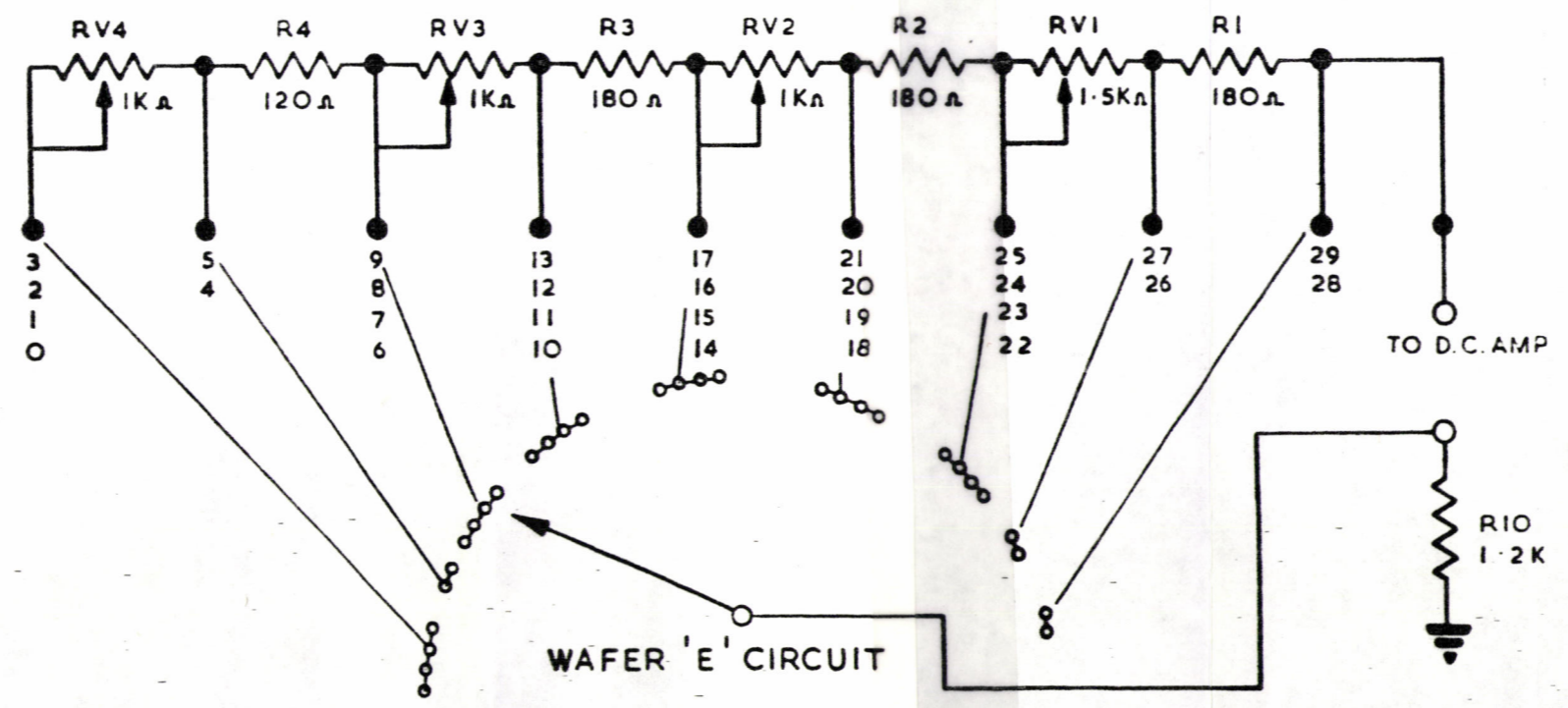
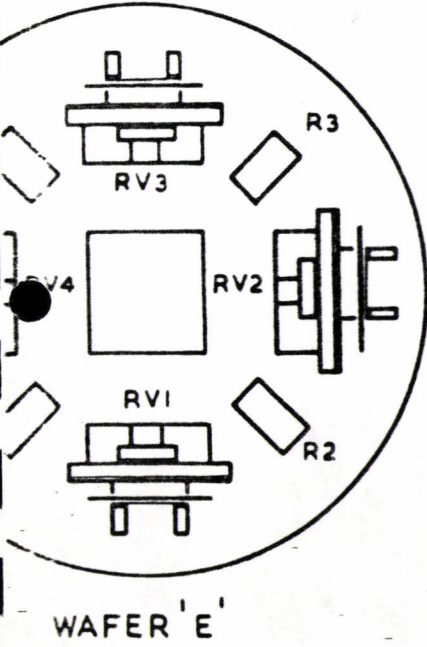
630/1/14020

Modifications		Fig. 9	Issue. 3
1	2	3	4
5	6	7	8
9	10	11	12

FIG. 9. INTERPOLATING OSCILLATOR : CIRCUIT AND BOARD LAYOUT FIG.9. INT. OSC.



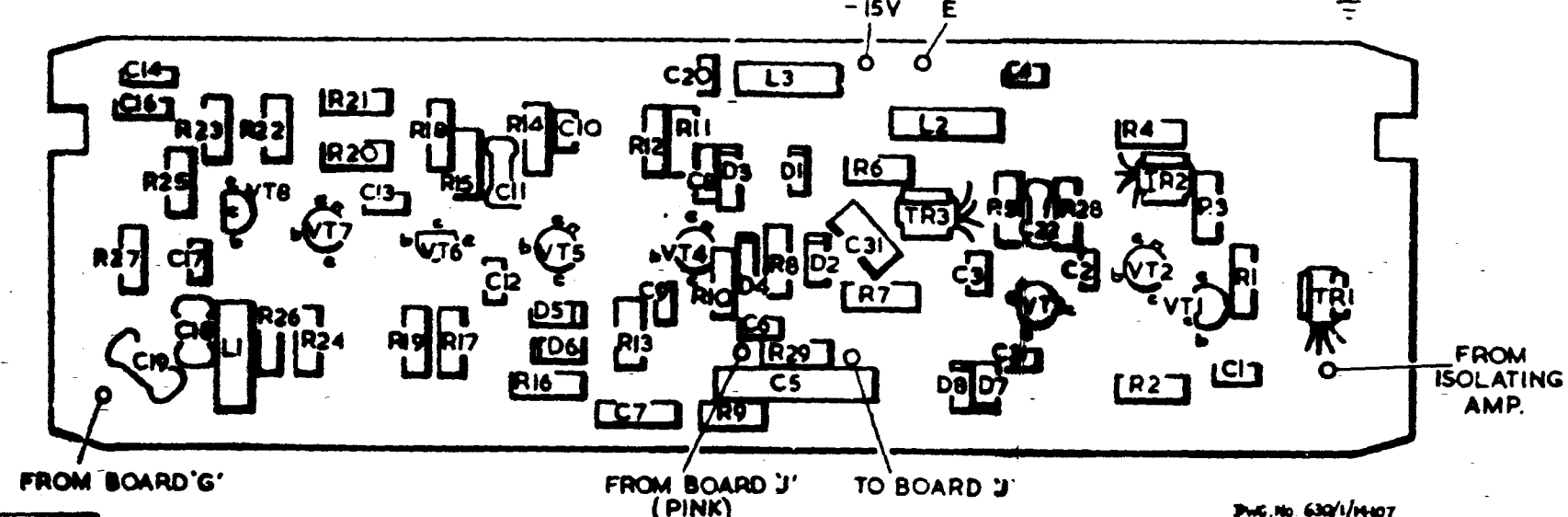
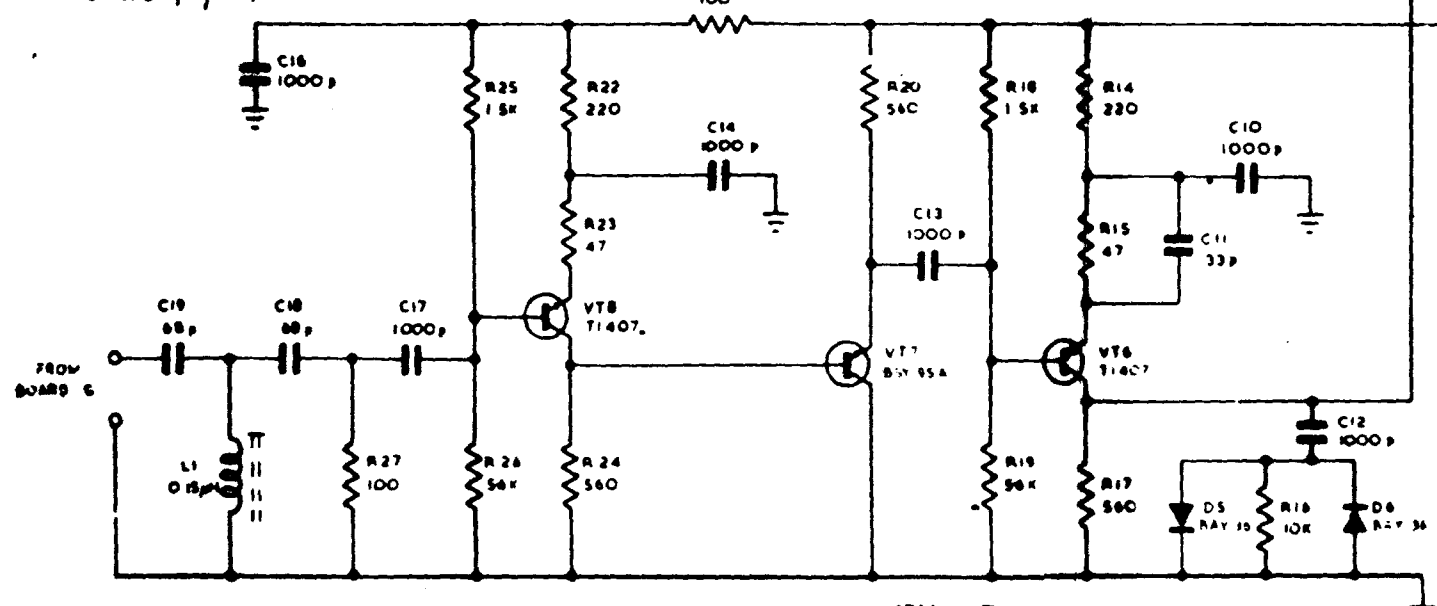
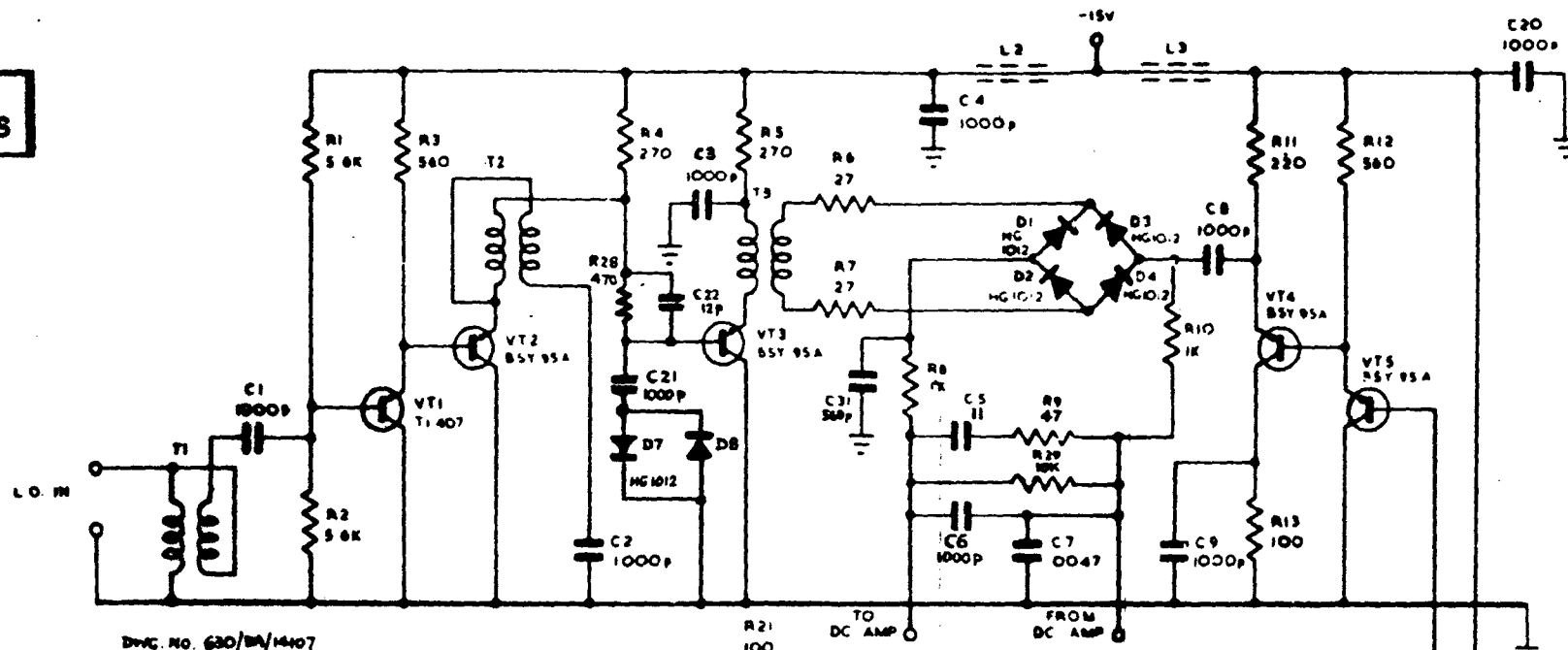
630/DA/14300



ifications Fig.10 Issue 3
 ret Mod.No.4
 bodied
 : Fig 1 For Overall Mod.State.

FIG. 10. MC/S. SELECTOR : TURRET COMPARTMENT 2 : CIRCUIT AND BOARD LAYOUT.

FIG. 10. TURRET COMP. 2

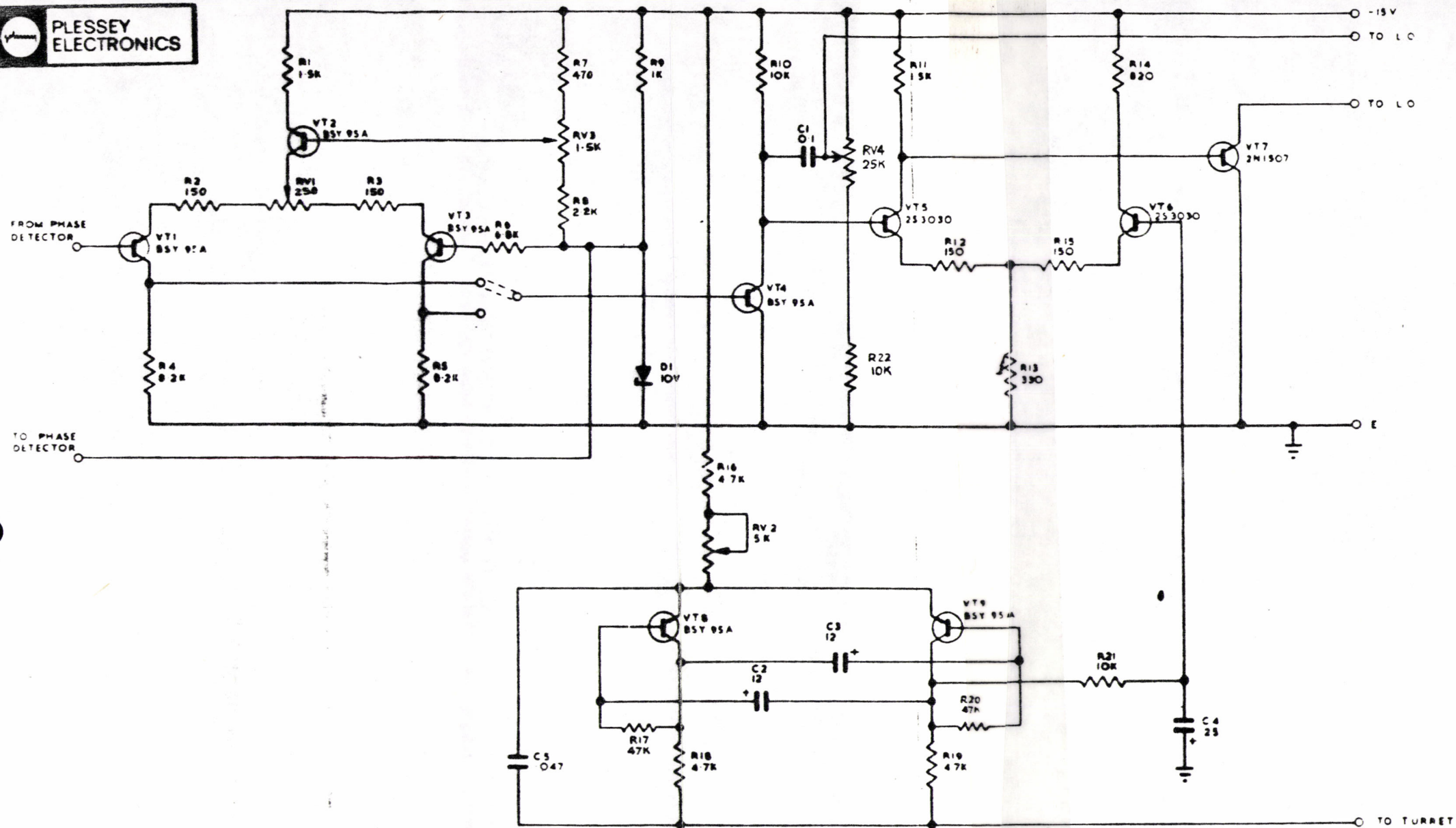


Modifications	Fig.12	Issue.5
Turret Mod.No.1		
Embodied.		

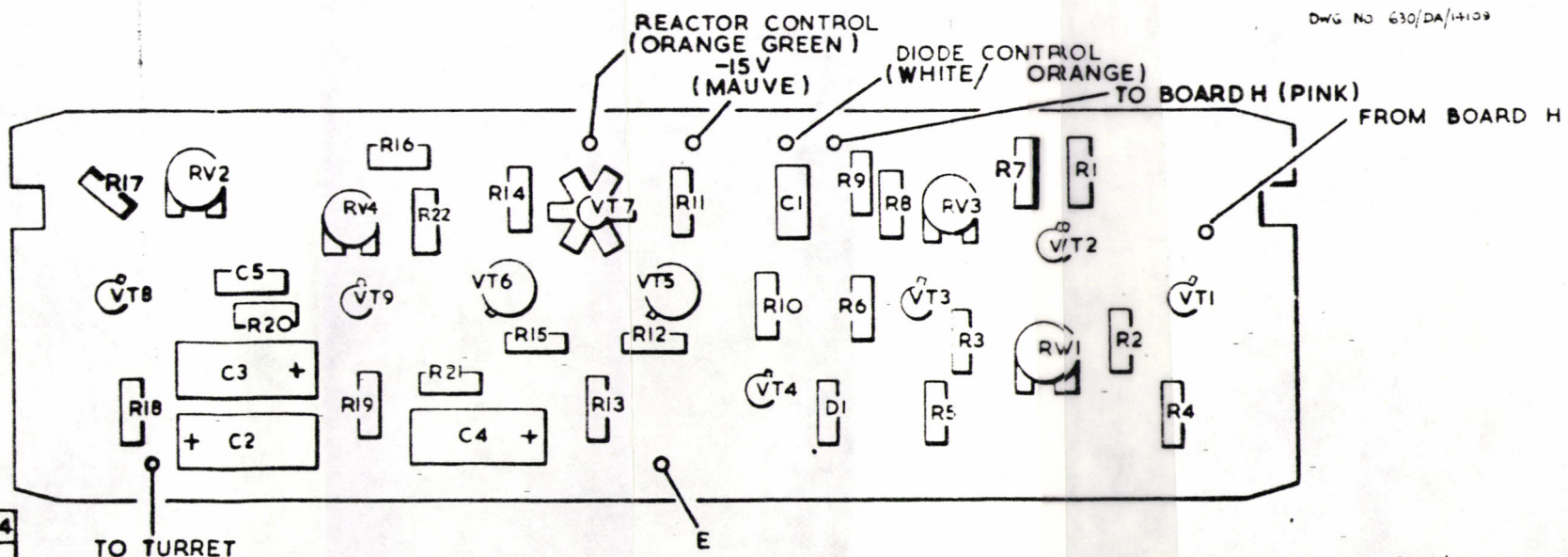
See Fig.1. For Overall Mod.State

FIG. 12. PR155 PHASE DETECTOR BOARD H : CIRCUIT AND LAYOUT (BOARD.H)

DWG.No. 630/1/14407



DWG NO 630/DA/14109



DWG NO 630/1/14109

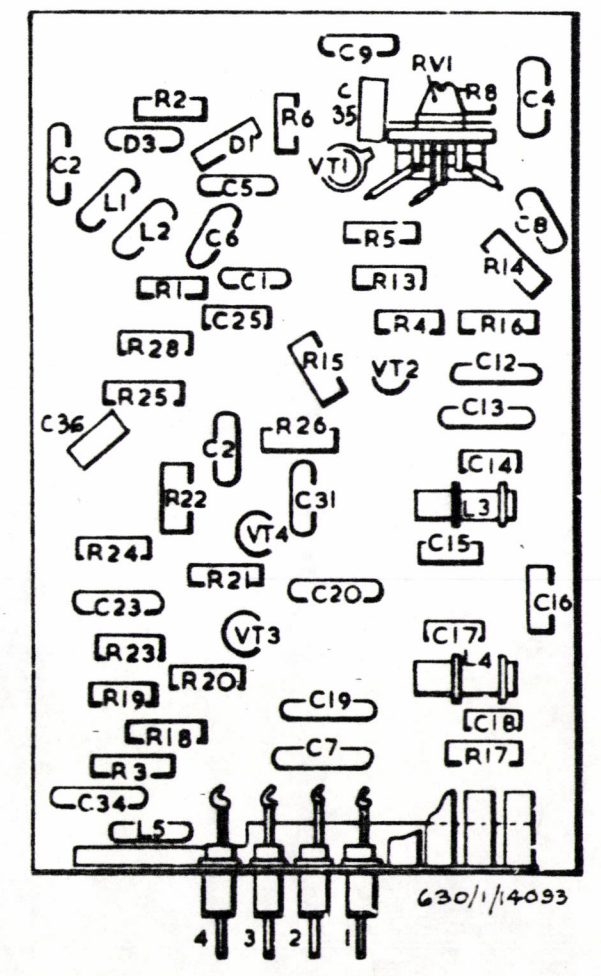
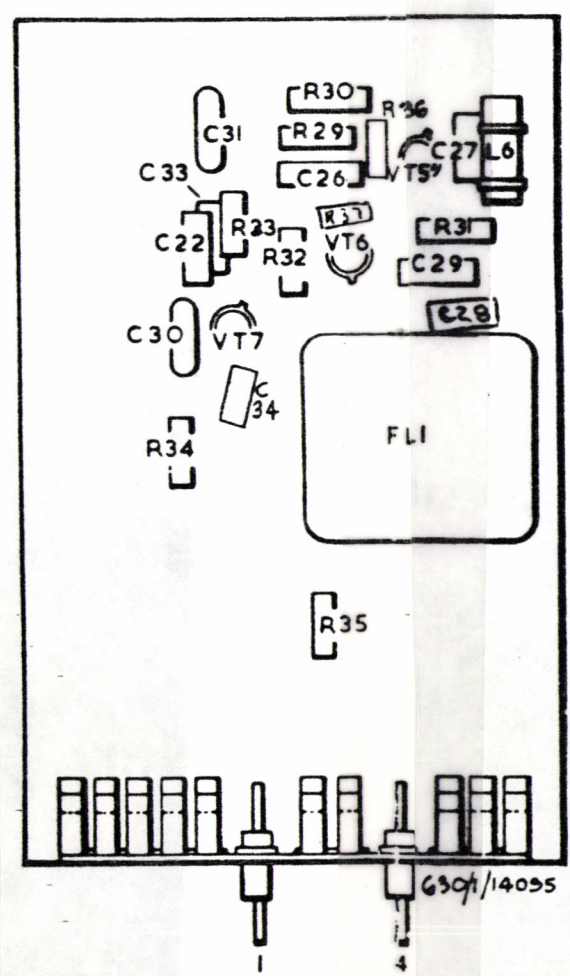
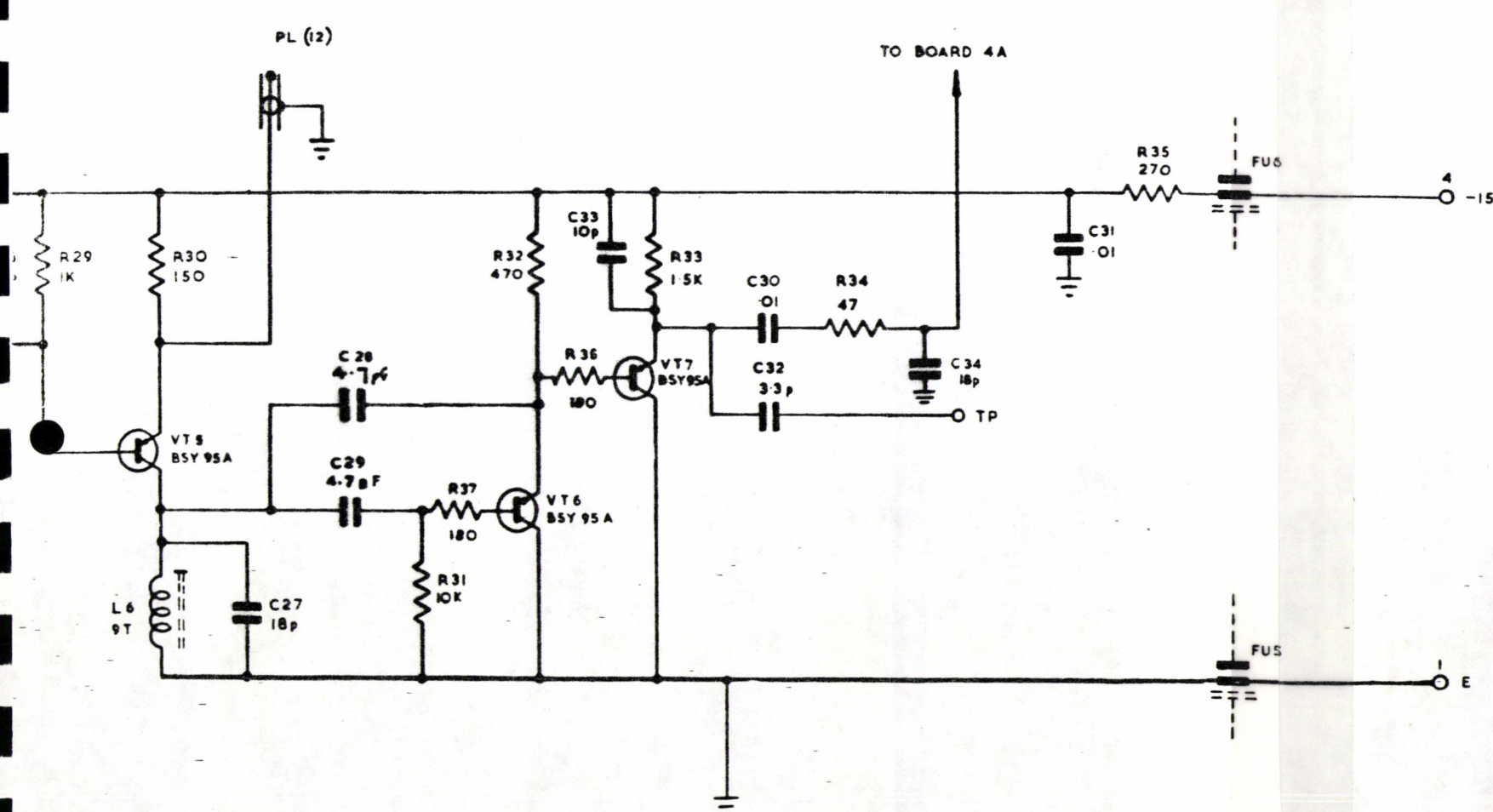
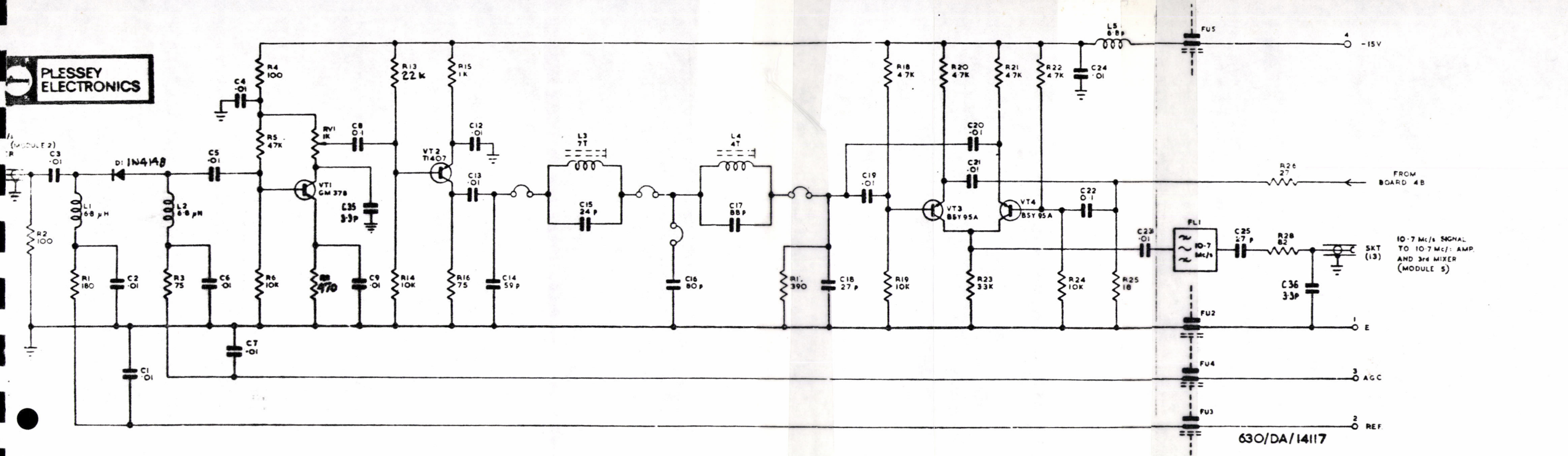
Modifications	Fig.13	Issue.4
Turret Mod.No.3		
Embodied.		

See Fig.1 For Overall Mod.State.

FIG.13. PRI55 D.C. AMPLIFIER AND REACTOR SWEEP GENERATOR, BOARD J : CIRCUIT AND LAYOUT (BOARD...)

**FIG.13.
TURRET**

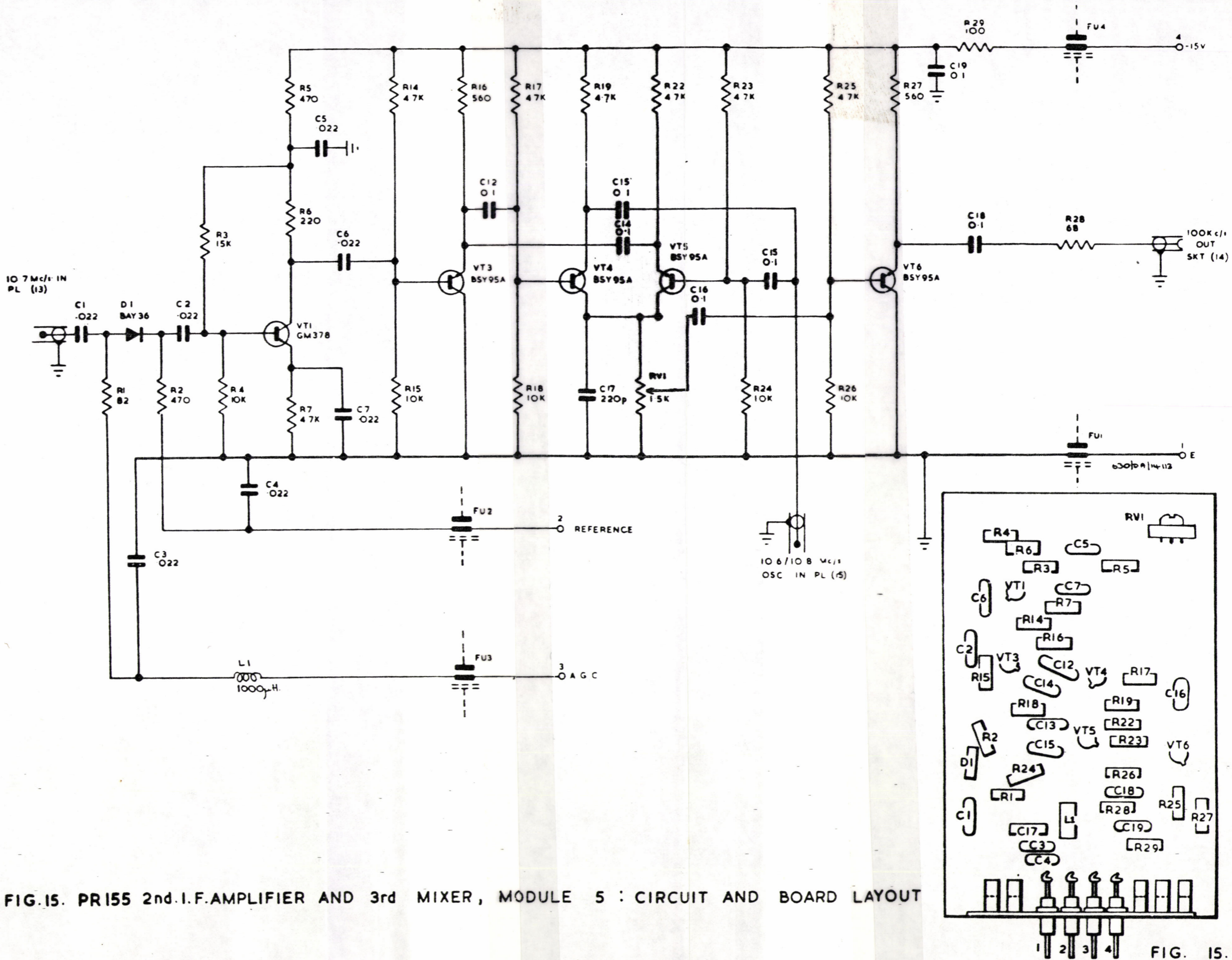
PLESSEY ELECTRONICS



Icon	Fig 14	Issue G
1	2	3
4	5	6
7	8	9
10	11	12

FIG.14. PR155 FIRST I.F. AMPLIFIER AND 2nd. MIXER, MODULE 4 : CIRCUIT AND BOARD LAYOUT

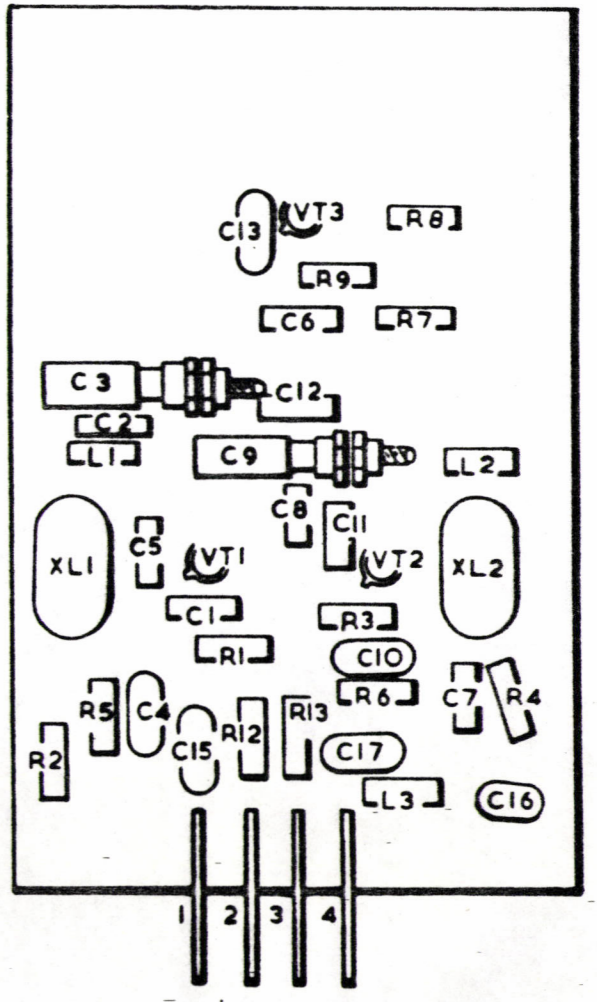
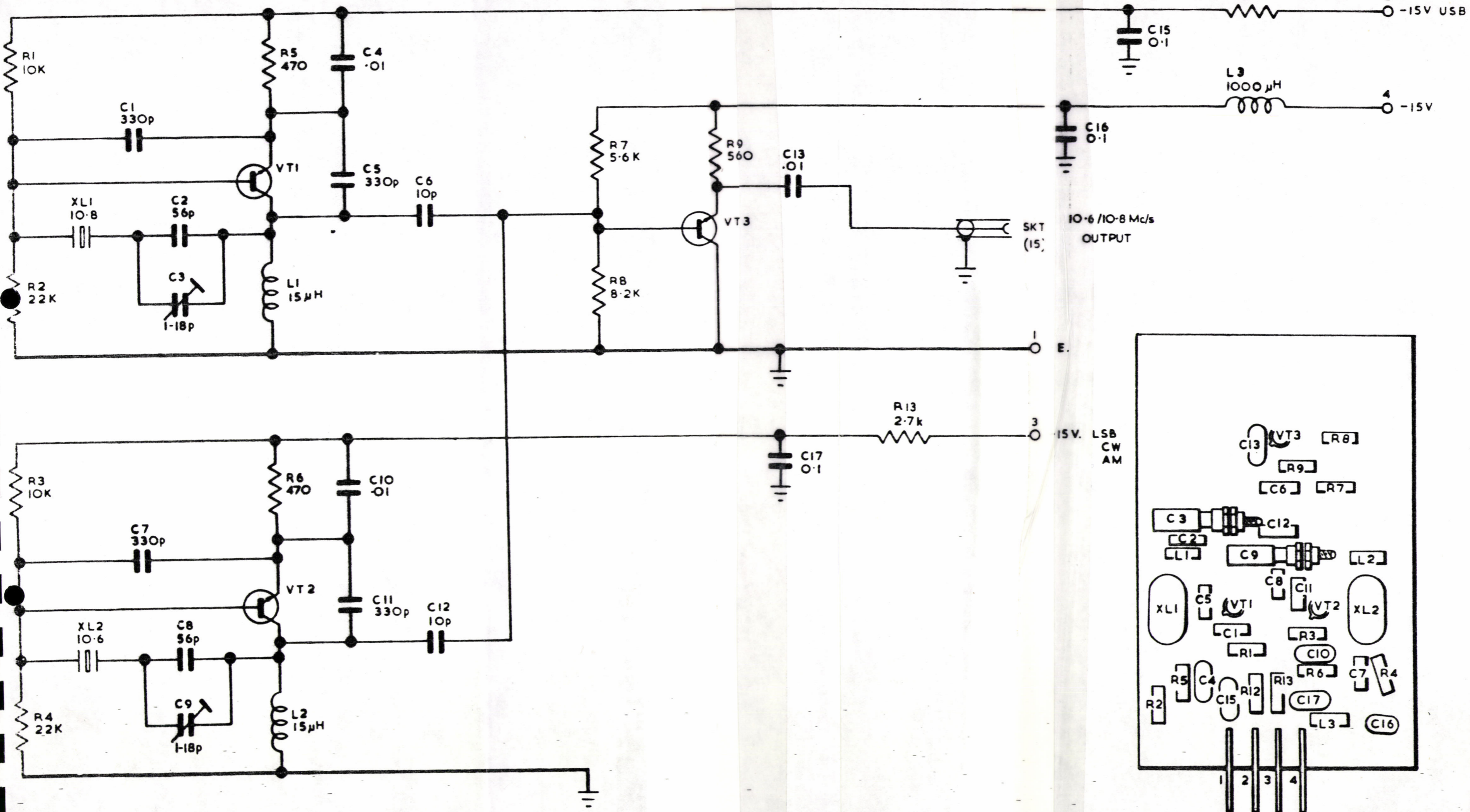
FIG.14
MODULE 4



Modification	Fig 15	Issue 4
3	4	5
6	7	8
9	10	11
12		

FIG. 15. PR155 2nd I.F. AMPLIFIER AND 3rd MIXER, MODULE 5 : CIRCUIT AND BOARD LAYOUT

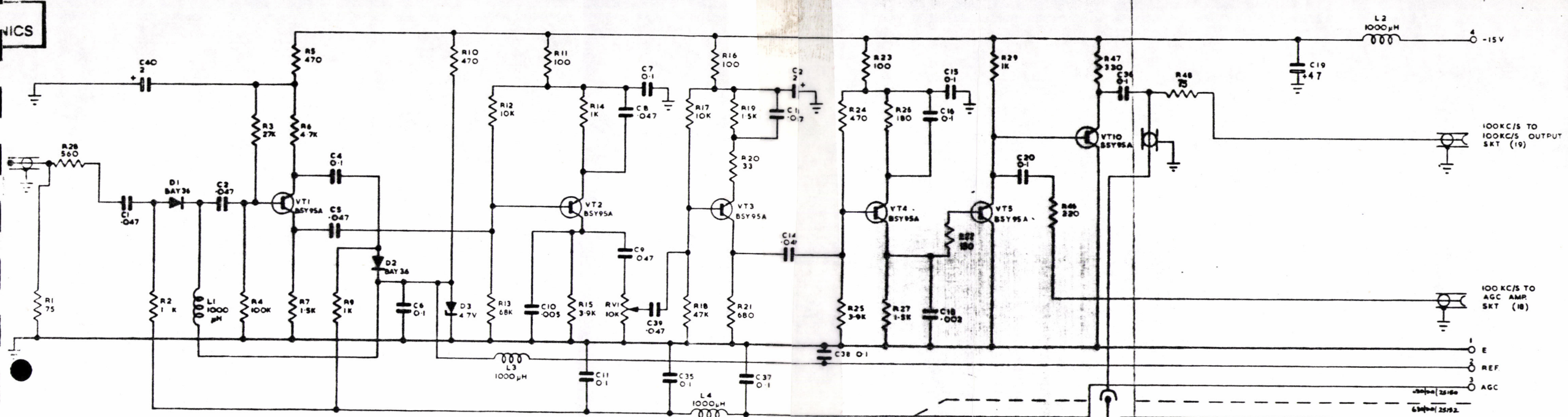
FIG. 15. MODULE 5



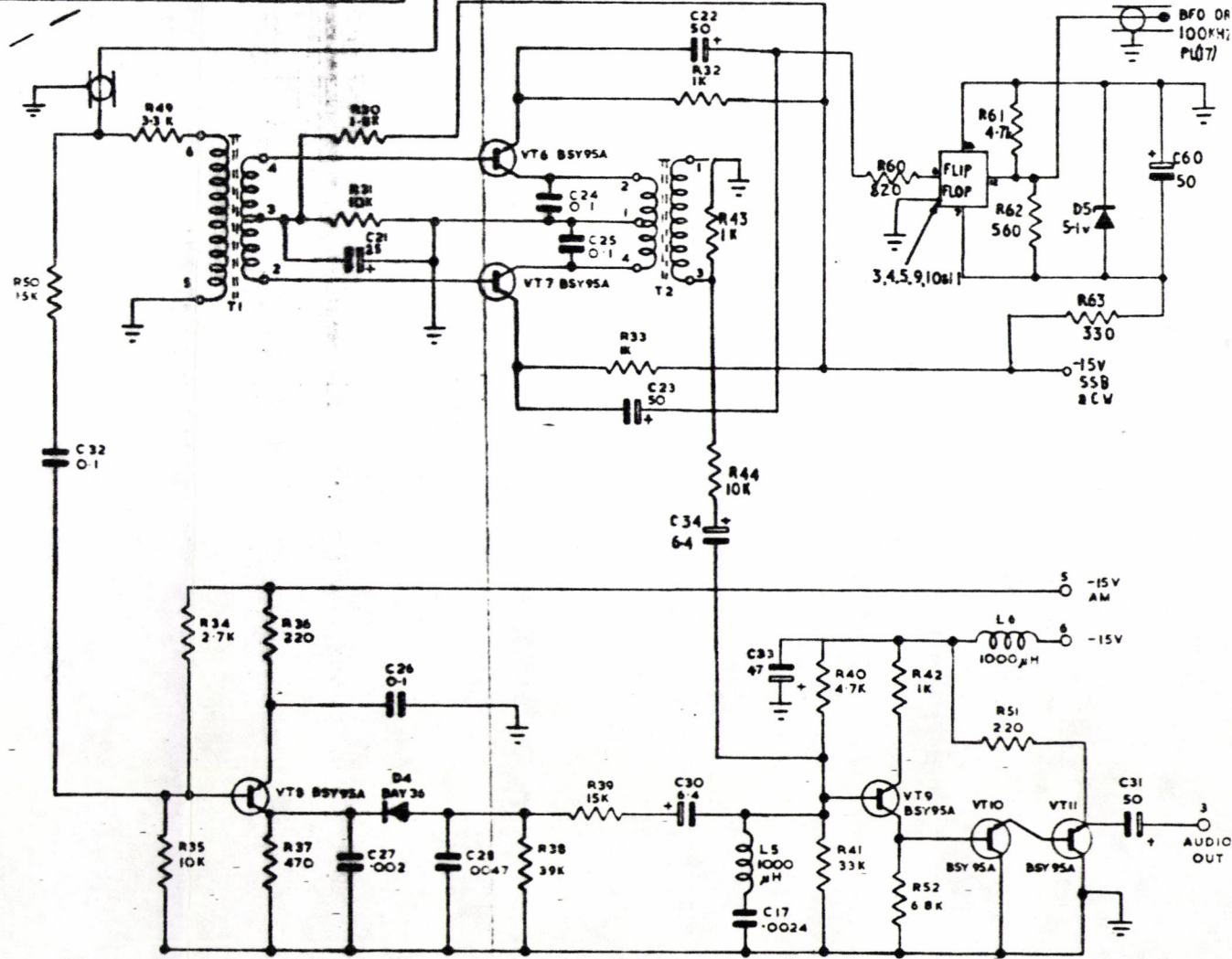
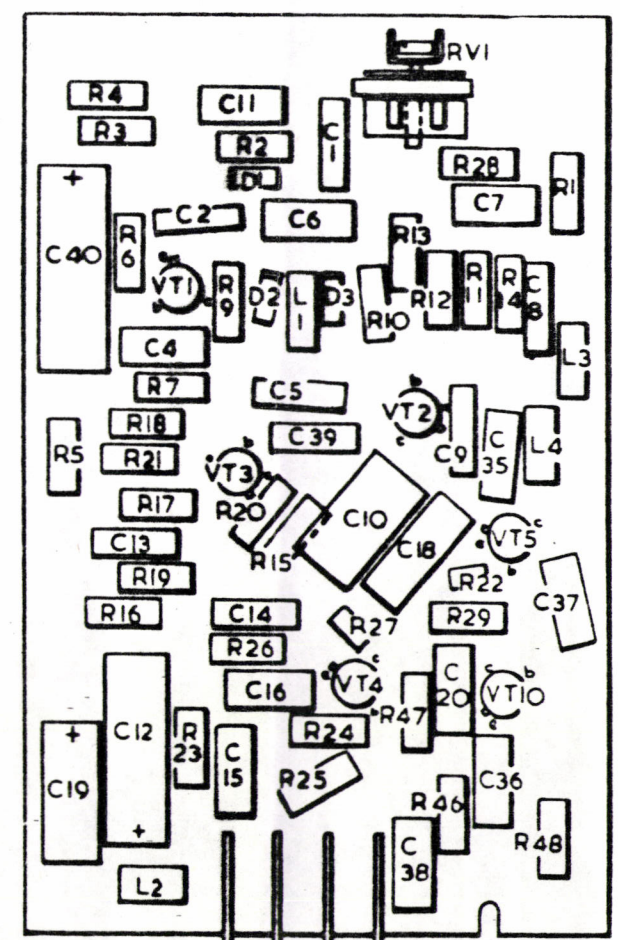
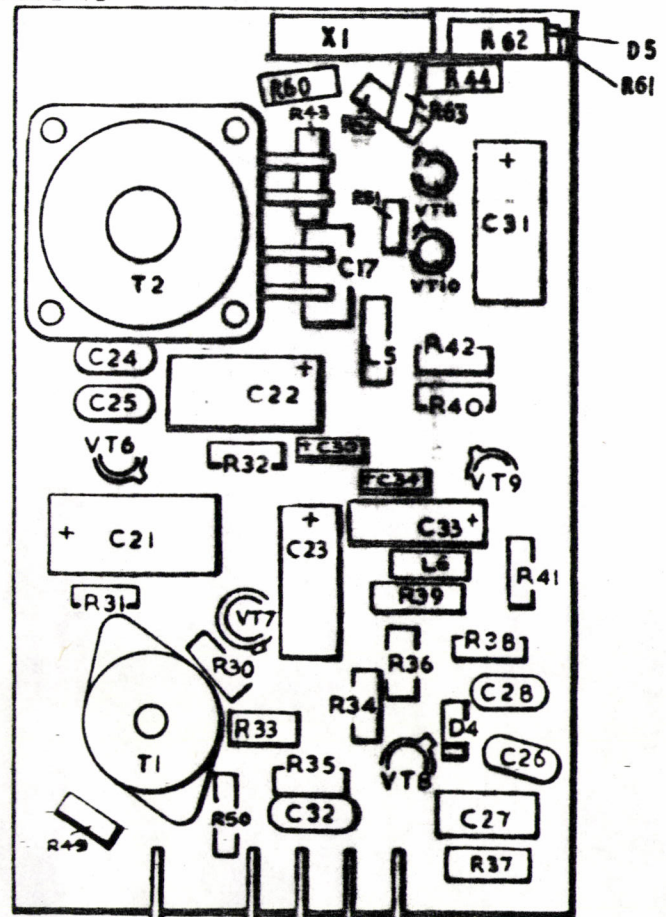
Modifications		Fig 16		Issue 4	
1	2	3	4	5	6
7	8	9	10	11	12

FIG.16. PRI55 10.6/10.8 MC/S GENERATOR , MOULE 11 : CIRCUIT AND BOARD LAYOUT

FIG.16 MODULE 11



MODULE 7A
MODULE 7B



Modifications	Fig. 17	Issue 7
2	3	4
5	6	7
8	9	10
11	12	

FIG. 17. PR 155 3rd. I. F. AMP (MODULE 7A) & DETECTOR (MODULE 7B) : CIRCUIT AND BOARD LAYOUTS FIG. 17. MODULES 7A & 7B

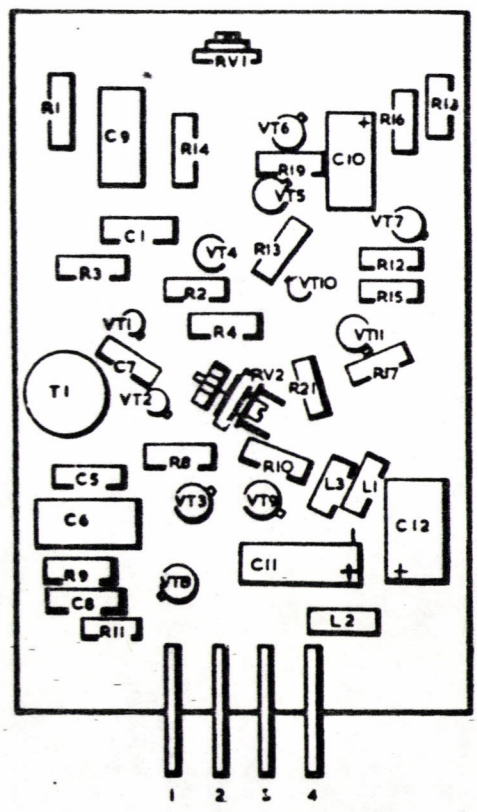
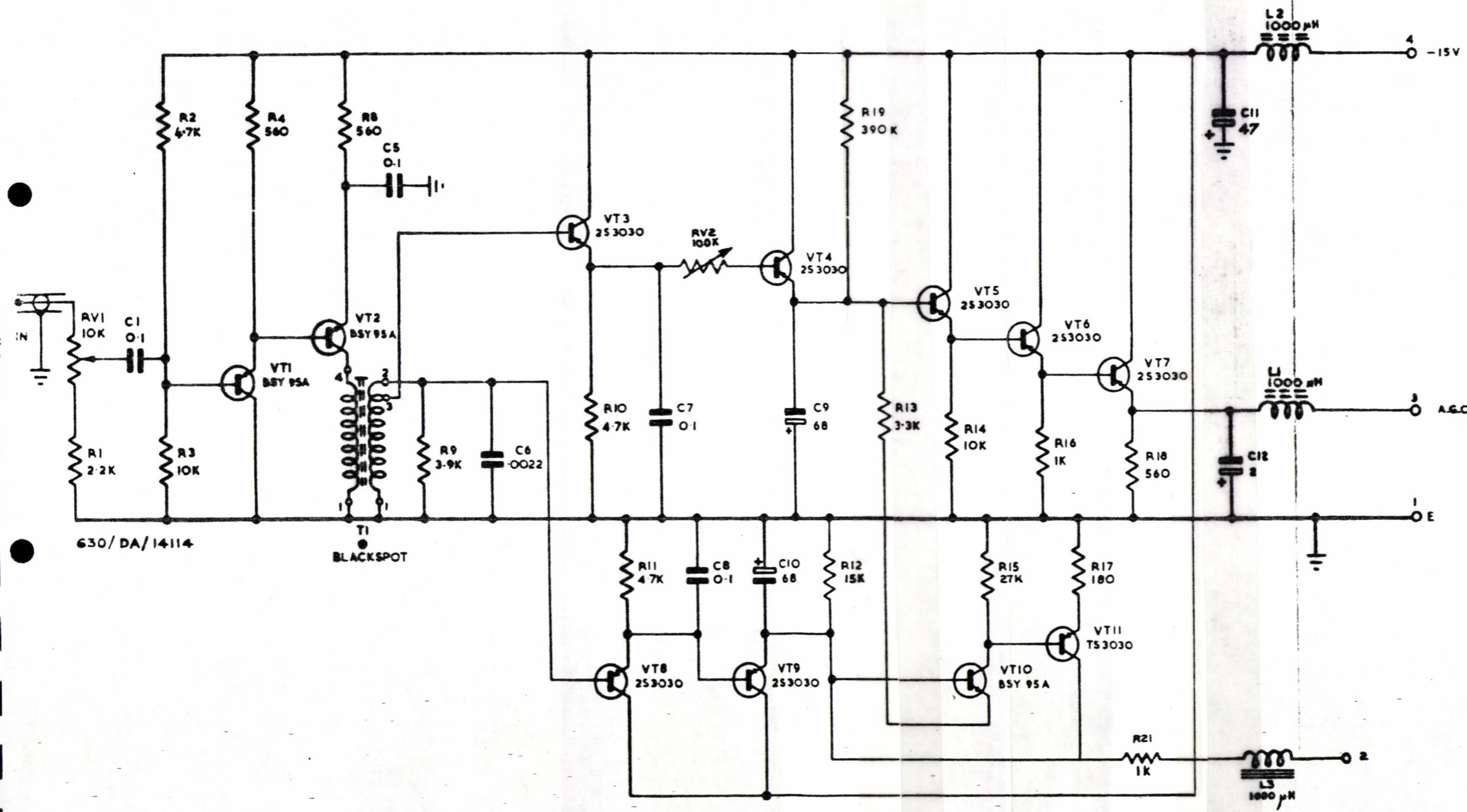
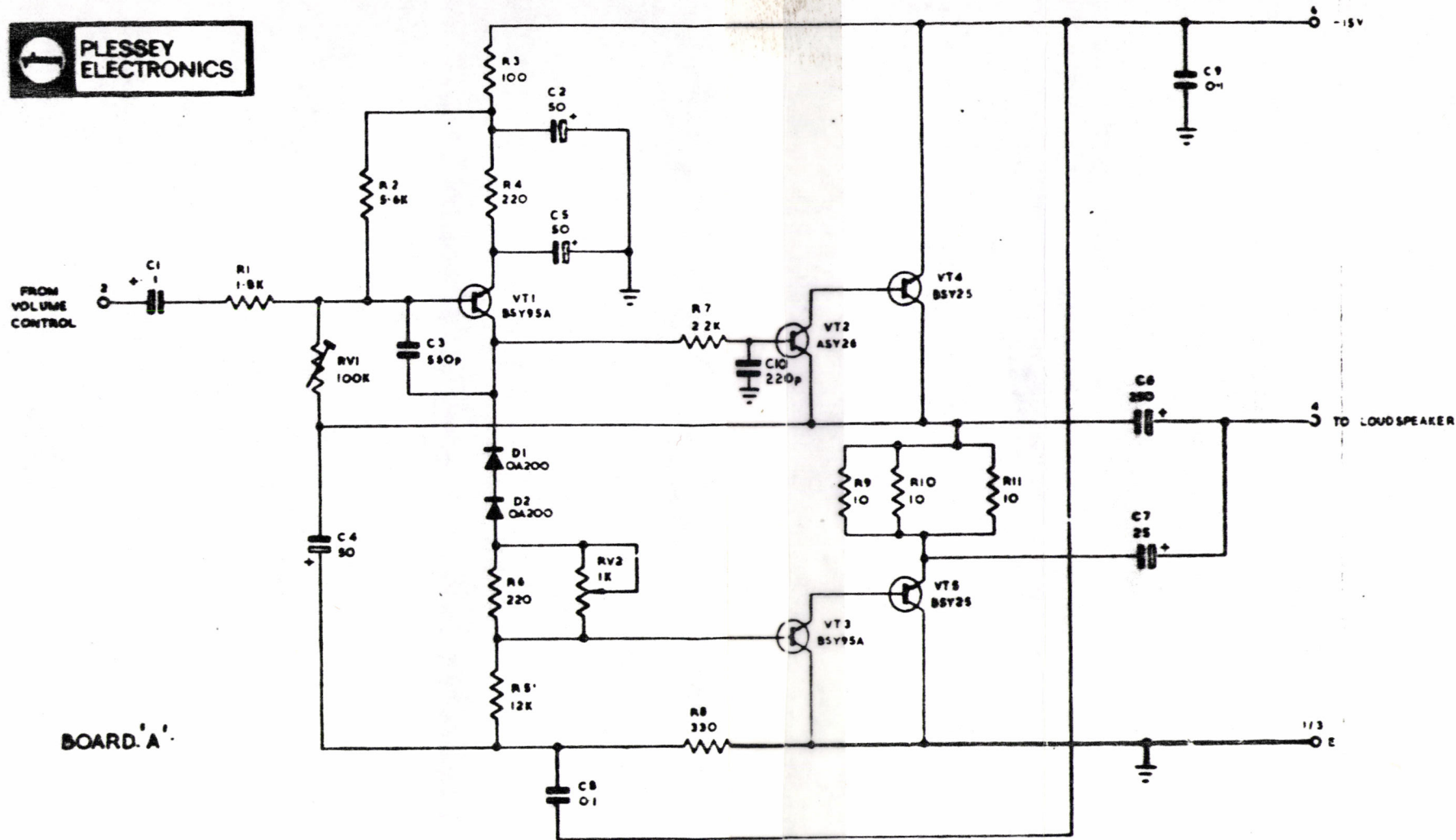
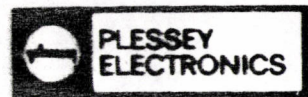
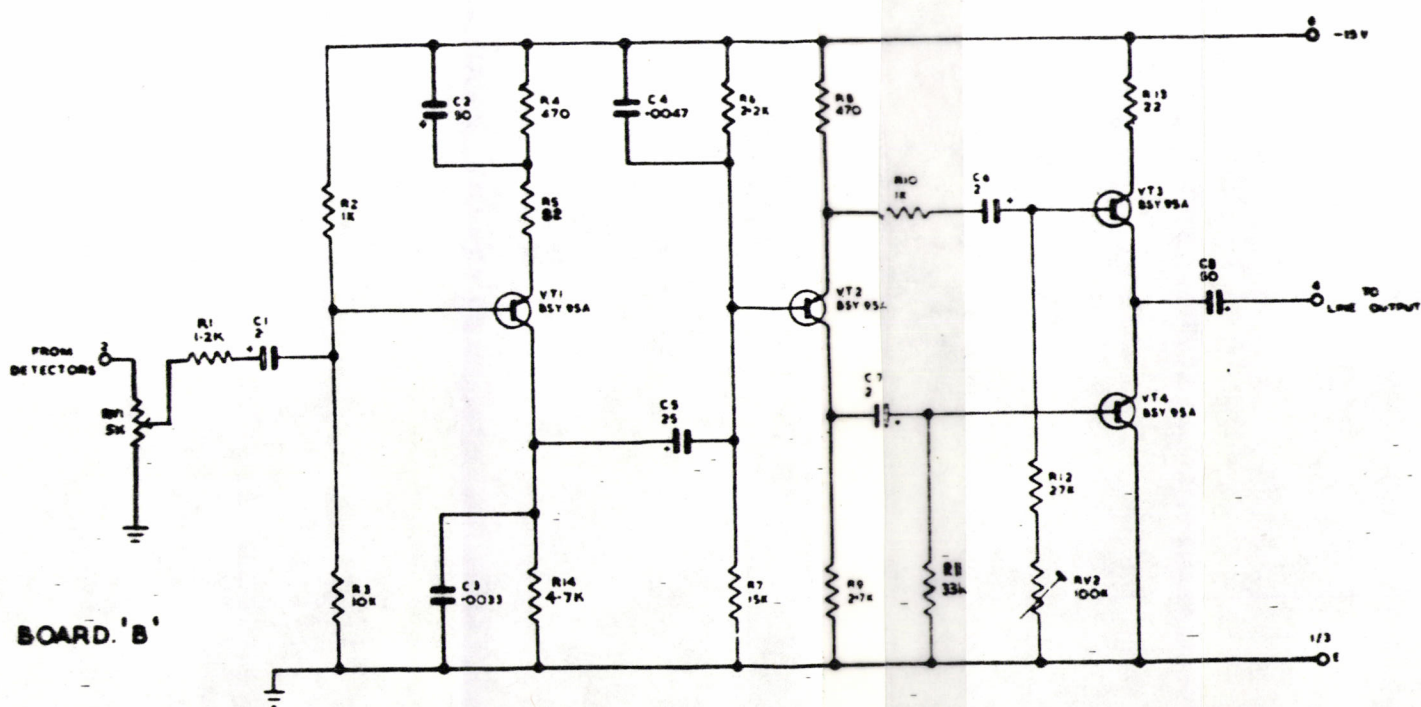


FIG. 18. PRI55 A.G.C. AMPLIFIER AND DETECTOR, MODULE 8: CIRCUIT AND BOARD LAYOUT

FIG. 18. MODULE 8



BOARD 'A'



BOARD 'B'

Modifications	Fig. 19	Issue. 6
1	2	3
4	5	6
7	8	9
10	11	12

FIG. 19 PR155 AUDIO AMPLIFIERS, MODULE 9: CIRCUIT AND BOARD LAYOUT

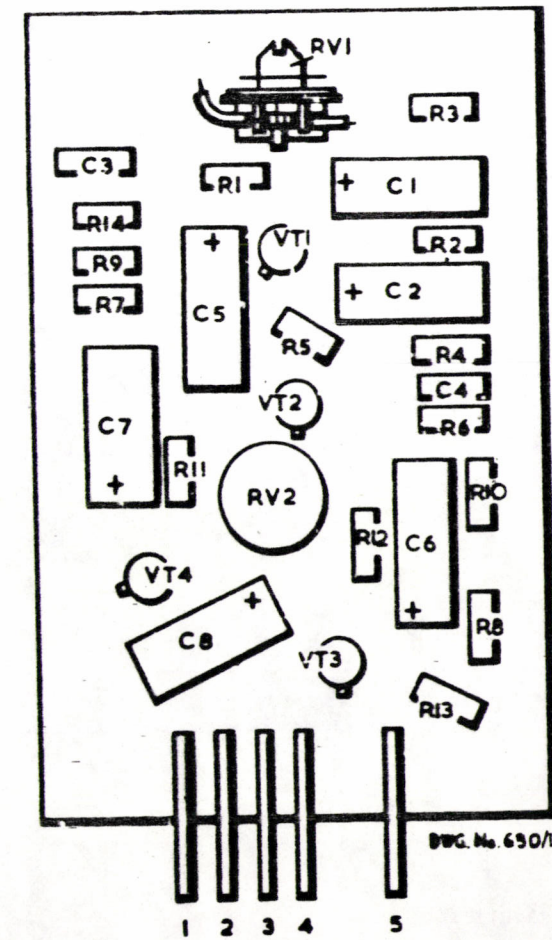
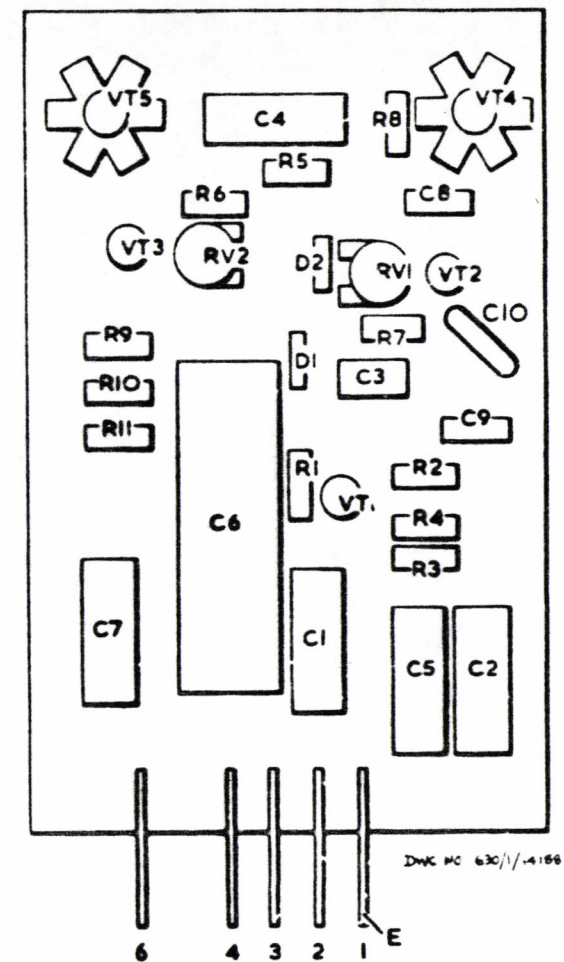
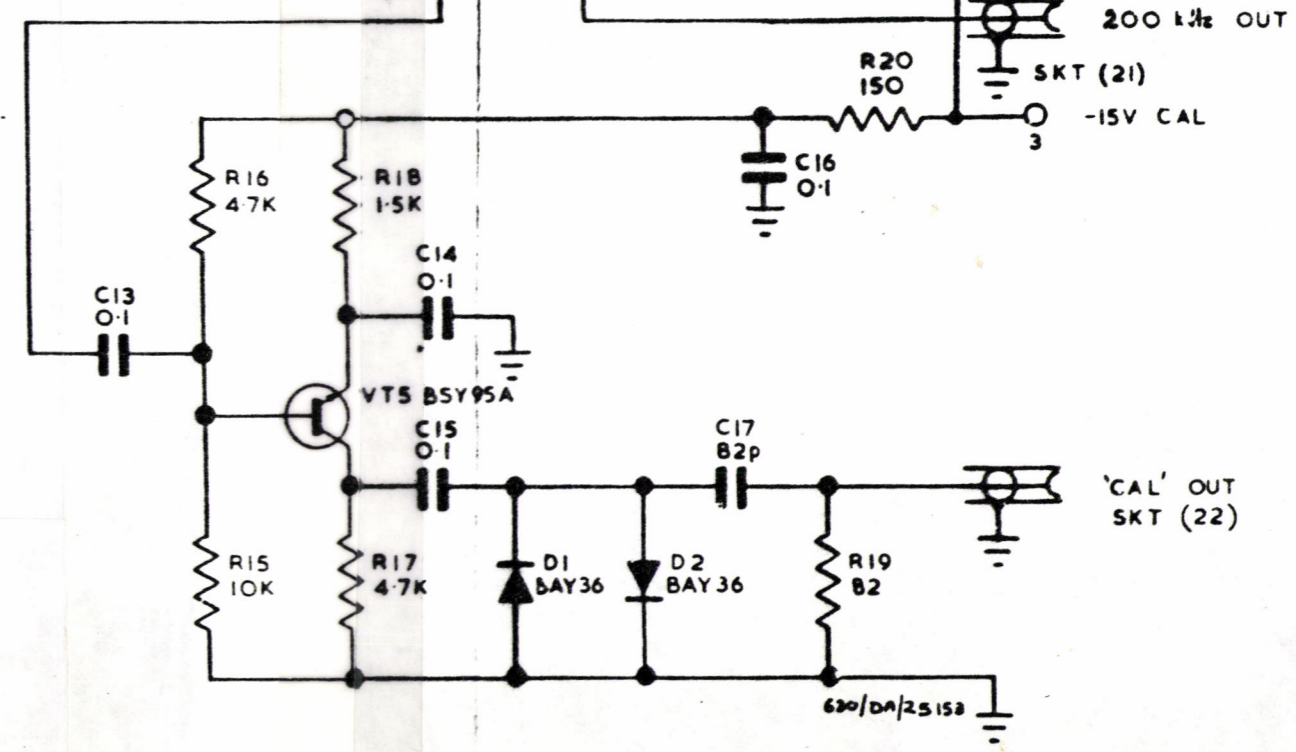
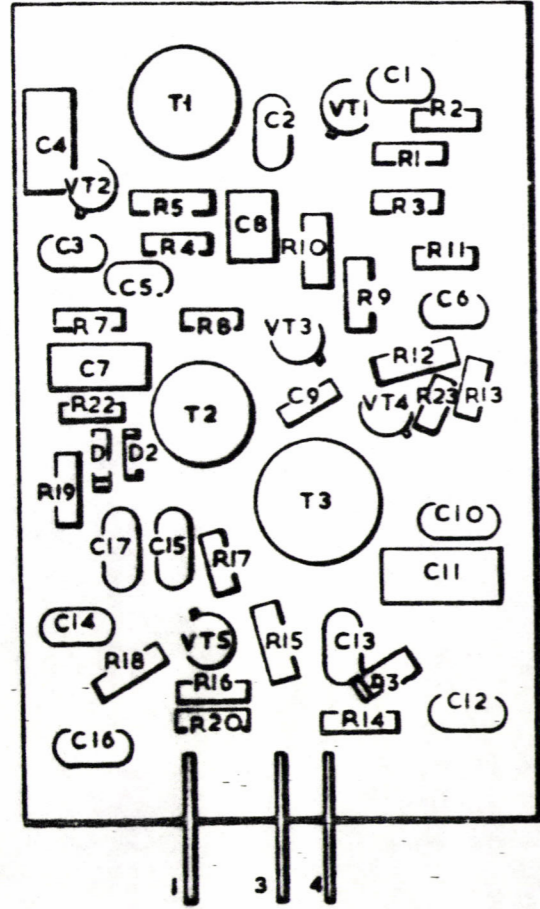
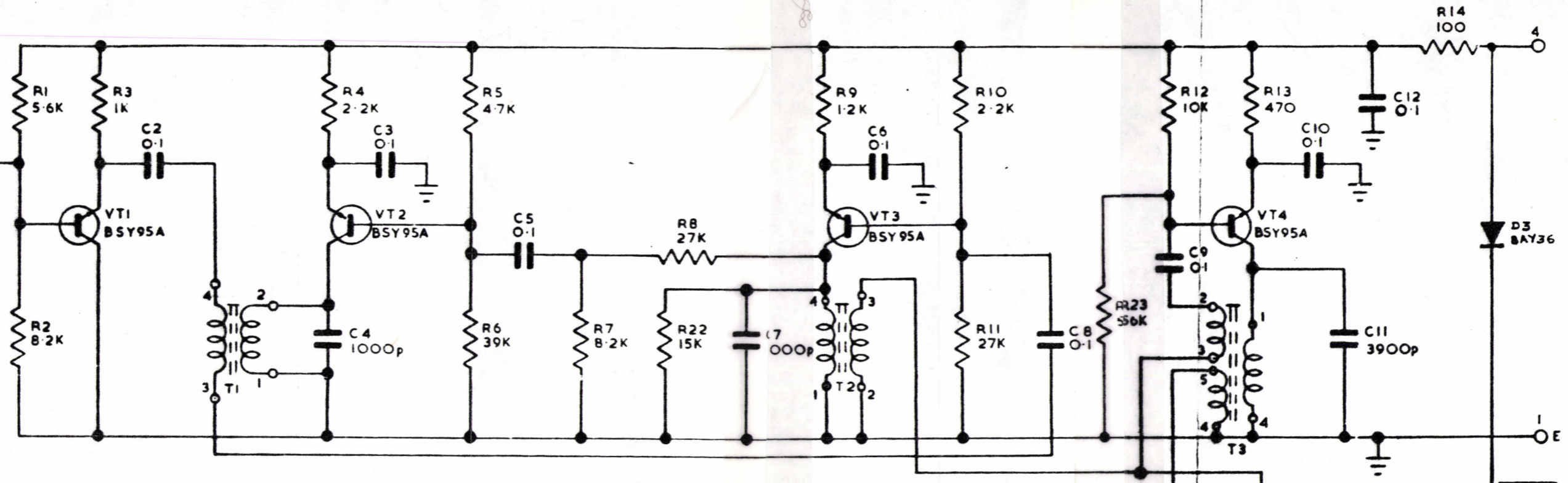


FIG. 19. MODULE 9

IN
OR
MHz IN

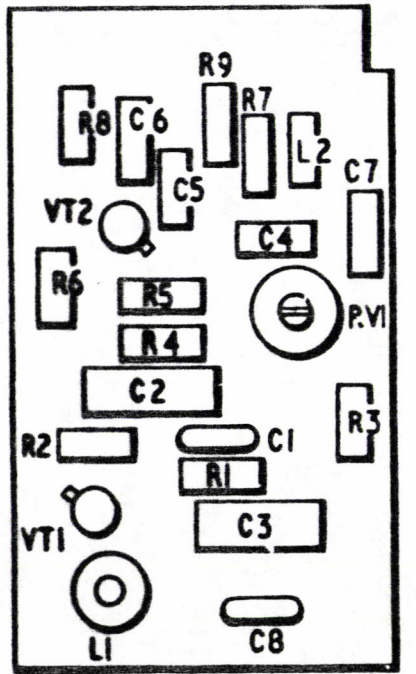
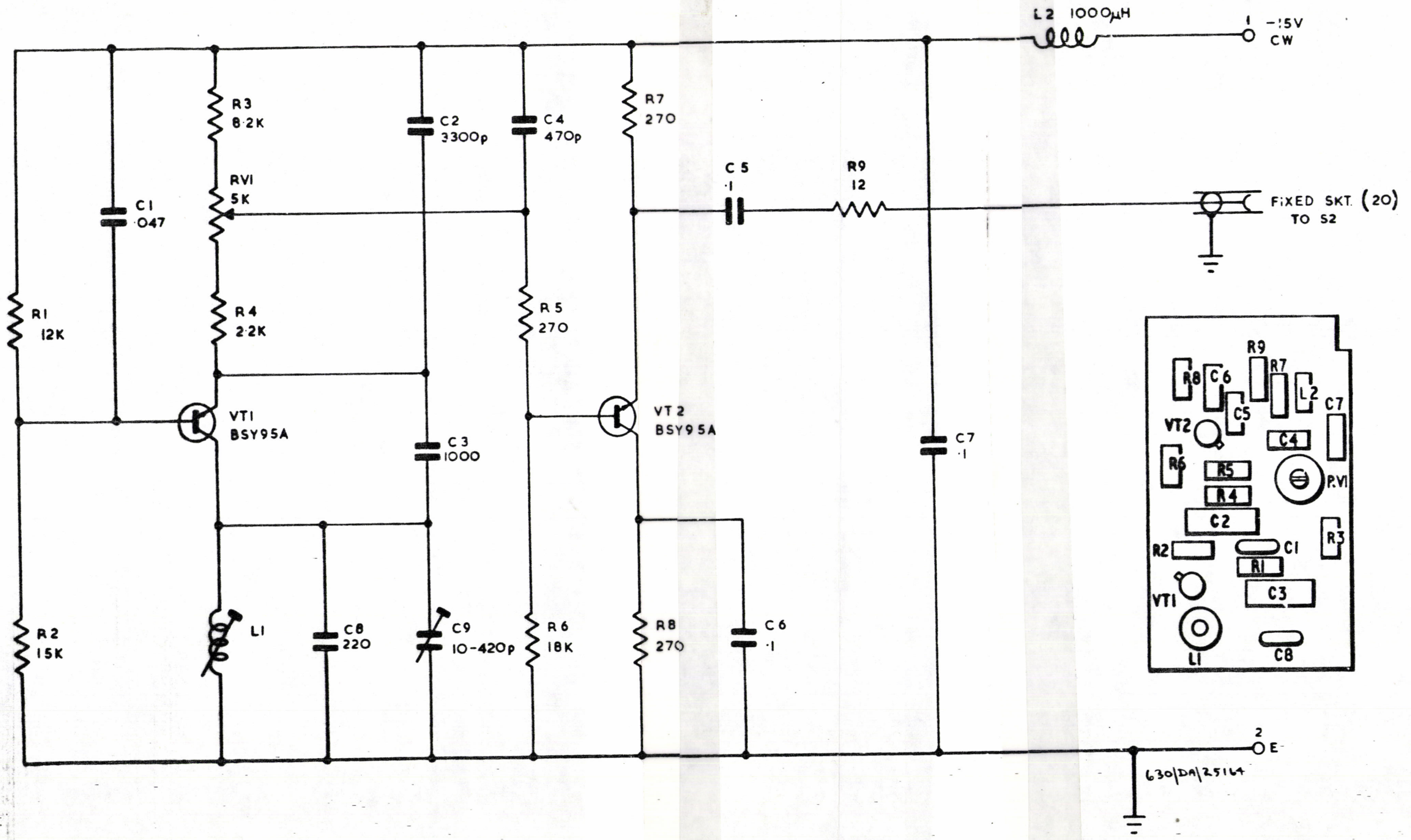
-15V 55B



Modification	Fig 20	Issue
1	2	3
4	5	6
7	8	9
10	11	12

FIG. 20. PR155 100KHz DIVIDER AND CALIBRATE CIRCUIT, MODULE 12 : CIRCUIT AND BOARD LAYOUT

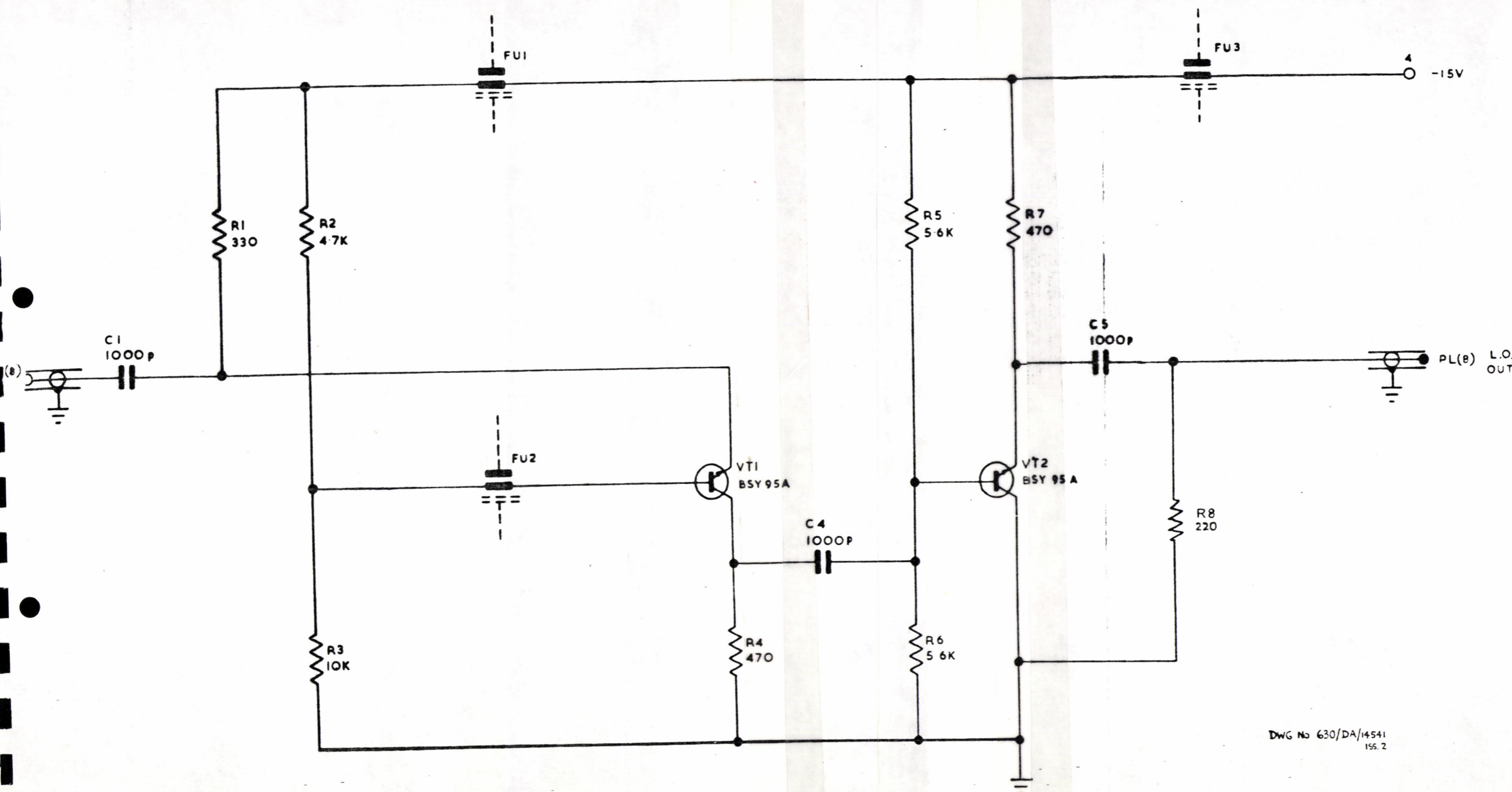
FIG. 20.
MODULE 12



Modifications		Fig. 21	Issue 5
1	2	3	4
5	6	7	8
9	10	11	12

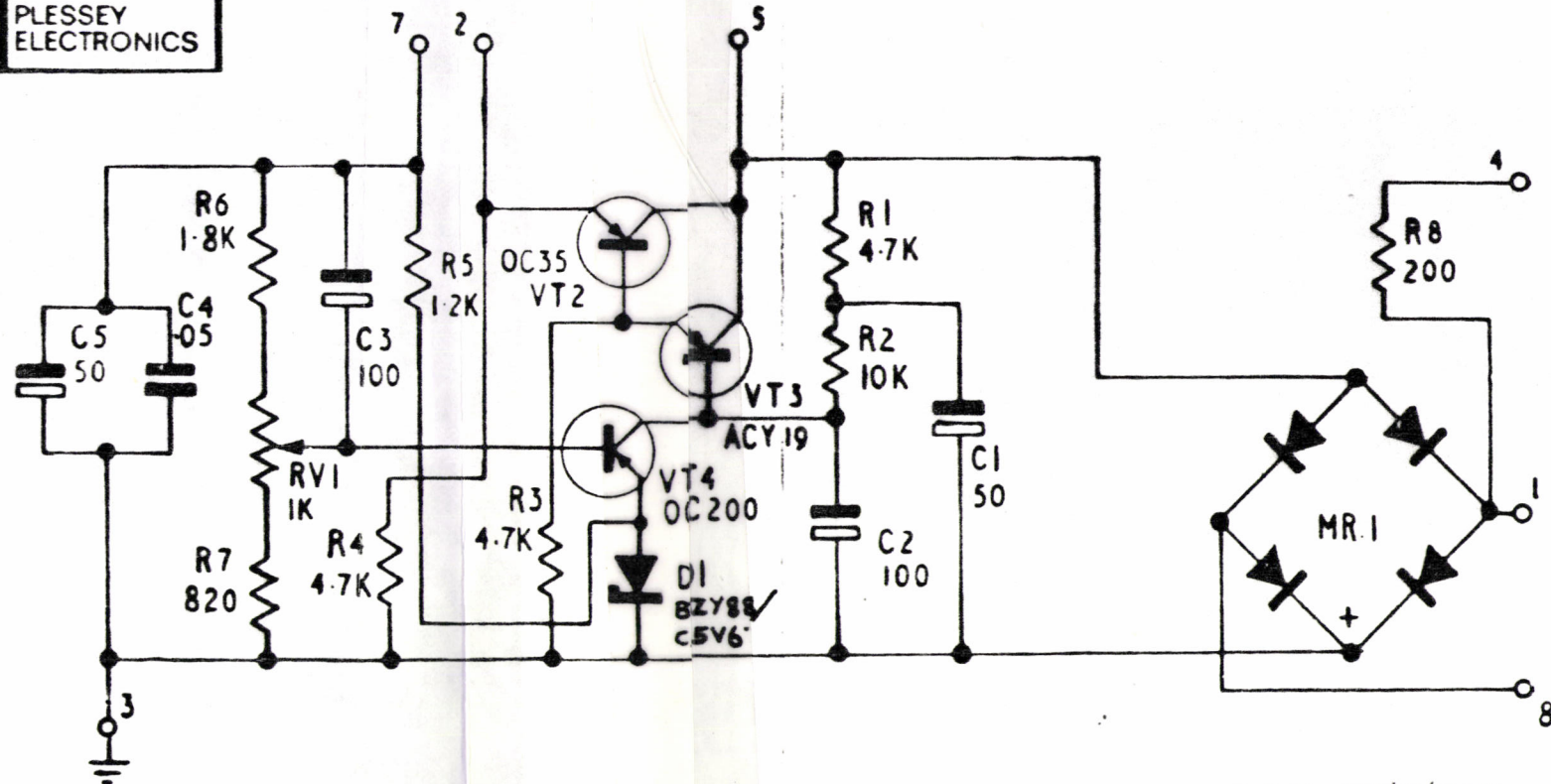
FIG. 21. PRI55 B.F.O. CIRCUIT AND LAYOUT

FIG. 21. B.F.O.

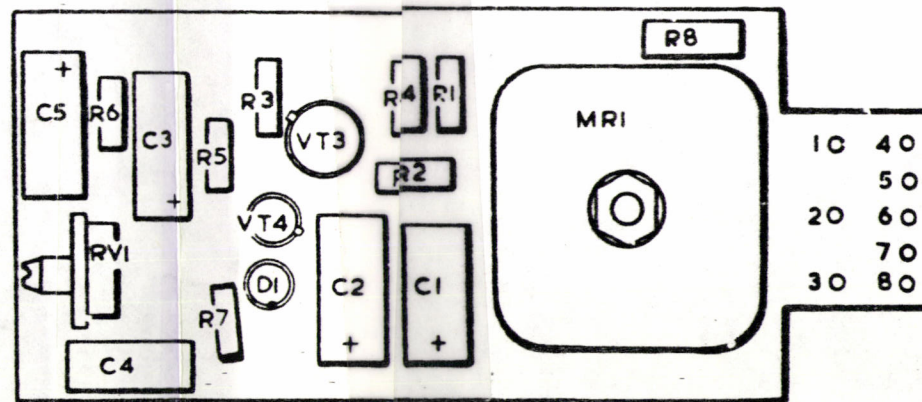


DWG No 630/DA/14541
ISS. 2

FIG. 22. ISOLATING AMPLIFIER : CIRCUIT



DWG No. 630/DA/14608



VT2 BELOW

DWG No. 630/1/14608

Modifications	Fig. 23	Issue 4
1	2	3
4	5	6
7	8	9
10	11	12

FIG. 23: REGULATOR: CIRCUIT AND LAYOUT.

FIG. 23. REGULATOR