

**THE PLESSEY COMPANY LIMITED**  
**PLESSEY AVIONICS & COMMUNICATIONS**



SERVICE MANUAL  
FOR  
PR1553  
MF/HF COMMUNICATIONS RECEIVER

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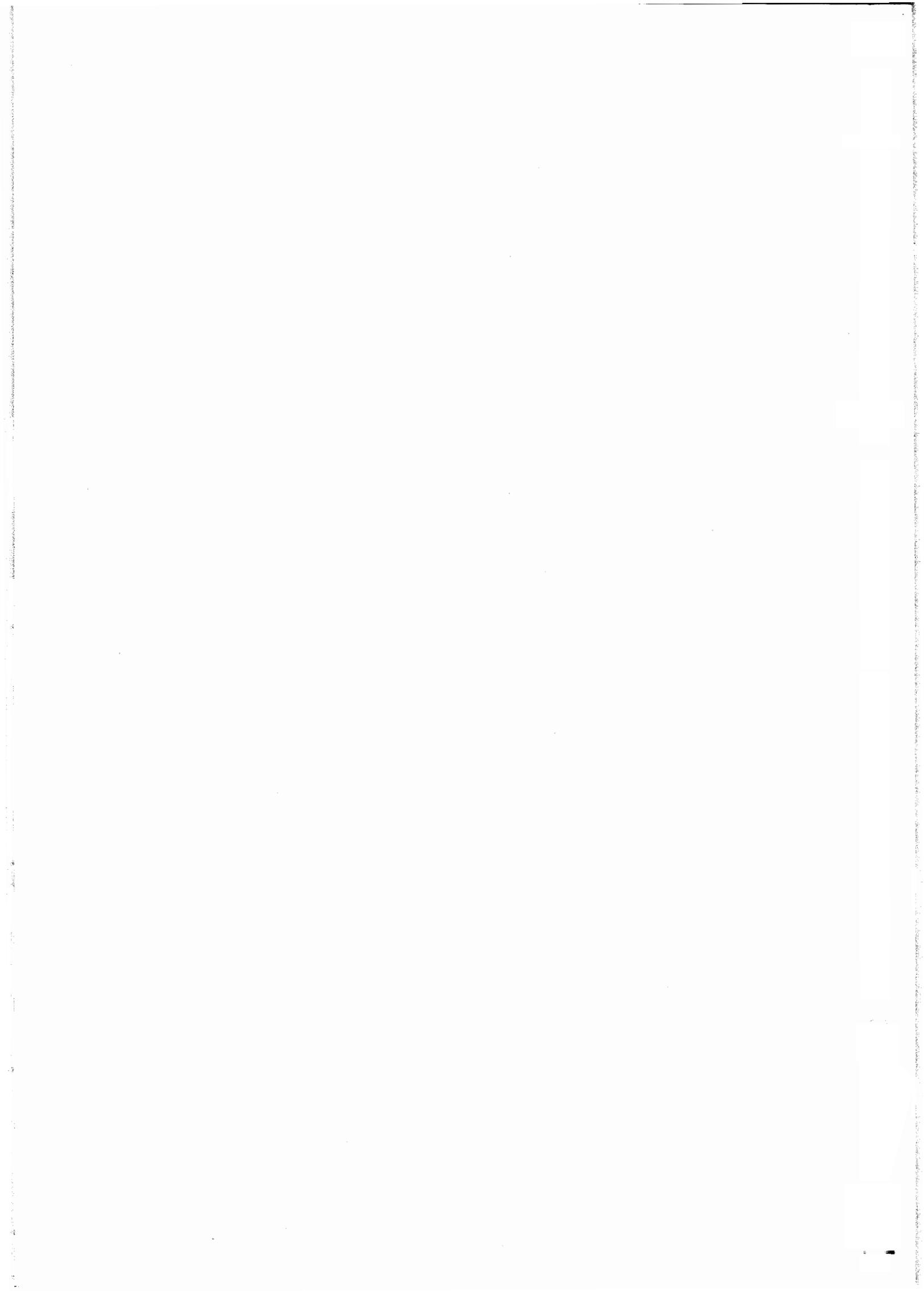
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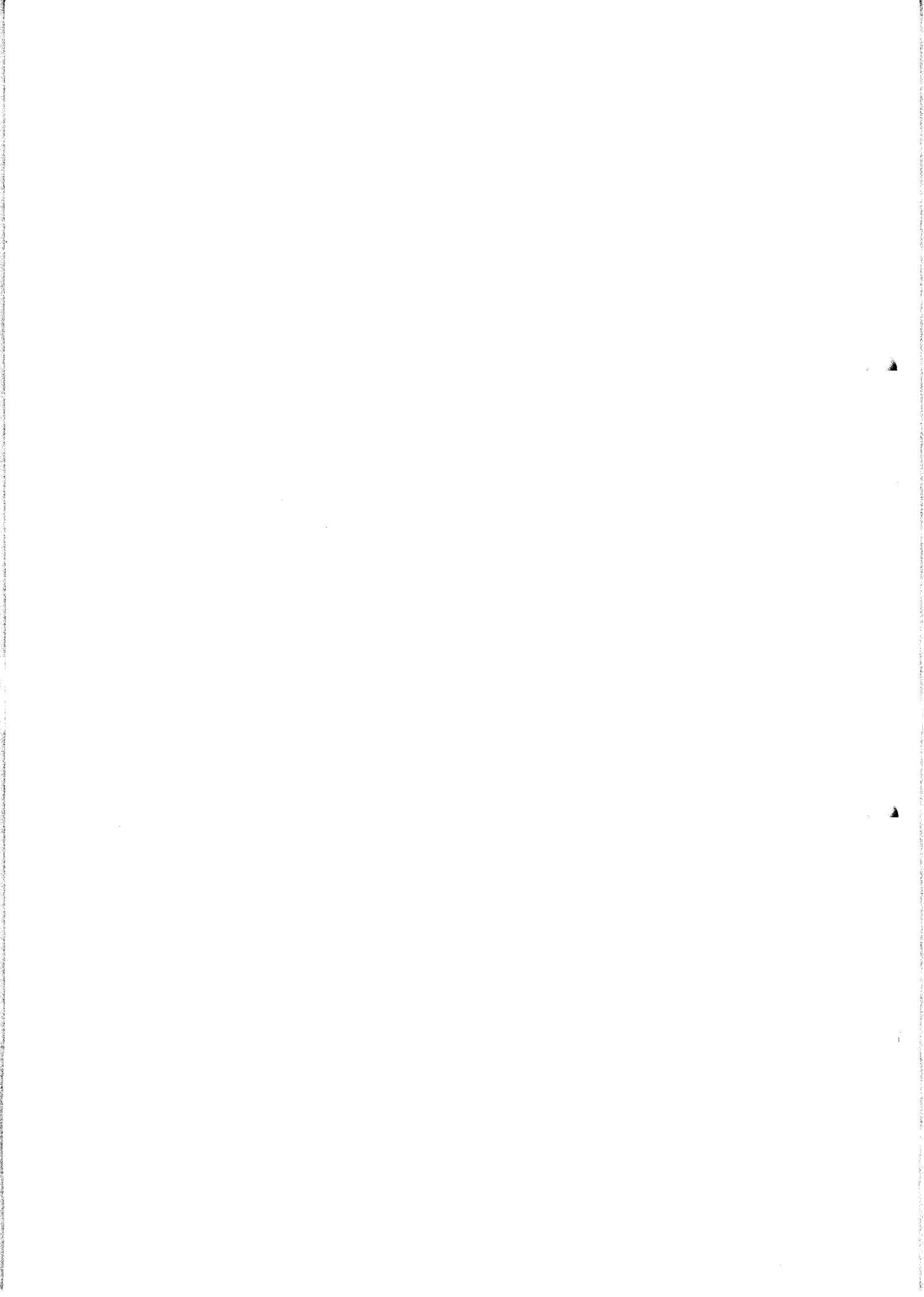
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PR1553 MF/HF RECEIVER



## TECHNICAL SUMMARY

Frequency Range: 60kHz to 30.1MHz continuous coverage (will operate down to 15kHz with slight degradation of performance).

Modes of Reception: CW (A1), MCW (A2), AM (A3), DSB, SSB (A3A, A3J, A3H). FSK (F1 with converter).

Frequency Stability  
Unlocked: After 4 hours warm-up at steady ambient, less than 30Hz drift per hour.  
Locked:  $\pm 2$  parts in  $10^7$ ,  $\pm 2$ Hz, over  $-20^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$ . At constant ambient this improves to  $\pm 3$  parts in  $10^8$ ,  $\pm 2$ Hz.

Drift with change of ambient (unlocked): Less than 40Hz per  $^{\circ}\text{C}$  after 5 hour warm-up.

Bandwidths:

Filter	6dB point	60dB point	Shape
150Hz >	150Hz <	1.8kHz	Symmetrical
300Hz >	300Hz <	3.0kHz	Symmetrical
1.4kHz >	1.4kHz <	5.5kHz	Symmetrical
3.5kHz >	3.5kHz <	12.0kHz	Symmetrical
6.0kHz >	6.0kHz <	18.0kHz	Symmetrical
12.0kHz $\frac{\mu}{\mu}$	12.0kHz <	36.0kHz	Symmetrical
3kHz SSB	3.0kHz <	4.8kHz	Asymmetrical

Sensitivity:  
(up to 30.1MHz typical)  
CW: 0.5 $\mu\text{V}$  for a 20dB signal/noise ratio  
AM: 2.5 $\mu\text{V}$  for a 10dB signal/noise ratio  
SSB: 0.5 $\mu\text{V}$  for a 10dB signal/noise ratio

Tuning: Continuous tuning over thirty 1MHz bands is provided by the use of a switch and a tuning control. The selected frequency is displayed on a digital indicator on the front panel.

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

AGC: Output constant within 4dB for approximately 130dB change in input level above AGC threshold approximately 0.5 $\mu\text{V}$  e.m.f.

AGC Time Constant:

	Attack	Decay
Short	10ms	100ms
Medium	10ms	1sec.
Long	10ms	10sec.

BFO: Variable  $\pm 8$ kHz with slow motion tuning and calibration facility.

RF Input: Nominal 75ohm. Can accept, without damage, either signals up to 30V e.m.f. of 15 mins. duration or 6V e.m.f. continuously.

IF Output: 100kHz, nominal 50mV across 75ohm. Following IF selectivity.

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

Audio Output Level: 150 line - 40mW; 600Ω line - 10mW  
Loudspeaker - 400mW; Headphones - 7mW

Noise Figure: Typically 8dB.

Audio Frequency Response: Within 4dB from 300Hz to 12kHz.

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

IF Rejection: Typically 75dB.

Image Rejection: Not less than 80dB up to 15MHz.  
Not less than 70dB 15-30MHz.

Internally Generated Spurious Responses: Less than equivalent 0.2μV e.m.f. all responses except up to eight which are less than 0.5μV e.m.f. equivalent between 500kHz - 30.1MHz.

Spurious Response to external signals: Better than 70dB ref. threshold (approximately 0.5μV e.m.f.).

Blocking: With receiver tuned to any frequency between 2MHz and 30MHz and a wanted signal level of 1mV e.m.f. the level of an interfering signal 290kHz removed required to reduce the output by 3dB is greater than 200mV e.m.f.

Cross Modulation: With the receiver tuned to any frequency between 2MHz and 30MHz and a wanted signal level of 1mV e.m.f. the level of an interfering signal 290kHz removed required to produce cross-modulation 20dB down on reference (1mV 30% modulated) is greater than 200mV e.m.f.

Inband Intermod. 2nd order - 30dB, 3rd order - 35dB.

Out of Band Intermod. With the receiver tuned as for cross modulation two interfering signals +65dB reference level producing 12dB  $\frac{S+N}{N}$  ratio and spaced +10kHz and +20kHz from tuned frequency produce an inter-modulation product at the tuned frequency equivalent to a wanted signal reference level.

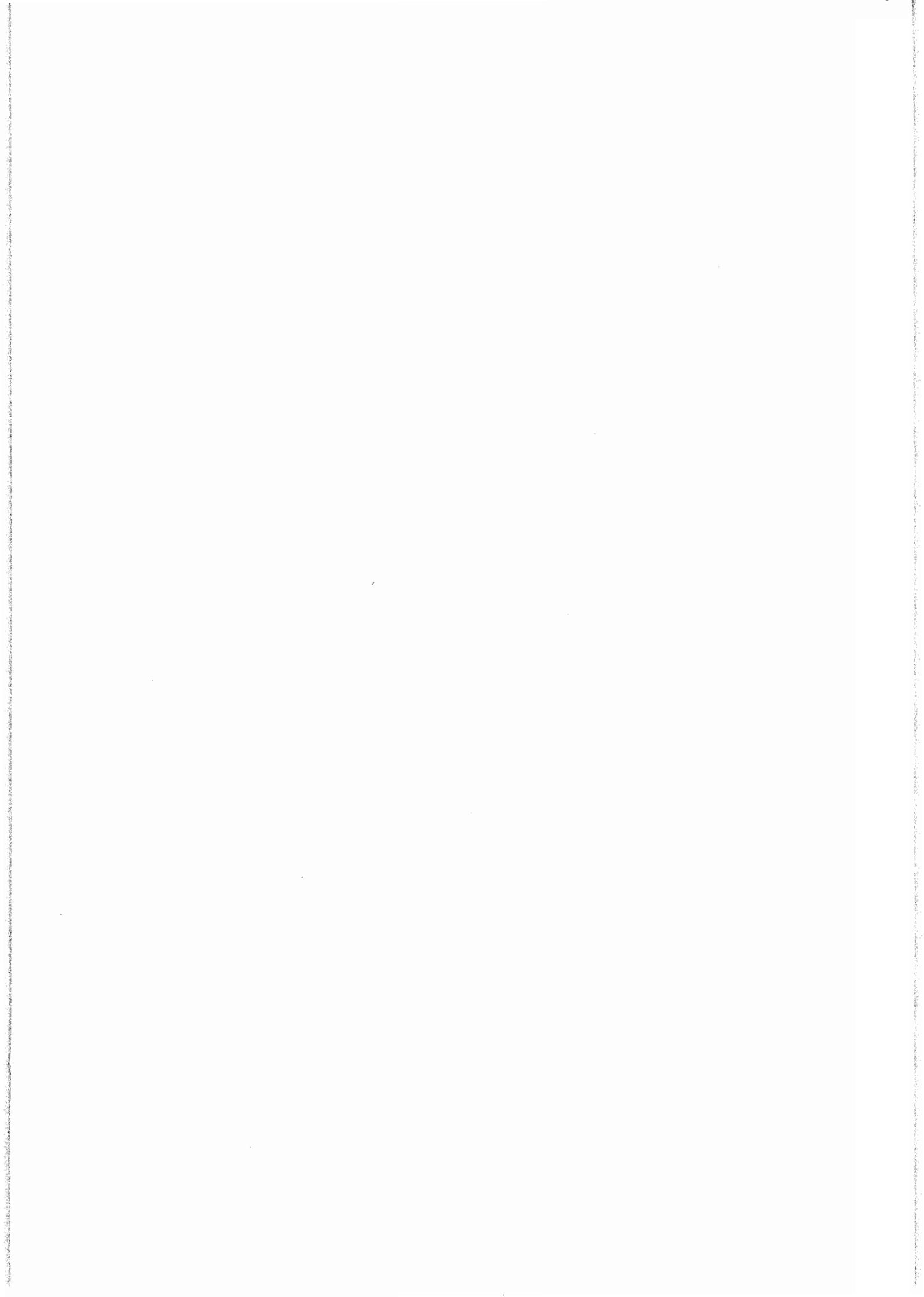
Power Requirements: 100V to 125V, or 200V to 250V, 48Hz to 420Hz single phase. Power consumption 64VA at 240V, 50Hz.

Environment:

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

Dimensions and Weight:

Width:  $16\frac{3}{4}$  in. (42.54cm)  
Height: 7 in. (17.78cm)  
Depth: 17 in. (43.18cm)  
Weight: 38 lbs. (17.3kg)



## CHAPTER 1

### INTRODUCTION

#### 1.1 GENERAL

The PR1553 MF/HF Receiver is an all transistor receiver designed for the reception of AM, CW, MCW, DSB or SSB signals in the frequency range 15kHz to 30MHz. Facilities can be provided to receive other types of transmission, if required. A second receiver may be controlled in a Dual Path system, utilising the V.F.O. and 1MHz external output sockets for frequency control.

The frequency counter circuits and digitron display forms an integral part of the receiver. Silicon integrated circuits are used in the frequency lock module and the counter circuits. The receiver will lock effectively to the 100Hz digit and any discrete frequency between 100Hz points is available by manipulation of the fine tune control which alters the read-out on the least significant digit.

Protection circuits are incorporated in the receiver which will enable a continuous RF input signal of up to 30V e.m.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 the operation of headsets and a 150 ohm and 600 ohm, balanced or unbalanced external line output. An internal loudspeaker is fitted. A digital display panel on the front of the receiver shows the frequency to which the receiver is tuned.

The equipment is designed to operate from a 100V to 125V or 200V to 250V, 48Hz to 420Hz single phase supply. Power consumption is approximately 64VA at 240V, 50Hz. All illustrations referred to in Chapters 1, 2 and 3 are in Chapter 7 at the end of this manual.

#### 1.2 MECHANICAL DESCRIPTION

##### 1.2.1 General

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.

##### 1.2.2 Main Chassis

The main chassis, with modules and sub-assemblies in position, is illustrated in Fig.1B.

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 eight, the BFO, interpolating oscillator, 5V regulator, 1MHz oscillator, counter assembly and turret modules are mounted above the main chassis member. The turret module protrudes through from the underside,

on which the isolating amplifiers are 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 fuseholder, link panels and the provisions for external connections to the receiver in the form of a plug, sockets and a terminal block.

### 1.3 MODULES

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. For identification, each of the modules is given a part number as indicated in the following list.

PR1553 - 630/1/25357/09

Item	Module No.	Part No.
RF Amplifier	1	630/1/17670
1st Mixer	2	630/1/14111
1st Local Oscillator	3	630/1/14112
Amplifier/2nd Mixer	4	630/1/14117
10.7MHz Amplifier/3rd Mixer	5	630/1/17760
100kHz Amplifier/Detector	7	630/1/27993
AGC Amplifier and Detector	8	630/1/17750
Audio Amplifiers	9	630/1/14119
Spectrum Generator Mk.II	10	630/1/14930
10.6/10.8MHz Generator Mk.II	11	630/1/14938
Integrator	13	630/1/25352
Waveform Generator	14	630/1/25354
Fixed BFO	-	630/1/28128
Interpolating Oscillator	-	630/1/25261
Isolating Amplifier	-	630/1/14541/001
BFO	-	630/1/23304
Turret Assembly	-	630/1/25395
Regulator Assembly	-	630/1/14608
Shaper Board	-	630/1/17869
Meter Amplifier	-	63Q/1/17742
1MHz Oscillator	-	630/1/28133
5V Regulator and 1MHz Isol. Amp.	-	630/1/25253
Counter Assembly (micro-min.)	-	630/1/25373

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 drive.

The counter assembly is of micro-miniature construction and is mounted on the front panel. It consists of a metal box which houses a 'mother board' on to which plug five decade counter boards, each mounting its own display tube: a 'megahertz board' which mounts two display tubes driven directly from the MEGAHERTZ switch S3; a decimal point indicator neon and a  $\pm 1$ MHz indicator neon. All connections to the counter unit are via plugs and sockets.

#### 1.4 BRIEF TECHNICAL DESCRIPTION (See Fig.2)

Three stages of frequency conversion are used in the receiver, the intermediate frequencies being 37.3MHz, 10.7MHz and 100kHz.

The received signal is filtered in one of eight sub-octave bandpass filters in turret compartment 1, the filter appropriate to the signal frequency being selected by the setting of the MEGAHERTZ control. After filtering the signal is amplified in a wideband amplifier (module 1). This amplifier incorporates a gain control loop which enables it to accept signal amplitudes in excess of 1V and at the same time maintain an output level compatible with minimum cross modulation and intermodulation products. The RF amplifier output is applied to the 1st mixer (module 2) in which it is mixed with the signal from the 1st local oscillator (module 3) for conversion to the 1st IF of 37.3MHz.

The 1st local oscillator covers the frequency range 37.3MHz to 67.3MHz. A free-running oscillator, capable of being tuned to any frequency within the range, is used and tuning is effected by a phase lock control loop.

The 1MHz oscillator unit generates a stable 1MHz signal which is applied to the spectrum generator (module 10) via the 1MHz isolating amplifier in the 5V regulator unit.

The spectrum generator output is fed, via turret compartment 2, to turret compartment 3 where the spectrum generator frequency, appropriate to the received signal frequency, is selected by means of tuned selective amplifiers. The tuning of the amplifiers is dependent upon the coils selected as a result of rotating the turret switch. In compartment 3, the signal from the interpolating oscillator is added to the signal from compartment 2 to produce a synthesizer signal at the desired local oscillator frequency.

Provision is made for the use of external oscillators in place of either or both the interpolating oscillator and the 1MHz oscillator which drives the spectrum generator.

When the LOCK switch S5 is switched to ON, the interpolating oscillator frequency is locked to the 1MHz crystal oscillator frequency, the tuning then being in 100Hz increments. The FINE TUNE control RV3 is included to adjust the receiver frequency between 100Hz points. The LOCK facility may be switched ON or OFF by means of front panel switch S5.

The output from the 1st local oscillator is fed into compartment 3 via two isolating amplifiers. The 1st local oscillator frequency is compared with the synthesized frequency and a control voltage, whose magnitude is proportional to the frequency difference, is produced. This control voltage is used to tune the 1st local oscillator until no control voltage is present, i.e. there is no frequency error.

The 1st IF signal is filtered in module 2 by a crystal filter having a 12kHz bandwidth. It is then amplified and mixed with a 48MHz (2nd local oscillator) signal from module 10, for conversion to the 2nd IF of 10.7MHz in the 37.3MHz amplifier and 2nd mixer (module 4). A second crystal filter follows the 2nd mixer and the filtered 10.7MHz output obtained is amplified and undergoes the final stage of frequency conversion to 100kHz in module 5. The 3rd local oscillator is the 10.6/10.8MHz generator (module 11). The output is dependent upon the mode of operation selected, i.e. 10.8MHz for USB operation and 10.6MHz for other modes.

The 3rd IF signal is filtered by one of seven bandpass filters, the bandwidth being selected by the BANDWIDTH selector switch. The frequencies of the filters fitted in the receiver are 3kHz (SSB), 150Hz, 300Hz, 1.4kHz, 3.5kHz, 6.0kHz and 12kHz.

Final IF amplification and detection takes place in module 7. A product detector is used for SSB and CW operation, and an envelope detector for AM. The 100kHz signal for carrier reinsertion on SSB is obtained from module 14 and a BFO is provided for CW operation. In addition a fixed BFO is provided for FSK reception when this mode is selected on the FUNCTION switch.

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

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

The counter unit displays the selected frequency to the nearest 10Hz on seven digitrons. The first two digitrons show the number of MHz and are controlled directly from the MEGAHERTZ switch. The remaining five digitrons are controlled by the counter circuits and display the remainder of the frequency count in decimal form.

Three separate d.c. supplies are derived from the mains supply via three of the four secondary windings on the mains transformer. From the 180V winding a 200V rectified and smoothed voltage supplies the digitrons. A 9V a.c. output feeds the 5V regulator unit supplying the waveform generator and the counter. The remainder of the receiver units are supplied from a regulated 15V supply derived from the 22V a.c. winding. The 12V a.c. winding of the transformer supplies power for the oven heater and oscillator circuits in the 1MHz unit.

## 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:

FUNCTION switch, S1:	An eight-position switch, used to switch the receiver into one of the conditions OFF, STANDBY, BFO, CAL, USB, LSB, CW, AM or F.
BANDWIDTH selector switch S2:	A seven-position switch used to select either the SSB condition or one of six bandwidths - 12kHz, 6kHz, 3.5kHz, 1.4kHz, 300Hz or 150Hz.
MEGAHERTZ control S3:	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 by the first two digits on the digital display panel.
Tuning control (kHz):	Used to tune the interpolating oscillator to the required 'kilohertz' frequency as indicated by the last five digits on the display panel. Fast or slow motion drive is provided by the SLOW/FAST/SLOW control below the tuning control.
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 0.1 sec., 1 sec. or 10 secs.
BFO control:	Used to tune the BFO by $\pm 8$ kHz about its nominal frequency.
AUDIO GAIN control (RV2):	Used to adjust the gain of the audio amplifier.
RF/IF GAIN control (RV1):	AGC off : Manual gain control AGC on : AGC threshold control
METER switch S6 (AF/RF):	Used in conjunction with the meter (M1) to monitor the audio output or as a '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 oscillators to be disabled when external oscillators are to be used.

LOCK control S5:

Used to switch ON the frequency lock facility when required. Accurate frequency setting is then by means of the FINE TUNE control.

FINE TUNE control (RV3):

Provides interpolation between 100Hz points in the frequency lock condition.

Loudspeaker muting:

Two headphone jacks are provided. When the lower jack is in use the loudspeaker is automatically muted.

## CHAPTER 2

### INSTALLATION, SETTING UP AND OPERATION

#### 2.1 INSTALLATION

##### 2.1.1 General

When received, the PR1553 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. 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

The mains 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

##### 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.

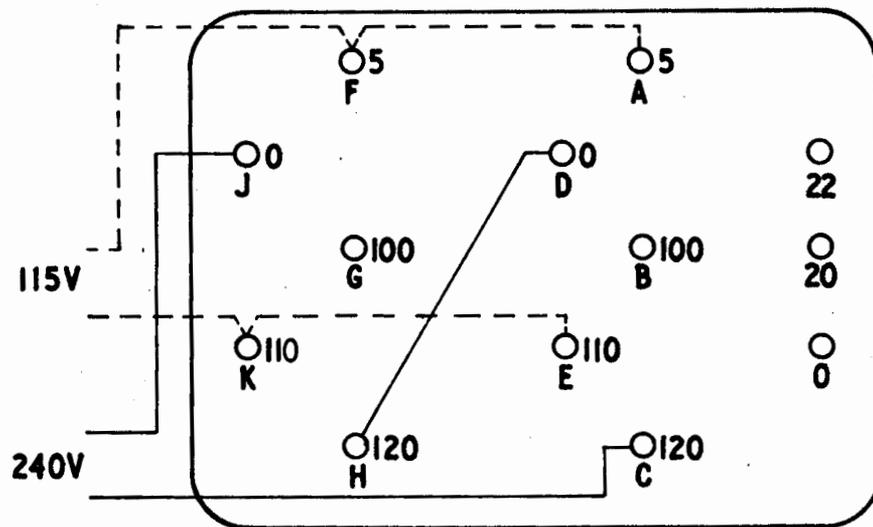
#### 2.2 SETTING UP

##### 2.2.1 Power Supply

The equipment is normally despatched from the manufacturers with the mains transformer tappings 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 the mains fuse is of the correct rating (1A for 200V to 250V operation and 2A for 100V to 125V operation).

The mains power is input to the transformer via a switch mounted on the FUNCTION switch (S1) spindle. Mains power is switched on when the FUNCTION switch is selected to any position except OFF.

MAINS  
TRANSFORMER  
TAPPINGS



Volt- age	Input to	Link	Volt- age	Input to	Link	Volt- age	Input to	Link
100	J & G	J to D and G to B	200	J & B	G to D	230	J & E	H to D
105	F & G	F to A and G to B	205	F & B	G to D	235	F & E	G to D
110	J & K	J to D and E to K	210	J & E	G to D	240	J & C	H to D
115	F & K	F to A and E to K	215	F & E	G to D	245	J & C	H to A
120	J & H	J to D and C to H	220	J & E	K to D	250	F & C	H to A
125	F & H	F to A and C to H	225	F & E	K to D			

### 2.2.2 Link Connections

If the internal 1MHz oscillator and VFO (interpolating oscillator) are to be used, set the INT. 1MHz and INT. VFO links to the ON position. If either, or both, oscillators are 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.

The appropriate connections must be made between the various modules via Panel 0, mounted over transformer T2. This panel and its connectors have been given numbers on the manual drawing for convenience of reference, but these numbers do not appear on the equipments. The leads are numbered appropriately, with sleeves, on the equipment. The connections to be made are as follows:

- (1) Internal Oscillators in use (connections as shown in Fig.1).
  - (a) Cable 26 is connected to SKTSB, Panel 0.
  - (b) Cable 44 is connected to the 1MHz oscillator.

(c) Cable 46 is connected between the 1MHz oscillator and SKTC, Panel 0.

(d) Cable 41 is connected between Module 14 and the VFO.

(2) External Oscillators in use

(a) To use External 1MHz oscillator:

(i) Change Cable 46 to load socket, Panel 0.

(ii) Disconnect Cable 44 from 1MHz oscillator and place in SKTC, Panel 0.

(b) To use External VFO:

(i) Disconnect Cable 26 from SKTSB, Panel 0.

(ii) Disconnect Cable 41 from the VFO and connect it to SKTSB, Panel 0.

(iii) For stowage, anchor Cable 26 in vacant VFO socket.

Set the LINE OUTPUT IMPEDANCE LINK to the appropriate position.

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:

FUNCTION switch (S1): to STANDBY

BANDWIDTH switch (S2): to the required bandwidth

AGC switch (S4): to 0.1 sec. position for tuning;  
to 1 or 10 sec. position when on tune.  
The 0.1 sec. position may be used on tune when rapid signal fading is experienced.

LOCK switch (S5): to OFF

BFO: to 0

AUDIO GAIN: to mid-position

RF/IF GAIN: initially fully clockwise, then adjusted to suppress the received background noise if required.

METER switch (S6): to RF

After allowing a period of 10 minutes for the oscillators to stabilize, set the control switch for the mode of operation required. Turn the MEGAHERTZ control until the 'megahertz' portion of the required reception frequency is indicated by the first two digits of the frequency counter display. Turn the RF/IF GAIN control anti-clockwise until the background noise in the speaker or headphones is reduced to a tolerable level. With the SLOW/FAST/SLOW control at FAST rotate the main tuning control until the 'kilohertz' portion of the required frequency is displayed by the remaining five digits of the counter. If necessary, set the SLOW/FAST/SLOW control to SLOW and tune for maximum signal as indicated by the tuning meter. For fine tuning and stability switch LOCK switch to ON and adjust FINE TUNE.

NOTE: The main tuning control provides a total tuning range from the interpolating oscillator of 1.2MHz (i.e. 1MHz with an overlap of  $\pm 100\text{kHz}$ ). As the 'MHz' indication is independent of this control it is therefore possible, when the tuning control is at either end of its travel, for the 'MHz' digits to indicate a frequency 1MHz above or below the true value. To guard against errors in read-out under these conditions an indicator showing ' $\pm 1\text{MHz}$ ' is illuminated at the left-hand end of the display panel.

Adjust the AUDIO GAIN control for optimum signal in the headphones or loudspeaker.

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

When the LOCK switch is switched to ON the FINE TUNE control will give interpolation between 100Hz points.

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

When the MEGAHERTZ control is set to the MHz of the required frequency, the filter appropriate to that frequency is automatically selected. The filters are 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 (Board A1) and SKT3/PL3 to the RF amplifier module 1. The filter C2/L1, on board A1, functions as an image rejector.

#### 3.2 RF AMPLIFIER MODULE 1 (Fig.5)

The RF amplifier comprises one stage of amplification (VT1) followed by three emitter follower stages, (VT2-4). It is preceded and followed by variable attenuators in the form of shunt diodes which are selected for high storage to prevent diode non-linearity effects.

The front end diodes are controlled by a local a.g.c. loop (VT9 and VT10). The voltage which operates 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/C15.

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

As the signal level increases to 20mV 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, thus applying some attenuation to the input signal. With further increases in signal strength VT9 draws more 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. The a.g.c. line from module 8 is applied to a control amplifier VT5 and VT6. This operates in a similar way to VT9 and VT10. As VT6 draws more current via D4 so the output signal is attenuated to maintain an output of approximately 30mV to prevent overloading of the first mixer. Threshold variation is by adjustment of RV1, the voltage across which is held constant by zener diode D5 and D6-D7.

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

The signal input to module 2 is applied via a 30MHz 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 ring bridge mixer configuration, the output from which, at the first IF of 37.3MHz, is filtered by the 37.3MHz bandpass filter FL1 and applied to the first IF amplifier in module 4.

### 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 Z1. 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. 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 Mk.II (Fig.8)

This module contains a spectrum generator (Board A) and a 48MHz selector circuit (Board B). The spectrum generator generates outputs at 1MHz spacing, covering the spectrum 35MHz - 64MHz. The selector circuit selects the 48MHz output from the spectrum generator for use at the second stage of frequency conversion.

A 1MHz signal, from either the 1MHz Oscillator unit or from an external 1MHz oscillator, is applied to amplifier stages VT3, VT4 and VT5. The output from VT5 is differentiated to produce harmonics at 1MHz spacing within the 35MHz - 64MHz spectrum. These harmonics are then coupled via emitter follower VT6 to provide three outputs:

- (a) One output is coupled to the 48MHz selector circuit in board B.
- (b) A second output is coupled via emitter follower VT7 to provide an output to the 10.6/10.8MHz Generator Mk.II (Module 11).
- (c) A third output is coupled via emitter follower VT9 and high-pass filter C20, C21, C30, L1, L2 to the Megahertz Selector in the Turret Assembly (Compartment 2).

The spectrum output from board A is injected at the base of VT1 on board B. The collector circuit of VT1 is tuned to 48MHz 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 48MHz, thus the 48MHz of the input signal is amplified and reproduced relatively free of all unwanted frequencies at VT2 emitter. From VT2 the 48MHz output is filtered in L2 (tuned to 48MHz), C4 and C5 and applied via VT3, an emitter follower, to a further selector circuit in module 4. The d.c. supply to VT1, VT2 and VT3 is locally stabilised at 10V by zener diode D2.

The -15V d.c. supplies to the spectrum generator and the 48MHz selector circuits are each independently filtered in filter circuits contained on board B.

### 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 a synthesized signal at first local oscillator frequency in order to control the first local oscillator at this frequency. It is tunable over the range 2.2MHz to 3.4MHz and the tuning is linear. A control voltage from the integrator (module 13) is applied to variable capacity diode D3 in order to control the oscillator frequency.

Transistor VT1 operates in a tunable oscillator circuit in which L1 is the variable component. Linearity of tuning is achieved in manufacture 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 follower/buffer stage VT2 to an amplifying stage VT3. The amplified output from VT3 is fed out to turret compartment 3 (3.8) via a second emitter follower VT4. A second output from VT4 is taken, via SKT41, to the waveform generator (module 14) which is used in conjunction with the integrator (module 13) to form a phase lock loop (para. 3.9.5). Output amplitude is adjusted by RV1 to a nominal 400mV r.m.s. at SKT26. 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 48MHz 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 35MHz to 64MHz) 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 respectively.

#### 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 a 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.

The synthesized frequency output from board G, at the required local oscillator frequency, is applied via a high pass filter circuit to the base of VT8 and the amplified output from VT8 collector is coupled via emitter follower VT7 to a second amplifier VT6, whose output is limited by the clipping diodes D5 and D6 and applied via two emitter followers, VT5 and VT4, to the phase detector.

When the two inputs to the phase detector are in quadrature, zero output is obtained. The output rises to a maximum in one polarity when the signals are of the same frequency and in phase, and in the other polarity when they are anti-phase. The output from the detector is integrated by R8, C5 and then applied to the amplifier on board J.

### 3.8.4 DC Amplifier and Reactor Sweep Generator, Board J (Fig.13)

A sweep voltage, whose mean level is variable according to the setting of the MEGAHERTZ control, is generated by a multivibrator in order to sweep the first local oscillator through the required frequency. The multivibrator employs transistors VT8 and VT9, whose collectors are returned to earth via a tapping on the resistance chain on wafer E of turret compartment 2 to control the mean level of the output from VT9 collector. The amplitude of the output from VT9 collector can be preset by adjustment of RV2. The squarewave voltage at the collector of VT9 is integrated by R21, C4 to produce an approximation to a sawtooth waveform. This sawtooth is applied to the base of VT6, which operates with VT5 in a differential amplifier circuit. Assuming no input to VT5 base, the sweep waveform appears at its collector and is directly coupled to VT7 base, controlling the emitter current. This current is drawn via one winding of the saturable reactor in the first local oscillator (Fig.7), sweeping the local oscillator frequency about the required frequency.

Transistors VT1 and VT3 are connected as a differential amplifier in which the total current drawn is maintained constant at a level controlled by VT2 and determined by the setting of RV3, the voltage across RV3 being clamped

by zener diode D1. Balance of the amplifier is preset by the setting of RV1 to give equal collector voltages. The output from the phase detector (board H) is applied between the transistor bases, but VT3 base is clamped by D1. Thus, antiphase voltages are developed at the two collectors when the local oscillator frequency is the same as the synthesized frequency obtained from board H. The amplitudes of these outputs are affected by the transistor characteristics and are not necessarily equal, the most suitable output is selected by the setting of a link in manufacturing tests. The selected output is coupled to the base of emitter follower VT4 and the voltage developed at VT4 emitter is connected to D1 and D2 in the first local oscillator to provide a fine control of oscillator frequency.

The emitter of VT4 is also directly coupled to VT5 base to oppose the sweep voltage at VT6 base and thus maintain a constant current through VT7, i.e. through the saturable reactor.

To summarize: the sweep voltage sweeps the local oscillator towards the frequency required; when this frequency is equal to the synthesized frequency a voltage is developed to provide accurate tuning and at the same time the reactor current is clamped at the value appropriate to this frequency. Thus the local oscillator is swept quickly on to frequency and held for the duration of each sweep from the multivibrator.

### 3.9 WAVEFORM GENERATOR MODULE 14 (Fig.20)

This module mainly controls the interpolating oscillator frequency locking circuits and the micro-miniature counter unit, but also controls other functions. A list of the generated waveforms and their uses is given below:

- (a) 100kHz CARRIER SIGNAL - used for carrier re-insertion on SSB operation and for BFO calibration.
- (b) 4Hz WAVEFORM - used in the overspill/underspill indicator circuits ( $\pm 1$ MHz) in the micro-miniature counter unit.
- (c) 8Hz 'GATE' WAVEFORM - used in the micro-miniature counter unit to gate the interpolating oscillator signal to a 100ms count period, and to generate the variable gate waveform.
- (d) VARIABLE GATE WAVEFORM - used in the interpolating oscillator frequency locking circuits and to generate the 'transfer' and 'reset' pulses.
- (e) 'TRANSFER' AND 'RESET' PULSES - used in all counting circuits.

#### 3.9.1 100kHz Carrier Circuits, Boards B and C

The 1MHz signal from the 1MHz oscillator unit is connected to the base of VT1 on board B via C1. VT1 is an emitter-follower whose output drives the divide-by-ten package ML8. The 1MHz signal is divided in two stages, firstly by five and then two. The 100kHz square-wave output from ML8 is fed via a buffer, incorporated in package ML7, to tuned circuit L1-C4 on board C and serves to restore the 100kHz signal to a near sine wave. The 100kHz sine wave signal is then fed via D1 for carrier re-insertion on SSB operation and for BFO calibration when front panel switch S1 is set to the relevant position.

### 3.9.2 '4Hz' and 'Gate' Waveforms, Board B

The 100kHz signal from the output of ML8 goes through a number of divider circuits to obtain the 4Hz waveform. It is firstly connected to ML9 where it is divided by two and then five. Output from ML9, at 10kHz, is divided by five in ML10 to give 2kHz, divided by five in ML11 to give 400Hz, divided again by five in ML12 to give 80Hz, then divided by ten in ML13 to give the 8Hz gating waveform, i.e. 100ms on, 25ms off.

Finally, the 8Hz signal is divided by two in ML12 to give the required 4Hz square-wave, i.e. 125ms on, 125ms off.

### 3.9.3 Variable Gate Waveform, Board C

The 8Hz gate signal is connected via time constant RV3 (front panel) - R11, C5, C14 to the base of the emitter follower VT3. The signal is then taken from VT3 emitter via a buffer portion of ML14 and time constant R23, C12 and combined with the signal from VT3 emitter to open the gate in ML14 from which a narrow pulse delayed by approximately 5 $\mu$ s from trailing edge is obtained. The delay is variable  $\pm 2.5\mu$ s by FINE TUNE control RV3. This pulse is then connected, together with the original 8Hz gate signal to one of the J-K flip flop sections of ML15, the resultant output of which is an inverted waveform similar to the original 8Hz gate signal but with an on time of 5 $\mu$ s  $\pm$  2.5 $\mu$ s greater. In order that the count of the interpolating oscillator frequency is correct, however, the sample time must be 100ms. This means that the modified 8Hz gate signal must now be shortened by 5 $\mu$ s at the beginning of its on period, and this is performed by connecting it through a similar circuit to the original 8Hz gate signal, to produce a narrow negative pulse delayed by 5 $\mu$ s from the leading edge of the original waveform. The length of the delay is variable by preset potentiometer RV1 which is set to adjust the sample time to 100ms when the FINE TUNE control RV3 is at mid-travel. This second pulse is connected, together with the modified 8Hz gate signal, to the second J-K flip flop section of ML15, the resultant output of which is a variable 8Hz square wave signal with an on time of 100ms  $\pm$  2.5 $\mu$ s and an 'off' time of 25ms. This signal is used to generate the 'transfer' and 'reset' pulses and to gate the interpolating oscillator signal to a count-of-ten unit whose output is not displayed but fed to the integrator module 13 which produces a control voltage to control the frequency of the interpolating oscillator.

### 3.9.4 'Transfer' and 'Reset' Pulse Generators, Board A

The variable 8Hz square wave signal from board C is fed to ML1 which, together with R20/C9, R19/C8, generates the 'transfer' and, R21/C10, R22/C11, the 'reset' pulses. These are triggered by the trailing edge of the 8Hz square wave signal.

### 3.9.5 Frequency Locking Logic Circuits, Board A

The amplified interpolating oscillator signal from VT2 collector is buffered and gated in ML7 by the variable 8Hz square wave signal. The resultant is a 100ms sample of the interpolating oscillator signal which may be varied in length by FINE TUNE control RV3. This sample is fed to a count-of-ten circuit consisting of ML2, ML3 and ML4. This circuit will count the number of tens of Hertz in the nominal 100ms sample, the interrogated output being in Johnson code. Only three of the five code lines are used and the information on these at the end of the 100ms count is transferred via the memory packs ML5 and ML6 to the integrator unit module 13 when the 'transfer'

pulse is applied to ML5 and ML6. The 'reset' pulse is then applied to the count-of-ten circuit ML2, ML3, ML4 to reset the circuit to zero for the next 100ms count. Increasing the length of the 100ms interpolating oscillator sample, or an increase in the oscillator frequency, alters the output to the integrator module 13 which in turn decreases the frequency of the interpolating oscillator, and vice versa.

### 3.10 INTEGRATOR MODULE 13 (Fig.25)

This module uses the logic output from the waveform generator module 14 to produce a d.c. voltage which is applied to the variable capacity diode D3 forming part of the interpolating oscillator tuned circuit.

#### 3.10.1 Frequency LOCK ON Conditions

As the counter in the waveform generator is counting tens of Hertz, when the oscillator is tuned to a 10Hz point the logic on the control line pin 6 will be switching between 0 and 1 and this logic signal is amplified by VT2 to switch VT1. The voltage at pin 5 is stabilized by C10 (main chassis) which charges via R4, D2 and R5 when VT1 is off. The voltage across C10 (pin 5) is amplified by VT5, VT6, VT8 and VT7 fed back to VT1 emitter to increase the charging time constant of C10. When VT1 is switched on, discharge of C10 is through R6 which gives a long discharge time constant. It is this voltage across C10 which is used to control the interpolating oscillator frequency.

When the interpolating oscillator is tuned to a 100Hz point, the logic on guard lines pins 3 and 4 will be 0 and 1 respectively. In this state VT3 will be held off and VT4 will be switched on. C10 (main chassis) will therefore assume a nominal 4.5 volts negative.

Should the oscillator frequency count increase by more than 15Hz, the logic on guard line pin 4 will change to 0 and switch on VT3. This provides a rapid discharge path for C10 via D3 to earth, the voltage on C10 going less negative to bring the oscillator back on to frequency. When the frequency is within 10Hz the logic on pin 4 will revert permanently to 1, cutting off C10 discharge via D3. The logic on pin 6 will then fluctuate between 0 and 1, gradually decreasing the percentage 'on time' of VT1, and therefore the discharge of C10 via R6, until the oscillator returns to its original frequency, when the on/off ratio of VT1 will be 1.

Should the oscillator frequency count decrease by more than 15Hz, the logic on guard line pin 3 will change to 1, switching off VT4. The logic on pin 6 will be 1 and therefore VT2 and VT1 will be off and C10 will continue to charge via D2. C10 will now also charge via R13, D4 and R9, its voltage rapidly going more negative to bring the oscillator back on to frequency. When the frequency is within 10Hz the logic on pin 3 will revert permanently to 0 switching on VT4 which connects D4 to earth to cut off the charge to C10 via this path. The logic on pin 6 will then fluctuate between 0 and 1, gradually decreasing the percentage 'off time' of VT1, and therefore the charge of C10 via D2, until the oscillator returns to its original frequency, when the on/off ratio of VT1 will be 1.

Table A shows state of logic lines with respect to frequency:

	- FREQUENCY (10's Hz) +									
	6	7	8	9	0	1	2	3	4	5
CONTROL LINE PIN 6	1	1	1	1	1	0	0	0	0	0
GUARD LINE PIN 3	1	1	1	1	0	0	0	0	0	1
GUARD LINE PIN 4	0	1	1	1	1	1	0	0	0	0

TABLE A LOGIC STATE/FREQUENCY

3.10.2 Frequency LOCK OFF Conditions

When the LOCK switch S5 is switched to OFF, the variable capacity diode D3 in the interpolating oscillator tuned circuit is fed with approximately 4.5 volts negative taken from potential divider R2/R3 across zener diode D1 to pin 7.

3.11 1MHz OSCILLATOR UNIT (Fig.26)

The 12V a.c. input is obtained from the mains transformer T2. Diodes D1-D4 provide full wave rectification smoothed by capacitor C1. Zener diodes D5, D6 together with emitter followers VT1 and VT2 provide the +9 volt d.c. supply for the oven heater of the crystal oscillator. Resistor R2 and capacitor C2 provide further smoothing of the 9V supply. Zener diode D7 provides the supply for the oscillator, the divide by ten integrated circuit, and the output stage VT3.

The oscillator frequency is 10MHz and this is divided by ML1 down to 1MHz. The emitter follower output stage VT3, R6, L1, L2 and C7, sets the output impedance of the module to 75 ohms. Capacitor C5 approximates the output to a sinewave.

Performance:

Frequency: 1MHz  
 Stability: For temperature range 0 to 60°C ± 0.1 p.p.m.  
 For temperature range -40 to +70°C ± 0.2 p.p.m.  
 Output: NLT 600mV into 75 ohms  
 Time to reach stabilisation: 10 minutes

3.12 5V REGULATOR AND 1MHz ISOLATING AMPLIFIER (Fig.27)

This unit supplies a stabilized output of +5 volts for operation of the waveform generator (module 14), the micro-miniature counter unit and the 1MHz isolating amplifier.

3.12.1 5V Regulator

VT1 and VT3 form a square-wave generator, the on/off period of which is controlled by the differential amplifier comprising VT2 and VT4. The voltage at VT6 emitter is chopped by VT6 which is controlled by VT5 and VT3. When VT6 is switched on, energy is stored in L4 (main chassis). This is transferred into reservoir capacitor C2 during the off period of VT6 so as to

maintain the output voltage. A proportion of the output voltage is compared to the reference voltage across D1 in the differential amplifier which controls the on/off ratio and hence the output voltage. Preset potentiometer RV1 is used to set the output voltage to +5 volts d.c.

### 3.12.2 1MHz Isolating Amplifier

This is used to isolate the 1MHz signal feed to the waveform generator module 14 from the 1MHz signal feed to the spectrum generator (module 10) to stop any interaction between these modules.

The 1MHz input signal from the 1MHz oscillator enters the unit on a coaxial connector and is connected directly from this point to a second coaxial connector for connection to the spectrum generator (module 10). The 1MHz input signal is also taken via C6 to the base of transistor VT1. The amplified output from which is taken, via R14, to the output coaxial connector for connection to the waveform generator (module 14). The d.c. supply for the amplifier is taken from the output of the 5V regulator via decoupling circuit R15/C5.

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

The 37.3MHz first IF output from the 1st 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 (3.16) applied to its cathode and the AGC voltage (3.17) 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 37.3MHz low pass filter. Links are provided in the filter circuit to facilitate alignment.

The output of the 48MHz selector circuit in module 10 is injected at the base of VT5 on board B. This transistor, in conjunction with VT6, operates in a similar circuit to that of VT1 and VT2 of the 48MHz selector circuit, except that the output from VT6 is directly coupled to the next stage, to provide a 48MHz 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 37.3MHz, is applied to VT3 base and VT4 emitter and the 48MHz 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 10.7MHz is selected in the crystal bandpass filter FL1 and coupled via C25, R28 to the second IF amplifier in module 5.

### 3.14 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 third IF amplifier in module 7 (3.16). VT1 is connected across the reference and AGC lines. D2 controls the stage gain which, as the emitter load greatly exceeds the collector load, would otherwise approach unity. During the reception of weak signals it is open, but its impedance increases as the signal strength increases.

The output from VT1 is amplified by VT3 and this stage feeds the third mixer VT4 and VT5. The 10.7MHz second IF signal is applied to VT4 base and VT5 emitter and the signal from the 10.6/10.8MHz generator (module 11) is applied to VT5 base and VT4 emitter. The resultant 100kHz output is coupled via C16, emitter follower VT6, and the bandwidth filter selected by the setting of S2, to the 100kHz amplifier in module 7.

### 3.15 10.6/10.8MHz GENERATOR MODULE 11 Mk.II (Fig.16)

The circuit accepts a spectrum output from the Spectrum Generator module 10 and provides an output at either 10.6MHz or 10.8MHz to the 3rd mixer module 5.

The spectrum input is applied to the Q multiplier VT1/VT2. This circuit, which is controlled by the LSB/USB bias network RV1/C7/R6/D8/C5 via S1BF, selects either 53MHz for LSB or 54MHz for USB. The required frequency is passed via the emitter follower VT3 to a divide-by-five circuit, VT4 to VT13.

The divide-by-five circuit is a ring counter type circuit from which only the output of the last transistor is taken. Two and a half input cycles are therefore required to cause bistable VT12/VT13 to change state and provide one half cycle of output, thus five input cycles will be required to provide one complete output cycle. The output from VT13 is a square wave at one fifth of the input frequency, i.e. 10.6MHz or 10.8MHz.

The square wave output from VT13 is passed to VT14. L3 and C15 in the collector of VT14 form a filter centred on 10.7MHz, which will pass 10.6MHz to 10.8MHz. This circuit also converts the square wave output from VT13 to a sine wave suitable for application to the 3rd mixer (module 5) via SKT15.

### 3.16 THIRD IF AMPLIFIER AND DETECTORS, MODULE 7 (Fig.17A)

The input circuit of VT1, the first stage of the third IF amplifier, includes an AGC controlled diode similar to the input circuits of modules 4 (3.13) 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 VT12 which provides outputs to the detectors and the 100kHz 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 this module, a product detector for SSB and 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 USB, LSB or CW are selected at S1, the 100kHz signal from module 14 (3.9) is injected into the transistor emitter circuits for carrier reinsertion on SSB operation, and the BFO (3.19) 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 S1. The output from VT12 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 module 9 (3.18) and to the AUDIO GAIN control, RV2 on the main chassis. When the 100kHz IN signal at SKT50 is used in a dual path system the connection from R48 (shown dotted) is removed.

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

Module 8 is an AGC amplifier and detector which in conjunction with the AGC decay shaper board provides the main AGC control for the receiver.

The signal level at which AGC action starts to be effective is set by threshold control potentiometer RV1. This is then applied to VT1 which is an emitter follower stage, the output of which is applied to amplifying stage VT2. Transformer T1 forms the collector load of VT2, provides impedance matching and offers some selectivity to the circuit. Components VT3, D1, R8 and C5 form the detector and voltage doubler stage. A sinusoidal signal across C3 is rectified and amplified and the resultant d.c. voltage applied to the base of VT4 for further amplification.

Diodes D3, D4, D5 and R13 provide a two stage rise time circuit. The first portion of the signal rise causes the diodes to conduct heavily, but as the voltage across C8 approaches that of the signal, the diodes will switch off. R13 and RV2 control the rise time at the leading edge of the signal, thus preventing instability whilst not affecting the overall rise time.

VT7, VT8 and VT9 are emitter followers; the IF gain control is applied to the base of VT9 and controls the AGC level.

VT5 and VT6 provide overshoot limiting and noise pulse protection should the signal rise sharply. D2 will conduct and charge C6. The sudden rise will cause the AGC to cut off the early stages of the receiver and thus no signal will appear at the emitter of VT5; at this instance C6 will discharge and cause VT6 to conduct and provide a discharge path for C8 until the correct a.g.c. level is obtained.

When the AGC is switched off the -15V to VT9 is removed and therefore there will be no AGC output, the gain being set by the RF/IF gain control.

D7 and D8, in the absence of a signal, prevent C8 from discharging to below 3.3 volts.

### 3.18 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, R1. 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, 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 and the preset gain control RV1. VT1 operates as an amplifier which drives the phase splitter VT2. One output, from VT2 emitter, is coupled, via R10, C6 to the base of VT3, the other, 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.

### 3.19 BFO FACILITIES (Figs.2 and 21)

The BFO is energised when the control switch, S1, 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 S1, for CW and SSB operation. The oscillator operates at a nominal 100kHz and is tunable by  $\pm 8$ kHz about 100kHz by means of the front panel BFO control, C9. The output amplitude is adjustable by means of the preset control RV1. In addition a Fixed BFO is provided for FSK reception. This is a sealed unit which should not be disturbed. A trimmer is provided for frequency adjustment.

### 3.20 ISOLATING AMPLIFIERS (Fig.22)

The isolating amplifiers are provided as a buffer stage between the first local oscillator and the phase lock loop circuits to isolate the oscillator from spurious oscillation. Each consists of an amplifier stage, VT1 and an emitter follower VT2. The input signal is injected at VT1 emitter and the signal from VT2 emitter is coupled to the output point via C5, R8. The two isolating amplifiers are connected in series.

### 3.21 MICRO-MINIATURE COUNTER UNIT (Fig.28)

#### 3.21.1 Counter Circuits

The interpolating oscillator signal from PL3 is gated in ML8 by the 'gate' waveform from the waveform generator (module 14) and applied to the first decade counter ML1 on board 1. The decade counter counts the number of tens of hertz in the 100ms sample time. The information contained in the four output lines is in binary form, and this is transferred, via the memory pack ML2 and binary decoder ML3, to the display tube X3 when the 'transfer' pulse is applied to ML2. The count will remain on the display tube, due to the memory capabilities of ML2, until the count changes. After each count is transferred to the display tube the 'reset' pulse is applied to the decade counter ML1 to reset it to zero for the next count. When the first decade counter has counted the number of tens of hertz, its output (pin G) is fed to the 100Hz decade counter on board 2, which counts the number of hundreds of hertz.

This process is repeated for boards 3, 4 and 5, which count respectively kHz, 10's of kHz and 100's of kHz. All five boards are identical except board 5 from which all four binary outputs are taken for operation of the  $\pm 1$ MHz indicator circuits. The indicator tube on board 5 is wired so that it reads correctly with respect to receiver frequency, i.e. with no input it will read 7 so that when the receiver is tuned to a 1MHz point (with interpolating oscillator frequency of 2.3MHz or 3.3MHz) it will read 0.

The megahertz indicator tubes X1 and X2 are operated directly from the MEGAHERTZ switch S3.

The decimal point indicator neon ILP1 is wired, in series with R3, directly across the 200 volt supply and therefore remains illuminated at all times.

### 3.21.2 Overspill/Underspill Indicator Circuits

The  $\pm 1$ MHz indicator neon ILP2 will flash on and off when the interpolating oscillator is tuned to below 2.3MHz, or to 3.3MHz or above, indicating that the receiver is tuned 1MHz above or below that shown on the counter. Three of the binary outputs from board 5 are so combined that they open a gate in ML10 only when the oscillator is tuned to 2.3MHz or 3.3MHz and ML9 counts the number of megahertz from the output of board 5. This information is combined and fed to a divide-by-two flip flop, ML12, whose operation is inhibited by the 4Hz waveform from the waveform generator (module 14). The 8Hz gate signal and 4Hz waveform are combined in one gate of ML11 and fed, along with the output of ML12, to another gate of ML11. The output of ML11 is inverted and fed to the base of VT1. When VT1 switches on it completes the d.c. path to the indicator neon ILP2. The flash rate of ILP2 is 8Hz.

## 3.22 MAIN CHASSIS (Fig.2)

### 3.22.1 Power Supplies

The mains supply is routed to the primary of the mains transformer T2 via FS1 and the double-pole switch (S7). The primary of T2 is in two sections, each with tappings to permit operation on any of the prescribed mains voltages. Four secondary windings are provided on the transformer as follows:

- (a) A 22-volt a.c. output is routed via FS2 to the regulator unit which supplies -15V d.c. for most of the receiver modules.
- (b) A 9-volt a.c. output supplies power to the 5-volt regulator in the 5V regulator and 1MHz isolating amplifier.
- (c) A 180-volt output rectified by bridge rectifier D1-D4 and smoothed by R20, C13 supplies 200 volts d.c. for the digitrons in the counter unit.
- (d) A 12-volt output supplies a.c. power to the oven heater in the 1MHz oscillator unit.

### 3.22.2 Regulator (Fig.23 and 2)

The 15-volt regulated d.c. supply is derived from the 22-volt secondary of T2 and rectified by MR1 and smoothed by C2. A conventional regulator circuit is used, employing VT4 with a reference voltage obtained

from zener diode D1 (5.6V). Transistor VT<sup>4</sup> is followed by two emitter followers VT3 and VT2, which drive the series regulator transistor VT1. The output from the regulator at -15V d.c. is connected to the common pole of S1DF.

### 3.22.3 Switching Circuits

#### FUNCTION Switch S1

When S1 is set to STANDBY, -15V is connected via S1DF to the 1MHz oscillator, interpolating oscillator and counter unit. In the remaining positions of S1, the receiver is operational and all circuits are supplied with -15V, with the exception of the waveform generator module 14, the micro-miniature counter unit and the 1MHz isolating amplifier which derive their supply from the 5V regulator unit via wafer S1DB.

Wafer S1BF switches the -15V supply to module 11 to energise the relevant circuit for each mode of operation. The -15V supply is switched to the relevant detector circuit in module 7 via S1CF.

#### BANDWIDTH Switch S2

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

#### AGC Switch S4

The AGC switch S4 has four positions, these being OFF, 0.1 sec., 1.0 sec. and 10 sec. In the AGC OFF position the 15V supply to the main AGC amplifier is removed and the receiver gain is controlled by RV1. The RF/IF gain control RV1 may be used as a threshold control when the AGC switch is set to any of the operating positions.

The 1.0 sec. and 10 sec. decay times are controlled by a shaper board which linearises the AGC characteristic. The 0.1 sec. decay time is intended for tuning purposes or when rapid signal fading is experienced.

#### Other Switches

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.

The loudspeaker may be muted when not required by inserting a jack plug into JK2. A dummy load R22 is then connected in place of the loudspeaker to maintain the loading of the audio amplifier and prevent the level at the PHONES jacks from rising.

### 3.22.4 Selector Links

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

### 3.22.5 Meter Amplifier (Fig.24A)

The meter amplifier board provides circuits for the following functions:

- (1) Audio Output Level adjustments.
- (2) AGC Threshold adjustment.
- (3) Provision of RF/IF Gain control voltage.

The audio input is applied at terminal 9 via R1 and C1 to rectifier D1. The d.c. is routed via RV1 and terminals 1 and 6 to the amplifier VT1, the amplified voltage being applied to the meter via terminal 3. RV1 is used to adjust the audio output to the required level.

The AGC voltage is applied via terminal 4 to R2 and thence via terminals 5 and 6 to the amplifier VT1. The AGC threshold level is adjusted by RV3 which sets the level of VT1 emitter. The voltage is read at the meter via terminal 3.

Zener diode D3 provides 12V at terminal 7 for the RF/IF gain voltage which is applied to modules via the RF/IF gain control RV1.

The AF/RF selector switch selects terminals 1 or 5 of the board.

RV2 is the meter shunt and D4/D5 provide temperature compensation for the network R8, R9, RV3, R10, D3.



## CHAPTER 4

### SERVICING AND ALIGNMENT

#### 4.1 INTRODUCTION

The information given in this Chapter provides a guide to fault location and details the procedures required for equipment alignment.

#### 4.2 TEST EQUIPMENT

The following test equipment is required for the tests detailed in this chapter:

- (a) Multimeter d.c., to measure between 1V d.c. and 16V d.c., e.g. AVOMETER Model 8.
- (b) 75 ohm resistive load.
- (c) Valve voltmeter, to measure up to 80mV at 100kHz to 67MHz, e.g. Boonton 91A.
- (d) H.F. signal generator - frequency range 60kHz-65MHz, output level between 0.2 $\mu$ V and 2V emf. Output impedance 75 ohm. e.g. Hewlett Packard Type 606B with 50/75 ohm adaptor.
- (e) Storage oscilloscope capable of measuring d.c. inputs having an amplitude response between 100mV/cm and 5V/cm and a time base range between 5ms/cm and 1 sec/cm, e.g. Tektronix type 564 storage scope.
- (f) Counter suitable for counting frequencies up to 65MHz with a 1MHz standard output facility of accuracy better than 1 in 10<sup>5</sup>. e.g. Hewlett Packard 5245L and converter 5253B.
- (g) Spectrum analyser, e.g. Hewlett Packard Main Frame Type 141T. I.F. Unit Type 8552. R.F. Unit Type 8553.
- (h) Distortion factor meter, e.g. Marconi type TF 2331.
- (j) Combining unit, capable of combining three inputs into a single output, with 40dB isolation between inputs and a maximum of 7dB insertion loss.

#### 4.3 GENERAL FAULT FINDING

- (a) Paragraph 4.3 details performance checks which should be carried out, if a faulty PR 1553 is suspected, in order to isolate the fault to a particular PCB or module.
- (b) Failure to satisfy the tests could be due to faulty power supplies to one or more PCB's/modules. Power supplies to the suspect PCB /module should therefore be checked before attempting more detailed fault finding. Power supply pin connections are given on the PR 1553 circuit diagram, Figure 2, and on the relevant circuit diagrams in Chapter 7.
- (c) If power supplies are correct, failure to satisfy the tests could be due to misalignment of the suspect PCB/module. The realignment procedures given in paragraph 4.4 should therefore be tried before attempting component replacement.

- (d) Check that the reference voltage at pin 3 of modules 1,4,5 and 7 varies between -3.4V and 6.5V, when the RF/IF GAIN control is varied throughout its range. Leave the control fully clockwise (maximum sensitivity).
- (e) Check that the voltage at pin 2 of modules 4,5 and 7 is -4.7V (zener controlled).
- (f) Check, as necessary, all coaxial leads and terminations for continuity, and isolation between inner and outer conductors.
- (g) Cable numbers referred to in the tests are shown on the chassis layout diagram, Figure 1B.

#### 4.3.1 Signal Path

##### 4.3.1.1 Front Panel Controls

Unless stated otherwise, set the front panel controls as follows:

FUNCTION switch - USB  
 BAND WIDTH switch - 6kHz  
 AGC switch - OFF  
 RF/IF GAIN control - fully clockwise

##### 4.3.1.2 Third IF Amplifiers and Detectors - Module 7 (Fig. 17)

- (a) Inject a 100kHz signal at 250 $\mu$ V e.m.f. into the cable 16 connection of Module 7.
- (b) Connect a valve voltmeter across the rear-panel 100kHz output socket, and check that the output is between 78mV and 83mV e.m.f.

##### 4.3.1.3 Module 5, Module 11 and Bandwidth Filter (Figs 15,16,14)

- (a) Inject a 10.7 MHz signal at 25 $\mu$ V e.m.f. into the cable 13 connection of module 5.
- (b) Tune the signal generator for maximum indication on the valve voltmeter (connected as in 4.3.1.2) and check that the reading is approximately 80mV rms.
- (c) If this result is not obtained, check Module 11 as detailed in paragraph 4.3.3.5.
- (d) Check the bandwidth filter by repeating the test, with the BANDWIDTH switch set to 3.5kHz.
- (e) When satisfactory results are obtained reconnect cable 13 and set the BANDWIDTH switch to 6kHz.

##### 4.3.1.4 Modules 4 and 10 (Figs 14,8)

- (a) Inject a 37.3 MHz signal at 1.0 $\mu$ V e.m.f. into the cable 11 connection of Module 4.
- (b) Tune the signal generator for maximum indication on the valve voltmeter (connected as in 4.3.1.2), and check that the reading is approximately 80mV. (For this measurement the output level could be +30mV on reference level).

(c) If this result is not obtained check Module 10 as detailed in paragraph 4.3.2.2.

(d) Reconnect cable 11 when test is satisfactory.

#### 4.3.1.5 Module 3 (Fig. 7)

(a) Terminate the cable 9 connection from Module 3 with a 75 ohm resistive load.

(b) Connect a valve voltmeter across the load, and check that a reading of approximately 500mV is obtained.

(c) Reconnect cable 9 when test is satisfactory.

#### 4.3.1.6 Modules 1 and 2 (Figs 5,6)

(a) Inject a 28.5MHz signal at 0.7 $\mu$ V emf into the cable 3 connection to Module 1.

(b) Tune the receiver for maximum indication on the valve voltmeter, connected as in 4.3.1.2, and check that the reading is approximately 80mV.

(c) If this reading is not obtained check Module 2 by increasing the signal input level to 2.5 $\mu$ V, and connect this signal into the cable 10 connection of Module 2.

(d) Tune the receiver for maximum indication on the valve voltmeter, and check that this reading is approximately 80mV rms.

#### 4.3.1.7 Signal Level Chart

The following table shown signal levels to be expected throughout the receiver for various input levels. By injecting signals at the levels indicated the appropriate outputs should be obtained.

NOTE: The levels shown should be used as a guide only, and are not mandatory.

### 4.3.2 Frequency Generation

#### 4.3.2.1 1MHz Oscillator

(a) Check that the rear-panel switches for the INT VFO and 1MHz are switched to ON.

(b) Monitor the output of the 1MHz Oscillator on the frequency counter. Check that this output is 1000000Hz and the output level is approximately 800mV rms.

NOTE: An additional 1MHz crystal oscillator is included in Module 10. This oscillator is activated by linking the module pins 3 and 4 and by changing the rear panel 1MHz links to OFF.

#### 4.3.2.2 Spectrum Generator Module 10 (Fig. 8)

(a) Terminate the cable 12 connection from Module 10 with a 75 ohm resistive load.

AERIAL INPUT	R.F. FILTERS	MODULE 1	MODULE 2	MODULE 4	MODULE 5	I.F. FILTERS	MODULE 7	I.F. OUTPUT
LEVEL FOR 12dB SINAD AGC OFF 0.62μV	-1dB 0.54μV	+12.5dB 2.4μV	-10dB 0.75μV	+24dB 12μV	+32dB 500μV	-6dB 230μV	+50dB	80mV
AGC ON 10μV	-1dB 8.8μV	+12dB 32μV	-10dB 10μV	+19dB 95μV	+23dB 1.32mV	-6dB 660μV	+42dB	85mV
AGC ON 100μV	-1dB 88μV	+12dB 400μV	-10dB 130μV	+14dB 620μV	+15dB 3.6mV	-6dB 1.8mV	+34dB	85mV
AGC ON 1mV	-1dB 880μV	+12dB 3.5mV	-10dB 1.2mV	+5dB 2mV	+9.5dB 6mV	-6dB 3mV	+29dB	85mV
AGC ON 10mV	-1dB 8.8mV	+8dB 24mV	-10dB 7.5mV	+1.5dB 9mV	+3dB 12.8mV	-6dB 6.4mV	+22.5dB	85mV
AGC ON 100mV	-1dB 88mV	-8dB 36mV	-10dB 11mV	+2dB 14mV	+1dB 15.2mV	-6dB 7.6mV	+21dB	86mV

NOTE: This chart refers to one particular equipment.  
These levels must be used only as a guide.

SIGNAL LEVEL CHART SSB 28.5 MHz

- (b) Connect the valve voltmeter across the load and check that a reading of at least 250mV is obtained.
- (c) Check, with the frequency counter, that the output frequency is 48MHz. (The output level may need to be attenuated to obtain correct reading on the counter).
- (d) Check the Module 10 outputs at SKT5 and SKT31 by observing the 1MHz spectrum comb on the spectrum analyser. This will be seen to extend above 65 MHz. If no analyser is available checks on the spectrum can be performed in conjunction with the Megahertz Selector Board.

#### 4.3.2.3 Megahertz Selectors (Turret Compartment 2 Fig. 10)

- (a) Remove the bottom cover of the turret and connect a coaxial lead from the megahertz input socket (above Board G) to the frequency counter.
- (b) Switch the Megahertz control through each turret position, in 1MHz steps up to 29MHz, and check that the frequency indicated is within  $\pm 1$  part in  $10^7$  of the control setting.

#### 4.3.2.4 Module 4 (48 MHz Selector Fig. 14)

- (a) Connect the spectrum analyser, tuned to 48MHz, to TP1 on Board 4B.
- (b) Check that 48 MHz is present, and that adjacent MHz sidebands are greater than 35dB down.
- (c) If the second local oscillator is suspect, and if no spectrum analyser is available, substitute 48MHz with the signal generator connected to R25 on Module 4 Board A.

#### 4.3.2.5 Module 11 (10.6 MHz/10.8 MHz Generator Fig. 16)

- (a) Connect the frequency counter to the output lead SKT15 from module 11.
- (b) Check that, with the front panel FUNCTION switch set to BFO CAL, USB or F the counter reading is 10.800MHz.
- (c) Check that, with the front panel FUNCTION switch set to LSB, CW or AM the counter reading is 10.600MHz,
- (d) Set the FUNCTION switch to USB.

#### 4.3.2.6 Module 3 - 1st Local Oscillator (Fig. 7)

- (a) Set the FUNCTION switch to OFF, and disconnect pin 3 of the chassis 'D' connector.
- (b) Connect cable 9 to the frequency counter, set the FUNCTION switch to USB and check that the counter reading is approximately 36MHz.
- (c) Set the FUNCTION switch to OFF, reconnect pin 3 and set the FUNCTION switch to USB.

#### 4.3.2.7 Interpolating Oscillator VFO (Fig. 9)

- (a) Set the front panel LOCK OFF/ON switch to OFF.
- (b) Connect the frequency counter, in turn, to the two output sockets SKT26 and SKT41.
- (c) Adjust the front panel KHz control over its full range, and check that the counter reading varies between at least 2.2MHz and 3.4MHz.
- (d) Check that the output level, measured across a 75 ohm resistive load, is approximately 400mV from SKT26 and 150mV from SKT41.
- (e) Set the front panel LOCK OFF/ON switch to ON.

#### 4.3.2.8 Operation of 100kHz (SSB)

- (a) Connect cable 17 to the frequency counter.
- (b) Set the front panel FUNCTION switch in turn, to the USB and LSB positions and check that the counter reading is 100 kHz in each case.
- (c) Check that the output level, measured across a 75 ohm resistive load, is approximately 100mV.

#### 4.3.2.9 F Facility and CW Operation

- (a) With the equipment controls set and equipment connected as in 4.3.2.8, set the FUNCTION switch to CW.
- (b) Check that, as the front panel BFO control is adjusted over its full range, the counter reading varies between 92kHz and 108kHz.
- (c) Check that the output level, measured across a 75 ohm resistive load, is approximately 500mV.
- (d) Set the FUNCTION switch to F and check that the counter reading is 102.55kHz.
- (e) Set the FUNCTION switch to USB.

#### 4.3.3 Phase Lock Fault Location

The first local oscillator frequency is derived from a free running oscillator, which is reactor-controlled by a phase-lock loop system. The system locks the oscillator to the combination of desired Megahertz harmonic selected output and interpolating oscillator (VFO) frequency. Some possible fault conditions and likely causes are given below.

##### 4.3.3.1 Fault Symptom - No Receiver Output Except Hum and Receiver Noise; i.e. No Sweep Heard at Output

- (a) Turn the FUNCTION switch to OFF, disconnect pin 2 of the turret block, and connect a 100k ohm series resistor. Reconnect pin 2 and turn the FUNCTION switch to USB.

- (b) Connect the oscilloscope between pin 3 (reactor control lead) of Turret Board J (Fig. 13) and check that a saw tooth waveform is observed, approximately 4V peak-to-peak, at a frequency of 1Hz as shown in diagram (a)

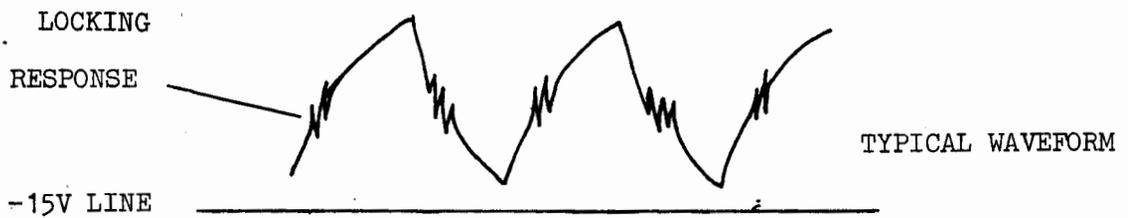


Diagram (a)

- (c) If this result is not obtained check transistor VT7 using the multimeter (ohms range).
- (d) If VT7 is satisfactory, check that a sweep waveform is present across C4, approximately 1.8V peak-to-peak, as shown in diagram (b).



Diagram (b)

- (e) If satisfactory, check transistors VT5, VT6 (differential amplifier) using the multimeter.
- (f) If VT5, VT6 are satisfactory, check transistors VT8, VT9 (multivibrator).
- (g) Set the FUNCTION switch to OFF, disconnect the 100 kohm resistor, reconnect pin 2 and set the FUNCTION switch to USB.

#### 4.3.3.2 Fault Symptom: No Receiver Output Except Noise, and Phase Locking Sweeping.

Phase lock sweeping is indicated by a 'swish' noise and switch clicks at approximately one second intervals.

- (a) Turn the MEGAHERTZ selector switch, and check to see if the fault occurs on all thirty Megahertz steps.
- (b) If fault occurs on only a few steps slight readjustment of RV3 on Turret Board J may bring the circuit back into the phase locked condition.

- (c) If procedure (b) clears the fault, recheck all thirty Megahertz steps.
- (d) If procedure (b) fails to clear the fault check that -6V is measured on the slider of potentiometer RV4 in Turret Board J.
- (e) Check sweep output on the reactor control line (pin 3 of the turret block) using the oscilloscope. A sawtooth waveform should be obtained, with an amplitude of at least 4V peak-to-peak at a frequency of approximately 1Hz.

NOTE: During this test the 100 kohm test resistor must be in circuit, and the MEGAHERTZ selector set to 28 MHz.

- (f) On Board H (Fig. 12), with the test resistor in circuit, check the output waveform between the pin 'to Board J' and earth. The waveform should show a signal burst approximately once per second, with an amplitude approximately 10mV peak-to-peak. If the waveform is not present check the inputs from Board G and the Isolating Amplifier. Short out the test resistor.
- (g) On Board G (Fig. 11), check the output lead to Board H using a high frequency oscilloscope or RF valve voltmeter. It should be greater than 5mV 'in circuit'. If incorrect check input from the Interpolating Oscillator (VFO) and the input from the Megahertz selector. The output from Board G will be at the selected Megahertz plus the frequency of the VFO.
- (h) On the Isolating Amplifier (Fig. 22), check the output level to Board H using a high frequency oscilloscope or RF valve voltmeter across the "LO in" terminal on Board H. The level should be approximately 1V rms.
- (j) On the Megahertz Selector Amplifier (Fig. 10), check the output level to Board G, at the 'MHz in' terminal on Board G, using a high frequency oscilloscope or RF valve voltmeter. The level should be greater than 250mV rms.

#### 4.3.3.3 Fault Symptom: Indicated Megahertz Not Selected But Receiver Functioning at a Different Frequency

This fault condition is probably caused by wrong Megahertz selection by the Megahertz Selector Amplifier, and could be due to a loose slug in a coil of wafer F1 or F2. Turn the FUNCTION switch to OFF, remove the test resistor, reconnect pin 2 and refer to paragraph 4.4.6.4 for re-alignment details.

### 4.4 ALIGNMENT

#### 4.4.1 Front Panel Controls

Unless stated otherwise set the receiver front panel controls as follows:

FUNCTION switch	-	USB
BANDWIDTH switch	-	SSB
AGC switch	-	OFF
RF/IF GAIN control	-	fully clockwise

#### 4.4.2 D C Voltage Adjustment - Power Supply Regulator (Fig. 23)

- (a) Connect the multimeter to monitor pin 4 on the turret block.
- (b) Adjust RV1 on the voltage regulator, accessible from the top of the receiver, for a meter reading of -15.5V d.c., and relock RV1.

#### 4.4.3 Signal Path

##### 4.4.3.1 Third 1F Amplifiers and Detectors - Module 7 (Fig. 17)

- (a) Inject a 100kHz signal at approximately 250 $\mu$ V emf into the cable 16 connection of Module 7.
- (b) Connect the valve voltmeter across the rear-panel 100kHz output socket, and adjust RV1, accessible through the module 7 handle, for a reading of 80mV rms.

##### 4.4.3.2 Audio Amplifier - Module 9 (Fig. 19)

- (a) Inject a 28.5 MHz signal at approximately 0.5 $\mu$ V into the rear-panel aerial socket.
- (b) Connect the distortion factor meter to the rear-panel line output (600 ohm) connector, and adjust the Audio Board B gain control RV1, accessible through the module 9 handle, for an output of approximately 1mW (0.775 V rms).

##### 4.4.3.3 1st 1F Amplifier/2nd Mixer - Module 4 (Fig. 14)

With test equipment connected as in 4.4.3.1 adjust the input level between 0.3 $\mu$ V and 0.85 $\mu$ V to obtain a line output of 12dB SINAD:

$$\text{SINAD} = \frac{\text{signal} + \text{noise} + \text{distortion}}{\text{noise}}$$

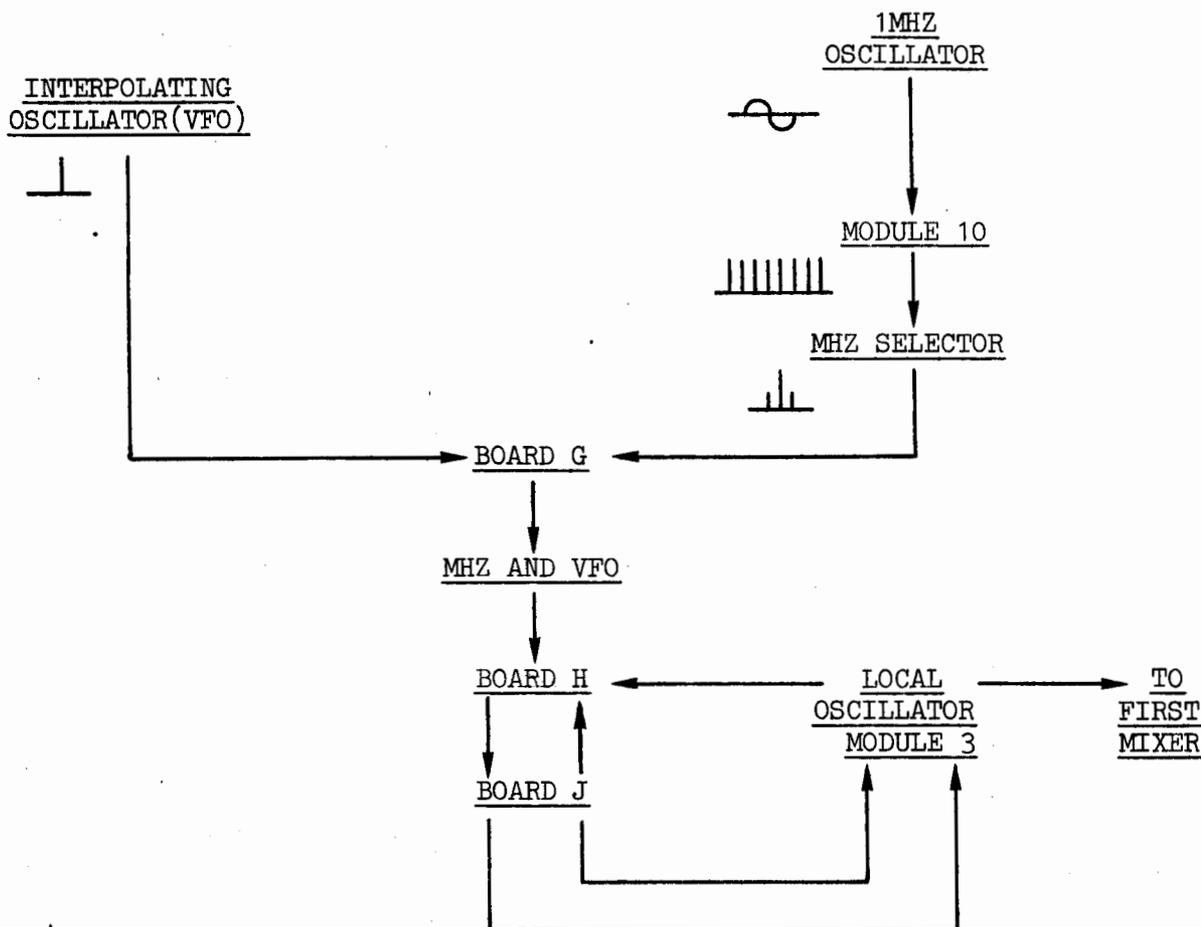
Adjust the receiver gain control RV1, accessible through the module 4 handle, for an output of 80mV at an 1F of 100kHz.

If the Marconi DFM or similar instrument is not available a signal + noise measurement of 12dB can be used as a reference parameter.  
noise

#### 4.4.4 Phase Lock Loop

##### 4.4.4.1 Turret Compartment 3

- (a) Turn the FUNCTION switch to OFF, disconnect pin 2 on the Turret Block, and connect a 100k ohm series resistor. Reconnect pin 2, turn the FUNCTION switch to USB, the BANDWIDTH switch to SSB and the AGC switch to 0.1 sec and receiver to 29.5 MHz.
- (b) Connect the oscilloscope between pin 3 (reactor control lead) and earth of Turret Board J.
- (c) Extend Turret Board J on its sliding earth contacts, adjust RV2 fully anti-clockwise, and lock RV2.



- (d) Adjust RV<sub>4</sub> for a reading of -6V, measured with a multimeter on RV<sub>4</sub> slider contact.
- (e) Adjust RV<sub>3</sub> to mid-position, turn the FUNCTION switch to OFF, and unsolder the link between the collector of VT<sub>1</sub> or VT<sub>3</sub> and the base of VT<sub>4</sub>. (The link will have been selected by the manufacturer).
- (f) Turn the FUNCTION switch to SSB, connect the multimeter between the VT<sub>1</sub> and VT<sub>2</sub> collectors, adjust RV<sub>1</sub> for zero multimeter reading and lock RV<sub>1</sub>.
- (g) Turn the FUNCTION switch to OFF, reconnect pin 2 and turn the FUNCTION switch to SSB.
- (h) With the receiver still set at 29.5 MHz check that the trace displayed on the oscilloscope is as shown on diagram (c).

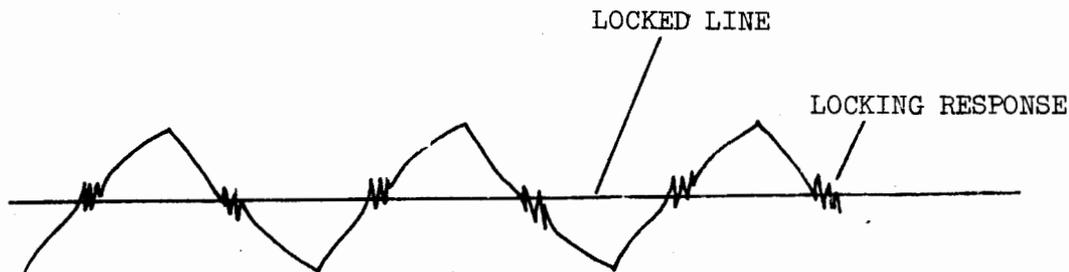


Diagram (c)

NOTE: The locking pulses shown in diagram (c) will not always be visible; however, they will correspond to the line drawn on the display when the loop is in the locked condition.

- (j) Adjust RV3, and check that the position of the sweep waveform varies about the locking line. (By shorting the 100 kohm resistor connected to pin 2 the locking line can be seen on the display).
- (k) Set RV3 such that the sweep waveform is equally spaced about the locking line, and lock RV3.
- (l) Adjust the MHz selector, in turn, from 29MHz to 22MHz, 14MHz, 7MHz and 2MHz. At each change adjust the Wafer E controls RV1 (29MHz), RV2 (14MHz), RV3 (7MHz) and RV4 (2MHz) for equal sweep about the locked line.

NOTE: As the frequency decreases the sweep waveform will be seen to limit to a certain extent, on the -15V line as shown in diagram (d). However, it is still essential to maintain the locking line between these points.

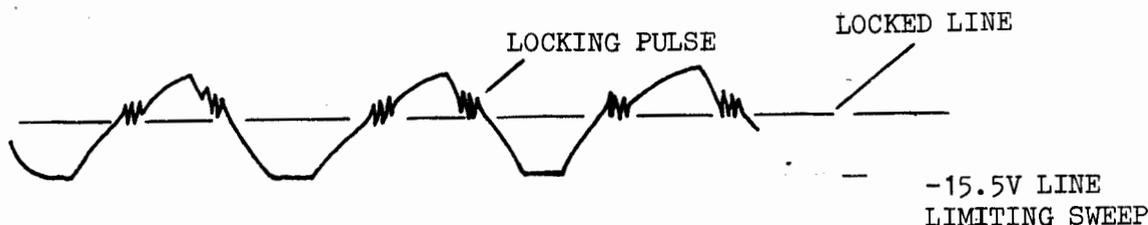


Diagram (d)

#### 4.4.5 Receiver AGC

##### 4.4.5.1 Threshold Level - Module 8 (Fig. 18)

- (a) Set the front panel controls as in 4.4.1.
- (b) Inject the 12dB SINAD level at approximately 28.5MHz into the rear-panel aerial connector.
- (c) Connect the distortion factor meter to the rear-panel line output (600 ohm) connector, and check that the reading is 80mV.
- (d) Set the AGC switch to 0.1 sec, and adjust RV1 on module 8 for a meter reading of 66mV.
- (e) Increase the input signal level in 10dB steps to 120dB and check that, with each step, the output level does not vary by more than 4dB above 66mV.

NOTE: The rise time is determined by RV2, and is typically 10mS to +40dB level.

#### 4.4.5.2 Decay Times - AGC Decay Shaper (Fig. 24)

- (a) With the equipment connected as in 4.4.5.1 set the AGC switch to 1.0 sec., and connect the multimeter (d.c. volts range) between the AGC line and earth.
- (b) Set the signal generator input to +80dB above SINAD and note the AGC voltage.
- (c) Decrease the input by 40dB, and check that the AGC voltage decays in a time between 0.75 sec. and 2 sec.
- (d) Set the AGC switch to 10 sec., set the input to +80dB above SINAD and note the AGC voltage.
- (e) Decrease the input by 40dB, and check that the AGC voltage decays in a time between 7.5 sec. and 20 sec.
- (f) If necessary, adjust RV1 on the AGC Decay Shaper Board to achieve these readings.

#### 4.4.5.3 AGC Threshold Adjustment - Module 1 (Fig. 5)

- (a) With the equipment connected as in 4.4.5.1 inject a 1.5MHz signal at 3mV emf, and a separate 1.0 MHz signal at  $150\mu\text{V} \pm 20\mu\text{V}$  emf into two inputs of the combining unit.
- (b) Connect the output of the combining unit to the r.f. input socket.
- (c) Connect an open coupler between Modules 1 and 2 (cable 10) and connect the oscilloscope between the coupler centre conductor and chassis.
- (d) Adjust RV1 on Module 1 until the signal displayed on the oscilloscope just starts to decrease in amplitude, then lock RV1.
- (e) Increase the 1MHz signal input to 1V emf, reduce the 1.5MHz signal input to zero and check that the signal displayed on the oscilloscope is  $80\text{mV} \pm 20\text{mV}$  peak-to-peak.

#### 4.4.6 Frequency Generation

##### 4.4.6.1 1MHz Oscillator (Fig. 26)

- (a) Turn the FUNCTION switch to USB, and allow a warm-up period of approximately 15 minutes (after this period the oscillator frequency should be stable, with an accuracy of 1 part in  $10^7$ ).
- (b) Check the oscillator output on a frequency counter. If necessary, adjust oscillator frequency for 1000000 Hz. Course control of frequency can be achieved by adjustment of the oscillator trimmer, accessible through the top of the 1MHz oscillator. Fine frequency control can be achieved by adjustment of RV1 on the 1MHz oscillator, which is accessible from the underside of the equipment chassis.

NOTE: If oscillator stability needs to be checked, a highly stable (1 part in  $10^9$ ) frequency standard is required. The 1MHz oscillator and frequency standard outputs can then be beat together and the resultant output monitored by observing a lissajous display on the oscilloscope.

#### 4.4.6.2 Spectrum Generator - Module 10 (Fig. 8)

- (a) Connect the spectrum analyser, in turn, to the cable 5 and 31 output connectors of the module. Check that, in each case, a comb of frequencies spaced at 1MHz intervals is displayed, up to a maximum frequency exceeding 64MHz.
- (b) Connect the spectrum generator to the cable 12 output connector. Check that the output displayed is at a frequency of 48MHz, with 1MHz sidebands approximately 12dB down. Check sideband rejection in conjunction with Module 4 alignment.

#### 4.4.6.3 48MHz Selector - Module 4 (Fig. 14)

- (a) Connect the spectrum analyser to TP1 on Module 4 Board B. Check that the output displayed is a frequency of 48MHz, with 1MHz sidebands approximately 12dB down. Adjust coils L1 and L2 (Module 10) and L6 (Module 4) if necessary, to achieve the required rejection.

#### 4.4.6.4 Megahertz Selectors

- (a) Connect the spectrum analyser via a small value capacitor (e.g. 2pF) to the inner plate of variable capacitor C13 on Board G of Turret Compartment 3. Check that an output is displayed corresponding to each of the thirty Megahertz steps.
- (b) Check that, with 0MHz indicated a display of 35MHz is observed, with a sideband rejection of approximately 20dB.
- (c) Check that, as each 1MHz step is selected, up to 29MHz, a display of 35 MHz above selected MHz is indicated (e.g. with 29MHz selected display is 64MHz) and sideband rejection is approximately 20dB.
- (d) If these results cannot be obtained re-alignment is required, but should only be carried out if absolutely necessary. Two coils, located on Wafers F1 and F2, are available for each 1MHz step, and can be adjusted by inserting a trimming tool through the access holes provided in the top of the turret case.

NOTE: Before adjusting the selector coils, the locking varnish must be removed by application of a small amount of cellulose solvent. Relock the coils with varnish after adjustment.

#### 4.4.6.5 10.6 MHz/10.8 MHz Generator - Module 11 (Fig. 16)

- (a) Connect the spectrum analyser via a small value capacitor (e.g. 2pF) to test point TP1 on module 11.

- (b) Set the FUNCTION switch in turn to USB, BFO CAL, and F positions. Check that, in each case, the frequency displayed is 54MHz and a symmetrical rejection of approximately 25dB is observed. Adjust coils L1 and L2 if necessary to achieve the required rejection.
- (c) Set the FUNCTION switch, in turn, to LSB, CW and AM positions.. Check that, in each case, the frequency displayed is 53MHz and a symmetrical rejection of approximately 25dB is observed. Adjust RV1 if necessary to achieve the required rejection.
- (d) Check that the amplitudes of the two signals are within 1dB.

#### 4.4.6.6 1st Local Oscillator - Module 3 (Fig. 7)

- (a) Turn the FUNCTION switch to OFF, unsolder pins 2 and 3 of module 3 and connect the frequency counter to pins 8 and 9 of module 3.
- (b) Turn the FUNCTION switch to SSB and adjust C5 for a counter reading of 35MHz.
- (c) Turn the FUNCTION switch to OFF, reconnect pins 2 and 3 and then turn the FUNCTION switch to SSB.

#### 4.4.6.7 Reinserted Carrier 100kHz

- (a) Connect the frequency counter to the output lead 17 connection from the function switch, and check that, with the FUNCTION switch turned to SSB, the counter reading is 100kHz.
- (b) Turn the FUNCTION switch to CW and check that, with the front panel BFO control turned from +8kHz to -8kHz the frequency reading varies between 100kHz  $\pm$  8kHz.
- (c) Turn the FUNCTION switch to F, and check that the counter is 102.55kHz. If necessary adjust capacitor C23, fitted on the octal base of the fixed BFO, to obtain this frequency.

#### 4.4.7 Meter Circuit

##### 4.4.7.1 S '0' and S '9' Adjustment - Meter Amplifier Board (Fig. 24)

- (a) Set the receive front panel controls as follows:

AGC switch           - 0.1 sec.  
 FUNCTION switch    - USB  
 BANDWIDTH switch   - SSB  
 RF/IF GAIN control - fully clockwise

- (b) Inject a 15.5 MHz signal at 1 $\mu$ V emf into the rear-panel 75 ohm aerial input socket. Set the METER switch to RF and tune the receiver to the input signal.
- (c) Adjust RV3 on the meter amplifier board to achieve as indication of S0( $\pm$  1/16 in) on the meter

- (d) Increase the input level to 100 $\mu$ V emf and adjust RV2 on the meter amplifier board to achieve an indication of S9 ( $\pm 1/16$  in) on the meter.
- (e) Repeat the S0 and S9 alignment procedures, if necessary, to achieve the required results.

#### 4.4.7.2 AF Adjustment - Audio Amplifier (Fig. 19)

- (a) With the equipment connected as in 4.4.7.1 increase the input signal level to 1mV emf, and adjust RV1 on Module 9 to give a 1mW output at the rear-panel line output (600 ohm) connector.
- (b) Set the front panel METER switch to AF, and adjust RV1 on the meter amplifier board for a meter reading of 1mW.

#### 4.4.7.3 Fine Tune Adjustment - Waveform Generator (Fig. 20)

- (a) With the front panel controls set (as in 4.4.7.1), set the front panel FINE TUNE control to mid position and turn the LOCK ON/OFF switch to ON.
- (b) Adjust RV1, accessible through the hand of module 14 until the Hz x 10 digit on the front panel display indicates 0 or 1.
- (c) Adjust the FINE TUNE control slowly over its full range, and check that the Hz x 10 reading indicates a minimum deviation of  $\pm 50$ Hz.

#### 4.4.7.4 Counter Operation (Fig. 28)

- (a) With the front-panel FUNCTION switch set to USB check that, for an input of 2.3MHz to the Counter Unit SKT3 from the Interpolating Oscillator, a reading of .00000MHz is obtained on the counter display.
- (b) Check that, when the Oscillator output frequency is set to 3.29999 MHz a reading of .99999MHz is obtained on the counter display.
- (c) Check that, when the Oscillator output frequency is increased above 3.29999MHz, or decreased below 2.3MHz, the overspill  $\pm 1$ MHz lamp flashes.
- (d) Check that, when the Oscillator input is disconnected from the counter the counter reading is .70000MHz and the overspill  $\pm 1$ MHz lamp flashes.
- (e) Check that, when the MEGAHERTZ switch is tuned through all thirty ranges the appropriate indication is given on the display.

NOTE: 1MHz switching is purely mechanical in operation; see switch wafer on turret rear-panel -200V d.c. is applied to this switch to operate the display tubes.

Miscellaneous

Circuit Ref	Description	Part No.
RV1, RV3	Loudspeaker Type C53/7789	409/4/11450
RV2	Potentiometer, 1k $\Omega$ Lin.	404/1/02650/154
VT1	Potentiometer, 5k $\Omega$ $\pm$ 20% Log.	404/1/02650/296
FLT1	Transistor, 2N.4908, Fairchild	417/9/01780
S1	Filter Composite	422/8/00100/001
D1-4	Switch	408/4/50004
S4	Diode 1S134	415/4/98208
S5,S6	Switch	408/1/00004/007
T1	Switch, Lever 81052-BP-83	408/4/98062/006
T2	Transformer	407/8/22047
L4	Transformer	407/4/98095
L6	Choke	407/8/22106/002
FS1	Choke 1000 $\mu$ H	406/4/98012/005
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	518/4/98004/007
PL1	Box Spanner 5242 Buck and Hickman	630/4/17437
JK1	Plug, electrical, fixed 3-pin, 5A, Mk.4	CZ48993
JK2	Socket, jack	508/9/21832
M1	Socket, jack	508/4/21953
L2,L3	Instrument, indicating	682/4/99011
L1	Choke	407/8/21965
L5	Choke, 16 $\mu$ H $\pm$ 2 $\mu$ H	407/8/21959
	Plug, electrical, free, (BNC)	406/8/08314/004
	Socket, electrical fixed, (BNC)	508/4/28436
	Socket, electrical, free, Mk.4	508/4/28435
	Socket, electrical, free, Mk.4	CZ49015
	Belling Lee Min. Twin Socket Type C1580	508/4/28002
	Belling Lee Min. Fixed Socket	
	L1465/CS/AG/N1	508/4/28075/001
	Belling Lee Min. Free Plug, Crimped,	
	L1465/AK/FP/AG	508/9/21838
	Belling Lee Min. Free Socket, Crimped	
	L1465/AK/FS/AG	508/9/21839
	Cable Type RG174U, Times Wire & Cable	
	Co. Ltd.	998/4/70537/001
	Crimping tools to be used with crimped	
	connectors and coaxial cable listed	
	above:	
	Erma-Buchanan Crimping Tool, inner,	
	No.612118 with crimp positioner	
	Type L1465/K/T	
	Erma-Buchanan Crimping Tool, outer,	
	No.29010 with centre aperture die set	
	Type 29263	

5.2 INTERPOLATING OSCILLATOR (630/1/25261)

Resistors

R.No.	Value ohms	Tol. + %	Rating Watts	Maker and Type	Part No.
1	22k	2	1/4W 1/2W 1W 2W 5W 10W 20W 50W 100W 250W 500W 1000W	Fixed, film	403/4/05324/220
2	39k	2		Fixed, film	403/4/05324/390
3,7,10	2.2k	2		Fixed, film	403/4/05323/220
4	1k	2		Fixed, film	403/4/05323/100
5	10k	2		Fixed, film	403/4/05324/100
6	15k	2		Fixed, film	403/4/05324/150
8	180	2		Fixed, film	403/4/05324/180
9	5.6k	2		Fixed, film	403/4/05323/560
11	470	2		Fixed, film	403/4/05322/470
12,13,15	560	2		Fixed, film	403/4/05322/560
14	4.7k	2		Fixed, film	403/4/05323/470
16,17	56	2		Fixed, film	403/4/05321/560
18	330	2		Fixed, film	403/4/05322/330
20	100k	2		Fixed, film	403/4/05325/100

Capacitors

C.No.	Value $\mu$ F	Tol. + %	V.Wkg.	Maker and Type	Part No.
1,9,14, ) 15,16, ) 19,20 )	.01	20	250	Mullard C280 Miniature foil	400/4/98268/001
2,5,6, ) 10 )	1000p	1	125	Mullard 425-4-1002	400/4/98724/
3	3000p	1	125	Mullard 425-4-3002	400/4/98724/
4	1000p	5	350	Mica, moulded	424/4/98070/004
7	0-6p			Trimmer	401/8/20006
8	33p	5		Erie, NPO/BD	400/4/98425/163
11	68p	5	125	Polystyrene	400/4/98179/019
12	220p	5	125	Polystyrene	400/4/98179/010
13	330p	5	125	Polystyrene	400/4/98179/015

Miscellaneous

Circuit Ref.	Description	Part No.
RV1	Potentiometer, 10k $\Omega$	404/1/00405/013
L1	Coil Assembly	406/1/08379
L2	Trimmer Coil	406/8/08327
L3	RF Choke, miniature, 6.8 $\mu$ H $\pm$ 10%	406/4/98012/002
L4,L5	RF Choke, miniature, 1000 $\mu$ H $\pm$ 10%	406/4/98012/005
VT1-VT4	Transistor, BSY95A	417/4/98138
D1	Diode, Zener, 10V $\pm$ 5%	415/4/98167/003
D3	Diode, var. capacity BA110	415/4/98084/001

5.3 BFO ASSEMBLY (630/1/23304)

Resistors

R.No.	Value ohms	Tol. + %	Rating Watts	Maker and Type	Part No.
3	8.2k	2	1/2 1/4 1/2 1 2 5	Fixed, film	403/4/05323/820
2	15k	2		Fixed, film	403/4/05324/150
1	12k	2		Fixed, film	403/4/05324/120
4	2.2k	2		Fixed, film	403/4/05323/220
5,7,8	270	2		Fixed, film	403/4/05322/270
6	18k	2		Fixed, film	403/4/05324/180
9	12	2		Fixed, film	403/4/05321/120

Capacitors

C.No.	Value $\mu$ F	Tol. + %	V.Wkg	Maker and Type	Part No.
1	.047	20	250	Miniature foil	400/4/98268/005
2	3300p	1	125	Fixed, Plastics	400/4/98724/037
3	1000p	1	125	Fixed, Plastics	400/4/98724/022
4	470p	5	125	Fixed, Polystyrene	400/4/98179/027
5,6,7	0.1	20	250	Miniature foil	400/4/98268/007
8	220p	5	125	Fixed, Polystyrene	400/4/98366/018
9				Variable	401/4/98026/003

Miscellaneous

Circuit Ref.	Description	Part No.
RV1	Potentiometer, 5K $\Omega$	404/8/00405/024
L1	Inductor Assembly	406/8/08323/005
L2	RF Choke, miniature, 1000 $\mu$ H $\pm$ 10%	406/4/98012/005
VT1,VT2	Transistor BSY95A	417/4/98138

5.4 REGULATOR ASSEMBLY (630/1/14608)

Refer to sub-section 5.22

5.5 TURRET ASSEMBLY (630/1/25395)

Circuit Ref.	Description	Part No.
C1	Capacitor, miniature foil 0.1 $\mu$ F $\pm$ 20% 250V d.c.	400/4/98268/007
L1	Min. RF Choke 100 $\mu$ H $\pm$ 10%	406/4/98012/003



Miscellaneous

Circuit Ref.	Description	Part No.
D2	Diode, Zener, 10V $\pm$ 5%	415/4/98167/003
VT1,VT2,VT3	Transistor, ZTX320	417/4/02036/001

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

Circuit Ref.	Description	Part No.
R4	Resistor, Fixed, film, 120 $\Omega$ $\pm$ 2% $\frac{1}{2}$ W	403/4/05322/120
R1,2,3	Resistor, Fixed, film, 180 $\Omega$ $\pm$ 2% $\frac{1}{2}$ W	403/4/05322/180
RV1	Potentiometer 1.5k $\Omega$	404/1/00405/069
RV2,RV3,RV4	Potentiometer 1k $\Omega$	404/1/00405/005

5.5.5 Wafer Assemblies (F1) and (F2) (630/1/38363)

Circuit Ref.	Description	Part No.
L1	Inductor Assembly 14 turns	406/8/08325/002
L2	Inductor Assembly 14 turns	406/8/08324/002
L3	Inductor Assembly 13 turns	406/8/08325/003
L4	Inductor Assembly 13 turns	406/8/08324/003
L5,L7	Inductor Assembly 12 turns	406/8/08325/004
L6,L8	Inductor Assembly 12 turns	406/8/08324/004
L10,L12	Inductor Assembly 11 turns	406/8/08324/005
L9,L11,L13	Inductor Assembly 11 turns	406/8/08325/005
L14,L16,L18	Inductor Assembly 9 turns	406/8/08324/006
L15,L17	Inductor Assembly 9 turns	406/8/08325/006
L20,L22	Inductor Assembly 8 turns	406/8/08324/007
L19,L21,L23	Inductor Assembly 8 turns	406/8/08325/007
L24,L26,L28,L30	Inductor Assembly 7 turns	406/8/08324/008
L25,L27,L29	Inductor Assembly 7 turns	406/8/08325/008

5.5.6 Compartment 3 Board G (630/1/14105)

Resistors

R.No.	Value ohms	Tol. + %	Rating Watts	Maker and Type	Part No.
1,11,16,28	82	2	1/2	Fixed, film	403/4/05321/820
2,26	5.6k	2	1/2	Fixed, film	403/4/05323/560
3,9,14, ) 21,27,33,)	10k	2	1/2	Fixed, film	403/4/05324/100
4,5,6,10,15, ) 18,24,25,30,)	470	2	1/2	Fixed, film	403/4/05322/470
7,12,17,34	1.2k	2	1/2	Fixed, film	403/4/05323/120
8,13,20,32	2.7k	2	1/2	Fixed, film	403/4/05323/270
19,22,31,39	47	2	1/2	Fixed, film	403/4/05321/470
23	270	2	1/2	Fixed, film	403/4/05322/270
29,41	27	2	1/2	Fixed, film	403/4/05321/270
35	4.7k	2	1/2	Fixed, film	403/4/05323/470
36,37,38, ) 42,43 )	560	2	1/2	Fixed, film	403/4/05322/560
40	100	2	1/2	Fixed, film	403/4/05322/100

Capacitors

C.No.	Value μF	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	400/4/98308/112
3	100p	5		Erie N750/BD	400/4/98439/019
5,7,9	.047	20	250	Mullard C280	400/4/98268/005
10,11,12,16) 18,19,20 )	.001	-20+40	250	Ceramic Hi-k	400/4/98260/016
13	1.5-18p			Variable	401/4/98023/004
14	27p	5		Erie N750/AD	400/4/98308/104
15	47p	5		Erie N750/AD	400/4/98308/110

Miscellaneous

Circuit Ref.	Description	Part No.
RV1	Potentiometer, 100Ω	404/1/00405/001
L1	RF Choke, miniature, 6.8μH ± 10%	400/4/98012/002
L2	Ferrite Beads (3 off)	905/4/98052
T1-T4	Transformer	406/8/08329/003
VT1-VT3, VT8	Transistor, BSY95A,	417/4/98138
VT4-VT6	Transistor, TIS 62	417/9/02086/001
D1-D4 ) D5-D8 )	Diode, matched quad HP-5082-2805	415/4/05620

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	5.6k	2	1/2	Fixed, film	403/4/05323/560
3,12,17,) 20,24 )	560	2	1/2	Fixed, film	403/4/05322/560
4,5	270	2	1/2	Fixed, film	403/4/05322/270
6,7	27	2	1/2	Fixed, film	403/4/05321/270
8,10	1k	2	1/2	Fixed, film	403/4/05323/100
11,14,22	220	2	1/2	Fixed, film	403/4/05322/220
13,21,27	100	2	1/2	Fixed, film	403/4/05322/100
15,23,9	47	2	1/2	Fixed, film	403/4/05321/470
16,29	10k	2	1/2	Fixed, film	403/4/05324/100
18,25	1.5k	2	1/2	Fixed, film	403/4/05323/150
28	470	2	1/2	Fixed, film	403/4/05322/470

Capacitors

C.No.	Value $\mu$ F	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	400/4/98308/106
18,19	68p	5		Erie N750	400/4/98308/114
22	12p	10		Erie NPO/AD	400/4/98308/096
31	560p	5	125	Lemco Polystyrene	400/4/98179/012
5	11	20	6	Kemet, K11N6 NS	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	406/9/29881
D1,D2,D3,D4, D7,D8 ) D5,D6 )	Diode, matched quad HP-5082-2805	415/4/05620
	Diode, IN4148	415/4/98393
VT1,VT5-VT8	Transistor, TIS 62	417/9/02086/001
VT2-VT4	Transistor, BSY95A,	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,	1.5k	2	1/2	Fixed, film	403/4/05323/150
4,5	8.2k	2		Fixed, film	403/4/05323/820
6	6.8k	2		Fixed, film	403/4/05323/680
7	470	2		Fixed, film	403/4/05322/470
8,11	2.2k	2		Fixed, film	403/4/05323/220
9	1.8k	2		Fixed, film	403/4/05323/180
10,21,22	10k	2		Fixed, film	403/4/05324/100
12,2,3	150	2		Fixed, film	403/4/05322/150
13	330	2		Fixed, film	403/4/05322/330
16,18,19	4.7k	2		Fixed, film	403/4/05323/470
17,20	47k	2		Fixed, film	403/4/05324/470
15	270	2		Fixed, film	403/4/05322/220
14	820	1		Fixed, film	403/4/05322/820

Capacitors

C.No	Value $\mu$ F	Tol. + %	V.Wkg.	Maker and Type	Part No.
1	0.1	20	250	Mullard C280	400/4/98268/007
2,3	15	10	20	Plessey Tantalum	402/8/50832/070
4	33	10	10	Plessey Tantalum	402/8/51832/094
5	.047	20	250	Mullard C280	400/4/98268/005

Miscellaneous

Circuit Ref.	Description	Part No.
RV1	Potentiometer, 250 $\Omega$	404/1/00405/008
RV2	Potentiometer, 5k $\Omega$	404/1/00405/024
RV3	Potentiometer, 1.5k $\Omega$	404/1/00405/069
RV4	Potentiometer, 25k $\Omega$	404/1/00405/023
D1	Diode, Zener, 5.6V	415/4/02792/009
VT1-4, VT8, VT9	Transistor, BSY95A	417/4/98138
VT5, VT6	Transistor, 2S3030, Texas Instruments	417/4/98136
VT7	Transistor, 2N1507, Texas Instruments	417/4/98139

5.6 MODULE 1 - RF AMPLIFIER (630/1/17670)

Resistors

R.No.	Value ohms	Tol. + %	Rating Watts	Maker and Type	Part No.
1a,b,c,d	33	2	1	Fixed, film	403/4/05221/330
2,21	10	2	1	Fixed, film	403/4/05321/100
3	39	2	1	Fixed, film	403/4/05321/390
4,11,23,8	820	2	1	Fixed, film	403/4/05322/820
6	6.8k	2	1	Fixed, film	403/4/05323/680
5	2.2k	2	1	Fixed, film	403/4/05323/220
7	2.7k	2	1	Fixed, film	403/4/05323/270
9,16	1.5k	2	1	Fixed, film	403/4/05323/150
10	470	2	1	Fixed, film	403/4/05322/470
18	100	2	1	Fixed, film	403/4/05322/100
13,27	390	2	1	Fixed, film	403/4/05322/390
14,26,12	220	2	1	Fixed, film	403/4/05322/220
15	180	2	1	Fixed, film	403/4/05322/180
22	82	2	1	Fixed, film	403/4/05321/820
17,25	150	2	1	Fixed, film	403/4/05322/150
24	270	2	1	Fixed, film	403/4/05322/270
40	10k	2	1	Fixed, film	403/4/05324/100
28	560	2	1	Fixed, film	403/4/05322/560
36	56k	2	1	Fixed, film	403/4/05324/560
35	1k	2	1	Fixed, film	403/4/05323/100
37	22k	2	1	Fixed, film	403/4/05324/220
44	820k	2	1	Fixed, film	403/4/05325/820
45	39	2	1	Fixed, film	403/4/05321/390
19	33	2	1	Fixed, film	403/4/05321/330

Capacitors

C.No.	Value $\mu$ F	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	424/4/98042/129
18	12		25	Lemco SM	402/4/98009/032
16,17	47		25		402/9/55707/011
24	68	10	15	STC Tantalum	402/4/98022/027

Miscellaneous

Circuit Ref.	Description	Part No.
L1,L5,L6,L7	RF miniature choke 1000 $\mu$ H	406/4/98012/005
L2	RF miniature choke 150 $\mu$ H	406/4/98012/004
VT1	Transistor, TIS84	417/4/98731/000
VT2,VT3,VT4) VT6,VT9 )	Transistor, BSY95A	417/4/98138
VT5	Transistor, BCY70, Texas Instruments	417/4/98267/001
VT10	Transistor, D986, Texas Instruments	417/4/98153
D1,D2,D4	Diode, FRB126	415/4/98400
D5	Zener Diode 6.8V $\pm$ 5%	415/4/98167/009
D6,D7	Diode IN4148	415/4/98393
RV1	Potentiometer 500 $\Omega$ $\pm$ 20%	404/1/00405/002
D8	Diode Germanium OA95	415/4/98214

5.7 MODULE 2 - 1ST MIXER (630/1/14111/003)

Capacitors

C.No	Value pF	Tol. $\pm$ %	V.Wkg.	Maker and Type	Part No.
1	94	1pF	125	LCR Ltd. Polystyrene	400/4/98263/026
2	11	1pF	125	LCR Ltd. Polystyrene	400/4/98263/022
3	119	2 $\frac{1}{2}$	125	LCR Ltd. Polystyrene	400/4/98263/010
4	58	1pF	125	LCR Ltd. Polystyrene	400/4/98263/024
5	103	2%	125	LCR Ltd. Polystyrene	400/4/98263/016
6	40	1pF	125	LCR Ltd. Polystyrene	400/4/98263/023
7	63	1pF	125	LCR 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	428/4/98059
D1,D2,D3,D4	Diode, HP2900	415/4/98403

5.8 MODULE 3 - 1ST LOCAL OSCILLATOR (630/1/14112)

Resistors

R.No.	Value ohms	Tol. + %	Rating Watts	Maker and Type	Part No.
3	68k	2	1/4	Fixed, film	403/4/05324/680
4	820	2		Fixed, film	403/4/05322/820
5	1.8k	2		Fixed, film	403/4/05323/180
6	1.5k	2		Fixed, film	403/4/05323/150
7,15	270	2		Fixed, film	403/4/05322/270
9,10	5.6k	2		Fixed, film	403/4/05323/560
11	560	2		Fixed, film	403/4/05322/560
12	330	2		Fixed, film	403/4/05322/330
14	100	2		Fixed, film	403/4/05322/100
18,19	47	2		Fixed, film	403/4/05321/470
13,16	56	2		Fixed, film	403/4/05321/560

Capacitors

C.No.	Value $\mu$ F	Tol. + %	V.Wkg.	Maker and Type	Part No.
C1,C2,C4,) C6,C7,C8,) C9 )	.001	20	125	Lemco Ceramic Hi-k	400/4/98260/007
C3	56p	5	300	Ceramic	400/4/98308/112
C5	0.8-12p			Trimmer, Tubular ceramic	401/4/98023/003

Miscellaneous

Circuit Ref.	Description	Part No.
Z1	Saturable reactor	407/1/21963/001
VT1,VT2	Transistor, TIS 62	417/9/02086/001
VT3,VT4	Transistor, BSY95A	417/4/98138
D1,D2	Diode, BA110,	415/4/98084/001
D3	Diode, 1N4148	415/4/98393
F1,F2,F3,F4	UHF min. feed-through Ceramicon, Erie 1214-001	400/4/98667

5.9 MODULE 4 - AMPLIFIER/2ND MIXER (630/1/14117)

5.9.1 Board A (630/1/14093)

Resistors

R.No.	Value ohms	Tol. + %	Rating Watts	Maker and Type	Part No.
1	180	2	1/2	Fixed, film	403/4/05322/180
2,4	100	2	1/2	Fixed, film	403/4/05322/100
3,16	75	2	1/2	Fixed, film	403/4/05321/250
5	47k	2	1/2	Fixed, film	403/4/05324/470
6,14,19,24	10k	2	1/2	Fixed, film	403/4/05324/100
15	1k	2	1/2	Fixed, film	403/4/05323/100
18,20,21,) 22 )	4.7k	2	1/2	Fixed, film	403/4/05323/470
17	390	2	1/2	Fixed, film	403/4/05322/390
23	3.3k	2	1/2	Fixed, film	403/4/05323/330
25	18	2	1/2	Fixed, film	403/4/05321/180
26	27	2	1/2	Fixed, film	403/4/05321/270
28	82	2	1/2	Fixed, film	403/4/05321/820
8	470	2	1/2	Fixed, film	403/4/05322/470
13	22k	2	1/2	Fixed, film	403/4/05324/220

Capacitors

C.No.	Value µF	Tol. + %	V.Wkg.	Maker and Type	Part No.
1-9,12,13,) 19-24 )	.01	20	250	Mullard C280, Film	400/4/98268/001
14	59p	1pF	125	LCR Ltd., Polystyrene	400/4/98263/005
15	24p	2	125	LCR Ltd., Polystyrene	400/4/98263/027
16	80p	2	125	LCR Ltd., Polystyrene	400/4/98263/028
17	88p	2	125	LCR Ltd., Polystyrene	400/4/98263/029
18	27p	1pF	125	LCR Ltd., Polystyrene	400/4/98263/002
25	27p	5	125	Ceramic NPO	400/4/98308/104
35,36	3.3pF	0.5pF		Erie Ceramic N750/AD	400/4/98425/106

Miscellaneous

Circuit Ref.	Description	Part No.
RV1	Potentiometer 1kΩ	404/1/00405/005
L1,L2,L5	Miniature RF Choke 6.8µH ± 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. feedthrough Ceramicon, Erie 1214-001	400/4/98667
VT1	Transistor, BF779	417/9/02077
VT2	Transistor, TIS62	417/9/02086/001
VT3,VT4	Transistor, BSY95A,	417/4/98133
D1	Diode IN4148	415/4/98393

5.9.2 Board B (630/1/14095)

Resistors

R. No.	Value ohms	Tol. ± %	Rating Watts	Maker and Type	Part No.
29	330	2	1/4	Fixed, film	403/4/05322/330
30	100	2		Fixed, film	403/4/05322/100
31,39	15k	2		Fixed, film	403/4/05324/150
32	820	2		Fixed, film	403/4/05322/820
33	150	2		Fixed, film	403/4/05322/150
34	47	2		Fixed, film	403/4/05321/470
35	82	2		Fixed, film	403/4/05321/820
38	2.2k	2		Fixed, film	403/4/05323/220
40	10	2		Fixed, film	403/4/05321/100

Capacitors

C. No.	Value $\mu$ F	Tol.	V. Wkg.	Maker and Type	Part No.
26	0.01	-20,+50	25	Ceramic Type 831/T/25V	400/4/98710/002
27,34	18pF	+5%	125	Ceramic	400/4/98308/100
28	6.8p	+0.5pF	100	Ceramic	400/4/98425/083
29	47pF	+5%		Ceramic	Erie Type 8003W
30,31	.01 $\mu$ F	+20%	250	Fixed, Foil, Type C280AE/P10K	400/4/98268/001
32	3.3pF	+2.5%		Ceramic Type NPO/AD	400/4/98425/044

Miscellaneous

Circuit Ref.	Description	Part No.
L6	Inductor (9 turns)	406/8/08324/006
D1	Diode BZY 88. C10	415/4/02792/015
FL1	Crystal Filter 10.7 MHz	428/4/98065
VT5,VT6,VT7	Transistor, Ferranti ZTX 320	417/4/02036/001
F1,F2	UHF min. feed-through Ceramicon, Erie 1214-001	400/4/98667

5.10 MODULE 5 - 10.7MHz AMPLIFIER/3RD MIXER (630/1/17760)

Resistors'

R.No	Value ohms	Tol. + %	Rating Watts	Maker and Type	Part No.
1	82	2	1/2	Fixed, film	403/4/05321/820
2,5	470	2	1/2	Fixed, film	403/4/05322/470
3	15k	2	1/2	Fixed, film	403/4/05324/150
4,15,18) 24,26 )	10k	2	1/2	Fixed, film	403/4/05324/100
6,30	1k	2	1/2	Fixed, film	403/4/05323/100
7,14,17,19) 22,23,25 )	4.7k	2	1/2	Fixed, film	403/4/05323/470
16,27	560	2	1/2	Fixed, film	403/4/05322/560
21	1.5k	2	1/2	Fixed, film	403/4/05323/150
28	68	2	1/2	Fixed, film	403/4/05321/680
29	100	2	1/2	Fixed, film	403/4/05322/100

Capacitors

C.No.	Value $\mu$ F	Tol. + %	V.Wkg.	Maker and Type	Part No.
1 to 7 12,13,14,) 15,16,18,) 19,20 )	.022	20	250	Erie NPO/911	400/4/98268/003
17	220p	5	125	Polystyrene	400/4/98179/010
21	0.001	20	500	Erie Ceramicon	400/4/98260/007

Miscellaneous

Circuit Ref.	Description	Part No.
VT1	Transistor BF779	417/9/02077
VT3,VT4,VT5,) VT6 )	Transistor BSY95A	417/4/98138
D1,D2	Diode IN4148	415/4/98393
F1,F2,F3,F4	UHF min. feedthrough Ceramicon, Erie 1214-001	400/4/98667
L1	Min. RF Choke 1000 $\mu$ H	406/4/98012/005

5.11 MODULE 7 - 100kHz AMPLIFIER/DETECTOR (630/1/27993)

5.11.1 Board A (630/1/17771)

Resistors

R.No.	Value ohms	Tol. + %	Rating Watts	Maker and Type	Part No.
1	75	1	1	Fixed, film	403/4/05311/750
9,14,29	1k	2	1	Fixed, film	403/4/05323/100
3	27k	2	1	Fixed, film	403/4/05324/270
4	100k	2	1	Fixed, film	403/4/05325/100
5,10,24	470	2	1	Fixed, film	403/4/05322/470
6	4.7k	2	1	Fixed, film	403/4/05323/470
7,19,2	1.5k	2	1	Fixed, film	403/4/05323/150
11,16,23	100	2	1	Fixed, film	403/4/05321/100
12,17	10k	2	1	Fixed, film	403/4/05324/100
13	68k	2	1	Fixed, film	403/4/05324/680
15,25	3.9k	2	1	Fixed, film	403/4/05323/390
18	47k	2	1	Fixed, film	403/4/05324/470
22	180	2	1	Fixed, film	403/4/05322/180
20	33	2	1	Fixed, film	403/4/05321/330
21	680	2	1	Fixed, film	403/4/05322/680
26	180	2	1	Fixed, film	403/4/05322/180
27	1.5k	2	1	Fixed, film	403/4/05323/150
28	560	2	1	Fixed, film	403/4/05322/560
46	220	2	1	Fixed, film	403/4/05322/220
47	330	2	1	Fixed, film	403/4/05322/330
48	39	2	1	Fixed, film	403/4/05321/390

Capacitors

C.No.	Value $\mu$ F	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	.0051	1	125		400/4/98724/038
12,40	2.2		63		439/1/03220/031
18	.002	1	125		400/4/98724/033
19	47		20	Electrolytic	402/8/50833/029

Miscellaneous

Circuit Ref:	Description	Part No.
RV1	Potentiometer 10k $\Omega$ $\pm$ 20%	404/1/00405/009
L1,L2,L3,L4	RF Choke, miniature 1000 $\mu$ H $\pm$ 10%	406/4/98012/005
VT1-VT5,VT10	Transistor, BSY95A,	417/4/98138
D1,D2	Diode, IN4148	415/4/98393
D3	Zener Diode 4.7V $\pm$ 5%	415/4/98167/001

5.11.2 Board B (630/1/17774)

Resistors

R.No	Value ohms	Tol. $\pm$ %	Rating Watts	Maker and Type	Part No.
30	1.8k	2	1	Fixed, film	403/4/05323/180
31,35	10k	2	1	Fixed, film	403/4/05324/100
32,33,43,42	1k	2	1	Fixed, film	403/4/05323/100
34	2.7k	2	1	Fixed, film	403/4/05323/270
36,51	220	2	1	Fixed, film	403/4/05322/220
37	470	2	1	Fixed, film	403/4/05322/470
38	39k	2	1	Fixed, film	403/4/05324/390
39,44	15k	2	1	Fixed, film	403/4/05324/150
40	4.7k	2	1	Fixed, film	403/4/05323/470
41	33k	2	1	Fixed, film	403/4/05324/330
49	3.3k	2	1	Fixed, film	403/4/05323/330
50	1.5k	2	1	Fixed, film	403/4/05323/150
52	6.8k	2	1	Fixed, film	403/4/05323/680
53,54	180	2	1	Fixed, film	403/4/05322/180

Capacitors

C.No.	Value $\mu$ F	Tol. $\pm$ %	V.Wkg.	Maker and Type	Part No.
17	.0024	1	125	Fixed, Plastics	400/4/98724/035
21	25	-10+50	25	Electrolytic	402/4/98031/034
22,23,31	47	-10+50	25	Electrolytic	402/9/55707/011
24,25,26,32	0.1	20	250	Miniature Foil	400/4/98268/007
27	.002	1	125	Fixed, Plastics	400/4/98724/033
28	.0047	-20+40	500	Ceramic 811/K35008	400/4/98113/010
30,34	6.4	-10+50	25	Electrolytic	402/4/98031/032
33	47	20	20	Tantalum Insulated	402/8/50833/029

Miscellaneous

Circuit Ref.	Description	Part No.
VT6-VT11	Transistor, BSY95A	417/4/98138
D4	Diode, IN4148	415/4/98393
L5,L6	RF Choke, Miniature 1000 $\mu$ H	406/4/98012/005
T1	Transformer	406/8/08326/002
T2	Transformer	406/8/08220/009

5.12 MODULE 8 - AGC AMPLIFIER AND DETECTOR (630/1/17750)

Resistors

R.No.	Value ohms	Tol. + %	Rating Watts	Maker and Type	Part No.
1	2.2k	2	1/4	Fixed, film	403/4/05323/220
2	2.7k	2		Fixed, film	403/4/05323/270
3,11,15	10k	2		Fixed, film	403/4/05324/100
4,5,17	560	2		Fixed, film	403/4/05322/560
6	3.9k	2		Fixed, film	403/4/05323/390
7,13	4.7k	2		Fixed, film	403/4/05323/470
12	27k	2		Fixed, film	403/4/05324/270
14	6.8k	2		Fixed, film	403/4/05323/680
16	82k	2		Fixed, film	403/4/05324/820
8	150	2		Fixed, film	403/4/05322/150
10	470	2		Fixed, film	403/4/05322/470
9	15k	2		Fixed, film	403/4/05324/150

Capacitors

C.No.	Value $\mu$ F	Tol. + %	V.Wkg.	Maker and Type	Part No.
1,2,3,7,9	0.1	20	250	Miniature Foil	400/4/98268/007
4	.0022	1	125	Fixed, Plastics	400/4/98724/034
8	68	10	15	STC Tantalum Electrolytic	402/4/98022/027
10,11	47		20	Electrolytic	402/8/50833/029
12	2.2		63	Plessey Electrolytic	439/1/03220/031
5	.47	10	160	Wima Tropyfol M	640/8/08705/003
6	10		63	Miniature Electrolytic	439/1/04320/041
13	6.8	+50-10	40	Miniature Electrolytic	402/9/55696/011

Miscellaneous

Circuit Ref.	Description	Part No.
T1	Transformer	406/8/08225/012
L1,L2,L3,L4	RF Choke, miniature, 1000 $\mu$ H $\pm$ 10%	406/4/98012/005
VT1,VT2	Transistor BSY95A,	417/4/98138
VT3	Transistor 2S3030 Texas Instruments	417/4/98136
VT4-VT8	Transistor BCY70	417/4/98267/001
VT9	Transistor BCY71	414/4/98267/002
RV1	Potentiometer, 10k $\Omega$	404/1/00405/009
RV2	Potentiometer, 2.5k $\Omega$	404/1/00405/004
D1,D3,D4,D5,D6, D8,D9	Diode, IN4148	415/4/98393
D2	Diode Zener 8.2V	415/4/98167/006
D7	Diode Zener 3.3V	415/4/98167/007

5.13 MODULE 9 - AUDIO AMPLIFIERS (630/1/14119)

5.13.1 Board A (630/1/14188)

Resistors

R.No.	Value ohms	Tol. $\pm$ %	Rating Watts	Maker and Type	Part No.
1	1.8k	2	1/2	Fixed, film	403/4/05323/180
2	5.6k	2	1/2	Fixed, film	403/4/05323/560
3	100	2	1/2	Fixed, film	403/4/05322/100
4,6	220	2	1/2	Fixed, film	403/4/05322/220
5	12k	2	1/2	Fixed, film	403/4/05324/120
7	2.2k	2	1/2	Fixed, film	403/4/05323/220
8	330	2	1/2	Fixed, film	403/4/05322/330
9,10,11	10	2	1/2	Fixed, film	403/4/05321/100

Capacitors

C.No.	Value $\mu$ F	Tol. $\pm$ %	V.Wkg.	Maker and Type	Part No.
1	1	10	50	Electrolytic	402/4/98049/095
2,4,5	47		25	Electrolytic	402/9/55707/011
3	560p	5	125	Polystyrene	400/4/98179/012
6	220		25	Electrolytic	439/1/05620/001
7	22	-10+50	25	Electrolytic	402/9/55696/010
8,9	0.1	20	250	Miniature Foil	400/4/98268/007
10	220p	5		Synthetic Resin	424/4/98047/065

Miscellaneous

Circuit Ref.	Description	Part No.
VT1,VT3	Transistor, BSY95A	417/4/98138
VT2	Transistor, ASY26, STC	417/4/98039/001
VT4,VT5	Transistor, 2N1507, Texas Instruments	417/4/98139
D1,D2	Diode, OA200 Mullard	415/4/98011
RV1	Potentiometer, 100k $\Omega$	404/1/00405/006
RV2	Potentiometer, 1k $\Omega$	404/1/00405/005

5.13.2 Board B (630/1/14084)

Resistors

R.No.	Value ohms	Tol. + %	Rating Watts	Maker and Type	Part No.
1	1.2k	2	1/4	Fixed, film	403/4/05323/120
6	2.2k	2	1/4	Fixed, film	403/4/05323/220
2,10	1k	2	1/4	Fixed, film	403/4/05323/100
3	10k	2	1/4	Fixed, film	403/4/05324/100
4,8	470	2	1/4	Fixed, film	403/4/05322/470
5	82	2	1/4	Fixed, film	403/4/05321/820
7	15k	2	1/4	Fixed, film	403/4/05324/150
9	2.7k	2	1/4	Fixed, film	403/4/05323/270
11	33k	2	1/4	Fixed, film	403/4/05324/330
12	27k	2	1/4	Fixed, film	403/4/05324/270
13	22	2	1/4	Fixed, film	403/4/05321/220
14	4.7k	2	1/4	Fixed, film	403/4/05323/470

Capacitors

C.No.	Value $\mu$ F	Tol. + %	V.Wkg.	Maker and Type	Part No.
1,6,7	2.2		63	Plessey Electrolytic	439/1/03220/031
2,8	47		20	Electrolytic	402/8/50833/029
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	22	-10+50	25	Plessey Electrolytic	402/9/55696/010

Miscellaneous

Circuit Ref.	Description	Part No.
RV1	Potentiometer 5k $\Omega$	404/1/00405/024
RV2	Potentiometer 100k $\Omega$	404/1/00405/006
VT1 to VT4	Transistor BSY95A,	417/4/98138

5.14 MODULE 10 MKII - SPECTRUM GENERATOR (630/1/14930)

5.14.1 Board A (Mk.II) (630/1/14931)

Resistors

R.No.	Value ohms	Tol. ± %	Rating Watts	Maker and Type	Part No.
8	2.2k	2	1/2	Fixed, film	403/4/05323/220
9,12	8.2k	2	1/2	Fixed, film	403/4/05323/820
10	1.5k	2	1/2	Fixed, film	403/4/05323/150
11,19	1k	2	1/2	Fixed, film	403/4/05323/100
13,15	1.8k	2	1/2	Fixed, film	403/4/05323/180
14	100	2	1/2	Fixed, film	403/4/05322/100
17	120	2	1/2	Fixed, film	403/4/05322/120
18,22,26	470	2	1/2	Fixed, film	403/4/05322/470
20	680	2	1/2	Fixed, film	403/4/05322/680
27	220k	2	1/2	Fixed, film	403/4/05325/220
28	3.3k	2	1/2	Fixed, film	433/4/05323/330
29	180	2	1/2	Fixed, film	403/4/05322/180
30,33	560	2	1/2	Fixed, film	403/4/05322/560
31	150k	2	1/2	Fixed, film	403/4/05325/150
32	68k	2	1/2	Fixed, film	403/4/05324/680
34	150	2	1/2	Fixed, film	403/4/05322/150
35	1k	2	1/2	Fixed, film	403/4/05323/100
37	330	2	1/2	Fixed, film	403/4/05322/330
38,39,40	180	2	1/2	Fixed, film	403/4/05322/180
43	47	2	1/2	Fixed, film	403/4/05321/470

Capacitors

C.No.	Value μF	Tol. ± %	V.Wkg.	Maker and Type	Part No.
5,7,8,10,) 11,12,13,) 14,26,28 )	0.1	20	250	Miniature Foil	400/4/98268/007
9,17	82p	5	125	Polystyrene	400/4/98179/011
20,30	68p	5		Ceramic	400/4/98038/114
21	33p	5		Ceramic	400/4/98308/106
23	10p	10		Erie Type NPO/AD	400/4/98425/118
24,25	220p	5	125	Polystyrene	400/4/98179/010
27	4p- 40p			Plastic Dielectric Trimmer	401/4/98083
29	1000p	1	125	Polystyrene Fixed	400/4/98724/022
15	47	10		Ceramic	400/4/98308/148
16	150p	10	125	Polystyrene Fixed	400/4/98179/024
31	6.4		25	Electrolytic	402/4/98031/032

Miscellaneous

Circuit Ref.	Description	Part No.
L1,L3	RF Choke, miniature .22 $\mu$ H	406/4/98012/006
L2	RF Choke, miniature 4.7 $\mu$ H	406/4/98012/001
VT1-4,) VT6-9 )	Transistor BSY95A	417/4/98138
VT5	Transistor, TIS62	417/9/02086/001
D1	Diode, IN4148	415/4/98393
XL1	Crystal 1MHz	428/4/98034

5.14.2 Board B (630/1/14271)

Resistors

R.No.	Value $\mu$ F	Tol. + %	Rating Watts	Maker and Type	Part No
1,8	100	2	1	Fixed, film	403/4/05322/100
2	330	2	1	Fixed, film	403/4/05322/330
3	2.2k	2	1	Fixed, film	403/4/05323/220
4,14	5.6k	2	1	Fixed, film	403/4/05323/560
5	470	2	1	Fixed, film	403/4/05322/470
6,11	33k	2	1	Fixed, film	403/4/05324/330
7	820	2	1	Fixed, film	403/4/05322/820
9	47	2	1	Fixed, film	403/4/05321/470
10	3.3k	2	1	Fixed, film	403/4/05323/330
12	100	2	1	Fixed, film	403/4/05322/100
13	10	2	1	Fixed, film	403/4/05321/100
15	560	2	1	Fixed, film	403/4/05322/560
16	82	2	1	Fixed, film	403/4/05321/820

Capacitors

C.No.	Value $\mu$ F	Tol. + %	V.Wkg.	Maker and Type	Part No.
1	56p	2		Fixed, Ceramic	400/9/98746/019
2	8.2p	0.5p		Fixed, Ceramic	400/4/98425/085
3	47p	5	125	Fixed, Plastics	400/4/98179/016
4	12p	5		Fixed, Ceramic	400/4/98425/089
5	10p	.5p		Fixed, Ceramic	400/4/98425/087
6,10,11	.01	20	250	Fixed, Foil	400/4/98268/001
7,9,14	0.1	20	250	Fixed, Foil	400/4/98268/007
12,13	.001	-20+40		Fixed, Ceramic	400/4/98260/016
8	47		25	Fixed, Electrolytic	402/9/55707/011

Miscellaneous

Circuit Ref	Description	Part No.
L1,L2	Inductor	406/8/08324/005
L4,L5	Inductor, Miniature 1000µH	406/4/98012/005
L6,L7	Inductor, Miniature 100µH	406/4/98012/003
L8,L9	Feroxcube Beads (6 off)	905/4/98052
D2	Diode Zener, 10V <u>+5%</u>	415/4/98167/003
VT1,VT2,VT3,) VT4 )	Transistor, ZTX 320	417/4/02036/001

5.15 MODULE 11 MKII - 10.6/10.8MHz GENERATOR (630/1/14938)

Resistors

R.No.	Value ohms	Tol. ± %	Rating Watts	Maker and Type	Part No.
1,12,14,17,) 20,23 )	330	2	1/2	Fixed, film	403/4/05322/330
2	2.2k	2	1/2	Fixed, film	403/4/05323/220
3,4	5.6k	2	1/2	Fixed, film	403/4/05323/560
5,31	470	2	1/2	Fixed, film	403/4/05322/470
6	220k	2	1/2	Fixed, film	403/4/05325/220
7	33k	2	1/2	Fixed, film	403/4/05324/330
8	10	2	1/2	Fixed, film	403/4/05321/100
9	120	2	1/2	Fixed, film	403/4/05322/120
11,15,18,) 21,24 )	1.8k	2	1/2	Fixed, film	403/4/05323/180
10,27	6.8k	2	1/2	Fixed, film	403/4/05323/680
13,16,19,) 22,25 )	180	2	1/2	Fixed, film	403/4/05322/180
26,42	100	2	1/2	Fixed, film	403/4/05322/100
28	18k	2	1/2	Fixed, film	403/4/05324/180
29	680	2	1/2	Fixed, film	403/4/05322/680
32	82	2	1/2	Fixed, film	403/4/05321/820
33	4.7k	2	1/2	Fixed, film	403/4/05323/470
34	1.2k	2	1/2	Fixed, film	403/4/05323/120
35	3.3k	2	1/2	Fixed, film	403/4/05323/330
36	33k	2	1/2	Fixed, film	403/4/05324/330
38	220	2	1/2	Fixed, film	403/4/05322/220
39	560	2	1/2	Fixed, film	403/4/05322/560
41	820	2	1/2	Fixed, film	403/4/05322/820
43	1.5k	2	1/2	Fixed, film	403/4/05323/150
30,40	100	2	1/2	Fixed, film	403/4/05322/100

Capacitors

C.No.	Value μF	Tol. ± %	V.Wkg.	Maker and Type	Part No.
1,18	.001	15		Fixed, Ceramic	400/4/18794/028
2	8.2p	5		Fixed, Ceramic NPO/AD	400/4/98047/006
3	47p	5	125	Fixed, Plastics	400/4/98179/016
4	12p	5		Fixed, Ceramic N560/AD	400/4/98394/033
5	33p	5		Fixed, Ceramic N750/AD	400/4/98308/106
6,12	12p	5		Fixed, Ceramic NPO/AD	400/4/98047/007
8,13,14	.047	20	250	Fixed, Foil	400/4/98268/005
9,11	.10	20	250	Fixed, Foil	400/4/98268/007
15	330p	5	125	Fixed, Plastics	400/4/98179/015
16	27p	5	500	Fixed, Ceramic NPO/801	400/4/19511/270
17	27p	1	160	Fixed, Plastics	400/4/98212/019

Miscellaneous

Circuit Ref.	Description	Part No.
RV1	Potentiometer, Mini Flat Pot, Painton 25K	404/4/98118/001
RV2	Potentiometer, Type G, Mk2A 500Ω	404/1/00405/002
D2	Diode, Zener, 10V ± 5%	415/4/98167/003
D3-7	Diode, Zener, 2.7V ± 5%	415/4/98167/005
D8	Diode, BA110	415/4/98084/001
D9	Diode, Zener, 6.8V ± 5%	415/4/98167/009
VT1,2,3,15	Transistor, ZTX 320	417/4/02036/001
L1	Inductor Assembly, 9 turns	406/8/08324/006
L3	Inductor Assembly, 11 turns	406/8/08324/005
L4,5,6	Choke, RF Miniature 100μH	406/4/98012/003
L7	Inductor Assembly	406/1/08459
VT4-14	Transistor XK 1099 (selected BSY 95A)	417/9/01747
L2	Inductor Assembly, 7 turns	406/8/08324/008

5.16 MODULE 13 - INTEGRATOR (630/1/25352)

Resistors

R.No.	Value ohms	Tol. ± %	Rating Watts	Maker and Type	Part No.
1	560	2	1/4	Fixed, film	403/4/05322/560
2	1k	1	1/4	Fixed, film	403/4/05313/100
3	820	1	1/4	Fixed, film	403/4/05312/820
4,17	2.2k	2	1/4	Fixed, film	403/4/05323/220
5	150k	2	1/4	Fixed, film	403/4/05325/150
6	1M	2	1/4	Fixed, film	403/4/05336/100
7,11,14	82k	2	1/4	Fixed, film	403/4/05324/820
8,10,12,15	10k	2	1/4	Fixed, film	403/4/05324/100
13,16	22k	2	1/4	Fixed, film	403/4/05324/220
9	47k	2	1/4	Fixed, film	403/4/05324/470
18	120	2	1/4	Fixed, film	403/4/05322/120
19,20	33k	2	1/4	Fixed, film	403/4/05324/330
21	1.8k	2	1/4	Fixed, film	403/4/05323/180
22	3.9k	2	1/4	Fixed, film	403/4/05323/390

Miscellaneous

Circuit Ref.	Description	Part No
C1,2,3,4	Capacitor, Min. Foil, 0.1 $\mu$ F $\pm$ 20%, 250V	400/4/98268/007
D1	Diode, Zener 10V, 5%	415/4/98167/003
D2,3,4,5	Diode, OA200	415/4/98011
D6	Diode, Zener, 3.9V, 5%	415/4/98064
RV1	Potentiometer, 1k $\pm$ 20% LIN. STD.	404/1/00405/005
VT1,8	Transistor, BSY95A	417/4/98138
VT2-7	Transistor, 2S3030	417/4/98136

5.17 MODULE 14 - WAVEFORM GENERATOR (630/1/25354)

5.17.1 Board A (630/1/25287)

Circuit Ref.	Description	Part No.
R9,20,21,22	Resistor, Fixed 220 $\Omega$ $\pm$ 2% $\frac{1}{2}$ W	403/4/05322/220
C8,9,11	Capacitor, Min.Foil, 0.01 $\mu$ F $\pm$ 20%, 250V	400/4/98268/001
C10	Capacitor, Min.Foil, 0.1 $\mu$ F $\pm$ 20%, 250V	400/4/98268/007
ML1	Semiconductor Network, SN5400N	446/9/98080/000
ML2	Semiconductor Network, SN5472N	446/9/98080/026
ML3,4	Semiconductor Network, SN5473N	446/9/98080/027
ML5,6	Semiconductor Network, SN5474N	446/9/98080/028

5.17.2 Board B (630/1/25392)

Circuit Ref.	Description	Part No.
R3	Resistor, Fixed 820 $\Omega$ $\pm$ 2% $\frac{1}{2}$ W	403/4/05322/820
R4,7	Resistor, Fixed 1k $\pm$ 2% $\frac{1}{2}$ W	403/4/05323/100
R5	Resistor, Fixed 180 $\Omega$ $\pm$ 2% $\frac{1}{2}$ W	403/4/05322/180
R6	Resistor, Fixed 10k $\pm$ 2% $\frac{1}{2}$ W	403/4/05324/100
C1,2	Capacitor, Min.Foil 0.1 $\mu$ F $\pm$ 20%, 250V	400/4/98268/007
ML7	Semiconductor Network, SN5400N	446/9/98080/000
ML8,9,10,11, 12,13	Semiconductor Network, SN5490N	445/4/02404
VT1,2	Transistor, BSY95A	417/4/98138

5.17.3 Board C (630/1/25431)

Circuit Ref.	Description	Part No.
R8,9	Resistor, Fixed, film, $270\Omega \pm 2\%$ $\frac{1}{2}W$	403/4/05322/270
R10,13,17	Resistor, Fixed, film, $330\Omega \pm 2\%$ $\frac{1}{2}W$	403/4/05322/330
R11,15	Resistor, Fixed, film, $220\Omega \pm 2\%$ $\frac{1}{2}W$	403/4/05322/220
R12,16	Resistor, Fixed, film, $2.2k \pm 2\%$ $\frac{1}{2}W$	403/4/05323/220
R14,18	Resistor, Fixed, film, $100\Omega \pm 2\%$ $\frac{1}{2}W$	403/4/05322/100
R23,24	Resistor, Fixed, film, $150\Omega \pm 2\%$ $\frac{1}{2}W$	403/4/05322/150
R25,26	Resistor, Fixed, film, $180\Omega \pm 2\%$ $\frac{1}{2}W$	403/4/05322/180
RV1	Potentiometer $1k\Omega \pm 20\%$ LIN STANDARD	404/1/00405/005
C3	Capacitor, Hi-k, $330pF \pm 10\%$ 500V	400/4/98331/005
C4,12,13	Capacitor, Min.Foil, $0.01\mu F \pm 20\%$ 250V	400/4/98268/001
C5,7,14,15	Capacitor, Polystyrene, $0.003\mu F \pm 1\%$ 160V	400/4/98261/013
C6	Capacitor, Min.Foil, $0.1\mu F \pm 20\%$ 250V	400/4/98268/007
D1,2	Diode, OA200	415/4/98011
ML14	Semiconductor Network, SN5400N	446/9/98080/000
ML15	Semiconductor Network, SN5473N	446/9/98080/027
VT3,4	Transistor, BSY95A	417/4/98138
L1	Choke, $100\mu H$	406/4/98012/003
L2	Choke, $16\mu H$	406/8/08314/004

5.18 1MHZ OSCILLATOR UNIT (630/1/28133)

Resistors

R.No.	Value ohms	Tol. + %	Rating Watts	Maker and Type	Part No.
1	180	2	$\frac{1}{2}W$	Fixed, film	403/4/05322/180
2	390	2	$\frac{1}{2}W$	Fixed, film	403/4/05322/390
3	27	5	$\frac{3}{4}W$	Wirewound CGS C3A	403/4/78355/048
4	820	2	$\frac{1}{2}W$	Fixed, film	403/4/05322/820
5	1k	2	$\frac{1}{2}W$	Fixed, film	403/4/05323/100
6	56	2	$\frac{1}{2}W$	Fixed, film	403/4/05321/560

Capacitors

C.No.	Value $\mu F$	Tol. + %	V.Wkg.	Maker and Type	Part No.
1	1000		16	Electrolytic	402/4/98210/011
2	100	-20+80	25	Electrolytic	402/4/98181/014
3	4.7	10	10	Electrolytic	402/9/55727/001
4,7	0.1	20	250	Mullard, C280	400/4/98268/007
5	0.003	20	500	Hunts, W97	400/4/98153/015
6	0.01	20	250	Mullard, C280	400/4/98268/001

Miscellaneous

Circuit Ref.	Description	Part No.
RV1	Resistor, Variable w/w 33Ω ± 10%	404/8/04083/001
VT1	Transistor 2N1507, Texas	417/4/98321
VT2	Transistor 2N3055, Texas	417/4/98431/001
VT3	Transistor BSY95A	417/4/98138
D1,D2,D3,D4	Diode IN4001 Texas	415/4/98243/001
D5	Diode, Zener, 5.6V ± 5%	415/4/98167/002
D6	Diode, Zener, 5.1V ± 5%	415/4/98167/010
D7	Diode, Zener, 4.7V ± 5%	415/4/98167/001
ML1	Semiconductor Network, SN5490N	445/4/02404
OSC1	Xtal Oscillator 10MHz Cathodeon FS951/01	428/4/98103/000
L1,L2	Choke, r.f. miniature, 6.8μH	406/4/98012/002

5.19 5V REGULATOR and 1MHz ISOLATING AMP. (630/1/25253)

Resistors

R.No.	Value ohms	Tol. ± %	Rating Watts	Maker and Type	Part No.
1	1.8k	2	1/2	Fixed, film	403/4/05323/180
2	4.7k	2	1/2	Fixed, film	403/4/05323/470
3	220	2	1/2	Fixed, film	403/4/05322/220
4,5,7,8	2.2k	2	1/2	Fixed, film	403/4/05323/220
6	1.5k	2	1/2	Fixed, film	403/4/05323/150
9	2.7k	2	1/2	Fixed, film	403/4/05323/270
10	150	2	1/2	Fixed, film	403/4/05322/150
12	10k	2	1/2	Fixed, film	403/4/05324/100
13	1k	2	1/2	Fixed, film	403/4/05323/100
14	120	2	1/2	Fixed, film	403/4/05322/120
15	100	2	1/2	Fixed, film	403/4/05322/100

Capacitors

C.No.	Value μF	Tol. ± %	V.Wkg.	Maker and Type	Part No.
1	4700		25	Electrolytic	402/4/98126/035
2	330		10	Min.Electrolytic	
3,6	0.01		250	Plessey Type CE280AE/P10K	400/4/98268/001
5	25		6.4	Electrolytic	402/4/98031/014

Miscellaneous

Circuit Ref.	Description	Part No.
RV1	Potentiometer 5k	404/8/00405/024
D1	Diode, Zener, 3.3V	415/4/98167/007
D2	Diode, 1S410	415/4/98388
MR1	Diode Bridge, 1B20K05	415/4/98164
D3-6	Diode IN4007	415/4/98243/007
VT1,2,3,4	Transistor, 2N3702	417/4/98285
VT7	Transistor, BSY95A	417/4/98138
VT5	Transistor, ASY28	417/4/98039/003
VT6	Transistor, 2N3713	417/4/98317

5.20 COUNTER ASSEMBLY, MICRO MINIATURE (630/1/25373)

5.20.1 Boards 1-4 (630/1/25363)

Board 5 (630/1/25364)

Circuit Ref.	Description	Part No.
R6,7	Resistor, Fixed 27k $\pm$ 2% $\frac{1}{2}$ W	403/4/05324/270
ML1,4	Semiconductor Network, SN5490N	445/4/02404
ML2,5	Semiconductor Network, SN5475N	446/9/01293/000
ML3,6	Semiconductor Network, DM5441AN	445/4/02405
X3,4	Valve Electronic ITT GN 13A	414/9/01904

5.20.2 'Megahertz' Board (630/1/25361)

Circuit Ref.	Description	Part No.
R1	Resistor Fixed, film 10k $\pm$ 2% $\frac{1}{2}$ W	403/4/05324/100
R2	Resistor Fixed, film 15k $\pm$ 2% $\frac{1}{2}$ W	403/4/05324/150
R3	Resistor Fixed, film 270k $\pm$ 2% $\frac{1}{2}$ W	403/4/05325/270
R4	Resistor Fixed, film 100k $\pm$ 2% $\frac{1}{2}$ W	403/4/05325/100
ML9	Semiconductor Network, SN5473N	446/9/98080/027
ML10	Semiconductor Network, SN5410N	446/9/98080/013
ML11	Semiconductor Network, SN5400N	446/9/98080/000
ML12	Semiconductor Network, SN5472N	446/9/98080/026
VT1	Transistor, BFR 86	417/9/01725/001
ILP1,2	Indicator Neon, Hivac 3L	517/1/90057
X1,2	Valve Electronic ITT GN 13A	414/9/01904
R5	Resistor, Fixed 150k $\pm$ 2% $\frac{1}{2}$ W	403/4/05325/150
C2,3	Capacitor Min. Foil 0.1 $\mu$ F $\pm$ 20% 250V	400/4/98268/007
VT2	Transistor BSY95A	417/4/98138
R8	Resistor, Fixed, 10k $\pm$ 2% $\frac{1}{2}$ W	403/4/05324/100
R9	Resistor, Fixed, 1k $\pm$ 2% $\frac{1}{2}$ W	403/4/05323/100

5.20.3 'Mother' Board (630/1/25362)

Circuit Ref.	Description	Part No.
C1	Capacitor, 68 $\mu$ F +50 -10%, 16V	402/9/55707/008
L1	Inductor	406/8/08314/004
ML7	Semiconductor Network, SN5440N	446/9/98080/019
ML8	Semiconductor Network, SN5400N	446/9/98080/000

5.21 ISOLATING AMPLIFIER (630/1/14541 and 630/1/14541/001)

Resistors

R.No.	Value ohms	Tol. $\pm$ %	Rating Watts	Maker and Type	Part No.
1	330	2	$\frac{1}{2}$	Fixed, film	403/4/05322/330
2	4.7k	2	$\frac{1}{2}$	Fixed, film	403/4/05323/470
3	10k	2	$\frac{1}{2}$	Fixed, film	403/4/05324/100
4,7	470	2	$\frac{1}{2}$	Fixed, film	403/4/05322/470
5,6	5.6k	2	$\frac{1}{2}$	Fixed, film	403/4/05323/560
8	220	2	$\frac{1}{2}$	Fixed, film	403/4/05322/220

Miscellaneous

Circuit Ref.	Description	Part No.
C1,C4,C5	Capacitor, .001 $\mu$ F, -20% +40%, Ceramic Hi-k	400/4/98260/016
VT1,VT2	Transistor, BSY95A	417/4/98138
F1,F2	UHF Min. feedthrough Ceramicon, Erie 1214-001	400/4/98667

5.22 REGULATOR (630/1/14608)

Resistors

R.No.	Value ohms	Tol. $\pm$ %	Rating Watts	Maker and Type	Part No.
1,3,4	4.7k	2	$\frac{1}{2}$	Fixed, film	403/4/05323/470
2	10k	2	$\frac{1}{2}$	Fixed, film	403/4/05324/100
5	1.2k	2	$\frac{1}{2}$	Fixed, film	403/4/05323/120
6	1.8k	2	$\frac{1}{2}$	Fixed, film	403/4/05323/180
7	820	2	$\frac{1}{2}$	Fixed, film	403/4/05322/820
8	220	2	1	Fixed, film	403/4/05222/220

Capacitors

C.No	Value F	Tol. + %	V.Wkg.	Maker and Type	Part No.
1,5	47		25	Fixed, Electrolytic	402/9/55707/011
2,3	100		20	Tantalum	402/8/50834/017
4	.05		250	Hunts W97	400/4/98507/010

Miscellaneous

Circuit Ref.	Description	Part No.
RV1	Potentiometer 1k $\Omega$ $\pm$ 20%	404/8/02856/036
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	417/4/98170
VT4	Transistor, BCY33	417/4/98033

5.23 METER AMPLIFIER (630/1/17742)

Resistors

R.No.	Value ohms	Tol. + %	Rating Watts	Maker and Type	Part No.
4	1.2k	2	1/2	Fixed, film	403/4/05323/120
2	12k	2	1/2	Fixed, film	403/4/05324/120
3	56k	2	1/2	Fixed, film	403/4/05324/560
1	820	2	1/2	Fixed, film	403/4/05322/820
5	150	2	1/2	Fixed, film	403/4/05322/150
6	8.2k	2	1/2	Fixed, film	403/4/05323/820
8	100	2	1/2	Fixed, film	403/4/05322/100
9	560	2	1/2	Fixed, film	403/4/05322/560
10	150	2	1/2	Fixed, film	403/4/05322/150

Capacitors

C.No.	Value $\mu$ F	Tol. + %	V.Wkg	Maker and Type	Part No.
1,3	47		25	Fixed, Electrolytic	402/9/55707/011
2	0.1	20	250	Miniature Foil	400/4/98268/007

Miscellaneous

Circuit Ref.	Description	Part No.
RV1	Potentiometer 100k	404/1/00405/006
RV2	Potentiometer 1k	404/1/00405/005
D1,D2,D4,D5	Diode IN4148	415/4/98393
D3	Diode Zener 12V	415/4/98167/011
VT1	Transistor BCY70	417/4/98267/001
RV3	Potentiometer 250 ohm	404/1/00405/008

5.24 AGC DECAY SHAPER (630/1/17869)

Resistors

R.No.	Value ohms	Tol. + %	Rating Watts	Maker and Type	Part No.
1	470	2	1/4	Fixed, film	403/4/05322/470
2	1k	2	1/4	Fixed, film	403/4/05323/100
3,4	2.2k	2	1/4	Fixed, film	403/4/05323/220
5,6	47k	2	1/4	Fixed, film	403/4/05324/470
7	100k	2	1/4	Fixed, film	403/4/05325/100
8	560k	2	1/4	Fixed, film	403/4/05325/560
9,10	1.5k	2	1/4	Fixed, film	403/4/05323/150

Miscellaneous

Circuit Ref.	Description	Part No.
RV1	Potentiometer Lin. 1k $\pm$ 20%	404/1/00405/005
D1	Zener Diode 4.7V $\pm$ 5%	415/4/98167/001
D2	Diode IN4148	415/4/98393
VT1,VT2	Transistor BCY70	417/4/98267/001

5.25 OSCILLATOR (FIXED BFO) (630/1/28128)

Circuit Ref.	Description	Part No.
R1	Resistor, fixed, film, 470 $\Omega$ $\pm$ 2% 1/2W	403/4/05322/470
C1	Capacitor, 0.1 $\mu$ F -25% +50%, 30V Oscillator module, fixed frequency BFO	400/4/98807/003 428/4/98096/001

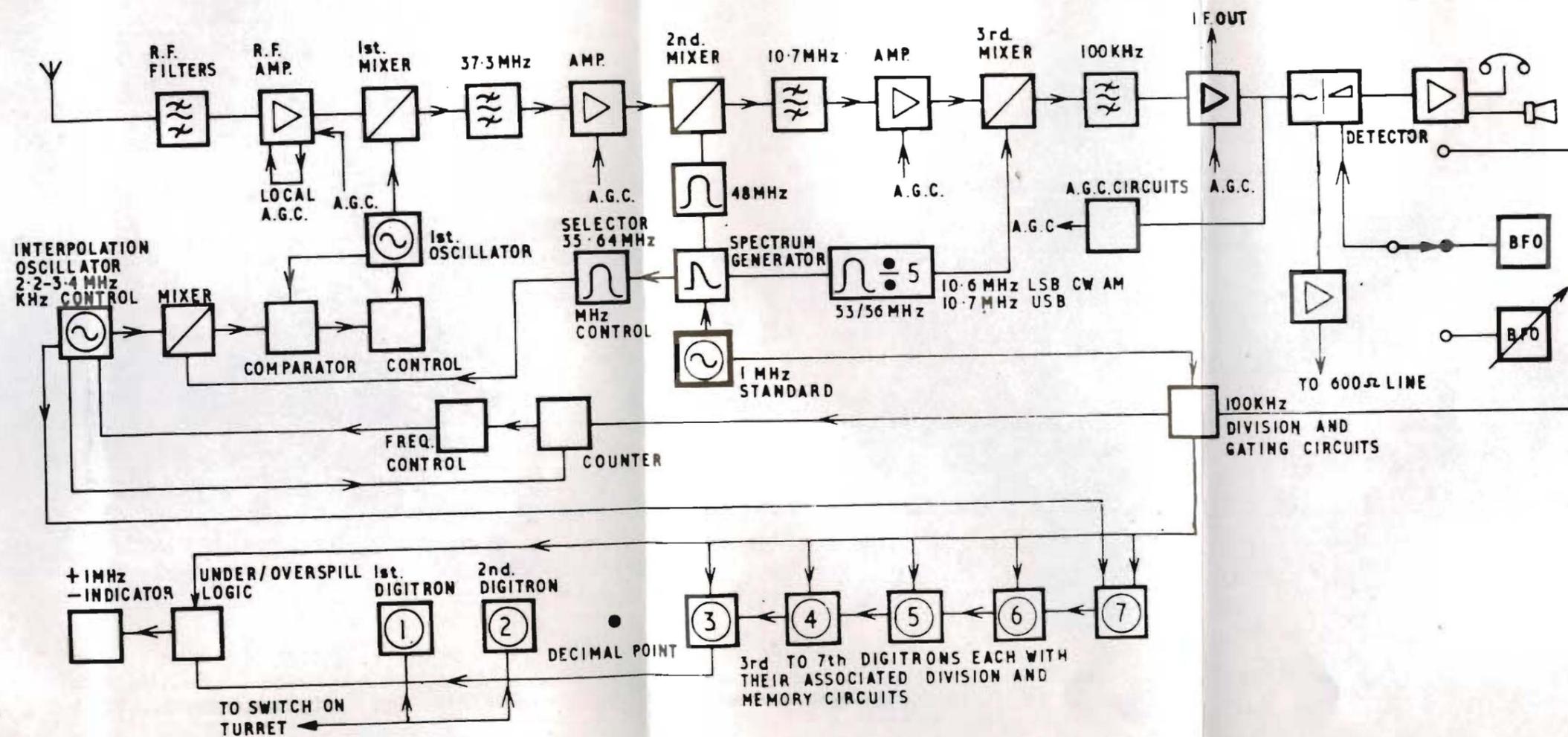


## CHAPTER 6

### ILLUSTRATIONS

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Fig.28A	Micro-Miniature Counter Unit Circuit Diagram
Fig.28B	Micro-Miniature Counter Unit Board Layout Diagram

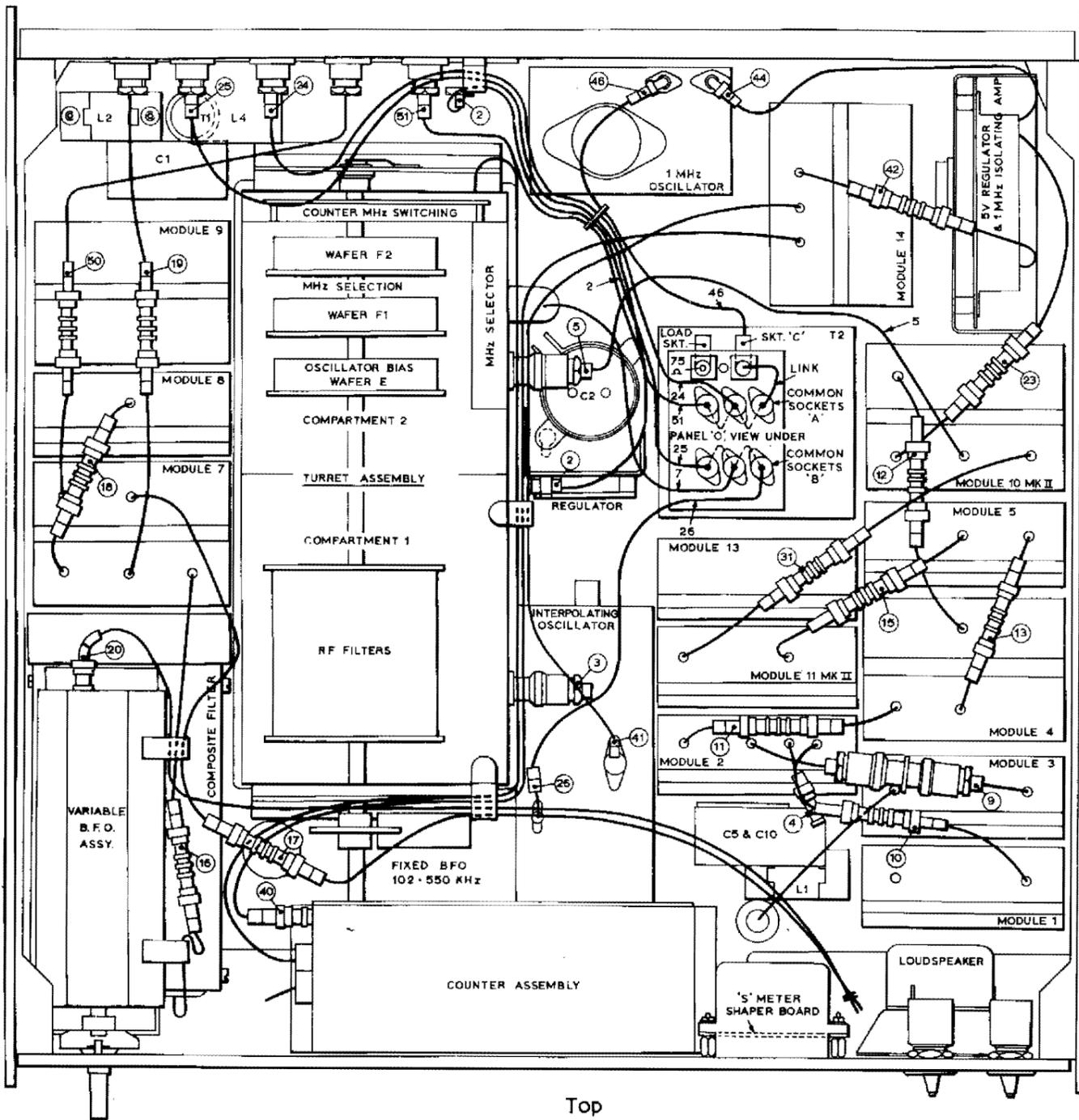




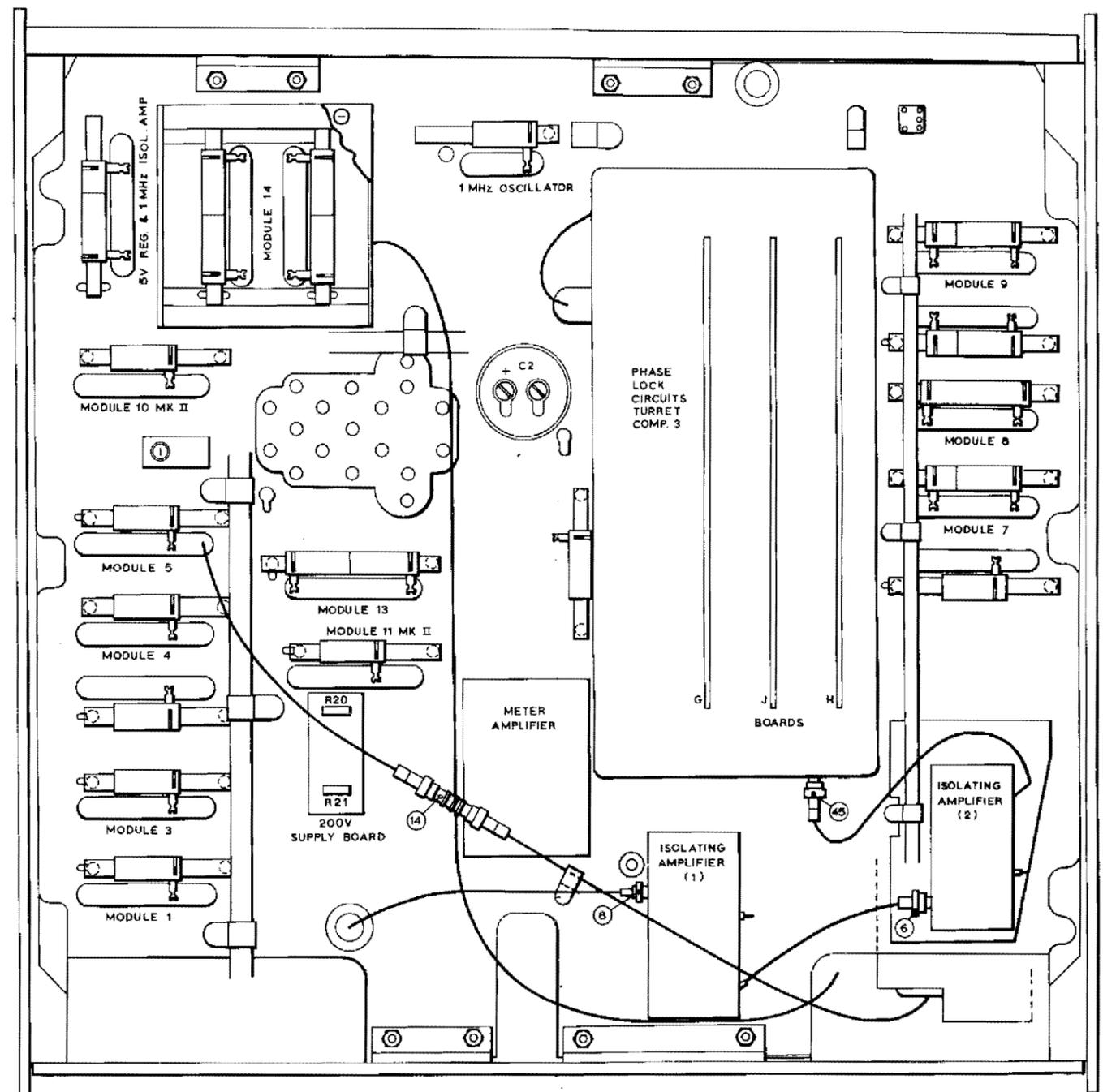
PR1553

FIG. 1A BLOCK SCHEMATIC.

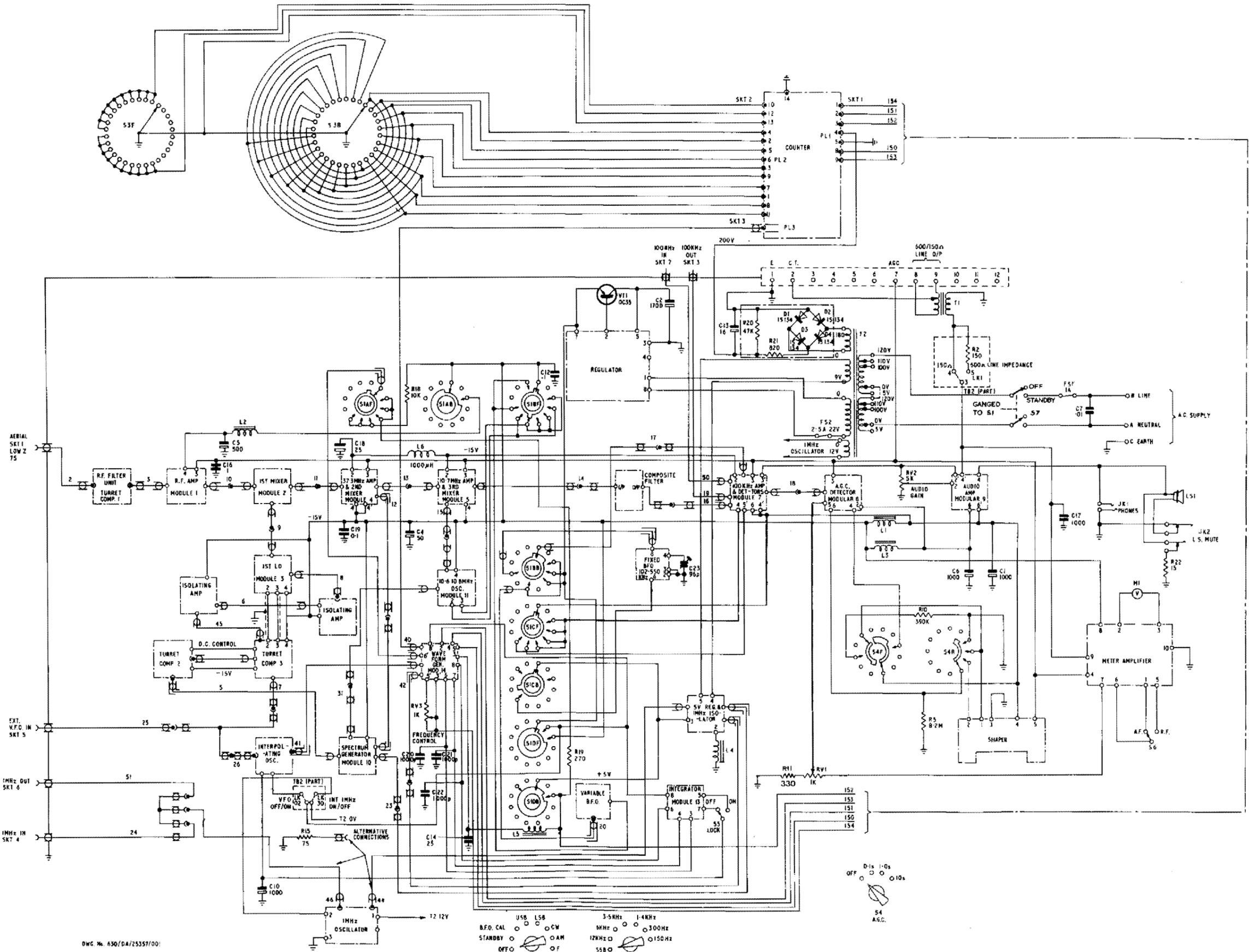
FIG. 1A



Top



Underside



DWG. No. 630/DA/25357/00

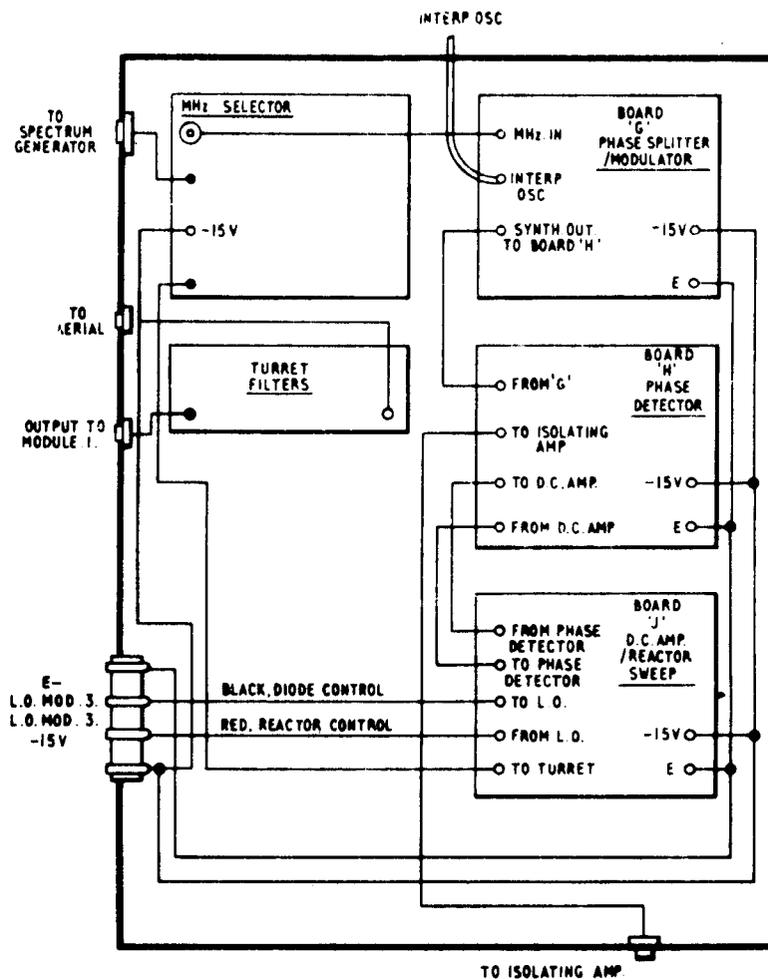
B.F.O. CAL USB L58 3-5KHz 1-4KHz  
 STANDBY 0 0 AM 5KHz 0 300Hz  
 OFF 0 0 F 12KHz 0 150Hz  
 58 0 3KHz  
 BANDWIDTH  
 S1  
 S2  
 S4 A.C.C.

SWITCHES SHOWN IN FULLY COUNTER CLOCKWISE POSITION

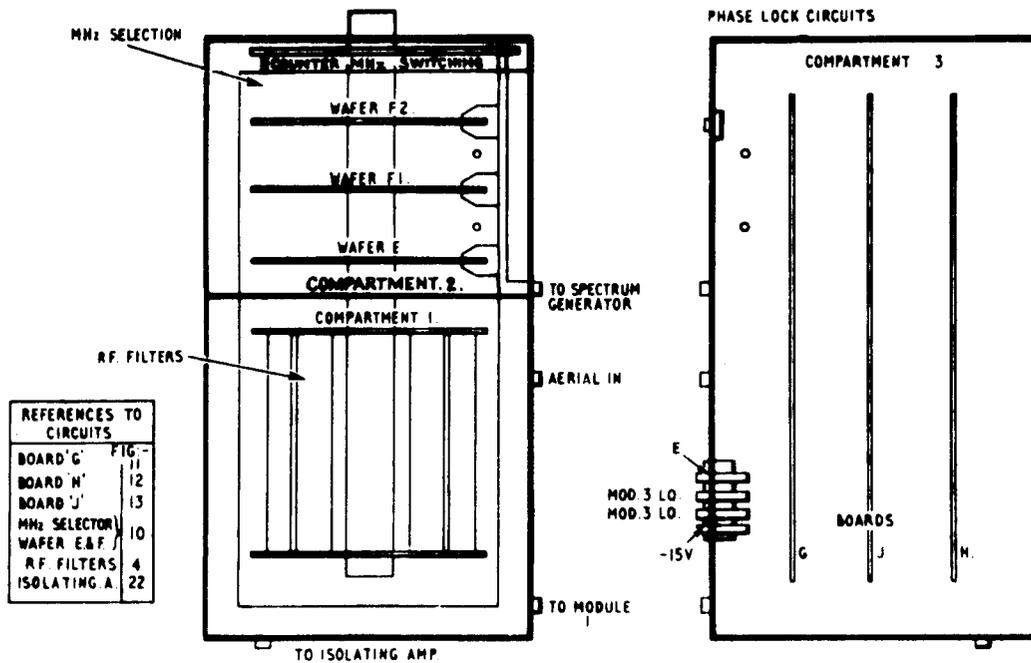
PR1553 CIRCUIT DIAGRAM

FIG 2

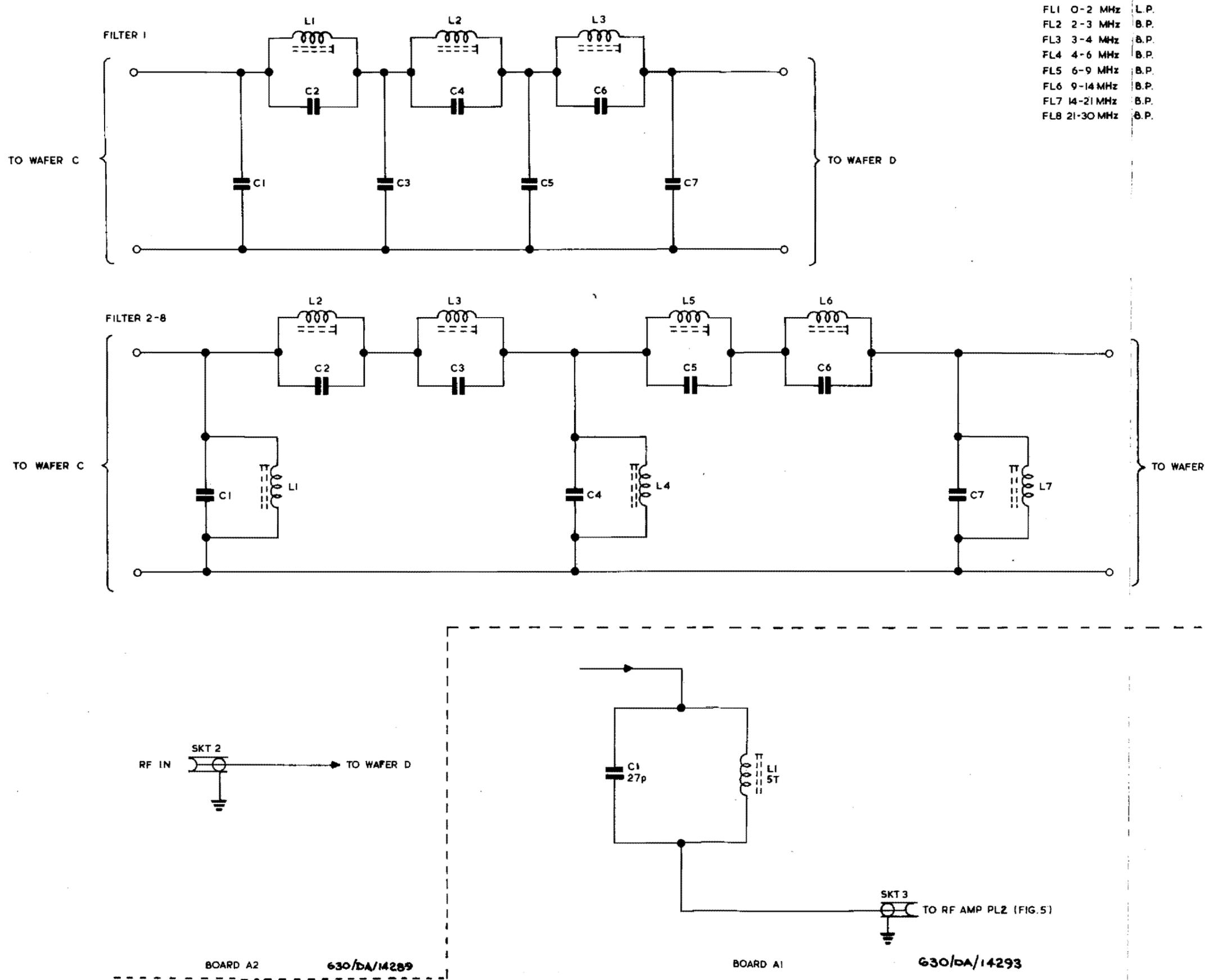
FIG 2



a. TURRET INTERCONNECTIONS



b. COMPONENT BOARD POSITIONS

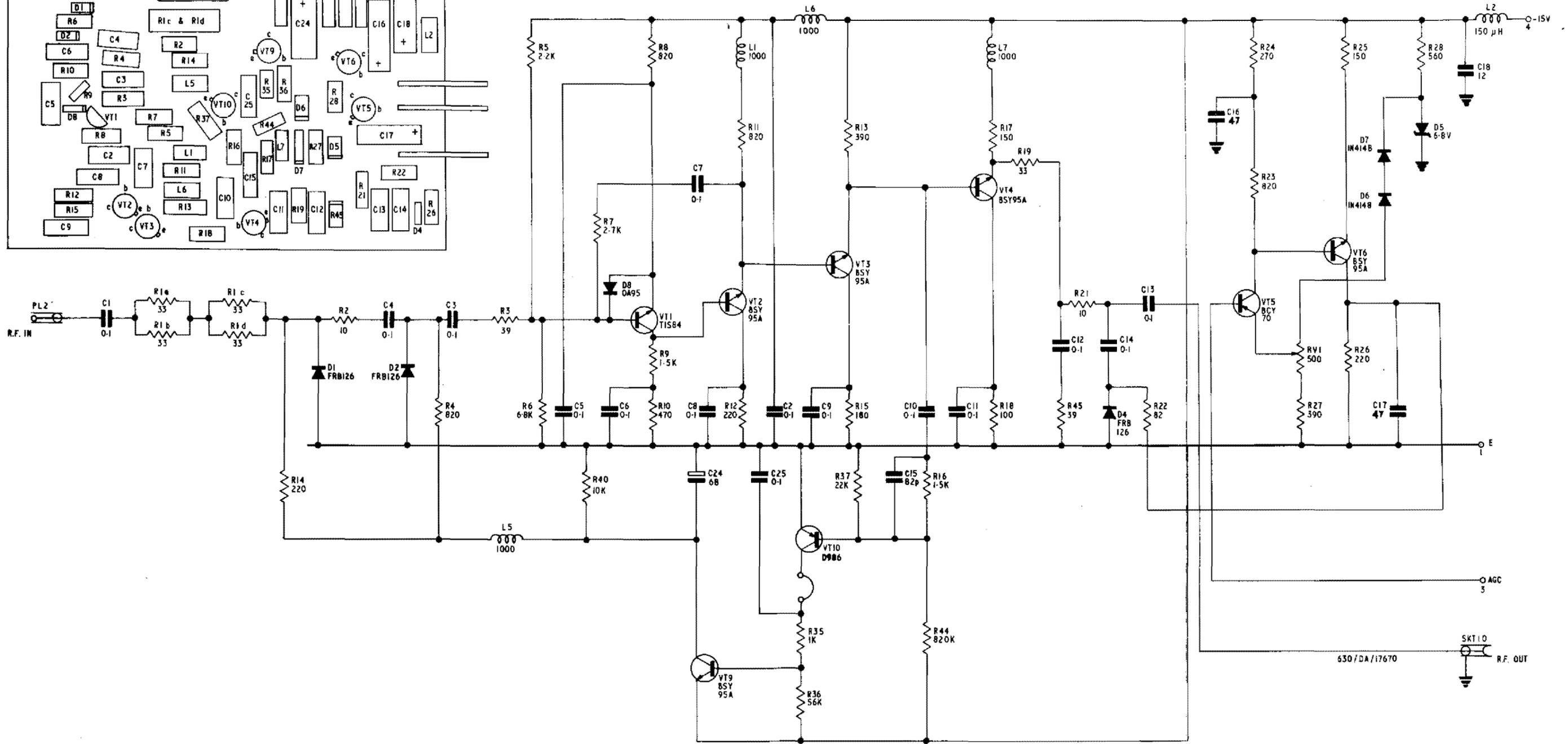
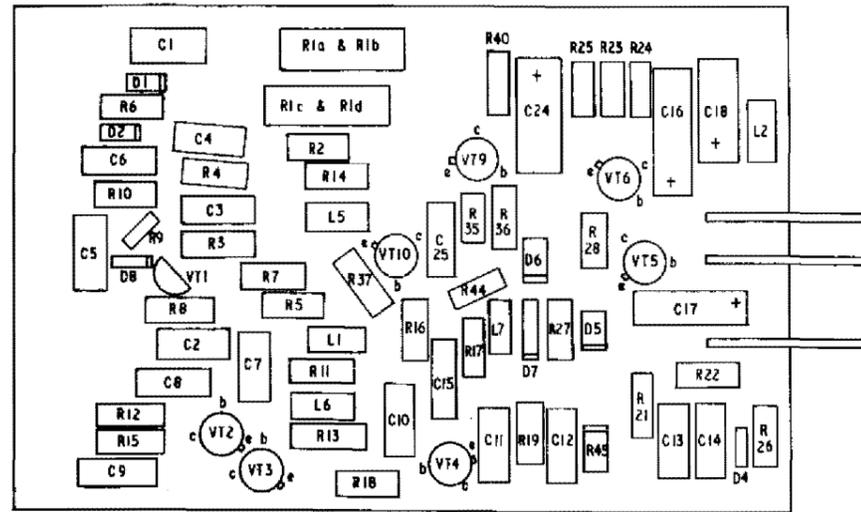


FL1	0-2 MHz	L.P.
FL2	2-3 MHz	B.P.
FL3	3-4 MHz	B.P.
FL4	4-6 MHz	B.P.
FL5	6-9 MHz	B.P.
FL6	9-14 MHz	B.P.
FL7	14-21 MHz	B.P.
FL8	21-30 MHz	B.P.

PR1553

FIG. 4 TURRET COMPARTMENT 1: FILTER CIRCUITS

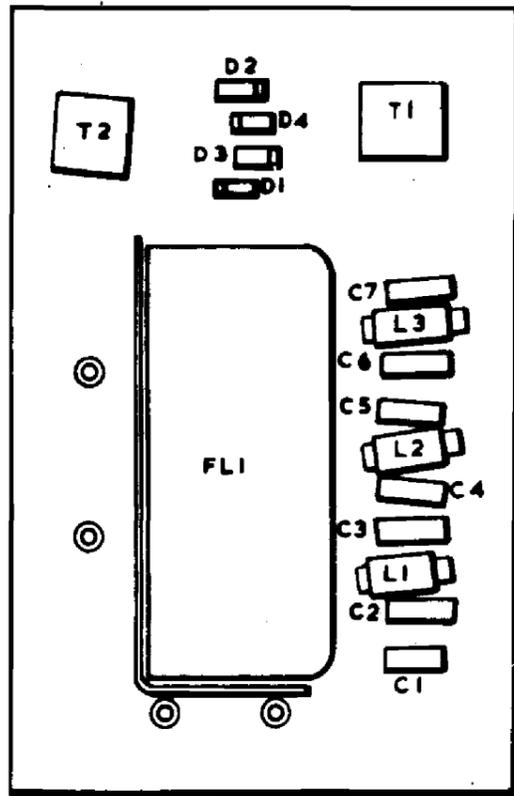
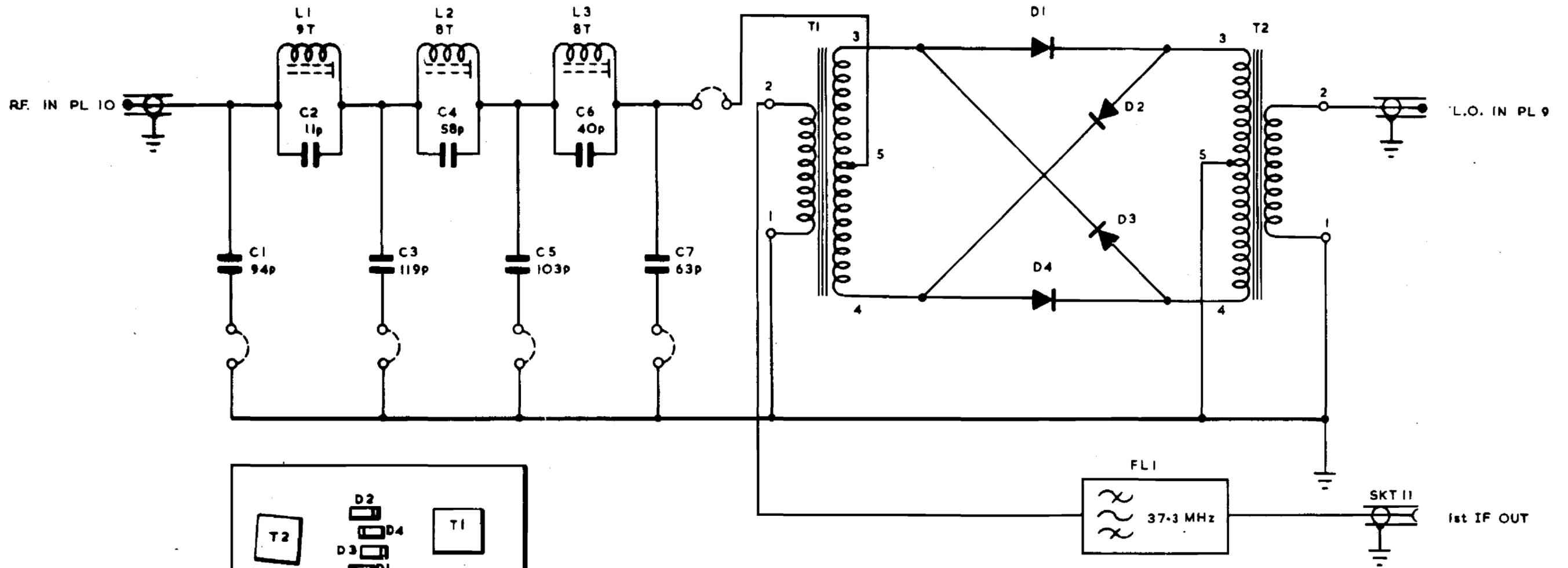
FIG. 4  
TURRET COMP. 1



PR1553

FIG.5 R.F. AMPLIFIER MODULE 1 : CIRCUIT AND BOARD LAYOUT

FIG.5 MODULE 1



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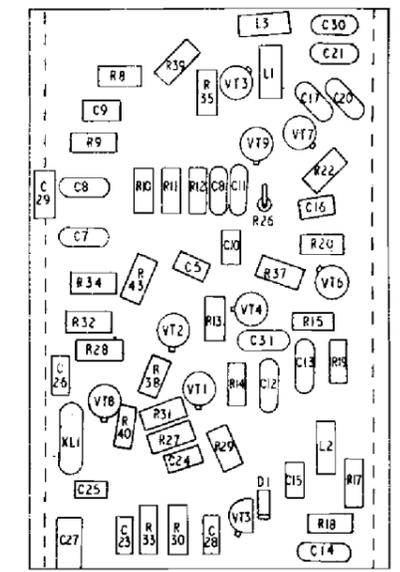
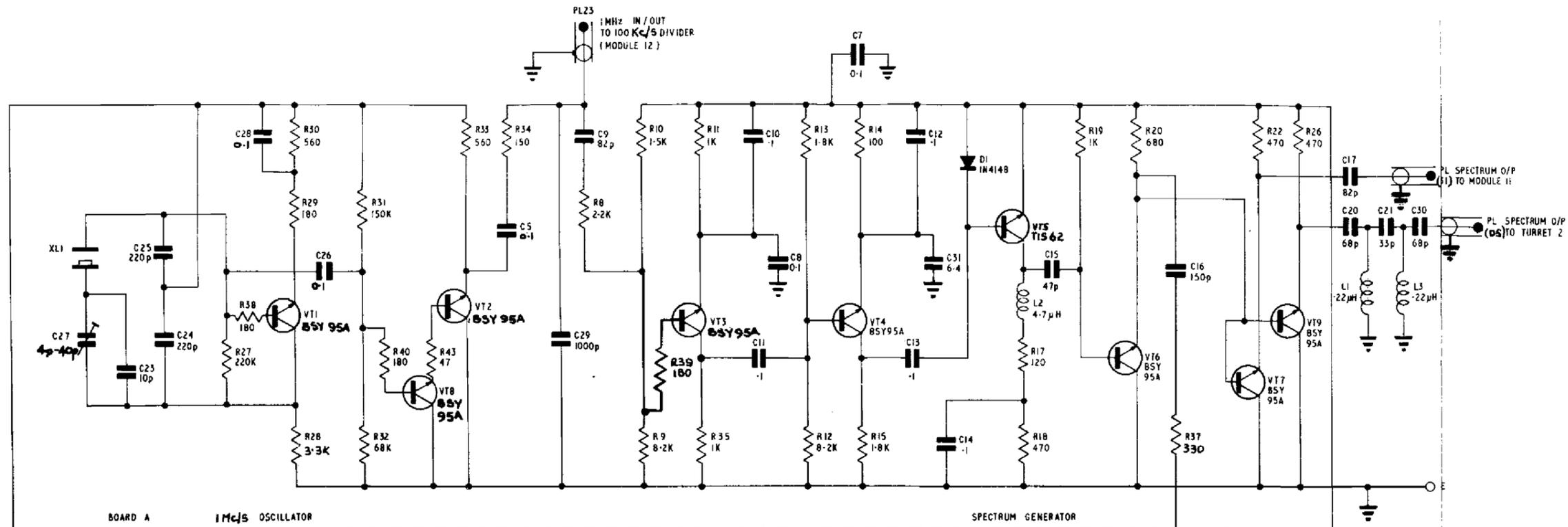
DWG. No. 630/DA/14111

PRI553

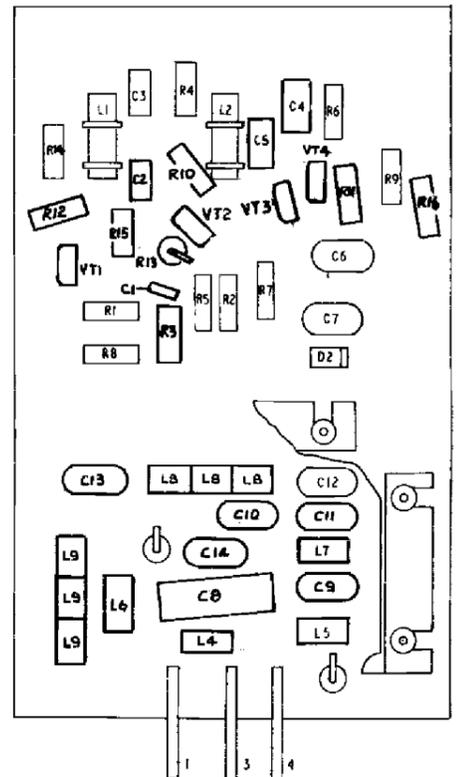
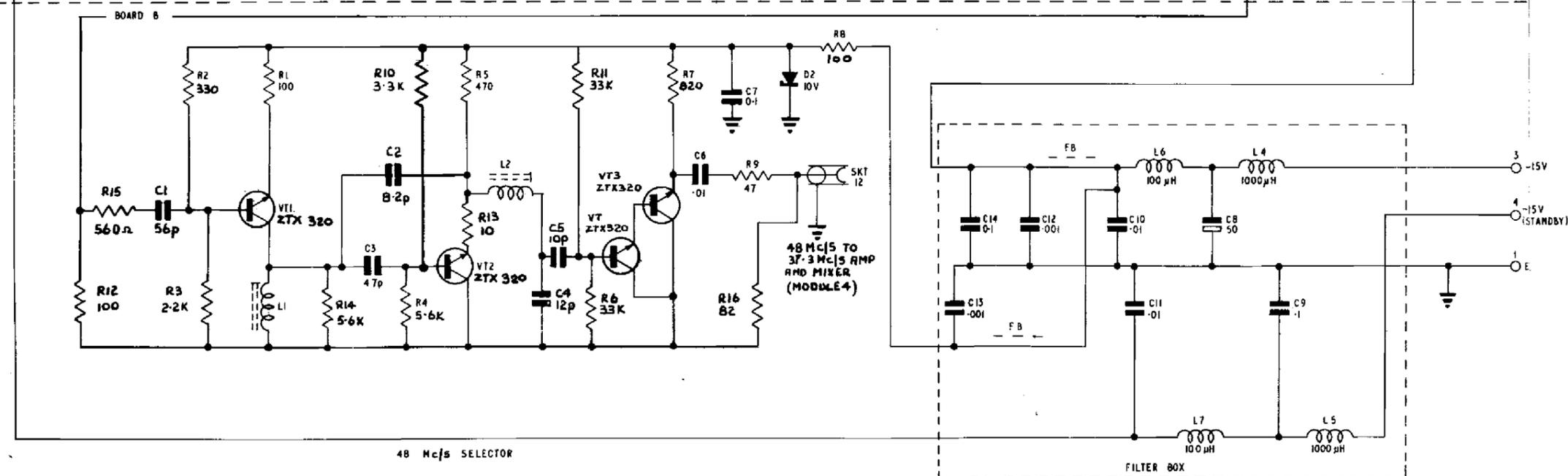
FIG. 6. FIRST MIXER : MODULE 2 : CIRCUIT AND BOARD LAYOUT

FIG. 6.MOD. 2





DWG. No. 630/1/14931  
COMPONENT LAYOUT BOARD 'A'

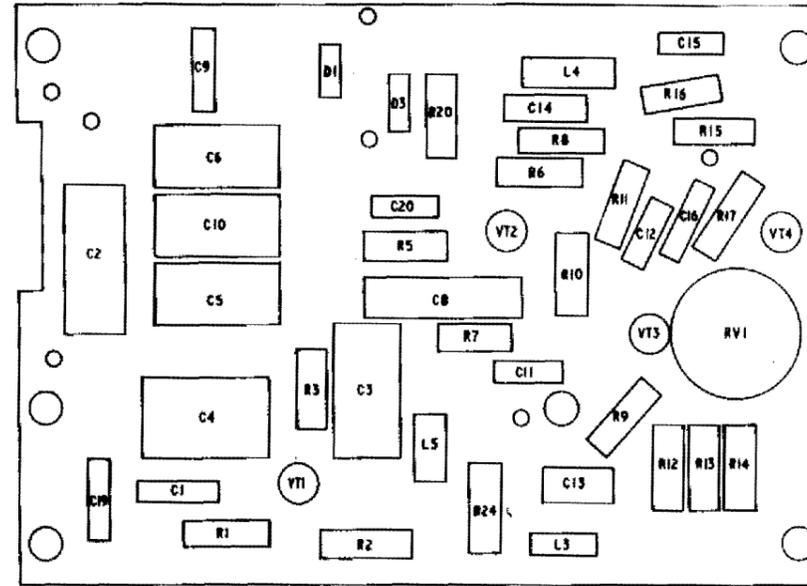


DWG. No. 630/1/14271

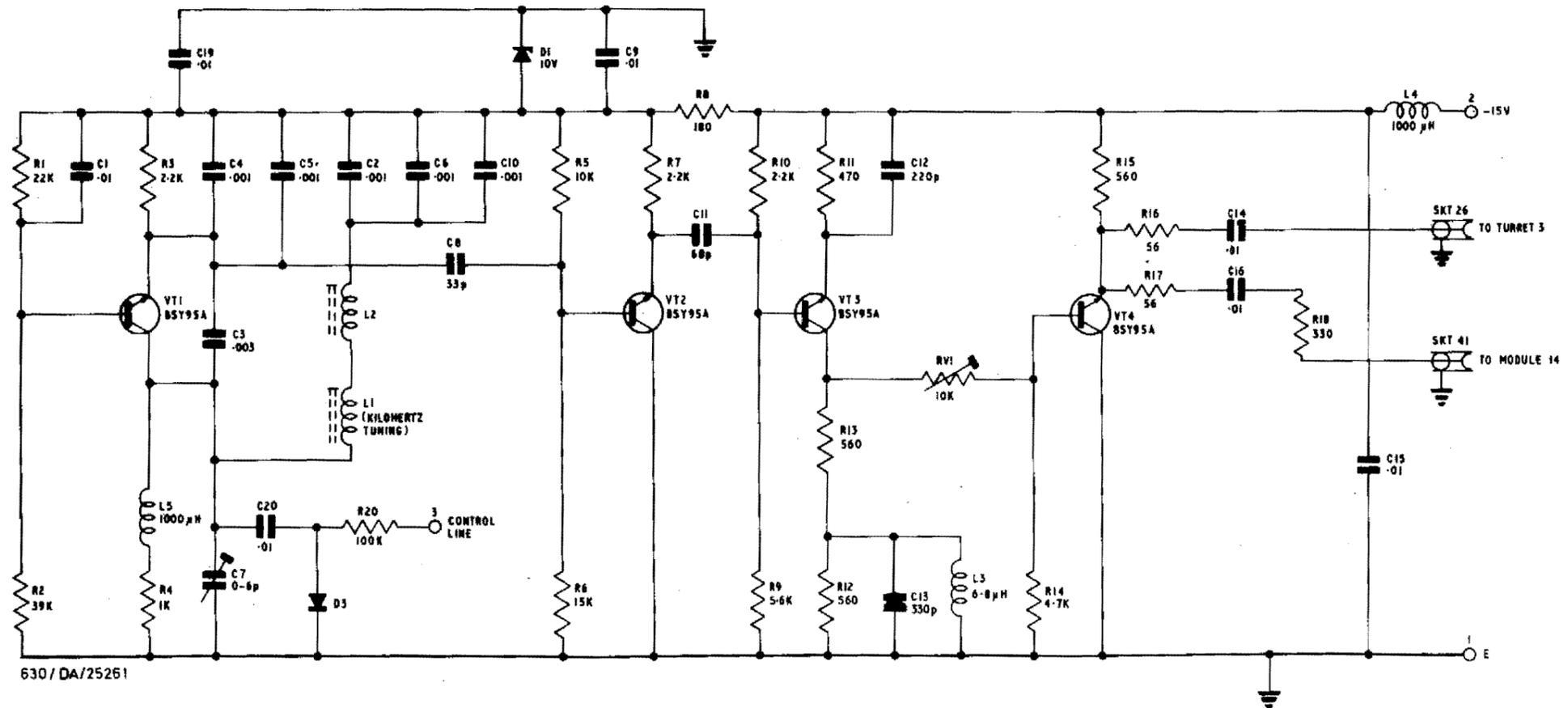
DWG. No. 630/DA/14930

FIG. 8. SPECTRUM GENERATOR/48 MHz SELECTOR MODULE 10 MK II

FIG. 8 MODULE 10 MK II



630/1/25261

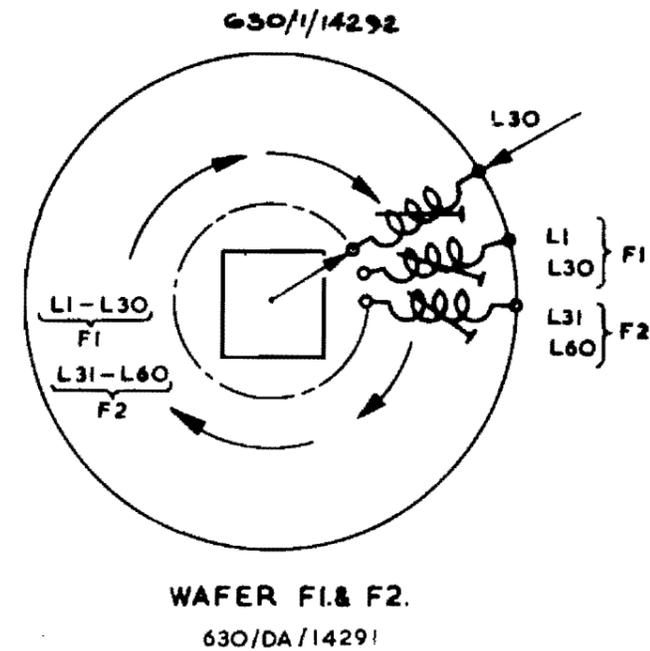
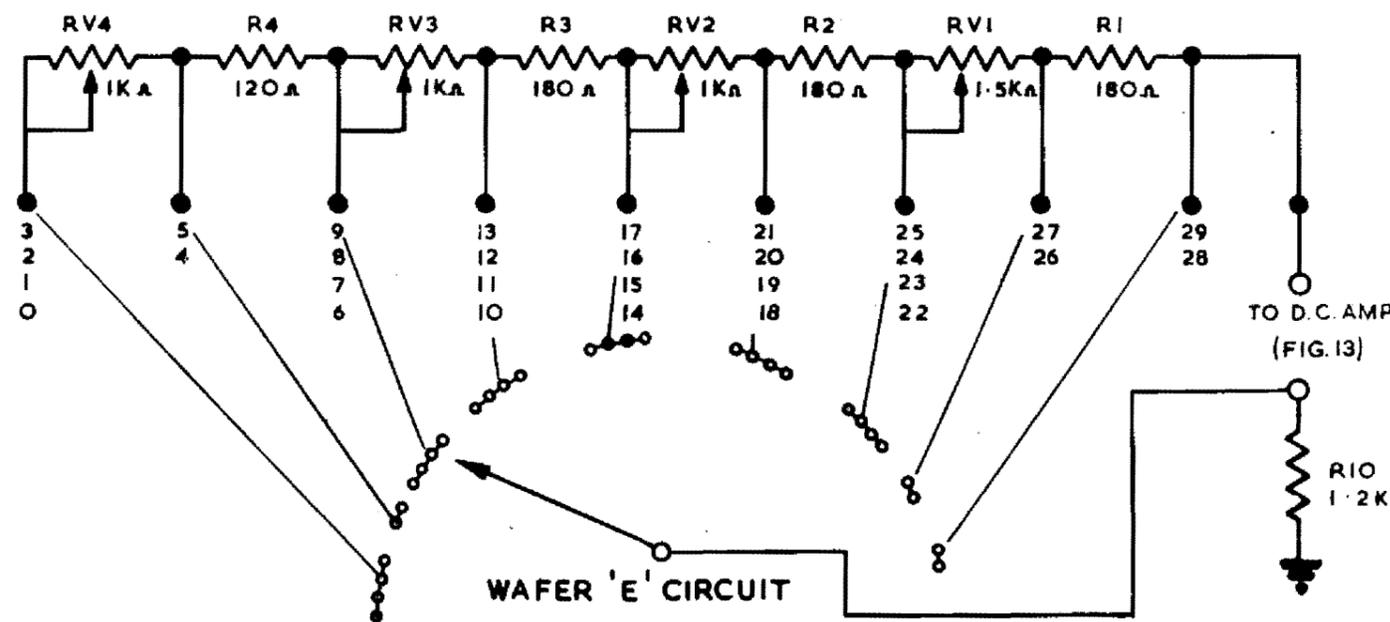
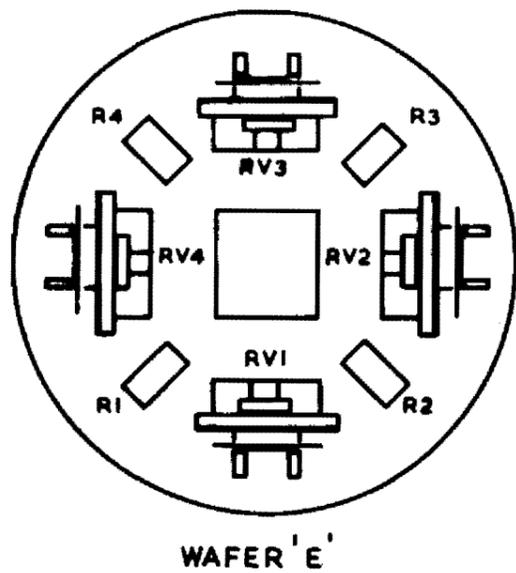
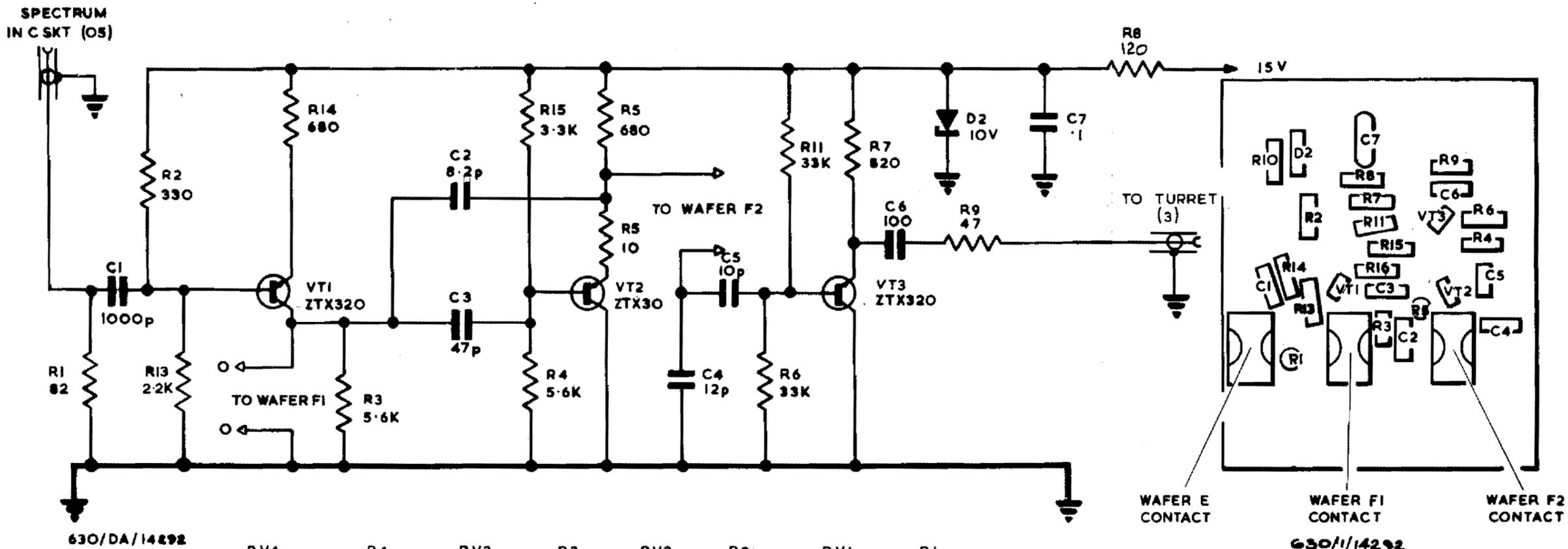


630/DA/25261

PR1553

FIG. 9 INTERPOLATING OSCILLATOR

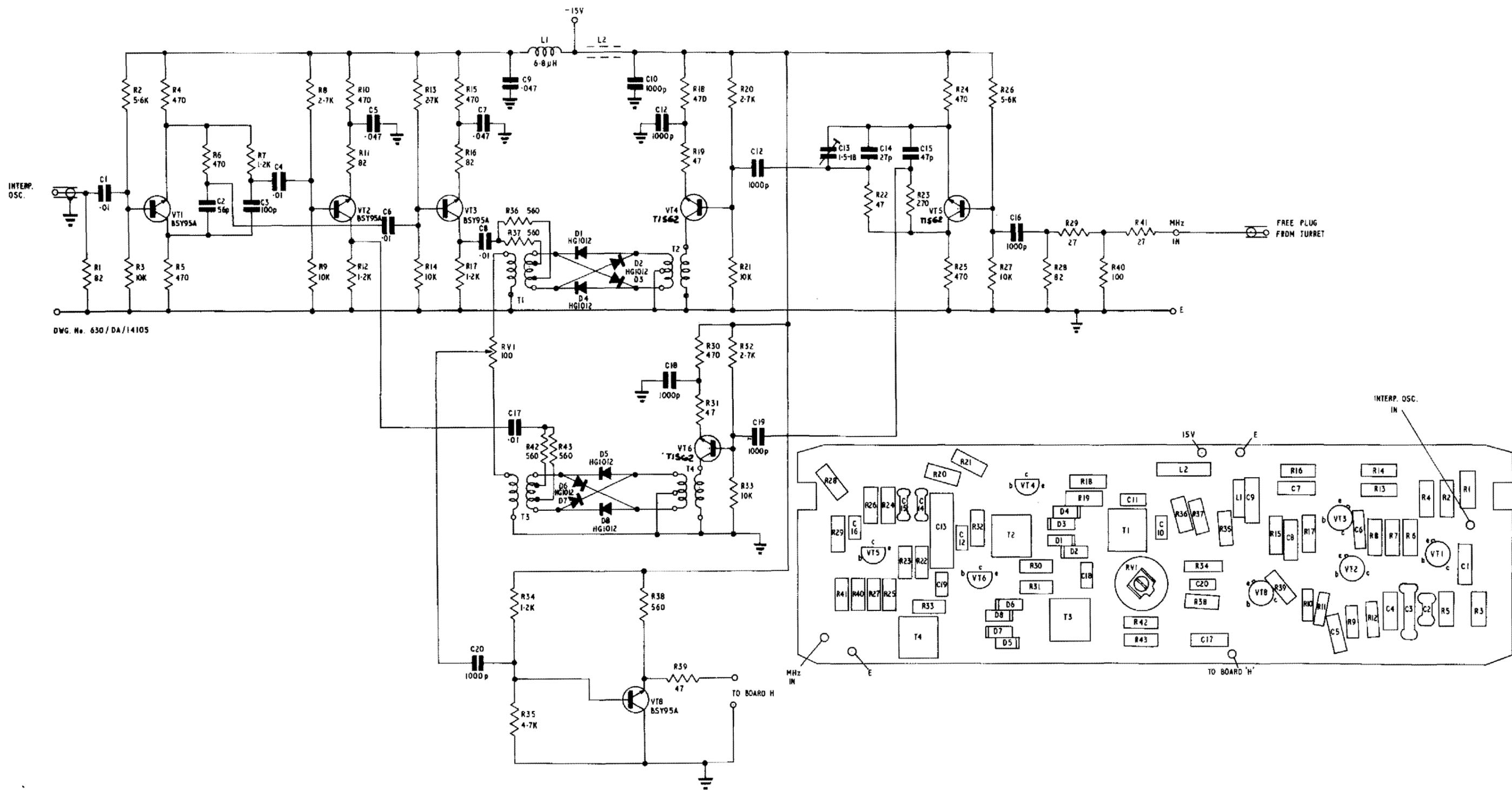
FIG. 9 INT. OSC.



PR1553

FIG. 10. MHZ. SELECTOR : TURRET COMPARTMENT 2 : CIRCUIT AND BOARD LAYOUT.

FIG. 10. TURRET COMP. 2

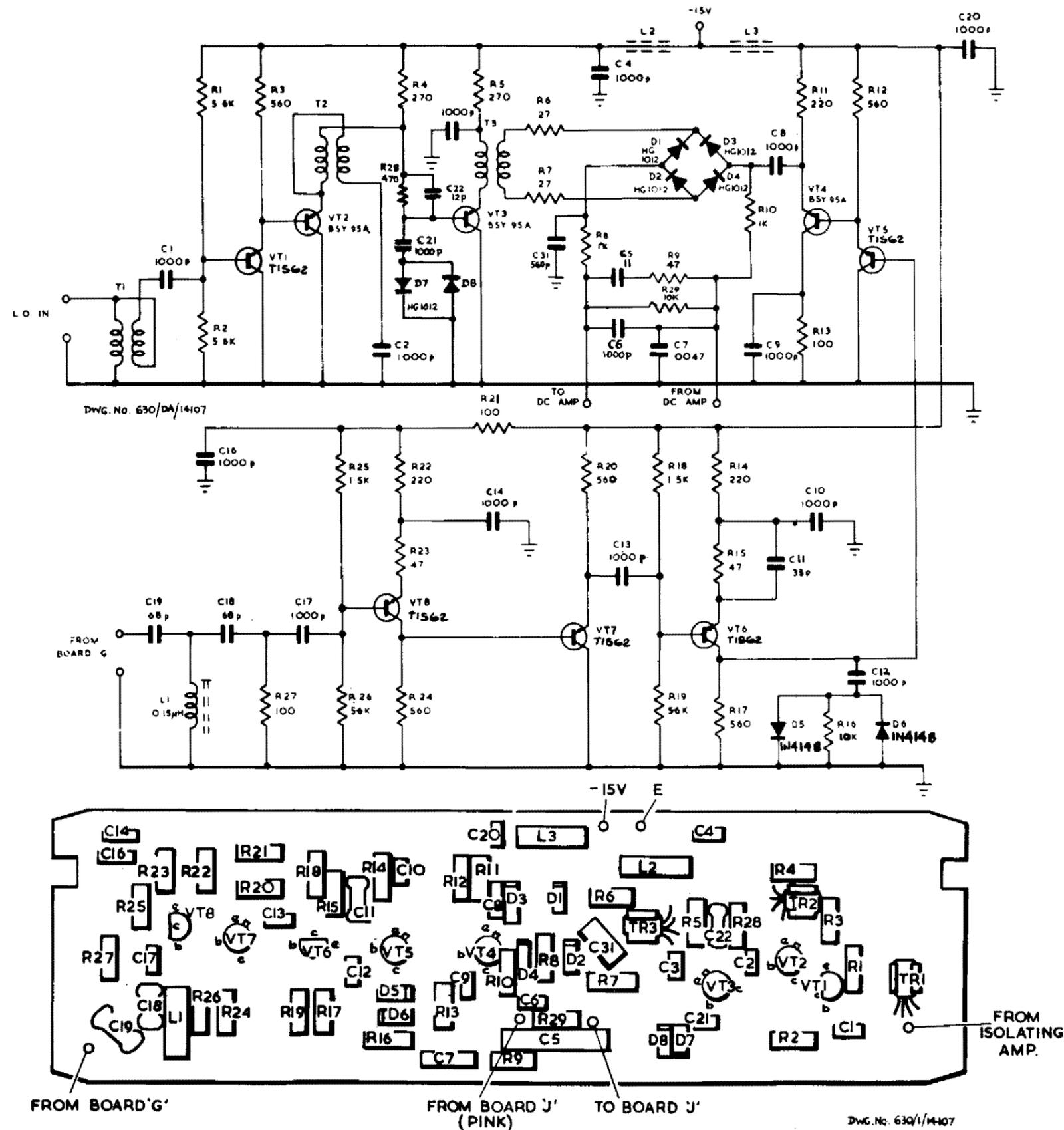


DWG. No. 630/DA/14105

PR1553

FIG.11. PHASE SPLITTERS AND MODULATOR BOARD G : CIRCUIT AND LAYOUT

FIG.11. TURRET (BOARD. G)

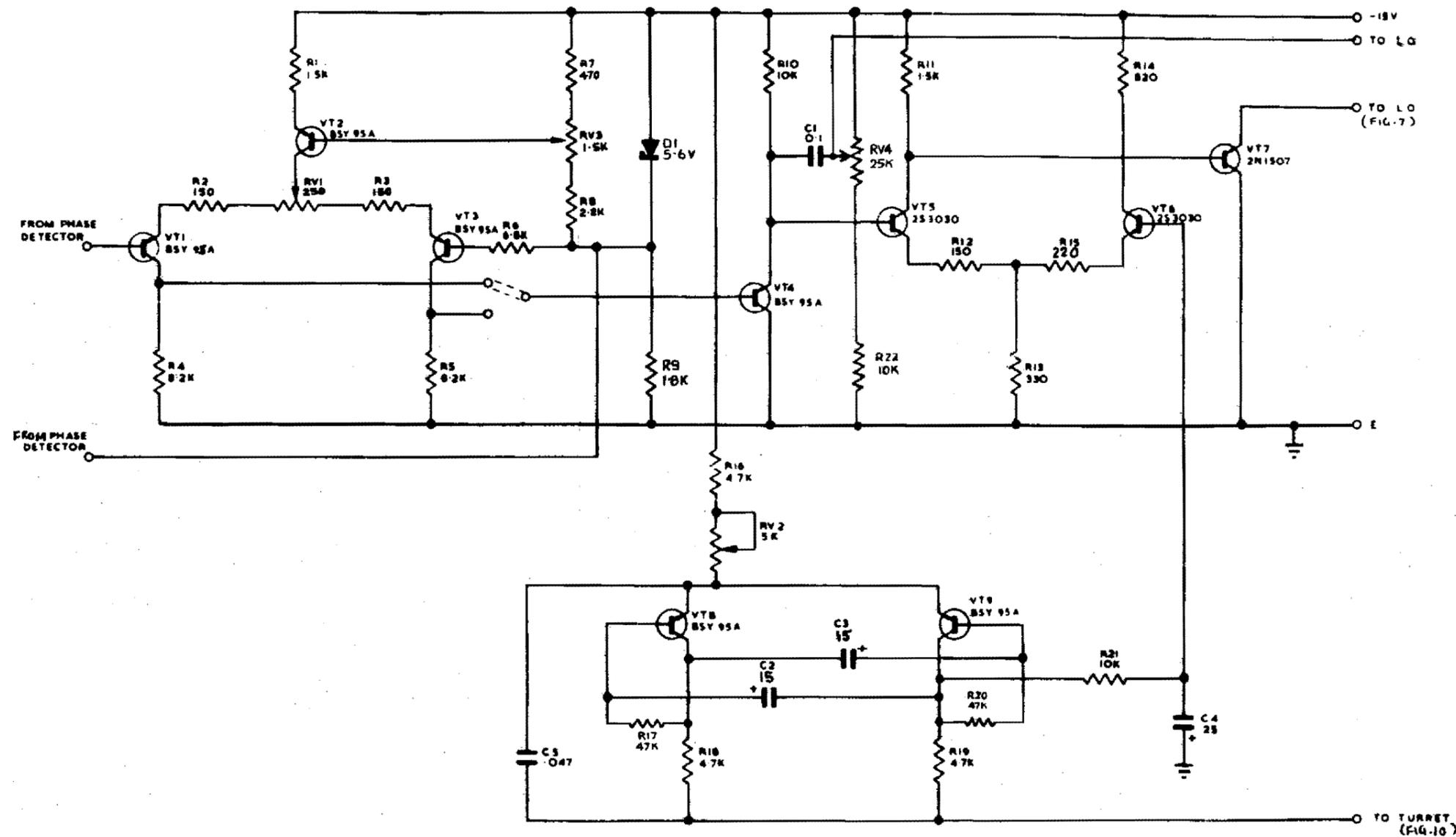


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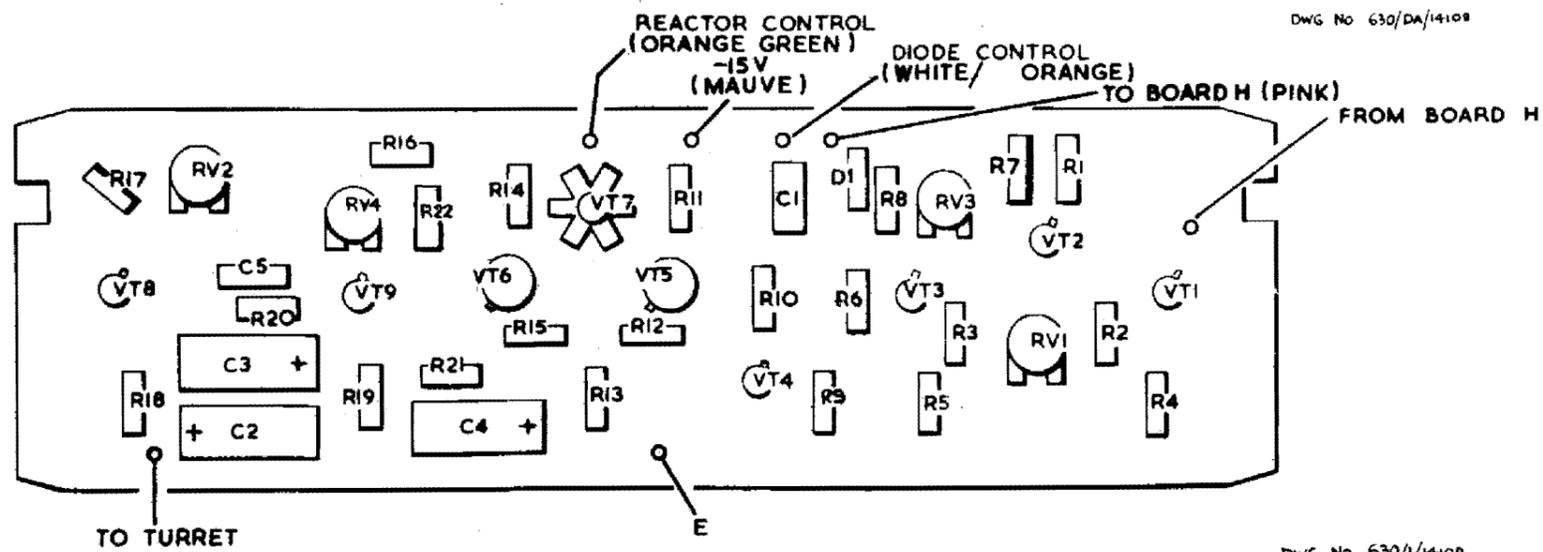
FIG. 12.

PHASE DETECTOR BOARD H : CIRCUIT AND LAYOUT (BOARD.H)

FIG.12.TURRET



DWG No 630/DA/14108



DWG No 630/1/14109

FIG. 13.

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

FIG. 13  
TURRET  
(BOARD.J)

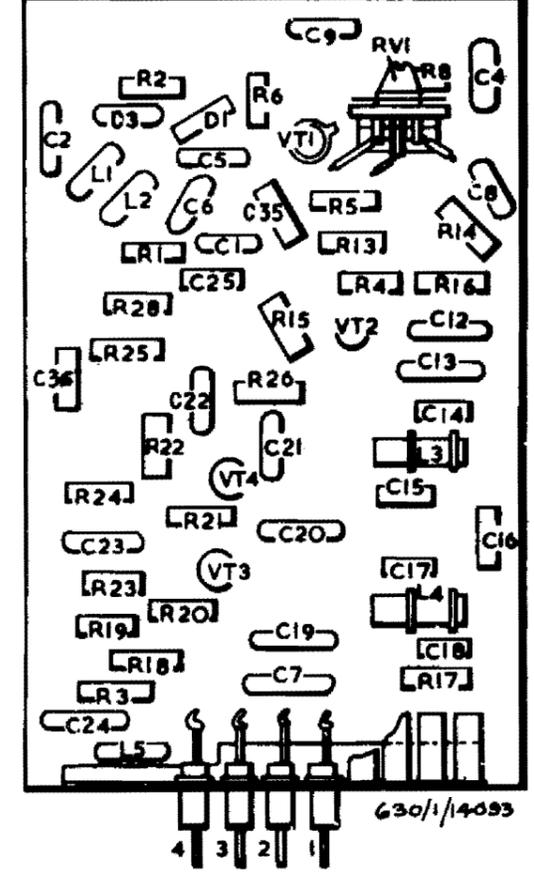
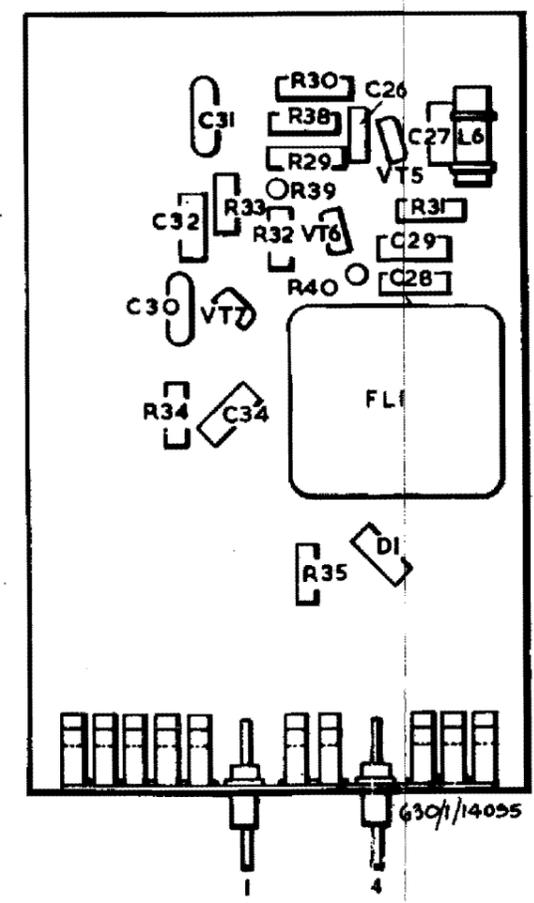
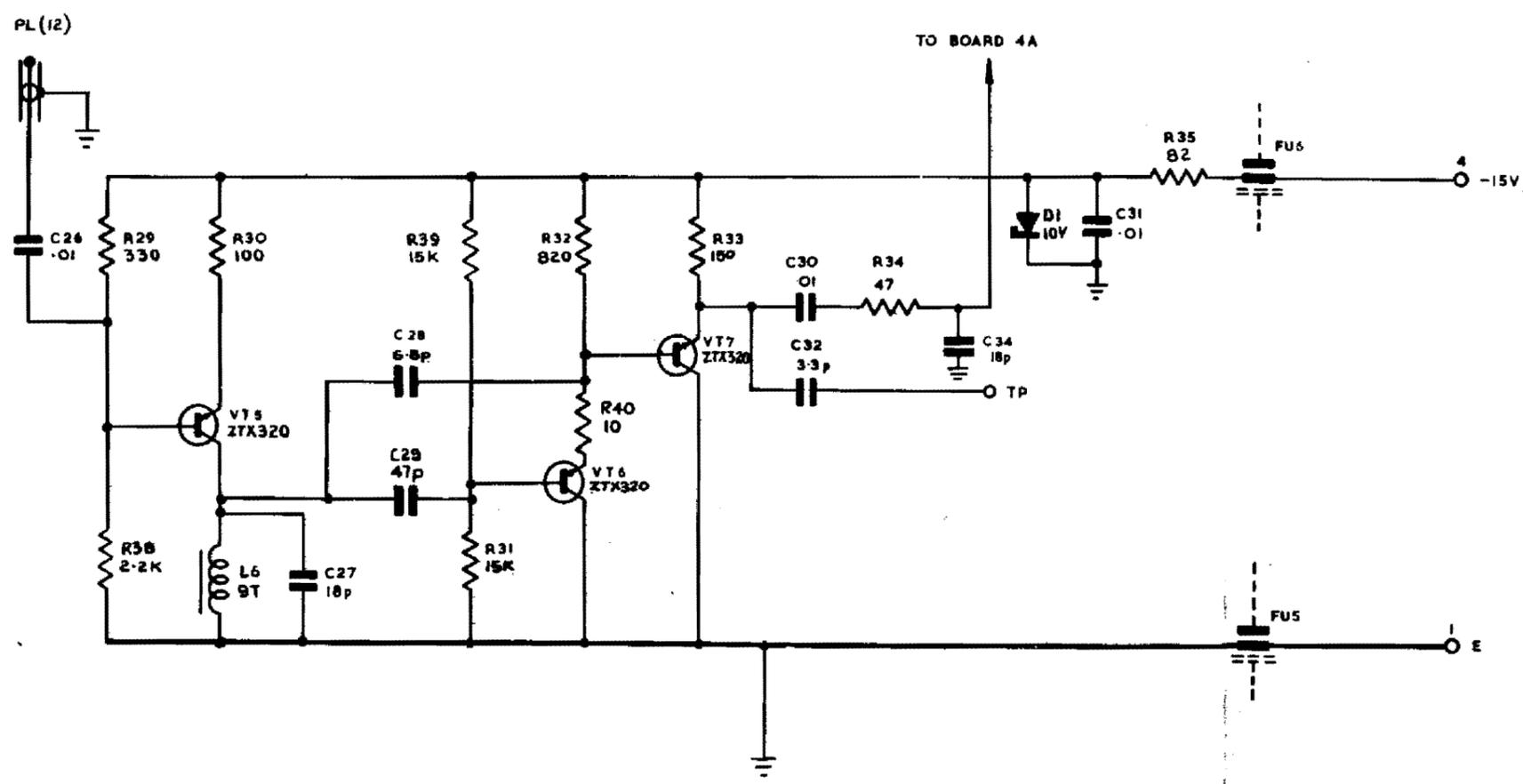
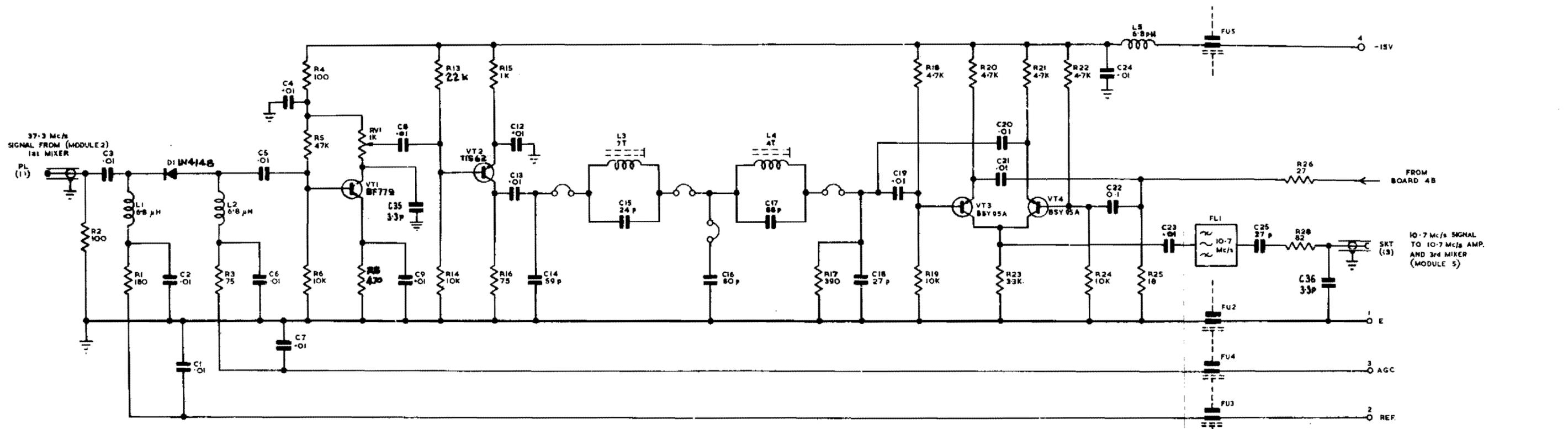
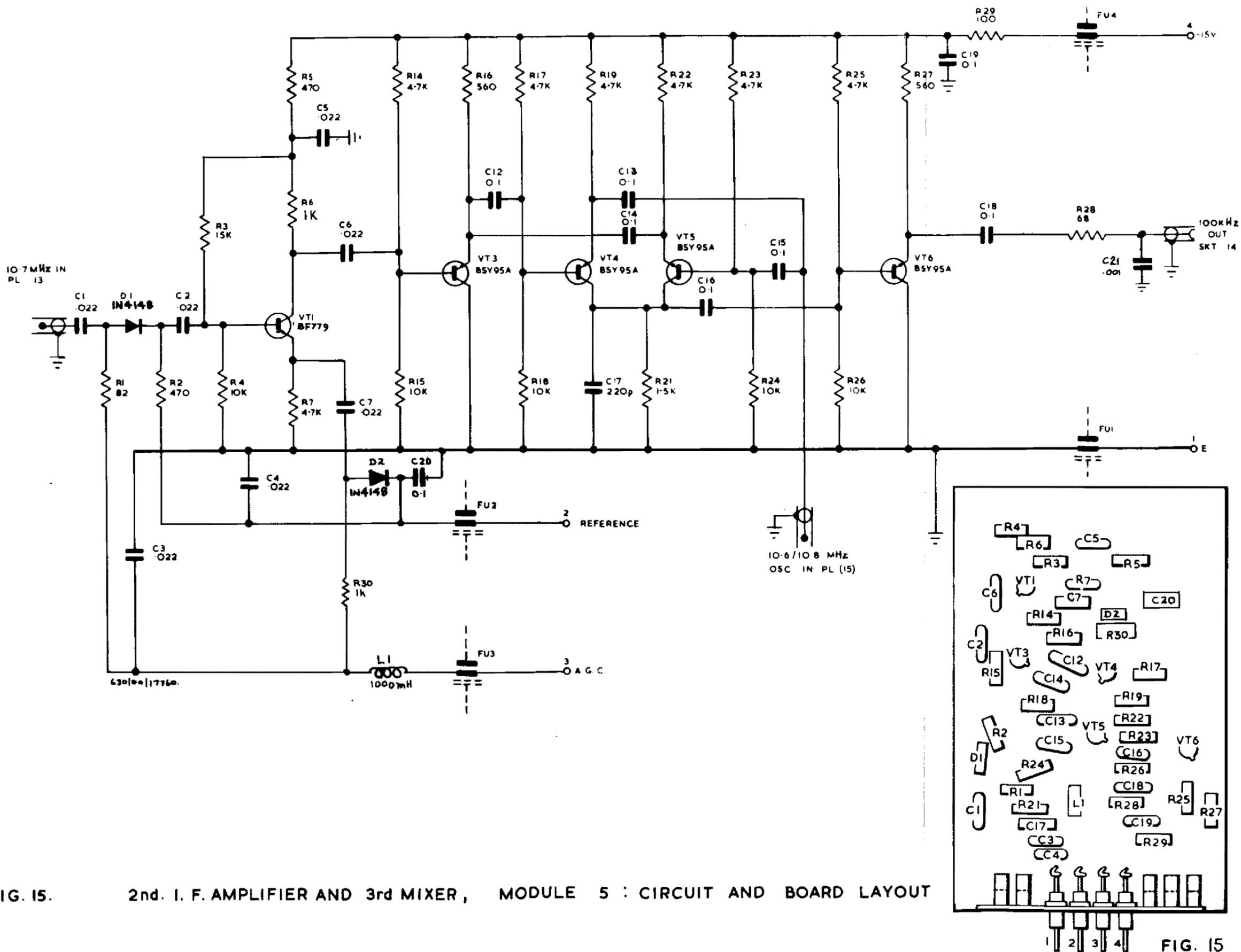


FIG.14. FIRST I.F. AMPLIFIER AND 2nd. MIXER, MODULE 4 : CIRCUIT AND BOARD LAYOUT

FIG.14  
MODULE 4



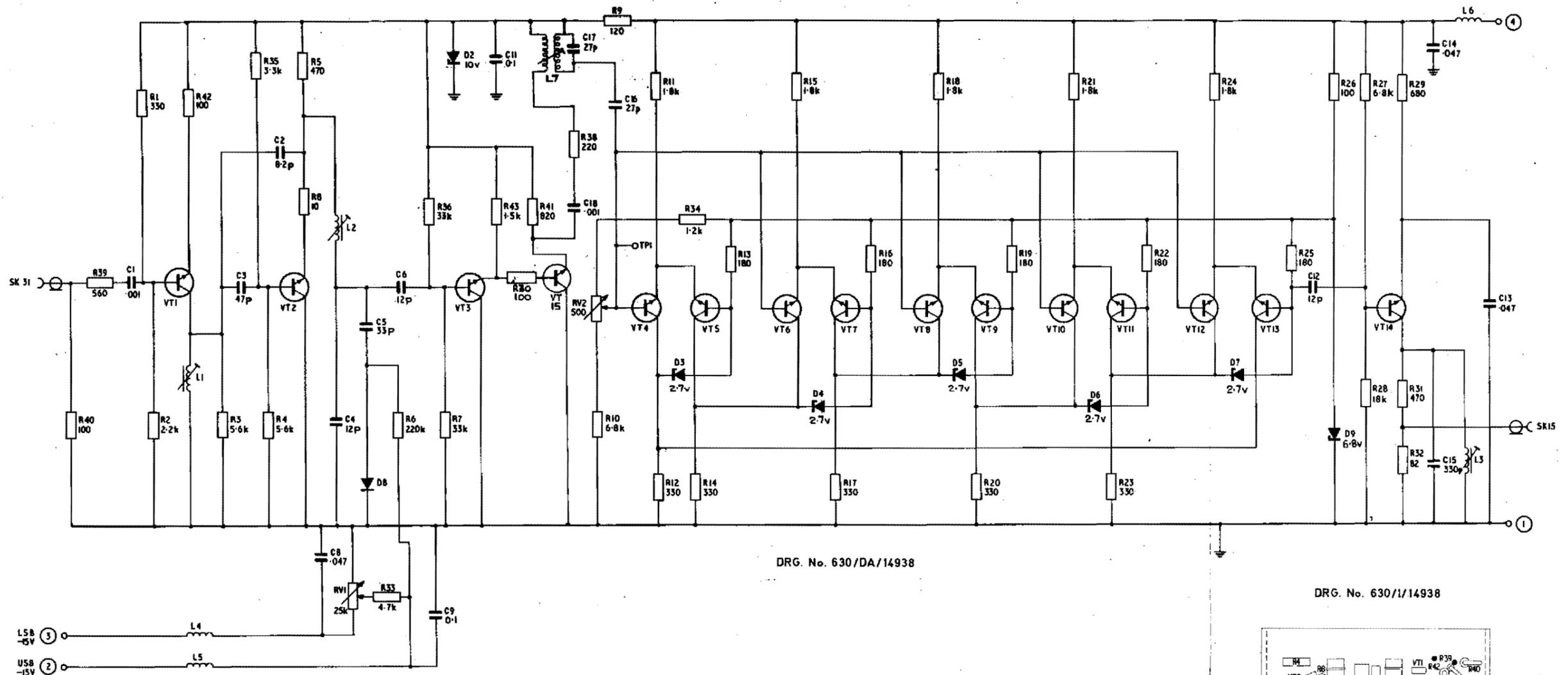
PRI553

FIG. 15.

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

FIG. 15

MODULE 5



DRG. No. 630/DA/14938

FIG. 16 10.6/10.8 MHz GENERATOR (MODULE 11) MK II

DRG. No. 630/I/14938

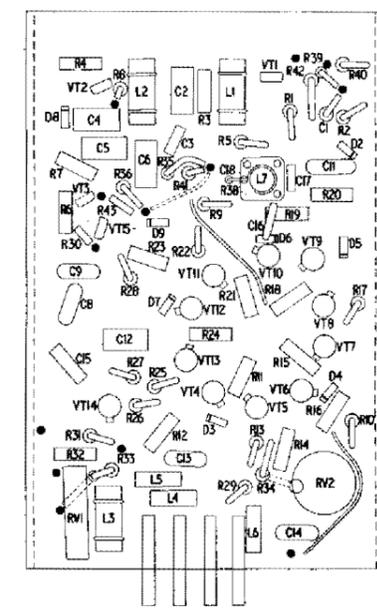
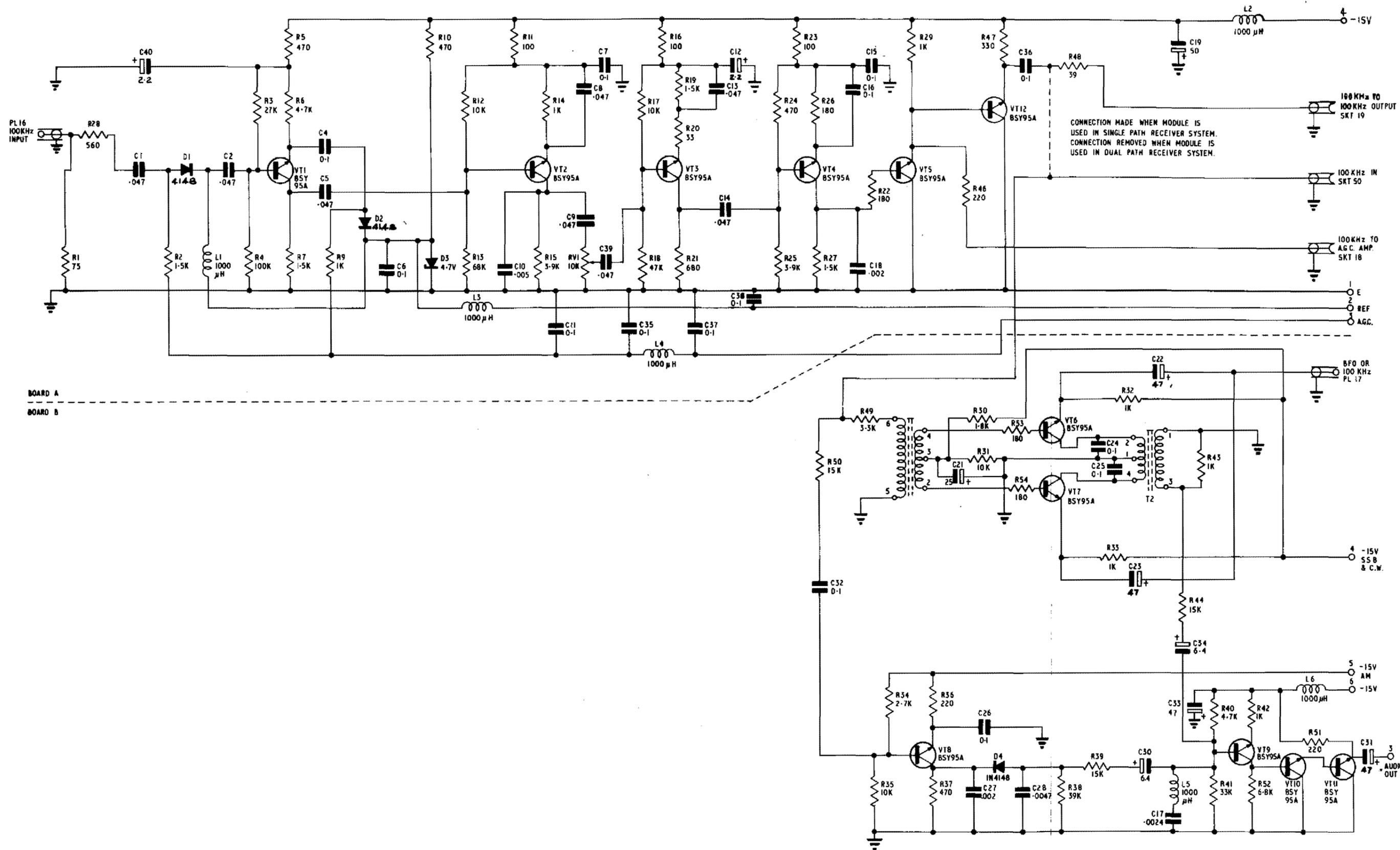


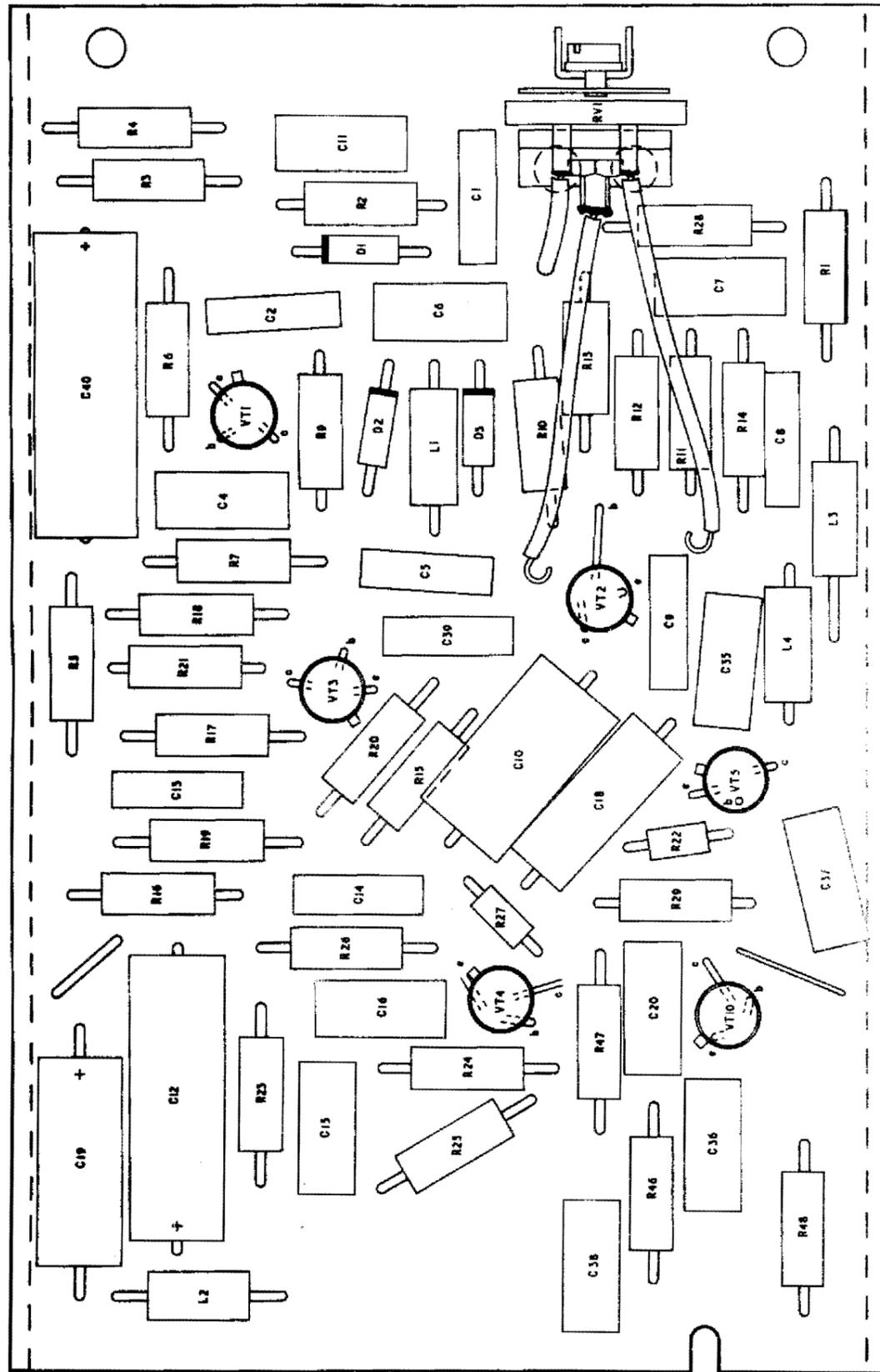
FIG. 16 MODULE 11 MK II



PR1553

FIG.17A 100KHz AMPLIFIER/DETECTOR (MODULE 7) CIRCUIT DIAGRAM

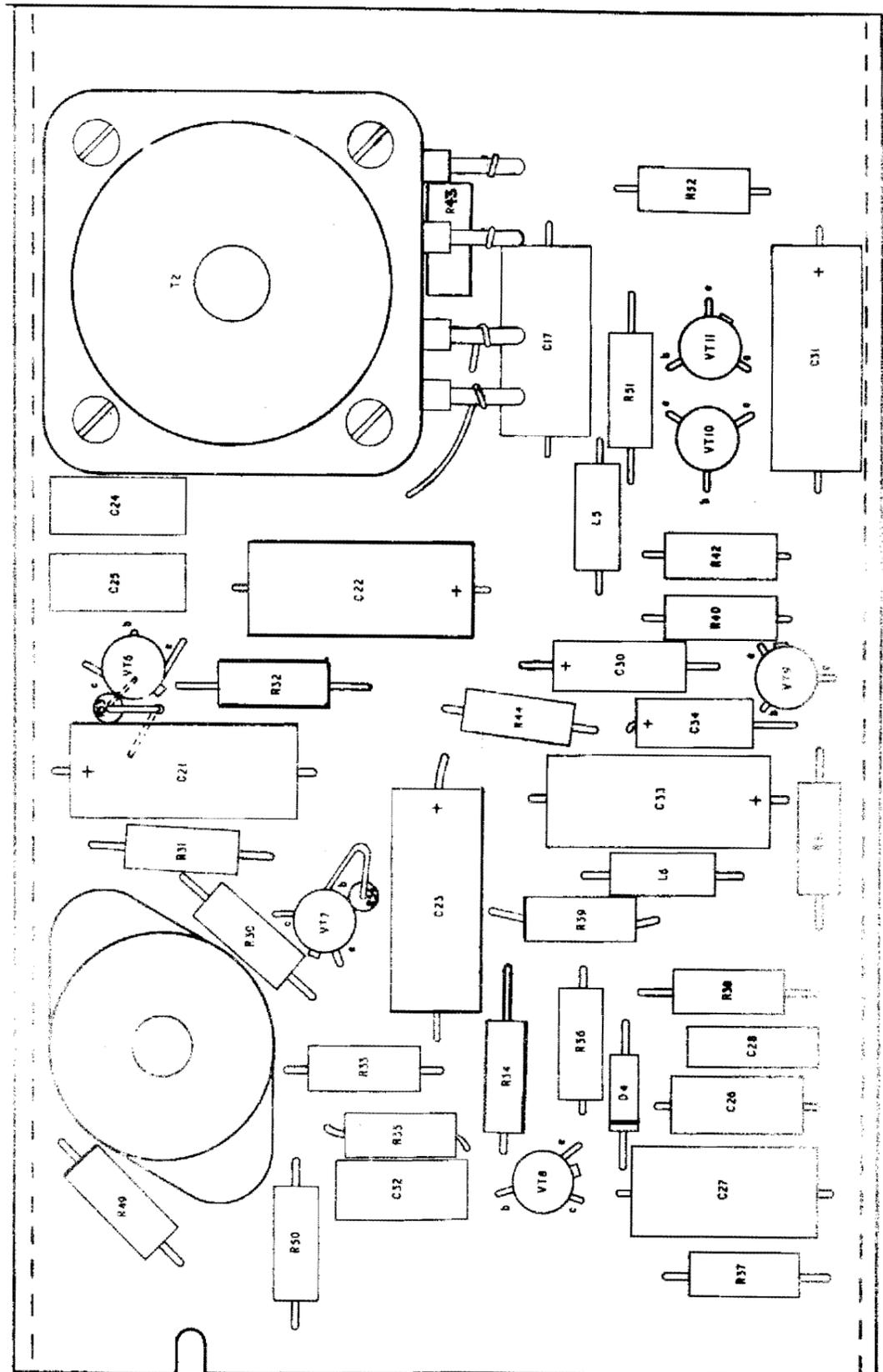
FIG.17A.MODULE 7



DWG. NO. 65911(1777) BOARD 7A

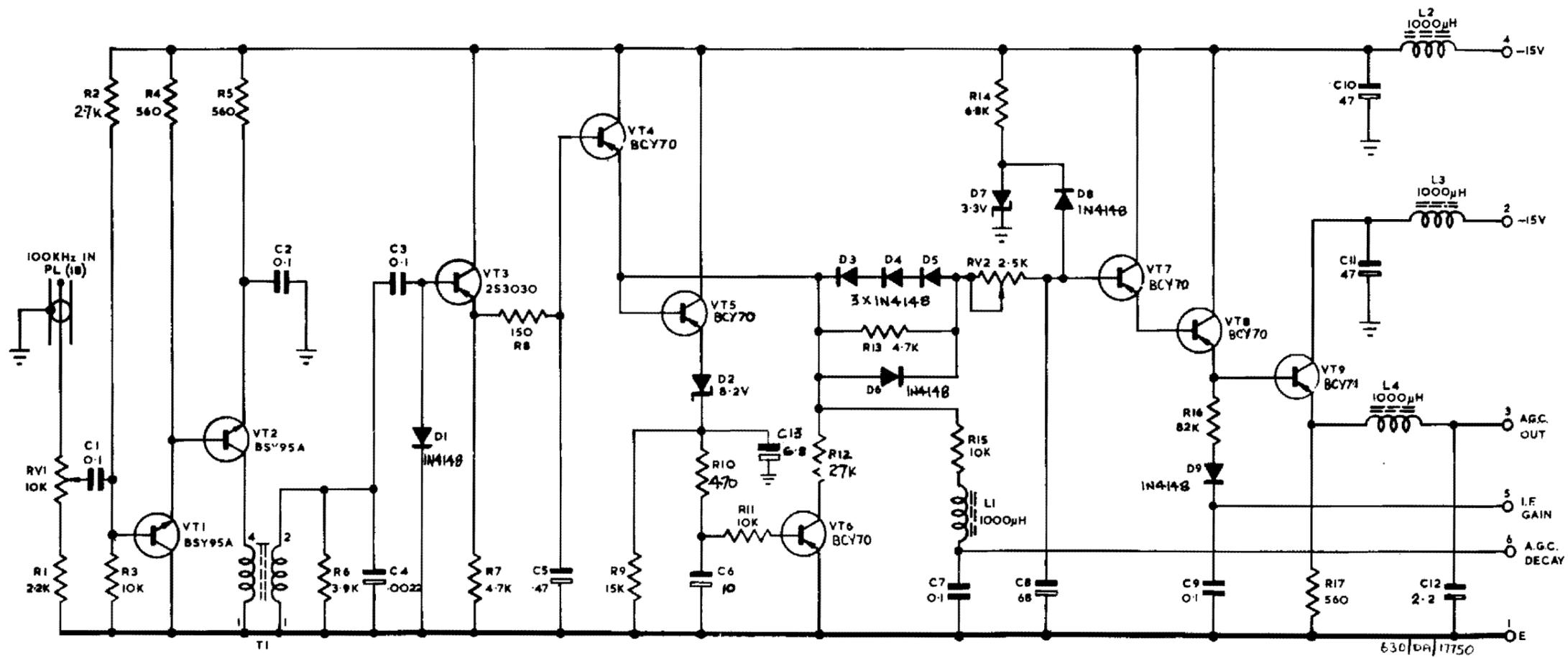
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FIG. 17B COMPONENT LAYOUTS - BOARDS 7A & B, MODULE 7



DWG. NO. 65911(1777) BOARD 7B

FIG. 17B  
ISS. 3



PRI553

FIG. 18.

A.G.C. AMPLIFIER AND DETECTOR, MODULE B: CIRCUIT AND BOARD LAYOUT

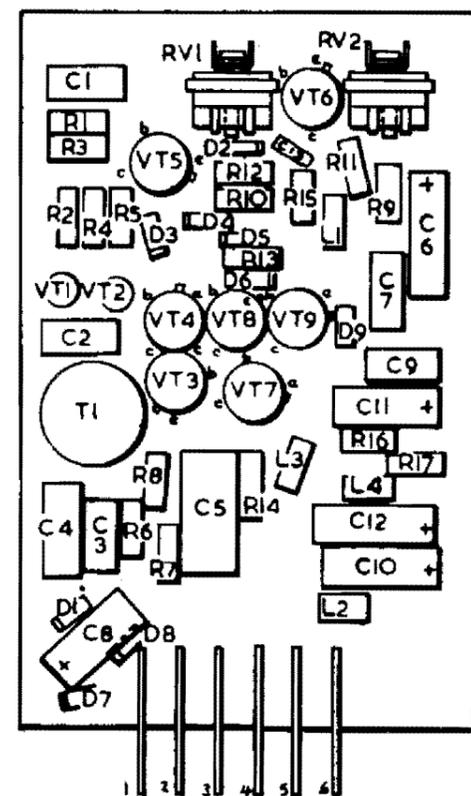
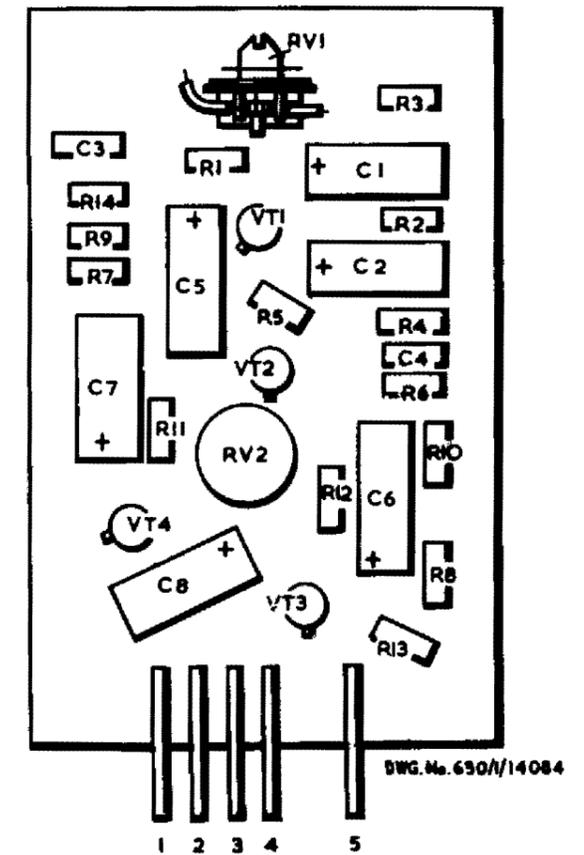
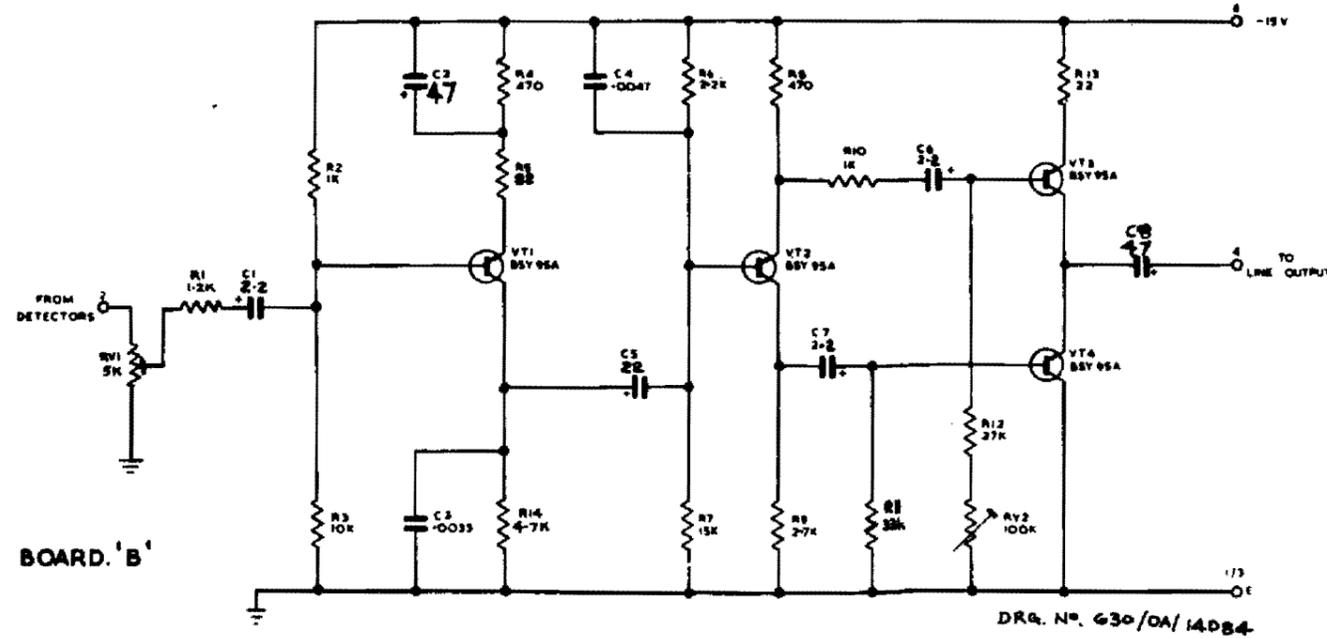
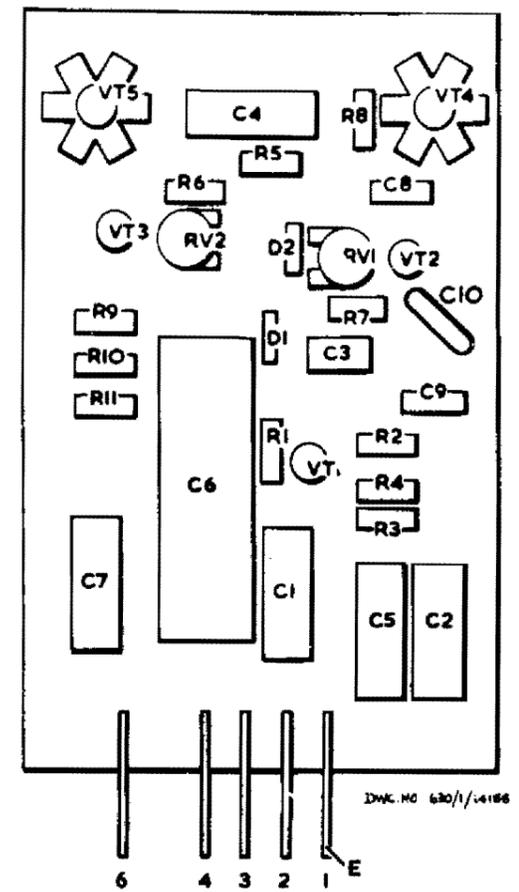
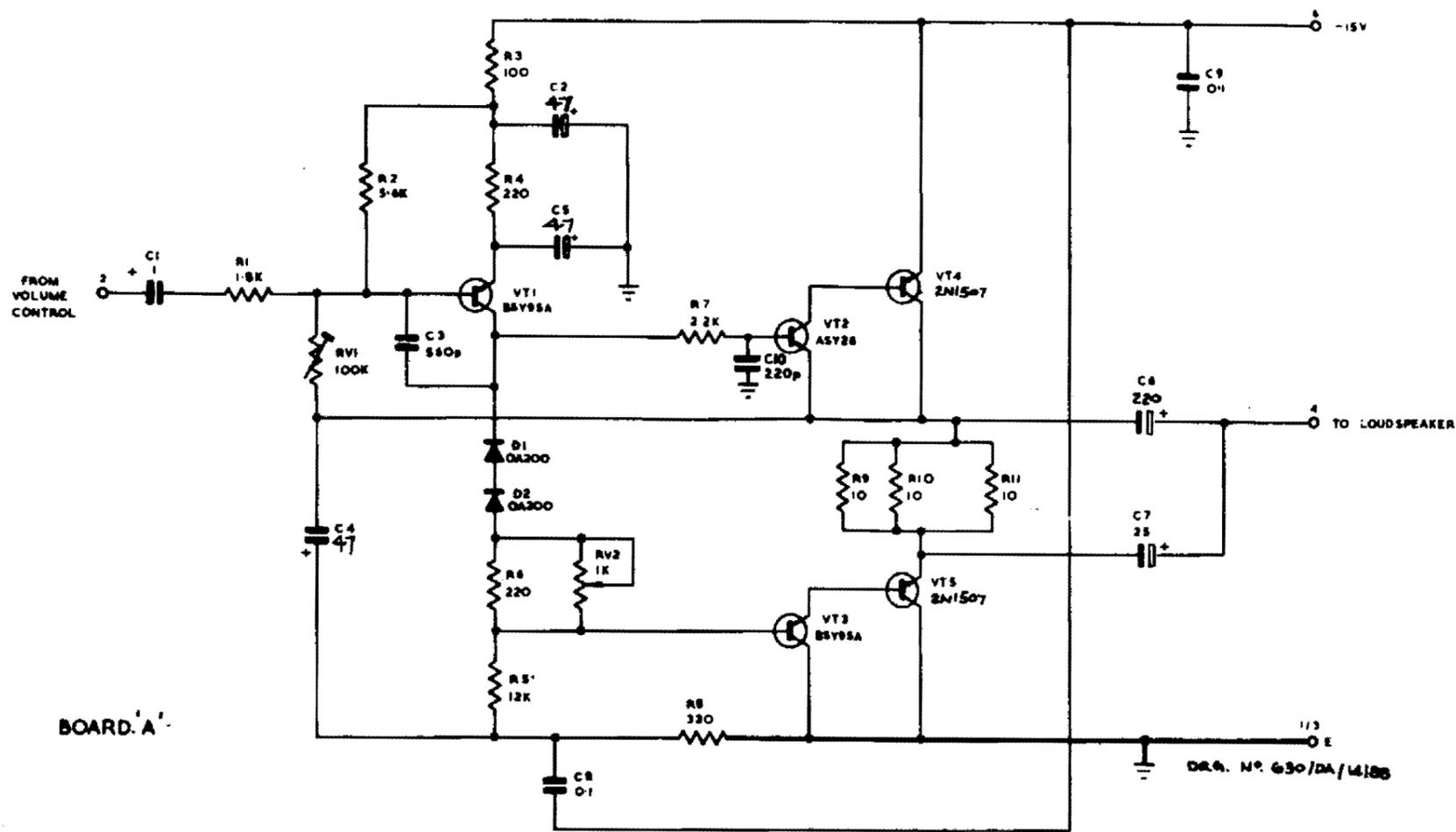


FIG. 18. MODULE B

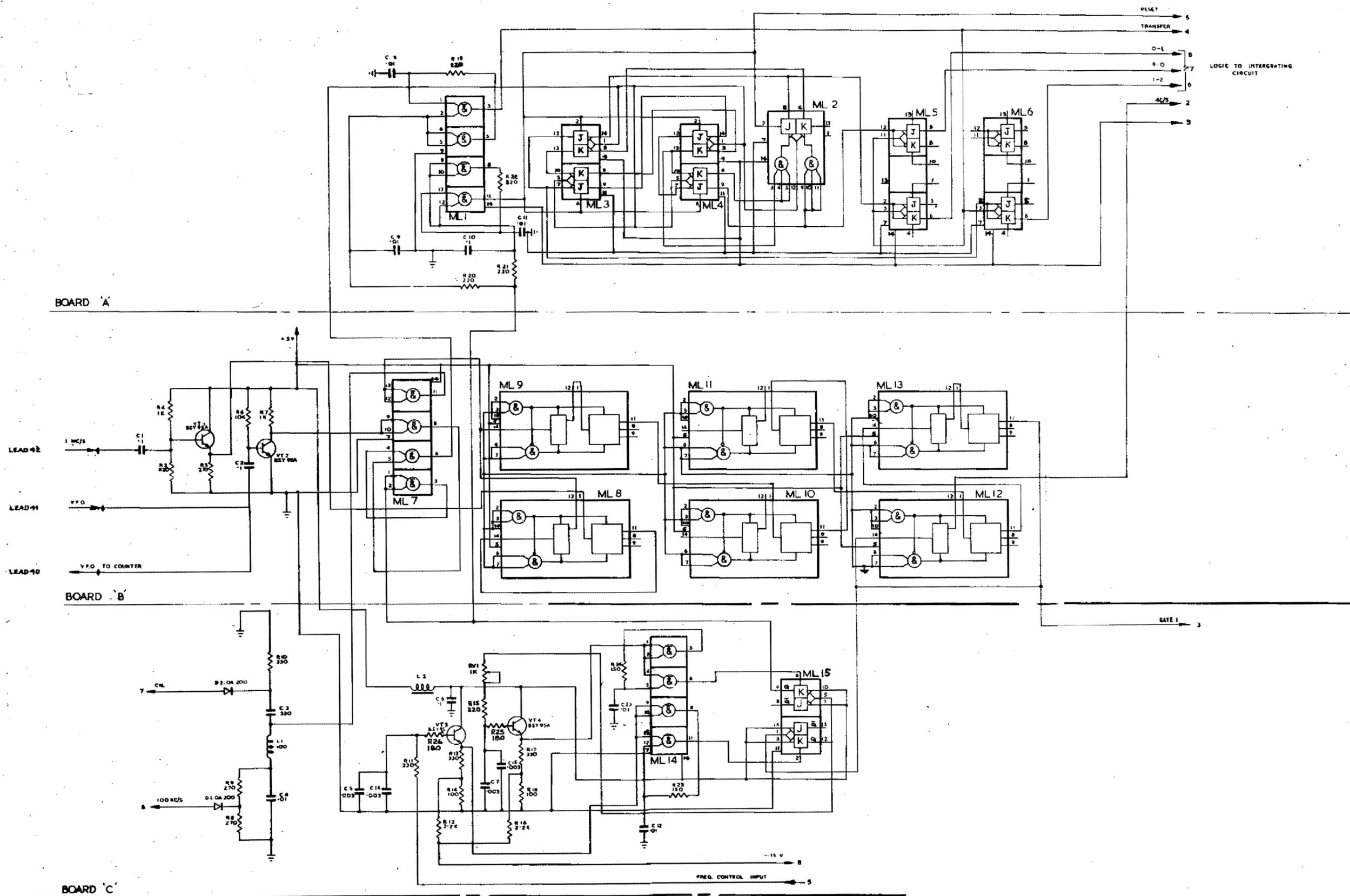


PRI553

FIG. 19

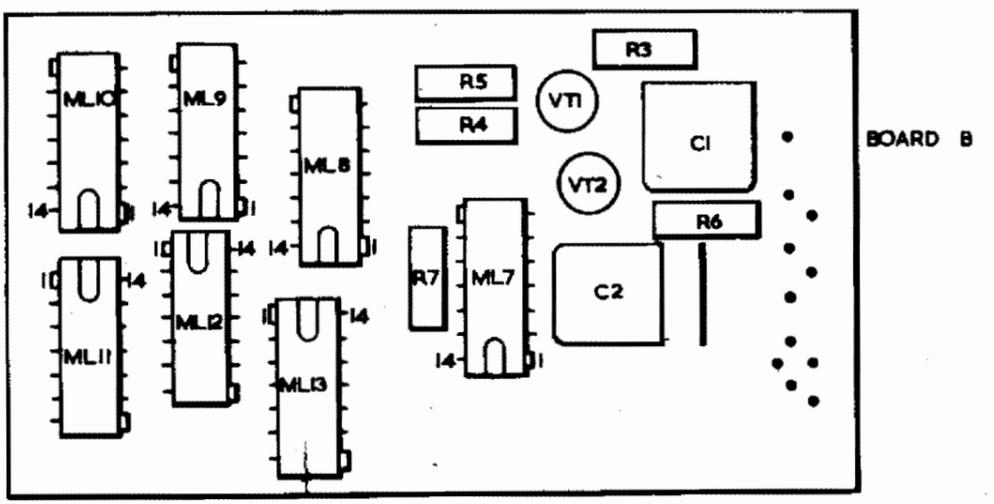
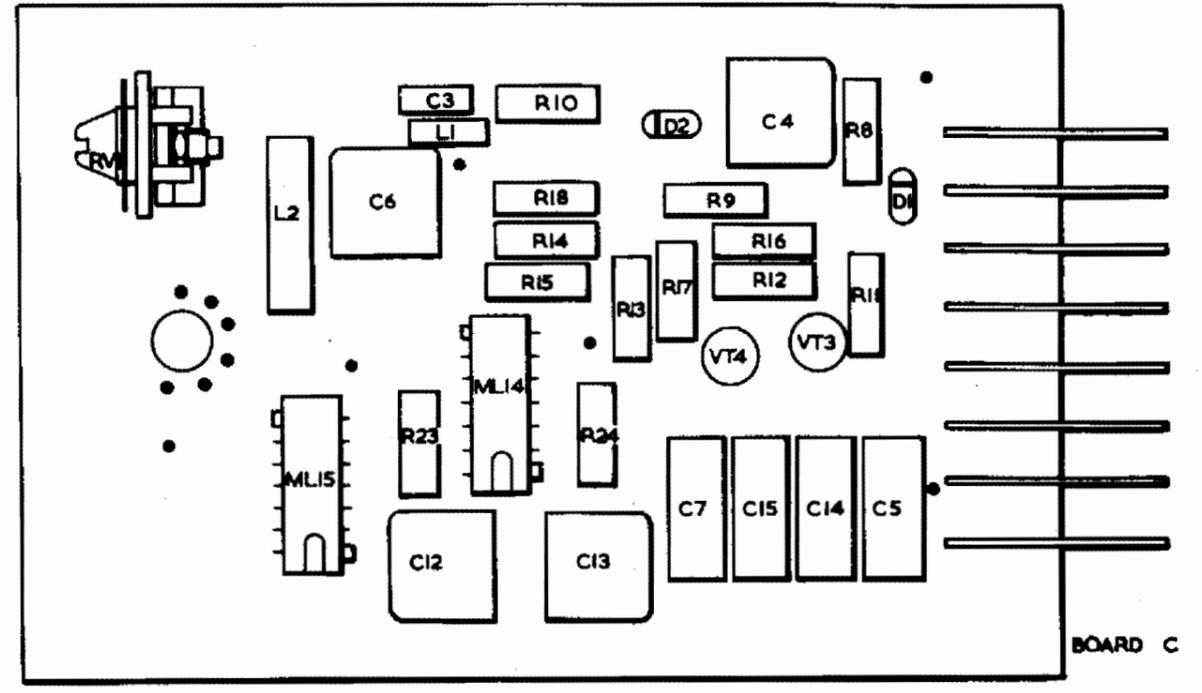
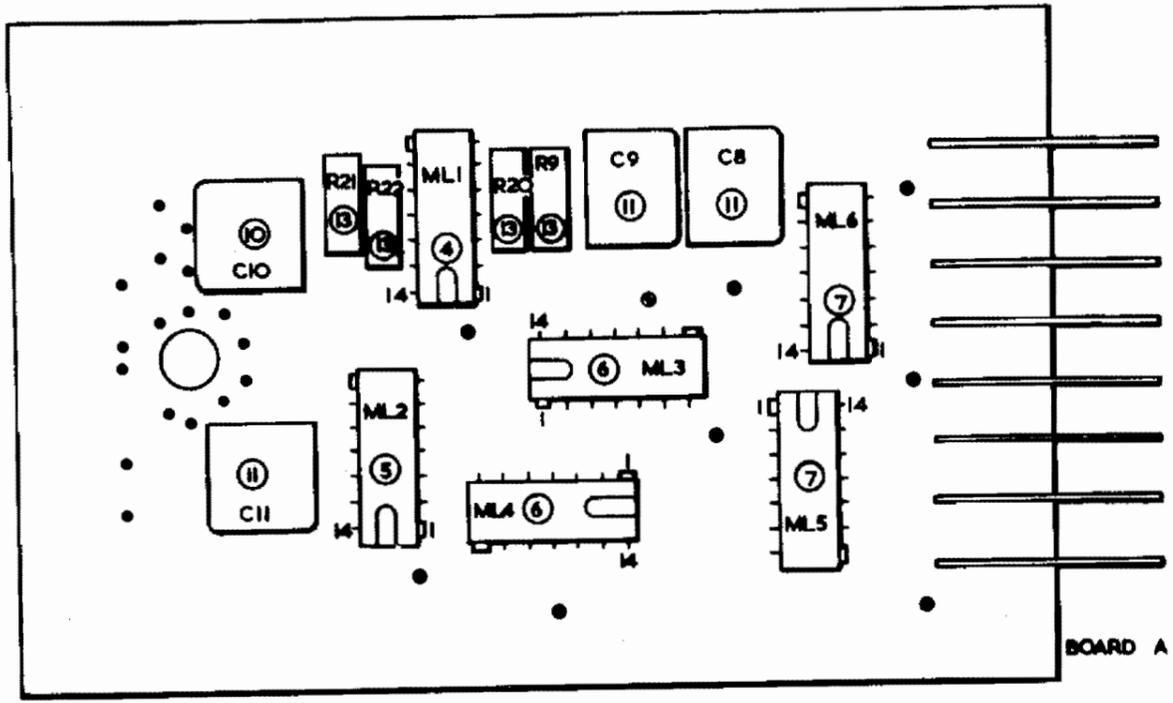
AUDIO AMPLIFIERS, MODULE 9: CIRCUIT AND BOARD LAYOUT

FIG. 19. MODULE 9



CIRCUIT DIAGRAM - PRI53 WAVEFORM GENERATOR

FIG. 20A  
ISS. 6

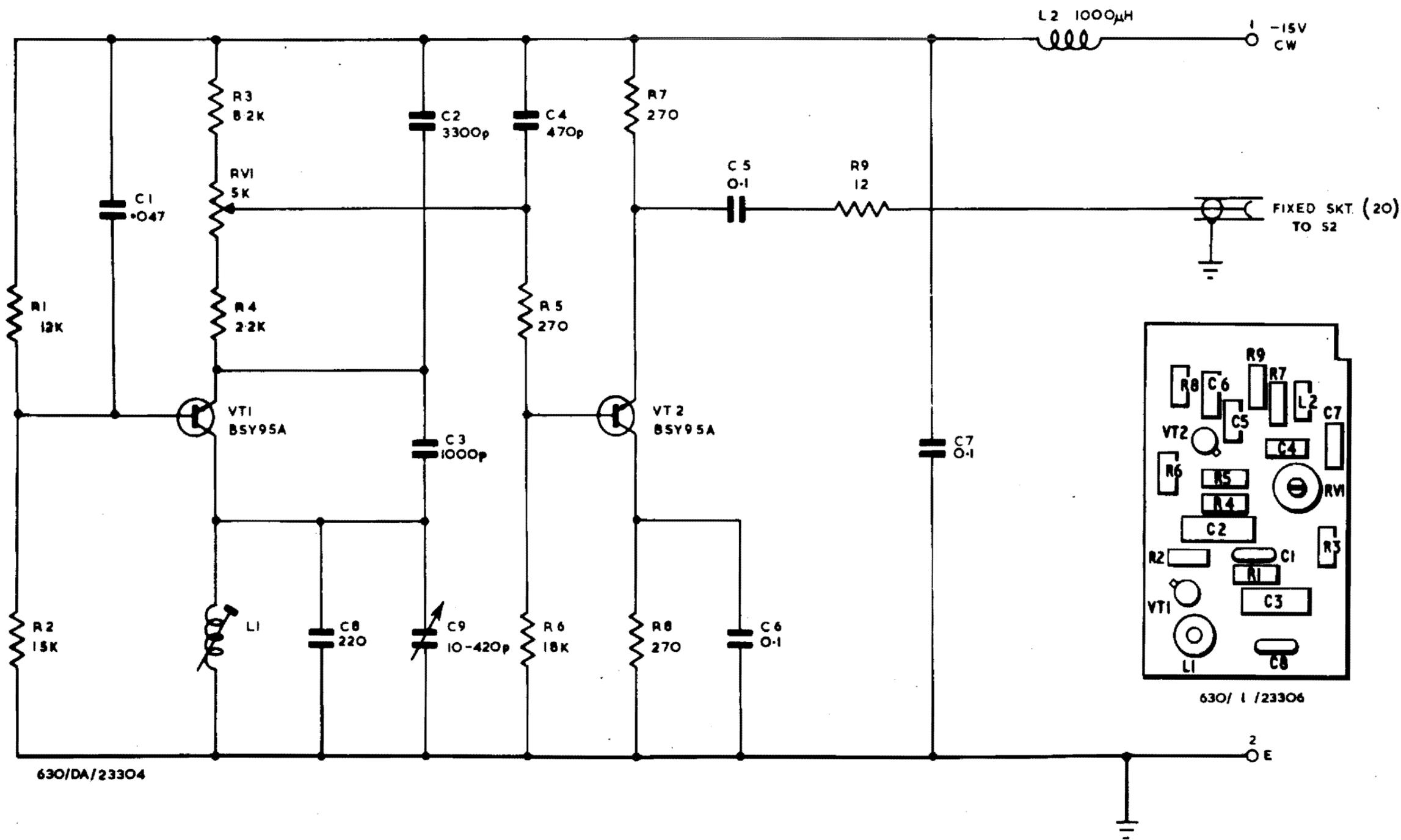


630/1/25354

PR1553

FIG. 20B WAVEFORM GENERATOR BOARD LAYOUT

FIG. 20B LAYOUT

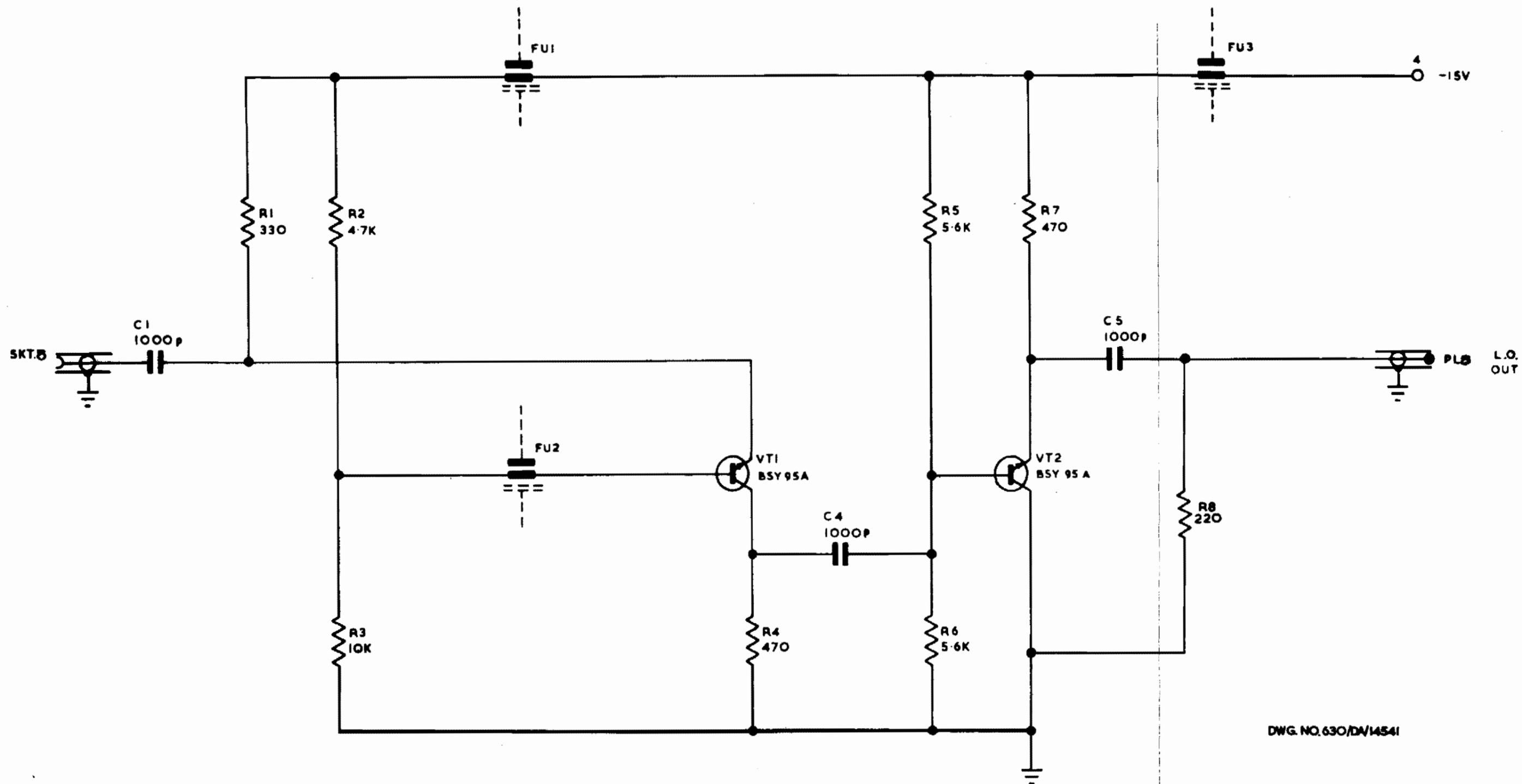


PRI553

FIG. 21.

B.F.O. CIRCUIT AND LAYOUT

FIG.21. B.F.O.

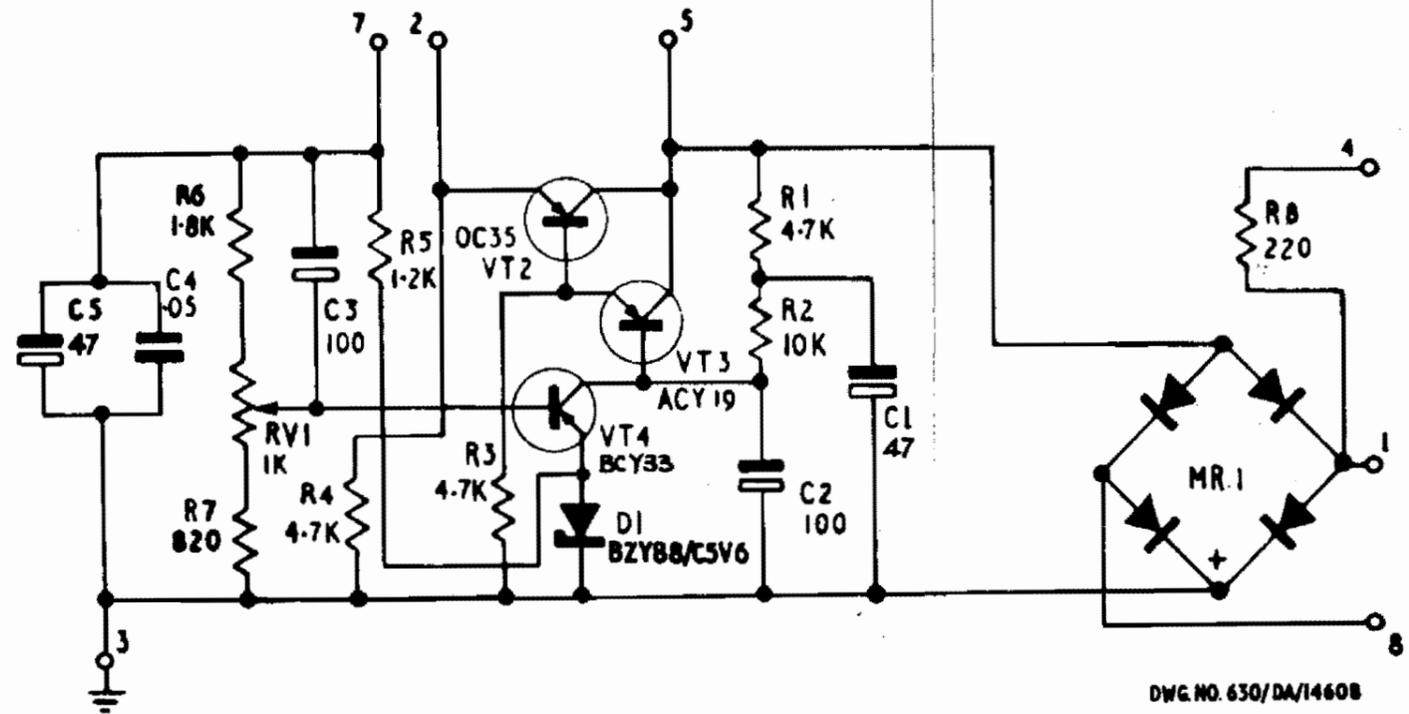


DWG. NO. 630/DV/14541

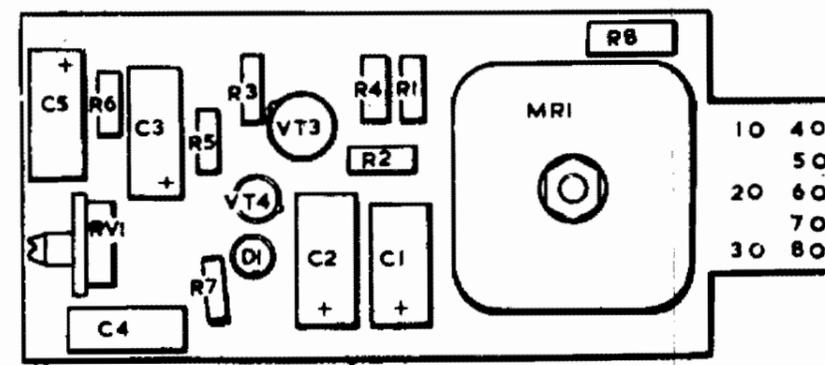
PRI553

FIG. 22. ISOLATING AMPLIFIER : CIRCUIT

FIG.22 ISOL. AMP.



DWG. NO. 630/DA/14608

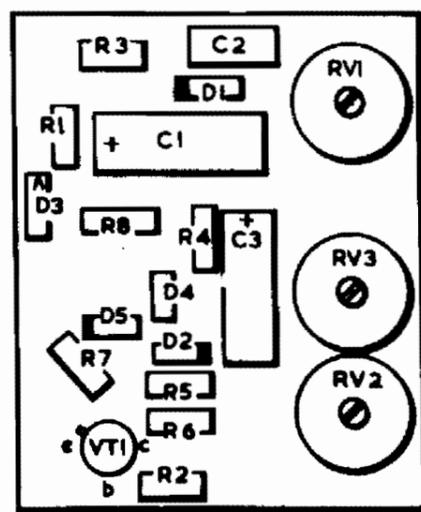
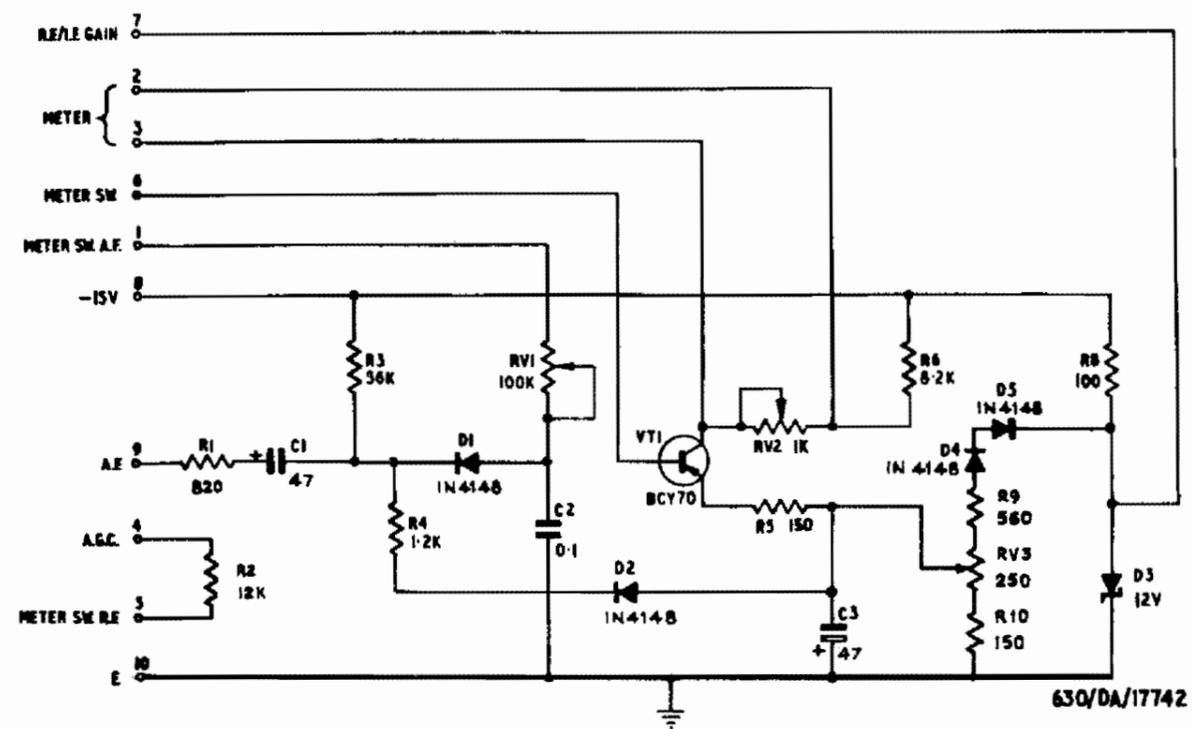


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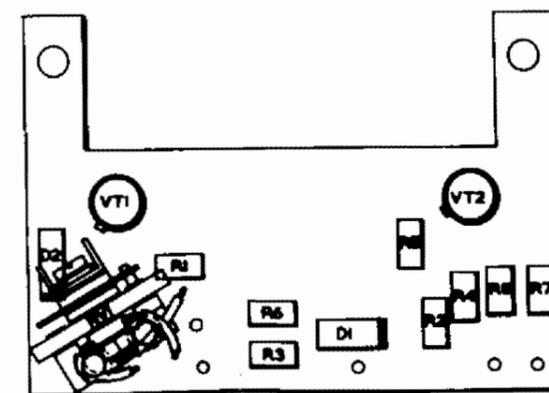
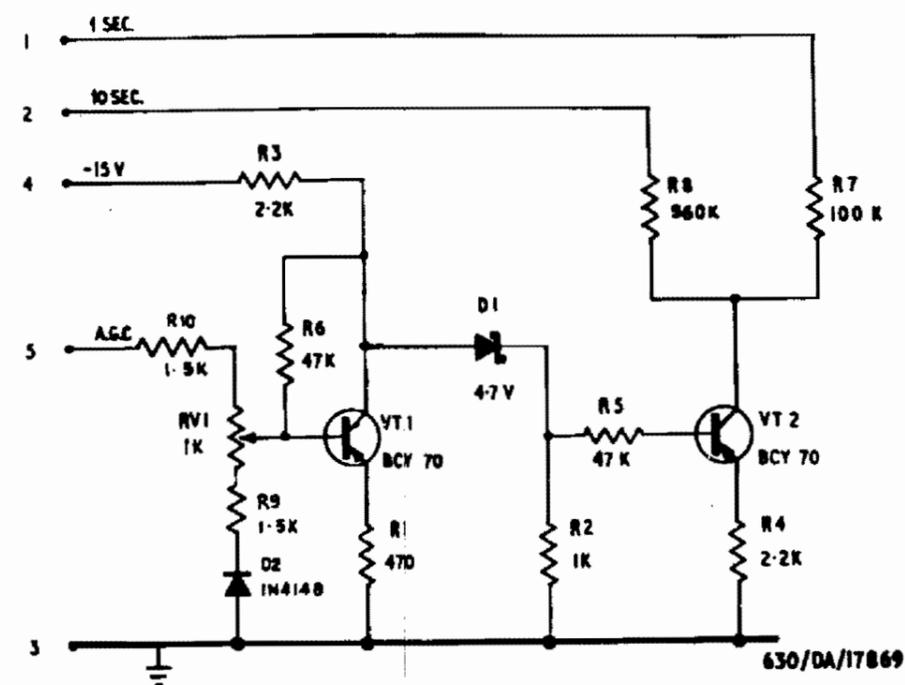
PR1553

FIG. 23: REGULATOR: CIRCUIT AND LAYOUT.

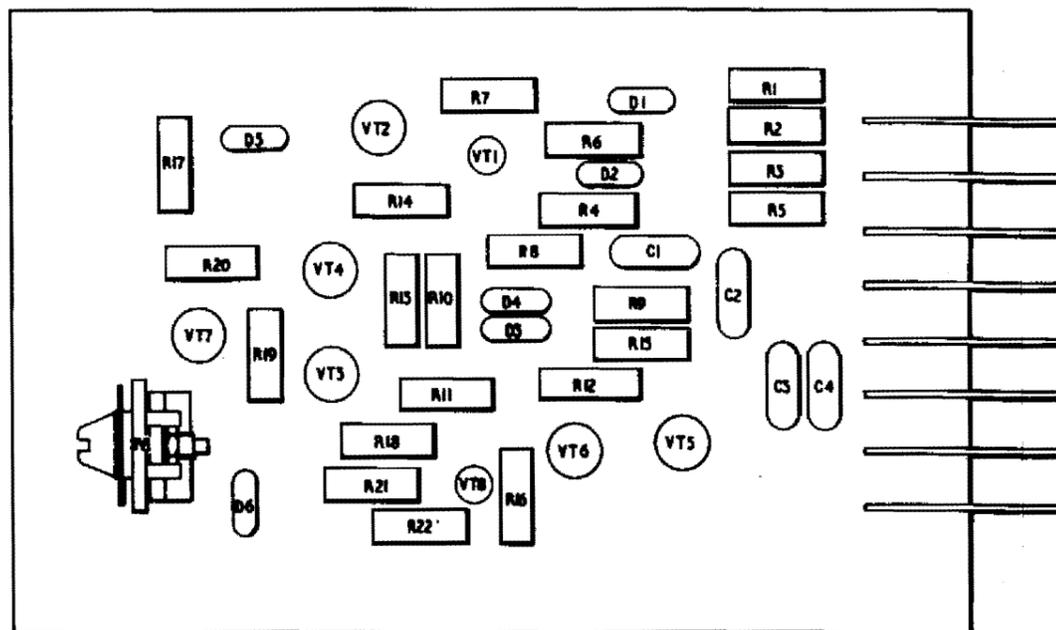
FIG. 23. REGULATOR



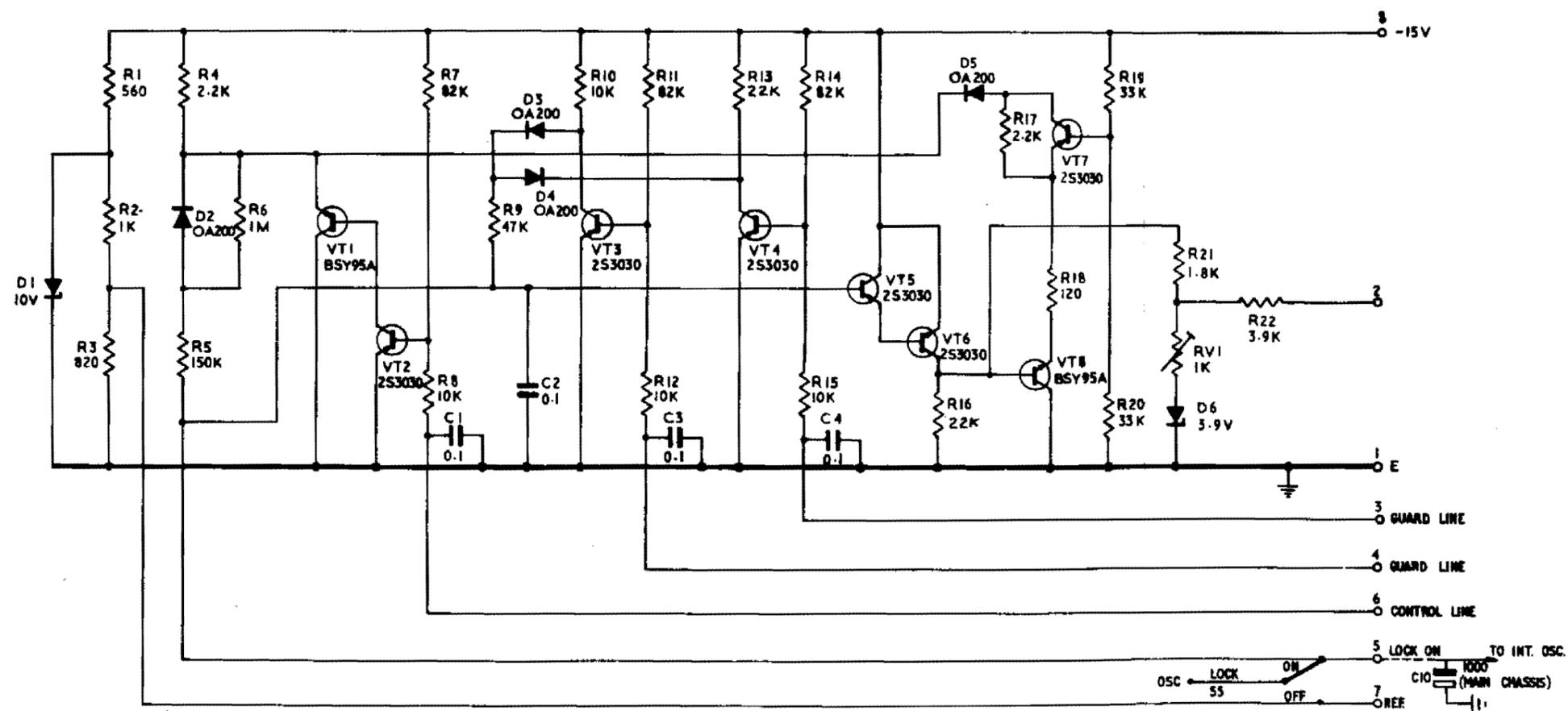
PR1553 FIG. 24A: METER AMPLIFIER: CIRCUIT & BOARD LAYOUT



PR1553 FIG. 24B: A.G.C. DECAY SHAPER: CIRCUIT & BOARD LAYOUT



630A/25352

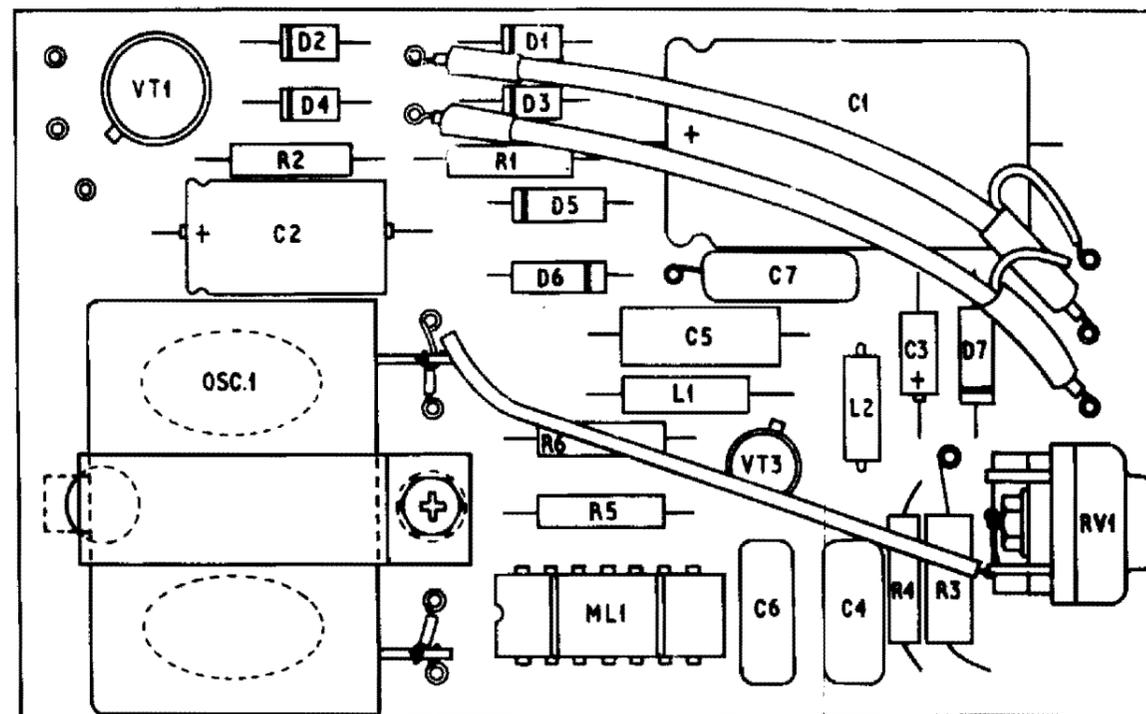
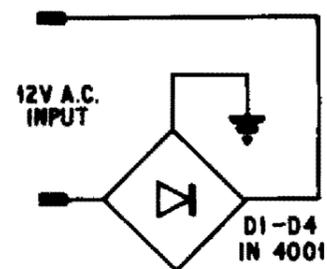


630/DA/25352

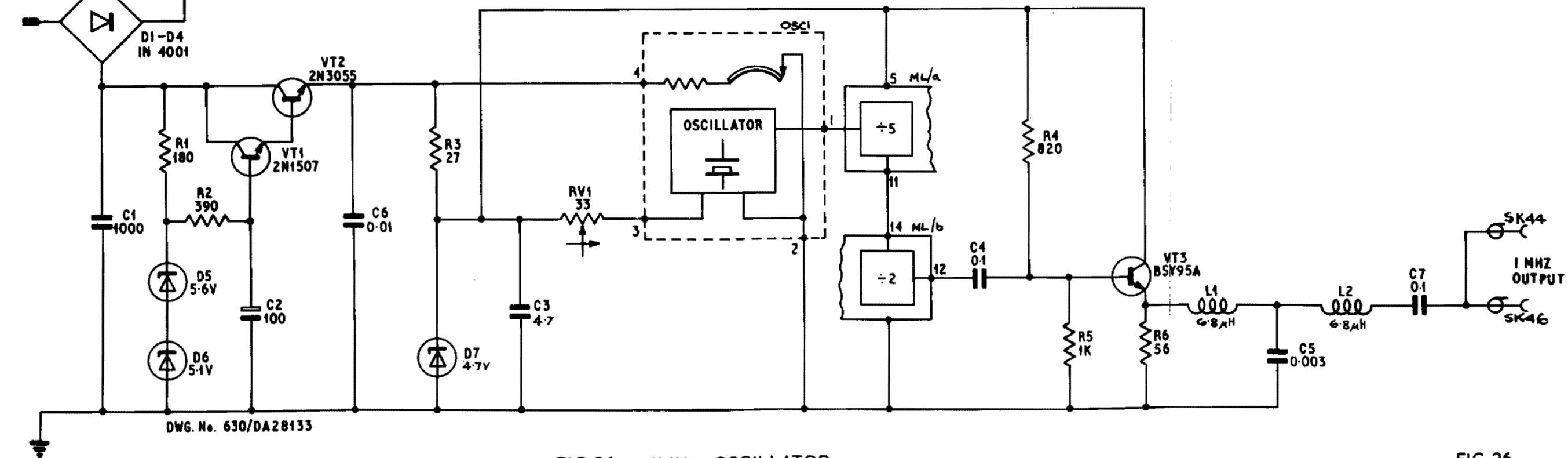
PR1553

FIG. 25 INTEGRATOR MODULE 13

FIG. 25 INTEGRATOR



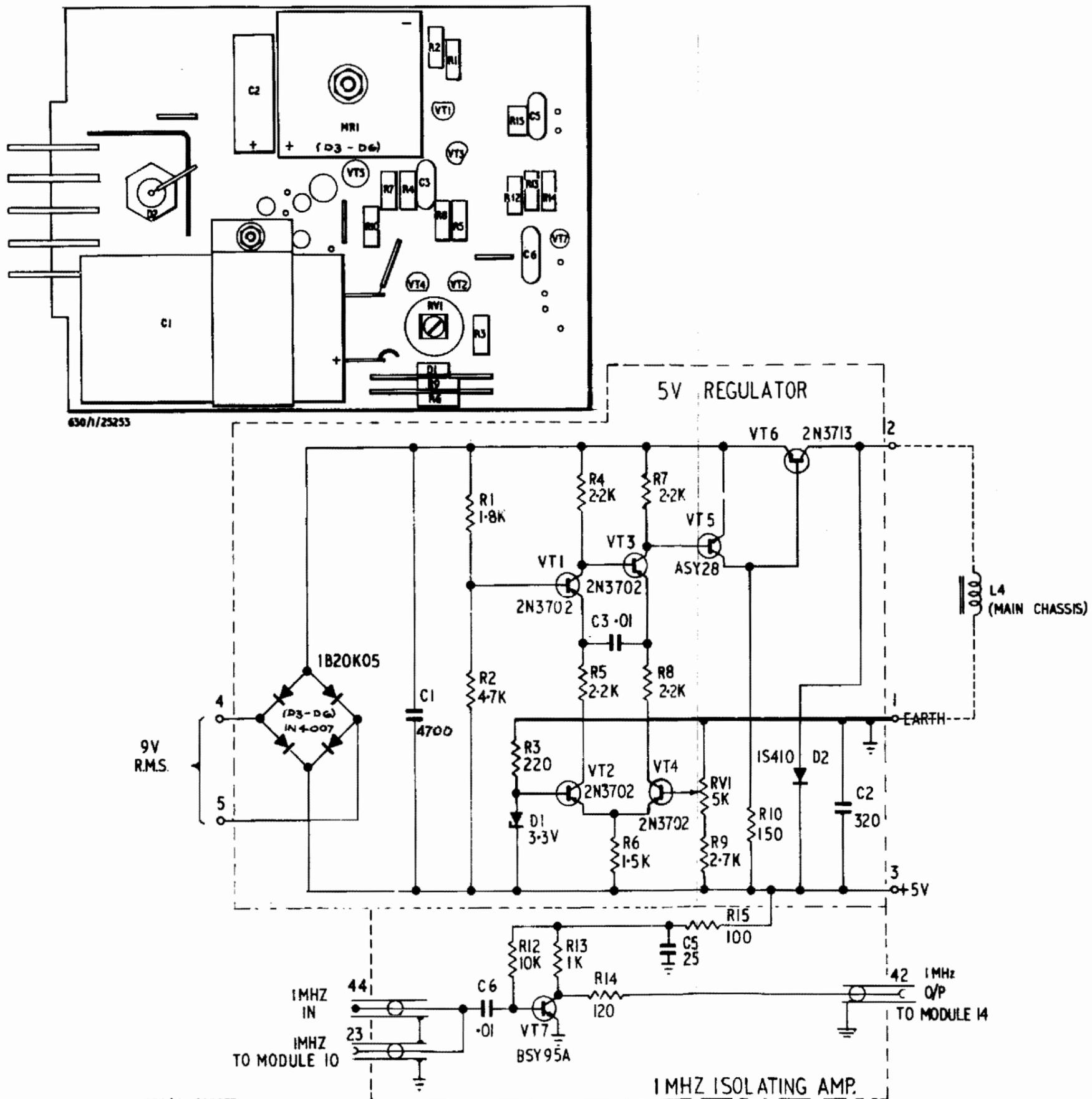
1MHz OSCILLATOR



PR1553

FIG.26 1MHz OSCILLATOR

FIG.26

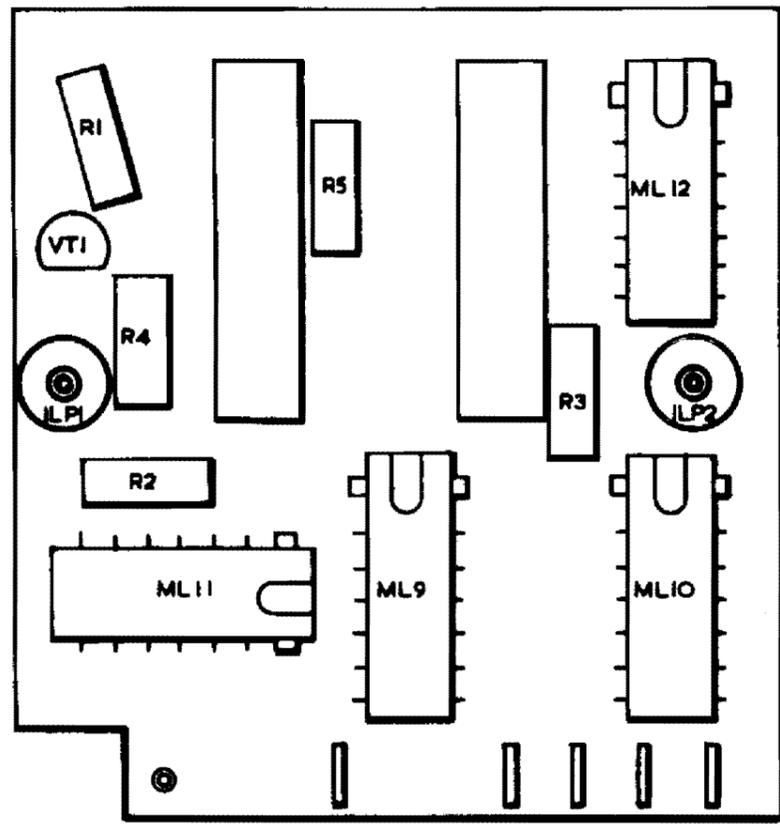


PRI553

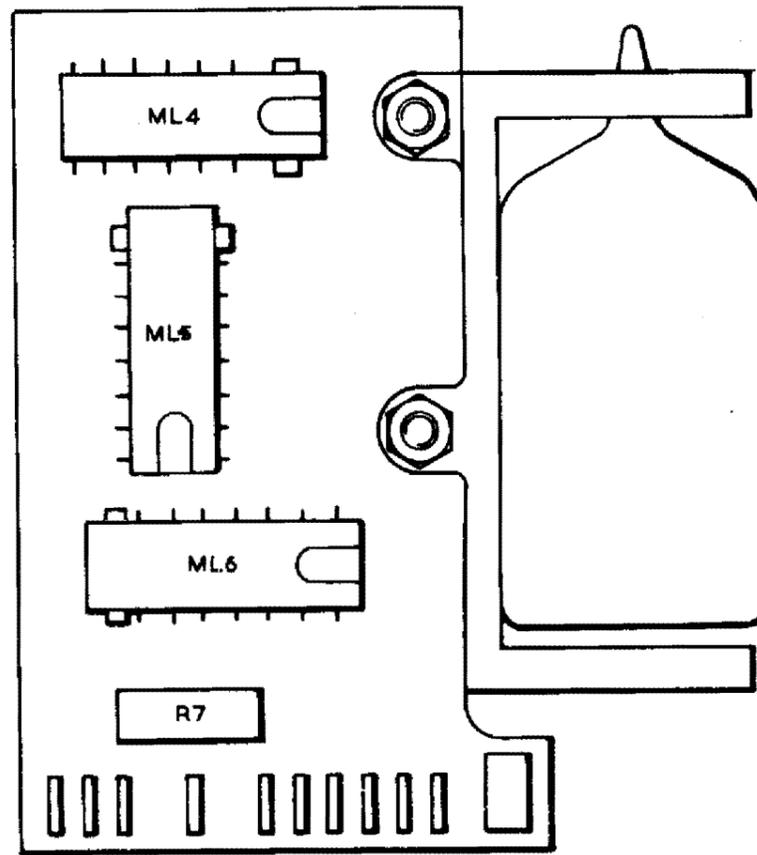
FIG.27 5V REGULATOR & 1MHZ ISOLATING AMPLIFIER

FIG.27 5V REG.

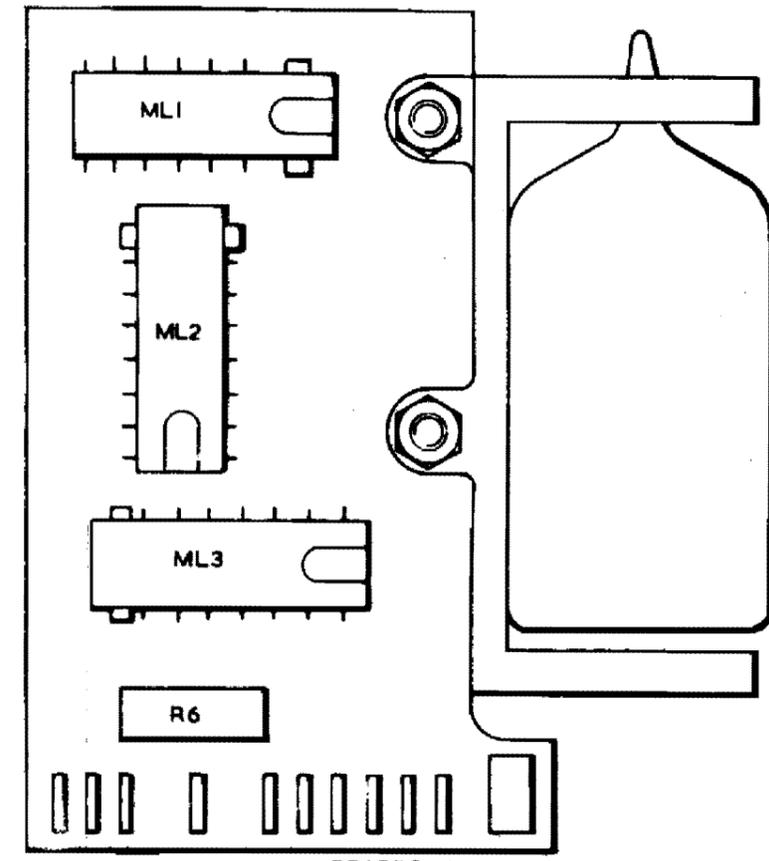




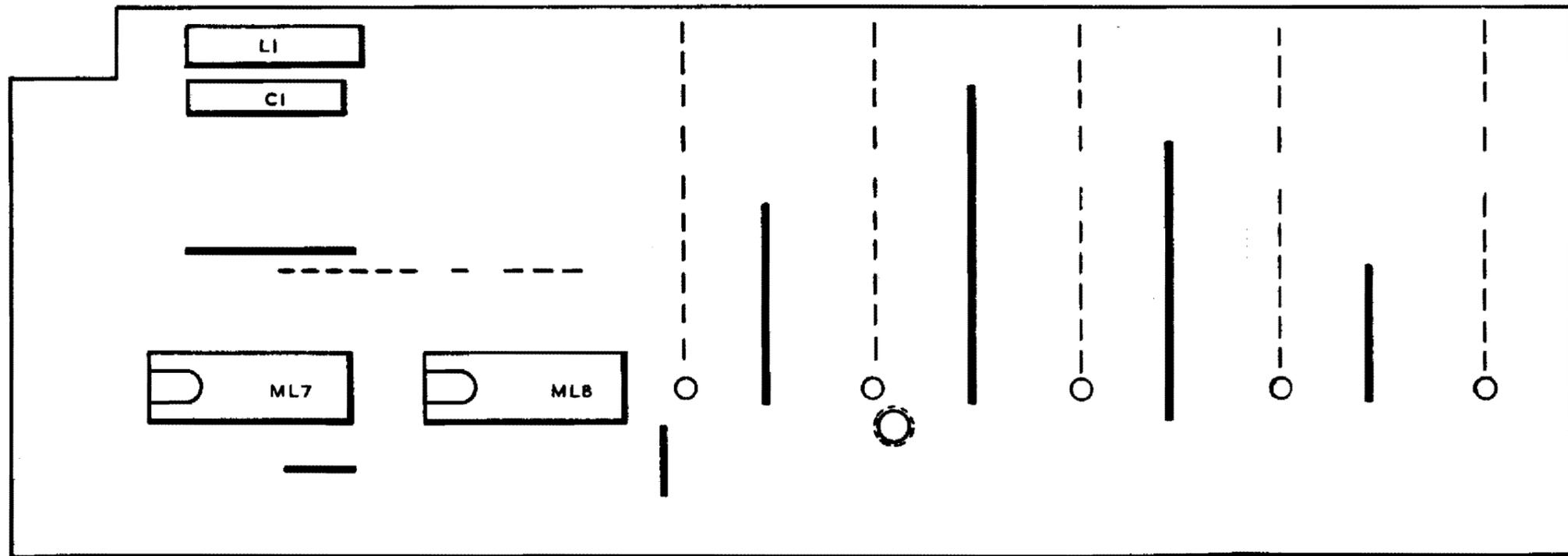
MEGAHERTZ BOARD



BOARD 5



BOARDS 1-4



MOTHER BOARD

630/1/25373