

**AWA**

**TR105 RADIOTELEPHONE**

**SERVICE MANUAL**  
**CODE No. 246.2326**

ISSUE  
2

**AWA** *New Zealand Limited*

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NEW ZEALAND

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1.

INTRODUCTION

The AWA TELERADIO 105 is a fully transistorised single sideband lightweight manpack radio-telephone designed for use in rugged conditions.

It is designed to meet all requirements of the New Zealand Post Office Specifications RTA19 (July 1971).

Teleradio 105 has 6 channels which may be in the 1.6 to 8 megahertz range and has a power output of 5 watts peak envelope power when operated with the standard battery pack which is secured under the main case.

The electronics are all contained in a sealed main case which has all the controls on one face.

The equipment is designed to operate into a dipole, long wire or AWA whip aerial.

For information outside the scope of this Manual, contact:

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NEW ZEALAND

2. GENERAL DESCRIPTION

2.1 Channel Selection is by a six position rotary switch and channel frequencies are available between 1.6MHz and 8MHz.

2.2 Power Supply Selection

The standard power supply is the battery pack which clips underneath the main case. This contains 9 "D" size zinc carbon cells in the standard configuration but nickel cadmium batteries may be fitted.

Alternatively any 10 to 15 volt 1 amp supply may be used to power the transceiver.

2.3 Aerial

As supplied the TR105 will operate into a dipole, long wire or AWA tunable whip antenna.

2.4 Circuitry

The TR105 uses a single I.F. at 1.4MHz on both receive and transmit. Much of the circuitry including oscillators, I.F. filter, mixer and R.F. selectivity is shared by the receiver and transmitter.

No "warm up" period is necessary. It is possible to operate the transceiver immediately after turn on.

2.5 Mechanical Design

The TR105 is packaged in two plastic cases sealed against the ingress of moisture and dirt. One case houses the batteries whilst the other houses the electronics. The electronic components are contained in six printed wiring boards which are in turn attached to an aluminium alloy chassis.

Access to the printed circuit boards is gained by removing the chassis from the main case. The power supply connections protrude through the bottom of the main case. Dipole and long wire aerial connections are made on two terminals mounted on the front panel and the whip aerial connection is made via a plate on the side of the main case.

### 3. OPERATION

#### 3.1 Aerial

The AWA TELERADIO 105 will operate into a dipole, long wire or AWA whip aerial which should be set up as follows:

- (1) Dipole: Select the correct dipole for the channel required and erect it with the centre as high as possible and with the aerial in a straight line. Keep the aerial clear of metal objects, roofs, fence wires, power lines, etc., and connect to terminals marked AERIAL.
- (2) Long Wire: Erect the long wire as high as possible keeping it clear of metal objects, roofs, fence wires, power lines, etc, and connect to RED terminal marked AERIAL. Long wire aerials should have a length within  $\pm 10\%$  of a quarter wavelength at the frequency of operation.
- (3) AWA Whip Aerial: Plug sections together and insert in mount on the side of the case. Set locking sleeve approximately by screwing the sleeve up or down until the bottom coincides with the frequency of operation as marked on the shank of the aerial. Turn AERIAL TUNE to WHIP.

#### 3.2 Transmitting and Receiving

- (1) Select antenna
- (2) Turn the VOLUME control power switch ON and set volume to required level.
- (3) SELECT the desired CHANNEL using the CHANNEL control.
- (4) CHECK BATTERIES by depressing WHITE MICROPHONE BUTTON and observing BATTERY LAMPS. If UPPER LAMP only is lit it indicates that the batteries are new.

If BOTH LAMPS are lit batteries are satisfactory.

If LOWER LAMP ONLY is lit the batteries are approaching the end of their useful life and should be replaced.

- (5) Depress PRESS TO TUNE and keep depressed while carrying out the tuning procedure as below.

3.2 Continued

- (a) For DIPOLE AND LONG WIRE adjust AERIAL TUNE control to get the highest pitch tone from MICROPHONE-LOUDSPEAKER, then release PRESS TO TUNE control.
- (b) For the AWA WHIP AERIAL release LOCKING SLEEVE on whip aerial and rotate black body in either direction to get highest pitch tone from MICROPHONE-LOUDSPEAKER. Screw LOCKING SLEEVE up against body of aerial. Adjust AERIAL TUNE control to get highest pitch tone from MICROPHONE-LOUDSPEAKER then release PRESS TO TUNE control.
- (6) TO TRANSMIT - Depress WHITE MICROPHONE BUTTON and speak into the microphone holding it close to your mouth. Speak slowly and clearly.
- (7) TO RECEIVE - Release WHITE MICROPHONE BUTTON. Adjust CLARIFIER if fitted to obtain clear voice quality.
- (8) TO SHUT DOWN - Turn the volume control power switch OFF.

4.

SPECIFICATION

4.1

General Features

Number of Channels	6 (single frequency simplex)
Modes of Operation	A3J (single sideband)
Choice of Sideband	Upper - standard Lower - special order
Transmitter Output	5W p.e.p. 1.6 to 8MHz
Frequency Range	1.6 to 8MHz
Frequency Stability	+ 100Hz over -10 to 60°C temperature range
Operating Temperature Range	-10 to +60°C
Size	Main Case: 192mm x 86mm x 175mm (7½in x 3in x 6½in)  Battery Case: 188mm x 82mm x 90mm (7½in x 3in x 3½in)  Whip Aerial (folded) fits into a cylinder 400mm long x 45mm diameter (12in x 1.75in)  Dipole Aerial held on container 180mm diameter x 39mm deep (7in x 1.5in)
Weight	Radio Telephone with Microphone 1.8kg Battery case & batteries 1.2kg 2387kHz dipole and Spool .7kg Whip Aerial .3 Carrying Case .5 <hr/> TOTAL 4.5kg
Sealing	The cases are completely sealed. Batteries may be changed without exposing the electronics.
Aerials	2.5m (8ft) whip with tuneable loading coil.  Dipole  Long Wire

#### 4. Continued

Aerial Matching	Internal control tunes transmitter to aeriols.
Batteries	Standard Pack is 9 D size zinc carbon cells in a waterproof container which is secured to the base of the main case. Alternative power sources are Nickel Cadmium cells or any other 10 to 15 volt dc 1 amp supply.
Microphone	Dynamic capsule in a sealed plastic case permanently connected to the main unit by a coiled cable. The same capsule is used as a microphone on transmit and speaker on receive.
Materials	The main case and battery pack are plastic mouldings. The front panel and internal brackets are formed from aluminium alloy sheet. The whip aerial is formed from sections of copper plated steel tubing. The dipole aerial wire is insulated stranded brass wire.
Instructions	The operating instructions are indelibly printed on the side of the case.

#### 4.2

##### Transmitter

Power Output	Not less than 5W p.e.p. 1.6 to 8MHz into 50 $\Omega$
Intermodulation Products	Greater than 25dB below p.e.p.
Spurious Emissions	Greater than 40dB below p.e.p. including harmonics, unwanted sideband and carrier.
Audio Bandwidth	-6dB at 350Hz and 2.7kHz
Speech Processing	Audio compression.

#### 4. Continued

Automatic Load Control	Provides constant output and protects transmitter power amplifier.
Power Consumption	500mA at 13.5 volts on speech.

#### 4.3

##### Receiver

Sensitivity	At least 1mW audio output and $\geq 12$ dB SINAD with $.5\mu\text{V}$ p.d. input.
Selectivity	6dB bandwidth : 2.35kHz minimum 60dB bandwidth: 3.9kHz maximum
Audio Output	100mW at 5% distortion into $150\Omega$ load.
Image Rejection	40dB
Other Spurious Rejection	60dB
Clarifier	Typically $\pm 200$ Hz if fitted
Power Consumption	90mA at 13.5 volts
A.G.C. Range	$5\mu\text{Vpd} + 80$ dB gives $\leq 6$ dB change in output level.

#### 4.4

##### Controls

Channel Selector	(rotary)
Off/On - Volume	(rotary)
Clarifier	(rotary) N.B. not fitted to export versions.
Press to Tune	(momentary Push Button)
Aerial Tune	(rotary)
Lamps (2)	Indicate battery voltage on transmit
Transmit/Receive	(momentary push button on microphone)
Audio Tune	An audio tone is emitted from the microphone during aerial tuning. The frequency of this tone is proportional to the transmitted power.

Channel Crystal Specification

TYPE: AT Cut  
 HOLDER: HC6/U  
 MODE OF OSCILLATIONS: Parallel  
 LOAD CAPACITY: 32pF  
 DRIVE LEVEL: < 2mW  
 FREQUENCY: Carrier +1400kHz at 25°C

MAXIMUM EQUIVALENT  
 SERIES RESISTANCE:

<u>FREQUENCY</u>		<u>E.S.R.</u>
3000	to 4000kHz	150Ω
4000+	to 6000kHz	75Ω
6000+	to 7000kHz	50Ω
7000+	to 10,000kHz	30Ω
10,000+	to 11,400kHz	25Ω

STABILITY WITH  
 TEMPERATURE CHANGE: ± 50Hz -10°C to +60°C

CALIBRATION  
 TOLERANCE: ± 10ppm

PULLABILITY: + 4pF change in load capacity  
 from 32pF shall produce a  
 frequency change of 100 to  
 360Hz.

HOLDER MARKING: .....kHz  
 105  
 32pF

5. CIRCUIT DESCRIPTION

5.1 Common Circuits

5.1.1 Introduction

The I.F. filter, mixer, both oscillators, R.F. tuned circuit, aerial filters and aerial tuning unit are common to both transmit and receive functions.

5.1.2 Aerial Tuning Unit

Location: Behind front panel.

Operation:

This unit tunes out the aerial reactance. The reactance of the unit is varied by the front panel tune control which moves a ferrite slug inside the loading coil.

5.1.3 Aerial Filter

Location: Aerial filter board adjacent to loading coil.

Operation:

The aerial filter unit consists of four low pass filters which improve receiver selectivity and limit spurious outputs from the transmitter.

The cut off frequencies of the filters are 2.5MHz, 4MHz, 6.4MHz and 8MHz respectively.

The filters are programmed according to the channel frequency as below.

<u>Channel Frequency</u>	<u>Use Filter No</u>
Below 2.5MHz	1
Between 2.5MHz and 4MHz	2
Between 4MHz and 6.4MHz	3
Between 6.4MHz and 8MHz	4

5.1.4 Common R.F. Filter

Location: Channel switch module

Operation:

Transformer T401 is tuned with the variable capacitors C411, C412, C413, C414, C416, C417. These tune over 1 octave and cover the 1.6 to 3.2MHz range. The next octave of 3.2 to 6.4MHz is tuned by connecting L402 in parallel with T401 and the range 6.4 to 8MHz is tuned by connecting L401 in parallel with T401.

#### 5.1.4 Continued

The tuned transformer also matches the  $50\Omega$  impedance of the mixer to the receiver and transmitter R.F. amplifiers. On receive the transformer T401 provides a dc path for the supply to the output of the R.F. amplifier. This supply is decoupled by R403 and C45.

The programming of this filter is dealt with in detail in paragraph 9.2. Included in the R.F. filter circuit is a series tuned I.F. trap C415 and L403 located below T401 on the channel switch module.

This provides attenuation at 1.4MHz on both receive and transmit.

#### 5.1.5

##### Mixer

Location: R.F. printed wiring board.

##### Operation:

This circuit is a double balanced type using four matched hot carrier diodes D312, D313, D314, D316.

NOTE: DO NOT REPLACE A SINGLE DIODE  
IF ONE IS DAMAGED, REPLACE ALL FOUR  
WITH A NEW MATCHED QUAD

The R.F. signal is fed to/from the trifilar wound transformer T308. The oscillator is fed through an identical transformer T307 and the I.F. signal is across the centre taps of these two transformers. Balance is dependent on careful construction of the transformers and matching diodes so it is important that none of these components are damaged during servicing.

#### 5.1.6

##### I.F. Filter

Location: R.F. printed wiring board

##### Operation:

The filter is an 8 pole 1.4MHz type. It has a pass band from 1397.3 to 1399.65kHz and a 60dB stop band outside 1396.6kHz and 1400.5kHz. This filter is matched to the mixer by the tuned transformer T306.

#### 5.1.7

##### Channel Oscillator

Location: Channel Switch Module

5.1.7 Continued

Operation:

The channel oscillator is a high stability crystal type using a high gain video I.C. I.C. 301 in a Colpitts circuit. The correct crystal is selected by the rotary channel switch SW401.

The frequency of the oscillator may be varied by the CLARIFIER control on receive.

The crystal capacity load is formed by C316, C318 and varicap D401. On transmit relay RL301 operates feeding a fixed bias voltage via R314, R316, R401 and R402 to the varicap diode hence, determining the crystal load capacity and therefore frequency.

On receive a d.c. voltage is fed to the varicap via R301, R309, R401, R402 and RV303 which varies the applied voltage and hence the frequency. Both the supply voltage for the varicap and that for the oscillator I.C. are regulated to ensure immunity to supply voltage variations.

The output signal from the oscillator is amplified by the emitter follower TR306 and fed to the mixer.

Operation (Export version) :

The channel oscillator is a high stability crystal type using a high gain video I.C. I.C. 301 in a Colpitts circuit. The correct crystal is selected by the rotary channel switch SW401.

The crystal capacity load is formed by C316, C318, 22pF silver mica capacitor and trimmers C403 thru C409. The frequency of individual crystals is set by the corresponding trimmer.

The output signal from the oscillator is amplified by the emitter follower TR306 and fed to the mixer.

d.c. Voltages (typical)

Conditions : No crystal installed.

<u>I.C. 301 pin</u>	<u>d.c. volts</u>
1	11.8
2	11.8
3	0
4	4.0
5	5.8
6	4.0
7	0
8	10.4
TR306 collector	12.6
base	5.2
emitter	4.5

a.c. Volts (typical)

Conditions : Crystal installed.

5.1.7 Continued

<u>Monitoring Point</u>	<u>ac Volts peak to peak</u>
Pin 1 I.C. 301	2.4
T.P.304	2.4

Frequency Measurement

Conditions: Crystal installed  
 Transmit  
 Ambient temperature 20 to 30°C  
 Supply voltage greater than 12V

Monitoring Point: TP304

5.1.8

Carrier Oscillator

Location: Hinged PWB left rear corner.

Operation:

This circuit provides a 1.4MHz signal to the detector on receive and modulator on transmit.

The oscillator is a high stability crystal type using TR14 in a Colpitts configuration. The dc supply is regulated to 8.2 volts to ensure immunity to supply fluctuations.

dc Voltages (typical)

Conditions: No crystal installed

	dc volts
TR14 collector	5.6
base	3.4
emitter	2.8

ac Volts (typical)

Conditions: Crystal installed

<u>Monitoring Point</u>	<u>ac Volts peak to peak</u>
T.P.8	2.4

Frequency Measurement

Conditions: Crystal installed  
 Ambient Temperature 20 to 30°C  
 Supply voltage greater than 12 volts

Monitoring Point: T.P.8

Frequency: 1400,000Hz ± 5Hz

Adjustment by C73.

5.2

RECEIVER CIRCUITS

5.2.1

R.F. Amplifier

General

The amplifier is located at the left front corner of the hinged PWB. The signal is fed via the loading coil and aerial filter through R.L.302/1 and a co-axial link to the broadband receiver input transformer.

Operation

The signal is fed to the video amplifier I.C., via the broadband transformer T1 which provides dc isolation and also protects the R.F. amplifier by saturating when large signals occur at the aerial terminal.

The output from the amplifier is fed to the common R.F. filter which is programmed depending on channel frequency as in Section 9.2.

The video amplifier is gain controlled and delayed a.g.c. is applied to the amplifier to ensure maximum signal to noise ratio. (See paragraph 5.2.5 for details).

DC Voltages

Conditions: Receive Mode  
No Input Signal

I.C.1 pin	DC volts
1	11.8
2	11.8
3	0
4	4.0
5	5.2
6	4.0
7	0
8	11.8

AC Voltage

Conditions: Receive Mode  
Carrier oscillator crystal removed. XT1

Input: 2.2 $\mu$ V pd (at aerial terminals)

Output: 2V p-p across volume control

## 5.2.2

I.F. AmplifierLocation:

The receiver I.F. amplifier is located on the hinged PWB on the left side to the rear of the R.F. amplifier.

Operation

The amplifier provides about 70dB voltage amplification and 60dB gain control range at 1.4MHz. TR3 is a low noise fixed gain stage ensuring the I.F. stage noise is insignificant at all times. D6 is reverse biased during transmit to prevent TR3 loading the transmitter circuitry.

The integrated circuit I.C. 2 is identical to the R.F. amplifier I.C. 4 with the gain control signal being applied to pin 5.

The amplifier feeds into T2 which is tuned to 1.4MHz and hence reduces the output at other frequencies.

DC Voltages

Conditions: Receive Mode  
No input signal

I.C. 2 Pin	DC volts
1	11.8
2	11.8
3	0
4	4.0
5	5.8
6	4.0
7	0
8	11.8
TR3 collector	9.2
base	1.3
emitter	.6

AC Voltages

Condition A: Carrier oscillator crystal XT1 removed  
Receive Mode

Input: 6.3 $\mu$ V pd (Com I.F.)

Output: 2V p-p across volume control

### 5.2.3

#### Detector

##### Location:

Left rear of hinged PWB adjacent to carrier oscillator.

##### Operation

The detector is based around a dual gate FET which has a relatively low level I.F. signal fed to gate 1 from the I.F. amplifier I.C.2. A large signal from the carrier oscillator is applied to gate 2. The resulting audio product present at the drain is filtered and fed to the audio pre-amplifier.

##### DC Voltages

Conditions: Receive Mode  
No input signal  
Carrier oscillator crystal XT 1 removed

##### DC volts

TR4 Drain	5.6
Source	1.4
Gate 1	0
Gate 2	3.2

##### AC Voltages

Conditions: Receive mode  
Input: 6.3mV pd (T.P.1)  
Output: 2Vp-p across volume control

### 5.2.4

#### Audio Pre-Amplifier

Location: Adjacent to the I.F. amplifier

##### Operation

The pre-amplifier uses a 741 operational amplifier in the inverting amplifier configuration. Signal is injected from the detector, amplified and is then fed out to the AGC system and audio power amplifier.

## 5.2.4 Continued

### DC Voltages

Conditions: Receive Mode  
No input signal  
Carrier oscillator crystal XT4 removed

I.C. 4 Pin	DC Volts
2	6.6
3	6.6
4	0
6	6.6
7	13.0

### AC Voltages

Conditions: Receive Mode

Input: 7mV r.m.s. (Drain TR4)

Output: 2Vp-p across volume control

## 5.2.5

### Automatic Gain Control

#### Location

The AGC is located adjacent to the receiver R.F. Amplifier in the left front corner of the hinged P.W.B.

#### Operation

The signal from the audio pre-amplifier I.C.4 is rectified by a diode D8. The output from D8 is fed directly to the AGC amplifier TR7 giving a fast attack by charging C51.

The AGC voltage is clamped to the bias voltage of TR7 by D7.

The AGC has a slow decay C51 discharging through TR7, R56 and R54.

C51 therefore provides the dc level at the base of TR7 which buffers the rectifier and provides the required drive for the AGC lines.

Since both the R.F. and I.F. amplifiers use the same type of I.C. the control voltages are the same varying from less than 3 volts for maximum gain to about 6 volts for minimum gain.

By careful selection of the series resistors in the AGC lines R59 and R63 and the individual threshold settings RV3 and RV4 the gains of the two amplifiers are optimised.

### 5.2.5 Continued

The I.F. gain is the first to be reduced and the R.F. starts about 20dB later to ensure optimum signal to noise ratio. However, the R.F. control overtakes the I.F. to become the dominant one at large input levels. This ensures the best possible large signal performance.

#### DC Voltages

Conditions: Receive Mode  
No input signal

#### DC Volts

TR7	collector	13.0
	base	5.2
	emitter	5.2

### 5.2.6

#### Audio Amplifier

Location: Centre front of hinged P.W.B.

#### Operation

The audio amplifier consists of three transistors, one driver and a complimentary output pair. One of the output transistors TR11 is biased slightly on whilst the other is biased off with D9 maintaining .7V between the bases of TR11 and TR12. At low levels TR11 operates in class A and as the drive is increased TR12 begins to operate. A large amount of negative feedback is fed to the base of TR9 by R72 to minimise distortion and a small amount of positive feedback is fed via C66 and R77 to TR12 to increase the voltage swing.

The closed loop voltage gain is in the region of 4 to 5 and maximum input is 1V R.M.S.

#### DC Voltages

Conditions: No input signal

Collector	Base	Emitter	
8.0	12.5	13.0	TR9
13.0	8.0	7.3	TR11
0	7.2	7.3	TR12

#### AC Voltages

Input: 1V r.m.s. (across volume control with volume set to maximum)

Output: 10V p-p (across 150 $\Omega$  load)

### 5.3 TRANSMITTER CIRCUITS

#### 5.3.1 Two Tone Generator

Location Right rear corner of hinged P.W.B.

##### Operation

The two tone generator produces two audio tones at 1.6kHz and 2.3kHz for tuning and testing purposes. Wein Bridge type oscillators are used, built around 741 type operational amplifiers contained in I.C.3. The output level is controlled by the available voltage swing from these amplifiers with the result that some clipping occurs causing up to 10% harmonic distortion. However, all harmonics are removed by the I.F. filter leaving a clean 2 tone signal for transmitting.

The generator operates when the PRESS TO TUNE control is activated and provides a signal output to allow the aerial to be tuned with the transmitter operating. It also provides a sensitive test voltage which allows each stage in the transmitter to be checked for satisfactory operation.

##### DC and AC Voltages

Conditions: Tune transmit

I.C.3	Pin	
	1,9	10Vp-p on 6V dc
	2,8	12.8V dc
	3,4,6,7	3.5Vp-p on 6V dc
	5,10	0V dc

#### 5.3.2 Microphone Amplifier

Location Centre rear of hinged P.W.B.

##### Operation

This circuit is an amplifier with automatic level control. The input signal comes from the microphone or two tone generator. This is amplified by up to 60dB in the operational amplifier I.C. 6 and the output level monitored by the transistor TR8. The output from TR8 varies the gate voltage of a FET TR6 which acts as a variable attenuator. The rate of rise and fall of the control voltage is carefully chosen to prevent the succeeding transmitter stages from being overloaded during speech input. The result is a constant average output from varying inputs.

### 5.3.2 Continued

#### DC Voltages

Conditions: Transmit  
No input signal

I.C. 6	Pin	DC Volts
	1	1.4
	2,3	7.5
	4	0
	5	1.2
	6	7.0
	7	13.3
	8	5.9
TR8	collector	3.4
	base	13.3
	emitter	13.3
TR6	drain	7.5
	source	7.5
	gate 1 and 2	3.4

#### AC Voltage

Condition: Tune transmit

I.C. 6 Pin 6 2Vp-p

### 5.3.3

#### Modulator and I.F. Amplifier

Location: Centre rear of hinged P.W.B.

#### Operation

The modulator is a balanced type employing the SN76514 modulator I.C. I.C.7. The carrier oscillator signal at 1.4MHz is mixed with the audio signal to form a double sideband suppressed carrier output at pin 2. This signal is then amplified by TR13 which in turn feeds the I.F. filter.

#### DC Voltages

Condition: Transmit  
Carrier oscillator crystal XT1 removed

### 5.3.3 Continued

I.C.7	Pin	DC Volts
	1	12.8
	2	11.2
	3	6.5
	4	4.1
	5	0
	6	4.1
	7	6.5
	8	6.5
	9	6.5
	10	11.8
TR13	collector	0.8
	base	11.8
	emitter	12.3

#### AC Voltages

Condition: Tune, transmit

I.C. 7	Pin 2 (TP7)	1.3Vp-p
	Pin 8	.25Vp-p
TR13	base	1.3Vp-p
	collector	12Vp-p

### 5.3.4

#### Driver

Location Right front corner of hinged P.W.B.

#### Operation

The R.F. signal from the common R.F. filter (Para 5.1.4) is amplified by a broad band amplifier. The first gain block is the driver which provides the drive for the final stage. The first stage TR16 is a dual gate FET used as a variable gain amplifier. Its gain is controlled by the automatic level control described in paragraph 5.3.6. The next stage consists of a pair of transistors connected as a dc coupled amplifier with feedback. This provides stable gain independent of temperature, supply voltage and frequency.

#### DC Voltages

Conditions: Transmit Mode  
Carrier Crystal XT1 removed

#### 5.3.4 Continued

Transistor	Terminal	DC volts
TR16	drain	9.2
	source	2.4
	gate 1	2.0
	gate 2	6.9
TR17	collector	2.4
	base	1.4
	emitter	0.7
TR18	collector	13.5
	base	2.4
	emitter	1.7

#### AC Voltages

Conditions: Tune, transmit

Because the driver stage falls within the A.L.C. control loop it is not possible to predict accurately what ac voltage levels will be as they are frequency dependant. If the driver stage is fed into a dummy load instead of the power amplifier hence breaking the A.L.C. control loop the driver will tend to overload because it will be operating at maximum gain.

Approximate ac voltage levels are tabulated below for the condition with the power amplifier connected. The transmitter should be in the tune mode and properly tuned to a  $50\Omega$  load. An R.F. probe must be used.

Signal source: internal two tone generator

gate 1	TR16	500mV to 700mVp-p
base	TR17	500mV to 800Vp-p
base	TR18	200mV to 700mVp-p
collector	TR18	6V to 10Vp-p

With R300 and R304 disconnected from the secondary at the driver transformer T301 and  $8.2\Omega$  placed across the secondary the following voltages will be observed.

gate 1	TR16	500V to 700mVp-p
base	TR17	1V to 1.5Vp-p
base	TR18	1V to 1.5Vp-p
connector	TR18	13Vp-p heavily distorted

### 5.3.5

#### Power Amplifier

Location: Right upper front of chassis

#### Operation

This amplifier consists of a pair of high frequency power transistors working in class B push-pull configuration. The bases are biased with a voltage derived from the current source TR303 via series resistors R313, R307 and RV301 and is clamped by diode D302. The bias is adjusted by varying the current through D302 i.e. by setting RV301. The emitter inductors improve stability under extreme operating conditions.

The output signal from the collectors is combined in the broadband transformer T302 which provides an unbalanced 50 $\Omega$  output.

#### DC Voltages

Conditions: Transmit  
Carrier crystal XT1 removed

#### DC volts

TR301, TR302	collector	13.5
	base	.65
	emitter	0

#### AC Voltages

R.F. voltages around the power amplifier are difficult to measure and interpret. If correctly loaded the base to earth voltage is 1 to 2.5 volts peak to peak in Tune mode correctly tuned. However, because of large signal currents these voltages can only be measured with an R.F. probe connected between the base terminal and a nearby earth. The voltage waveform will appear significantly distorted under normal operating conditions.

The collector waveform should be 25 to 35 volts peak to peak. Because the aerial tuning unit presents a frequency dependant impedance to frequencies off tune some spurious products (harmonics etc) will appear as significant voltages at the collectors. The result is a waveform which appears visibly distorted at this point.

### 5.3.6

#### Automatic Level Control

Location: R.F. P.W.B. in front of I.F. Filter

### 5.3.6 Continued

#### Operation

The A.L.C. adjusts the gain of the R.F. amplifier to ensure that the power amplifier is never overloaded. Both output voltage and current are sampled. Voltage via R319 and R321 which is then rectified by D306 and fed to the A.L.C. generator TR304. The output current is sensed by a current sensing transformer T305. The resultant ac being rectified by D305 before being fed to the A.L.C. generator.

When a high impedance loads the power amplifier its voltage swing will tend to be too large for linear operation. This is monitored by the A.L.C. and the gain reduced accordingly. Similarly, for a low impedance load current swings can be excessive and the A.L.C. also controls this.

During speech modulation the A.L.C. must ensure that none of the large impulses overload the power amplifier and cause adjacent channel "splatter". To achieve this the rise and decay times must be carefully chosen. It is therefore important that C313, RV302 are replaced only with components of the correct value.

#### DC Voltages

Conditions: Transmit  
Carrier Crystal XT1 removed

#### DC volts

TR304	collector	6.9
	base	0
	emitter	1.2

### 5.3.7

#### Tone Tune Circuit

Location: Centre of hinged P.W.B.

#### Operation

The tone tune circuit generates a tone which is fed to the microphone/speaker when the PRESS TO TUNE control is depressed. The frequency of the tone is proportional to power output and is used for tuning the transmitter for maximum power output.

### 5.3.7 Continued

The basic tone generator is a UJT transistor TR2 used as a relaxation oscillator. The frequency determining components are R6, C6, TR1 and R4. A current sense transformer T309 on the output of the power amplifier develops an R.F. voltage which is rectified by D317 and smoothed by C331. This voltage is then applied to TR1 varying the collector to emitter resistance and hence the frequency of the oscillator.

#### DC Voltages

Conditions: Tune, Transmit  
Carrier Crystal XT1 removed

TR1	collector	6Vp-p triangular wave on 6V dc
	base	12.2V dc
	emitter	12.6V dc
TR2	base 1	7Vp-p spikes
	base 2	12.8V dc
	emitter	6Vp-p triangular wave on 6V dc

### 5.3.8

#### Battery Indicator Circuit

Location: Right front of hinged P.W.B.

#### Operation

The battery indicator circuit operates two L.E.D.'s indicating battery conditions when on transmit.

The three conditions are:

Upper L.E.D. Lit	-	new batteries
Both L.E.D. Lit	-	batteries satisfactory
Lower L.E.D. Lit	-	replace batteries

At high voltage zener diode D16 conducts passing current through R111, D18 and R109 holding the emitter potential of TR19 high and hence holding TR19 off and D17 unlit whilst D18 is lit. As the voltage drops zener diode D18 starts to turn off allowing the emitter potential of TR19 to drop hence turning TR19 on and lighting D17. Finally D16 ceases conducting at low voltage and only D17 remains lit.

#### DC Conditions

Upper L.E.D. only lit	13V to 16V
Both L.E.D.'s lit	10.2V to 13V
Lower L.E.D. only lit	8.6 to 10.2V

## 6. MECHANICAL DESCRIPTION

### 6.1 Construction

The TR105 consists of an aluminium alloy chassis in which the six printed wiring boards are mounted. The main chassis member is C shaped to which the front panel is screwed. The main member also has a screened box located in the left upper rear corner and this contains the channel switching module which consists of one horizontally mounted P.W.B. with two other boards mounted vertically from it.

The P.W.B's are mounted with components uppermost. The lower board is hinged to provide access to all components this board being secured by two captive screws.

The R.F. board is retained by two screws under the I.F. filter which screw through a bracket into nuts on the underside.

The aerial filter P.W.B. is screwed to two spacers which are held between the front panel and the screened box. All P.W.B.'s are accessible after removing chassis from the main case.

### 6.2 Removal of Chassis from Case

1. Remove battery box.
2. Remove the four screws from the bottom of the main case.
3. Ease chassis forward and detach whip antenna connection from the right hand side of the chassis.
4. Withdraw chassis.

### 6.3 Removal of Channel Switch Module

1. Detach all wiring.
2. Slacken shaft connecting bush to the rear of second rotary switch section. (Early models only)
3. Remove rear cover.
4. Slide module to the rear and out of the chassis.

### 6.4 Removal of R.F. Board

1. Remove I.F. Filter.
2. Detach P.W.B. from bracket under the board and remove bracket from chassis.
3. Remove screws that pass through the right hand side of the chassis into the heatsink.
4. Detach all wiring.
5. Slide module to the rear of the chassis and out.

7.

RECEIVER ALIGNMENT AND TESTS

Test Set Up

Connect R.F. signal generator to the aerial terminals  
(Marconi TF2002 or similar).

Connect an audio power meter (Marconi TF893A or similar),  
set to  $150\Omega$  and a CRO across the microphone terminations.

Other instruments required are:

DC voltmeter ( $20,000\Omega/V$ ) and a frequency counter  
(calibrated to within  $\pm 1\text{Hz}$ )

- NOTE
- (a) all tests to be done with 13.5V supply.
  - (b)  $f_c$  = carrier frequency.
  - (c) The channel programming must be correct  
before commencing tests (refer Section 9).

TR105 RECEIVER ALIGNMENT AND TEST

TEST	FREQUENCY	INPUT	LEVEL (pd)	ADJUSTMENT OR CHECK
1. Carrier Oscillator	-	None	-	Adjust C73 for 1,400,000Hz $\pm 5$ Hz at TP8.
2. Channel Oscillator	-	None	-	Adjust the appropriate capacitor for the marked crystal frequency $\pm 5$ Hz at TP304 when on transmit. Check that clarifier range is $\pm (230 \pm 130)$ Hz.
2a. Channel Oscillator (Export Version)		None	-	Adjust the appropriate capacitor for marked crystal frequency $\pm 5$ Hz at TP304.
3. Sensitivity	$f_c + 1\text{KHz}$	-	0.5 $\mu$ V	Adjust T2 and appropriate channel tuned circuit for maximum outp Check for $>12\text{dB}$ Sinad and $>1\text{mW}$ output.
4. Audio Response	$f_c + 300\text{Hz}$ to $f_c + 3\text{KHz}$	-	0.5 $\mu$ V	Check for $<6\text{dB}$ variation over bandwidth of 350 to 2,700Hz.
5. A.G.C. Threshold	$f_c + 1\text{KHz}$	-	3 $\mu$ V	Set RV4 and RV3 to minimum. Then adjust RV3 while monitoring TP6 until a rise in the d.c. level is observed.
6. R.F. A.G.C.	$f_c + 1\text{KHz}$	-	30 $\mu$ V	Adjust RV4 until a drop in d.c. level on TP6 is observed. Typical
7. A.G.C. Range	$f_c + 1\text{KHz}$	-	5 $\mu$ V rising by 80dB	Check for $\leq 6\text{dB}$ rise in output level.
8. Audio Output	$f_c + 1\text{KHz}$	-	2mV	Check for 100mW.
9. Image	$f_c + 2799\text{KHz}$	-	100 $\mu$ V	Check for output $<$ output obtained on test 3.
10. I.F. Rejection	1399KHz	-	500 $\mu$ V	Adjust L403 for minimum audio output and then ensure that output level is $<$ output level obtained on test 3.
11. Selectivity	$f_c - 2.2\text{KHz}$ $f_c + 5\text{KHz}$	-	560 $\mu$ V	Check output level is $<$ output level obtained on test 3.

TRANSMITTER ALIGNMENT AND TESTS

Test set up.

Connect a  $50\Omega$  10 watt load to the aerial and earth terminals.

Connect set to a 13.5V 1.5 Amp supply.

Connect audio generator with  $150\Omega$  source to microphone terminals.

A 10MHz CRO is also required.

TESTADJUSTMENT OR CHECK

Tx AF gain

Set RV6 for maximum gain.

Bias

Adjust to 100mA between T.P.'s 301 using RV301 with microphone button depressed.

A.L.C.

Set Tx R.F. GAIN control RV7 to maximum and adjust RV302 to give 6W p.e.p. with press to tune control depressed and transmitter tuned.

Tx R.F. Gain

Adjust RV7 to give 6W p.e.p. output when audio input signal is 6dB below compression.

Tone Balance

Adjust RV2 for two equal tones when monitoring transmitter output.

Tone Tune Level

Adjust RV1 to get the desired level of tune tone from the microphone/speaker.

Transmitter Bandpass

Adjust input level to microphone terminals to 1.5mV r.m.s. and slowly sweep from 300Hz to 3kHz. Check for < 6dB variation in output in the range 350Hz to 2,700Hz.

Carrier Suppression

Depress microphone pressel switch and measure voltage across  $50\Omega$  load which should be less than 500mV p-p with RV6 set to min and the microphone is replaced by a  $150\Omega$  resistor.

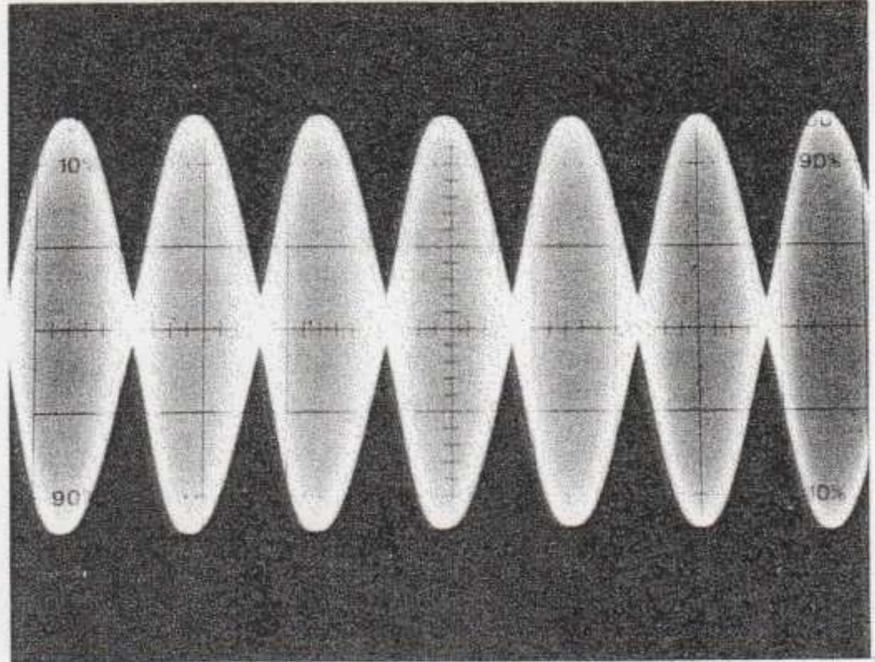
Power Output and Waveforms

Swing AERIAL TUNE control over full range ensuring that the output waveform is as expected from the diagrams shown in Section 8.1. Decrease supply voltage to 10V and check transmitter output which should be  $40 \pm 5$  volts peak to peak and swing AERIAL TUNE control observing waveforms as before. Increase supply voltage to 16V and repeat the steps above. Output should be  $60 \pm 5$  volts peak to peak. Return supply to 13.5V and change load to  $22\Omega$ . Output should be  $28 \pm 5$  volts peak to peak. Change load to  $100\Omega$ . Output should be  $64 \pm 5$  volts peak to peak.

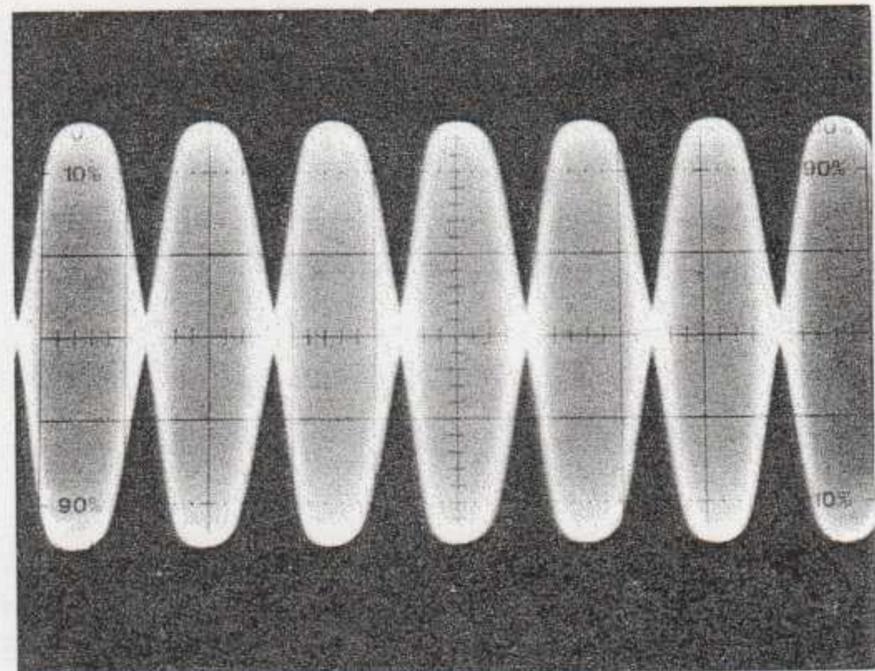
8.1

The following is a guide to the waveform shapes that may be observed while testing the transmitter.

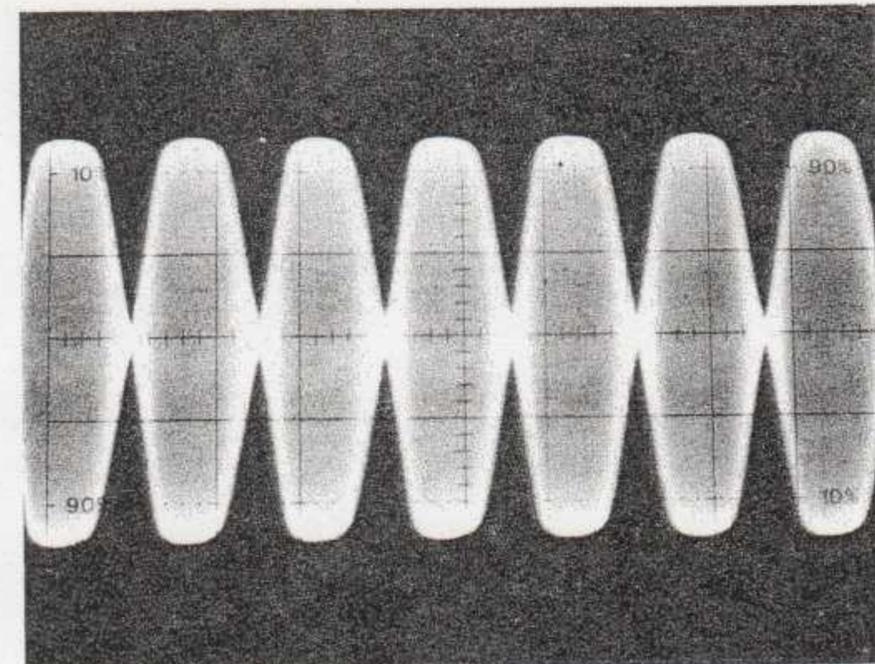
Two equal tones.  
Intermodulation  
distortion  
products 33dB  
below peak envelope  
power.



Two equal tones.  
Intermodulation  
distortion  
products 25dB  
below peak envelope  
power.  
(legal limit)

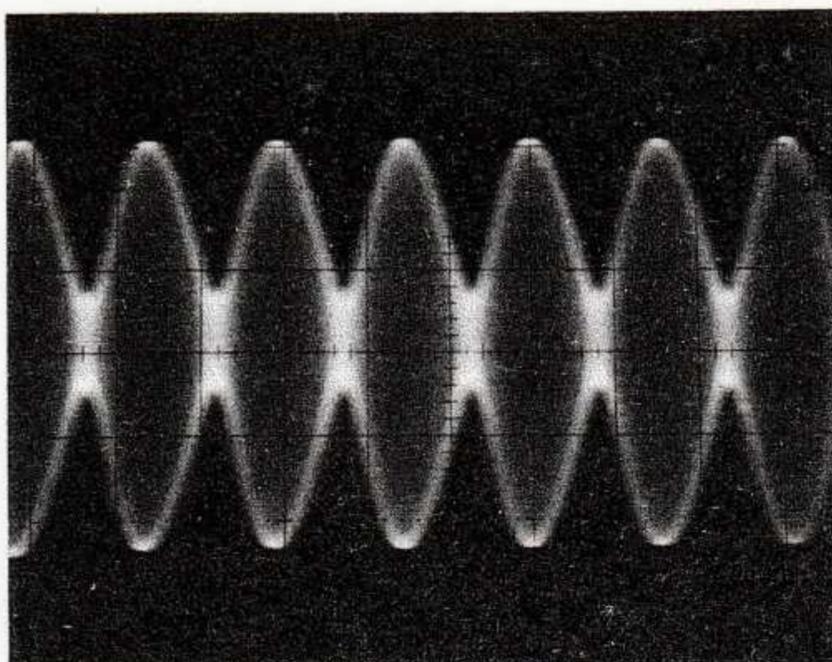


Two equal tones.  
Intermodulation  
distortion  
products 22dB  
below peak envelope  
power.



8.1 continued

Two unequal tones.  
6dB difference  
in level.



9. CHANNEL PROGRAMMING

9.1 Selecting Aerial Filter

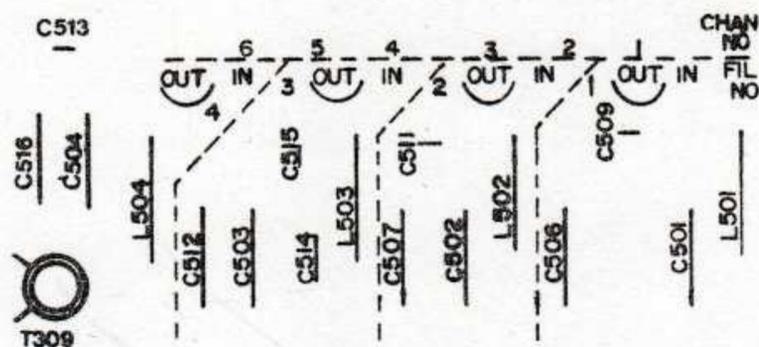
The aerial filters have to be programmed in conjunction with SW 301/1 and SW 301/2.

The appropriate lug on the rotary switch section 1 i.e. SW 301/1 is programmed to the input of the filters and the output from the filters is programmed to the corresponding lug on SW 301/2.

The lugs from SW 301/1 are wired permanently to pins on the aerial filter board as indicated below and therefore the programming of the input to the filters requires only short links.

Filters should be programmed as follows.

<u>Channel Frequency</u>	<u>Use Filter No</u>
Below 2.5MHz	1
Between 2.5MHz and 4MHz	2
Between 4MHz and 6.4MHz	3
Between 6.4MHz and 8MHz	4



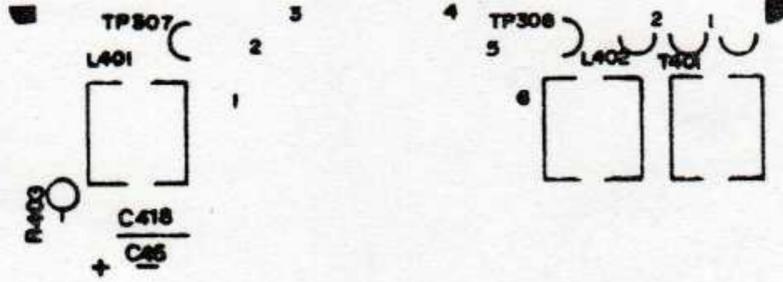
9.2 Selecting Common R.F. Filter

If the channel frequency is above 3.2MHz programming is required from SW 402 to L401 or L402.

If the channel frequency lies in the region of 3.2MHz to 6.4MHz a link must be established from the switch section to TP308 which is connected to L402.

9.2 Continued

If the channel frequency lies above 6.4MHz a link must be soldered from the appropriate lug to TP307 and hence L401.



FAULT FINDING PROCEDURE FOR TR105

This section is designed to speed fault finding in both the transmitter and receiver. Typical ac input voltage levels are quoted at various points in the receiver to give 2V peak to peak across the volume control and voltage levels to be expected at various points in the transmitter with the PRESS TO TUNE control activated are tabulated.

The first check should be on both the carrier and channel crystal oscillators.

Carrier oscillator output:	Typically 2.4Vp-p on TP8
Channel oscillator output:	Typically 2.4Vp-p Pin 1 IC301 or TP304.

See next page for Fault Finding Block diagrams.

**STAGE 1 LOCATING MOUNTING PLATE**

Drill holes in right hand side of case using jig.

**STAGE 11 GLUING**

Materials - All cleaners and glues are Bostik products

1. Case (IT2033 Drg A1/3128)
2. Mounting Plate (IT2053 Drg A3/20085)
3. No. 1 cleaner
4. PVC Primer Bostik 13678 (solvent is No.4 cleaner)
5. Primer No. 9252
6. Epoxy, Boscrete 20 - Part A, Part B
7. Gamlen #26 (not a Bostik Product)
8. Bostik No. 4 Cleaner.

**Method**

1. Clean the right side of the case, i.e. side with holes through the case, with No. 1 cleaner, using a clean rag.
2. Prime the area that the Mounting Plate will cover with the PVC Primer 13678.
3. Clean the Mount using Gamlen #26
4. Prime the Mount with Primer No. 9252.
5. Leave both the Case and the Mount for two hours to dry.
6. Mix about 10mls of Epoxy per set, preferable in 250mls quantities i.e. enough for 25 or more sets. Leave standing for approximately 10 minutes. To mix Epoxy use 2 parts of Part A to 1 part of Part B.
7. After the Epoxy has been left to stand, apply it to one surface only.
8. Press the Mount onto the case using about 5lb of weight i.e. a firm hand pressure. This pressure is to ensure that the Epoxy fills all small holes, cracks etc but does not allow all the glue to be squeezed out from between the two surfaces.
9. Remove the pressure and leave the items to stand and dry for several hours.

CHANGES	NO
ORIGINAL	0
NOC.O. 27.1.76	1
C.O. 3002 B.M.N. 3.11.76	2

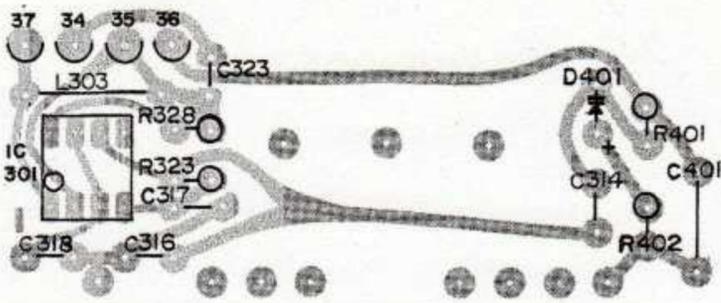
DO NOT SCALE PRINT	
3rd ANGLE PROJECTION	
UNIT	SCALE
TOLERANCES UNLESS OTHERWISE SPECIFIED TO ONE OR NO DEC. ±0.5mm	

MATERIAL	ORIG.	
	DRAWN	FAP
	CKD.	G.D.C 8/12/75
	APP.	HJP 9/12/75
	A.F.P.	
FINISH	JOB NUMBERS	
	2141	

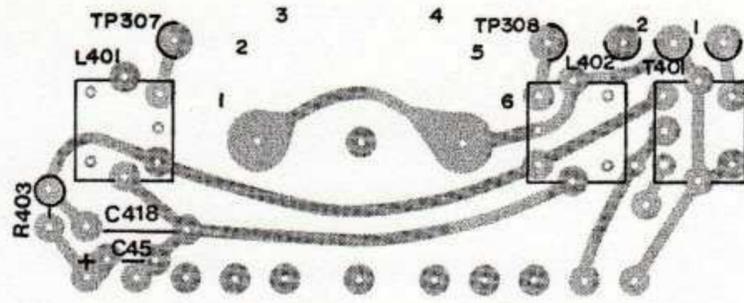
AMALGAMATED WIRELESS (AUSTRALASIA) N.Z. LTD.
DESCRIPTION
INSTRUCTIONS FOR GLUING WHIP MOUNTING PLATE TO CASE.
SHEET 1 OF 1
DRAWING NUMBER - ISSUE

ORIG.	
DRAWN	FAP
CKD.	G.D.C 8/12/75
APP.	HJP 9/12/75
A.F.P.	
JOB NUMBERS	
2141	
SUPERSEDES	

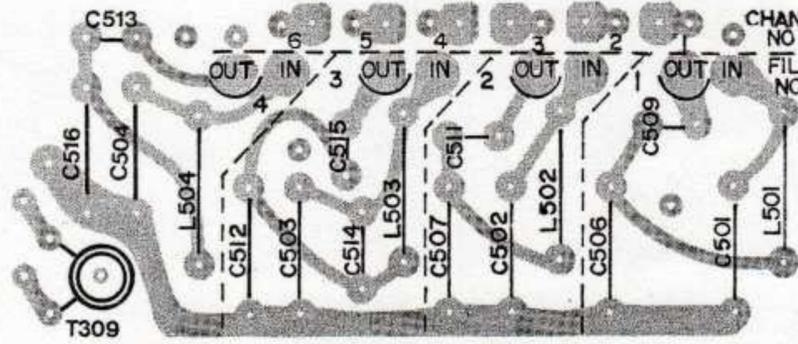
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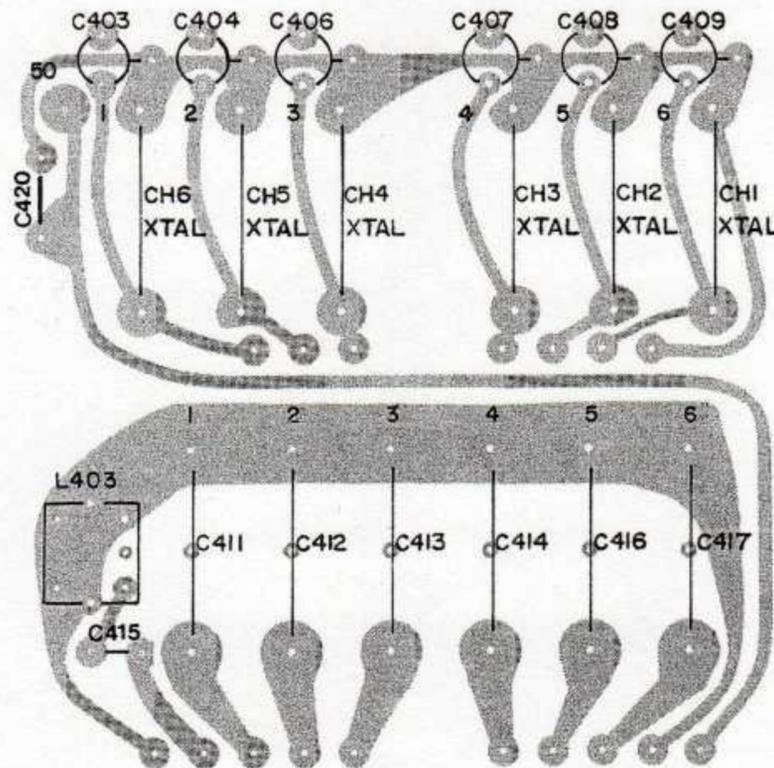
**OSCILLATOR SW. BOARD  
M64005**



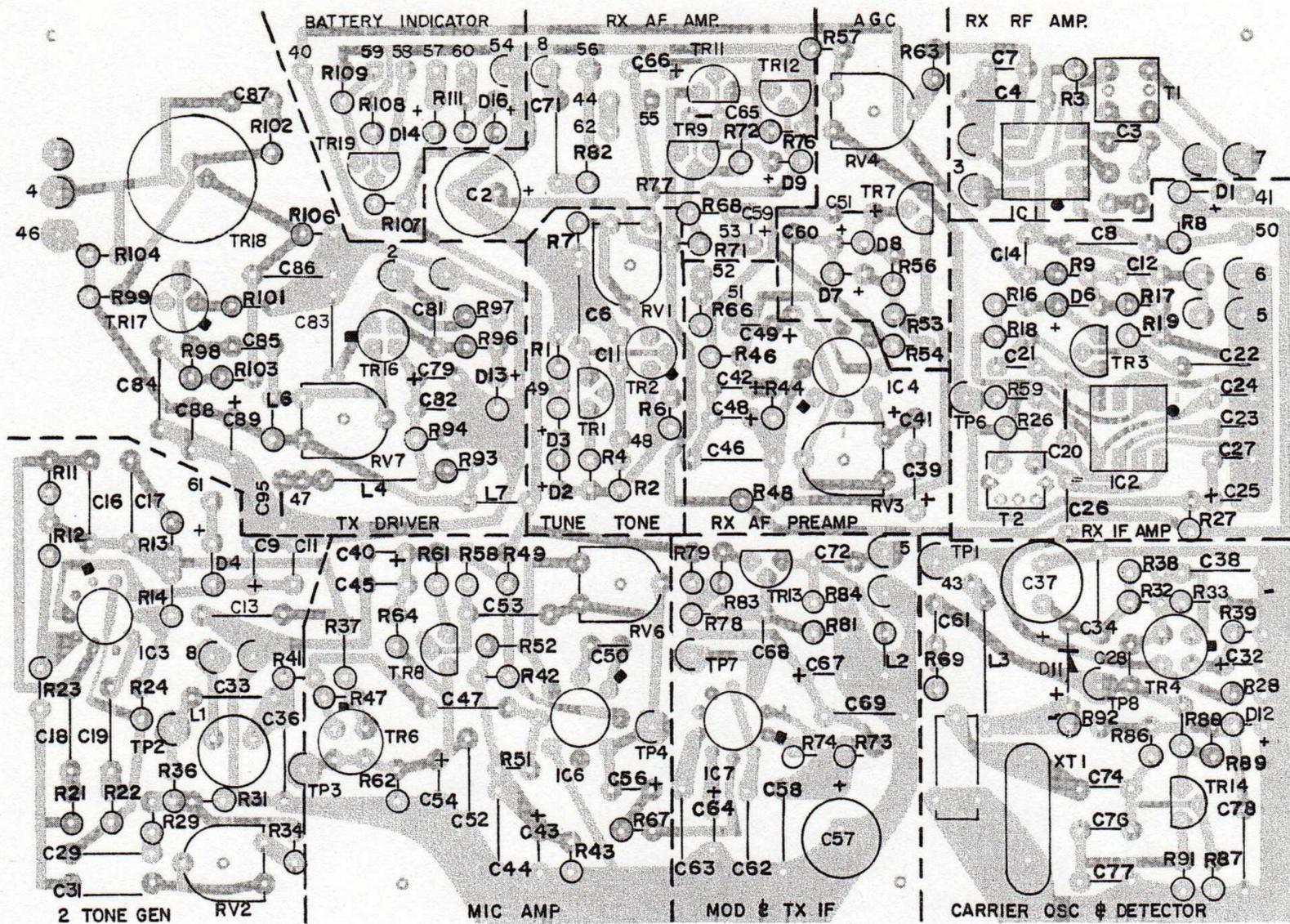
**RF FILTER SW. BOARD  
M64003**



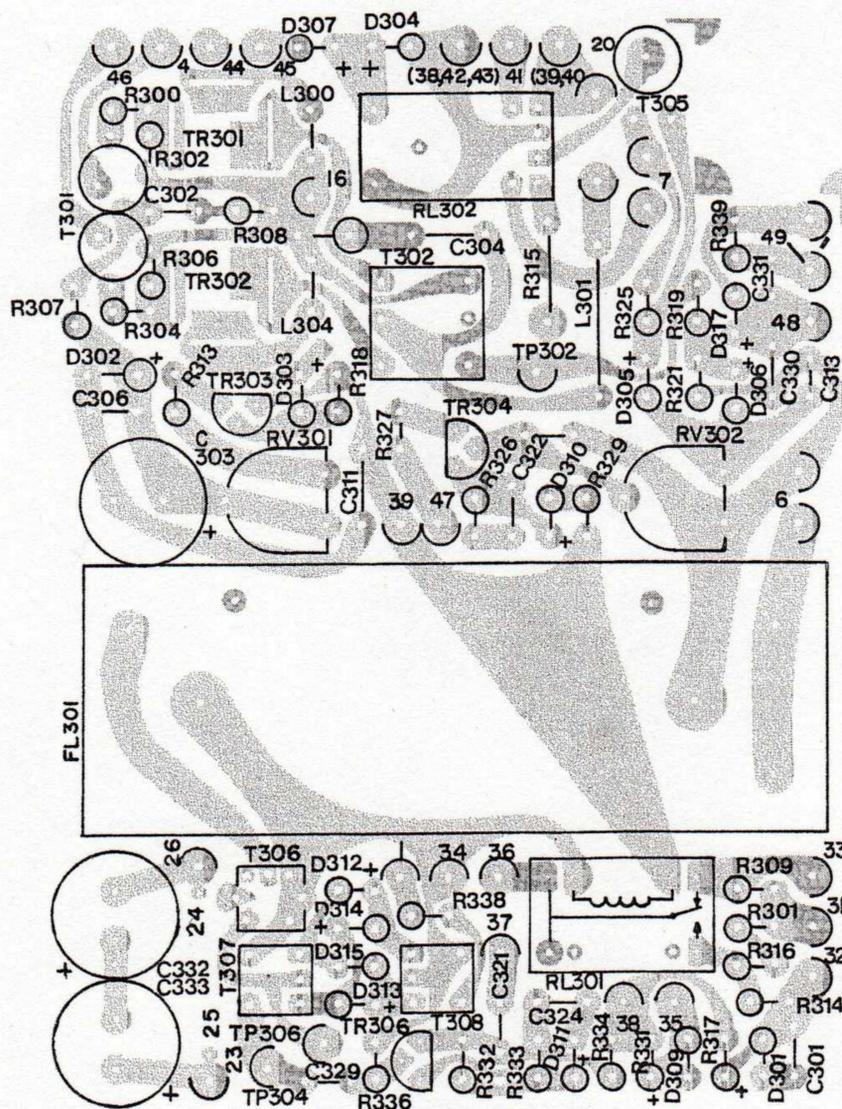
**AERIAL FILTER BOARD  
M64004**



**MASTER CHANNEL SW. BOARD  
M64008**



**HINGED BOARD  
M3163**



**R F BOARD  
M3167**

TR105 PARTS LIST

13.1 FRONT PANEL ASSEMBLY

	<u>Part Numbers</u>
Switch Push Button Momentary	246.2386
RV3 Potentiometer 100k $\Omega$ linear clarifier	246.2371
RV5 Potentiometer 10k $\Omega$ Log with DPDT switch volume	246.2370
D17 Led Red HP5082-4658 High intensity	246.2368
D18 Led Red HP5082-4658 High intensity	246.2368
Microphone SG Brown IC102/6	246.2392
Terminal Belling & Lee Red	246.2390
Terminal Belling & Lee Black	246.2391
Knob 73-14- $\frac{1}{4}$ Black Elma, Collet Fixing	246.2393
Knob 70-14- $\frac{1}{4}$ Black Elma, Collet Fixing	246.2394
Knob 71-14- $\frac{1}{4}$ Black Elma, Collet Fixing	246.2395
Knob 71-14- $\frac{1}{8}$ Block Elma, Collet Fixing	246.2396

## 13.2

AERIAL FILTER SWITCH BOARD ASSEMBLY

Aerial Filter Switch Board M64004

Part NumbersCapacitors

C501	1.8nF	125V	Polystyrene	Voltron or equiv	
C502	1.0nF	125V	Polystyrene	Voltron or equiv	
C503	360pF	125V	Polystyrene	Voltron or equiv	
C504	510pF	125V	Polystyrene	Voltron or equiv	
C506	1.8nF	125V	Polystyrene	Voltron or equiv	
C507	1.0nF	125V	Polystyrene	Voltron or equiv	
C509	470pF		Silver Mica	Nitsuko or equiv	246.2165
C511	180pF		Silver Mica	Nitsuko or equiv	
C512	360pF	125V	Polystyrene	Voltron or equiv	
C513	47pF		Silver Mica	Nitsuko or equiv	
C514	220pF		Silver Mica	Nitsuko or equiv	246.2124
C515	82pF		Silver Mica	Nitsuko or equiv	
C516	510pF	125V	Polystyrene	Voltron or equiv	

Inductors

L501	Inductor	Aerial Filter		246.2431
L502	Inductor	Aerial Filter		246.2430
L503}	Inductor	Aerial Filter		246.2429
L504}				

## 13.3

CHANNEL SWITCH P.W.B. ASSEMBLY

Channel Switch P.W.B. M64008

C403	1.2-10pF	Ceramic	Trimmer, Stettner	R-Triko	246.1997
C404	1.2-10pF	Ceramic	Trimmer, Stettner	R-Triko	246.1997
C406	1.2-10pF	Ceramic	Trimmer, Stettner	R-Triko	246.1997
C407	1.2-10pF	Ceramic	Trimmer, Stettner	R-Triko	246.1997
C408	1.2-10pF	Ceramic	Trimmer, Stettner	R-Triko	246.1997
C409	1.2-10pF	Ceramic	Trimmer, Stettner	R-Triko	246.1997
C411	37-250pF	Mica	Trimmer Arco	type 426	246.2250
C412	37-250pF	Mica	Trimmer Arco	type 426	246.2250
C413	37-250pF	Mica	Trimmer Acro	type 426	246.2550
C414	37-250pF	Mica	Trimmer Arco	type 426	246.2550
C415	820pF	Silver Mica	Nitsuko or equiv		246.2550
C416	37-250pF	Mica	Trimmer Arco	type 426	246.2250
C417	37-250pF	Mica	Trimmer Arco	type 426	246.2550
C420	100nF	50V	Disc Ceramic	High K	

13.3 Continued

Inductors

L403 A4/10112 AWA Toko 412582

Part Numbers

246.2295

Crystals

XT401 )  
 XT402 )  
 XT403 )      Supplied to order  
 XT404 )  
 XT406 )  
 XT407 )

13.4 HINGED P.W.B. ASSEMBLY

Hinged P.W.B. M3163

Semiconductors

Integrated Circuits

IC1	MC1350P	Motorola
IC2	MC1350P	Motorola
IC3	CA747CT	RCA
IC4	CA741CT	RCA
IC6	CA748CT	RCA
IC7	SN76514	Texas

Transistors

TR1	BC308	TKN
TR2	2N2646	G.E.
TR3	BF254	TKN
TR4	40822 or 40841	RCA
TR6	40822 or 40841	RCA
TR7	BC238	TKN
TR8	BC308	TKN
TR9	BC308	TKN
TR11	BC238	TKN
TR12	BC308	TKN
TR13	BC308	TKN
TR14	BC238	TKN
TR16	40822 or 40841	RCA
TR17	2N2218	Philips or RCA
TR18	2N2218	Philips or RCA
TR19	BC238	TKN

## 13.4 Continued

<u>Diodes</u>		<u>Part Numbers</u>	
D1	IN4003	RCA or EDI	
D2	1N4148	TKN	
D3	1N4148	TKN	
D4	1N4148	TKN	
D6	BA182	Philips	
D7	1N4148	TKN	
D8	1N4148	TKN	
D9	1N4148	TKN	
D11	1N4148	TKN	
D12	BZY85C8V2	TKN or Philips	
D13	ED220R or equiv	EEP corp	246.2239
D14	BZY85C6V8	TKN or Philips	
D16	BZY85C7V5	TKN or equiv	

Resistors Fixed Carbon Film + 5% Philips CR25A or equiv

R1	10k $\Omega$
R2	10k $\Omega$
R3	680 $\Omega$
R4	2.7k $\Omega$
R6	27k $\Omega$
R7	220 $\Omega$
R8	100 $\Omega$
R9	27k $\Omega$
R11	10k $\Omega$
R12	6.8k $\Omega$
R13	15k $\Omega$
R14	6.8k $\Omega$
R16	100k $\Omega$
R17	10k $\Omega$
R18	470 $\Omega$
R19	470 $\Omega$
R21	10k $\Omega$
R22	15k $\Omega$
R23	15k $\Omega$
R24	15k $\Omega$
R26	330 $\Omega$
R27	100 $\Omega$
R28	1k $\Omega$
R29	180 $\Omega$
R31	2.2k $\Omega$

13.4 Continued

Resistors continued

R32	120k $\Omega$
R33	39k $\Omega$
R34	100k $\Omega$
R36	4.7k $\Omega$
R37	47k $\Omega$
R38	1k $\Omega$
R39	180 $\Omega$
R41	4.7k $\Omega$
R42	10k $\Omega$
R43	10k $\Omega$
R44	10k $\Omega$
R46	10k $\Omega$
R47	100k $\Omega$
R48	100 $\Omega$
R49	100 $\Omega$
R51	10k $\Omega$
R52	330 $\Omega$
R53	15k $\Omega$
R54	10k $\Omega$
R56	100k $\Omega$
R57	10k $\Omega$
R58	10k $\Omega$
R59	10k $\Omega$
R61	390 $\Omega$
R62	100k $\Omega$
R63	1k $\Omega$
R64	470k $\Omega$
R66	1k $\Omega$
R67	4.7k $\Omega$
R68	1k $\Omega$
R69	680 $\Omega$
R71	1k $\Omega$
R72	8.2k $\Omega$
R73	47 $\Omega$
R74	1k $\Omega$
R76	1k $\Omega$
R77	1k $\Omega$
R78	3.3k $\Omega$
R79	10 $\Omega$
R81	22k $\Omega$

13.4 Continued

Resistors continued

Part. Numbers

R82	4.7k $\Omega$
R83	47 $\Omega$
R84	1.5k $\Omega$
R86	27k $\Omega$
R87	22k $\Omega$
R88	100 $\Omega$
R89	1.8k $\Omega$
R91	2.2k $\Omega$
R92	1k $\Omega$
R93	10k $\Omega$
R94	10k $\Omega$
R96	1k $\Omega$
R97	33 $\Omega$
R98	1k $\Omega$
R99	680 $\Omega$
R101	39 $\Omega$
R102	560 $\Omega$
R103	1k $\Omega$
R104	220 $\Omega$
R106	22 $\Omega$
R107	15k $\Omega$
R108	2.7k $\Omega$
R109	82 $\Omega$
R111	82 $\Omega$

Variable Resistors, Preset CRL Type 62, T Film Linear

RV1	1k $\Omega$	246.1382
RV2	100k $\Omega$ )	246.1528
RV3	100k $\Omega$ )	246.1897
RV4	10k $\Omega$	246.1528
RV6	100k $\Omega$	246.1382
RV7	1k $\Omega$	

Capacitors

C1	10nF 50V Disc Ceramic High K	
C2	100 $\mu$ F Electrolytic Elcap Vertical Mount	246.1990
C3	10nF 50V Disc Ceramic High K	
C4	100nF 100V Polyester Philips C280	
C6	100nF 100V Polyester Philips C280	

## 13.4 Continued

<u>Capacitors</u> continued		<u>Part Numbers</u>
C7	10nF 50V Disc Ceramic High K	
C8	100nF 100V Polyester Philips C280	
C9	10 $\mu$ F 16V Tantalum	246.2307
C11	10nF 50V Disc Ceramic High K	
C12	10nF 50V Disc Ceramic High K	
C13	100nF 100V Polyester Philips C280	
C14	10nF 50V Disc Ceramic High K	
C16	6.8nF 250V Polyester Philips C280	
C17	6.8nF 250V Polyester Philips C280	
C18	6.8nF 250V Polyester Philips C280	
C19	6.8nF 250V Polyester Philips C280	
C21	10nF 50V Disc Ceramic High K	
C22	100nF 100V Polyester Philips C280	
C23	10nF 50V Disc Ceramic High K	
C24	10nF 50V Disc Ceramic High K	
C25	10 $\mu$ F 16V Tantalum	246.2307
C26	10nF 50V Disc Ceramic High K	
C27	10nF 50V Disc Ceramic High K	
C28	10nF 50V Disc Ceramic High K	
C29	1.5nF 250V Polyester Philips C280	
C31	1nF 250V Polyester Philips C280	
C32	22 $\mu$ F 16V Tantalum	246.1992
C33	100nF 100V Polyester Philips C280	
C34	100nF 100V Polyester Philips C280	
C36	1nF 250V Polyester Philips C280	
C37	100 $\mu$ F 16V Electrolytic Vertical Mount	246.1990
C38	10nF 250V Polyester Philips C280	
C39	1 $\mu$ F 35V Tantalum	246.2372
C40	22 $\mu$ F 16V Tantalum	246.1992
C41	1 $\mu$ F 35V Tantalum	246.2372
C42	1 $\mu$ F 35V Tantalum	246.2372
C43	10 $\mu$ F 16V Tantalum	246.2307
C44	100nF 100V Polyester Philips C280	
C45	10nF 50V Disc Ceramic High K	
C46	100nF 100V Polyester Philips C280	
C47	100nF 100V Polyester Philips C280	
C48	10 $\mu$ F 16V Tantalum	246.2307
C49	1 $\mu$ F 35V Tantalum	246.2372
C50	4.7p 50V Disc Ceramic High K	
C51	4.7 $\mu$ F 16V Tantalum	246.2106
C52	100nF 100V Polyester Philips C280	
C53	100nF 100V Polyester Philips C280	
C54	10 $\mu$ F 16V Tantalum	246.2307
C56	1 $\mu$ F 35V Tantalum	246.2372
C57	100 $\mu$ F 16V Electrolytic Elcap	246.1990

## 13.4 Continued

<u>Capacitors</u> continued		<u>Part Numbers</u>
C58	100nF 100V Polyester Philips C280	
C59	4.7 $\mu$ F 16V Tantalum	246.2106
C60	100nF 100V Polyester Philips C280	
C61	10nF 50V Disc Ceramic High K	
C62	100nF 100V Polyester Philips C280	
C63	100nF 100V Polyester Philips C280	
C64	1 $\mu$ F 35V Tantalum	246.2372
C65	220pF $\pm$ 20% 50V Disc Ceramic	
C66	10 $\mu$ F 16V Tantalum	246.2307
C67	22 $\mu$ F 16V Tantalum	246.1992
C68	10nF 50V Disc Ceramic High K	
C69	100nF 100V Polyester Philips C280	
C71	100nF 100V Polyester Philips C280	
C72	10nF 50V Disc Ceramic High K	
C73	1.2-10pF Stettner	246.2373
C74	27pF Dipped Silver Mica DM10E 270J3	
C76	510pF Dipped Silver Mica DM15E 511J3	
C77	510pF Dipped Silver Mica DM15E 511J3	
C78	100nF 100V Polyester Philips C280	
C79	10 $\mu$ F 16V Tantalum	246.2307
C81	10nF 50V Disc Ceramic High K	
C82	10nF 50V Disc Ceramic High K	
C83	100nF 100V Polyester Philips C280	
C84	100nF 100V Polyester Philips C280	
C85	10nF 50V Disc Ceramic High K	
C86	100nF 100V Polyester Philips C280	
C87	10nF 50V Disc Ceramic High K	
C88	10nF 50V Disc Ceramic High K	
C89	10 $\mu$ F 16V Tantalum	246.2307
<u>Inductors</u>		
L1	Choke RF	246.2375
L2	1mH TDK )	
L3	1mH TDK )	246.2254
L4	100 $\mu$ H TDK Choke RF )	
L6	100 $\mu$ H TDK )	
L7	100 $\mu$ H TDK )	246.2255
T1	A4/10021 AWA Receiver Input Transformer	246.2374
T2	2987N Toko 7MC	246.2294
<u>Crystal</u>		
XT1	A4/2783 AWA 1.4MHz	

TX POWER AMP ASSEMBLY

RF PWB M3167

SemiconductorsTransistors

TR301	2N5992	or 2N5642
TR302	2N5992	or 2N5642
TR303	BC238	TKN
TR304	BC238	TKN
TR306	BF254	

Diodes

D301	BZY85C10	TKN or Philips
D302	1N4003	RCA or EDI
D303	BZY85C6V8	TKN or Philips
D304	1N4148	TKN
D305	1N4148	TKN
D306	1N4148	TKN
D307	1N4148	TKN
D309	BZY85C12	TKN or Philips
D310	BZY85C5V1	TKN or Philips
D311	BZY85CV6	TKN or Philips
D312	5082-2826	Hewlett Packard
D313	5082-2826	Hewlett Packard
D314	5082-2826	Hewlett Packard
D316	5082-2826	Hewlett Packard
D317	1N4148	TKN

Resistors Fixed carbon film + 5% Philips CR25A or equiv

R300	1 $\Omega$
R301	39k $\Omega$
R302	100 $\Omega$
R304	1 $\Omega$
R306	100 $\Omega$
R307	1 $\Omega$
R308	8.2 $\Omega$
R309	47k $\Omega$
R313	82 $\Omega$
R314	56k $\Omega$
R315	1k $\Omega$
R316	68k $\Omega$
R317	3.3k $\Omega$
R318	1.2k $\Omega$
R319	1k $\Omega$

## 13.5 Continued

Resistors continuedPart Numbers

R321 220 $\Omega$   
 R325 150 $\Omega$   
 R326 33 $\Omega$   
 R329 220 $\Omega$   
 R331 100 $\Omega$  1 watt  
 R332 1k $\Omega$   
 R333 3.9k $\Omega$   
 R334 47 $\Omega$   
 R336 220 $\Omega$   
 R338 22 $\Omega$   
 R339 100 $\Omega$

Variable Resistors Preset CRL Type 62 T Film Linear

RV301 250 $\Omega$  246.2249  
 RV302 1k $\Omega$  246.1382

Capacitors

C301 10nF 50V Disc Ceramic High K  
 C302 10nF 50V Disc Ceramic High K  
 C303 200 $\mu$ F 15V Electrolytic Elcap Vertical Mount 246.1991  
 C304 100nF 50V Disc Ceramic High K 246.1707  
 C306 10nF 50V Disc Ceramic High K  
 C311 100nF 50V Disc Ceramic High K 246.1707  
 C313 1 $\mu$ F 35V Tantalum 246.2372  
 C320 10nF 50V Disc Ceramic High K  
 C321 10nF 50V Disc Ceramic High K  
 C322 10nF 50V Disc Ceramic High K  
 C324 10nF 50V Disc Ceramic High K  
 C329 10nF 30V Disc Ceramic High K  
 C330 10nF 50V Disc Ceramic High K  
 C331 10 $\mu$ F 30V Disc Ceramic High K  
 C332 200 $\mu$ F 13V Electrolytic Elcap Vertical Mount 246.1991  
 C333 200 $\mu$ F 15V Electrolytic Elcap Vertical Mount 246.1991

Inductors

L300 A4/10374 AWA  
 L301 5 $\mu$ H 246.2382  
 L302 Aerial Tune 246.2378  
 L304 A4/10374 AWA

13.5 Continued

<u>Inductors</u> continued				<u>Part Numbers</u>
T301	A4/10019	AWA	Transmitter Drive	246.2376
T302	A4/10018	AWA	Transmitter Output	246.2377
T305	A4/10022	AWA	A.L.C.	246.2378
T306	TOKO 2986N	AWA	7Mc	246.2294
T307	A4/2394	AWA	Mixer 7	246.2379
T308	A4/2394	AWA	Mixer 8	246.2378
T309	A4/10022	AWA	Aerial Tune	246.2378
RL301	Associated Automation Type AA 831C-4			246.2388
RL302	Kaco Type RA19002 A1			246.2389
FL301	Crystal Filter L.S.B. Cathadeon BP470S-1			246.2260

13.6 R.F. FILTER SWITCH ASSEMBLY

RF Filter Switch PWB M64003

Capacitors

C405	22 $\mu$ F 16V Tantalum	246.1992
C418	100nF Polyester Philips C280	

Resistor

R403	10 $\Omega$ Philips CR25A or equiv
------	------------------------------------

Inductors

L401	Toko 94AN 30502Z	246.2381
L402	Toko 94AN 30499Z	246.2252
T401	Toko 154AN 40686A	246.2259

13.7 OSCILLATOR SWITCH BOARD ASSEMBLY

Oscillator Switch PWB M64005

Semiconductors

Integrated Circuits

IC301	MC1350P Motorola
-------	------------------

Diodes Varicap

D401	MV2107 Motorola
------	-----------------

13.7 Continued

Resistors Philips CR25A or equiv

R323 10k $\Omega$   
R328 470 $\Omega$   
R401 100k $\Omega$   
R402 100k $\Omega$

Capacitors

C314 10nF Disc Ceramic High K  
C316 390pF Dipped Silver Mica DM15E 391J3  
C317 10nF Disc Ceramic High K  
C318 390pF Dipped Silver Mica DM15E 391J3  
C323 100nF Disc Ceramic High K

C401 100nF Polyester Philips C280

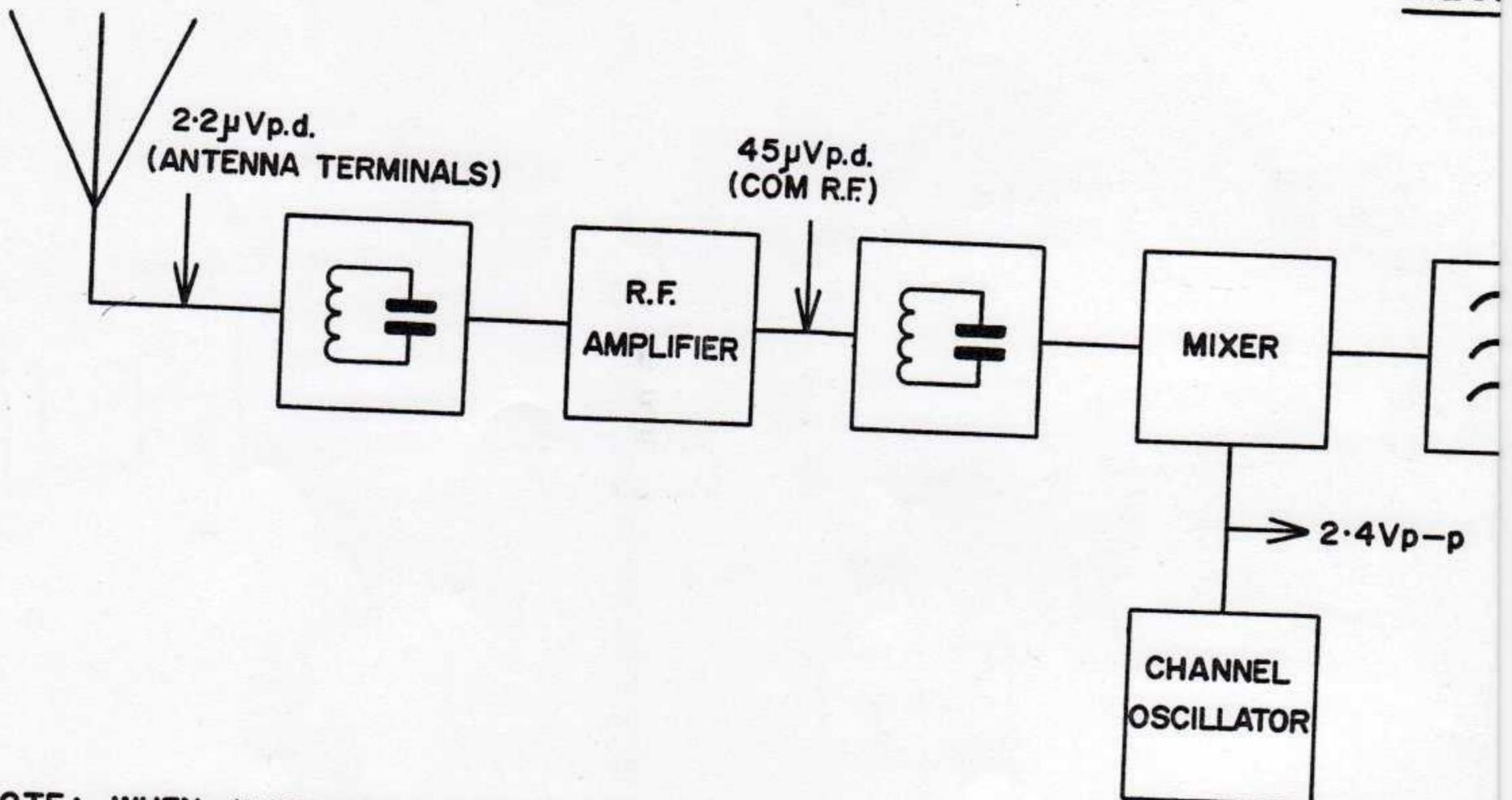
Inductors

L303 30 $\mu$ H

13.8 For export versions without clarifier the following parts are removed.

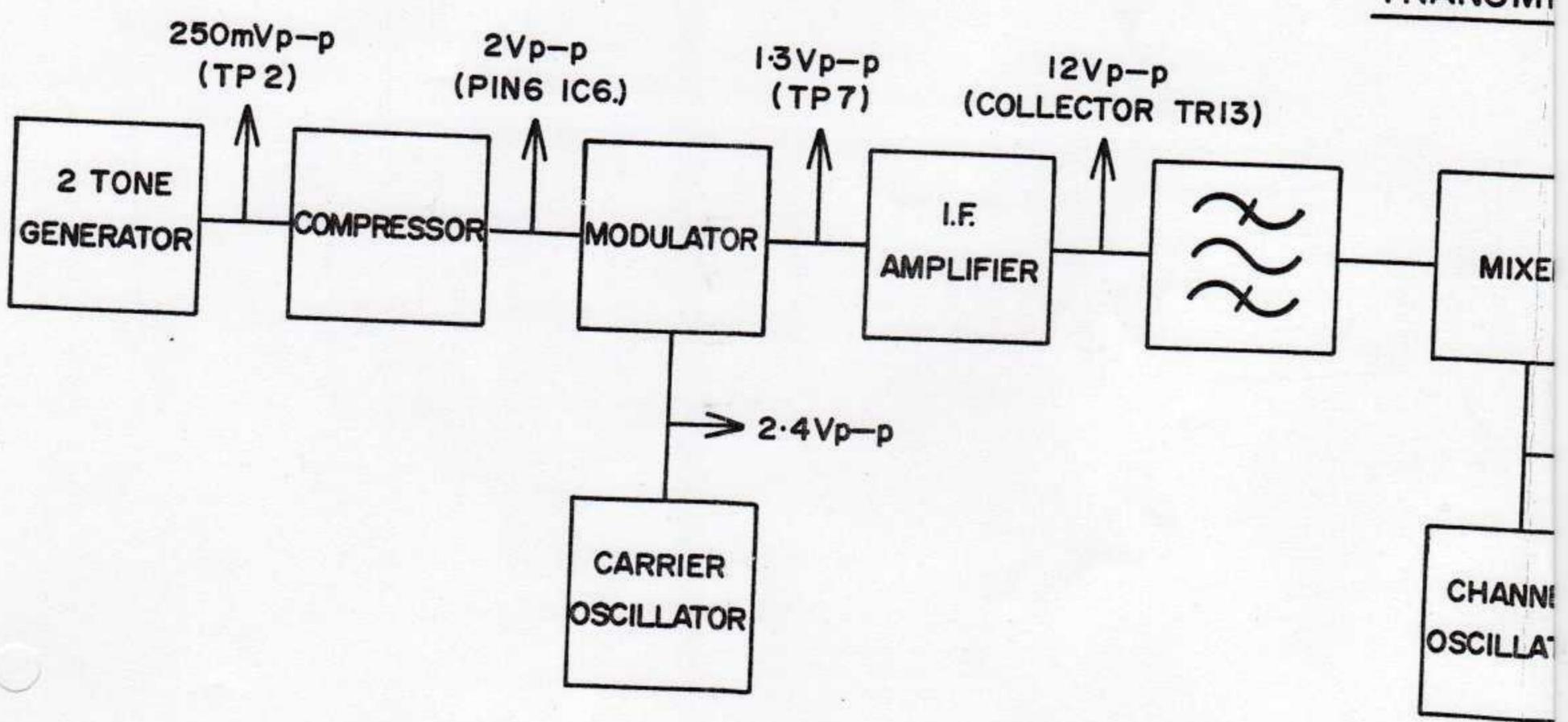
C301 10nF  
C401 100nF  
D301 BZY85C10  
D401 MV2107 replaced by 22pF Dipped Silver Mica Capacitor  
RL301  
R301 39K $\Omega$   
R309 47K $\Omega$   
R314 56K $\Omega$   
R316 68K $\Omega$   
R317 3.3 $\Omega$   
R401 100K $\Omega$   
R402 100K $\Omega$   
RU303 100K $\Omega$

RECI

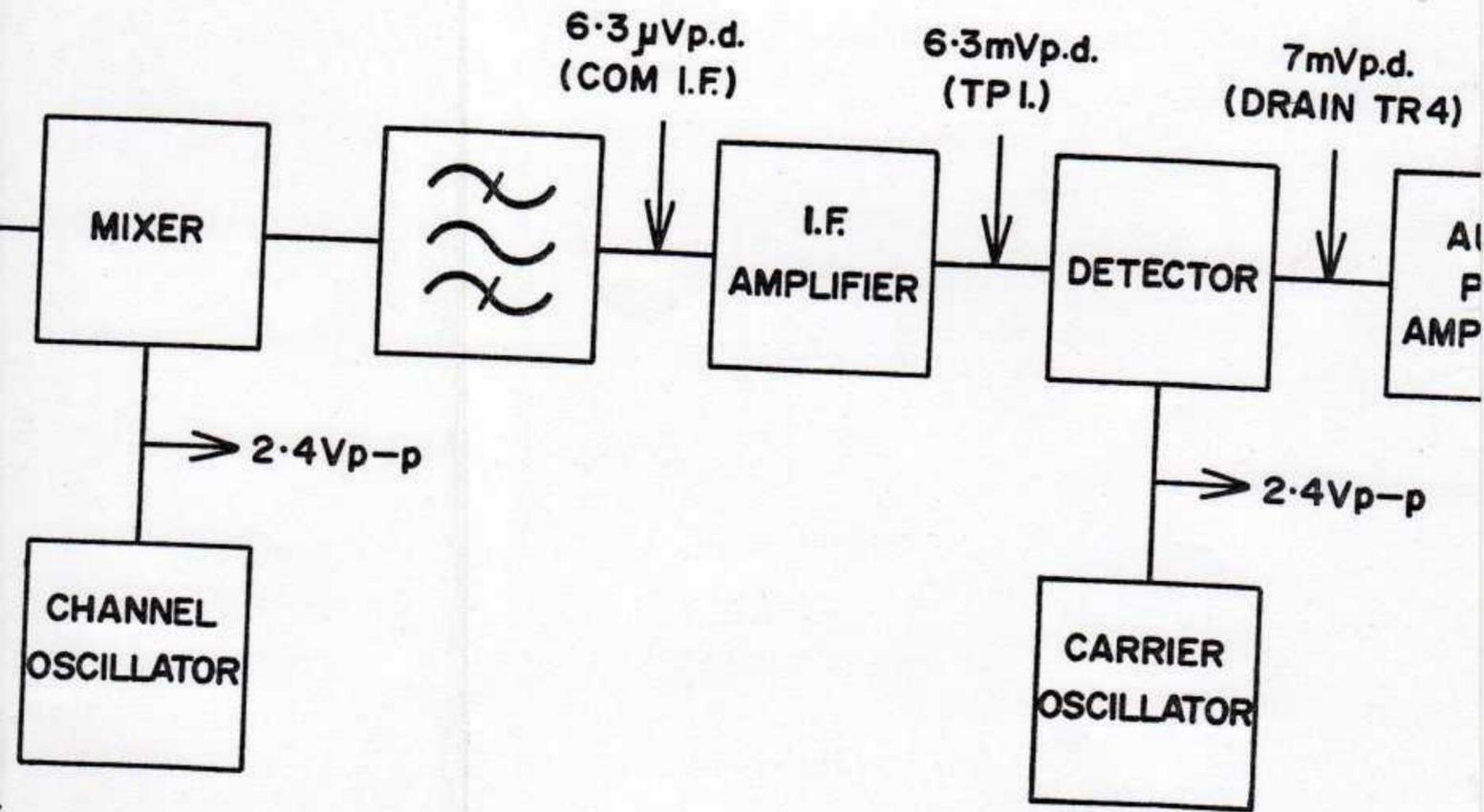


NOTE: WHEN INJECTING VOLTAGES INTO THE RECEIVER, PLACE A 100nF BLOCKING CAPACITOR BETWEEN THE SIGNAL GENERATOR AND THE RECEIVER

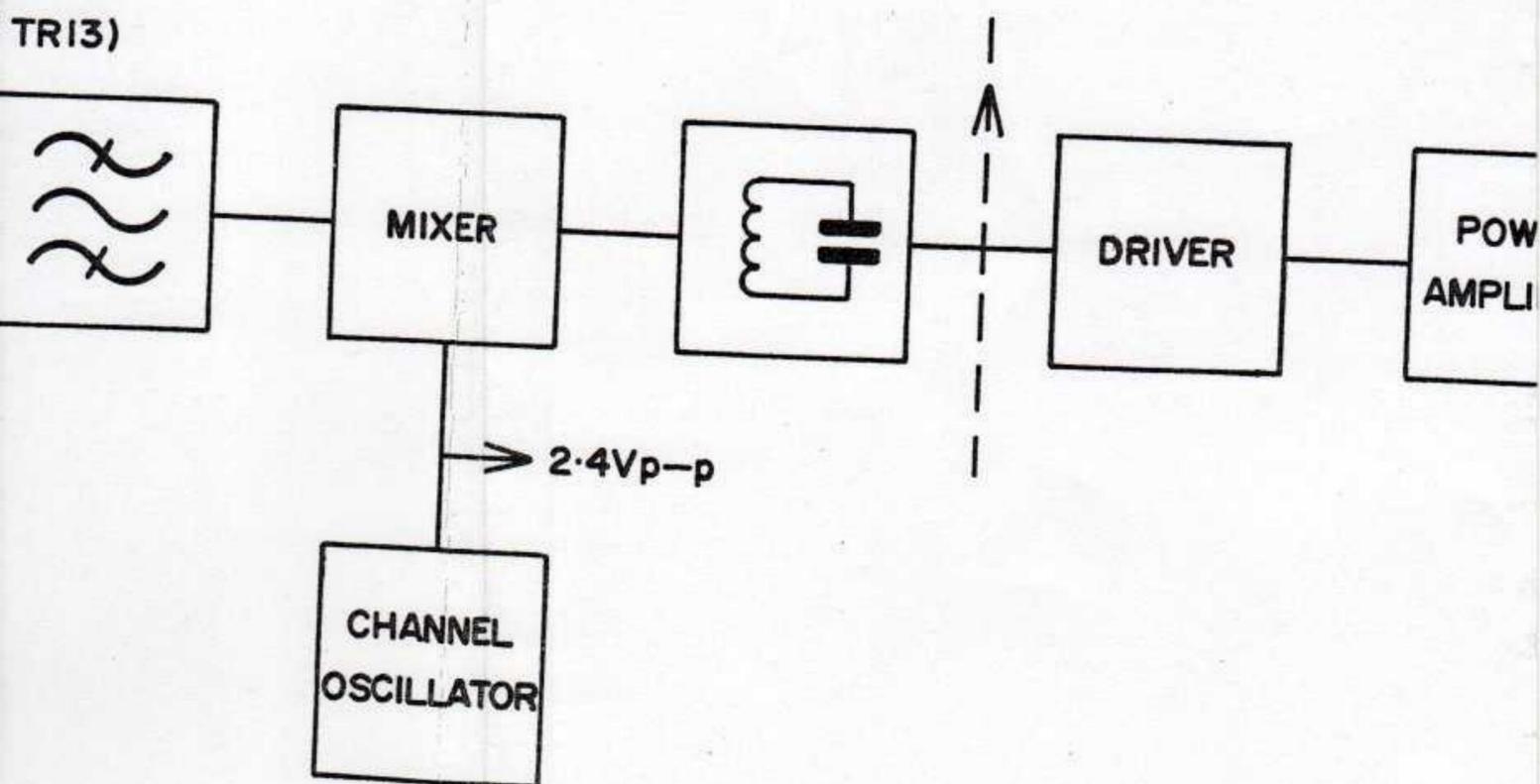
TRANSMI



# RECEIVER

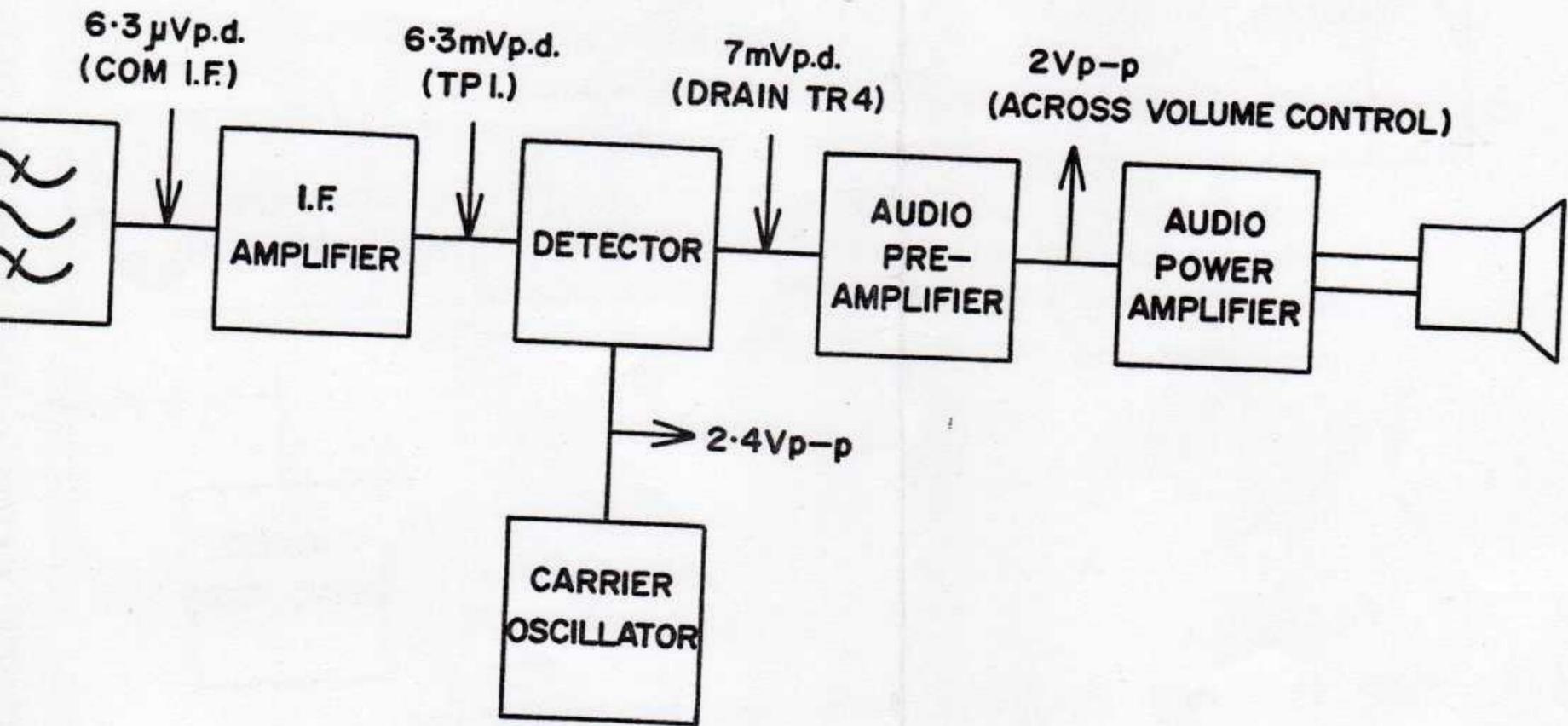


# TRANSMITTER

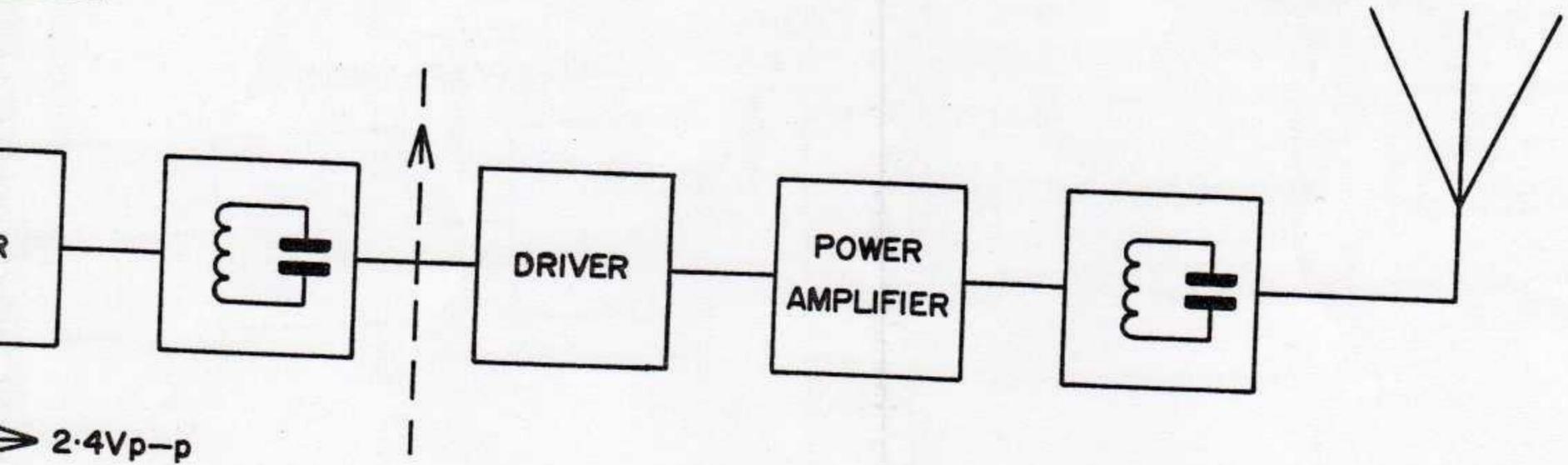


NOTE: FOR VOLTAGE LEVELS  
LINE, REFER TO CIRCUIT

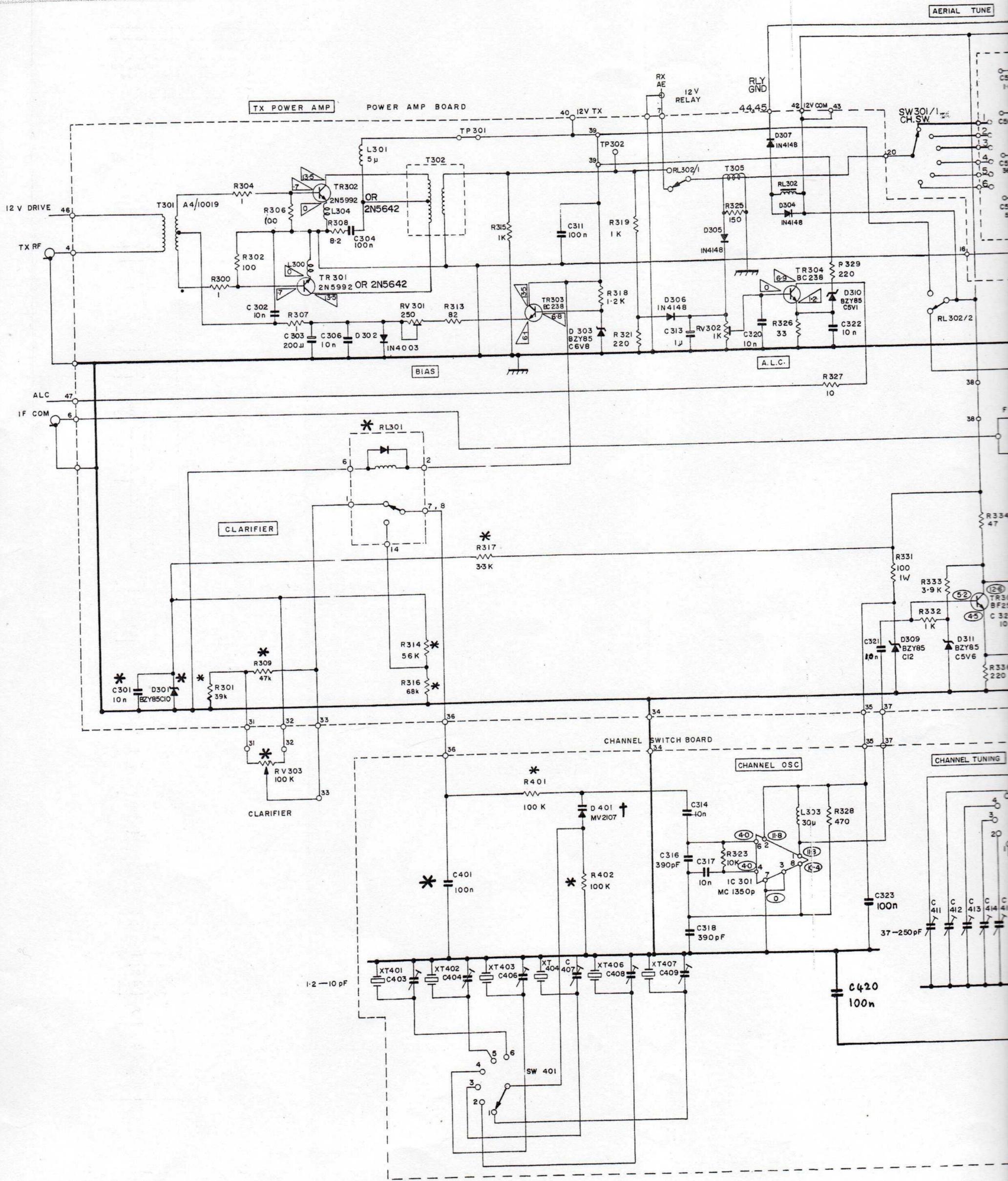
REIVER

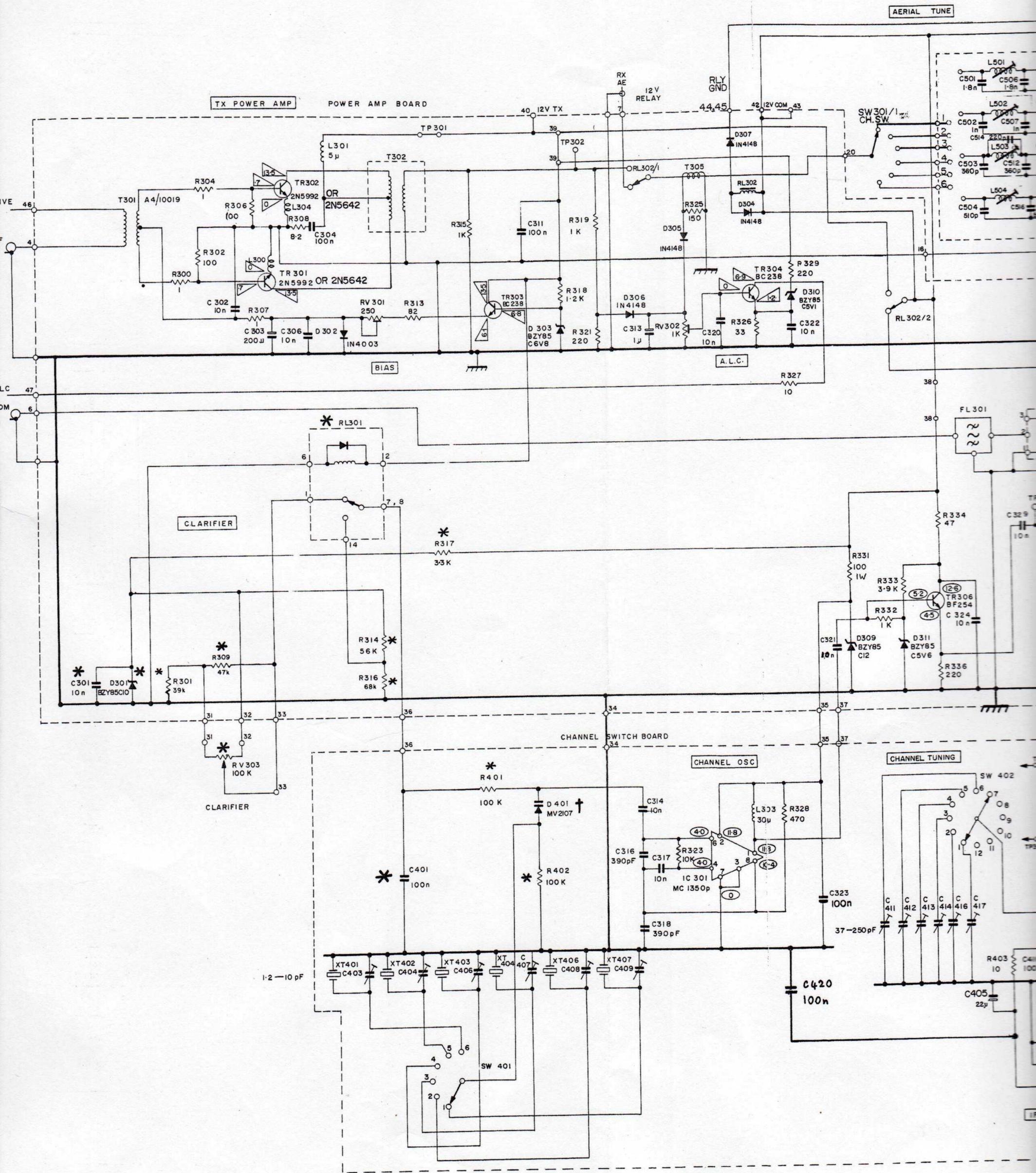


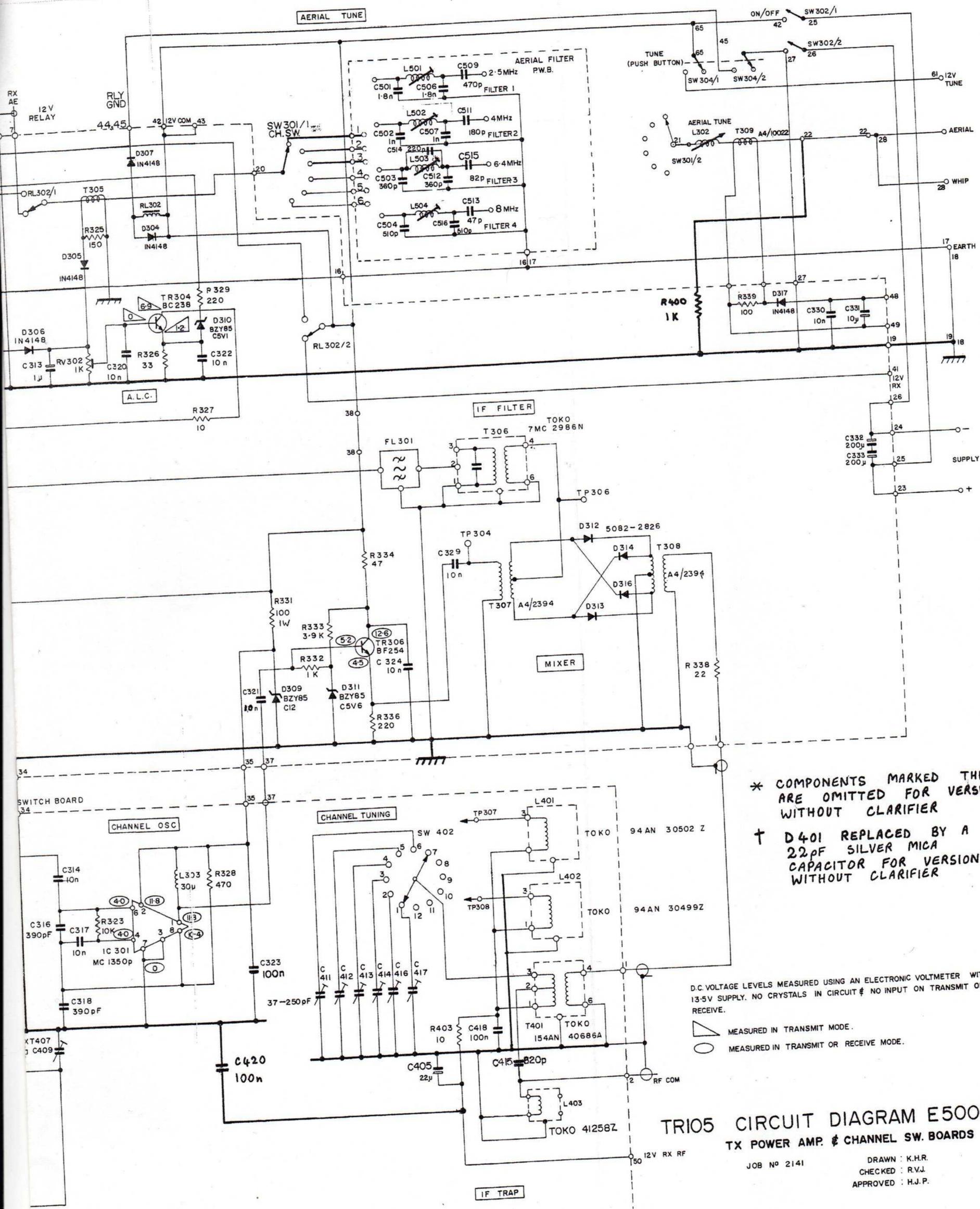
ITTER



NOTE: FOR VOLTAGE LEVELS TO RIGHT OF DOTTED LINE, REFER TO CIRCUIT DESCRIPTION







\* COMPONENTS MARKED THUS ARE OMITTED FOR VERSIONS WITHOUT CLARIFIER

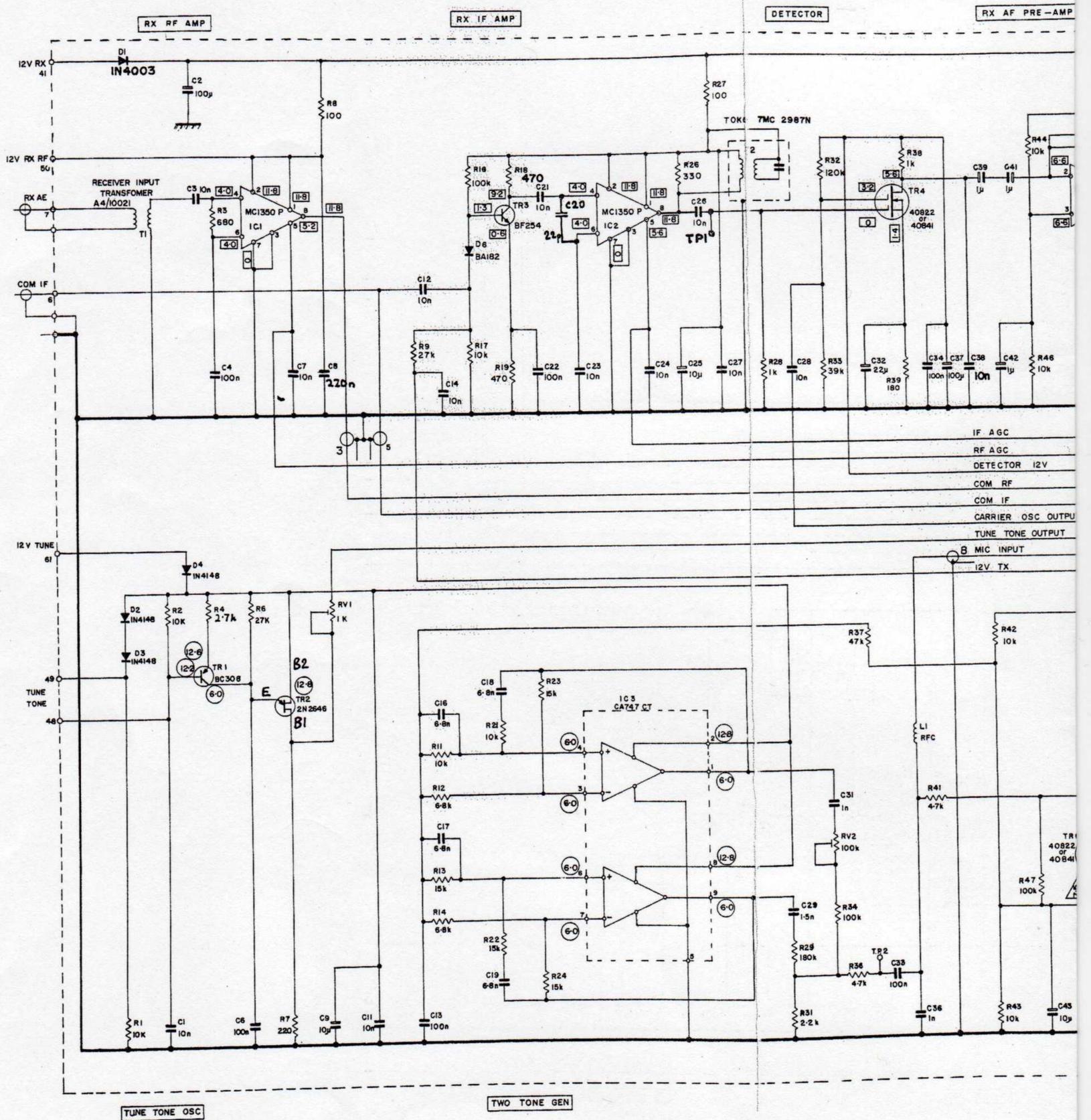
† D401 REPLACED BY A 22pF SILVER MICA CAPACITOR FOR VERSIONS WITHOUT CLARIFIER

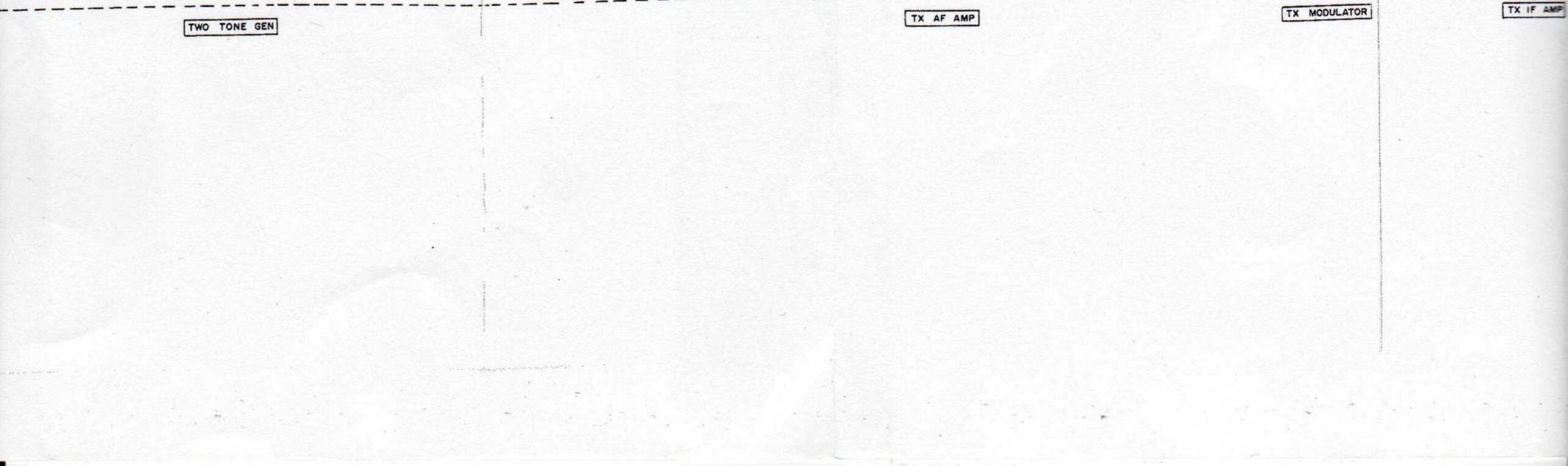
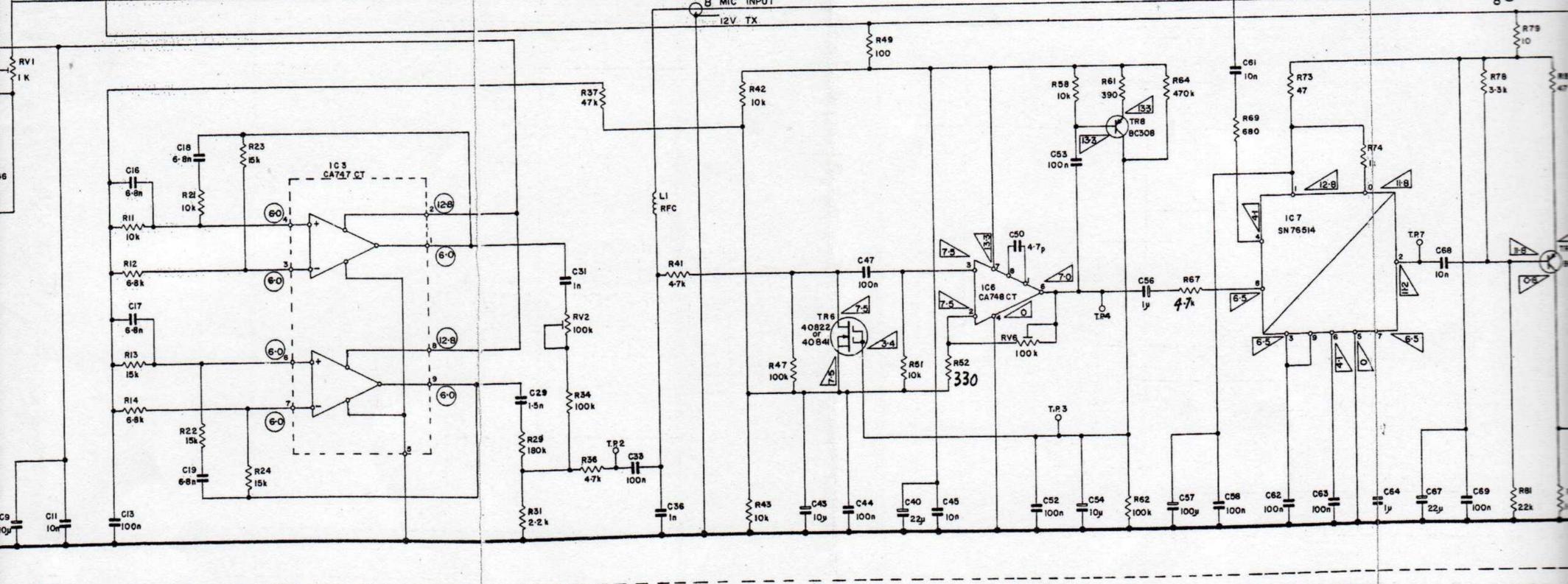
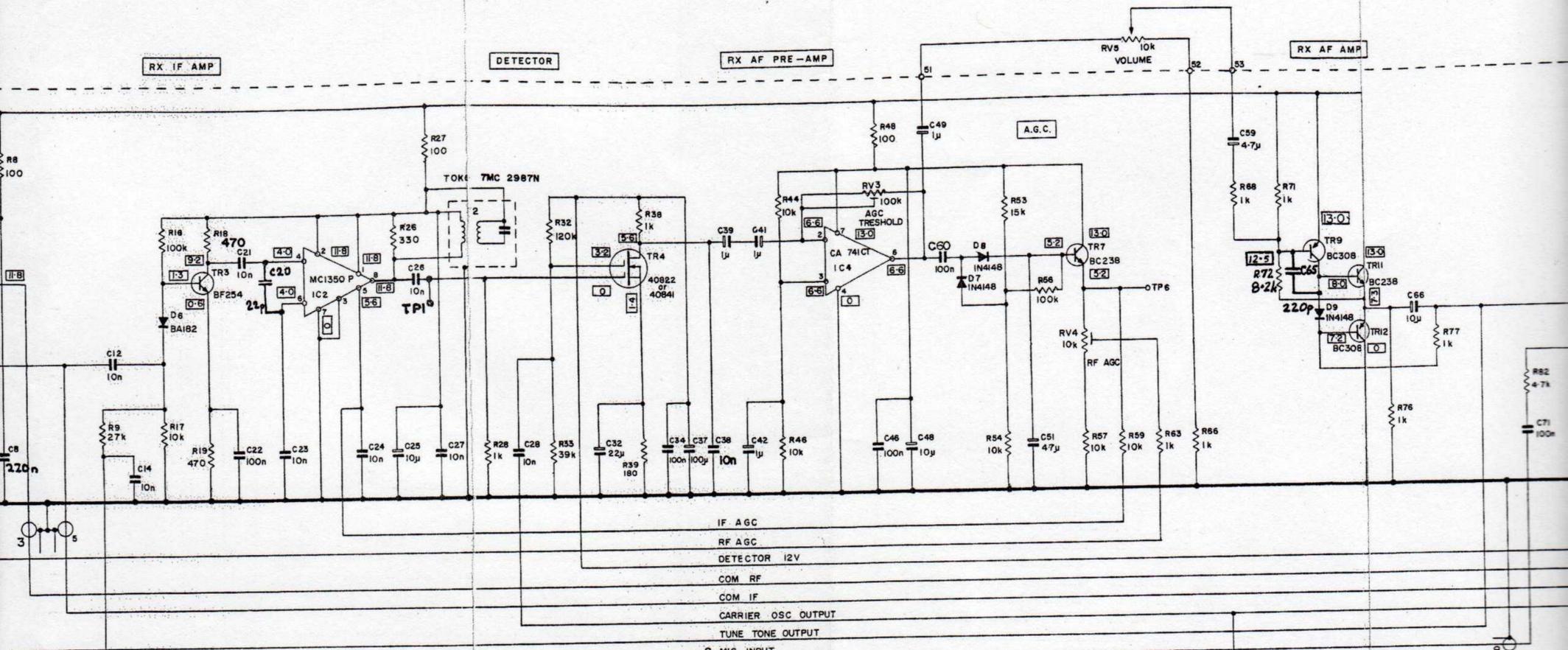
D.C. VOLTAGE LEVELS MEASURED USING AN ELECTRONIC VOLTMETER WITH 13.5V SUPPLY. NO CRYSTALS IN CIRCUIT & NO INPUT ON TRANSMIT OR RECEIVE.

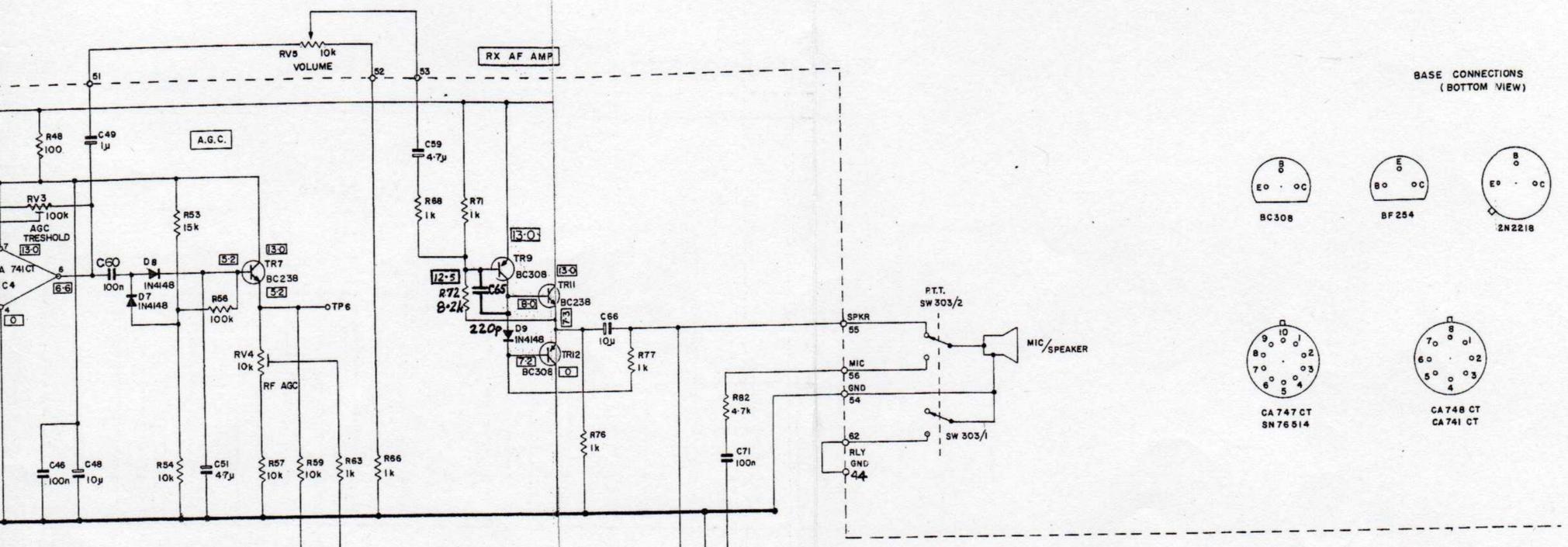
△ MEASURED IN TRANSMIT MODE.  
○ MEASURED IN TRANSMIT OR RECEIVE MODE.

**TRI05 CIRCUIT DIAGRAM E50005 - 5**  
TX POWER AMP. & CHANNEL SW. BOARDS

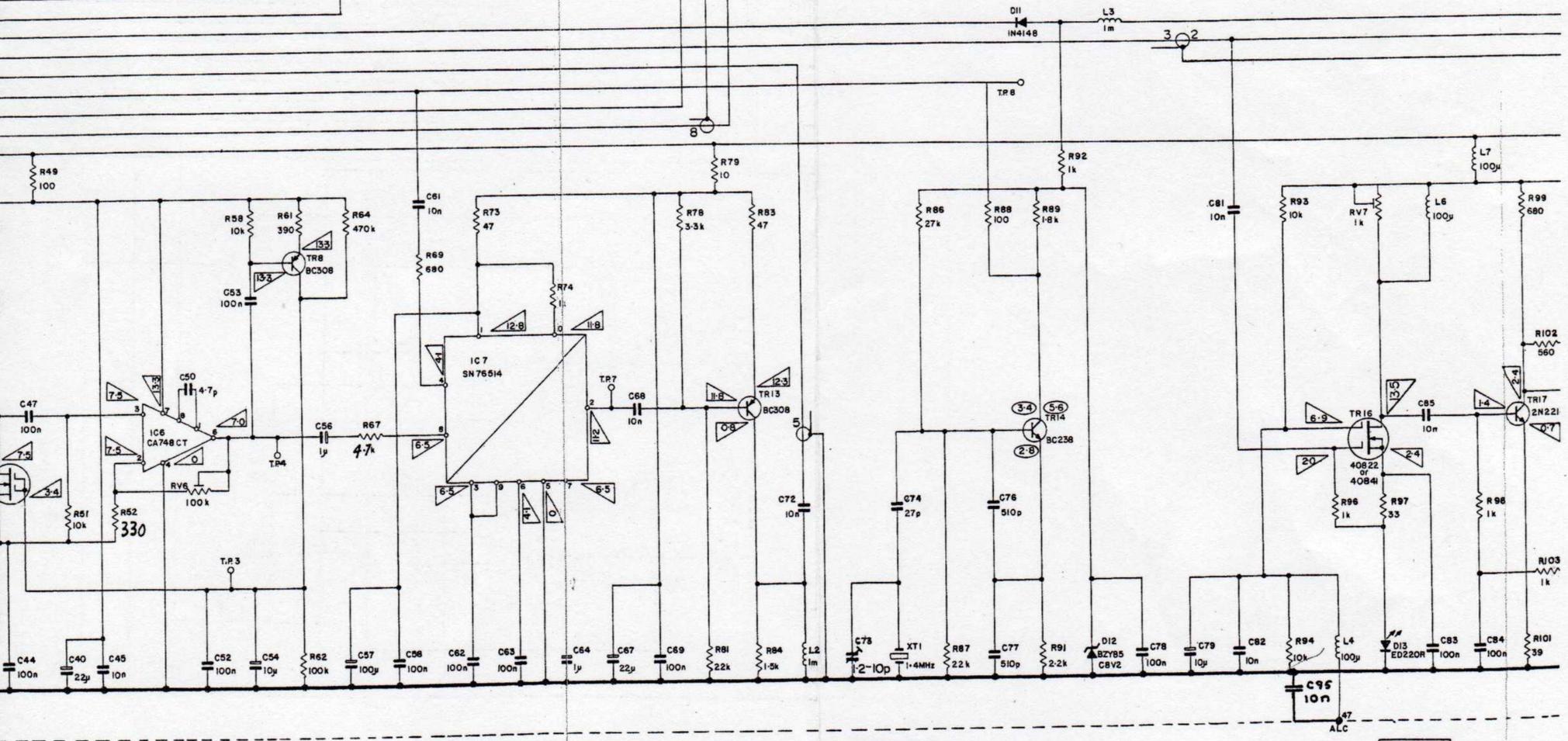
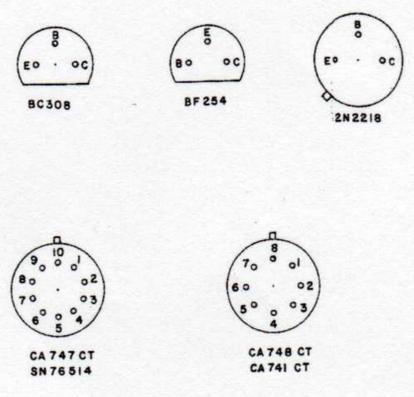
JOB No 2141  
DRAWN : K.H.R.  
CHECKED : R.V.J.  
APPROVED : H.J.P.







BASE CONNECTIONS  
(BOTTOM VIEW)



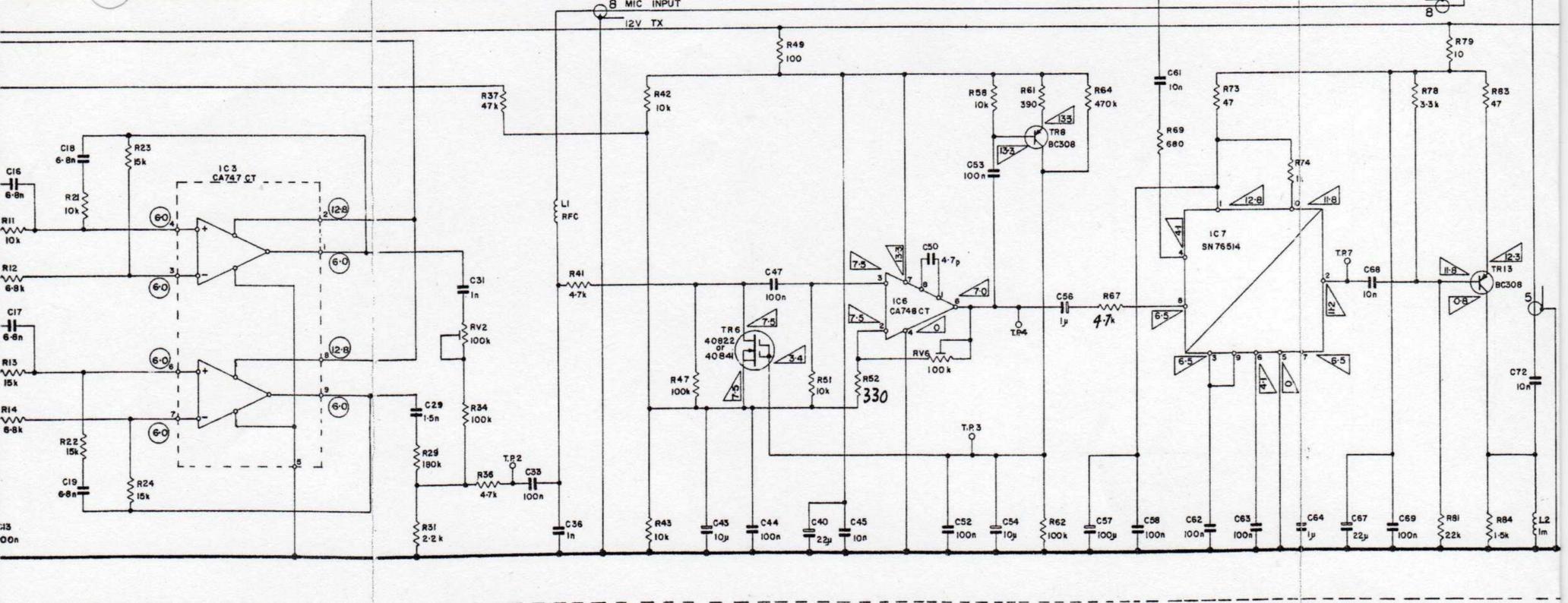
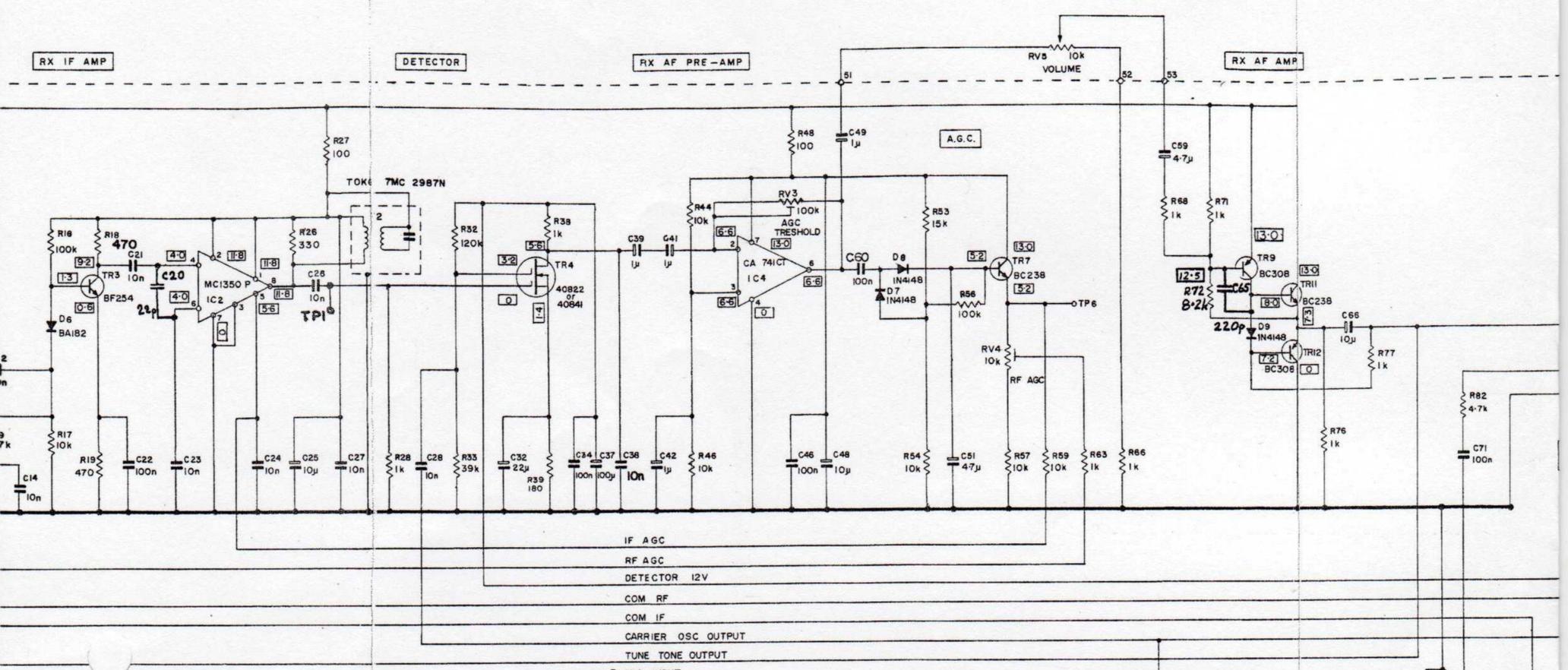
TX AF AMP

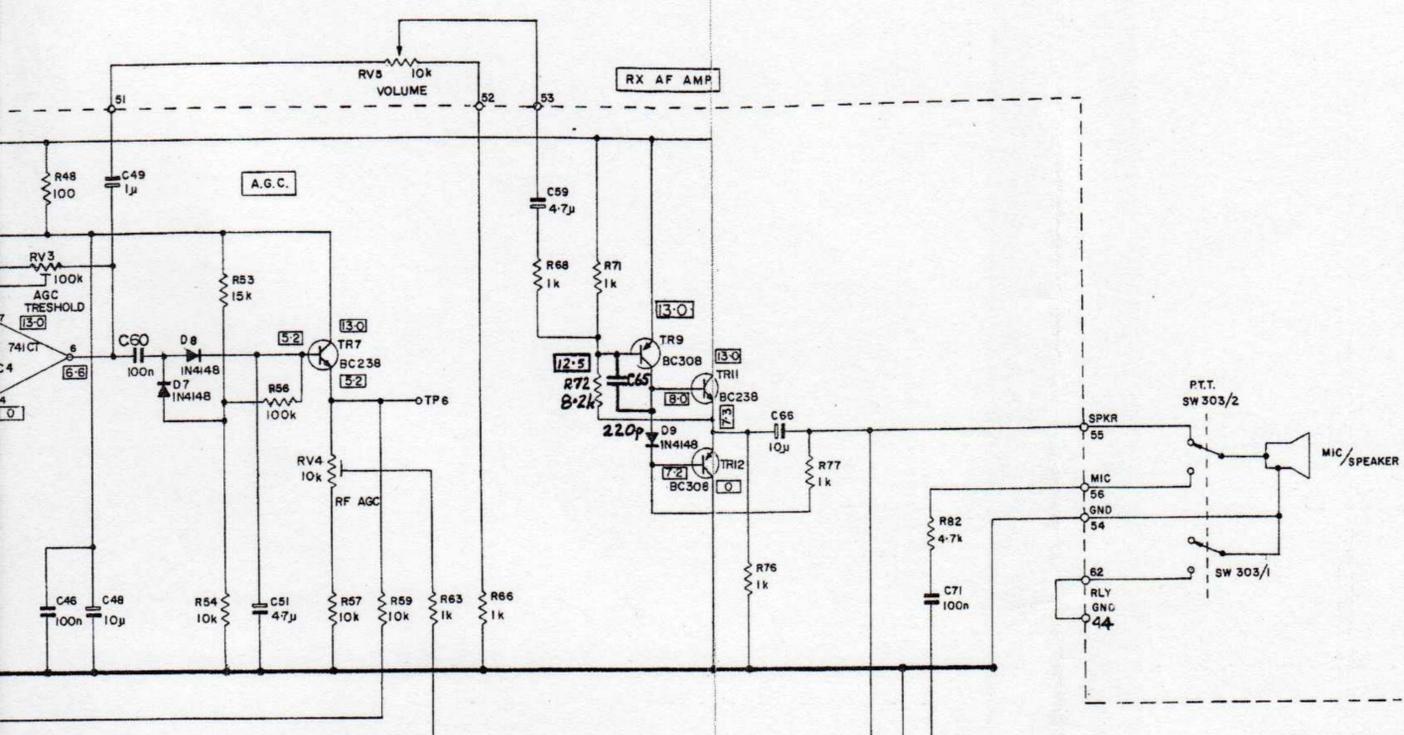
TX MODULATOR

TX IF AMP

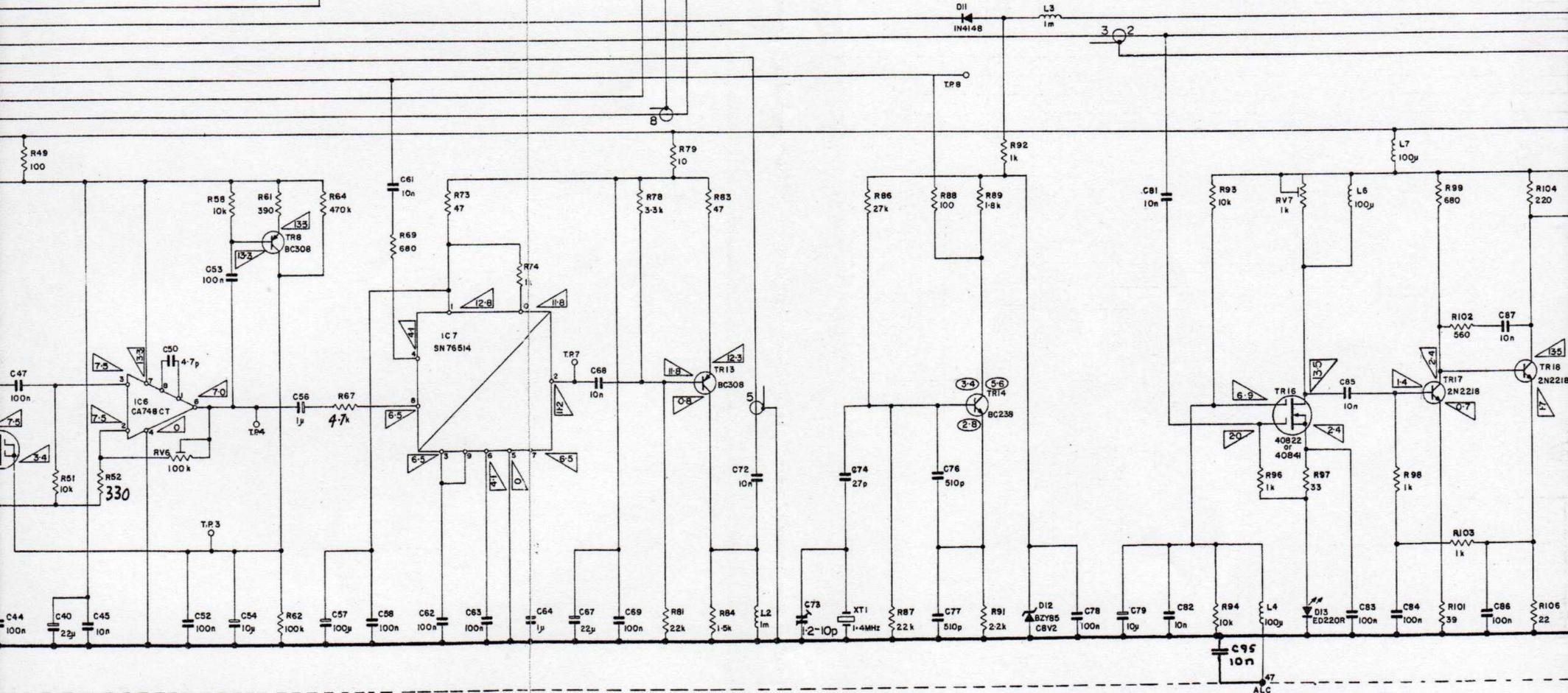
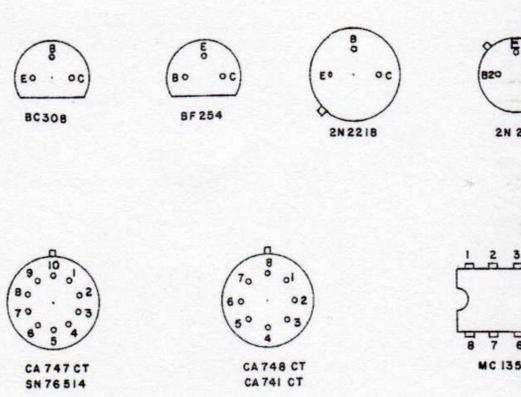
CARRIER OSC

TX DRIVER





BASE CONNECTIONS  
(BOTTOM VIEW)



TX AF AMP

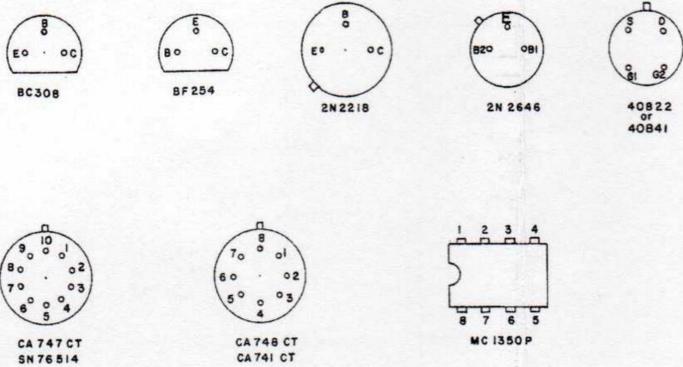
TX MODULATOR

TX IF AMP

CARRIER OSC

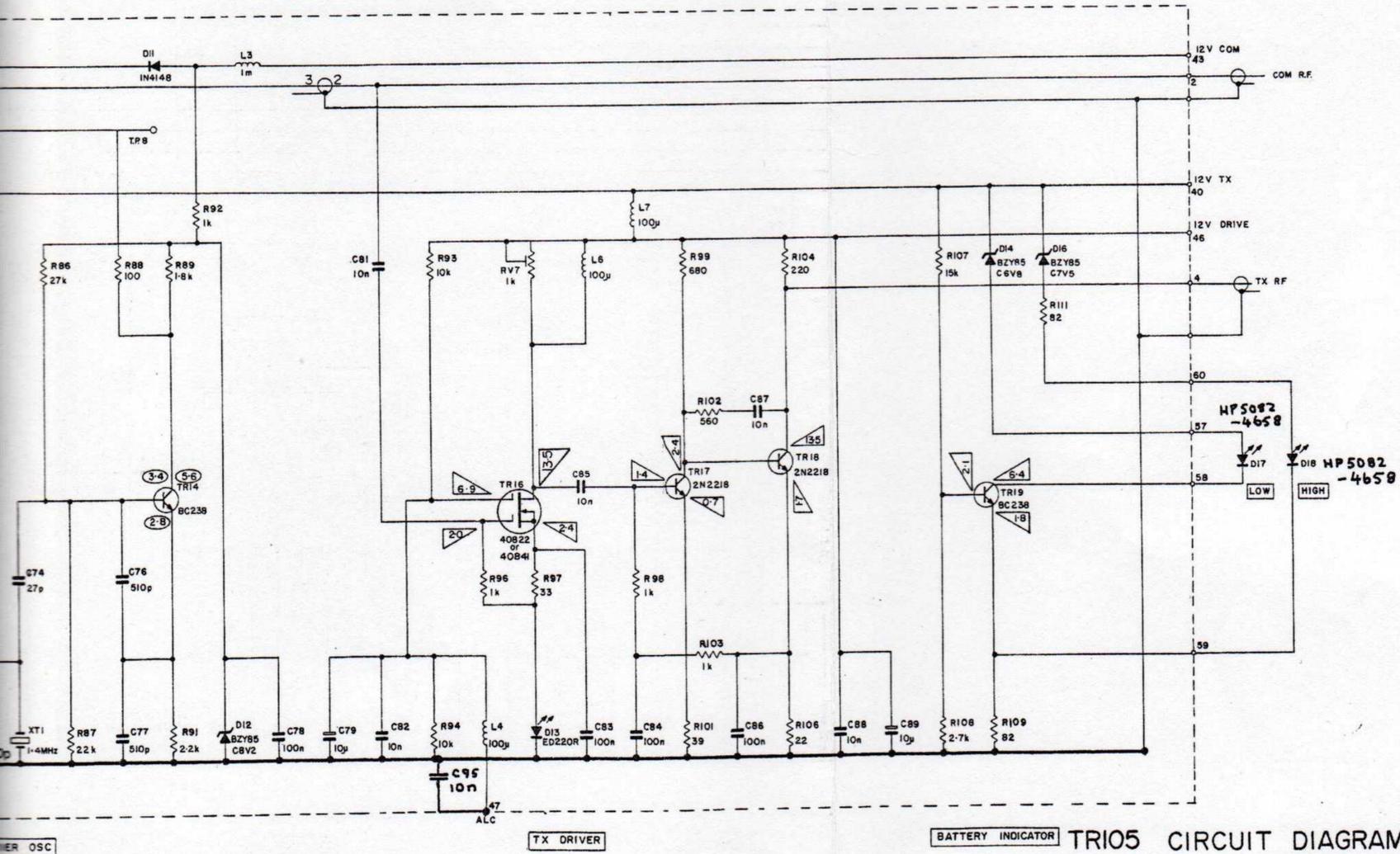
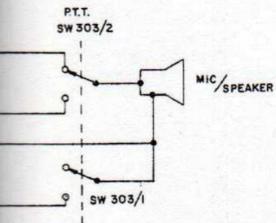
TX DRIVER

BASE CONNECTIONS  
(BOTTOM VIEW)



D.C. VOLTAGE LEVELS MEASURED USING AN ELECTRONIC VOLTMETER WITH 13.5 V SUPPLY. NO CRYSTALS IN CIRCUIT & NO INPUT ON TRANSMIT OR RECEIVE.

- MEASURED IN TRANSMIT MODE.
- MEASURED IN TRANSMIT OR RECEIVE MODE.
- MEASURED IN RECEIVE MODE.
- MEASURED WHEN PRESS TO TUNE BUTTON ACTIVATED.



TX DRIVER BATTERY INDICATOR TRI05 CIRCUIT DIAGRAM E50004 - 2  
FOR HINGED P.W.B. M3163

JOB NO 2141 DRAWN : C.B.CAMPBELL  
CHECKED : R.V.JOHANSEN  
APPROVED : H.J.PURCHAS