DANIELS ELECTRONICS LTD. ®

MT-3 RADIO SYSTEMS

VHF AMPLIFIER INSTRUCTION MANUAL

VT-3

132 - 174 MHz

Covers models:
VT-3/150 Amplifier

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NOTE:

The user's authority to operate this equipment could be revoked through any changes or modifications not expressly approved by Daniels Electronics Ltd.

The design of this equipment is subject to change due to continuous development. This equipment may incorporate minor changes in detail from the information contained in this manual.

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1 GENERAL

1.1 Introduction

The VT-3/150 Amplifier provides the final stage of RF amplification and filtering for the entire VHF Transmitter VT-3 132 - 174 MHz family. The amplifier has two distinct frequency ranges: 132 to 150 MHz, and 150 to 174 MHz with continuously adjustable 2.0 to 8.0 Watts output power. The VT-3/150 Amplifier is housed in a machined aluminum case that ensures optimum RF shielding, provides a good ground, and also acts as a heatsink.

Additionally, the VT-3/150 Amplifier is equipped with output power and VSWR sensing lines which can be individually configured as open collector or linear outputs. The internal VSWR sensor protects the amplifier from high antenna VSWR by approximately halving the amplifier's RF gain when a VSWR overload condition is present.

Output filtering for the VT-3/150 Amplifier is provided by the VT-3/150 Lowpass Filter Board. The lowpass filter assembly is mounted in a separate compartment of the amplifier case in order to provided maximum attenuation of harmonic and other spurious signals.

Refer to Section 4 for the VT-3 132 - 174 MHz VHF amplifier and lowpass filter component layouts and schematic diagrams

1.2 Performance Specification

Type:	MT-3 series VHF Amplifier module.
Compatibility:	MT-3 series Transmitter Main Board.
Frequency Range:	132 MHz to 150 MHz or 150 MHz to 174 MHz.
RF Power Output:	adjustable 2.0 to 8.0 Watts
RF power Input:	nominal level adjustable from +4 dBm to +10 dBm, held within +/- 2 dB of nominal.
Ouput Impedance and VSWR:	50 Ω, Type N connector; 3:1 max. VSWR.
Input /Output Isolation:	> 60 dB
Duty Cycle:	100%: Continuous operation from -40˚ C to +60˚C.
Harmonic Emissions:	Less than -80 dB_C .

Transmitter Mismatch Protection:	20:1 VSWR at all phase angles.
Transmitter Alarm:	Forward power sense and reverse VSWR; - open collector output (separate or 'OR'ed configuration); -linear output (separate lines only).
Operating Temperature Range:	-30˚ C to +60˚ C, optional -40˚ C temperature test.
Operating Humidity:	95% RH (non-condensing) at +25˚ C.
Operating Voltage:	+13.8 Vdc Nominal (range +11 to +16 Vdc), +9.5 Vdc Regulated.
Transmit Current:	0.7 Amp typical; 1.1 Amp maximum
Amplifier Standby Current:	less than 0.5 mA.
Amplifier Enable:	Active to ground.
Amplifier Enable Response:	typically overdamped, rising to within 90% of full power within 5 msec; maximum (underdamped) overshoot of 30%.

2 THEORY OF OPERATION

2.1 Amplifier Operation

A power control circuit monitors the RF output power of amplifier U4 and keeps the power constant. The output power from the high power amplifier will change as the unregulated +13.8 Vdc supply varies. Note that the frequency band does not change how the amplifier operates; it only changes a few component values in the RF circuitry.

Power for the VT-3/150 Amplifier is provided from the MT-3 Transmitter Board. The +13.8 Vdc supply (if required) is continuously connected to the amplifier; whereas, the +9.5 Vdc supply is always switched by the transmitter's PTT circuitry. The VT-3/150 Amplifier will not use any power from the +13.8 Vdc supply until the amplifier's +9.5 Vdc line is switched on and an RF input signal is present. The synthesizer or crystal control module controls the +9.5 Vdc to the amplifier's circuitry; switching it on by grounding the amplifier's input enable line. The synthesizer or crystal control module will ground the input enable line only when the RF signal from the synthesizer or crystal control module is phase locked. This prevents unwanted spurious emissions during transmitter start-up. A typical start-up sequence is shown below:

1) the transmitter is keyed on (+13.8 Vdc is always present)
2) +9.5 Vdc is switched on by the PTT circuitry and the synthesizer or crystal control module PTT line is pulled low
3) an RF signal is output to the amplifier
4) the amplifier's input enable line is activated
5) the amplifier outputs RF power

2.2 Power Requirements

Typical current requirements for the VT-3/150 Amplifier at different power levels are given in the Table 2-3 below. The current drawn from the +9.5 Vdc supply should never exceed 1.2 Amps and the current drawn from the +13.8 Vdc supply should never exceed 1.5 Amps.

Table 2-1 VT-3/150 Amplifier Current Consumption

Output Power	+9.5 Vdc Supply Current	+13.8 Vdc Supply Current
2.0 W	0.64 A	0.51 A
4.0 W	0.79 A	0.75 A
6.0 W	0.89 A	0.93 A
8.0 W	1.04 A	1.10 A

Note: Current consumption measured at 153 MHz

2.3 RF Circuitry

The RF circuitry consists of several blocks: a 7 dB input pad (R1, R2, and R3), an RF amplifier module (U4), an output power boosting transistor (Q7), three directional couplers (TL1, TL3, and TL4), and the VT-3/150 Lowpass Filter. The heart of the VT-3/150 Amplifier is RF amplifier module U4. The output of U4 is further amplified by Q1 to a maximum of 8.0 Watts at the antenna connector. The frequency band of the VT-3/150 Amplifier is determined by the operating frequency range of the RF amplifier module U4. Directional couplers (TL1, TL3, and TL4) are used to sample forward and reverse power. The sampled power is used by the sensing and power control circuits to control the amplifier's operation. The final step in the RF path is output filtering and, as mentioned earlier, this is done by the VT-3/150 Lowpass Filter.

2.3.1 VT-3/150 Lowpass Filter

The VT-3/150 Lowpass Filter is a 50 ohm, 9 pole, reciprocal filter with a 3 dB cutoff frequency of approximately 185 MHz. The lowpass filter assembly attenuates the desired signal's harmonics as well as any other out-of-band emissions so that a 'clean' RF signal is output to the antenna connector.

2.4 Power Control Circuitry

The VT-3/150 Amplifier employs a closed loop power control which uses a sample of the forward RF power to control the gain of RF amplifier U4. Op-amp U1b compares the sampled RF voltage to the output power setpoint and generates an error signal which Q3 uses to control the voltage on U4's gain control pin. The output power setpoint is determined by R7, the Output Power Adjust potentiometer.

The forward power is sampled by TL1, D5, C14, R13, L6, R12, and C15. The power control circuitry keeps the output power of U4 constant. Therefore the amplifier's output power will fluctuate with variations in the +13.8 Vdc supply voltage.

2.5 Power Sensing Circuitry

The VT-3/150 Amplifier is equipped with output power and VSWR sensing lines which can be individually configured as open collector or linear outputs. In open collector configuration, the output is active low, that is, when a fail condition is detected (not enough output power or too high antenna VSWR) the open collector transistor is turned on. In linear configuration, a voltage proportional to the sensed output power or antenna VSWR is output.

Both the Output Power Alarm setpoint and the VSWR Alarm setpoint are individually adjustable; however, the Output Power Alarm setpoint must always be adjusted before the VSWR Alarm setpoint. This is because the Output Power Alarm setpoint is used as a reference by the VSWR Alarm circuitry.

2.5.1 Output Power Sense

The output power sense circuitry uses directional coupler TL2 to sample some of the forward power. The sampled power is rectified by diode D6 and capacitor C20 and then amplified by op-amp U3b. Op-amp U3b's amplification is controlled by R21, the output power alarm adjust potentiometer. The amplified voltage is then output directly in linear operation (JU1 installed, JU2 not installed) or compared by op-amp U1a which then drives transistors Q4 and Q3 for open collector operation (JU1 not installed, JU2 installed).

In open collector configuration, Q3 (the open collector output transistor) is turned on when an alarm condition occurs. The adjustment range for the output power alarm can vary depending on the setting of R21 (the Output Power Alarm Adjust potentiometer).

2.5.2 VSWR Sense

The VSWR sense circuitry uses directional coupler TL3 to sample some of the power reflected from the antenna terminal. The reflected power is rectified by diode D7 and capacitor C25 and then amplified by op-amp U2b. Op-amp U2b's amplification is controlled by R36, the VSWR Alarm Adjust potentiometer. The amplified voltage is then output directly in linear operation (JU4 installed, JU3 not installed) or compared to the output power alarm setpoint by op-amp U3a which then drives transistor Q5 for open collector operation (JU4 not installed, JU3 installed).
In open collector configuration, Q5 (the open collector output transistor) is turned on when an alarm condition occurs. The adjustment range for the VSWR Alarm can depending on the setting of R36 (the VSWR Alarm Adjust potentiometer).

2.5.3 VSWR Overload

The VSWR overload circuit protects the VT-3/150 Amplifier from excessive antenna VSWR by reducing the amplifier's gain (output power) when an overload condition occurs. The VSWR overload circuit (R14, R37, R39, R40, U2a, and Q6) is an extension of the VSWR sense circuit and operates the same as the VSWR sense open collector circuit. The VSWR Overload Adjust potentiometer (R37) reduces the voltage level of the VSWR Alarm Setpoint. The voltage set by R37 is the compared to the output power alarm setpoint by op-amp U2a which then drives transistor Q6. When transistor Q6 turns on, signaling an overload condition, resistor R14 is grounded which reduces the output power setpoint. Reducing the output power setpoint lowers the VT-3/150 Amplifier's gain and protects the amplifiers from excessive current draw resulting from high antenna VSWR.

The VSWR overload circuit's range of adjustment depends on the setting of the VSWR Alarm Adjust potentiometer (R36). The VSWR overload transistor Q6 can be activated at the same point at which the VSWR alarm becomes active or the VSWR overload circuit can be disabled by turning R37 completely counterclockwise.

3 VT-3/150 AMPLIFIER ALIGNMENT

3.1 General

Connections to the power supply, alarm and transmit enable lines (ENA), are clearly marked on the amplifier case. The amplifier is enabled when the enable line (ENA) is grounded.
If the amplifier is installed in the transmitter, alignment is simplified by using an SR-3 Subrack, SM-3 System Monitor, and RF extender cable to provide transmitter power and signal interconnection (see the Transmitter Main Board Manual for details). For complete transmitter alignment, the Transmitter Main Board, Synthesizer, Amplifier, and Audio Processor should be tuned in the aforementioned order. Please refer the corresponding manuals for each module.

If the input RF level is not changed, adjustments to the output power and alarm thresholds may be made without removing the amplifier cover. However, in the case of a complete amplifier alignment, the amplifier should be separated from the Transmitter Main Board and the amplifier cover removed to expose all amplifier circuitry. All jumpers and test points are clearly marked.

3.2 Repair Note

The VT-3/150 Amplifier is mainly made up of surface mount devices which should not be removed or replaced using an ordinary soldering iron. Removal and replacement of surface mount components should be performed only with specifically designed surface mount rework and repair stations complete with ElectroStatic Dissipative (ESD) protection.

When removing Surface Mount Solder Jumpers, it is recommended to use solder braid in place of manual vacuum type desoldering tools when removing jumpers. This will help prevent damage to the circuitboards.

3.3 Recommended Test Equipment List

Alignment of the transmitter requires the following test equipment or its equivalent.

Dual Power Supply:	Regulated +9.5 Vdc at 0.1 A.
	Regulated +13.8 Vdc at 2 A - Topward TPS-4000
Oscilloscope / Multimeter:	Fluke 97 Scopemeter
Current Meter:	Fluke 75 multimeter
Radio communications test set :	Marconi Instruments 2955R
VSWR 3:1 mismatch load:	JFW 50T-035-3.0:1
coaxial test cable set	three 50 Ω cables of incremental length 20 to 40 cm
Alignment Tool:	Johanson 4192

It is recommended that the radio communications test set be frequency locked to an external reference (WWVH, GPS, Loran C) so that the high stability oscillator may be accurately set to within its ±1 ppm frequency tolerance.

3.4 Printed Circuitboard Numbering Convention

To ease troubleshooting and maintenance procedures, Daniels Electronics Limited has adopted a printed circuitboard (PCB) numbering convention in which the last two digits of the circuitboard number represent the circuitboard version. For example:

- PCB number 43-912010 indicates circuitboard version 1.0;
- PCB number 50002-02 indicates circuitboard version 2.0.

All PCB's manufactured by Daniels Electronics are identified by one of the above conventions.

3.5 Standard Factory Settings and Jumper Configuration

The VT-3/150 Amplifier is factory configured as follows:

- Open collector configuration for Output Power Alarm.
- Open collector configuration for Antenna VSWR Alarm.

The corresponding jumper settings are:

• Jumper JU1:	not installed	Output power alarm - linear output
• Jumper JU2:	installed	Output power alarm - open collector output
• Jumper JU3:	installed	Antenna VSWR alarm - open collector output
• Jumper JU4:	not installed	Antenna VSWR alarm - linear output

3.6 VT-3/150 Amplifier Alignment

3.6.1 General

The VT-3/150 Amplifier is a frequency sensitive module that is factory assembled to operate in one of two frequency bands: 132 to 150 MHz or 150 to 174 MHz. The amplifier requires 7 dBm of input power and is continuously adjustable over the its power range of 2.0 to 8.0 Watts. The VT-3/150 Amplifier provides Output Power and Antenna VSWR Alarm outputs which can be configured for open collector output or linear operation. The amplifier's output power level and alarm levels can be set without detaching the amplifier from the transmitter board. However, to change the configuration of the output power alarm or the Antenna VSWR alarm, the VT-3/150 Amplifier must be detached from the MT-3 Transmitter Board. Refer to page 4-2 "VT-3/150 VHF Amplifier Component Layout" for the location of solder jumpers JU1 to JU4.

3.6.2 VT-3/150 Amplifier Adjustment

The Amplifier alignment consists of two adjustment procedures; (i) a general set up (section 3.6.2.1) procedure which sets up the proper bias conditions for the RF transistors and (ii) the RF threshold adjustments which set up the desired alarm threshold levels as well as the RF output power. The general alignment procedure is required following major repair operations, changes in RF input levels or large changes in operating frequency (greater than ± 1.0 MHz).

The RF output and alarm threshold level adjustments are more easily accessible so that fine adjustments can be made in the field. Depending on user requirements, the RF alarm threshold levels should be checked whenever a significant change in operating frequency (± 0.5 MHz) is made. As the antenna VSWR alarm is dependent on the output power alarm, the output power alarm should always be set first. The order of adjustment should be:

1) Set the desired output power alarm level (section 3.6.2.2).
2) Set the output power (section 3.6.2.3).
3) Set the desired Antenna VSWR alarm level (section 3.6.2.4).
4) Set the desired overload condition level (section 3.6.2.5).

Details for the alignment steps are outlined below.

3.6.2.1 General Set-Up

All of the setup steps detailed below are performed at the factory as part of the initial Transmitter alignment. A general realignment of the Amplifier Module will be required under the following conditions:

(i) the nominal RF input power applied to the amplifier is changed from that which the amplifier was intially set up for, and
(ii) components, particularly the RF transistors Q1 and Q2, are replaced during a repair operation.

1. Connect the transmitter's antenna output connector to the type N input of the radio communications test set through a short section of low loss 50 Ω coaxial cable.

2. Turn all four (4) of the adjustment potentiometers (R7, R21, R36, and R37) fully counterclockwise.

3. Turn on the power to the transmitter.

4. Monitor the +9.5 Vdc and 13.8 Vdc supply current and adjust R7, the output power adjustment, so that approximately 1 Amp is being drawn on the +9.5 Vdc line and 1.3 Amps or less is being drawn on the 13.8 Vdc line. This should produce approximately 8 Watts.

5. If only a 6 or 7 watt output is obtained, adjust the low pass filter coil pairs L2/L3 and L1/L4 to obtain 8 watts.

3.6.2.2 Output Power Alarm (Forward Power)

Open Collector Output

* note: the output power alarm output is factory configured as an open collector output so a pull-up resistor may be required on transmitter pin B26 if one is not already present.

1. Adjust R7, the output power adjustment, to the output power at which the Output Power Alarm is to be activated.

2. Monitor transmitter pin B26, the Output Power Alarm line, and slowly turn R21, the output power alarm adjustment, clockwise until pin B26 goes low. The alarm is now set for the current output power of the transmitter.

Linear Output

1. Open the amplifier case to disable (open circuit) jumper JU2 and enable (short) jumper JU1.

2. Monitor transmitter pin B26 with a voltmeter.

3. Adjust R7, the output power adjustment, for full transmitter output power.

4. Adjust R21, the output power alarm adjustment, so that the voltmeter indicates +7.5 Vdc for full transmitter output power.

5. Turn R7, the output power adjustment, fully counterclockwise. The voltmeter should read approximately +3 Vdc.

6. Disconnect the voltmeter.

3.6.2.3 Output Power

1. Turn R7, the output power adjustment, clockwise to the desired transmitter output power.

3.6.2.4 Antenna VSWR Alarm (Reverse Power)

Open Collector Output

* note: the antenna VSWR alarm output is factory configured as an open collector output so a pull-up resistor may be required on transmitter pin Z26 if one is not already present. The output power alarm must be set first before the antenna VSWR alarm can be set.

1. Disconnect the radio communications test and terminate the transmitter with the 3:1 mismatch load.

2. Monitor pin Z26, the Antenna VSWR Alarm line, and turn R36 fully counterclockwise. Pin Z26 should be high. Slowly turn R36 clockwise until pin Z26 is pulled low. Put the 50 ohm load back on again, Pin Z26 should go high. The reverse power trip point is now set for a VSWR of 3:1.

Linear Output

1. Open the amplifier case to disable (open circuit) jumper JU3 and enable (short) jumper JU4.

2. Monitor transmitter pin Z26 with a voltmeter.

3. Disconnect the radio communications test set and terminate the transmitter with the 3:1 mismatch load.

4. Adjust R36, the VSWR alarm adjustment, so that the voltmeter indicates +5 Vdc for a 3:1 mismatch.

5. Put the 50 ohm load back on again. The voltmeter should read approximately 0 Vdc.

6. Disconnect the voltmeter.

3.6.2.5 Antenna VSWR Overload

1. Disconnect the radio communications test set and so that the amplifier is terminated with an open circuit.

2. Monitor the current from the +9.5 Vdc supply.

3. Adjust R37, the VSWR overload adjustment, clockwise until a noticeable drop in the +9.5 Vdc current occurs.

4. Reconnect the radio communications test set and, the +9.5 Vdc current should return to the previous level.

3.6.2.6 Procedure Verification

1. Verify that the current drawn from the +13.8 Vdc supply is less than 1.5 A and from the +9.5 Vdc supply is less than 1.2 A when transmitting full RF output power (8 Watts).

2. Turn off the power to the transmitter.

4 ILLUSTRATIONS AND SCHEMATIC DIAGRAMS

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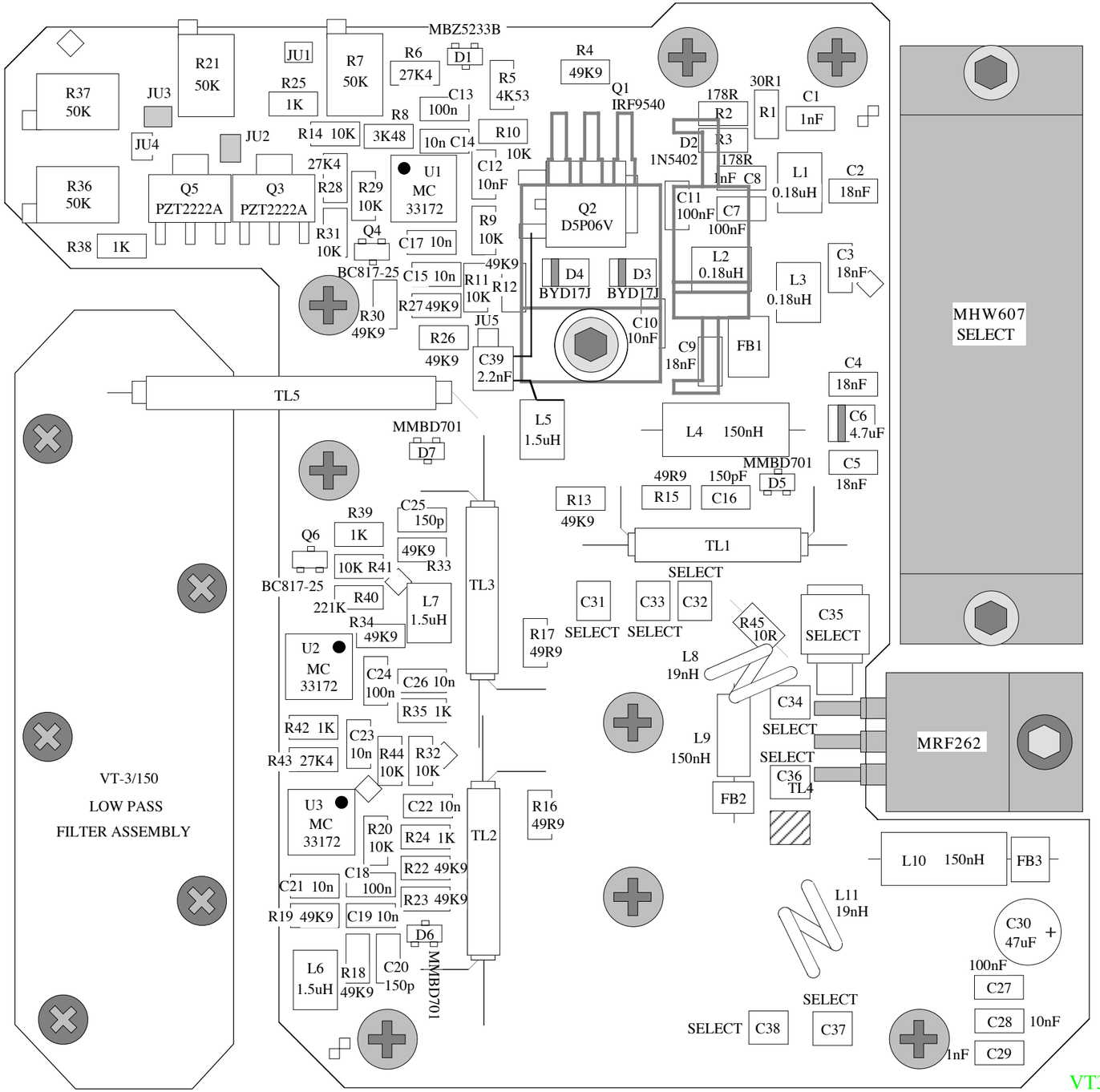
4.1 VT-3/150 VHF Amplifier Component Layout



COMPONENT INSTALLED ON BOTTOM OF BOARD

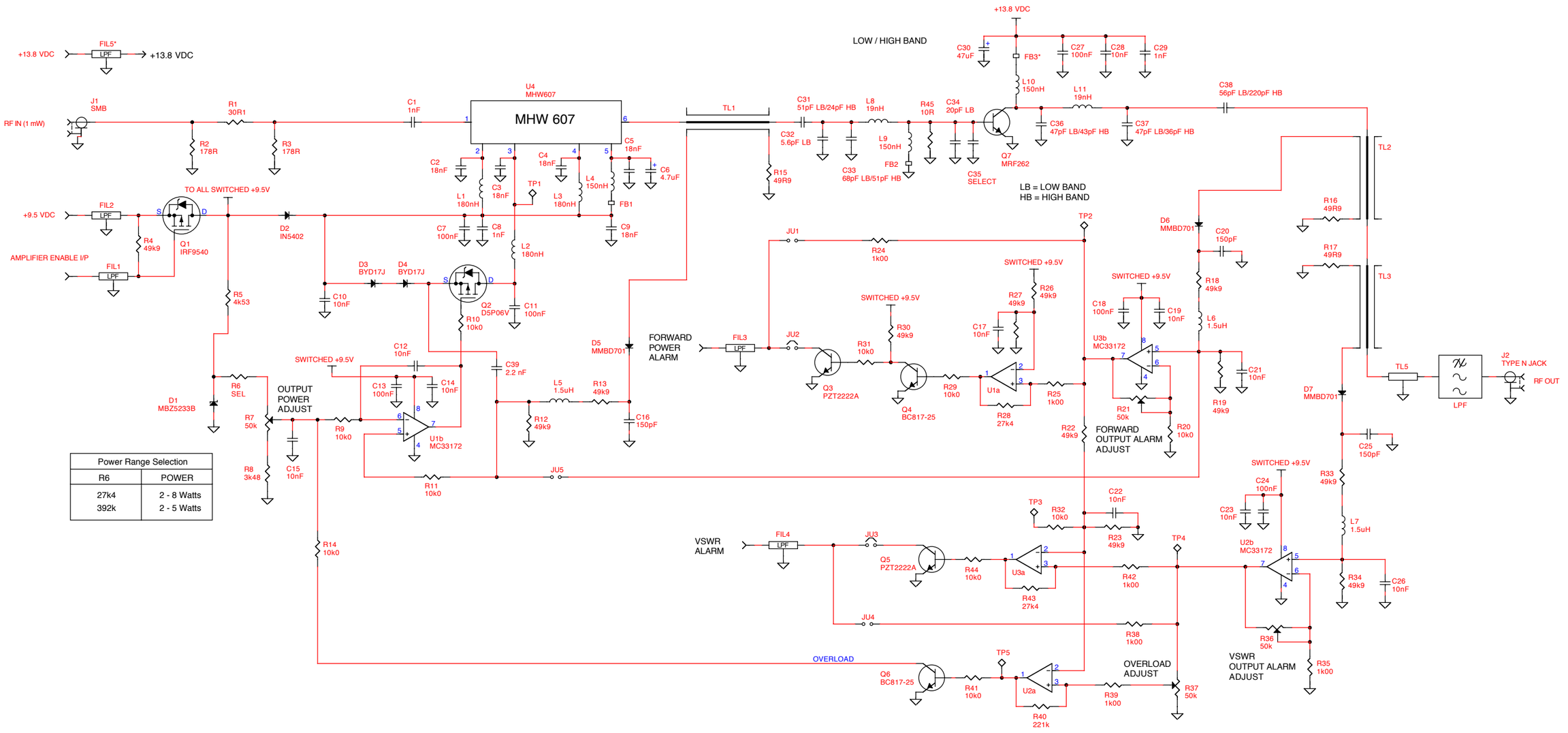
COMPONENT NOT INSTALLED

COMPONENT MOUNTED ON CASE

NOTE Q1 MOUNTED ON CASE WITH LEADS INSERTED TO BOTTOM OF BOARD

VT3AMPM1

4.2 VT-3/150 VHF Amplifier Schematic Diagram



Power Range Selection	
R6	POWER
27k4	2 - 8 Watts
392k	2 - 5 Watts

HIGHEST REFERENCE DESIGNATORS		
C39	J2, JU5	R45
D7	L11	TL5, TP5
FB3, FIL5	Q7	U4
UNUSED REFERENCE DESIGNATORS		
-----	-----	-----
-----	-----	-----
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DE DANIELS ELECTRONICS	VICTORIA B.C.	
TITLE: VT-3/150 VHF AMPLIFIER SCHEMATIC DIAGRAM		
DATE: 4 MARCH 1994	DWN BY: REX WONG	APRVD:
DWG No: VT3AMPM2A	DWG REV DATE:	10 DECEMBER 1995
BOARD No: 43-932611	BOARD REV:	1.1

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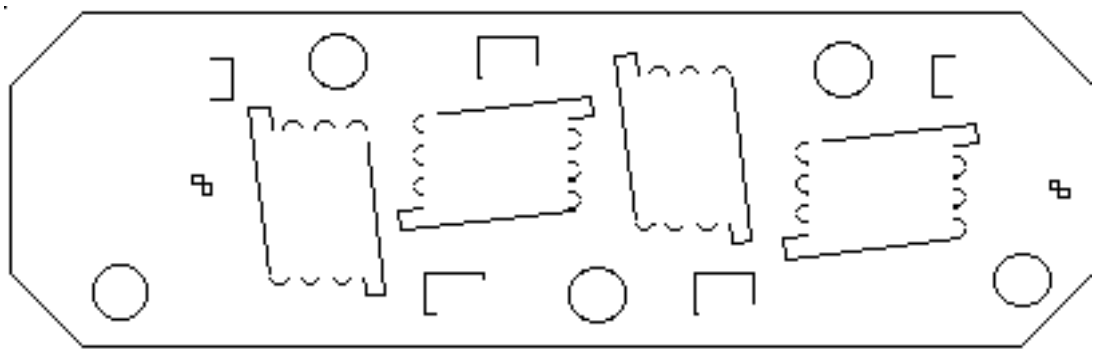
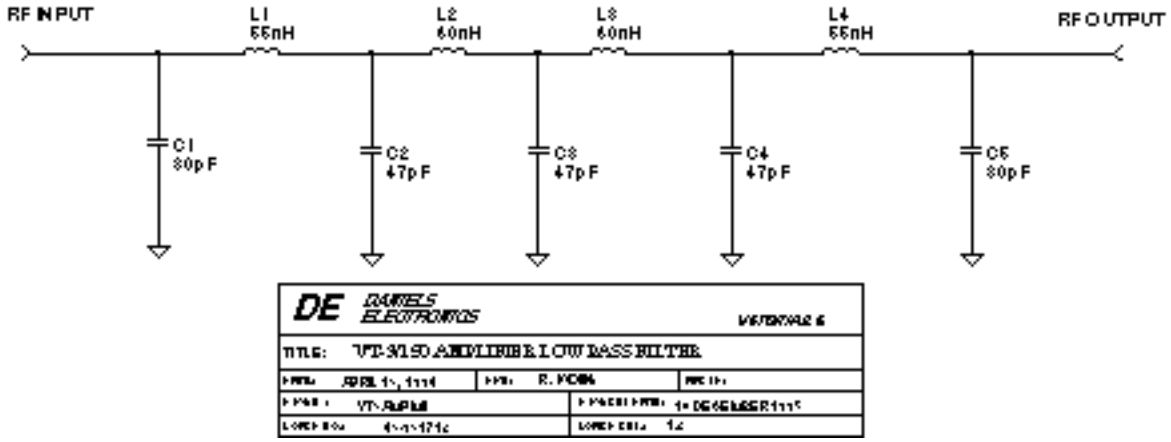
4.3 VT-3/150 VHF Lowpass Filter Component Layout



4.4 VT-3/150 VHF Lowpass Filter Schematic Diagram



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5 PARTS LISTS

5.1 VT-3/150 Amplifier Electrical Parts List

Ref Desig	Description	Part No.	
C1	CAP., SM, 1nF CER, 1206, C0G	1008-3B102K1G	
C2-C5	CAP., SM, 18nF CER, 1206, X7R	1008-4B183K5R	
C6	CAP., SM, 4.7µF TANT., 10%, 16V	1055-5B475K16	
C7	CAP., SM, 100nF CER, 1206, X7R	1008-5B104K5R	
C8	CAP., SM, 1nF CER, 1206, C0G	1008-3B102K1G	
C9	CAP., SM, 18nF CER, 1206, X7R	1008-4B183K5R	
C10	CAP., SM, 10nF CER, 1206, X7R	1008-4B103K5R	
C11	CAP., SM, 100nF CER, 1206, X7R	1008-5B104K5R	
C12	CAP., SM, 10nF CER, 1206, X7R	1008-4B103K5R	
C13	CAP., SM, 100nF CER, 1206, X7R	1008-5B104K5R	
C14, C15	CAP., SM, 10nF CER, 1206, X7R	1008-4B103K5R	
C16	CAP., SM, 150pF CER, 1206, C0G	1008-2B151J1G	
C17	CAP., SM, 10nF CER, 1206, X7R	1008-4B103K5R	
C18	CAP., SM, 100nF CER, 1206, X7R	1008-5B104K5R	
C19	CAP., SM, 10nF CER, 1206, X7R	1008-4B103K5R	
C20	CAP., SM, 150pF CER, 1206, C0G	1008-2B151J1G	
C21-C23	CAP., SM, 10nF CER, 1206, X7R	1008-4B103K5R	
C24	CAP., SM, 100nF CER, 1206, X7R	1008-5B104K5R	
C25	CAP., SM, 150pF CER, 1206, C0G	1008-2B151J1G	
C26	CAP., SM, 10nF CER, 1206, X7R	1008-4B103K5R	
C27	CAP., SM, 100nF CER, 1206, X7R	1008-5B104K5R	
C28	CAP., SM, 10nF CER, 1206, X7R	1008-4B103K5R	
C29	CAP., SM, 1nF CER, 1206, C0G	1008-3B102K1G	
C30	CAP., 47µF DIP. TANT., 20%, 35V	1054-6M476M35	
C31	CAP.,SM, 51pF PORCEL., 5% 500V	1036-1B2510J5	(132 - 150 MHz)
C31	CAP.,SM, 24pF PORCEL., 5% 500V	1036-1B2240J5	(150 - 174 MHz)
C32	CAP.,SM, 5.6pF PORCEL., ±0.25pF 500V	1036-0B2569C5	(132 - 150 MHz)
C32	CAP.,SM, NOT INSTALLED	NOT INSTALLED	(150 - 174 MHz)
C33	CAP.,SM, 68pF PORCEL., 5% 500V	1036-1B2680J5	(132 - 150 MHz)
C33	CAP.,SM, 51pF PORCEL., 5% 500V	1036-1B2510J5	(150 - 174 MHz)
C34	CAP.,SM, 20pF PORCEL., 5% 500V	1036-1B2200J5	(132 - 150 MHz)
C34	CAP.,SM, NOT INSTALLED	NOT INSTALLED	(150 - 174 MHz)
C35	CAP., 330pF METAL CLAD,1% 250V	1046-2A331FDB	(132 - 150 MHz)
C35	CAP., 270pF METAL CLAD, 1% 250V	1046-2A27TFDB	(150 - 174 MHz)
C36	CAP.,SM, 47pF PORCEL., 5% 500V	1036-1B2470J5	(132 - 150 MHz)
C36	CAP.,SM, 43pF PORCEL., 5% 500V	1036-1B2430J5	(150 - 174 MHz)
C37	CAP.,SM, 47pF PORCEL., 5% 500V	1036-1B2470J5	(132 - 150 MHz)
C37	CAP.,SM, 36pF PORCEL., 5% 500V	1036-1B2360J5	(150 - 174 MHz)
C38	CAP.,SM, 56pF PORCEL., 5% 500V	1036-1B2560J5	(132 - 150 MHz)
C38	CAP.,SM, 220pF PORCEL., 5% 200V	1036-2B2221J2	(150 - 174 MHz)
C39	CAP., 2.2nF FILM, MMK5,10%,63V	1016-3A222K63	
D1	DIODE, MBZ5233B 6.0V ZENER, SOT-23	2102-MBZ5233B	
D2	DIODE, IN5402 3A RECT, DO-201AD	2001-1N540200	
D3, D4	DIODE, BYD17J RECTIFIER, SOD-87	2101-BYD17J00	
D5	DIODE, MMBD701 HOT CARRIER, SOT-23	2105-MMBD7010	
D6, D7	DIODE, MMBD701 HOT CARRIER, SOT-23	2105-MMBD7010	

Ref Desig	Description	Part No.	
FB1	FERRITE BEAD, SM, 43 MIX 1812 PKG	1213-43181200	
FB2, FB3	FERRITE BEAD, 64MIX 3X3.5mm OD	1210-64030350	
FIL1-FIL5	FILTER, EMI PI/5500pF, 8-32 UNC	1302-P552D10D	
J1	CONNECTOR, SMB, JACK,2 HOLE FLANGE	5120-J2SC01BG	
J2	CONNECTOR, N JACK PANEL MNT, C/SNK	5184-10923011	
L1-L3	INDUCTOR, SM., 180nH 20%, 1812	1255-2GR1800M	
L4	CHOKE, RF/MOULD., 150nH 10%, .37	1251-2B00R15K	
L5	INDUCTOR, SM, 1.5µH 10%, 1812	1255-3G1R500K	
L6, L7	INDUCTOR, SM, 1.5µH 10%, 1812	1255-3G1R500K	
L8	COIL, 1.5 TURNS, 18AWG, 3.83mmID	1220-1T501812	
L9	CHOKE, RF/MOULD., 150nH 10%, .25	1251-2A00R15K	
L10	CHOKE, RF/MOULD., 150nH 10%, .37	1251-2B00R15K	
L11	COIL, 1.5 TURNS, 18AWG, 3.83mmID	1220-1T501812	
LPF1	LPF, ASSEMBLY VT-3/150 AMPLIFIER	A21-LPF3/150	
PCB	PCB, VT-3/150 TX AMPLIFIER	4321-15932611	
Q1	MOSFET, IRF9540 P-CHANNEL, TO-220	2044-IRF95400	
Q2	MOSFET, D5P06V P-CHAN., DPAK	2144-D5P06V00	
Q3	TRANSISTOR, PZT2222A NPN, SOT-223	2120-PZT2222A	
Q4	TRANSISTOR, BC817-25 NPN, SOT-23	2120-BC817025	
Q5	TRANSISTOR, PZT2222A NPN, SOT-223	2120-PZT2222A	
Q6	TRANSISTOR, BC817-25 NPN, SOT-23	2120-BC817025	
Q7	TRANSISTOR, MRF262 VHF, TO-220	2025-MRF26200	
R1	RES., SM, 30R1 1206, 1%,100ppm	1150-1B30R1FP	
R2, R3	RES., SM, 178R 1206, 1%,100ppm	1150-2B1780FP	
R4	RES., SM, 49k9 1206, 1%, 100ppm	1150-4B4992FP	
R5	RES., SM, 4k53 1206, 1%, 100ppm	1150-3B4531FP	
R6	RES., SM, 27k4 1206, 1%, 100ppm	1150-4B2742FP	(Default)
R6	RES., SM, 392k 1206, 1%, 100ppm	1150-4B3922FP	(Exciter for VT-30)
R7	POT., SM, 50k 12 TURN, SIDE ADJUST	1172-M30503X5	
R8	RES., SM, 3k48 1206, 1%, 100ppm	1150-3B3481FP	
R9-R11	RES., SM, 10k0 1206, 1%, 100ppm	1150-4B1002FP	
R12, R13	RES., SM, 49k9 1206, 1%, 100ppm	1150-4B4992FP	
R14	RES., SM, 10k0 1206, 1%, 100ppm	1150-4B1002FP	
R15-R17	RES., SM, 49R9 1206, 1%, 100ppm	1150-1B49R9FP	
R18, R19	RES., SM, 49k9 1206, 1%, 100ppm	1150-4B4992FP	
R20	RES., SM, 10k0 1206, 1%, 100ppm	1150-4B1002FP	
R21	POT., SM, 50k 12 TURN, SIDE ADJUST	1172-M30503X5	
R22, R23	RES., SM, 49k9 1206, 1%, 100ppm	1150-4B4992FP	
R24, R25	RES., SM, 1k00 1206, 1%, 100ppm	1150-3B1001FP	
R26, R27	RES., SM, 49k9 1206, 1%, 100ppm	1150-4B4992FP	
R28	RES., SM, 27k4 1206, 1%, 100ppm	1150-4B2742FP	
R29	RES., SM, 10k0 1206, 1%, 100ppm	1150-4B1002FP	
R30	RES., SM, 49k9 1206, 1%, 100ppm	1150-4B4992FP	
R31, R32	RES., SM, 10k0 1206, 1%, 100ppm	1150-4B1002FP	
R33, R34	RES., SM, 49k9 1206, 1%, 100ppm	1150-4B4992FP	
R35	RES., SM, 1k00 1206, 1%, 100ppm	1150-3B1001FP	
R36, R37	POT., SM, 50k 12 TURN, SIDE ADJUST	1172-M30503X5	

Ref Desig	Description	Part No.	
R38, R39	RES., SM, 1k00 1206, 1%, 100ppm	1150-3B1001FP	
R40	RES., SM, 221k 1206, 1%, 100ppm	1150-5B2213FP	
R41	RES., SM, 10k0 1206, 1%, 100ppm	1150-4B1002FP	
R42	RES., SM, 1k00 1206, 1%, 100ppm	1150-3B1001FP	
R43	RES., SM, 27k4 1206, 1%, 100ppm	1150-4B2742FP	
R44	RES., SM, 10k0 1206, 1%, 100ppm	1150-4B1002FP	
R45	RES., 10R METAL FILM, 5%, 0.5W	1101-1A0100JP	
TL1	COAX, DIRECTIONAL COUPLER 0.5"	7496-30CR005T	
TL2, TL3	COAX, DIRECTIONAL COUPLER 0.5"	7496-30CR005T	
TL5	COAX, CONFORMABLE 31.5mm, 50 OHM, 0.083	7482-5024T083	
U1-U3	I.C., MC33172 DUAL OP AMP, S0-8	2302-33172N08	
U4	AMP, RF,MHW607-1,7W,136-154MHz	2256-MHW60701	(132 - 150 MHz)
U4	AMP, RF,MHW607-2,7W,146-174MHz	2256-MHW60702	(150 - 174 MHz)

5.2 VT-3/150 Low Pass Filter Electrical Parts List

Ref Desig	Description	Part No.
C1	CAP., SM, 30pF PORCEL., 5%, 500V	1036-1B2300J5
C2-C4	CAP., SM, 47pF PORCEL., 5%, 500V	1036-1B2470J5
C5	CAP., SM, 30pF PORCEL., 5%, 500V	1036-1B2300J5
L1	COIL, 55nH 3.0 TURNS, 18AWG, 6.70mm ID	1220-3T001822
L2, L3	COIL, 60nH 3.0 TURNS, 18AWG, 6.70mm ID	1220-3T001822
L4	COIL, 55nH 3.0 TURNS, 18AWG, 6.70mm ID	1220-3T001822
PCB	PCB, LPF VT-3/150, UT-3/400 AMP	4321-16931712

5.3 VT-3/150 Amplifier Mechanical Parts List

Description	Part No.	Qty.
CASE, MT-3 VHF/UHF AMPLIFIER, ALUMINUM	3702-66102130	1
HEATSHRINK, 1/8" DIA, RED, 1" LENGTH	CONSUMABLE	1
INSULATOR, THERM. COND. TO-220	5622-1T220701	1
LABEL, MTL/PE, VT-3/150 AMP ID	3508-21002010	1
LID, CASE MT-3 AMPLIFIER, ALUMINUM	3702-66102151	1
SCREW, M2 X 6, PAN/PHILLIPS,A2	5812-2M0PP06S	2
SCREW, M2 X 4, PAN/PHIL., S/S	5812-2M0PP04S	10
SCREW, M2.5 X 6, PAN/PHIL., S/S	5812-2M5PP06S	3
SCREW, M3 X 6, FLAT/PHIL., S/S	5812-3M0FP06S	4
SCREW, M3 X 8, PAN/PHIL., S/S	5812-3M0PP08S	9

Description	Part No.	Qty.
SCREW, M3 X 8, CAP SOCK-M2.5, S/S	5812-3M0SA08S	3
SCREW, M3 X 8, CAP SOCK-M2.5, S/S	5812-3M0SA08S	2
SET SCREW, M3 X 3, HEX SOCKET, A2	5817-3M0AC03S	1
SHOULDER WASHER, M3 0.24" OD, NYLON	5674-120N2440	1
TUBING, TFE-260C, 22AWG,Thin 5mm	7610-260C22TW	1
TURRET TERMINAL, 4-40 0.188L, Tn	5053-144M188T	1
WIRE, PVC/STRANDED 16AWG, RED, 70 mm	7110-16S26302	1

6 REVISION HISTORY

ISSUE	DATE	REVISION
1	Jul 97	First Issue.