1 GENERAL

1.1 Introduction

The OC-3 Crystal Control Module produces low distortion, high stability, modulated or unmodulated RF signals covering the frequency bands of 118 - 174 MHz and 406 - 512 MHz. The Crystal Control Modules achieve a ±1 ppm frequency stability from -40°C to +60°C using a plug-in, factory calibrated, OC-3 Oscillator Module. The crystal frequency of the oscillator module determines the operating frequency of the transmitter or receiver. The OC-3 Oscillator Module is a fully contained module that may be purchased separately for installation in the OC-3 Crystal Control Module in order to switch the transmitter or receiver to a new operating frequency.

1.2 OC(R/T)-3 Crystal Control Module Family Models

The OC-3 Crystal Control Module family forms an integral component of the MT-3 receiver and transmitter product line. There are ten distinct models in the OC-3 Crystal Control Module Family. Note that this manual provides service and operating information for all ten Crystal Control Modules. It is important to establish the correct crystal control module model number of interest in order to direct attention to specific documented information. The specific model number is printed on the crystal control module top cover.

The ten models are described as follows:
Frequency Band: 118 - 512 MHz

	OC-3 Model No.	OC-3 Modulation	OC-3 Frequency	Receiver/Transmitter Model No.
1	OCT-3A128	Not Applicable	118 - 138 MHz	VT-3A130CY
2	OCR-3A149	Not Applicable	139 - 159 MHz	VR-3A130CW
3	OCT-3/141	FM	128.6 - 152.6 MHz	VT-3/140/CN, VT-3/140/CW
4	OCT-3/162	FM	150 - 174 MHz	VT-3/160-CN, VT-3/160-CW
5	OCR-3/141	Not Applicable	128.6 - 152.6 MHz	VR-3/160-CN, VR-3/160-CW
6	OCR-3/162	Not Applicable	150 - 174 MHz	VR-3/140/CN, VR-3/140/CW
7	OCT-3/450	FM	406 - 470 MHz	UT-3/420-CN, UT-3/420-CW
	OCT-3/450	FM	406 - 470 MHz	UT-3/460-CN, UT-3/460-CW
8	OCT-3/490	FM	470 - 512 MHz	UT-3/490-CN, UT-3/490-CW
9	OCR-3/450	Not Applicable	406 - 470 MHz	UR-3/420-CN, UR-3/420-CW
	OCR-3/450	Not Applicable	406 - 470 MHz	UR-3/460-CN, UR-3/460-CW
10	OCR-3/490	Not Applicable	470 - 512 MHz	UR-3/490-CN, UR-3/490-CW

The OC-3 Crystal Control models are very similar; all models use the same circuit boards and mechanical construction. The significant differences between the models relates to the Multiplier board. Frequency select components in the multiplier board differentiate the model types.

1.3 Performance Specifications

Frequency Generation:	Crystal Controlled (internal plug-in module: 2 bands).
Frequency Range:	118 MHz - 138 MHz [± 1.0 MHz] (OCT-3A128, OCR-3A149) 128.6 MHz - 152.6 MHz [± 1.0 MHz] (OCT-3/141, OCR-3/141) 150 MHz - 174 MHz [± 1.0 MHz] (OCT-3/162, OCR-3/162) 406 MHz - 470 MHz [± 1.0 MHz] (OCT-3/450, OCR-3/450) 470 MHz - 512 MHz [± 1.0 MHz] (OCT-3/490, OCR-3/490)
Output Power:	+5 dBm ±2 dBm into 50Ω
Harmonics:	<-30 dBc
Spurious:	<-90 dBc <-70 dBc above 400 MHz
Attack Time:	<50 ms (Power down mode)
Hum and Noise:	-55 dB
Modulation Sensitivity:	3.0 kHz peak deviation / 400 mVrms input
External Reference Input:	External reference input signal via SMB connector J1 Input level 0 dBm ± 3 dB. Input impedance 50Ω Input frequency 10.0 MHz or 9.6 MHz selected through digital board jumper JU1.
Standby Current and Rise time:	• 95% RF power, 95% system deviation within; • 25 ms: typically 6 mA (normal configuration); • 10 ms: typically 28 mA (audio circuitry enabled).
Channel Selection:	Internal plug-in oscillator module.
Frequency Stability:	Standard: ±1 ppm, -40°C to +60°C.

1.4 Printed Circuit board Numbering Convention

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

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

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

2 THEORY OF OPERATION

The Crystal Control Module is a complex module comprised of several building blocks each of which contribute a unique function (see Figure 4-1 "OC-3 Crystal Control Module Block Diagram"). The OC-3 Control Board provides power distribution and controls overall module operation. The OC-3 Oscillator Module is a factory temperature compensated module responsible for providing a stable oscillator frequency. The OC-3 Multiplier multiplies the oscillator frequency up to the required operating frequency and the OC-3 Helical Filter drastically reduces all multiplier harmonics and spurious emissions to output a clean RF signal.

2.1 OC-3 Control Board

The OC-3 Control Board provides two functions for the Crystal Control Module. First, it supplies and controls power to the OC-3 Oscillator Module and Multiplier. Second, it performs the frequency compensation algorithm required to maintain the module's ±1 ppm frequency tolerance. The control board is independent of the crystal control module's operating frequency and has no tuning or adjustment points.

Refer to the Control Board component layout and schematic diagram in sections 4.2 and 4.3.

2.1.1 Internal Power

The Crystal Control Module operates from +9.5 Vdc applied to connector pin P1-2. Current drain for the crystal control module is nominally 14 mA for VHF models and 20 mA for UHF models during normal operation and 3.5 mA in standby mode (transmitter only). Regulator IC U1 provides continuously regulated +5.0 Vdc to the microprocessor and digital circuits. Regulator IC U2 supplies regulated +7.0 Vdc exclusively to the oscillator board of the OC-3 Oscillator Module. Jumper JU1 selects the power source for regulator U2. In the 'X' position (factory setting), power is continuously supplied to the oscillator board. In the 'Y' position, power to the oscillator board is supplied to the oscillator board at the same time power is switched on to the multiplier. Power for the OC-3 Multiplier is switched by Q1 which is turned on by applying +9.5 Vdc to crystal control module pin P2-4. For receiver applications, the crystal control module is always operating with the enable line P2-4 being permanently connected to +9.5 Vdc. In transmitter applications, pin P2-4 is controlled by MT-3 Transmitter Board jumper J18 which selects the crystal control module's standby mode.

2.1.2 Microprocessor Operation

The microprocessor in conjunction with timer IC U3 controls frequency compensation of the OC-3 Crystal Control Module. Timer U3 has a clock period of approximately 1 minute set by R6 and C11. Each minute an interrupt request is issued to the microprocessor which then wakes up out of sleep mode and performs the following sequence:

1. Queries the oscillator module for the current temperature.
2. Converts the current temperature to an address for the temperature look-up table.
3. Reads the oscillator module's memory for the compensating D/A value .
4. Writes the compensating D/A value to the oscillator module's D/A.
5. Goes back into low power sleep mode.

The microprocessor only controls the above frequency compensation algorithm, it does not set the frequency of operation so user programming of the microprocessor is not required. The frequency of operation is set by the crystal in the oscillator module. The frequency compensation algorithm is performed each minute, independent of PTT (transmitters) or COR (receivers) activity.

2.2 OC-3 Oscillator Module

The OC-3 Oscillator Module is a compact digitally temperature compensated oscillator. The oscillator module is comprised of two boards: the oscillator board which is the RF oscillator; and the digital board which provides compensation information for the oscillator board to maintain a ±1 ppm frequency tolerance. The crystal installed in the oscillator on the oscillator board determines the Crystal Control Module's frequency of operation. OC-3 Oscillator Modules are factory calibrated for each specific crystal. To change the transmitter or receiver operating frequency, a new OC-3 Oscillator Module should be purchased.

Refer to the Oscillator Board and Digital Board component layouts and schematic diagrams in sections 4.4 and 4.5.

2.2.1 OC-3 Digital Board

The OC-3 Digital Board provides temperature sensing, memory for a look-up table and a D/A converter, all of which are vital for accurate temperature compensation of the crystal oscillator. The digital board also has an op-amp summing circuit which combines the modulation inputs with the temperature compensating voltage from the D/A converter.

Temperature sensing is performed by a DS1620 digital thermometer (U1). Temperature is read from U1 by the microprocessor on the control board in 0.5°C increments from -55°C to +125°C. The microprocessor checks the current temperature to see if it is in the calibration range of the module (-50°C to +90°C). If the current temperature is outside the calibration range, the temperature reading is truncated to -50°C or +90°C depending if the current temperature is too low or too high. The microprocessor then converts the temperature into an address for the look-up table stored in the digital board's memory. A 16 x 256 serial EEPROM (U2) is used to hold the temperature compensation table. Each memory location stores the D/A value required to keep the oscillator on frequency at one specific temperature. The look-up table increments in 0.5°C steps from -50°C to +12°C (addresses 00h to 7Ch) and from +40°C to +90°C (addresses 98h to FCh). From +12°C to +40°C (addresses 7Ch to 98h), the look-up table is incremented in 1°C steps. Addresses FDh, FEh and FFh are reserved for the date and time the module was factory calibrated. The 16 bit temperature compensating value read from the memory is output by the microprocessor to the digital board's D/A (U3). U3 is an LTC1257 which is a 12 bit serial D/A converter; consequently, the upper 4 bits from the memory information are not used. The voltage output from the D/A is summed with the modulation inputs by op-amp U4 before being applied to the oscillator board.

2.2.2 OC-3 Oscillator Board

The OC-3 Oscillator Board uses a fundamental mode Colpitt's oscillator to produce the desired signal. Fundamental mode crystal X51 determines the operating frequency of the oscillator and the crystal control module. The OC-3 Oscillator Module's output frequency is three times the crystal frequency since the output transistor's collector (Q52) is tuned to the third harmonic of the crystal. For all OC(R/T)-3 118 - 174 MHz modules, the OC-3 Oscillator Module's output is tripled by the OC-3 Multiplier so the OC-3 Crystal Control Module's operating frequency is nine times the crystal frequency. For all OC(R/T)-3 406 - 512 MHz modules modules, the OC-3 Oscillator Module's output is tripled twice by the OC-3 Multiplier so the OC-3 Crystal Control Module's operating frequency is twenty-seven times the crystal frequency.

Low distortion modulation capability and frequency stability of ±1 ppm is maintained by applying the summed voltage signal from the OC-3 Digital Board to voltage variable capacitor diodes D51 and D52. Diodes D51 and D52 form part of the crystal's load capacitance so a change in the voltage across the diodes varies their capacitance which in turn changes the oscillator frequency. To compensate for aging characteristics the oscillator may be trimmed onto frequency by variable capacitor C55.

2.3 OC-3 Multiplier

Refer to the Multiplier Board component layouts and schematic diagrams in sections 4.6 through 4.9.

2.3.1 OC(R/T)-3 118 - 159 MHz Multiplier (AM Products)

The OC(R/T)-3 118 - 159 MHz Multiplier has two active stages. The first stage, Q1, triples the input signal from the oscillator module. The second stage is a buffer / amplifier to boost the VHF signal to approximately 9 dBm before it is filtered by the Helical Filter. The OC(R/T)-3 118 - 159 MHz Multiplier has 5 select components which determine the frequency range of the multiplier, either 118 - 138 MHz range exclusively for the AM transmitter or 139 - 159 MHz range exclusively for the AM receiver. Tuning for the multiplier is explained in section 3.5.4.1 "OC(R/T)-3 Crystal Control Module Alignment".

2.3.2 OC(R/T)-3 128.6 - 174 MHz Multiplier (FM Products)

The OC(R/T)-3 128.6 - 174 MHz Multiplier has two active stages. The first stage, Q1, triples the input signal from the oscillator module. The second stage is a buffer / amplifier to boost the VHF signal to approximately 9 dBm before it is filtered by the OC(R/T)-3 128.6 - 174 MHz Helical Filter. The OC(R/T)-3 128.6 - 174 MHz Multiplier has 5 select components which determine the frequency range of the multiplier, either 128.6 - 152.6 MHz or 150 - 174 MHz. Tuning for the multiplier is explained in section 3.5.4.1 "OC(R/T)-3 Crystal Control Module Alignment".

2.3.2 OC(R/T)-3 406 - 512 MHz Multiplier

The OC(R/T)-3 406 - 512 MHz Multiplier has three active stages which provide a nine times frequency multiplication to the input signal from the OC-3 Oscillator Module. The first stage, Q1, triples the input signal from the oscillator module. The second stage, Q2, triples the output from Q1 while the third stage is a buffer / amplifier to boost the UHF signal to approximately 9 dBm before it is filtered by the OC(R/T)-3 406 - 512 MHz Helical Filter. The OC(R/T)-3 406 - 512 MHz Multiplier has 6 select components which determine the frequency range of the multiplier, either 406 - 470 MHz or 470 - 512 MHz. Tuning for the multiplier is explained in section 3.5.4.1 "OC(R/T)-3 Crystal Control Module Alignment".

2.4 OC-3 Helical Filter

The OC-3 Helical Filter is a three section filter which provides output filter for the crystal control module. The filter has a insertion loss of approximately 4 dB, a 3 dB bandwidth of approximately 3.5 MHz and is capable of tuning the entire VHF range without any component changes. The OC-3 Helical Filter reduces spurious and harmonic emissions from the multiplier to output a 'clean' RF signal.

2.5 Crystal Controlled Operating Frequency

The crystal control module is a direct replacement for the synthesizer module and therefore uses the same connections as the synthesizer to connects to the main board (MT-3 Transmitter Main board or MT-3 Receiver IF/Audio board). The channel select lines and switches FSW1 to FSW4 are not used by the crystal control module as the receiver's or transmitter's operating frequency is determined by the crystal control module's crystal frequency.

For OCT-3A128 (118 - 138 MHz), OCT-3/141 (128.6 - 152.6 MHz) and OCT-3/162 (150 - 174 MHz) models:

$$Xtal_{frequency} = \frac{Tx_{frequency}}{9}$$

or

$$Tx_{frequency} = 9 \times Xtal_{frequency}$$

For OCR-3/141 models (128.6 -152.6 MHz):

$$Xtal_{frequency} = \left[\frac{Rx_{frequency} + 21.4 \text{ MHz}}{9}\right]$$

or

$$Rx_{frequency} = [Xtal_{frequency} \times 9] - 21.4 \text{ MHz}$$

For OCR-3A149 (139 - 159 MHz), OCR-3/162 (150 - 174 MHz) models :

$$Xtal_{frequency} = \left[\frac{Rx_{frequency} - 21.4 \text{ MHz}}{9}\right]$$

or

$$Rx_{frequency} = [Xtal_{frequency} \times 9] + 21.4 \text{ MHz}$$

For OCT-3/450 models (406 - 470 MHz) and OCT-3/490 models (470 - 512 MHz):

$$Xtal_{frequency} = \frac{Tx_{frequency}}{27}$$

or

$$Tx_{frequency} = 27 \times Xtal_{frequency}$$

For OCR-3/450 models (406 - 430 MHz) and OCR-3/490 models (470 - 490 MHz):

$$Xtal_{frequency} = \left[\frac{Rx_{frequency} + 21.4\ \text{MHz}}{27} \right]$$

or

$$Rx_{frequency} = [Xtal_{frequency} \times 27] - 21.4\ \text{MHz}$$

For OCR-3/450 models (450 - 470 MHz) and OCR-3/490 models (490 - 512 MHz):

$$Xtal_{frequency} = \left[\frac{Rx_{frequency} - 21.4\ \text{MHz}}{27} \right]$$

or

$$Rx_{frequency} = [Xtal_{frequency} \times 27] + 21.4\ \text{MHz}$$

3 OC-3 CRYSTAL CONTROL MODULE ALIGNMENT

3.1 General

Under normal circumstances, the alignment procedure is accomplished without removing the crystal control module from the MT-3 Receiver IF/Audio Board or the MT-3 Transmitter Board. Alignment involves tuning the OC-3 Multiplier and OC-3 Helical Filter to the operating frequency. Select components (and additional components added for OC(R/T)-3/450 and OC(R/T)-3/490) on the multiplier differentiate the ten model types. The OC-3 Crystal Control Module should be tuned any time the operating frequency is changed in order to optimize performance.

3.2 Repair Note

The OC-3 Crystal Control Module 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 circuit boards.

3.3 Recommended Test Equipment List

Alignment of the OC-3 Crystal Control Module requires the following test equipment or its equivalent.

Dual Power Supply:	Regulated +9.5 Vdc at 2 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
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 OC-3 Control Board Factory Configuration

The OC-3 Crystal Control Module is factory configured as follows:

- Oscillator Board power continuously enabled.

The corresponding jumper settings are:

- Jumper JU1: 'X' position Continuous / Switched Oscillator power - continuous

3.5 OC-3 Crystal Control Module Alignment

3.5.1 General

Under normal circumstances, the alignment procedure is accomplished without removing the crystal control module from the MT-3 Receiver IF/Audio Board or the MT-3 Transmitter Board. Alignment involves tuning the OC-3 Multiplier and OC-3 Helical Filter to the operating frequency.

3.5.2 OC-3 Control Board

There are no adjustments on the OC-3 Control Board; however, there are two main test points which can be probed to see if the control board's power supplies are operating properly. Test point TP1 (refer to page 4-2: OC-3 Control Board Component Layout) measures the power supply for the digital circuitry and should be +5.0 ± 0.1 Vdc. Test point TP2 measures the power supply for the oscillator board and should be +6.75 ± 0.1 Vdc which indicates that the correct current is being drawn by the oscillator board.

3.5.3 OC-3 Crystal Control Module Installation and Removal

Installation of the OC-3 Crystal Control Module is facilitated by alignment pins on each corner of the module. When the four pins are aligned with their corresponding hole in the receiver IF/audio board or transmitter board, push the module down and the necessary connection will be made.

To remove the OC-3 Crystal Control Module, simply remove the center screw from the module lid and pull the module out. The module should be pulled straight out so that the four alignment pins do not bend or damage the circuit board.

3.5.4 OC-3 Crystal Control Module Tuning Procedure

The tuning procedure for the OC-3 Crystal Control Module has three basic steps:

1 - Pretune the helical filter.
2 - Peak the output level by tuning the multiplier and helical filter.
3 - If necessary, tweak the oscillator onto frequency.

1. Turn the transmitter / receiver off and remove the OC-3 Crystal Control Module lid.

2. Connect the OC-3 Crystal Control Module output to a radio communications test set or spectrum analyzer and inject a 0 dBm on-channel signal at the input of the Helical Filter. The input of the communication test set or spectrum analyzer should be able to handle a +15 dBm signal.

3. Tune the three helical filter capacitors for the maximum response. The capacitors' tuning slugs should all be at approximately the same depth. The further in the slugs are in the capacitors the lower the frequency response of the helical filter.

4. For OCT-3A128 and OCR-3A149 models:
   Disconnect the injected signal and turn the transmitter / receiver on. Tune the slugs of L1, L2, L3 and L4 to the middle of the coil. Tune C9 to the top if the operating frequency is near the top of the band (138 MHz for Tx or 159 MHz for Rx), to the bottom if the operating frequency is near the bottom of the band (118 MHz for Tx or 139 MHz for Rx) or proportionately in between for the operating frequency.

   For OC(R/T)-3/141 and OC(R/T)-3/162 models:
   Disconnect the injected signal and turn the transmitter / receiver on. Tune the slugs of L1, L2, L3 and L4 to the middle of the coil. Tune C9 to the top if the operating frequency is near the top of the band (152.6 or 174 MHz), to the bottom if the operating frequency is near the bottom of the band (128.6 or 150 MHz) or proportionately in between for the operating frequency.

   For OC(R/T)-3/450 and OC(R/T)-3/490 models:
   Model:Disconnect the injected signal and turn the transmitter / receiver on. Tune the slugs of L1, L2 and L3 to the middle of the coil. Also set C25, C27 and C33 to the middle of their tuning range. Tune C9 to the top if the operating frequency is near the top of the band (470 or 512 MHz), to the bottom if the operating frequency is near the bottom of the band (406 or 470 MHz) or proportionately in between for the operating frequency.

5. <u>For OCT-3A128, OCR-3A149, OC(R/T)-3/141 and OC(R/T)-3/162 models:</u>
Peak L1, L2, L3 and L4 for maximum signal level. L1 and L2 will have the greatest effect on the signal.

<u>For OC(R/T)-3/450 and OC(R/T)-3/490 models:</u>
Peak L1, L2, L3, C25, C27 and C33 for maximum signal level. L1 and L2 will have the greatest effect on the signal.

6. Tune the helical filter for maximum output level.

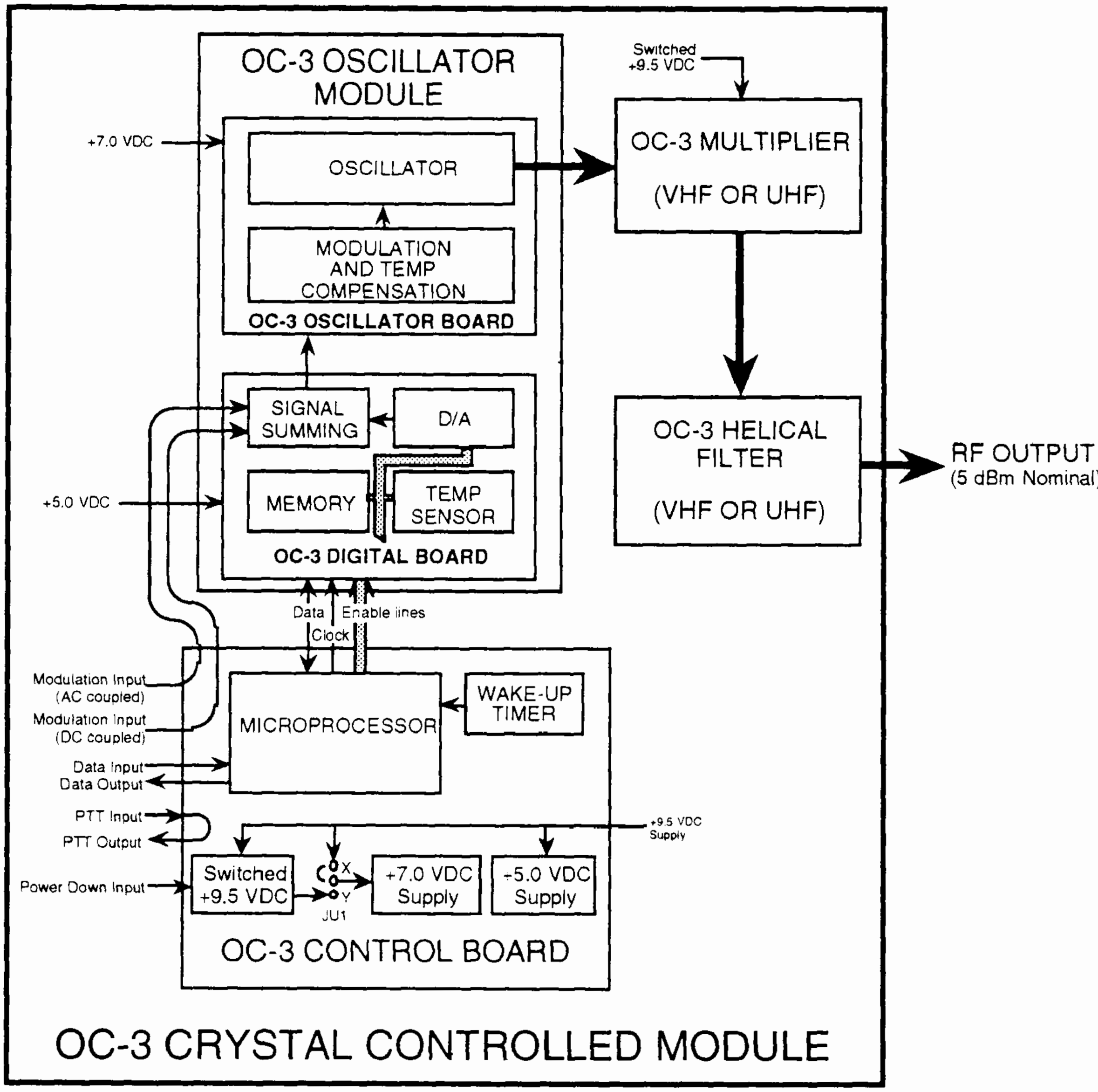
7. Repeat steps 5 and 6 until the maximum output level is achieved. This should be greater than +3 dBm. L52 on the oscillator module may need to be peaked if the proper output level is not achieved.

8. Replace the OC-3 Crystal Control Module lid and if required tune the crystal control module onto frequency by adjusting C9 on the oscillator board (accessible through the hole in the lid).

9. Turn the transmitter / receiver off and reconnect the crystal control module to the amplifier module or IF/audio board.

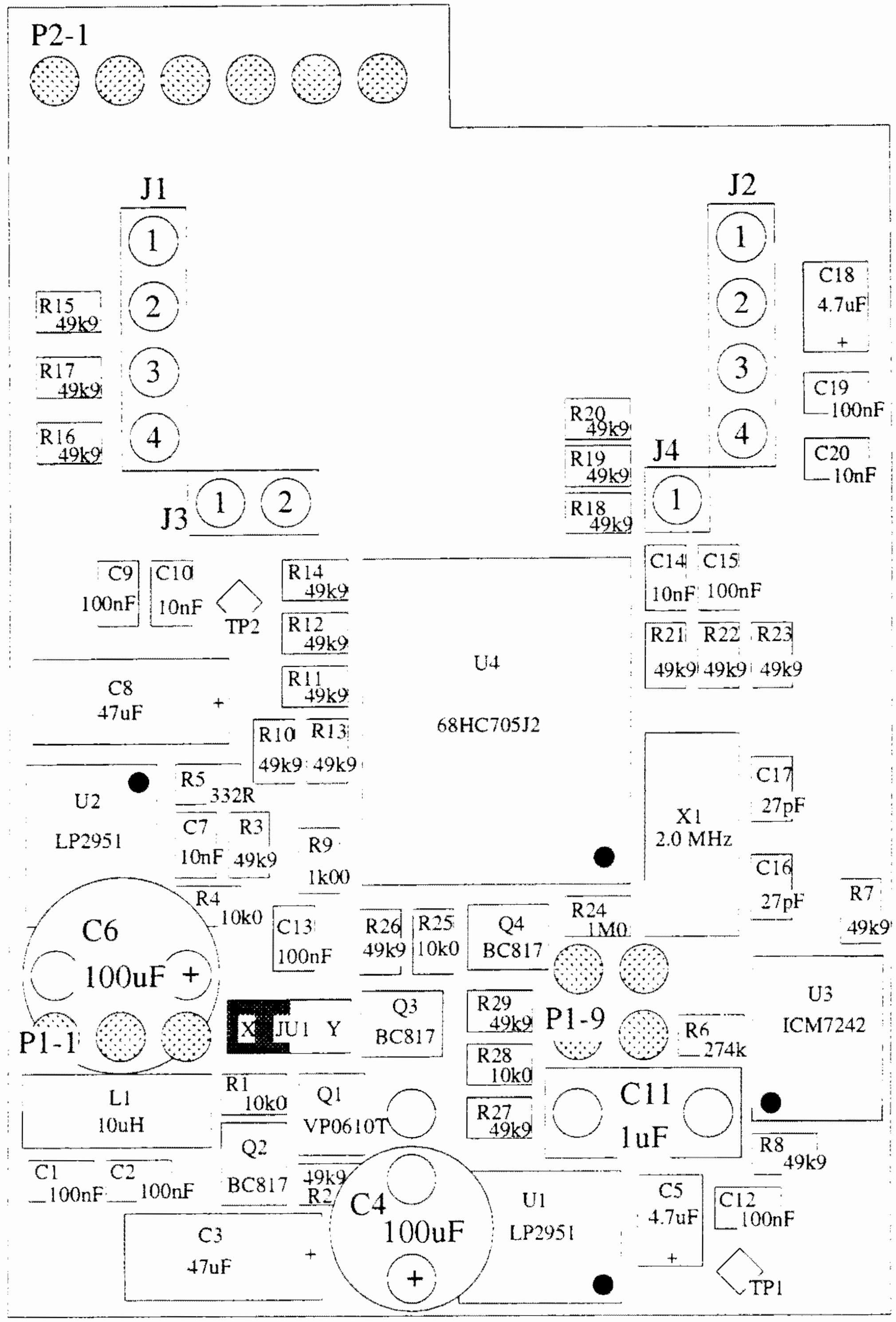
4 ILLUSTRATIONS AND SCHEMATIC DIAGRAMS

4.1 OC-3 Crystal Control Module Block Diagram



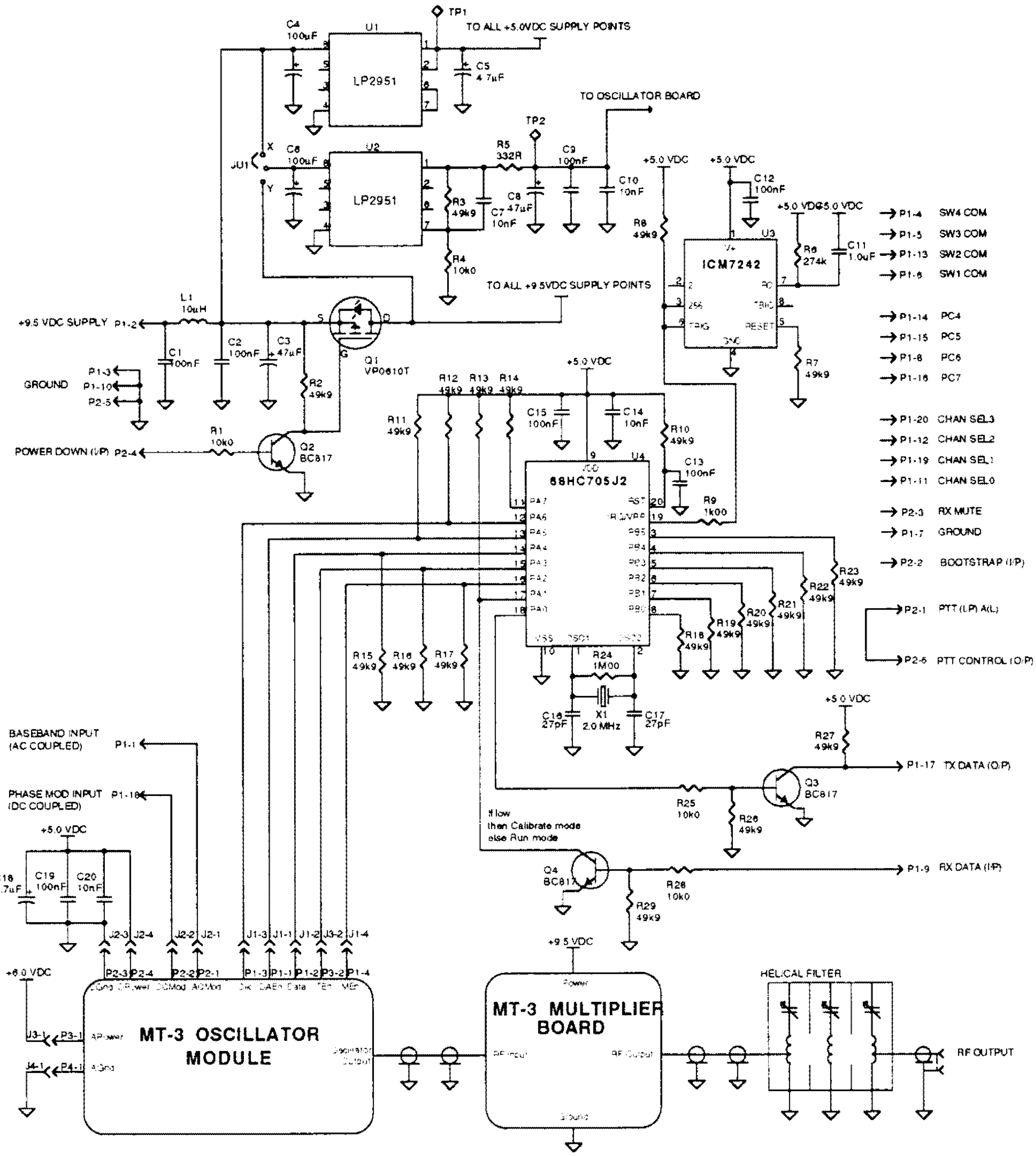
OC3M1B

4.2 OC-3 Control Board Component Layout



OC3M3

4.3 OC-3 Control Board Schematic Diagram

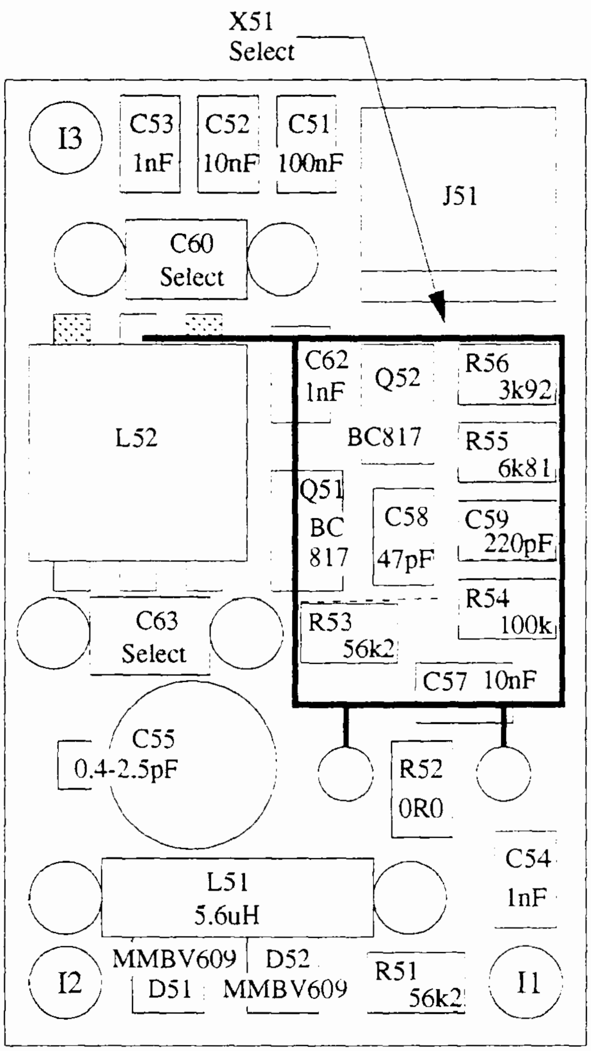


HIGHEST REFERENCE DESIGNATORS		
C20	JU1	L1
R29	U4	X1
REFERENCE DESIGNATORS NOT USED		

DE DANIELS ELECTRONICS		VICTORIA B.C.
TITLE: OC-3 CONTROL BOARD SCHEMATIC DIAGRAM		
DATE: SEPT 1, 1994	DWN: MICHAEL GAUBE	APRVD:
DWG No: OC3M2B	DWG REV DATE: 17 APRIL 1997	
BOARD NO.: 50002-02	BOARD REV: 2.0	

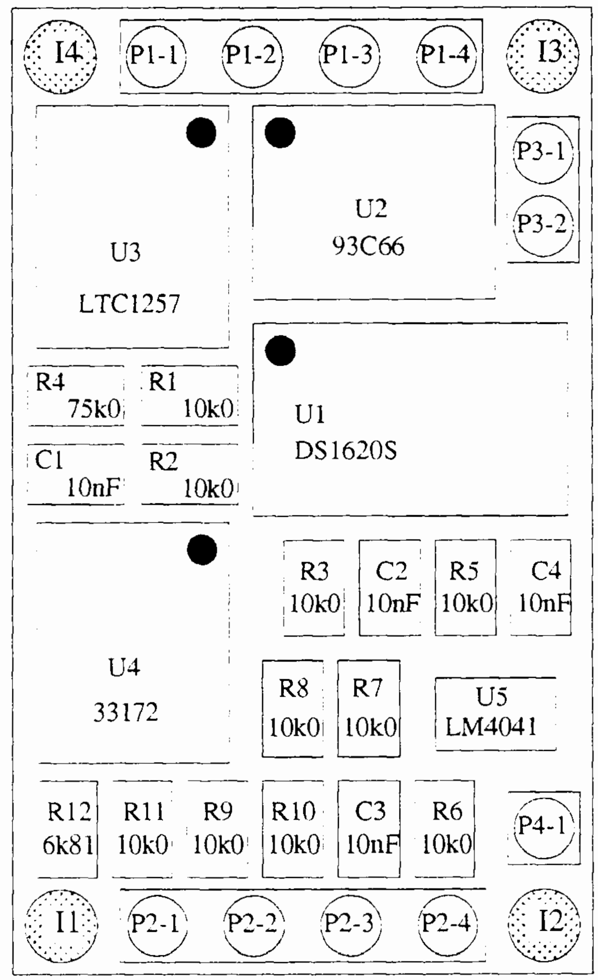
4.4 OC-3 Oscillator and Digital Board Component Layouts

Oscillator Board



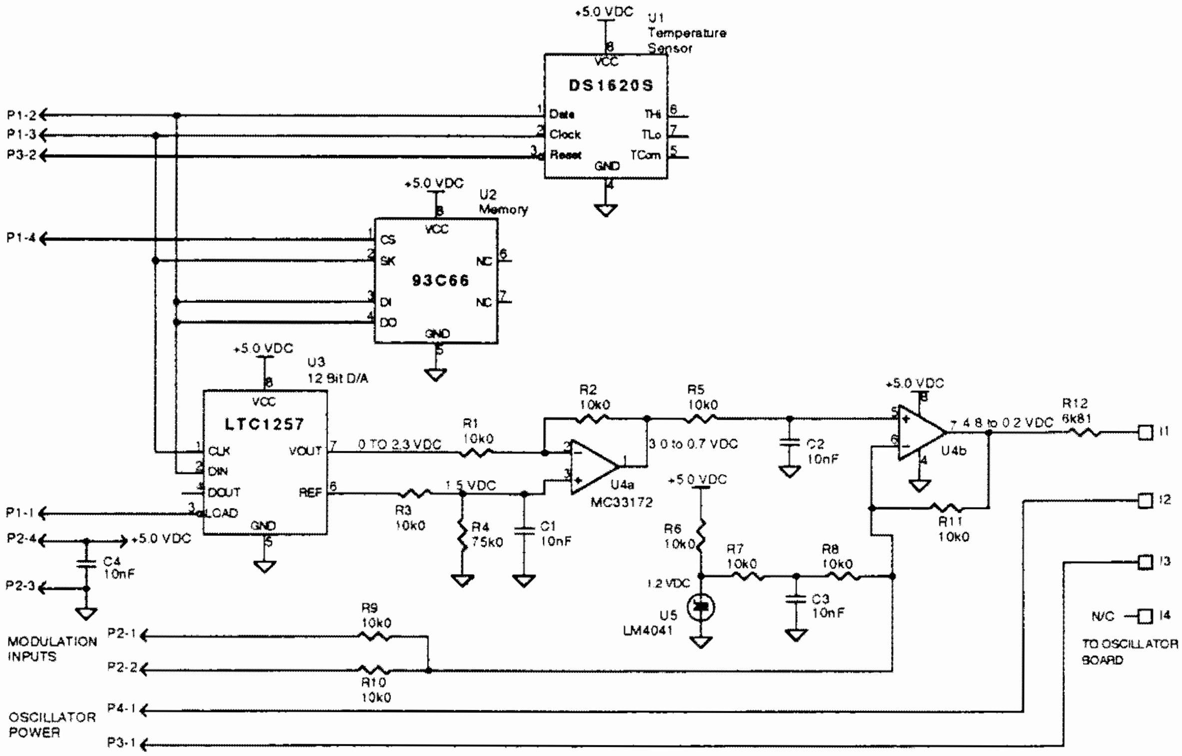
OC3M4

Digital Board



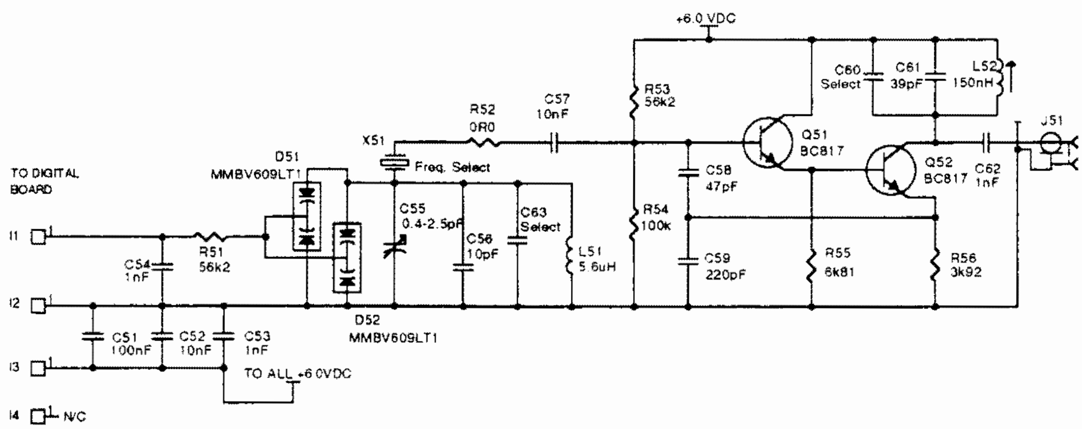
OC3M5

4.5 OC-3 Oscillator and Digital Board Schematic Diagrams



HIGHEST REFERENCE DESIGNATORS		
C3	I4	P4
R12	U5	—
—	—	—
UNUSED REFERENCE DESIGNATORS		
—	—	—
—	—	—
—	—	—

DANIELS ELECTRONICS LTD.	VICTORIA B.C.
TITLE: OC-3 OSCILLATOR MODULE DIGITAL BOARD SCHEMATIC DIAGRAM	
DATE: 01 SEPTEMBER 1994 | DWN BY: MICHAEL GAUBE	APRVD:
DWG No. OC3M6	DWG REV DATE: 18 APRIL 1997
BOARD No. 43-934011	BOARD REV: 1.1



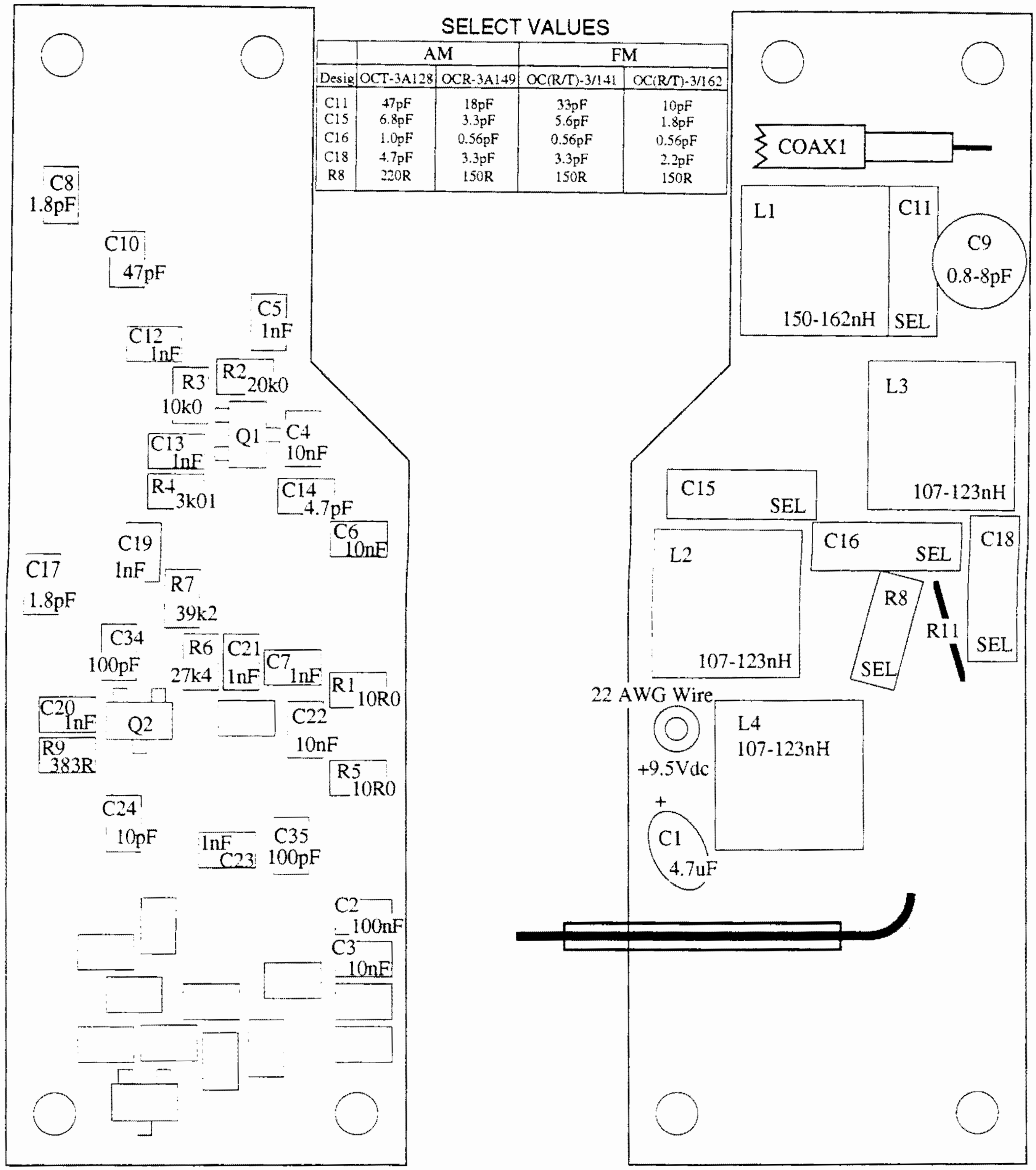
HIGHEST REFERENCE DESIGNATORS		
C63	D52	I4
J51	L52	Q52
R56	X51	—
UNUSED REFERENCE DESIGNATORS		
C1-C50	D1-D50	J1-J50
L1-L50	Q1-Q50	R1-R50
X1-X50	—	—

DANIELS ELECTRONICS LTD.	VICTORIA B.C.
TITLE: OC-3 OSCILLATOR MODULE OSCILLATOR BOARD SCHEMATIC DIAGRAM	
DATE: 01 SEPTEMBER 1994 | DWN BY: MIKE GAUBE	APRVD:
DWG No: OC3M7	DWG REV DATE: 18 APRIL 1997
BOARD No: 43-933912	BOARD REV:

4.6 OC(R/T)-3 118 - 174 MHz Multiplier Component Layout

SELECT VALUES

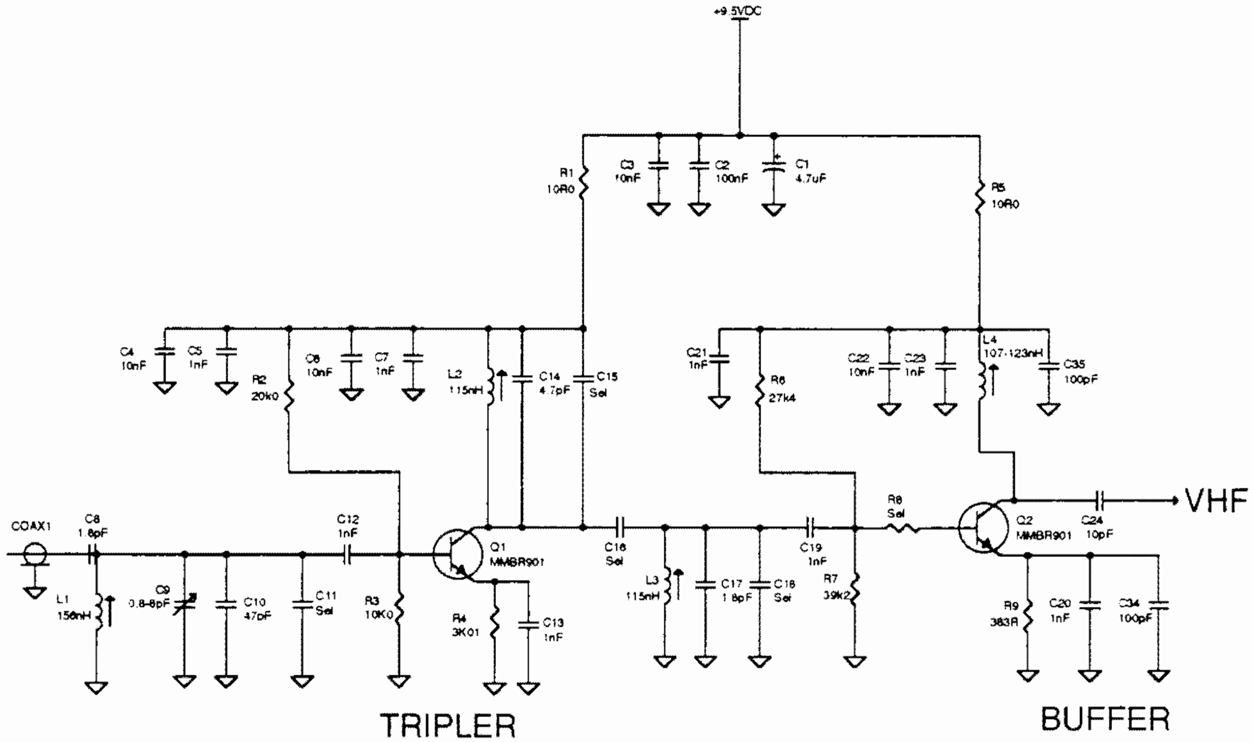
	AM		FM	
Desig	OCT-3A128	OCR-3A149	OC(R/T)-3/141	OC(R/T)-3/162
C11	47pF	18pF	33pF	10pF
C15	6.8pF	3.3pF	5.6pF	1.8pF
C16	1.0pF	0.56pF	0.56pF	0.56pF
C18	4.7pF	3.3pF	3.3pF	2.2pF
R8	220R	150R	150R	150R



ALL TRANSISTORS ARE
MMBR901

OC3M8

4.7 OC(R/T)-3 118 - 174 MHz Multiplier Schematic Diagram



SELECT VALUES

	AM		FM	
Desig	OCT-3A128	OCR-3A149	OC(R/T)-3/141	OC(R/T)-3/162
C11	47pF	18pF	33pF	10pF
C15	6.8pF	3.3pF	6.8pF	2.2pF
C16	1.0pF	0.56pF	0.56pF	0.56pF
C18	4.7pF	3.3pF	2.2pF	Not Installed
R8	220R	150R	150R	100R

HIGHEST REFERENCE DESIGNATORS		
C35	COAX1	L4
Q2	R9	

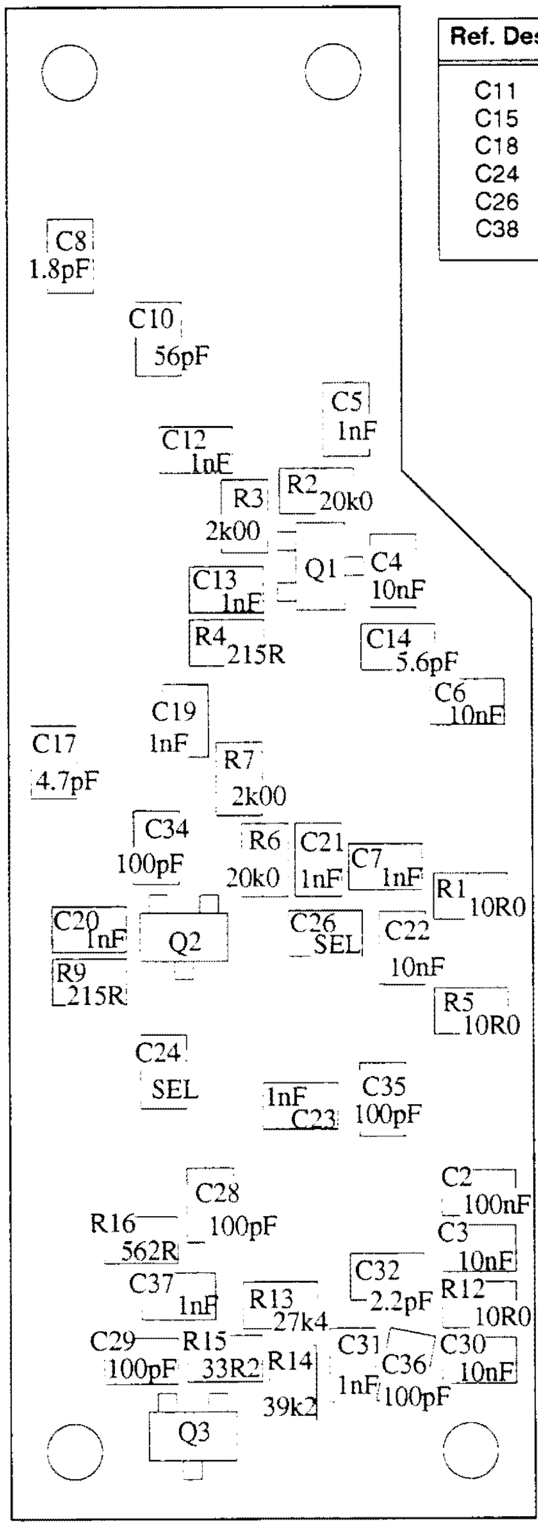
HIGHEST REFERENCE NOT USED		
C25-C33		

DE DANIELS ELECTRONICS		VICTORIA B.C.	
TITLE:	OC-3/150 CRYSTAL MODULE MULTIPLIER BOARD		
DATE: AUG 28 1995	DWN: MICHAEL GAUBE	APRVD:	
DWG No: OC3M9		DWG REV DATE: 14 JULY 1997	
BOARD NO: 43-934112		BOARD REV: 1.2	

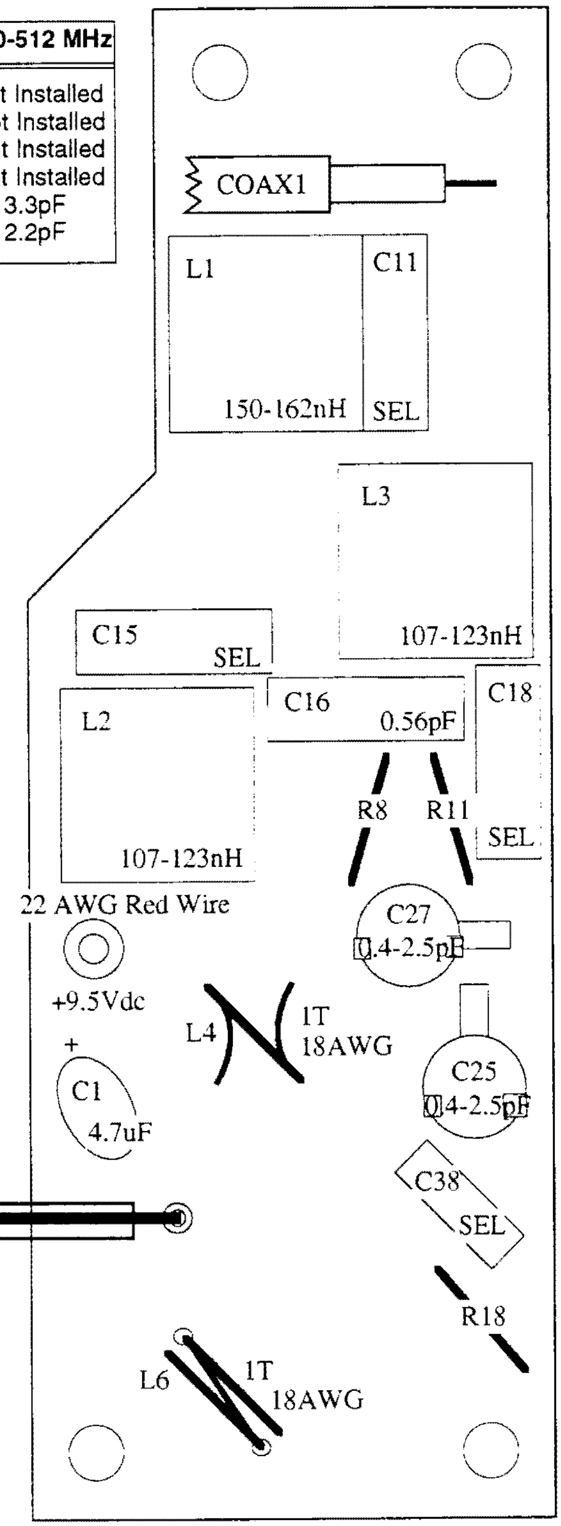
4.8 OC(R/T)-3 406 - 512 MHz Multiplier Component Layout

SELECT VALUES

Ref. Des.	406-470 MHz	470-512 MHz
C11	12pF	Not Installed
C15	3.3pF	Not Installed
C18	2.7pF	Not Installed
C24	3.3pF	Not Installed
C26	4.7pF	3.3pF
C38	4.7pF	2.2pF

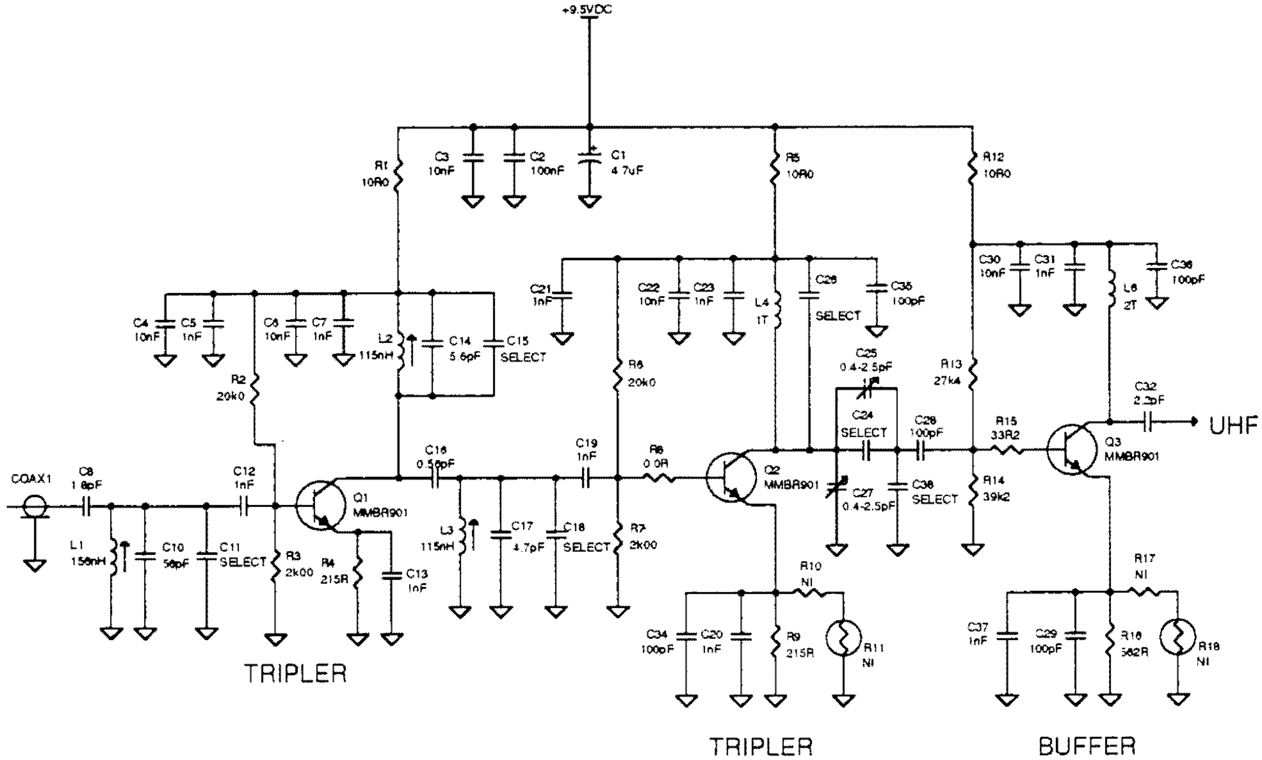


ALL TRANSISTORS ARE
MMBR901



OC3M10

4.9 OC(R/T)-3 406 - 512 MHz Multiplier Schematic Diagram



FREQUENCY RANGE		
PART	400-470 MHz	470-512 MHz
C11	12pF	N.I
C15	3.3pF	N.I
C18	2.7pF	N.I
C24	3.3pF	N.I
C26	4.7pF	3.3pF
C38	4.7pF	2.2pF

HIGHEST REFERENCE DESIGNATORS		
C38	COAX1	L6
Q3	R18	
REFERENCES NOT USED		
L5	C9	C33

DE DANIELS ELECTRONICS		VICTORIA B.C.
TITLE: OC-3/400 CRYSTAL MODULE MULTIPLIER BOARD		
DATE: AUG 28, 1995	DWN: MICHAEL GAUBE	APRVD:
DWG No: OC3M11	DWG REV DATE: 25 OCT 1996	
BOARD NO: 43-934112	BOARD REV.: 1.2	