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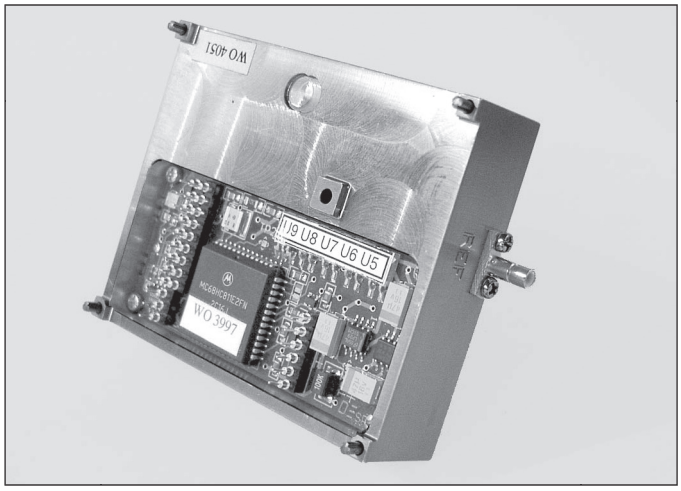

ENHANCED FM SYNTHESIZER INSTRUCTION MANUAL

29-470MHZ

Covers Models:	
OSR-3H061	OST-3H035
OSR-3H141	OST-3H045
OSR-3H162	OST-3H141
OSR-3H440	OST-3H162
OST-3H440	

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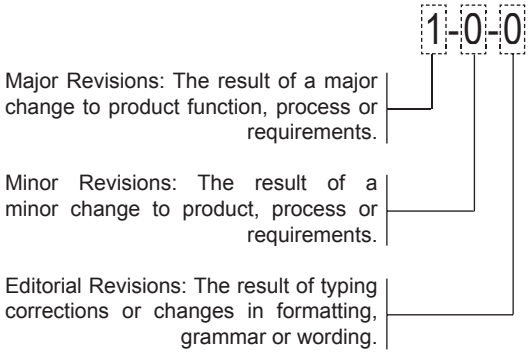
Daniels Electronics Ltd. utilizes a three-level revision system. This system enables Daniels to identify the significance of a revision. Each element of the revision number signifies the scope of change as described in the diagram below.



Three-level revision numbers start at 1-0-0 for the first release. The appropriate element of the revision number is incremented by 1 for each subsequent revision, causing any digits to the right to be reset to 0.

For example:
If the current revision = 2-1-1 Then the next major revision = 3-0-0
If the current revision = 4-3-1 Then the next minor revision = 4-4-0
If the current revision = 3-2-2 Then the next editorial revision = 3-2-3

The complete revision history is provided at the back of the document.

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.

Contents

MANUAL SECTION LOCATOR

To help determine the correct section for the synthesizer in question, refer to this chart.

It is important to establish the correct synthesizer model number, as documentation is model-specific. The model number can be found on the synthesizer label, located on the synthesizer module top cover.

	Transmitters			Receivers		
Radio Frequency	**Transmitter Model & Frequency Range**	**Enhanced Synthesizer Model & Synthesizer Frequency**	**Location in Manual**	**Receiver Model & Frequency Range**	**Enhanced Synthesizer Model & Synthesizer Frequency**	**Location in Manual**
VHF Low Band 29-50MHz	VT-3H035 29-38MHz	OST-3H035 29-38MHz	See Page 3 Enhanced FM Synthesizer OS(R/T)-3H 29-71.4MHz	VR-3H035 29-38MHz	OSR-3H061 50.4-71.4MHz	See Page 3 Enhanced FM Synthesizer OS(R/T)-3H 29-71.4MHz
	VT-3H045 38-50MHz	OST-3H045 38-50MHz		VR-3H045 38-50MHz		
VHF 132-174MHz	VT-3/140 132-150MHz	OST-3H141 132-150MHz	See Page 31 Enhanced FM Synthesizer OS(R/T)-3H 128.6-174MHz	VR-3H140 132-150MHz	OSR-3H162 153.4-171.4MHz	See Page 31 Enhanced FM Synthesizer OS(R/T)-3H 128.6-174MHz
	VT-3/160 150-174MHz	OST-3H162 150-174MHz		VR-3H160 150-174MHz	OSR-3H141 128.6-152.6MHz	
UHF 406-470MHz	UT-3/420 406-430MHz	OST-3H418 406-430MHz	See Page 59 Enhanced FM Synthesizer OS(R/T)-3H 406-470MHz	UR-3H420 406-430MHz	OSR-3H440 427.4-451.4MHz	See Page 59 Enhanced FM Synthesizer OS(R/T)-3H 406-470MHz
	UT-3/460 450-470MHz	OST-3H460 450-470MHz		UR-3H460 450-470MHz		

Note that the operating frequency of the synthesizers in receivers is different from the receive frequency of the radio itself. This is due to the 21.4MHz IF Offset correction factor, and is described in each section.

29-71.4MHZ ENHANCED FM SYNTHESIZER

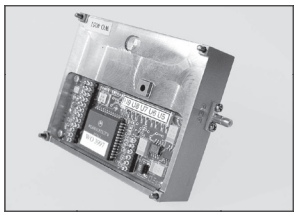
Covers Models:

OST-3H035

OST-3H045

OSR-3H061

	Transmitters			Receivers		
Radio Frequency	Transmitter Model & Frequency Range	Enhanced Synthesizer Model & Synthesizer Frequency	Location in Manual	Receiver Model & Frequency Range	Enhanced Synthesizer Model & Synthesizer Frequency	Location in Manual
VHF Low Band 29-50MHz	VT-3H035 29-38MHz	OST-3H035 29-38MHz	Enhanced FM Synthesizer OS(R/T)-3H 29-71.4MHz	VR-3H035 29-38MHz	OSR-3H061 50.4-71.4MHz	Enhanced FM Synthesizer OS(R/T)-3H 29-71.4MHz
	VT-3H045 38-50MHz	OST-3H045 38-50MHz		VR-3H045 38-50MHz		
VHF 132-174MHz	VT-3/140 132-150MHz	OST-3H141 132-150MHz	See Page 31 Enhanced FM Synthesizer OS(R/T)-3H 128.6-174MHz	VR-3H140 132-150MHz	OSR-3H162 153.4-171.4MHz	See Page 31 Enhanced FM Synthesizer OS(R/T)-3H 128.6-174MHz
	VT-3/160 150-174MHz	OST-3H162 150-174MHz		VR-3H160 150-174MHz	OSR-3H141 128.6-152.6MHz	
UHF 406-470MHz	UT-3/420 406-430MHz	OST-3H418 406-430MHz	See Page 59 Enhanced FM Synthesizer OS(R/T)-3H 406-470MHz	UR-3H420 406-430MHz	OSR-3H440 427.4-451.4MHz	See Page 59 Enhanced FM Synthesizer OS(R/T)-3H 406-470MHz
	UT-3/460 450-470MHz	OST-3H460 450-470MHz		UR-3H460 450-470MHz		



GENERAL INFORMATION

INTRODUCTION

The OS(R/T)-3H Synthesizer is a compact, fully shielded and environmentally rugged frequency synthesis module that is the nucleus of every MT-3 synthesized Receiver and Transmitter radio module. The OS(R/T)-3H generates a high stability, low distortion radio frequency signal in one of several frequency bands. The OS(R/T)-3H utilizes an internal temperature compensated 9.6 or 10.0MHz reference to produce a signal stable to ±1 ppm within the temperature range of -40°C to +60°C. Alternately, the OS(R/T)-3H can be disciplined by an external 9.6MHz or 10MHz reference of higher stability. All synthesizer modules are designed to be easily removed for programming, calibration and/or repair. The synthesizer circuitry is distributed between two printed circuit boards (PCBs) which are isolated yet interconnected via photo-logic optical transceivers that effectively eliminate residual electrical noise between digital and analog circuitry. Further shielding of the synthesizer's RF filter circuitry is provided by an internal shielded enclosure.

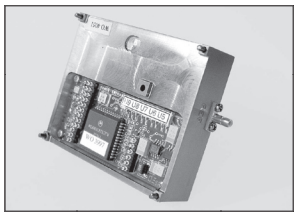
OS(R/T)-3H ENHANCED SYNTHESIZER FAMILY MODELS

The OS(R/T)-3H Synthesizer Module is utilized in both the MT-3 Receiver and Transmitter product lines. In MT-3 Transmitters, the OS(R/T)-3H synthesizer provides a modulated, low-level RF signal to the Power Amplifier module. In MT-3 Receivers, the OS(R/T)-3H synthesizer provides a low noise local oscillator (LO) signal that either directly drives the mixer circuitry or first drives a buffer amplifier which precedes the mixer circuitry (if a higher LO drive signal is required for enhanced intermodulation capability).

All OS(R/T)-3H FM Enhanced Synthesizer Modules, regardless of the frequency band, use the same digital PCB and mechanical construction. There are, however, significant differences between the various models when it comes to the analog PCB. Each model's specific sub-band of operation within a given frequency band is determined through SELECT components on the corresponding analog board.

PERFORMANCE SPECIFICATIONS

Type:	Narrow band FM, Single loop synthesizer module utilizing low noise VCO and PLL technology. Compatible with Daniels' MT-3 Series Transmitter and Receiver modules.
Frequency Range (Tuning range with no adjustment is shown in [ ] brackets.):	29MHz-38MHz [±0.5MHz] (OST-3H035) 38MHz-50MHz [±1.0MHz] (OST-3H045) 50.4MHz-71.4MHz [±1.0MHz] (OSR-3H061)
Output Power:	+5dBm ±2dBm into 50 Ω
Harmonics:	<-30 dBc
Spurious:	<-90 dBc
Hum and Noise:	>55 dB
Modulation Sensitivity:	3.0kHz peak deviation (400mVrms input)
External Reference Input:	External reference input signal via SMB connector J1 Input level 0dBm ±3 dB Input impedance 50 Input frequency 10.0MHz or 9.6MHz selectable through digital board jumper JU1
Power Requirements:	Normal Configuration: +9.5VDC @ 160mA Low Current Standby Mode (TCXO enabled): +9.5VDC @ 14mA



THEORY OF OPERATION

THEORY OF OPERATION

Internal Power and Control (Digital Board)

The synthesizer operates from a +9.5VDC power source applied to connector pin P1-2. Total current draw is approximately 160mA. POWER DOWN control line P2-4 controls the +5.0VDC microcontroller regulator U2 through power MOSFET switch U1. For receiver applications the synthesizer is always ON, with the enable line P2-4 directly connected to +9.5VDC. For transmitter applications, pin P2-4 is controlled by the MT-3 Transmitter Board jumper J18 which selects the synthesizer standby mode. In Low Current Standby Mode, less than 14mA is drawn, however, a delay of approximately 50ms from PTT activation to transmitter turn on is then required to allow for the synthesizer to lock. In Normal Mode, with the synthesizer ON continuously, less than 10ms delay is encountered. This capability comes at the expense of additional standby current (160mA).

Synthesizer Analog Circuitry (Analog Board)

The Analog Board utilizes four optical receivers (U1–U4) and one optical transmitter (U5) to provide an isolated data interface to the digital board. The regulator IC U8 provides a continuous +5.0VDC to the internal TCXO and power control optical receiver U1 when ever +9.5VDC is applied to the synthesizer's voltage terminals. The analog board's main power is turned on and off by driving the optical receiver U1. U1 is driven by U4 on the digital board, which is controlled by the microcontroller. The main power regulators are provided by U6 and U7. Regulator U6 provides switched +8.0VDC and regulator U7 proves switched +5.0VDC. The power MOSFET IC U9 works as a clamping circuit to quickly discharge the VCO filter capacitors C32 and C33; when U9 is powered down the RF output from the VCO is suppressed almost immediately.

At the heart of the OS(R/T)-3H Enhanced Synthesizer is U10 a low power, single chip PLL synthesizer IC. U10 is setup to use a 9.6 or 10.0MHz reference signal provided either from the internal TCXO (with JU1-B selected) or from the external SMB connector J1 (with JU1-A selected). The reference signal's frequency is selected by jumper JU2 on the digital board; 9.6MHz is selected if JU2 is not installed and 10MHz if JU2 is installed. If an external reference signal is used it must be sinusoidal, low phase noise, and highly stable with an output power of 0dBm ±3dBm. A poor quality reference source will degrade the receiver or transmitter performance to unacceptable levels. The external reference is buffered by transistor Q2 on the analog board, which has 50Ω input impedance at 10.0MHz. The internal TCXO reference of 10.0MHz provides better than ±1ppm frequency stability from -30°C to +60°C (-40°C to +60°C optional). The TCXO fine frequency adjustment is made through potentiometer RV1, which is accessible through the synthesizer's top cover.

The 9.6 or 10.0MHz reference source is divided down to establish a channel selection step size of 5.0 or 6.25kHz. A third order passive loop filter comprised of C37, C38, C39, C45, C49, R36 and R32 are employed to achieve the required noise performance, modulation and worst case switching time of 50ms. A small sample of RF energy is coupled from the VCO output buffer U16 to the synthesizer IC U10 prescaler input (pin 11). FM modulation of the VCO from approximately 100Hz to 3kHz is achieved through the baseband input pin P1-1 on the Digital Board. A 1kHz sine wave with a level of approximately 400mVrms at P1-1 provides FM deviation of 3.0kHz. SMB connector J2 provides an RF output level of approximately +5dBm into a 50Ω load.

An optional low frequency modulation input is provided through connector P1-18 on the digital board, and routed to the analog board via connector P3. This modulation input is coupled to a low impedance DC coupled source. The input provides a phase modulated bandwidth from 0Hz (DC) to the PLL loop filter bandwidth. This allows for specialized applications such as paging or trunking where a separate low frequency digital/analog modulation channel is required. The phase modulation input on the digital board, connector P1-18, is routed to the transmitter's audio processor pin P4-2 via JA4-2 on the MT-3 transmitter's main board. It should be noted that any application that uses the direct TCXO modulation port transfers control of the synthesizer's steady state frequency setting to the external modulation source. The internal TCXO frequency control potentiometer RV1 is then effectively removed from the circuitry.

A lock detect LED on the synthesizer's analog board (LED1) indicates an unlocked PLL condition. An unlocked PLL condition normally indicates that the VCO is not tuned within the lock in range of the desired channel frequency. In a transmitter, the loss of lock will prevent a PTT from keying the power amplifier module, thus preventing the transmission of a spurious output signal. Adjusting capacitor C24 will normally re-establish a frequency lock within the synthesizer's frequency range. The optical transmitter U5 on the analog board is also activated in an unlocked condition and enables the micro controller on the digital board to respond to the unlocked PLL condition.

The field effect transistor Q5 forms part of the negative resistance VHF amplifier oscillator that is tuned on-frequency by the combination of the resonator L5 and the total capacitive reactance presented across L5 through capacitors C62, C63, C64, C23 (Select), variable capacitor C24, and varactor diodes D1 and D2. Fine frequency adjustment is obtained via the multi-turn trimmer capacitor C24 in conjunction with the coarse frequency jumper selections JU2, JU3 and JU4. Select capacitor values are chosen to position the operating frequency in one of three bands: 29-38MHz, 38-50MHz or 50.4-71.4MHz. Varactor diodes D1 and D2 provide oscillator frequency control. The PLL control voltage, at the output of the low-pass loop filter (TP4), controls the VCO frequency through the reverse biasing of varactor diodes D1 and D2. The PLL control voltage can range between ≈ +0.5VDC and +4.5VDC and is nominally set to ≈ +2.3VDC at the synthesizer centre frequency. Setting of the PLL control voltage test point (TP4) is achieved by adjusting fine frequency variable capacitor C24 combined with binary weighted lumped capacitor coarse frequency jumpers (JU2, JU3, JU4). External baseband frequency modulation is provided through connection P1 and a voltage divider network formed by R21 and R22. A large signal division ratio, established by the resistive dividers R21 and R22, allows low deviation (less than 5kHz) direct frequency modulation of the VCO output signal.

The PLL low-pass filter is formed by SELECT components C37, C38, C39, C45, R32 and R36. The loop filter response is optimized for switching time, noise and modulation requirements specific to each sub-band within the 29-71.4MHz frequency range. The SELECT components (including the loop filter) can be found in tabular format on the VHF OS(R/T)-3H 29-71.4MHz Analog Board Schematic diagram.

RF output power is taken from the source of Q5 and amplified/buffered by U11. U15 provides further amplification and isolation while delivering approximately +10dBm into a six-pole low-pass notch formed by C53, C57, C58, C59, L11 and L13. The six pole output filter, with a cutoff frequency of 50MHz for models OST-3H035 and OST-3H045 or 80MHz for the OSR-3H061 effectively eliminates output harmonics. SMB connector J2 provides interconnection to the companion transmitter or receiver with an output level of +5dBm ±2dBm.

Synthesizer Digital Circuitry (Digital Board)

The synthesizer's digital board circuitry generates control signals utilized within the synthesizer. The microcontroller U4 on the digital board: communicates with the synthesizer's PLL IC U10 on the analog board; monitors the synthesizer lock detect; manages the PTT input and output; and determines the operating frequency by reading the channel code number information from either the four rotary binary coded decimal (BCD) switches mounted on the transmitter or receiver's main board, or by reading the four externally driven channel select lines. The microcontroller U4 is also designed to communicate with Daniels' Synthesizer Channel Programmer (CP-SC-3) through I/O lines TX Data (P1-17), RX Data (P1-9) and Bootstrap (P2-2). This external programmer places the operating program in non-volatile microprocessor memory and programs up to 15 user defined channel code numbers. An internal "watchdog" timer provides robust software protection in all operating modes.

Data communication between the digital and analog circuit boards is achieved through four optical transmitters (U5 through U8) and one optical receiver (U9). The optical interface provides a fully isolated inter-board data communications link designed to prevent digital noise from interfering with the sensitive PLL circuitry.

BCD Switch Frequency Control

Selection of the desired synthesizer output frequency is straightforward. If all four of the CHANNEL SELECT lines (CHAN SEL3-CHAN SEL0) are pulled low (to GND), the synthesizer will scan the four BCD switches (FSW1- FSW4) located on the receiver or transmitter main boards via connections SW1 COM-SW4 COM and PC4-PC7 and establish the operating frequency from these switches. The four CHANNEL SELECT lines, CHAN SEL3-CHAN SEL0, are connected via the MT-3 transmitter or receiver main board module connector to the M3 motherboard subrack. These lines are by default normally pulled low (to GND) via jumpers located on the M3 motherboard subrack.

If any one of the CHANNEL SELECT lines are pulled high (to +9.5VDC), then the synthesizer's frequency of operation will be determined by the CHANNEL SELECT lines and not the BCD switches. Up to 15 separate channel frequencies can be pre-programmed into a 'table' in non-volatile microprocessor memory and accessed through binary interpretation of the CHANNEL SELECT lines. The most significant bit (MSB) in the CHANNEL SELECT binary code is represented by CHAN SEL3 and the least significant bit (LSB) is represented by CHAN SEL0. For example, if all CHANNEL SELECT lines are pulled high, (i.e. binary '1111') then the 15th frequency entry in the internal channel table will be selected. The channel table is normally pre-programmed at the factory to user specifications, but may be programmed in the field using Daniels' Synthesizer Channel Programmer (CP-SC-3).

In transmitters, the synthesizer operating frequency is the transmitter operating frequency. For receivers the synthesizer's operating frequency is 21.4MHz above the receiver frequency. Refer to the Channel Designation Table Manual for a channel code number versus frequency table.

Synthesizer Base and Frequency Increments

The OS(R/T)-3H Synthesizer operates in frequency increments of 5.0/6.25kHz. The Base Frequency for any given synthesizer model is the lowest frequency generated.

Model Number	Freq. Range	Base Freq.	Freq. Increment
OST-3H035	29-38MHz	29MHz	5.0/6.25kHz
OST-3H045	38-50MHz	29MHz	5.0/6.25kHz
OSR-3H061	50.4-71.4MHz	50.4MHz	5.0/6.25kHz

5.0/6.25kHz Channelization

The OS(R/T)-3H synthesizers have been designed to generate frequencies in both 5.0 kHz and 6.25 kHz channel increments. The frequency increments are determined by the channel code number range. The channel code numbers from 0000 to 4999 increment the frequency in 5.0 kHz increments, and channel code numbers from 5000 to 9999 increment the frequency by 6.25 kHz increments. The channel code number is either stored in the synthesizer's memory or by the BCD switches on the transmitter or receiver's main board. The channel number determines where the channel code number is retrieved from; channel 1 is stored by the BCD switches, and channels 2 through 16 are stored in the synthesizer's memory.

To calculate the operating frequency for the OS(R/T)-3H from the channel code numbers refer to the Channel Table Instruction Manual or the calculations below.

BCD switch settings from 0000 to 4999:

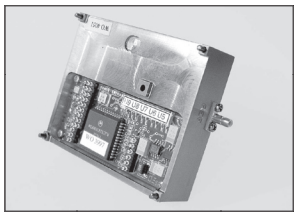
Multiply the switch setting by 5.0kHz and add the result to the synthesizer base frequency.

Example: An OST-3H045 synthesizer has a base frequency of 29MHz. The selected channel number is 0988. The *synthesizer* output frequency is: ((988 x 5kHz) +29MHz) = 33.940MHz

BCD switch settings from 5000 to 9999:

Subtract 5000 from the switch setting. Multiply the result by 6.25kHz and add the result to the synthesizer base frequency.

Example: An OST-3H035 synthesizer has a base frequency of 29MHz. The selected channel number is 7205. The *synthesizer* output frequency is: (((7205-5000) x 6.25kHz) +29MHz) = 42.78125MHz



SYNTHESIZER ALIGNMENT

GENERAL

OS(R/T)-3H enhanced synthesizer alignment is simplified by using a Type 84 subrack and RF extender card/cable for providing receiver or transmitter power and signal interconnection. Alternately, a +9.5VDC may be directly connected to a receiver or transmitter module with the positive connection on pins B6/Z6 and the negative connection on pins B30/ Z30/B32/Z32. The receiver's balanced audio output (600Ω) is available at pins B26 and Z26. The transmitter's balanced audio output (600Ω) is available at pins B18 and Z18.

REPAIR NOTE

The OS(R/T)-3H synthesizer employs a large number of surface mount components. Removal and/or replacement of surface mount components should never be performed using an ordinary soldering iron but should only be performed at surface mount rework and repair stations equipped with Electrostatic Discharge (ESD) protection.

When removing Surface Mount Solder Jumpers, it is recommended that a solder wick braid be used in lieu of vacuum type de-soldering tools to help prevent damage to the printed circuit boards.

RECOMMENDED TEST EQUIPMENT

Synthesizer alignment requires the following test equipment, or its equivalent:

Power supply-Regulated +9.5VDC at 2 A. Phillips PM 2811

Oscilloscope/Multimeter-Fluke 97 Scopemeter

Radio communications test set-Marconi Instruments 2965A

It is recommended that the radio communications test set be referenced to an external high stability frequency source (WWVH, GPS, Loran C) so that the OS(R/T)-3H internal high stability local oscillator may be accurately set to within its ±1 ppm frequency tolerance.

OS(R/T)-3H SYNTHESIZER FACTORY CONFIGURATION

The OS(R/T)-3H Synthesizer is factory configured as follows:

Internal 9.6 or 10.0MHz reference selected.

VCO modulation (via audio processor) enabled (OST TX versions only)

The corresponding synthesizer jumper settings are:

Digital Board

Jumper JU2	installed 10.0MHz reference frequency selected (default)
Jumper JU2	not installed 9.6MHz reference frequency selected (default)
Jumper JU1	not installed AM Multichannel mode selected (default)

Analog Board

Jumper JU1:	'B' position Internal TCXO reference frequency selected (default)

OS(R/T)-3H SYNTHESIZER ALIGNMENT PROCEDURE

General

Synthesizer alignment is normally accomplished with the synthesizer installed in the MT-3 Receiver IF/Audio Board or the MT-3 Transmitter Main Board. The alignment procedure involves setting the internal TCXO reference frequency, the internal reference option is enabled. This step is described in 'Reference Frequency Alignment' in this section. A change in operating frequency from the initial factory setting that exceeds the synthesizer's maximum tuning range (Refer to Specifications) requires a more involved alignment procedure as described below. The conversion of a synthesizer from an internal reference to an external reference or vice-versa is accomplished through the selection of jumper JU1 A (for external) or B (for internal, on the analog board), and as appropriate JU2 on the digital board (Refer to 'Jumper Configuration').

Synthesizer Test Points

Analog Board Component Layout (Top)

TP1	+8.0 ±0.3VDC U6 positive regulator output
TP2	+5.0 ±0.1VDC U7 positive regulator output
TP3	+5.0 ±0.1VDC U8 positive regulator output (always on)
TP4	PLL error voltage. Normal range is +0.5 to +4.5VDC (depending on frequency). Nominally adjusted for +2.3VDC (via C24) for center channel

Digital Board Component Layout (Bottom)

TP1	+5.0 ±0.1VDC. U2 positive regulator output (controlled via pin P2-4)
TP2	Microcontroller E clock. 2MHz logic level square wave

Synthesizer Removal and Installation

Note: Complete synthesizer alignment can be performed without removing the synthesizer from the radio.

The synthesizer module is secured to the main board (MT-3 Receiver IF/Audio Board or MT-3 Transmitter Main board) with a single counter sunk Phillips machine screw accessible from the top cover. Remove this screw to remove the synthesizer module. Using a plastic coated lifting tool, such as a small screwdriver with the tip covered in heat shrink material, gently lift the synthesizer module from the main circuit board by applying pressure in a rotating fashion about the four corners of the synthesizer module. It is important to gently remove the synthesizer module “straight out” in order to prevent damage to the connector pins. Installation of the synthesizer is performed by first ensuring complete connector pin alignment; second appling reinsertion force; and third securing the synthesizer to the main board with the single countersunk phillips machine screw. Note the four corner locating pins on the synthesizer housing assist in connector pin alignment during the installation.

Circuit Board Removal

Note: Circuit board removal is not required for tuning purposes.

The analog and digital boards can be removed using a vacuum de-soldering station. To remove the analog board: de-solder connections P1, P2 and P3; remove the SMB connectors J1 and J2 by de-soldering the center pins and removing the four (2 per connector) M2 machine screws; remove the seven M2 machine screws (that secure the analog board) and carefully remove the analog circuit board. Removal of the analog circuit board will expose three inter-board wire connections. Carefully remove three ferrite beads and six Teflon washers from the inter-board connection wires. Attempt to maintain the position of the three inter-board wires in order to simplify re-assembly. The digital board may now be extracted by removing four M2 machine screws. Follow a reverse procedure to re-assemble.

Frequency Adjustment and Channel Selection

Connect a radio communications test set through a short section of low loss 50Ω coaxial cable to the synthesizer’s SMB RF output jack (J2). Select the desired channel code number via the BCD frequency selection switches on the main board, or reprogram the synthesizer memory with a Channel Synthesizer Programer (CP-SC-3). Turn the power off and back on and wait a few minutes for the oscillator to completely stabilize. It should be noted that the internal synthesizer TCXO, if installed, operates continuously (regardless of the TX PTT state) when installed in a transmitter.

The measured RF output signal should be within ±1.0 ppm of the specified oscillator frequency at an output level of +5dBm ±2dBm @ 25°C. Note that an unlocked synthesizer operation will also be indicated by an unstable or spurious RF output signal. The “Unlocked” red LED will be illuminated if the PLL is unlocked. If a VCO Alignment does not resolve the unlocked condition, check that the requested channel code number is within the frequency range of the particular synthesizer model. An unlocked condition will probably be rectified by adjusting the VCO tuning elements as described in the following procedures.

VCO Alignment

Refer to the ‘Analog Board Component Layout’ diagrams and on.

1) Measure the PLL DC control voltage at TP4 located on the synthesizer module analog board (top) using a high impedence (10MΩ) voltmeter (access to TP4 is available through the synthesizer top cover).

2) Carefully adjust the VCO fine frequency “TUNE” trimmer capacitor C24, using a small standard blade screwdriver, until a test point (TP4) voltage of approximately +2.3VDC is obtained. PLL loop control voltages below approximately +0.5VDC and above approximately +4.5VDC will indicate an “out of lock” synthesizer condition.

If a TP4 reading of approximately +2.3VDC is unattainable through adjustment of C24, then the coarse frequency jumpers, JU2-JU4 require modification in order to pull the VCO tune range within the adjustment range of fine tuning capacitor C24. The top synthesizer cover must be removed in order to gain access to the coarse frequency jumpers. The coarse frequency jumpers (JU2-JU4) may be considered to be a selectable binary weighted capacitor element with JU2 being the most significant “bit” and JU4 being the least significant “bit”. The tuning resolution size is approximately 12pF (JU4). If the tuning voltage remains higher than +2.3VDC, decrease the tuning jumper setting by 1 “bit” position and re-adjust C24 in an attempt to achieve +2.3VDC at TP4. For example, if coarse frequency jumpers JU2-JU4 are all installed and represented by 111 then a decrease by 1 “bit” position (12pF) is represented by a binary jumper selection of 110; jumper JU4 is not installed and jumpers JU2, JU3 are installed. Continue to decrease the jumper position one “bit” at a time until the synthesizer regains lock with TP4 adjusted (C24) for +2.3VDC. If the tuning voltage remains lower than +2.3VDC, increase the jumper setting by 1 “bit” position and re-adjust C24 in an attempt to achieve +2.3VDC at TP4. Repeat this procedure until +2.3VDC is achieved at TP4.

It is important to check the loop control voltage at TP4 when multiple synthesizer channels have been programmed. All channel selections should result in a TP4 voltage within a +1.0 to +4.0VDC range. Adjust the fine-tuning capacitor C24 to center multiple channel voltages symmetrically about +2.3VDC. Channel selections beyond the tuning range capability of the synthesizer will result in unlocked operation. The tuning range capability of this synthesizer model is listed in the Therory of Operation section.

Reference Frequency Alignment

To adjust the output frequency of the synthesizer the reference frequency of the TCXO is adjusted. Note this adjustment is only valid when the internal reference is selected (JU1 in the B position on the analog board). To adjust the internal TCXO referency frequency adjust the synthesizer TCXO fine frequency potentiometer RV1 until the correct output frequency is achieved. Access to this potentiometer is through an opening in the synthesizer top cover.

An RF power level of approximately +5dBm ±2dBm should be measured at the synthesizer’s SMB output connector J2. The frequency should be within ±1 ppm of the desired operating frequency. Reference frequency adjustments should be made at room temperature (+25°C) after a ten minute stabilization period.

JUMPER CONFIGURATION

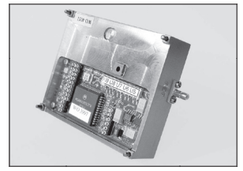
The synthesizer’s surface mount solder jumpers are clearly marked on both of it’s digital and analog circuit boards. Refer to the ‘Digital Board Component Layout (Bottom)’ diagram in this section and the ‘Analog Board Component Layout (Top)’ diagram for jumper locations. The following list details the required jumper configuration for the two synthesizer operating modes:

1) Internal reference. Install jumper JU1 in the B position, on the Analog Board (Standard). The internal temperature compensated crystal oscillator (TCXO) provides the reference signal with a stability of ±1 ppm from -30°C (Optional -40°C) to +60°C.

2) External reference input. Install jumper JU1 in the A position on the Analog Board. This mode is used in applications requiring better than ±1 ppm frequency stability. An external reference signal must be provided at the synthesizer’s SMB connector J1. An optional front panel external reference connector is available as an option for transmitters and receivers.

3) Reference Frequency Select. Install jumper JU2 on the Digital Board to select a 10.0MHz reference frequency. When not installed, the reference frequency is by default 9.6MHz. JU2 is used by the microcontroller to establish the correct reference frequency division ratio. (the Synthesizer module must be removed to change jumper JU2 on the digital board.)

Note: Care must be exercised when reinstalling the synthesizer module on the Transmitter Main board or the IF/Audio board. Pay careful attention to pin alignment before pressing the synthesizer module into its mating sockets..



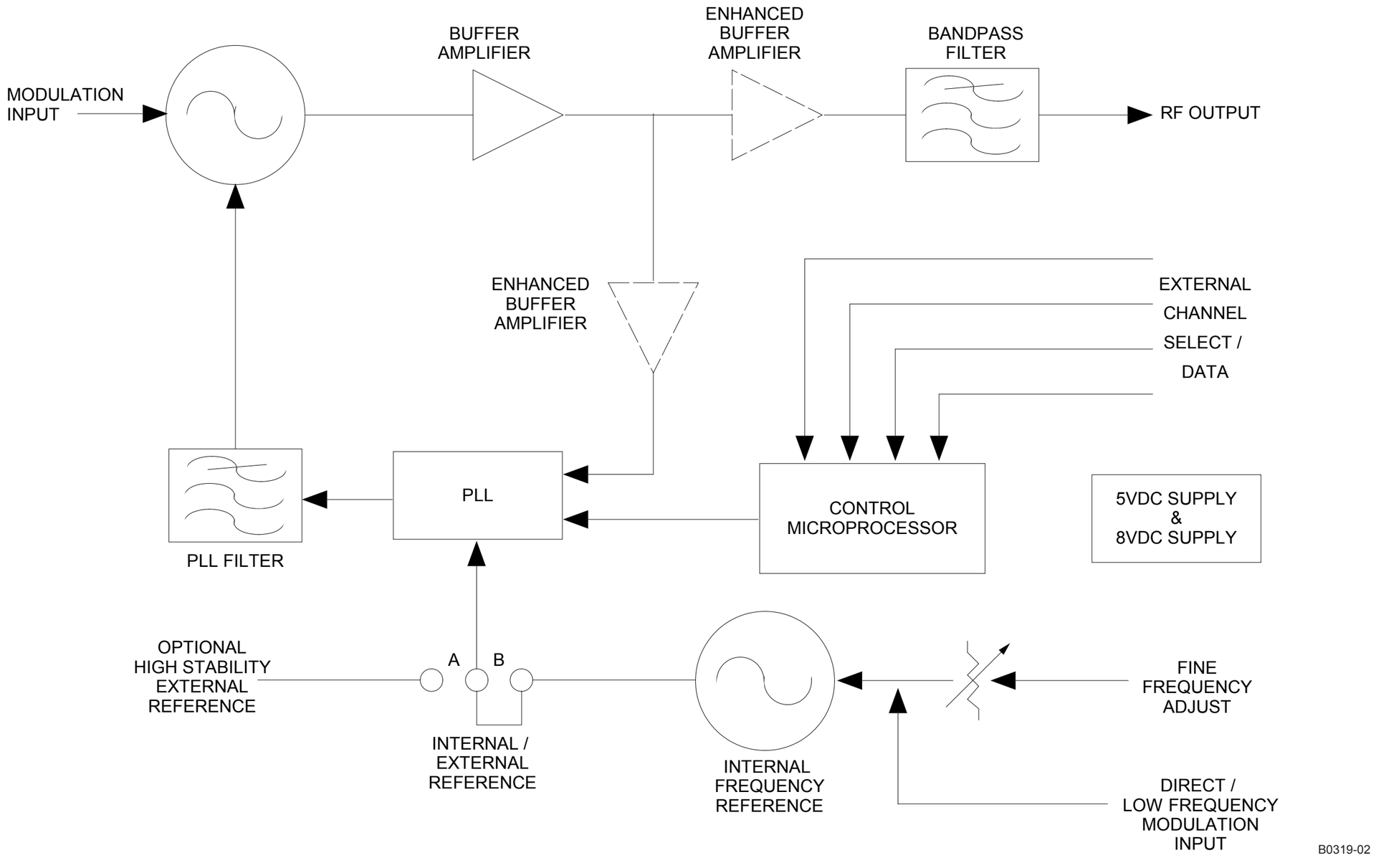
SCHEMATICS AND ILLUSTRATIONS

PRINTED CIRCUIT BOARD NUMBERING CONVENTION

Daniels Electronics Ltd. 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. All PCB's manufactured by Daniels Electronics Ltd. are identified by one of the following numbering conventions:

PCB number	43-91201<u>0</u> Indicates circuit board version 1.0
PCB number	50002-<u>02</u> Indicates circuit board version 2 (no decimal version)

SYNTHESIZER MODULE BLOCK DIAGRAM

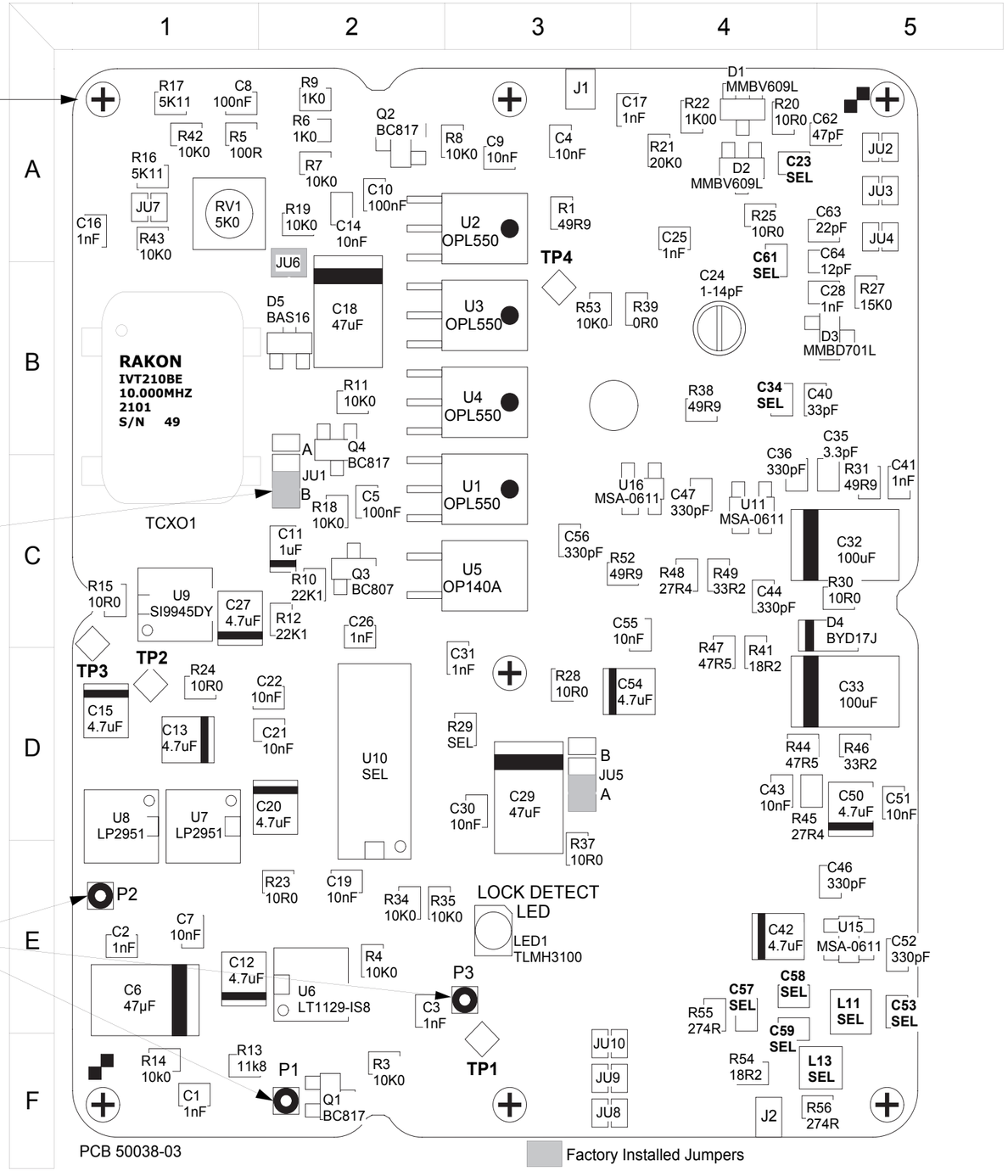


OS(R/T)-3H 29-71.4MHZ ANALOG BOARD COMPONENT LAYOUT (TOP)

Remove seven M2.0 machine screws to remove analog board.

JU1 position B selected for internal reference

Desolder three board interconnect points to separate analog and digital boards.



DESIG.	TRANSMITTER		RECEIVER
	TX 29 - 40 MHz OST - 3H035	TX 39 - 50 MHz OST - 3H045	RX 50.4 - 71.4 MHz OSR - 3H061
C23	150 pF	68 pF	27 pF
C34	56 pF	47 pF	33 pF
C53	56 pF	56 pF	Not Installed
C57	15 pF	15 pF	68 pF
C58	33 pF	33 pF	68 pF
C59	33 pF	33 pF	100 pF
C61	150 pF	100 pF	56 pF
L11	100 nH	100 nH	120 nH
L13	100 nH	100 nH	120 nH
R29	See U10 Sel Table	See U10 Sel Table	See U10 Sel Table
U10	MC145191 or MC145192	MC145191, MC145192 or MC145193	MC145191, MC145192 or MC145193

U10 SELECT TABLE		
	MC145191F or MC145192F	MC145193F
R29	18k2	3k92

SELECT COMPONENTS		
	Rakon TCVCXO IVT210BE	Saronix TCVCXO S2045-9.6 MHz
JU7	Not installed	Installed

COMPONENT LOCATION TABLE

DES	LC	SD	DES	LC	SD	DES	LC	SD	DES	LC	SD	DES	LC	SD	DES	LC	SD
C1	F1	T	C41	C5	T	L1	F2	B	R19	A2	T	TCXO1	C1	T			
C2	E1	T	C42	E4	T	L2	E2	B	R20	A4	T						
C3	E2	T	C43	D4	T	L3	E2	B	R21	A4	T	TP1	F3	T			
C4	A3	T	C44	C4	T	L4	A4	B	R22	A4	T	TP2	D1	T			
C5	C2	T	C45	D4	B	L5	A5	B	R23	E2	T	TP3	C1	T			
C6	E1	T	C46	E5	T	L6	A4	B	R24	D1	T	TP4	B3	T			
C7	E1	T	C47	C4	T	L7	B5	B	R25	A4	T	U1	C3	T			
C8	A1	T	C48	A3	B	L8	C4	B	R26	A3	B	U2	A3	T			
C9	A3	T	C49	D3	B	L9	E5	B	R27	B5	T	U3	B3	T			
C10	A2	T	C50	D5	T	L10	C3	B	R28	D3	T	U4	B3	T			
C11	C2	T	C51	D5	T	L11	E5	T	R29	D3	T	U5	C3	T			
C12	E1	T	C52	E5	T	L12	B5	B	R30	C5	T	U6	E2	T			
C13	D1	T	C53	E5	T	L13	F4	T	R31	C5	T	U7	D1	T			
C14	A2	T	C54	D3	T				R32	E3	B	U8	D1	T			
C15	D1	T	C55	C4	T	LED1	E3	T	R33	E3	B	U9	C1	T			
C16	A1	T	C56	C3	T				R34	E2	T	U10	E2	T			
C17	A3	T	C57	E4	T	Q1	F2	T	R35	E2	T	U11	C4	T			
C18	B2	T	C58	E4	T	Q2	A2	T	R36	E3	B	U15	E5	T			
C19	E2	T	C59	E4	T	Q3	C2	T	R37	E3	T	U16	C4	T			
C20	D2	T	C61	A4	T	Q4	B2	T	R38	B4	T						
C21	D2	T	C62	A5	T	Q5	B5	B	R39	B4	T						
C22	D2	T	C63	A5	T				R40	D4	B						
C23	A4	T	C64	B5	T	R1	A3	T	R41	D4	T						
C24	B4	B				R2	C2	B	R42	A1	T						
C25	A4	T	D1	A4	T	R3	F2	T	R43	A1	T						
C26	C2	T	D2	A4	T	R4	E2	T	R44	D4	T						
C27	C1	T	D3	B4	T	R5	A1	T	R45	D4	T						
C28	B5	T	D4	C5	T	R6	A2	T	R46	D5	T						
C29	D3	T	D5	B2	T	R7	A2	T	R47	D4	T						
C30	D3	T				R8	A3	T	R48	C4	T						
C31	D3	T	JU1	B2	T	R9	A2	T	R49	C4	T						
C32	C5	T	JU2	A5	T	R10	C2	T	R50	E5	B						
C33	D5	T	JU3	A5	T	R11	B2	T	R51	C3	B						
C34	B4	T	JU4	A5	T	R12	C2	T	R52	C3	T						
C35	C5	T	JU5	D3	T	R13	F1	T	R53	B3	T						
C36	C4	T	JU6	B2	T	R14	F1	T	R54	F4	T						
C37	E4	B	JU7	A1	T	R15	C1	T	R55	E4	T						
C38	E4	B	JU8	F3	T	R16	A1	T	R56	F4	T						
C39	E4	B	JU9	F3	T	R17	A1	T									
C40	B4	T	JU10	F3	T	R18	C2	T	RV1	A1	T						

DES - Designation
LC - Location
SD - Side
B - Bottom
T - Top

50038-03-01-T-01-01

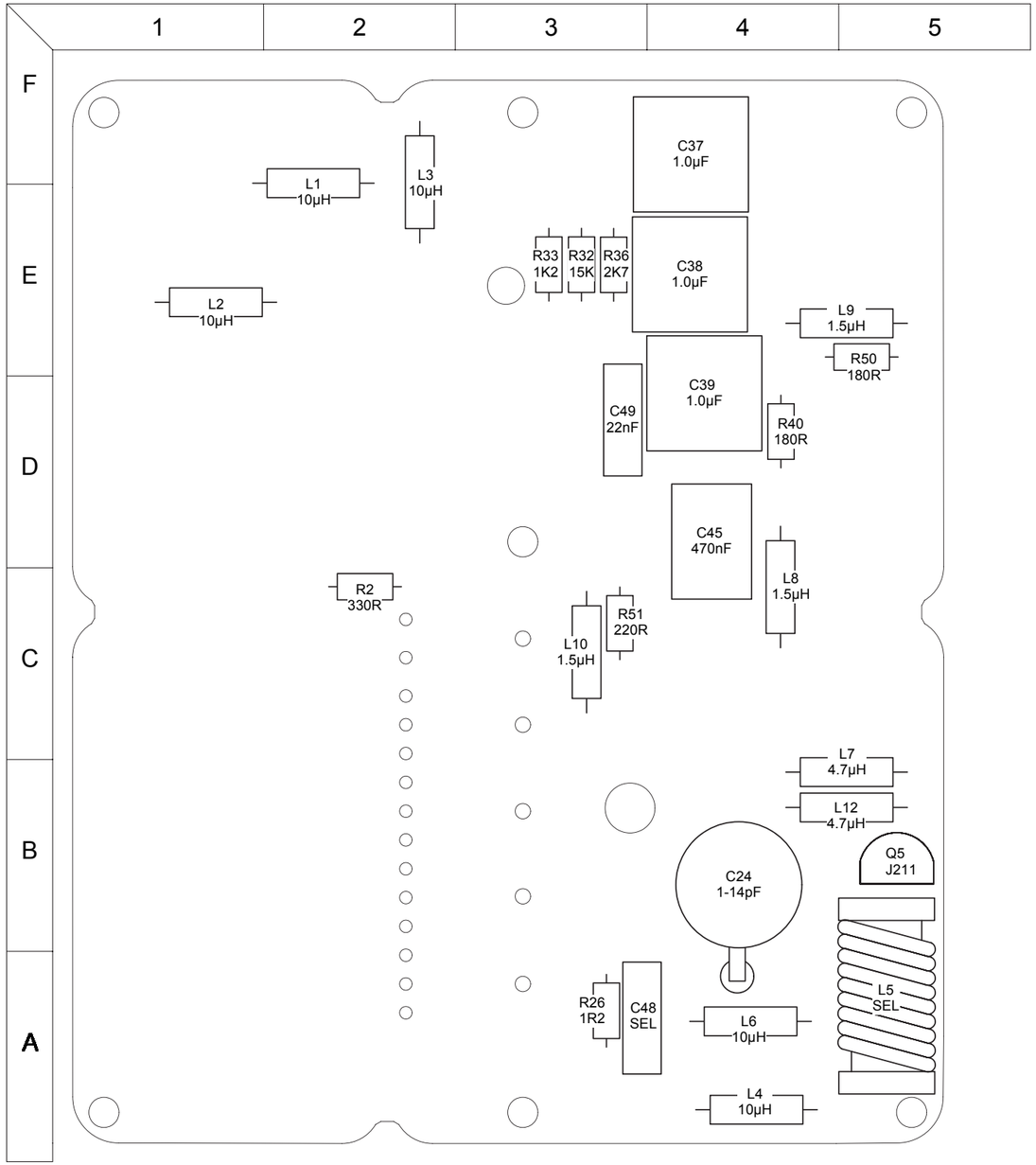
OS(R/T)-3H 29-71.4MHZ ANALOG BOARD COMPONENT LAYOUT (BOTTOM)

COMPONENT LOCATION TABLE

DES	LC	SD	DES	LC	SD	DES	LC	SD	DES	LC	SD	DES	LC	SD
C1	F1	T	C41	C5	T	L1	F2	B	R19	B2	T	TP1	F3	T
C2	E1	T	C42	E4	T	L2	E2	B	R20	A4	T	TP2	D1	T
C3	E2	T	C43	D4	T	L3	E2	B	R21	A4	T	TP3	C1	T
C4	A3	T	C44	C4	T	L4	A4	B	R22	A4	T	TP4	B3	T
C5	C2	T	C45	D4	B	L5	A5	B	R23	E2	T	U1	C3	T
C6	E1	T	C46	E5	T	L6	A4	B	R24	D1	T	U2	A3	T
C7	E1	T	C47	C4	T	L7	B5	B	R25	A4	T	U3	B3	T
C8	A1	T	C48	A3	B	L8	C4	B	R26	A3	B	U4	B3	T
C9	A3	T	C49	D3	B	L9	E5	B	R27	B5	T	U5	C3	T
C10	A2	T	C50	D5	T	L10	C3	B	R28	D3	T	U6	E2	T
C11	C2	T	C51	D5	T	L11	E5	T	R29	D3	T	U7	D1	T
C12	E1	T	C52	E5	T	L12	B5	B	R30	C5	T	U8	D1	T
C13	D1	T	C53	E5	T	L13	F4	T	R31	C5	T	U9	C1	T
C14	A2	T	C54	D3	T				R32	E3	B	U10	E2	T
C15	D1	T	C55	C4	T	LED1	E3	T	R33	E3	B	U11	C4	T
C16	A1	T	C56	C3	T				R34	E2	T	U15	E5	T
C17	A3	T	C57	E4	T	Q1	F2	T	R35	E2	T	U16	C4	T
C18	B2	T	C58	E4	T	Q2	A2	T	R36	E3	B			
C19	E2	T	C59	E4	T	Q3	C2	T	R37	E3	T			
C20	D2	T	C61	A4	T	Q4	B2	T	R38	B4	T			
C21	D2	T	C62	A5	T	Q5	B5	B	R39	B4	T			
C22	D2	T	C63	A5	T				R40	D4	B			
C23	A4	T	C64	B5	T	R1	A3	T	R41	D4	T			
C24	B4	B				R2	C2	B	R44	D4	T			
C25	A4	T	D1	A4	T	R3	F2	T	R45	D4	T			
C26	C2	T	D2	A4	T	R4	E2	T	R46	D5	T			
C27	C1	T	D3	B4	T	R5	A1	T	R47	D4	T			
C28	B5	T	D4	C5	T	R6	A2	T	R48	C4	T			
C29	D3	T	D5	B2	T	R7	A2	T	R49	C4	T			
C30	D3	T				R8	A3	T	R50	E5	B			
C31	D3	T	JU1	B2	T	R9	A2	T	R51	C3	B			
C32	C5	T	JU2	A5	T	R10	C2	T	R52	C3	T			
C33	D5	T	JU3	A5	T	R11	B2	T	R53	B3	T			
C34	B4	T	JU4	A5	T	R12	C2	T	R54	F4	T			
C35	C5	T	JU5	D3	T	R13	F1	T	R55	E4	T			
C36	C4	T	JU6	F3	T	R14	F1	T	R56	F4	T			
C37	E4	B	JU7	F3	T	R15	C1	T						
C38	E4	B	JU8	F3	T	R16	A1	T	RV1	A1	T			
C39	E4	B				R17	A1	T						
C40	B4	T				R18	C2	T	TCXO1	C1	T			

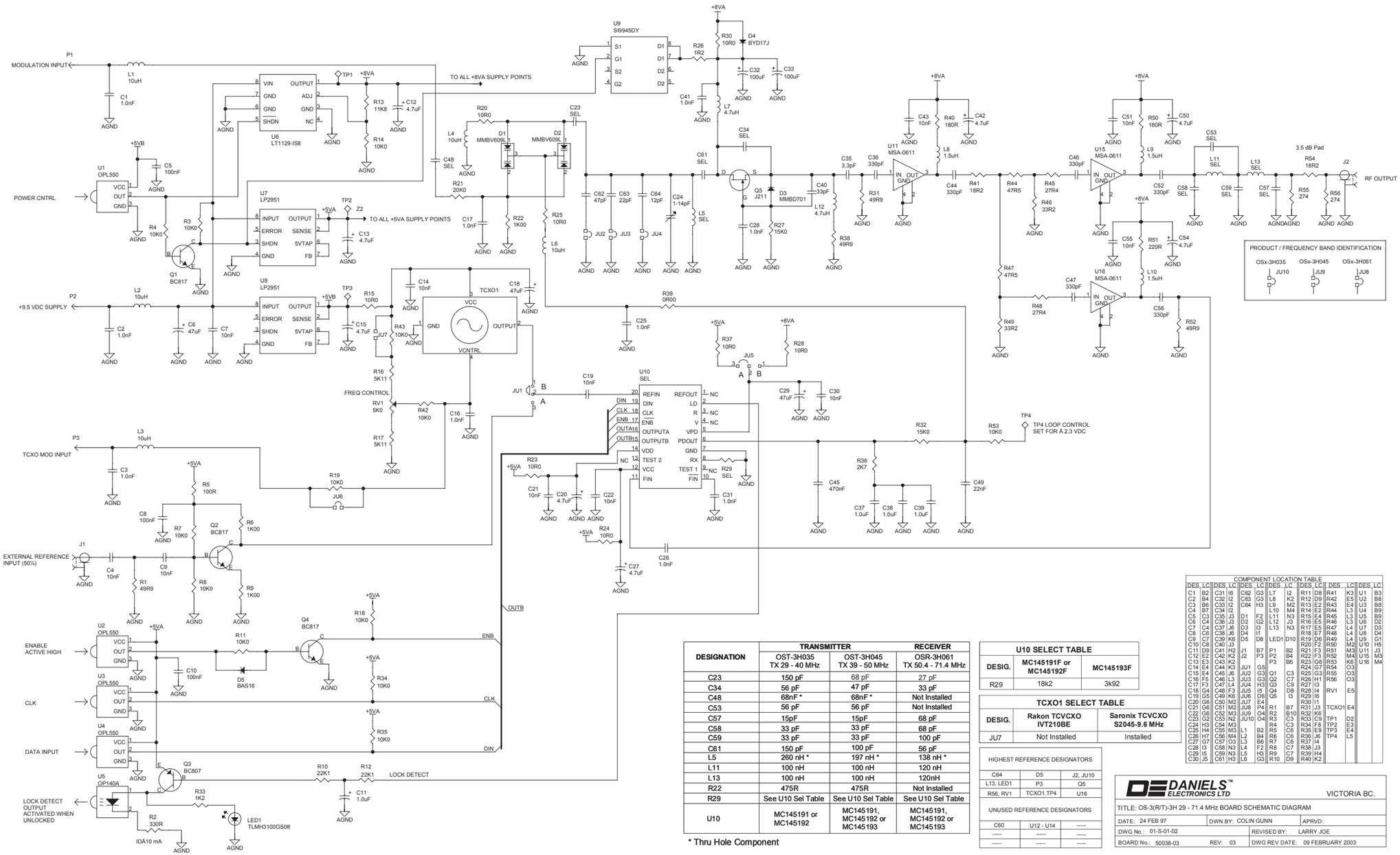
DES - Designation
LC - Location
SD - Side
B - Bottom
T - Top

	TRANSMITTER		RECEIVER
DESIG.	TX 29 - 40 MHz OST - 3H035	TX 39 - 50 MHz OST - 3H045	RX 50.4 - 71.4 MHz OSR - 3H061
C48	68 nF (1016-4A683K63)	68 nF (1016-4A683K63)	Not Installed
L5	260 nH (1253-A1352603)	197 nH (1253-A1151971)	138 nH (1253-A0951389)



50038-03-01-B-01-01

OS(R/T)-3H 29-71.4MHZ ANALOG BOARD SCHEMATIC DIAGRAM



DESIGNATION	TRANSMITTER OST-3H035 TX 29 - 40 MHz	TRANSMITTER OST-3H045 TX 39 - 50 MHz	RECEIVER OSR-3H061 TX 50.4 - 71.4 MHz
C23	150 pF	68 pF	27 pF
C34	56 pF	47 pF	33 pF
C48	68nF *	68nF *	Not Installed
C53	56 pF	56 pF	Not Installed
C57	15pF	15pF	68 pF
C58	33 pF	33 pF	68 pF
C59	33 pF	33 pF	100 pF
C61	150 pF	100 pF	56 pF
L5	260 nH *	197 nH *	138 nH *
L11	100 nH	100 nH	120 nH
L13	100 nH	100 nH	120nH
R22	475R	475R	Not Installed
R29	See U10 Sel Table	See U10 Sel Table	See U10 Sel Table
U10	MC145191 or MC145192	MC145191, MC145192 or MC145193	MC145191, MC145192 or MC145193

* Thru Hole Component

U10 SELECT TABLE		
DESIG.	MC145191F or MC145192F	MC145193F
R29	18k2	3k92

TCXO1 SELECT TABLE		
DESIG.	Rakon TCVCXO IVT210BE	Saronix TCVCXO S2045-9.6 MHz
JU7	Not Installed	Installed

HIGHEST REFERENCE DESIGNATORS		
C64	D5	J2, JU10
L13, LED1	P3	Q5
R56, RV1	TCXO1,TP4	U16

UNUSED REFERENCE DESIGNATORS		
C60	U12 - U14	-----
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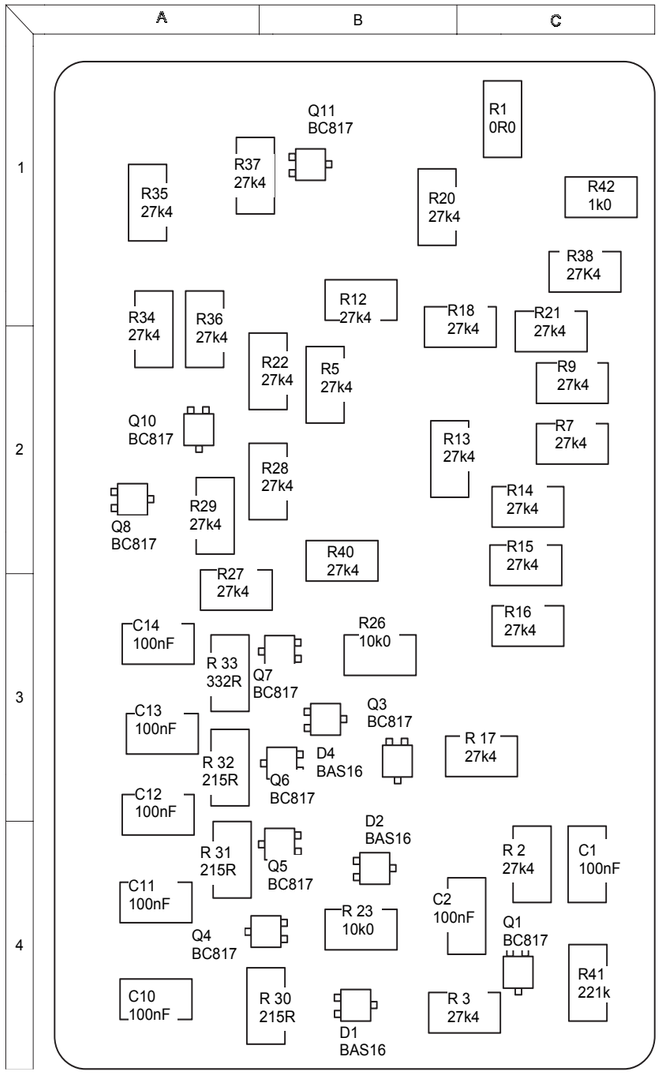
COMPONENT LOCATION TABLE

DES	LC	DES	LC	DES	LC	DES	LC	DES	LC	DES	LC	DES	LC	DES	LC
C1	B2	C31	I6	C62	G3	L7	I2	R11	D8	R41	K3	U1	B3		
C2	B4	C32	I2	C63	G3	L8	K2	R12	D9	R42	E5	U2	B8		
C3	B6	C33	I2	C64	H3	L9	M2	R13	E2	R43	E4	U3	B8		
C4	B7	C34	I2			L10	M4	R14	E2	R44	L3	U4	B9		
C5	C2	C36	J3	D1	F2	L11	N3	R15	E4	R45	L3	U5	B9		
C6	C4	C36	J3	D2	G2	L12	J3	R16	E5	R46	L3	U6	D2		
C7	C4	C37	J6	D3	I3	L13	N3	R17	E5	R47	L4	U7	D3		
C8	C5	C38	J6	D4	I1			R18	E7	R48	L4	U8	D4		
C9	C7	C39	K6	D5	D8	LED1	D10	R19	D6	R49	L4	U9	G1		
C10	G8	C40	L6					R20	F2	R50	M2	U10	H5		
C11	D9	C41	H2	J1	B7	P1	B2	R21	F3	R51	M3	U11	J3		
C12	E2	C42	K2	J2	P3	P2	B4	R22	F3	R52	M4	U15	M3		
C13	E3	C43	K2			P3	B6	R23	G6	R53	K6	U16	M4		
C14	E4	C44	K3	JU1	G5			R24	G7	R54	O3				
C15	E4	C45	J6	JU2	G3	Q1	C3	R25	G3	R55	O3				
C16	F5	C46	L3	JU3	G3	Q2	C7	R26	H1	R56	O3				
C17	F3	C47	L4	JU4	H3	Q3	C9	R27	I3						
C18	G4	C48	F3	JU5	I5	Q4	D8	R28	I4	RV1	E5				
C19	G5	C49	K6	JU6	D6	Q5	I3	R29	I6						
C20	G6	C50	M2	JU7	E4			R30	I1						
C21	G6	C51	M2	JU8	P4	R1	B7	R31	J3	TCXO1	E4				
C22	G6	C52	M3	JU9	O4	R2	B10	R32	K6						
C23	G2	C53	N2	JU10	O4	R3	C3	R33	C9	TP1	D2				
C24	H3	C54	M3			R4	C3	R34	F8	TP2	E3				
C25	H4	C55	M3	L1	B2	R5	C6	R35	E9	TP3	E4				
C26	H7	C56	M4	L2	B4	R6	C6	R36	J6	TP4	L5				
C27	G7	C57	O3	L3	B6	R7	C6	R37	I4						
C28	I3	C58	N3	L4	F2	R8	C7	R38	J3						
C29	I5	C59	N3	L5	H3	R9	C7	R39	H4						
C30	J5	C61	H3	L6	G3	R10	D9	R40	K2						

DANIELS™ ELECTRONICS LTD — VICTORIA BC.

TITLE: OS-3(R/T)-3H 29 - 71.4 MHz BOARD SCHEMATIC DIAGRAM		
DATE: 24 FEB 97	DWN BY: COLIN GUNN	APRVD:
DWG No.: 01-S-01-02	REVISED BY:	LARRY JOE
BOARD No.: 50038-03 REV: 03	DWG REV DATE:	09 FEBRUARY 2003

OS(R/T)-3H 29-71.4MHZ DIGITAL BOARD COMPONENT LAYOUT (TOP)

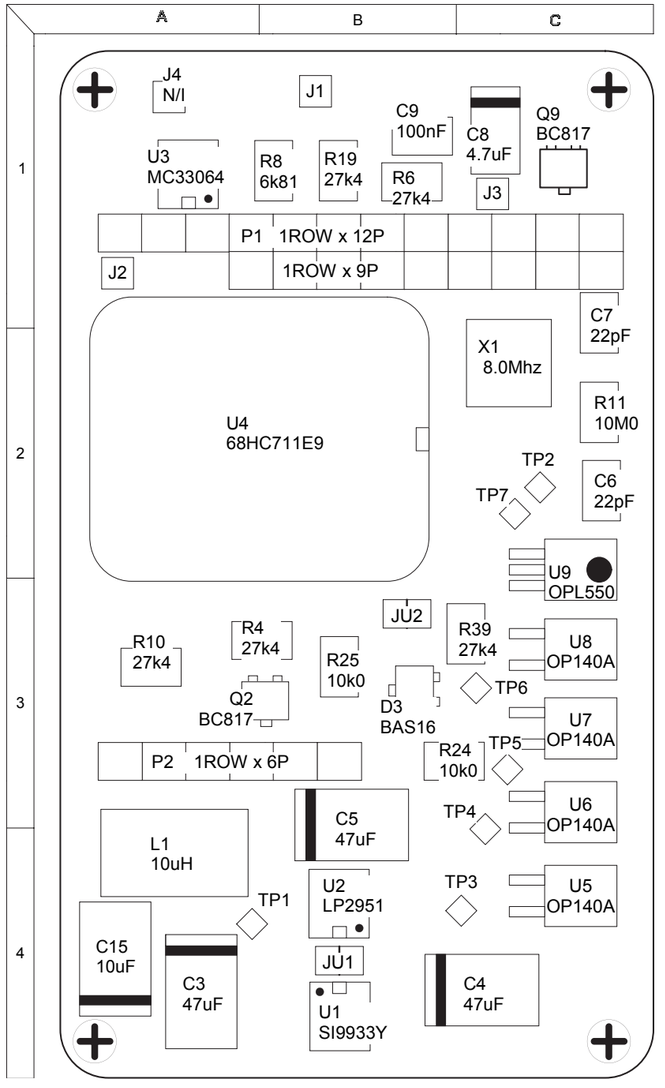


COMPONENT LOCATION TABLE

DES	LC	SD	DES	LC	SD	DES	LC	SD
C1	C4	T	Q6	B3	T	R33	A3	T
C2	C4	T	Q7	B3	T	R34	A2	T
C3	A4	B	Q8	A2	T	R35	A1	T
C4	C4	B	Q9	C1	B	R36	A2	T
C5	B4	B	Q10	A2	T	R37	A1	T
C6	C2	B	Q11	B1	T	R38	C1	T
C7	C1	B				R39	C3	B
C8	C1	B	R1	C1	T	R40	B2	T
C9	B1	B	R2	C4	T	R41	C4	T
C10	A4	T	R3	C4	T	R42	C1	T
C11	A4	T	R4	B3	B			
C12	A3	T	R5	B2	T	TP1	A4	B
C13	A3	T	R6	B1	B	TP2	C2	B
C14	A3	T	R7	C2	T	TP3	C4	B
C15	A4	B	R8	B1	B	TP4	C3	B
			R9	C2	T	TP5	C3	B
D1	B4	T	R10	A3	B	TP6	C3	B
D2	B4	T	R11	C2	B	TP7	C2	B
D3	B3	B	R12	B1	T			
D4	B3	T	R13	B2	T	U1	B4	B
			R14	C2	T	U2	B4	B
J1	B1	B	R15	C2	T	U3	A1	B
J2	A1	B	R16	C3	T	U4	A2	B
J3	C1	B	R17	C3	T	U5	C4	B
J4	A1	B	R18	C1	T	U6	C3	B
			R19	B1	B	U7	C3	B
JU1	B4	B	R20	B1	T	U8	C3	B
JU2	B3	B	R21	C2	T	U9	C2	B
			R22	B2	T			
L1	A4	B	R23	B4	T	X1	C2	B
			R24	B3	B			
P1	B1	B	R25	B3	B			
P2	A3	B	R26	B3	T			
			R27	A3	T			
Q1	C4	T	R28	B2	T			
Q2	B3	B	R29	A2	T			
Q3	B3	T	R30	B4	T			
Q4	B4	T	R31	A4	T			
Q5	B4	T	R32	A3	T			

50021-04-01-T-01-01

OS(R/T)-3H 29-71.4MHZ DIGITAL BOARD COMPONENT LAYOUT (BOTTOM)



COMPONENT LOCATION TABLE

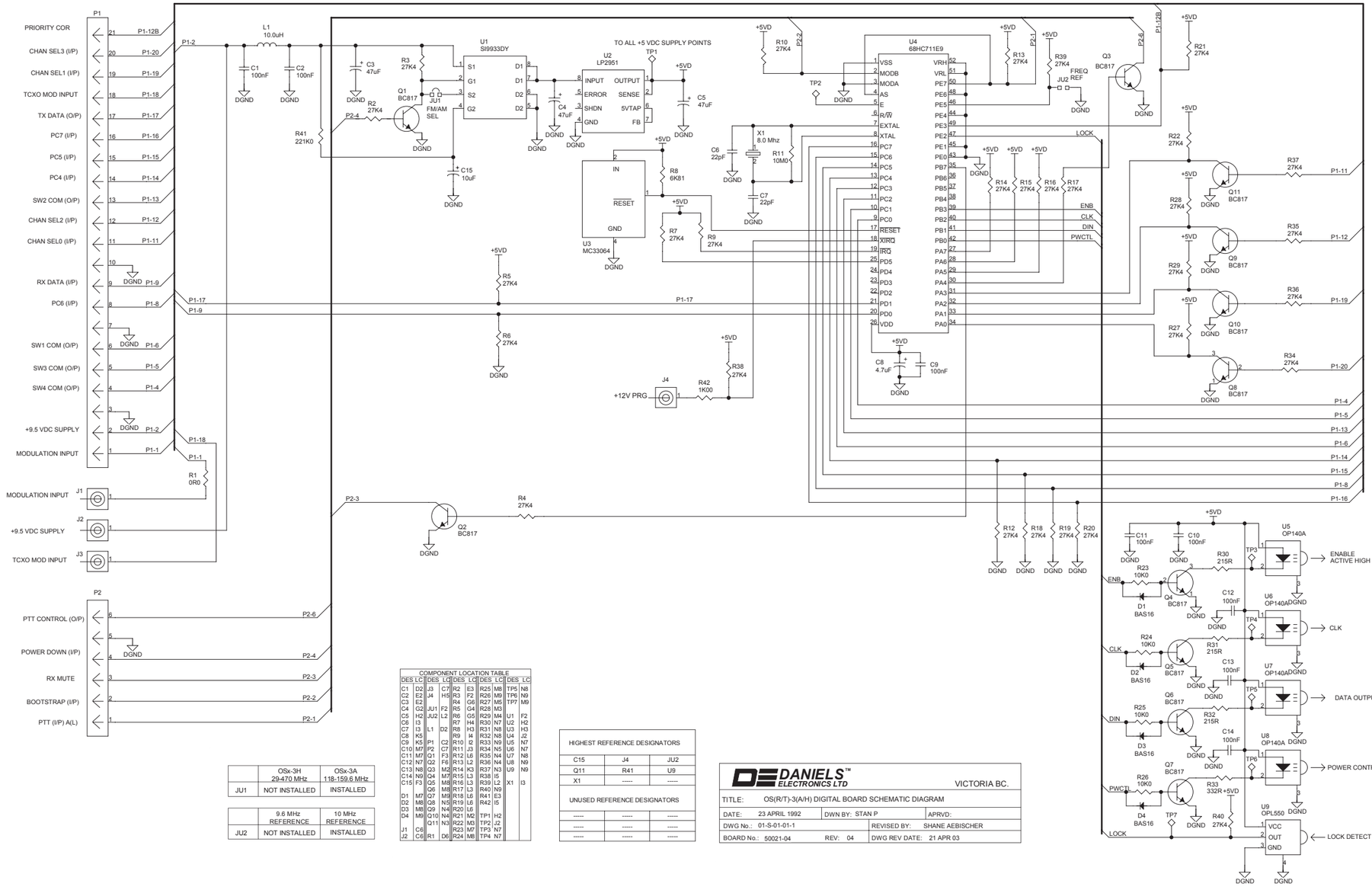
DES	LC	SD	DES	LC	SD	DES	LC	SD
C1	C4	T	Q6	B3	T	R33	A3	T
C2	C4	T	Q7	B3	T	R34	A2	T
C3	A4	B	Q8	A2	T	R35	A1	T
C4	C4	B	Q9	C1	B	R36	A2	T
C5	B4	B	Q10	A2	T	R37	A1	T
C6	C2	B	Q11	B1	T	R38	C1	T
C7	C1	B				R39	C3	B
C8	C1	B	R1	C1	T	R40	B2	T
C9	B1	B	R2	C4	T	R41	C4	T
C10	A4	T	R3	C4	T	R42	C1	T
C11	A4	T	R4	B3	B			
C12	A3	T	R5	B2	T	TP1	A4	B
C13	A3	T	R6	B1	B	TP2	C2	B
C14	A3	T	R7	C2	T	TP3	C4	B
C15	A4	B	R8	B1	B	TP4	C3	B
			R9	C2	T	TP5	C3	B
D1	B4	T	R10	A3	B	TP6	C3	B
D2	B4	T	R11	C2	B	TP7	C2	B
D3	B3	B	R12	B1	T			
D4	B3	T	R13	B2	T	U1	B4	B
			R14	C2	T	U2	B4	B
J1	B1	B	R15	C2	T	U3	A1	B
J2	A1	B	R16	C3	T	U4	A2	B
J3	C1	B	R17	C3	T	U5	C4	B
J4	A1	B	R18	C1	T	U6	C3	B
			R19	B1	B	U7	C3	B
JU1	B4	B	R20	B1	T	U8	C3	B
JU2	B3	B	R21	C2	T	U9	C2	B
			R22	B2	T			
L1	A4	B	R23	B4	T	X1	C2	B
			R24	B3	B			
P1	B1	B	R25	B3	B			
P2	A3	B	R26	B3	T			
			R27	A3	T			
Q1	C4	T	R28	B2	T			
Q2	B3	B	R29	A2	T			
Q3	B3	T	R30	B4	T			
Q4	B4	T	R31	A4	T			
Q5	B4	T	R32	A3	T			

	OSx-3H 29-470 MHz	OSx-3A 118-159.6 MHz
JU1	NOT INSTALLED	INSTALLED

	9.6 MHz REFERENCE	10 MHz REFERENCE
JU2	NOT INSTALLED	INSTALLED

50021-04-01-B-01-01

OS(R/T)-3H 29-71.4MHZ DIGITAL BOARD SCHEMATIC DIAGRAM



	OSx-3H 29-470 MHz	OSx-3A 118-159.6 MHz
JU1	NOT INSTALLED	INSTALLED

	9.6 MHz REFERENCE	10 MHz REFERENCE
JU2	NOT INSTALLED	INSTALLED

COMPONENT LOCATION TABLE

DES	LC	DES	LC	DES	LC	DES	LC	DES	LC	DES	LC
C1	D2	J3		C7	R2	E3	R25	M8	TP5	N8
C2	E2	J4		H5	R3	F2	R26	M9	TP6	N9
C3	E2				R4	G6	R27	M5	TP7	M9
C4	G2	JU1	F2		R5	G4	R28	M3		
C5	H2	JU2	L2		R6	G5	R29	M4	U1	F2
C6	I3				R7	H4	R30	N7	U2	H2
C7	I3	L1	D2		R8	H3	R31	N8	U3	H3
C8	K5				R9	I4	R32	N8	U4	J2
C9	K5	P1		C2	R10	I2	R33	N9	U5	N7
C10	M7	P2		C7	R11	J3	R34	N5	U6	N7
C11	M7	Q1		F3	R12	L6	R35	N4	U7	N8
C12	N7	Q2		F6	R13	L2	R36	N4	U8	N9
C13	N8	Q3		M2	R14	K3	R37	N3	U9	N9
C14	N9	Q4		M7	R15	L3	R38	I5		
C15	F3	Q5		M8	R16	L3	R39	L2	X1	I3
		Q6		M8	R17	L3	R40	N9		
D1	M7	Q7		M9	R18	L6	R41	E3		
D2	M8	Q8		N5	R19	L6	R42	I5		
D3	M8	Q9		N4	R20	L6				
D4	M9	Q10		N4	R21	M2	TP1	H2		
		Q11		N3	R22	M3	TP2	J2		
J1	C6				R23	M7	TP3	N7		
J2	C6	R1		D6	R24	M8	TP4	N7		

HIGHEST REFERENCE DESIGNATORS		
C15	J4	JU2
Q11	R41	U9
X1	-----	-----

UNUSED REFERENCE DESIGNATORS		
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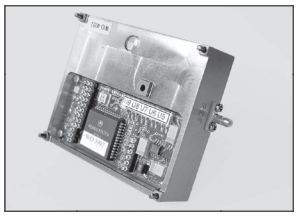
DANIELS™ ELECTRONICS LTD — VICTORIA BC.

TITLE:	OS(R/T)-3(A/H) DIGITAL BOARD SCHEMATIC DIAGRAM		
DATE: 23 APRIL 1992		DWN BY: STAN P	APRVD:
DWG No.: 01-S-01-01-1		REVISED BY:	SHANE AEBISCHER
BOARD No.: 50021-04	REV: 04	DWG REV DATE:	21 APR 03



PARTS LIST

29-71.4MHZ ANALOG BOARD ELECTRICAL PARTS LIST

Ref Desig	Description	Part Number	OSR-3H061	OST-3H035	OST-3H045
C1	CAP., SM, 1nF CER,0805,X7R,50V	1008-3A102K5R	•	•	•
C2	CAP., SM, 1nF CER,0805,X7R,50V	1008-3A102K5R	•	•	•
C3	CAP., SM, 1nF CER,0805,X7R,50V	1008-3A102K5R	•	•	•
C4	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R	•	•	•
C5	CAP., SM,100nF CER,0805,X7R,50	1008-5A104K5R	•	•	•
C6	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16	•	•	•
C7	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R	•	•	•
C8	CAP., SM,100nF CER,0805,X7R,50	1008-5A104K5R	•	•	•
C9	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R	•	•	•
C10	CAP., SM,100nF CER,0805,X7R,50	1008-5A104K5R	•	•	•
C11	CAP., SM, 1.0uF TANT., 20%,16V	1055-5A105M16	•	•	•
C12	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•	•
C13	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•	•
C14	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R	•	•	•
C15	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•	•
C16	CAP., SM, 1nF CER,0805,X7R,50V	1008-3A102K5R	•	•	•
C17	CAP., SM, 1nF CER,0805,X7R,50V	1008-3A102K5R	•	•	•
C18	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16	•	•	•
C19	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R	•	•	•
C20	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•	•
C21	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R	•	•	•
C22	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R	•	•	•
C23	CAP., SM, 150pF CER., 0805,C0G	1008-2A151J1G		•	
C23	CAP., SM, 27pF CER., 0805, C0G	1008-1A270J1G	•		
C23	CAP., SM, 68pF CER., 0805, C0G	1008-1A680J1G			•
C24	CAP.,TRIM. 1-14pF, STAND. >6T	1082-A1R0014J	•	•	•

29-71.4MHz Analog Board
Electrical Parts List continued

Ref Desig	Description	Part Number	OSR-3H061	OST-3H035	OST-3H045
C25	CAP., SM, 1nF CER,0805,X7R,50V	1008-3A102K5R	•	•	•
C26	CAP., SM, 1nF CER,0805,X7R,50V	1008-3A102K5R	•	•	•
C27	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•	•
C28	CAP., SM, 1nF CER,0805,X7R,50V	1008-3A102K5R	•	•	•
C29	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16	•	•	•
C30	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R	•	•	•
C31	CAP., SM, 1nF CER,0805,X7R,50V	1008-3A102K5R	•	•	•
C32	CAP., SM, 100uF TANT., 20%,16V	1055-7D107M16	•	•	•
C33	CAP., SM, 100uF TANT., 20%,16V	1055-7D107M16	•	•	•
C34	CAP., SM, 33pF CER., 0805, C0G	1008-1A330J1G	•		
C34	CAP., SM, 47pF CER., 0805, C0G	1008-1A470J1G			•
C34	CAP., SM, 56pF CER., 0805, C0G	1008-1A560J1G		•	
C35	CAP., SM, 3.3pF CER., 0805,C0G	1008-0A339J1G	•	•	•
C36	CAP., SM, 330pF CER., 0805,C0G	1008-2A331J1G	•	•	•
C37	CAP., 1.0uF FILM, MMK5,10%,50V	1016-6D105K50	•	•	•
C38	CAP., 1.0uF FILM, MMK5,10%,50V	1016-6D105K50	•	•	•
C39	CAP., 1.0uF FILM, MMK5,10%,50V	1016-6D105K50	•	•	•
C40	CAP., SM, 33pF CER., 0805, C0G	1008-1A330J1G	•	•	•
C41	CAP., SM, 1nF CER,0805,X7R,50V	1008-3A102K5R	•	•	•
C42	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•	•
C43	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R	•	•	•
C44	CAP., SM, 330pF CER., 0805,C0G	1008-2A331J1G	•	•	•
C45	CAP., 470nF FILM, MMK5,10%,63V	1016-5D474K63	•	•	•
C46	CAP., SM, 330pF CER., 0805,C0G	1008-2A331J1G	•	•	•
C47	CAP., SM, 330pF CER., 0805,C0G	1008-2A331J1G	•	•	•
C48	CAP., 68nF FILM, MMK5, 10%,63V	1016-4A683K63		•	•
C49	CAP., 22nF FILM, MMK5, 10%,63V	1016-4A223K63	•	•	•
C50	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•	•
C51	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R	•	•	•
C52	CAP., SM, 330pF CER., 0805,C0G	1008-2A331J1G	•	•	•
C53	CAP., SM, 56pF CER., 0805, C0G	1008-1A560J1G		•	•
C54	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•	•
C55	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R	•	•	•
C56	CAP., SM, 330pF CER., 0805,C0G	1008-2A331J1G	•	•	•
C57	CAP., SM, 15pF CER., 0805, C0G	1008-1A150J1G		•	•
C57	CAP., SM, 68pF CER., 0805, C0G	1008-1A680J1G	•		
C58	CAP., SM, 33pF CER., 0805, C0G	1008-1A330J1G		•	•
C58	CAP., SM, 68pF CER., 0805, C0G	1008-1A680J1G	•		
C59	CAP., SM, 100pF CER., 0805,C0G	1008-2A101J1G	•		
C59	CAP., SM, 33pF CER., 0805, C0G	1008-1A330J1G		•	•

29-71.4MHz Analog Board
Electrical Parts List continued

Ref Desig	Description	Part Number	OSR-3H061	OST-3H035	OST-3H045
C61	CAP., SM, 100pF CER., 0805,C0G	1008-2A101J1G			•
C61	CAP., SM, 150pF CER., 0805,C0G	1008-2A151J1G		•	
C61	CAP., SM, 56pF CER., 0805, C0G	1008-1A560J1G	•		
C62	CAP., SM, 47pF CER., 0805, C0G	1008-1A470J1G	•	•	•
C63	CAP., SM, 22pF CER., 0805, C0G	1008-1A220J1G	•	•	•
C64	CAP., SM, 12pF CER., 0805, C0G	1008-1A120J1G	•	•	•
D1	DIODE, MMBV609L,VARICAP,SOT-23	2106-MMBV609L	•	•	•
D2	DIODE, MMBV609L,VARICAP,SOT-23	2106-MMBV609L	•	•	•
D3	DIODE, MMBD701,HOT CARR.,SOT23	2105-MMBD7010	•	•	•
D4	DIODE, BYD17J, RECTIFIER,SOD87	2101-BYD17J00	•	•	•
D5	DIODE, BAS16, SWITCHING, SOT23	2100-BAS16000	•	•	•
L1	CHOKE, RF/MOLDED,10uH,10%,.25”	1251-4A00100K	•	•	•
L2	CHOKE, RF/MOLDED,10uH,10%,.25”	1251-4A00100K	•	•	•
L3	CHOKE, RF/MOLDED,10uH,10%,.25”	1251-4A00100K	•	•	•
L4	CHOKE, RF/MOLDED,10uH,10%,.25”	1251-4A00100K	•	•	•
L5	INDUCTOR, 9.5T/138nH,MOLD.,WHT	1253-A0951389	•		
L5	INDUCTOR,11.5T/197nH,MOLD.,BRN	1253-A1151971			•
L5	INDUCTOR,13.5T/260nH,MOLD.,ORG	1253-A1352603		•	
L6	CHOKE, RF/MOLDED,10uH,10%,.25”	1251-4A00100K	•	•	•
L7	CHOKE, RF/MOLDED,4.7uH,10%,.25	1251-3A004R7K	•	•	•
L8	CHOKE, RF/MOLDED,1.5uH,10%,.25	1251-3A001R5K	•	•	•
L9	CHOKE, RF/MOLDED,1.5uH,10%,.25	1251-3A001R5K	•	•	•
L10	CHOKE, RF/MOLDED,1.5uH,10%,.25	1251-3A001R5K	•	•	•
L11	INDUCTOR,SM,100nH CER,10%,1008	1256-2BR1000K		•	•
L11	INDUCTOR,SM,120nH CER,10%,1008	1256-2BR1200K	•		
L12	CHOKE, RF/MOLDED,4.7uH,10%,.25	1251-3A004R7K	•	•	•
L13	INDUCTOR,SM,100nH CER,10%,1008	1256-2BR1000K		•	•
L13	INDUCTOR,SM,120nH CER,10%,1008	1256-2BR1200K	•		
LED1	LED/SM,PLCC-3.2X2.8,TOP,CL/RED	2111-T3228CRD	•	•	•
PCB	PCB, ANALOG,OS-3H VHF 30-50MHz	4309-26500383	•	•	•
Q1	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025	•	•	•
Q2	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025	•	•	•
Q3	TRANSISTOR, BC807-25,PNP,SOT23	2120-BC807025	•	•	•
Q4	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025	•	•	•
Q5	JFET, J211, RF, N-CHAN., TO-92	2041-J2110000	•	•	•

29-71.4MHz Analog Board
Electrical Parts List continued

Ref Desig	Description	Part Number	OSR-3H061	OST-3H035	OST-3H045
R1	RES., SM, 49R9 0805, 1%,100ppm	1150-1A49R9FP	•	•	•
R2	RES., 330R METAL FILM, 5%,0.5W	1101-2A0331JP	•	•	•
R3	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•
R4	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•
R5	RES., SM, 100R 0805, 1%,100ppm	1150-2A1000FP	•	•	•
R6	RES., SM, 1K00 0805, 1%,100ppm	1150-3A1001FP	•	•	•
R7	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•
R8	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•
R9	RES., SM, 1K00 0805, 1%,100ppm	1150-3A1001FP	•	•	•
R10	RES., SM, 22K1 0805, 1%,100ppm	1150-4A2212FP	•	•	•
R11	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•
R12	RES., SM, 22K1 0805, 1%,100ppm	1150-4A2212FP	•	•	•
R13	RES., SM, 11K8 0805, 1%,100ppm	1150-4A1182FP	•	•	•
R14	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•
R15	RES., SM, 10R0 0805, 1%,100ppm	1150-1A10R0FP	•	•	•
R16	RES., SM, 5K11 0805, 1%,100ppm	1150-3A5111FP	•	•	•
R17	RES., SM, 5K11 0805, 1%,100ppm	1150-3A5111FP	•	•	•
R18	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•
R19	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•
R20	RES., SM, 10R0 0805, 1%,100ppm	1150-1A10R0FP	•	•	•
R21	RES., SM, 20K0 0805, 1%,100ppm	1150-4A2002FP	•	•	•
R22	RES., SM, 1K00 0805, 1%,100ppm	1150-3A1001FP	•	•	•
R23	RES., SM, 10R0 0805, 1%,100ppm	1150-1A10R0FP	•	•	•
R24	RES., SM, 10R0 0805, 1%,100ppm	1150-1A10R0FP	•	•	•
R25	RES., SM, 10R0 0805, 1%,100ppm	1150-1A10R0FP	•	•	•
R26	RES., 1R2 METAL FILM, 5%, 0.5W	1101-0A01R2JI	•	•	•
R27	RES., SM, 15K0 0805, 1%,100ppm	1150-4A1502FP	•	•	•
R28	RES., SM, 10R0 0805, 1%,100ppm	1150-1A10R0FP	•	•	•
R29	RES., SM, 18K2 0805, 1%,100ppm	1150-4A1822FP	•	•	•
R30	RES., SM, 10R0 0805, 1%,100ppm	1150-1A10R0FP	•	•	•
R31	RES., SM, 49R9 0805, 1%,100ppm	1150-1A49R9FP	•	•	•
R32	RES., 15K METAL FILM, 5%, 0.5W	1101-4A0153JP	•	•	•
R33	RES., 1K2 METAL FILM, 5%, 0.5W	1101-3A0122JP	•	•	•
R34	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•
R35	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•
R36	RES., 2K7 METAL FILM, 5%, 0.5W	1101-3A0272JP	•	•	•
R37	RES., SM, 10R0 0805, 1%,100ppm	1150-1A10R0FP	•	•	•
R38	RES., SM, 49R9 0805, 1%,100ppm	1150-1A49R9FP	•	•	•
R39	RES., SM, ZERO OHM JUMPER,0805	1150-0A0R0000	•	•	•
R40	RES., 180R METAL FILM, 5%,0.5W	1101-2A0181JP	•	•	•
R41	RES., SM, 18R2 0805, 1%,100ppm	1150-1A18R2FP	•	•	•

29-71.4MHz Analog Board
Electrical Parts List continued

Ref Desig	Description	Part Number	OSR-3H061	OST-3H035	OST-3H045
R42	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•
R43	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•
R44	RES., SM, 47R5 0805, 1%,100ppm	1150-1A47R5FP	•	•	•
R45	RES., SM, 27R4 0805, 1%,100ppm	1150-1A27R4FP	•	•	•
R46	RES., SM, 33R2 0805, 1%,100ppm	1150-1A33R2FP	•	•	•
R47	RES., SM, 47R5 0805, 1%,100ppm	1150-1A47R5FP	•	•	•
R48	RES., SM, 27R4 0805, 1%,100ppm	1150-1A27R4FP	•	•	•
R49	RES., SM, 33R2 0805, 1%,100ppm	1150-1A33R2FP	•	•	•
R50	RES., 180R METAL FILM, 5%,0.5W	1101-2A0181JP	•	•	•
R51	RES., 220R METAL FILM, 5%,0.5W	1101-2A0221JP	•	•	•
R52	RES., SM, 49R9 0805, 1%,100ppm	1150-1A49R9FP	•	•	•
R53	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•
R54	RES., SM, 18R2 0805, 1%,100ppm	1150-1A18R2FP	•	•	•
R55	RES., SM, 274R 0805, 1%,100ppm	1150-2A2740FP	•	•	•
R56	RES., SM, 274R 0805, 1%,100ppm	1150-2A2740FP	•	•	•
RV1	POT., SM/4mm SQ,5K,SINGLE TURN	1174-AS2502J1	•	•	•
TCXO1	TCVCXO,SMT,10MHz,1ppm,0-3V,4PN	2641-10000AM7	•	•	•
U1	DIODE, I/R SENSOR,TTL O/P,PLST	2014-1L18230T	•	•	•
U2	DIODE, I/R SENSOR,TTL O/P,PLST	2014-1L18230T	•	•	•
U3	DIODE, I/R SENSOR,TTL O/P,PLST	2014-1L18230T	•	•	•
U4	DIODE, I/R SENSOR,TTL O/P,PLST	2014-1L18230T	•	•	•
U5	LED, I/R,GaAs,.81 x .23,PLAST.	2013-1G18230A	•	•	•
U6	IC, LT1129I,PROG. VOLT REG,SO8	2305-11290N08	•	•	•
U7	IC, LP2951,PROG. VOLT REG,SO-8	2305-29510N08	•	•	•
U8	IC, LP2951,PROG. VOLT REG,SO-8	2305-29510N08	•	•	•
U9	MOSFET, SI9945AEY,N CHAN.,SO-8	2142-SI9945DY	•	•	•
U10	IC, 45191,PLL FREQ/SYNTH,SO-20	2355-45191N20	•	•	•
U11	IC,msA-0611, MMIC AMP,SOT-143	2354-MSA06110	•	•	•
U15	IC,msA-0611, MMIC AMP,SOT-143	2354-MSA06110	•	•	•
U16	IC,msA-0611, MMIC AMP,SOT-143	2354-MSA06110	•	•	•

DIGITAL BOARD
ELECTRICAL PARTS LIST

Ref Desig	Description	Part Number
C1	CAP., SM,100nF CER,0805,X7R,50	1008-5A104K5R
C2	CAP., SM,100nF CER,0805,X7R,50	1008-5A104K5R
C3	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16
C4	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16
C5	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16
C6	CAP., SM, 22pF CER., 0805, C0G	1008-1A220J1G
C7	CAP., SM, 22pF CER., 0805, C0G	1008-1A220J1G
C8	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16
C9	CAP., SM,100nF CER,0805,X7R,50	1008-5A104K5R
C10	CAP., SM,100nF CER,0805,X7R,50	1008-5A104K5R
C11	CAP., SM,100nF CER,0805,X7R,50	1008-5A104K5R
C12	CAP., SM,100nF CER,0805,X7R,50	1008-5A104K5R
C13	CAP., SM,100nF CER,0805,X7R,50	1008-5A104K5R
C14	CAP., SM,100nF CER,0805,X7R,50	1008-5A104K5R
C15	CAP., SM, 10uF TANT., 20%, 16V	1055-6C106M16
D1	DIODE, BAS16, SWITCHING, SOT23	2100-BAS16000
D2	DIODE, BAS16, SWITCHING, SOT23	2100-BAS16000
D3	DIODE, BAS16, SWITCHING, SOT23	2100-BAS16000
D4	DIODE, BAS16, SWITCHING, SOT23	2100-BAS16000
L1	INDUCTOR, SM, 10.0uH, 10%,1812	1255-4G10000K
P1	INTERCONNECT/STD,1ROW x 12P,Au	5015-IS112G21
P1	INTERCONNECT/STD,1ROW x9PIN,Au	5015-IS109G21
P2	INTERCONNECT/STD,1ROW x6PIN,Au	5015-IS106G21
PCB	PCB, DIGITAL, OS-3H H/P SYNTH.	4309-26002104
Q1-Q11	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025
R1	RES., SM, ZERO OHM JUMPER,0805	1150-0A0R0000
R2	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R3	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R4	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R5	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R6	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R7	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R8	RES., SM, 6K81 0805, 1%,100ppm	1150-3A6811FP
R9	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R10	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R11	RES., SM, 10M0 1206, 5%,400ppm	1151-7B0106JG
R12	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP

Digital Board
Electrical Parts List continued

Ref Desig	Description	Part Number
R13	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R14	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R15	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R16	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R17	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R18	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R19	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R20	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R21	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R22	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R23	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP
R24	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP
R25	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP
R26	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP
R27	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R28	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R29	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R30	RES., SM, 215R 0805, 1%,100ppm	1150-2A2150FP
R31	RES., SM, 215R 0805, 1%,100ppm	1150-2A2150FP
R32	RES., SM, 215R 0805, 1%,100ppm	1150-2A2150FP
R33	RES., SM, 332R 0805, 1%,100ppm	1150-2A3320FP
R34	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R35	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R36	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R37	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R38	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R39	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R40	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R41	RES., SM, 221K 0805, 1%,100ppm	1150-5A2213FP
R42	RES., SM, 1K00 0805, 1%,100ppm	1150-3A1001FP
U1	MOSFET, SI9933ADY,P CHAN.,SO-8	2142-SI9933DY
U2	IC, LP2951,PROG. VOLT REG,SO-8	2305-29510N08
U3	IC, MC33064,UNDR/VOLT SEN.SO-8	2308-33064N08
U4	IC, 68HC711E9, MIC/CTR, PLCC52	2380-68711P52
U5	LED, I/R,GaAs,.81 x .23,PLAST.	2013-1G18230A
U6	LED, I/R,GaAs,.81 x .23,PLAST.	2013-1G18230A
U7	LED, I/R,GaAs,.81 x .23,PLAST.	2013-1G18230A
U8	LED, I/R,GaAs,.81 x .23,PLAST.	2013-1G18230A
U9	DIODE, I/R SENSOR,TTL O/P,PLST	2014-1L18230T
X1	RESONATOR, SM, 8.0MHz, CERAMIC	1575-8001816A

OS(R/T) 29-71.4MHZ
MECHANICAL PARTS LIST

Description	Part Number	Qty.
CASE, OS-3H SYNTH. MODULE,ALUM	3702-66100920	1
CONN., SMB, JACK,2 HOLE FLANGE	5120-J2SC01BG	2
FERRITE BEAD, 43MIX,3x3.5mm OD	1210-43030350	3
LID, CASE,OS-3H SYNTH/MODL.,AL	3702-66100921	1
PIN, 2 x 10mm, GROOVED W/PILOT	5876-D1470210	4
SCREW, M2 X 4, PAN/PHILLIPS,A2	5812-2M0PP04S	15
SCREW, M2 x 4, FLAT/PHIL, A2	5812-2M0FP04S	8
SCREW,M2.5x24.5mm,FLAT/PHIL,A2	5812-2M5FP24S	1
WASHER, TFE,0.036ID,1/8 OD,.02T	5805-T3612F20	6

128-174MHZ ENHANCED FM SYNTHESIZER

Covers Models:

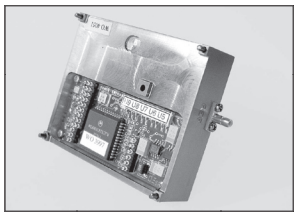
OST-3H141

OST-3H162

OSR-3H141

OSR-3H162

	Transmitters			Receivers		
Radio Frequency	Transmitter Model & Frequency Range	Enhanced Synthesizer Model & Synthesizer Frequency	Location in Manual	Receiver Model & Frequency Range	Enhanced Synthesizer Model & Synthesizer Frequency	Location in Manual
VHF Low Band 29-50MHz	VT-3H035 29-38MHz	OST-3H035 29-38MHz	See Page 3 Enhanced FM Synthesizer OS(R/T)-3H 29-71.4MHz	VR-3H035 29-38MHz	OSR-3H061 50.4-71.4MHz	See Page 3 Enhanced FM Synthesizer OS(R/T)-3H 29-71.4MHz
	VT-3H045 38-50MHz	OST-3H045 38-50MHz		VR-3H045 38-50MHz		
VHF 132-174MHz	VT-3/140 132-150MHz	OST-3H141 132-150MHz	Enhanced FM Synthesizer OS(R/T)-3H 128.6-174MHz	VR-3H140 132-150MHz	OSR-3H162 153.4-171.4MHz	Enhanced FM Synthesizer OS(R/T)-3H 128.6-174MHz
	VT-3/160 150-174MHz	OST-3H162 150-174MHz		VR-3H160 150-174MHz	OSR-3H141 128.6-152.6MHz	
UHF 406-470MHz	UT-3/420 406-430MHz	OST-3H418 406-430MHz	See Page 59 Enhanced FM Synthesizer OS(R/T)-3H 406-470MHz	UR-3H420 406-430MHz	OSR-3H440 427.4-451.4MHz	See Page 59 Enhanced FM Synthesizer OS(R/T)-3H 406-470MHz
	UT-3/460 450-470MHz	OST-3H460 450-470MHz		UR-3H460 450-470MHz		



GENERAL INFORMATION

INTRODUCTION

The OS(R/T)-3H Synthesizer is a compact, fully shielded and environmentally rugged frequency synthesis module that is the nucleus of every MT-3 synthesized Receiver and Transmitter radio module. The OS(R/T)-3H generates a high stability, low distortion radio frequency signal in one of several frequency bands. The OS(R/T)-3H utilizes an internal temperature compensated 9.6 or 10.0MHz reference to produce a signal stable to ±1 ppm within the temperature range of -40°C to +60°C. Alternately, the OS(R/T)-3H can be disciplined by an external 9.6MHz or 10MHz reference of higher stability. All synthesizer modules are designed to be easily removed for programming, calibration and/or repair. The synthesizer circuitry is distributed between two printed circuit boards (PCBs) which are isolated yet interconnected via photo-logic optical transceivers that effectively eliminate residual electrical noise between digital and analog circuitry. Further shielding of the synthesizer's RF filter circuitry is provided by an internal shielded enclosure.

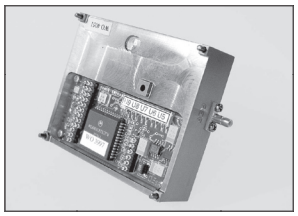
OS(R/T)-3H ENHANCED SYNTHESIZER FAMILY MODELS

The OS(R/T)-3H Synthesizer Module is utilized in both the MT-3 Receiver and Transmitter product lines. In MT-3 Transmitters, the OS(R/T)-3H synthesizer provides a modulated, low-level RF signal to the Power Amplifier module. In MT-3 Receivers, the OS(R/T)-3H synthesizer provides a low noise local oscillator (LO) signal that either directly drives the mixer circuitry or first drives a buffer amplifier which precedes the mixer circuitry (if a higher LO drive signal is required for enhanced intermodulation capability).

All OS(R/T)-3H FM Enhanced Synthesizer Modules, regardless of the frequency band, use the same digital PCB and mechanical construction. There are, however, significant differences between the various models when it comes to the analog PCB. Each model's specific sub-band of operation within a given frequency band is determined through SELECT components on the corresponding analog board.

PERFORMANCE SPECIFICATIONS

Type:	Narrow band FM, Single loop synthesizer module utilizing low noise VCO and PLL technology. Compatible with Daniels' MT-3 Series Transmitter and Receiver modules.
Frequency Range (Tuning range with no adjustment is shown in [ ] brackets.):	128.6MHz-152.6MHz [±2.0MHz] (OST-3H141, OSR-3H141) 150MHz-174MHz [±2.0MHz] (OST-3H162, OSR-3H162)
Output Power:	+5dBm ±2dBm into 50 Ω
Harmonics:	<-30 dBc
Spurious:	<-90 dBc
Hum and Noise:	>55 dB
Modulation Sensitivity:	3.0kHz peak deviation (400mVrms input)
External Reference Input:	External reference input signal via SMB connector J1 Input level 0dBm ±3 dB Input impedance 50 Ω Input frequency 10.0MHz or 9.6MHz selectable through digital board jumper JU1
Power Requirements:	Normal Configuration: +9.5VDC @ 160mA Low Current Standby Mode (TCXO enabled): +9.5VDC @ 14mA



THEORY OF OPERATION

THEORY OF OPERATION

Internal Power and Control (Digital Board)

The synthesizer operates from a +9.5VDC power source applied to connector pin P1-2. Total current draw is approximately 160mA. POWER DOWN control line P2-4 controls the +5.0VDC microcontroller regulator U2 through power MOSFET switch U1. For receiver applications the synthesizer is always ON, with the enable line P2-4 directly connected to +9.5VDC. For transmitter applications, pin P2-4 is controlled by the MT-3 Transmitter Board jumper J18 which selects the synthesizer standby mode. In Low Current Standby Mode, less than 14mA is drawn, however, a delay of approximately 50ms from PTT activation to transmitter turn on is then required to allow for the synthesizer to lock. In Normal Mode, with the synthesizer ON continuously, less than 10ms delay is encountered. This capability comes at the expense of additional standby current (160mA).

Synthesizer Analog Circuitry (Analog Board)

The Analog Board utilizes four optical receivers (U1–U4) and one optical transmitter (U5) to provide an isolated data interface to the digital board. The regulator IC U8 provides a continuous +5.0VDC to the internal TCXO and power control optical receiver U1 when ever +9.5VDC is applied to the synthesizer's voltage terminals. The analog board's main power is turned on and off by driving the optical receiver U1. U1 is driven by U4 on the digital board, which is controlled by the microcontroller. The main power regulators are provided by U6 and U7. Regulator U6 provides switched +8.0VDC and regulator U7 proves switched +5.0VDC. The power MOSFET IC U9 works as a clamping circuit to quickly discharge the VCO filter capacitors C32 and C33; when U9 is powered down the RF output from the VCO is suppressed almost immediately.

At the heart of the OS(R/T)-3H Enhanced Synthesizer is U10 a low power, single chip PLL synthesizer IC. U10 is setup to use a 9.6 or 10.0MHz reference signal provided either from the internal TCXO (with JU1-B selected) or from the external SMB connector J1 (with JU1-A selected). The reference signal's frequency is selected by jumper JU2 on the digital board; 9.6MHz is selected if JU2 is not installed and 10MHz if JU2 is installed. If an external reference signal is used it must be sinusoidal, low phase noise, and highly stable with an output power of 0dBm ±3dBm. A poor quality reference source will degrade the receiver or transmitter performance to unacceptable levels. The external reference is buffered by transistor Q2 on the analog board, which has 50Ω input impedance at 10.0MHz. The internal TCXO reference of 10.0MHz provides better than ±1ppm frequency stability from -30°C to +60°C (-40°C to +60°C optional). The TCXO fine frequency adjustment is made through potentiometer RV1, which is accessible through the synthesizer's top cover.

The 9.6 or 10.0MHz reference source is divided down to establish a channel selection step size of 5.0, 6.25, 2.5kHz. A third order passive loop filter comprised of C37, C38, C39, C45, C49, R36 and R32 are employed to achieve the required noise performance, modulation and worst case switching time of 50ms. A small sample of RF energy is coupled from the VCO output buffer U16 to the synthesizer IC U10 prescaler input (pin 11). FM modulation of the VCO from approximately 100Hz to 3kHz is achieved through the baseband input pin P1-1 on the Digital Board. A 1kHz sine wave with a level of approximately 400mVrms at P1-1 provides FM deviation of 3kHz. SMB connector J2 provides an RF output level of approximately +5dBm into a 50Ω load.

An optional low frequency modulation input is provided through connector P1-18 on the digital board, and routed to the analog board via connector P3. This modulation input is coupled to a low impedance DC coupled source. The input provides a phase modulated bandwidth from 0Hz (DC) to the PLL loop filter bandwidth. This allows for specialized applications such as paging or trunking where a separate low frequency digital/analog modulation channel is required. The phase modulation input on the digital board, connector P1-18, is routed to the transmitter's audio processor pin P4-2 via JA4-2 on the MT'3 transmitter's main board. It should be noted that any application that uses the direct TCXO modulation port transfers control of the synthesizer's steady state frequency setting to the external modulation source. The internal TCXO frequency control potentiometer RV1 is then effectively removed from the circuitry.

A lock detect LED on the synthesizer's analog board (LED1) indicates an unlocked PLL condition. An unlocked PLL condition normally indicates that the VCO is not tuned within the lock in range of the desired channel frequency. In a transmitter, the loss of lock will prevent a PTT from keying the power amplifier module, thus preventing the transmission of a spurious output signal. Adjusting capacitor C24 will normally re-establish a frequency lock within the synthesizer's frequency range. The optical transmitter U5 on the analog board is also activated in an unlocked condition and enables the micro controller on the digital board to respond to the unlocked PLL condition.

The field effect transistor Q5 forms part of the negative resistance VHF amplifier oscillator that is tuned on-frequency by the combination of the resonator L5 and the total capacitive reactance presented across L5 through capacitors C62, C63, C64, C23 (Select), variable capacitor C24 and varactor diodes D1 and D2. Fine frequency adjustment is obtained via the multi-turn trimmer capacitor C24. SELECT capacitor values C40 and/or C23 are chosen to position the operating frequency in one of two bands; 128-152.6MHz or 150-174MHz. Varactor diodes D1 and D2 provide oscillator frequency control. The PLL control voltage, at the output of the low-pass loop filter, controls the VCO frequency through the reverse biasing of diodes D1 and D2. The PLL control voltage can range between +1.0VDC to +4.0VDC and is nominally set to +2.3VDC at the synthesizer centre frequency. Setting of the PLL control voltage test point (TP4) is achieved by adjusting the fine frequency variable capacitor C24. External baseband frequency modulation is provided through connector P1 and a voltage divider network formed by R21 and R22. A large signal division ratio, established by the resistive dividers R21 and R22, allows low deviation (less than 5kHz) direct frequency modulation of the VCO output signal.

The PLL low-pass filter is formed by SELECT components C37, C38, C39, C45, R32 and R36. The loop filter response is optimized for switching time, noise and modulation requirements specific to each sub-band within the 128-174MHz frequency range. The SELECT components (including the loop filter) can be found in tabular format on the VHF OS(R/T)-3H 128-174MHz Analog Board Schematic diagram.

RF output power is taken from the source of Q5 and amplified/buffered by U11. U15 provides further amplification and isolation while delivering ≈ +10dBm into a six-pole low-pass/notch output filter formed by C53, C57, C58, C59, L11 and L12. The five pole low-pass output filter, with a cutoff frequency of 190MHz, effectively eliminates output harmonics. SMB connector J2 provides interconnection to the companion transmitter or receiver with an output level of +5dBm ±2dBm.

Synthesizer Digital Circuitry (Digital Board)

The synthesizer's digital board circuitry generates control signals utilized within the synthesizer. The microcontroller U4 on the digital board: communicates with the synthesizer's PLL IC U10 on the analog board; monitors the synthesizer lock detect; manages the PTT input and output; and determines the operating frequency by reading the channel code number information from either the four rotary binary coded decimal (BCD) switches mounted on the transmitter or receiver's main board, or by reading the four externally driven channel select lines. The microcontroller U4 is also designed to communicate with Daniels' Synthesizer Channel Programmer (CP-SC-3) through I/O lines TX Data (P1-17), RX Data (P1-9) and Bootstrap (P2-2). This external programmer places the operating program in non-volatile microprocessor memory and programs up to 15 user defined channel code numbers. An internal "watchdog" timer provides robust software protection in all operating modes.

Data communication between the digital and analog circuit boards is achieved through four optical transmitters (U5 through U8) and one optical receiver (U9). The optical interface provides a fully isolated inter-board data communications link designed to prevent digital noise from interfering with the sensitive PLL circuitry.

BCD Switch Frequency Control

Selection of the desired synthesizer output frequency is straight forward. If all four of the CHANNEL SELECT lines (CHAN SEL3-CHAN SEL0) are pulled low (to GND), the synthesizer will scan the four BCD switches (FSW1- FSW4) located on the receiver or transmitter main circuit boards via connections SW1 COM-SW4 COM and PC4-PC7 and establish the operating frequency from these switches. The four CHANNEL SELECT lines, CHAN SEL3-CHAN SEL0, are connected via the MT-3 transmitter or receiver main board module connector to the M3 motherboard subrack. These lines are by default normally pulled low (to GND) via jumpers located on the M3 motherboard subrack.

If any one of the CHANNEL SELECT lines are pulled high (to +9.5VDC), then the synthesizer's frequency of operation will be determined by the CHANNEL SELECT lines and not the BCD switches. Up to 15 separate channel frequencies can be pre-programmed into a 'table' in non-volatile microprocessor memory and accessed through binary interpretation of the CHANNEL SELECT lines. The most significant bit (MSB) in the CHANNEL SELECT binary code is represented by CHAN SEL3 and the least significant bit (LSB) is represented by CHAN SEL0. For example, if all CHANNEL SELECT lines are pulled high, (i.e. binary '1111') then the 15th frequency entry in the internal channel table will be selected. The channel table is normally pre-programmed at the factory to user specifications, but may be programmed in the field using Daniels' Synthesizer Channel Programmer (CP-SC-3).

In transmitters, the synthesizer operating frequency is the transmitter operating frequency. For receivers the synthesizer's operating frequency is 21.4MHz above or below the receiver frequency. Refer to the Channel Designation Table Manual for a channel code number versus frequency table.

Synthesizer Base and Frequency Increments

The OS(R/T)-3H Synthesizer operates in frequency increments of 5.0/6.25/2.5kHz. The Base Frequency for any given synthesizer model is the lowest frequency generated.

Model Number	Freq. Range	Base Freq.	Freq. Increment
OST-3H141	132-150MHz	128MHz	5.0/6.25/2.5kHz
OST-3H162	150-174MHz	150MHz	5.0/6.25/2.5kHz
OSR-3H141	128.6-152.6MHz	128MHz	5.0/6.25/2.5kHz
OSR-3H162	150-174MHz	150MHz	5.0/6.25/2.5kHz

5.0/6.25/2.5kHz Channelization

The OS(R/T)-3H synthesizers have been designed to generate frequencies in 5.0, 6.25, and 2.5kHz channel increments. The frequency increments are determined by the channel code number range. The channel code numbers: from 0000 to 4999 increment the frequency in 5.0 kHz increments, from 5000 to 9999 increment the frequency by 6.25 kHz increments, and from A000 to F999 increment the frequency by 5.0 kHz with a 2.5 kHz offset. The channel numbers starting at F000 are a combination of hexadecimal and decimal; the first digit 'A' is hexadecimal and the rest are decimal. The channel code number is either stored in the synthesizer's memory or by the BCD switches on the transmitter or receiver's main board. The channel number determines where the channel code number is retrieved from; channel 1 is stored by the BCD switches, and channels 2 through 16 are stored in the synthesizer's memory.

To calculate the operating frequency for the OS(R/T)-3H from the channel code numbers refer to the Channel Table Instruction Manual or the calculations below.

BCD switch settings from 0000 to 4999:

Multiply the switch setting by 5.0kHz and add the result to the synthesizer base frequency.

Example: An OST-3H162 synthesizer has a base frequency of 150MHz. The selected channel code number is 0350. The synthesizer output frequency is: 0350 x 5kHz = 150MHz = 151.75MHz

BCD switch settings from 5000 to 9999:

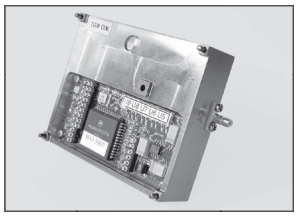
Subtract 5000 from the switch setting. Multiply the result by 6.25kHz and add the result to the synthesizer base frequency.

Example: An OSR-3H141 synthesizer has a base frequency of 128MHz. The selected channel code number is 5544. The synthesizer output frequency is: (5544-5000) x 6.25kHz +128MHz = 131.4MHz

BCD switch settings from A000 to F999:

Subtract A from the most significant BCD digit of the channel code number, multiply the result fo 5.0 kHz, add 2.5 kHz, and add the result to the base frequency.

Example: An OST-3H162 synthesizer has a base frequency of 150 MHz. The selected channel code number is B778. The synthesizer output frequency is: B-A = 1 => 1778



SYNTHESIZER ALIGNMENT

GENERAL

OS(R/T)-3H enhanced synthesizer alignment is simplified by using a Type 84 subrack and RF extender card/cable for providing receiver or transmitter power and signal interconnection. Alternately, a +9.5VDC may be directly connected to a receiver or transmitter module with the positive connection on pins B6/Z6 and the negative connection on pins B30/ Z30/B32/Z32. The receiver's balanced audio output (600Ω) is available at pins B26 and Z26. The transmitter's balanced audio output (600Ω) is available at pins B18 and Z18.

REPAIR NOTE

The OS(R/T)-3H synthesizer employs a large number of surface mount components. Removal and/or replacement of surface mount components should never be performed using an ordinary soldering iron but should only be performed at surface mount rework and repair stations equipped with Electrostatic Discharge (ESD) protection.

When removing Surface Mount Solder Jumpers, it is recommended that a solder wick braid be used in lieu of vacuum type de-soldering tools to help prevent damage to the printed circuit boards.

RECOMMENDED TEST EQUIPMENT

Synthesizer alignment requires the following test equipment, or its equivalent:

Power supply-Regulated +9.5VDC at 2 A. Phillips PM 2811

Oscilloscope/Multimeter-Fluke 97 Scopemeter

Radio communications test set-Marconi Instruments 2965A

It is recommended that the radio communications test set be referenced to an external high stability frequency source (WWVH, GPS, Loran C) so that the OS(R/T)-3H internal high stability local oscillator may be accurately set to within its ±1 ppm frequency tolerance.

OS(R/T)-3H SYNTHESIZER FACTORY CONFIGURATION

The OS(R/T)-3H Synthesizer is factory configured as follows:

Internal 9.6 or 10.0MHz reference selected.

VCO modulation (via audio processor) enabled (OST TX versions only)

The corresponding synthesizer jumper settings are:

Digital Board

Jumper JU2	installed 10.0MHz reference frequency selected (default)
Jumper JU2	not installed 9.6MHz reference frequency selected (default)
Jumper JU1	not installed AM Multichannel mode selected (default)

Analog Board

Jumper JU1:	'B' position Internal TCXO reference freq. selected (default)

OS(R/T)-3H SYNTHESIZER ALIGNMENT PROCEDURE

General

Synthesizer alignment is normally accomplished with the synthesizer installed in the MT-3 Receiver IF/Audio Board or the MT-3 Transmitter Main Board. The alignment procedure involves setting the internal TCXO reference frequency, the internal reference option is enabled. This step is described in 'Reference Frequency Alignment' in this section. A change in operating frequency from the initial factory setting that exceeds the synthesizer's maximum tuning range (Refer to Specifications) requires a more involved alignment procedure as described below. The conversion of a synthesizer from an internal reference to an external reference or vice-versa is accomplished through the selection of jumper JU1 A (for external) or B (for internal, on the analog board), and as appropriate JU2 on the digital board (Refer to 'Jumper Configuration').

Synthesizer Test Points

Analog Board Component Layout (Top)

TP1	+8.0 ±0.3VDC. U6 positive regulator output.
TP2	+5.0 ±0.1VDC. U7 positive regulator output.
TP3	+5.0 ±0.1VDC. U8 positive regulator output (always on).
TP4	PLL error voltage. Normal range is +0.5 to +4.5VDC (depending on frequency). Nominally adjusted for +2.3VDC (via C24) for center channel.

Digital Board Component Layout (Bottom)

TP1	+5.0 ±0.1VDC. U2 positive regulator output (controlled via pin P2-4).
TP2	Microcontroller E clock. 2MHz logic level square wave.

Synthesizer Removal and Installation

Note: Complete synthesizer alignment can be performed without removing the synthesizer

The synthesizer module is secured to the main board (MT-3 Receiver IF/Audio Board or MT-3 Transmitter Main board) with a single counter sunk Phillips machine screw accessible from the top cover. Remove this screw to remove the synthesizer module. Using a plastic coated lifting tool, such as a small screwdriver with the tip covered in heat shrink material, gently lift the synthesizer module from the main circuit board by applying pressure in a rotating fashion about the four corners of the synthesizer module. It is important to gently remove the synthesizer module “straight out” in order to prevent damage to the connector pins. Installation of the synthesizer is performed in a reverse fashion. It is important to ensure complete connector pin alignment prior to any application of reinsertion force. Four corner locating pins on the synthesizer housing assist in connector pin alignment during installation and removal.

Circuit Board Removal

Note: Circuit board removal is not required for tuning purposes.

Using a vacuum de-soldering station, de-solder connections P1, P2 and P3. Remove SMB connectors J1 and J2 by de-soldering the center pins and removing four M2 machine screws. These connection points are shown in the Analog Board Component Layout diagrams. Remove seven M2 machine screws and carefully remove the analog circuit board. Removal of the analog circuit board will expose three inter-board wire connections. Carefully remove three ferrite beads and six Teflon washers from the inter-board connection wires. Attempt to maintain the position of the three inter-board wires in order to simplify re-assembly. The digital board may now be extracted by removing four M2 machine screws. Follow a reverse procedure to re-assemble.

Frequency Adjustment and Channel Selection

Connect a radio communications test set through a short section of low loss 50Ω coaxial cable to the synthesizer module SMB RF output jack (J2). Select the desired channel code number via the BCD frequency selection switches on the MT-3 Transmitter Main board or the MT-3 Receiver IF/Audio board (or through .the Frequency Programming Module). Turn the power off and back on and wait a few minutes for the oscillator to completely stabilize. It should be noted that the internal synthesizer TCXO, if installed, operates continuously (regardless of the TX PTT state) when installed in a transmitter.

The measured RF output signal should be within ±1.0 ppm of the specified oscillator frequency at an output level of +5dBm ±2dBm at 25°C. Note that unlocked synthesizer operation will be indicated by an unstable or spurious RF output signal. The “Unlocked” red LED will also be illuminated when the PLL is unlocked. Check that the requested channel number is within the frequency range of the particular synthesizer model. An unlocked condition may be rectified by adjusting the VCO tuning elements as described in the following procedures.

VCO Alignment

Refer to the ‘Analog Board Component Layout’ diagrams and the ‘Analog Board Schematic Diagram’ in this section.

1) Measure the PLL DC control voltage at TP4 located on the synthesizer module analog board (top) using a high impedence (10MΩ) voltmeter (access to TP4 is available through the synthesizer top cover).

2) Carefully adjust the VCO fine frequency “TUNE” trimmer capacitor C24, using a small standard blade screwdriver, until a test point (TP4) voltage of approximately +2.3VDC is obtained. PLL loop control voltages below approximately +0.5VDC and above approximately +4.5VDC will indicate an “out of lock” synthesizer condition.

It is important to check the loop control voltage at TP4 when multiple synthesizer channels have been programmed. All channel selections should result in a TP4 voltage within a +1.0 to +4.0VDC range. Adjust the fine-tuning capacitor C24 to center multiple channel voltages symmetrically about +2.3VDC. Channel selections beyond the tuning range capability of the synthesizer will result in unlocked operation. The tuning range capability of this synthesizer model is listed in the Therory of Operation section.

Reference Frequency Alignment

To adjust the output frequency of the synthesizer the reference frequency of the TCXO is adjusted. Note this adjustment is only valid when the internal reference is selected (JU1 in the B position on the analog board). To adjust the internal TCXO referency frequency adjust the synthesizer TCXO fine frequency potentiometer RV1 until the correct output frequency is achieved. Access to this potentiometer is through an opening in the synthesizer top cover. An RF power level of approximately +5dBm ±2dBm should be measured at the synthesizer's SMB output connector J2. The frequency should be within ±1 ppm of the desired operating frequency. Reference frequency adjustments should be made at room temperature (+25°C) after a ten minute stabilization period.

JUMPER CONFIGURATION

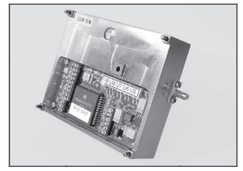
The synthesizer's surface mount solder jumpers are clearly marked on both of it's digital and analog circuit boards. Refer to the 'Digital Board Component Layout (Bottom)' diagram in this section and the 'Analog Board Component Layout (Top)' diagram for jumper locations. The following list details the required jumper configuration for the two synthesizer operating modes:

1) Internal reference. Install jumper JU1 in the B position, on the Analog Board (Standard). The internal temperature compensated crystal oscillator (TCXO) provides the reference signal with a stability of ±1 ppm from -30°C (Optional -40°C) to +60°C.

2) External reference input. Install jumper JU1 in the A position on the Analog Board. This mode is used in applications requiring better than ±1 ppm frequency stability. An external reference signal must be provided at the synthesizer's SMB connector J1. An optional front panel external reference connector is available as an option for transmitters and receivers.

3) Reference Frequency Select. Install jumper JU2 on the Digital Board to select a 10.0MHz reference frequency. When not installed, the reference frequency is by default 9.6MHz. JU2 is used by the microcontroller to establish the correct reference frequency division ratio. (the Synthesizer module must be removed to change jumper JU2 on the digital board.)

Note: Care must be exercised when reinstalling the synthesizer module on the Transmitter Main board or the IF/Audio board. Pay careful attention to pin alignment before pressing the synthesizer module into its mating sockets.



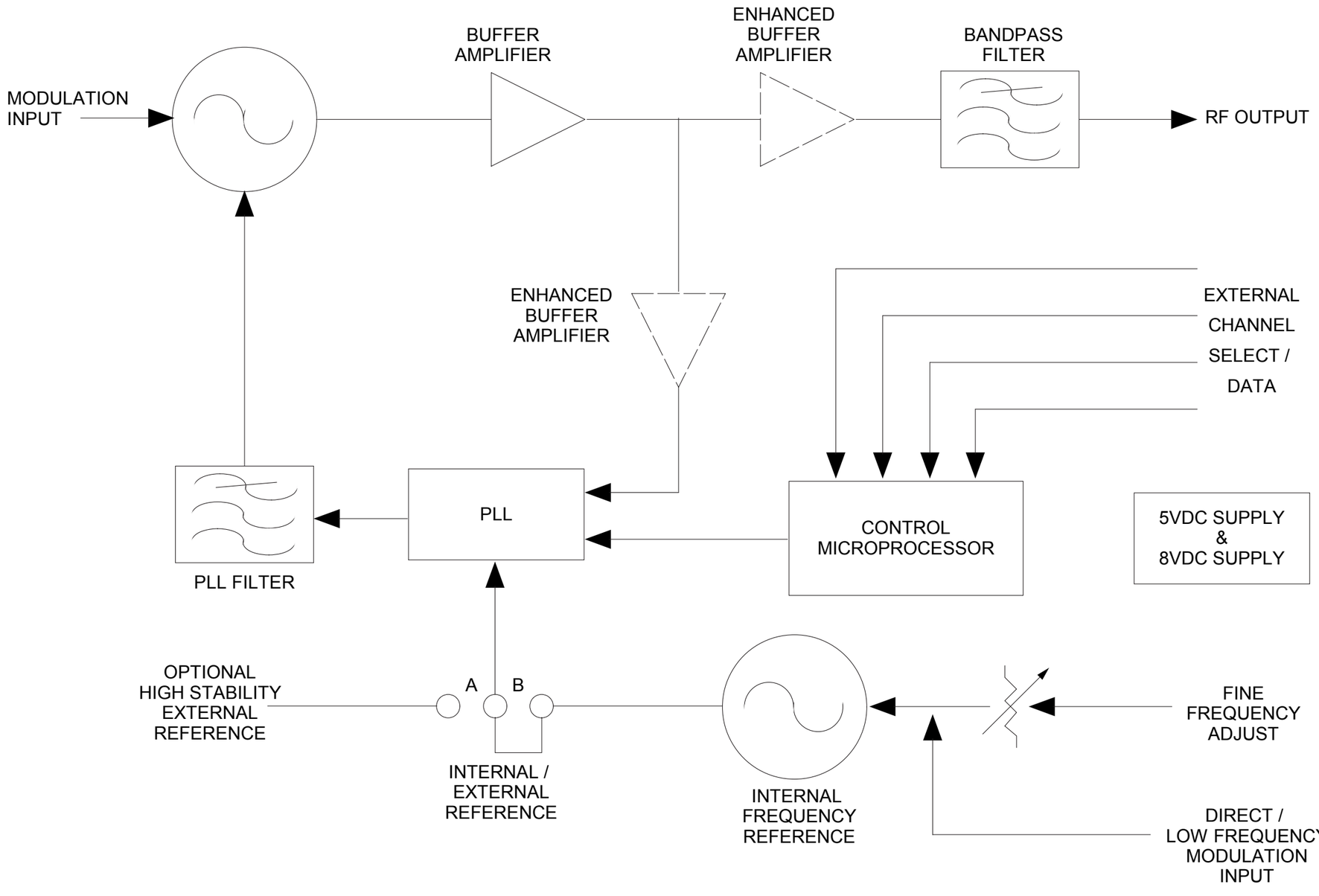
SCHEMATICS AND ILLUSTRATIONS

PRINTED CIRCUIT BOARD NUMBERING CONVENTION

Daniels Electronics Ltd. 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. All PCB's manufactured by Daniels Electronics Ltd. are identified by one of the following numbering conventions:

PCB number	43-91201<u>0</u> Indicates circuit board version 1.0
PCB number	50002-<u>02</u> Indicates circuit board version 2 (no decimal version)

SYNTHESIZER MODULE BLOCK DIAGRAM



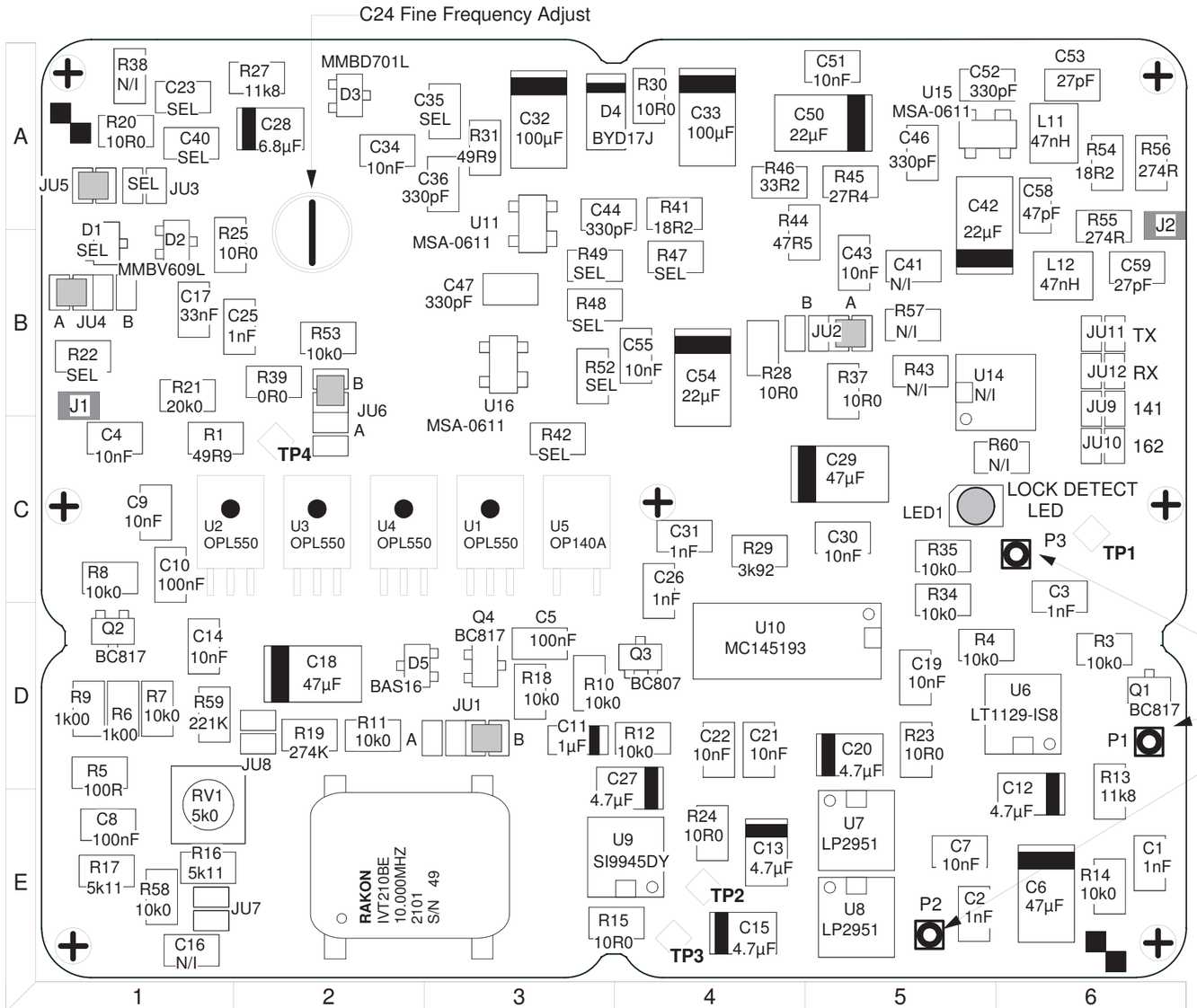
OS(R/T)-3H 128-174MHZ ANALOG BOARD COMPONENT LAYOUT (TOP)

COMPONENT LOCATION TABLE																			
DES	LC	DES	LC	DES	LC	DES	LC	DES	LC	DES	LC	DES	LC	DES	LC	DES	LC	DES	LC
C1	E6	C31	C4	D1	B1	L9	BS	R14	E6	R44	B4	U1	C3						
C2	E5	C32	A3	D2	B1	L10	BS	R15	E4	R45	A5	U2	C1						
C3	C6	C33	A4	D3	A2	L11	A6	R16	E1	R46	R4	U3	C2						
C4	C1	C34	A2	D4	A3	L12	B6	R17	E1	R47	B4	U4	C2						
C5	D3	C35	A3	D5	D2			R18	D3	R48	B3	U5	C3						
C6	E6	C36	A3			LED1	C5	R19	D2	R49	B3	U6	D6						
C7	E5	C37	BS	J1	B1			R20	A1	R50	BS	U7	E5						
C8	E1	C38	BS	J2	A6	P1	D6	R21	B1	R51	BS	U8	E5						
C9	C1	C39	BS			P2	E5	R22	B1	R52	B3	U9	E4						
C10	D1	C40	A1	JU1	D3	P3	C6	R23	D5	R53	B2	U10	C4						
C11	D3	C41	B5	JU2	B5			R24	E4	R54	A6	U11	A3						
C12	E6	C42	A5	JU3	A1	Q1	D6	R25	B1	R55	A6	U14	B5						
C13	E4	C43	B5	JU4	B1	Q2	D1	R26	BS	R56	A6	U15	A5						
C14	D1	C44	A3	JU5	A1	Q3	C4	R27	A2	R57	B5	U16	B3						
C15	E4	C45	BS	JU6	B2	Q4	D3	R28	B4	R58	E1								
C16	E1	C46	A5	JU7	E1	Q5	BS	R29	C4	R59	D1								
C17	B1	C47	B3	JU8	D2			R30	A4	R60	C6								
C18	D2	C49	BS	JU9	B6	R1	C1	R31	A3										
C19	D5	C50	A5	JU10	C6	R2	BS	R32	BS	RV1	E1								
C20	D5	C51	A5	JU11	B6	R3	D6	R33	BS										
C21	C4	C52	A5	JU12	B6	R4	D5	R34	D5	TCXO1	E2								
C22	C4	C53	A6			R5	D1	R35	C5										
C23	A1	C54	B4	L1	B2	R6	D1	R36	BS	TP1	C6								
C24	B2	C55	B4	L2	B4	R7	D1	R37	B5	TP2	E4								
C25	B2	C58	A6	L3	BS	R8	C1	R38	A1	TP3	E4								
C26	C4	C59	B6	L4	BS	R9	D1	R39	B2	TP4	C2								
C27	E4			L5	BS	R10	D3	R40	BS										
C28	A2			L6	BS	R11	D2	R41	A4										
C29	C5			L7	BS	R12	C4	R42	C3										
C30	C5			L8	BS	R13	E6	R43	B5										

BS - Bottom Side Component Layout

SELECT COMPONENTS		
	Transmitter 128 - 174 MHz OST - 3Hxxx	Receiver 128 - 174 MHz OSR - 3Hxxx
R22	130R	0R0

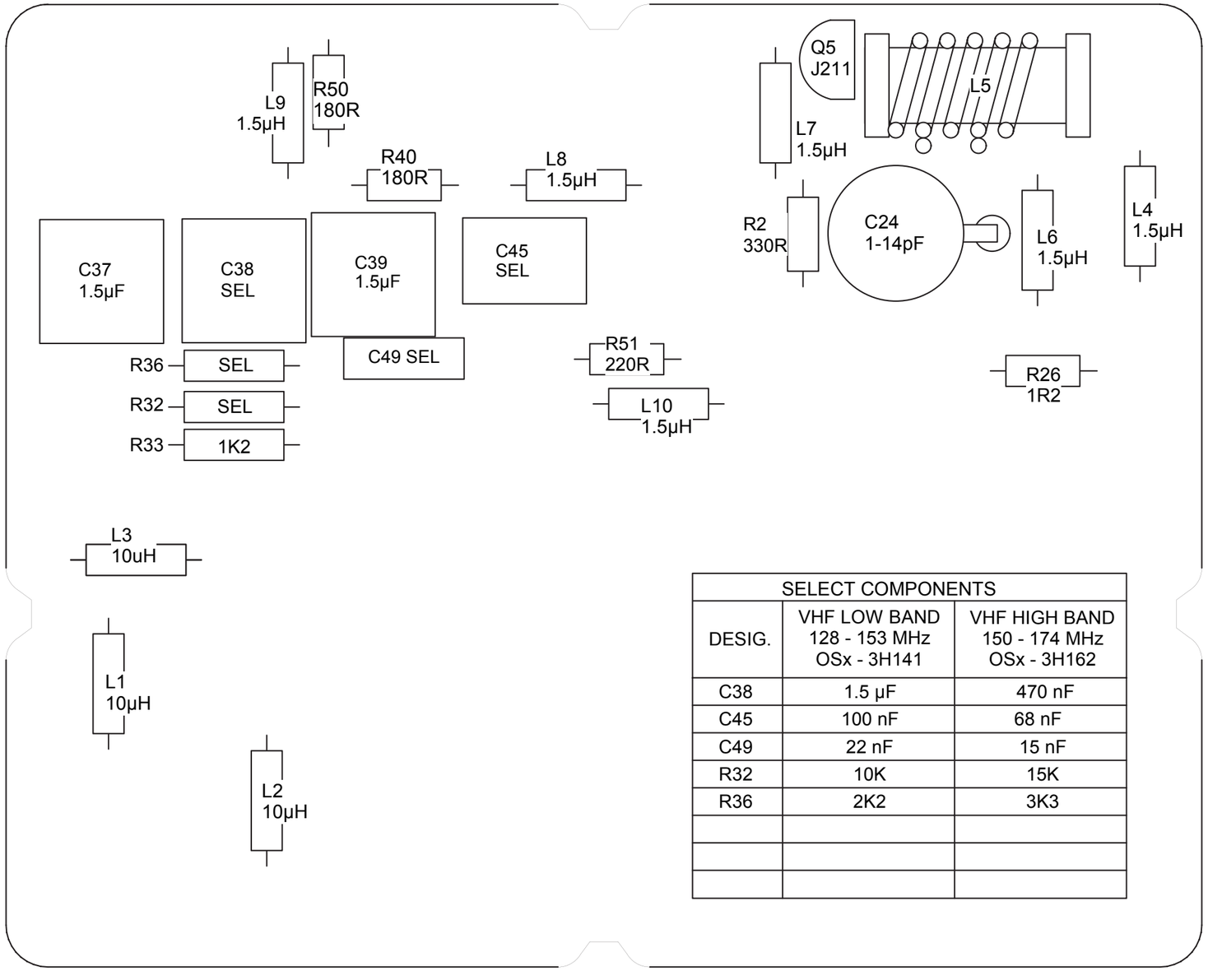
SELECT COMPONENTS		
	VHF LOW BAND 128 - 153 MHz OSx - 3H141	VHF HIGH BAND 150 - 174 MHz OSx - 3H162
C23	10 pF	6.8 pF
C35	3.3 pF	8.2 pF
C40	12 pF	6.8 pF
D1	MMBV609L	NOT INSTALLED
JU3	INSTALLED	NOT INSTALLED
R42	130R	383R
R47	27R4	47R5
R48	27R4	47R5
R49	39R2	10R0
R52	150R	NOT INSTALLED



SELECT COMPONENTS		
	Rakon TCVCXO IVT210BE	Saronix TCVCXO S2045-9.6 MHz
JU8	Not installed	Installed

50025-04-01-T-01-01

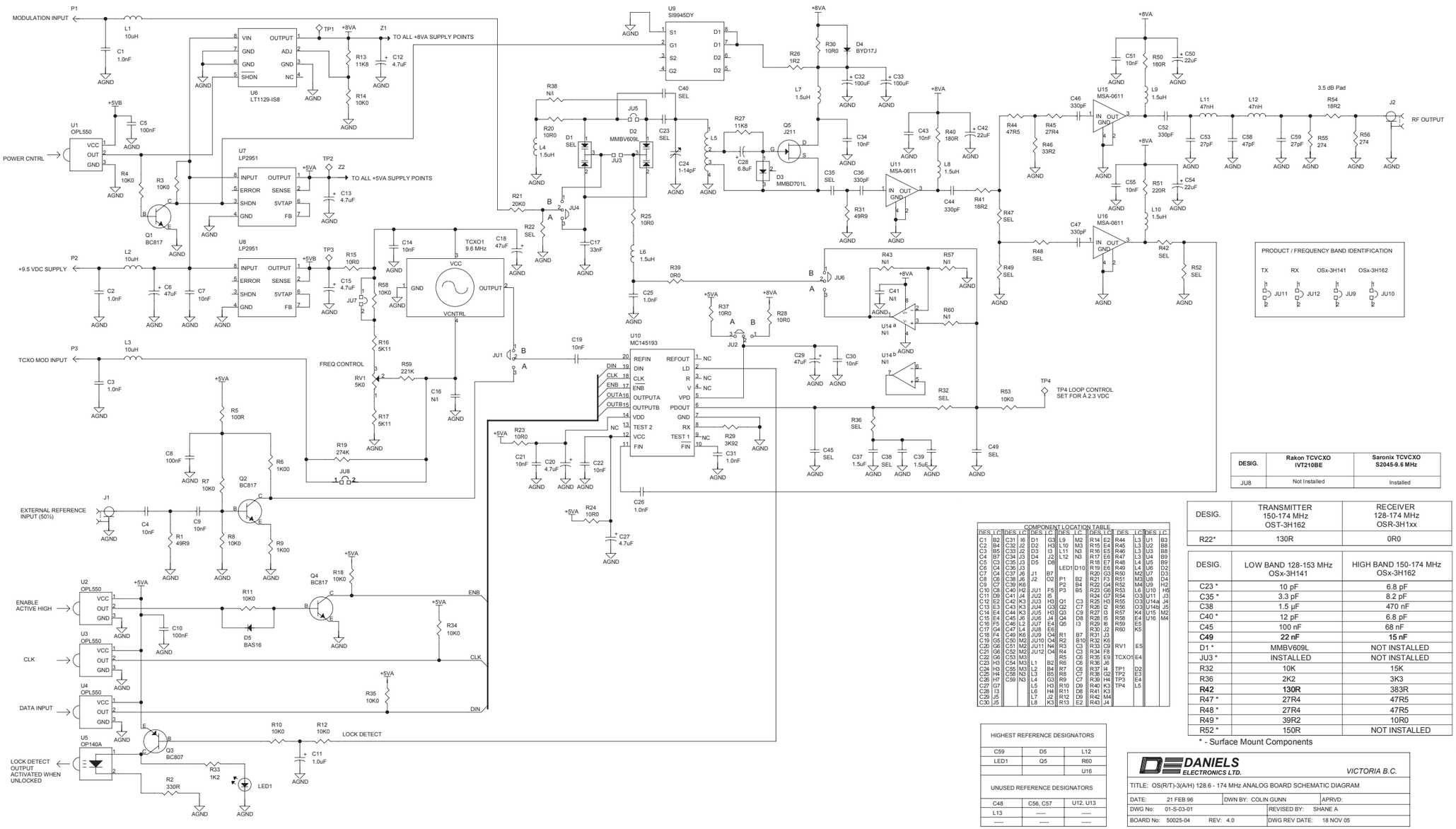
OS(R/T)-3H 128-174MHZ ANALOG BOARD COMPONENT LAYOUT (BOTTOM)



SELECT COMPONENTS		
DESIG.	VHF LOW BAND 128 - 153 MHz OSx - 3H141	VHF HIGH BAND 150 - 174 MHz OSx - 3H162
C38	1.5 µF	470 nF
C45	100 nF	68 nF
C49	22 nF	15 nF
R32	10K	15K
R36	2K2	3K3

50025-04-01-B-01-03

OS(R/T)-3H 128-174MHZ ANALOG BOARD SCHEMATIC DIAGRAM



DESIG.	Rakon TCVCXO IVT2108E	Saronix TCVCXO S2045-9.6 MHz
JU8	Not Installed	Installed

COMPONENT LOCATION TABLE

DES.	LC	DES.	LC	DES.	LC	DES.	LC	DES.	LC	DES.	LC	DES.	LC
C1	B2	C31	I6	D1	G3	L9	M2	R14	E2	R44	L3	U1	B3
C2	B4	C32	J2	D2	H3	L10	M3	R15	E4	R45	L3	U2	B8
C3	B5	C33	J2	D3	I3	L11	N3	R16	E5	R46	L3	U3	B8
C4	B7	C34	J3	D4	J2	L12	N3	R17	E6	R47	L3	U4	B9
C5	C3	C35	J3	D5		LED1	D10	R18	E7	R48	L4	U5	B9
C6	C4	C36	J3					R19	E6	R40	L4	U6	D2
C7	C4	C37	J6	J1	B7			R20	G3	R50	M2	U7	D3
C8	C6	C38	J6	J2	O2	P1	B2	R21	F3	R51	M3	U8	D4
C9	C7	C39	K6			P2	B4	R22	G4	R52	M4	U9	H2
C10	C8	C40	H2	JU1	F5	P3	B5	R23	G6	R53	L6	U10	H5
C11	D6	C41	J4	JU2	I5			R24	G7	R54	O3	U11	J3
C12	E2	C42	K3	JU3	H3	Q1	C3	R25	H3	R55	O3	U14a	J4
C13	E3	C43	K3	JU4	G3	Q2	C7	R26	I2	R56	O3	U14b	J5
C14	E4	C44	K3	JU5	H3	Q3	C9	R27	I3	R57	K4	U15	M2
C15	E4	C45	J6	JU6	J4	Q4	D8	R28	I5	R58	E4	U16	M4
C16	F5	C46	L2	JU7	E4	Q5	I3	R29	I6	R59	E5		
C17	G4	C47	L4	JU8	E6			R30	J2	R60	K5		
C18	F4	C49	K6	JU9	O4	R1	B7	R31	J3				
C19	G5	C50	M2	JU10	O4	R2	B10	R32	K6				
C20	G6	C51	M2	JU11	N4	R3	C3	R33	C9	RV1	E5		
C21	G6	C52	M2	JU12	O4	R4	C3	R34	F8				
C22	G6	C53	M3			R5	C6	R35	E9	TCXO1	E4		
C23	H3	C54	M3	L1	B2	R6	C6	R36	J6				
C24	H3	C55	M3	L2	B4	R7	C6	R37	I4	TP1	D2		
C25	H4	C58	N3	L3	B5	R8	C7	R38	G2	TP2	E3		
C26	H7	C59	N3	L4	G3	R9	C7	R39	H4	TP3	E4		
C27	G7			L5	H3	R10	D9	R40	K3	TP4	L5		
C28	I3			L6	H4	R11	D8	R41	K3				
C29	J5			L7	J2	R12	D9	R42	M4				
C30	J5			L8	K3	R13	E2	R43	J4				

DESIG.	TRANSMITTER 150-174 MHz OST-3H162	RECEIVER 128-174 MHz OSR-3H1xx
R22*	130R	0R0

DESIG.	LOW BAND 128-153 MHz OSx-3H141	HIGH BAND 150-174 MHz OSx-3H162
C23 *	10 pF	6.8 pF
C35 *	3.3 pF	8.2 pF
C38	1.5 pF	470 nF
C40 *	12 pF	6.8 pF
C45	100 nF	68 nF
C49	**22 nF**	**15 nF**
D1 *	MMBV609L	NOT INSTALLED
JU3 *	INSTALLED	NOT INSTALLED
R32	10K	15K
R36	2K2	3K3
R42	**130R**	383R
R47 *	27R4	47R5
R48 *	27R4	47R5
R49 *	39R2	10R0
R52 *	150R	NOT INSTALLED

* - Surface Mount Components

HIGHEST REFERENCE DESIGNATORS		
C59	D5	L12
LED1	Q5	R60
		U16

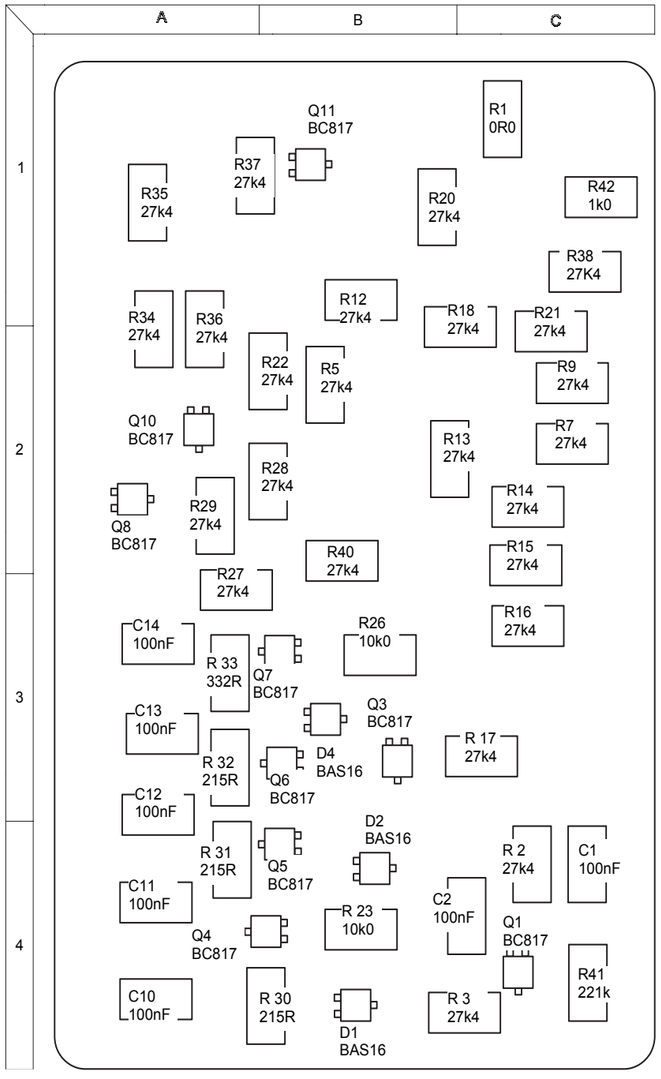
UNUSED REFERENCE DESIGNATORS		
C48	C56, C57	U12, U13
L13	------	------
------	------	------

DANIELS ELECTRONICS LTD. VICTORIA B.C.

TITLE: OS(R/T)-3(A/H) 128.6 - 174 MHz ANALOG BOARD SCHEMATIC DIAGRAM

DATE: 21 FEB 96	DWN BY: COLIN GUNN	APRVD:
DWG No: 01-S-03-01		REVISED BY: SHANE A
BOARD No: 50025-04 REV: 4.0		DWG REV DATE: 18 NOV 05

OS(R/T)-3H 128-174MHZ DIGITAL BOARD COMPONENT LAYOUT (TOP)

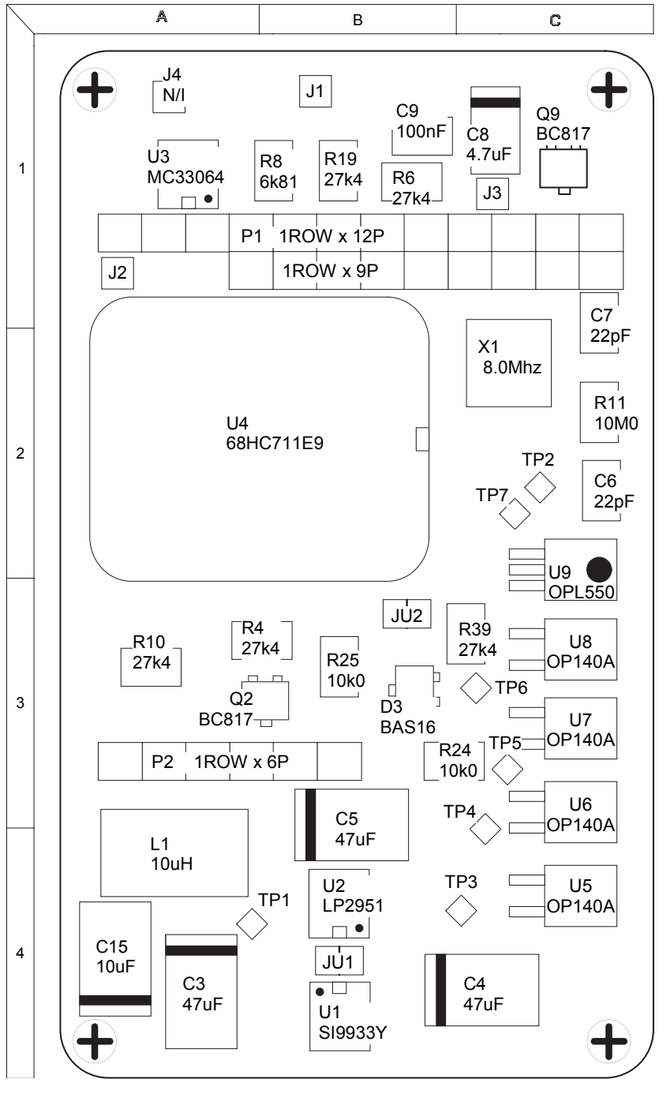


COMPONENT LOCATION TABLE

DES	LC	SD	DES	LC	SD	DES	LC	SD
C1	C4	T	Q6	B3	T	R33	A3	T
C2	C4	T	Q7	B3	T	R34	A2	T
C3	A4	B	Q8	A2	T	R35	A1	T
C4	C4	B	Q9	C1	B	R36	A2	T
C5	B4	B	Q10	A2	T	R37	A1	T
C6	C2	B	Q11	B1	T	R38	C1	T
C7	C1	B				R39	C3	B
C8	C1	B	R1	C1	T	R40	B2	T
C9	B1	B	R2	C4	T	R41	C4	T
C10	A4	T	R3	C4	T	R42	C1	T
C11	A4	T	R4	B3	B			
C12	A3	T	R5	B2	T	TP1	A4	B
C13	A3	T	R6	B1	B	TP2	C2	B
C14	A3	T	R7	C2	T	TP3	C4	B
C15	A4	B	R8	B1	B	TP4	C3	B
			R9	C2	T	TP5	C3	B
D1	B4	T	R10	A3	B	TP6	C3	B
D2	B4	T	R11	C2	B	TP7	C2	B
D3	B3	B	R12	B1	T			
D4	B3	T	R13	B2	T	U1	B4	B
			R14	C2	T	U2	B4	B
J1	B1	B	R15	C2	T	U3	A1	B
J2	A1	B	R16	C3	T	U4	A2	B
J3	C1	B	R17	C3	T	U5	C4	B
J4	A1	B	R18	C1	T	U6	C3	B
			R19	B1	B	U7	C3	B
JU1	B4	B	R20	B1	T	U8	C3	B
JU2	B3	B	R21	C2	T	U9	C2	B
			R22	B2	T			
L1	A4	B	R23	B4	T	X1	C2	B
			R24	B3	B			
P1	B1	B	R25	B3	B			
P2	A3	B	R26	B3	T			
			R27	A3	T			
Q1	C4	T	R28	B2	T			
Q2	B3	B	R29	A2	T			
Q3	B3	T	R30	B4	T			
Q4	B4	T	R31	A4	T			
Q5	B4	T	R32	A3	T			

50021-04-01-T-01-01

OS(R/T)-3H 128-174MHZ DIGITAL BOARD COMPONENT LAYOUT (BOTTOM)



COMPONENT LOCATION TABLE

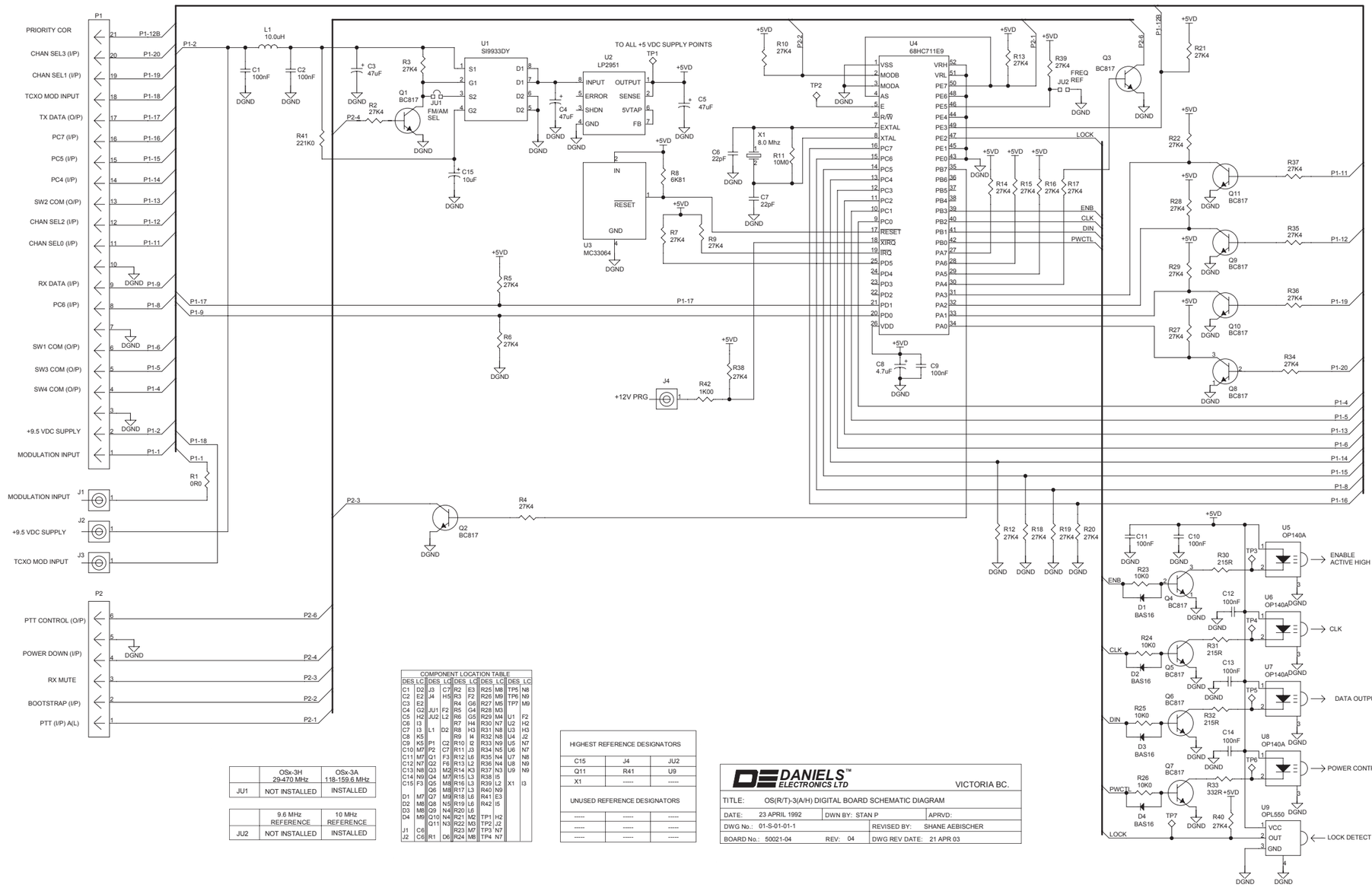
DES	LC	SD	DES	LC	SD	DES	LC	SD
C1	C4	T	Q6	B3	T	R33	A3	T
C2	C4	T	Q7	B3	T	R34	A2	T
C3	A4	B	Q8	A2	T	R35	A1	T
C4	C4	B	Q9	C1	B	R36	A2	T
C5	B4	B	Q10	A2	T	R37	A1	T
C6	C2	B	Q11	B1	T	R38	C1	T
C7	C1	B				R39	C3	B
C8	C1	B	R1	C1	T	R40	B2	T
C9	B1	B	R2	C4	T	R41	C4	T
C10	A4	T	R3	C4	T	R42	C1	T
C11	A4	T	R4	B3	B			
C12	A3	T	R5	B2	T	TP1	A4	B
C13	A3	T	R6	B1	B	TP2	C2	B
C14	A3	T	R7	C2	T	TP3	C4	B
C15	A4	B	R8	B1	B	TP4	C3	B
			R9	C2	T	TP5	C3	B
D1	B4	T	R10	A3	B	TP6	C3	B
D2	B4	T	R11	C2	B	TP7	C2	B
D3	B3	B	R12	B1	T			
D4	B3	T	R13	B2	T	U1	B4	B
			R14	C2	T	U2	B4	B
J1	B1	B	R15	C2	T	U3	A1	B
J2	A1	B	R16	C3	T	U4	A2	B
J3	C1	B	R17	C3	T	U5	C4	B
J4	A1	B	R18	C1	T	U6	C3	B
			R19	B1	B	U7	C3	B
JU1	B4	B	R20	B1	T	U8	C3	B
JU2	B3	B	R21	C2	T	U9	C2	B
			R22	B2	T			
L1	A4	B	R23	B4	T	X1	C2	B
			R24	B3	B			
P1	B1	B	R25	B3	B			
P2	A3	B	R26	B3	T			
			R27	A3	T			
Q1	C4	T	R28	B2	T			
Q2	B3	B	R29	A2	T			
Q3	B3	T	R30	B4	T			
Q4	B4	T	R31	A4	T			
Q5	B4	T	R32	A3	T			

	OSx-3H 29-470 MHz	OSx-3A 118-159.6 MHz
JU1	NOT INSTALLED	INSTALLED

	9.6 MHz REFERENCE	10 MHz REFERENCE
JU2	NOT INSTALLED	INSTALLED

50021-04-01-B-01-01

OS(R/T)-3H 128-174MHZ DIGITAL BOARD SCHEMATIC DIAGRAM



	OSx-3H 29-470 MHz	OSx-3A 118-159.6 MHz
JU1	NOT INSTALLED	INSTALLED

	9.6 MHz REFERENCE	10 MHz REFERENCE
JU2	NOT INSTALLED	INSTALLED

COMPONENT LOCATION TABLE

DES	LC	DES	LC	DES	LC	DES	LC	DES	LC
C1	D2	J3		C7	R2	E3	R25	M8	TP5	N8
C2	E2	J4		H5	R3	F2	R26	M9	TP6	N9
C3	E2				R4	G6	R27	M5	TP7	M9
C4	G2	JU1	F2		R5	G4	R28	M3		
C5	H2	JU2	L2		R6	G5	R29	M4	U1	F2
C6	I3				R7	H4	R30	N7	U2	H2
C7	I3	L1		D2	R8	H3	R31	N8	U3	H3
C8	K5				R9	I4	R32	N8	U4	J2
C9	K5	P1		C2	R10	I2	R33	N9	U5	N7
C10	M7	P2		C7	R11	J3	R34	N5	U6	N7
C11	M7	Q1		F3	R12	L6	R35	N4	U7	N8
C12	N7	Q2		F6	R13	L2	R36	N4	U8	N9
C13	N8	Q3		M2	R14	K3	R37	N3	U9	N9
C14	N9	Q4		M7	R15	L3	R38	I5		
C15	F3	Q5		M8	R16	L3	R39	L2	X1	I3
		Q6		M8	R17	L3	R40	N9		
D1	M7	Q7		M9	R18	L6	R41	E3		
D2	M8	Q8		N5	R19	L6	R42	I5		
D3	M8	Q9		N4	R20	L6				
D4	M9	Q10		N4	R21	M2	TP1	H2		
		Q11		N3	R22	M3	TP2	J2		
J1	C6				R23	M7	TP3	N7		
J2	C6	R1		D6	R24	M8	TP4	N7		

HIGHEST REFERENCE DESIGNATORS		
C15	J4	JU2
Q11	R41	U9
X1	-----	-----

UNUSED REFERENCE DESIGNATORS		
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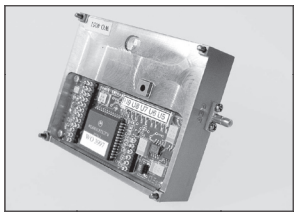
DANIELS™ ELECTRONICS LTD — VICTORIA BC.

TITLE:	OS(R/T)-3(A/H) DIGITAL BOARD SCHEMATIC DIAGRAM		
DATE:	23 APRIL 1992	DWN BY: STAN P	APRVD:
DWG No.:	01-S-01-01-1	REVISED BY:	SHANE AEBISCHER
BOARD No.:	50021-04	REV: 04	DWG REV DATE: 21 APR 03



PARTS LIST

128-174MHZ ANALOG BOARD ELECTRICAL PARTS LIST

Ref Desig	Description	Part Number	OSR-3H141	OSR-3H162	OST-3H141	OST-3H162
C1	CAP., SM, 1nF CER,0805,X7R,50V	1008-3A102K5R	•	•	•	•
C2	CAP., SM, 1nF CER,0805,X7R,50V	1008-3A102K5R	•	•	•	•
C3	CAP., SM, 1nF CER,0805,X7R,50V	1008-3A102K5R	•	•	•	•
C4	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R	•	•	•	•
C5	CAP., SM,100nF CER,0805,X7R,50	1008-5A104K5R	•	•	•	•
C6	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16	•	•	•	•
C7	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R	•	•	•	•
C8	CAP., SM,100nF CER,0805,X7R,50	1008-5A104K5R	•	•	•	•
C9	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R	•	•	•	•
C10	CAP., SM,100nF CER,0805,X7R,50	1008-5A104K5R	•	•	•	•
C11	CAP., SM, 1.0uF TANT., 20%,16V	1055-5A105M16	•	•	•	•
C12	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•	•	•
C13	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•	•	•
C14	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R	•	•	•	•
C15	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•	•	•
C17	CAP., SM, 33nF CER,0805,X7R,50V	1008-4A333K5R	•	•	•	•
C18	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16	•	•	•	•
C19	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R	•	•	•	•
C20	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•	•	•
C21	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R	•	•	•	•
C22	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R	•	•	•	•
C23	CAP., SM, 6.8pF CER., 0805,C0G	1008-0A689J1G		•		•
C23	CAP., SM, 10pF CER., 0805, C0G	1008-1A100J1G	•		•	
C24	CAP.,TRIM. 1-14pF, STAND. >6T	1082-A1R0014J	•	•	•	•
C25	CAP., SM, 1nF CER,0805,X7R,50V	1008-3A102K5R	•	•	•	•
C26	CAP., SM, 1nF CER,0805,X7R,50V	1008-3A102K5R	•	•	•	•

128-174MHz Analog Board
Electrical Parts List continued

Ref Desig	Description	Part Number	OSR-3H141	OSR-3H162	OST-3H141	OST-3H162
C27	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•	•	•
C28	CAP., SM, 6.8uF TANT., 20%,10V	1055-5B685M10	•	•	•	•
C29	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16	•	•	•	•
C30	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R	•	•	•	•
C31	CAP., SM, 1nF CER,0805,X7R,50V	1008-3A102K5R	•	•	•	•
C32	CAP., SM, 100uF TANT., 20%,16V	1055-7D107M16	•	•	•	•
C33	CAP., SM, 100uF TANT., 20%,16V	1055-7D107M16	•	•	•	•
C34	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R	•	•	•	•
C35	CAP., SM, 3.3pF CER., 0805,C0G	1008-0A339J1G	•		•	
C35	CAP., SM, 8.2pF CER., 0805,C0G	1008-0A829J1G		•		•
C36	CAP., SM, 330pF CER., 0805,C0G	1008-2A331J1G	•	•	•	•
C37	CAP., 1.5uF FILM, MMK5,10%,50V	1016-6E155K63	•	•	•	•
C38	CAP., 1.5uF FILM, MMK5,10%,50V	1016-6E155K63	•		•	
C38	CAP., 470nF FILM, MMK5,10%,63V	1016-5D474K63		•		•
C39	CAP., 1.5uF FILM, MMK5,10%,50V	1016-6E155K63	•	•	•	•
C40	CAP., SM, 6.8pF CER., 0805,C0G	1008-0A689J1G		•		•
C40	CAP., SM, 12pF CER., 0805, C0G	1008-1A120J1G	•		•	
C42	CAP., SM, 22uF TANT., 20%, 20V	1055-6D226M20	•	•	•	•
C43	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R	•	•	•	•
C44	CAP., SM, 330pF CER., 0805,C0G	1008-2A331J1G	•	•	•	•
C45	CAP., 100nF FILM, MMK5,10%,63V	1016-5A104K63	•		•	
C45	CAP., 68nF FILM, MMK5, 10%,63V	1016-4A683K63		•		•
C46	CAP., SM, 330pF CER., 0805,C0G	1008-2A331J1G	•	•	•	•
C47	CAP., SM, 330pF CER., 0805,C0G	1008-2A331J1G	•	•	•	•
C49	CAP., 15nF FILM, MMK5, 10%,63V	1016-4A153K63		•		•
C49	CAP., 22nF FILM, MMK5, 10%,63V	1016-4A223K63	•		•	
C50	CAP., SM, 22uF TANT., 20%, 20V	1055-6D226M20	•	•	•	•
C51	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R	•	•	•	•
C52	CAP., SM, 330pF CER., 0805,C0G	1008-2A331J1G	•	•	•	•
C53	CAP., SM, 27pF CER., 0805, C0G	1008-1A270J1G	•	•	•	•
C54	CAP., SM, 22uF TANT., 20%, 20V	1055-6D226M20	•	•	•	•
C55	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R	•	•	•	•
C58	CAP., SM, 47pF CER., 0805, C0G	1008-1A470J1G	•	•	•	•
C59	CAP., SM, 27pF CER., 0805, C0G	1008-1A270J1G	•	•	•	•
D1	DIODE, MMBV609L,VARICAP,SOT-23	2106-MMBV609L	•		•	
D2	DIODE, MMBV609L,VARICAP,SOT-23	2106-MMBV609L	•	•	•	•
D3	DIODE, MMBD701,HOT CARR.,SOT23	2105-MMBD7010	•	•	•	•
D4	DIODE, BYD17J, RECTIFIER,SOD87	2101-BYD17J00	•	•	•	•
D5	DIODE, BAS16, SWITCHING, SOT23	2100-BAS16000	•	•	•	•

128-174MHz Analog Board
Electrical Parts List continued

Ref Desig	Description	Part Number	OSR-3H141	OSR-3H162	OST-3H141	OST-3H162
L1	CHOKE, RF/MOLDED,10uH,10%,.25”	1251-4A00100K	•	•	•	•
L2	CHOKE, RF/MOLDED,10uH,10%,.25”	1251-4A00100K	•	•	•	•
L3	CHOKE, RF/MOLDED,10uH,10%,.25”	1251-4A00100K	•	•	•	•
L4	CHOKE, RF/MOLDED,1.5uH,10%,.25	1251-3A001R5K	•	•	•	•
L5	BOBBIN, 5.5 TURNS,1.59mm PITCH	5791-A1010300	•	•	•	•
L6	CHOKE, RF/MOLDED,1.5uH,10%,.25	1251-3A001R5K	•	•	•	•
L7	CHOKE, RF/MOLDED,1.5uH,10%,.25	1251-3A001R5K	•	•	•	•
L8	CHOKE, RF/MOLDED,1.5uH,10%,.25	1251-3A001R5K	•	•	•	•
L9	CHOKE, RF/MOLDED,1.5uH,10%,.25	1251-3A001R5K	•	•	•	•
L10	CHOKE, RF/MOLDED,1.5uH,10%,.25	1251-3A001R5K	•	•	•	•
L11	INDUCTOR, SM,47nH CER,10%,1008	1256-1B47N00K	•	•	•	•
L12	INDUCTOR, SM,47nH CER,10%,1008	1256-1B47N00K	•	•	•	•
LED1	LED/SM,PLCC-3.2X2.8,TOP,CL/RED	2111-T3228CRD	•	•	•	•
PCB	PCB, ANALOG, OS-3H VHF SYNTH.	4309-26500254	•	•	•	•
Q1	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025	•	•	•	•
Q2	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025	•	•	•	•
Q3	TRANSISTOR, BC807-25,PNP,SOT23	2120-BC807025	•	•	•	•
Q4	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025	•	•	•	•
Q5	JFET, J211, RF, N-CHAN., TO-92	2041-J2110000	•	•	•	•
R1	RES., SM, 49R9 0805, 1%,100ppm	1150-1A49R9FP	•	•	•	•
R2	RES., 330R METAL FILM, 5%,0.5W	1101-2A0331JP	•	•	•	•
R3	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•	•
R4	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•	•
R5	RES., SM, 100R 0805, 1%,100ppm	1150-2A1000FP	•	•	•	•
R6	RES., SM, 1K00 0805, 1%,100ppm	1150-3A1001FP	•	•	•	•
R7	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•	•
R8	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•	•
R9	RES., SM, 1K00 0805, 1%,100ppm	1150-3A1001FP	•	•	•	•
R10	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•	•
R11	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•	•
R12	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•	•
R13	RES., SM, 11K8 0805, 1%,100ppm	1150-4A1182FP	•	•	•	•
R14	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•	•
R15	RES., SM, 10R0 0805, 1%,100ppm	1150-1A10R0FP	•	•	•	•
R16	RES., SM, 5K11 0805, 1%,100ppm	1150-3A5111FP	•	•	•	•
R17	RES., SM, 5K11 0805, 1%,100ppm	1150-3A5111FP	•	•	•	•
R18	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•	•

128-174MHz Analog Board
Electrical Parts List continued

Ref Desig	Description	Part Number	OSR-3H141	OSR-3H162	OST-3H141	OST-3H162
R19	RES., SM, 274K 0805, 1%,100ppm	1150-5A2743FP	•	•	•	•
R20	RES., SM, 10R0 0805, 1%,100ppm	1150-1A10R0FP	•	•	•	•
R21	RES., SM, 20K0 0805, 1%,100ppm	1150-4A2002FP	•	•	•	•
R22	RES., SM, 130R 0805, 1%,100ppm	1150-2A1300FP			•	•
R22	RES., SM, ZERO OHM JUMPER,0805	1150-0A0R0000	•	•		
R23	RES., SM, 10R0 0805, 1%,100ppm	1150-1A10R0FP	•	•	•	•
R24	RES., SM, 10R0 0805, 1%,100ppm	1150-1A10R0FP	•	•	•	•
R25	RES., SM, 10R0 0805, 1%,100ppm	1150-1A10R0FP	•	•	•	•
R26	RES., 1R2 METAL FILM, 5%, 0.5W	1101-0A01R2JI	•	•	•	•
R27	RES., SM, 11K8 0805, 1%,100ppm	1150-4A1182FP	•	•	•	•
R28	RES., SM, 10R0 0805, 1%,100ppm	1150-1A10R0FP	•	•	•	•
R29	RES., SM, 3K92 0805, 1%,100ppm	1150-3A3921FP	•	•	•	•
R30	RES., SM, 10R0 0805, 1%,100ppm	1150-1A10R0FP	•	•	•	•
R31	RES., SM, 49R9 0805, 1%,100ppm	1150-1A49R9FP	•	•	•	•
R32	RES., 10K METAL FILM, 5%, 0.5W	1101-4A0103JP	•		•	
R32	RES., 15K METAL FILM, 5%, 0.5W	1101-4A0153JP		•		•
R33	RES., 1K2 METAL FILM, 5%, 0.5W	1101-3A0122JP	•	•	•	•
R34	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•	•
R35	RES., SM, 1K00 0805, 1%,100ppm	1150-3A1001FP	•	•	•	•
R36	RES., 2K2 METAL FILM, 5%, 0.5W	1101-3A0222JP	•		•	
R36	RES., 3K3 METAL FILM, 5%, 0.5W	1101-3A0332JP		•		•
R37	RES., SM, 10R0 0805, 1%,100ppm	1150-1A10R0FP	•	•	•	•
R39	RES., SM, ZERO OHM JUMPER,0805	1150-0A0R0000	•	•	•	•
R40	RES., 180R METAL FILM, 5%,0.5W	1101-2A0181JP	•	•	•	•
R41	RES., SM, 18R2 0805, 1%,100ppm	1150-1A18R2FP	•	•	•	•
R42	RES., SM, 130R 0805, 1%,100ppm	1150-2A1300FP	•		•	
R42	RES., SM, 383R 0805, 1%,100ppm	1150-2A3830FP		•		•
R44	RES., SM, 47R5 0805, 1%,100ppm	1150-1A47R5FP	•	•	•	•
R45	RES., SM, 27R4 0805, 1%,100ppm	1150-1A27R4FP	•	•	•	•
R46	RES., SM, 33R2 0805, 1%,100ppm	1150-1A33R2FP	•	•	•	•
R47	RES., SM, 27R4 0805, 1%,100ppm	1150-1A27R4FP	•		•	
R47	RES., SM, 47R5 0805, 1%,100ppm	1150-1A47R5FP		•		•
R48	RES., SM, 27R4 0805, 1%,100ppm	1150-1A27R4FP	•		•	
R48	RES., SM, 47R5 0805, 1%,100ppm	1150-1A47R5FP		•		•
R49	RES., SM, 10R0 0805, 1%,100ppm	1150-1A10R0FP		•		•
R49	RES., SM, 39R2 0805, 1%,100ppm	1150-1A39R2FP	•		•	
R50	RES., 180R METAL FILM, 5%,0.5W	1101-2A0181JP	•	•	•	•
R51	RES., 220R METAL FILM, 5%,0.5W	1101-2A0221JP	•	•	•	•
R52	RES., SM, 150R 0805, 1%,100ppm	1150-2A1500FP	•		•	
R53	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•	•
R54	RES., SM, 18R2 0805, 1%,100ppm	1150-1A18R2FP	•	•	•	•

128-174MHz Analog Board
Electrical Parts List continued

Ref Desig	Description	Part Number	OSR-3H141	OSR-3H162	OST-3H141	OST-3H162
R55	RES., SM, 274R 0805, 1%,100ppm	1150-2A2740FP	•	•	•	•
R56	RES., SM, 274R 0805, 1%,100ppm	1150-2A2740FP	•	•	•	•
R58	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•	•
R59	RES., SM, 221K 0805, 1%,100ppm	1150-5A2213FP	•	•	•	•
RV1	POT., SM/4mm SQ,5K,SINGLE TURN	1174-AS2502J1	•	•	•	•
TCXO1	TCVCXO,SMT,10MHz,1ppm,0-3V,4PN	2641-10000AM7	•	•	•	•
U1	DIODE, I/R SENSOR,TTL O/P,PLST	2014-1L18230T	•	•	•	•
U2	DIODE, I/R SENSOR,TTL O/P,PLST	2014-1L18230T	•	•	•	•
U3	DIODE, I/R SENSOR,TTL O/P,PLST	2014-1L18230T	•	•	•	•
U4	DIODE, I/R SENSOR,TTL O/P,PLST	2014-1L18230T	•	•	•	•
U5	LED, I/R,GaAs,.81 x .23,PLAST.	2013-1G18230A	•	•	•	•
U6	IC, LT1129I,PROG. VOLT REG,SO8	2305-11290N08	•	•	•	•
U7	IC, LP2951,PROG. VOLT REG,SO-8	2305-29510N08	•	•	•	•
U8	IC, LP2951,PROG. VOLT REG,SO-8	2305-29510N08	•	•	•	•
U9	MOSFET, SI9945AEY,N CHAN.,SO-8	2142-SI9945DY	•	•	•	•
U10	IC, 45193,PLL FREQ/SYNTH,S0-20	2355-45193N20	•	•	•	•
U11	IC,msA-0611, MMIC AMP,SOT-143	2354-MSA06110	•	•	•	•
U15	IC,msA-0611, MMIC AMP,SOT-143	2354-MSA06110	•	•	•	•
U16	IC,msA-0611, MMIC AMP,SOT-143	2354-MSA06110	•	•	•	•

DIGITAL BOARD
ELECTRICAL PARTS LIST

Ref Desig	Description	Part Number
C1	CAP., SM,100nF CER,0805,X7R,50	1008-5A104K5R
C2	CAP., SM,100nF CER,0805,X7R,50	1008-5A104K5R
C3	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16
C4	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16
C5	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16
C6	CAP., SM, 22pF CER., 0805, C0G	1008-1A220J1G
C7	CAP., SM, 22pF CER., 0805, C0G	1008-1A220J1G
C8	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16
C9	CAP., SM,100nF CER,0805,X7R,50	1008-5A104K5R
C10	CAP., SM,100nF CER,0805,X7R,50	1008-5A104K5R
C11	CAP., SM,100nF CER,0805,X7R,50	1008-5A104K5R
C12	CAP., SM,100nF CER,0805,X7R,50	1008-5A104K5R
C13	CAP., SM,100nF CER,0805,X7R,50	1008-5A104K5R
C14	CAP., SM,100nF CER,0805,X7R,50	1008-5A104K5R
C15	CAP., SM, 10uF TANT., 20%, 16V	1055-6C106M16
D1	DIODE, BAS16, SWITCHING, SOT23	2100-BAS16000
D2	DIODE, BAS16, SWITCHING, SOT23	2100-BAS16000
D3	DIODE, BAS16, SWITCHING, SOT23	2100-BAS16000
D4	DIODE, BAS16, SWITCHING, SOT23	2100-BAS16000
L1	INDUCTOR, SM, 10.0uH, 10%,1812	1255-4G10000K
P1	INTERCONNECT/STD,1ROW x 12P,Au	5015-IS112G21
P1	INTERCONNECT/STD,1ROW x9PIN,Au	5015-IS109G21
P2	INTERCONNECT/STD,1ROW x6PIN,Au	5015-IS106G21
PCB	PCB, DIGITAL, OS-3H H/P SYNTH.	4309-26002104
Q1-Q11	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025
R1	RES., SM, ZERO OHM JUMPER,0805	1150-0A0R0000
R2	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R3	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R4	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R5	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R6	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R7	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R8	RES., SM, 6K81 0805, 1%,100ppm	1150-3A6811FP
R9	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R10	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R11	RES., SM, 10M0 1206, 5%,400ppm	1151-7B0106JG
R12	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP

Digital Board
Electrical Parts List continued

Ref Desig	Description	Part Number
R13	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R14	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R15	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R16	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R17	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R18	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R19	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R20	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R21	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R22	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R23	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP
R24	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP
R25	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP
R26	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP
R27	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R28	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R29	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R30	RES., SM, 215R 0805, 1%,100ppm	1150-2A2150FP
R31	RES., SM, 215R 0805, 1%,100ppm	1150-2A2150FP
R32	RES., SM, 215R 0805, 1%,100ppm	1150-2A2150FP
R33	RES., SM, 332R 0805, 1%,100ppm	1150-2A3320FP
R34	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R35	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R36	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R37	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R38	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R39	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R40	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R41	RES., SM, 221K 0805, 1%,100ppm	1150-5A2213FP
R42	RES., SM, 1K00 0805, 1%,100ppm	1150-3A1001FP
U1	MOSFET, SI9933ADY,P CHAN.,SO-8	2142-SI9933DY
U2	IC, LP2951,PROG. VOLT REG,SO-8	2305-29510N08
U3	IC, MC33064,UNDR/VOLT SEN.SO-8	2308-33064N08
U4	IC, 68HC711E9, MIC/CTR, PLCC52	2380-68711P52
U5	LED, I/R,GaAs,.81 x .23,PLAST.	2013-1G18230A
U6	LED, I/R,GaAs,.81 x .23,PLAST.	2013-1G18230A
U7	LED, I/R,GaAs,.81 x .23,PLAST.	2013-1G18230A
U8	LED, I/R,GaAs,.81 x .23,PLAST.	2013-1G18230A
U9	DIODE, I/R SENSOR,TTL O/P,PLST	2014-1L18230T
X1	RESONATOR, SM, 8.0MHz, CERAMIC	1575-8001816A

OS(R/T) 128-174MHZ
MECHANICAL PARTS LIST

Description	Part Number	Qty.
CASE, OS-3H SYNTH. MODULE,ALUM	3702-66100920	1
CONN., SMB, JACK,2 HOLE FLANGE	5120-J2SC01BG	2
FERRITE BEAD, 43MIX,3x3.5mm OD	1210-43030350	3
LID, CASE,OS-3H SYNTH/MODL.,AL	3702-66100921	1
PIN, 2 x 10mm, GROOVED W/PILOT	5876-D1470210	4
SCREW, M2 X 4, PAN/PHILLIPS,A2	5812-2M0PP04S	15
SCREW, M2 x 4, FLAT/PHIL, A2	5812-2M0FP04S	8
SCREW,M2.5x24.5mm,FLAT/PHIL,A2	5812-2M5FP24S	1
WASHER, TFE,0.036ID,1/8 OD,.02T	5805-T3612F20	6

406-470MHZ-ENHANCED SYNTHESIZER

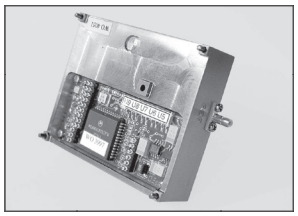
Covers Models:

OST-3H418

OST-3H460

OSR-3H440

	Transmitters			Receivers		
Radio Frequency	Transmitter Model & Frequency Range	Enhanced Synthesizer Model & Synthesizer Frequency	Location in Manual	Receiver Model & Frequency Range	Enhanced Synthesizer Model & Synthesizer Frequency	Location in Manual
VHF Low Band 29-50MHz	VT-3H035 29-38MHz	OST-3H035 29-38MHz	See Page 3 Enhanced FM Synthesizer OS(R/T)-3H 29-71.4MHz	VR-3H035 29-38MHz	OSR-3H061 50.4-71.4MHz	See Page 3 Enhanced FM Synthesizer OS(R/T)-3H 29-71.4MHz
	VT-3H045 38-50MHz	OST-3H045 38-50MHz		VR-3H045 38-50MHz		
VHF 132-174MHz	VT-3/140 132-150MHz	OST-3H141 132-150MHz	See Page 31 Enhanced FM Synthesizer OS(R/T)-3H 128.6-174MHz	VR-3H140 132-150MHz	OSR-3H162 153.4-171.4MHz	See Page 31 Enhanced FM Synthesizer OS(R/T)-3H 128.6-174MHz
	VT-3/160 150-174MHz	OST-3H162 150-174MHz		VR-3H160 150-174MHz	OSR-3H141 128.6-152.6MHz	
UHF 406-470MHz	UT-3/420 406-430MHz	OST-3H418 406-430MHz	Enhanced FM Synthesizer OS(R/T)-3H 406-470MHz	UR-3H420 406-430MHz	OSR-3H440 427.4-451.4MHz	Enhanced FM Synthesizer OS(R/T)-3H 406-470MHz
	UT-3/460 450-470MHz	OST-3H460 450-470MHz		UR-3H460 450-470MHz		



GENERAL INFORMATION

INTRODUCTION

The OS(R/T)-3H Synthesizer is a compact, fully shielded and environmentally rugged frequency synthesis module that is the nucleus of every MT-3 synthesized Receiver and Transmitter radio module. The OS(R/T)-3H generates a high stability, low distortion radio frequency signal in one of several frequency bands. The OS(R/T)-3H utilizes an internal temperature compensated 9.6 or 10.0MHz reference to produce a signal stable to ±1 ppm within the temperature range of -40°C to +60°C. Alternately, the OS(R/T)-3H can be disciplined by an external 9.6MHz or 10MHz reference of higher stability. All synthesizer modules are designed to be easily removed for programming, calibration and/or repair. The synthesizer circuitry is distributed between two printed circuit boards (PCBs) which are isolated yet interconnected via photo-logic optical transceivers that effectively eliminate residual electrical noise between digital and analog circuitry. Further shielding of the synthesizer's RF filter circuitry is provided by an internal shielded enclosure.

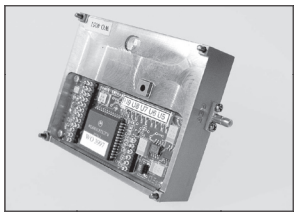
OS(R/T)-3H ENHANCED SYNTHESIZER FAMILY MODELS

The OS(R/T)-3H Synthesizer Module is utilized in both the MT-3 Receiver and Transmitter product lines. In MT-3 Transmitters, the OS(R/T)-3H synthesizer provides a modulated, low-level RF signal to the Power Amplifier module. In MT-3 Receivers, the OS(R/T)-3H synthesizer provides a low noise local oscillator (LO) signal that either directly drives the mixer circuitry or first drives a buffer amplifier which precedes the mixer circuitry (if a higher LO drive signal is required for enhanced intermodulation capability).

All OS(R/T)-3H FM Enhanced Synthesizer Modules, regardless of the frequency band, use the same digital PCB and mechanical construction. There are, however, significant differences between the various models when it comes to the analog PCB. Each model's specific sub-band of operation within a given frequency band is determined through SELECT components on the corresponding analog board.

PERFORMANCE SPECIFICATIONS

Type:	Narrow band FM, Single loop synthesizer module utilizing low noise VCO and PLL technology. Compatible with Daniels MT-3 series Transmitter and Receiver modules.
Frequency Range (Tuning range with no adjustment is shown in [ ] brackets.):	406MHz-430MHz [Full Band] (OST-3H418) 427.4MHz-451.4MHz [Full Band] (OST-3H440) 450MHz-470MHz [Full Band] (OST-3H460)
Output Power:	+5dBm ±2dBm into 50Ω
Harmonics:	<-30 dBc
Spurious:	<-90 dBc
Hum and Noise:	>55 dB
Modulation Sensitivity:	3.0kHz peak deviation (400mVrms input)
External Reference Input:	External reference input signal via SMB connector J1 Input level 0dBm ±3 dB Input impedance 50 Input frequency 10.0MHz or 9.6MHz selectable through digital board jumper JU1
Power Requirements:	Normal Configuration: +9.5VDC @ 160mA Low Current Standby Mode (TCXO enabled): +9.5VDC @ 14mA



THEORY OF OPERATION

THEORY OF OPERATION

Internal Power and Control (Digital Board)

The synthesizer operates from a +9.5VDC power source applied to connector pin P1-2. Total current draw is approximately 160mA. POWER DOWN control line P2-4 controls the +5.0VDC microcontroller regulator U2 through power MOSFET switch U1. For receiver applications the synthesizer is always ON, with the enable line P2-4 directly connected to +9.5VDC. For transmitter applications, pin P2-4 is controlled by the MT-3 Transmitter Board jumper J18 which selects the synthesizer standby mode. In Low Current Standby Mode, less than 14mA is drawn, however, a delay of approximately 50ms from PTT activation to transmitter turn on is then required to allow for the synthesizer to lock. In Normal Mode, with the synthesizer ON continuously, less than 10ms delay is encountered. This capability comes at the expense of additional standby current (160mA).

Synthesizer Analog Circuitry (Analog Board)

The Analog Board utilizes four optical receivers (U1–U4) and one optical transmitter (U5) to provide an isolated data interface to the digital board. The regulator IC U8 provides a continuous +5.0VDC to the internal TCXO and power control optical receiver U1 when ever +9.5VDC is applied to the synthesizer's voltage terminals. The analog board's main power is turned on and off by driving the optical receiver U1. U1 is driven by U4 on the digital board, which is controlled by the microcontroller. The main power regulators are provided by U6 and U7. Regulator U6 provides switched +8.0VDC and regulator U7 proves switched +5.0VDC. The power MOSFET IC U9 works as a clamping circuit to quickly discharge the VCO filter capacitors C32 and C33; when U9 is powered down the RF output from the VCO is suppressed almost immediately.

At the heart of the OS(R/T)-3H Enhanced Synthesizer is U10 a low power, single chip PLL synthesizer IC. U10 is setup to use a 9.6 or 10.0MHz reference signal provided either from the internal TCXO (with JU1-B selected) or from the external SMB connector J1 (with JU1-A selected). The reference signal's frequency is selected by jumper JU2 on the digital board; 9.6MHz is selected if JU2 is not installed and 10MHz if JU2 is installed. If an external reference signal is used it must be sinusoidal, low phase noise, and highly stable with an output power of 0dBm ±3dBm. A poor quality reference source will degrade the receiver or transmitter performance to unacceptable levels. The external reference is buffered by transistor Q2 on the analog board, which has 50Ω input impedance at 10.0MHz. The internal TCXO reference of 10.0MHz provides better than ±1ppm frequency stability from -30°C to +60°C (-40°C to +60°C optional). The TCXO fine frequency adjustment is made through potentiometer RV1, which is accessible through the synthesizer's top cover.

The 9.6 or 10.0MHz reference source is divided down to establish a channel selection step size of 5.0/6.25, 12.5, or 25.0kHz. A third order passive loop filter comprised of C37, C38, C39, C45, C49, R36 and R32 is employed to achieve the required noise performance, modulation and worst case switching time of 50ms. A small sample of RF energy is coupled from the VCO output buffer U16 to the synthesizer IC U10 prescaler input (pin 11). FM modulation of the VCO from approximately 100Hz to 3kHz is achieved through the baseband input pin P1-1 on the Digital Board. A 1kHz sine wave with a level of approximately 400mVrms at P1-1 provides FM deviation of 3.0kHz. SMB connector J2 provides an RF output level of approximately +5dBm into a 50Ω load.

An optional low frequency modulation input is provided through connector P1-18 on the digital board, and routed to the analog board via connector P3. This modulation input is coupled to a low impedance DC coupled source. The input provides a phase modulated bandwidth from 0Hz (DC) to the PLL loop filter bandwidth. This allows for specialized applications such as paging or trunking where a separate low frequency digital/analog modulation channel is required. The phase modulation input on the digital board, connector P1-18, is routed to the transmitter's audio processor pin P4-2 via JA4-2 on the MT-3 transmitter's main board. It should be noted that any application that uses the direct TCXO modulation port transfers control of the synthesizer's steady state frequency setting to the external modulation source. The internal TCXO frequency control potentiometer RV1 is then effectively removed from the circuitry.

A lock detect LED on the synthesizer's analog board (LED1) indicates an unlocked PLL condition. An unlocked PLL condition normally indicates that the VCO is not tuned within the lock in range of the desired channel frequency. In a transmitter, the loss of lock will prevent a PTT from keying the power amplifier module, thus preventing the transmission of a spurious output signal. Adjusting capacitor C24 will normally re-establish a frequency lock within the synthesizer's frequency range. The optical transmitter U5 on the analog board is also activated in an unlocked condition and enables the micro controller on the digital board to respond to the unlocked PLL condition.

The UHF OS(R/T)-3H 406-470MHz synthesizer employs an integrated surface mount VCO module (U17) capable of full frequency band coverage. Two VCO modules are used to cover the 406-470MHz frequencies in the Transmitter module, and one VCO Module is used to cover the 427.4-451.4MHz frequencies in the Receiver module. The VCO modules are optimized for low phase noise, however the transmitter VCO is additionally configured with modulation input capability. PLL feedback control voltage, at the output of the low-pass loop filter, controls the VCO frequency through pin 2, the modulation input (Mod I/P) port. The PLL control voltage can range between +1.0VDC and +7.0VDC depending on the selected operating frequency. External baseband frequency modulation is provided through connector P1 and VCO Mod input pin 6.

The PLL low-pass filter is formed by SELECT components C37, C38, C39, C45, R32 and R36. The loop filter response is optimized for switching time, noise and modulation requirements specific to each sub-band within the 406-470MHz frequency range. The SELECT components (including the loop filter and VCO type) can be found in tabular format on the UHF OS(R/T)-3H 406-470MHz Analog Board Schematic diagram.

RF output power is taken from the VCO RF output and amplified/buffered by U11. U15 provides further amplification and isolation while delivering approximately +10dBm to a five pole low-pass output filter formed by C53, C58, C59, L11 and L12. The five-pole low-pass output filter, with a cutoff frequency of 530MHz, effectively eliminates output harmonics. SMB connector J2 provides interconnection to the companion transmitter or receiver with an output level of +5dBm ±2dBm.

Synthesizer Digital Circuitry (Digital Board)

The synthesizer's digital board circuitry generates control signals utilized within the synthesizer. The microcontroller U4 on the digital board: communicates with the synthesizer's PLL IC U10 on the analog board; monitors the synthesizer lock detect; manages the PTT input and output; and determines the operating frequency by reading the channel code number information from either the four rotary binary coded decimal (BCD) switches mounted on the transmitter or receiver's main board, or by reading the four externally driven channel select lines. The microcontroller U4 is also designed to communicate with Daniels' Synthesizer Channel Programmer (CP-SC-3) through I/O lines TX Data (P1-17), RX Data (P1-9) and Bootstrap (P2-2). This external programmer places the operating program in non-volatile microprocessor memory and programs up to 15 user defined channel code numbers. An internal "watchdog" timer provides robust software protection in all operating modes.

Data communication between the digital and analog circuit boards is achieved through four optical transmitters (U5 through U8) and one optical receiver (U9). The optical interface provides a fully isolated inter-board data communications link designed to prevent digital noise from interfering with the sensitive PLL circuitry.

BCD Switch Frequency Control

Selection of the desired synthesizer output frequency is straightforward. If all four of the CHANNEL SELECT lines (CHAN SEL3-CHAN SEL0) are pulled low (to GND), the synthesizer will scan the four BCD switches (FSW1- FSW4) located on the receiver or transmitter main boards via connections SW1 COM-SW4 COM and PC4-PC7 and establish the operating frequency from these switches. The four CHANNEL SELECT lines, CHAN SEL3-CHAN SEL0, are connected via the MT-3 transmitter or receiver main board module connector to the M3 motherboard subrack. These lines are by default normally pulled low (to GND) via jumpers located on the M3 motherboard subrack.

If any one of the CHANNEL SELECT lines are pulled high (to +9.5VDC), then the synthesizer's frequency of operation will be determined by the CHANNEL SELECT lines and not the BCD switches. Up to 15 separate channel frequencies can be pre-programmed into a 'table' in non-volatile microprocessor memory and accessed through binary interpretation of the CHANNEL SELECT lines. The most significant bit (MSB) in the CHANNEL SELECT binary code is represented by CHAN SEL3 and the least significant bit (LSB) is represented by CHAN SEL0. For example, if all CHANNEL SELECT lines are pulled high, (i.e. binary '1111') then the 15th frequency entry in the internal channel table will be selected. The channel table is normally pre-programmed at the factory to user specifications, but may be programmed in the field using Daniels' Synthesizer Channel Programmer (CP-SC-3).

In transmitters, the synthesizer operating frequency is the transmitter operating frequency. For receivers the synthesizer's operating frequency is 21.4MHz above or below the receiver frequency. Refer to the Channel Designation Table Manual for a channel code number versus frequency table.

Synthesizer Base and Frequency Increments

The OS(R/T)-3H Synthesizer operates in frequency increments of 12.5kHz. The Base Frequency for any given synthesizer model is the lowest frequency generated.

Model Number	Freq. Range	Base Freq.	Freq. Increment
OST-3H418	406-430MHz	406MHz	12.5kHz
OST-3H460	450-470MHz	450MHz	12.5kHz
OSR-3H440	427.4-451.4MHz	427.4MHz	12.5kHz

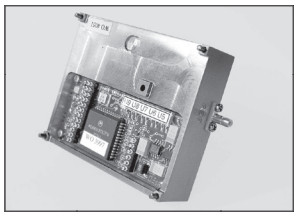
12.5kHz Channelization

The operating frequency for Synthesizers having 12.5kHz channelization is determined as follows:

BCD switch settings from 0000 to 4999:

Multiply the switch setting by 12.5kHz and add the result to the synthesizer base frequency.

Example: An OST-3H418 synthesizer has a base frequency of 406MHz. The selected channel number is 1660. The *synthesizer* output frequency is: ((1660 x 21.5kHz) +406MHz) = 426.7500MHz



SYNTHESIZER ALIGNMENT

GENERAL

OS(R/T)-3H enhanced synthesizer alignment is simplified by using a Type 84 subrack and RF extender card/cable for providing receiver or transmitter power and signal interconnection. Alternately, a +9.5VDC may be directly connected to a receiver or transmitter module with the positive connection on pins B6/Z6 and the negative connection on pins B30/ Z30/B32/Z32. The receiver's balanced audio output (600Ω) is available at pins B26 and Z26. The transmitter's balanced audio output (600Ω) is available at pins B18 and Z18.

REPAIR NOTE

The OS(R/T)-3H synthesizer employs a large number of surface mount components. Removal and/or replacement of surface mount components should never be performed using an ordinary soldering iron but should only be performed at surface mount rework and repair stations equipped with Electrostatic Discharge (ESD) protection.

When removing Surface Mount Solder Jumpers, it is recommended that a solder wick braid be used in lieu of vacuum type de-soldering tools to help prevent damage to the printed circuit boards.

RECOMMENDED TEST EQUIPMENT

Synthesizer alignment requires the following test equipment, or its equivalent:

Power supply-Regulated +9.5VDC at 2 A. Phillips PM 2811

Oscilloscope/Multimeter-Fluke 97 Scopemeter

Radio communications test set-Marconi Instruments 2965A

It is recommended that the radio communications test set be referenced to an external high stability frequency source (WWVH, GPS, Loran C) so that the OS(R/T)-3H internal high stability local oscillator may be accurately set to within its ±1 ppm frequency tolerance.

OS(R/T)-3H SYNTHESIZER FACTORY CONFIGURATION

The OS(R/T)-3H Synthesizer is factory configured as follows:

Internal 9.6 or 10.0MHz reference selected.

VCO modulation (via audio processor) enabled (OST TX versions only)

The corresponding synthesizer jumper settings are:

Digital Board

Jumper JU2	installed 10.0MHz reference frequency selected (default)
Jumper JU2	not installed 9.6MHz reference frequency selected (default)
Jumper JU1	not installed AM Multichannel mode selected (default)

Analog Board

Jumper JU1:	'B' position Internal TCXO reference freq. selected (default)

OS(R/T)-3H SYNTHESIZER ALIGNMENT PROCEDURE

General

Synthesizer alignment is normally accomplished with the synthesizer installed in the MT-3 Receiver IF/Audio Board or the MT-3 Transmitter Main Board. The alignment procedure involves setting the internal TCXO reference frequency, the internal reference option is enabled. This step is described in 'Reference Frequency Alignment' in this section. A change in operating frequency from the initial factory setting that exceeds the synthesizer's maximum tuning range (Refer to Specifications) requires a more involved alignment procedure as described below. The conversion of a synthesizer from an internal reference to an external reference or vice-versa is accomplished through the selection of jumper JU1 A (for external) or B (for internal, on the analog board), and as appropriate JU2 on the digital board (Refer to 'Jumper Configuration').

Synthesizer Test Points

Analog Board Component Layout (Top)

TP1	+8.0 ±0.3VDC U6 positive regulator output
TP2	+5.0 ±0.1VDC U7 positive regulator output
TP3	+5.0 ±0.1VDC U8 positive regulator output (always on)
TP4	PLL error voltage. UHF versions employ an integrated VCO module and require no adjustment.

Digital Board Component Layout (Bottom)

TP1	+5.0 ±0.1VDC. U2 positive regulator output (controlled via pin P2-4)
TP2	Microcontroller E clock. 2MHz logic level square wave

Synthesizer Removal and Installation

Note: Complete synthesizer alignment can be performed without removing the synthesizer from the radio.

The synthesizer module is secured to the main board (MT-3 Receiver IF/Audio Board or MT-3 Transmitter Main board) with a single counter sunk Phillips machine screw accessible from the top cover. Remove this screw to remove the synthesizer module. Using a plastic coated lifting tool, such as a small screwdriver with the tip covered in heat shrink material, gently lift the synthesizer module from the main circuit board by applying pressure in a rotating fashion about the four corners of the synthesizer module. It is important to gently remove the synthesizer module “straight out” in order to prevent damage to the connector pins. Installation of the synthesizer is performed by first ensuring complete connector pin alignment; second appling reinsertion force; and third securing the synthesizer to the main board with the single countersunk phillips machine screw. Note the four corner locating pins on the synthesizer housing assist in connector pin alignment during the installation.

Circuit Board Removal

Note: Circuit board removal is not required for tuning purposes.

The analog and digital boards can be removed using a vacuum de-soldering station. To remove the analog board: de-solder connections P1, P2 and P3; remove the SMB connectors J1 and J2 by de-soldering the center pins and removing the four (2 per connector) M2 machine screws; remove the seven M2 machine screws (that secure the analog board) and carefully remove the analog circuit board. Removal of the analog circuit board will expose three inter-board wire connections. Carefully remove three ferrite beads and six Teflon washers from the inter-board connection wires. Attempt to maintain the position of the three inter-board wires in order to simplify re-assembly. The digital board may now be extracted by removing four M2 machine screws. Follow a reverse procedure to re-assemble.

Frequency Adjustment and Channel Selection

Connect a radio communications test set through a short section of low loss 50Ω coaxial cable to the synthesizer’s SMB RF output jack (J2). Select the desired channel code number via the BCD frequency selection switches on the main board, or reprogram the synthesizer memory with a Channel Synthesizer Programer (CP-SC-3). Turn the power off and back on and wait a few minutes for the oscillator to completely stabilize. It should be noted that the internal synthesizer TCXO, if installed, operates continuously (regardless of the TX PTT state) when installed in a transmitter.

The measured RF output signal should be within ±1.0 ppm of the specified oscillator frequency at an output level of +5dBm ±2dBm @ 25°C. Note that an unlocked synthesizer operation will also be indicated by an unstable or spurious RF output signal. The “Unlocked” red LED will be illuminated if the PLL is unlocked. If a VCO Alignment does not resolve the unlocked condition, check that the requested channel code number is within the frequency range of the particular synthesizer model. An unlocked condition will probably be rectified by adjusting the VCO tuning elements as described in the following procedures.

VCO Alignment

Refer to the ‘Analog Board Component Layout’ diagrams and the ‘Analog Board Schematic Diagram’ in this section.

Using a high impedance (10 MΩ) DC Voltmeter, measure the PLL control voltage at TP4 located on the synthesizer module analog board (top). Access to TP4 is available through the synthesizer top cover. The UHF synthesizers operating in the 406-470MHz frequency range employ integrated VCO modules having no external frequency adjustment capability. The OST-3H418, OST-3H460 and OSR-3H440 models cover frequencies from 406-430MHz, 450-470MHz and 427.4-451.4MHz respectively and provide full band coverage without tuning adjustment. For the OST-3H418, measured PLL control voltages below approximately +0.5VDC and above approximately +4.5VDC will indicate an “out of lock” condition. For the OSR-3H440 and the OST-3H460, measured

PLL control voltages below approximately +1.0VDC and above approximately +7.0VDC will indicate an “out of lock” condition. It is important to check the loop control voltage at TP4 when multiple synthesizer channels have been programmed. All channel selections should result in a TP4 voltage within the +0.5 to +4.5VDC range for the OST-3H418. The TP4 voltage for the OSR-3H440 and the OST-3H460 should be within the +1.0 to +7.0VDC range. Channel selections beyond the tuning range capability of the synthesizer will result in unlocked operation. The tuning range capability of all synthesizer models is listed in the Theory of Operation section of this manual.

Reference Frequency Alignment

To adjust the output frequency of the synthesizer the reference frequency of the TCXO is adjusted. Note this adjustment is only valid when the internal reference is selected (JU1 in the B position on the analog board). To adjust the internal TCXO referency frequency adjust the synthesizer TCXO fine frequency potentiometer RV1 until the correct output frequency is achieved. Access to this potentiometer is through an opening in the synthesizer top cover. An RF power level of approximately +5dBm ±2dBm should be measured at the synthesizer’s SMB output connector J2. The frequency should be within ±1 ppm of the desired operating frequency. Reference frequency adjustments should be made at room temperature (+25°C) after a ten minute stabilization period.

JUMPER CONFIGURATION

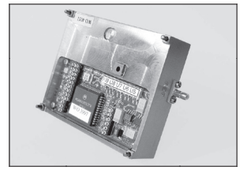
The synthesizer’s surface mount solder jumpers are clearly marked on both of it’s digital and analog circuit boards. Refer to the ‘Digital Board Component Layout (Bottom)’ diagram in this section and the ‘Analog Board Component Layout (Top)’ diagram for jumper locations. The following list details the required jumper configuration for the two synthesizer operating modes:

1) Internal reference. Install jumper JU1 in the B position, on the Analog Board (Standard). The internal temperature compensated crystal oscillator (TCXO) provides the reference signal with a stability of ±1 ppm from -30°C (Optional -40°C) to +60°C.

2) External reference input. Install jumper JU1 in the A position on the Analog Board. This mode is used in applications requiring better than ±1 ppm frequency stability. An external reference signal must be provided at the synthesizer’s SMB connector J1. An optional front panel external reference connector is available as an option for transmitters and receivers.

3) Reference Frequency Select. Install jumper JU2 on the Digital Board to select a 10.0MHz reference frequency. When not installed, the reference frequency is by default 9.6MHz. JU2 is used by the microcontroller to establish the correct reference frequency division ratio. (the Synthesizer module must be removed to change jumper JU2 on the digital board.)

Note: Care must be exercised when reinstalling the synthesizer module on the Transmitter Main board or the IF/Audio board. Pay careful attention to pin alignment before pressing the synthesizer module into its mating sockets.



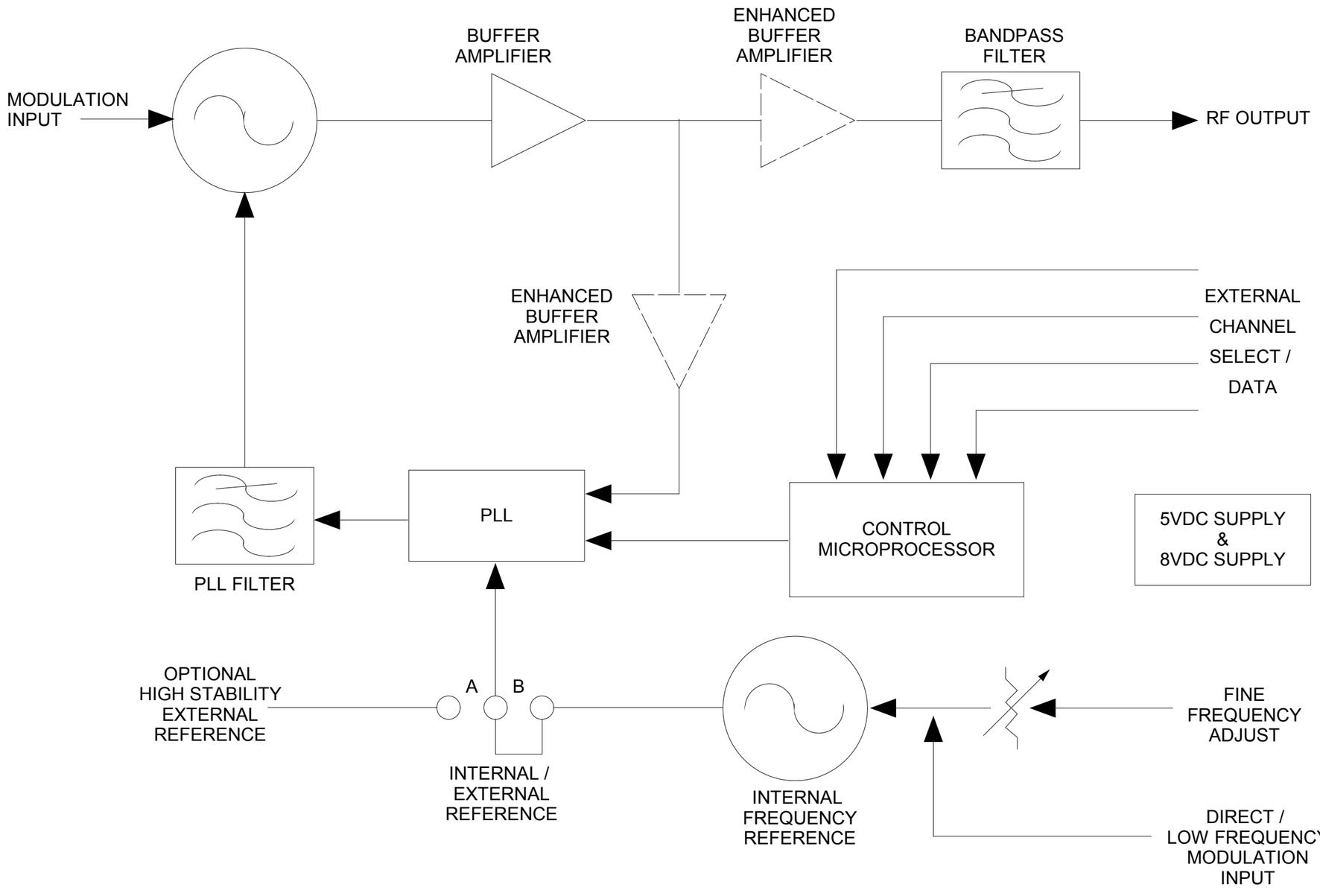
SCHEMATICS AND ILLUSTRATIONS

PRINTED CIRCUIT BOARD NUMBERING CONVENTION

Daniels Electronics Ltd. 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. All PCB's manufactured by Daniels Electronics Ltd. are identified by one of the following numbering conventions:

PCB number	43-91201<u>0</u> Indicates circuit board version 1.0
PCB number	50002-<u>02</u> Indicates circuit board version 2 (no decimal version)

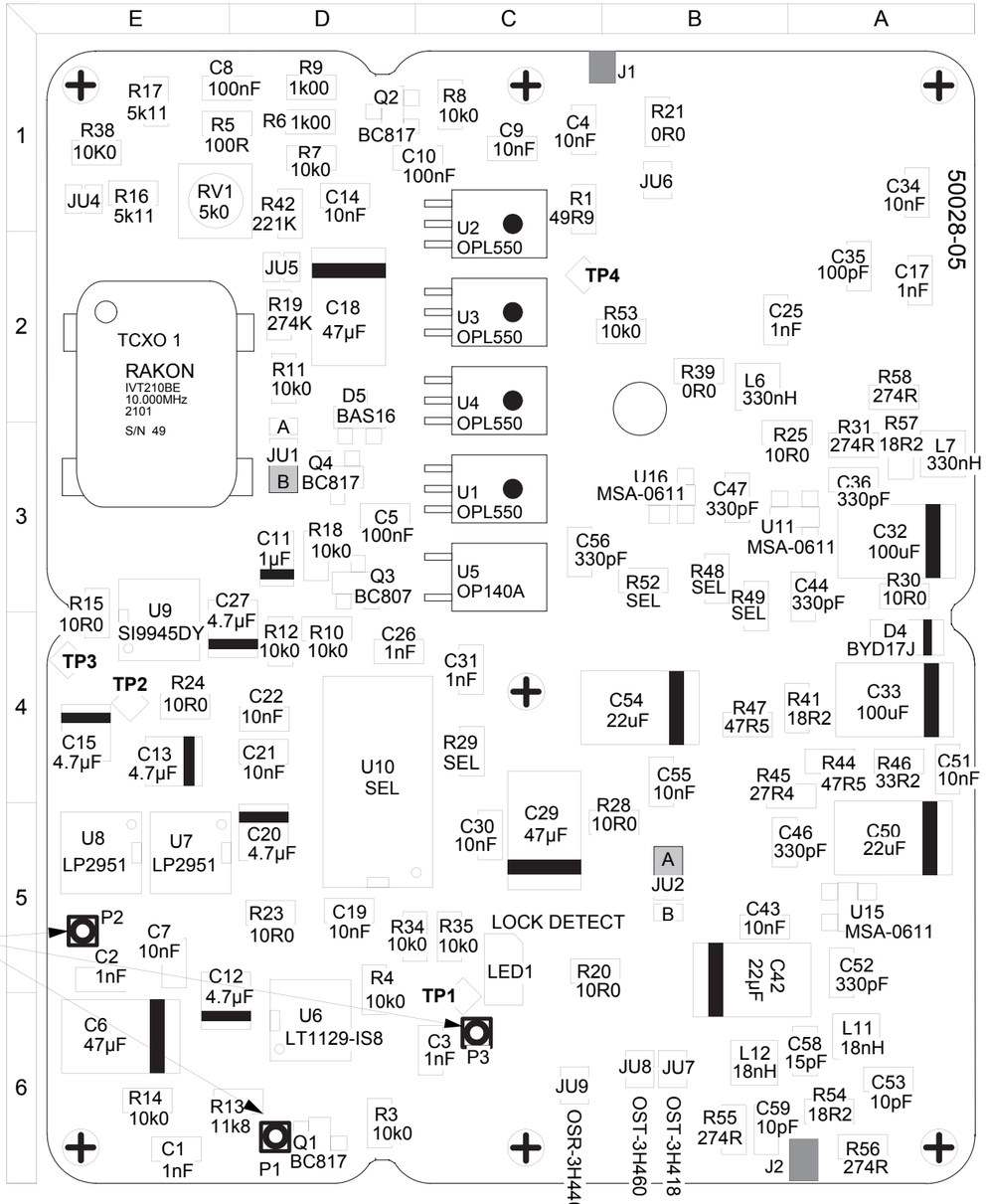
SYNTHESIZER MODULE BLOCK DIAGRAM



OS(R/T)-3H 406-470MHZ ANALOG BOARD COMPONENT LAYOUT (TOP)

COMPONENT LOCATION TABLE																				
DES	LC	SD	DES	LC	SD	DES	LC	SD	DES	LC	SD	DES	LC	SD	DES	LC	SD	DES	LC	SD
C1	E6	T	C42	B5	T	L3	C6	B	R17	E1	T	R57	A3	T						
C2	E5	T	C43	B5	T	L6	B2	T	R18	D3	T	R58	A2	T						
C3	C6	T	C44	A3	T	L7	A3	T	R19	D2	T									
C4	C1	T	C45	D3	B	L8	D3	B	R20	C5	T	RV1	E1	T						
C5	D3	T	C46	B5	T	L9	E5	B	R21	B1	T									
C6	E6	T	C47	B3	T	L10	C3	B	R23	D5	T	TCXO1	E2	T						
C7	E5	T	C49	D5	B	L11	A6	T	R24	E4	T									
C8	E1	T	C50	A5	T	L12	B6	T	R25	B3	T	TP1	C6	T						
C9	C1	T	C51	A4	T				R26	D1	B	TP2	E4	T						
C10	C1	T	C52	A5	T	LED1	C5	T	R28	B5	T	TP3	E4	T						
C11	D3	T	C53	A6	T				R29	C4	T	TP4	C2	T						
C12	E6	T	C54	B4	T	P1	B2	T	R30	A3	T									
C13	E4	T	C55	B4	T	P2	E5	T	R31	A3	T	U1	C3	T						
C14	D1	T	C56	C3	T	P3	C6	T	R32	C5	B	U2	C1	T						
C15	E4	T	C58	A6	T				R33	C5	B	U3	C2	T						
C16	A1	B	C59	B6	T	Q1	D6	T	R34	D5	T	U4	C2	T						
C17	A2	T				Q2	D1	T	R35	C5	T	U5	C3	T						
C18	D2	T	D4	A4	T	Q3	D3	T	R36	C6	B	U6	D6	T						
C19	D5	T	D5	D2	T	Q4	D3	T	R38	E1	T	U7	E5	T						
C20	D5	T							R39	B2	T	U8	E5	T						
C21	D4	T	F1	D5	T	R1	C1	T	R40	D4	B	U9	E4	T						
C22	D4	T				R2	D2	B	R41	A4	T	U10	D4	T						
C25	B2	T	J1	B1	T	R3	D6	T	R42	D1	T	U11	A3	T						
C26	D4	T	J2	A6	T	R4	D6	T	R44	A4	T	U15	A5	T						
C27	E4	T				R5	E1	T	R45	A4	T	U16	B3	T						
C29	C5	T	JU1	D3	T	R6	D1	T	R46	A4	T	U17	E2	B						
C30	C5	T	JU2	B5	T	R7	D1	T	R47	B4	T									
C31	C4	T	JU4	E1	T	R8	C1	T	R48	B3	T									
C32	A3	T	JU5	D2	T	R9	D1	T	R49	B4	T									
C33	A4	T	JU6	B1	T	R10	D4	T	R50	E5	B									
C34	A1	T	JU7	B6	T	R11	D2	T	R51	D3	B									
C35	A2	T	JU8	B6	T	R12	D4	T	R52	B3	T									
C36	A3	T	JU9	C6	T	R13	D6	T	R53	B2	T									
C37	D6	B				R14	E6	T	R54	A6	T									
C38	D4	B	L1	B6	B	R15	E4	T	R55	B6	T									
C39	D5	B	L2	A5	B	R16	E1	T	R56	A6	T									

DES - DESIGNATION
LC - LOCATION
SD - SIDE OF PCB
T - TOP SIDE
B- BOTTOM SIDE



Desolder three board interconnect points to separate analog and digital boards..

Factory Installed Jumpers

U10 COMPONENT SELECTION TABLE (TX 406 - 430 MHz band only)		
DESIG	MC145190	MC145202F or MC145193F
R29	36k5	3k92
R48	27R4	47R5
R49	33R2	10R0
R52	49R9	Not Installed
JU2	'A' INSTALLED	'B' INSTALLED

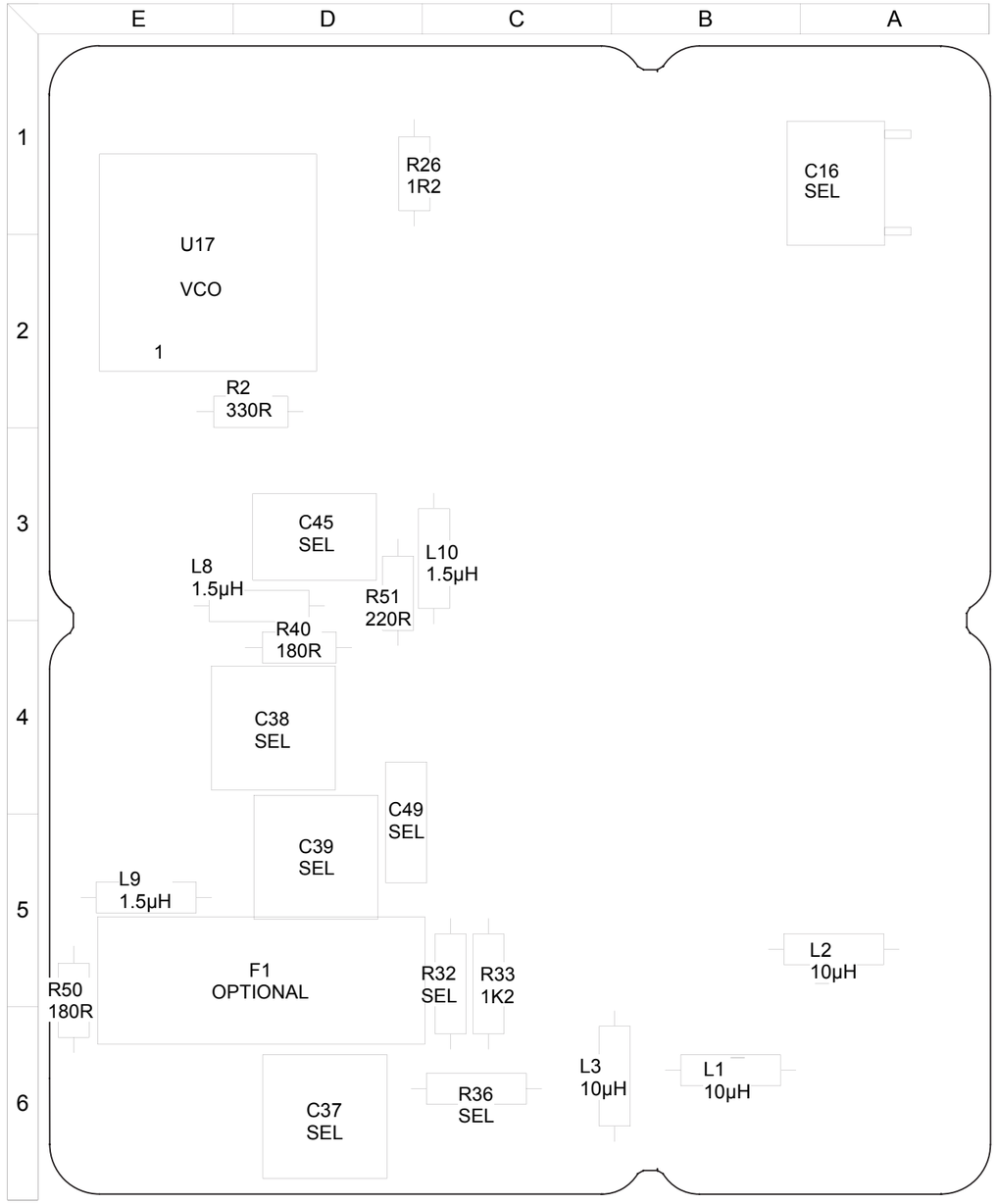
JU4 SELECTION TABLE		
	TCXO1	
DESIG	SARONIX S2045-9.6000	RAKON IVT210BE 10.0 MHz
JU4	INSTALLED	NOT INSTALLED

MODEL SELECTION TABLE		
DESIG	OSR-3H440 RX 427.4 - 451.4 MHz LVCO-2309 TEV	OST-3H4xx TX 406 - 470 MHz VCO-190-435 MT
JU6	NOT INSTALLED	INSTALLED

50028-05-01-T-02-02

OS(R/T)-3H 406-470MHZ ANALOG BOARD COMPONENT LAYOUT (BOTTOM)

VCO INSTALLED (U17)	
RX 427.4 - 451.4 MHz	TX 406 - 470 MHz
LVCO-2309 TEV	VCO-190-435 MT



COMPONENT LOCATION TABLE

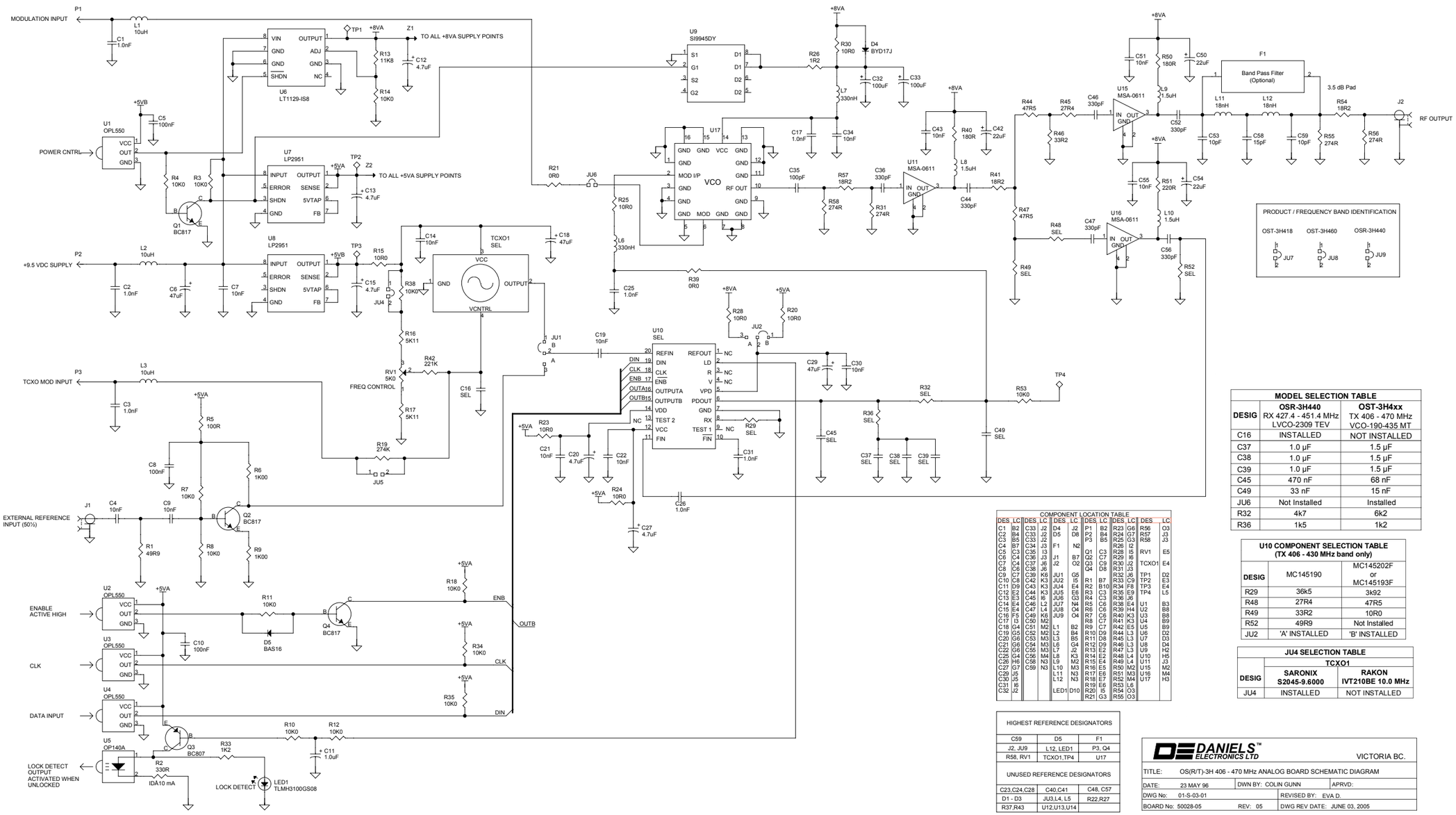
DES	LC	SD	DES	LC	SD	DES	LC	SD	DES	LC	SD	DES	LC	SD
C1	E6	T	C42	B5	T	L3	C6	B	R17	E1	T	R57	A3	T
C2	E5	T	C43	B5	T	L6	B2	T	R18	D3	T	R58	A2	T
C3	C6	T	C44	A3	T	L7	A3	T	R19	D2	T			
C4	C1	T	C45	D3	B	L8	D3	B	R20	C5	T	RV1	E1	T
C5	D3	T	C46	B5	T	L9	E5	B	R21	B1	T			
C6	E6	T	C47	B3	T	L10	C3	B	R23	D5	T	TCXO1	E2	T
C7	E5	T	C49	D5	B	L11	A6	T	R24	E4	T			
C8	E1	T	C50	A5	T	L12	B6	T	R25	B3	T	TP1	C6	T
C9	C1	T	C51	A4	T				R26	D1	B	TP2	E4	T
C10	C1	T	C52	A5	T	LED1	C5	T	R28	B5	T	TP3	E4	T
C11	D3	T	C53	A6	T				R29	C4	T	TP4	C2	T
C12	E6	T	C54	B4	T	P1	B2	T	R30	A3	T			
C13	E4	T	C55	B4	T	P2	E5	T	R31	A3	T	U1	C3	T
C14	D1	T	C56	C3	T	P3	C6	T	R32	C5	B	U2	C1	T
C15	E4	T	C58	A6	T				R33	C5	B	U3	C2	T
C16	A1	B	C59	B6	T	Q1	D6	T	R34	D5	T	U4	C2	T
C17	A2	T				Q2	D1	T	R35	C5	T	U5	C3	T
C18	D2	T	D4	A4	T	Q3	D3	T	R36	C6	B	U6	D6	T
C19	D5	T	D5	D2	T	Q4	D3	T	R38	E1	T	U7	E5	T
C20	D5	T							R39	B2	T	U8	E5	T
C21	D4	T	F1	D5	T	R1	C1	T	R40	D4	B	U9	E4	T
C22	D4	T				R2	D2	B	R41	A4	T	U10	D4	T
C25	B2	T	J1	B1	T	R3	D6	T	R42	D1	T	U11	A3	T
C26	D4	T	J2	A6	T	R4	D6	T	R44	A4	T	U15	A5	T
C27	E4	T				R5	E1	T	R45	A4	T	U16	B3	T
C29	C5	T	JU1	D3	T	R6	D1	T	R46	A4	T	U17	E2	B
C30	C5	T	JU2	B5	T	R7	D1	T	R47	B4	T			
C31	C4	T	JU4	E1	T	R8	C1	T	R48	B3	T			
C32	A3	T	JU5	D2	T	R9	D1	T	R49	B4	T			
C33	A4	T	JU6	B1	T	R10	D4	T	R50	E5	B			
C34	A1	T	JU7	B6	T	R11	D2	T	R51	D3	B			
C35	A2	T	JU8	B6	T	R12	D4	T	R52	B3	T			
C36	A3	T	JU9	C6	T	R13	D6	T	R53	B2	T			
C37	D6	B				R14	E6	T	R54	A6	T			
C38	D4	B	L1	B6	B	R15	E4	T	R55	B6	T			
C39	D5	B	L2	A5	B	R16	E1	T	R56	A6	T			

DES - DESIGNATION
LC - LOCATION
SD - SIDE OF PCB
T - TOP SIDE
B- BOTTOM SIDE

MODEL SELECTION TABLE		
DESIG	**OSR-3H440** RX 427.4 - 451.4 MHz LVCO-2309 TEV	**OST-3H4xx** TX 406 - 470 MHz VCO-190-435 MT
C16	INSTALLED	NOT INSTALLED
C37	1.0 µF	1.5 µF
C38	1.0 µF	1.5 µF
C39	1.0 µF	1.5 µF
C45	470 nF	68 nF
C49	33 nF	15 nF
R32	4k7	6k2
R36	1k5	1k2

50028-05-01-B-01-01

OS(R/T)-3H 406-470MHZ ANALOG BOARD SCHEMATIC DIAGRAM



MODEL SELECTION TABLE

DESIG	OSR-3H440 RX 427.4 - 451.4 MHz LVCO-2309 TEV	OST-3H4xx TX 406 - 470 MHz VCO-190-435 MT
C16	INSTALLED	NOT INSTALLED
C37	1.0 µF	1.5 µF
C38	1.0 µF	1.5 µF
C39	1.0 µF	1.5 µF
C45	470 nF	68 nF
C49	33 nF	15 nF
JU6	Not Installed	Installed
R32	4k7	6k2
R36	1k5	1k2

U10 COMPONENT SELECTION TABLE (TX 406 - 430 MHz band only)

DESIG	MC145190	MC145202F or MC145193F
R29	36k5	3k92
R48	27R4	47R5
R49	33R2	10R0
R52	49R9	Not Installed
JU2	'A' INSTALLED	'B' INSTALLED

JU4 SELECTION TABLE

DESIG	TCXO1	
	SARONIX S2045-9.6000	RAKON IVT210BE 10.0 MHz
JU4	INSTALLED	NOT INSTALLED

COMPONENT LOCATION TABLE

DES	LC	DES	LC	DES	LC	DES	LC	DES	LC	DES	LC	DES	LC
C1	B2	C33	J2	D4	J2	P1	B2	R23	G6	R56	C3		
C2	B4	C33	J2	D5	D8	P2	B4	R24	G7	R57	J3		
C3	B5	C33	J2			P3	B5	R25	G3	R58	J3		
C4	B7	C34	J3	F1	N2			R26	I2				
C5	C3	C35	I3			Q1	C3	R28	I5	RV1	E5		
C6	C4	C36	J3	J1	B7	Q2	C7	R29	I6				
C7	C4	C37	J6	J2	O2	Q3	C9	R30	J2	TCXO1	E4		
C8	C6	C38	J6			Q4	D8	R31	J3				
C9	C7	C39	K6	JU1	G5			R32	J6	TP1	D2		
C10	C8	C42	K3	JU2	I5	R1	B7	R33	C9	TP2	E3		
C11	D9	C43	K3	JU4	E4	R2	B10	R34	F8	TP3	E4		
C12	E2	C44	K3	JU5	E6	R3	C3	R35	E9	TP4	L5		
C13	E3	C45	I6	JU6	G3	R4	C3	R36	J6				
C14	E4	C46	L2	JU7	N4	R5	C6	R38	E4	U1	B3		
C15	E4	C47	L4	JU8	O4	R6	C6	R39	H4	U2	B8		
C16	F5	C49	K6	JU9	O4	R7	C6	R40	K3	U3	B8		
C17	I3	C50	M2			R8	C7	R41	K3	U4	B9		
C18	G4	C51	M2	L1	B2	R9	C7	R42	E5	U5	B9		
C19	G5	C52	M2	L2	B4	R10	D9	R44	L3	U6	D2		
C20	G6	C53	M3	L3	B5	R11	D8	R45	L3	U7	D3		
C21	G6	C54	M3	L6	G4	R12	D9	R46	L3	U8	D4		
C22	G6	C55	M3	L7	J2	R13	E2	R47	L3	U9	H2		
C25	G4	C56	M4	L8	K3	R14	E2	R48	L4	U10	H5		
C26	H6	C58	N3	L9	M2	R15	E4	R49	L4	U11	J3		
C27	G7	C59	N3	L10	M3	R16	E5	R50	M2	U15	M2		
C29	J5			L11	N3	R17	E6	R51	M3	U16	M4		
C30	J5			L12	N3	R18	E7	R52	M4	U17	H3		
C31	I6					R19	E6	R53	L6				
C32	J2			LED1	D10	R20	I5	R54	O3				
						R21	G3	R55	O3				

HIGHEST REFERENCE DESIGNATORS

C59	D5	F1
J2, JU9	L12, LED1	P3, Q4
R58, RV1	TCXO1,TP4	U17

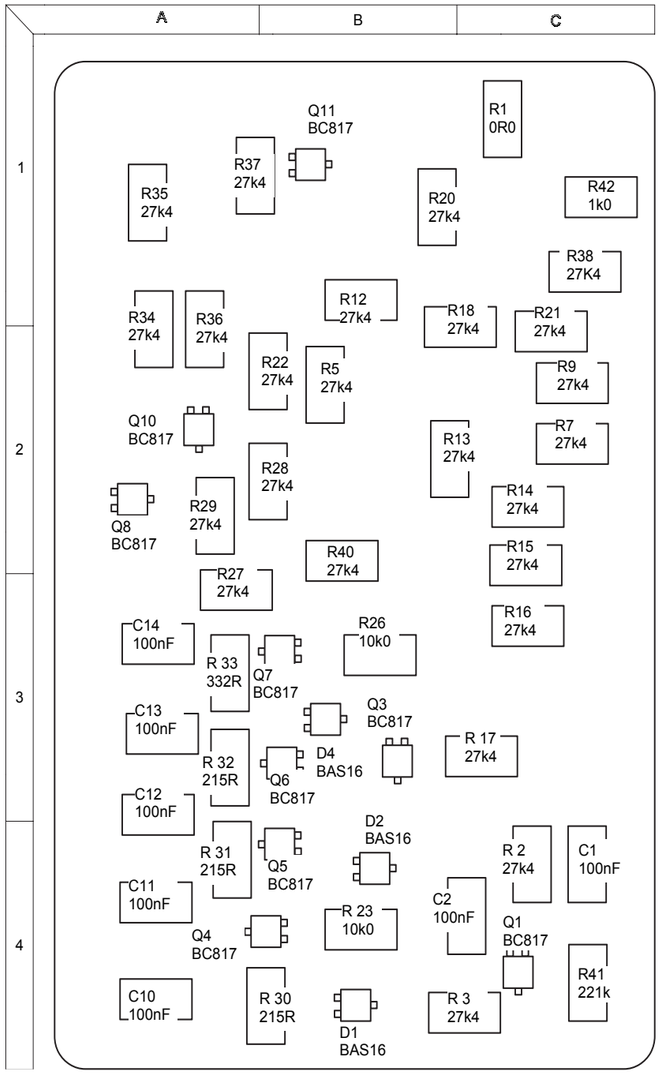
UNUSED REFERENCE DESIGNATORS

C23,C24,C28	C40,C41	C48, C57
D1 - D3	JU3,L4, L5	R22,R27
R37,R43	U12,U13,U14	

DANIELS™ ELECTRONICS LTD — VICTORIA BC.

TITLE:	OS(R/T)-3H 406 - 470 MHz ANALOG BOARD SCHEMATIC DIAGRAM		
DATE:	23 MAY 96	DWN BY: COLIN GUNN	APRVD:
DWG No:	01-S-03-01		REVISED BY: EVA D.
BOARD No:	50028-05	REV: 05	DWG REV DATE: JUNE 03, 2005

OS(R/T)-3H 406-470MHZ DIGITAL BOARD COMPONENT LAYOUT (TOP)

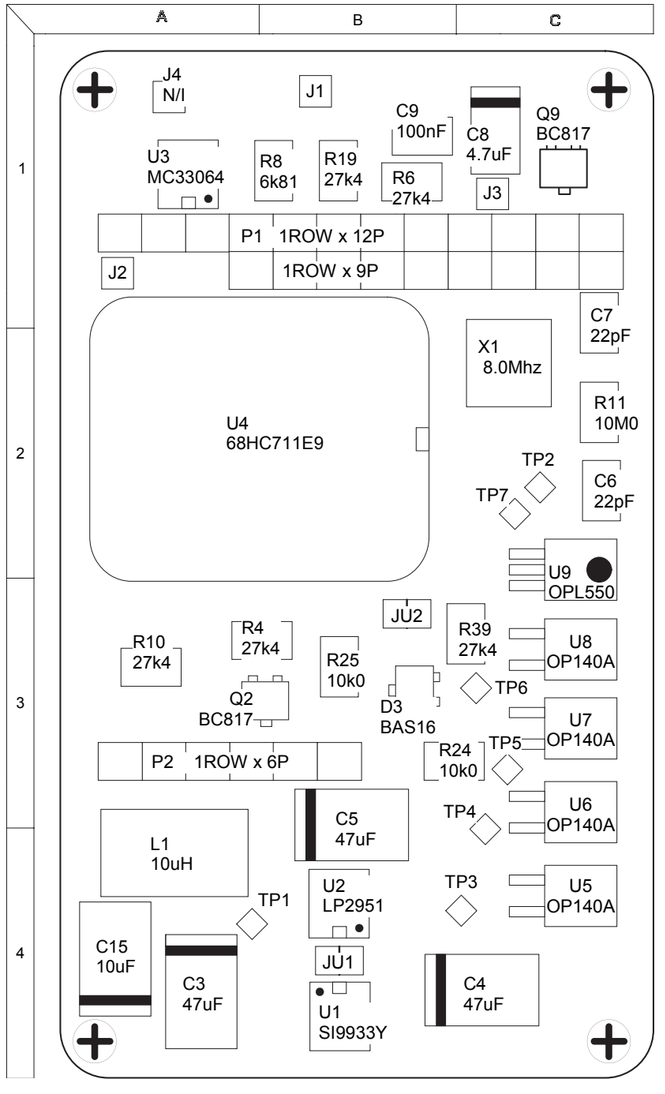


COMPONENT LOCATION TABLE

DES	LC	SD	DES	LC	SD	DES	LC	SD
C1	C4	T	Q6	B3	T	R33	A3	T
C2	C4	T	Q7	B3	T	R34	A2	T
C3	A4	B	Q8	A2	T	R35	A1	T
C4	C4	B	Q9	C1	B	R36	A2	T
C5	B4	B	Q10	A2	T	R37	A1	T
C6	C2	B	Q11	B1	T	R38	C1	T
C7	C1	B				R39	C3	B
C8	C1	B	R1	C1	T	R40	B2	T
C9	B1	B	R2	C4	T	R41	C4	T
C10	A4	T	R3	C4	T	R42	C1	T
C11	A4	T	R4	B3	B			
C12	A3	T	R5	B2	T	TP1	A4	B
C13	A3	T	R6	B1	B	TP2	C2	B
C14	A3	T	R7	C2	T	TP3	C4	B
C15	A4	B	R8	B1	B	TP4	C3	B
			R9	C2	T	TP5	C3	B
D1	B4	T	R10	A3	B	TP6	C3	B
D2	B4	T	R11	C2	B	TP7	C2	B
D3	B3	B	R12	B1	T			
D4	B3	T	R13	B2	T	U1	B4	B
			R14	C2	T	U2	B4	B
J1	B1	B	R15	C2	T	U3	A1	B
J2	A1	B	R16	C3	T	U4	A2	B
J3	C1	B	R17	C3	T	U5	C4	B
J4	A1	B	R18	C1	T	U6	C3	B
			R19	B1	B	U7	C3	B
JU1	B4	B	R20	B1	T	U8	C3	B
JU2	B3	B	R21	C2	T	U9	C2	B
			R22	B2	T			
L1	A4	B	R23	B4	T	X1	C2	B
			R24	B3	B			
P1	B1	B	R25	B3	B			
P2	A3	B	R26	B3	T			
			R27	A3	T			
Q1	C4	T	R28	B2	T			
Q2	B3	B	R29	A2	T			
Q3	B3	T	R30	B4	T			
Q4	B4	T	R31	A4	T			
Q5	B4	T	R32	A3	T			

50021-04-01-T-01-01

OS(R/T)-3H 406-470MHZ DIGITAL BOARD COMPONENT LAYOUT (BOTTOM)



COMPONENT LOCATION TABLE

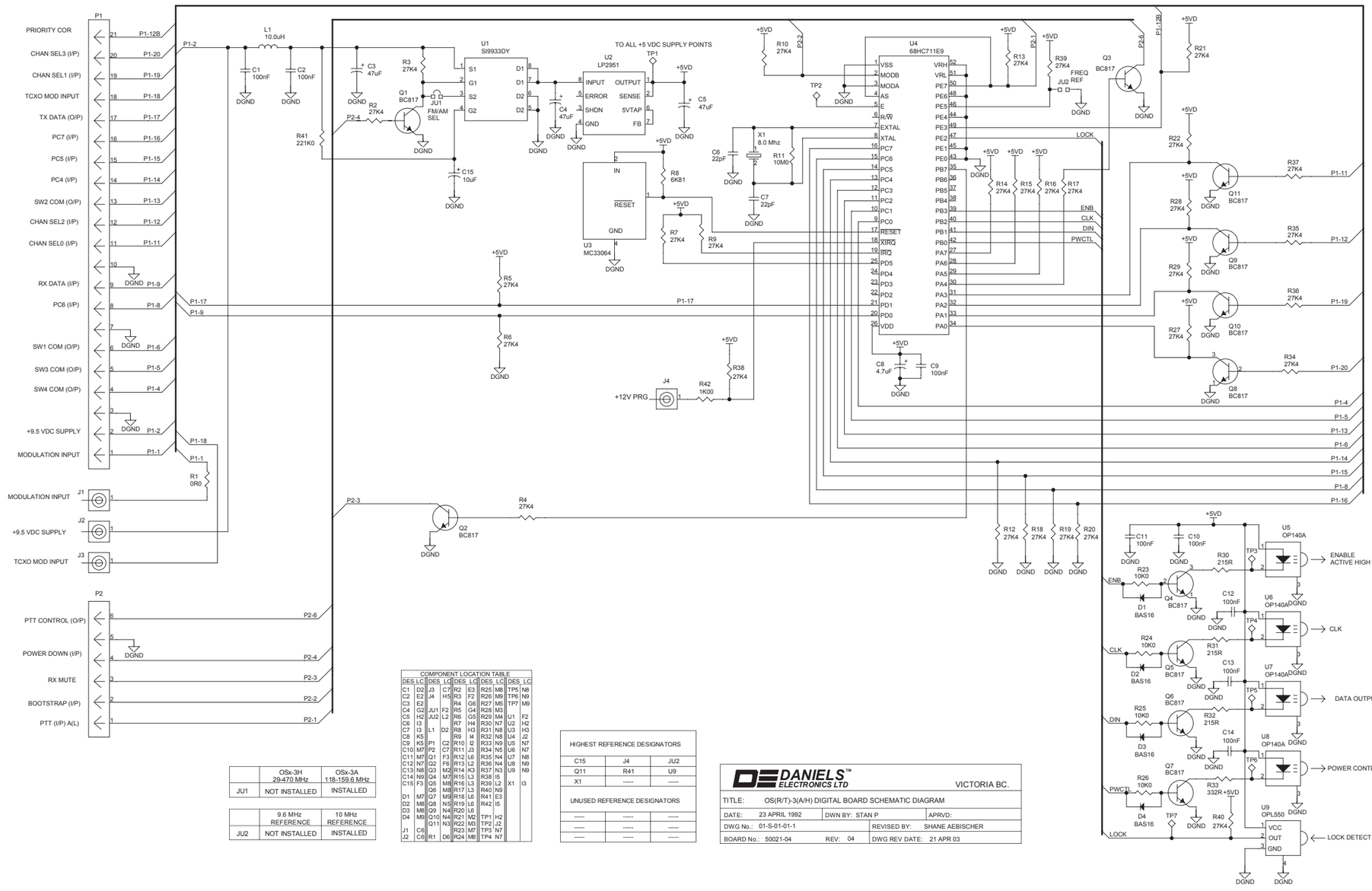
DES	LC	SD	DES	LC	SD	DES	LC	SD
C1	C4	T	Q6	B3	T	R33	A3	T
C2	C4	T	Q7	B3	T	R34	A2	T
C3	A4	B	Q8	A2	T	R35	A1	T
C4	C4	B	Q9	C1	B	R36	A2	T
C5	B4	B	Q10	A2	T	R37	A1	T
C6	C2	B	Q11	B1	T	R38	C1	T
C7	C1	B				R39	C3	B
C8	C1	B	R1	C1	T	R40	B2	T
C9	B1	B	R2	C4	T	R41	C4	T
C10	A4	T	R3	C4	T	R42	C1	T
C11	A4	T	R4	B3	B			
C12	A3	T	R5	B2	T	TP1	A4	B
C13	A3	T	R6	B1	B	TP2	C2	B
C14	A3	T	R7	C2	T	TP3	C4	B
C15	A4	B	R8	B1	B	TP4	C3	B
			R9	C2	T	TP5	C3	B
D1	B4	T	R10	A3	B	TP6	C3	B
D2	B4	T	R11	C2	B	TP7	C2	B
D3	B3	B	R12	B1	T			
D4	B3	T	R13	B2	T	U1	B4	B
			R14	C2	T	U2	B4	B
J1	B1	B	R15	C2	T	U3	A1	B
J2	A1	B	R16	C3	T	U4	A2	B
J3	C1	B	R17	C3	T	U5	C4	B
J4	A1	B	R18	C1	T	U6	C3	B
			R19	B1	B	U7	C3	B
JU1	B4	B	R20	B1	T	U8	C3	B
JU2	B3	B	R21	C2	T	U9	C2	B
			R22	B2	T			
L1	A4	B	R23	B4	T	X1	C2	B
			R24	B3	B			
P1	B1	B	R25	B3	B			
P2	A3	B	R26	B3	T			
			R27	A3	T			
Q1	C4	T	R28	B2	T			
Q2	B3	B	R29	A2	T			
Q3	B3	T	R30	B4	T			
Q4	B4	T	R31	A4	T			
Q5	B4	T	R32	A3	T			

	OSx-3H 29-470 MHz	OSx-3A 118-159.6 MHz
JU1	NOT INSTALLED	INSTALLED

	9.6 MHz REFERENCE	10 MHz REFERENCE
JU2	NOT INSTALLED	INSTALLED

50021-04-01-B-01-01

OS(R/T)-3H 406-470MHZ DIGITAL BOARD SCHEMATIC DIAGRAM



	OSx-3H 29-470 MHz	OSx-3A 118-159.6 MHz
JU1	NOT INSTALLED	INSTALLED

	9.6 MHz REFERENCE	10 MHz REFERENCE
JU2	NOT INSTALLED	INSTALLED

COMPONENT LOCATION TABLE

DES	LC	DES	LC	DES	LC	DES	LC	DES	LC
C1	D2	J3		C7	R2	E3	R25	M8	TP5	N8
C2	E2	J4		H5	R3	F2	R26	M9	TP6	N9
C3	E2				R4	G6	R27	M5	TP7	M9
C4	G2	JU1	F2		R5	G4	R28	M3		
C5	H2	JU2	L2		R6	G5	R29	M4	U1	F2
C6	I3				R7	H4	R30	N7	U2	H2
C7	I3	L1		D2	R8	H3	R31	N8	U3	H3
C8	K5				R9	I4	R32	N8	U4	J2
C9	K5	P1		C2	R10	I2	R33	N9	U5	N7
C10	M7	P2		C7	R11	J3	R34	N5	U6	N7
C11	M7	Q1		F3	R12	L6	R35	N4	U7	N8
C12	N7	Q2		F6	R13	L2	R36	N4	U8	N9
C13	N8	Q3		M2	R14	K3	R37	N3	U9	N9
C14	N9	Q4		M7	R15	L3	R38	I5		
C15	F3	Q5		M8	R16	L3	R39	L2	X1	I3
		Q6		M8	R17	L3	R40	N9		
D1	M7	Q7		M9	R18	L6	R41	E3		
D2	M8	Q8		N5	R19	L6	R42	I5		
D3	M8	Q9		N4	R20	L6				
D4	M9	Q10		N4	R21	M2	TP1	H2		
		Q11		N3	R22	M3	TP2	J2		
J1	C6				R23	M7	TP3	N7		
J2	C6	R1		D6	R24	M8	TP4	N7		

HIGHEST REFERENCE DESIGNATORS		
C15	J4	JU2
Q11	R41	U9
X1	-----	-----

UNUSED REFERENCE DESIGNATORS		
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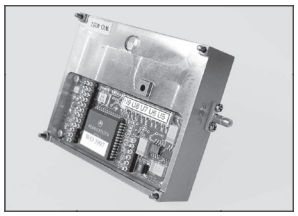
DANIELS™ ELECTRONICS LTD — VICTORIA BC.

TITLE:	OS(R/T)-3(A/H) DIGITAL BOARD SCHEMATIC DIAGRAM		
DATE:	23 APRIL 1992	DWN BY: STAN P	APRVD:
DWG No.:	01-S-01-01-1	REVISED BY:	SHANE AEBISCHER
BOARD No.:	50021-04	REV: 04	DWG REV DATE: 21 APR 03



PARTS LISTS

406-470MHZ ANALOG BOARD ELECTRICAL PARTS LIST

Ref Desig	Description	Part Number	OSR-3H440	OST-3H418	OST-3H460
C1	CAP., SM, 1nF CER,0805,X7R,50V	1008-3A102K5R	•	•	•
C2	CAP., SM, 1nF CER,0805,X7R,50V	1008-3A102K5R	•	•	•
C3	CAP., SM, 1nF CER,0805,X7R,50V	1008-3A102K5R	•	•	•
C4	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R	•	•	•
C5	CAP., SM,100nF CER,0805,X7R,50	1008-5A104K5R	•	•	•
C6	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16	•	•	•
C7	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R	•	•	•
C8	CAP., SM,100nF CER,0805,X7R,50	1008-5A104K5R	•	•	•
C9	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R	•	•	•
C10	CAP., SM,100nF CER,0805,X7R,50	1008-5A104K5R	•	•	•
C11	CAP., SM, 1.0uF TANT., 20%,16V	1055-5A105M16	•	•	•
C12	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•	•
C13	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•	•
C14	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R	•	•	•
C15	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•	•
C16	CAP., 100nF FILM, MMK5,10%,63V	1016-5A104K63	•		
C17	CAP., SM, 1nF CER,0805,X7R,50V	1008-3A102K5R	•	•	•
C18	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16	•	•	•
C19	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R	•	•	•
C20	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•	•
C21	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R	•	•	•
C22	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R	•	•	•
C25	CAP., SM, 1nF CER,0805,X7R,50V	1008-3A102K5R	•	•	•
C26	CAP., SM, 1nF CER,0805,X7R,50V	1008-3A102K5R	•	•	•
C27	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•	•
C29	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16	•	•	•

406-470MHz Analog Board
Electrical Parts List continued

Ref Desig	Description	Part Number	OSR-3H440	OST-3H418	OST-3H460
C30	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R	•	•	•
C31	CAP., SM, 1nF CER,0805,X7R,50V	1008-3A102K5R	•	•	•
C32	CAP., SM, 100uF TANT., 20%,16V	1055-7D107M16	•	•	•
C33	CAP., SM, 100uF TANT., 20%,16V	1055-7D107M16	•	•	•
C34	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R	•	•	•
C35	CAP., SM, 100pF CER., 0805,C0G	1008-2A101J1G	•	•	•
C36	CAP., SM, 330pF CER., 0805,C0G	1008-2A331J1G	•	•	•
C37	CAP., 1.0uF FILM, MMK5,10%,50V	1016-6D105K50	•		
C37	CAP., 1.5uF FILM, MMK5,10%,50V	1016-6E155K63		•	•
C38	CAP., 1.0uF FILM, MMK5,10%,50V	1016-6D105K50	•		
C38	CAP., 1.5uF FILM, MMK5,10%,50V	1016-6E155K63		•	•
C39	CAP., 1.0uF FILM, MMK5,10%,50V	1016-6D105K50	•		
C39	CAP., 1.5uF FILM, MMK5,10%,50V	1016-6E155K63		•	•
C42	CAP., SM, 22uF TANT., 20%, 20V	1055-6D226M20	•	•	•
C43	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R	•	•	•
C44	CAP., SM, 330pF CER., 0805,C0G	1008-2A331J1G	•	•	•
C45	CAP., 470nF FILM, MMK5,10%,63V	1016-5D474K63	•		
C45	CAP., 68nF FILM, MMK5, 10%,63V	1016-4A683K63		•	•
C46	CAP., SM, 330pF CER., 0805,C0G	1008-2A331J1G	•	•	•
C47	CAP., SM, 330pF CER., 0805,C0G	1008-2A331J1G	•	•	•
C49	CAP., 15nF FILM, MMK5, 10%,63V	1016-4A153K63		•	•
C49	CAP., 33nF FILM, MMK5, 10%,63V	1016-4A333K63	•		
C50	CAP., SM, 22uF TANT., 20%, 20V	1055-6D226M20	•	•	•
C51	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R	•	•	•
C52	CAP., SM, 330pF CER., 0805,C0G	1008-2A331J1G	•	•	•
C53	CAP., SM, 10pF CER., 0805, C0G	1008-1A100J1G	•	•	•
C54	CAP., SM, 22uF TANT., 20%, 20V	1055-6D226M20	•	•	•
C55	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R	•	•	•
C56	CAP., SM, 330pF CER., 0805,C0G	1008-2A331J1G	•	•	•
C58	CAP., SM, 15pF CER., 0805, C0G	1008-1A150J1G	•	•	•
C59	CAP., SM, 10pF CER., 0805, C0G	1008-1A100J1G	•	•	•
D4	DIODE, BYD17J, RECTIFIER,SOD87	2101-BYD17J00	•	•	•
D5	DIODE, BAS16, SWITCHING, SOT23	2100-BAS16000	•	•	•
L1	CHOKE, RF/MOLDED,10uH,10%,.25”	1251-4A00100K	•	•	•
L2	CHOKE, RF/MOLDED,10uH,10%,.25”	1251-4A00100K	•	•	•
L3	CHOKE, RF/MOLDED,10uH,10%,.25”	1251-4A00100K	•	•	•
L6	INDUCTOR,SM,330nH CER,10%,1008	1256-2BR3300K	•	•	•
L7	INDUCTOR,SM,330nH CER,10%,1008	1256-2BR3300K	•	•	•
L8	CHOKE, RF/MOLDED,1.5uH,10%,.25	1251-3A001R5K	•	•	•

406-470MHz Analog Board
Electrical Parts List continued

Ref Desig	Description	Part Number	OSR-3H440	OST-3H418	OST-3H460
L9	CHOKE, RF/MOLDED,1.5uH,10%,.25	1251-3A001R5K	•	•	•
L10	CHOKE, RF/MOLDED,1.5uH,10%,.25	1251-3A001R5K	•	•	•
L11	INDUCTOR, SM,18nH CER,10%,1008	1256-1B18N00K	•	•	•
L12	INDUCTOR, SM,18nH CER,10%,1008	1256-1B18N00K	•	•	•
LED1	LED/SM,PLCC-3.2X2.8,TOP,CL/RED	2111-T3228CRD	•	•	•
PCB	PCB, ANALOG, OS-3H UHF SYNTH.	4309-27500285	•	•	•
Q1	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025	•	•	•
Q2	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025	•	•	•
Q3	TRANSISTOR, BC807-25,PNP,SOT23	2120-BC807025	•	•	•
Q4	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025	•	•	•
R1	RES., SM, 49R9 0805, 1%,100ppm	1150-1A49R9FP	•	•	•
R2	RES., 330R METAL FILM, 5%,0.5W	1101-2A0331JP	•	•	•
R3	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•
R4	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•
R5	RES., SM, 100R 0805, 1%,100ppm	1150-2A1000FP	•	•	•
R6	RES., SM, 1K00 0805, 1%,100ppm	1150-3A1001FP	•	•	•
R7	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•
R8	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•
R9	RES., SM, 1K00 0805, 1%,100ppm	1150-3A1001FP	•	•	•
R10	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•
R11	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•
R12	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•
R13	RES., SM, 11K8 0805, 1%,100ppm	1150-4A1182FP	•	•	•
R14	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•
R15	RES., SM, 10R0 0805, 1%,100ppm	1150-1A10R0FP	•	•	•
R16	RES., SM, 5K11 0805, 1%,100ppm	1150-3A5111FP	•	•	•
R17	RES., SM, 5K11 0805, 1%,100ppm	1150-3A5111FP	•	•	•
R18	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•
R19	RES., SM, 274K 0805, 1%,100ppm	1150-5A2743FP	•	•	•
R20	RES., SM, 10R0 0805, 1%,100ppm	1150-1A10R0FP	•	•	•
R21	RES., SM, ZERO OHM JUMPER,0805	1150-0A0R0000	•	•	•
R23	RES., SM, 10R0 0805, 1%,100ppm	1150-1A10R0FP	•	•	•
R24	RES., SM, 10R0 0805, 1%,100ppm	1150-1A10R0FP	•	•	•
R25	RES., SM, 10R0 0805, 1%,100ppm	1150-1A10R0FP	•	•	•
R26	RES., 1R2 METAL FILM, 5%, 0.5W	1101-0A01R2JI	•	•	•
R28	RES., SM, 10R0 0805, 1%,100ppm	1150-1A10R0FP	•	•	•
R29	RES., SM, 36K5 0805, 1%,100ppm	1150-4A3652FP	•	•	•

406-470MHz Analog Board
Electrical Parts List continued

Ref Desig	Description	Part Number	OSR-3H440	OST-3H418	OST-3H460
R30	RES., SM, 10R0 0805, 1%,100ppm	1150-1A10R0FP	•	•	•
R31	RES., SM, 274R 0805, 1%,100ppm	1150-2A2740FP	•	•	•
R32	RES., 4K7 METAL FILM, 5%, 0.5W	1101-3A0472JP	•		
R32	RES., 6K2 METAL FILM, 5%, 0.5W	1101-3A0622JP		•	•
R33	RES., 1K2 METAL FILM, 5%, 0.5W	1101-3A0122JP	•	•	•
R34	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•
R35	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•
R36	RES., 1K2 METAL FILM, 5%, 0.5W	1101-3A0122JP		•	•
R36	RES., 1K5 METAL FILM, 5%, 0.5W	1101-3A0152JP	•		
R38	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•
R39	RES., SM, ZERO OHM JUMPER,0805	1150-0A0R0000	•	•	•
R40	RES., 180R METAL FILM, 5%,0.5W	1101-2A0181JP	•	•	•
R41	RES., SM, 18R2 0805, 1%,100ppm	1150-1A18R2FP	•	•	•
R42	RES., SM, 221K 0805, 1%,100ppm	1150-5A2213FP	•	•	•
R44	RES., SM, 47R5 0805, 1%,100ppm	1150-1A47R5FP	•	•	•
R45	RES., SM, 27R4 0805, 1%,100ppm	1150-1A27R4FP	•	•	•
R46	RES., SM, 33R2 0805, 1%,100ppm	1150-1A33R2FP	•	•	•
R47	RES., SM, 47R5 0805, 1%,100ppm	1150-1A47R5FP	•	•	•
R48	RES., SM, 27R4 0805, 1%,100ppm	1150-1A27R4FP	•	•	•
R49	RES., SM, 33R2 0805, 1%,100ppm	1150-1A33R2FP	•	•	•
R50	RES., 180R METAL FILM, 5%,0.5W	1101-2A0181JP	•	•	•
R51	RES., 220R METAL FILM, 5%,0.5W	1101-2A0221JP	•	•	•
R52	RES., SM, 49R9 0805, 1%,100ppm	1150-1A49R9FP	•	•	•
R53	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP	•	•	•
R54	RES., SM, 18R2 0805, 1%,100ppm	1150-1A18R2FP	•	•	•
R55	RES., SM, 274R 0805, 1%,100ppm	1150-2A2740FP	•	•	•
R56	RES., SM, 274R 0805, 1%,100ppm	1150-2A2740FP	•	•	•
RV1	POT., SM/4mm SQ,5K,SINGLE TURN	1174-AS2502J1	•	•	•
TCXO1	TCVCXO,SMT,10MHz,1ppm,0-3V,4PN	2641-10000AM7	•	•	•
U1	DIODE, I/R SENSOR,TTL O/P,PLST	2014-1L18230T	•	•	•
U2	DIODE, I/R SENSOR,TTL O/P,PLST	2014-1L18230T	•	•	•
U3	DIODE, I/R SENSOR,TTL O/P,PLST	2014-1L18230T	•	•	•
U4	DIODE, I/R SENSOR,TTL O/P,PLST	2014-1L18230T	•	•	•
U5	LED, I/R,GaAs,.81 x .23,PLAST.	2013-1G18230A	•	•	•
U6	IC, LT1129I,PROG. VOLT REG,SO8	2305-11290N08	•	•	•
U7	IC, LP2951,PROG. VOLT REG,SO-8	2305-29510N08	•	•	•
U8	IC, LP2951,PROG. VOLT REG,SO-8	2305-29510N08	•	•	•
U9	MOSFET, SI9945AEY,N CHAN.,SO-8	2142-SI9945DY	•	•	•
U10	IC, 45190,PLL FREQ/SYNTH,SO-20	2355-45190N20	•	•	•

406-470MHz Analog Board
Electrical Parts List continued

Ref Desig	Description	Part Number	OSR-3H440	OST-3H418	OST-3H460
U11	IC,msA-0611, MMIC AMP,SOT-143	2354-MSA06110	•	•	•
U15	IC,msA-0611, MMIC AMP,SOT-143	2354-MSA06110	•	•	•
U16	IC,msA-0611, MMIC AMP,SOT-143	2354-MSA06110	•	•	•
R57	RES., SM, 18R2 0805, 1%,100ppm	1150-1A18R2FP	•	•	•
R58	RES., SM, 274R 0805, 1%,100ppm	1150-2A2740FP	•	•	•
U17	VCO MODULE, 406-470MHz,T-PKG.	2621-190435MT		•	•
U17	VCO MODULE,427.4-451.4MHz,T-PK	2621-L002309T	•		

DIGITAL BOARD
ELECTRICAL PARTS LIST

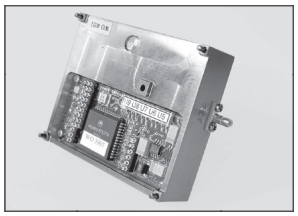
Ref Desig	Description	Part Number
C1	CAP., SM,100nF CER,0805,X7R,50	1008-5A104K5R
C2	CAP., SM,100nF CER,0805,X7R,50	1008-5A104K5R
C3	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16
C4	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16
C5	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16
C6	CAP., SM, 22pF CER., 0805, C0G	1008-1A220J1G
C7	CAP., SM, 22pF CER., 0805, C0G	1008-1A220J1G
C8	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16
C9	CAP., SM,100nF CER,0805,X7R,50	1008-5A104K5R
C10	CAP., SM,100nF CER,0805,X7R,50	1008-5A104K5R
C11	CAP., SM,100nF CER,0805,X7R,50	1008-5A104K5R
C12	CAP., SM,100nF CER,0805,X7R,50	1008-5A104K5R
C13	CAP., SM,100nF CER,0805,X7R,50	1008-5A104K5R
C14	CAP., SM,100nF CER,0805,X7R,50	1008-5A104K5R
C15	CAP., SM, 10uF TANT., 20%, 16V	1055-6C106M16
D1	DIODE, BAS16, SWITCHING, SOT23	2100-BAS16000
D2	DIODE, BAS16, SWITCHING, SOT23	2100-BAS16000
D3	DIODE, BAS16, SWITCHING, SOT23	2100-BAS16000
D4	DIODE, BAS16, SWITCHING, SOT23	2100-BAS16000
L1	INDUCTOR, SM, 10.0uH, 10%,1812	1255-4G10000K
P1	INTERCONNECT/STD,1ROW x 12P,Au	5015-IS112G21
P1	INTERCONNECT/STD,1ROW x9PIN,Au	5015-IS109G21
P2	INTERCONNECT/STD,1ROW x6PIN,Au	5015-IS106G21
PCB	PCB, DIGITAL, OS-3H H/P SYNTH.	4309-26002104
Q1-Q11	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025
R1	RES., SM, ZERO OHM JUMPER,0805	1150-0A0R0000
R2	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R3	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R4	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R5	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R6	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R7	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R8	RES., SM, 6K81 0805, 1%,100ppm	1150-3A6811FP
R9	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R10	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R11	RES., SM, 10M0 1206, 5%,400ppm	1151-7B0106JG
R12	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP

Digital Board
Electrical Parts List continued

Ref Desig	Description	Part Number
R13	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R14	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R15	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R16	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R17	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R18	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R19	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R20	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R21	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R22	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R23	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP
R24	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP
R25	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP
R26	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP
R27	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R28	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R29	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R30	RES., SM, 215R 0805, 1%,100ppm	1150-2A2150FP
R31	RES., SM, 215R 0805, 1%,100ppm	1150-2A2150FP
R32	RES., SM, 215R 0805, 1%,100ppm	1150-2A2150FP
R33	RES., SM, 332R 0805, 1%,100ppm	1150-2A3320FP
R34	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R35	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R36	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R37	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R38	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R39	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R40	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R41	RES., SM, 221K 0805, 1%,100ppm	1150-5A2213FP
R42	RES., SM, 1K00 0805, 1%,100ppm	1150-3A1001FP
U1	MOSFET, SI9933ADY,P CHAN.,SO-8	2142-SI9933DY
U2	IC, LP2951,PROG. VOLT REG,SO-8	2305-29510N08
U3	IC, MC33064,UNDR/VOLT SEN.SO-8	2308-33064N08
U4	IC, 68HC711E9, MIC/CTR, PLCC52	2380-68711P52
U5	LED, I/R,GaAs,.81 x .23,PLAST.	2013-1G18230A
U6	LED, I/R,GaAs,.81 x .23,PLAST.	2013-1G18230A
U7	LED, I/R,GaAs,.81 x .23,PLAST.	2013-1G18230A
U8	LED, I/R,GaAs,.81 x .23,PLAST.	2013-1G18230A
U9	DIODE, I/R SENSOR,TTL O/P,PLST	2014-1L18230T
X1	RESONATOR, SM, 8.0MHz, CERAMIC	1575-8001816A

OS(R/T) 406-470MHZ
MECHANICAL PARTS LIST

Description	Part Number	Qty.
CASE, OS-3H SYNTH. MODULE,ALUM	3702-66100920	1
CONN., SMB, JACK,2 HOLE FLANGE	5120-J2SC01BG	2
FERRITE BEAD, 43MIX,3x3.5mm OD	1210-43030350	3
LID, CASE,OS-3H SYNTH/MODL.,AL	3702-66100921	1
PIN, 2 x 10mm, GROOVED W/PILOT	5876-D1470210	4
SCREW, M2 X 4, PAN/PHILLIPS,A2	5812-2M0PP04S	15
SCREW, M2 x 4, FLAT/PHIL, A2	5812-2M0FP04S	8
SCREW,M2.5x24.5mm,FLAT/PHIL,A2	5812-2M5FP24S	1
WASHER, TFE,0.036ID,1/8 OD,.02T	5805-T3612F20	6



REVISION HISTORY

Revision	Date	ECO	Description
1	May 97	n/a	• Issue 1
2	Mar 98	547	• Changes to the AM Analog board (OST-3A128) to improve performance. C37 was 220nF now 100nF and C40 was 8.2pF is now not installed C45 was 33nF is now 22nF and C49 was 2.2nF is now 1.5nF R32 was 33K is now 56K and R36 was 3K3 is now 5K6.
3	Mar 00	565	• Changes to the AM Analog board to improve performance at -40°C. L4 was 1.5µH is now 3.9µH
		572	• Changes to the FM Analog boards to improve manufacturing. C32 & C33 were 100µF through hole tantalums are now 100µF surface mount tantalums.
		579	• Changes to the OS-3A/H Digital board for compatibility with the new AM wideband Synthesizers. Added C15 (10µF) and R41 (221K). JU1 was added and is installed for AM modules only. PCB, DIGITAL, OS-3H/P SYNTH was version 2 now version 3. Added the new component layouts, schematic diagram and parts lists for the new AM wideband synthesizer. Wideband referring to only having to be tune once and working over the whole AM band (118-138MHz).
4	May 00	603	• Changes to the OS-3H 128-174MHz Analog board. R29 was 18K2 is now 3K92, U10 was MC145191 is now MC145193.
		609	• Changes to the OSR-3H 128-174MHz Analog board. R22 was 100R is now 0R0.
		601	• Changes to the OS-3A 118-159.4 Analog board. R42 & R53 were 137K. are now 100K
	Jul 00	n/a	• Corrected the SELECT table on the OS(R/T)-3H 128-174MHz Schematic diagram (section 4.3.3).
	Aug 00	599	• Changes to the OS(R/T)-3(A/H) Digital board. R30, R31 & R32 were 332R are now 215R.
		597	• Changes to the OS-3H 406-470MHz Analog board. R48 was 27R4 is now 47R5, R49 was 33R2 is now 10R. R52 was 49R9 is now Not Installed.
	Oct 00	n/a	• Added the TBA part numbers for U1- U4 & U18 on the OS-3A 118-159.4MHz Analog Board.
	Dec 00	631	• Changes to the OS-3H 29-71.4MHz Analog Board. R22 eas 475R is now 1K00.

Revision	Date	ECO	Description
	Jan 01	589	• Change to the OS-3A 118-159.4MHz Analog Board. R31 was 100R is now 49R9 • Changes to the OST-3A128 Analog Board. C35 was 5.6pF is now 3.3pF and R40 was 330R is now 220R.
	Feb 01		• Corrected the confusion with D6 & D7 on the OS-3A 118-159.4MHz Analog Board parts list.
		634	• Changes to the OS-3A 118-159.4MHz Analog Board. C26 was 1nF is now 3.3pF.
		635	• Changes to the OS-3 128 – 174MHz Analog Board. C56 was 330pF is now R42 (Select).
	Apr 01	619	• Changes to the OST-3H4xx Analog Board. C37 – C39 were 1.0µF are now 1.5µF C45 was 220nF is now 68nF. C49 was 22nF now 15nF, C60 was 100nF now a zero ohm wire jumper. R19 was 10K0 is now zero ohm jumper (Both OS(R/T)-3H4xx). R32 was 5K6 is now 6K2 and R36 was 2K2 is now 1K2.
	May 01	637	• Changes to the OS(R/T)-3A 118-159.4MHz Analog Board. U10 was Select, now VC145193F. R29 was Select, now 3K92.
	Aug 01	658	• Changes to the OS(R/T)-3/xx 128-174MHz Analog Board. TCXO was Saronix, now Rakon.
4A	Oct 01	652	• New design of OS(R/T)-3H 128-174MHz Analog Board. PCB was 50025-02, now 50025-04 (version –04.) Added “Appendix” section 6 to provide Layout, Schematic and Parts List of new board, along with an explanation of the board changes.
	Mar 02	679	• VHF Analog PCB R19 value changed to 221K to prevent excessive frequency error with modulation. R19 was 1150-4A2212FP, 22K1 SM 805 now 1150-5A2213FP, 221K, SM 805
4B	Aug 02	713	• New design of OS(R/T)-3H 406-470MHz Analog Board. PCB was 50028-02, now 50025-05 (version –05.) Added “Appendix” section 7 to provide Layout, Schematic and Parts List of new board, along with an explanation of the board changes.
	Oct 02	n/a	• VHF Analog Board (pg 6-4): Corrected label for JU1 – remove reference to 9.6MHz.
4C	Nov 02	729	• New design of OS(R/T)-3H 29-71.4MHz Analog Board. Added “Appendix” section 8 to provide Layout, Schematic and Parts List of new board, along with an explanation of the board changes. PCB was 50038-02, now 50038-03 (version –03.) New board uses a Rakon TCXO and U10 is selectable with MC145191F, MC145192F or MC145193F.
5-0-0	Aug 03	n/a	• Converted to new manual format. Seperated models into discrete manual sections. Included appendixes into main body of manual. Removed AM Enhanced Synthesizer as it is now part of a product specific manual and is no longer required in this modual manual.
		699	• Changes applied to Low Band only-Unfiltered audio is coupling with the low level signal close to the output of the audio processor (not included in this manual). R10 and R12 were 1150-4A1002FP, 10K0 SM 0805 Now 1150-4A2212FP, 22K1 0805
		759	• New Digital PCB to allow for new Microprocessor PCB was 4309-26500213, PCB 50021 Rev 3 Now 4309-26002104, PCB 50021 Rev 4 Added R42 10150-3A1001FP, 1K00 0805
5-0-1	Aug 03	n/a	• Corrected header and footer to match sections. Corrected VHF band reference in manual locator section.

Revision	Date	ECO	Description
5-1-1	Feb 05	812	• Ferrite Bead was: 1210-73030350 FERRITE BEAD, 73MIX,3x3.5mm OD now: 1210-43030350 FERRITE, BEAD,43MIX,3x3.5mm OD • Synthesizer Block Diagram now included. • Top frequency corrected from 512 to 470MHz
		829	• To allow for an additional channel step size of 2.5 kHz in the VHF 150MHz Enhanced Receivers and Transmitters.
5-2-1	May 05	846	• Affects OSR-3H141, OSR-3H162, OST-3H141, and OST-3H162 with PCB 50025-04; R19 was 1150-5A2213FP RES., SM, 221K 0805, 1%,100ppm now 1150-5A2743FP RES., SM, 274K 0805, 1%,100ppm R59 was 1150-4A1002FP RES., SM, 10K0 0805, 1%,100ppm now 1150-5A2213FP RES., SM, 221K 0805, 1%,100ppm C16 was 1008-3A102K5R CAP., SM, 1nF CER, 0805,X7R,50V now Not Installed All associated drawings, schematics, and parts lists updated. • Affects OSR-3H440 AND OST-3H440 with PCB 50028-05 R19 was 1150-4A7502FP RES., SM, 75K0 0805, 1%,100ppm now 1150-5A2743FP RES., SM, 274K 0805, 1%,100ppm R42 was 1150-4A1002FP RES., SM, 10K0 0805, 1%,100ppm now 1150-5A2213FP RES., SM, 221K 0805, 1%,100ppm All associated drawings, schematics, and parts lists updated.
5-3-0	Dec 05	6113	• Affects OSR-3H141 and OST-3H141 with PCB 50025-04; C23 was 1008-1A120J1G CAP., SM, 12pF CER., 0805, C0G now 1008-1A100J1G CAP., SM, 10pF CER., 0805, C0G D1 was not installed now 2106-MMBV609L DIODE, MMBV609L,VARICAP,SOT-23 R47 was 1150-1A47R5FP RES., SM, 47R5 0805, 1%,100ppm now 1150-1A27R4FP RES., SM, 27R4 0805, 1%,100ppm R48 was 1150-1A47R5FP RES., SM, 47R5 0805, 1%,100ppm now 1150-1A27R4FP RES., SM, 27R4 0805, 1%,100ppm R49 was 1150-1A10R0FP RES., SM, 10R0 0805, 1%,100ppm now 1150-1A39R2FP RES., SM, 39R2 0805, 1%,100ppm R52 was not installed now 1150-2A1500FP RES., SM, 150R 0805, 1%,100ppm JU3 was generic not installed now band specific installed
5-4-0	Apr 06	6138	• Affects OSR-3H141, OSR-3H162, OST-3H141, and OST-3H162 with PCB 50025-04; C17 was 1008-3A102K5R CAP., SM, 1nF CER 0805, X7R, 50V now 1008-4A333K5R CAP., SM, 33nF CER 0805, X7R, 50V