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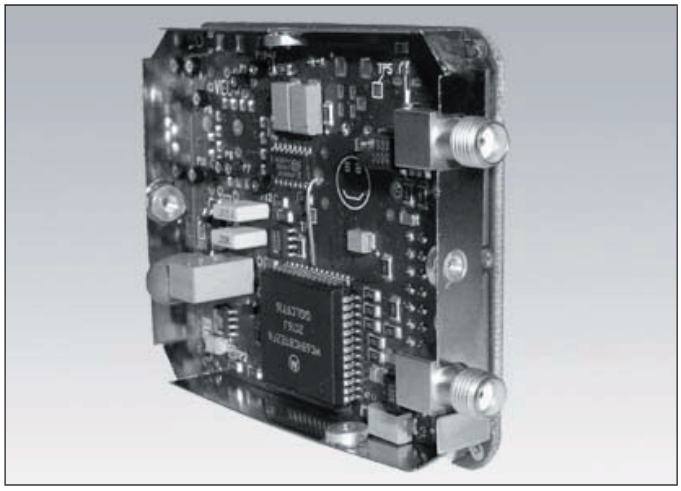

LOW CURRENT SYNTHESIZER INSTRUCTION MANUAL

OS(R/T)-3 132 - 960 MHZ

Covers Models:

OSR-3/141	OSR-3/162	OSR-3/440
OSR-3/770	OSR-3/815	OSR-3/860
OST-3/815	OST-3/860	OSR-3/885
OSR-3/901	OST-3/899	OST-3/932
		OST-3/948

Document Number: IM11-OS3
Revision: 3-2-0
Revision Date: Nov 2004

Daniels Electronics Ltd.
Victoria, BC
PRINTED IN CANADA

DOCUMENT CONTROL

This document has been produced, verified and controlled in accordance with Daniels Electronics' Quality Management System requirements.

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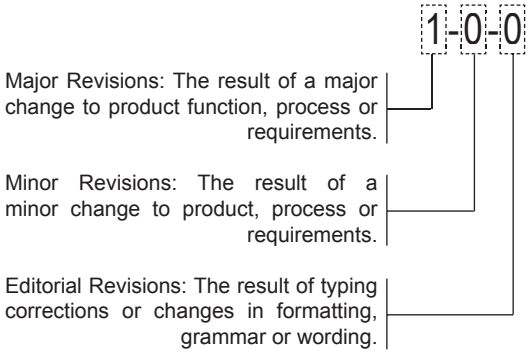
DOCUMENT REVISION DEFINITION

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

	Transmitters			Receivers		
Radio Frequency	**Transmitter Model & Frequency Range**	**Low Current Synthesizer Model & Synthesizer Frequency**	**Location in Manual**	**Receiver Model & Frequency Range**	**Low Current Synthesizer Model & Synthesizer Frequency**	**Location in Manual**
VHF 132-174 MHz	Requires Enhanced Synthesizer	Not covered in this Manual	Not covered in this Manual	VR-3/140 132-150 MHz	OSR-3/162 150-174 MHz	See Page 5 LOW CURRENT SYNTHESIZER OSR-3 132 - 174 MHZ
				VR-3/160 150-174 MHz	OSR-3/141 128-150 MHz	
UHF 406-470 MHz				UR-3/420 406-430 MHz	OSR-3/440 427.4-451.4 MHz	See Page 31 LOW CURRENT SYNTHESIZER OSR-3 406 - 470 MHZ
				UR-3/460 450-470 MHz		
UHF 800 806-869 MHz	UT-3/815 806-824 MHz	OST-3/815 806-824 MHz	See Page 59 LOW CURRENT SYNTHESIZER OSR-3 806 - 896 MHZ	UR-3/815 806-824 MHz	OSR-3/770 761-779 MHz	See Page 59 LOW CURRENT SYNTHESIZER OSR-3 806 - 869 MHZ
	UT-3/860 851-869 MHz	OST-3/860 851-869 MHz		UR-3/860 851-869 MHz	OSR-3/815 806-824 MHz	
UHF 900 896-960 MHz	UT-3/900 896-902 MHz	OST-3/899 896-902 MHz	See Page 83 LOW CURRENT SYNTHESIZER OSR-3 896 - 960 MHZ	UR-3/900 896-902 MHz	OSR-3/860 851-869 MHz	
	UT-3/930 928-935 MHz	OST-3/932 896-902 MHz		UR-3/930 928-935 MHz	OSR-3/885 883-890 MHz	See Page 83 LOW CURRENT SYNTHESIZER OSR-3 896 - 960 MHZ
	UT-3/950 935-960 MHz	OST-3/948 896-902 MHz		UR-3/950 935-960 MHz	OSR-3/901 890-915 MHz	

LOW CURRENT SYNTHESIZER OSR-3 132-174 MHZ

Covers Models:
OSR-3/141
OSR-3/162

	Transmitters			Receivers		
Radio Frequency	**Transmitter Model & Frequency Range**	**Low Current Synthesizer Model & Synthesizer Frequency**	**Location in Manual**	**Receiver Model & Frequency Range**	**Low Current Synthesizer Model & Synthesizer Frequency**	**Location in Manual**
VHF 132-174 MHz	Requires Enhanced Synthesizer	Not covered in this Manual	Not covered in this Manual	VR-3/140 132-150 MHz	OSR-3/162 150-174 MHz	See Page 5 LOW CURRENT SYNTHESIZER OSR-3 132 - 174 MHZ
				VR-3/160 150-174 MHz	OSR-3/141 128-150 MHz	
UHF 406-470 MHz				UR-3/420 406-430 MHz	OSR-3/440 427.4-451.4 MHz	See Page 31 LOW CURRENT SYNTHESIZER OSR-3 406 - 470 MHZ
				UR-3/460 450-470 MHz		
UHF 800 806-869 MHz	UT-3/815 806-824 MHz	OST-3/815 806-824 MHz	See Page 59 LOW CURRENT SYNTHESIZER OSR-3 806 - 896 MHZ	UR-3/815 806-824 MHz	OSR-3/770 761-779 MHz	See Page 59 LOW CURRENT SYNTHESIZER OSR-3 806 - 869 MHZ
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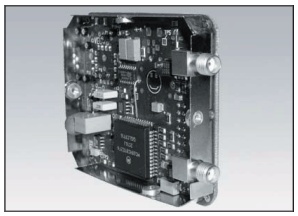
UHF 900 896-960 MHz	UT-3/900 896-902 MHz	OST-3/899 896-902 MHz	See Page 83 LOW CURRENT SYNTHESIZER OSR-3 896 - 960 MHZ	UR-3/900 896-902 MHz	OSR-3/860 851-869 MHz	
	UT-3/930 928-935 MHz	OST-3/932 896-902 MHz		UR-3/930 928-935 MHz	OSR-3/885 883-890 MHz	See Page 83 LOW CURRENT SYNTHESIZER OSR-3 896 - 960 MHZ
	UT-3/950 935-960 MHz	OST-3/948 896-902 MHz		UR-3/950 935-960 MHz	OSR-3/901 890-915 MHz	



GENERAL INFORMATION

INTRODUCTION

The OSR-3 Low Current Synthesizer Module produces a low distortion, high stability, FM unmodulated (receiver) RF signal covering a frequency band of 132 - 174 MHz. It achieves a ±1 ppm frequency stability from -40°C to +60°C with its own internal reference, or it can be slaved to an external reference signal of desired stability. The synthesizer is easily removed for programming, calibration, or repair.

LOW CURRENT SYNTHESIZER FAMILY MODELS

The OSR-3 Low Current Synthesizer module family forms an integral component of the MT-3 receiver product line. The OSR-3 synthesizer provides a low noise local oscillator signal that directly drives the mixer circuitry.
Note that this section of the manual provides service and operating information for just the synthesizer models listed below. It is important to establish the correct synthesizer model number of interest in order to direct attention to specific documented information. The specific model number is printed on the synthesizer module top cover.

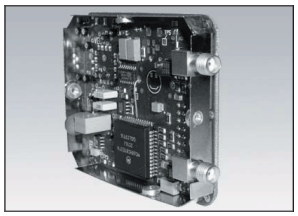
This Section of the manual covers the following Synthesizers:

- OSR-3/141- synthesized, installed in receiver, 128 - 153 MHz RF output.
- OSR-3/162- synthesized, installed in receiver, 150 - 174 MHz RF output.

Each model's band of operation in a given frequency band is determined by select components on the Synthesizer board. The OSR-3 132 - 174 MHz models use specially designed VCOs that occupy circuit boards that plug into the synthesizer module main circuit boards through machined contact pins.

PERFORMANCE SPECIFICATIONS

Type:	NBFM 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 shown in [ ] brackets	128 MHz - 153 MHz [± 1.0 MHz] (OSR-3/141). 150 MHz - 174 MHz [± 1.0 MHz] (OSR-3/162).
Output Power:	+4 dBm to 7 dBm.
External Reference Input:	External reference input signal via SMB connector J1. Input level 2.0 Vpp to 5.0 Vpp. Input impedance 50Ω. Input frequency 9.6 MHz.



THEORY OF OPERATION

INTERNAL POWER AND CONTROL

The synthesizer operates from +9.5 Vdc applied to connector pin P1-2. Current drain is approximately 60 mA. Regulator IC U1 provides continuously regulated +5.0 Vdc to the reference TCXO. Regulator IC U3 supplies regulated + 5.0 Vdc to all other synthesizer circuitry including the VCO, synthesizer IC U4, and microprocessor U6. Supply U3 is turned on by applying +9.5 Vdc to synthesizer pin P2-4. For receiver applications, the synthesizer is always operating with the enable line P2-4 being permanently connected to +9.5 Vdc.

RF CIRCUITRY

The synthesizer itself is formed around a low power, single chip synthesizer IC U4. A 9.6 MHz reference signal is provided from either the internal TCXO (JU1-B), or an external source via SMA connector J4 and jumper JU1-A. If an external signal is used for the reference source, it must be of low phase noise, high stability, and between 2.0 Vpp and 5.0 Vpp. A sinusoidal signal shape is required for an external reference source. A poor quality reference source will degrade receiver performance to unacceptable levels.

The 9.6 MHz reference source is divided down to establish a channel selection step size of 5.0 kHz or 6.25 kHz. A third order passive loop filter comprised of C10, C11, C14, R11, and R12, is employed to achieve the required

noise performance, modulation and worst case switching time of 50 ms. A small sample of RF energy is coupled from the VCO output to the synthesizer IC U4 prescaler input (pin 8). FM modulation of the VCO from 60 Hz to 3 kHz, is provided through the baseband input pin P1-1 and installation of jumper JU3-B. A 1 kHz sine wave with a level of approximately 315 mVrms at P1-1 provides FM deviation of 3.0 kHz. The output of the VCO is filtered by low pass filter F1. SMA connector J5 provides frequency coverage with an RF output level of approximately +7 dBm into a 50Ω load. Synthesizer frequency band selection is made by the appropriate selection of a fixed value tuning capacitors mounted on the VCO board.

SYNTHESIZER VCO

The synthesizer module VCO provides frequency generation and amplification/isolation together with frequency voltage control and modulation input capability. It occupies a small circuit board that plugs into the synthesizer module main circuit board through seven machined contact pins.

Field effect transistor Q1 provides a UHF negative resistance amplifier/oscillator that is tuned on frequency by the combination of resonator L2 and a total capacitive reactance presented across L2 through capacitors C2 and C5. Coarse frequency adjustment is provided by multi-turn trimmer capacitor C5. Select capacitor values C2, C6, and C12 are chosen to position the operating frequency in one of two bands; 128 - 150 MHz, and 150 - 174 MHz. Specific values for these capacitors are shown in the VCO schematic diagram.

RF output power is taken from a tap point near the grounded end of resonator L2. MMIC U2 provides amplification and isolation of the oscillator signal with output applied to pin P13, which in turn drives the synthesizer prescaler found on the synthesizer module main board.

Voltage control required for implementation of the PLL function is provided through Loop Control input pin P6. A DC control voltage, from the synthesizer PLL loop filter, controls VCO frequency by controlling oscillator resonating capacitance through changing the reverse bias potential across tuning diode D1. Modulation capability operates in a similar fashion through the application of a modulation signal to input pin P7. A large signal division ratio, established by resistive dividers R2 and R3, allows low deviation (less than 5 kHz) direct frequency modulation of the VCO output signal.

MICROPROCESSOR CONTROLLER

Microprocessor U6 provides control of the synthesizer module. It communicates with synthesizer IC U4, monitors the synthesizer lock detect, manages PTT input/output, and determines the operating frequency from either four rotary BCD switches or four externally driven channel select lines. It also communicates with an external factory programmer through I/O lines TX DATA (P1-17), RX DATA (P1-9), and BOOTSTRAP (P2-2). The external programmer places the operating program in non volatile microprocessor memory. It is also used to program 15 user channel selections.

The microprocessor spends the majority of time in a low power sleep state. Wake up is achieved when external events such as PTT action, synthesizer lock failure, or a change in channel selection dictate immediate action. An internal “watchdog” timer provides robust software protection in all operating modes.

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 (grounded), the synthesizer will scan four BCD switches connected to SW1 COM - SW4 COM and PC4 - PC7 to establish the operating frequency. The BCD switches are located on the receiver main circuit boards.

Note: The four channel select lines, CHAN SEL3 - Chan SEL0, are connected via the MT-3 receiver main board module connector to the M3 motherboard subrack. These lines may be used for external frequency control. They are normally pulled low via jumper sets located on the M3 motherboard subrack.

If the channel select lines are pulled high to +9.5 Vdc in any combination resulting in a binary code greater than 0000 (all low), then the frequency is established as the preprogrammed entry in a table containing 15 separate frequency settings. For example; if all of the channel select lines are pulled high then a binary code of 1111 results which selects the frequency entry from the 15th table position. CHAN SEL3 is the most significant bit of the binary channel selection code. The channel table is normally programmed at the factory for those applications requiring specialized remote control of frequency. These programmed channel assignments are stored in non-volatile microprocessor EEPROM and are not susceptible to inadvertent erasure.

For receivers, an IF Offset correction factor (21.4 MHz for OSR-3 132 - 174 MHz) must be added to or subtracted from the synthesizer operating frequency in order to determine the actual receive frequency. Refer to the channel designation table documentation provided with the receiver modules for simplified channel number and frequency information.

SYNTHESIZER BASE AND FREQUENCY INCREMENTS

The OSR-3 Low Current Synthesizer operates in frequency increments of 5.0 kHz or 6.25 kHz depending on the particular band of operation. The Base Frequency is the lowest frequency of any given synthesizer model.

Model Number	Freq. Range	Base Frequency	Freq. Increment
OSR-3/141	128-153 MHz	128 MHz	5.0/6.25 kHz
OSR-3/162	150-174 MHz	150 MHz	5.0/6.25 kHz

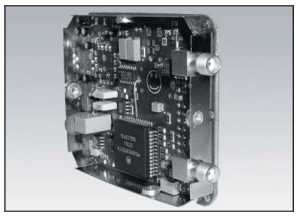
CHANNEL SELECTION

OS-3 synthesizers have been designed to generate frequencies in both 5.0 kHz and 6.25 kHz channel increments. BCD channel switch settings from 0000 to 4999 will therefore select operating frequencies with 5.0 kHz increments, while BCD switch settings from 5000 to 9999 will select operating frequencies with 6.25 kHz increments. The switch settings are scanned by the synthesizer module when the receiver is first powered up, and the desired local oscillator frequency is generated.

Calculation of the operating frequency is determined as follows:

OSR-3 132-174 MHz Channel Selection

OSR-3/141 (installed in VR-3/160, 150-174 MHz)	OSR-3/162 (installed in VR-3/140, 132-150 MHz)
BCD switch settings from 0120 to 4920:	BCD switch settings from 0680 to 4280:
Multiply the switch setting by 5.0 kHz and add the result to the synthesizer base frequency plus the IF offset.	Multiply the switch setting by 5.0 kHz and add the result to the synthesizer base frequency minus the IF offset.
Example: An OSR-3/141 synthesizer has a base frequency of 128 MHz. The IF offset correction factor is 21.4 MHz. The selected channel number is 0988. Therefore the receiver frequency is:	Example: An OSR-3/162 synthesizer has a base frequency of 150 MHz. The IF offset correction factor is 21.4 MHz. The selected channel number is 0988. Therefore the receiver frequency is:
((988 x 5 kHz) + (128 MHz + 21.4 MHz)) = 154.340 MHz	((988 x 5 kHz) + (150 MHz - 21.4 MHz)) = 133.540 MHz
BCD switch settings from 5096 to 8936:	BCD switch settings from 5544 to 8424:
Subtract 5000 from the switch setting. Multiply the result by 6.25 kHz and add the result to the synthesizer base frequency plus the IF offset.	Subtract 5000 from the switch setting. Multiply the result by 6.25 kHz and add the result to the synthesizer base frequency minus the IF offset.
Example: An OSR-3/141 synthesizer has a base frequency of 128 MHz. The IF offset correction factor is 21.4 MHz. The selected channel number is 7205. Therefore the receiver frequency is:	Example: An OSR-3/162 synthesizer has a base frequency of 150 MHz. The IF offset correction factor is 21.4 MHz. The selected channel number is 7205. Therefore the receiver frequency is:
(((7205-5000) x 6.25 kHz) + (128 MHz + 21.4 MHz)) = 163.18125 MHz	(((7205-5000) x 6.25 kHz) + (150 MHz - 21.4 MHz)) = 142.38125 MHz



SYNTHESIZER ALIGNMENT

GENERAL

OSR-3 Low Current Synthesizer alignment is simplified by using a Type 84 subrack and RF extender card/cable to provide receiver power and signal interconnection. Alternatively, +9.5 Vdc may be applied directly to a receiver module through positive connection to pins B6 / Z6, and negative connection to pins B30 / Z30 / B32 / Z32. Receiver balanced audio (600 Ω) is available at pins B26 and Z26.

REPAIR NOTE

OSR-3 Low Current Synthesizer employs a high percentage of surface mount components that should not be removed or replaced using an ordinary soldering iron. Removal and replacement of surface mount components should be performed only with specifically designed surface mount rework and repair stations complete with Electrostatic Discharge (ESD) protection.

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

RECOMMENDED TEST EQUIPMENT

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

Power supply - Regulated +9.5 Vdc 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 frequency locked to an external reference (WWVH, GPS, Loran C) so that the internal high stability local oscillator may be accurately set to within its ±1 ppm frequency tolerance.

OSR-3 SYNTHESIZER FACTORY CONFIGURATION

All solder jumpers are clearly marked on the underside of the synthesizer module. The following list details the required jumper configuration for the two synthesizer operating modes:

1) Internal reference. Install jumper JU1B (Standard). The internal temperature compensated crystal oscillator (TCXO) provides the reference signal with a stability not exceeding ±1 ppm from -40°C to + 60°C.
2) External reference input. Install jumper JU1A. This mode reduces receiver current by approximately 4 mA by eliminating the internal TCXO reference and is used in applications requiring better than ±1 ppm frequency stability.

Remember: Care must be exercised when installing the reconfigured synthesizer module back into the IF/audio board. Pay careful attention to pin alignment before pressing the synthesizer module into it's mating sockets.

OSR-3 SYNTHESIZER ALIGNMENT

General

Under normal circumstances, the alignment procedure is accomplished without removing the synthesizer from the MT-3 Receiver IF/ Audio Board. Alignment simply involves setting the internal TCXO reference frequency (if one is installed). A change in receiver operating frequency greater than ±5 MHz from an initial factory setting requires a more involved synthesizer alignment procedure. To convert a synthesizer with an internal reference source to a synthesizer requiring an external reference signal or vice-versa is done through the appropriate selection of jumper JU1 A or B.

Synthesizer Test Points

TP1	+5.0 ± 0.1 Vdc. U1 positive regulator output.
TP2	+5.0 ± 0.1 Vdc. U3 positive regulator output (remotely controlled via pin P2-4).
TP3	Lock detect. Logic high (5.0 Vdc) = locked condition.
TP4	PLL error voltage. Ranges from +0.5 to 4.5 Vdc depending on frequency.
TP5	+5.0 Vdc ± 0.5 Vdc. Buffer amplifier bias. (access under VCO board).
TP6	+9.5 Vdc. U3 positive regulator input (remotely controlled via pin P2-4).

Synthesizer Installation and Removal

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 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. Remove the two remaining synthesizer cover screws and cover to expose the synthesizer circuitry. Carefully reinsert the synthesizer module, without the cover, back into the main circuit board. Visually line up the connector pins and sockets before applying firm reinsertion pressure. Failure to do so could lead to damaged synthesizer module pins. Reconnect the SMA RF output connector. The alignment procedure may now be performed. Installation of the synthesizer is performed in a fashion reverse to the above procedure. It is important to emphasize the importance of connector pin alignment prior to any application of reinsertion force.

OS-3 132-174 MHz Frequency Adjustment

Synthesizer VCO Configuration

The synthesizer VCO board is of sealed surface mount construction and is considered to be a non-serviceable unit. Defective VCO modules should be returned to the factory for repair or replacement.

Frequency Adjustment and Channel Selection

Connect a radio communications test set through a short section of low loss 50 Ω coaxial cable to the synthesizer module SMA RF output jack. Select the desired channel number through the BCD frequency selection switches on the IF/audio board. Turn the power off and on and wait a few minutes for the oscillator to completely stabilize.

The measured signal should be at or close to (± 1 ppm) the specified oscillator frequency. Note that unlocked synthesizer operation will be indicated by an incorrect or spurious RF output signal. This may be rectified by adjusting the VCO trim capacitor (C5) as described in the following procedure.

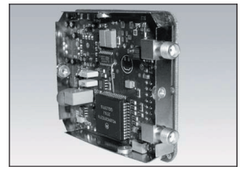
VCO Phase Lock Loop

Using a high impedance (10 MΩ) DC Voltmeter, measure the PLL control voltage at TP4 located on the synthesizer module main circuit board (top). Using a small standard bladed screwdriver, carefully adjust the horizontally located VCO fine frequency trimmer capacitor C5 until a test point (TP4) voltage of approximately 3.5 Vdc is obtained. This adjustment is quite sensitive and must be carefully performed. Measured voltages below approximately 0.5 Vdc and above approximately 4.5 Vdc indicate an “out of lock” synthesizer condition.

Reference Frequency Alignment

Adjust the synthesizer TCXO fine frequency potentiometer until the correct frequency is measured. Access to this potentiometer is made available through an opening in the synthesizer cover, or if the cover is off, through an opening on the enclosed TCXO module. Note that frequency adjustment may be made through a potentiometer (R4) located next to the TCXO module if the installed TCXO module has no internal frequency adjustment capability. An RF power level of approximately +7 dBm for OS(R/T)-3 132 - 174 MHz or +4 dBm for OS(R/T)-3 406 - 470 MHz should be measured at the synthesizer module output connector and the frequency should be within ±1 ppm from the desired operating frequency.

The reference TCXO frequency must be adjusted at room temperature (+25°C) to match a factory specified frequency offset error, recorded in ± ppm variation directly on the synthesizer module cover label. This offset, which varies from unit to unit, positions the absolute synthesizer frequency within the required frequency temperature variation window, which effectively allows the ±1 ppm frequency versus temperature specification, from -40°C to +60°C, to be met.



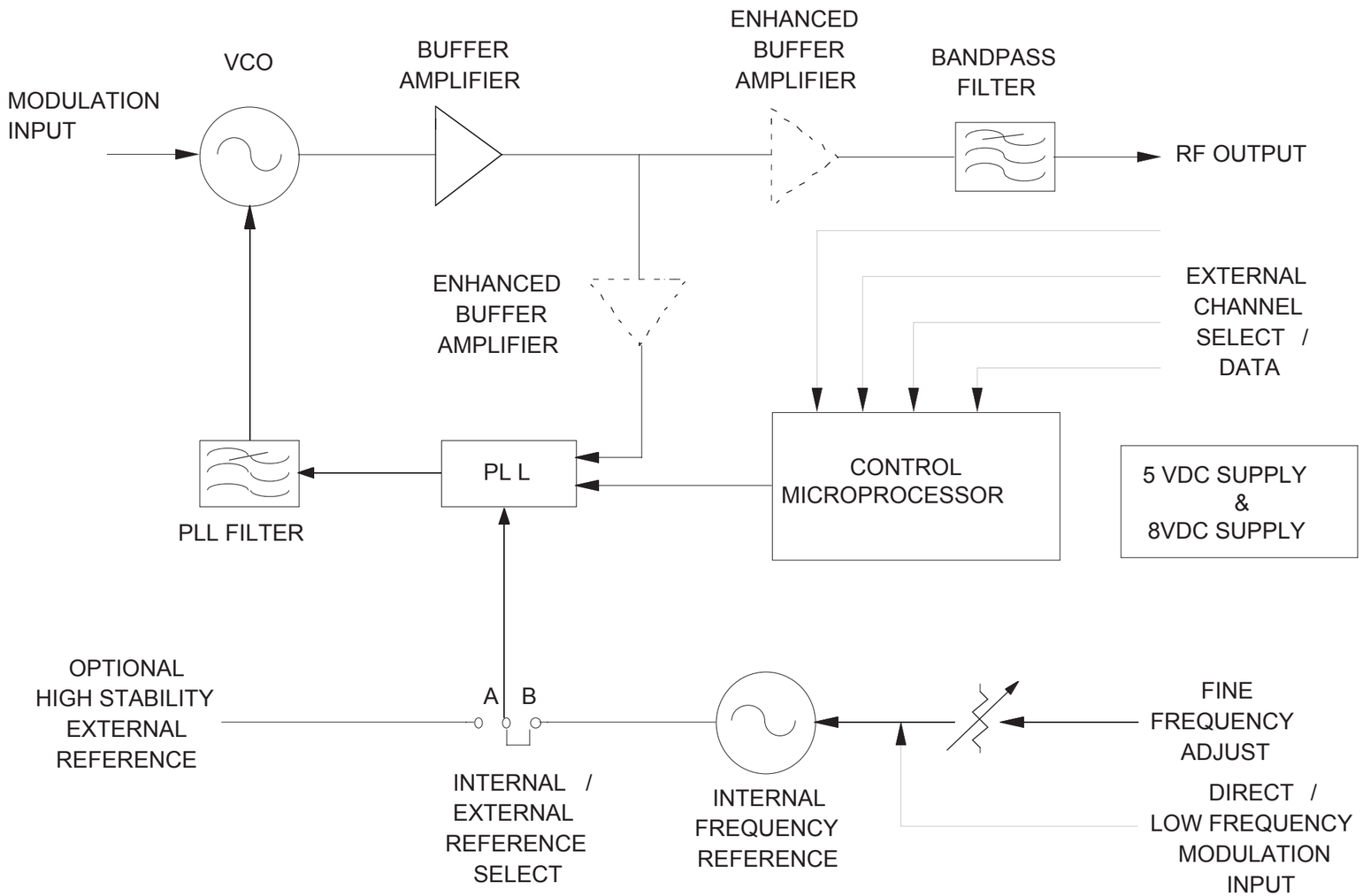
ILLUSTRATIONS AND SCHEMATICS

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	43-912010 Indicates circuit board version 1.0
PCB number	50002-02 Indicates circuit board version 2 (no decimal version)

SYNTHESIZER MODULE BLOCK DIAGRAM



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OSR-3 132-174 MHZ SYNTHESIZER COMPONENT LAYOUT (TOP)

COMPONENT LOCATION TABLE

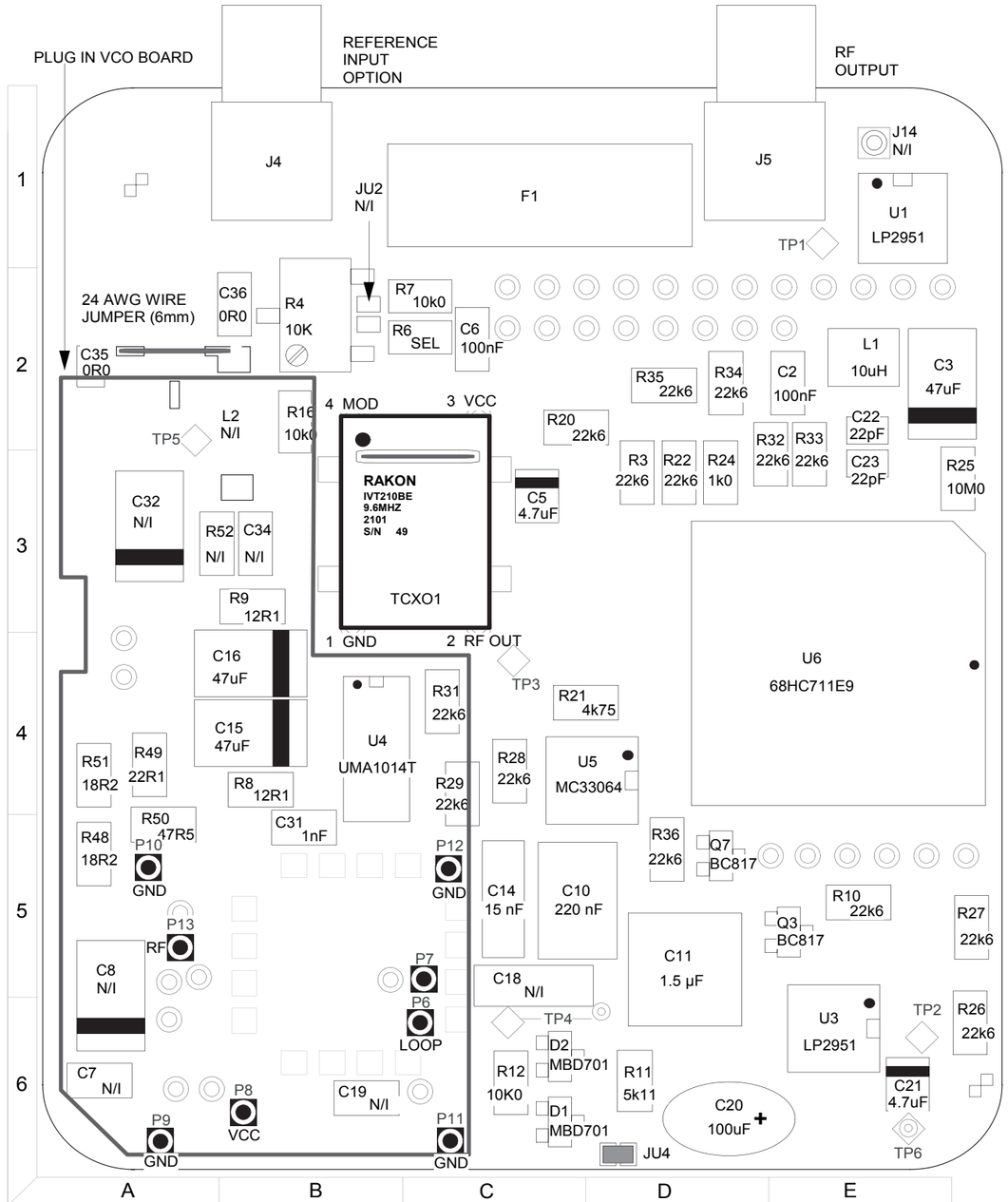
DES	SD	LC	DES	SD	LC	DES	SD	LC	DES	SD	LC	DES	SD	LC
C1	B	A1	D1	T	C6	Q1	B	A5	R21	T	C4	TCXO1	T	B3
C2	T	E2	D2	T	C6	Q2	B	A6	R22	T	D3			
C3	T	E2				Q3	T	D5	R23	B	B3	TP1	T	E1
C4	B	A1	F1	T	C1	Q4	B	C3	R24	T	D3	TP2	T	E6
C5	T	C3				Q7	T	D5	R25	T	E3	TP3	T	C4
C6	T	C2	J4	T	B1	Q8	B	A4	R26	T	E6	TP4	T	C5
C7	T	A6	J5	T	D1	Q9	B	A4	R27	T	E5	TP5	T	A2
C8	T	A5	J14	T	E1	Q10	B	B4	R28	T	C4	TP6	T	E6
C9	B	D4				Q11	B	B4	R29	T	C4			
C10	T	C5	JU1	B	E4				R30	B	C3	U1	T	E1
C11	T	D5	JU2	T	B2	R1	B	A5	R31	T	C4	U2	B	C3
C12	B	D5	JU3	B	C5	R2	B	A5	R32	T	D2	U3	T	E6
C14	T	C5	JU4	T	D6	R3	T	D3	R33	T	E2	U4	T	B4
C15	T	B4	JU5	T	B2	R4	T	B2	R34	T	D2	U5	T	C4
C16	T	B4	JU6	B	C2	R5	B	D1	R35	T	D2	U6	T	D4
C17	B	E3				R6	T	B2	R36	T	D5	U7	T	A2
C18	T	C5	L1	T	E2	R7	T	B2	R37	B	B4			
C19	T	B6	L2	T	B2	R8	T	B4	R38	B	B4	VCO	T	B6
C20	T	D6				R9	T	B3	R39	B	B5			
C21	T	E6	P1	B	C2	R10	T	E5	R40	B	B5	X1	B	A3
C22	T	E2	P2	B	B5	R11	T	D6	R41	B	A4			
C23	T	E3	P3	B	E4	R12	T	C6	R42	B	A4			
C24	B	B3	P6	T	C5	R13	B	E5	R43	B	B4			
C25	B	B3	P7	T	C6	R14	B	C6	R44	B	B4			
C26	B	C2	P8	T	B6	R15	B	D5	R48	T	A5			
C31	T	B5	P9	T	A6	R16	T	B2	R49	T	A4			
C32	T	A3	P10	T	A5	R17	B	C6	R50	T	A5			
C34	T	B3	P11	T	C6	R18	B	C5	R51	T	A4			
C35	T	A2	P12	T	C5	R19	B	C4	R52	T	A3			
C36	T	B2	P13	T	A5	R20	T	C2	R53	B	A1			

DES - DESIGNATION
SD - SIDE OF PCB
LC - LOCATION

T - TOP SIDE COMPONENT LAYOUT
B - BOTTOM SIDE COMPONENT LAYOUT

TCXO SELECT COMPONENTS		
DESIG.	**RAKON (9.6000 MHZ)**	**SARONIX (S2045-9.6000)**
R6*	33K2	10K0

* SURFACE MOUNT CONPONENTS



FACTORY INSTALLED JUMPERS

43-914921-01-T-P1-ABBAAA

OSR-3 132-174 MHZ SYNTHESIZER COMPONENT LAYOUT (BOTTOM)

COMPONENT LOCATION TABLE

DES	SD	LC	DES	SD	LC	DES	SD	LC	DES	SD	LC	DES	SD	LC
C1	B	A1	D1	T	C6	Q1	B	A5	R21	T	C4	TCXO1	T	B3
C2	T	E2	D2	T	C6	Q2	B	A6	R22	T	D3			
C3	T	E2				Q3	T	D5	R23	B	B3	TP1	T	E1
C4	B	A1	F1	T	C1	Q4	B	C3	R24	T	D3	TP2	T	E6
C5	T	C3				Q7	T	D5	R25	T	E3	TP3	T	C4
C6	T	C2	J4	T	B1	Q8	B	A4	R26	T	E6	TP4	T	C5
C7	T	A6	J5	T	D1	Q9	B	A4	R27	T	E5	TP5	T	A2
C8	T	A5	J14	T	E1	Q10	B	B4	R28	T	C4	TP6	T	E6
C9	B	D4				Q11	B	B4	R29	T	C4			
C10	T	C5	JU1	B	E4				R30	B	C3	U1	T	E1
C11	T	D5	JU2	T	B2	R1	B	A5	R31	T	C4	U2	B	C3
C12	B	D5	JU3	B	C5	R2	B	A5	R32	T	D2	U3	T	E6
C14	T	C5	JU4	T	D6	R3	T	D3	R33	T	E2	U4	T	B4
C15	T	B4	JU5	T	B2	R4	T	B2	R34	T	D2	U5	T	C4
C16	T	B4	JU6	B	C2	R5	B	D1	R35	T	D2	U6	T	D4
C17	B	E3				R6	T	B2	R36	T	D5	U7	T	A2
C18	T	C5	L1	T	E2	R7	T	B2	R37	B	B4			
C19	T	B6	L2	T	B2	R8	T	B4	R38	B	B4	VCO	T	B6
C20	T	D6				R9	T	B3	R39	B	B5			
C21	T	E6	P1	B	C2	R10	T	E5	R40	B	B5	X1	B	A3
C22	T	E2	P2	B	B5	R11	T	D6	R41	B	A4			
C23	T	E3	P3	B	E4	R12	T	C6	R42	B	A4			
C24	B	B3	P6	T	C5	R13	B	E5	R43	B	B4			
C25	B	B3	P7	T	C6	R14	B	C6	R44	B	B4			
C26	B	C2	P8	T	B6	R15	B	D5	R48	T	A5			
C31	T	B5	P9	T	A6	R16	T	B2	R49	T	A4			
C32	T	A3	P10	T	A5	R17	B	C6	R50	T	A5			
C34	T	B3	P11	T	C6	R18	B	C5	R51	T	A4			
C35	T	A2	P12	T	C5	R19	B	C4	R52	T	A3			
C36	T	B2	P13	T	A5	R20	T	C2	R53	B	A1			

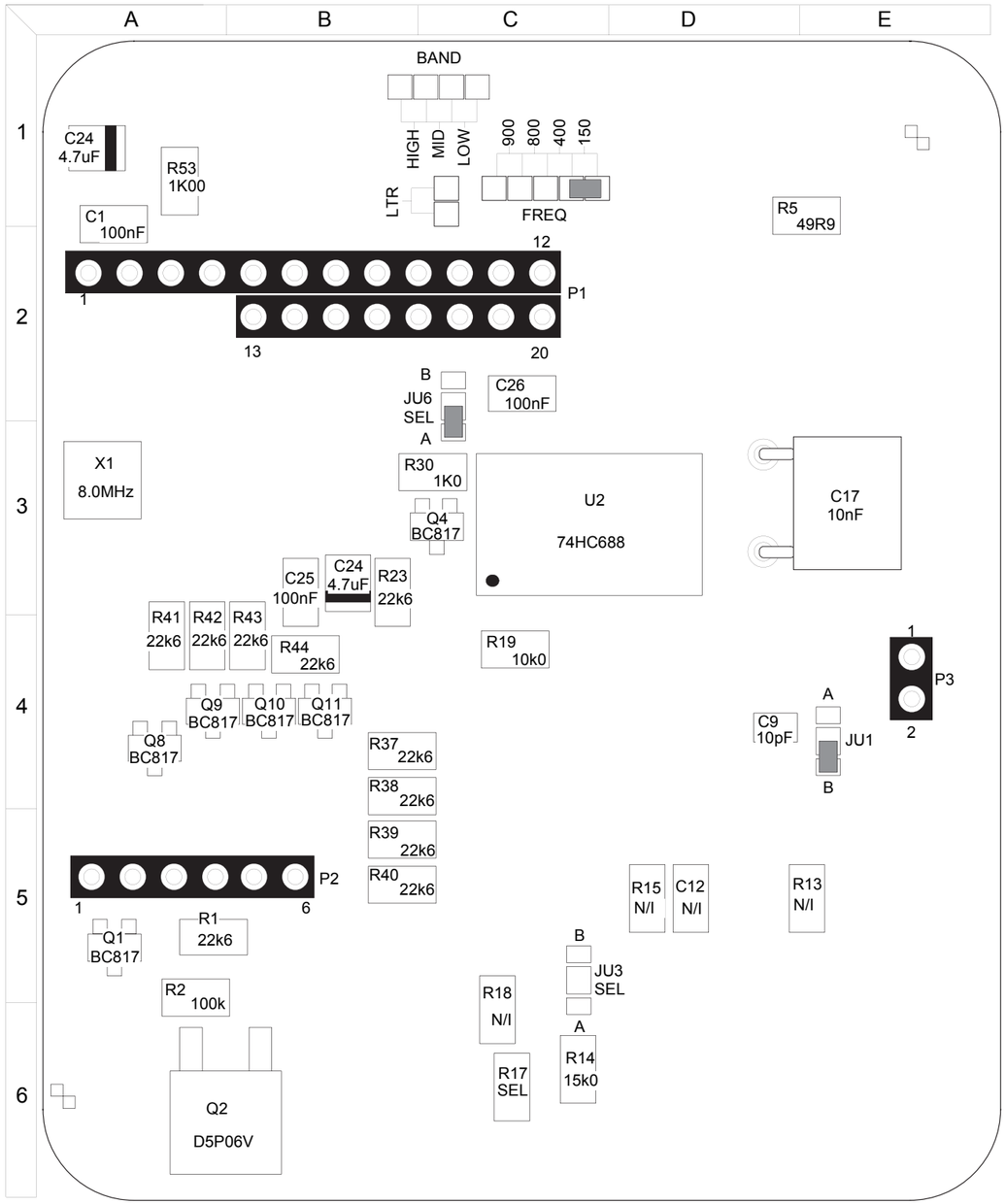
DES - DESIGNATION
SD - SIDE OF PCB
LC - LOCATION

T - TOP SIDE COMPONENT LAYOUT
B - BOTTOM SIDE COMPONENT LAYOUT

TX/RX SELECT COMPONENTS		
DESIG.	**TRANSMITTER**	**RECEIVER**
R17*	4K75	ZERO OHM
JU3	'B' POSITION	NOT INSTALLED

68HC711E9 BOOTSTRAP/NORMAL MODE		
DESIG.	**NORMAL**	**BOOTSTRAP**
JU6	'A' POSITION	'B' POSITION

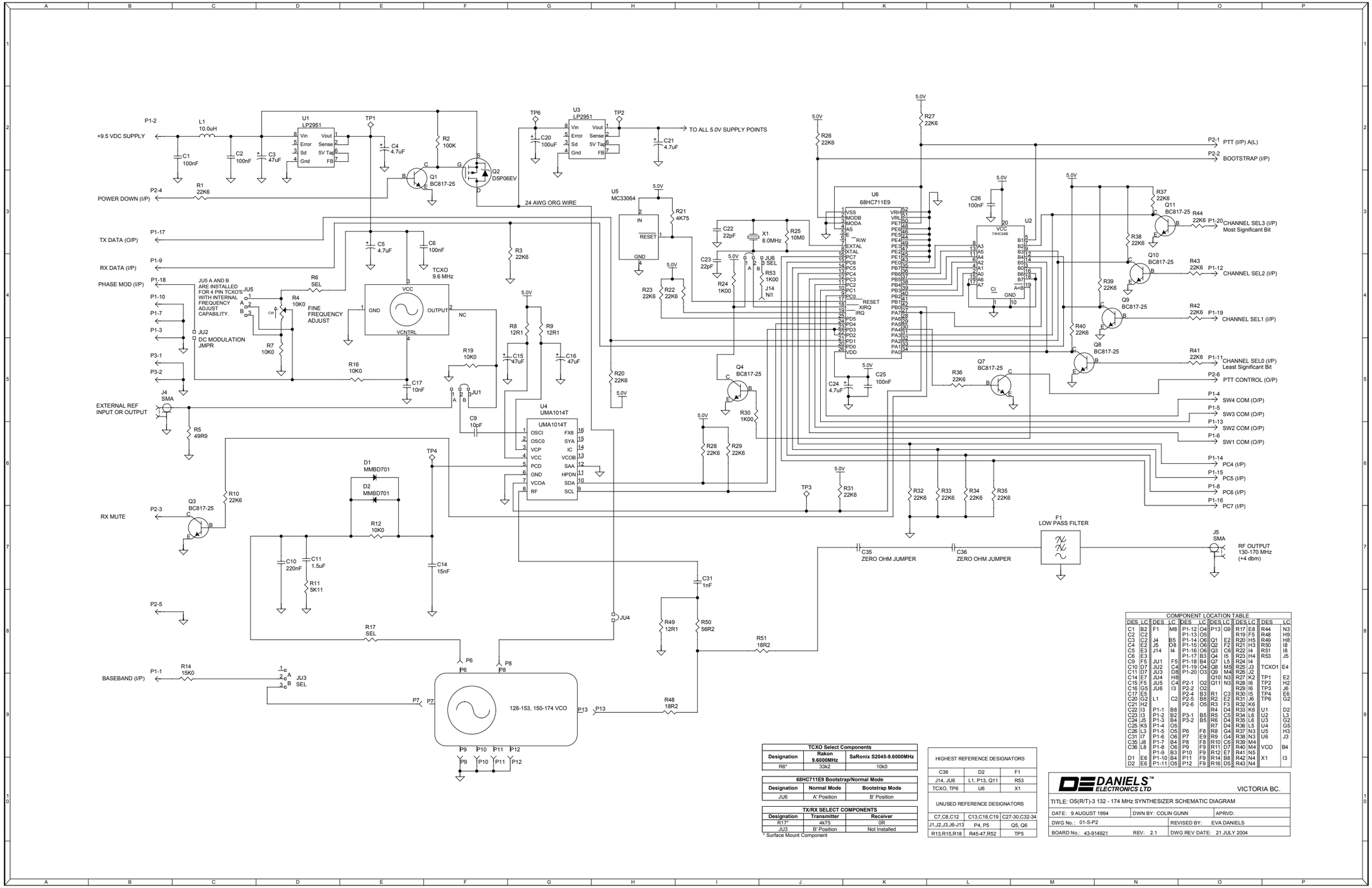
* SURFACE MOUNT COMPONENTS



FACTORY INSTALLED JUMPERS

43-914921-01-B-P1-AAAAAA

OSR-3 132-174 MHZ SYNTHESIZER SCHEMATIC DIAGRAM



COMPONENT LOCATION TABLE															
DES	LC	DES	LC	DES	LC	DES	LC	DES	LC	DES	LC	DES	LC	DES	LC
C1	B2	F1		M8		P1-13	O4	P13	G9	R17	E8	R44	N3
C2	C2					P1-13	O5			R19	F5	R48	H9
C3	C2	J4		B5		P1-14	O6	Q1	E2	R20	H5	R49	H8
C4	E2	J5		O8		P1-15	O6	Q2	F2	R21	H3	R50	I8
C5	E3	J14		I4		P1-16	O6	Q3	C6	R22	I4	R51	I8
C6	E3					P1-17	B3	Q4	I5	R23	H4	R53	J5
C9	F5	JU1		F5		P1-18	B4	Q7	L5	R24	I4		
C10	D7	JU2		C4		P1-19	O4	Q8	M5	R25	J3	TCXO1	E4
C11	D7	JU3		D8		P1-20	O3	Q9	M4	R26	J2		
C14	E7	JU4		H8				Q10	N3	R27	K2	TP1	E2
C15	F5	JU5		C4		P2-1	O2	Q11	N3	R28	I6	TP2	H2
C16	G5	JU6		I3		P2-2	O2			R29	I6	TP3	J6
C17	E5					P2-4	B3	R1	C3	R30	I5	TP4	E6
C20	G2	L1		C2		P2-5	B6	R2	E2	R31	J6	TP6	G2
C21	H2					P2-6	O5	R3	F3	R32	K6		
C22	I3	P1-1	B8					R4	D4	R33	K6	U1	D2
C23	I3	P1-2	B2			P3-1	B5	R5	C5	R34	L6	U2	L3
C24	J5	P1-3	B4			P3-2	B5	R6	D4	R35	L6	U3	G2
C25	K5	P1-4	O5					R7	D4	R36	L5	U4	G5
C26	L3	P1-5	O5	P6		F8	R8	G4	R37	N3	U5	H3	
C31	I7	P1-6	O6	P7		E9	R9	G4	R38	N3	U6	J3	
C35	J8	P1-7	B4	P8		F8	R10	C6	R39	M4			
C36	L8	P1-8	O6	P9		F9	R11	D7	R40	M4	VCO	B4	
		P1-9	B3	P10		F9	R12	E7	R41	N5			
D1	E6	P1-10	B4	P11		F9	R14	B8	R42	N4	X1	I3	
D2	E6	P1-11	O5	P12		F9	R16	D5	R43	N4			

TCXO Select Components		
Designation	Rakon 9.6000MHz	SaRonix S2045-9.6000MHz
R6*	33k2	10k0

68HC711E9 Bootstrap/Normal Mode		
Designation	Normal Mode	Bootstrap Mode
JU6	A' Position	B' Position

TX/RX SELECT COMPONENTS		
Designation	Transmitter	Receiver
R17*	4k75	0R
JU3	B' Position	Not Installed

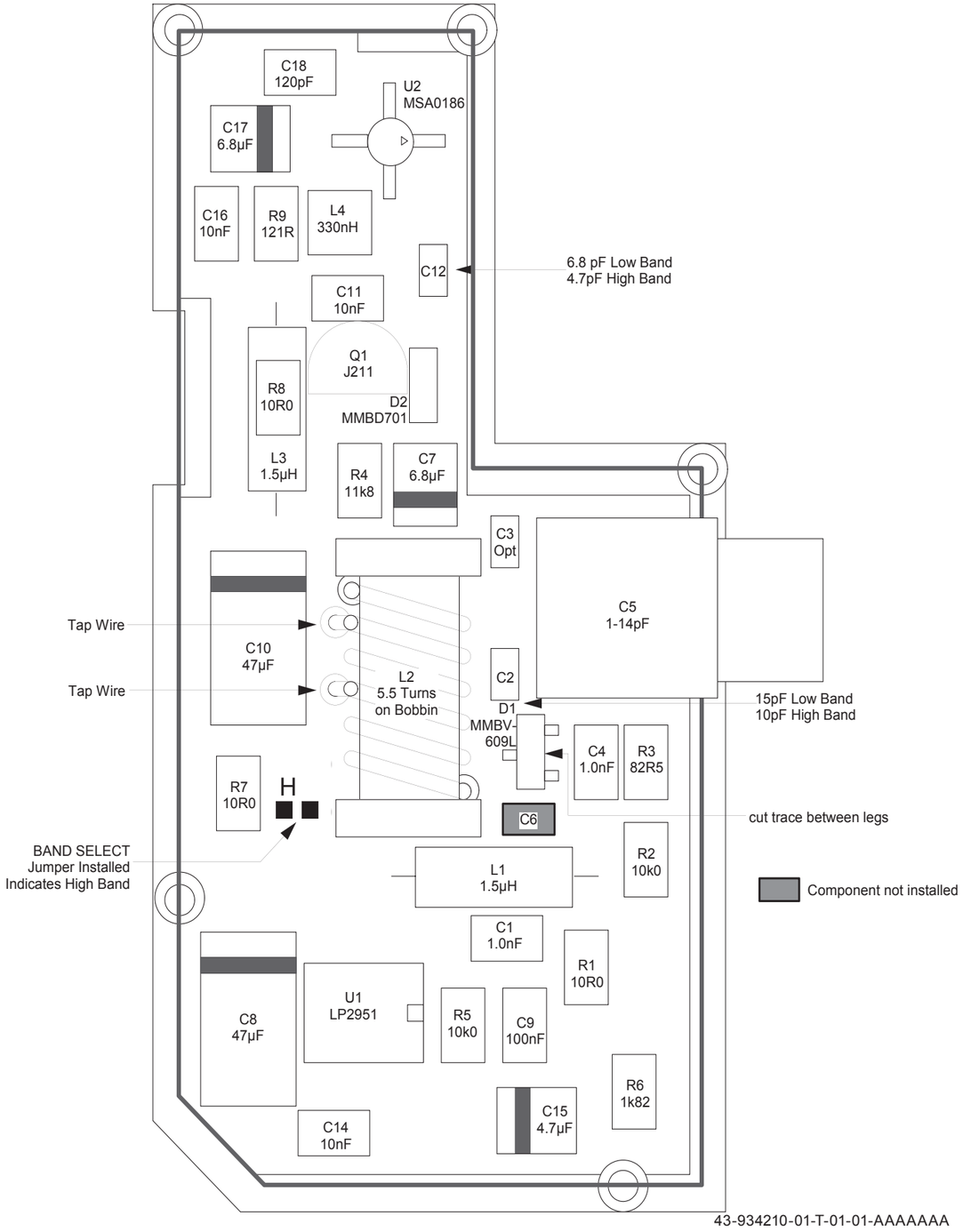
* Surface Mount Component

HIGHEST REFERENCE DESIGNATORS		
C36	D2	F1
J14, JU6	L1, P13, Q11	R53
TCXO, TP6	U6	X1
UNUSED REFERENCE DESIGNATORS		
C7,C8,C12	C13,C18,C19	C27-30,C32-34
J1,J2,J3,J6-J13	P4, P5	Q5, Q6
R13,R15,R18	R45-47,R52	TP5

DANIELS™ ELECTRONICS LTD — VICTORIA BC.

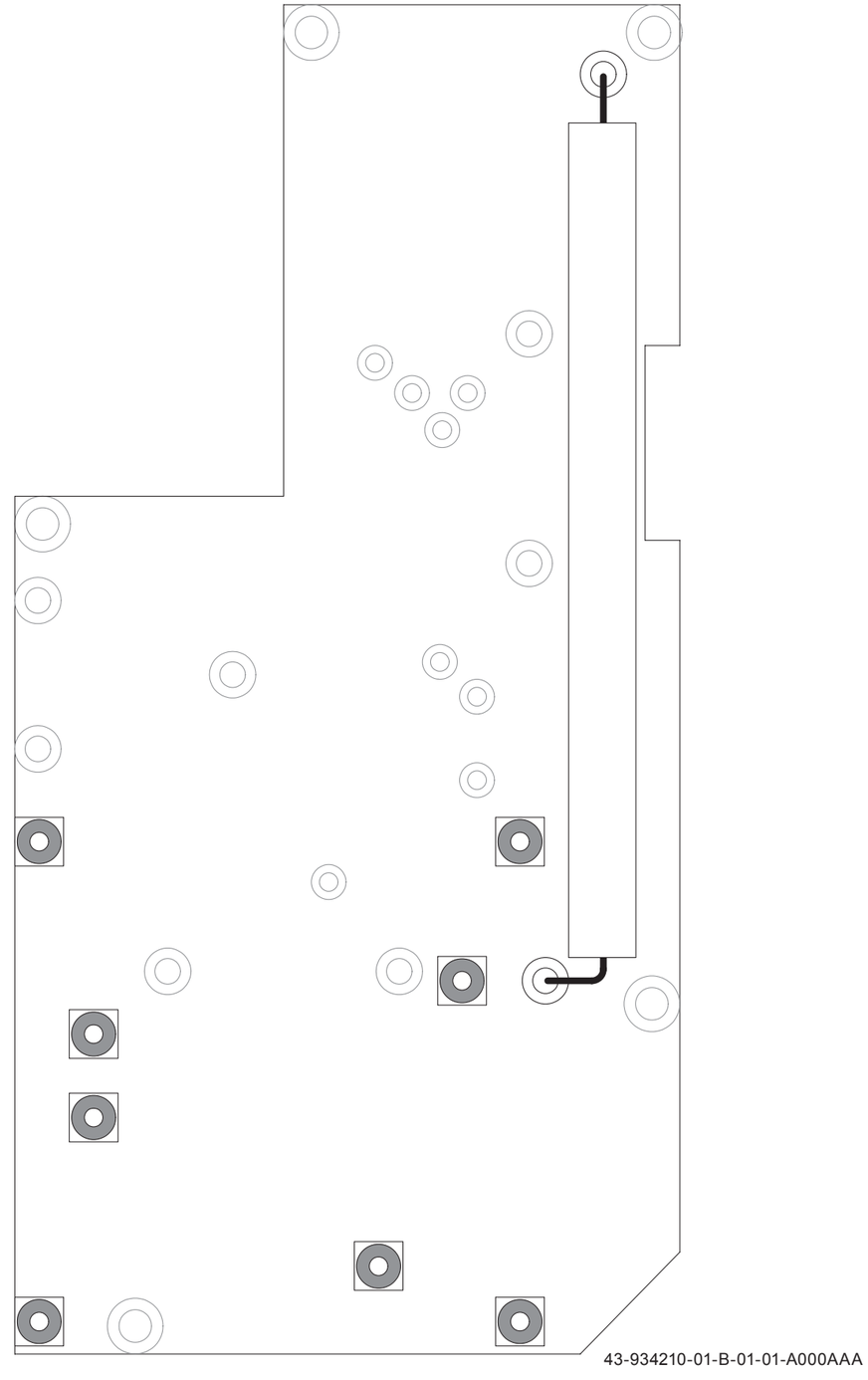
TITLE: OS(R/T)-3 132 - 174 MHz SYNTHESIZER SCHEMATIC DIAGRAM		
DATE: 9 AUGUST 1994	DWN BY: COLIN GUNN	APRVD:
DWG No.: 01-S-P2		REVISED BY: EVA DANIELS
BOARD No.: 43-914921 REV: 2.1		DWG REV DATE: 21 JULY 2004

OSR-3 132-174 MHZ VCO COMPONENT LAYOUT (TOP)



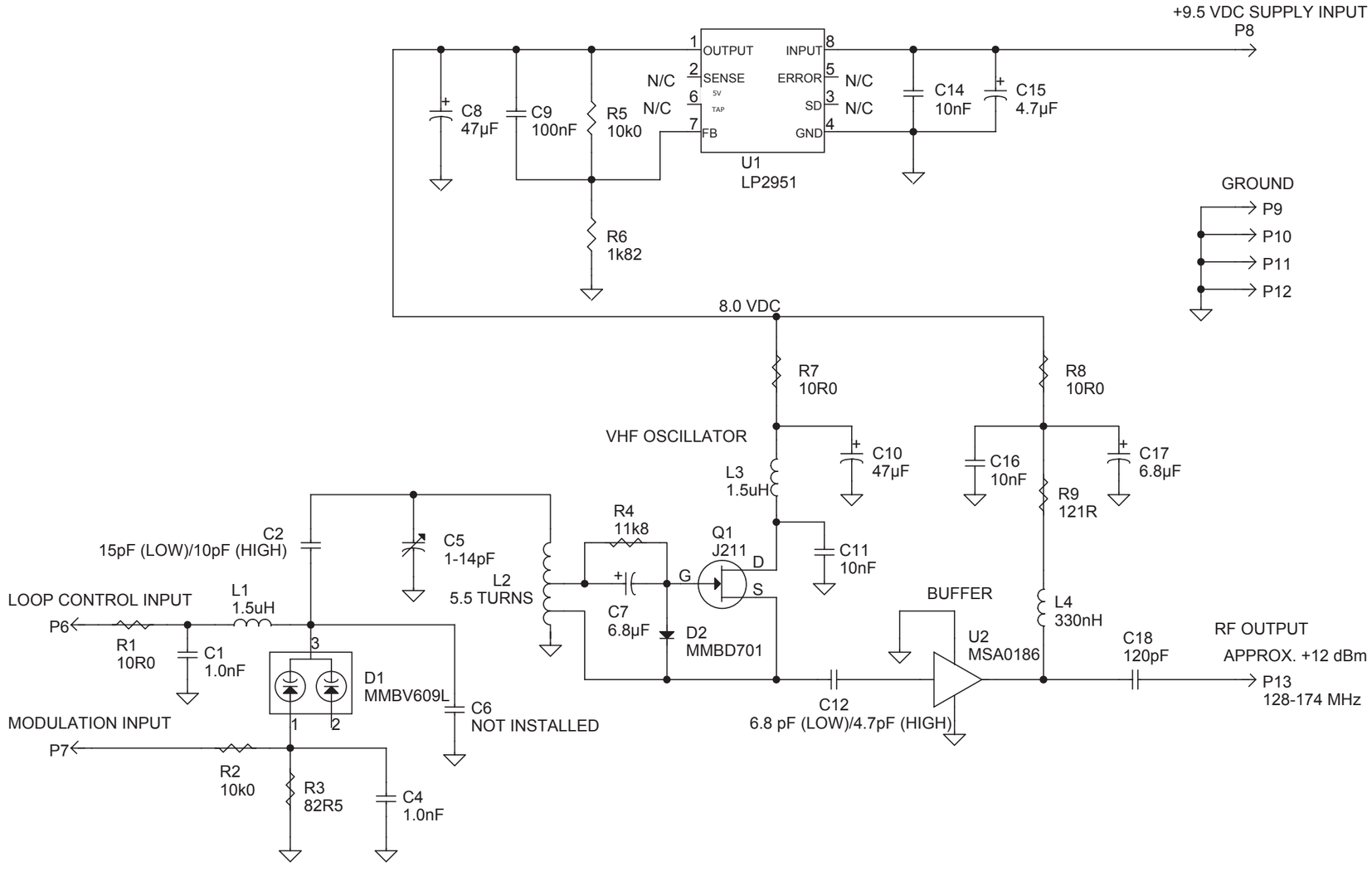
43-934210-01-T-01-01-AAAAAAA

OSR-3 132-174 MHZ VCO COMPONENT LAYOUT (BOTTOM)



43-934210-01-B-01-01-A000AAA

OSR-3 132-174 MHZ VCO SCHEMATIC DIAGRAM



HIGHEST REFERENCE DESIGNATORS		
C19	D2	L4
P13	Q1	R9
TL1	-----	-----
UNUSED REFERENCE DESIGNATORS		
P1-P5	C3	-----
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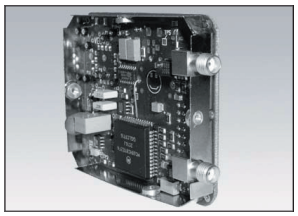
DANIELS™ ELECTRONICS LTD		VICTORIA BC.
TITLE: OS-3/150 VCO SCHEMATIC DIAGRAM		
DATE: 06 JULY 1994	DWN BY: COLIN GUNN	APRVD:
DWG No.: 01-S-01-01-1		REVISED BY: COLIN GUNN
BOARD No.: 43-934210 REV: 1.0		DWG REV DATE: 28 MAY 1998



PARTS LIST

132 - 174 MHZ LOW CURRENT SYNTHESIZER ELECTRICAL PARTS LIST

Ref Desig	Description	Part No
C1	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R
C2	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R
C3	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16
C4	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16
C5	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16
C6	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R
C9	CAP., SM, 10pF CER., 0805, C0G	1008-1A100J1G
C10	CAP., 220nF FILM, MMK5,10%,50V	1016-5A224K50
C11	CAP., 1.5uF FILM, MMK5,10%,50V	1016-6E155K63
C14	CAP., 15nF FILM, MMK5, 10%,63V	1016-4A153K63
C15	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16
C16	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16
C17	CAP., 10nF FILM, MMK5, 10%,63V	1016-4A103K63
C20	CAP., 100uF DIP. TANT.,20%,20V	1054-7M107M20
C21	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16
C22	CAP., SM, 22pF CER., 0805, C0G	1008-1A220J1G
C23	CAP., SM, 22pF CER., 0805, C0G	1008-1A220J1G
C24	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16
C25	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R
C26	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R
C31	CAP., SM, 1nF CER., 1206, C0G	1008-3B102K1G
C35	RES., SM, ZERO OHM JUMPER,0805	1150-0A0R0000
C36	RES., SM, ZERO OHM JUMPER,1206	1150-0B0R0000
D1	DIODE, MMBD701,HOT CARR.,SOT23	2105-MMBD7010
D2	DIODE, MMBD701,HOT CARR.,SOT23	2105-MMBD7010

Ref Desig	Description	Part No
J4	CONN., SMA R/A JACK,PCMNT,.200	5112-J20010BG
J5	CONN., SMA R/A JACK,PCMNT,.200	5112-J20010BG
L1	INDUCTOR, SM, 10.0uH, 10%,1812	1255-4G10000K
P1 - 1	INTERCONNECT/LP,1ROW x12PIN,Au	5015-IL112G07
P1 - 13	INTERCONNECT/LP,1ROW x 8PIN,Au	5015-IL108G07
P2 - 1	INTERCONNECT/LP,1ROW x 6PIN,Au	5015-IL106G07
P3 - 1	INTERCONNECT/LP,1ROW x 2PIN,Au	5015-IL102G07
P6	SOCK. STRIP-L/P,1ROW x 1PIN,Au	5016-SL101G08
P7	SOCK. STRIP-L/P,1ROW x 1PIN,Au	5016-SL101G08
P8	SOCK. STRIP-L/P,1ROW x 1PIN,Au	5016-SL101G08
P9	SOCK. STRIP-L/P,1ROW x 1PIN,Au	5016-SL101G08
P10	SOCK. STRIP-L/P,1ROW x 1PIN,Au	5016-SL101G08
P11	SOCK. STRIP-L/P,1ROW x 1PIN,Au	5016-SL101G08
P12	SOCK. STRIP-L/P,1ROW x 1PIN,Au	5016-SL101G08
P13	SOCK. STRIP-L/P,1ROW x 1PIN,Au	5016-SL101G08
PCB	PCB, MT-3 SYNTHESIZER	4309-25914921
Q1	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025
Q2	MOSFET, D5P06V, P-CHAN., D-PAK	2144-D5P06V00
Q3	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025
Q4	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025
Q7	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025
Q8	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025
Q9	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025
Q10	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025
Q11	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025
R1	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R2	RES., SM, 100K 1206, 1%,100ppm	1150-5B1003FP
R3	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R4	POT., SM, 10K, 12T, TOP ADJUST	1172-M30103W5
R5	RES., SM, 49R9 1206, 1%,100ppm	1150-1B49R9FP
R6	RES., SM, 33K2 1206, 1%,100ppm	1150-4B3322FP
R7	RES., SM, 10K0 1206, 1%,100ppm	1150-4B1002FP
R8	RES., SM, 12R1 1206, 1%,100ppm	1150-1B12R1FP
R9	RES., SM, 12R1 1206, 1%,100ppm	1150-1B12R1FP
R10	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R11	RES., SM, 5K11 1206, 1%,100ppm	1150-3B5111FP
R12	RES., SM, 10K0 1206, 1%,100ppm	1150-4B1002FP
R14	RES., SM, 15K0 1206, 1%,100ppm	1150-4B1502FP
R16	RES., SM, 10K0 1206, 1%,100ppm	1150-4B1002FP

Ref Desig	Description	Part No
R17	RES., SM, ZERO OHM JUMPER,1206	1150-0B0R0000
R19	RES., SM, 10K0 1206, 1%,100ppm	1150-4B1002FP
R20	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R21	RES., SM, 4K75 1206, 1%,100ppm	1150-3B4751FP
R22	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R23	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R24	RES., SM, 1K00 1206, 1%,100ppm	1150-3B1001FP
R25	RES., SM, 10M0 1206, 5%,400ppm	1151-7B0106JG
R26	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R27	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R28	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R29	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R30	RES., SM, 1K00 1206, 1%,100ppm	1150-3B1001FP
R31	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R32	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R33	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R34	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R35	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R36	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R37	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R38	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R39	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R40	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R41	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R42	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R43	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R44	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R48	RES., SM, 18R2 1206, 1%,100ppm	1150-1B18R2FP
R49	RES., SM, 22R1 1206, 1%,100ppm	1150-1B22R1FP
R50	RES., SM, 47R5 1206, 1%,100ppm	1150-1B47R5FP
R51	RES., SM, 18R2 1206, 1%,100ppm	1150-1B18R2FP
R53	RES., SM, 1K00 1206, 1%,100ppm	1150-3B1001FP
TCXO1	TCVCXO,SMT, 9.6MHz,+-1ppm,0-3V	2641-09600AM7
U1	IC, LP2951,PROG. VOLT REG,SO-8	2305-29510N08
U2	IC, 74HC688, 8BIT COMP.,SO-20L	2376-06880W20
U3	IC, LP2951,PROG. VOLT REG,SO-8	2305-29510N08
U4	IC, UMA1014T,FREQ. SYNTH,SO-16	2355-10140N16
U5	IC, MC33064,UNDR/VOLT SEN.SO-8	2308-33064N08
U6	IC, 68HC711E9, MIC/CTR, PLCC52	2380-68711P52
X1	RESONATOR, SM, 8.0MHz, CERAMIC	1575-8001816A

132 - 174 MHZ LOW CURRENT SYNTHESIZER MECHANICAL PARTS LIST

Description	Part No.	Qty.
BOX, ALUM.,2.5”W x 3”L x.781”H	3702-66400050	1
BRACKET, SHIELD,MT-3 SYNTH.,BR	3702-67300910	1
LABEL, FOIL,FRQ/SN,MT-3 SYNTH.	3501-13091005	1
NUT, SELF-CLINCH., M2,6.3mm OD	5833-S2M06315	4
SCREW, M2 X 4, PAN/PHILLIPS,A2	5812-2M0PP04S	4
TAB, GROUND, MT-3 SYNTH.,BRASS	3702-67800905	2

132 - 174 MHZ LOW PASS FILTER ELECTRICAL PARTS LIST

Ref Desig	Description	Part No
C1	CAP., SM, 27pF CER., 0805, C0G	1008-1A270J1G
C2	CAP., SM, 47pF CER., 0805, C0G	1008-1A470J1G
C3	CAP., SM, 27pF CER., 0805, C0G	1008-1A270J1G
L1	INDUCTOR, SM,47nH CER,10%,1008	1256-1B47N00K
L2	INDUCTOR, SM,47nH CER,10%,1008	1256-1B47N00K
PCB	PCB, LPF, MT-3 150/400 SYNTH.	4309-50932512

132 - 174 MHZ LOW PASS FILTER MECHANICAL PARTS LIST

Description	Part No.	Qty.
SHIELD, LPF,OS-3 150/400 SYNTH	3702-67300970	1

132 - 174 MHZ VCO
ELECTRICAL PARTS LIST

Ref Desig	Description	Part No	OSR--3/141-1A00	OSR-3/162-1A00
C1	CAP., SM, 1nF CER., 1206, C0G	1008-3B102K1G	•	•
C2	CAP., SM, 10pF CER., 0805, C0G	1008-1A100J1G		•
C2	CAP., SM, 15pF CER., 0805, C0G	1008-1A150J1G	•	
C4	CAP., SM, 1nF CER., 1206, C0G	1008-3B102K1G	•	•
C5	CAP.,TRIM. 1-14pF, STAND. >6T SEAL, SLOTTED, .234-64 UNS-2	1082-A1R0014J 1083-S234T640	•	•
C7	CAP., SM, 6.8uF TANT., 20%,10V	1055-5B685M10	•	•
C8	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16	•	•
C9	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•
C10	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16	•	•
C11	CAP., SM, 10nF CER., 1206, X7R	1008-4B103K5R	•	•
C12	CAP., SM, 4.7pF CER., 0805,C0G	1008-0A479J1G		•
C12	CAP., SM, 6.8pF CER., 0805,C0G	1008-0A689J1G	•	
C14	CAP., SM, 10nF CER., 1206, X7R	1008-4B103K5R	•	•
C15	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•
C16	CAP., SM, 10nF CER., 1206, X7R	1008-4B103K5R	•	•
C17	CAP., SM, 6.8uF TANT., 20%,10V	1055-5B685M10	•	•
C18	CAP., SM, 120pF CER., 1206,C0G	1008-2B121J1G	•	•
D1	DIODE, MMBV609L,VARICAP,SOT-23	2106-MMBV609L	•	•
D2	DIODE, MMBD701,HOT CARR.,SOT23	2105-MMBD7010	•	•
L1	CHOKE, RF/MOLDED,1.5uH,10%,.25	1251-3A001R5K	•	•
L2	BOBBIN, 5.5 TURNS,1.59mm PITCH WIRE, COPPER,20AWG,SILVER PLTD	5791-A1010300 7140-30002000	•	•
L3	CHOKE, RF/MOLDED,1.5uH,10%,.25	1251-3A001R5K	•	•
L4	INDUCTOR,SM,330nH CER,10%,1008	1256-2BR3300K	•	•
P6	INTERCONNECT/LP,1ROW x 1PIN,Au	5015-IL101G07	•	•
P7	INTERCONNECT/LP,1ROW x 1PIN,Au	5015-IL101G07	•	•
P8	INTERCONNECT/LP,1ROW x 1PIN,Au	5015-IL101G07	•	•
P9	INTERCONNECT/LP,1ROW x 1PIN,Au	5015-IL101G07	•	•
P10	INTERCONNECT/LP,1ROW x 1PIN,Au	5015-IL101G07	•	•
P11	INTERCONNECT/LP,1ROW x 1PIN,Au	5015-IL101G07	•	•
P12	INTERCONNECT/LP,1ROW x 1PIN,Au	5015-IL101G07	•	•
P13	INTERCONNECT/LP,1ROW x 1PIN,Au	5015-IL101G07	•	•
PCB	PCB, VCO, MT-3/150 SYNTHESIZER	4309-31934210	•	•
Q1	JFET, J211, RF, N-CHAN., TO-92	2041-J2110000	•	•

Ref Desig	Description	Part No	OSR--3/141-1A00	OSR-3/162-1A00
R1	RES., SM, 10R0 1206, 1%,100ppm	1150-1B10R0FP	•	•
R2	RES., SM, 10K0 1206, 1%,100ppm	1150-4B1002FP	•	•
R3	RES., SM, 82R5 1206, 1%,100ppm	1150-1B82R5FP	•	•
R4	RES., SM, 11K8 1206, 1%,100ppm	1150-4B1182FP	•	•
R5	RES., SM, 10K0 1206, 1%,100ppm	1150-4B1002FP	•	•
R6	RES., SM, 1K82 1206, 1%,100ppm	1150-3B1821FP	•	•
R7	RES., SM, 10R0 1206, 1%,100ppm	1150-1B10R0FP	•	•
R8	RES., SM, 10R0 1206, 1%,100ppm	1150-1B10R0FP	•	•
R9	RES., SM, 121R 1206, 1%,100ppm	1150-2B1210FP	•	•
TL1	CABLE, CONFORM., 42mm/5mm/6mm	7489-C1081100	•	•
U1	IC, LP2951,PROG. VOLT REG,SO-8	2305-29510N08	•	•
U2	IC, MSA-0186, MMIC AMP, PKG-86	2354-MSA01860	•	•

OSR-3 132 - 174 MHZ VCO MECHANICAL PARTS LIST

Description	Part No.	Qty.
SHIELD, VCO, OS-3/150 SYNTH.	3702-67300945	1

LOW CURRENT SYNTHESIZER OSR-3 406-470 MHZ

Covers Models:
OSR-3/440

<table>
<tr><th></th><th colspan="3">Transmitters</th><th colspan="3">Receivers</th></tr>
<tr><th>Radio Frequency</th><th>Transmitter Model & Frequency Range</th><th>Low Current Synthesizer Model & Synthesizer Frequency</th><th>Location in Manual</th><th>Receiver Model & Frequency Range</th><th>Low Current Synthesizer Model & Synthesizer Frequency</th><th>Location in Manual</th></tr>
<tr><td rowspan="2">VHF
132-174 MHz</td><td rowspan="3">Requires Enhanced Synthesizer</td><td rowspan="3">Not covered in this Manual</td><td rowspan="3">Not covered in this Manual</td><td>VR-3/140
132-150 MHz</td><td>OSR-3/162
150-174 MHz</td><td rowspan="2">See Page 5

LOW CURRENT SYNTHESIZER
OSR-3 132 - 174 MHZ</td></tr>
<tr><td>VR-3/160
150-174 MHz</td><td>OSR-3/141
128-150 MHz</td></tr>
<tr><td rowspan="2">UHF
406-470 MHz</td><td>UR-3/420
406-430 MHz</td><td rowspan="2">OSR-3/440
427.4-451.4 MHz</td><td rowspan="2">See Page 31

LOW CURRENT SYNTHESIZER
OSR-3 406 - 470 MHZ</td></tr>
<tr><td>UR-3/460
450-470 MHz</td></tr>
<tr><td rowspan="2">UHF 800
806-869 MHz</td><td>UT-3/815
806-824 MHz</td><td>OST-3/815
806-824 MHz</td><td rowspan="2">See Page 59

LOW CURRENT SYNTHESIZER
OSR-3 806 - 896 MHZ</td><td>UR-3/815
806-824 MHz</td><td>OSR-3/770
761-779 MHz</td><td rowspan="2">See Page 59

LOW CURRENT SYNTHESIZER
OSR-3 806 - 869 MHZ</td></tr>
<tr><td>UT-3/860
851-869 MHz</td><td>OST-3/860
851-869 MHz</td><td>UR-3/860
851-869 MHz</td><td>OSR-3/815
806-824 MHz</td></tr>
<tr><td rowspan="3">UHF 900
896-960 MHz</td><td>UT-3/900
896-902 MHz</td><td>OST-3/899
896-902 MHz</td><td rowspan="3">See Page 83

LOW CURRENT SYNTHESIZER
OSR-3 896 - 960 MHZ</td><td>UR-3/900
896-902 MHz</td><td>OSR-3/860
851-869 MHz</td><td></td></tr>
<tr><td>UT-3/930
928-935 MHz</td><td>OST-3/932
896-902 MHz</td><td>UR-3/930
928-935 MHz</td><td>OSR-3/885
883-890 MHz</td><td rowspan="2">See Page 83

LOW CURRENT SYNTHESIZER
OSR-3 896 - 960 MHZ</td></tr>
<tr><td>UT-3/950
935-960 MHz</td><td>OST-3/948
896-902 MHz</td><td>UR-3/950
935-960 MHz</td><td>OSR-3/901
890-915 MHz</td></tr>
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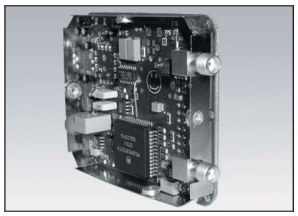


GENERAL INFORMATION

INTRODUCTION

The OSR-3 Low Current Synthesizer Module produces a low distortion, high stability, FM unmodulated (receiver) RF signal covering a frequency band of 406 - 470 MHz. It achieves a ±1 ppm frequency stability from -40°C to +60°C with its own internal reference, or it can be slaved to an external reference signal of desired stability. The synthesizer is easily removed for programming, calibration, or repair.

OSR LOW CURRENT SYNTHESIZER FAMILY MODELS

The OSR-3 Low Current Synthesizer module family forms an integral component of the MT-3 receiver product line. The OSR-3 synthesizer provides a low noise local oscillator signal that directly drives the mixer circuitry.
Note that this section of the manual provides service and operating information for just the synthesizer models listed below. It is important to establish the correct synthesizer model number of interest in order to direct attention to specific documented information. The specific model number is printed on the synthesizer module top cover.

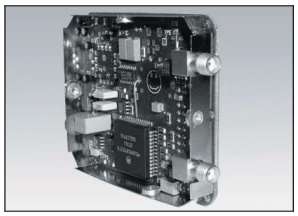
This Section of the manual covers the following Synthesizers:

•OSR-3/440 - synthesized, installed in receiver, 427 - 451 MHz RF output.

Each model's band of operation in a given frequency band is determined by select components on the Synthesizer board. The OSR-3 406 - 470 MHz model uses a specially designed VCO that occupies a circuit board that plugs into the synthesizer module main circuit board through machined contact pins.

PERFORMANCE SPECIFICATIONS

Type:	NBFM 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 shown in [ ] brackets.	427.4 MHz - 451.4 MHz [± 1.0 MHz] (OSR-3/440).
Output Power:	+4 dBm to 7 dBm into 50Ω.
External Reference Input:	External reference input signal via SMB connector J1. Input level 2.0 Vpp to 5.0 Vpp. Input impedance 50Ω Input frequency 9.6 MHz.



THEORY OF OPERATION

INTERNAL POWER AND CONTROL

The synthesizer operates from +9.5 Vdc applied to connector pin P1-2. Current drain is approximately 60 mA. Regulator IC U1 provides continuously regulated +5.0 Vdc to the reference TCXO. Regulator IC U3 supplies regulated + 5.0 Vdc to all other synthesizer circuitry including the VCO, synthesizer IC U4, and microprocessor U6. Supply U3 is turned on by applying +9.5 Vdc to synthesizer pin P2-4. For receiver applications, the synthesizer is always operating with the enable line P2-4 being permanently connected to +9.5 Vdc.

RF CIRCUITRY

The synthesizer itself is formed around a low power, single chip synthesizer IC U4. A 9.6 MHz reference signal is provided from either the internal TCXO (JU1-B), or an external source via SMA connector J4 and jumper JU1-A. If an external signal is used for the reference source, it must be of low phase noise, high stability, and between 2.0 Vpp and 5.0 Vpp. A sinusoidal signal shape is required for an external reference source. A poor quality reference source will degrade receiver performance to unacceptable levels.

The 9.6 MHz reference source is divided down to establish a channel selection step size of 12.5 kHz, or 25 kHz. A third order passive loop filter comprised of C10, C11, C14, R11, and R12, is employed to achieve the required

noise performance, modulation and worst case switching time of 50 ms. A small sample of RF energy is coupled from the VCO output to the synthesizer IC U4 prescaler input (pin 8). FM modulation of the VCO from 60 Hz to 3 kHz, is provided through the baseband input pin P1-1 and installation of jumper JU3-B. A 1 kHz sine wave with a level of approximately 315 mVrms at P1-1 provides FM deviation of 3.0 kHz. The output of the VCO is filtered by low pass filter F1. SMA connector J5 provides frequency coverage with an RF output level of approximately +7 dBm into a 50Ω load. Synthesizer frequency band selection is made by the appropriate selection of a fixed value tuning capacitors mounted on the VCO board.

OSR-3 406 - 470 MHZ SYNTHESIZER VCO

The synthesizer module VCO provides frequency generation and amplification/isolation together with frequency voltage control and modulation input capability. It occupies a small circuit board that plugs into the synthesizer module main circuit board through eight machined contact pins. Additional grounding and mechanical attachment is provided through three points where the circuit board edge is soldered directly to the main board synthesizer mounting shield support bracket and TCXO cover.

Field effect transistor Q1 provides a UHF negative resistance amplifier/oscillator that is tuned on frequency by the combination of transmission line resonator TL1 and a total capacitive reactance presented at the output drain port through capacitors C5 and C6. Coarse frequency adjustment is provided by trimmer capacitor C5.

RF output power is taken from a tap point near the bypassed end of resonator TL1. Transistor Q2 provides amplification and isolation of the oscillator signal with output applied to pin P13, which in turn drives the synthesizer prescaler and MMIC amplifier found on the synthesizer module main board.

Voltage control required for implementation of the PLL function is provided through Loop Control input pin P6. A DC control voltage, from the synthesizer PLL loop filter, controls VCO frequency by controlling oscillator resonating capacitance through changing the reverse bias potential across tuning diode D1. Modulation capability operates in a similar fashion through the application of a modulation signal to input pin P7. A large signal division ratio, established by resistive dividers R2 and R3, allows low deviation (less than 5 kHz) direct frequency modulation of the VCO output signal.

MICROPROCESSOR CONTROLLER

Microprocessor U6 provides control of the synthesizer module. It communicates with synthesizer IC U4, monitors the synthesizer lock detect, manages PTT input/output, and determines the operating frequency from either four rotary BCD switches or four externally driven channel select lines. It also communicates with an external factory programmer through I/O lines TX DATA (P1-17), RX DATA (P1-9), and BOOTSTRAP (P2-2). The external programmer places the operating program in non volatile microprocessor memory. It is also used to program 15 user channel selections.

The microprocessor spends the majority of time in a low power sleep state. Wake up is achieved when external events such as PTT action, synthesizer lock failure, or a change in channel selection dictate immediate action. An internal “watchdog” timer provides robust software protection in all operating modes.

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 (grounded), the synthesizer will scan four BCD switches connected to SW1 COM - SW4 COM and PC4 - PC7 to establish the operating frequency. The BCD switches are located on the receiver main circuit boards.

Note: The four channel select lines, CHAN SEL3 - Chan SEL0, are connected via the MT-3 receiver main board module connector to the M3 motherboard subrack. These lines may be used for external frequency control. They are normally pulled low via jumper sets located on the M3 motherboard subrack.

If the channel select lines are pulled high to +9.5 Vdc in any combination resulting in a binary code greater than 0000 (all low), then the frequency is established as the preprogrammed entry in a table containing 15 separate frequency settings. For example; if all of the channel select lines are pulled high then a binary code of 1111 results which selects the frequency entry from the 15th table position. CHAN SEL3 is the most significant bit of the binary channel selection code. The channel table is normally programmed at the factory for those applications requiring specialized remote control of frequency. These programmed channel assignments are stored in non-volatile microprocessor EEPROM and are not susceptible to inadvertent erasure.

For receivers, an IF Offset correction factor (21.4 MHz for OSR-3 406 - 470 MHz) must be added to or subtracted from the synthesizer operating frequency in order to determine the actual receive frequency. Refer to the channel designation table documentation provided with the receiver modules for simplified channel number and frequency information.

SYNTHESIZER BASE AND FREQUENCY INCREMENT TABLE

The OSR-3 Low Current Synthesizer operates in frequency increments of 12.5 kHz. The Base Frequency is the lowest frequency of any given synthesizer model.

Model Number	Freq. Range	Base Frequency	Freq. Increment
OSR-3/440 (installed in UR-3/420 Rx 406-430 MHz)	427.4-451.4 MHz	406 MHz	12.5 kHz
OSR-3/440 (intalled in UR-3/460 Rx 450-470 MHz)	427.4-451.4 MHz	406 MHz	12.5 kHz

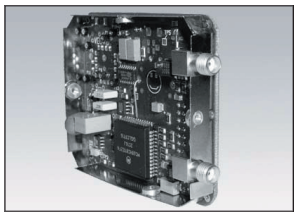
CHANNEL SELECTION

OS-3 synthesizers have been designed to generate frequencies in 12.5 kHz channel increments. BCD channel switch settings from 1712 to 3632 (for 406 - 430 MHz) and 1808 to 3408 (for 450 - 470 MHz) will therefore select operating frequencies with 12.5 kHz increments. The switch settings are scanned by the synthesizer module when the receiver is first powered up, and the desired local oscillator frequency is generated. Calculation of the operating frequency is determined as follows:

OSR-3 406-470 MHz Channel Selection

OSR-3/440 (installed in UR-3/420, 406-430 MHz)
BCD switch settings from 1712 to 3632:
Multiply the switch setting by 12.5 kHz and add the result to the synthesizer base frequency minus the IF offset.
Example: An OSR-3/440 synthesizer has a base frequency of 406 MHz. The IF offset correction factor is 21.4 MHz.The selected channel number is 2050. Therefore the receiver frequency is:
((2050 x 12.5 kHz) + (406 MHz - 21.4 MHz)) = 410.2250 MHz

OSR-3/440 (installed in UR-3/460, 450-470 MHz)
BCD switch settings from 1808 to 3408:
Multiply the switch setting by 12.5 kHz and add the result to the synthesizer base frequency minus the IF offset.
Example: An OSR-3/440 synthesizer has a base frequency of 406 MHz. The IF offset correction factor is 21.4 MHz.The selected channel number is 2050. Therefore the receiver frequency is:
((3340 x 12.5 kHz) + (406 MHz - 21.4 MHz)) = 469.15000 MHz



SYNTHESIZER ALIGNMENT

GENERAL

OSR-3 Low Current Synthesizer alignment is simplified by using a Type 84 subrack and RF extender card/cable to provide receiver power and signal interconnection. Alternatively, +9.5 Vdc may be applied directly to a receiver module through positive connection to pins B6 / Z6, and negative connection to pins B30 / Z30 / B32 / Z32. Receiver balanced audio (600 Ω) is available at pins B26 and Z26.

REPAIR NOTE

OSR-3 Low Current Synthesizer employs a high percentage of surface mount components that should not be removed or replaced using an ordinary soldering iron. Removal and replacement of surface mount components should be performed only with specifically designed surface mount rework and repair stations complete with Electrostatic Discharge (ESD) protection.

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

RECOMMENDED TEST EQUIPMENT

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

Power supply - Regulated +9.5 Vdc 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 frequency locked to an external reference (WWVH, GPS, Loran C) so that the internal high stability local oscillator may be accurately set to within its ±1 ppm frequency tolerance.

OSR-3 SYNTHESIZER FACTORY CONFIGURATION

All solder jumpers are clearly marked on the underside of the synthesizer module. The following list details the required jumper configuration for the two synthesizer operating modes:

1) Internal reference. Install jumper JU1B (Standard). The internal temperature compensated crystal oscillator (TCXO) provides the reference signal with a stability not exceeding ±1 ppm from -40°C to + 60°C.
2) External reference input. Install jumper JU1A. This mode reduces receiver current by approximately 4 mA by eliminating the internal TCXO reference and is used in applications requiring better than ±1 ppm frequency stability.

Remember: Care must be exercised when installing the reconfigured synthesizer module back into the IF/audio board. Pay careful attention to pin alignment before pressing the synthesizer module into it's mating sockets.

OSR-3 SYNTHESIZER ALIGNMENT

General

Under normal circumstances, the alignment procedure is accomplished without removing the synthesizer from the MT-3 Receiver IF/ Audio Board. Alignment simply involves setting the internal TCXO reference frequency (if one is installed). A change in receiver operating frequency greater than ±5 MHz from an initial factory setting requires a more involved synthesizer alignment procedure. To convert a synthesizer with an internal reference source to a synthesizer requiring an external reference signal or vice-versa is done through the appropriate selection of jumper JU1 A or B.

Synthesizer Test Points

TP1	+5.0 ± 0.1 Vdc. U1 positive regulator output.
TP2	+5.0 ± 0.1 Vdc. U3 positive regulator output (remotely controlled via pin P2-4).
TP3	Lock detect. Logic high (5.0 Vdc) = locked condition.
TP4	PLL error voltage. Ranges from +0.5 to 4.5 Vdc depending on frequency.
TP5	+5.0 Vdc ± 0.5 Vdc. Buffer amplifier bias. (access under VCO board).
TP6	+9.5 Vdc. U3 positive regulator input (remotely controlled via pin P2-4).

Synthesizer Installation and Removal

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 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. Remove the two remaining synthesizer cover screws and cover to expose the synthesizer circuitry. Carefully reinsert the synthesizer module, without the cover, back into the main circuit board. Visually line up the connector pins and sockets before applying firm reinsertion pressure. Failure to do so could lead to damaged synthesizer module pins. Reconnect the SMA RF output connector. The alignment procedure may now be performed. Installation of the synthesizer is performed in a fashion reverse to the above procedure. It is important to emphasize the importance of connector pin alignment prior to any application of reinsertion force.

OSR-3 406 - 470 MHz Frequency Adjustment

Synthesizer VCO Configuration

The synthesizer VCO board is of sealed surface mount construction and is considered to be a non-serviceable unit. Defective VCO modules should be returned to the factory for repair or replacement.

Frequency Adjustment and Channel Selection

Connect a radio communications test set through a short section of low loss 50 Ω coaxial cable to the synthesizer module SMA RF output jack. Select the desired channel number through the BCD frequency selection switches on the IF/audio board. Turn the power off and on and wait a few minutes for the oscillator to completely stabilize.

The measured signal should be at or close to (± 1 ppm) the specified oscillator frequency.

Note that unlocked synthesizer operation will be indicated by an incorrect or spurious RF output signal. This may be rectified by adjusting the VCO trim capacitor (C5) as described in the following procedure.

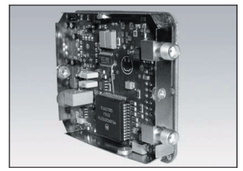
VCO Phase Lock Loop

Using a high impedance (10 MΩ) DC Voltmeter, measure the PLL control voltage at TP4 located on the synthesizer module main circuit board (top). Using a small standard bladed screwdriver, carefully adjust the horizontally located VCO fine frequency trimmer capacitor C5 until a test point (TP4) voltage of approximately 3.5 Vdc is obtained. This adjustment is quite sensitive and must be carefully performed. Measured voltages below approximately 0.5 Vdc and above approximately 4.5 Vdc indicate an “out of lock” synthesizer condition.

Reference Frequency Alignment

Adjust the synthesizer TCXO fine frequency potentiometer until the correct frequency is measured. Access to this potentiometer is made available through an opening in the synthesizer cover, or if the cover is off, through an opening on the enclosed TCXO module. Note that frequency adjustment may be made through a potentiometer (R4) located next to the TCXO module if the installed TCXO module has no internal frequency adjustment capability. An RF power level of approximately +4 dBm for OS(R/T)-3 406 - 470 MHz or +4 dBm for OS(R/T)-3 406 - 470 MHz should be measured at the synthesizer module output connector and the frequency should be within ±1 ppm from the desired operating frequency.

The reference TCXO frequency must be adjusted at room temperature (+25°C) to match a factory specified frequency offset error, recorded in ± ppm variation directly on the synthesizer module cover label. This offset, which varies from unit to unit, positions the absolute synthesizer frequency within the required frequency temperature variation window, which effectively allows the ±1 ppm frequency versus temperature specification, from -40°C to +60°C, to be met.



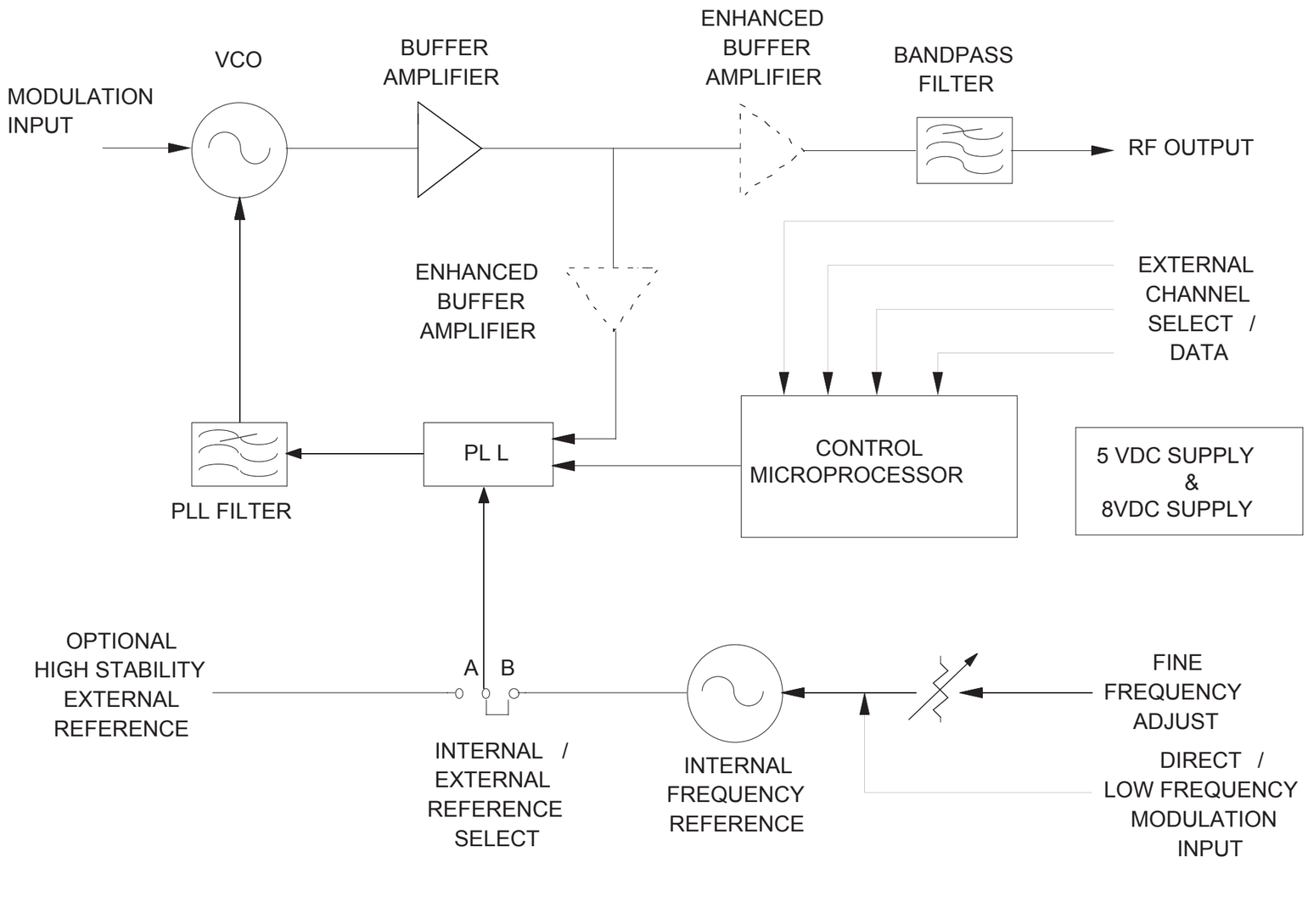
ILLUSTRATIONS AND SCHEMATICS

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



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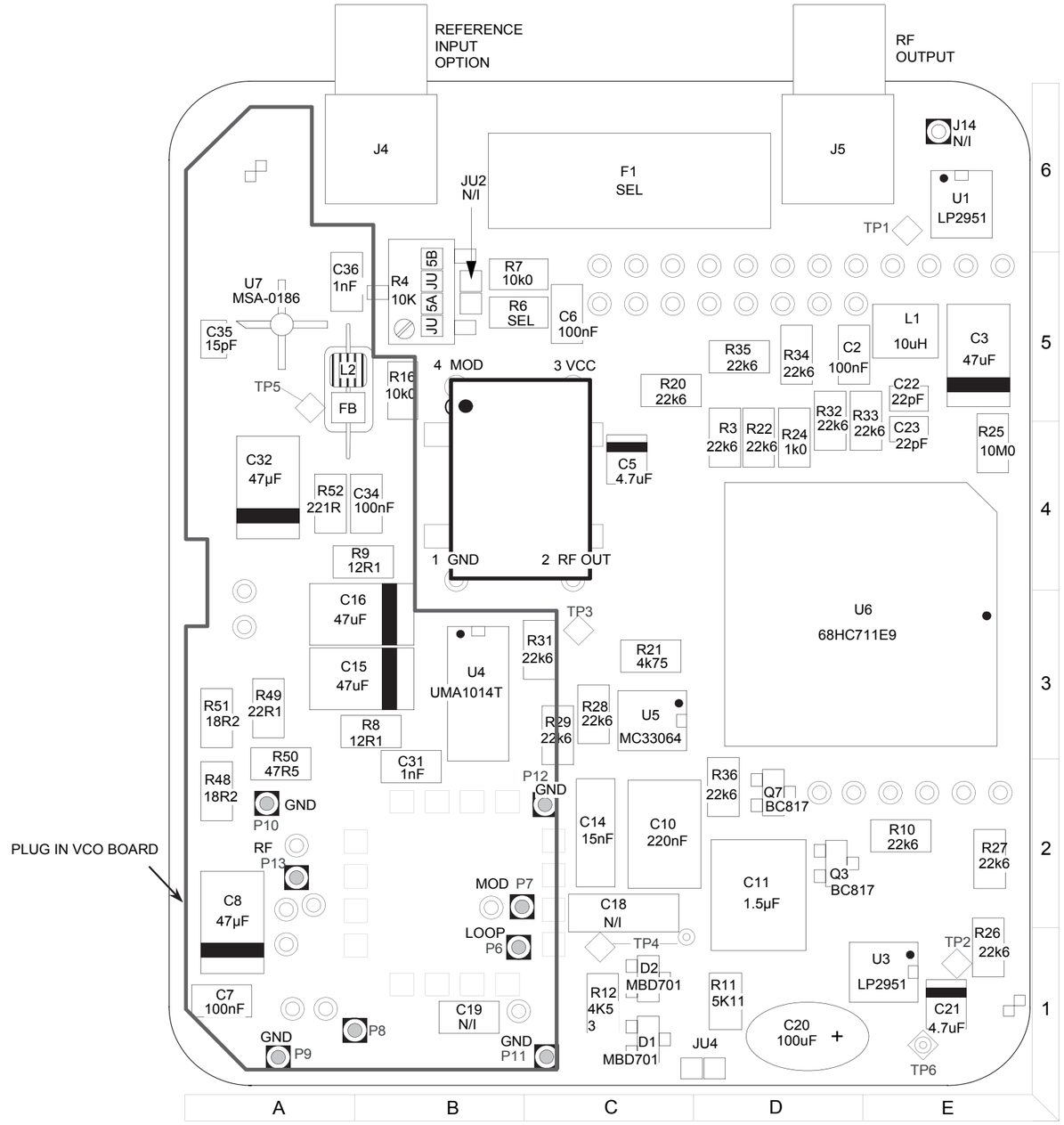
OSR-3 406-470 MHZ SYNTHESIZER COMPONENT LAYOUT (TOP)

COMPONENT LOCATION TABLE															
DES	PG	LC	DES	PG	LC	DES	PG	LC	DES	PG	LC	DES	PG	LC
C1	B	E1	D1	T	C1	Q1	B	E5	R21	T	C3	TCXO1	T	B4
C2	T	D5	D2	T	C1	Q2	B	E6	R22	T	D4			
C3	T	E5				Q3	T	D2	R23	B	D3	TP1	T	E6
C4	B	E1	F1	T	C6	Q4	B	C3	R24	T	D4	TP2	T	E1
C5	T	C4				Q7	T	D2	R25	T	E4	TP3	T	C3
C6	T	C5	J4	T	B6	Q8	B	E4	R26	T	E1	TP4	T	C1
C7	T	A1	J5	T	D6	Q9	B	E4	R27	T	E2	TP5	T	A4
C8	T	A2	J14	T	E6	Q10	B	D4	R28	T	C3	TP6	T	E1
C9	B	B4				Q11	B	D4	R29	T	C3			
C10	T	C2	JU1	B	A4				R30	B	C3	U1	T	E6
C11	T	D2	JU2	T	B5	R1	B	E5	R31	T	C3	U2	B	C3
C12	B	B5	JU3	B	C5	R2	B	E5	R32	T	D4	U3	T	E1
C14	T	C2	JU4	T	D1	R3	T	D4	R33	T	E4	U4	T	B3
C15	T	B3	JU5	T	B5	R4	T	B5	R34	T	D5	U5	T	C3
C16	T	B3	JU6	B	C2	R5	B	A1	R35	T	D5	U6	T	D3
C17	B	B3				R6	T	B5	R36	T	D2	U7	T	A5
C18	T	C2	L1	T	E5	R7	T	B5	R37	B	D4			
C19	T	B1	L2	T	A5	R8	T	B3	R38	B	D4	VCO	T	B2
C20	T	D1				R9	T	B4	R39	B	D4			
C21	T	E1	P1	B	D2	R10	T	E2	R40	B	D5	X1	B	E3
C22	T	E5	P2	B	E5	R11	T	D2	R41	B	E3			
C23	T	E4	P3	B	A4	R12	T	C1	R42	B	E3			
C24	B	D3	P6	T	B1	R13	B	B5	R43	B	D3			
C25	B	D3	P7	T	B2	R14	B	C6	R44	B	D4			
C26	B	C2	P8	T	B1	R15	B	B5	R48	T	A2			
C31	T	B2	P9	T	A1	R16	T	B5	R49	T	A3			
C32	T	A4	P10	T	B2	R17	B	C6	R50	T	A2			
C34	T	B4	P11	T	C2	R18	B	C6	R51	T	A3			
C35	T	A5	P12	T	C2	R19	B	C4	R52	T	A4			
C36	T	A5	P13	T	A2	R20	T	C5	R53	B	E1			

T - Top Side Component Layout
B - Bottom Side Component Layout

TCXO SELECT COMPONENTS		
DESIG.	**RAKON (9.6000 MHZ)**	**SARONIX (S2045-9.6000)**
R6*	33K2	10K0

* SURFACE MOUNT CONPONENTS



43-914921-02-T-P1-ABBAAA

OSR-3 406-470 MHZ SYNTHESIZER COMPONENT LAYOUT (BOTTOM)

COMPONENT LOCATION TABLE

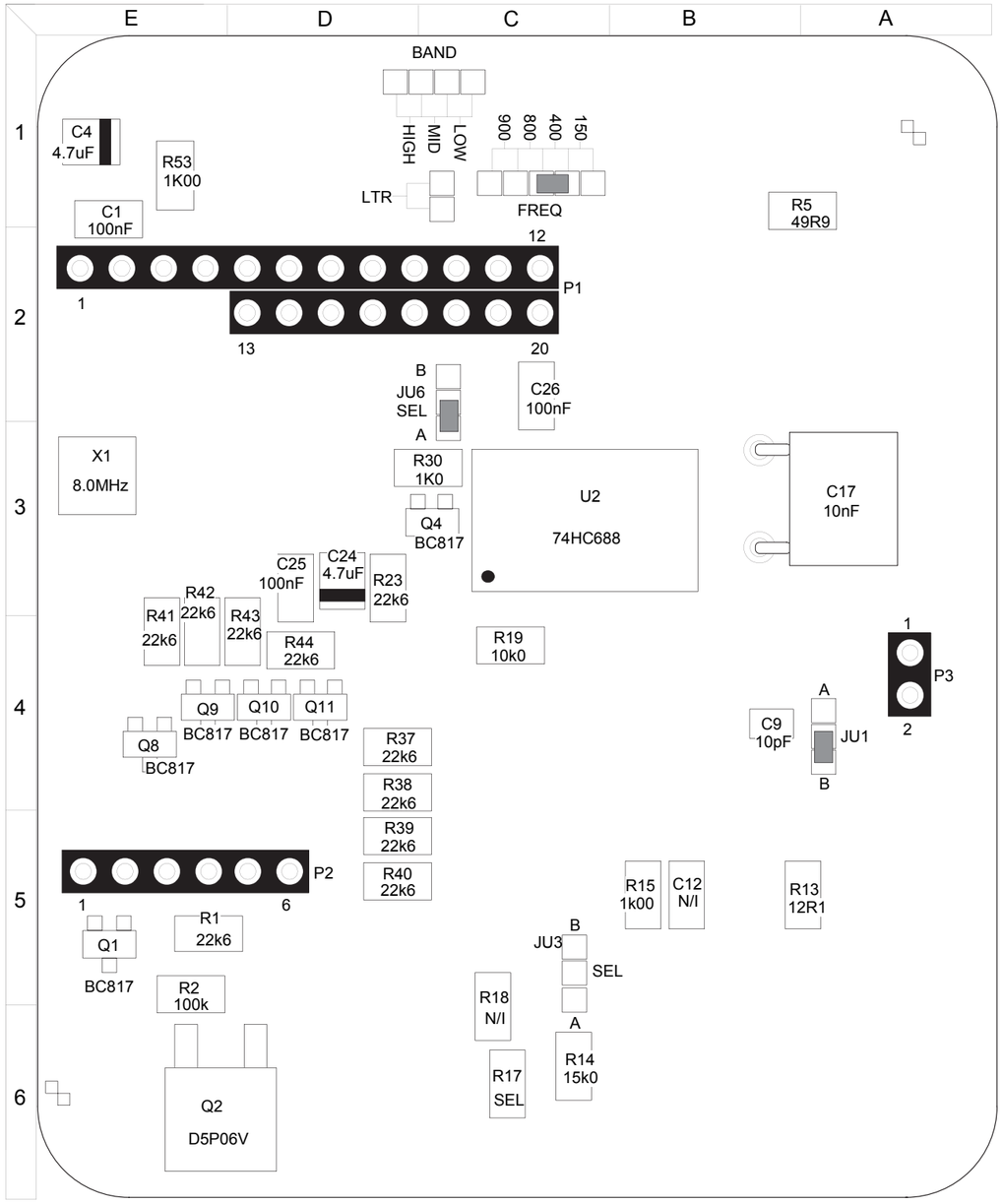
DES	PG	LC	DES	PG	LC	DES	PG	LC	DES	PG	LC	DES	PG	LC
C1	B	E1	D1	T	C1	Q1	B	E5	R21	T	C3	TCXO1	T	B4
C2	T	D5	D2	T	C1	Q2	B	E6	R22	T	D4			
C3	T	E5				Q3	T	D2	R23	B	D3	TP1	T	E6
C4	B	E1	F1	T	C6	Q4	B	C3	R24	T	D4	TP2	T	E1
C5	T	C4				Q7	T	D2	R25	T	E4	TP3	T	C3
C6	T	C5	J4	T	B6	Q8	B	E4	R26	T	E1	TP4	T	C1
C7	T	A1	J5	T	D6	Q9	B	E4	R27	T	E2	TP5	T	A4
C8	T	A2	J14	T	E6	Q10	B	D4	R28	T	C3	TP6	T	E1
C9	B	B4				Q11	B	D4	R29	T	C3			
C10	T	C2	JU1	B	A4				R30	B	C3	U1	T	E6
C11	T	D2	JU2	T	B5	R1	B	E5	R31	T	C3	U2	B	C3
C12	B	B5	JU3	B	C5	R2	B	E5	R32	T	D4	U3	T	E1
C14	T	C2	JU4	T	D1	R3	T	D4	R33	T	E4	U4	T	B3
C15	T	B3	JU5	T	B5	R4	T	B5	R34	T	D5	U5	T	C3
C16	T	B3	JU6	B	C2	R5	B	A1	R35	T	D5	U6	T	D3
C17	B	B3				R6	T	B5	R36	T	D2	U7	T	A5
C18	T	C2	L1	T	E5	R7	T	B5	R37	B	D4			
C19	T	B1	L2	T	A5	R8	T	B3	R38	B	D4	VCO	T	B2
C20	T	D1				R9	T	B4	R39	B	D4			
C21	T	E1	P1	B	D2	R10	T	E2	R40	B	D5	X1	B	E3
C22	T	E5	P2	B	E5	R11	T	D2	R41	B	E3			
C23	T	E4	P3	B	A4	R12	T	C1	R42	B	E3			
C24	B	D3	P6	T	B1	R13	B	B5	R43	B	D3			
C25	B	D3	P7	T	B2	R14	B	C6	R44	B	D4			
C26	B	C2	P8	T	B1	R15	B	B5	R48	T	A2			
C31	T	B2	P9	T	A1	R16	T	B5	R49	T	A3			
C32	T	A4	P10	T	B2	R17	B	C6	R50	T	A2			
C34	T	B4	P11	T	C2	R18	B	C6	R51	T	A3			
C35	T	A5	P12	T	C2	R19	B	C4	R52	T	A4			
C36	T	A5	P13	T	A2	R20	T	C5	R53	B	E1			

T - Top Side Component Layout
B - Bottom Side Component Layout

TX/RX SELECT COMPONENTS		
DESIG.	**TRANSMITTER**	**RECEIVER**
R17*	4K75	ZERO OHM
JU3	'B' POSITION	NOT INSTALLED

68HC711E9 BOOTSTRAP/NORMAL MODE		
DESIG.	**NORMAL**	**BOOTSTRAP**
JU6	'A' POSITION	'B' POSITION

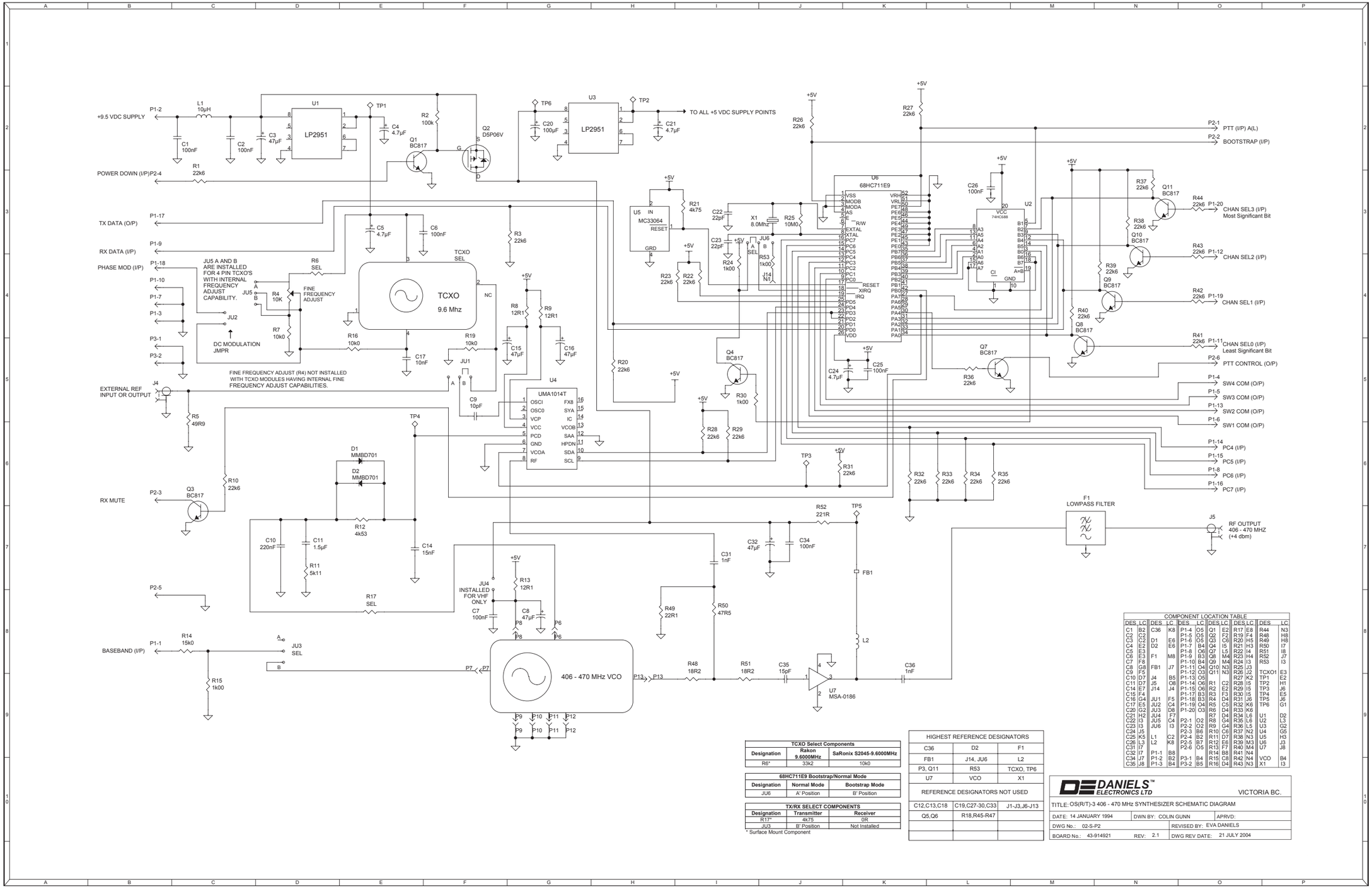
* SURFACE MOUNT COMPONENTS



INSTALLED JUMPERS

43-914921-02-B-P1-AAAAAA

OSR-3 406-470 MHZ SYNTHESIZER SCHEMATIC DIAGRAM



TCXO Select Components		
Designation	Rakon 9.6000MHz	SaRonix S2045-9.6000MHz
R6*	33k2	10k0

68HC711E9 Bootstrap/Normal Mode		
Designation	Normal Mode	Bootstrap Mode
JU6	A' Position	B' Position

TX/RX SELECT COMPONENTS		
Designation	Transmitter	Receiver
R17*	4k75	0R
JU3	B' Position	Not Installed

* Surface Mount Component

HIGHEST REFERENCE DESIGNATORS		
C36	D2	F1
FB1	J14, JU6	L2
P3, Q11	R53	TCXO, TP6
U7	VCO	X1
REFERENCE DESIGNATORS NOT USED		
C12,C13,C18	C19,C27-30,C33	J1-J3,J6-J13
Q5,Q6	R18,R45-R47	

COMPONENT LOCATION TABLE

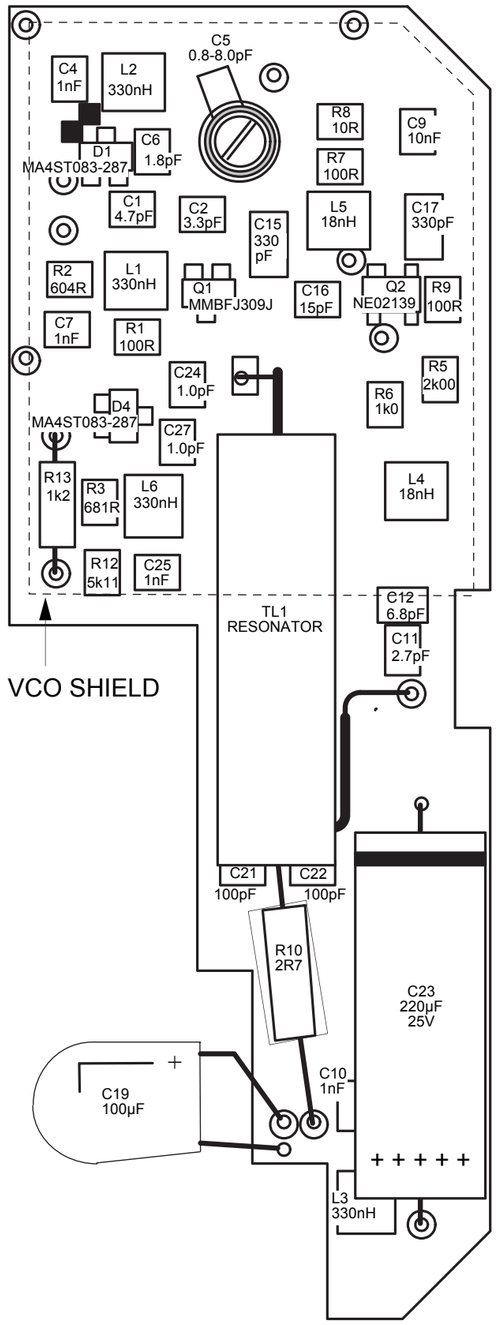
DES	LC	DES	LC	DES	LC	DES	LC	DES	LC	DES	LC	DES	LC
C1	B2	C36	K8	P1-4	O5	Q1	E2	R17	E8	R44	N3		
C2	C2			P1-5	O5	Q2	F2	R19	F4	R48	H8		
C3	C2	D1	E6	P1-6	O5	Q3	C6	R20	H5	R49	H6		
C4	E2	D2	E6	P1-7	B4	Q4	I5	R21	H3	R50	I7		
C5	E3			P1-8	O6	Q7	L5	R22	I4	R51	I8		
C6	E3	F1	M8	P1-9	B3	Q8	M4	R23	H4	R52	J7		
C7	F8			P1-10	B4	Q9	M4	R24	I3	R53	I3		
C8	G8	FB1	J7	P1-11	O4	Q10	N3	R25	J3				
C9	F5			P1-12	O3	Q11	N3	R26	J2	TCXO1	E3		
C10	D7	J4	B5	P1-13	O5			R27	K2	TP1	E2		
C11	D7	J5	O8	P1-14	O6	R1	C2	R28	I5	TP2	H1		
C14	E7	J14	J4	P1-15	O6	R2	E2	R29	I5	TP3	J6		
C15	F4			P1-17	B3	R3	F3	R30	I5	TP4	E5		
C16	G4	JU1	F5	P1-18	B3	R4	D4	R31	J6	TP5	J6		
C17	E5	JU2	C4	P1-19	O4	R5	C5	R32	K6	TP6	G1		
C20	G2	JU3	D6	P1-20	O3	R6	D4	R33	K6				
C21	H2	JU4	F7			R7	D4	R34	L6	U1	D2		
C22	I3	JU5	C4	P2-1	O2	R8	G4	R35	L6	U2	L3		
C23	I3	JU6	I3	P2-2	O2	R9	G4	R36	L5	U3	G2		
C24	J5			P2-3	B6	R10	C6	R37	N2	U4	G5		
C25	K6	L1	C2	P2-4	B2	R11	D7	R38	N3	U5	H3		
C26	L3	L2	K8	P2-5	B7	R12	E6	R39	M3	U6	J3		
C31	I7			P2-6	O5	R13	F7	R40	M4	U7	J8		
C32	I7	P1-1	B8			R14	B8	R41	N4				
C34	J7	P1-2	B2	P3-1	B4	R15	C8	R42	N4	VCO	B4		
C35	J8	P1-3	B4	P3-2	B5	R16	D4	R43	N3	X1	I3		

DANIELS™ ELECTRONICS LTD — VICTORIA BC.

TITLE: OS(R/T)-3 406 - 470 MHz SYNTHESIZER SCHEMATIC DIAGRAM

DATE: 14 JANUARY 1994	DWN BY: COLIN GUNN	APRVD:
DWG No.: 02-S-P2		REVISED BY: EVA DANIELS
BOARD No.: 43-914921 REV: 2.1		DWG REV DATE: 21 JULY 2004

OSR-3 406-470 MHZ VCO COMPONENT LAYOUT (TOP)



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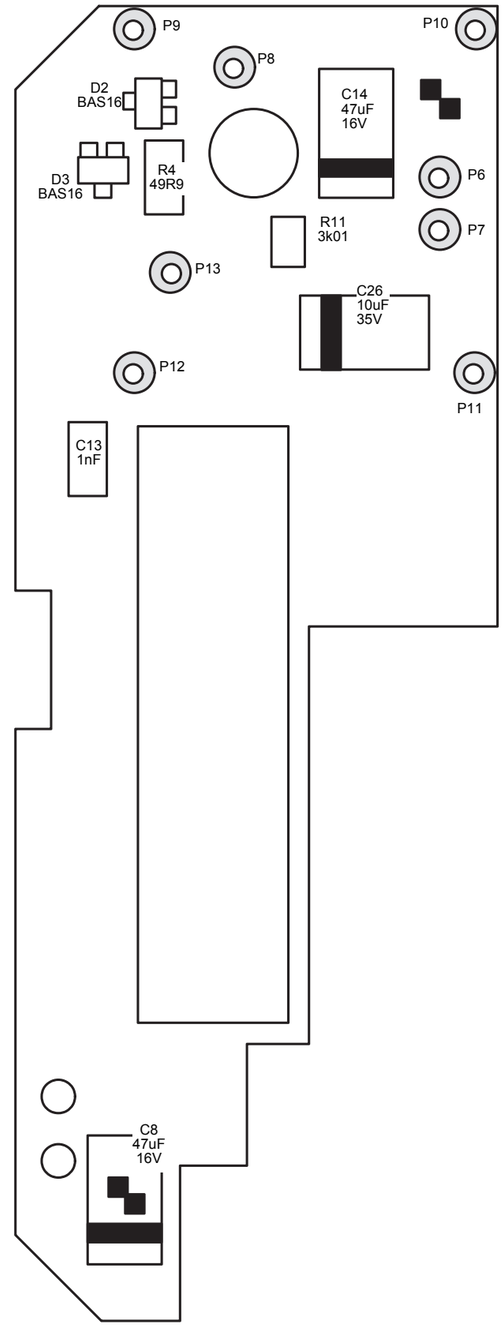
OSR-3 406-470 MHZ VCO COMPONENT LAYOUT (BOTTOM)



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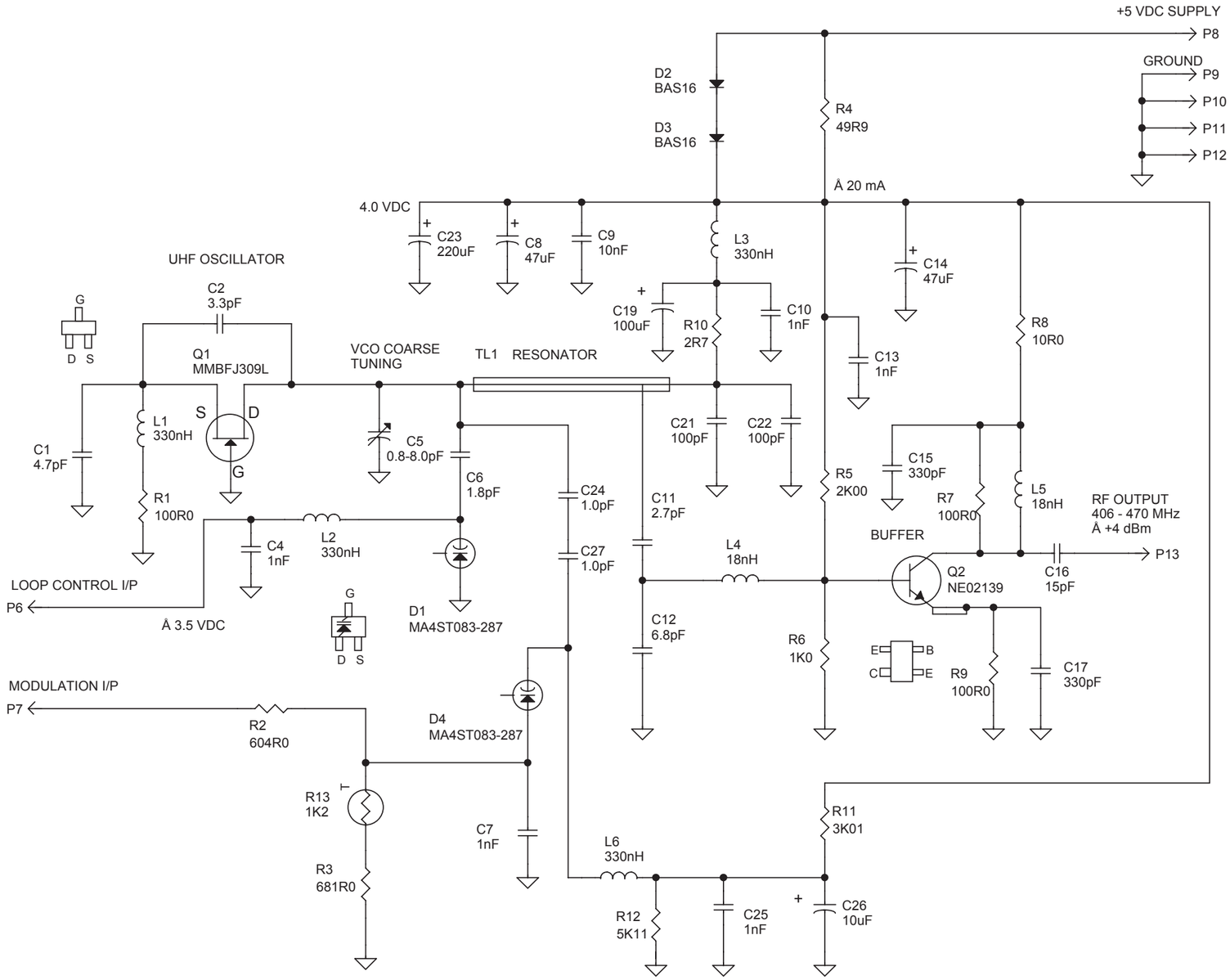
OSR-3 406-470 MHZ VCO SCHEMATIC DIAGRAM



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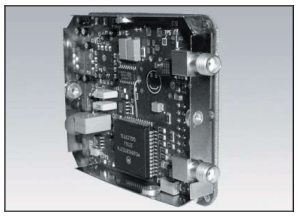


PARTS LIST

406 - 470 MHZ LOW CURRENT SYNTHESIZER ELECTRICAL PARTS LIST

Ref Desig	Description	Part No
C1	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R
C2	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R
C3	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16
C4	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16
C5	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16
C6	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R
C7	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R
C8	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16
C9	CAP., SM, 10pF CER., 0805, C0G	1008-1A100J1G
C10	CAP., 22nF FILM, MMK5, 10%,63V	1016-4A223K63
C10	CAP., 220nF FILM, MMK5,10%,50V	1016-5A224K50
C11	CAP., 1.5uF FILM, MMK5,10%,50V	1016-6E155K63
C11	CAP., 150nF FILM, MMK5,10%,63V	1016-5B154K63
C14	CAP., 1.5nF FILM, MMK5,10%,63V	1016-3A152K63
C14	CAP., 15nF FILM, MMK5, 10%,63V	1016-4A153K63
C15	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16
C16	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16
C17	CAP., 10nF FILM, MMK5, 10%,63V	1016-4A103K63
C20	CAP., 100uF DIP. TANT.,20%,20V	1054-7M107M20
C21	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16
C22	CAP., SM, 22pF CER., 0805, C0G	1008-1A220J1G
C23	CAP., SM, 22pF CER., 0805, C0G	1008-1A220J1G
C24	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16
C25	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R
C26	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R
C31	CAP., SM, 1nF CER., 1206, C0G	1008-3B102K1G
C32	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16

Ref Desig	Description	Part No
C34	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R
C35	CAP., SM, 15pF CER., 0805, C0G	1008-1A150J1G
C36	CAP., SM, 1nF CER., 1206, C0G	1008-3B102K1G
D1	DIODE, MMBD701,HOT CARR.,SOT23	2105-MMBD7010
D2	DIODE, MMBD701,HOT CARR.,SOT23	2105-MMBD7010
J4	CONN., SMA R/A JACK,PCMNT,.200	5112-J20010BG
J5	CONN., SMA R/A JACK,PCMNT,.200	5112-J20010BG
L1	INDUCTOR, SM, 10.0uH, 10%,1812	1255-4G10000K
L2	COIL, 5T,28AWG W/BEAD+HEATSHRK	1223-5T002880
P6 - P13	SOCK. STRIP-L/P,1ROW x 1PIN,Au	5016-SL101G08
P1 - 1	INTERCONNECT/LP,1ROW x12PIN,Au	5015-IL112G07
P1 - 13	INTERCONNECT/LP,1ROW x 8PIN,Au	5015-IL108G07
P2 - 1	INTERCONNECT/LP,1ROW x 6PIN,Au	5015-IL106G07
P3 - 1	INTERCONNECT/LP,1ROW x 2PIN,Au	5015-IL102G07
PCB	PCB, MT-3 SYNTHESIZER	4309-25914921
Q1	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025
Q2	MOSFET, D5P06V, P-CHAN., D-PAK	2144-D5P06V00
Q3	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025
Q4	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025
Q7	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025
Q8	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025
Q9	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025
Q10	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025
Q11	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025
R1	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R2	RES., SM, 100K 1206, 1%,100ppm	1150-5B1003FP
R3	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R4	POT., SM, 10K, 12T, TOP ADJUST	1172-M30103W5
R5	RES., SM, 49R9 1206, 1%,100ppm	1150-1B49R9FP
R6	RES., SM, 33K2 1206, 1%,100ppm	1150-4B3322FP
R7	RES., SM, 10K0 1206, 1%,100ppm	1150-4B1002FP
R8	RES., SM, 12R1 1206, 1%,100ppm	1150-1B12R1FP
R9	RES., SM, 12R1 1206, 1%,100ppm	1150-1B12R1FP
R10	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP

Ref Desig	Description	Part No
R11	RES., SM, 5K11 1206, 1%,100ppm	1150-3B5111FP
R11	RES., SM, 15K0 1206, 1%,100ppm	1150-4B1502FP
R12	RES., SM, 4K53 1206, 1%,100ppm	1150-3B4531FP
R12	RES., SM, 39K2 1206, 1%,100ppm	1150-4B3922FP
R13	RES., SM, 12R1 1206, 1%,100ppm	1150-1B12R1FP
R14	RES., SM, 15K0 1206, 1%,100ppm	1150-4B1502FP
R15	RES., SM, 1K00 1206, 1%,100ppm	1150-3B1001FP
R16	RES., SM, 10K0 1206, 1%,100ppm	1150-4B1002FP
R17	RES., SM, ZERO OHM JUMPER,1206	1150-0B0R0000
R19	RES., SM, 10K0 1206, 1%,100ppm	1150-4B1002FP
R20	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R21	RES., SM, 4K75 1206, 1%,100ppm	1150-3B4751FP
R22	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R23	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R24	RES., SM, 1K00 1206, 1%,100ppm	1150-3B1001FP
R25	RES., SM, 10M0 1206, 5%,400ppm	1151-7B0106JG
R26	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R27	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R28	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R29	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R30	RES., SM, 1K00 1206, 1%,100ppm	1150-3B1001FP
R31	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R32	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R33	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R34	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R35	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R36	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R37	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R38	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R39	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R40	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R41	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R42	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R43	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R44	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP
R48	RES., SM, 18R2 1206, 1%,100ppm	1150-1B18R2FP
R49	RES., SM, 22R1 1206, 1%,100ppm	1150-1B22R1FP
R50	RES., SM, 47R5 1206, 1%,100ppm	1150-1B47R5FP
R51	RES., SM, 18R2 1206, 1%,100ppm	1150-1B18R2FP
R52	RES., SM, 221R 1206, 1%,100ppm	1150-2B2210FP
R53	RES., SM, 1K00 1206, 1%,100ppm	1150-3B1001FP

Ref Desig	Description	Part No
TCXO1	TCVCXO,SMT, 9.6MHz,+-1ppm,0-3V	2641-09600AM7
U1	IC, LP2951,PROG. VOLT REG,SO-8	2305-29510N08
U2	IC, 74HC688, 8BIT COMP.,SO-20L	2376-06880W20
U3	IC, LP2951,PROG. VOLT REG,SO-8	2305-29510N08
U4	IC, UMA1014T,FREQ. SYNTH,SO-16	2355-10140N16
U5	IC, MC33064,UNDR/VOLT SEN.SO-8	2308-33064N08
U6	IC, 68HC711E9, MIC/CTR, PLCC52	2380-68711P52
U7	IC, MSA-0186, MMIC AMP, PKG-86	2354-MSA01860
X1	RESONATOR, SM, 8.0MHz, CERAMIC	1575-8001816A

406 - 470 MHZ LOW CURRENT SYNTHESIZER MECHANICAL PARTS LIST

Description	Part No.	Qty.
BOX, ALUM.,2.5”W x 3”L x.781”H	3702-66400050	1
BRACKET, SHIELD,MT-3 SYNTH.,BR	3702-67300910	1
LABEL, FOIL,FRQ/SN,MT-3 SYNTH.	3501-13091005	1
NUT, SELF-CLINCH., M2,6.3mm OD	5833-S2M06315	4
SCREW, M2 X 4, PAN/PHILLIPS,A2	5812-2M0PP04S	4
TAB, GROUND, MT-3 SYNTH.,BRASS	3702-67800905	2

406 - 470 MHZ LOW PASS FILTER ELECTRICAL PARTS LIST

Ref Desig	Description	Part No
C1	CAP., SM, 10pF CER., 0805, C0G	1008-1A100J1G
C2	CAP., SM, 15pF CER., 0805, C0G	1008-1A150J1G
C3	CAP., SM, 10pF CER., 0805, C0G	1008-1A100J1G
L1	INDUCTOR, SM,18nH CER,10%,1008	1256-1B18N00K
L2	INDUCTOR, SM,18nH CER,10%,1008	1256-1B18N00K
PCB	PCB, LPF, MT-3 150/400 SYNTH.	4309-50932512

406 - 470 MHZ LOW PASS FILTER MECHANICAL PARTS LIST

Description	Part No.	Qty.
SHIELD, LPF,OS-3 150/400 SYNTH	3702-67300970	1

406 - 470 MHZ VCO
ELECTRICAL PARTS LIST

Ref Desig	Description	Part No
C1	CAP., SM, 4.7pF CER., 0805,C0G	1008-0A479J1G
C2	CAP., SM, 3.3pF CER., 0805,C0G	1008-0A339J1G
C4	CAP., SM, 1nF CER,0805,X7R,50V	1008-3A102K5R
C5	CAP.,TRIM. .8-8pF VERT/STYLE 4	1082-G0R8008P
C6	CAP., SM, 1.8pF CER., 0805,C0G	1008-0A189C1G
C7	CAP., SM, 1nF CER,0805,X7R,50V	1008-3A102K5R
C8	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16
C9	CAP., SM,10nF CER,0805,X7R,50V	1008-4A103K5R
C10	CAP., SM, 1nF CER,0805,X7R,50V	1008-3A102K5R
C11	CAP., SM, 2.7pF CER., 0805,C0G	1008-0A279J1G
C12	CAP., SM, 6.8pF CER., 0805,C0G	1008-0A689J1G
C13	CAP., SM, 1nF CER,0805,X7R,50V	1008-3A102K5R
C14	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16
C15	CAP., SM, 330pF CER., 1206,C0G	1008-2B331J1G
C16	CAP., SM, 15pF CER., 0805, C0G	1008-1A150J1G
C17	CAP., SM, 330pF CER., 1206,C0G	1008-2B331J1G
C19	CAP., 100uF DIP. TANT.,20%,20V	1054-7M107M20
	TUBING, TFE-260C,24AWG T/W,CLR	7610-260C24TW
C21	CAP., SM, 100pF CER., 0805,C0G	1008-2A101J1G
C22	CAP., SM, 100pF CER., 0805,C0G	1008-2A101J1G
C23	CAP., 220uF ELECTRO.,AXIAL,25V	1064-1EE221ML
C24	CAP., SM, 1.0pF CER., 0805,C0G	1008-0A109J1G
C25	CAP., SM, 1nF CER,0805,X7R,50V	1008-3A102K5R
C26	CAP., SM, 10uF TANT., 10%, 35V	1055-6D106K35
C27	CAP., SM, 1.0pF CER., 0805,C0G	1008-0A109J1G
D1	DIODE, MA4ST083 HYP/ABR,SOT-23	2106-MA4ST083
D2	DIODE, BAS16, SWITCHING, SOT23	2100-BAS16000
D3	DIODE, BAS16, SWITCHING, SOT23	2100-BAS16000
D4	DIODE, MA4ST083 HYP/ABR,SOT-23	2106-MA4ST083
L1	INDUCTOR,SM,330nH CER,10%,1008	1256-2BR3300K
L2	INDUCTOR,SM,330nH CER,10%,1008	1256-2BR3300K
L3	INDUCTOR,SM,330nH CER,10%,1008	1256-2BR3300K
L4	INDUCTOR, SM,18nH CER,10%,1008	1256-1B18N00K
L5	INDUCTOR, SM,18nH CER,10%,1008	1256-1B18N00K
L6	INDUCTOR,SM,330nH CER,10%,1008	1256-2BR3300K

Ref Desig	Description	Part No
P6 - P13	INTERCONNECT/LP,1ROW x 1PIN,Au	5015-IL101G07
PCB	PCB, VCO, MT-3/400 SYNTHESIZER	4309-33932714
Q1	JFET, MBFJ309L,RF,N-CH.,SOT-23	2141-MBFJ309L
Q2	TRANSISTOR, NE02139,HIGH FREQ.	2124-NE021390
R1	RES., SM, 100R 0805, 1%,100ppm	1150-2A1000FP
R2	RES., SM, 604R 0805, 1%,100ppm	1150-2A6040FP
R3	RES., SM, 681R 0805, 1%,100ppm	1150-2A6810FP
R4	RES., SM, 49R9 1206, 1%,100ppm	1150-1B49R9FP
R5	RES., SM, 2K00 0805, 1%,100ppm	1150-3A2001FP
R6	RES., SM, 1K00 0805, 1%,100ppm	1150-3A1001FP
R7	RES., SM, 100R 0805, 1%,100ppm	1150-2A1000FP
R8	RES., SM, 10R0 0805, 1%,100ppm	1150-1A10R0FP
R9	RES., SM, 100R 0805, 1%,100ppm	1150-2A1000FP
R10	RES., 2R7 METAL FILM, 5%, 0.5W	1101-0A02R7JI
	TUBING, TFE-260C,14AWG T/W,CLR	7610-260C14TW
R11	RES., SM, 3K01 0805, 1%,100ppm	1150-3A3011FP
R12	RES., SM, 5K11 0805, 1%,100ppm	1150-3A5111FP
R13	TEMPSISTOR, 1K2,PTC, 10%,AXIAL	1181-3AGD122K
TL1	COAX, 1.27”LONG,.17”CENTRE CON	7493-A1008402
	TUBING, TFE-260C,22AWG T/W,CLR	7610-260C22TW

406 - 470 MHZ VCO
MECHANICAL PARTS LIST

Description	Part No.	Qty.
SHIELD, VCO, OS-3/400 SYNTH.	3702-67300950	1

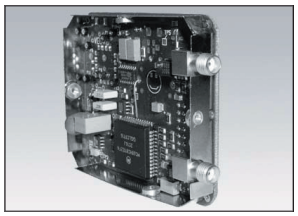
LOW CURRENT SYNTHESIZER OS(R/T)-3 806-869 MHZ

Covers Models:

OSR-3/770
OSR-3/815
OSR-3/860

OST-3/815
OST-3/860

	Transmitters			Receivers		
Radio Frequency	**Transmitter Model & Frequency Range**	**Low Current Synthesizer Model & Synthesizer Frequency**	**Location in Manual**	**Receiver Model & Frequency Range**	**Low Current Synthesizer Model & Synthesizer Frequency**	**Location in Manual**
VHF 132-174 MHz	Requires Enhanced Synthesizer	Not covered in this Manual	Not covered in this Manual	VR-3/140 132-150 MHz	OSR-3/162 150-174 MHz	See Page 5 LOW CURRENT SYNTHESIZER OSR-3 132 - 174 MHZ
				VR-3/160 150-174 MHz	OSR-3/141 128-150 MHz	
UHF 406-470 MHz				UR-3/420 406-430 MHz	OSR-3/440 427.4-451.4 MHz	See Page 31 LOW CURRENT SYNTHESIZER OSR-3 406 - 470 MHZ
				UR-3/460 450-470 MHz		
UHF 800 806-869 MHz	UT-3/815 806-824 MHz	OST-3/815 806-824 MHz	See Page 59 LOW CURRENT SYNTHESIZER OSR-3 806 - 896 MHZ	UR-3/815 806-824 MHz	OSR-3/770 761-779 MHz	See Page 59 LOW CURRENT SYNTHESIZER OSR-3 806 - 869 MHZ
	UT-3/860 851-869 MHz	OST-3/860 851-869 MHz		UR-3/860 851-869 MHz	OSR-3/815 806-824 MHz	
UHF 900 896-960 MHz	UT-3/900 896-902 MHz	OST-3/899 896-902 MHz	See Page 83 LOW CURRENT SYNTHESIZER OSR-3 896 - 960 MHZ	UR-3/900 896-902 MHz	OSR-3/860 851-869 MHz	
	UT-3/930 928-935 MHz	OST-3/932 896-902 MHz		UR-3/930 928-935 MHz	OSR-3/885 883-890 MHz	See Page 83 LOW CURRENT SYNTHESIZER OSR-3 896 - 960 MHZ
	UT-3/950 935-960 MHz	OST-3/948 896-902 MHz		UR-3/950 935-960 MHz	OSR-3/901 890-915 MHz	



GENERAL INFORMATION

INTRODUCTION

The OS(R/T)-3 Low Current Synthesizer Module produces a low distortion, high stability, FM modulated (transmitter) or unmodulated (receiver) RF signal covering a frequency band of 806 - 869 MHz. It achieves a ±1 ppm frequency stability from -40°C to +60°C with its own internal reference, or it can be slaved to an external reference signal of desired stability. A common synthesizer module works in both receivers and transmitters and is easily removed for programming, calibration, or repair.

OS(R/T) LOW CURRENT SYNTHESIZER FAMILY MODELS

The OS-3 Low Current Synthesizer module family forms an integral component of the MT-3 receiver and transmitter product line. In transmitters, the OS-3 synthesizer provides a modulated low level RF signal to the Power Amplifier module. In receivers, the OS-3 synthesizer provides a low noise local oscillator signal that directly drives the mixer circuitry. It is important to establish the correct synthesizer model number of interest in order to direct attention to specific documented information. The specific model number is printed on the synthesizer module top cover.

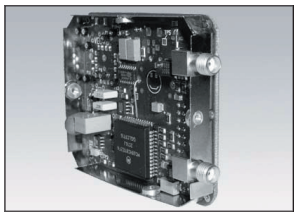
This Section of the manual covers the following Synthesizers:

- OST-3/815 - synthesized, installed in transmitter, 806 - 824 MHz RF output.
- OST-3/860 - synthesized, installed in transmitter, 851 - 869 MHz RF output.
- OSR-3/770 - synthesized, installed in receiver, 761 - 779 MHz RF output.
- OSR-3/815 - synthesized, installed in receiver, 806 - 824 MHz RF output.
- OSR-3/860 - synthesized, installed in receiver, 851 - 869 MHz RF output.

Each model's band of operation in a given frequency band is determined by select components on the Synthesizer board.

PERFORMANCE SPECIFICATIONS

Type:	NBFM 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 shown in [ ] brackets.	761 MHz - 779 MHz [± 1.0 MHz] (OSR-3/770). 806 MHz - 824 MHz [Full Band] (OST-3/815, OSR-3/815). 851 MHz - 869 MHz [Full Band] (OST-3/860, OSR-3/860).
Output Power:	+4 dBm to 7 dBm into 50Ω.
External Reference Input:	External reference input signal via SMB connector J1. Input level 2.0 Vpp to 5.0 Vpp. Input impedance 50Ω. Input frequency 9.6 MHz.



THEORY OF OPERATION

INTERNAL POWER AND CONTROL

The synthesizer operates from +9.5 Vdc applied to connector pin P1-2. Current drain is approximately 45mA. Regulator IC U1 provides continuously regulated +5.0 Vdc to the reference TCXO. Regulator IC U3 supplies regulated + 5.0 Vdc to all other synthesizer circuitry including the VCO, synthesizer IC U4, and microprocessor U6. Supply U3 is turned on by applying +9.5 Vdc to synthesizer pin P2-4. For receiver applications, the synthesizer is always operating with the enable line P2-4 being permanently connected to +9.5 Vdc. In transmitter applications, pin P2-4 is controlled by MT-3 Transmitter Board jumper J18 which selects the synthesizer's standby mode. In low current standby mode approximately 50 ms of transmitter turn on delay from PTT activation must be tolerated (settling time of synthesizer). For transmitter applications requiring only 10 ms of turn on delay, the synthesizer can be made to run continuously. This capability comes at the expense of an additional 45mA of transmitter standby current.

RF CIRCUITRY

The synthesizer itself is formed around a low power, single chip synthesizer IC U4. A 9.6 MHz reference signal is provided from either the internal TCXO (JU1-B), or an external source via SMA connector J4 and jumper JU1-A. If an external signal is used for the reference source, it must be of low phase noise, high stability, and between 2.0 Vpp and 5.0 Vpp. A sinusoidal signal shape is required for an external reference source. A poor quality reference source will degrade receiver/transmitter performance to unacceptable levels.

The 9.6 MHz reference source is divided down to establish a channel selection step size of 12.5 kHz, or 25 kHz. A third order passive loop filter comprised of C10, C11, C14, R11, and R12, is employed to achieve the required noise performance, modulation and worst case switching time of 50 ms. A small sample of RF energy is coupled from the VCO output to the synthesizer IC U4 prescaler input (pin 8). FM modulation of the VCO from 60 Hz to 3 kHz, is provided through the baseband input pin P1-1 and installation of jumper JU3-B. A 1 kHz sine wave with a level of approximately 315 mVrms at P1-1 provides FM deviation of 3.0 kHz. The output of the VCO is amplified / buffered by the MMIC amplifier U7 and filtered by the bandpass filter F1. SMA connector J5 provides frequency coverage with an RF output level of approximately +3 dBm into a 50Ω load. Synthesizer frequency band selection is made by the appropriate selection of VCO and bandpass filter F1.

MICROPROCESSOR CONTROLLER

Microprocessor U6 provides control of the synthesizer module. It communicates with synthesizer IC U4, monitors the synthesizer lock detect, manages PTT input/output, and determines the operating frequency from either four rotary BCD switches or four externally driven channel select lines. It also communicates with an external factory programmer through I/O lines TX DATA (P1-17), RX DATA (P1-9), and BOOTSTRAP (P2-2). The external programmer places the operating program in non volatile microprocessor memory. It is also used to program 15 user channel selections.

The microprocessor spends the majority of time in a low power sleep state. Wake up is achieved when external events such as PTT action, synthesizer lock failure, or a change in channel selection dictate immediate action. An internal “watchdog” timer provides robust software protection in all operating modes.

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 (grounded), the synthesizer will scan four BCD switches connected to SW1 COM - SW4 COM and PC4 - PC7 to establish the operating frequency. The BCD switches are located on the receiver and transmitter main circuit boards.

Note: 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 may be used for external frequency control. They are normally pulled low via jumper sets located on the M3 motherboard subrack.

If the channel select lines are pulled high to +9.5 Vdc in any combination resulting in a binary code greater than 0000 (all low), then the frequency is established as the preprogrammed entry in a table containing 15 separate frequency settings. For example; if all of the channel select lines are pulled high then a binary code of 1111 results which selects the frequency entry from the 15th table position. CHAN SEL3 is the most significant bit of the binary channel selection code. The channel table is normally programmed at the factory for those applications requiring specialized remote control of frequency. These programmed channel assignments are stored in non-volatile microprocessor EEPROM and are not susceptible to inadvertent erasure.

In transmitters, the synthesizer operating frequency is the transmitter operating frequency; however, for receivers, an IF Offset correction factor (45 MHz for OSR-3 806 - 869 MHz models) must be added to or subtracted from the synthesizer operating frequency in order to determine the actual receive frequency. Refer to the channel designation table documentation provided with the transmitter or receiver modules for simplified channel number and frequency information.

SYNTHESIZER BASE AND FREQUENCY INCREMENT TABLE

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

Model Number	Freq. Range	Base Frequency	Freq. Increment
OST-3/815	806-824 MHz	806 MHz	12.5 kHz
OST-3/860	851-869 MHz	851 MHz	12.5 kHz
OSR-3/770	761-779 MHz	761 MHz	12.5 kHz
OSR-3/815	860-824 MHz	860 MHz	12.5 kHz
OSR-3/860	851-869 MHz	851 MHz	12.5 kHz

CHANNEL SELECTION

OS-3 synthesizers have been designed to generate frequencies in 12.5 kHz. BCD channel switch settings from 0000 to 1440 (for 806-824 MHz and 851-869 MHz) with 12.5 kHz increments. The switch settings are scanned by the synthesizer module when the receiver is first powered up, and the desired local oscillator frequency is generated. Calculation of the operating frequency is determined as follows:

OST-3 806-869 MHz Channel Selection

OST-3/815 (installed in UT-3/815 Tx, 806-824 MHz)

BCD switch settings from 0000 to 1440:

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

Example: An OST-3/815 synthesizer has a base frequency of 806 MHz. The selected channel number is 0988. Therefore the receiver frequency is:

((0988 x 12.5 kHz) + 806 MHz) = 818.3500 MHz

OST-3/860 (installed in UT-3/860 Tx, 851-869 MHz)

BCD switch settings from 0000 to 1440:

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

Example: An OST-3/860 synthesizer has a base frequency of 851 MHz. The selected channel number is 0988. Therefore the receiver frequency is:

((0988 x 12.5 kHz) + 851 MHz) = 863.3500 MHz

OSR-3 806-869 MHz Channel Selection

OSR-3/770 (installed in UR-3/815 Rx, 806-824 MHz)

BCD switch settings from 0000 to 1440:

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

Example: An OSR-3/770 synthesizer has a base frequency of 761 MHz. The IF offset correction factor is 45 MHz.The selected channel number is 0988. Therefore the receiver frequency is:

((0988 x 12.5 kHz) + (761 MHz + 45 MHz)) = 818.3500 MHz

OSR-3/815 (installed in UR-3/860 Rx, 851-869 MHz)

BCD switch settings from 0000 to 1440:

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

Example: An OSR-3/815 synthesizer has a base frequency of 806 MHz. The IF offset correction factor is 45 MHz.The selected channel number is 0988. Therefore the receiver frequency is:

((0988 x 12.5 kHz) + (806 MHz + 45 MHz)) = 863.3500 MHz

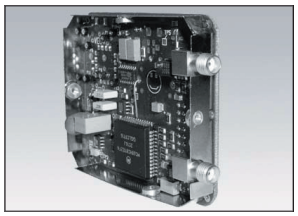
OSR-3/860 (installed in UR-3/900 Rx, 896-902 MHz)
Note: UR-3/900 uses 6.25 kHz channel spacing.

BCD switch settings from 0000 to 0960:

Multiply the switch setting by 6.25 kHz and add the result to the synthesizer base frequency plus the IF offset.

Example: An OSR-3/860 synthesizer has a base frequency of 851 MHz. The IF offset correction factor is 45 MHz.The selected channel number is 0734. Therefore the receiver frequency is:

((0734 x 6.25 kHz) + (851 MHz + 45 MHz)) = 900.5875 MHz



SYNTHESIZER ALIGNMENT

GENERAL

OS(R/T)-3 Low Current Synthesizer alignment is simplified by using a Type 84 subrack and RF extender card/cable to provide receiver or transmitter power and signal interconnection. Alternatively, +9.5 Vdc may be applied directly to a receiver or transmitter module through positive connection to pins B6 / Z6, and negative connection to pins B30 / Z30 / B32 / Z32. Receiver balanced audio (600 Ω) is available at pins B26 and Z26.

REPAIR NOTE

OS(R/T)-3 Low Current Synthesizer employs a high percentage of surface mount components that should not be removed or replaced using an ordinary soldering iron. Removal and replacement of surface mount components should be performed only with specifically designed surface mount rework and repair stations complete with Electrostatic Discharge (ESD) protection.

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

RECOMMENDED TEST EQUIPMENT

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

Power supply - Regulated +9.5 Vdc 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 frequency locked to an external reference (WWVH, GPS, Loran C) so that the internal high stability local oscillator may be accurately set to within its ±1 ppm frequency tolerance.

OS(R/T)-3 SYNTHESIZER FACTORY CONFIGURATION

All solder jumpers are clearly marked on the underside of the synthesizer module. The following list details the required jumper configuration for the two synthesizer operating modes:

1) Internal reference. Install jumper JU1B (Standard). The internal temperature compensated crystal oscillator (TCXO) provides the reference signal with a stability not exceeding ±1 ppm from -40°C to + 60°C.
2) External reference input. Install jumper JU1A. This mode reduces receiver current by approximately 4 mA by eliminating the internal TCXO reference and is used in applications requiring better than ±1 ppm frequency stability.

Remember: Care must be exercised when installing the reconfigured synthesizer module back into the transmitter board or the IF/audio board. Pay careful attention to pin alignment before pressing the synthesizer module into it's mating sockets.

OS(R/T)-3 SYNTHESIZER ALIGNMENT

General

Under normal circumstances, the alignment procedure is accomplished without removing the synthesizer from the MT-3 Receiver IF/ Audio Board or the MT-3 Transmitter Board. Alignment simply involves setting the internal TCXO reference frequency (if one is installed). A change in receiver or transmitter operating frequency greater than ±5 MHz from an initial factory setting requires a more involved synthesizer alignment procedure. To convert a synthesizer with an internal reference source to a synthesizer requiring an external reference signal or vice-versa is done through the appropriate selection of jumper JU1 A or B.

Synthesizer Test Points

TP1	+5.0 ± 0.1 Vdc. U1 positive regulator output.
TP2	+5.0 ± 0.1 Vdc. U3 positive regulator output (remotely controlled via pin P2-4).
TP3	Lock detect. Logic high (5.0 Vdc) = locked condition.
TP4	PLL error voltage. Ranges from +0.5 to 4.5 Vdc depending on frequency.
TP5	+5.0 Vdc ± 0.5 Vdc. Buffer amplifier bias. (access under VCO board).
TP6	+9.5 Vdc. U3 positive regulator input (remotely controlled via pin P2-4).

Synthesizer Installation and Removal

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 transmitter main circuit board by applying pressure in a rotating fashion about 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. Remove the two remaining synthesizer cover screws and cover to expose the synthesizer circuitry. Carefully reinsert the synthesizer module, without the cover, back into the transmitter main circuit board. Visually line up the connector pins and sockets before applying firm reinsertion pressure. Failure to do so could lead to damaged synthesizer module pins. Reconnect the SMA RF output connector. The alignment procedure may now be performed. Installation of the synthesizer is performed in a fashion reverse to the above procedure. It is important to emphasize the importance of connector pin alignment prior to any application of reinsertion force

OS(R/T)-3 806 - 869 MHz Frequency Adjustment

Adjustment to frequency can only be made if the synthesizer module has been configured with an internal reference source (Standard). Aligning the internal reference to precisely 9.600 000 MHz is best done by monitoring the synthesizer output and adjusting the synthesizer fine frequency potentiometer until the desired channel frequency is measured. The procedure is outlined below.

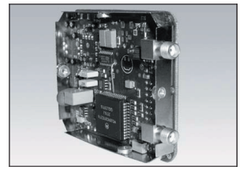
Connect the radio communications test set through a short section of low loss 50 Ω coaxial cable to the synthesizer module RF output jack. This involves disconnecting the short cable leading to the RF input of the receiver front end or transmitter amplifier. Select channel 0000 through the BCD frequency selection switches on the receiver IF / Audio board or transmitter main board. Turn the receiver or transmitter on and wait a few minutes for the oscillator to stabilize. The measured signal should be at or close to the desired channel frequency. It should be noted that ±1 ppm at 806 MHz represents a frequency tolerance of ±806 Hz.

Adjust the synthesizer fine frequency adjust potentiometer until the correct frequency is measured. Access to this potentiometer is made available through an opening in the synthesizer cover. A power level of approximately +3 dBm should be measured at the RF output jack of the synthesizer. Reconnect the short cable leading to the RF input of the receiver front end or transmitter amplifier.

Modifications for LTR™

Modifications of the OS-3 Synthesizer applies to transmitters only. For board modifications for the LTR™are shown in the table below. Refer to the Component Layout and Schematic diagram corresponding to the frequency band of your transmitter.

Component	U-3/800
C10	68nF
C11	1.0µF
C14	15nF
C18	100nF
R11	3K48
R12	16k2
R14	10k0
R15	100R
R17	4K75



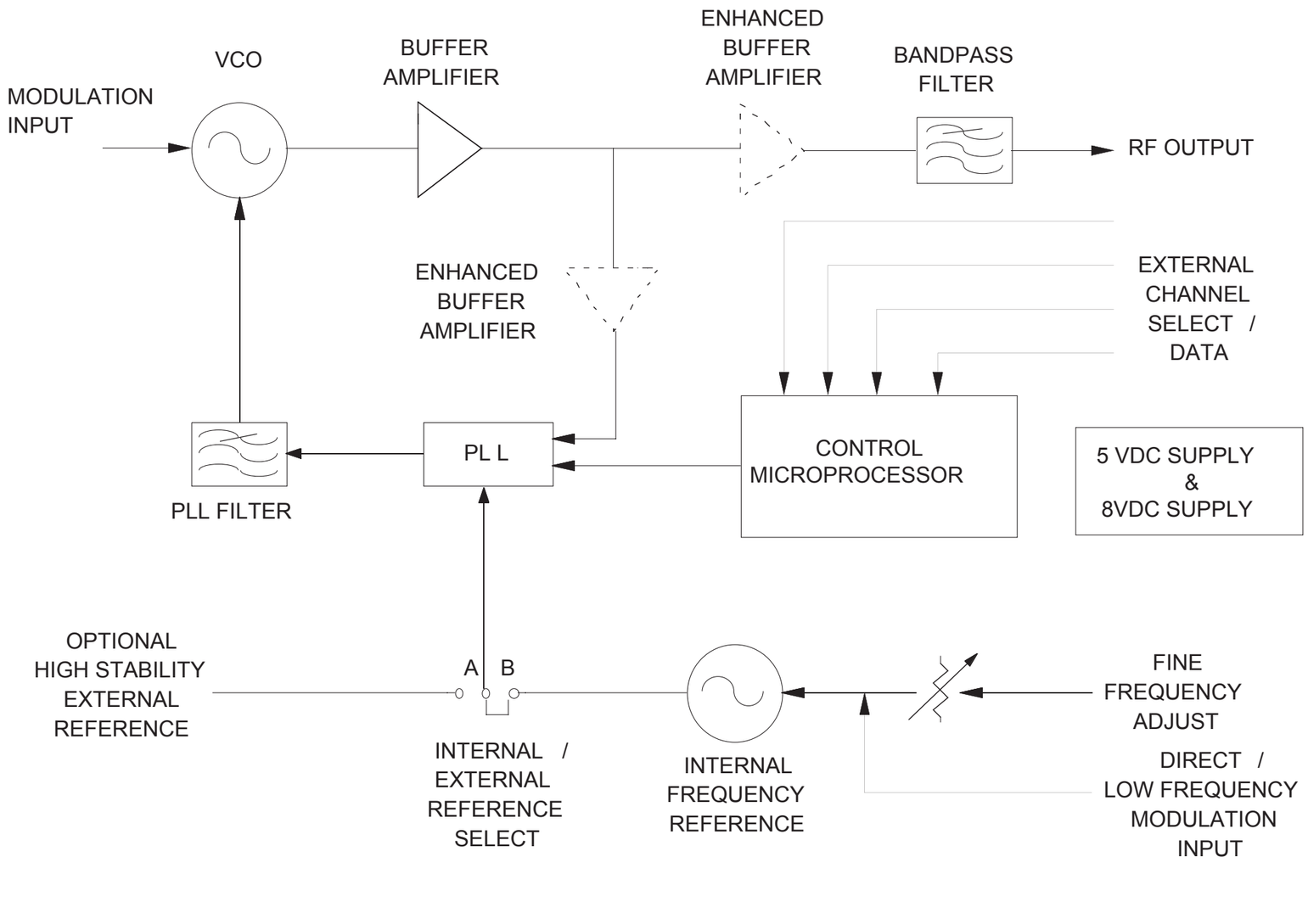
ILLUSTRATIONS AND SCHEMATICS

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	43-912010 Indicates circuit board version 1.0
PCB number	50002-02 Indicates circuit board version 2 (no decimal version)

SYNTHESIZER MODULE BLOCK DIAGRAM



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OS(R/T)-3 806-869 MHZ SYNTHESIZER COMPONENT LAYOUT (TOP)

COMPONENT LOCATION TABLE																				
DES	PG	LC	DES	PG	LC	DES	PG	LC	DES	PG	LC	DES	PG	LC	DES	PG	LC	DES	PG	LC
C1	B	E1	D1	T	C1	Q1	B	E5	R21	T	C3	TCXO1	T	B4						
C2	T	D5	D2	T	C1	Q2	B	E6	R22	T	D4									
C3	T	E5				Q3	T	D2	R23	B	D3	TP1	T	E6						
C4	B	E1	F1	T	C6	Q4	B	C3	R24	T	D4	TP2	T	E1						
C5	T	C4				Q7	T	D2	R25	T	E4	TP3	T	C3						
C6	T	C5	J4	T	B6	Q8	B	E4	R26	T	E1	TP4	T	C1						
C7	T	A1	J5	T	D6	Q9	B	E4	R27	T	E2	TP5	T	A4						
C8	T	A2	J14	T	E6	Q10	B	D4	R28	T	C3	TP6	T	E1						
C9	B	B4				Q11	B	D4	R29	T	C3									
C10	T	C2	JU1	B	A4				R30	B	C3	U1	T	E6						
C11	T	D2	JU2	T	B5	R1	B	E5	R31	T	C3	U2	B	C3						
C12	B	B5	JU3	B	C5	R2	B	E5	R32	T	D4	U3	T	E1						
C14	T	C2	JU4	T	D1	R3	T	D4	R33	T	E4	U4	T	B3						
C15	T	B3	JU5	T	B5	R4	T	B5	R34	T	D5	U5	T	C3						
C16	T	B3	JU6	B	C2	R5	B	A1	R35	T	D5	U6	T	D3						
C17	B	B3				R6	T	B5	R36	T	D2	U7	T	A5						
C18	T	C2	L1	T	E5	R7	T	B5	R37	B	D4									
C19	T	B1	L2	T	A5	R8	T	B3	R38	B	D4	VCO	T	B2						
C20	T	D1				R9	T	B4	R39	B	D4									
C21	T	E1	P1	B	D2	R10	T	E2	R40	B	D5	X1	B	E3						
C22	T	E5	P2	B	E5	R11	T	D2	R41	B	E3									
C23	T	E4	P3	B	A4	R12	T	C1	R42	B	E3									
C24	B	D3	P6	T	B1	R13	B	B5	R43	B	D3									
C25	B	D3	P7	T	B2	R14	B	C6	R44	B	D4									
C26	B	C2	P8	T	B1	R15	B	B5	R48	T	A2									
C31	T	B2	P9	T	A1	R16	T	B5	R49	T	A3									
C32	T	A4	P10	T	B2	R17	B	C6	R50	T	A2									
C34	T	B4	P11	T	C2	R18	B	C6	R51	T	A3									
C35	T	A5	P12	T	C2	R19	B	C4	R52	T	A4									
C36	T	A5	P13	T	A2	R20	T	C5	R53	B	E1									

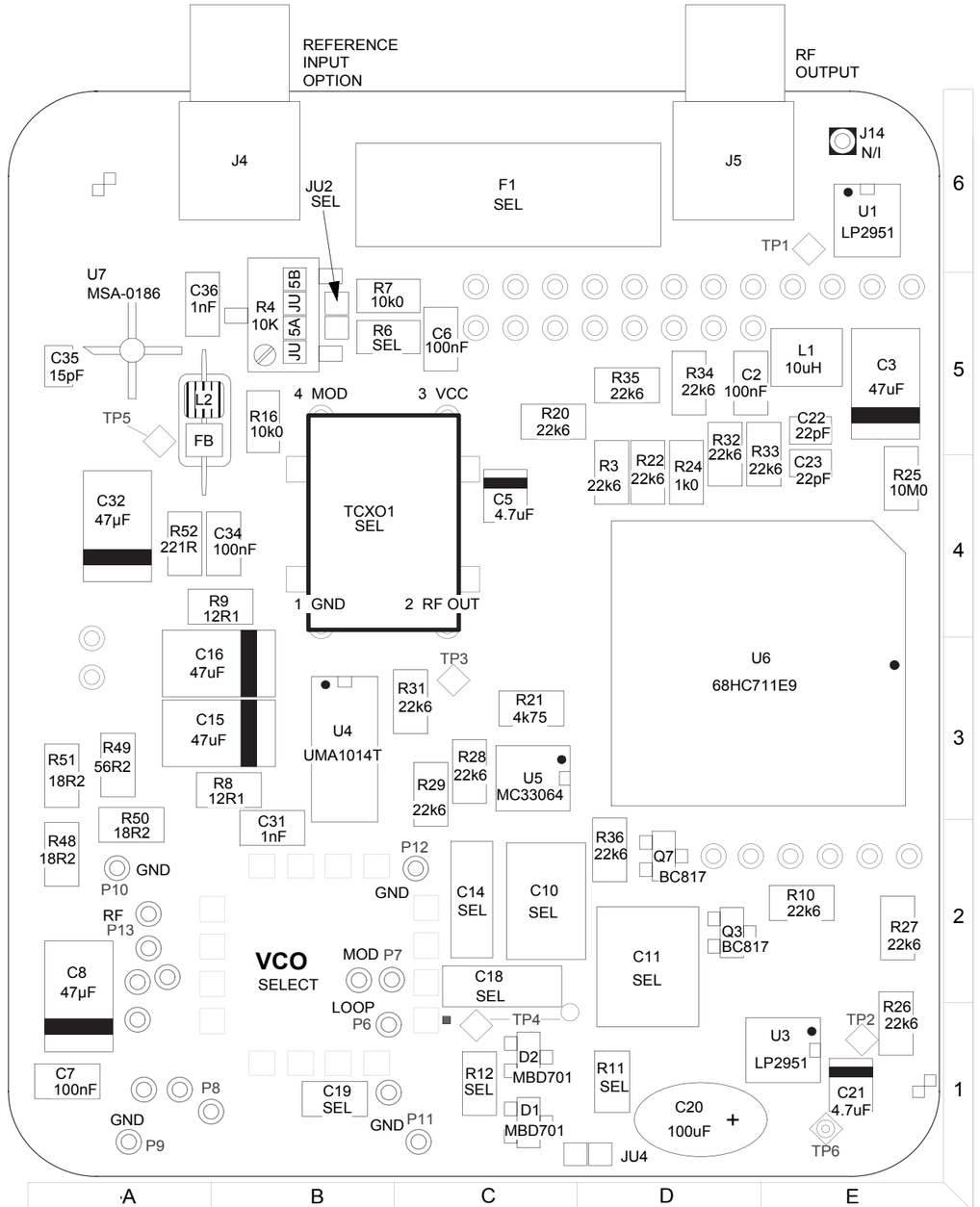
T - Top Side Component Layout
B - Bottom Side Component Layout

SYTH MODEL / VCO MODULE SELECT TABLE		
SYNTH MODEL	**VCO TYPE**	**C19***
OSR-3/770	MQC505-766	NOT INSTALLED
	VCO190-773T*	10nF
OSR-3/815	MQC505-810	NOT INSTALLED
	VCO190-810T*	10nF
OSR-3/860	MQC505-860	NOT INSTALLED
	VCO190-864T*	10nF
OST-3/815	MQC505-810	NOT INSTALLED
	VCO190-810T*	10nF
OST-3/860	MQC505-860	NOT INSTALLED
	VCO190-864T*	10nF

DESIG.	806 - 869 MHZ STANDARD VERSION	806 - 869 MHZ LTR™ VERSION
C10	470 nF	68 nF
C11	2.2 µF	1.0 µF
C14	33 nF	15 nF
C18	100 nF	100 nF
R11*	2K80	3K48
R12*	2K37	16K2
JU2	NOT INSTALLED	INSTALLED

TCXO SELECT COMPONENTS		
DESIG.	**RAKON (9.6000 MHZ)**	**SARONIX (S2045-9.6000)**
R6*	33K2	10K0

* SURFACE MOUNT COMPONENTS



FACTORY INSTALLED JUMPERS

43-914921-03-T-P1-AAAAAA

OS(R/T)-3 806-869 MHZ SYNTHESIZER COMPONENT LAYOUT (BOTTOM)

COMPONENT LOCATION TABLE																
DES	PG	LC	DES	PG	LC	DES	PG	LC	DES	PG	LC	DES	PG	LC
C1	B	E1	D1	T	C1	Q1	B	E5	R21	T	C3	TCXO1	T	B4
C2	T	D5	D2	T	C1	Q2	B	E6	R22	T	D4			
C3	T	E5				Q3	T	D2	R23	B	D3	TP1	T	E6
C4	B	E1	F1	T	C6	Q4	B	C3	R24	T	D4	TP2	T	E1
C5	T	C4				Q7	T	D2	R25	T	E4	TP3	T	C3
C6	T	C5	J4	T	B6	Q8	B	E4	R26	T	E1	TP4	T	C1
C7	T	A1	J5	T	D6	Q9	B	E4	R27	T	E2	TP5	T	A4
C8	T	A2	J14	T	E6	Q10	B	D4	R28	T	C3	TP6	T	E1
C9	B	B4				Q11	B	D4	R29	T	C3			
C10	T	C2	JU1	B	A4				R30	B	C3	U1	T	E6
C11	T	D2	JU2	T	B5	R1	B	E5	R31	T	C3	U2	B	C3
C12	B	B5	JU3	B	C5	R2	B	E5	R32	T	D4	U3	T	E1
C14	T	C2	JU4	T	D1	R3	T	D4	R33	T	E4	U4	T	B3
C15	T	B3	JU5	T	B5	R4	T	B5	R34	T	D5	U5	T	C3
C16	T	B3	JU6	B	C2	R5	B	A1	R35	T	D5	U6	T	D3
C17	B	B3				R6	T	B5	R36	T	D2	U7	T	A5
C18	T	C2	L1	T	E5	R7	T	B5	R37	B	D4			
C19	T	B1	L2	T	A5	R8	T	B3	R38	B	D4	VCO	T	B2
C20	T	D1				R9	T	B4	R39	B	D4			
C21	T	E1	P1	B	D2	R10	T	E2	R40	B	D5	X1	B	E3
C22	T	E5	P2	B	E5	R11	T	D2	R41	B	E3			
C23	T	E4	P3	B	A4	R12	T	C1	R42	B	E3			
C24	B	D3	P6	T	B1	R13	B	B5	R43	B	D3			
C25	B	D3	P7	T	B2	R14	B	C6	R44	B	D4			
C26	B	C2	P8	T	B1	R15	B	B5	R48	T	A2			
C31	T	B2	P9	T	A1	R16	T	B5	R49	T	A3			
C32	T	A4	P10	T	B2	R17	B	C6	R50	T	A2			
C34	T	B4	P11	T	C2	R18	B	C6	R51	T	A3			
C35	T	A5	P12	T	C2	R19	B	C4	R52	T	A4			
C36	T	A5	P13	T	A2	R20	T	C5	R53	B	E1			

T - Top Side Component Layout
B - Bottom Side Component Layout

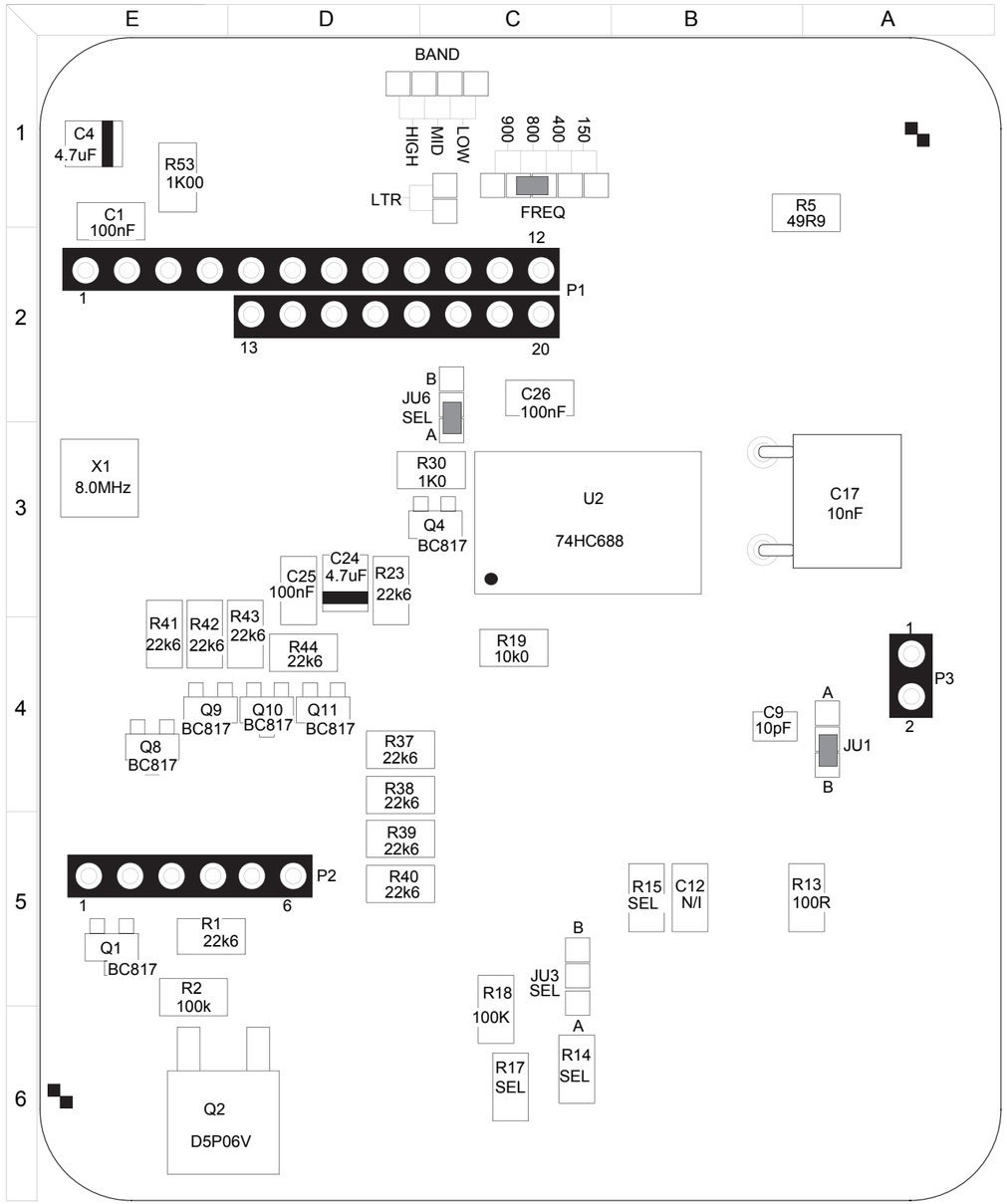
SYTH MODEL / VCO MODULE SELECT TABLE				
SYNTH MODEL	**VCO TYPE**	**JU3**	**R15**	**R17**
OSR-3/770	MQC505-766	NOT INSTALLED	1K00	0R0
	VCO190-773T*	NOT INSTALLED	150R	0R0
OSR-3/815	MQC505-810	NOT INSTALLED	1K00	0R0
	VCO190-810T*	NOT INSTALLED	150R	0R0
OSR-3/860	MQC505-860	NOT INSTALLED	1K00	0R0
	VCO190-864T*	NOT INSTALLED	150R	0R0
OST-3/815	MQC505-810	B	1K00	4K75
	VCO190-810T*	A	150R	4K75
OST-3/860	MQC505-860	B	1K00	4K75
	VCO190-864T*	A	150R	4K75

68HC711E9 BOOTSTRAP / NORMAL MODE		
DESIG.	**NORMAL MODE**	**BOOTSTRAP MODE**
JU6	'A' POSITION	'B' POSITION

TCXO SELECT COMPONENTS		
DESIG.	**RAKON (9.6000 MHZ)**	**SARONIX (S2045-9.6000)**
R6*	33K2	10K0

* SURFACE MOUNT COMPONENTS

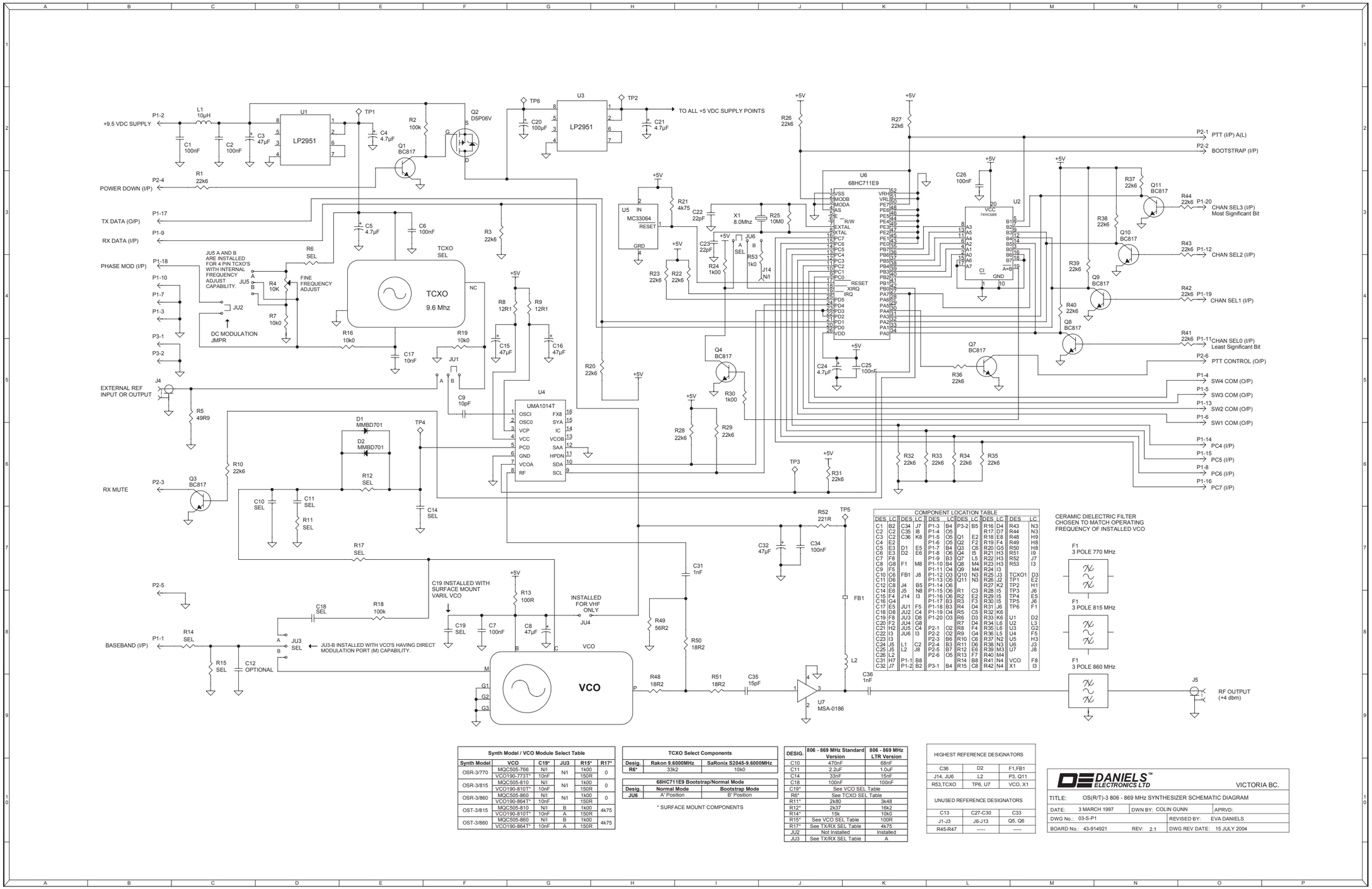
DESIG.	806 - 869 MHZ STANDARD VERSION	806 - 869 MHZ LTR™ VERSION
R14	15K0	10K0
R15	SEE VCO SELECT TABLE	100R
R17	SEE VCO SELECT TABLE	4K75
JU3	SEE VCO SELECT TABLE	A



INSTALLED JUMPERS

43-914921-03-B-P1-AAAAAA

OS(R/T)-3 806-869 MHZ SYNTHESIZER SCHEMATIC DIAGRAM



COMPONENT LOCATION TABLE																
DES	LC	DES	LC	DES	LC	DES	LC	DES	LC	DES	LC	DES	LC	DES	LC	
C1	I82	C34	J7	P1-3	B4	P3-2	B5	R16	D4	R43	N3					
C2	C2	C35	I8	P1-4	O5			R17	D7	R44	N3					
C3	C2	C36	K8	P1-5	O5	Q1	E2	R18	E8	R48	H9					
C4	E2			P1-6	O5	Q2	F2	R19	F4	R49	H8					
C5	E3	D1	E5	P1-7	B4	Q3	O6	R20	G5	R50	H8					
C6	E3	D2	E6	P1-8	O4	I5	R21	H5	R51	I9						
C7	F8			P1-9	B3	Q7	L5	R22	H3	R52	J7					
C8	G8	F1	M8	P1-10	B4	Q8	M4	R23	H3	R53	I3					
C9	F5			P1-11	O4	Q9	M4	R24	I3							
C10	C6	FB1	J8	P1-12	O3	Q10	N3	R25	J3	TCXO1	D3					
C11	D6			P1-13	O6	Q11	N3	R26	J2	TP1	E2					
C12	C8	J4	B5	P1-14	O6			R27	K2	TP2	H1					
C14	E6	J5	N8	P1-15	O6	R1	C3	R28	I5	TP3	J6					
C15	F4	J14	I3	P1-16	O6	R2	E2	R29	I5	TP4	E5					
C16	G4			P1-17	B3	R3	F3	R30	I5	TP5	J6					
C17	E5	JU1	F5	P1-18	B3	R4	D4	R31	J6	TP6	F1					
C18	D8	JU2	C4	P1-19	O4	R5	O5	R32	K6							
C19	F8	JU3	D8	P1-20	O3	R6	D3	R33	K6	U1	D2					
C20	F2	JU4	C8			R7	D4	R34	L6	U2	L3					
C21	H2	JU5	C4	P2-1	O2	R8	F4	R35	L6	U3	G2					
C22	I3	JU6	I3	P2-2	O2	R9	G4	R36	L5	U4	F5					
C23	I3			P2-3	B6	R10	O6	R37	N2	U5	H3					
C24	J5	L1	C2	P2-4	B3	R11	D6	R38	N3	U6	J3					
C25	J5	L2	J8	P2-5	B7	R12	E6	R39	M3	U7	J8					
C26	L2			P2-6	O5	R13	F7	R40	M4							
C31	H7	P1-1	B8			R14	B8	R41	N4	VCO	F8					
C32	J7	P1-2	B2	P3-1	B4	R15	C8	R42	N4	X1	I3					

Synth Model / VCO Module Select Table					
Synth Model	VCO	C19*	JU3	R15*	R17*
OSR-3/770	MQC505-766	N/I	N/I	1k00	0
	VCO190-7731*	10nF		150R	
OSR-3/815	MQC505-810	N/I	N/I	1k00	0
	VCO190-8107*	10nF		150R	
OSR-3/860	MQC505-860	N/I	N/I	1k00	0
	VCO190-8641*	10nF		150R	
OST-3/815	MQC505-810	N/I	B	1k00	4k75
	VCO190-8107*	10nF	A	150R	
OST-3/860	MQC505-860	N/I	B	1k00	4k75
	VCO190-8641*	10nF	A	150R	

TCXO Select Components		
Desig.	Rakon 9.6000MHz	SaRonix S2045-9.6000MHz
R6*	33k2	10k0

68HC711E9 Bootstrap/Normal Mode		
Desig.	Normal Mode	Bootstrap Mode
JU6	A' Position	B' Position

* SURFACE MOUNT COMPONENTS

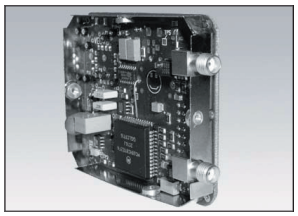
DESIG	806 - 869 MHz Standard Version	806 - 869 MHz LTR Version
C10	470nF	68nF
C11	2.2uF	1.0uF
C14	33nF	15nF
C18	100nF	100nF
C19*	See VCO SEL Table	
R6*	See TCXO SEL Table	
R11*	2k80	3k48
R12*	2k37	16k2
R14*	15k	10k0
R15*	See VCO SEL Table	100R
R17*	See TX/RX SEL Table	4k75
JU2	Not Installed	Installed
JU3	See TX/RX SEL Table	A

HIGHEST REFERENCE DESIGNATORS		
C36	D2	F1,FB1
J14, JU6	L2	P3, Q11
R53,TCXO	TP6, U7	VCO, X1

UNUSED REFERENCE DESIGNATORS		
C13	C27-C30	C33
J1-J3	J6-J13	Q5, Q6
R45-R47	------	------

DANIELS™ ELECTRONICS LTD — VICTORIA BC.

TITLE:	OS(R/T)-3 806 - 869 MHz SYNTHESIZER SCHEMATIC DIAGRAM		
DATE:	3 MARCH 1997	DWN BY: COLIN GUNN	APRVD:
DWG No.:	03-S-P1		REVISED BY: EVA DANIELS
BOARD No.:	43-914921 REV: 2.1		DWG REV DATE: 15 JULY 2004



PARTS LIST

806 - 869 MHZ
LOW CURRENT SYNTHESIZER
ELECTRICAL PARTS LIST

Ref Desig.	Description	Part No	OSR-3/770	OSR-3/815	OSR-3/860	OST-3/815	OST-3/860	LTR™ Option
C1	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•	•	•	•	•
C2	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•	•	•	•	•
C3	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16	•	•	•	•	•	•
C4	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•	•	•	•	•
C5	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•	•	•	•	•
C6	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•	•	•	•	•
C7	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•	•	•	•	•
C8	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16	•	•	•	•	•	•
C9	CAP., SM, 10pF CER., 0805, C0G	1008-1A100J1G	•	•	•	•	•	•
C10	CAP., 470nF FILM, MMK5,10%,63V	1016-5D474K63	•	•	•	•	•	
C10	CAP., 68nF FILM, MMK5,10%,63V	1016-4A683K63						•
C11	CAP., 2.2uF FILM, MMK5, 5%,50V	1016-6F225J50	•	•	•	•	•	
C11	CAP., 1.0uF FILM, MMK5, 5%,50V	1016-6D105K50						•
C14	CAP., 33nF FILM, MMK5, 10%,63V	1016-4A333K63	•	•	•	•	•	
C14	CAP., 15nF FILM, MMK5, 10%,63V	1016-4A153K63						•
C15	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16	•	•	•	•	•	•
C16	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16	•	•	•	•	•	•
C17	CAP., 10nF FILM, MMK5, 10%,63V	1016-4A103K63	•	•	•	•	•	•
C18	CAP., 100nF FILM, MMK5, 10%,63V	1016-5A104K63	•	•	•	•	•	
C18	CAP., 100nF FILM, MMK5, 10%,63V	1016-5A104K63						•
C19	CAP., SM, 10nF CER., 1206, X7R	1008-4B103K5R	•		•		•	†
C20	CAP., 100uF DIP. TANT.,20%,20V	1054-7M107M20	•	•	•	•	•	•
C21	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•	•	•	•	•
C22	CAP., SM, 22pF CER., 0805, C0G	1008-1A220J1G	•	•	•	•	•	•

*Based on the bandwidth of the synthesizer
†Based on the value associated with the synthesizer

Ref Desig.	Description	Part No	OSR-3/770	OSR-3/815	OSR-3/860	OST-3/815	OST-3/860	LTR™ Option
C23	CAP., SM, 22pF CER., 0805, C0G	1008-1A220J1G	•	•	•	•	•	•
C24	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•	•	•	•	•
C25	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•	•	•	•	•
C26	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•	•	•	•	•
C31	CAP., SM, 1nF CER., 1206, C0G	1008-3B102K1G	•	•	•	•	•	•
C32	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16	•	•	•	•	•	•
C34	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•	•	•	•	•
C35	CAP., SM, 15pF CER., 0805, C0G	1008-1A150J1G	•	•	•	•	•	•
C36	CAP., SM, 1nF CER., 1206, C0G	1008-3B102K1G	•	•	•	•	•	•
D1	DIODE, MMBD701,HOT CARR.,SOT23	2105-MMBD7010	•	•	•	•	•	•
D2	DIODE, MMBD701,HOT CARR.,SOT23	2105-MMBD7010	•	•	•	•	•	•
F1	FILTER, B/P, 735-805MHZ, 3POLE	1342-3P770M10	•					
F1	FILTER, B/P, 805-825MHZ, 3POLE	1342-3P815M10		•		•		•*
F1	FILTER, B/P, 850-870MHz, 3POLE	1342-3P860M10			•		•	•*
J4	CONN., SMA R/A JACK,PCMNT,.200	5112-J20010BG	•	•	•	•	•	•
J5	CONN., SMA R/A JACK,PCMNT,.200	5112-J20010BG	•	•	•	•	•	•
L1	INDUCTOR, SM, 10.0uH, 10%,1812	1255-4G10000K	•	•	•	•	•	•
L2	COIL, 5T,28AWG W/BEAD+HEATSHRK	1223-5T002880	•	•	•	•	•	•
P1-1	INTERCONNECT/LP,1ROW x12PIN,Au	5015-IL112G07	•	•	•	•	•	•
P1-13	INTERCONNECT/LP,1ROW x 8PIN,Au	5015-IL108G07	•	•	•	•	•	•
P2-1	INTERCONNECT/LP,1ROW x 6PIN,Au	5015-IL106G07	•	•	•	•	•	•
P3-1	INTERCONNECT/LP,1ROW x 2PIN,Au	5015-IL102G07	•	•	•	•	•	•
PCB	PCB, MT-3 SYNTHESIZER	4309-25914921	•	•	•	•	•	•
Q1	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025	•	•	•	•	•	•
Q2	MOSFET, D5P06V, P-CHAN., D-PAK	2144-D5P06V00	•	•	•	•	•	•
Q3	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025	•	•	•	•	•	•
Q4	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025	•	•	•	•	•	•
Q7	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025	•	•	•	•	•	•
Q8	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025	•	•	•	•	•	•
Q9	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025	•	•	•	•	•	•
Q10	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025	•	•	•	•	•	•
Q11	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025	•	•	•	•	•	•

*Based on the bandwidth of the synthesizer
†Based on the value associated with the synthesizer

Ref Desig.	Description	Part No	OSR-3/770	OSR-3/815	OSR-3/860	OST-3/815	OST-3/860	LTR™ Option
R1	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•	•
R2	RES., SM, 100K 1206, 1%,100ppm	1150-5B1003FP	•	•	•	•	•	•
R3	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•	•
R4	POT., SM, 10K, 12T, TOP ADJUST	1172-M30103W5	•	•	•	•	•	•
R5	RES., SM, 49R9 1206, 1%,100ppm	1150-1B49R9FP	•	•	•	•	•	•
R6	RES., SM, 33K2 1206, 1%,100ppm	1150-4B3322FP	•	•	•	•	•	•
R7	RES., SM, 10K0 1206, 1%,100ppm	1150-4B1002FP	•	•	•	•	•	•
R8	RES., SM, 12R1 1206, 1%,100ppm	1150-1B12R1FP	•	•	•	•	•	•
R9	RES., SM, 12R1 1206, 1%,100ppm	1150-1B12R1FP	•	•	•	•	•	•
R10	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•	•
R11	RES., SM, 2K80 1206, 1%,100ppm	1150-3B2801FP	•	•	•	•	•	
R11	RES., SM, 3K48 1206, 1%,100ppm	1150-3B3481FP						•
R12	RES., SM, 2K37 1206, 1%,100ppm	1150-3B2371FP	•	•	•	•	•	
R12	RES., SM, 16K2 1206, 1%,100ppm	1150-4B1622FP						•
R13	RES., SM, 100R 1206, 1%,100ppm	1150-2B1000FP	•	•	•	•	•	•
R14	RES., SM, 15K0 1206, 1%,100ppm	1150-4B1502FP	•	•	•	•	•	
R14	RES., SM, 10K0 1206, 1%,100ppm	1150-4B1002FP						•
R15	RES., SM, 1K00 1206, 1%,100ppm	1150-3B1001FP		•		•		
R15	RES., SM, 150R 1206, 1%,100ppm	1150-2B1500FP	•		•		•	
R15	RES., SM, 100R 1206, 1%,100ppm	1150-2B1000FP						•
R16	RES., SM, 10K0 1206, 1%,100ppm	1150-4B1002FP	•	•	•	•	•	•
R17	RES., SM, ZERO OHM JUMPER,1206	1150-0B0R0000	•	•	•			
R17	RES., SM, 4K75 1206, 1%,100ppm	1150-3B4751FP				•	•	•
R18	RES., SM, 100K 1206, 1%,100ppm	1150-5B1003FP	•	•	•	•	•	•
R19	RES., SM, 10K0 1206, 1%,100ppm	1150-4B1002FP	•	•	•	•	•	•
R20	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•	•
R21	RES., SM, 4K75 1206, 1%,100ppm	1150-3B4751FP	•	•	•	•	•	•
R22	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•	•
R23	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•	•
R24	RES., SM, 1K00 1206, 1%,100ppm	1150-3B1001FP	•	•	•	•	•	•
R25	RES., SM, 10M0 1206, 5%,400ppm	1151-7B0106JG	•	•	•	•	•	•
R26	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•	•
R27	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•	•
R28	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•	•
R29	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•	•
R30	RES., SM, 1K00 1206, 1%,100ppm	1150-3B1001FP	•	•	•	•	•	•
R31	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•	•
R32	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•	•
R33	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•	•

*Based on the bandwidth of the synthesizer
†Based on the value associated with the synthesizer

Ref Desig.	Description	Part No	OSR-3/770	OSR-3/815	OSR-3/860	OST-3/815	OST-3/860	LTR™ Option
R34	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•	•
R35	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•	•
R36	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•	•
R37	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•	•
R38	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•	•
R39	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•	•
R40	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•	•
R41	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•	•
R42	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•	•
R43	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•	•
R44	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•	•
R48	RES., SM, 18R2 1206, 1%,100ppm	1150-1B18R2FP	•	•	•	•	•	•
R49	RES., SM, 56R2 1206, 1%,100ppm	1150-1B56R2FP	•	•	•	•	•	•
R50	RES., SM, 18R2 1206, 1%,100ppm	1150-1B18R2FP	•	•	•	•	•	•
R51	RES., SM, 18R2 1206, 1%,100ppm	1150-1B18R2FP	•	•	•	•	•	•
R52	RES., SM, 221R 1206, 1%,100ppm	1150-2B2210FP	•	•	•	•	•	•
R53	RES., SM, 1K00 1206, 1%,100ppm	1150-3B1001FP	•	•	•	•	•	•
TCXO	TCVCXO,SMT, 9.6MHz,+-1ppm,0-3V	2641-09600AM7	•	•	•	•	•	•
U1	IC, LP2951,PROG. VOLT REG,SO-8	2305-29510N08	•	•	•	•	•	•
U2	IC, 74HC688, 8BIT COMP.,SO-20L	2376-06880W20	•	•	•	•	•	•
U3	IC, LP2951,PROG. VOLT REG,SO-8	2305-29510N08	•	•	•	•	•	•
U4	IC, UMA1014T,FREQ. SYNTH,SO-16	2355-10140N16	•	•	•	•	•	•
U5	IC, MC33064,UNDR/VOLT SEN.SO-8	2308-33064N08	•	•	•	•	•	•
U6	IC, 68HC711E9, MIC/CTR, PLCC52	2380-68711P52	•	•	•	•	•	•
U7	IC, MSA-0186, MMIC AMP, PKG-86	2354-MSA01860	•	•	•	•	•	•
VCO	VCO MODULE, 753-780MHZ, 5.0VDC	2622-766M0501	•					
VCO	VCO MODULE, 796-825MHz, 5.0VDC	2622-810M0501		•		•		•*
VCO	VCO MODULE, 851-870MHz, 5.0VDC	2622-860M0501			•		•	•*
X1	RESONATOR, SM, 8.0MHz, CERAMIC	1575-8001816A	•	•	•	•	•	•

*Based on the bandwidth of the synthesizer
†Based on the value associated with the synthesizer

806 - 869 MHZ
LOW CURRENT SYNTHESIZER
MECHANICAL PARTS LIST

Description	Part No.	Qty.
BOX, ALUM.,2.5”W x 3”L x.781”H	3702-66400050	1
BRACKET, SHIELD,MT-3 SYNTH.,BR	3702-67300910	1
LABEL, FOIL,FRQ/SN,MT-3 SYNTH.	3501-13091005	1
NUT, SELF-CLINCH., M2,6.3mm OD	5833-S2M06315	4
SCREW, M2 X 4, PAN/PHILLIPS,A2	5812-2M0PP04S	4
TAB, GROUND, MT-3 SYNTH.,BRASS	3702-67800905	2

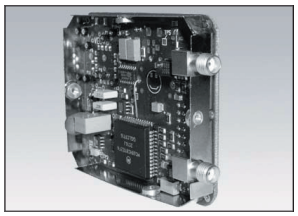
LOW CURRENT SYNTHESIZER OS(R/T)-3 896-960 MHZ

Covers Models:

OSR-3/885
OSR-3/901

OST-3/899
OST-3/932
OST-3/948

	Transmitters			Receivers		
Radio Frequency	**Transmitter Model & Frequency Range**	**Low Current Synthesizer Model & Synthesizer Frequency**	**Location in Manual**	**Receiver Model & Frequency Range**	**Low Current Synthesizer Model & Synthesizer Frequency**	**Location in Manual**
VHF 132-174 MHz	Requires Enhanced Synthesizer	Not covered in this Manual	Not covered in this Manual	VR-3/140 132-150 MHz	OSR-3/162 150-174 MHz	See Page 5 LOW CURRENT SYNTHESIZER OSR-3 132 - 174 MHZ
				VR-3/160 150-174 MHz	OSR-3/141 128-150 MHz	
UHF 406-470 MHz				UR-3/420 406-430 MHz	OSR-3/440 427.4-451.4 MHz	See Page 31 LOW CURRENT SYNTHESIZER OSR-3 406 - 470 MHZ
				UR-3/460 450-470 MHz		
UHF 800 806-869 MHz	UT-3/815 806-824 MHz	OST-3/815 806-824 MHz	See Page 59 LOW CURRENT SYNTHESIZER OSR-3 806 - 896 MHZ	UR-3/815 806-824 MHz	OSR-3/770 761-779 MHz	See Page 59 LOW CURRENT SYNTHESIZER OSR-3 806 - 869 MHZ
	UT-3/860 851-869 MHz	OST-3/860 851-869 MHz		UR-3/860 851-869 MHz	OSR-3/815 806-824 MHz	
UHF 900 896-960 MHz	UT-3/900 896-902 MHz	OST-3/899 896-902 MHz	See Page 83 LOW CURRENT SYNTHESIZER OSR-3 896 - 960 MHZ	UR-3/900 896-902 MHz	OSR-3/860 851-869 MHz	
	UT-3/930 928-935 MHz	OST-3/932 896-902 MHz		UR-3/930 928-935 MHz	OSR-3/885 883-890 MHz	See Page 83 LOW CURRENT SYNTHESIZER OSR-3 896 - 960 MHZ
	UT-3/950 935-960 MHz	OST-3/948 896-902 MHz		UR-3/950 935-960 MHz	OSR-3/901 890-915 MHz	



GENERAL INFORMATION

INTRODUCTION

The OS(R/T)-3 Low Current Synthesizer Module produces a low distortion, high stability, FM modulated (transmitter) or unmodulated (receiver) RF signal covering a frequency band of 896 - 960 MHz. It achieves a ±1 ppm frequency stability from -40°C to +60°C with its own internal reference, or it can be slaved to an external reference signal of desired stability. A common synthesizer module works in both receivers and transmitters and is easily removed for programming, calibration, or repair.

OS(R/T) LOW CURRENT SYNTHESIZER FAMILY MODELS

The OS-3 Low Current Synthesizer module family forms an integral component of the MT-3 receiver and transmitter product line. In transmitters, the OS-3 synthesizer provides a modulated low level RF signal to the Power Amplifier module. In receivers, the OS-3 synthesizer provides a low noise local oscillator signal that directly drives the mixer circuitry. It is important to establish the correct synthesizer model number of interest in order to direct attention to specific documented information. The specific model number is printed on the synthesizer module top cover.

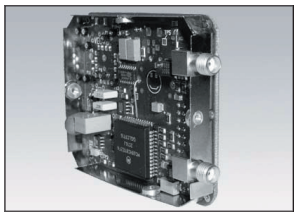
This Section of the manual covers the following Synthesizers:

- OST-3/899 - synthesized, installed in transmitter, 896 - 902 MHz RF output.
- OST-3/932 - synthesized, installed in transmitter, 928 - 935 MHz RF output.
- OST-3/948 - synthesized, installed in transmitter, 935 - 960 MHz RF output.
- OSR-3/885 - synthesized, installed in receiver, 883 - 890 MHz RF output.
- OSR-3/901 - synthesized, installed in receiver, 890 - 915 MHz RF output.

Each model's band of operation in a given frequency band is determined by select components on the Synthesizer board.

PERFORMANCE SPECIFICATIONS

Type:	NBFM 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 shown in [ ] brackets. .	883 MHz - 890 MHz [Full Band] (OSR-3/885). 896 MHz - 902 MHz [Full Band] (OST-3/899). 890 MHz - 915 MHz [Full Band] (OSR-3/901). 928 MHz - 935 MHz [Full Band] (OST-3/932). 935 MHz - 960 MHz [Full Band] (OST-3/948).
Output Power:	+4 dBm to 7 dBm into 50Ω.
External Reference Input:	External reference input signal via SMB connector J1. Input level 2.0 Vpp to 5.0 Vpp. Input impedance 50Ω. Input frequency 9.6 MHz.



THEORY OF OPERATION

INTERNAL POWER AND CONTROL

The synthesizer operates from +9.5 Vdc applied to connector pin P1-2. Current drain is approximately 45mA. Regulator IC U1 provides continuously regulated +5.0 Vdc to the reference TCXO. Regulator IC U3 supplies regulated + 5.0 Vdc to all other synthesizer circuitry including the VCO, synthesizer IC U4, and microprocessor U6. Supply U3 is turned on by applying +9.5 Vdc to synthesizer pin P2-4. For receiver applications, the synthesizer is always operating with the enable line P2-4 being permanently connected to +9.5 Vdc. In transmitter applications, pin P2-4 is controlled by MT-3 Transmitter Board jumper J18 which selects the synthesizer's standby mode. In low current standby mode approximately 50 ms of transmitter turn on delay from PTT activation must be tolerated (settling time of synthesizer). For transmitter applications requiring only 10 ms of turn on delay, the synthesizer can be made to run continuously. This capability comes at the expense of an additional 45mA of transmitter standby current.

RF CIRCUITRY

The synthesizer itself is formed around a low power, single chip synthesizer IC U4. A 9.6 MHz reference signal is provided from either the internal TCXO (JU1-B), or an external source via SMA connector J4 and jumper JU1-A. If an external signal is used for the reference source, it must be of low phase noise, high stability, and between 2.0 Vpp and 5.0 Vpp. A sinusoidal signal shape is required for an external reference source. A poor quality reference source will degrade receiver/transmitter performance to unacceptable levels.

The 9.6 MHz reference source is divided down to establish a channel selection step size of 6.25 kHz. A third order passive loop filter comprised of C10, C11, C14, R11, and R12, is employed to achieve the required noise performance, modulation and worst case switching time of 50 ms. A small sample of RF energy is coupled from the VCO output to the synthesizer IC U4 prescaler input (pin 8). FM modulation of the VCO from 60 Hz to 3 kHz, is provided through the baseband input pin P1-1 and installation of jumper JU3-B. A 1 kHz sine wave with a level of approximately 315 mVrms at P1-1 provides FM deviation of 3.0 kHz. The output of the VCO is amplified / buffered by the MMIC amplifier U7 and filtered by the bandpass filter F1. SMA connector J5 provides frequency coverage with an RF output level of approximately +3 dBm into a 50Ω load. Synthesizer frequency band selection is made by the appropriate selection of VCO and bandpass filter F1.

MICROPROCESSOR CONTROLLER

Microprocessor U6 provides control of the synthesizer module. It communicates with synthesizer IC U4, monitors the synthesizer lock detect, manages PTT input/output, and determines the operating frequency from either four rotary BCD switches or four externally driven channel select lines. It also communicates with an external factory programmer through I/O lines TX DATA (P1-17), RX DATA (P1-9), and BOOTSTRAP (P2-2). The external programmer places the operating program in non volatile microprocessor memory. It is also used to program 15 user channel selections.

The microprocessor spends the majority of time in a low power sleep state. Wake up is achieved when external events such as PTT action, synthesizer lock failure, or a change in channel selection dictate immediate action. An internal “watchdog” timer provides robust software protection in all operating modes.

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 (grounded), the synthesizer will scan four BCD switches connected to SW1 COM - SW4 COM and PC4 - PC7 to establish the operating frequency. The BCD switches are located on the receiver and transmitter main circuit boards.

Note: 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 may be used for external frequency control. They are normally pulled low via jumper sets located on the M3 motherboard subrack.

If the channel select lines are pulled high to +9.5 Vdc in any combination resulting in a binary code greater than 0000 (all low), then the frequency is established as the preprogrammed entry in a table containing 15 separate frequency settings. For example; if all of the channel select lines are pulled high then a binary code of 1111 results which selects the frequency entry from the 15th table position. CHAN SEL3 is the most significant bit of the binary channel selection code. The channel table is normally programmed at the factory for those applications requiring specialized remote control of frequency. These programmed channel assignments are stored in non-volatile microprocessor EEPROM and are not susceptible to inadvertent erasure.

In transmitters, the synthesizer operating frequency is the transmitter operating frequency; however, for receivers, an IF Offset correction factor (45 MHz for OS(R/T)-3 806 - 960 MHz models) must be added to or subtracted from the synthesizer operating frequency in order to determine the actual receive frequency. Refer to the channel designation table documentation provided with the transmitter or receiver modules for simplified channel number and frequency information.

SYNTHESIZER BASE AND FREQUENCY INCREMENT TABLE

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

Model Number	Freq. Range	Base Frequency	Freq. Increment
OST-3/899	896-902 MHz	896 MHz	6.25 kHz
OST-3/932	928-935 MHz	928 MHz	6.25 kHz
OST-3/948	935-960 MHz	935 MHz	6.25 kHz
OSR-3/885	883-890 MHz	883 MHz	6.25 kHz
OSR-3/901	890-915 MHz	890 MHz	6.25 kHz

CHANNEL SELECTION

OS-3 synthesizers have been designed to generate frequencies in 6.25 kHz. BCD channel switch settings from 0000 to 0960 (for 896-902 MHz), 0000 to 1120 (for 928-935 MHz) and 0000 to 4000 (for 935-960 MHz) with 6.25 kHz increments. The switch settings are scanned by the synthesizer module when the receiver is first powered up, and the desired local oscillator frequency is generated. Calculation of the operating frequency is determined as follows:

OST-3 896-960 MHz Channel Selection

OST-3/899 (installed in UT-3/900 Tx, 896-902 MHz)

BCD switch settings from 0000 to 0960:

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

Example: An OST-3/899 synthesizer has a base frequency of 896 MHz. The selected channel number is 0734. Therefore the receiver frequency is:

((0734 x 6.25 kHz) + 896 MHz) = 900.587500 MHz

OST-3/932 (installed in UT-3/930 Tx, 928-935 MHz)

BCD switch settings from 0000 to 1120:

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

Example: An OST-3/932 synthesizer has a base frequency of 928 MHz. The selected channel number is 0988. Therefore the receiver frequency is:

((0988 x 6.25 kHz) + 928 MHz) = 934.17500 MHz

OST-3/948installed in UT-3/950 Tx, 935-960 MHz)

BCD switch settings from 0000 to 4000:

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

Example: An OST-3/948 synthesizer has a base frequency of 935 MHz. The selected channel number is 0988. Therefore the receiver frequency is:

((0988 x 6.25 kHz) + 935 MHz) = 941.17500 MHz

OSR-3 896-960 MHz Channel Selection

OSR-3/885 (installed in UR-3/930 Rx, 928-935 MHz)

BCD switch settings from 0000 to 1120:

Multiply the switch setting by 6.25 kHz and add the result to the synthesizer base frequency plus the IF offset.

Example: An OSR-3/885 synthesizer has a base frequency of 883 MHz. The IF offset correction factor is 45 MHz.The selected channel number is 0988. Therefore the receiver frequency is:

((0988 x 6.25 kHz) + (883 MHz + 45 MHz)) = 934.17500 MHz

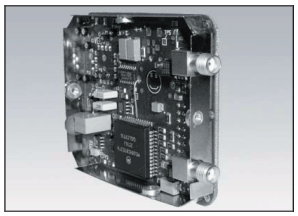
OSR-3/948 (installed in UR-3/950 Rx, 935-960 MHz)

BCD switch settings from 0000 to 4000:

Multiply the switch setting by 6.25 kHz and add the result to the synthesizer base frequency plus the IF offset.

Example: An OSR-3/948 synthesizer has a base frequency of 890 MHz. The IF offset correction factor is 45 MHz.The selected channel number is 0988. Therefore the receiver frequency is:

((0988 x 6.25 kHz) + (890 MHz + 45 MHz)) = 941.17500 MHz



SYNTHESIZER ALIGNMENT

GENERAL

OS(R/T)-3 Low Current Synthesizer alignment is simplified by using a Type 84 subrack and RF extender card/cable to provide receiver or transmitter power and signal interconnection. Alternatively, +9.5 Vdc may be applied directly to a receiver or transmitter module through positive connection to pins B6 / Z6, and negative connection to pins B30 / Z30 / B32 / Z32. Receiver balanced audio (600 Ω) is available at pins B26 and Z26.

REPAIR NOTE

OS(R/T)-3 Low Current Synthesizer employs a high percentage of surface mount components that should not be removed or replaced using an ordinary soldering iron. Removal and replacement of surface mount components should be performed only with specifically designed surface mount rework and repair stations complete with Electrostatic Discharge (ESD) protection.

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

RECOMMENDED TEST EQUIPMENT

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

Power supply - Regulated +9.5 Vdc 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 frequency locked to an external reference (WWVH, GPS, Loran C) so that the internal high stability local oscillator may be accurately set to within its ±1 ppm frequency tolerance.

OS(R/T)-3 SYNTHESIZER FACTORY CONFIGURATION

All solder jumpers are clearly marked on the underside of the synthesizer module. The following list details the required jumper configuration for the two synthesizer operating modes:

1) Internal reference. Install jumper JU1B (Standard). The internal temperature compensated crystal oscillator (TCXO) provides the reference signal with a stability not exceeding ±1 ppm from -40°C to + 60°C.
2) External reference input. Install jumper JU1A. This mode reduces receiver current by approximately 4 mA by eliminating the internal TCXO reference and is used in applications requiring better than ±1 ppm frequency stability.

Remember: Care must be exercised when installing the reconfigured synthesizer module back into the transmitter board or the IF/audio board. Pay careful attention to pin alignment before pressing the synthesizer module into it's mating sockets.

OS(R/T)-3 SYNTHESIZER ALIGNMENT

General

Under normal circumstances, the alignment procedure is accomplished without removing the synthesizer from the MT-3 Receiver IF/ Audio Board or the MT-3 Transmitter Board. Alignment simply involves setting the internal TCXO reference frequency (if one is installed). A change in receiver or transmitter operating frequency greater than ±5 MHz from an initial factory setting requires a more involved synthesizer alignment procedure. To convert a synthesizer with an internal reference source to a synthesizer requiring an external reference signal or vice-versa is done through the appropriate selection of jumper JU1 A or B.

Synthesizer Test Points

TP1	+5.0 ± 0.1 Vdc. U1 positive output.
TP2	+5.0 ± 0.1 Vdc. U3 positive regulator output (remotely controlled via pin P2-4).
TP3	Lock detect. Logic high (5.0 Vdc) = locked condition.
TP4	PLL error voltage. Ranges from +0.5 to 4.5 Vdc depending on frequency.
TP5	+5.0 Vdc ± 0.5 Vdc. Buffer amplifier bias. (access under VCO board).
TP6	+9.5 Vdc. U3 positive regulator input (remotely controlled via pin P2-4).

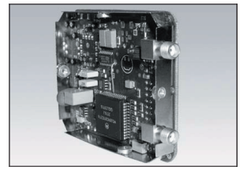
Synthesizer Installation and Removal

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 transmitter main circuit board by applying pressure in a rotating fashion about 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. Remove the two remaining synthesizer cover screws and cover to expose the synthesizer circuitry. Carefully reinsert the synthesizer module, without the cover, back into the transmitter main circuit board. Visually line up the connector pins and sockets before applying firm reinsertion pressure. Failure to do so could lead to damaged synthesizer module pins. Reconnect the SMA RF output connector. The alignment procedure may now be performed. Installation of the synthesizer is performed in a fashion reverse to the above procedure. It is important to emphasize the importance of connector pin alignment prior to any application of reinsertion force

OS(R/T)-3 896 - 960 MHz Frequency Adjustment

Adjustment to frequency can only be made if the synthesizer module has been configured with an internal reference source (Standard). Aligning the internal reference to precisely 9.600 000 MHz is best done by monitoring the synthesizer output and adjusting the synthesizer fine frequency potentiometer until the desired channel frequency is measured. The procedure is outlined below.

Connect the radio communications test set through a short section of low loss 50 Ω coaxial cable to the synthesizer module RF output jack. This involves disconnecting the short cable leading to the RF input of the receiver front end or transmitter amplifier. Select channel 0000 through the BCD frequency selection switches on the receiver IF / Audio board or transmitter main board. Turn the receiver or transmitter on and wait a few minutes for the oscillator to stabilize. The measured signal should be at or close to the desired channel frequency. It should be noted that ±1 ppm at 806 MHz represents a frequency tolerance of ±806 Hz. Adjust the synthesizer fine frequency potentiometer until the correct frequency is measured. Access to this potentiometer is made available through an opening in the synthesizer cover. A power level of approximately +3 dBm should be measured at the RF output jack of the synthesizer. Reconnect the short cable leading to the RF input of the receiver front end or transmitter amplifier.



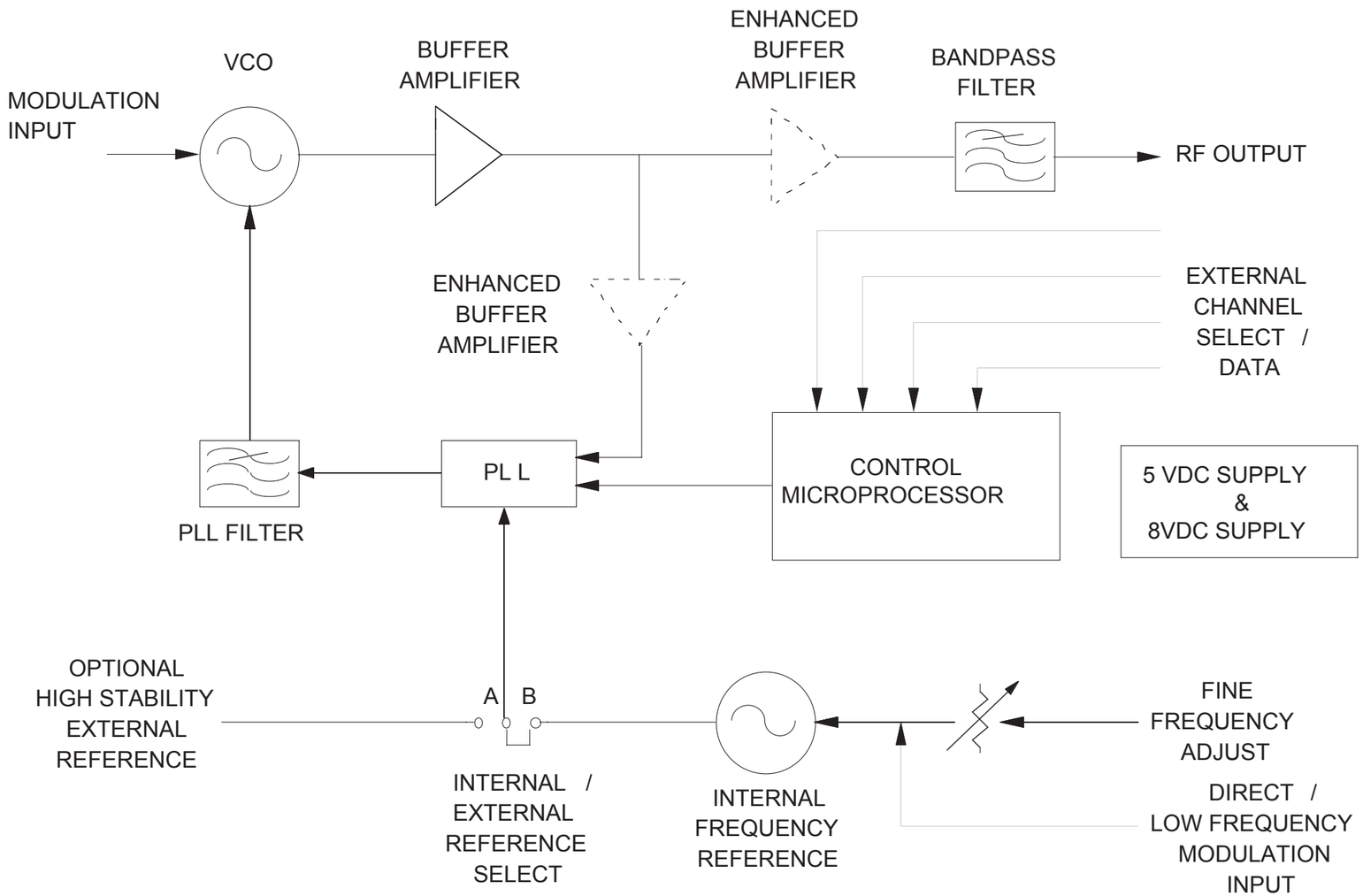
ILLUSTRATIONS AND SCHEMATICS

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



B0319

OS(R/T)-3 896-960 MHZ SYNTHESIZER COMPONENT LAYOUT (TOP)

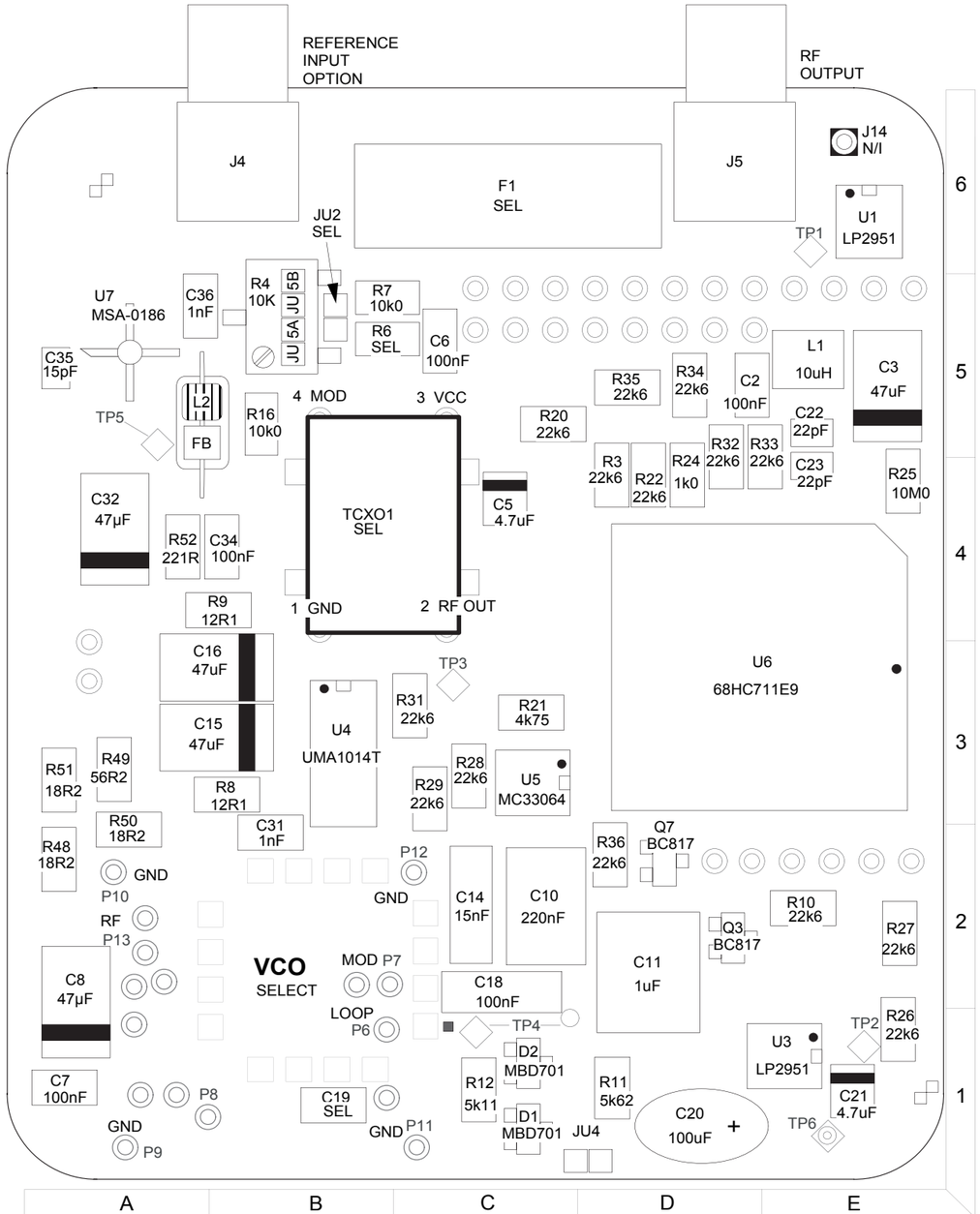
COMPONENT LOCATION TABLE																				
DES	PG	LC	DES	PG	LC	DES	PG	LC	DES	PG	LC	DES	PG	LC	DES	PG	LC	DES	PG	LC
C1	B	E1	D1	T	C1	Q1	B	E5	R21	T	C3	TCXO1	T	B4						
C2	T	D5	D2	T	C1	Q2	B	E6	R22	T	D4									
C3	T	E5				Q3	T	D2	R23	B	D3	TP1	T	E6						
C4	B	E1	F1	T	C6	Q4	B	C3	R24	T	D4	TP2	T	E1						
C5	T	C4				Q7	T	D2	R25	T	E4	TP3	T	C3						
C6	T	C5	J4	T	B6	Q8	B	E4	R26	T	E1	TP4	T	C1						
C7	T	A1	J5	T	D6	Q9	B	E4	R27	T	E2	TP5	T	A4						
C8	T	A2	J14	T	E6	Q10	B	D4	R28	T	C3	TP6	T	E1						
C9	B	B4				Q11	B	D4	R29	T	C3									
C10	T	C2	JU1	B	A4				R30	B	C3	U1	T	E6						
C11	T	D2	JU2	T	B5	R1	B	E5	R31	T	C3	U2	B	C3						
C12	B	B5	JU3	B	C5	R2	B	E5	R32	T	D4	U3	T	E1						
C14	T	C2	JU4	T	D1	R3	T	D4	R33	T	E4	U4	T	B3						
C15	T	B3	JU5	T	B5	R4	T	B5	R34	T	D5	U5	T	C3						
C16	T	B3	JU6	B	C2	R5	B	A1	R35	T	D5	U6	T	D3						
C17	B	B3				R6	T	B5	R36	T	D2	U7	T	A5						
C18	T	C2	L1	T	E5	R7	T	B5	R37	B	D4									
C19	T	B1	L2	T	A5	R8	T	B3	R38	B	D4	VCO	T	B2						
C20	T	D1				R9	T	B4	R39	B	D4									
C21	T	E1	P1	B	D2	R10	T	E2	R40	B	D5	X1	B	E3						
C22	T	E5	P2	B	E5	R11	T	D2	R41	B	E3									
C23	T	E4	P3	B	A4	R12	T	C1	R42	B	E3									
C24	B	D3	P6	T	B1	R13	B	B5	R43	B	D3									
C25	B	D3	P7	T	B2	R14	B	C6	R44	B	D4									
C26	B	C2	P8	T	B1	R15	B	B5	R48	T	A2									
C31	T	B2	P9	T	A1	R16	T	B5	R49	T	A3									
C32	T	A4	P10	T	B2	R17	B	C6	R50	T	A2									
C34	T	B4	P11	T	C2	R18	B	C6	R51	T	A3									
C35	T	A5	P12	T	C2	R19	B	C4	R52	T	A4									
C36	T	A5	P13	T	A2	R20	T	C5	R53	B	E1									

T - Top Side Component Layout
B - Bottom Side Component Layout

SYTH MODEL / VCO MODULE SELECT TABLE		
SYNTH MODEL	**VCO TYPE**	**C19***
OSR-3/885	MQC505-888	NOT INSTALLED
	VCO190-888T*	10nF
OSR-3/901	MQC505-888	NOT INSTALLED
	VCO190-902MT*	10nF
OST-3/899	MQC505-888	NOT INSTALLED
	VCO190-902MT*	10nF
OST-3/932	MQC505-926	NOT INSTALLED
	VCO190-926MT*	10nF
OST-3/948	MQC505-950	NOT INSTALLED
	VCO190-947MT*	10nF

TCXO SELECT COMPONENTS		
DESIG.	**RAKON (9.6000 MHZ)**	**SARONIX (S2045-9.6000)**
R6*	33K2	10K0

* SURFACE MOUNT COMPONENTS



INSTALLED JUMPERS

43-914921-04-T-P2-ABABBB

OS(R/T)-3 896-960 MHZ SYNTHESIZER COMPONENT LAYOUT (BOTTOM)

COMPONENT LOCATION TABLE

DES	PG	LC	DES	PG	LC	DES	PG	LC	DES	PG	LC	DES	PG	LC
C1	B	E1	D1	T	C1	Q1	B	E5	R21	T	C3	TCXO1	T	B4
C2	T	D5	D2	T	C1	Q2	B	E6	R22	T	D4			
C3	T	E5				Q3	T	D2	R23	B	D3	TP1	T	E6
C4	B	E1	F1	T	C6	Q4	B	C3	R24	T	D4	TP2	T	E1
C5	T	C4				Q7	T	D2	R25	T	E4	TP3	T	C3
C6	T	C5	J4	T	B6	Q8	B	E4	R26	T	E1	TP4	T	C1
C7	T	A1	J5	T	D6	Q9	B	E4	R27	T	E2	TP5	T	A4
C8	T	A2	J14	T	E6	Q10	B	D4	R28	T	C3	TP6	T	E1
C9	B	B4				Q11	B	D4	R29	T	C3			
C10	T	C2	JU1	B	A4				R30	B	C3	U1	T	E6
C11	T	D2	JU2	T	B5	R1	B	E5	R31	T	C3	U2	B	C3
C12	B	B5	JU3	B	C5	R2	B	E5	R32	T	D4	U3	T	E1
C14	T	C2	JU4	T	D1	R3	T	D4	R33	T	E4	U4	T	B3
C15	T	B3	JU5	T	B5	R4	T	B5	R34	T	D5	U5	T	C3
C16	T	B3	JU6	B	C2	R5	B	A1	R35	T	D5	U6	T	D3
C17	B	B3				R6	T	B5	R36	T	D2	U7	T	A5
C18	T	C2	L1	T	E5	R7	T	B5	R37	B	D4			
C19	T	B1	L2	T	A5	R8	T	B3	R38	B	D4	VCO	T	B2
C20	T	D1				R9	T	B4	R39	B	D4			
C21	T	E1	P1	B	D2	R10	T	E2	R40	B	D5	X1	B	E3
C22	T	E5	P2	B	E5	R11	T	D2	R41	B	E3			
C23	T	E4	P3	B	A4	R12	T	C1	R42	B	E3			
C24	B	D3	P6	T	B1	R13	B	B5	R43	B	D3			
C25	B	D3	P7	T	B2	R14	B	C6	R44	B	D4			
C26	B	C2	P8	T	B1	R15	B	B5	R48	T	A2			
C31	T	B2	P9	T	A1	R16	T	B5	R49	T	A3			
C32	T	A4	P10	T	B2	R17	B	C6	R50	T	A2			
C34	T	B4	P11	T	C2	R18	B	C6	R51	T	A3			
C35	T	A5	P12	T	C2	R19	B	C4	R52	T	A4			
C36	T	A5	P13	T	A2	R20	T	C5	R53	B	E1			

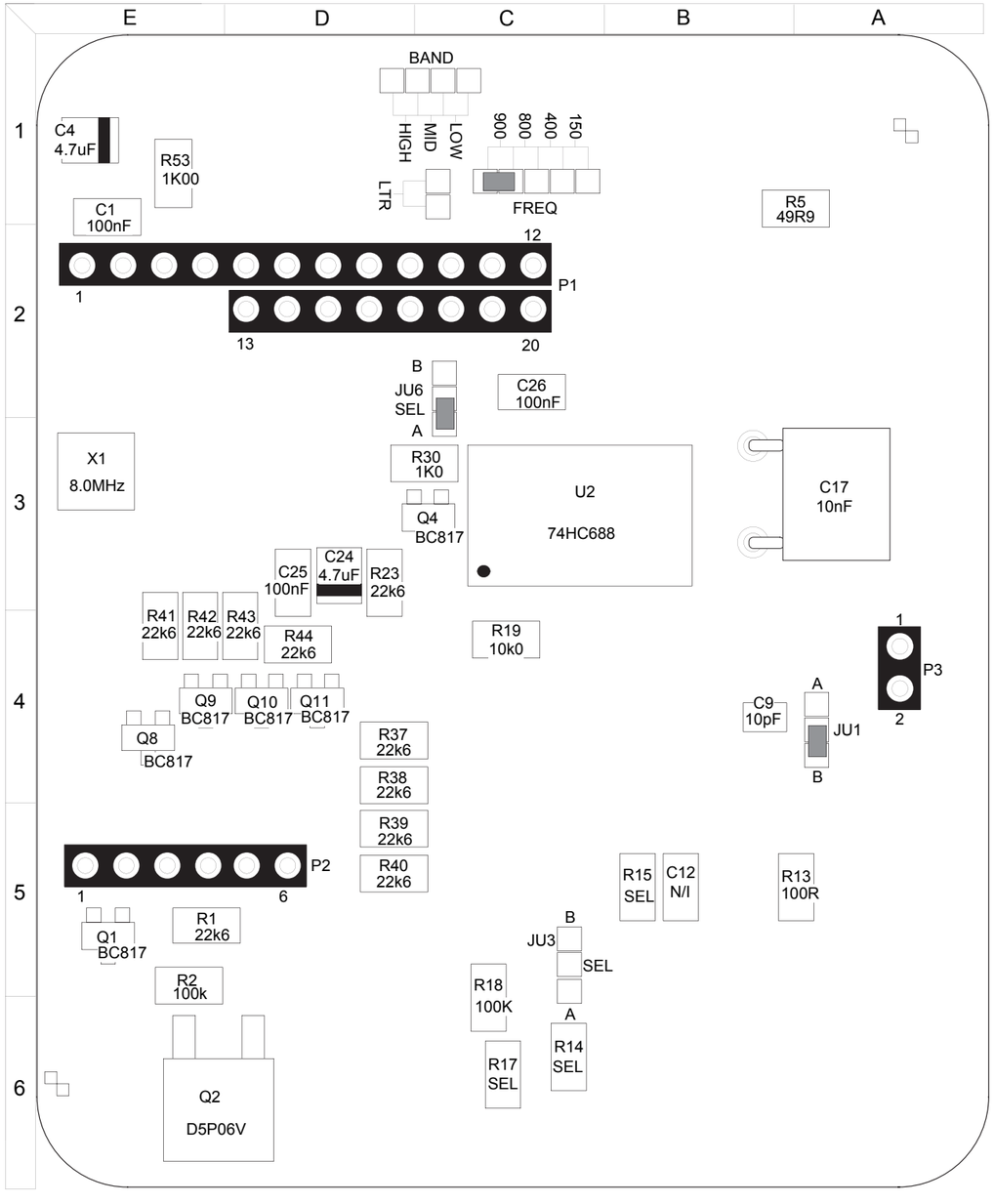
T - Top Side Component Layout
B - Bottom Side Component Layout

SYTH MODEL / VCO MODULE SELECT TABLE					
SYNTH MODEL	**VCO TYPE**	**JU3**	**R14***	**R15***	**R17***
OSR-3/885	MQC505-888	NOT INSTALLED	15K0	2K21	0R0
	VCO190-888T*	NOT INSTALLED	2K21	NOT INSTALLED	0R0
OSR-3/901	MQC505-888	NOT INSTALLED	15K0	2K21	0R0
	VCO190-902MT*	NOT INSTALLED	2K21	NOT INSTALLED	0R0
OST-3/899	MQC505-888	B	15K0	2K21	4K75
	VCO190-902MT*	B	2K21	NOT INSTALLED	4K75
OST-3/932	MQC505-926	A	15K0	200R	4K75
	VCO190-926MT*	B	2K21	NOT INSTALLED	4K75
OST-3/948	MQC505-950	B	15K0	6K81	4K75
	VCO190-947MT*	B	2K21	NOT INSTALLED	4K75

68HC711E9 BOOTSTRAP / NORMAL MODE		
DESIG.	**NORMAL MODE**	**BOOTSTRAP MODE**
JU6	'A' POSITION	'B' POSITION

TCXO SELECT COMPONENTS		
DESIG.	**RAKON (9.6000 MHZ)**	**SARONIX (S2045-9.6000)**
R6*	33K2	10K0

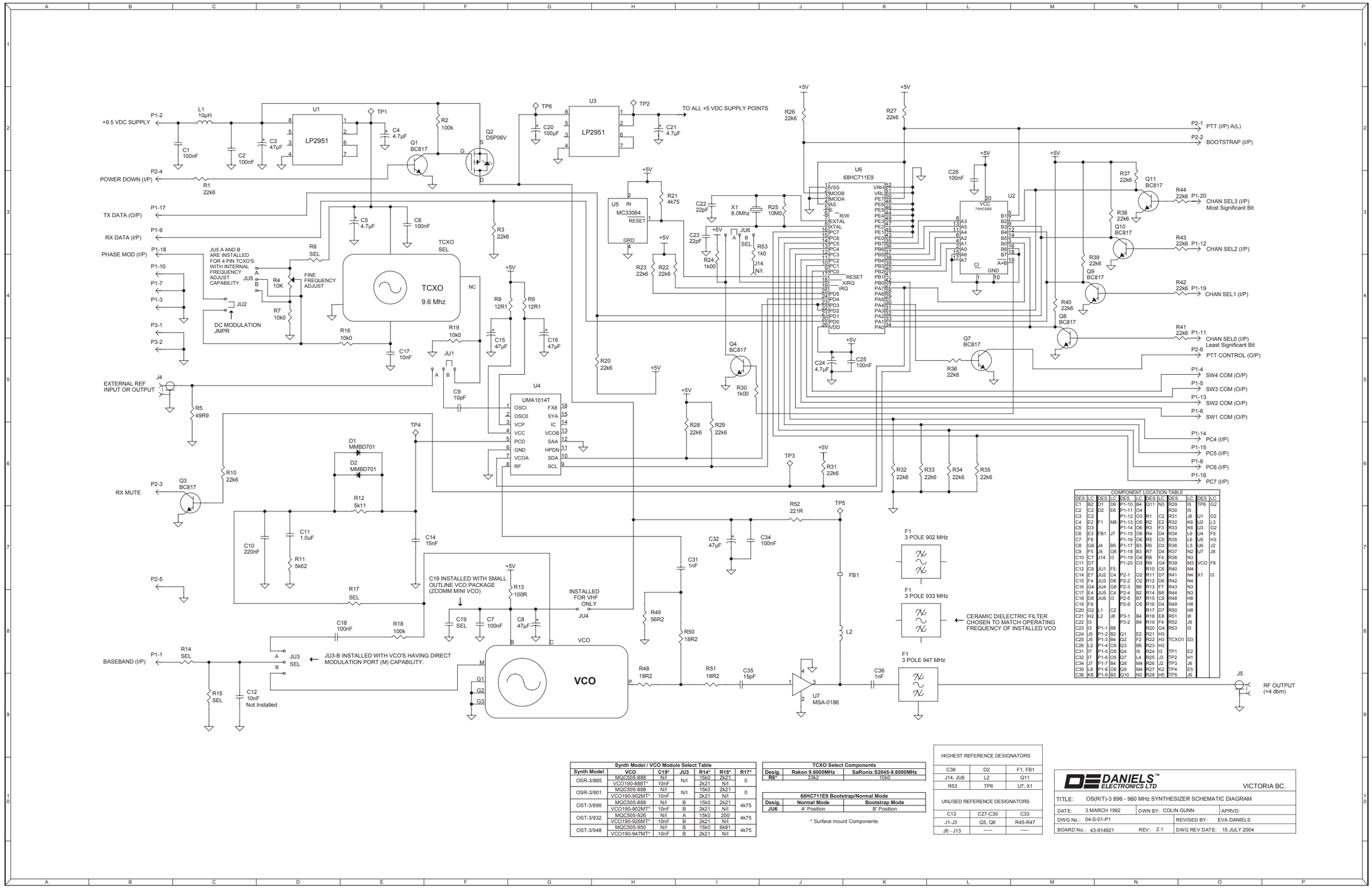
* SURFACE MOUNT COMPONENTS



INSTALLED JUMPERS

43-914921-04-B-P1-AAAAAA

OS(R/T)-3 896-960 MHZ SYNTHESIZER SCHEMATIC DIAGRAM



COMPONENT LOCATION TABLE

DES	LC	DES	LC	DES	LC	DES	LC	DES	LC	DES	LC	DES	LC
C1	B2	D1		D6	P1-10	B4	Q11	N3	R29	I5		TP6	G2
C2	C2	D2		E6	P1-11	O4			R30	I5			
C3	C2				P1-12	O3	R1	C2	R31	J6	U1	D2	
C4	E2	F1		M8	P1-13	O5	R2	E2	R32	K6	U2	L3	
C5	D3				P1-14	O6	R3	F3	R33	K6	U3	G2	
C6	E3	FB1	J7		P1-15	O6	R4	D4	R34	L6	U4	F5	
C7	F8				P1-16	O6	R5	C5	R35	L6	U5	H2	
C8	G8	J4		B5	P1-17	B3	R6	D3	R36	L5	U6	J2	
C9	F5	J5		O8	P1-18	B3	R7	D4	R37	N2	U7	J8	
C10	C7	J14		I3	P1-19	O4	R8	F4	R38	N3			
C11	D7				P1-20	O3	R9	G4	R39	M3	VCO	F8	
C12	C9	JU1		F5			R10	C6	R40	M4			
C14	E7	JU2		C4	P2-1	O2	R11	D7	R41	N4	X1	I3	
C15	F4	JU3		D8	P2-2	O2	R12	D6	R42	N4			
C16	G4	JU4		G8	P2-3	B6	R13	F7	R43	N3			
C17	E4	JU5		C4	P2-4	B2	R14	B8	R44	N3			
C18	D8	JU6		I3	P2-5	B7	R15	C8	R48	H8			
C19	F8				P2-6	O5	R16	D4	R49	H8			
C20	G2	L1		C2			R17	D7	R50	H8			
C21	H2	L2		J8	P3-1	B4	R18	E8	R51	I8			
C22	I3				P3-2	B4	R19	F4	R52	J6			
C23	I3	P1-1	B8				R20	G4	R53	I3			
C24	J5	P1-2	B2	Q1	E2	R21	H3						
C25	J5	P1-3	B4	Q2	F2	R22	H3	TCXO1	D3				
C26	L2	P1-4	C5	Q3	B6	R23	H3						
C31	I7	P1-5	O5	Q4	I5	R24	I3	TP1	E2				
C32	I7	P1-6	O5	Q7	L4	R25	J3	TP2	H1				
C34	J7	P1-7	B4	Q8	M4	R26	J2	TP3	J6				
C35	L8	P1-8	O6	Q9	M4	R27	K2	TP4	E5				
C36	K8	P1-9	B3	Q10	N3	R28	H5	TP5	J6				

Synth Model / VCO Module Select Table

Synth Model	VCO	C19*	JU3	R14*	R15*	R17*
OSR-3/885	MQC505-888	N/I	N/I	15k0	2k21	0
	VCO190-888T*	10nF		2k21	N/I	
OSR-3/901	MQC505-888	N/I	N/I	15k0	2k21	0
	VCO190-902MT*	10nF		2k21	N/I	
OST-3/899	MQC505-888	N/I	B	15k0	2k21	4k75
	VCO190-902MT*	10nF	B	2k21	N/I	
OST-3/932	MQC505-926	N/I	A	15k0	200	4k75
	VCO190-926MT*	10nF	B	2k21	N/I	
OST-3/948	MQC505-950	N/I	B	15k0	6k81	4k75
	VCO190-947MT*	10nF	B	2k21	N/I	

TCXO Select Components

Desig.	Rakon 9.6000MHz	SaRonix S2045-9.6000MHz
R6*	33k2	10k0

68HC711E9 Bootstrap/Normal Mode

Desig.	Normal Mode	Bootstrap Mode
JU6	A' Position	B' Position

* Surface mount Components

HIGHEST REFERENCE DESIGNATORS

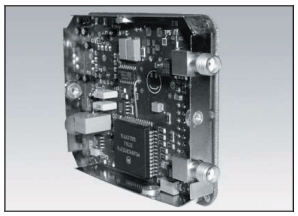
C36	D2	F1, FB1
J14, JU6	L2	Q11
R53	TP6	U7, X1

UNUSED REFERENCE DESIGNATORS

C13	C27-C30	C33
J1-J3	Q5, Q6	R45-R47
J6 - J13	-----	-----

DANIELS™ ELECTRONICS LTD — VICTORIA BC.

TITLE:	OS(R/T)-3 896 - 960 MHz SYNTHESIZER SCHEMATIC DIAGRAM		
DATE:	3 MARCH 1992	DWN BY: COLIN GUNN	APR/D:
DWG No.:	04-S-01-P1		REVISED BY: EVA DANIELS
BOARD No.:	43-914921 REV: 2.1		DWG REV DATE: 15 JULY 2004



PARTS LIST

OS(R/T)-3 896 - 960 MHZ LOW CURRENT SYNTHESIZER ELECTRICAL PARTS LIST

Ref Desig.	Description	Part Number	OSR-3/885	OSR-3/901	OST-3/899	OST-3/932	OST-3/948
C1	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•	•	•	•
C2	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•	•	•	•
C3	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16	•	•	•	•	•
C4	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•	•	•	•
C5	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•	•	•	•
C6	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•	•	•	•
C7	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•	•	•	•
C8	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16	•	•	•	•	•
C9	CAP., SM, 10pF CER., 0805, C0G	1008-1A100J1G	•	•	•	•	•
C10	CAP., 220nF FILM, MMK5,10%,50V	1016-5A224K50	•	•	•	•	•
C11	CAP., 1.0uF FILM, MMK5,10%,50V	1016-6D105K50	•	•	•	•	•
C14	CAP., 15nF FILM, MMK5, 10%,63V	1016-4A153K63	•	•	•	•	•
C15	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16	•	•	•	•	•
C16	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16	•	•	•	•	•
C17	CAP., 10nF FILM, MMK5, 10%,63V	1016-4A103K63	•	•	•	•	•
C18	CAP., 100nF FILM, MMK5,10%,63V	1016-5A104K63	•	•	•	•	•
C19	CAP., SM, 10nF CER., 1206, X7R	1008-4B103K5R				•	
C20	CAP., 100uF DIP. TANT.,20%,20V	1054-7M107M20	•	•	•	•	•
C21	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•	•	•	•
C22	CAP., SM, 22pF CER., 0805, C0G	1008-1A220J1G	•	•	•	•	•
C23	CAP., SM, 22pF CER., 0805, C0G	1008-1A220J1G	•	•	•	•	•
C24	CAP., SM, 4.7uF TANT., 10%,16V	1055-5B475K16	•	•	•	•	•
C25	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•	•	•	•
C26	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•	•	•	•
C31	CAP., SM, 1nF CER., 1206, C0G	1008-3B102K1G	•	•	•	•	•
C32	CAP., SM, 47uF TANT., 20%, 16V	1055-6D476M16	•	•	•	•	•

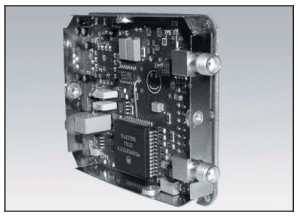
Ref Desig.	Description	Part Number	OSR-3/885	OSR-3/901	OST-3/899	OST-3/932	OST-3/948
C34	CAP., SM, 100nF CER., 1206,X7R	1008-5B104K5R	•	•	•	•	•
C35	CAP., SM, 15pF CER., 0805, C0G	1008-1A150J1G	•	•	•	•	•
C36	CAP., SM, 1nF CER., 1206, C0G	1008-3B102K1G	•	•	•	•	•
D1	DIODE, MMBD701,HOT CARR.,SOT23	2105-MMBD7010	•	•	•	•	•
D2	DIODE, MMBD701,HOT CARR.,SOT23	2105-MMBD7010	•	•	•	•	•
F1	FILTER, B/P, 869-894MHZ, 3POLE	1342-3P881M12	•				
F1	FILTER, B/P, 890-915MHZ, 3POLE	1342-3P902M12		•	•		
F1	FILTER, B/P, 921-946MHZ, 3POLE	1342-3P933M12				•	
F1	FILTER, B/P, 935-960MHZ, 3POLE	1342-3P947M12					•
J4	CONN., SMA R/A JACK,PCMNT,.200	5112-J20010BG	•	•	•	•	•
J5	CONN., SMA R/A JACK,PCMNT,.200	5112-J20010BG	•	•	•	•	•
L1	INDUCTOR, SM, 10.0uH, 10%,1812	1255-4G10000K	•	•	•	•	•
L2	COIL, 5T,28AWG W/BEAD+HEATSHRK	1223-5T002880	•	•	•	•	•
P1-1	INTERCONNECT/LP,1ROW x12PIN,Au	5015-IL112G07	•	•	•	•	•
P1-13	INTERCONNECT/LP,1ROW x 8PIN,Au	5015-IL108G07	•	•	•	•	•
P2-1	INTERCONNECT/LP,1ROW x 6PIN,Au	5015-IL106G07	•	•	•	•	•
P3-1	INTERCONNECT/LP,1ROW x 2PIN,Au	5015-IL102G07	•	•	•	•	•
PCB	PCB, MT-3 SYNTHESIZER	4309-25914921	•	•	•	•	•
Q1	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025	•	•	•	•	•
Q2	MOSFET, D5P06V, P-CHAN., D-PAK	2144-D5P06V00	•	•	•	•	•
Q3	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025	•	•	•	•	•
Q4	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025	•	•	•	•	•
Q7	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025	•	•	•	•	•
Q8	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025	•	•	•	•	•
Q9	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025	•	•	•	•	•
Q10	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025	•	•	•	•	•
Q11	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025	•	•	•	•	•
R1	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•
R2	RES., SM, 100K 1206, 1%,100ppm	1150-5B1003FP	•	•	•	•	•
R3	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•
R4	POT., SM, 10K, 12T, TOP ADJUST	1172-M30103W5	•	•	•	•	•
R5	RES., SM, 49R9 1206, 1%,100ppm	1150-1B49R9FP	•	•	•	•	•
R6	RES., SM, 33K2 1206, 1%,100ppm	1150-4B3322FP	•	•	•	•	•

Ref Desig.	Description	Part Number	OSR-3/885	OSR-3/901	OST-3/899	OST-3/932	OST-3/948
R7	RES., SM, 10K0 1206, 1%,100ppm	1150-4B1002FP	•	•	•	•	•
R8	RES., SM, 12R1 1206, 1%,100ppm	1150-1B12R1FP	•	•	•	•	•
R9	RES., SM, 12R1 1206, 1%,100ppm	1150-1B12R1FP	•	•	•	•	•
R10	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•
R11	RES., SM, 5K62 1206, 1%,100ppm	1150-3B5621FP	•	•	•	•	•
R12	RES., SM, 5K11 1206, 1%,100ppm	1150-3B5111FP	•	•	•	•	•
R13	RES., SM, 100R 1206, 1%,100ppm	1150-2B1000FP	•	•	•	•	•
R14	RES., SM, 2K21 1206, 1%,100ppm	1150-3B2211FP				•	
R14	RES., SM, 15K0 1206, 1%,100ppm	1150-4B1502FP	•	•	•		•
R15	RES., SM, 2K21 1206, 1%,100ppm	1150-3B2211FP	•	•	•		
R15	RES., SM, 6K81 1206, 1%,100ppm	1150-3B6811FP					•
R16	RES., SM, 10K0 1206, 1%,100ppm	1150-4B1002FP	•	•	•	•	•
R17	RES., SM, ZERO OHM JUMPER,1206	1150-0B0R0000	•	•			
R17	RES., SM, 4K75 1206, 1%,100ppm	1150-3B4751FP			•	•	•
R18	RES., SM, 100K 1206, 1%,100ppm	1150-5B1003FP	•	•	•	•	•
R19	RES., SM, 10K0 1206, 1%,100ppm	1150-4B1002FP	•	•	•	•	•
R20	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•
R21	RES., SM, 4K75 1206, 1%,100ppm	1150-3B4751FP	•	•	•	•	•
R22	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•
R23	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•
R24	RES., SM, 1K00 1206, 1%,100ppm	1150-3B1001FP	•	•	•	•	•
R25	RES., SM, 10M0 1206, 5%,400ppm	1151-7B0106JG	•	•	•	•	•
R26	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•
R27	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•
R28	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•
R29	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•
R30	RES., SM, 1K00 1206, 1%,100ppm	1150-3B1001FP	•	•	•	•	•
R31	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•
R32	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•
R33	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•
R34	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•
R35	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•
R36	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•
R37	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•
R38	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•
R39	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•
R40	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•
R41	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•
R42	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•
R43	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•
R44	RES., SM, 22K6 1206, 1%,100ppm	1150-4B2262FP	•	•	•	•	•

Ref Desig.	Description	Part Number	OSR-3/885	OSR-3/901	OST-3/899	OST-3/932	OST-3/948
R48	RES., SM, 18R2 1206, 1%,100ppm	1150-1B18R2FP	•	•	•	•	•
R49	RES., SM, 56R2 1206, 1%,100ppm	1150-1B56R2FP	•	•	•	•	•
R50	RES., SM, 18R2 1206, 1%,100ppm	1150-1B18R2FP	•	•	•	•	•
R51	RES., SM, 18R2 1206, 1%,100ppm	1150-1B18R2FP	•	•	•	•	•
R52	RES., SM, 221R 1206, 1%,100ppm	1150-2B2210FP	•	•	•	•	•
R53	RES., SM, 1K00 1206, 1%,100ppm	1150-3B1001FP	•	•	•	•	•
TCXO	TCVCXO,SMT, 9.6MHz,+-1ppm,0-3V	2641-09600AM7	•	•	•	•	•
VCO	VCO MODULE, 872-905MHz, 5.0VDC	2622-888M0501	•	•	•		
VCO	VCO MODULE, 914-939MHz, 5.0VDC	2621-190926MT				•	
VCO	VCO MODULE, 913-939MHz, 5.0VDC	2622-950M0503					•
U1	IC, LP2951,PROG. VOLT REG,SO-8	2305-29510N08	•	•	•	•	•
U2	IC, 74HC688, 8BIT COMP.,SO-20L	2376-06880W20	•	•	•	•	•
U3	IC, LP2951,PROG. VOLT REG,SO-8	2305-29510N08	•	•	•	•	•
U4	IC, UMA1014T,FREQ. SYNTH,SO-16	2355-10140N16	•	•	•	•	•
U5	IC, MC33064,UNDR/VOLT SEN.SO-8	2308-33064N08	•	•	•	•	•
U6	IC, 68HC711E9, MIC/CTR, PLCC52	2380-68711P52	•	•	•	•	•
U7	IC, MSA-0186, MMIC AMP, PKG-86	2354-MSA01860	•	•	•	•	•
X1	RESONATOR, SM, 8.0MHz, CERAMIC	1575-8001816A	•	•	•	•	•

OS(R/T)-3 896 - 960 MHZ LOW CURRENT SYNTHESIZER MECHANICAL PARTS LIST

Description	Part Number	Quantity
BOX, ALUM.,2.5”W x 3”L x.781”H	3702-66400050	1
BRACKET, SHIELD,MT-3 SYNTH.,BR	3702-67300910	1
LABEL, FOIL,FRQ/SN,MT-3 SYNTH.	3501-13091005	1
NUT, SELF-CLINCH., M2,6.3mm OD	5833-S2M06315	4
SCREW, M2 X 4, PAN/PHILLIPS,A2	5812-2M0PP04S	4
TAB, GROUND, MT-3 SYNTH.,BRASS	3702-67800905	2



REVISION HISTORY

Revision	Date	ECO	Description
1	May 98		• Issue 1
1A	Jul 98	562	• OST-3/948. To improve performance. R15 was 2k21 now 3k48
	Jan 99	571	• OST-3/932 & OST-3/948. To improve performance. R13 was 12R1 now 100R
	Feb 99	559	• OS(R/T)-3/xxx. To simplify manufacturing. L2 was a sub-assembly now bought-out
	Mar 00		• Corrected the 400 MHz schematic diagram (Dwg: OS3400M6A). C5 indicates that it is not installed when in fact it is installed. • Corrected the part number for Q2 & U7 in the Generic Parts List.
	Jun 00		• Corrected the part number for F1 in the OS(R/T)-3 406 - 470MHz Select Parts List. • Corrected the part numbers for C23 & C27 in the VCO 406-470 MHz Electrical Parts List.
	Dec 00	623	• OST-3/932. To improve performance. R15 was 100r now 200R
		624	• OST-3/948. To improve performance. R15 was 3k48 now 6k81.
		607	• OS(R/T)-3 806 – 869. Murata VCO is obsolete. R13 was 12R1 now 100R, R15 was 1k00 now 100R. C19 was not installed now 10nF, JU3A is now the default jumper.
	Jan 01	587	• OS(R/T)-3 132-960. To improve performance. R24 & R30 were 22k6 now 1k00 625 OS-3/860. To improve performance. R15 was 100R now 150R.
	Feb 01	5050	• OS(R/T)-3 406-470 VCO. To simplify manufacturing. P6 & P7 were 1 Row x 2 Pin now 1 Row x 1 Pin Added 24 Awg teflon tubing, 2cm & 22 Awg teflon tubing, 1.2cm.
	Jul 01	643	• OST-3/860 LTR™ C10 was 33nF now 15nF, C11 was 220nF now 1.0µF C14 was 2.2nF now 3.3nF, C18 was 100nF now 3.3nF R11 was 10k0 now 5k62, R12 was 33k2 now 27k4 R14 was 15k0 now 24k3, R15 was 1k0 now 22R1 R17 was 4k75 now 100k
2	Feb 02		• No Changes

Revision	Date	ECO	Description
3-0-0	Mar 03	704	• For Receivers only: R17 was 4k75, now 0R0 Removed JU3 Corrected R12 Designation on 406-470 MHz
		726	• Improve Low Temperature Lock R49 was 12R1, now 22R1 R50 was 56R2, now 47R5
	745, 749, 749A1		• TCXO Conversion or 132-174 and 406-470 MHz Only: R6 was 10K0, now Select TCXO now Select PCB was 43-9149 1.6, now 43-9149 1.8 For 406-470 MHz Only Added: R53 1K00, J14, JU6
3-0-1	Apr 03		• Corrected page 21 – Misprinted in first run of 3-0-0 Replaced footer with higher resolution image.
3-1-0	Oct 03	697	• PCB 43-914916 OST 3/8xx LTR Synthesizer component changes to C10,C14,C18,R11,R12,R14,R15,R17
		777	• PCB was 43-9-25914918; now 4309-25914920 for all VHF & 400 MHz U6 was 2380-68811P52, IC, 68HC811E2, obsolete; now 2380-68711P52, IC,68HC711E9
		777A1	• J14 was 5015-IL101G07 for all VHF & 400 MHz now Not Installed
3-2-0	Jul 04	5156	• TL1 was made in house, now a bought out part.
		809	• PCB was 4309-25914920 now 4309-25914921 for all VHF and UHF 400 All drawings and BOMs updated
		820	• PCB was 4309-25914920 now 4309-25914921 for all 800 and 900 MHz All drawings and BOMs updated