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DEM Part Number MICROLO and MICROLOK
Microwave Transverter Local Oscillator

Theory and Operation:

The LO is intended to be used as part of an DEMI's line of microwave transverters. It may also be used as a stand alone oscillator. The following table provides crystal information and multiplication factors for DEMI microwave transverters using a 144 MHz IF and low side injection. These are the standard "Weak Signal" frequency's configurations. Other frequency's may be used within the ranges given for other microwave transverters or transverter schemes.

Band	Crystal	LO Output Frequency and Output Power	Multiplication	Xverter LO Frequency
2304	180.000 MHz.	1080.000 MHz. +3dBm	X2	2160.000 MHz.
2400	188.000 MHz.	1128.000 MHz. +3dBm	X2	2256.000 MHz.
3456	184.000 MHz.	1104.000 MHz. +3dBm	X3	3312.000 MHz.
5760	187.200 MHz.	1123.200 MHz. +3dBm	X5	5616.000 MHz.
10368	189.333 MHz.	1136.000 MHz. +3dBm	X9	10224.000MHz

Construction:

1. Using the Top Assembly component placement diagram, install IC1 - IC4 . Also Refer to Figure 2. Install Q1, Q2, and VR1 on the bottom side of the circuit board using the Bottom Assembly component placement diagram. Q1 and Q2 cans should be placed on the surface of the ground plane but do not solder the cans of Q1 and Q2 to the ground plane now.
3. Install all surface mount capacitors, resistors and D1. (Top Side)
4. Form and install L2. Refer to Figure 2. Save one lead from L2. (Top Side)
5. Form and install L1, L3 and L4. Refer to Figure 3. (Top Side)
6. Install C2 from the Top side of the circuit board. See Figure 4. The adjustment of C2 is made on the bottom side of the board. Solder C2 on the bottom side of the circuit board. After forming the lead as shown.
7. Connect jumper wires. All wires are connected on the Bottom side of the PCB. Locate the holes by on the Bottom side component placement diagram. They have a "X" in them and a number them. Install a 6" wire in #1 Install a 3.5" wire between # 2 and #3. Install a 1" wire between #4 and #5. Install a 2.5" wire between #6 and #7.
8. Install Y1. See figure 5 , but do not install the PTC-50

***Testing and Tune Up*:**

Inspect all solder connections for opens or shorts. Review all active components for correct polarity placement. Connect the 6"wire to a +9volt supply and the negative to any spot on the circuit board ground plane. Refer to the DC check list and with a voltmeter, proceed down the list in order. All voltages are referenced to ground. Keep in mind that MMIC's either draw current or they don't.

Voltage test points

Test junction point	Voltage	Test junction point	Voltage

Input of IC1 - IC4	1.5V ± 0.5	Output of IC1 - IC4	5V± 1 V
Junction of Q1 - C3	5V ± 0.2	Junction of R1-C1	1.8V± .5
Junction of R5 - Q2	0.8V ± 0.3	TP1	> 0.7V

The voltage at TP1 is peaked by adjusting C2. If TP1 voltage can not be peaked, be sure that L1 is the correct size and there is no space between windings. If so Compress it and slowly adjust C2 again for voltage peak. If you have a milliwatt power meter, the output power of the LO may be measured and should be approx. +3dBm. If you have a frequency meter, the frequency may be adjusted with C2 and measured at the output or at the Xtal frequency by probing between C11 and L3.

If any of the test voltages can not be obtained look for solder defects or incorrect installation of components before assuming dead MMIC's or transistors. MMIC's sometimes operate out of spec. The important thing is that they draw current and have something other than the supply voltage or a short to ground on both Input and output.

If the frequency can not be netted, please check L1 for size and shape. Also check C4, C5 for workmanship and value. If frequency is off by 300 hertz or less, R3 and R1 may be adjusted. This is a voltage divider. If the voltage needs to go up or down, R1 may be adjusted. Lower value to drop voltage. Increase value to increase voltage. Optimum is 1.8 Volts but it may not net the frequency. Move the voltage and recheck frequency.

LO completion

After the LO is working correctly, to ensure frequency stability over time, the cans of Q1 and Q2 should be soldered to the ground plane. Heat the cans and flow solder around the can. Be careful not to short Q2 to TP1 in the process. See figure 6. Now install the PTC-50 Thermistor to the Xtal as shown in figure 5. Remove one wire from the Thermistor by re-flowing the solder and then solder it to the Xtal. Do not be afraid to heat the Xtal and flow the solder to attach the Thermistor. Then attach the ground wire as shown. Be sure to leave a 1/16" space between the circuit board and the Xtal. Allow the LO to operate for 1 hour with the Thermistor in place before adjusting the final frequency. This should be enough time for Aging.

In real operation, from start-up to final resting frequency time should be 5 minuets Maximum, but operation could be immediate without severe frequency drift.

Parts List

All capacitors are chips and are pF unless otherwise noted. Chips are in Vials. See vial Chart. White Band is Positive on 1.0 μF. All resistors are in ohms. The coils are formed using #24 enamel wire.

C1 0.01μF	C10 0.1μF	D1 HSMS2800	R3 1K	VR1 78L05
C2 1-8 Piston	C11 22	L1 3T 1/8" ID	R4 100	Y1 CRYSTAL
C3 0.01μF	C12 15	L2 0.1μH molded	R5 51	IC1 MAR-3
C4 18	C13 15	L3 6T 1/8" ID	R6 100	IC2 MAR-1
C5 22	C14 0.1μF	L4 4T 1/8" ID	R7 100	IC3 MAR-1
C6 1.0 μF	C15 22	Q1 2N5179	R8A,B 220	IC4 MAR-3
C7 1.0μF	C16 0.1μF	Q2 2N5179	R9 180	PTC-Thermistor
C8 0.01μF	C17 0.1μF	R1 560	R10 180	Micro-LO PCB
C9 0.1μF	C18 22	R2 1K	R11A, B 220	

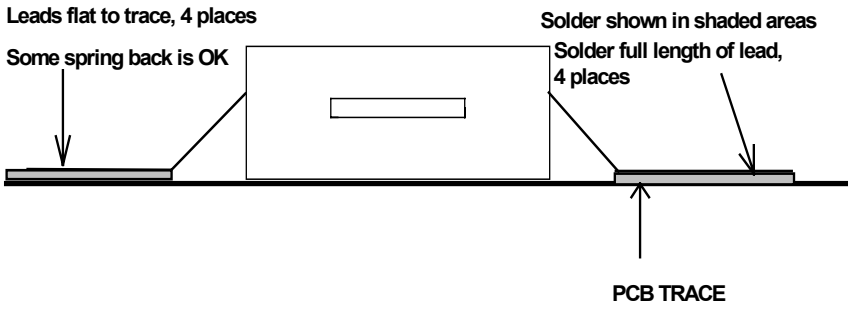

Figure 1. MMIC Installation details.

Note: The dots of the MMIC's on the Top Side component placement diagram indicate the input.

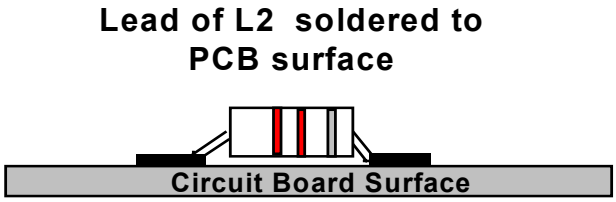

Figure 2.

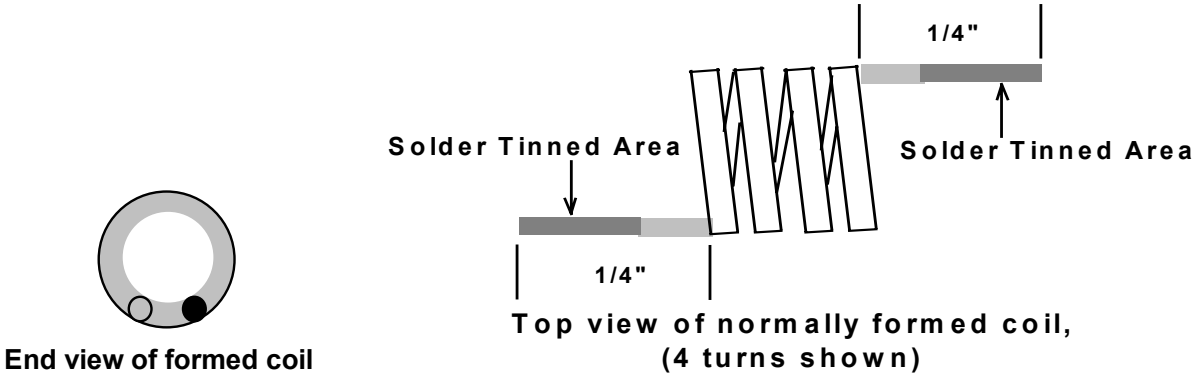

Figure 3. L1, L3, and L4 details.

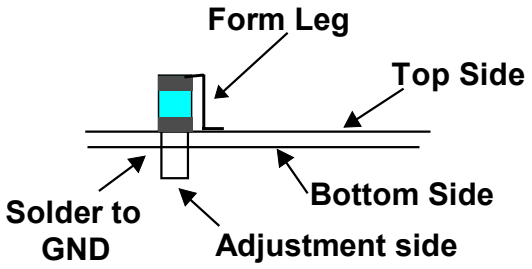

Figure 4. C2 Installation details.

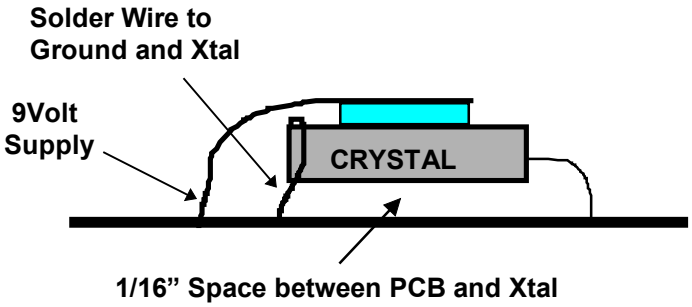

Figure 5. Thermistor Installation details.

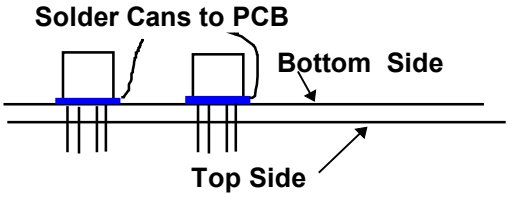

Figure 6. Q1 and Q2 Installation.

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Design Note

From: DEMI R&D Dept.

To: **ALL DEM 2304,3456,5760, and 10368 MHz transverter owners**

DN#: 016

Date: March 3, 2005

Re: Low Frequency of Local Oscillators in all Microwave transverters

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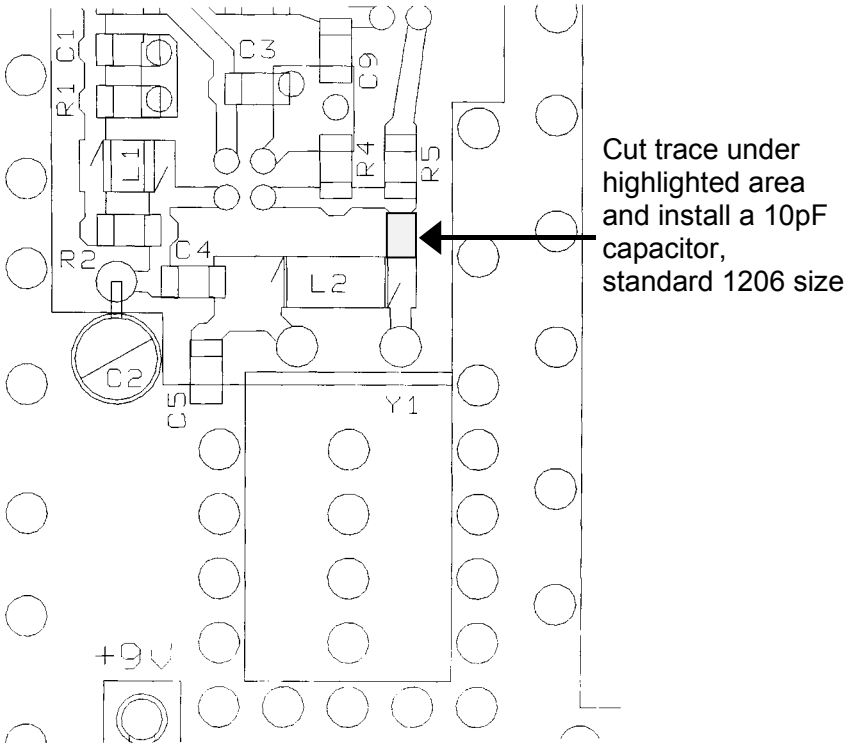
PROBLEM: In some instances, due to the nature of a crystal oscillators, the base local oscillator frequency can not be adjusted to produce a transverter that will have a "Zero" frequency offset. This design note will only cover oscillators that exhibit low frequency operation. A low frequency oscillator, requires a "+" frequency offset adjustment to the IF transceiver used. An example of a low frequency "LO" would be if the IF transceiver is required to be adjusted to 144.150 to operate on 2304.100. Simple subtraction shows the low frequency oscillator operation. (2304.100 - 144.150 = 2159.950)

DISCUSSION: Very few oscillators, including Down East Microwave MICRO-LO, run with the crystal operating at its true series resonant frequency. Most oscillator circuits look capacitive to the crystals used. The newer design DEM MICRO-LO circuit looks inductive to the standard series resonate crystals that are used in all DEM local oscillator circuits. It has been found that to properly match the true series resonate frequency of the crystal to the inductive nature of the oscillator, some type of capacitive loading is required. This will allow the oscillator circuit to operate near the true series resonate frequency of the crystal and allow a the user a better opportunity to "Net" the design frequency of the MICRO-LO.

Please note that this Design Note covers low frequency operation only. This fix will not solve high frequency operation, operation on the wrong overtone, start-up problems, frequency drift over temperature, frequency wandering in a stable temperature environment ,excessive spurious response and should not be applied to a non operating MICRO-LO . Most of these problems are caused by incorrect assembly or failed components. Design Notes will be established at a later date to address some of the problems stated above. If any of these problem do exist in your MICRO-LO, please consult us with symptoms for suggestions of repair.

SOLUTION: The solution for a low frequency MICRO-LO is to add some loading capacitance (5-15ρF) to the base circuit. It is simple one but does require a circuit modification. To add loading capacitance to the circuit, the crystal and its shunt inductor need to be separated from the original circuit and then attached back to the circuit through a series capacitor. As indicated in the pictorial which is a copy of a segment of the MICRO-LO component placement diagram, you should wick off all excess solder in the area before cutting the trace. This will allow easy use of a razor knife to cut the trace. You may find that removing the L2 inductor (a .1uH molded choke) will provide extra space to cut the trace and install a 1206 chip capacitor. You will need to remove approximately 0.05" of trace to avoid a solder bridge while attaching the capacitor. The chip capacitor quality is not that important. A standard NPO 1206 size chip will be more than adequate. You could use a better quality chip such as a ceramic microwave type with a smaller foot print but it is not necessary. Do not use a leaded capacitor!

After installation, re-start and adjust the MICRO-LO as stated in the MICRO-LO document. You will need to adjust C2 for maximum voltage at the test point and then re-adjust for frequency if required. You should also recheck the frequency of operation after the MICRO-LO is installed in its enclosure and has completely warmed to its operating temperature. Re-adjust as necessary and then check for cold re-start after the LO and/or transverter have completely cooled down.



Tips for Retrofitting the "NEW" MICRO-LO in DEMI Transverters.

At the time of introduction of the MICRO-LO, some transverter kit documents were not updated to include the necessary changes to the Tune up and Assembly sections. Please use this document as it pertains to the use of the LO-LV with all DEMI transverters. The MICRO-LO is easier to use and assemble. Using the MICRO-LO verses the LO-LV will produce more stability, easier assembly, and a more reliable operation over time.

1. If you plan to replace the original LO in your existing transverter with the new MICRO-LO, there are a few important points to discuss. First of all, since the frequency of the MICRO-LO is now double that of the original LO, the output power required is much lower. Almost half! Therefore, if your transverter required +5 dBm with the original LO, +3dBm will be more than enough. This is the reason for designing the MICRO-LO at this power level. If you have a requirement for higher power output, MMIC's may be substituted to produce the desired level.

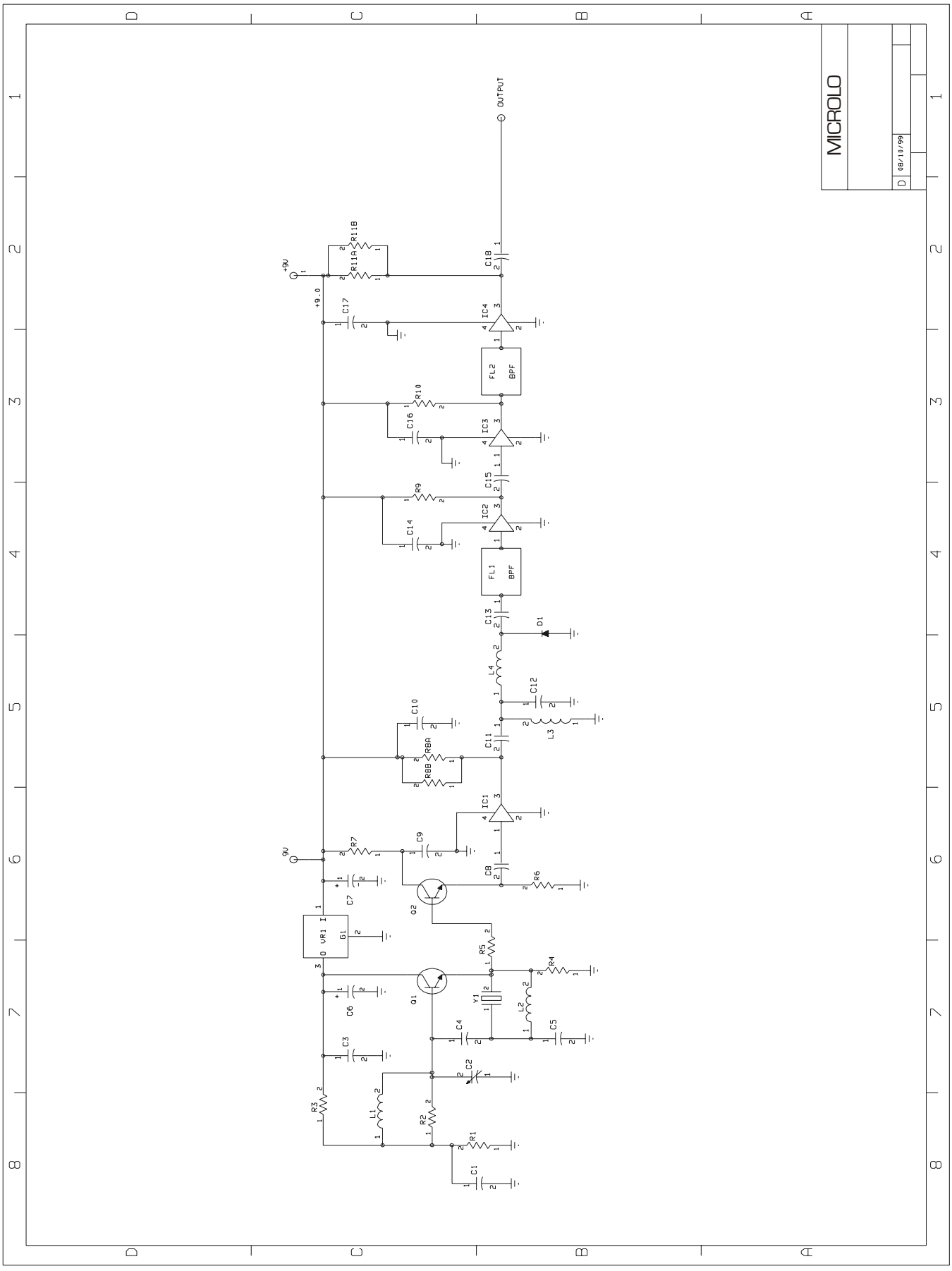
2. If you are replacing the original version LO in our 2304 , 3456, and 5760 transverter that are assembled in the clam shell aluminum extrusions, you will not need the fiber insulators when mounting the MICRO-LO. It has been designed to bolt directly to the Ribs in the extrusion. Simply use the MICRO-LO as a template to mark and drill 4 new 4-40 holes.

3. The RF output connection is made by soldering the coax directly to the back of the PCB as opposed to the original LO where the coax was needed to be soldered before attaching the MICRO-LO to the housing.

4. The test point that concerns the oscillator operation is accessible on the back side of the MICRO-LO after it is assembled to the housing along with the oscillator adjustment.

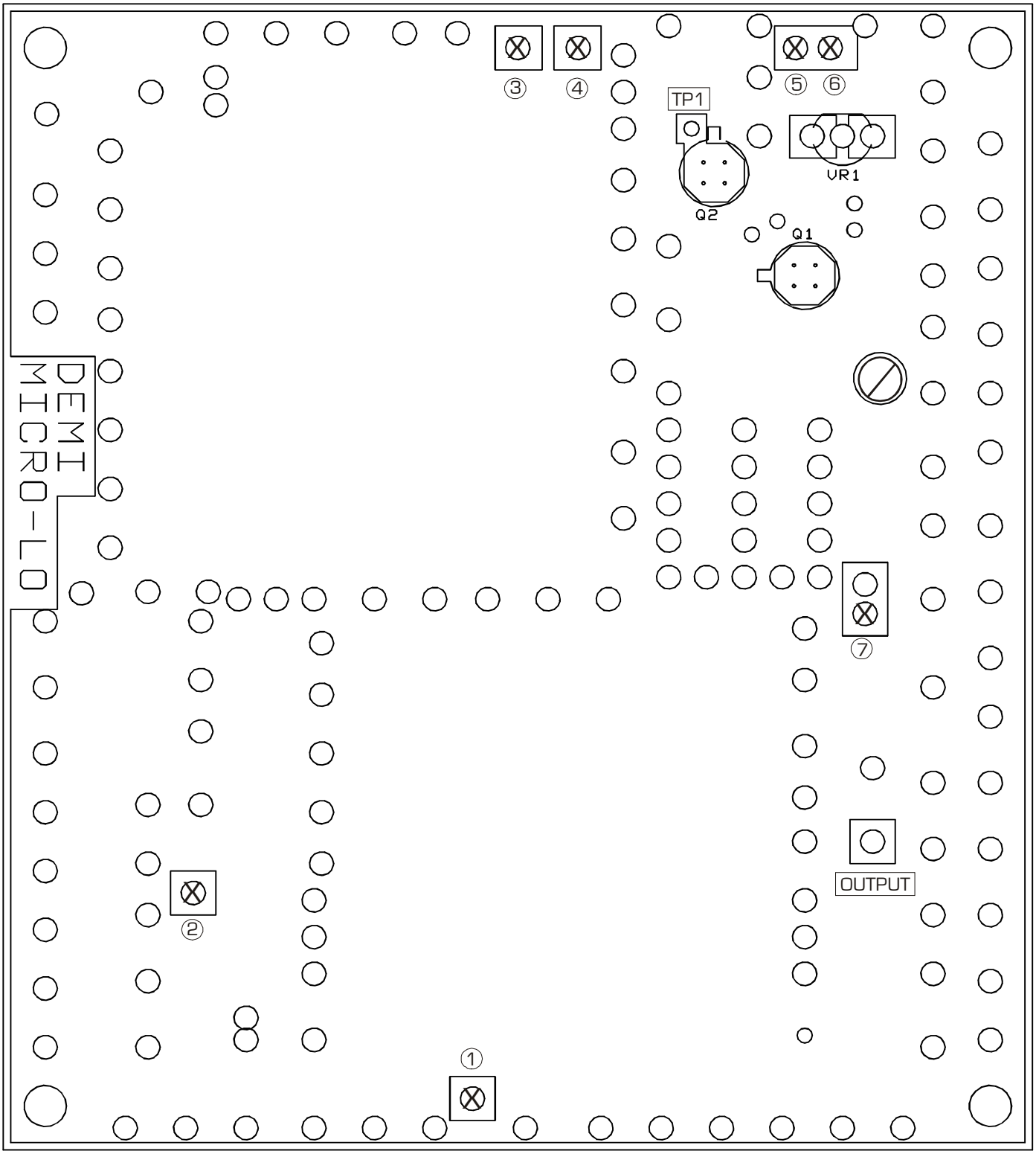
5. The MICRO-LO will operate from a 8 Volt regulated source at an lower output power. The oscillator section uses a built in 5 volt regulator. The 8 or 9 volt source controls the gain of the MMIC's. Lower voltage, lower power.

6. The MICRO-LO requires less space than the LO-LV.


MICROLO
D 08/10/99
OUTPUT
-9V
+9.0
9V
R11B
R11A
C18
C17
IC4
FL2
BPF
R10
C16
IC3
C15
R9
IC2
C14
FL1
BPF
C13
D1
L4
C12
L3
C10
C11
R8A
R8B
IC1
R7
C9
C8
R6
C7
Q2
VR1
G1
R5
R4
Q1
Y1
L2
C6
C4
C5
C3
C2
L1
R3
R2
R1
C1

DEM MICRO LO

BOTTOM SIDE ASSEMBLY



DEM MICRO LO

TOP SIDE ASSEMBLY