**Update and Enhancements for**
Locked VCXOs for Stable Microwave Local Oscillators with Low Phase Noise

*Paul Wade W1GHZ ©2014, 2015*

*w1ghz@arrl.net*

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The 96 MHz VCXO is used as an accurate source for a 1152 MHz local oscillator for a 1296 MHz transverter. I found that spurious outputs generated by the locking scheme are reduced by powering the VCXO and the phase detector chip, a 74AC86, from separate voltage regulators. The latest PC board revision, marked “2014b,” includes separate voltage regulators – U9 has been added, as shown in the schematic diagram, Rev 1.2. Unfortunately, I got the silk screen shape for U9 backwards, so insert it in the opposite direction.

In order to get the bypass capacitors close to power pins on the chips, some of the chip capacitors are on the bottom of the board.

One user reported that his VCXO required a high tuning voltage to reach the desired frequency, near the 3.3 volt limit, and the resistors in the circuit prevented the voltage from rising high enough. The solution is to replace U9, the regulator powering U4, the 74AC86 phase detector, with a 5-volt 78L05 regulator. This provides the needed voltage margin, and the locking circuit prevents overvoltage.

January 2015 – Oliver Barrett, KB6BA, figured out surface-mount component placements from my photos and was kind enough to provide these annotated photos of the bare board.

Oliver also found an error in the programming table, Appendix A. The “Signal” column for 96, 120, and 108 MHz should read “Y4 > Z”. The corrected Appendix A is also below.
Remember, U9 symbol is backward
### Microwave VCXO Board Programming

<table>
<thead>
<tr>
<th>Freq</th>
<th>VCXO</th>
<th>DigiKey</th>
<th>Prescaler</th>
<th>Prescale</th>
<th>Divide</th>
<th>ABCD*</th>
<th>±2</th>
<th>Signal</th>
<th>Comparison</th>
<th>Ref ±5</th>
<th>Ref ±2</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>80 MHz</td>
<td>Crystek</td>
<td>744-1214-ND</td>
<td>MC12093</td>
<td>8</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>Q-&gt;Z</td>
<td>10 MHz</td>
<td>na</td>
<td>10MHz-&gt;REF</td>
</tr>
<tr>
<td>80 MHz</td>
<td>Abracon</td>
<td>535-11429-ND</td>
<td>MC12093</td>
<td>8</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>Q-&gt;Z</td>
<td>10 MHz</td>
<td>na</td>
<td>10MHz-&gt;REF</td>
</tr>
<tr>
<td>96 MHz</td>
<td>Abracon</td>
<td>535-11431-ND</td>
<td>MC12093</td>
<td>8</td>
<td>6</td>
<td>LHHL</td>
<td>Q2-&gt;X4</td>
<td>Y4-&gt;Z</td>
<td>1 MHz</td>
<td>10MHz-&gt;X5</td>
<td>Y5-&gt;X6</td>
<td>Y6-&gt;REF</td>
</tr>
<tr>
<td>100 MHz</td>
<td>Abracon</td>
<td>535-11433-ND</td>
<td>MC12080</td>
<td>10</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>Q-&gt;Z</td>
<td>10 MHz</td>
<td>na</td>
<td>10MHz-&gt;REF</td>
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<tr>
<td>120 MHz</td>
<td>Abracon</td>
<td>535-11437-ND</td>
<td>MC12080</td>
<td>10</td>
<td>6</td>
<td>LHHL</td>
<td>Q2-&gt;X4</td>
<td>Y4-&gt;Z</td>
<td>1 MHz</td>
<td>10MHz-&gt;X5</td>
<td>Y5-&gt;X6</td>
<td>Y6-&gt;REF</td>
</tr>
<tr>
<td>200 MHz</td>
<td>Abracon</td>
<td>535-11451-ND</td>
<td>MC12080</td>
<td>20</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>Q-&gt;Z</td>
<td>10 MHz</td>
<td>na</td>
<td>10MHz-&gt;REF</td>
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<tr>
<td>108 MHz</td>
<td>homebrew?</td>
<td>MC12026</td>
<td>na</td>
<td>9</td>
<td>6</td>
<td>LHHL</td>
<td>Q2-&gt;X4</td>
<td>Y4-&gt;Z</td>
<td>1 MHz</td>
<td>10MHz-&gt;X5</td>
<td>Y5-&gt;X6</td>
<td>Y6-&gt;REF</td>
</tr>
</tbody>
</table>

**NOTES:**
- Y5->X6 means add a wire from point y5 to point X6, etc.
- ABCD = LHHL: L is ground, H is +5 Volts
- na means not applicable - chip may be left out
- MC12093 ÷8: pins 3 and 6 grounded (unmodified board)
- MC12080 ÷10: pins 3 and 6 high (jumpers to pins 2 and 7)
- MC12080 ÷20: pins 3 grounded (unmodified) and pin 6 high (jumper to pin 7)

Crystek VCXO are CVHD-950 series
Abracon VCXO are ABLJO-V series
Comparator 74AC86 compares Z and REF inputs

PC Boards marked 2013a are good for all frequencies
PC Boards marked 2012 are good for 80, 100, and 200 MHz. A wire is needed from Pin 1 of U4 (LT116) to +5 Volts.