Down East Microwave Inc.

Design Note

DEMI

From: DEMI R & D Dept.

DN#: 027

Date: March, 7, 2012

Re: LO replacement in VHF Transverters with the VHF ApolLO retro fit kit (VHF ApolLOK)

PREFACE: This document will aid the installation of the VHF ApolLO synthesizer in all DEM 144 and 222 -28 transverters eliminating the original Local Oscillator using the supplied Retro Fit Kit.

CIRCUIT AND INSTALL: This install document assumes this modification will be made to a functioning transverter. After reading and becoming familiar with the VHF ApolLO document, you should decide what frequency to program your synthesizer to. It is simplest to set the ApolLO to the same frequency as the original oscillator. If you desire a different IF frequency, select one that is band specific for your transverter (listed between 24 and 30 MHz.), and understand that your 28 MHz IF transverter will not operate at the 50 MHz range just by changing the LO frequency. It would require many other component changes including a Helical filter and would be quite a task.

The 2M frequency selection is straight forward. For 222 MHz, you may have a very early transverter with a 97 MHz oscillator. In this case, you may set the ApolLO for 97MHz or 194 MHz. In both cases, 194 MHz is the final injection frequency into the mixer. The 97 MHz version passes through an active doubler and then is filtered. If you use 194 MHz directly, it will be amplified by the active doubler and the correct level will pass through the filter. Some of the 97 MHz versions had issues with low drive levels to the mixer. Using 194 MHz would solve that problem.

Having the frequency now selected, start the modification to the transverter by disabling the original oscillator. There have been 6 Revs produced of the 2M and 222 MHz transverters. Most Revisions were made due to changes to the LO circuit. The key to the installation is to not allow the standard oscillator to run but to be sure the Amplifier/Buffer or the Active Multiplier (both the same MMIC) stays active in the circuit after the modifications. It would be very handy to have the original transverter document but generic copies can be found on the DEMI website. The most basic difference is the newer versions have 9 VDC regulators, the older have 5 VDC regulators.

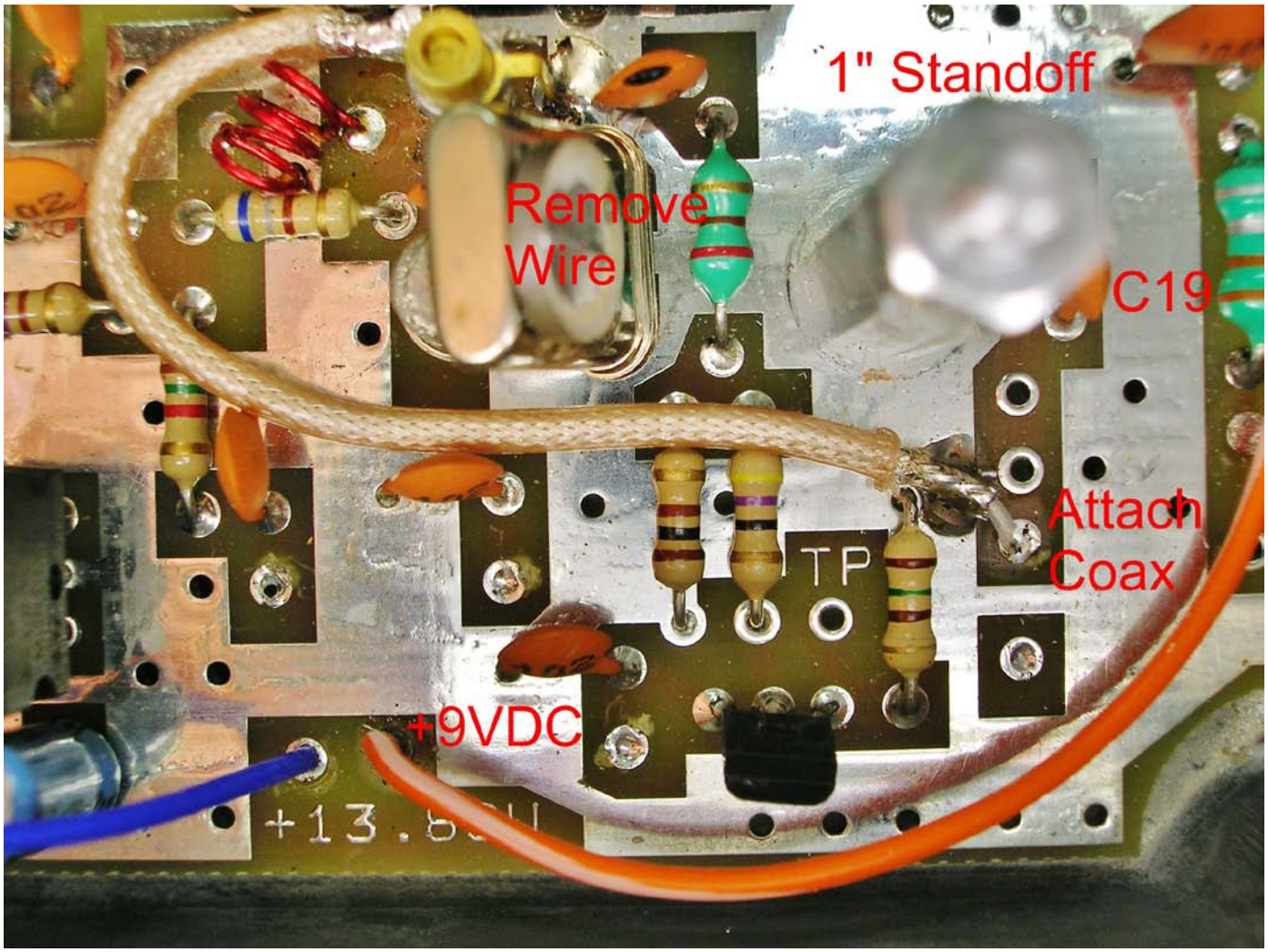
9VDC regulator mod: Remove the supply chokes L26 and L27. If your version has C19 and C22, remove C22. If C19 does not exist, remove only R15 and Q2.

5VDC regulator mod: Remove the 5VDC regulator and R2. Then remove C22. If there any components between C22 and C19 such as C70, C23 or a 2-3 turn inductor, remove them.

The important thing to note is that a DC blocking capacitor is required on the input of the IC7 MMIC. (The Amplifier/Buffer/Doubler) It may be either C19 or C22, makes no difference!

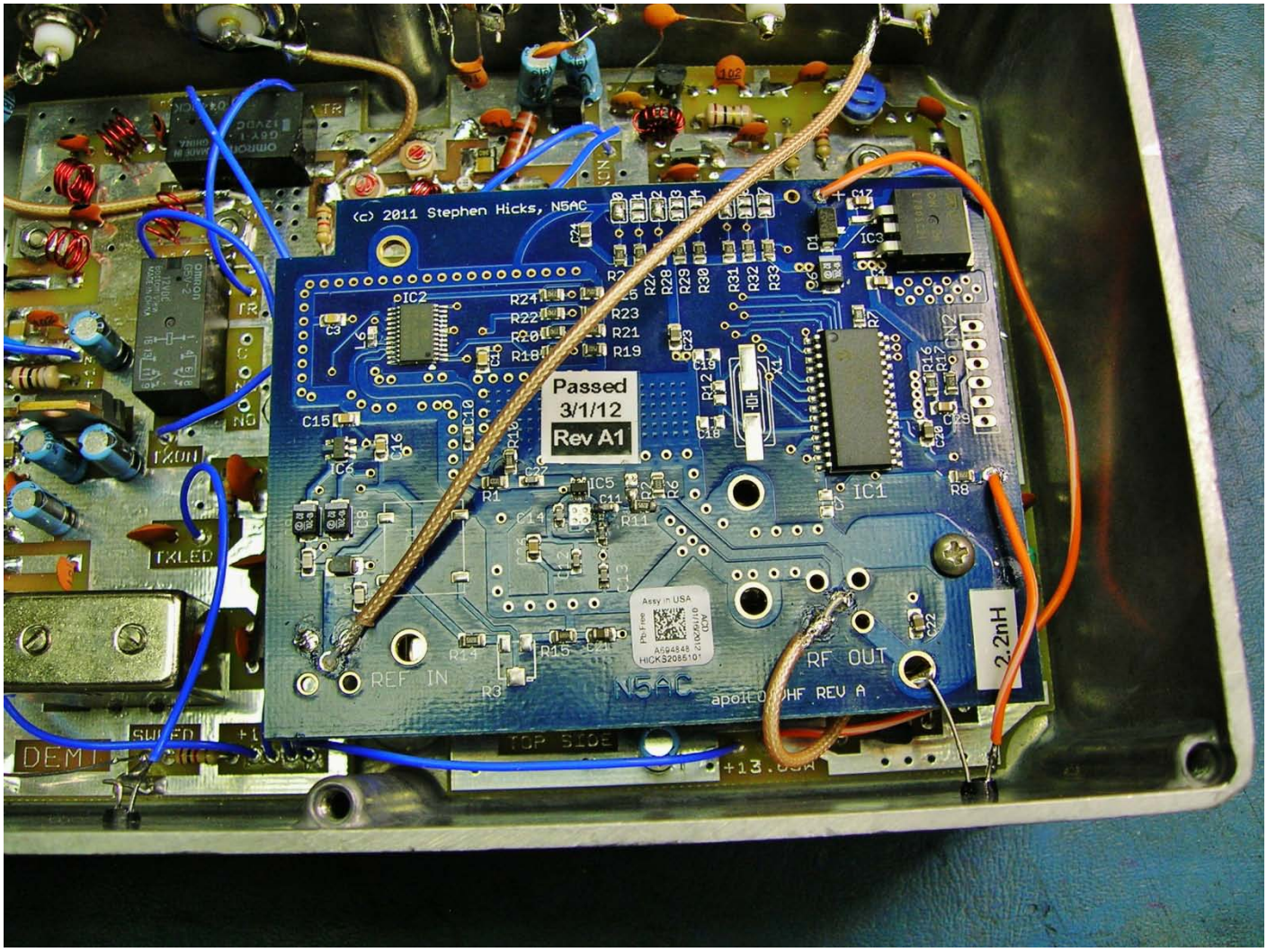
On all versions, if a Thermistor is installed, disconnect the +DC wire. Then DC test the unit by verifying that the Oscillator transistors do not have power but IC7 is biased. You can check IC 7 by measuring a voltage drop across R28. Inductor (L19) or a jumper may be involved in IC7's DC supply.

The following picture shows a 9VDC version with the supply chokes and C22 removed only because C19 exists. What is important in the picture is the attachment of the LO input coax. In this case, it is where C22 was. Please note the 1" mounting standoff is pictured in the correct position and is the same in all versions. The DC supply to the synthesizer may be picked off just about anywhere, It can be the raw +13.8 VDC or the preferred regulated 9VDC voltage if you transverter has it. The coax should be 3" long to get the job done. The wire is 5" long.



Now, if you desire a LOC light, a hole will need to be made in the enclosure at approximately 1" from the enclosure side and 1"down from the opening. The hole size can be 1/8" if you do not want to use the LED holder or either a #16 or a 11/64th drill size with the holder. See the following picture for its placement. Of course, you can use any other color LED or configuration you desire. It is not critical. This is also the time to verify that there is an extra 3/8" hole for a BNC connector or and extra BNC connection already installed. This is for the external 10 MHz signal If you have a common IF, there should be one available. If not select a position, drill the hole, and make the installation.

Mount the VHF ApolLO on the stud using a 4-40 nut. Yes, it is only one mount but it works. After it is secure attach a 5” coax between the new BNC connector and the REF input on the VHF ApolLO.



Now connect the LO input coax to the RF out on the VHF ApolLO. 3” may be a bit long so trim if needed. Then, attach the LED as shown. The short lead of the LED is the ground lead. Shorten the “Hot” lead and install a insulated wire.

TESTING: If you desire, you may measure the level of injected signal into the mixer. It should be between +15 and +19 dBm. It can be measured with a calibrated RF probe or C53 can be removed and the output of F1 can be measured into a 50 Ohm system.

First connect the 10 MHz source and then power up the transverter. The LOC light should light. Disconnect the 10 MHZ source, and the LOC light will diminish. Connecting the 10 MHz source back up may produce a Blinking LOC light and will require the power to be cycled. All RX and TX functions will act normally except the only frequency error you will have will be because by your IF rig!

OPTIONS: The VHF ApolLO may be mounted on the lid of the transverter if you extend the cables. It may also be mounted at other positions on the transverter board but please caution. It has not been tested for spurious at other positions. It is possible if mounted to close to the power module, conducted mixing could occur. BUT—it's only a possibility!

A frequency select switch may be installed to choose a different IF frequency if desired to protect from interference from a different transceivers output such as in a multi-op contest environment. An example would be to configure the board for 194 MHz. This is 222 = 28 Mhz. The board would have solder jumpers on 0, 2, and 5 as show in the picture on the previous page. Toggling the #1 pad to ground would then make 222 = 26 MHz and hopefully far enough away from the offending IF rig on the 432 station. This can be done on the fly if a switch is installed to ground.

The VHF ApolLO may be installed in a separate enclosure and its output may be switch to different transverters in a single operator's station. Either a band switch or a computer generated switching mechanism may be utilized. It would require a quality RF switch to direct the RF output of the VHF ApolLO at the same time the frequency selection was made. It is possible with a single inductor value, to supply the three DEMI VHF transverters the VHF ApolLO was designed for on 144, 222 and 432 MHz.

It is possible to install the VHF ApolLO so that it can be switch in and out of the circuit with the standard Local Xtal Oscillator. It would require extra circuit modification and a RF type switch installed (could be PIN diodes) supplying the mixer. There are many possibilities including adding a gain stage after the VHF ApolLO and amplifying it up to the +17dBm level for direct injection into the mixer. Just remember to completely remove the DC power from the circuit this is not in use.

CONCLUSION: There will be future Design Notes as we discover the full potential of the VHF ApolLO. There most likely will be frequency expansions as newer ideas and concepts are developed e hope that this simple modification and install enables the use of a sidelined transverter of simply increases the performance of one that was on the air.

Have fun on the Bands!

Component Parts List for the VHF ApolLOK:

1- 1" standoff (could be a ¾" and a ¼". Screw them together)

1 – 4-40 Nut (picture shows a screw head, use a nut on the mounting stud supplied)

10" of Teflon coax

8" of wire, # 26 or #24

1 – Blue LED and holder

1- BNC connector and hardware.