Down East Microwave Inc.

Design Note

DEMI

From: DEMI R & D Dept.

DN#: 028

Date: March, 10, 2012

Re: LO replacement in 432-28 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 432-28 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 understand that there are a few frequency selection options. It is simplest to set the ApolLO to the same frequency as the oscillator frequency in the 100 MHz range as the original oscillator operated at. The standard transverter utilizes 101 MHz and is multiplied 4X with an active or a passive circuit depending on the revision. This operates fine but has some low level harmonics every 100 MHz or so.

Since the VHF ApolLO has programmed frequencies that may be directly injected into the mixer to produce the desired results without requiring any multiplication, we recommend to utilized it. Chose one frequency in the 404 MHz range and set the VHF ApolLO. If you desire a different IF frequency from standard, select one that is band specific for your transverter (listed between 24 and 30 MHz IF.), 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 helical filters and would be quite a task.

There are 5 revs of the 432-28 but for this modification only two major differences in the local oscillator circuit apply. They are the active and passive multiplier circuits. Some earlier versions had 5 or 8 VDC regulators and multiplier diode circuits, while the later versions had 9 VDC regulators and an active multiplier. And yes, there was a cross over. But the modification to the circuit is simple. The circuit difference is the presence of CR10 or not! It is located on the circuit board just below the frequency select switch on the enclosure and to the middle. CR10 is part of the Passive multiplier. Refer to you manual. If you are modifying a 432-28HP transverter, it is an active multiplier.

Now, all 432-28 transverters have two oscillators. The 2nd was designed to be used for Satellite operation and enabled the transverter to operate on 435 MHz. This" two band" operation can be maintained with the VHF ApolLO and actually simplified.

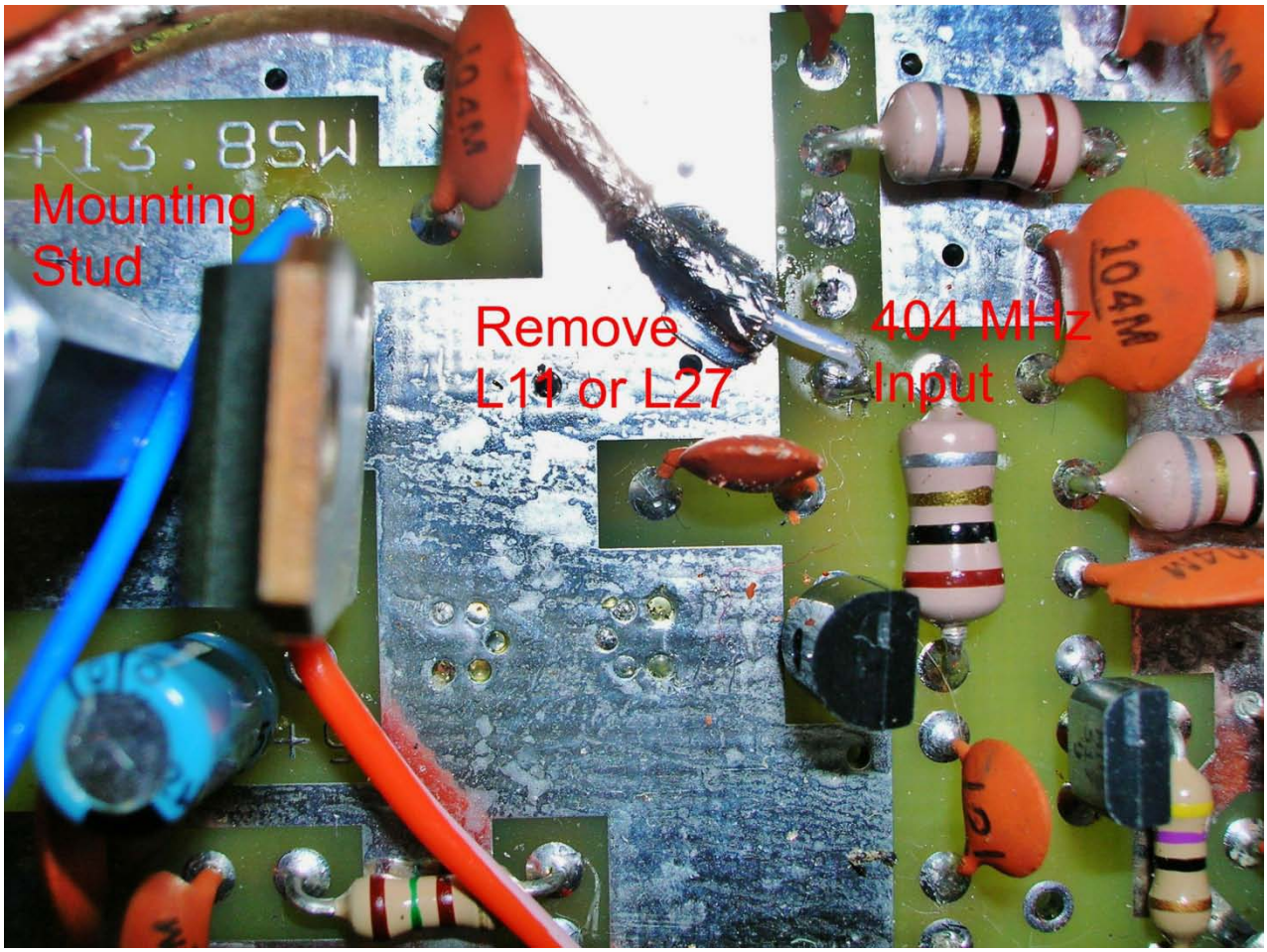
Active Multiplier Mod: Remove the Switched DC supply wires to both the LO1 and LO2 positions. This disables the DC to both oscillators. The Multiplier/amplifier circuit is supplied by VR5 and is directly

connected to the main switch. Then, remove L11. This will be the injection point of the 404 MHz output of the VHF ApolLO

Passive Multiplier mod: Remove the Switched DC supply wires to both LO1 and LO2 positions. This disables the DC to both oscillators. The multiplier/amplifier section is connected directly to the switched 13.7VDC circuit. Then remove L27, C23, L8 CR10 and L24. This is the passive multiplier circuit. Next install a 100pf or larger disc capacitor in the removed L24 position. If C19 is less than 100 pf, replace it with a 100pf or larger.

On all versions, if a Thermistor is installed and wired “Hot” and not on the LO1 or LO2 circuit, remove the + side wire.

The following picture shows a active multiplier version. What is important in the picture is the attachment of the LO input coax. In this case, it is where L11 was. Please note that CR2 (PIN Switching Diode) was also removed. It is not necessary to do that. Because the voltage is removed from the base oscillator circuits, the PIN diodes will not switch and offer a high impedance input not allowing the VHF ApolLO signal to enter the disabled circuit. 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 as shown here if you transverter has it. The coax should be 3” long to get the job done. The +DC wire is 4-5” long.

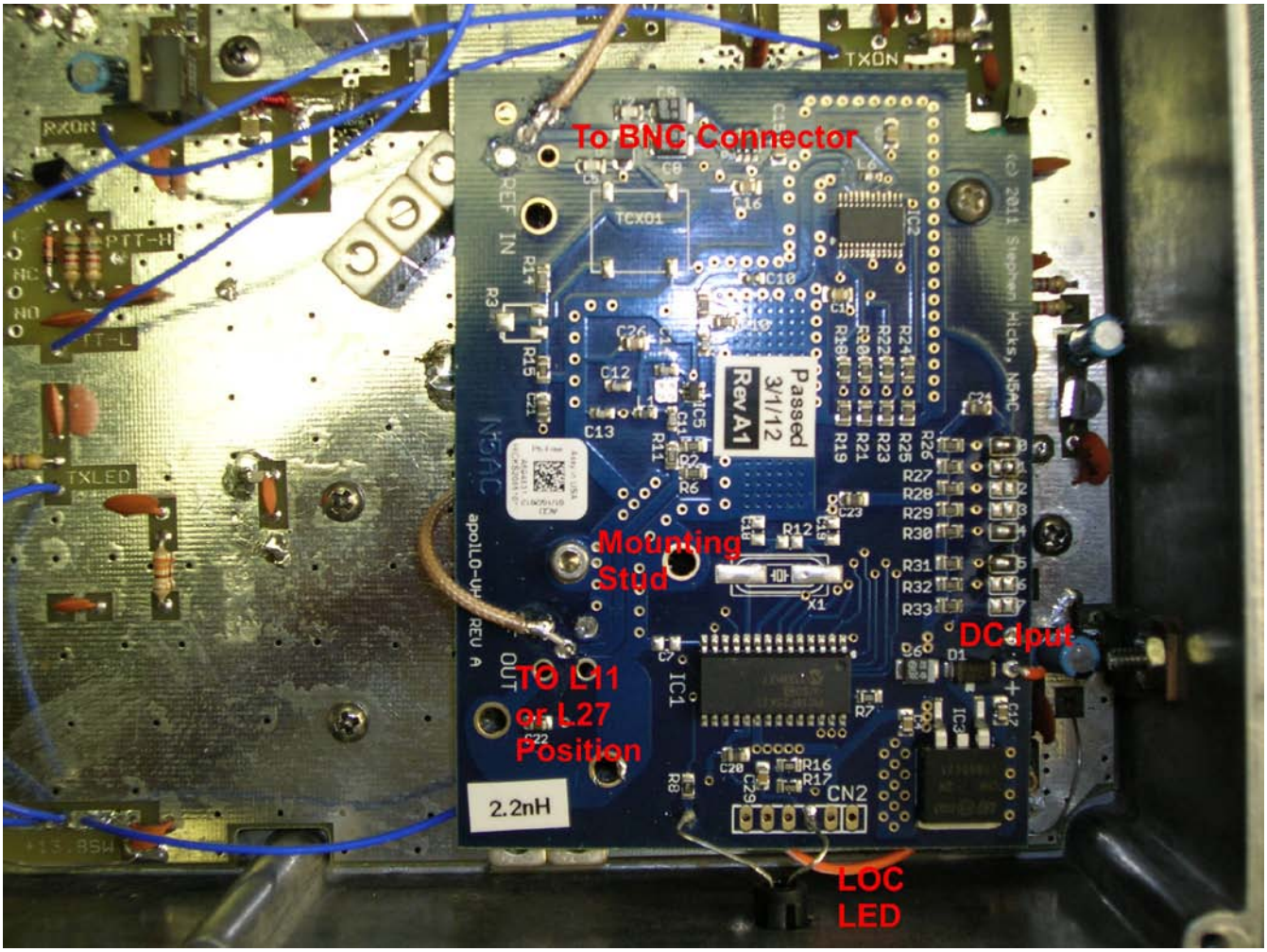


Now, this is the time to verify that there is an extra 3/8” hole for a BNC connector or an extra BNC connection already installed. This is for the external 10 MHz signal. If you have a common IF, there should be one available. If not select a position, drill the hole, and make the installation.

If you desire a LOC light, a hole will need to be made in the enclosure near the frequency select switch. 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. You can use any other color LED or configuration you desire. It is not critical. The following picture shows it's placement in the frequency switch position only because one frequency selection was desired so the switch was removed.

If you desire a "Dual" frequency selection to operate on 432 and 435 (as an example) the switch may be utilized for this selection. Examine the frequency selection chart of the VHF ApolLO. When utilizing a 28 MHz IF for 432 operation and a 404 MHz LO injection, it requires 5, 4 and 0 to be strapped. For 435, it requires 5, 4, and 2. The 5 and 4 positions can be strapped on the board and then use the switch to toggle the "0" and "2" positions to ground to select the desired frequency. Any other combination is possible and the use of a multiple position switch is possible if you desire more than two frequency selections such as to make the transverter "IF Frequency Agile"

Mount the VHF ApolLO on the stud using a 4-40 nut in the position as show in the next picture. Yes, it is only one mount but it works. After it is secure attach a 5" coax between the 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 on the board as shown and mounted in the enclosure as specified before. The short lead of the LED is the ground lead. Shorten the "Hot" lead and install an insulated wire if necessary. Wire the dual band switch now if desired

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 or C34 depending on versions, can be removed and the level 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!

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 a different LO injection point and leaving the Passive multiplier circuit intact if your transverter is of that version. Simply disable the +DC to the 2nd oscillator and remove Q6 and R38 (Passive) or Q4 and R14 (Active) and then injecting the signal at the points of the circuit where the resistors were removed. If the transverter is a active multiplier version, the VHF ApolLO can be set for the 400 MHz but not with the passive multiplier. Connect the LO2 wire to the +DC input of the VHF ApolLO and toggle between the Standard Oscillator and the Synthesizer.

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.