An Idea for a FT-817 Stable Local Oscillator for the Rover

By Bill Koch, W2RMA

FT8 is growing like wild fire on the VHF bands. That's good; we need more folks operating from fixed and rover stations. Activity nights are being added, and hams are experimenting with FT8 up to 10GHz. Elsewhere in this year's Super Conference Proceedings is a paper that addresses the use of the WSJT modes in various situations and their advantages and limitations.

FT8's 15 second 'overs' are particularly attractive and even more so for contest work. 'Contest guns' get itchy when having to spend one minute on each over! One of FT8's limitations is that of 'net drift', or the absolute value of the net frequency movement, between the two stations. Frequency movement cannot exceed about 6 Hz in the 15 second over (actually 6.25 Hz in 12.6 seconds). My experience with two FT817s is that the unit is generally stable enough up through 144 MHz for FT8, although roving can provide temperature swings that cause frequency movement greater than what is tolerated even with the TCXO. While roving, moving the rig from a 70F car into 50F mountain air, or moving it to a table when it is 90F and bright sunshine can cause the limits to be exceeded on your end not to mention what may be happening to your QSO partner.

I did some measurement on my two units, one with the stock LO and the other with the TCXO upgrade. Up through 144 in a stable environment frequency drift was acceptable[1]. However, the 3 bar power setting causes heating that can affect stability. For 432 MHz, the drift was low double digits for the stock LO and TCXO, and would not decode consistently. If one is using the FT817 to drive a transverter, then one must also consider the drift of *four* LOs – two IF rigs and two transverters. Such thinking led me to look for a more stable FT817 LO.

VK3HZ[2] published a paper addressing this need using a GPS locked approach to create a 22.625 MHz LO. Unfortunately, it appears that the necessary boards/components are no longer available so I needed to find another approach. I am using the digiLO board as a LO for some of my transverters, and it seemed that it might be able to do the job. I contacted Corey Abercrombie, N4NGZ, at Q5 Signal, LLC as to whether the board could provide a 22.625 MHz output. Unfortunately, the answer was 'no', but it could be programmed to provide a 45.250 MHz signal, twice the LO frequency. I was thinking that if I could get double the frequency, then a simple divide by two IC could generate the required frequency.

Corey indicated that they had done a similar approach for six meters and provided me with a schematic[3] that they used. The RF flow is from the digiLO to an inverter to standardize the incoming 45.25 MHz frequency, followed by a divide by two chip followed by an emitter follower then to a filter. Simple and straight forward, right?

Well not exactly. I prototyped the board using leaded components and it worked – my frequency counter said 22.625 MHz. Great. But my spectrum analyzer showed a wonderful comb of harmonics from the divider well past 1 GHz that a 9 pole filter attenuated some, but not enough. Such would have made a wonderful chorus for birders. Why? Radiation from connecting wires and components mixed with inadequate shielding and grounding came to mind. I used small adapter boards for the SMD chips and quarter watt sized leaded components – a mistake. It might have been good enough for VHF wiring but not for today's high speed chips. I used ferrite cores for the filter inductances hoping to keep radiation down, though there are still leads. I tried bypassing and ferrite beads to help with cleanliness,

but I stopped short of adding shielding. Why? The board's traces were not designed for this application and I was likely signing up for something that would be bigger and uglier than what I had in mind.

So what now? The rover need is still there, at least for the DX inclined. Yes, 10 GHz JT4F works well; a partner and I demonstrated such recently over a 170 mile path with plenty of mountains in between us. We turned our 33dBi dishes off the direct path such that we couldn't hear the other signal, but still had decodes. On the other hand, if we could not hear the other station at the beginning, we would need signals with known stability and accuracy. And some luck.

I hope to find someone that has this same need and who is also a good circuit board layout designer, something I've never done for VHF frequencies. I'm attaching the schematic that Corey Abercrombie, N4NGZ sent with the custom boards. My sense is that this idea has some legs. I can be contacted via email, W2RMA (at) ARRL.NET.

There's no reason why we rovers can't take advantage of the latest technology to enhance scores!

Footnotes:

1. If one doesn't have a frequency counter capable of measuring the frequency of interest, reach back to the days of 'beat note drift' on a second receiver – the 'wow-wow-wow' sound.
2. http://www.vk3hz.net/riglock/FT817_External_Reference.pdf
3. Attachment provided by Corey Abercrombie, N4NGZ of Q5 Signal, LLC.

Attachment

Circuitry courtesy of Corey Abercrombie, N4NGZ, Q5 Signal, LLC.