Heathkit Home Brew Project

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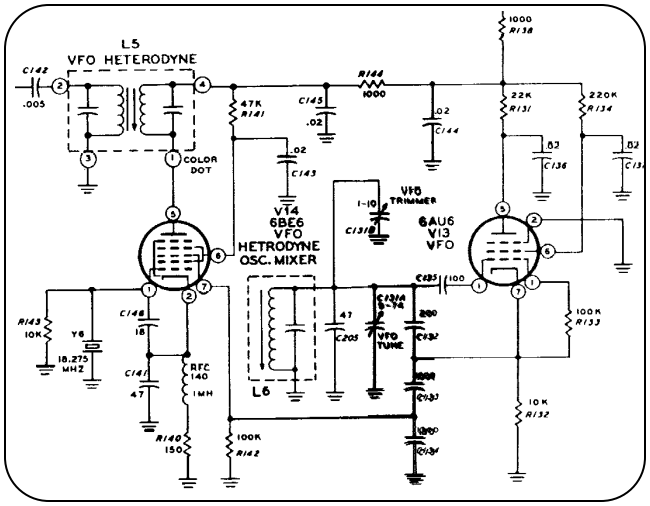
In the April article I stated that my goals were to have the VFO and the heterodyne oscillator built and installed on the hybrid chassis. Part of what I stated has been completed. The VFO was bread boarded and assembled on to the hybrid chassis. The two clunkers that I bought from E Bay proved to be very useful.

I was able to use the adjustable inductor and variable capacitor from the original Heath design. The inductor is part of the VFO tank circuit and is used to set the frequency at the low end of the band. The variable capacitor is used to tune across the band. There is a small trimmer capacitor that is used to set the frequency at the high end of the tuning band. This trimmer will provide 1 -10pF of trimming. I was also able to use the front panel frequency indicator that I salvaged from one of the units that I picked up from E Bay.

Keeping with my design plan, I used the 2N5484 N Channel J FET as the replacement for a 6AU6 vacuum tube in the VFO. Only three leads are connected to the new VFO board: power, ground and the output which goes to the heterodyne oscillator /mixer.

The variable inductor shows a capacitor across the variable inductor. This is shown on the HW32 schematic. I left it off the hybrid schematic as it is not readily visible.



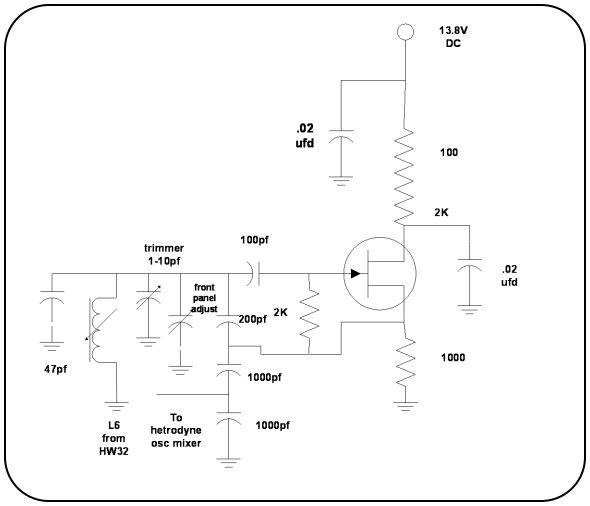


Figure 1. (a) Original HW-23A VFO **(b) New FET Circuit**

I have started to look into the heterodyne oscillator. The original Heathkit circuit used a 6BE6 tube as combination oscillator and mixer. The 6BE6 is a Heptode (or pentagrid — yes it has 5 grids) converter. The oscillator portion of the circuit is configured as a Clapp crystal oscillator. My plan is to use an MC1496 mixer, modulator, demodulator IC to replace the mixer function.

I want to review the mixer as a circuit. It is a very important circuit in the analog world of things. If you "mix" two signals (a non-linear process where the two signals are not added, but multiplied), you get four frequencies out. You get the two original frequencies, the sum of the two and the difference of the two. Along with those frequencies, you also get the harmonics of the originals. It is important to choose the frequencies wisely so you can filter out the unwanted frequencies.

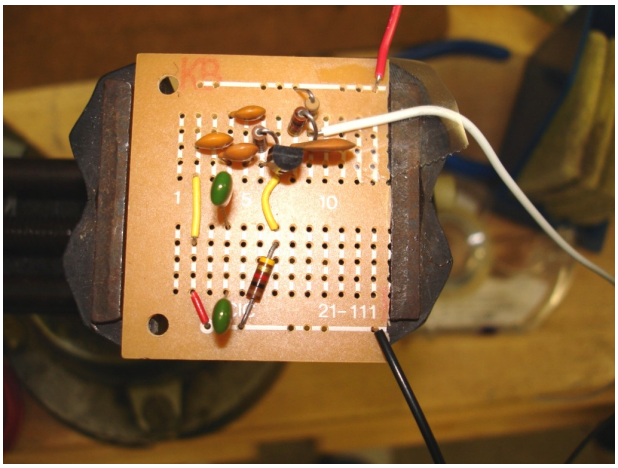


Figure 2. Solderable Bread Board

The HW-32A uses a heterodyne oscillator frequency of 18.275MHz. The VFO tunes over a range about 1.705MHz. It is mixed with the heterodyne oscillator and the difference frequency is used. This results in a "local oscillator" frequency of (18.275 –1.705 =) 16.570MHz. This local oscillator is mixed with the received signal to produce an IF frequency of 2.306MHz. Some quick math tells us we are tuned to 14.264MHz. In the transmit mode there is a carrier oscillator which generates the 2.306 MHz (USB).

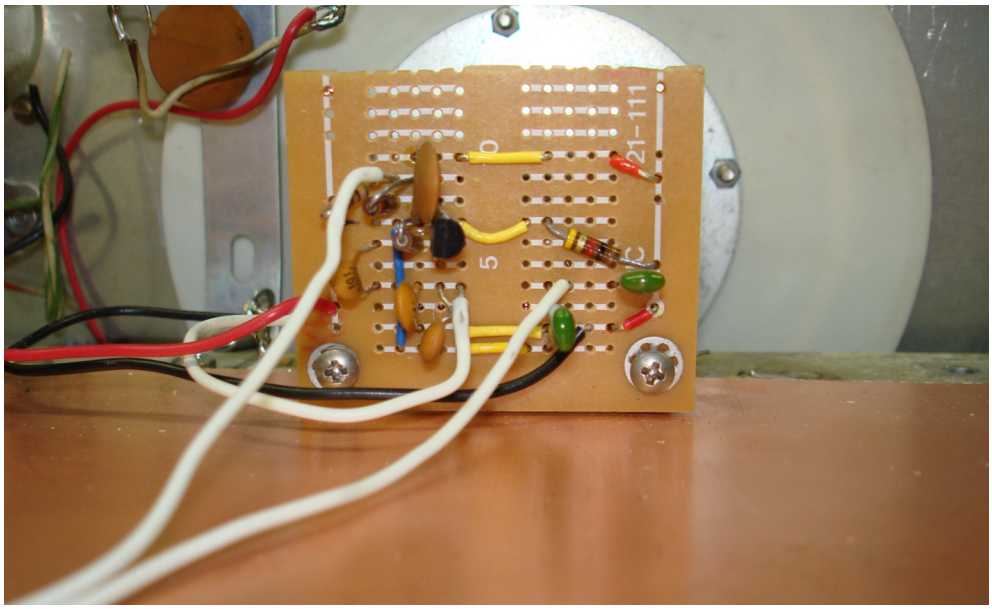


Figure 3. VFO Board Mounted on Chassis

The picture in Figure 3 shows the VFO board mounted on the chassis close to the front panel. The chassis has the VFO tuning capacitor mounted so that the frequency can be front panel adjusted.

I was able to find some small

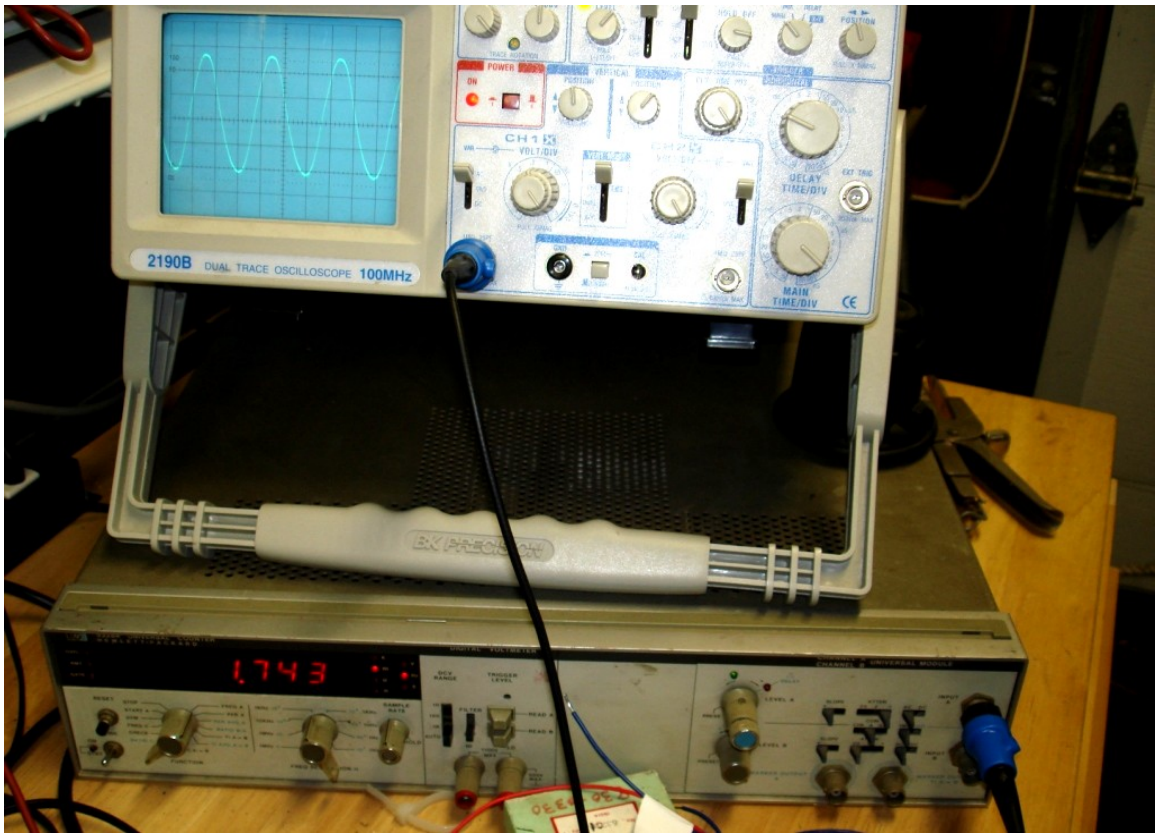


Figure 4. Oscilloscope and Counter: Frequency is 1.743 MHz

angle brackets from the Mouser Catalog and ordered two different sizes. This board is mounted with 4-40 hardware.

The picture in Figure 4 shows the output of the VFO and the frequency of the output. The output voltage is 2.5Vp-p. The frequency is 1.743MHz. The scope trace is steady and the waveform is a clean sine wave. What I have observed so far is that the original tube design requires a 30 minute warm up to get the tubes up to temperature. The solid state FET design comes up to frequency and has no noticeable frequency drift. However the final test with the covers on and the transmitter tube filaments heating up will be the proof of the pudding.

My plans for next month are to have the heterodyne oscillator and mixer breadboarded.

If you have any questions regarding this article, please contact me at WB6WXO@SOARA.ORG