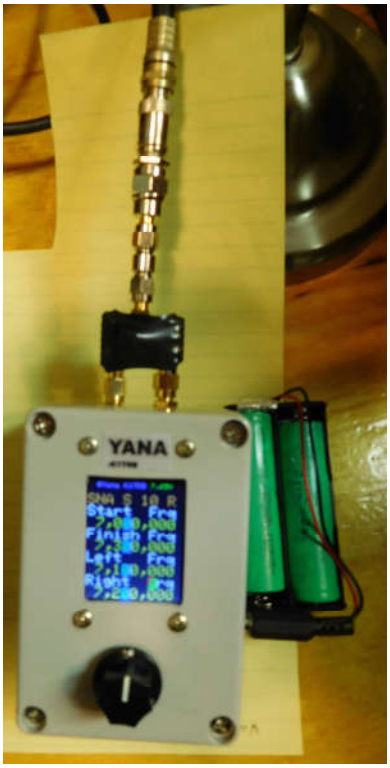
SWR … Antenna SWR on 40m and 20m

K1TRB 5/5/17



There is a back story to this experiment. I had an 80m horizontal loop which fell down at the end of last summer. Several of the tree corner supports failed. Winter was closing in and there was no time to fix all supports. Two corners oriented north-south remained, therefore, I could pull up a dipole. To have some multiband capability I decided on an off center fed antenna. The G5RV is a favorite but not a good match to 50 ohms. ZS6BKW found a better version for 50 ohms. I use 75 ohm coax because it is cheap and of high quality (the effect of cable TV). W0BTU has moved the antenna to 75 ohms.
http://www.w0btu.com/g5rv_antenna.html

I chose the W0BTU antenna. I had the wire but not enough ladder line. So I spliced onto the ladder line some old cracking 300 ohm twin lead. The ladder line acts as an impedance transformer, so that connecting the 300 ohm twin lead to the 450 ohm ladder line would just change the character of this transformer a bit. That is: no harm done. (If I had a high power amplifier, I would worry.)

The W0BTU antenna is really a system. It consists of an off center fed dipole connected to a section of transmission line that radiates and transforms the antenna impedance to a different value. The impedance and length of the ladder line determine how much the antenna feed point impedance is changed.

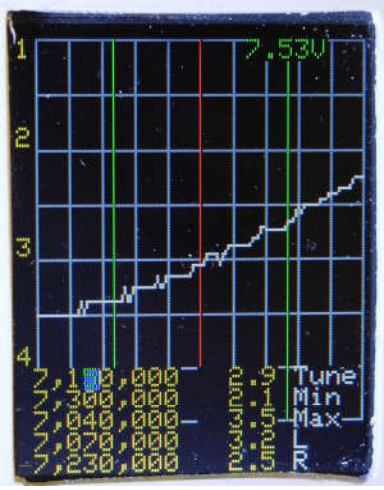
There is an advantage to this scheme. The dipole does not need precision trimming. Any errors due to wire length, antenna height, or terrain can be tuned out by trimming the ladder line length: a far easier process than trimming the antenna.

So, with freezing weather closing in fast, I had to get this thing up and trimmed. The 300 ohm line kept cracking and was not totally cooperative. So I did the best I could in really cold conditions. I wanted the SWR at the end of the ladder line to be less than 4:1. My very long coax to the shack would transform the impedance further, but with a 4:1 match losses would not be too large. That was my hope.

An off center fed dipole has badly unbalanced currents at the feed point. Therefore, the connection between the unbalanced coax and the feed line with unknown balance currents requires a common mode choke. This choke hangs up in the air at the end of the transmission line. When cutting the ladder line, the swr is measured at the coax side of the choke.

I persevered. How did I do? This measurement is made at the transmitter position. Technically, my checking was done with a 50 ohm system where the coax is really 75 ohm. The swr of 75 ohms connected to 50 ohms is 1.5:1 which is not very different. Therefore, hoping for a 4:1 swr, there is no harm in measuring at 50 ohms.

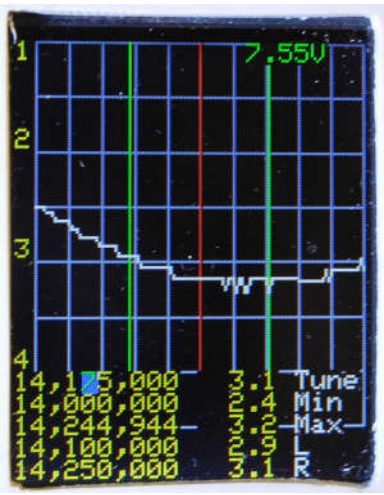
The setup is simple: I connected the swr bridge to the coax with adapters that changed Type F fittings into sma fittings. A picture shows the result.



The ladder line was cut for swr at its end. There is a long run of 75 ohm coax to the shack. This long run will transform the impedance to some other value. Therefore, what happens at the transmitter is what is measured.

The Measurements

For these measurements, markers are not necessary so they were set to reasonable values. The first scan was set for 7 to 7.3MHz, i.e. the 40 meter band. The results are shown at the right.



Over the band the SWR varies from 3.5 at 7MHz to 2.1 at 7.3MHz. This is within the range I was hoping for. My autotuner had no difficulty with a match on 40 meters. The graph shows why.

The second scan was set for 14MHz to 14.35MHz, i.e. the 20 meter band. This antenna is supposed to be a good match for 40 and 20 meters.

The second graph also shows that the match is what I had hoped for.

There is an interaction between the antenna length, feed point, and ladder line length that moves the multiple band resonances around. It might be possible to move the swr minima to band center on both 40 and 20 meters by judicious trimming. In fact, the major adjustments are due to the investigations of W0BTU. My implementation is good enough for me so I'll wait for the return of my loop.