30 Meter Band Pass Filter

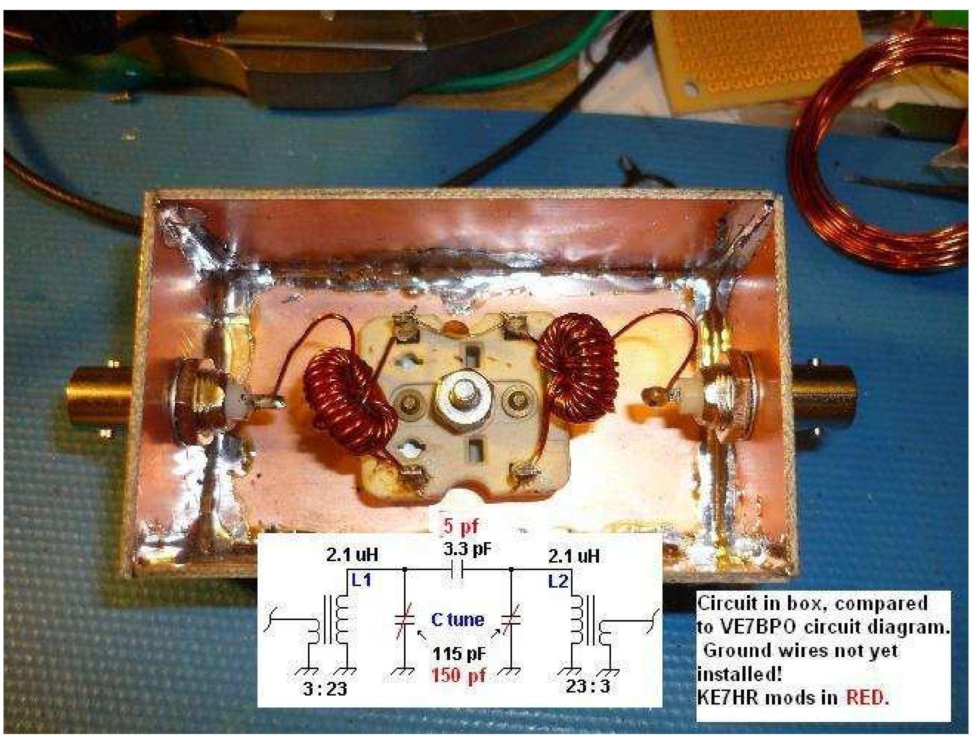
Paul R. Jorgenson KE7HR
NSS 39382RLFE

I had the occasion to build a band pass filter for the 30 meter band. One of my favorite sources for quick and useful radio projects and ideas is the web pages of Todd Gale, VE7BPO. The "QRP / SWL Homebuilder" pages start at http://www.qrp.pops.net/default.asp and the specific page that I was referencing was "High-Pass and Band-Pass Filter Information" page at: http://www.qrp.pops.net/bandpass.asp which has a section on [cue music] 30 meter band pass filters.

The "popcorn" aspect (quick easy to replicate circuit with readily available parts) of Todd's circuits is always appealing to me. Time to gather the few parts and get to building.

Some people have an aversion to winding a transformer on a toroid. It really is very simple. Put the wire through the ring—very good, that is your first turn. Keep adding turns until you reach the inductance required or the number of turns on the circuit you are copying! I use enameled magnet wire most of the time. Scrape the ends of the wire where it will need to be soldered to the circuit and tin the leads.

It the case of this circuit, wind 23 turns through the torrid with one wire and 3 turns with another wire. There, you have a transformer! I changed the circuit slightly (this is EXPERIMENTATION, after all!) to reflect what I had in the junk box and made two of the capacitors mica variables (15 to 150 pF) that just happened to be on the same ceramic carrier. The variables allow me to make adjustments for any slight variation in the rest of the circuit using parts that I have on hand. The coupling capacitor was also changed, slightly, to a 5 pF since I had one on hand.



The circuit builds up just like the schematic!

I used T50-2 cores instead of the T50-6 since I had them on hand at the time. If the circuit was to be on a much higher frequency than 10 MHz, then I would go for the –6 part since it works better at higher frequencies.

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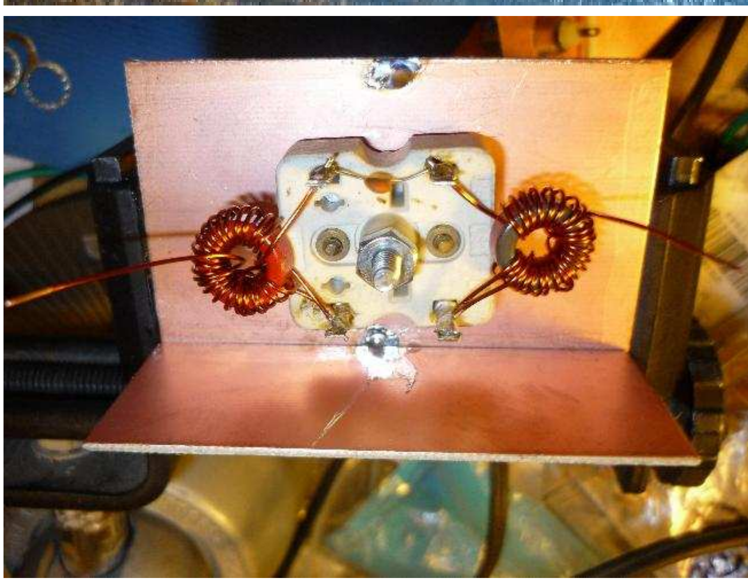
The box is built of circuit board material. I used to use an old school paper cutter to trim my boards to size, but now have a shear that makes the work a bit easier. If you don't have either tool, then a hacksaw or tin snips will help you make do.



The top board segment with holes drilled to hold the capacitors on and allow adjustment.

Then, start adding the rest of the pieces, starting with tack soldering.

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The testing of the filter was made easier with a wide band programmable noise generator and spectrum analyzer (at work…). With the noise going in one end of the filter, the other end was hooked to the analyzer and the real time adjustments were made to center the filter shape on the frequency and also go for maximum depth of the skirts.

It is a good looking filter shape for so few parts! This is a 500 sweep average which takes the jaggedness of the noise and makes it smoother.

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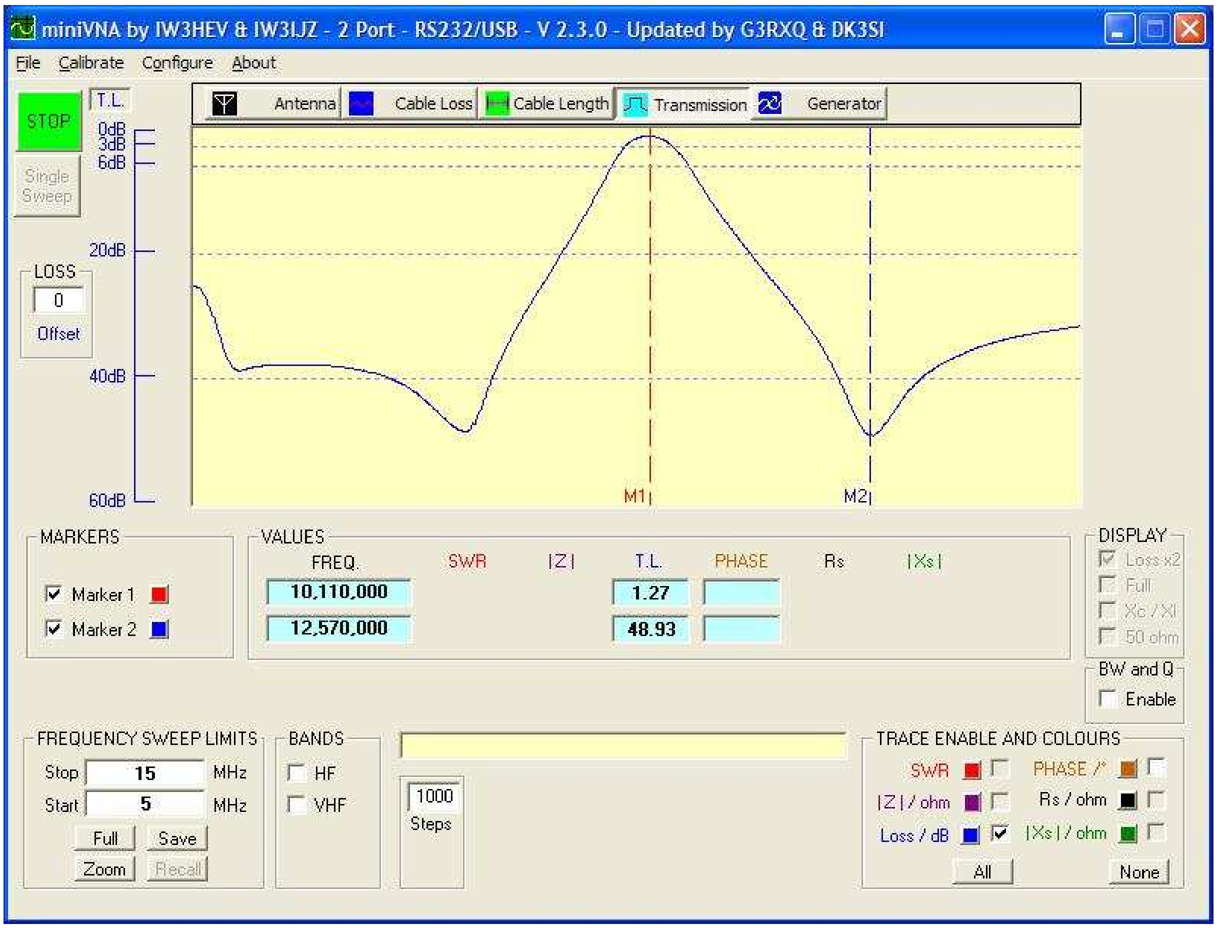
I personally own a much less expensive, but very versatile tool called the miniVNA. The price as of this writing (June 2011) is in the vicinity of $400 (was just over $300 when I got it a few years ago) but it will allow testing of filters (and antennas, and coax, and…) with great speed and in real time. I don't know how I ever lived without it when tuning antennas! This was my first opportunity to try it on a filter and I am very impressed by the quality of the results from a tool that costs about 5% of the professional equipment at work! It was easy to make adjustments and see the filter shape morph in real time as the adjustments were made .



I am very happy with the simple filter circuit. No expensive testing tools? It should be easy to tune by just listening to a receiver (GASP! No expensive tools, just a tuned ear!) and an oscillator or strong station in the band. The two variable capacitors interact and a bit of back and forth must be done to get the filter to lay exactly where you need it. Peak response on the band of interest is the key.

The noise floor of the spectrum analyzer was about –98 dBm with the settings used measured with no input. This filter has an insertion loss of about 2.5 dB. I was expecting about 3 dB. Not too bad for a circuit put together in less than 20 minutes. The box took about another

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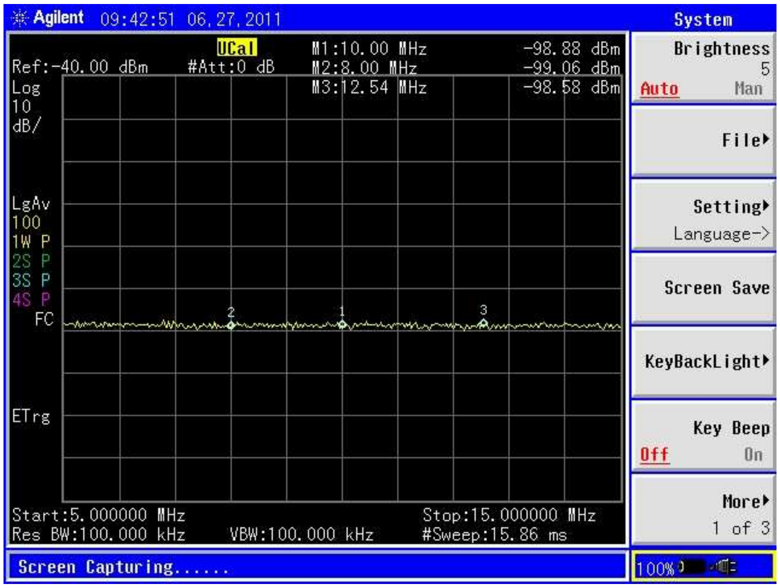

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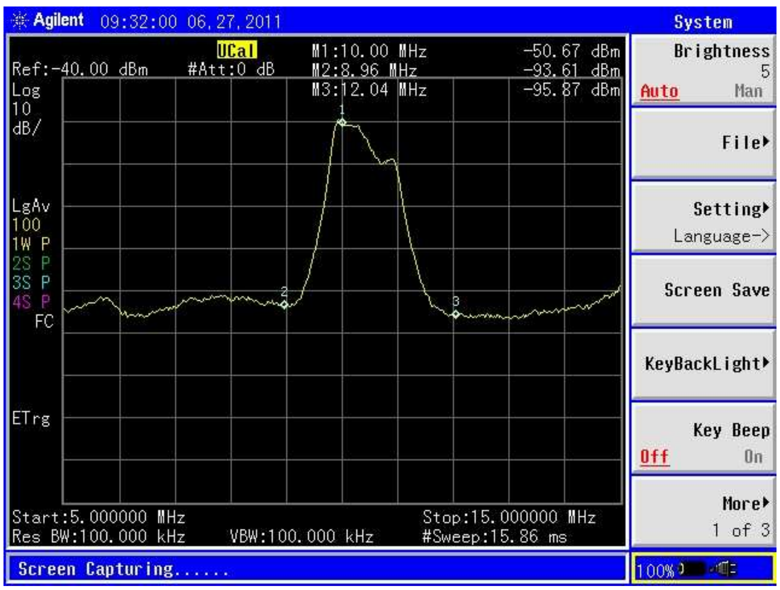
hour, but that is fun time!

The noise floor of the spectrum analyzer.



I built a second filter (if one is good, how many are too many?) and the filter shape and magnitude of the skirt cut off were nearly identical. This one was done with the T50-6 toroid and variable capacitors.

I then put one filter in series with the other to see what the filter shape was. The skirts are much steeper but there is a lump in the higher frequencies. It would probably be much better if there were an appropriate coupling capacitor as opposed to a piece of coax. More experimentation will be needed!