My History With the KN-Q7A and Other Kits

22 August 2018 – Larry Lovell (N7RGW) – QRVTronics.com

In January 2009, I found myself out of work and into early retirement. I had a goal to start a webpage where I could sell products (more for the fun than the money). My desire was to sell KITS, electronic Kits. I liked the idea of Amateur Radio Kits.

Sometime in 2011 I found a kit that would satisfy my needs. It was the KN-Q7A. This was a Single Band, Single Sideband Transceiver. The cost was under $130. It had limitations, but it also had the ability to be expanded and experimented with. This could all be done inexpensively.

I started selling this kit on my newly formed webpage of QRVTronics.com. I also offered several suggestions for upgrading as some of my customers volunteered their ideas. Some were my own experiments.
http://www.qrvtronics.com/Side_Left_B/Modifications.htm

This Page will list Modifications people have made to the KN-Q7A kit.
Please email any suggestions larry@qrvtronics.com
These will become Hyperlinks when material is available.

- KN-Q7A Microphone Speaker
- KN-Q7A Multiple Frequency Operation
- KN-Q7A Original VFO Replacement for VXO

- Internal Speaker
- Winding the T1, T2 and T3 Toroid's

- Sandwich Replacement for VXO
- ON/Off Switch
- Dual Band Addition
- I2C-LCD Display for Sandwich
- I2C-OLED Display for Sandwich

Sometime around 2014 (I think), Adam Rong, BD6CR/4 took a suggestion from a customer and added a speaker to the microphone. This made it a lot less expensive that trying to do it myself. He made a minor modification to the Main PCB to incorporate this feature. Earlier models would have to have added a jumper wire from the speaker connection to the appropriate Microphone pin.

The major issue that I had was that I didn't like the crystal limited frequency. One option was to add multiple crystals and enable them with a switch. This worked but was not very satisfying. I began looking for an upgrade that would take me from a limited 20 KHz in a band to the full band capability. I found the N3ZI DDS2. It also came with a frequency display. But at a cost of about $100 at the time I decided that there had to be a better way. The price has since come down.

Then in 2016 Adam Rong, BD6CR/4 informed me that the KNQ-7A had reached the end of its life and he would no longer be able to supply it. I was devastated by this possibility.

However, near the beginning of 2017, Adam introduced what he called was a "Sandwich". The Sandwich was a digital VFO made from two PC boards with an Arduino-Pro-Mini in between, thus the origin of the Sandwich name. One PC board was the control board on the front. The back board was an Oscillator board that used an Si5351 clock chip that would provide both the BFO and VFO for the radio. The Arduino was then programmed to provide the appropriate BFO and VFO frequencies. At first this "Sandwich" was offered as an upgrade for the KN-Q7A radio.

Then Adam introduced the CS-Series Single Side Band Radio which was basically the KN-Q7A with the Sandwich included. The price was about the same and that was great. The radio was offered at first for the 40 Meter band, then the 20 Meter band and eventually the 80 Meter, 17 Meter and 15 Meter bands.

With the introduction of the Sandwich many customers looked at the code. The original CS-Series radio used a single LED to identify the frequency that was being used. You knew at what frequency you started with, and you could count the color changes to estimate the location of your radio. This worked well but remembering the N3ZI LCD display got me thinking.

I thought of two upgrades at the same time. One was adding a frequency display and the other was adding a Dual Band capability to the CS-Series radio. The Dual Band Option was the easiest to implement so that is what I worked on first.

I used a DPDT switch to open/close the JP10 jumper to switch between bands in software and the other pole on the switch provided power to relays to switch between the two bands. My first bands were 40 Meters and 80 Meters. This worked very well. I next introduced the 20 Meter band. By this time Adam had added 17 and 15 Meters to the radio so I was able to procure the band pass filters. I started selling this upgrade for $35. The only issue that I found was that the 20, 17 and 15 Meter bands did not have as much power as the 80 and 40 Meter bands. More on this later.

Then I started working on a display for the radio. I started by trying to find a frequency counter that might work. This proved to be too expensive. As I was studying the Arduino I discovered that we were using an I2C bus for the Si5351 chip. This meant that the bus could be available to drive and LCD.

I found that the LCD with I2C capability was inexpensive. But where do I place it in the radio. I did not want to mount it in the lid as some had done. So, I thought of putting it in its own matching case. Adam was able to provide me with the matching case and feet. I noticed that the case was mostly empty, so I decided to add a Li-Ion battery pack and charger to the case. This went together well but the cost was more than I think most people wanted to spend. It is still available as an option for about $65. It does make the radio work well with having an attached power supply.

I kept looking for a display that could be mounted in the faceplate or the radio without the need for an external case. I came across two different OLED displays that would work and were well priced. The first one I called the small OLED because it could be placed in the faceplate without having to move the Gain Control of the radio.

The other I called the Large OLED. It was more pleasant for me to read and had a nice read out. But this required moving the Gain Control and hand wiring it back in.

I still provide both options, but in the process, I developed what I called my Option 5. Option 5 is only available with the Larger OLED Display. I took the schematic of the Sandwich and combined the Control Board and Oscillator Boards into a single PCB. I also added a Gain Control to the board itself to eliminate the need for external wiring of the Gain Control. I then changed the Dual Band switch and incorporated it into a push button for changing bands. This also required several changes to the Arduino software. This took about 4 different spins of PC boards and adding new ideas until I came up with this Option 5.

By this time, Option 5 had its own faceplate and so I decided to change the faceplate on the back of the radio and add a nice ON/OFF switch. These options were so different from the original CS-Series that I decided to call it a different name. Thus, came the ALX-SSB Transceiver.

The

ALX-SSB Transceiver is basically the CS-Series guts with my new Option 5 and front and rear faceplates.

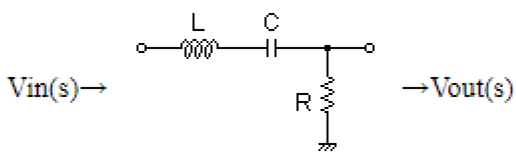
While investigating these changes I decided that it might be possible to obtain a Quad Band radio for 80, 40, 20 and 15 Meters. I figured how to control this in software and have created a Quad Band filter board which checks out well. I was still disappointed with the power out on 20, 17 and 15 Meters.

I had built a 40/15 Meter radio for a customer, but I was only getting out about 0.5 watts on 15 Meters. He needed at least 2 or 3 watts. My experiments confirmed that the Transmitter was capable of more wattage on those bands, so I investigated further.

What I discovered was that the existing design of the 17 and 15 Meter band pass filter attenuated the signal, thus reducing the power available to the input of the transmitter.

I went in search of a simple band pass filter similar to the original but without attenuating the signal. I came across a simple L, C, R band pass filter and tried it out.

To my surprise, it worked better than the original with no attenuation in the pass band that would affect the power out. I was now getting about 7 watts out.



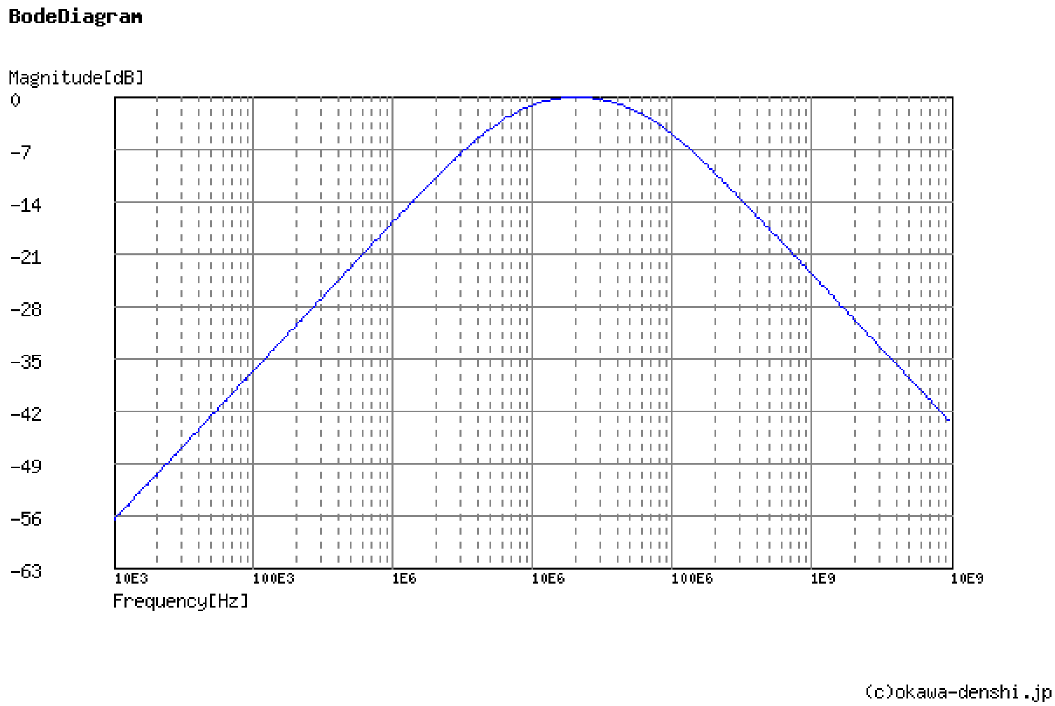
Transfer function

$$\frac{vo}{vi} = \frac{\frac{R}{L}s}{s^2 + \frac{R}{L}s + \frac{1}{LC}}$$

The filter is a little broader than the original filter and allows both 17 and 15 meters to use the same filter. I now have a 5 Band Pass filter design.

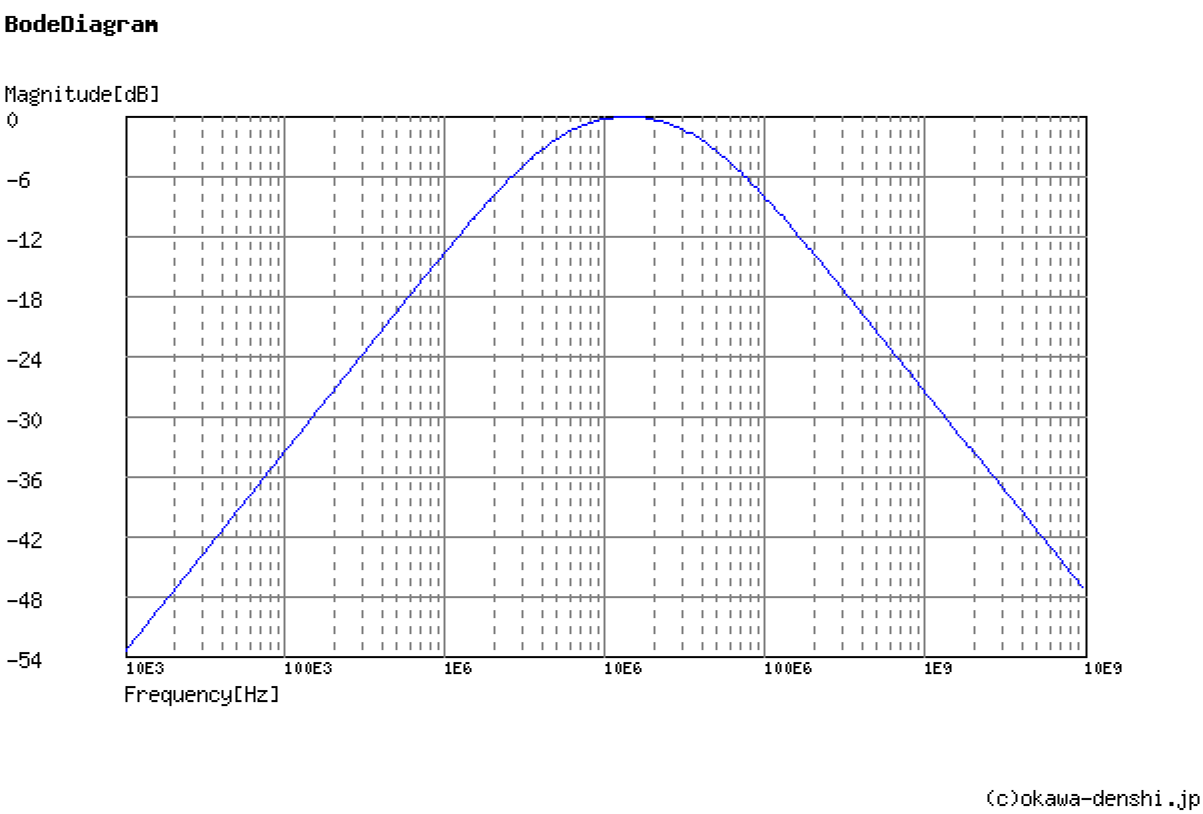
The filter uses One DIY7-21, a 2.2K resistor and a 47-pf capacitor. The band width looks about like this in the transmit section of the band (Simulated):

This is the Bode Diagram for the 15/17 Meter filter: (Simulated)

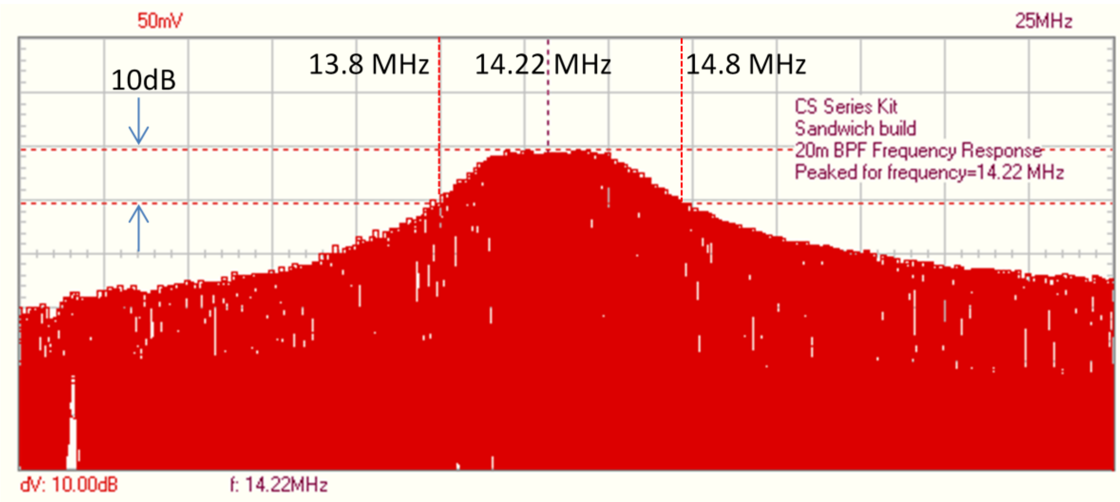


I will be using a similar design for the 20 Meter Band (Simulated).

f_0 = 14001961.359343[Hz] at mid-range of DIY7.



Present 20 Meter Band Filter as measured:



First pass of the Quad, now 5 Band Filter Board looks like this: