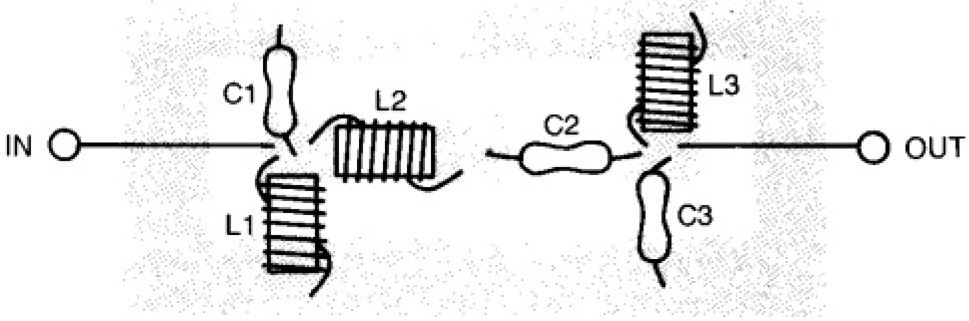
160 Meter Butterworth Bandpass Filter Construction

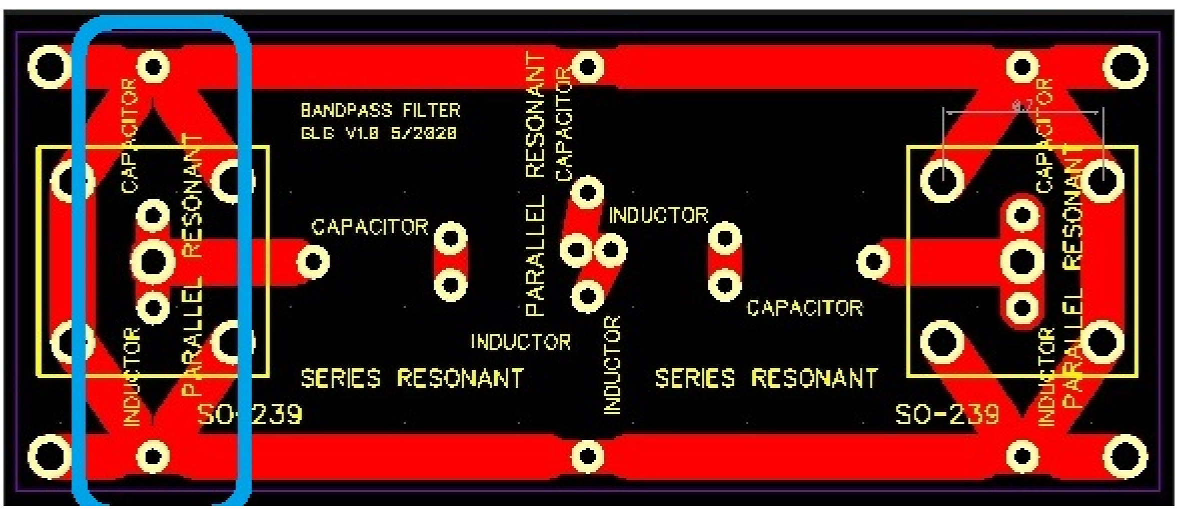
Suggested construction technique.   Your methods, techniques, and results may vary.



1. Solder SO-239 with pigtails to the left side of the printed circuit board (center, ground) This will allow you to provide a signal INPUT.

2. Solder SO-239 with pigtails to the right side of the printed circuit board (center, ground)

3. Install C1 and L1 as shown in the above Layout.   They form a PARALLEL TUNED CIRCUIT that does not short out 160 meter signals, but tends to short out other frequencies.   It isn't very sharp.   Set them on the input connector shown in the image below:



Use paralleled capacitors as necessary to construct C1 (2 or 3 is a good choice and will spread out the RF current) and try to come close to the recommended values:
(For our purposes, use the T80-6 and 22 turns of AWG #20 wire; avoid overlap.)   Use the solder-drop technique to tin the last 1/4" of the wires from the inductor, making them about 3/4" long.

160m ARRL Butterworth BPF	end parallel filter

Inductor	~ 2.2 uH*
Estimated turns	15 turns T130-6 22 turns T80-6
Capacitor	4000pf >=1kV

You'll notice these are relative low impedances, because the purpose of this filter is to SHORT OUT undesired signals

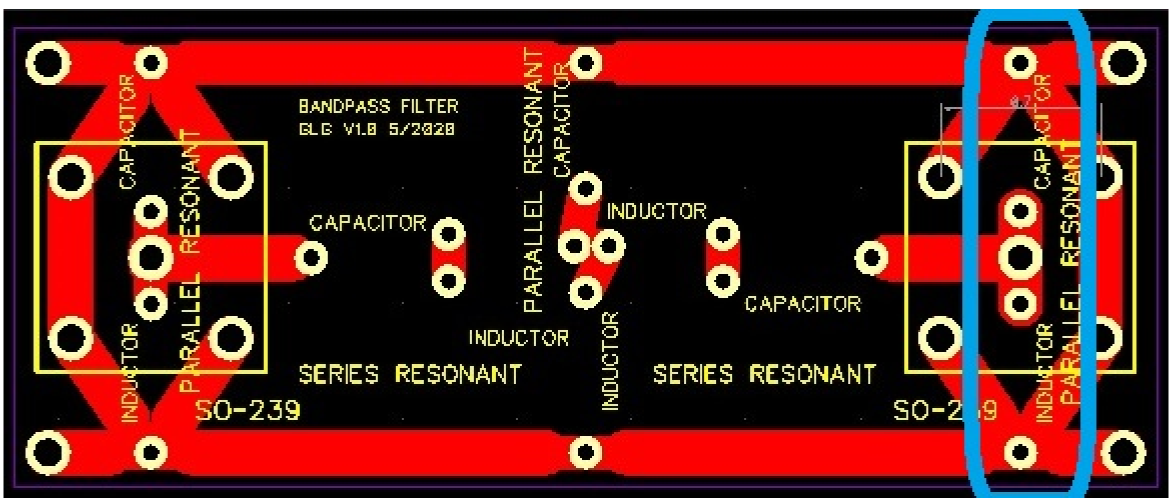
3. Temporarily solder a jumper wire from the center of the left SO239 to the center of the right SO39.

4. Using a spectrum analyzer or nanoVNA, find the resonance frequency of the parallel tuned circuit. The goal is to get it about 1.75 MHz.

- Pushing turns together raises inductance and lowers resonant frequency
- Spreading turns apart reduces inductance and raises resonant frequency
- If the frequency is way off, use the mathematical proportion of the measured frequency to 1.75 MHz to predict the % change to turns on the coil.

5. Replicate your tuned circuit on the other end of the printed circuit board, installing **L3, C3**, using the combination that worked for you on the left side. Hopefully this will make it be pretty close from the start.

It isn't that important whether you put the capacitor or the inductor on the up or down side, when you are using toroids, because they are fairly "self-shielding".

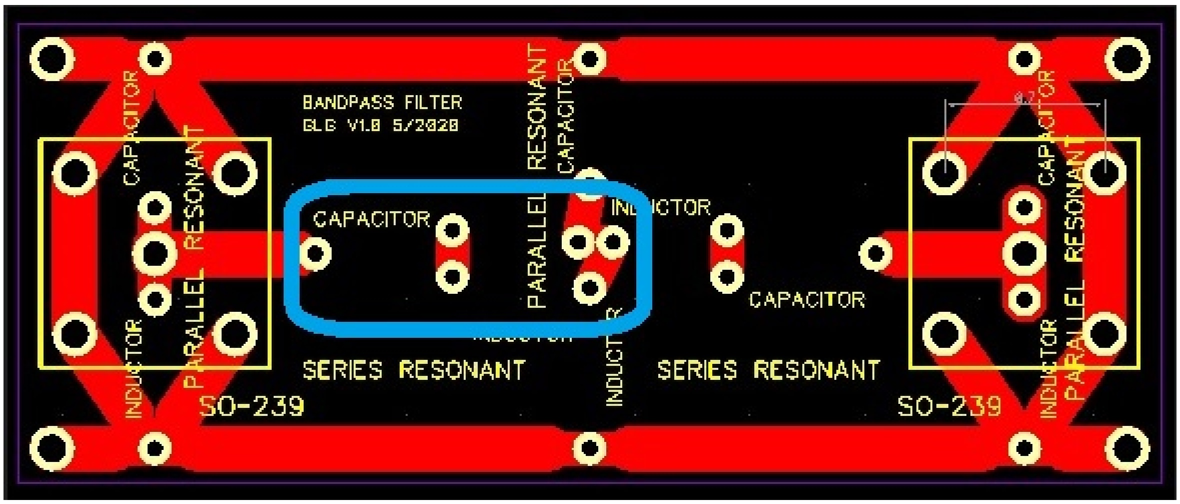


6. De-solder the center conductor of the LEFT SO239 and using a short jumper wire to connect it to the center of the RIGHT sided tuned circuit you have just created. This eliminates the influence of the LEFT tuned circuit that you have already tuned, and allows you to measure just the RIGHT hand parallel tuned circuit you have created.

7. Using a spectrum analyzer or nanoVNA, find the resonance frequency of the newly constructed parallel tuned circuit. The goal is to get it about 1.75 MHz.

- Pushing turns together raises inductance and lowers resonant frequency
- Spreading turns apart reduces inductance and raises resonant frequency
- If the frequency is way off, use the mathematical proportion of the measured frequency to 1.75 MHz to predict the % change to turns on the coil.

8 Install L2 and C2 on the "left center side as shown in the image below: These form a SERIES tuned circuit that passes easily 160meter energy, but provides impedance to resist the flow of other frequencies. You'll notice that the impedances used here are significantly LARGER than those used in the parallel tuned circuits created earlier. That's so they can resist undesired frequencies.



160m ARRL Butterworth BPF	Series Tuned center
Inductor	~22uH*
Calculated turns	48 turns T130-6
Capacitor	400 pf >= 1kV

9. Use AWG 20 wire and place the turns so you don't overlap any. Use the larger T130-6 core to give enough room for 48 turns.

10. Re solder the left SO239 to its proper connection on the board.

11. Connect a short jumper from the right hand side of the series tuned resonant circuit over to the center conductor of the right SO239, so that you have the entire filter now soldered together.

12. Study the frequency response of the filter using a spectrum analyzer or nanoVNA and make adjustments as needed to get the center passband evenly across the 160 meter band (1.8-2.0 MHz). The loss should be on the order of 0.5 dB.

There is room left on the printed circuit board for adding another series tuned circuit and another parallel tuned circuit if the sharpness of the filter is judged inadequate for your needs.   For the first construction, we're just building this single-section filter.

13. Remove the pigtail SO239's, install the board in the aluminum case using about 1/2" brass standoffs and 3MM screws.

14. Using two 3MM screws and nuts on each side, install an SO239 on each end.

15. Using short jumper wire, connect each SO239 to the proper center conductor on the printed circuit board

16. Recheck the performance of the Filter and fill in this table:

Frequency:	1.8 MHz	2.0 MHz	3.5 MHz	7.0 MHz	14.0 MHz
dB loss:					