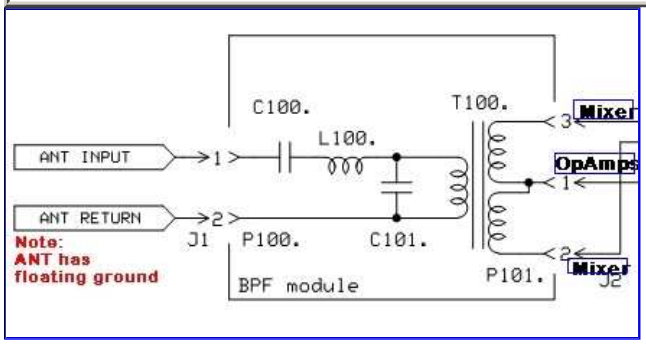
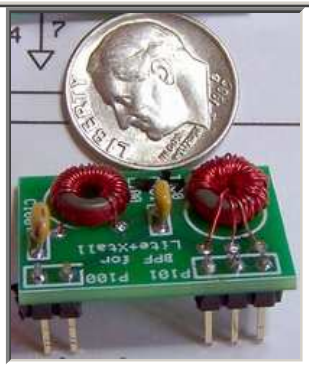
V - Bandpass Filter(s) Stage

Home Page Power Supply Local Oscillator Dividers Op Amps; BPF(s) Mixer Comments

Schematic





Theory of Operation

This stage lets the SDR filter out the RF spectrum arriving at the antenna into a "chunk" of the RF spectrum corresponding to the desired band(s). This is filtering "in the large", and is designed to minimize interference/harmonics from very strong, out-of-band signals.

Summary Build Steps

- Saw the boards
- For each board
  - Wind and install L100
  - Wind and install T100
  - Install ceramic capacitors (2)
  - Install plugs P100 and P101
- Testing

Bill of Materials

Bill of Materials for the 4 BPF Boards

Designation	Component	Type	Qty	Notes	Circuit
BPF-Board-1	Board	BPF Board	1	BPF-160	BPF-1
C100-1	390 pF (code 391)	ceramic	1	BPF-160	BPF-1
C101-1	5600 pF (code 562)	ceramic	1	BPF-160	BPF-1
L100-1	18.7 uH	T-30-2 red #30	1	BPF-160 - 66Turns (32")	BPF-1
T100-1	1.4 uH pri	T30-2 red #30	1	BPF-160 18T(pri 10"); 9T bifilar (5")	BPF-1
P100-1	2 pin	header	1	BPF-1	BPF-1
P101-1	3 pin	header	1	BPF-1	BPF-1
BPF-Board-2	Board	BPF Board	1	BPF-80/40	BPF-2
C100-2	560 pF (code 561)	ceramic	1	BPF-80/40	BPF-2
C101-2	680 pF (code 681)	ceramic	1	BPF-80/40	BPF-2
L100-2	1.6 uH	T25-2 red #30	1	BPF-80/40 - 22 turns (11")	BPF-2
T100-2	1.2 uH pri	T25-2 red #30	1	BPF-80/40 18T(pri 10"); 9T bifilar(5")	BPF-2
P100-2	2 pin	header	1	BPF-2	BPF-2
P101-2	3 pin	header	1	BPF-2	BPF-2
BPF-Board-3	Board	BPF Board	1	BPF-30/20/17	BPF-3
C100-3	180 pF (code 181)	ceramic	1	BPF-30/20/17	BPF-3
C101-3	220 pF (code 221)	ceramic	1	BPF-30/20/17	BPF-3
L100-3	0.78 uH	T25-6 yellow #30	1	BPF-30/20/17 - 17 turns (9")	BPF-3
T100-3	0.6 uH pri	T25-6 yellow #30	1	BPF-30/20/17 14T(pri 8"); 7T bifilar (5")	BPF-3
P100-3	2 pin	header	1	BPF-3	BPF-3
P101-3 P101-3	3 pin	header	1	BPF-3	BPF-3

BPF-Board-4	Board	BPF Board	1	BPF-15/12/10	BPF-4
C100-4	82 pF (code 82)	ceramic	1	BPF-15/12/10	BPF-4
C101-4	330 pF (code 331)	ceramic	1	BPF-15/12/10	BPF-4
L100-4	0.53 uH	T25-6 yellow #30	1	BPF-15/12/10 - 14 turns (8")	BPF-4
T100-4	0.13 uH pri	T25-6 yellow #30	1	BPF-15/12/10 7T(pri 5"); 4T bifilar (4")	BPF-4
P100-4	2 pin	header	1	BPF-4	BPF-4
P101-4	3 pin	header	1	BPF-4	BPF-4

Installation Notes

There are four bandpass filters (BPFs) you can build, each on its own board with 2 caps, a coil, a transformer, and two sockets for plugging it into the main board. The Bill of Materials above provides you with the parts list for each board. You only need to build one BPF to test out your receiver capability. It is recommended - especially if you are inexperienced in winding coils and toroids - to begin with a BPF for the band you are least interested in (just to get the practice in a non-threatening fashion).

Saw The Boards

The BPF filter boards are in a strip of four boards and will require the kit builder to hacksaw between the boards to separate the individual BPF boads. It is suggested to use a small plastic miter box and a fine-toothed blade (24 tpi or better) to help cut perpendicularly across the 0.65 inch wide strip. This seems to work well. However, please note the safety warnings on the Softrock reflector (message 23126) concerning the danger in inhaling the dust resulting from sawing.

Included with the BPF kits is a 9-pin length of a SIP pin strip. This pin strip is to be used as a tool to align the 2-pin and 3-pin sections of the sockets on the v8.3 main circuit board. Afterwards the 9-pin strip may be snipped into 2-pin or 3-pin lengths as spares for the pins that mount on the bottom of each BPF board.

Winding Inductors

To learn how to wind coils and transformers, please read the tips from the experts and then view the excellent videos on KC0WOXs Website to solidify your understanding of the task.

Concernimg the number of turns in the windings, David WW2R has reported that he had to adjust the number of windings on L100-1 (the 66 turn coil on the 160m band) because of the fact that the toroid was not able to accept 66 turns as a single layer, without winding back over some of the existing winding. Overlapping turns caused him to need 69 turns to reach the required inductance of 18.7 uH.

Pete N4ZR chimed in on this subject, too, adding: "The 160-meter L100 requires 66 turns, but only about 40-45 turns will fit on the core in a single layer. You need to keep winding in the same direction in a second layer until you complete the 66-69 turns. I wound 69 originally, but on checking with my MFJ-259, which may not be very accurate the inductance appeared to be a little high.

When winding bifilar windings, it is a lot easier to wind the bifilar winding if you fold the wire in half but don't cut, and use the folded (closed) end (with or without a sewing needle) to feed through the toroid or binocular core.

Wire Lengths

: Refer to the BOM above to see the recommended length of wire (in inches) for each inductor. These lengths include generous SWAGS to accomodate lead lengths, etc.

When the BOM states *BPF-80/40: primary 18T #30 (10"); secondaries 9T bifilar#30 (5")* this means:

- Primary: use 10" for the single winding.
- Secondaries: Take a 10" length of wire and fold it over at the 5" point, twisting it together into a bifilar strand, winding it evenly distributed over the primary winding for 9 turns.

Core Sizes

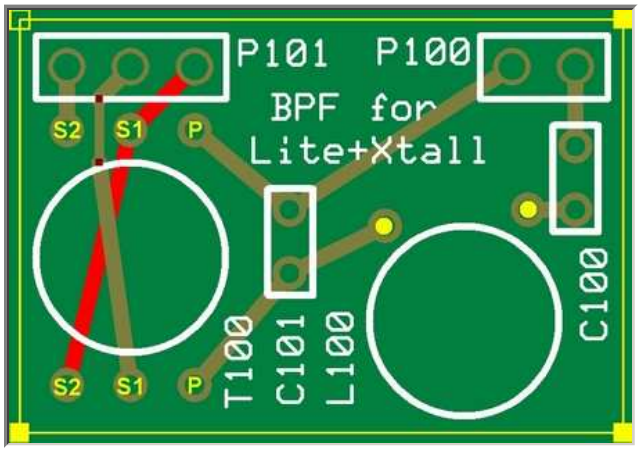
: The chart below provides the capacitance values and the winding instructions by band group. Carefully note that some bands use different size and color cores. Be sure to use the right core for the board you are building:

160 m: T30-2 (red)
80/40m: T25-2 (red)
30/20/17/15/12/10m : T25-6 (yellow)

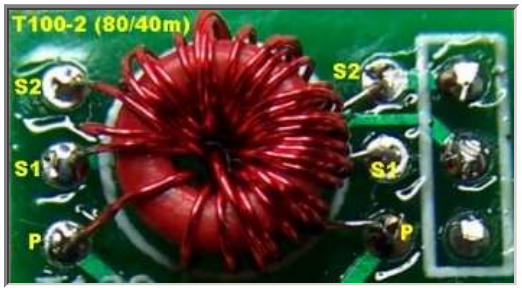
Band specific values

Bands	C100	C101	L100	T100
160m	390pF	5600pF	18.7uH, T30-2(red) core 66T #30 AWG	1.4uH(primary), T30-2(red) core 18T #30 AWG on primary 9T #30 AWG on each bifilar secondary
80m/40m	560pF	680pF	1.6uH, T25-2(red) core 22T #30 AWG	1.2uH(primary), T25-2(red) core 18T #30 AWG on primary 9T #30 AWG on each bifilar secondary
30m/20m/17m	180pF	220pF	0.78uH, T25-6(yellow) core 17T #30 AWG	0.6uH(primary), T25-6(yellow) core 14T #30 AWG on primary 7T #30 AWG on each bifilar secondary
15m/12m/10m	82pF	330pF	0.53uH, T25-6(yellow) core 14T #30 AWG	0.13uH(primary), T25-6(yellow) core 7T #30 AWG on primary 4T #30 AWG on each bifilar secondary

For Each BPF Board



(referring to the Band Specific Values chart, above):



BUILD STEPS FOR EACH BPF BOARD

Check	Designation	Type	Notes
	L100-#	Coil	Wind, prepare, horizontally mount, and solder the coil, L100, using the correct core size and color and turn count.. • Carefully count the turns[1]. Each pass thru the center is 1 turn. • Leave approximately 1/2 inch for each lead. • Use an emery cloth to scrape the insulation off the leads up to the last 1/8 inch. • Pull the leads through the holes directly above the circle for L100 on the BPF board (marked in yellow above). • Flatten the core horizontally, pull the leads snug, bend them on the bottom side of the board, and solder the leads. • Test for continuity (~0 ohms) from the lower hole of C100 through the coil to the lower hole of C101. • If there is no continuity, check soldering of the leads and resolder as necessary.
	T100-#	Transformer	Wind, prepare, horizontally mount, and solder the transformer, T100 • Transformer T100-# will be mounted horizontally and raised above the board about 1/16 of an inch. In winding T100-#, first wind the primary winding with enameled wire so that the primary winding starts and ends at about the same point on the core and is uniformly spread around the core. • Twist two pieces of enameled wire together (bifilar) at about 3 twists per inch and wind the secondary windings with the windings starting and ending where the primary winding starts and ends. When you have wound the transformer, you will have 6 leads, 3 (one primary, one secondary 1, and one secondary 2) on each side of the core. • When trimming the wires, recognize that the 3 leads coming from one side of the core may need to be a little longer than those from the other side (to facilitate mounting the transformer horizontally. • Insert the leads, following the annotations on the BPF board above: ○ "P" represents the primary leads on each side of the core; ○ "S1" represents the leads for the first secondary winding on each side; ○ "S2" represents the leads for the second secondary winding on each side. • Test for continuity on the two primary leads ("P" in the image above) by putting your ohmmeter leads on the two holes for C101. If you do not have continuity, then you likely have a soldering issue on the primary leads. • Test for continuity between either of the primary leads and each of the secondary leads. You should see an open circuit. • If you **do** get continuity, look for a short in the transformer or in its solder joints. • Test for continuity between pins 2 and 3 of P101. You should get continuity. • If you do not get continuity, one or more of your secondary leads has a solder problem.

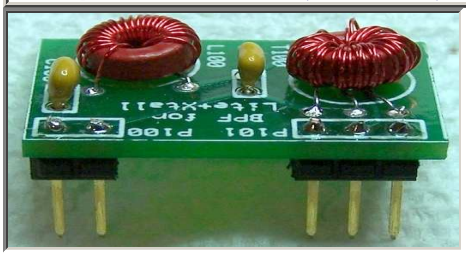
	C100-#	ceramic capacitor	Mount and solder the capacitor, C100
	C101-#	ceramic capacitor	Mount and solder the capacitor, C101
	P100-#	2 pin header	Mount and solder the 2-pin header, P100, on the underside of the board, with the shorter pins going through the holes from the bottomside to the topside and the longer pins extending out from the bottom side to mate with the main board [(2)].
	P101-#	3-pin header	Mount and solder the 3-pin header, P101, on the underside of the board, with the shorter pins going through the holes from the bottomside to the topside and the longer pins extending out from the bottom side to mate with the main board. [(2)]

[1] *The L-100 for the 160m BPF will require overlapping the windings in order to fit all of them on the toroid. The first layer pretty well fills up after 45 or so turns.*

[2] *The BPF board connectors (P100 and P101 headers) are mounted, short ends into the holes for P100-# and P101-#, on the bottom of the board with the other components on top.*

Use the main board sockets (J1and J2) as a "tool" to align the pin headers on each BPF board so that the two will mate properly. Initially in the build of the main board (Local Oscillator Stage) a 9-pin header piece was used as a tool to align the 2-pin and 3-pin sockets (J1 and J2). This 9-pin header strip can then be snipped to 2-pin and/or 3-pin lengths and used as spares for the BPF board build.

Completed Board (80/40m)

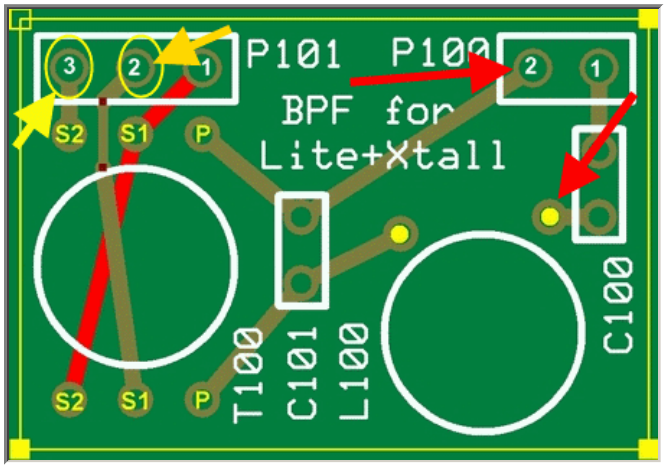


Testing

Current Draw

See test for Mixer Stage.

Continuity



Test T100 Primary Resistance

- Using your ohmmeter, measure the resistance from The C100 hole farthest away from P100 to ANT Return. It should be ~0 ohms, indicating continuity in the primary windings of T100, through the L100 windings.
- If you get any appreciable resistance or an open circuit, you should inspect/touch up the solder joints on T100 primary and/or L100.

Test T100 Secondaries Resistance

- Using your ohmmeter, measure the resistance between pins 2 and 3 of P101.
  It should be ~0 ohms, indicating continuity between the ends of the two secondary windings and through the center tap.
- If you get any resistance or an open circuit, you should inspect and/or touch up the solder joints.
- **Note: that the two secondaries are center-tapped so both windings are "connected" continuously in the circuit from pin 2 to pin 3.**

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