30 MHz Low-Pass / Shelf Filter
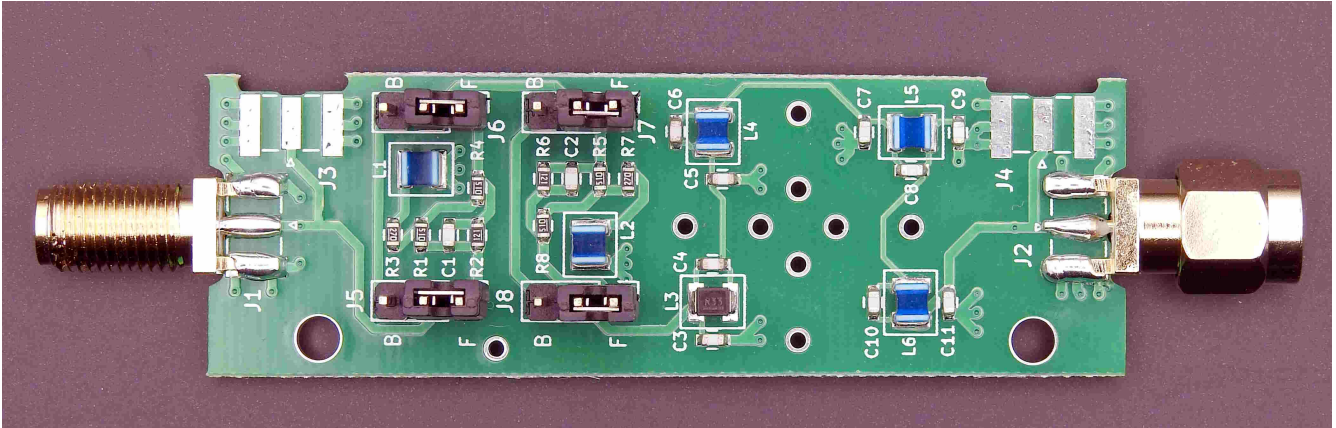

Illustration 1: In-Line Filter
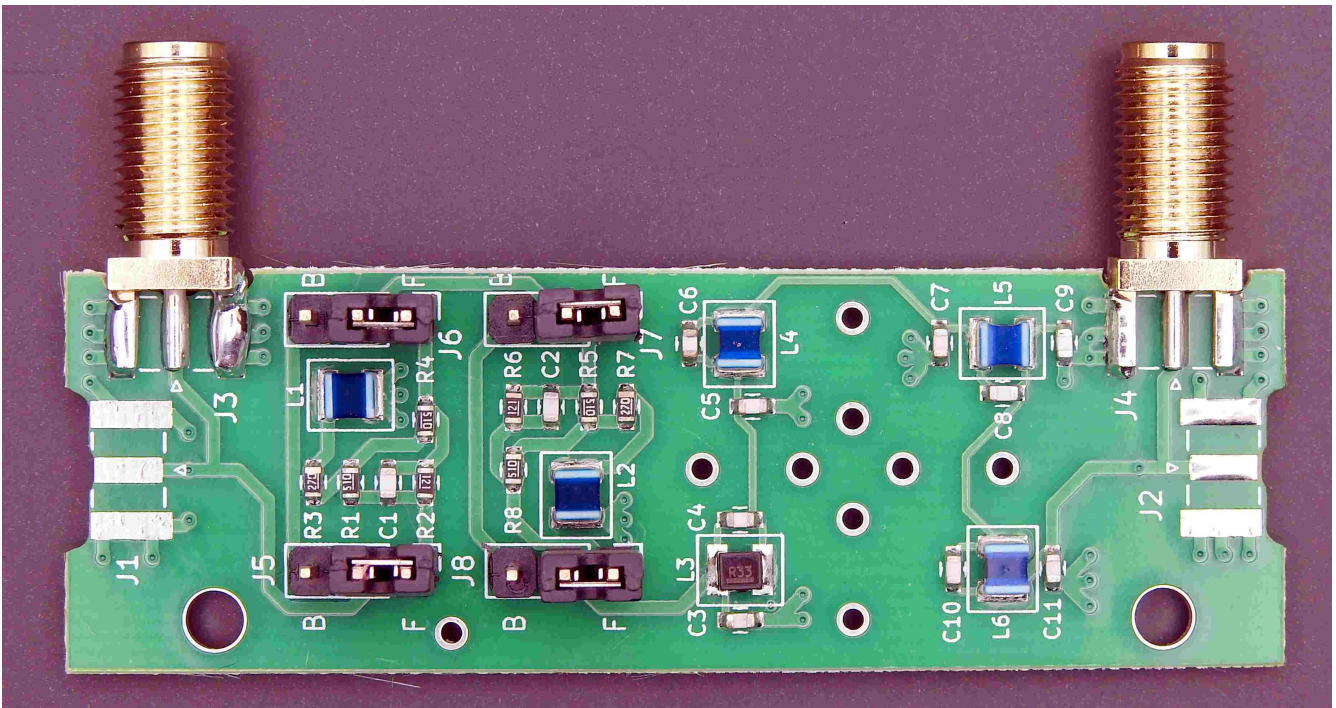

Illustration 2: Right-Angle Filter

About

This is a 30 MHz four section elliptic low-pass filter, combined with a bypassable two-section shelf filter. The low-pass filter serves as an anti-aliasing filter for a SDR, especially one that is clocked at 66 MHz or so. The shelf filters will provide moderate attenuation at the lower

frequencies, where powerful signals can cause overload. Each of the two shelf filters can be bypassed or enabled, using the provided jumper clips. The filter is available in the in-line plug/jack configuration, or in a two-jack arrangement (which fits nicely in a small die-cast aluminum box for extra shielding.)

Enabling or bypassing the shelf filters
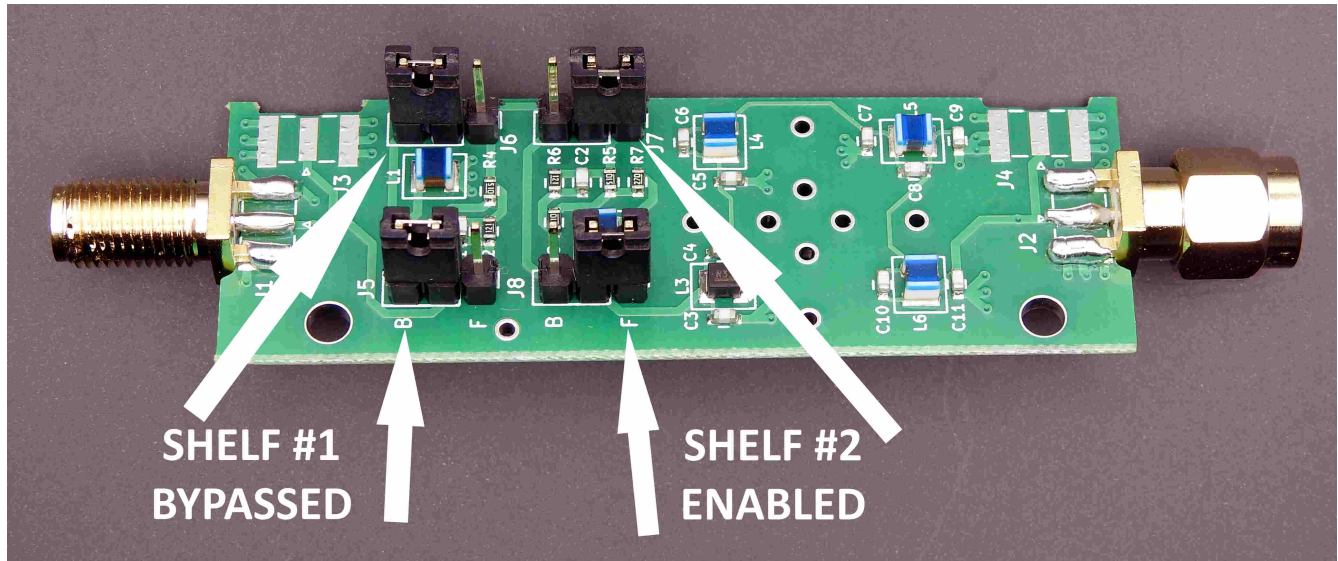
The jumper positions are indicated on the board silkscreen:

'F' is the filter-in position
'B' is the filter bypassed position

The jumper pair to the left is one filter, the pair to the right is for the other. The filters are identical. The jumper pairs must be in the same mode or the signal path will be interrupted.

Typical Filter Response

Frequency	Shelf Filters Bypassed	Both Shelf Filters Enabled
0 Hz	-0.1 dB	-20 dB
10 MHz	-0.1 dB	-9 dB
25 MHz	-1.5 dB	-4 dB
28 MHz	-3 dB	-5 dB
35 MHz	-60 dB	-60 dB
35 MHz – 200 MHz	-64 dB	-64 dB
200 MHz – 1 GHz	-40 dB	-40 dB

Here are some measured attenuation values for the filter at the various ham-band center frequencies, with both shelf sections disabled and enabled

Frequency	Attenuation No Shelf	Attenuation Both Shelf
MHz	dB	dB
0.450	-0.1	-19.3
1.90	-0.1	-18.3
3.75	-0.2	-16
5.35	-0.2	-13.5
7.10	-0.3	-11.5
10.1	-0.3	-8.4
14.2	-0.7	-6.1
18.1	-0.7	-4.6
21.1	-0.9	-3.9
24.9	-1.2	-3.5
28.1	-2.8	-4.7
30.0	-11.5	-12.8

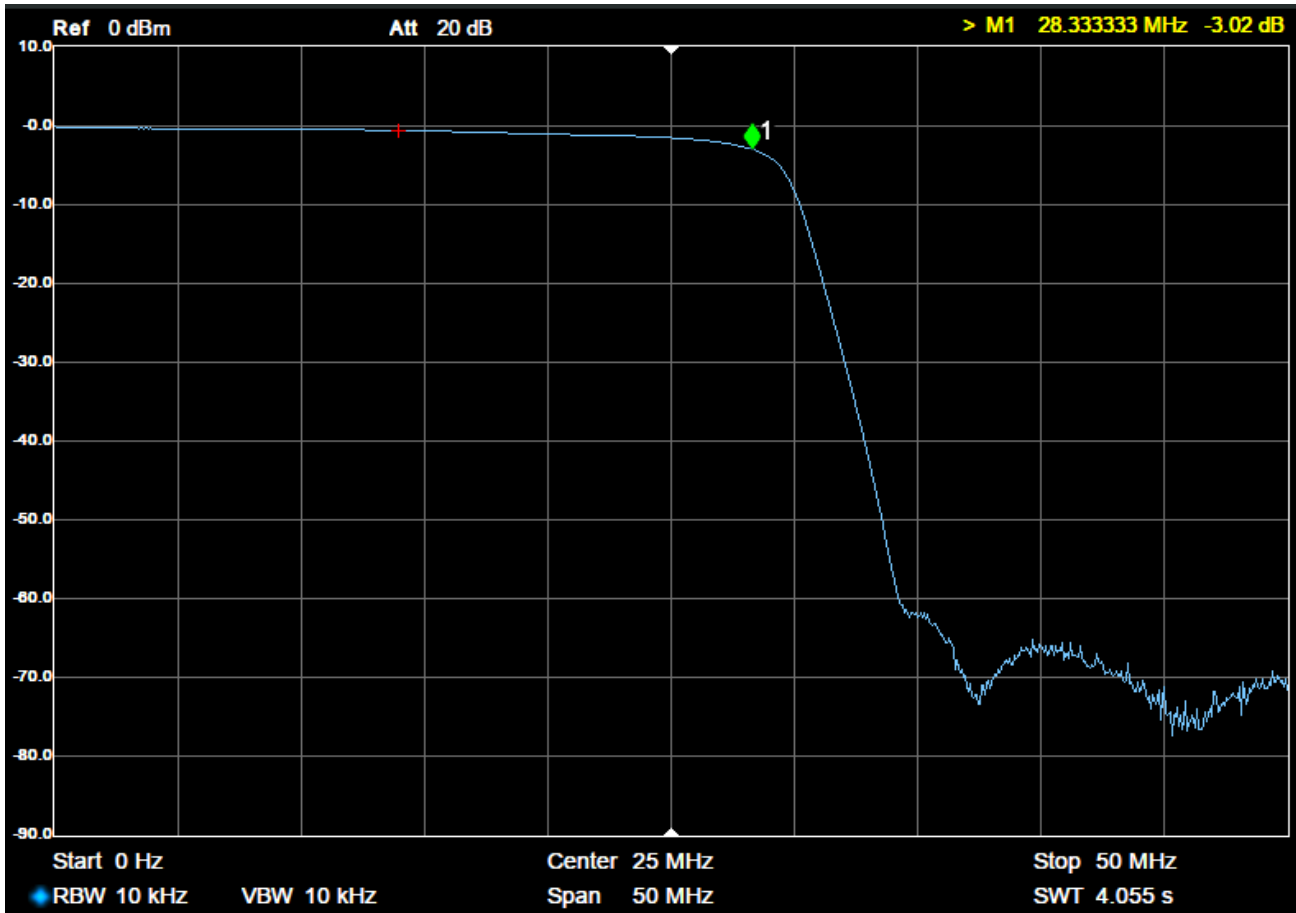And plots showing the overall frequency response:

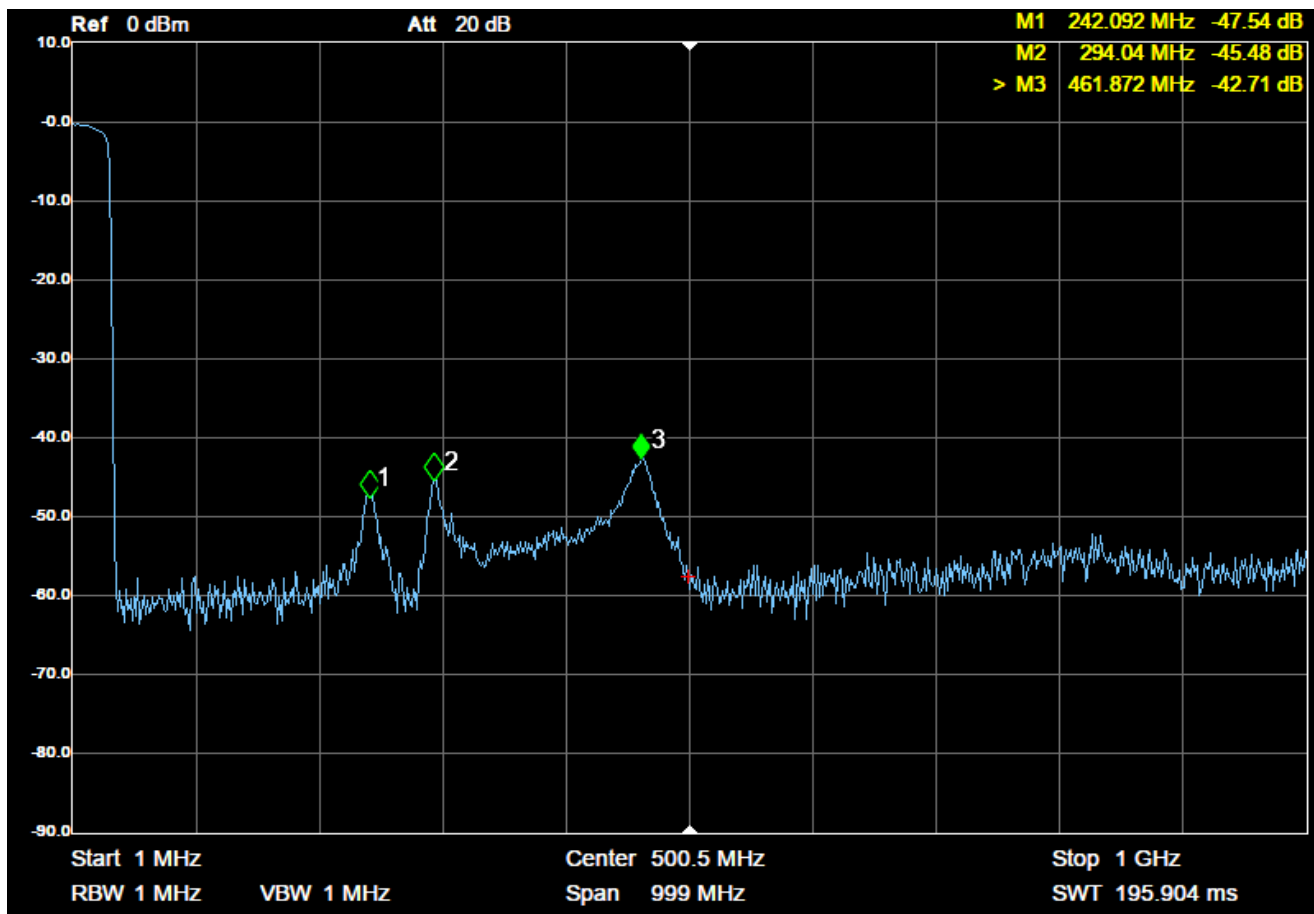*Illustration 3: 0 - 50 MHz, Shelf Filters Bypassed*
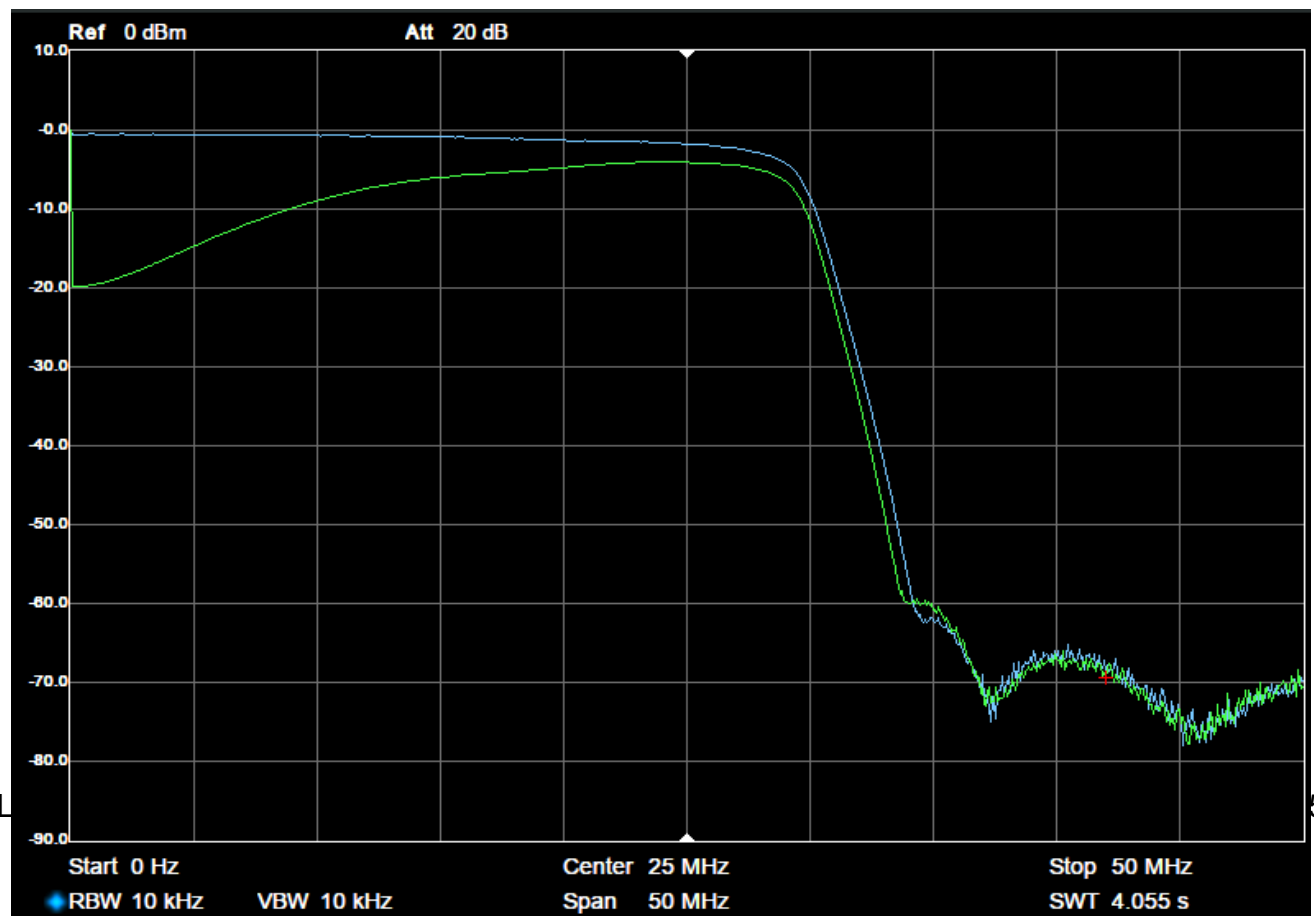
Illustration 4: 0 - 1 GHz, Shelf Filters Bypassed

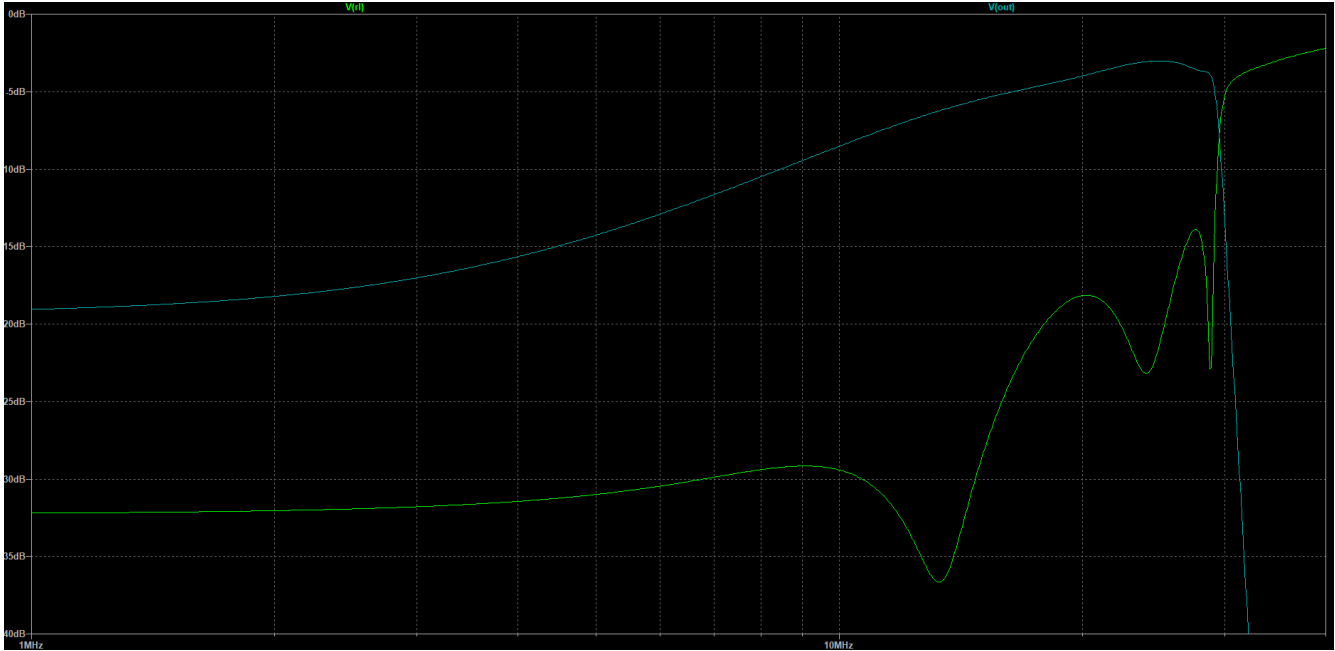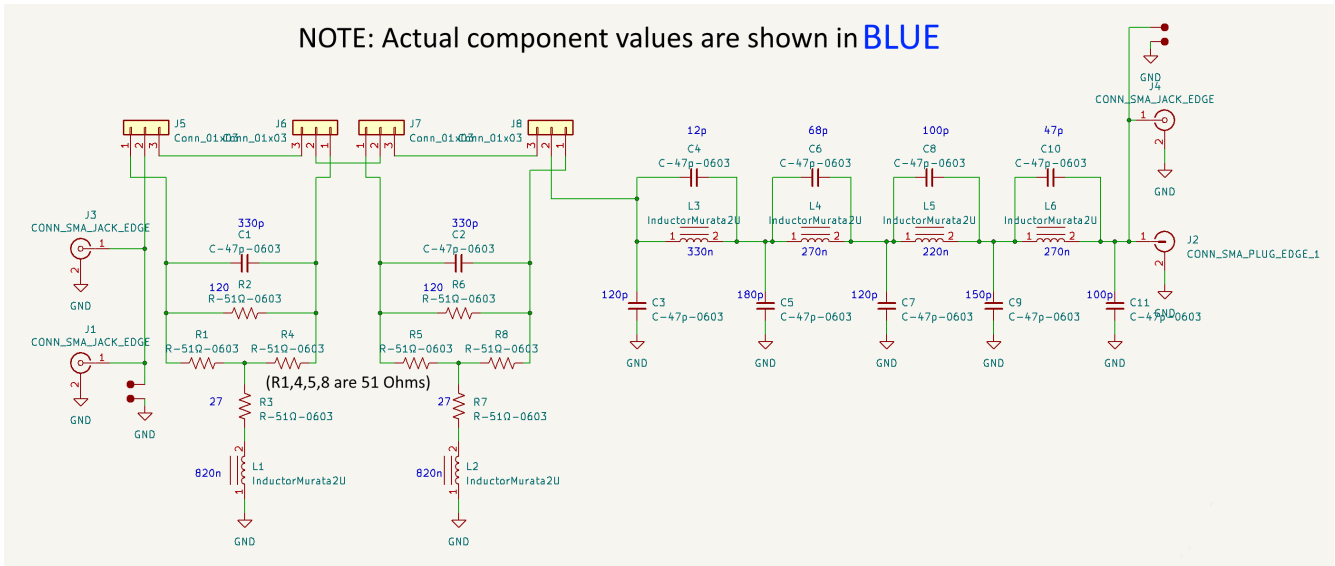*Illustration 5: 0 - 50 MHz, Both Shelf Filters Enabled / Bypassed*

Illustration 6: Attenuation and return loss at shelf port, both shelf filters enabled (simulation)

Schematic

Die-Cast Enclosure

The right-angle filter option fits nicely in a small die-cast enclosure. We do not currently provide the box, but it's easy to build this yourself. Here is the filter in a "Hammond 1590A" enclosure.
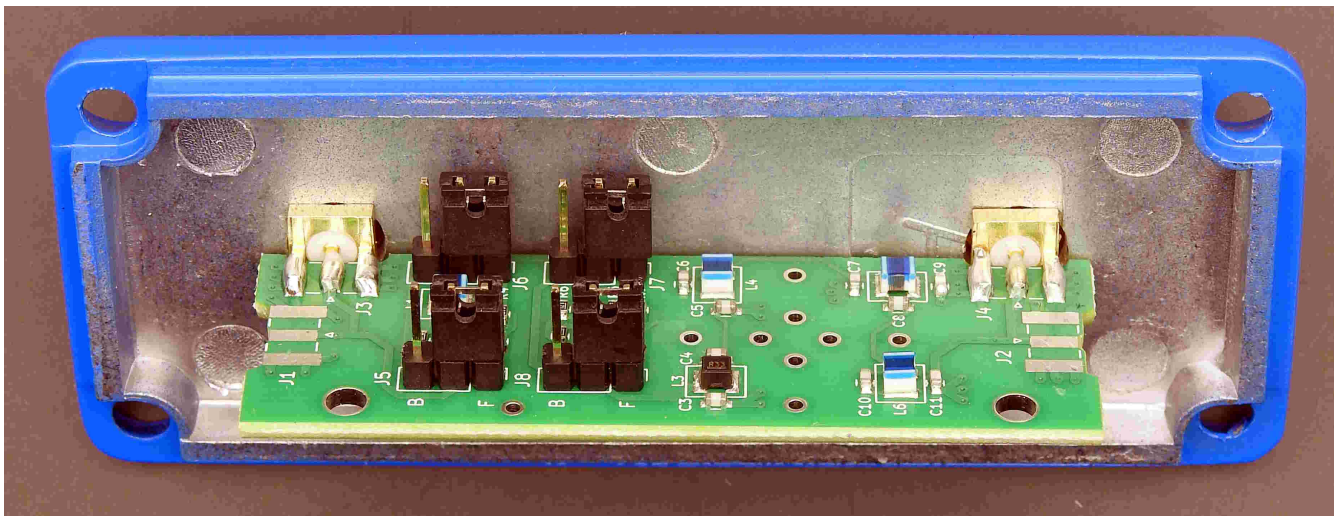
The SMA jacks are on 2-inch centers. While an SMA jack will fit through ¼ inch diameter hole, I suggest making a slightly larger hole to accommodate slight variations in connector alignment.

While the box shown here is pre-painted in a lovely "Turn Island Blue", I recommend using the typical unpainted variety, as the paint requires aggressive scraping to ensure reasonable shielding. These boxes are available from many sources, most of them probably clones. Sources I have used are:

Tayda Electronics (https://www.taydaelectronics.com/hardware/enclosures/1590a-style/1590a-style-aluminum-diecast-enclosure.html)

and

StompBoxParts (https://stompboxparts.com/enclosures/1590a-enclosure/)

Of course you can buy actual "Hammond" boxes from DigiKey and other traditional suppliers.