CHEAP MICROWAVE FILTERS

By Kent Britain, WA5VJB

These filters are for our 3, 5 and 10 GHz ham bands. The design is based on the filters used in the DJ6EP 5760 MHz transverter.

When I first saw these filters used in the DJ6EP transverter I thought; Wow, how neat and simple! But Roman's design used Teflon P.C. board and small pins through 50 Ohm stripline for coupling. The next trick was to find a simple way of putting them together with commonly available materials. I ended up using 1/2", 3/4", and 1" Copper plumbing end caps sweat soldered onto common PC board.

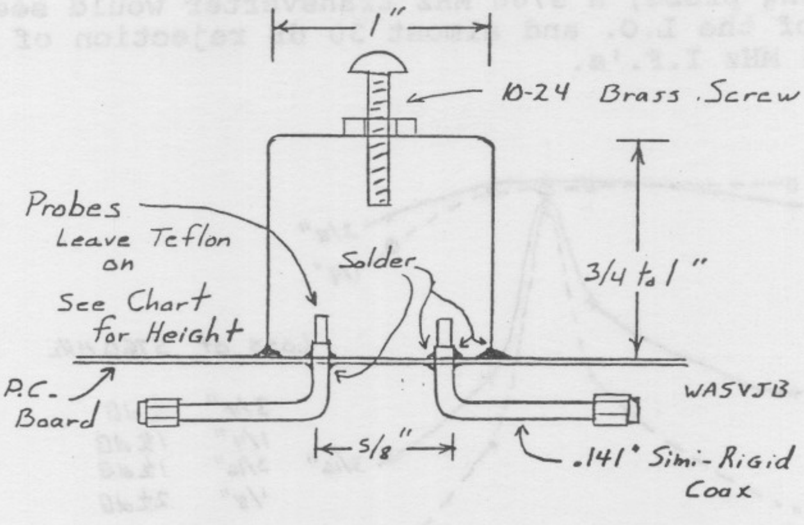
First I've built a bunch of these filters, and they all worked. Next I built several with intentional errors, lots of sloppy solder, misaligned probes, unequal probes, off center tuning screws, etc. Loss went up a bit on a few of them, but they all <u>WORKED</u>! These guys are very forgiving!

The length of the probe determines the coupling and therefore the Q of the filter. Keep the probes as short as you can, consistent with how much loss you can stand in your system. I did build some multi-stage versions to get a tighter bandwidth. But it really wasn't worth effort, just use shorter probes.

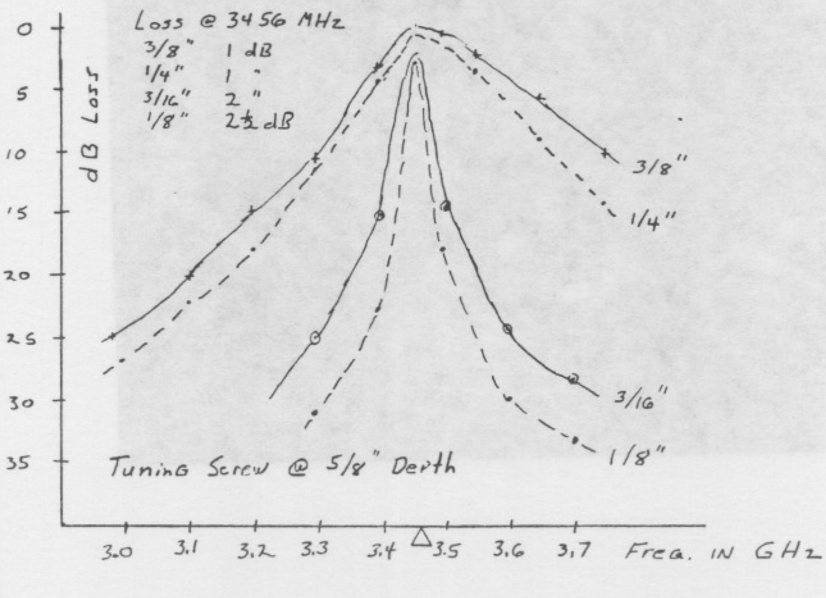
You can drill and tap the hole for the tuning screw, but I found it much easier to drill a slightly undersized hole and just force a steel screw (same thread size) through. The locking nut is tightened down after you have everything tuned.

3456 MHz Filter

The 3456 MHz version is based on a 1" Copper plumbing end cap. The hollow filter resonates between 6 and 7 GHz. The tuning screw pulls the filter down to 3.4 GHz at a depth of about 5/8".



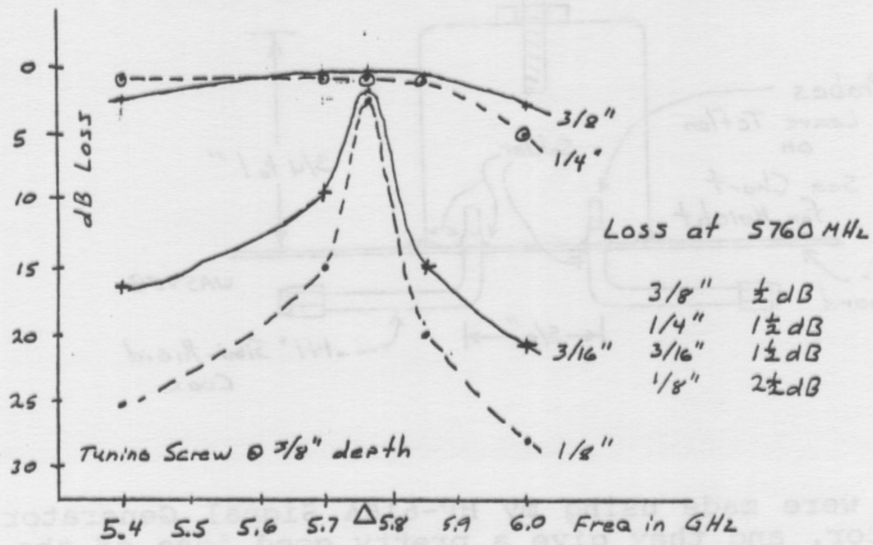
These plots were made using my HP-616A Signal Generator and HP-415B indicator, and they give a pretty good idea of the shape of these filters. In a 3456 MHz station using a 144 MHz I.F., a filter using 3/16" probes would give 25 dB rejection of the L.O. and better than 30 dB rejection of the image with 2 dB of loss.

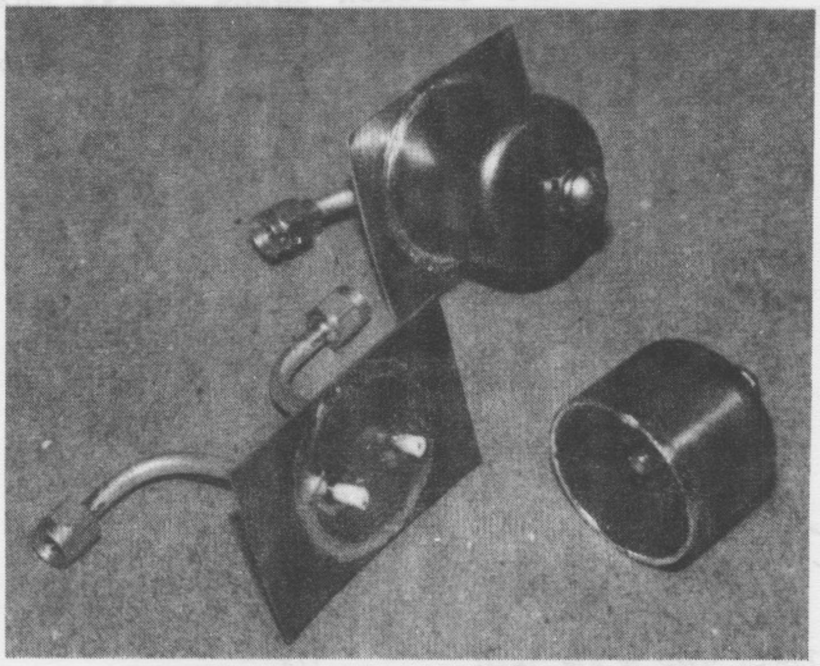


5760 MHz 1" Filter

The 1" filters will also tune 5760 MHz with the tuning screw set at about 3/8" into the cavity. The plots below were made using my HP-614A signal generator driving a passive tripler and bandpass filter into a HP-415B indicator. Again a pretty good idea of the characteristics of these filters emerge.

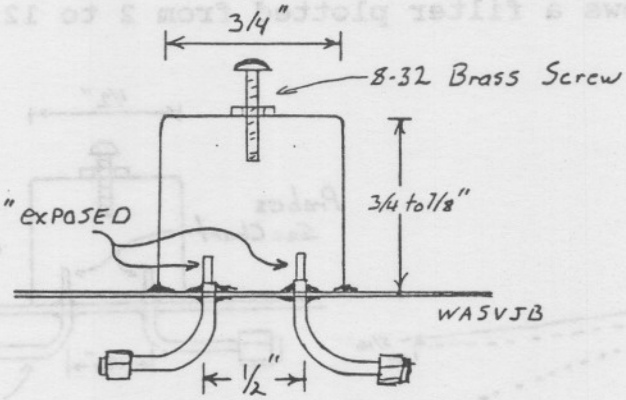
With a 1/8" long probe, a 5760 MHz transverter would see about 20 dB rejection of the L.O. and almost 30 dB rejection of the image when using 144 MHz I.F.'s.

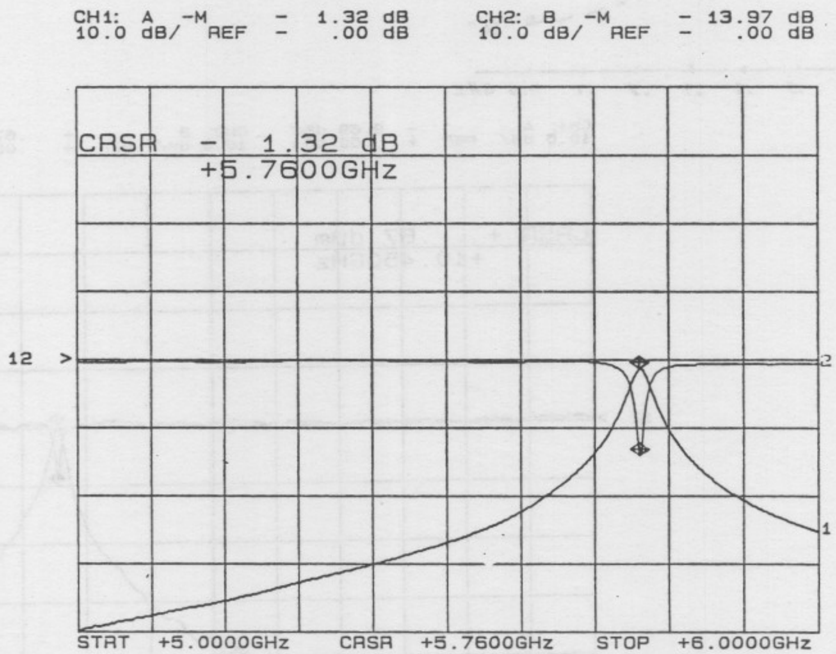




5760 MHz 3/4" Filter

This was one of the filters I was fortunate to get plotted on some really fancy equipment. I didn't get an opportunity to build a family of these filters before the proceedings deadline, but my first try seems to have done pretty well. Again a 5760 MHz transverter using a 144 MHz I.F. would have about 20 dB rejection of the L.O. and almost 30 dB image rejection with less insertion loss than the 1" filter.

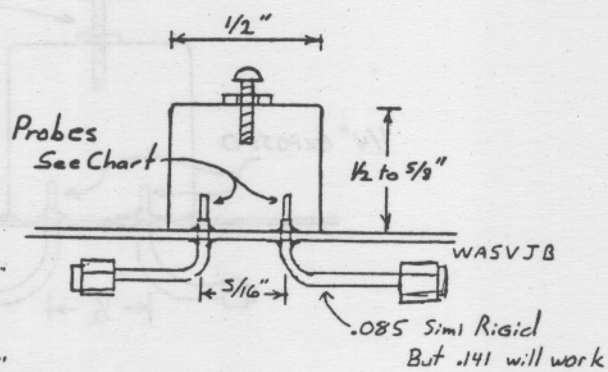


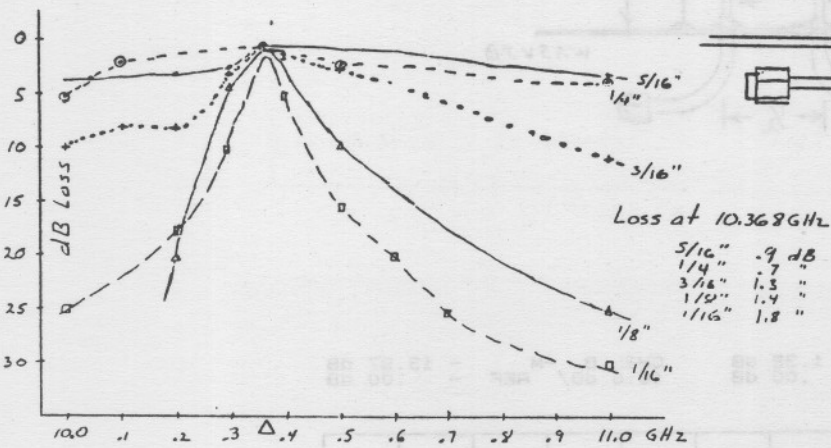


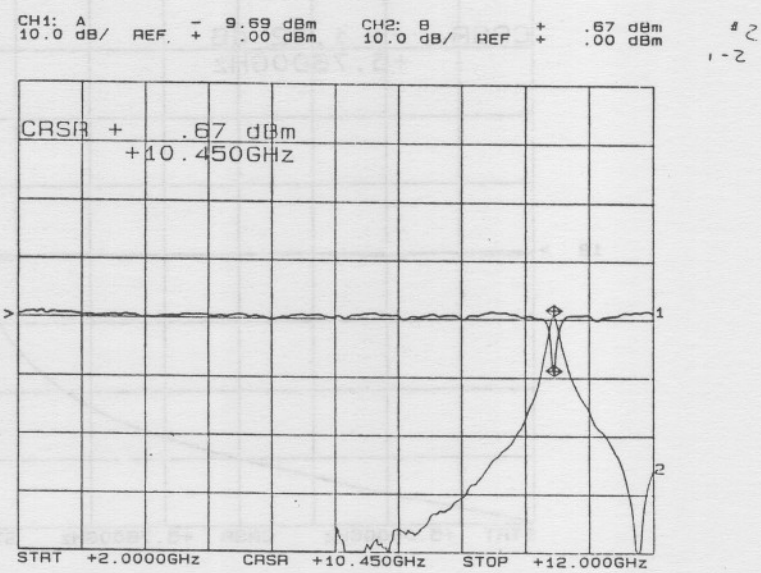
10 GHz Filter

When I first started building these probe coupled filters, they were used at 10.368 GHz. If you can dig up some .085" semi-rigid coax, it's much easier to use than the larger .141", but both sizes work. The filter resonates somewhere between 11.5 and 12GHz, so while digging through the bins at your hardware store, look for the longer end caps. The longer ones will have slightly lower loss, but it's not worth driving around town. I did try replacing the brass tuning screw with a steel screw on the 1/8" filter, loss went up from 1.3 to 2.0 dB.

The fancy plot shows a filter plotted from 2 to 12 GHz.







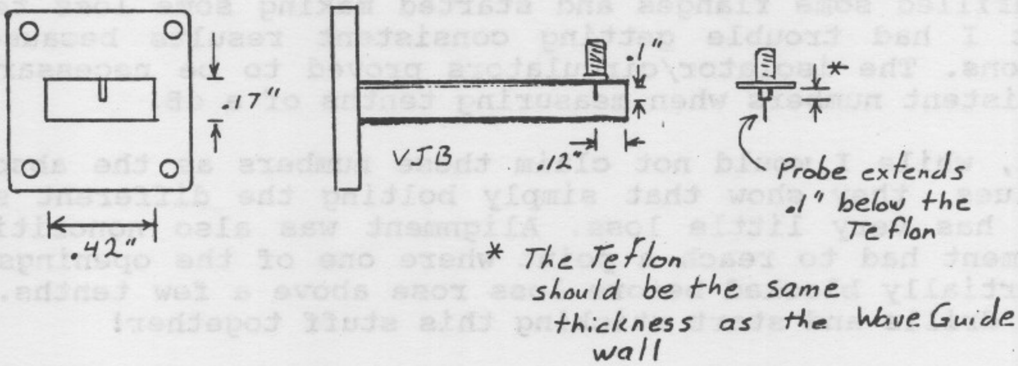
AJW

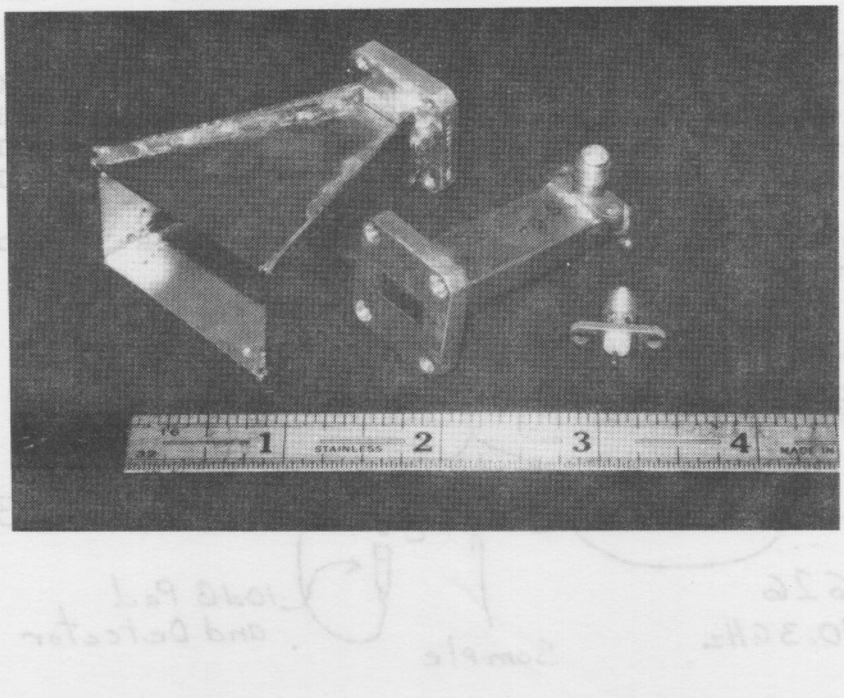
24.1 GHz Transition

When I first started some serious work with 24 GHz, one of the first items I needed was a WaveGuide to Coax transition. Very few of the commercial K band transitions are designed for use near our 24 GHz ham band so I came up with this design optimized for 24.1 GHz.

In constructing this transitions you must use either K or SMA connectors. I highly suggest the 2 hold flange mounts and avoid the stainless steel SMA's which are impossible to solder. It can be a bit tricky to solder the SMA and the backplate at the same time so use plenty of clamps or a vice. My thanks to K5SXK for his help with the "Wavelength in Guide" calculations.

WR-42 / WG-20 to SMA





WAVEGUIDE TRANSITIONS

by Kent Britain, WA5VJB

In putting together several 10 GHz stations out of surplus parts, the first thing you notice is the different sizes of moding, WR112, WR 90, WR 75, and WR 62. These can be identified by measuring the width of the opening. WR112 is 1.12", WR 90 is .9", WR 75 is .75" and of course WR 62 is .62" across.

Well, very quickly you'd like to hook a WR 90 thinga-migag, to a WR 75 whatsamacallit. I had two commercial adapters and they had simply milled a step changing the opening from one waveguide size to another. I contacted our local waveguide expert (K5SXK) and asked Harold what was going on. He explained that the impedance of a waveguide is the ratio of width to height, so if you go from one size to another it's like connecting RG 8 to RG 58.

So I redrilled some flanges and started making some loss tests. At first I had trouble getting consistent results because of reflections. The isolator/circulators proved to be necessary to get consistent numbers when measuring tenths of a dB.

In short, while I would not claim these numbers as the absolute loss values, they show that simply bolting the different sizes together has very little loss. Alignment was also noncritical. Misalignment had to reach a point where one of the openings was being partially blocked before loss rose above a few tenths. Get out your drills and start sticking this stuff together!

Results:

Flange	Sample WR-62	WR-75	WR-90	WR-112
WR-62	>.1dB	.3dB	.3dB	.4dB (dB Loss)
WR-75	.3dB	>.1dB	.1dB	.1dB
WR-90	.3dB	.1dB	>.1dB	>.1dB
WR-112	.4dB	.2dB	.1dB	>.1dB

Note: This test is actually measuring the loss in two waveguide size transitions.