

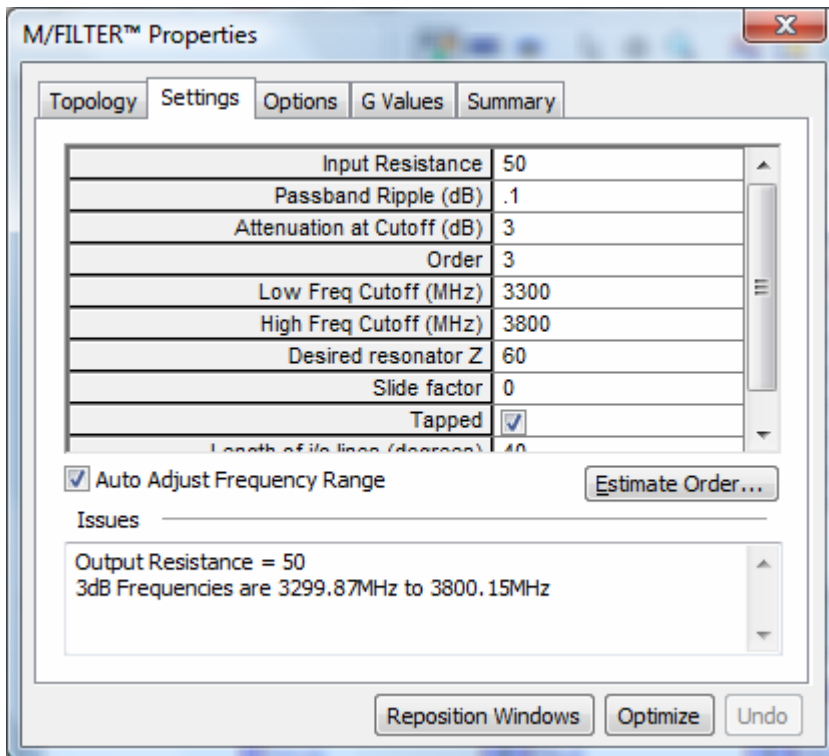
Prototyping capability test case #1 7/7/2007

After finally taking the plunge into buying a PCB milling machine for RFdude.com, I thought a microstrip filter would be a great initial test case for experimenting with the capabilities. This example turned out quite well. This brief write-up is simply intended to summarize our results with the first example as we learn the machine.

I used M/FILTER in Agilent/Eagleware Genesys to synthesize a filter quickly. The assumptions were that the PCB thickness was 20 mils (some stock I had around) and the FR4 dielectric constant was 4.2 with a dielectric loss tangent of 0.022. With all of the variables of FR4 this is perhaps a poor test case....

In any case, the pictures tell most of the story. I would not get too worried about the fact that the filter basically didn't really meet the desired specification – without EM analysis and optimization I've found in the past that it can be very tough to hit it in one try.

Enough words....



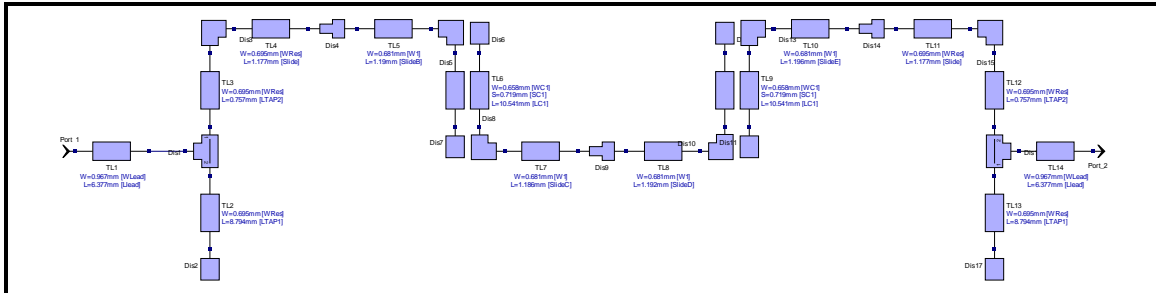


Figure 1: basic 3.5 GHz filter synthesized in Genesys on 20 mil thick FR4

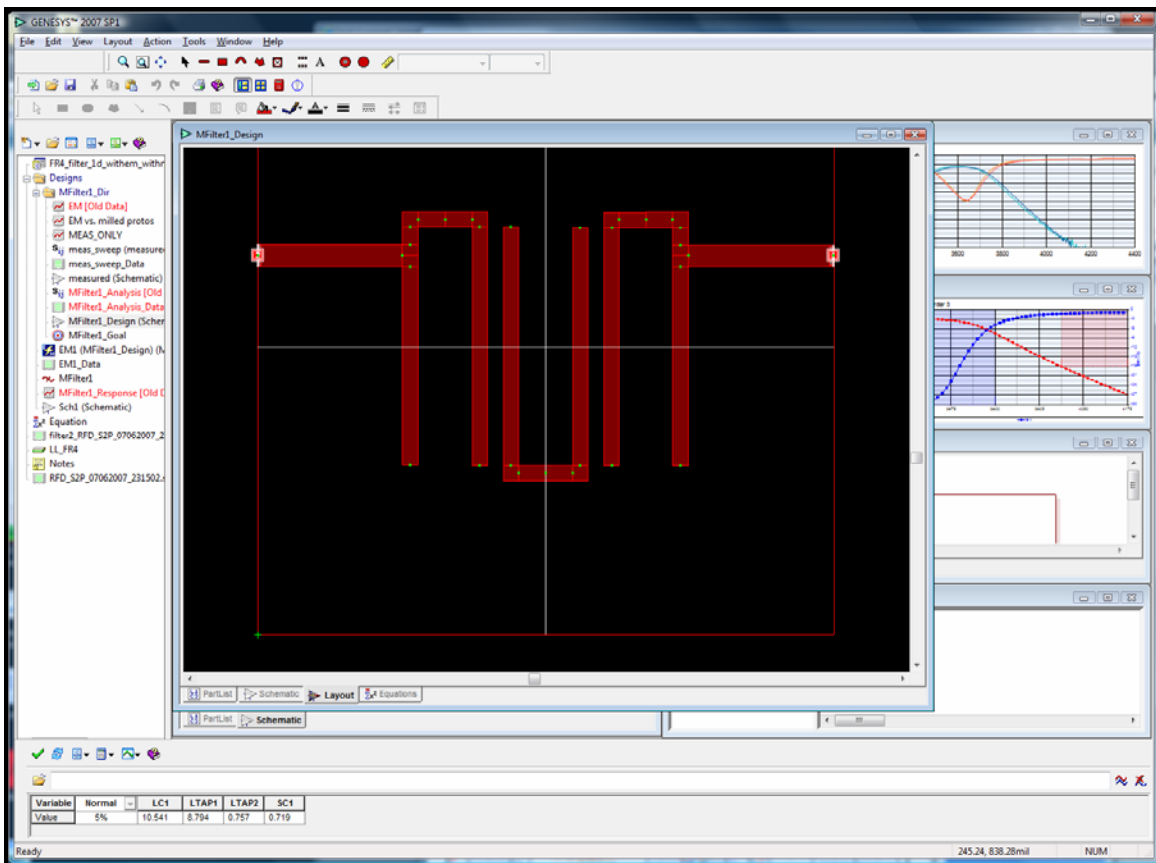


Figure 2: Layout & EM analysis setup. I used a 6.6666 mil x and y grid for the EMPOWER analysis which gave 150 cells in X and Y

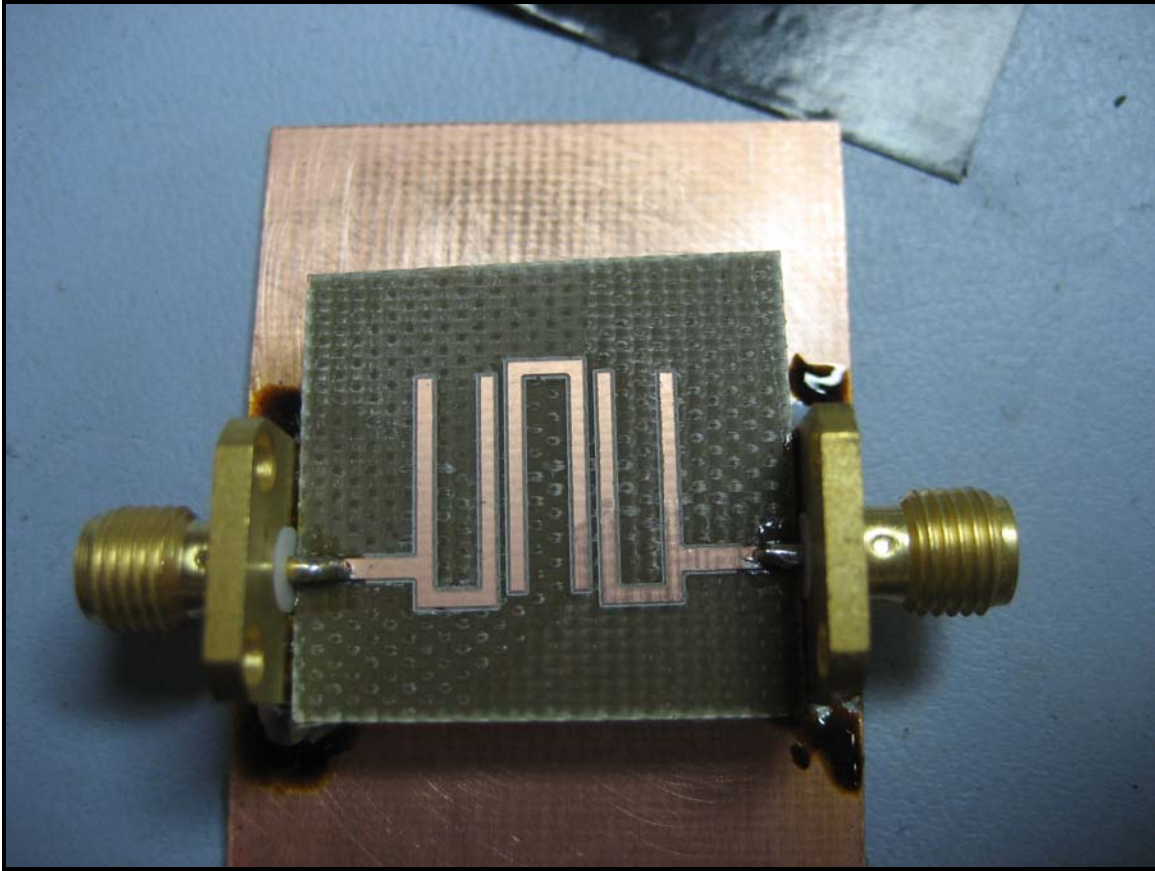


Figure 3: Prototype Milled at RFdude.com using new [AccurateCNC](#) machine (one of two prototypes). Note, the software that runs the machine doesn't support the "rub-out" so after the isolation was done, I used a heat gun, an exacto knife, and tweezers to peel the excess copper off.

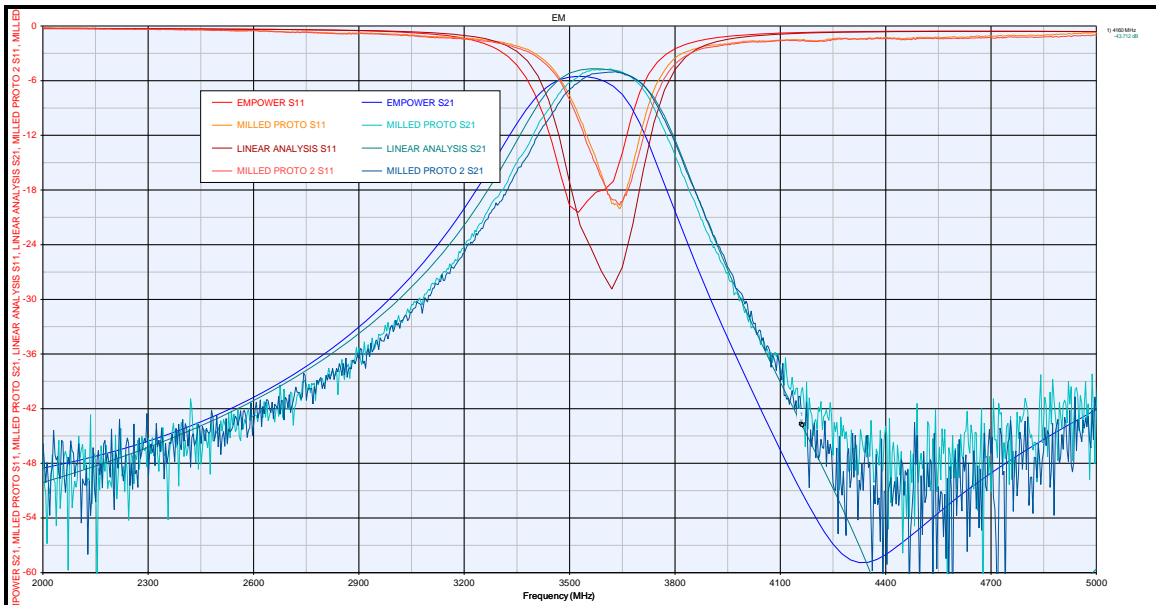


Figure 4: EMPOWER (EM) simulation vs. linear analysis vs. 2 milled prototypes

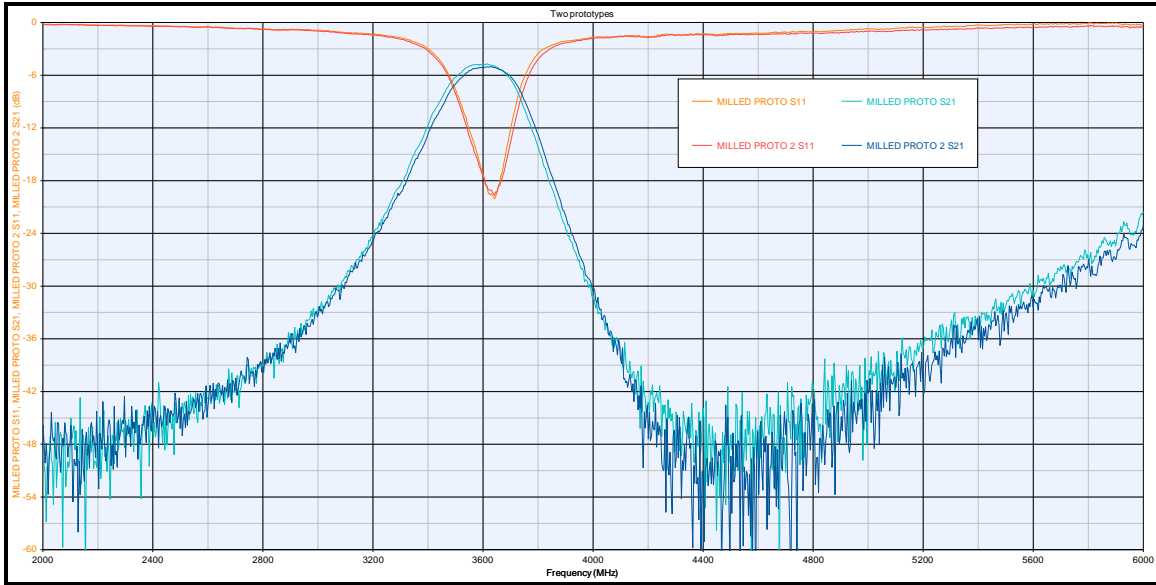


Figure 5: Two prototypes tested against eachother. Excellent repeatability (luck or skill and quality of mill?)