Post-Manufacturing SMA Launch Tuning Network

Michael's Work on the SMA Launch

as of 3/24/2009

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De-embedding / Tuning in Designer

Name	X	Y
m1	10.0000	-32.3331
m2	11.0000	-36.9060
m3	12.0000	-39.7102
m4	18.0000	-12.7515
m5	6.2900	-24.4136

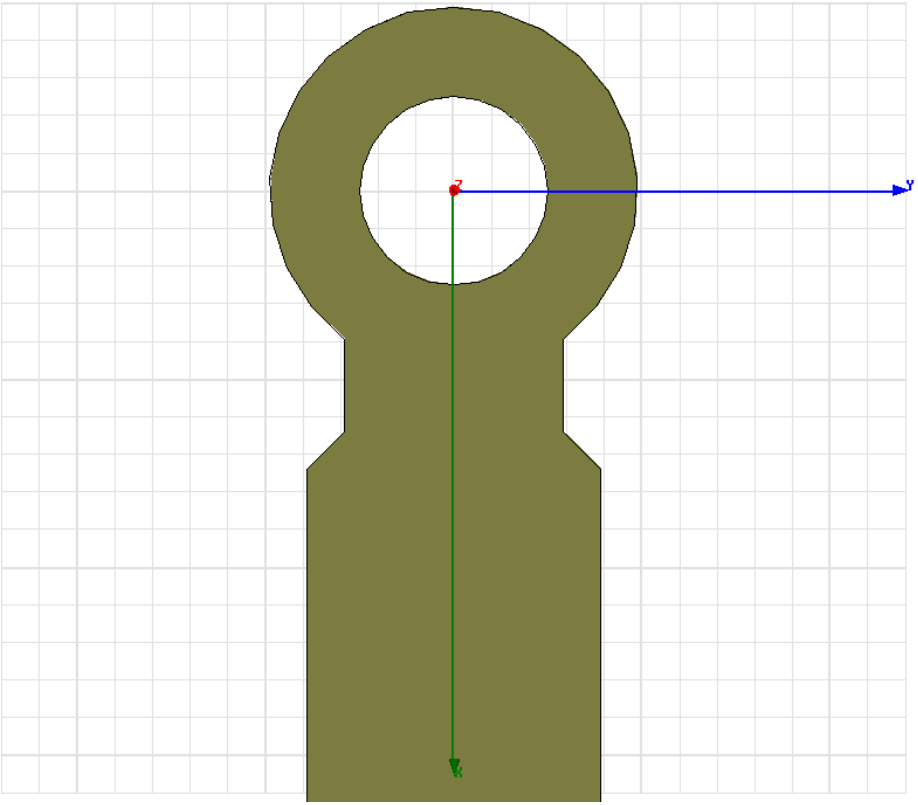
Name	X	Y
m1	10.0000	-32.2673
m2	11.0000	-36.8349
m3	12.0000	-39.6338
m4	18.0000	-12.6443
m5	6.2900	-24.3683

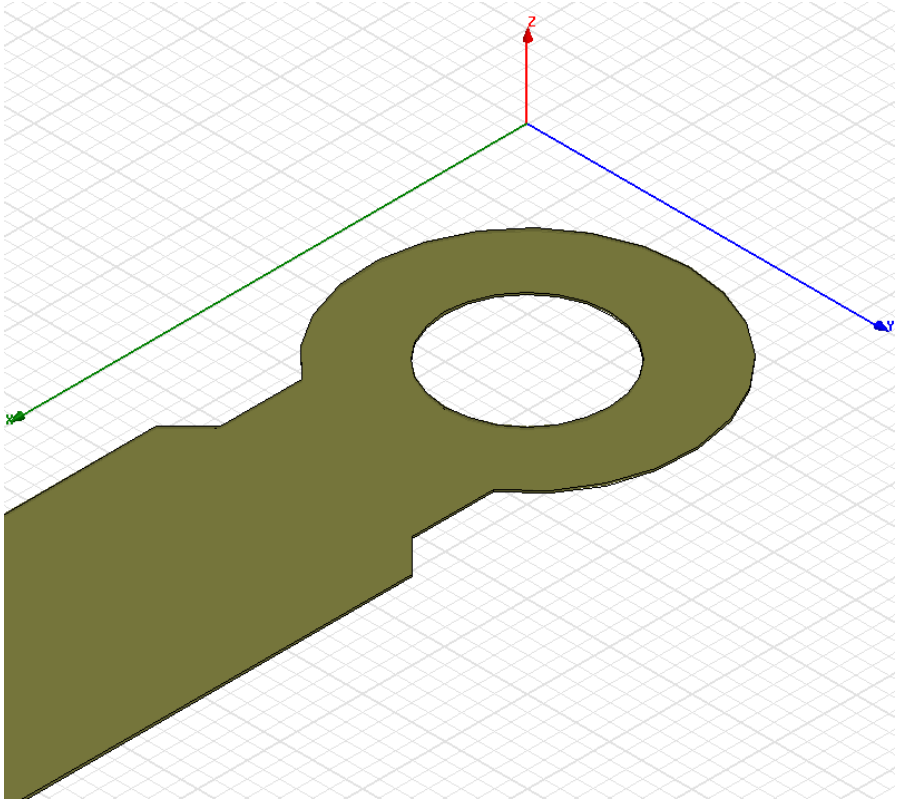
The top table are the markers for the Final Launch, while the bottom table are the same frequencies but with the port de-embeded. They are approximately the same – looking at the plot itself shows this is the case across the entire frequency range. This makes sense because we are just getting rid of a fifty ohm line.

Before de-embedding, I tried to create a tuning network for the launch – it was unsuccessful (which I mentioned at the Detailed Design Review). Unsuccessful was described as 'the results only got worse' no matter what type of tuning was done. Because de-embedding did nothing to change the overall result, again, tuning in designer did not yield any type of result that was better than what was already obtained.

This led me to believe that tuning should be done in HFSS through specifically creating the 'neck' that was brought up in the DDR and then trying different widths and lengths of said neck. This means that tuning would be done only in HFSS and not in Designer at all.

HFSS Tuning (neck added)





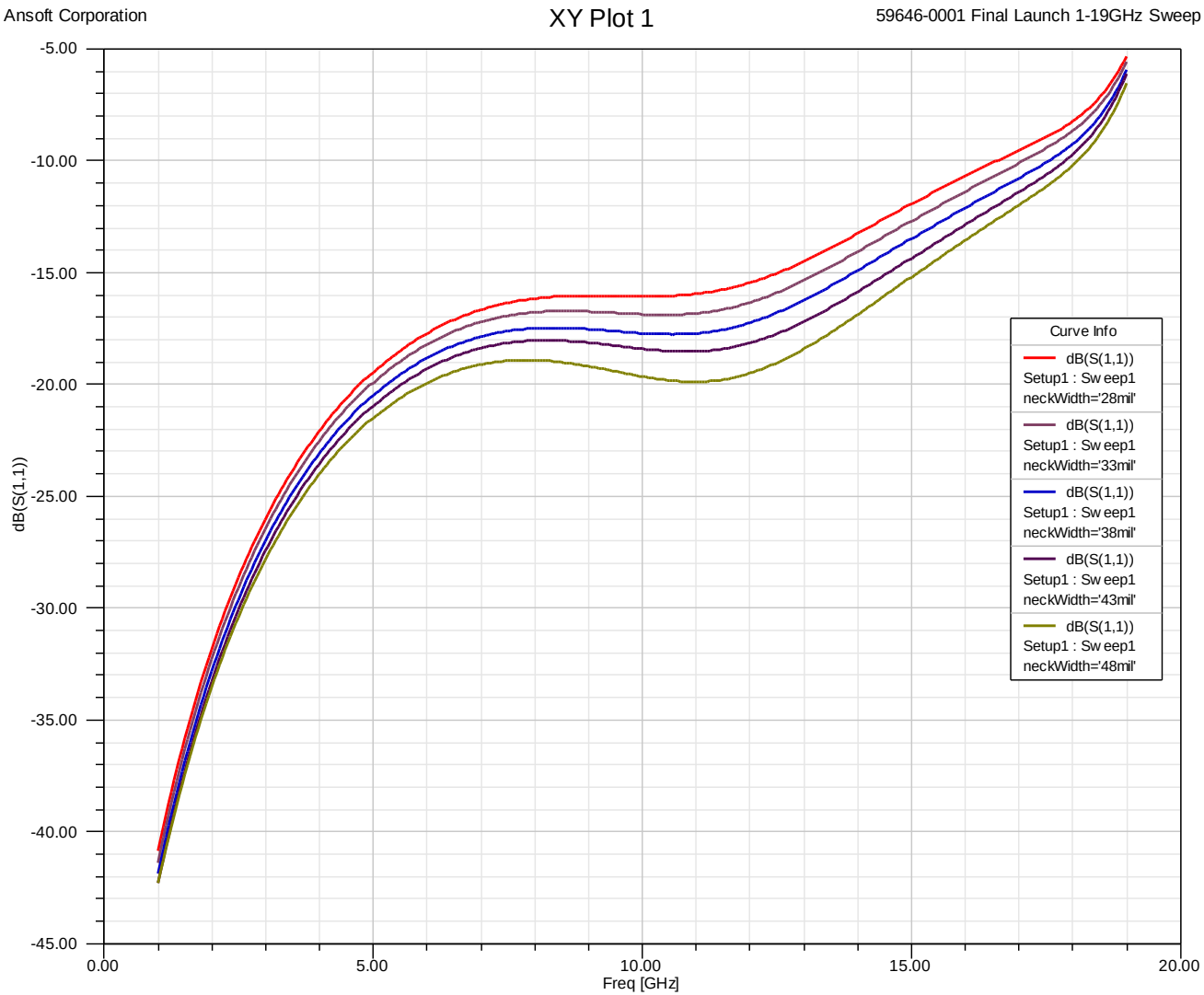
The figures above show different views of the neck that was added. Variables, admittedly crude ones, were created to make adjustment of the neck easier. It can be widened, narrowed, extended or shortened. The pad at the top, which has a restriction of being no smaller than "diameter_SMA_pin + 14mil", can also be resized to tune. The chamfering stays 45deg no matter what – it is hardcoded in the variables to adjust with the other variables changing.

'extraNeck' changes the length of the neck

'neckWidth' chagnes the width of the neck

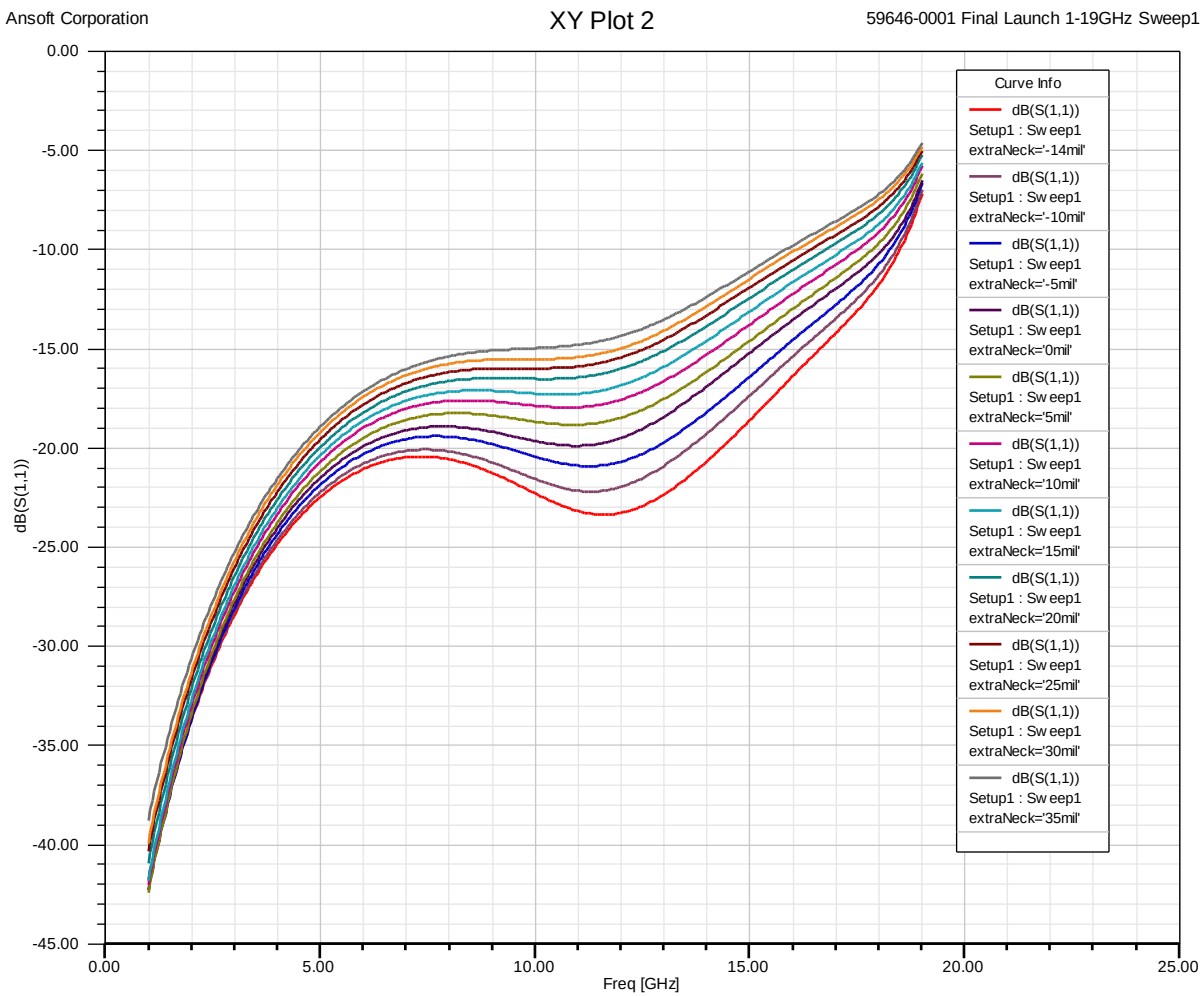
'extra_fifty_pad' changes the pad radius

HFSS Tuning (neck added), neckWidth changed



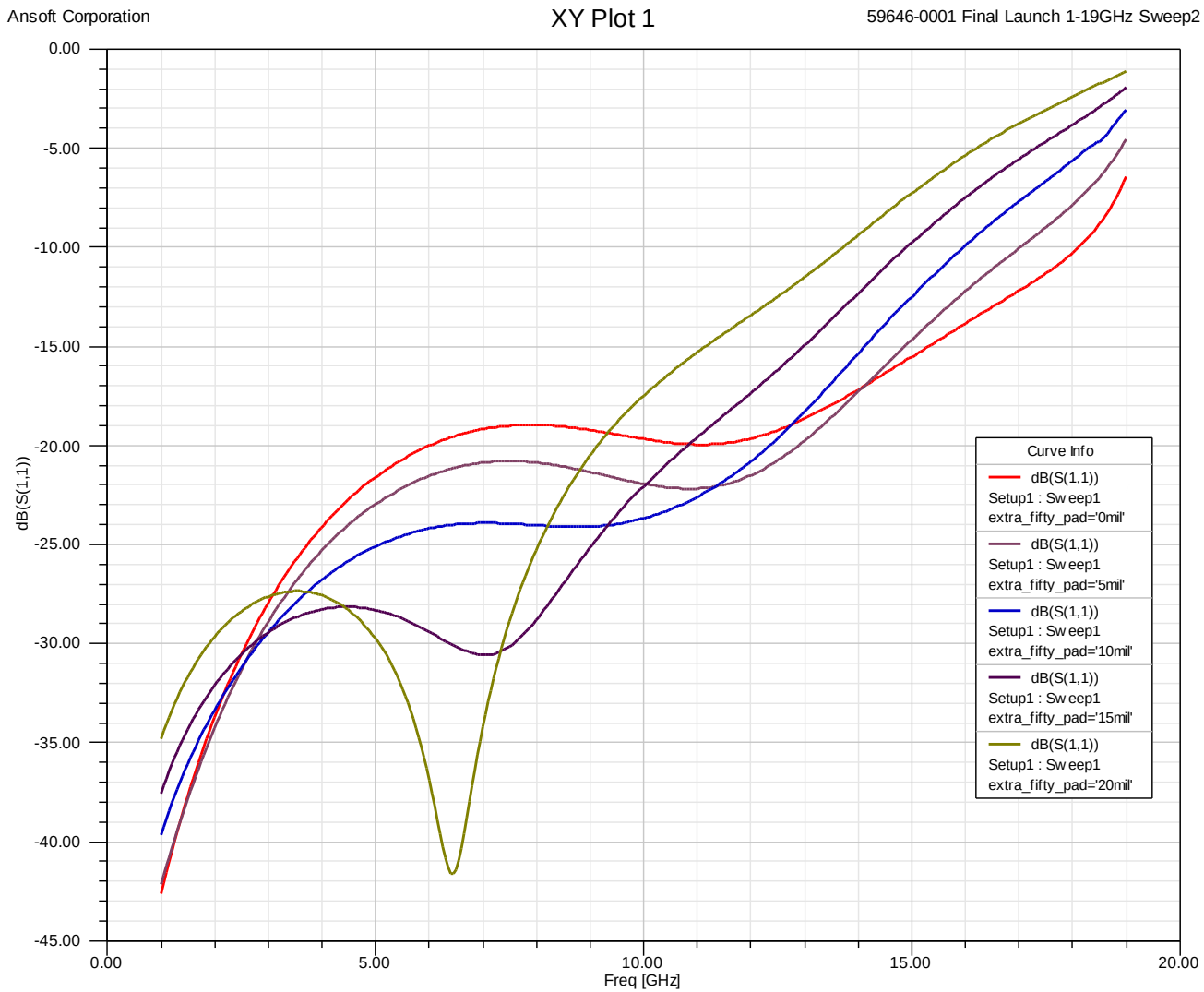
The neck width was changed from 28mil:5mil:48mil. The width of the fifty ohm line is approximately 78mil. We see, however, the overall trend of the results is that as neckWidth increases, the launch is better matched. The wider the neck, then, the better.

HFSS Tuning (neck added), extraNeck changed



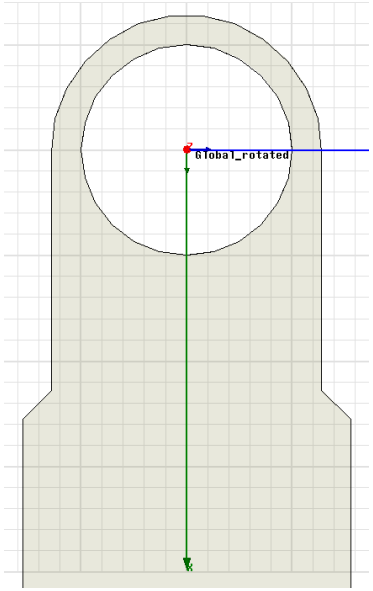
The length of the neck was changed by adjusting the variable 'extraNeck' from -14:5:35mil. The trend here shows that the shorter the neck, the better... Note also that all these results are not as good as the final SMA launch. Regardless of that information, the trend that is showing up is the following: make a wide neck that is very short… if we take that to the extreme, that means basically no neck – which was what was done in the first place – whose results were very good.

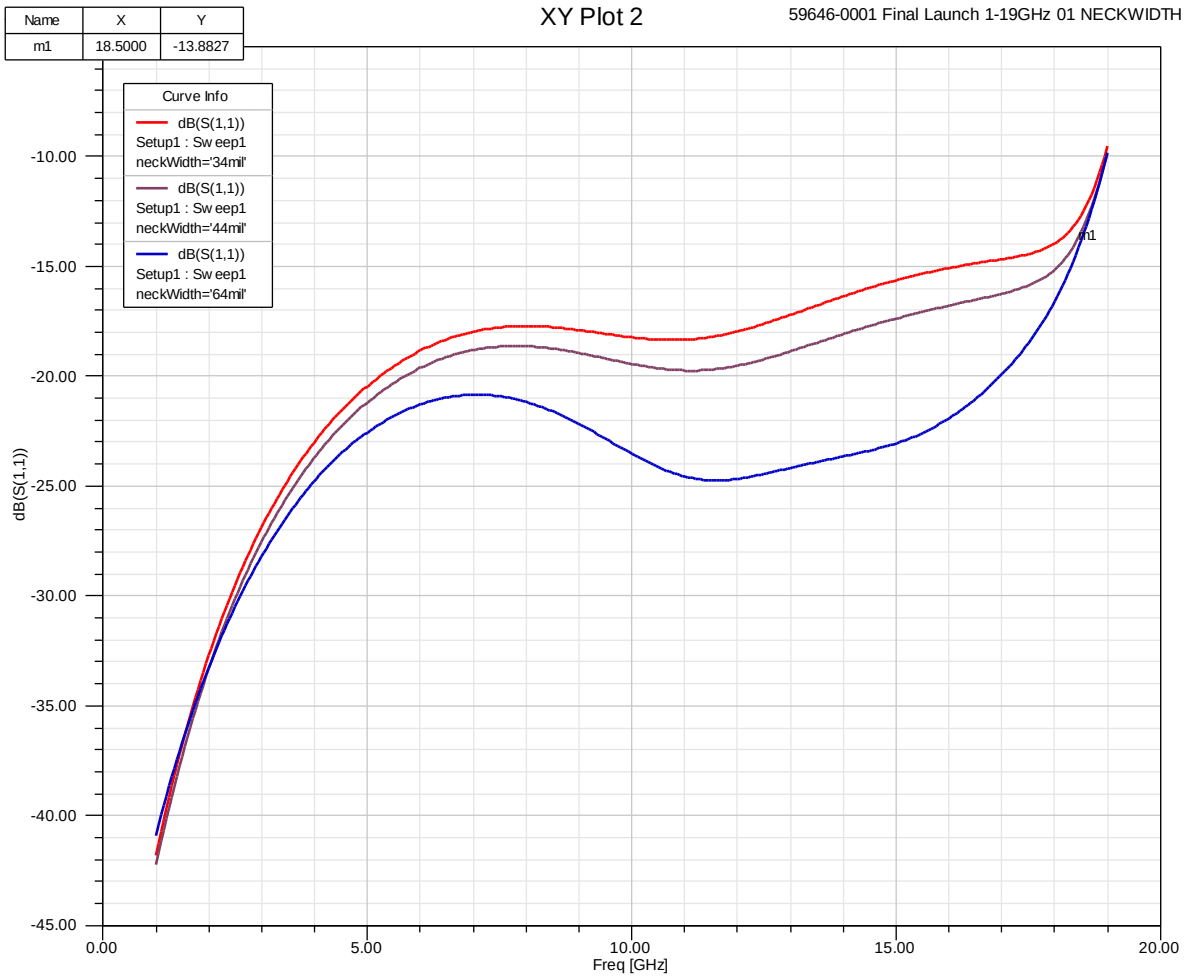
HFSS Tuning (neck added), fifty-ohm-pad-radius changed



This plot shows the results as the radius of the fifty ohm pad (through which the SMA pin is inserted) is increased. The major trend here is that as the radius is increased, the match gets worse... The smallest the pad can be is d_SMA_pin + 14… so the next few plots use this minimum value and change the width/length of the neck

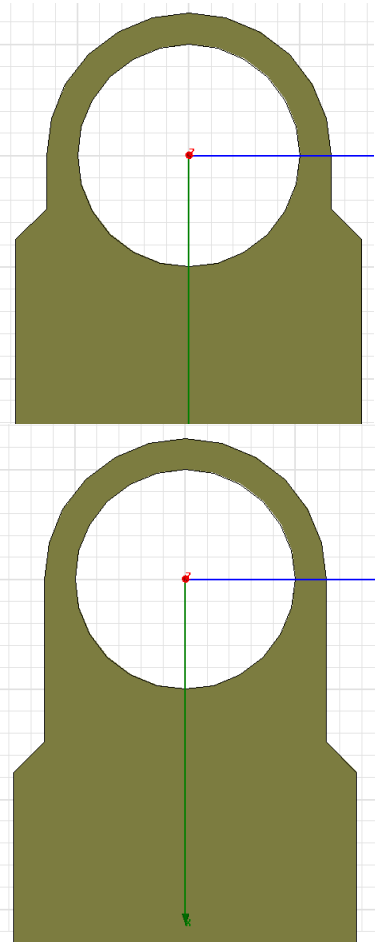
HFSS Tuning (neck added), smallest pad, neckWidth

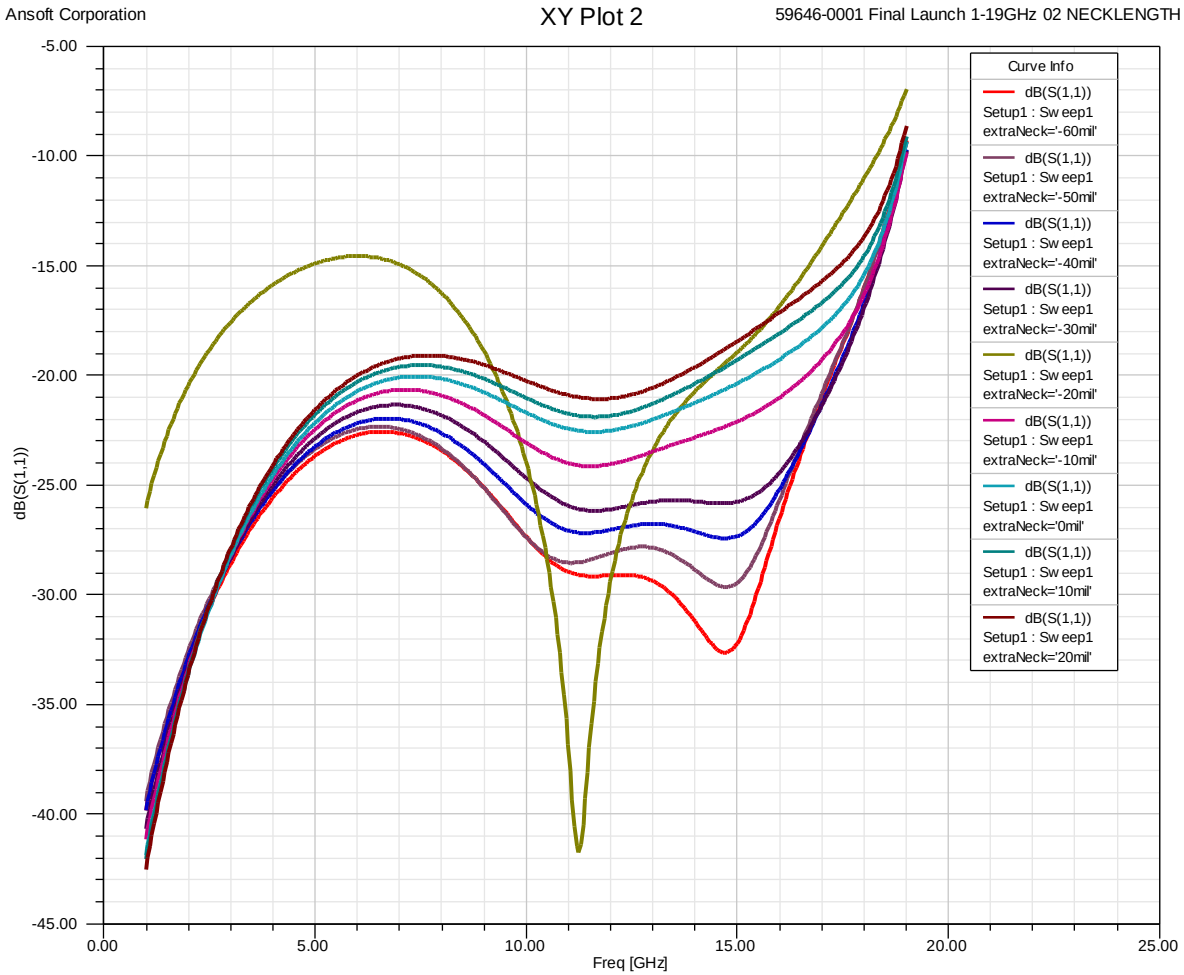




This plot shows, with the minimum dimension for the pad around the center pin, the effect of changing the width of the neck. The maximum width is when neckWidth = 64 (shown in the picture). As the neck gets wider, the overall match gets better. HOWEVER, that is not to say that it is much better than the original model that was sent for manufacture. We are only getting a minimum -14dB of Return loss at 18GHz. The manufactured one simulated at -12.66dB BUT it had a maximum of -32 for the 10-12GHz range.

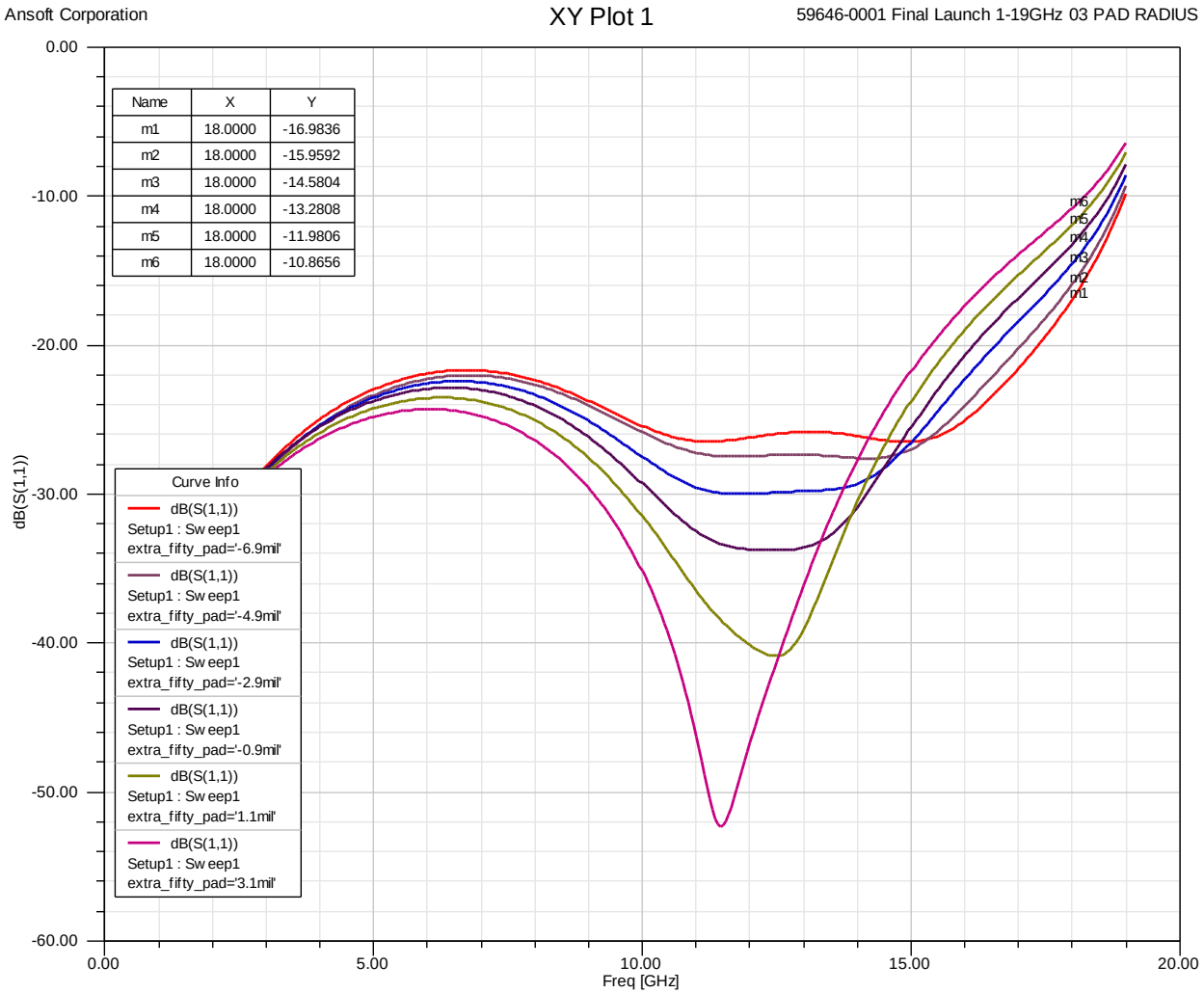
HFSS Tuning (neck added), smallest pad, ‘extraNeck’ changed





Using the fact that the widest neck was the best, it was kept at the maximum while the length of the neck was changed by changing the variable ‘extraNeck.’ As can be seen from the trend of the results, the shorter the neck the better the overall results. There is one very odd plot… which is confusing to me, but the others seem to follow a nice trend. In fact, for the shortest neck length tested (shown top above), the results may be rivaling the ‘sent’ one. -35 is shown (bottom above)

HFSS Tuning (neck added), further pad radius changed



Using -35 for the neckLength and the maximum neckWidth, more tuning (very slight) was done for the pad radius. Changes of only 2 mil make fairly drastic changes… however, for the best result at 18GHz (the minimum possible pad radius), we have below 25dB return loss for 10-12GHz AND almost -17dB for 18GHz! This is an SWR of less than 1.5 for the entire bandwidth of 0-18GHz. Further sims will be done.