



Best in Filter Designs

Application Note ANAWR103

Fast and Easy

Miniaturized Hairpin Filter Design Using
Nuhertz[®] FilterSolutions[®] Synthesis Software and
AWR[®] Axiem[®] EM

Port tuning was originally developed between Nuhertz and Sonnet Software with a thanks to Sonnet Software's Dr. Jim Rautio

Nuhertz/AWR

www.nuhertz.com

www.awrcorp.com

FilterSolutions Synthesis Software

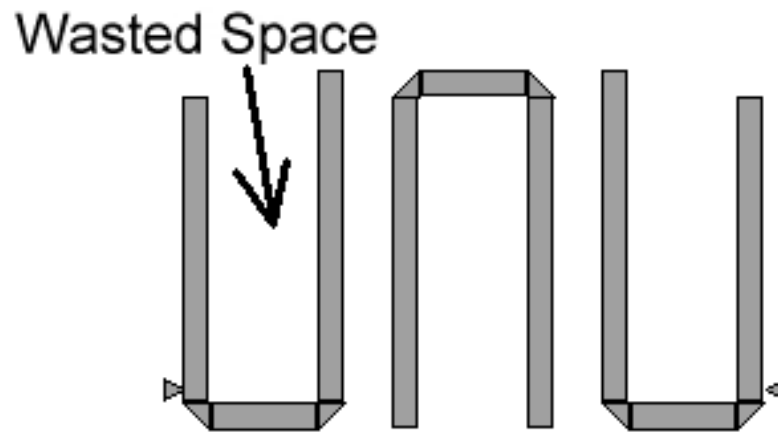
- **Quick and Easy to Use for Novices and Experts, Alike**
- Generates filter layout geometries from user- entered design requirements
- Many different filter topologies are possible
- Generates AXIEM EM simulation projects directly
- **Easy to use** graphical user interface (GUI)
- Runs on Windows PCs

Tuning and Optimizing

- Synthesized planar filters generally require tuning or optimizing to maximize performance
- Tuning is achieved by repeated manual edits
- Optimizations may be performed with AWR direct AXIEM extraction optimizations
- *Faster optimizations obtainable with Axiem port tuning*

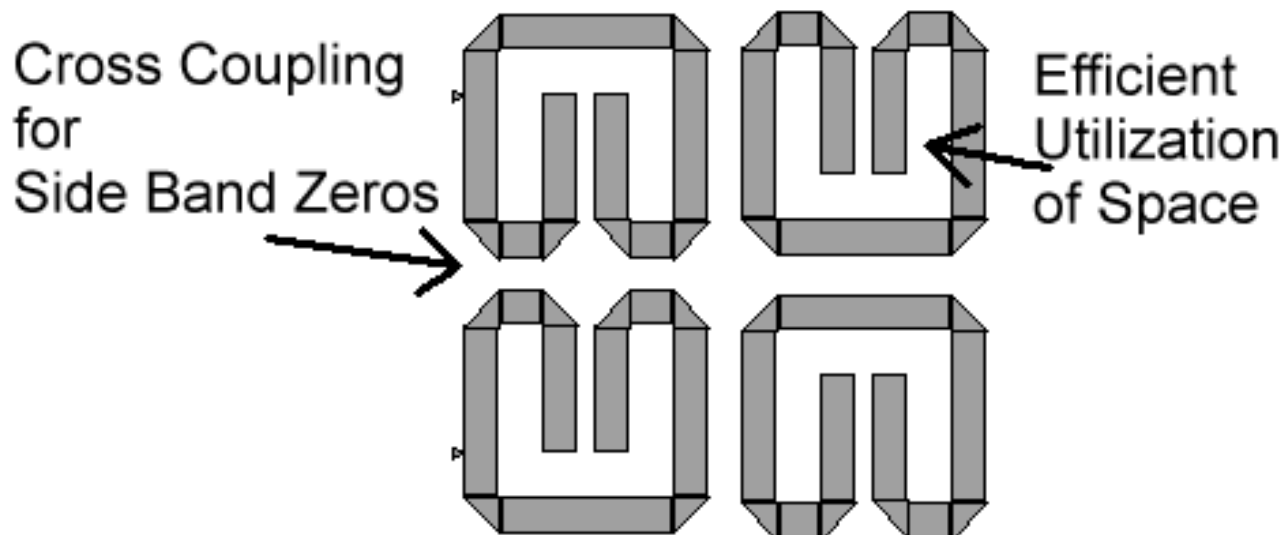
Goal for Miniaturizing the Hairpin

- Traditional hairpin designs are inefficient in space utilization
- Traditional hairpin designs are all-pole, permitting excessive pass band spread



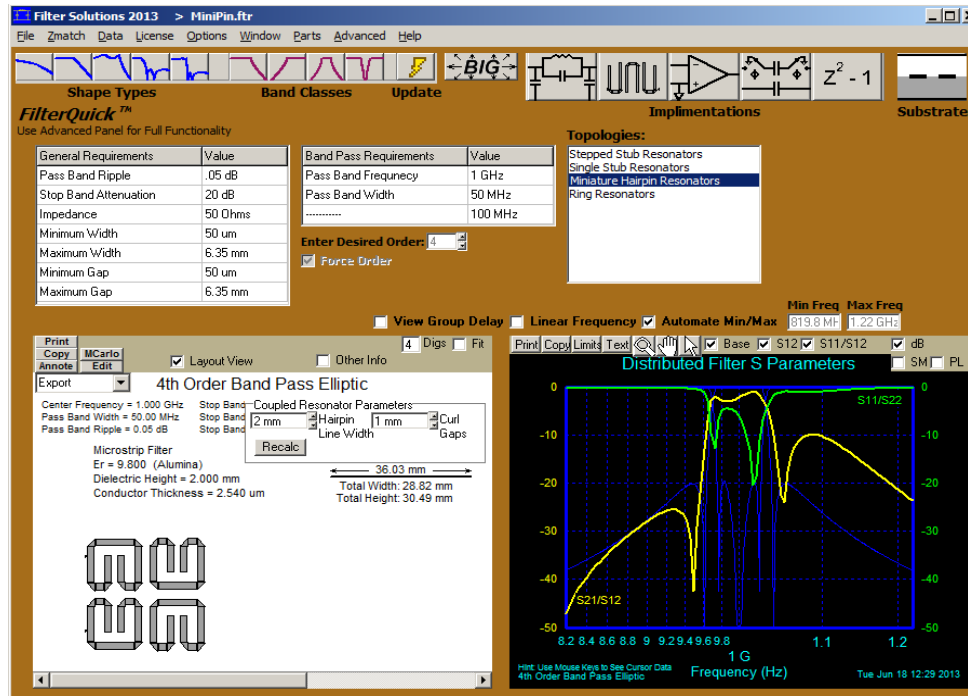
Miniaturized Hairpin Design With FilterSolutions

- Efficient use of space provided by folding over hairpin ends
- Cross coupling produces side band zeros for narrow passbands



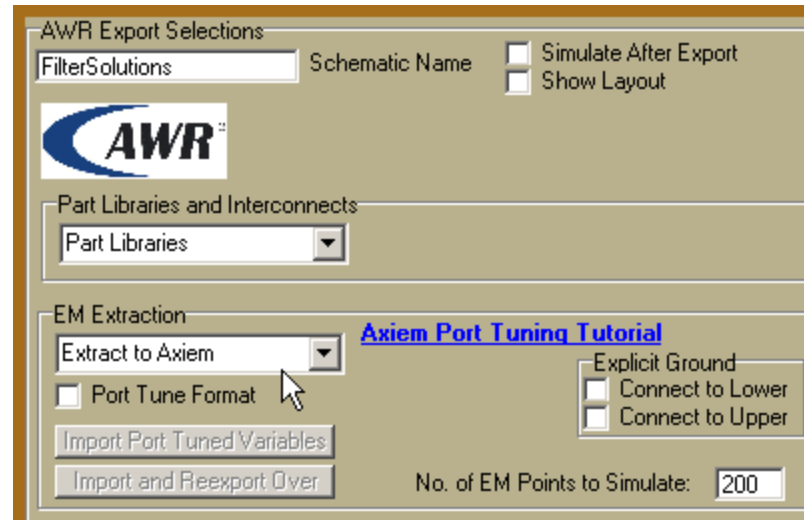
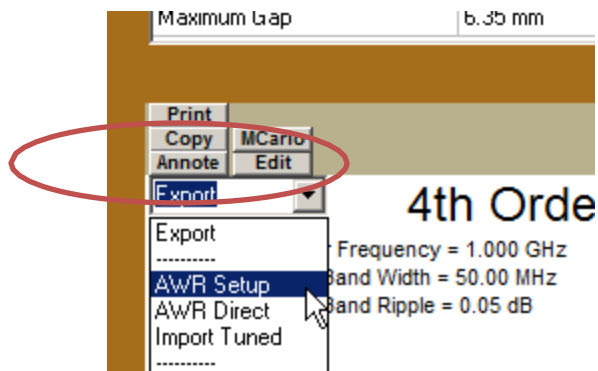
Miniaturized Hairpin Issues

Closed-form circuit level analyses of folded hairpin filters are generally poor because they do not capture coupling of the folded elements



Axiem Extraction Setup With AWR Export Control Panel

- Select, “Extract to Axiem”, desired “Points to Simulate” and other selections, and Export



Export to AWR Using Saved Settings with AWR Direct

- Stackup and extract blocks are automatically set

Minimum Gap	50 um
Maximum Gap	6.35 mm

Print	MCarlo
Copy	Edit
Annotate	
Export	

4th Order

Frequency = 1.000 GHz
 Band Width = 50.00 MHz
 Band Ripple = 0.05 dB
 Filter Type = Chebyshev
 Dielectric = Alumina

Export

- AWR Setup
- AWR Direct**
- Import Tuned

Stackup

Extract

Nuhertz Filter 5 parameters

Nuhertz Filter Axiem_Extract_Do...

Nuhertz Filter

DB[S(1,1)] Nuhertz Filter
 DB[S(2,1)] Nuhertz Filter

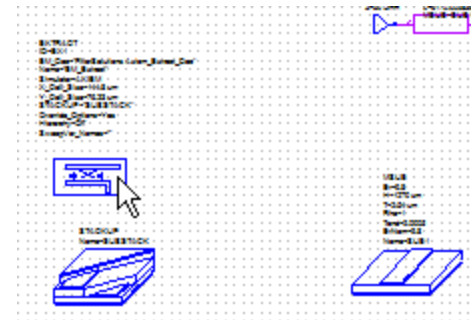
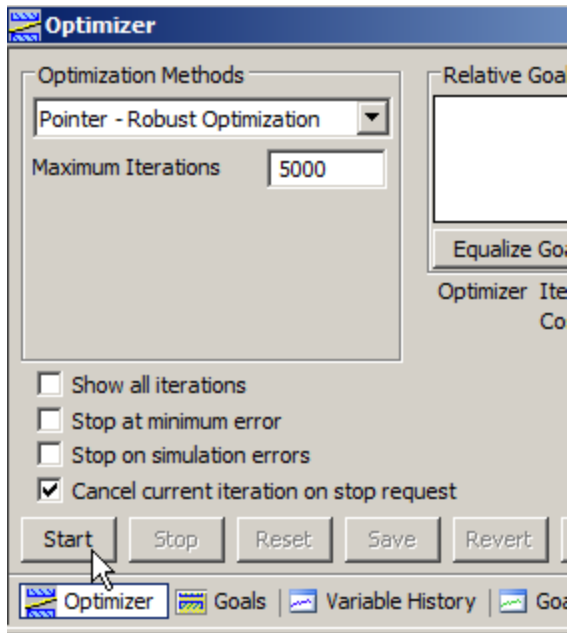
Frequency (GHz)

1

2

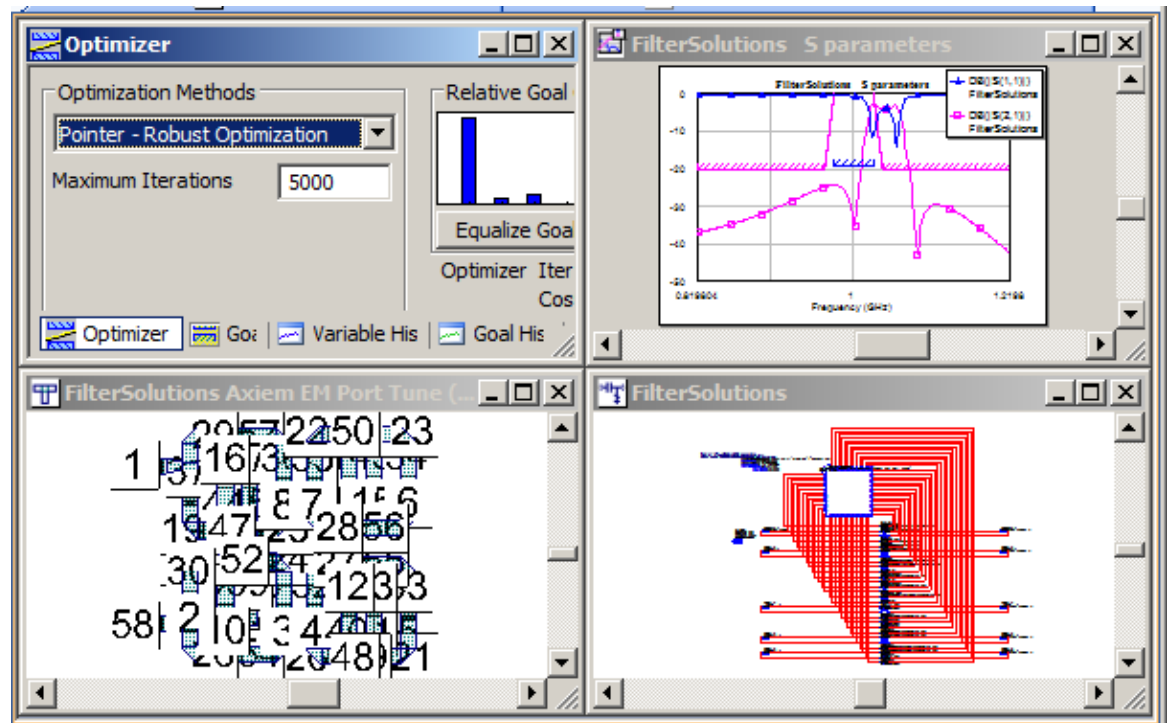
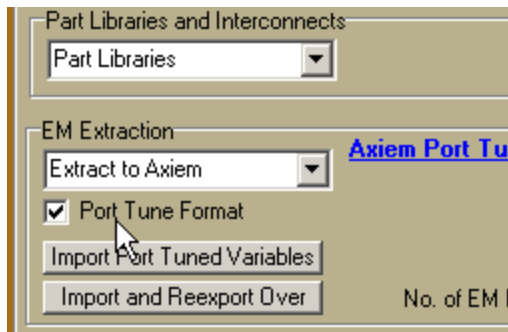
Extraction Optimizations

- Easy to Use Microwave Office Optimization Selection with Extraction Block Enabled
- May Require Excessive Amount of Time



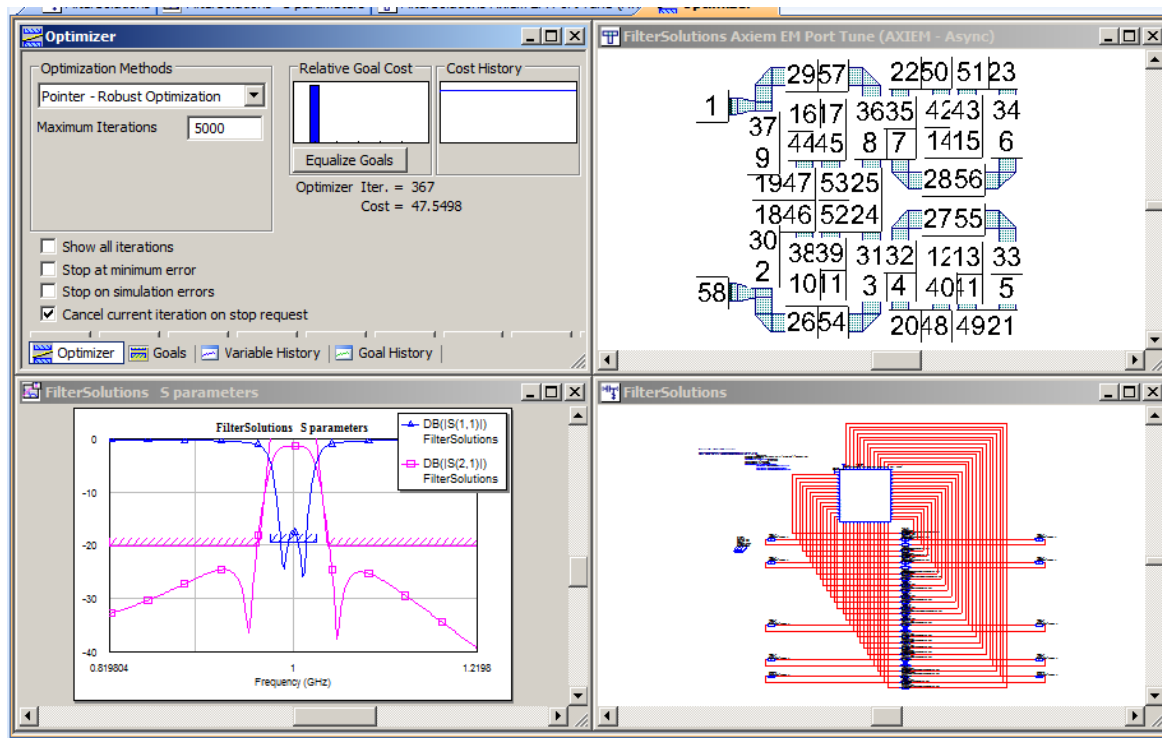
Optimize With Highly Efficient Axitem EM Port Tuning

- Accurate EM Optimization Obtainable in **five minutes**, or less
- Single Mouse Click Required to Export in Port Tuning Format

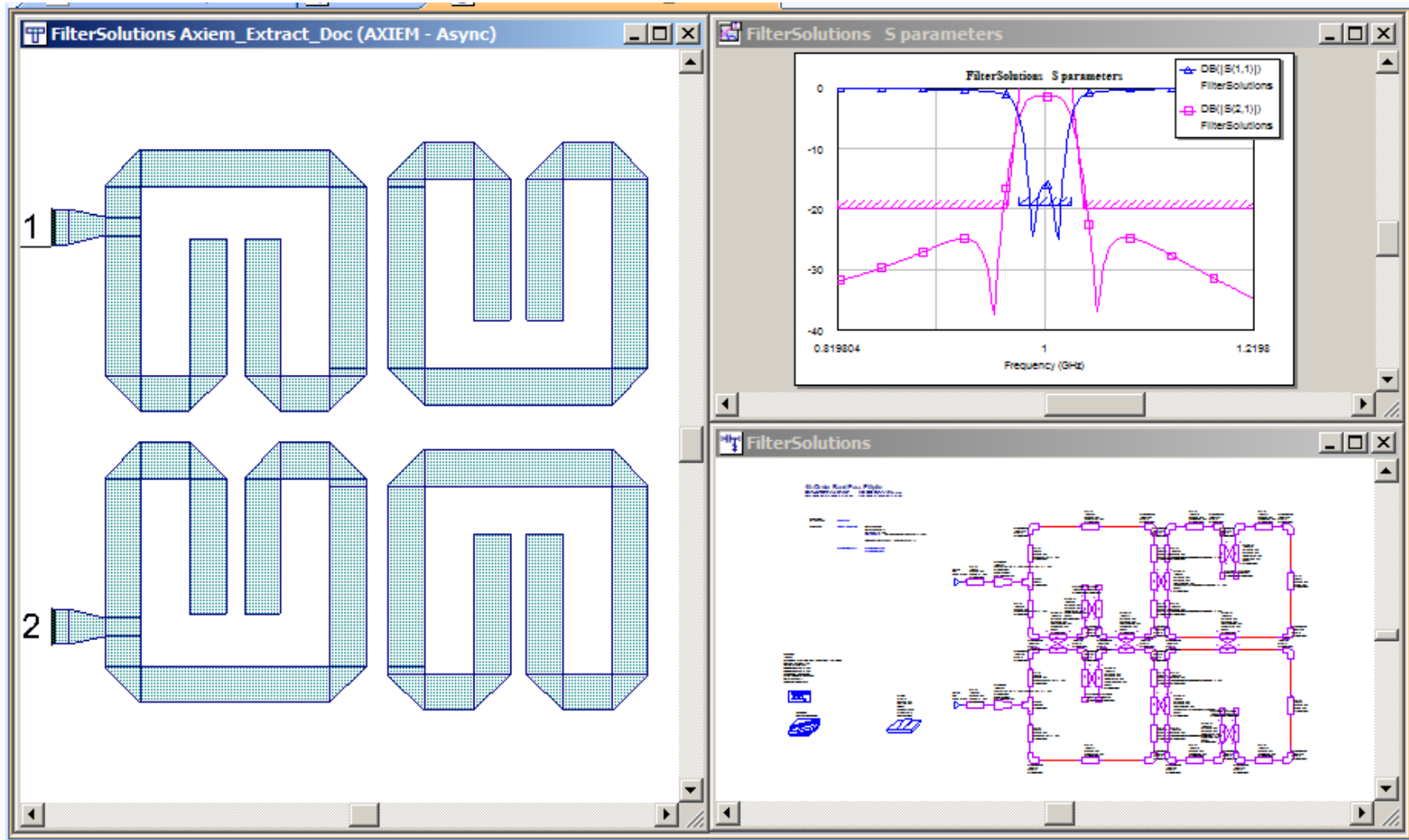


Port Tuning Optimization

- Optimize and Re-export as Needed.
- Single Mouse Click to Import or Re-export With Tuned Variables
- Accurate Results Obtainable After One to Two Port Tuning Cycles
- Manufacturer Geometry Limits are Maintained and Enforced



Final Axiem Design





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