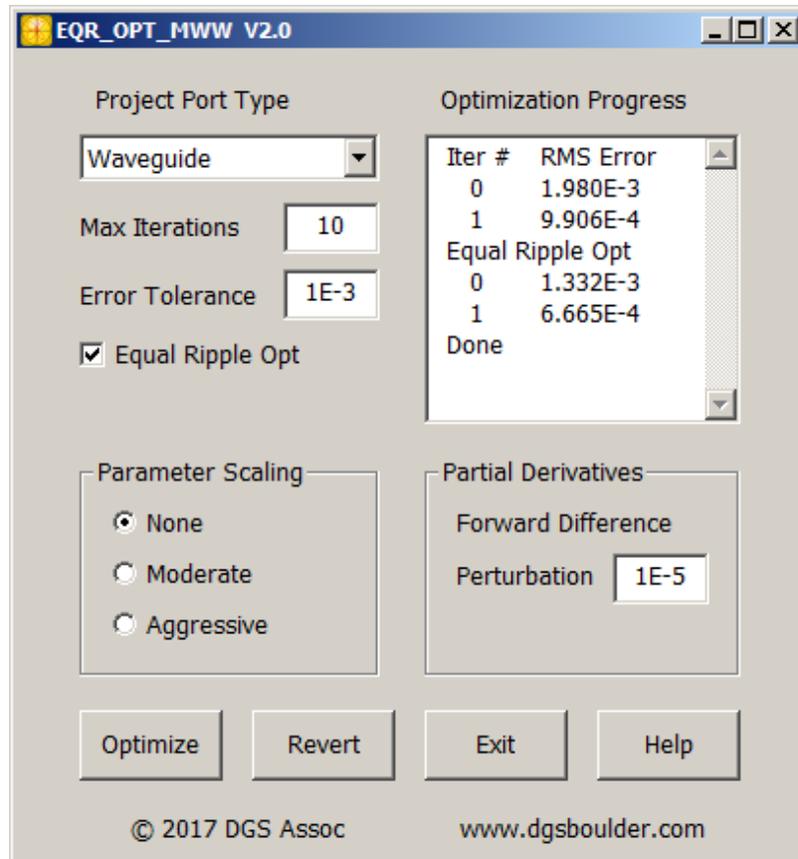


Equal Ripple Optimization for μ Wave Wizard



Equal Ripple Optimization for Mician μ Wave Wizard (EQR_OPT_MWW) is a specialized engine for filter optimization. It leverages the μ Wave Wizard COM API and can optimize many of the filters that can be defined in the μ Wave Wizard design environment. Unlike earlier optimization schemes that utilize port tuning, EQR_OPT_MWW operates directly on the filter physical dimensions in the EM domain. EQR_OPT_MWW will be most efficient for filters that can be defined using only mode matching based elements. It may be possible to include a few 2D FEM or 3D FEM elements in the filter model as well. Unlike many general purpose optimizers, EQR_OPT_MWW finds an exact equal ripple response. General purpose optimizers often fail to find all the reflection zeros in the passband, particularly for higher order filters. EQR_OPT_MWW also controls the bandwidth of the filter exactly, which general purpose optimizers cannot easily do. This is particularly important for diplexers and multiplexers.

Key Features

- Exact equal ripple optimization of any bandpass filter.
- Exact equal ripple optimization of diplexers and multiplexers.
- Exact control of the filter bandwidth and return loss.
- Rapid convergence with very few optimization iterations.
- Example files for many filter topologies are included.
- Tested and supported on 32 and 64 bit versions of Windows XP and Windows 7 thru 10.

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Example 1: N=6 iris coupled waveguide filter

The schematic below represents a standard iris coupled waveguide filter. Twelve variables are needed to define the resonator frequencies, the coupling between resonators and the return loss level. The WGC program from SW Filter Design provides an excellent starting point for the optimization. In this example we will detune the starting dimensions to make the problem more interesting.

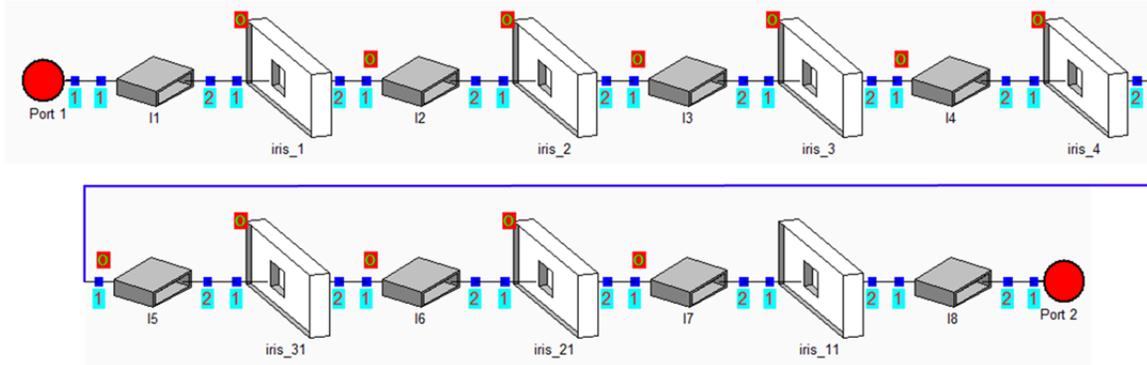


Figure 1. μ Wave Wizard schematic for an N=6 iris coupled waveguide filter.

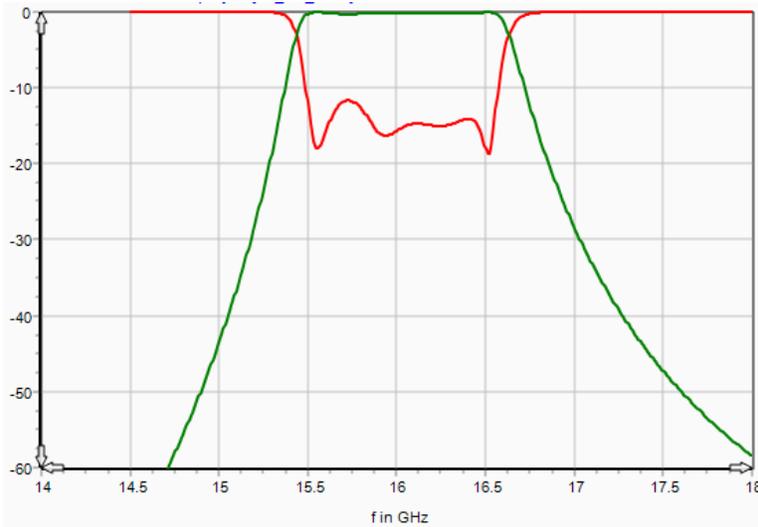


Figure 2. Detuned optimization starting point.

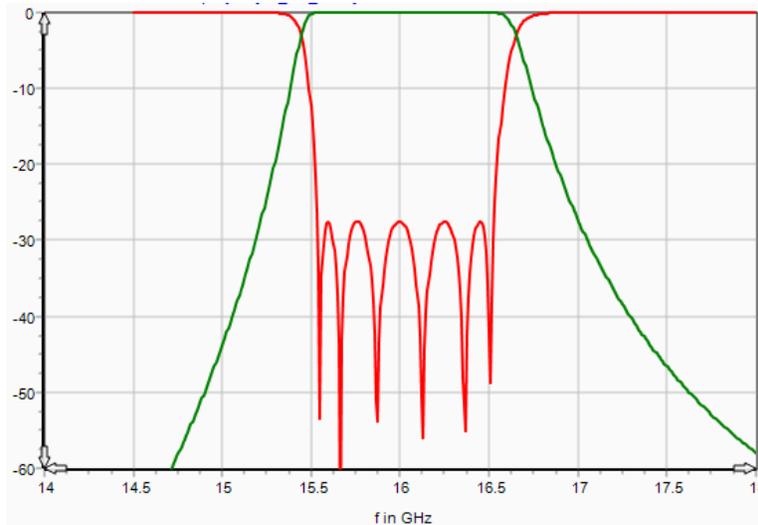


Figure 3. Optimized result after 7 iterations.

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Example 2: N=6 Iris coupled waveguide diplexer

With the robust optimization capability of EQR_OPT_MWW, diplexer design can begin with two doubly terminated bandpass filters connect to a common junction. The line lengths between each filter and the common junction are adjusted for best match at band center. Notice that only five return loss nulls are visible in each channel when we expect to see six. The optimizer adjusts all the variables in both channels simultaneously.

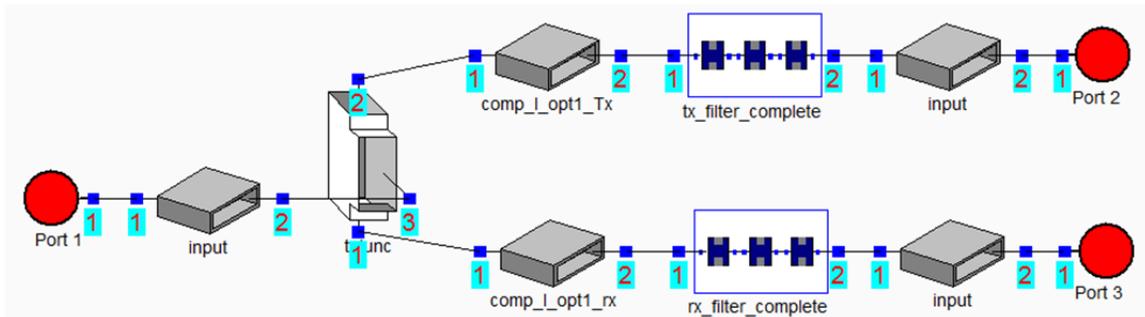


Figure 4. μ Wave Wizard top level schematic for an N=6 iris coupled waveguide diplexer.

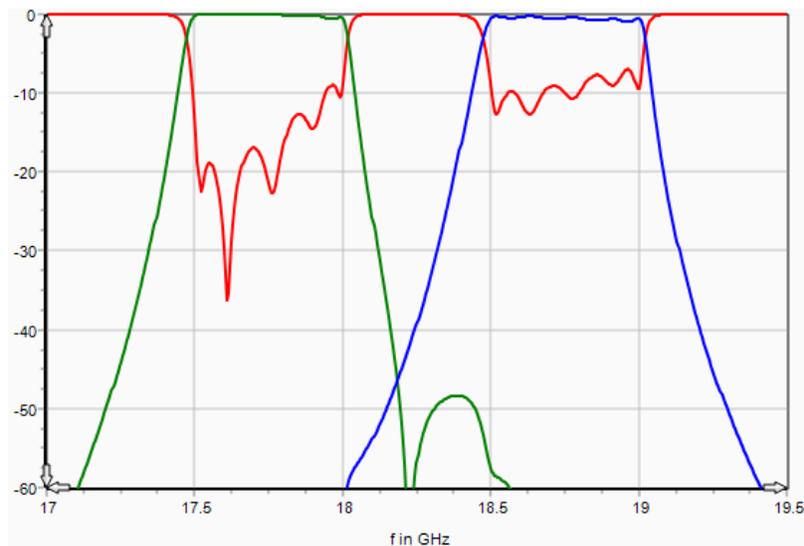


Figure 5. Phasing two doubly terminated filter designs gives us this starting point.

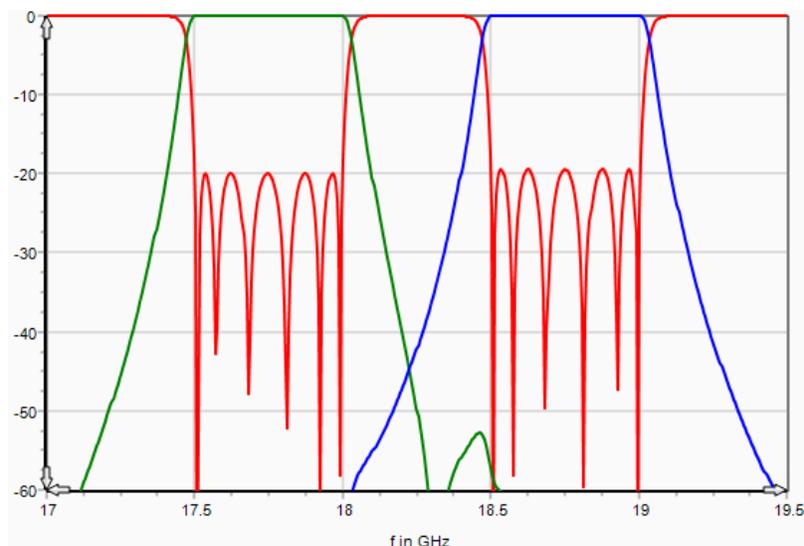


Figure 6. Optimized equal ripple diplexer response after 8 iterations.

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Example 3: N=5 combline filter with lumped tuning

The example below is a basic combline filter with lumped tuning. The CCL program was used to find most of the starting dimensions. The couplings at the input and output are realized with a capacitive probe. Next steps might be to add coupling screws, or we might add irises between the resonators to reduce the length of the filter. Both of these modifications would be quite easy with the optimizer.

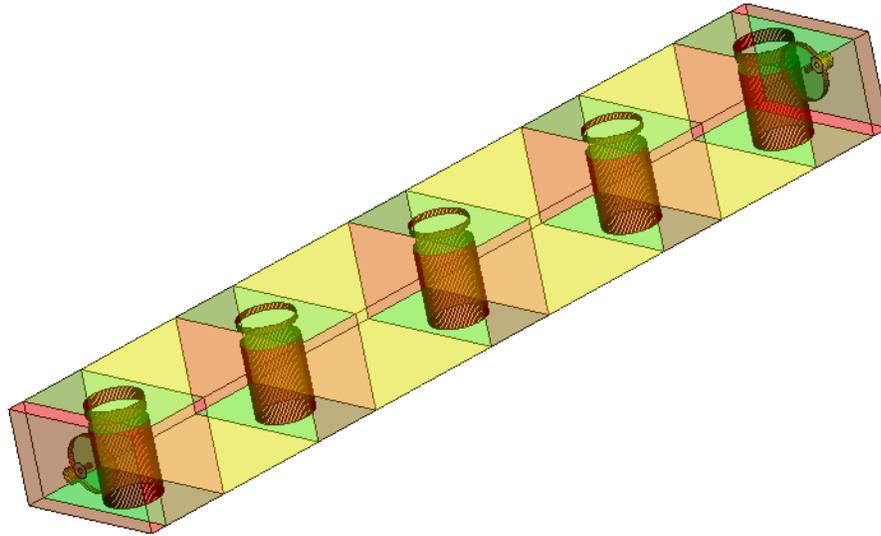


Figure 7. N=5 combline filter.

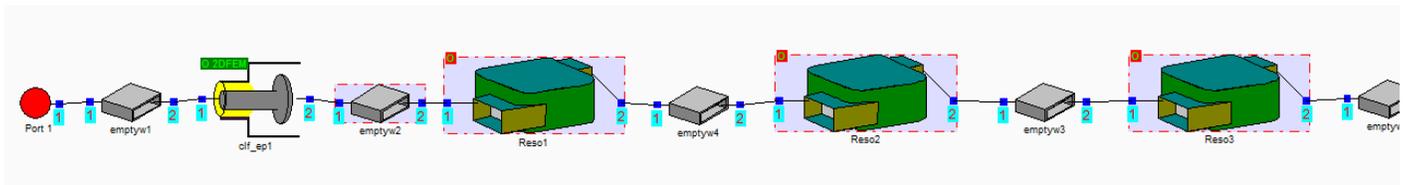


Figure 8. μ Wave Wizard schematic (first three resonators).

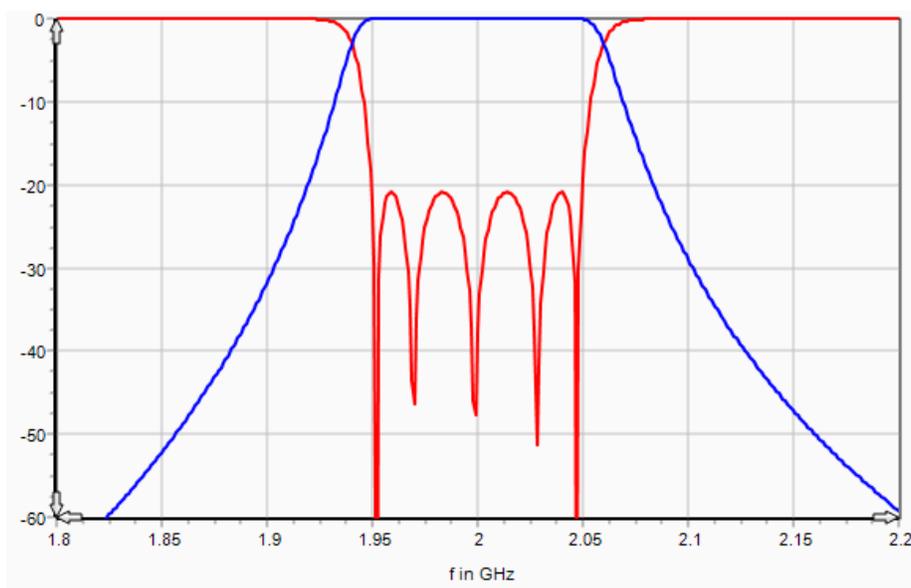


Figure 9. Optimized combline filter response.