Dual Mode Circular Waveguide Filter

1. Description

The CWDM (Circular-Waveguide Dual-Mode Filter) filters are widely used as narrow bandwidth band-pass filters in communication satellite output multiplexers due to their unique merits such as high unloaded Q (Quality Factor). Intensive research has been carried out on EM modeling and design of the CWDM filters [1]. The filter showed the expected performances presenting a dual mode resonance (two frequencies) using only one physical resonator.

![Figure 1: Circular-Waveguide Dual-Mode Filter](image)

**Dimensions**

The following figure shows different views of the filter's model. All dimensions have been annotated.
2. Simulation

The design and dimensions of the model have been optimized to a point where great performance was significantly shown alongside with good matching around 11 GHz (Ku Band satellite communications). The simulation is using the scattering parameter solver around 11 GHz with one of the available frequency plans: Fast sweep or Discrete sweep. Fast sweep gives results faster but its precision decreases as we move away from the center frequency.

The created Finite Element mesh must respond to a certain extent of accuracy to the curved shapes introduced in the boss of the filter: As we can see: the screws have been given more attention with a finer mesh control.
3. **Load/ Restraint**

The lateral faces of the hollow parallelepiped are considered as the input and output of the waveguide. The outer face of the circular filter's extruded boss is considered as perfect electric conductor. We assign air to its' inner part or hollow. The shapes inside are treated as PEC as well.

4. **Results**

The output results show we have excellent performance and that the filter's performance is suitable for the aimed domain of application.
Using the 3D viewer of HFWorks along with the section clipping feature, we can have a closer view on the inner part of the circular waveguide: we visualize the distribution of the electric field in time domain: i.e. the propagation of the wave from input till output.

![Electric Field Distribution]

**Figure 4:** Inner distribution of electric field at 11.8 GHz

5. **References**