How does a Wilkinson Power Divider work at 9 GHz?

A Wilkinson Power Divider

The Wilkinson power divider, introduced by Ernest Wilkinson in 1960, can split an input signal into two in-phase outputs or combine two equal-phase inputs. It uses a quarter-wave transformer to match the split ports to the common port and includes a resistor between the second and third ports for simultaneous matching. In this example, we model a Printed Wilkinson RF Power Splitter at 9 GHz using HFWorks, presenting reflection, transmission coefficients, and other parameters.

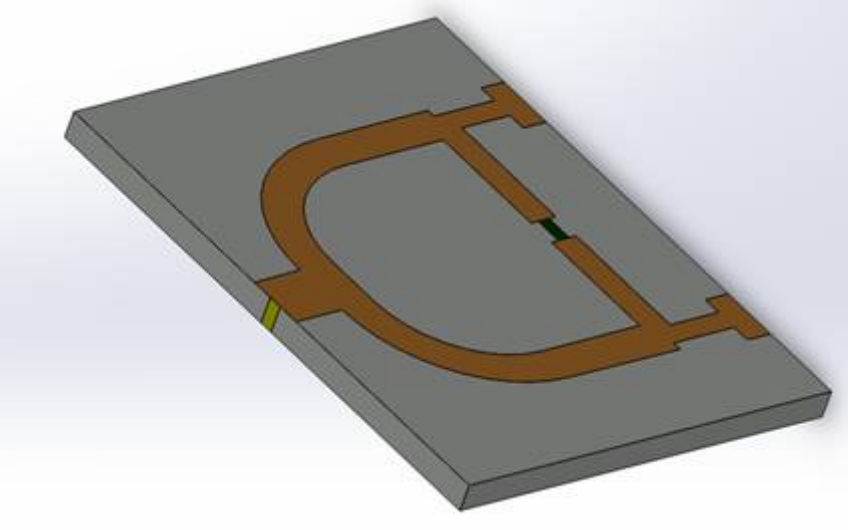
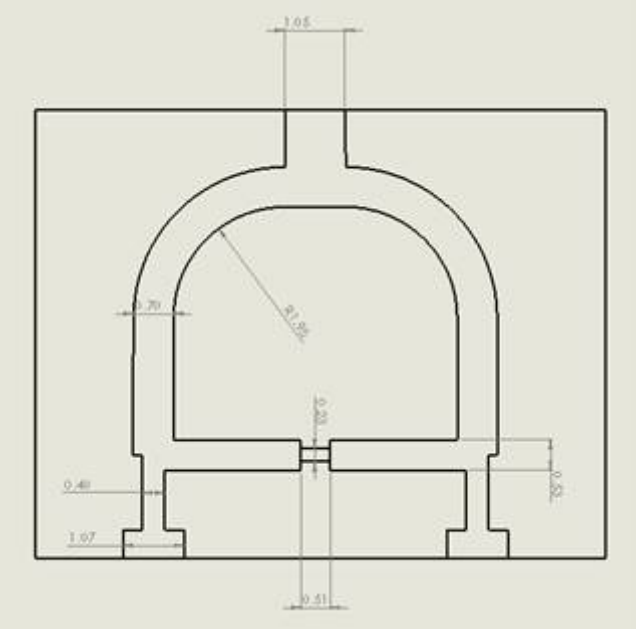


Figure 1 - *3D view of the modeled Wilkinson divider*

The model has been optimized using the best dimensions, which are described in this figure.



Simulation

The simulation of this power divider was conducted using a Scattering Parameters study from 4 GHz to 12 GHz, and it efficiently split the power into two in-phase outputs.

Solids and Materials

Considering the skin effect's shallow penetration, we can model multiple conductors by assigning air to them. The substrate material can be selected from the library or defined by the user. Additionally, we can specify Signal and PEC boundary conditions for the RF carrier and the ground metal beneath the substrate, respectively.

Load/ Restraint

The ports are connected to the main excitation path's pad, with the RF conductor assigned a signal boundary condition..

Meshing

The model doesn't have complex shapes, so a uniform mesh for the assembly should suffice without the need for specific mesh controls.

Results

Animating the 3D electric field distribution by varying the omega-T angle provides insights into how the wave propagates into the port and splits within the two branches of the divider. Initially, we can examine the reflection coefficient curve at the port to determine the frequency that offers the best matching and optimal propagation into the two ports. However, it's also possible to visualize the near field even for frequencies where no propagation occurs.