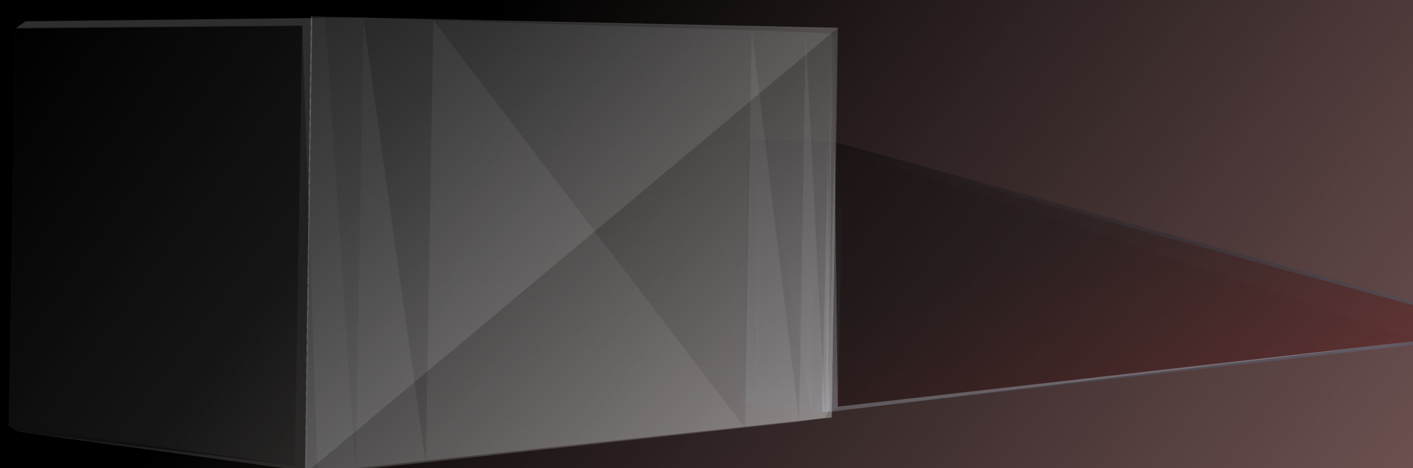
Quarter Ehorn Antenna



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ANTENNA SIMULATION OF A QUARTER EHORN ANTENNA

A Quarter wavelength antenna is named so because it is thanks to its quarter wavelength dimension that it does perfectly its job. Without getting into technical or physics details, this dimension has unsurprisingly been found the most suitable antenna dimension either for radiating or receiving. This example illustrates a basic model of an ideal horn (dimension around 3000 mm) that profits the its symmetry.

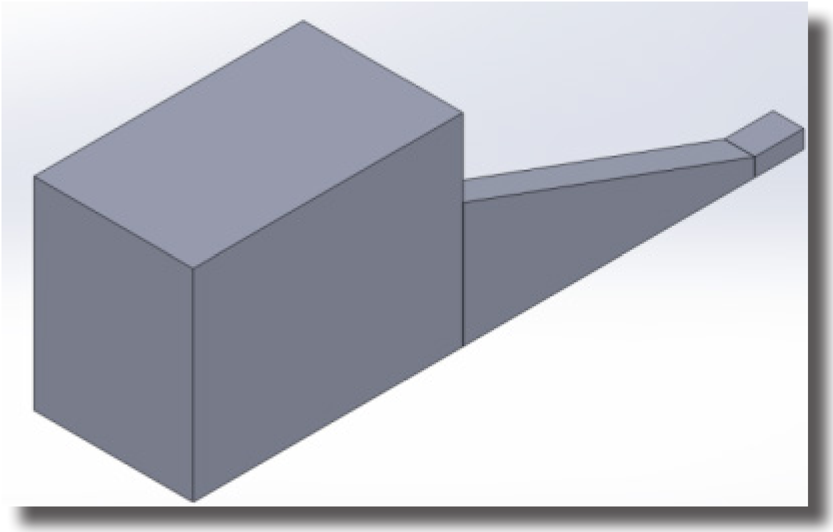


Figure 1: Quarter Ehorn antenna model (3D SolidWorks view)

Simulation

To simulate the behavior of this filter (insertion and return loss at the desired frequency band, input and output matching), we will create a scattering parameters study, and specify the relevant frequency band at which the filter operates (in our case 21 frequencies uniformly distributed from 1.8 GHz to 3.8 GHz). In an antenna simulation, radiation boundaries which are peculiar features of such a simulation have to be assigned to the radiation surfaces. These surfaces truncate the air surrounding the antenna and somehow

Boundary conditions

The port is applied to the small lateral face of the antenna. PEC boundaries are assigned to lateral boundaries. PECS and PEMS boundaries are also assigned to other lateral faces but conveniently to symmetry of the model.

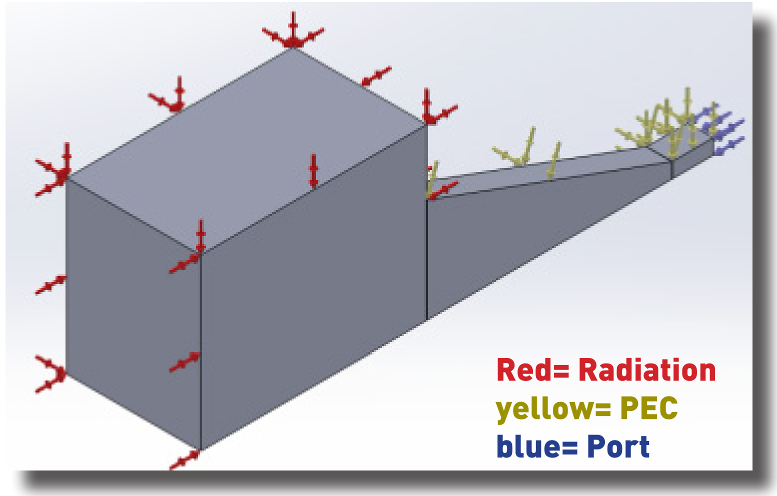


Figure 1: Boundaries

Meshing

The model doesn't have very particular shapes. A uniform mesh of the assembly should be sufficient without any applied mesh controls.

Solids and Materials

The antenna is filled in with air. So, we select all the solids and apply air to them as filling material. The faces of the solids are then treated as Perfect Electric or magnetic conductors depending on the relative direction of the electric field.

Results

Animating the 3D electric field's distribution by varying the omega-T angle gives us a hint on how the wave propagates into the port and gets radiated within the air box. We can first have a look at the curve of the reflection coefficient at the port, to decide which frequency yields the best matching. This figure shows conformal plots (2D and smith charts) of the variation of the reflection coefficient at the port. As mentioned within the beginning of this report, HFWorks computes scattering parameters within antenna studies as well; this is mostly relevant to antennas' matching optimization tasks. In this example, the antenna is best matched at 0.4 GHz.

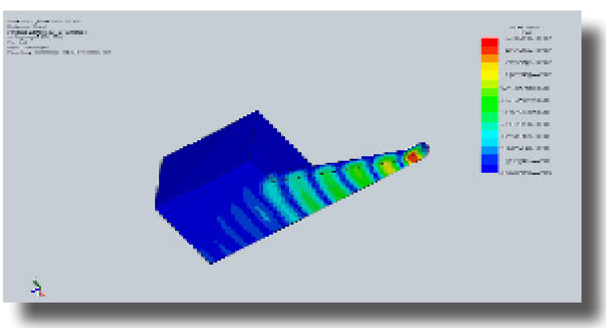


Figure 3: Wave propagation in the antenna at 0.9 GHz

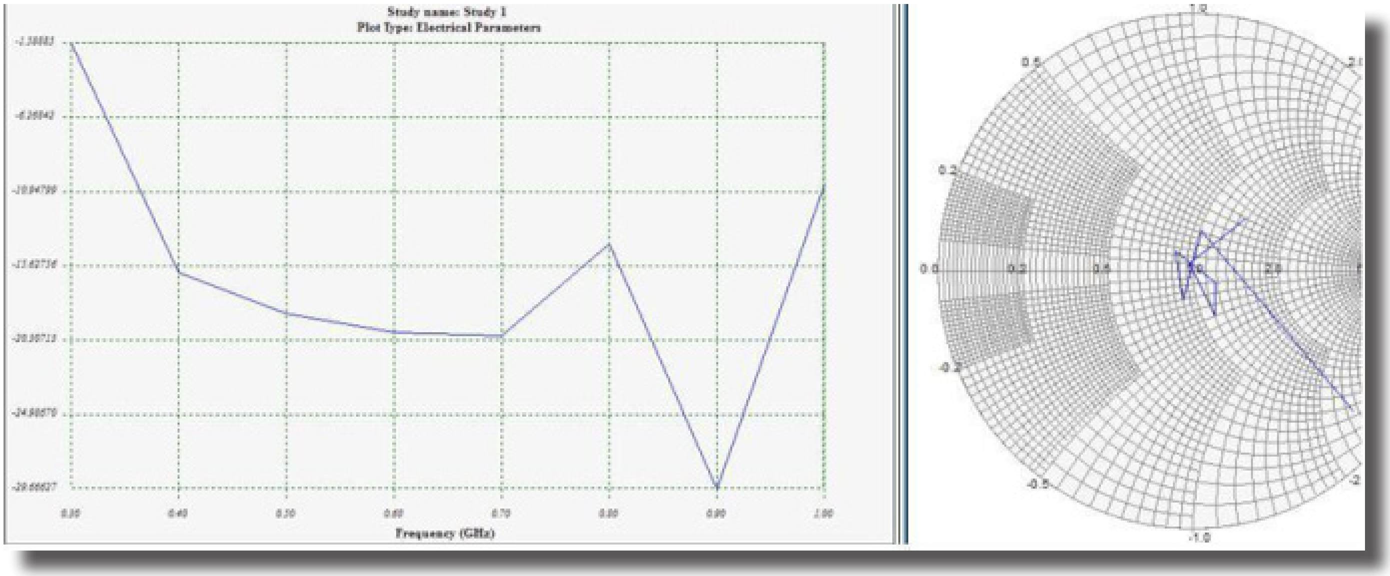


Figure 4: Variations of reflection coefficient at the antenna's port

The polar plots for the antenna parameters cover a wide range of parameters: radiated electric field, radiation intensity, directivity, gain pattern, axial ratio... etc. This is a plot of the radiated electric field at 0.4 GHz:

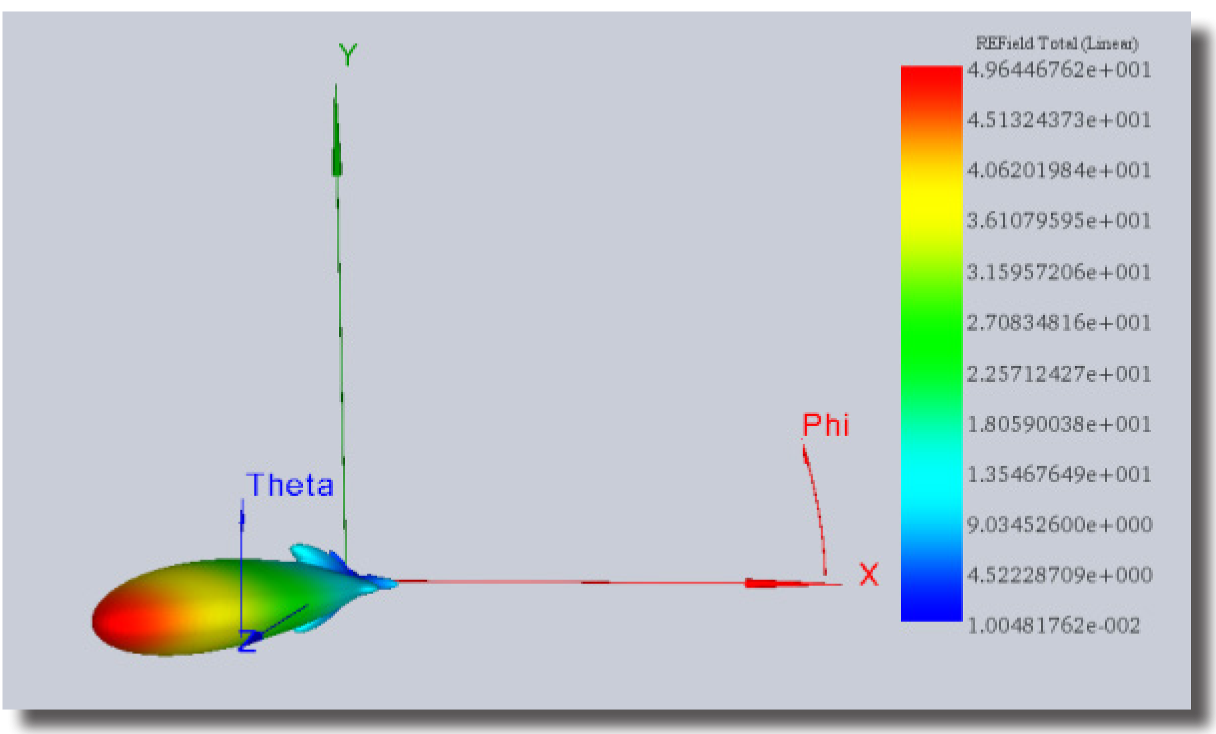
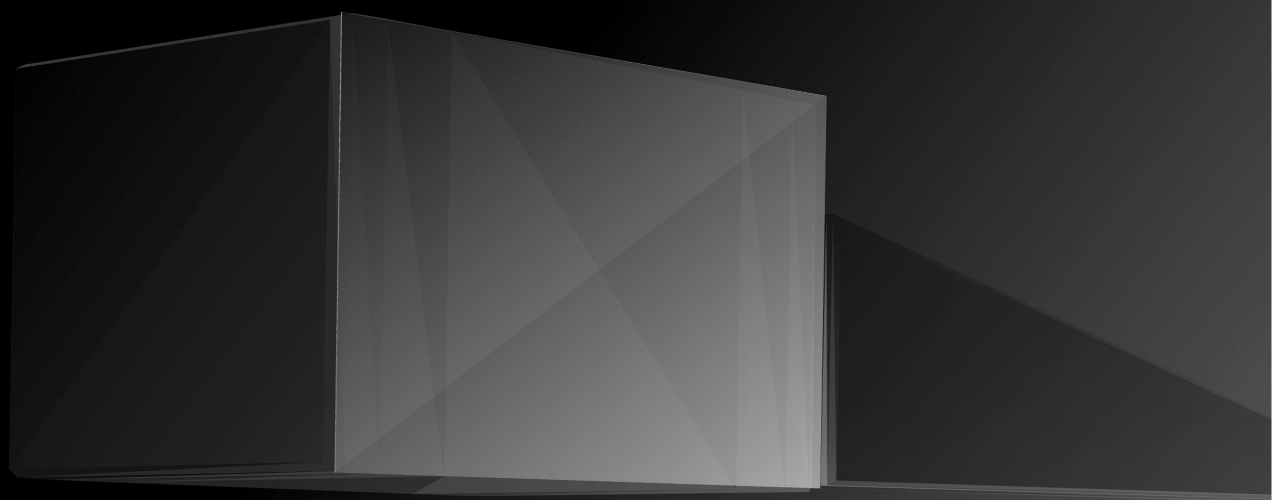


Figure 5: Radiated Electric field vector distribution at 0.4 GHz



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