Coupled line

Electro
Magnetic
Works

Coupled line filter simulation

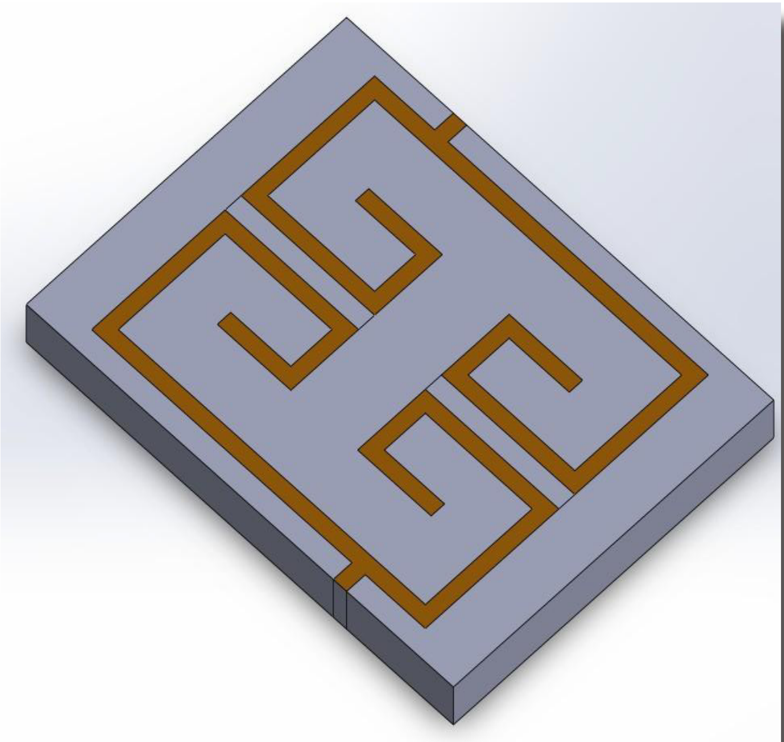


Figure 1: Coupled microstrip filter

Coupling between two transmission lines is introduced by their proximity to each other. Coupling effects may be undesirable, such as cross-talk in printed circuits, or they may be desirable, as in directional couplers where the objective is to transfer power from one line to the other. Based on the coupled lines theory [1], filters can be generated out of microstrip coupled lines. In this example, we show a band pass filter operating around 2.3 GHz.

Simulation

The simulation is a scattering parameters simulation. The frequency plan is fine with a small step; it is uniformly distributed between 2 and 3 GHz.

SOLIDS AND MATERIALS

The microstrip lines described in the shape shown in the previous figures are printed on a substrate with a relative permittivity of 3.3. The layer beneath the substrate has a very small thickness and thus can be applied a PEC surface. Since microstrips do not allow TEM propagation due to the air layer above the conductor, we should model this with an air box that creates heterogeneity between the two mediums

BOUNDARY CONDITIONS

The ports are applied to small areas next to microstrip line beginning and end. The ground metal is considered as a Perfect Electric Conductor.

RESULTS

Various 3D and 2D plots are available to exploit, depending on the nature of the task and on which parameter the user is interested in. As we are dealing with a filter simulation we could plot the reflection coefficient along the insertion loss for matching purposes.

MESHING

The mesh has to be fine enough on the port and RF carrier conductor. The gap between the conductor segments shall be accurately meshed as well.

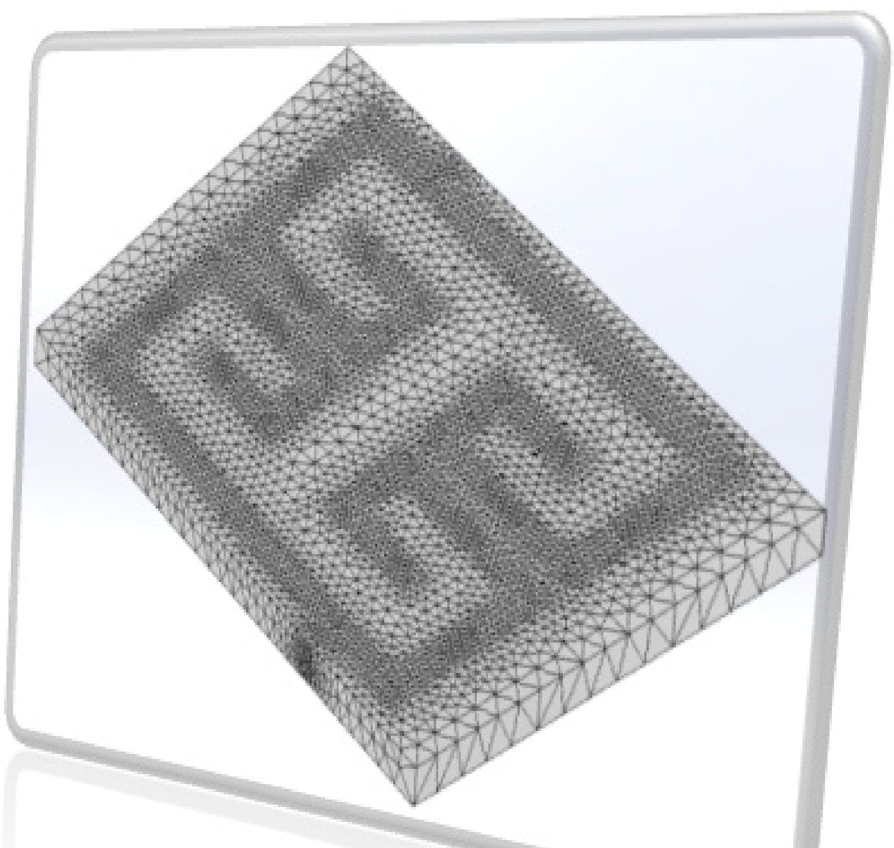


Figure 2: Mesh of the dipole antenna

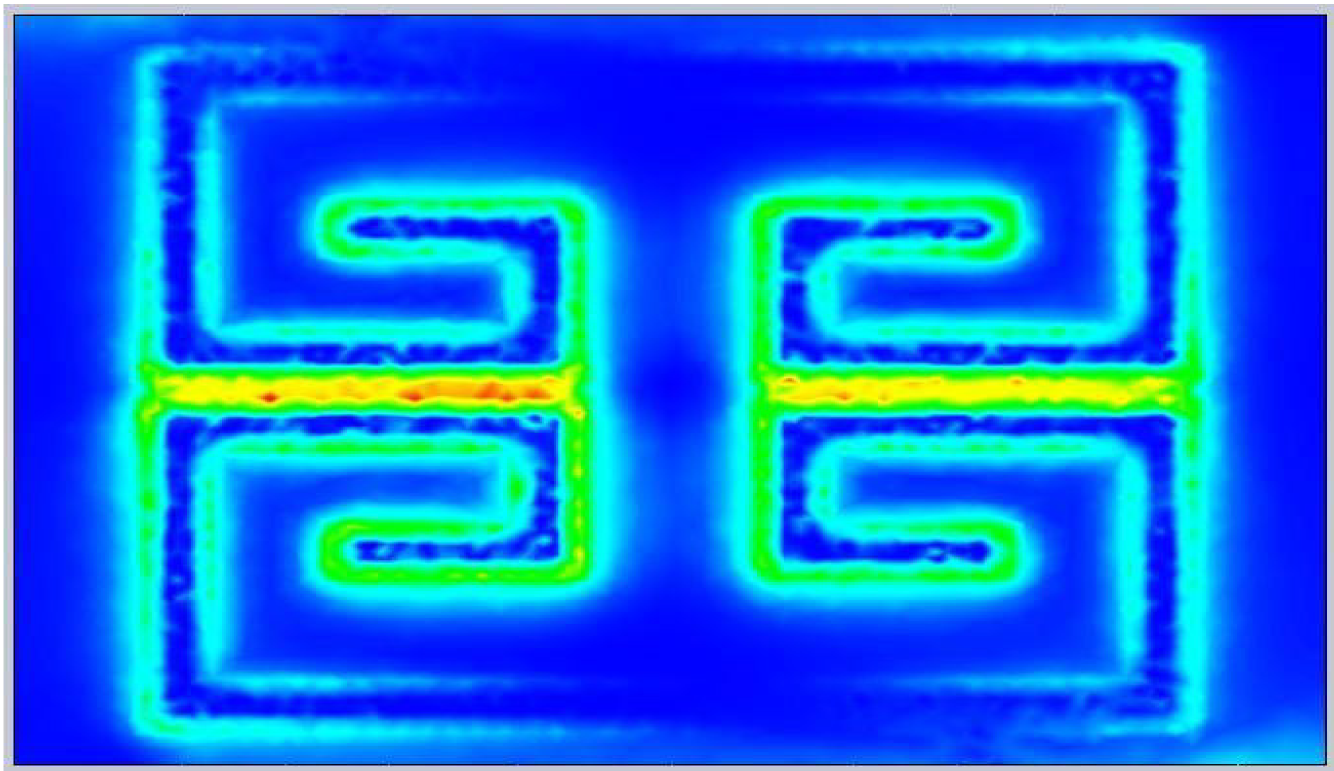


Figure 3: Near Electric Field distribution at 2.3 GHz

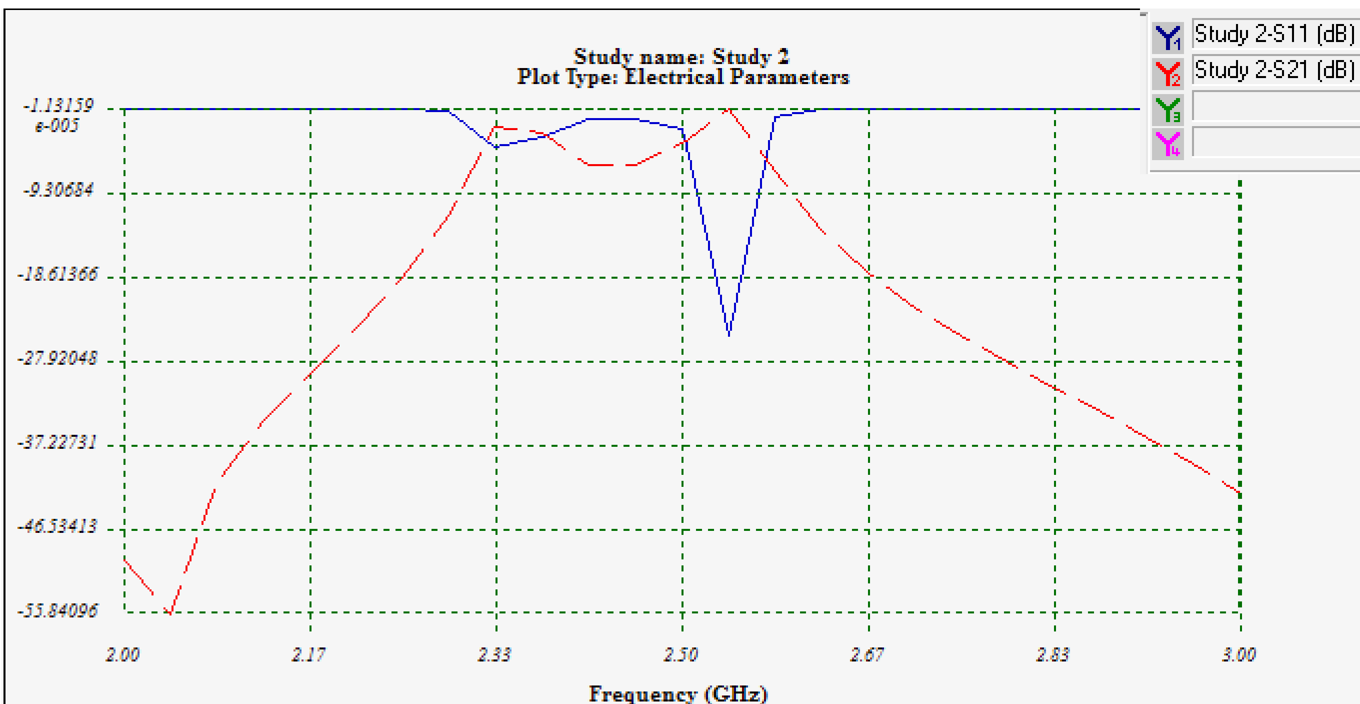
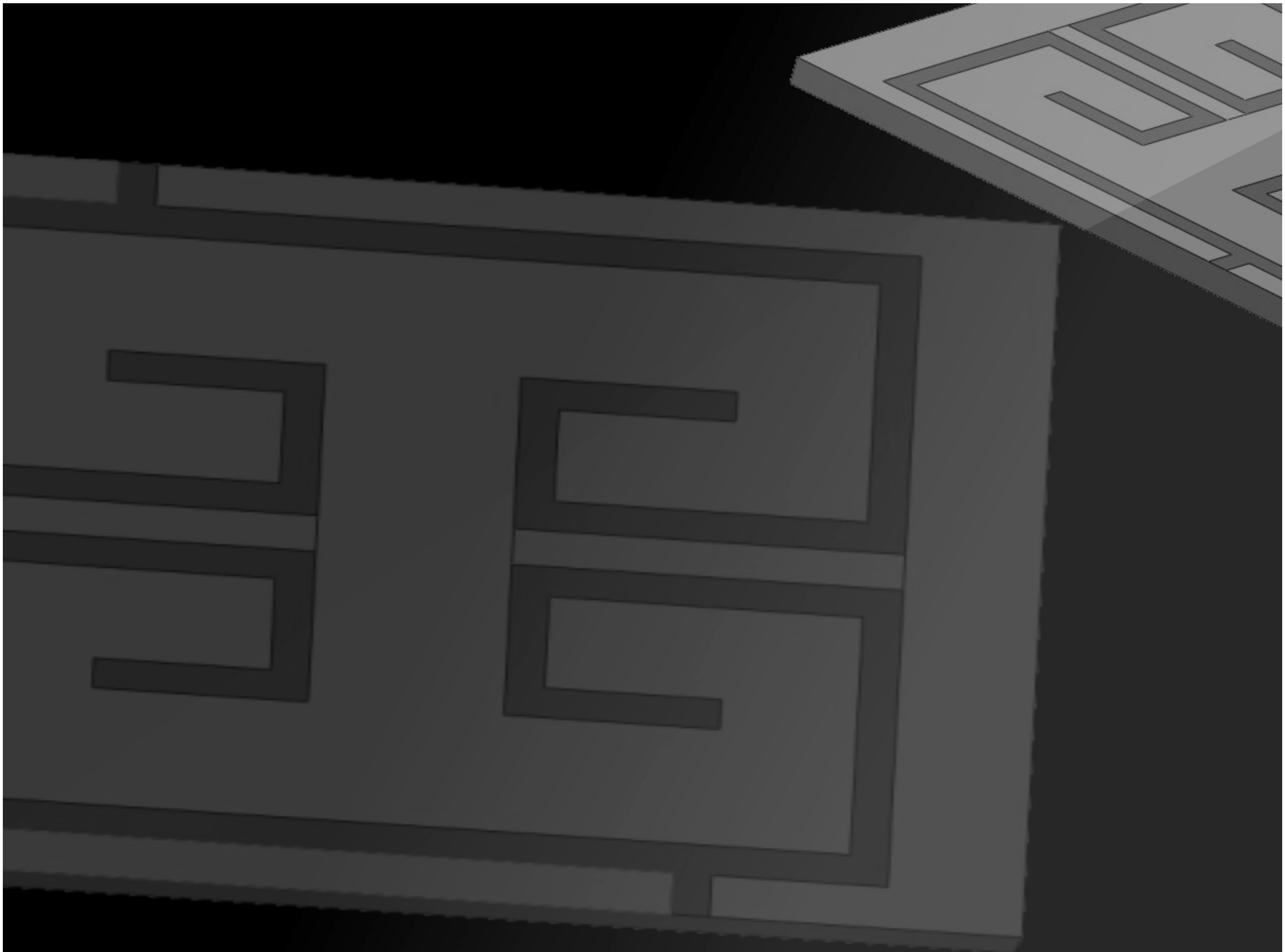


Figure 4: Variations of reflection coefficient at the filter's input port

The filter is best matched at 2.54 GHz: the return loss is very low. The plot might be smoother if we apply a smaller frequency step and reduce the start and end frequencies. We can plot the input reflection coefficient on a Smith chart as well.



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