emGine Environment™ Examples

emGine Environment home page: http://www.petr-lorenz.com/emgine

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Contents

Antenna Examples

Bow-tie Antenna

The example can be found in the menu: File → Examples → Bowtie antenna.

This example shows the modeling of a broad-band planar bow-tie antenna using the emGine Environment. The broad-band S-parameters and the radiation pattern of the antenna at 2.6 GHz are computed and shown.

The antenna is modeled by two polygons and is excited by a voltage port excitation. The boundary conditions of the simulation domain are modeled as open boundary conditions, i.e., absorbing boundary conditions. The additional simulation region around the antenna is set using the "surrounding space" (menu: Simulation → Surrounding Space...). The complete simulation region is shown in green color.

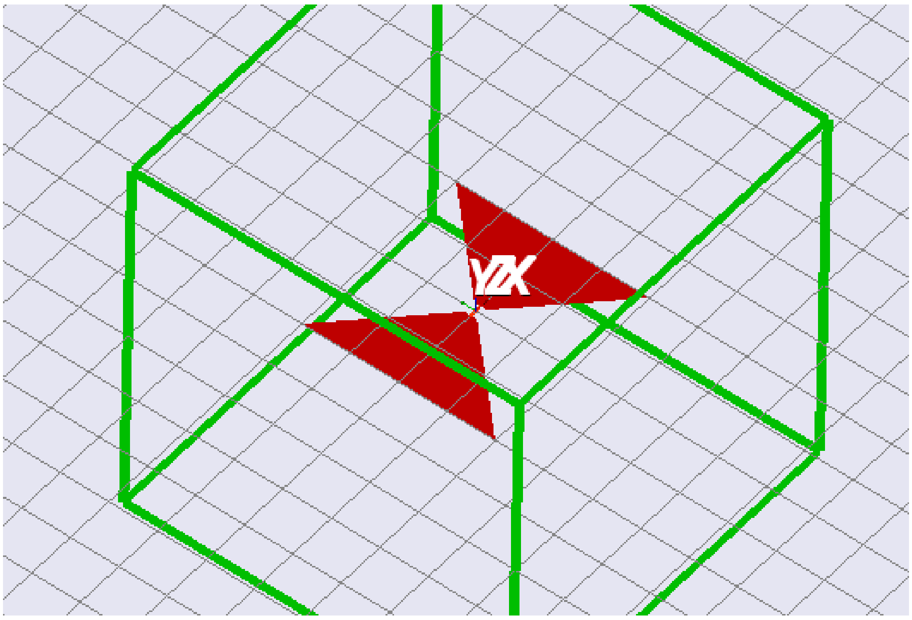

Figure 1: The modeled bow-tie antenna.

The solver (menu: Solver → Setup...) is set to use -60 dB simulation accuracy, a maximum number of time-steps of 3500 and a minimum spatial resolution of 1 mm.

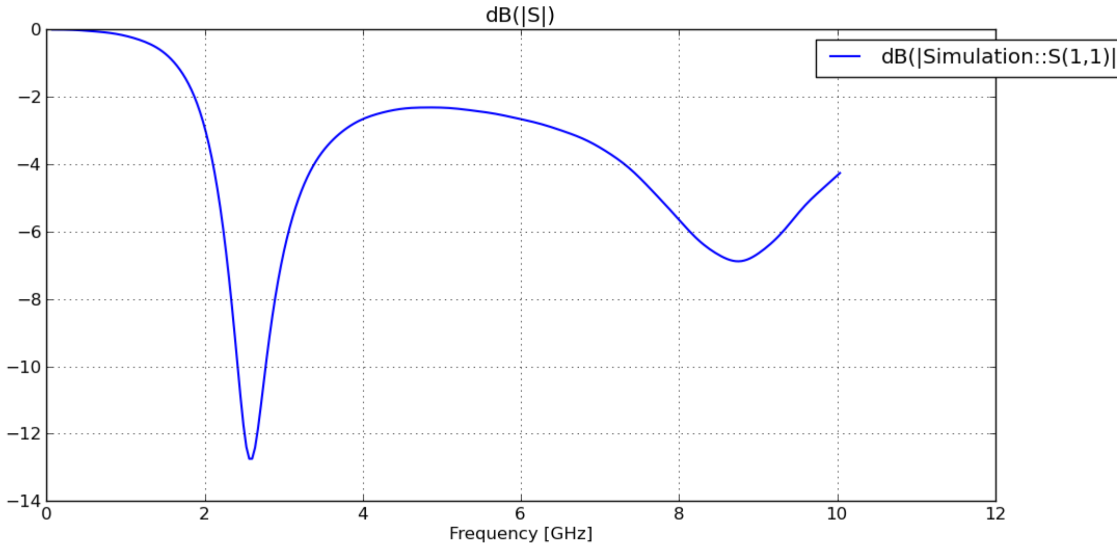

Figure 2: The computed S-parameters – s11 – of the bow-tie antenna.

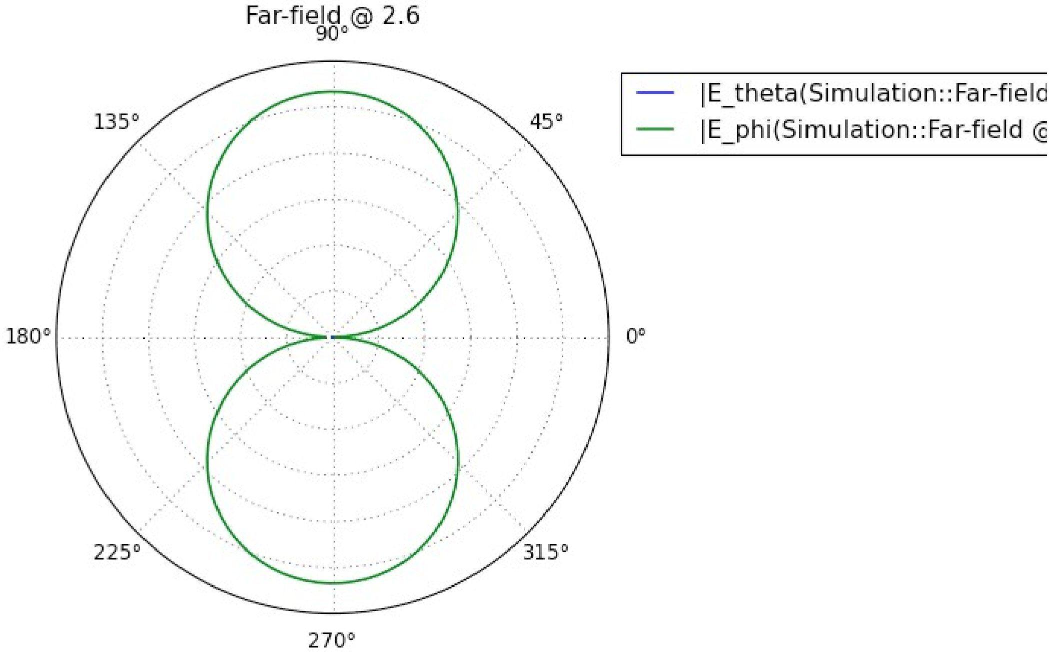

Figure 3: The computed radiation pattern of the bow-tie antenna at 2.6 GHz; Phi sweep of |E_phi| at theta = 90 degree.

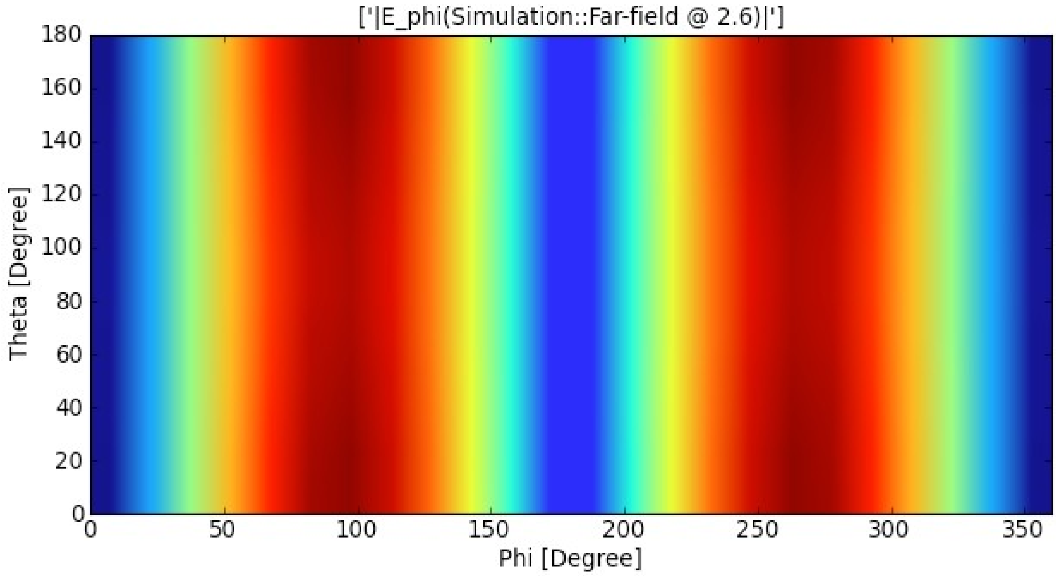

Figure 4: The computed 2D radiation pattern of the bow-tie antenna at 2.6 GHz; |E_phi| component.

Dipole Antenna

The example can be found in the menu: File → Examples → Dipole antenna.

This example shows the modeling of a resonant dipole antenna with the first resonance frequency around 9 GHz.

The dipole antenna is modeled by two perfectly conducting (PEC) cylinders and is excited by a voltage port excitation.

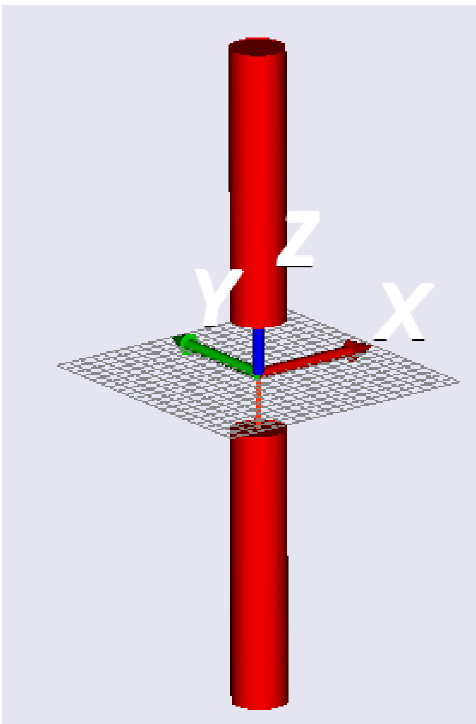

Figure 5: The modeled dipole antenna.

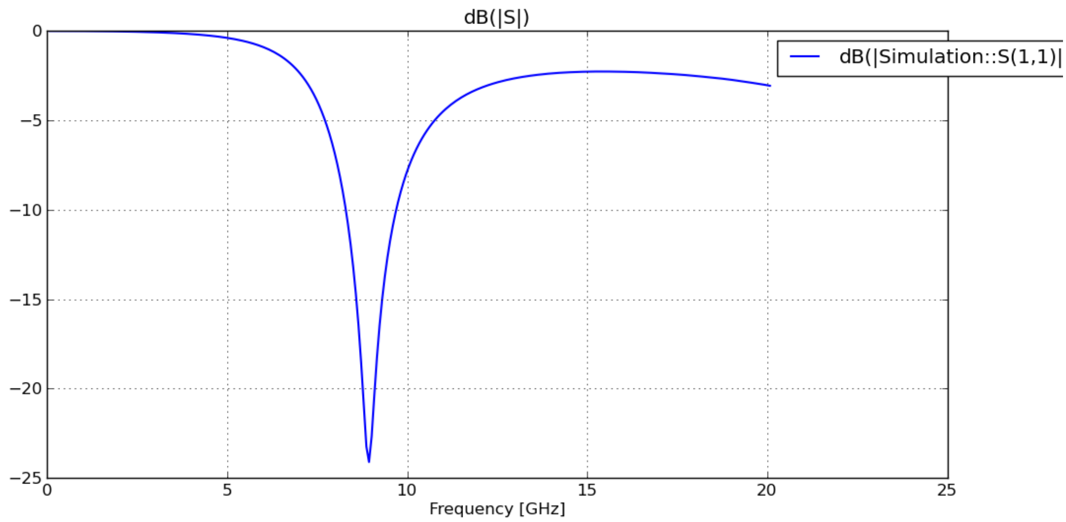

Figure 6: The computed S-parameters of the dipole antenna.

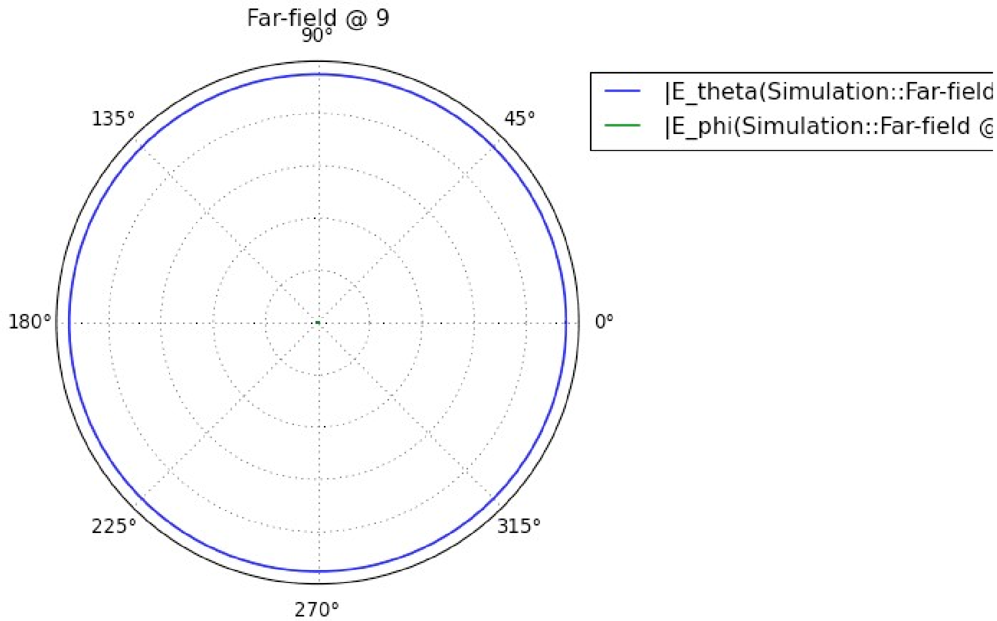

Figure 7: The computed radiation pattern of the dipole antenna at 9 GHz;
Phi sweep of |E_theta| at theta = 90 degree.

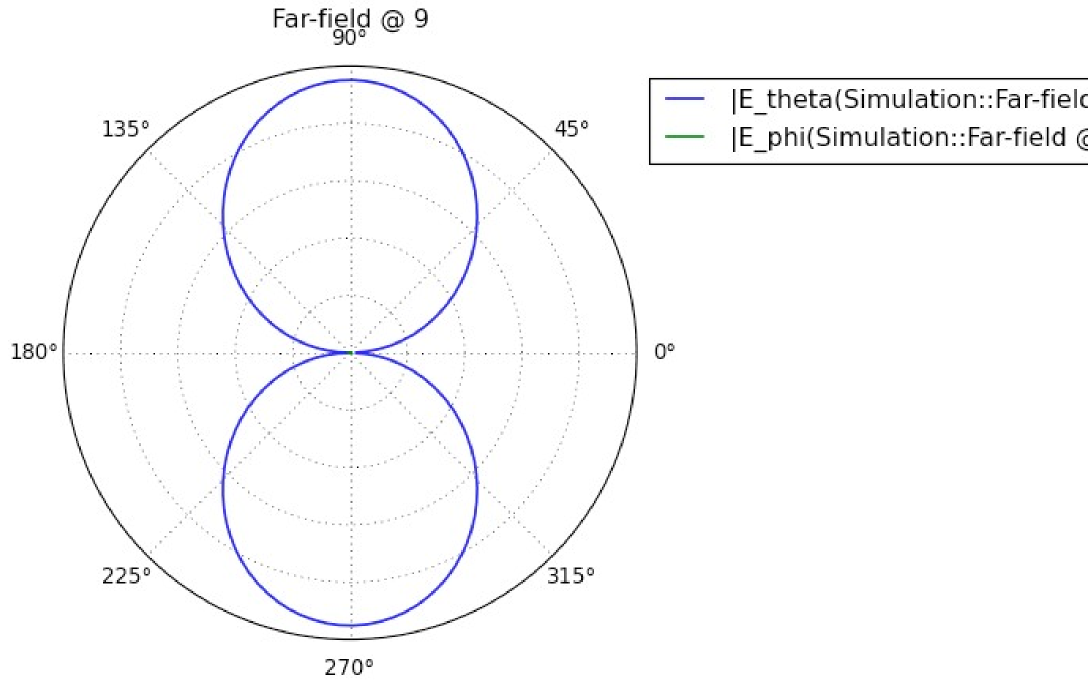

Figure 8: The computed radiation pattern of the dipole antenna at 9 GHz; Theta sweep of |E_phi| at phi = 0 degree.

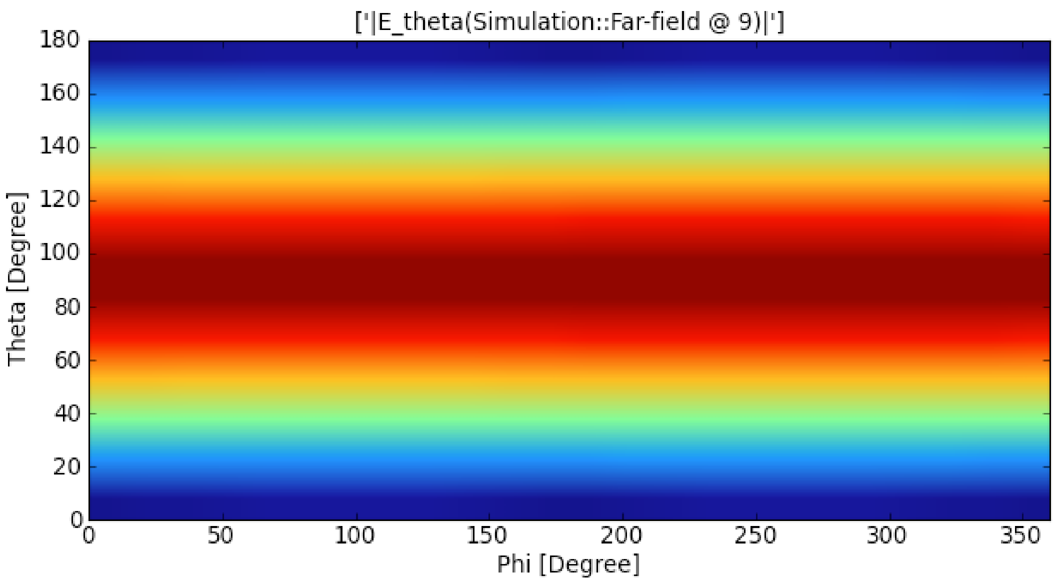

Figure 9: The computed 2D radiation pattern of the dipole antenna; |E_theta| component.

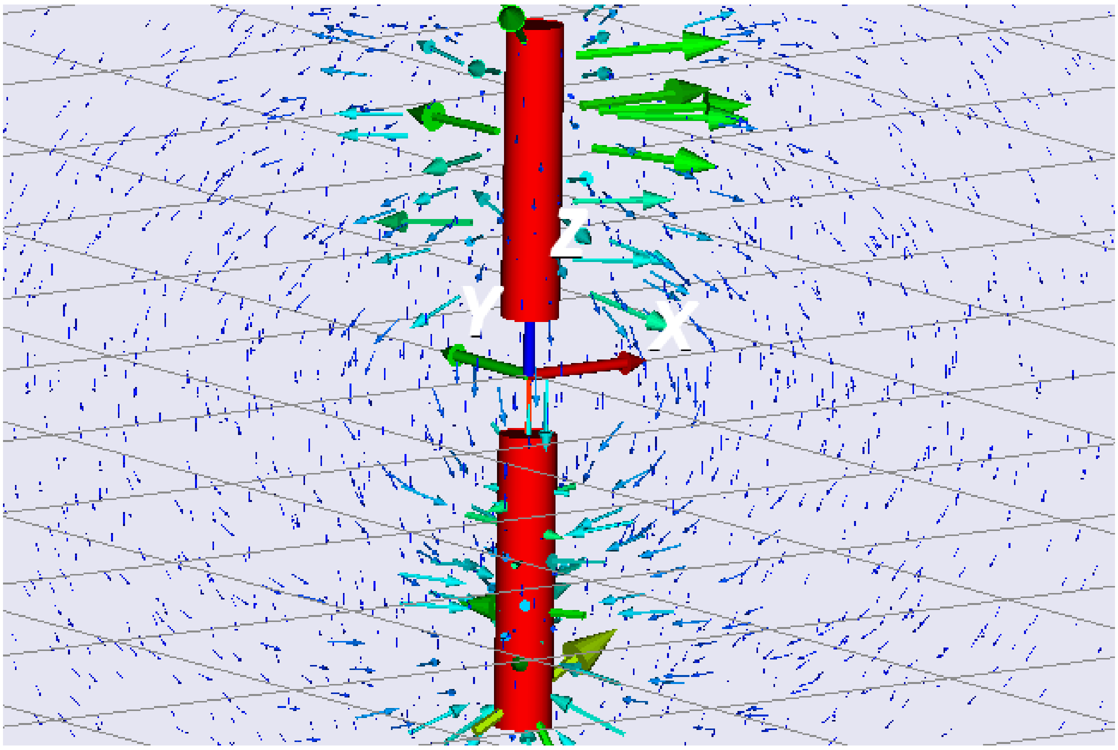

Figure 10: The computed electric field – E-field @ 9 GHz – of the dipole antenna.

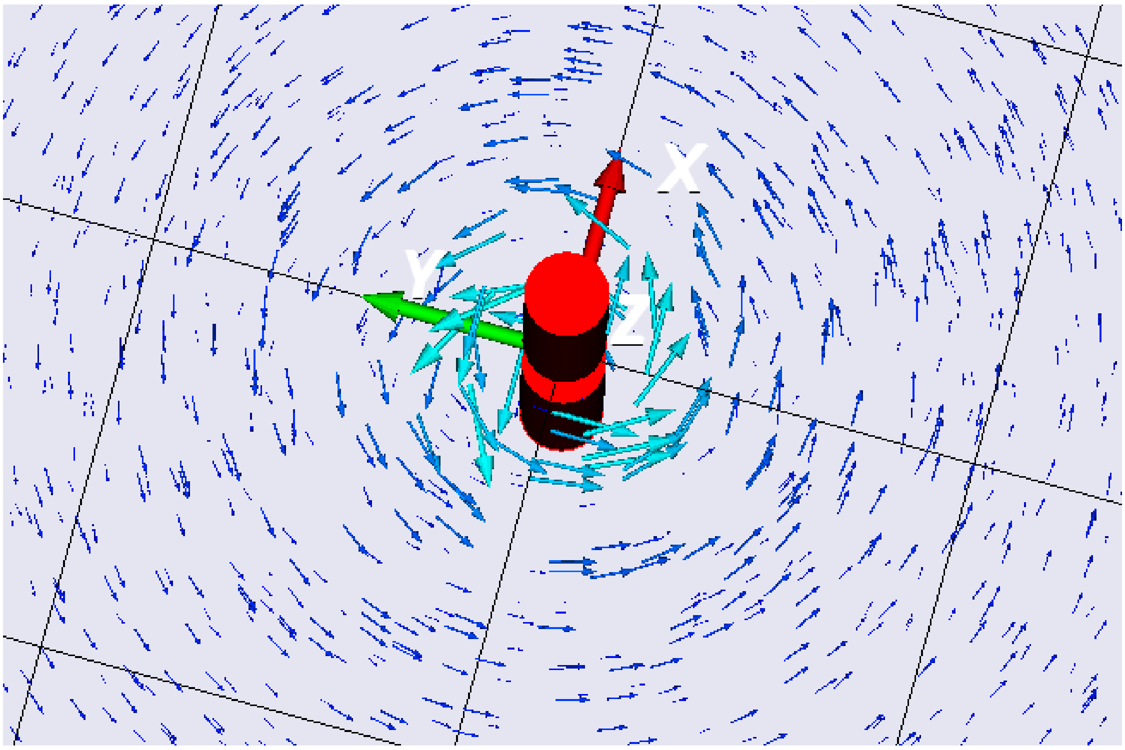

Figure 11: The computed magnetic field – H-field @ 9 GHz – of the dipole antenna.

Yagi-Uda Antenna

The example can be found in the menu: File → Examples → Yagi-Uda antenna.

This example shows the modeling of a Yagi-Uda antenna using the emGine Environment. The broad-band S-parameters and the radiation pattern at 6.5 GHz are computed.

The antenna is modeled by perfectly conducting (PEC) cylinders and is excited by a voltage port excitation.

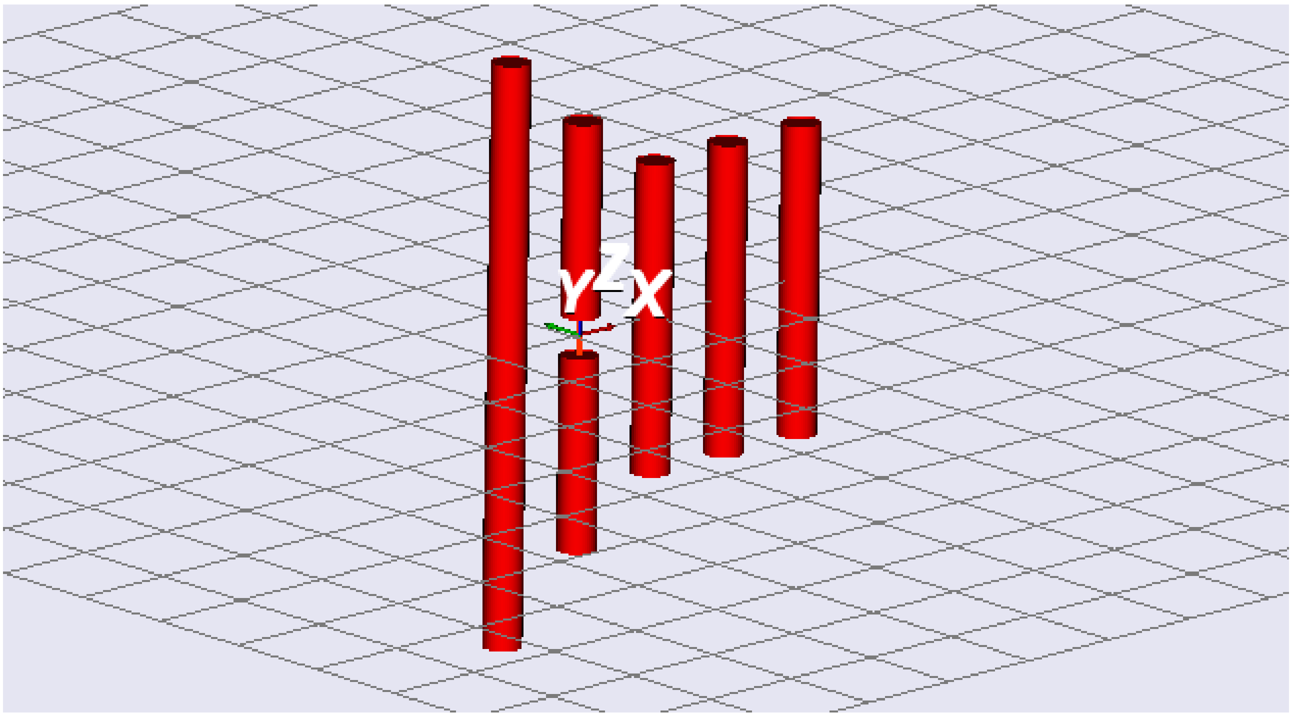

Figure 12: The modeled Yagi-Uda antenna.

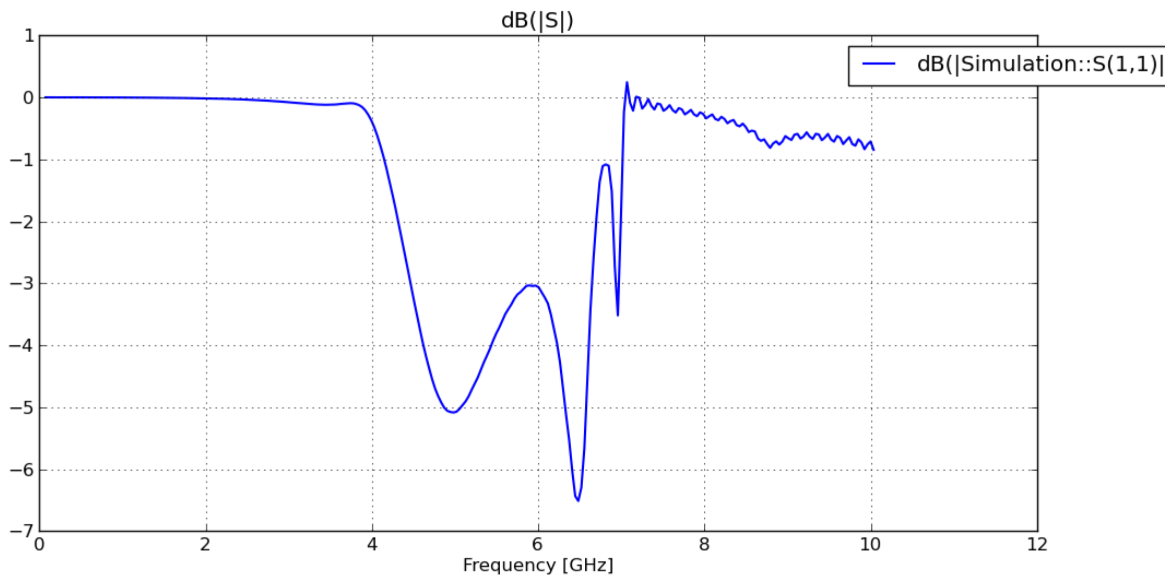

Figure 13: The computed S-parameters of the Yagi-Uda antenna.

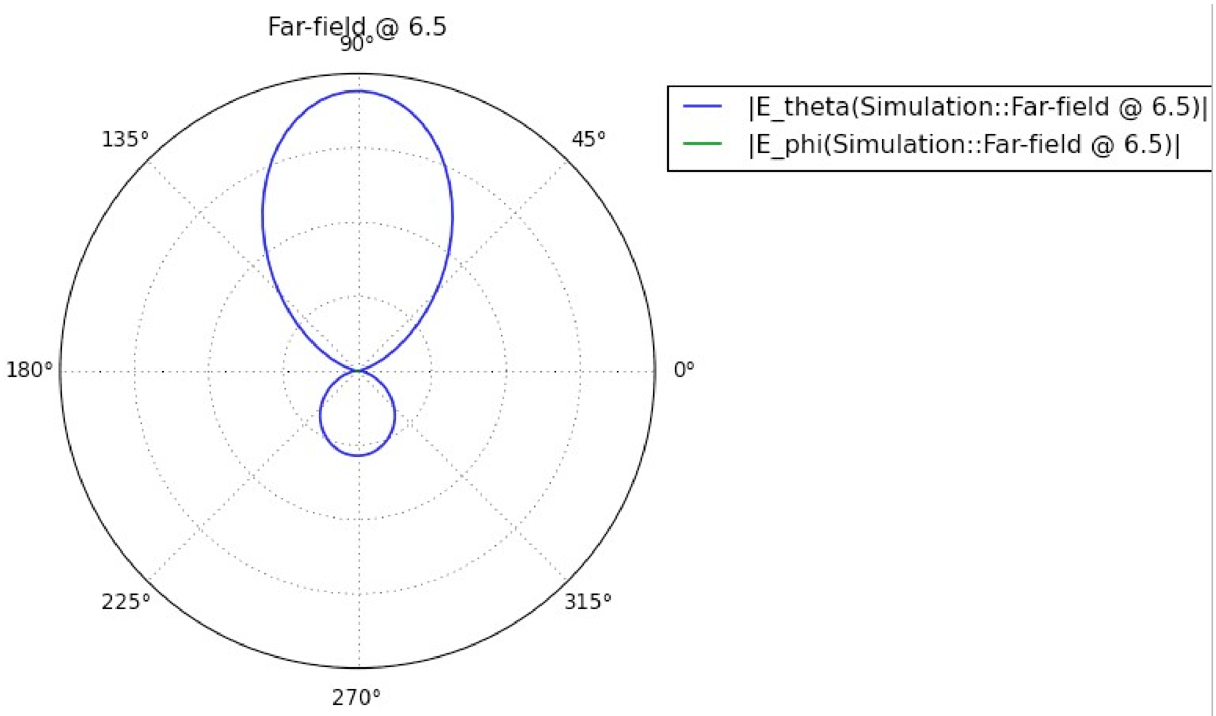

Figure 14: The computed radiation pattern of the Yagi-Uda antenna at 6.5 GHz; Theta sweep of |E_theta| at phi = 0 degree.

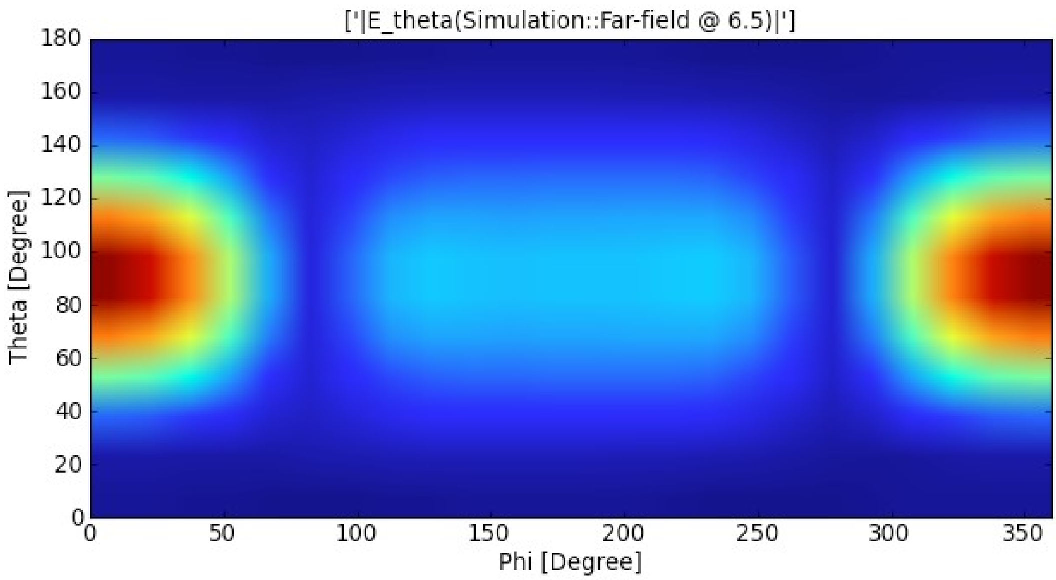

Figure 15: The computed 2D radiation pattern of the Yagi-Uda antenna at 6.5 GHz; |E_theta| component.

Rectangular Waveguide Examples

Rectangular Hollow Waveguide

The example can be found in the menu: File → Examples → Hollow waveguide.

This example shows the modeling of a rectangular hollow waveguide using the emGine Environment. The broad-band S-parameters are computed.

The walls of the hollow waveguide are modeled in this particular example by PEC boundary conditions applied at the boundary of the simulation region. The waveguide is excited by modal port excitation. The excitation excites the TE10 mode of the rectangular waveguide.

!! The modal excitation of the emGine Environment enables very accurate modeling of the wave propagation, even in the evanescent wave region of the waveguide. There are some other time-domain based commercial simulators, e.g., a famous one based on the Finite-Integration Technique (FIT), which has great problems with the accurate modeling of wave propagation in the evanescent region of the waveguide and gives non-physical results !!

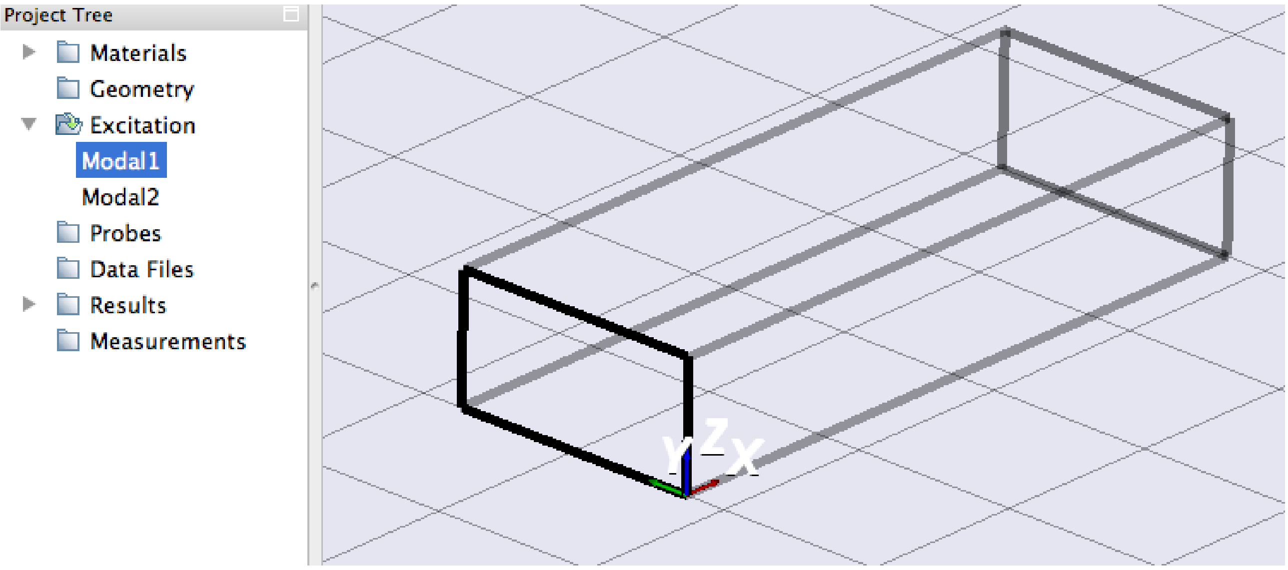

Figure 16: The modeled hollow rectangular waveguide and the modeled modal excitation.

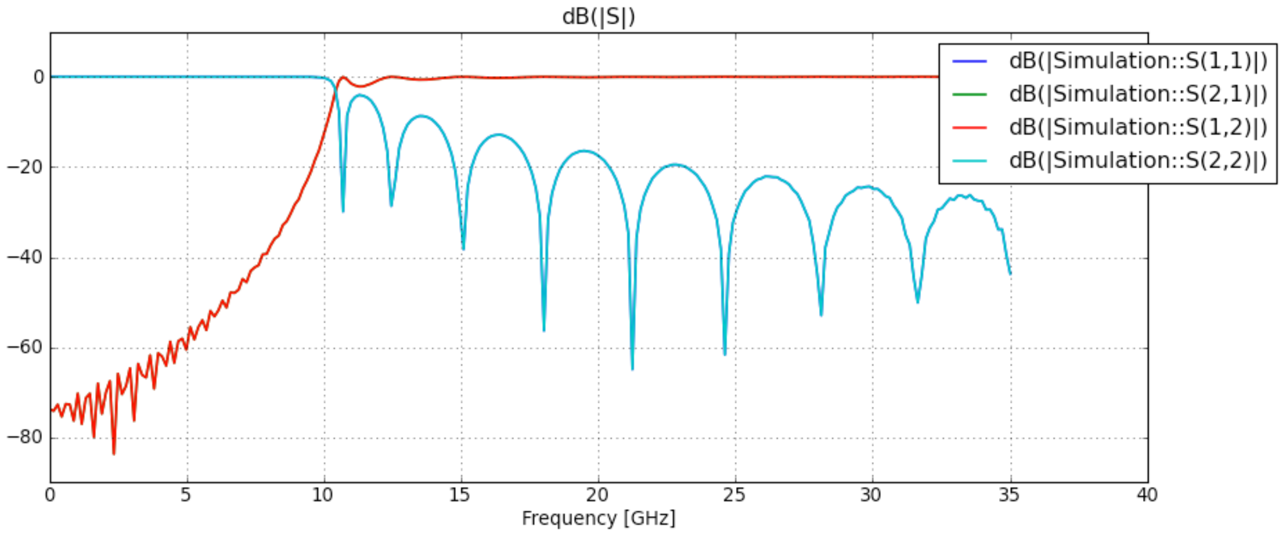

Figure 17: The computed S-parameters of the rectangular hollow waveguide. The reference port impedance of the S-parameters is R = 377 Ohm. Please note the correct energy-conservative behavior of the S-parameters below the cut-off frequency !!

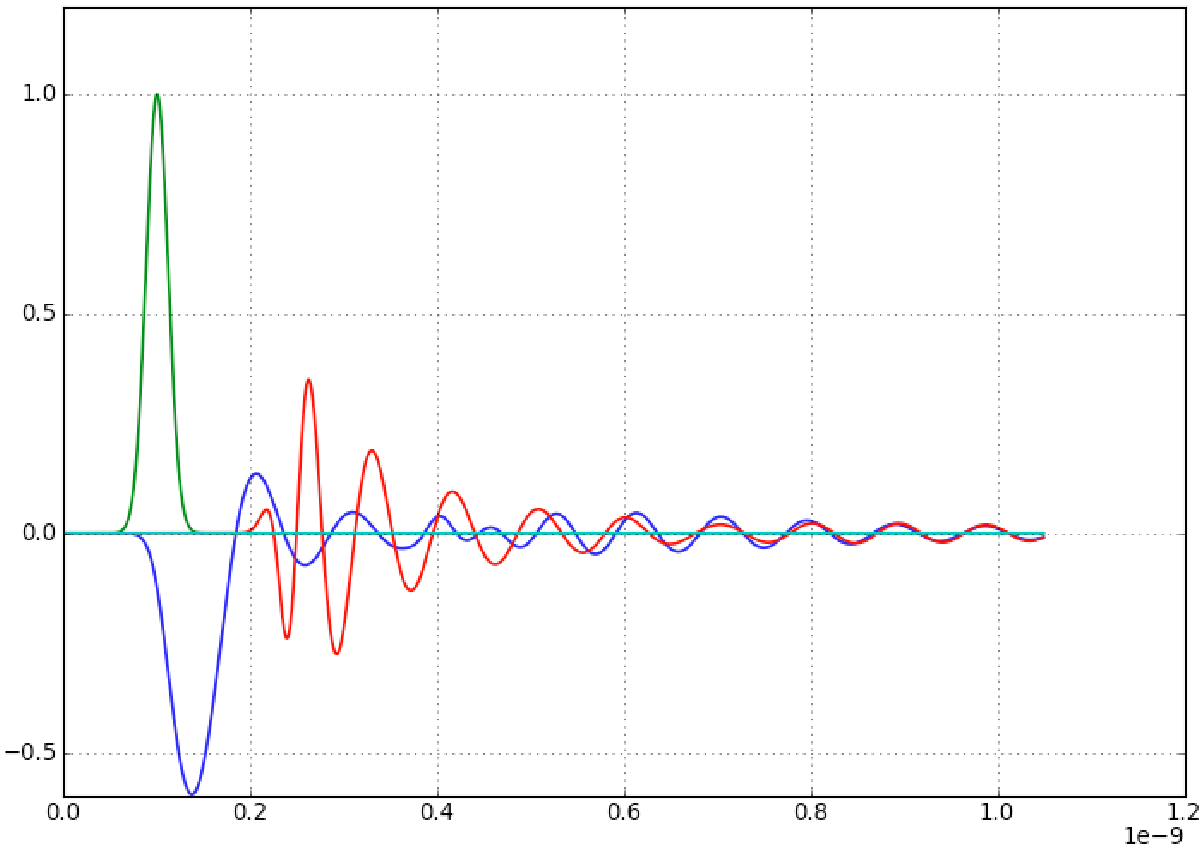

Figure 18: Time-domain signals of the modeled rectangular waveguide;
green – the incoming wave at port 1,
blue – the reflected wave at port 1,
red – the transmitted wave at port 2.

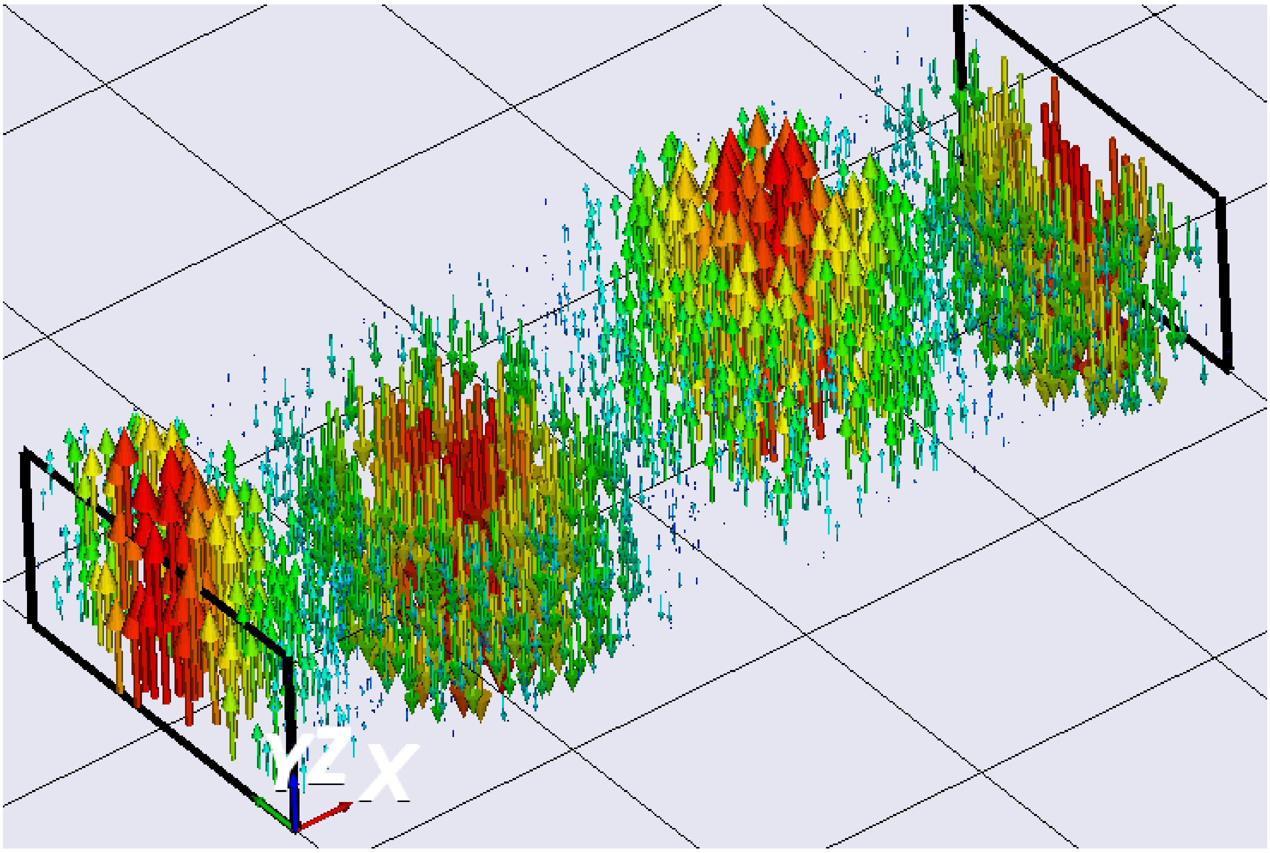

Figure 19: The computed electric field – E-field @ 15 GHz – inside the hollow waveguide.

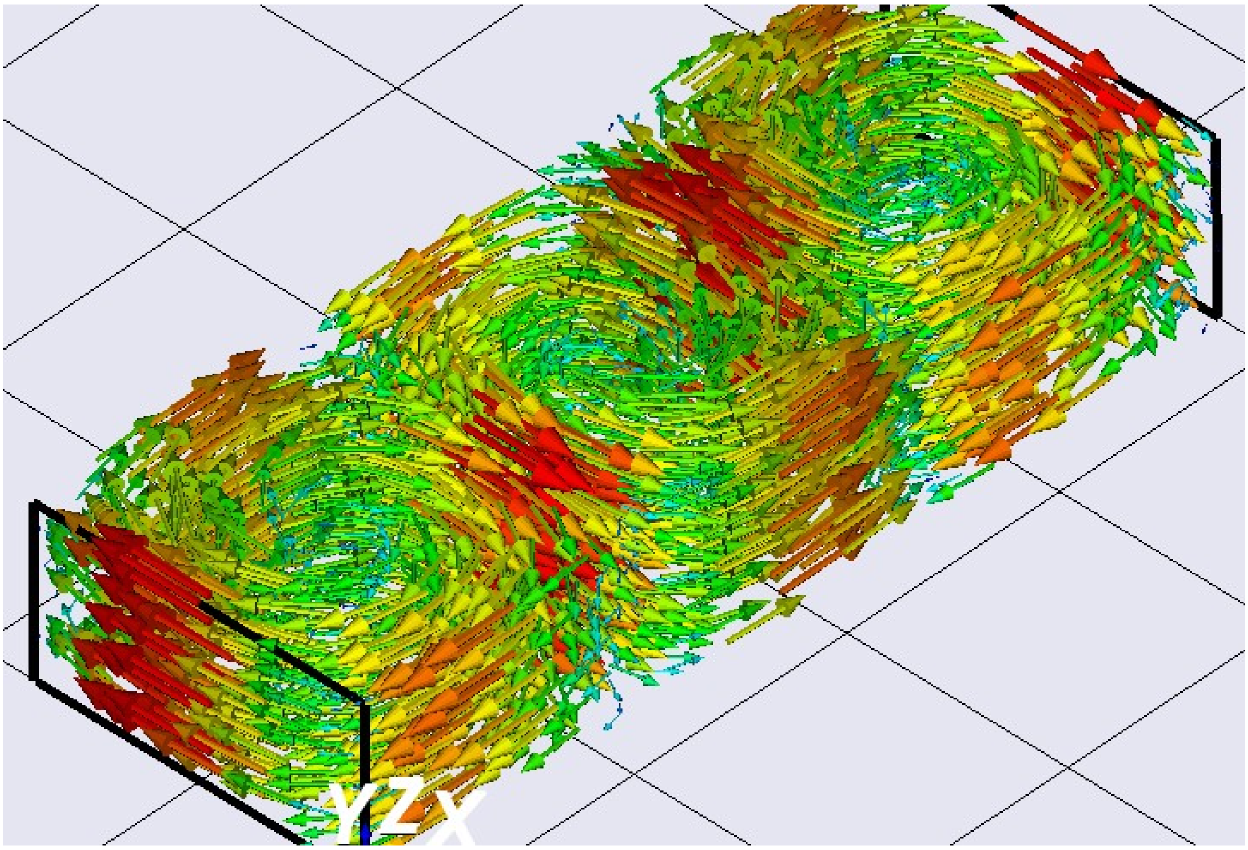

Figure 20: The computed magnetic field – H-field @ 15 GHz – inside the hollow waveguide.

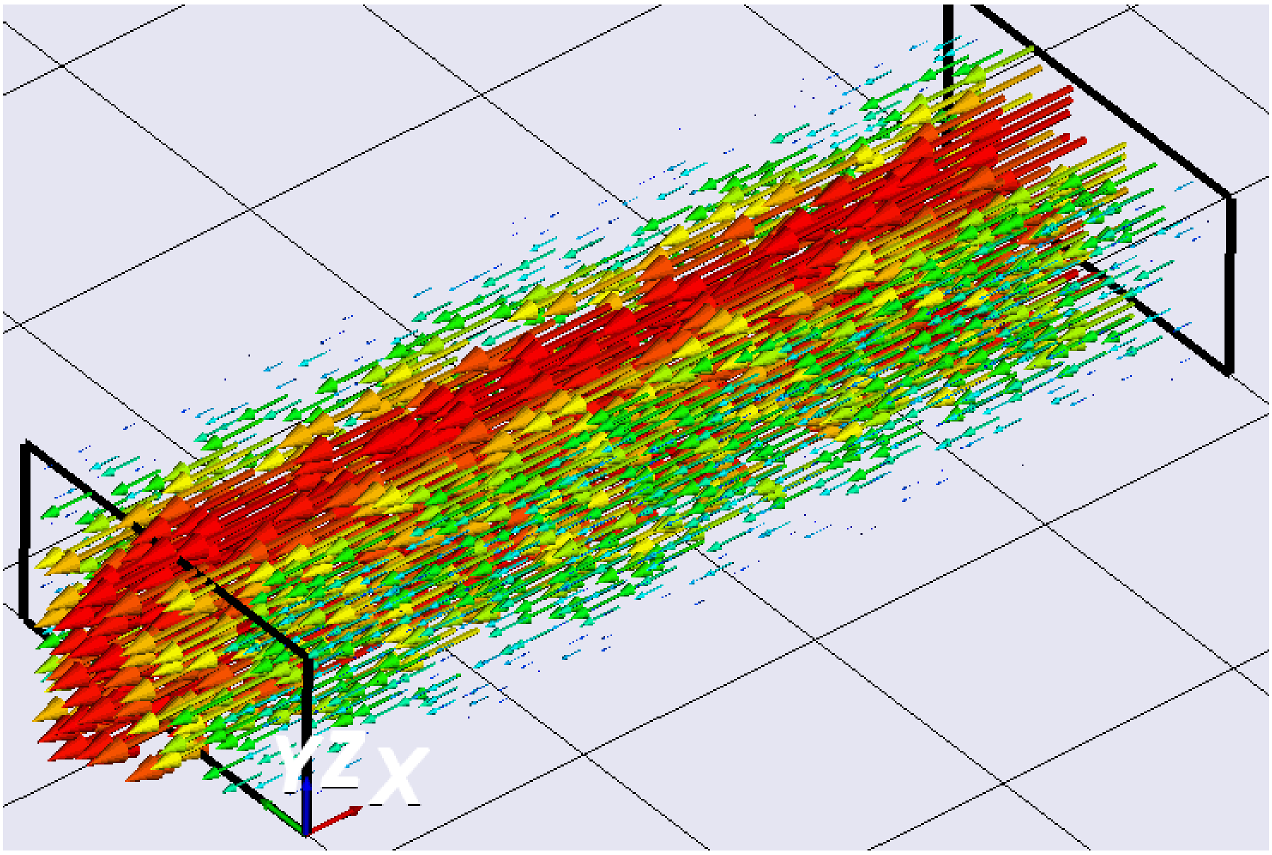

Figure 21: The computed real power flow Poynting vector– P-field @ 15 GHz – inside the hollow waveguide.

Substrate Integrated Waveguide (SIW) Band-pass Filter

<u>The example can be found in the menu: File → Examples → SIW band-pass filter with posts.</u>

This example shows the modeling of a substrate integrated waveguide (SIW) band-pass filter using the emGine Environment. The posts of the filter are modeled by perfectly conducting (PEC) cylinders. The walls of the SIW filter are modeled by PEC boundary conditions imposed on the simulation boundaries. The filter is excited with modal ports.

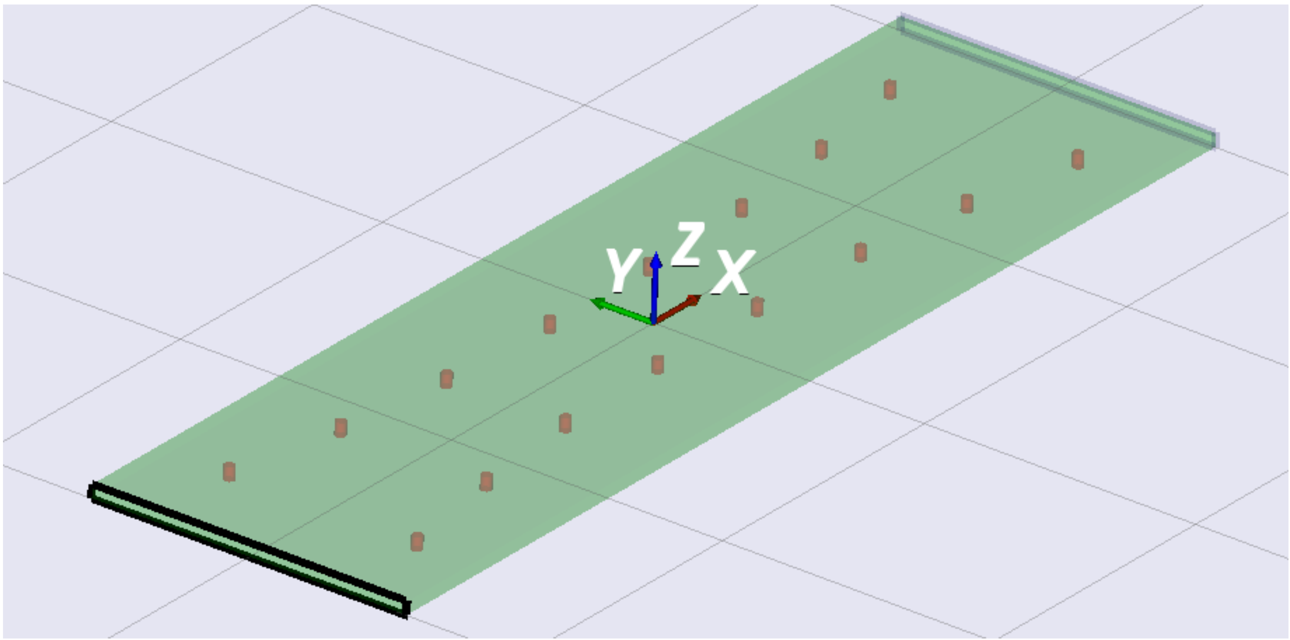

Figure 22: The modeled SIW band-pass filter; highlighted is the modal excitation at port 1.

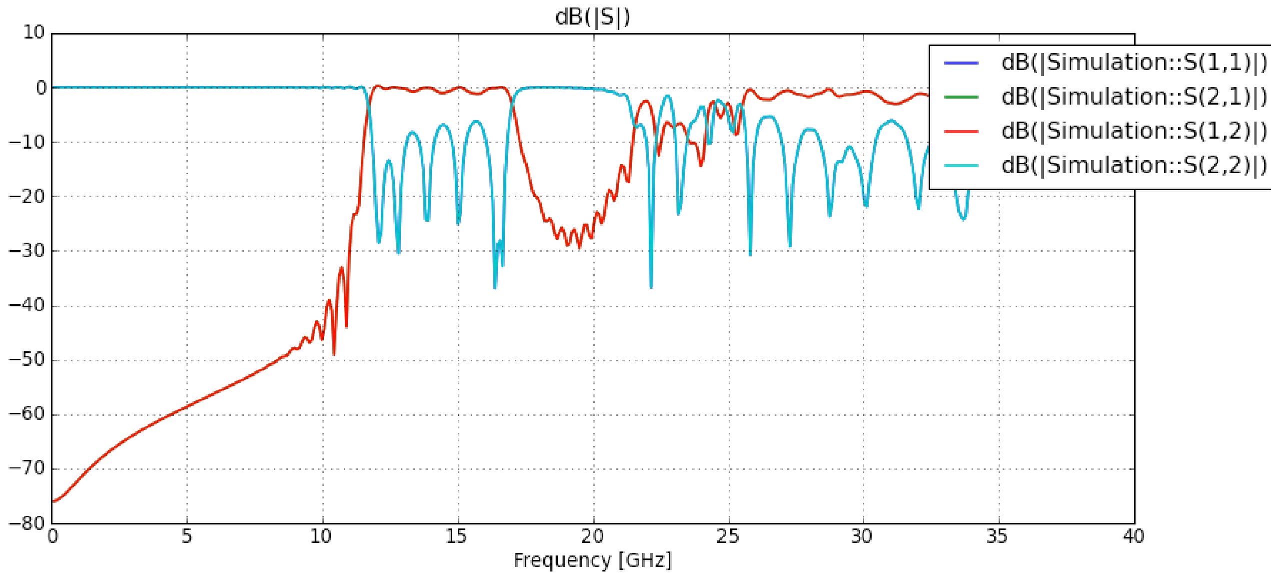

Figure 23: The computed S-parameters of the SIW band-pass filter. The reference port impedance of the S-parameters is R = 377 Ohm.

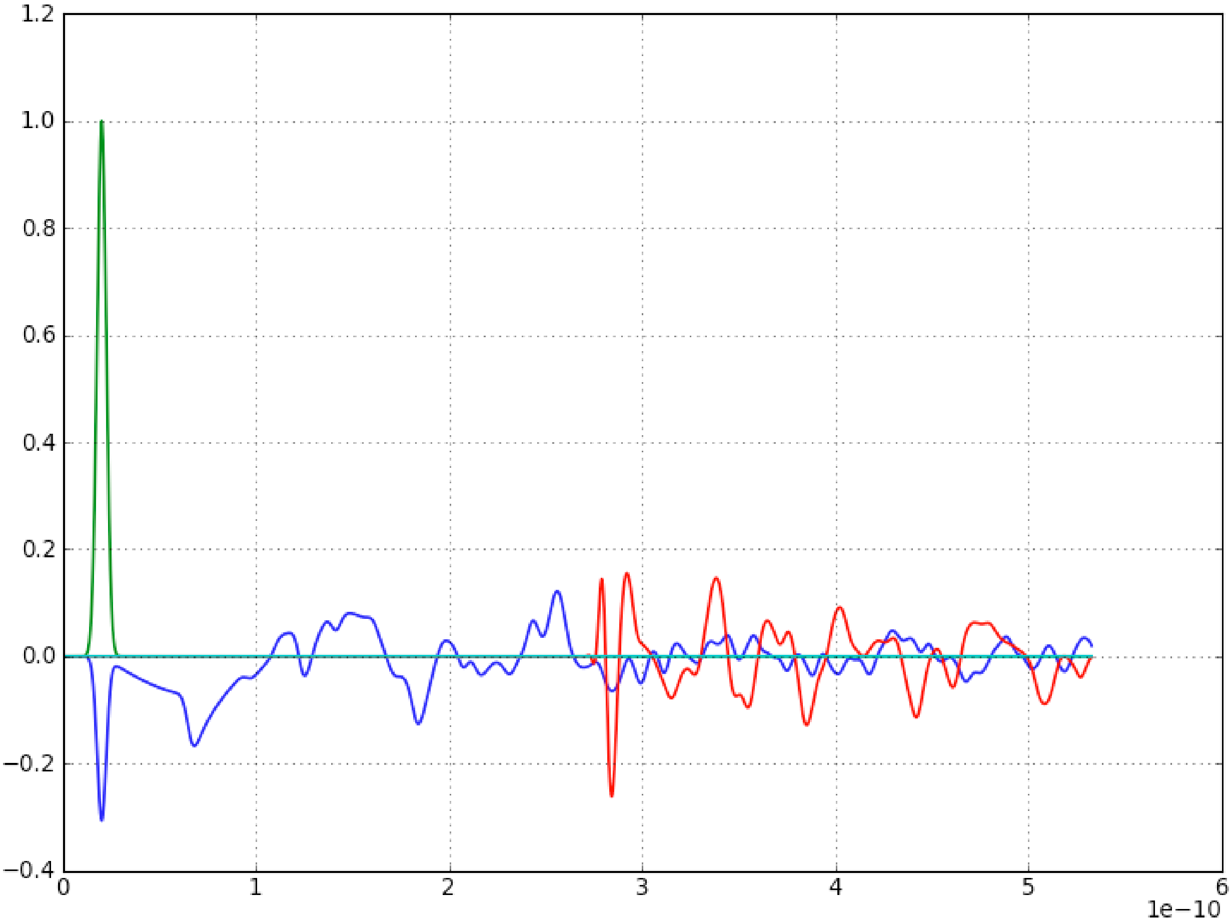

Figure 24: Time-domain signals of the modeled SIW band-pass filter;
shown is just the first part of the time-domain signals;
green – the incoming wave at port 1,
blue – the reflected wave at port 1,
red – the transmitted wave at port 2.