Microstrip_Patch_Antenna

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Design Notes

L-BAND RECTANGULAR MICROSTRIP PATCH ANTENNA

This project demonstrates the simulation of a microstrip patch antenna at L-band. A vertically-stacked design is implemented in an attempt to enhance the bandwidth of the antenna. The antenna is probe-fed using a via port. The location of the feed point results in a left-hand circularly-polarized radiated field. This example is taken from an article in the January 1998 issue of Microwave Journal [1]. Simulations compare very closely with the published data.

This example demonstrates antenna design using EM Sight, antenna patterns and E-field and current animations.

EM Structures:

"Patch Antenna"

This structure is used to obtain s-parameter data for a frequency range of 1.48 to 1.81 GHz. Due to the numerous frequency points, the E-fields are not calculated for this structure. The Advanced Frequency Sweep (AFS) option is turned on for this structure to speed up the simulation.

"Patch Antenna Center Frequency"

This structure is an exact copy of the "Patch Antenna" structure except that results are calculated only at the center frequency of 1.61 GHz (the frequency range for this structure is set locally to the structure). The E-field and antenna patterns are calculated at this single frequency to cut down the simulation time.

Antenna Plots:

"Antenna Patterns 45 Deg Conic Circular"

This graph shows full 360 degree conic cuts at an elevation angle of 45 degrees. Both right-hand and left-hand circular polarizations are shown.

"Antenna Patterns PPC Circular"

This graph shows upper-hemisphere principal plane cuts at azimuth angles of 0 and 90 degrees. Both right-hand and left-hand circular polarizations are shown.

"Antenna Patterns PPC Linear"

This graph shows upper-hemisphere principal plane cuts at azimuth angles of 0 and 90 degrees. The theta and phi components of the E-field are plotted. Note that due to the infinite ground plane that is assumed to surround the top of the enclosure, the phi component of the E-field, which is tangential to the ground plane, must go to zero at the horizon (theta = 90 deg).

"Match Rectangular"

This graph shows the match at the input to the antenna (in dB) vs. frequency on a rectangular graph and can be compared to the graph shown in Figure 2 of [1].

"Match Smith"

This graph shows the match at the input to the antenna vs. frequency on a Smith chart.

E-Field Visualization:

The E-field for this antenna is shown in the 3D view of the EM Structure. Please select Animate Play button from the toolbar to see an animation of the E-field. The E-field visualization was added to this project by right mouse clicking on the EM Structure in the project browser and selecting Add Annotation. Once this is added it will display under the Annotations node under the EM Structures node of the project browser. This is also how you would view the structure mesh and current. Please see the help for the annotations to understand what each setting does.

References:

EM Structure - Patch_Antenna

Graph - Antenna Patterns 45 Deg Conic Circular
Antenna Patterns 45 Deg Conic Circular

p2: Freq = 1.61 GHz
p1: Freq = 1.61 GHz

Graph - Match Smith
Graph - Antenna Patterns PPC Circular