Simulating a Dipole Array in HFSS

Viewing The Simulation Results In HFSS

Developed by Kathryn L. Smith, PhD

Ansys

Sources

The material presented herein is from the following sources:

"Engineering Electromagnetics," by Nathan Ida, 3rd ed. (2015)
"Antenna Theory," by Constantine A. Balanis, 4th ed. (2016)

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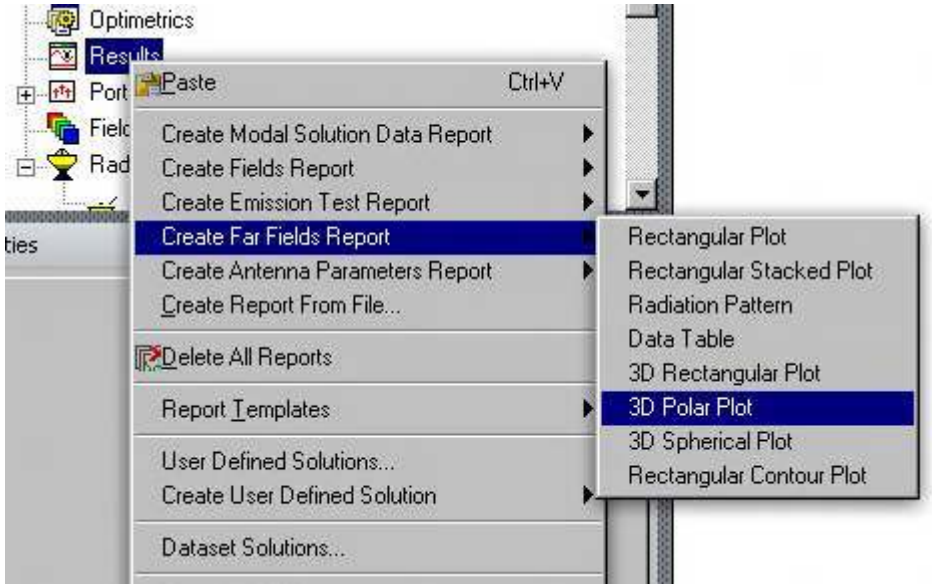
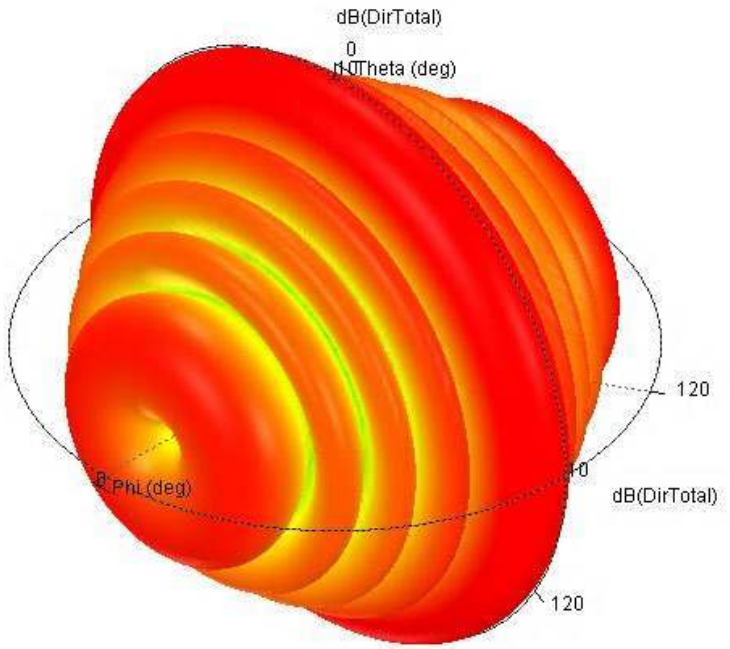
Step 1: Create 3D Polar Plot of Directivity

In the project manager, right-click on “Results” and select “Create 3D Polar Plot…”





In the pop-up dialog box that appears, select Directivity -> DirTotal -> dB

Click “New Report” at the bottom left.

This will result in the plot shown here on the right.

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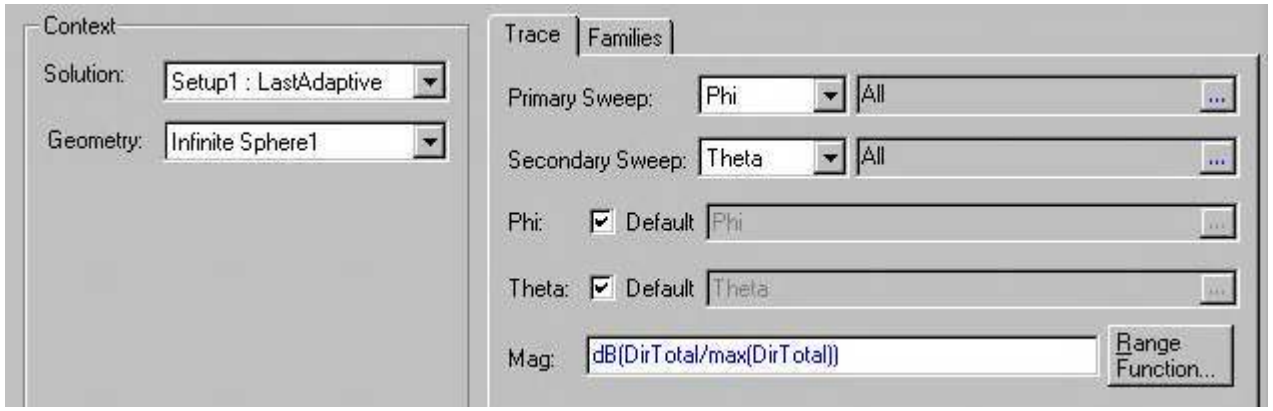
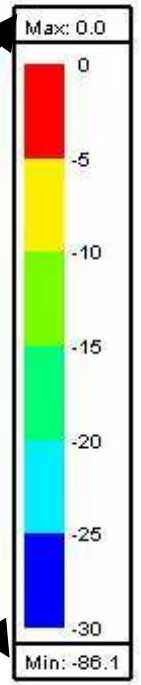
Step 2: Create 3D Polar Plot of Normalized Directivity

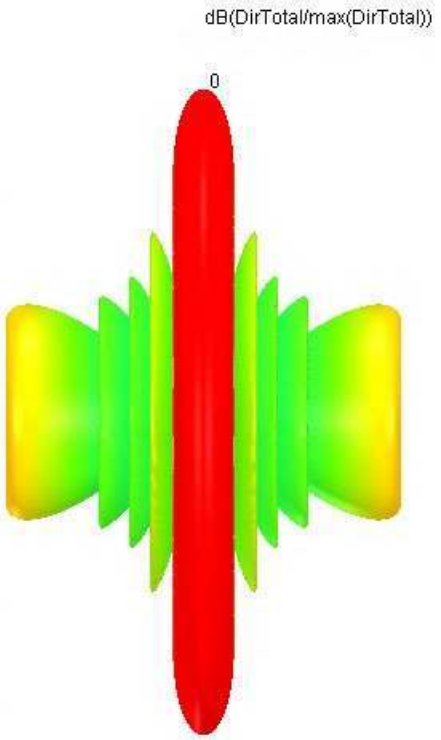
Note that, in the previous module, we were considering *normalized* directivity. To plot this value, right-click on "Results," then Select "Far Fields Report" -> "3D Polar Plot"

In the pop-up dialog box that appears, in the "Mag" field, type: "dB(DirTotal/max(DirTotal))"



Adjustable scale limits





Keeping all other settings as default, click "New Report"

Note that you can also change the plot limits by double-clicking on the scale

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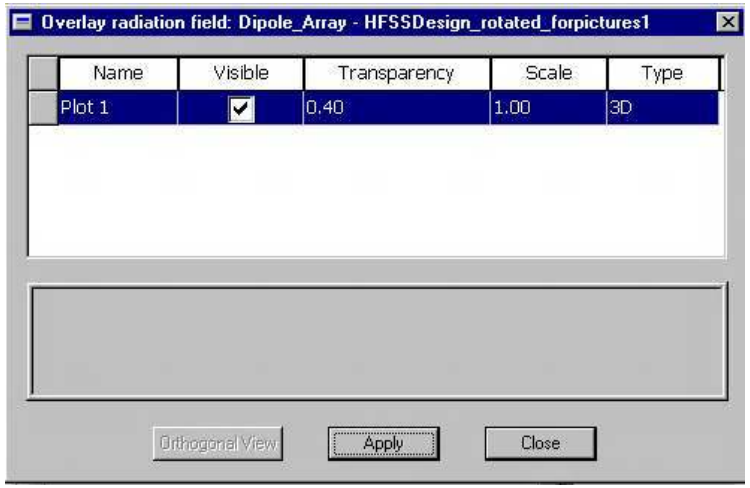
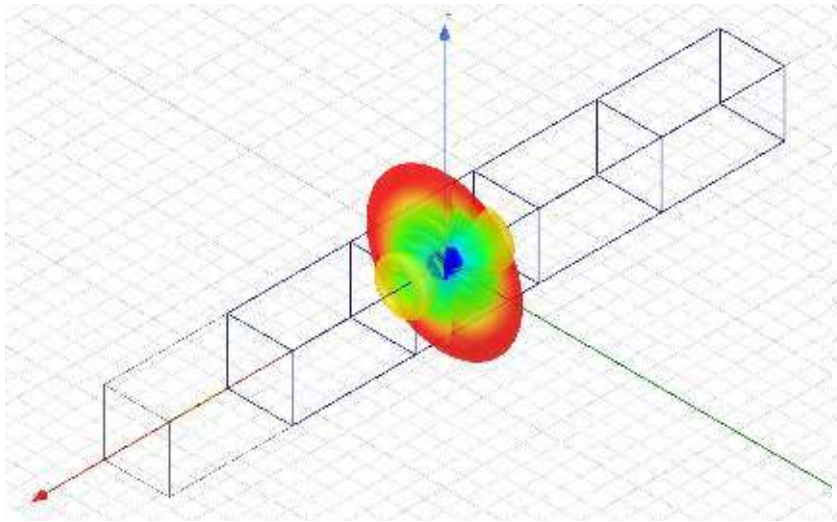
Step 3: Overlay 3D Polar Plot

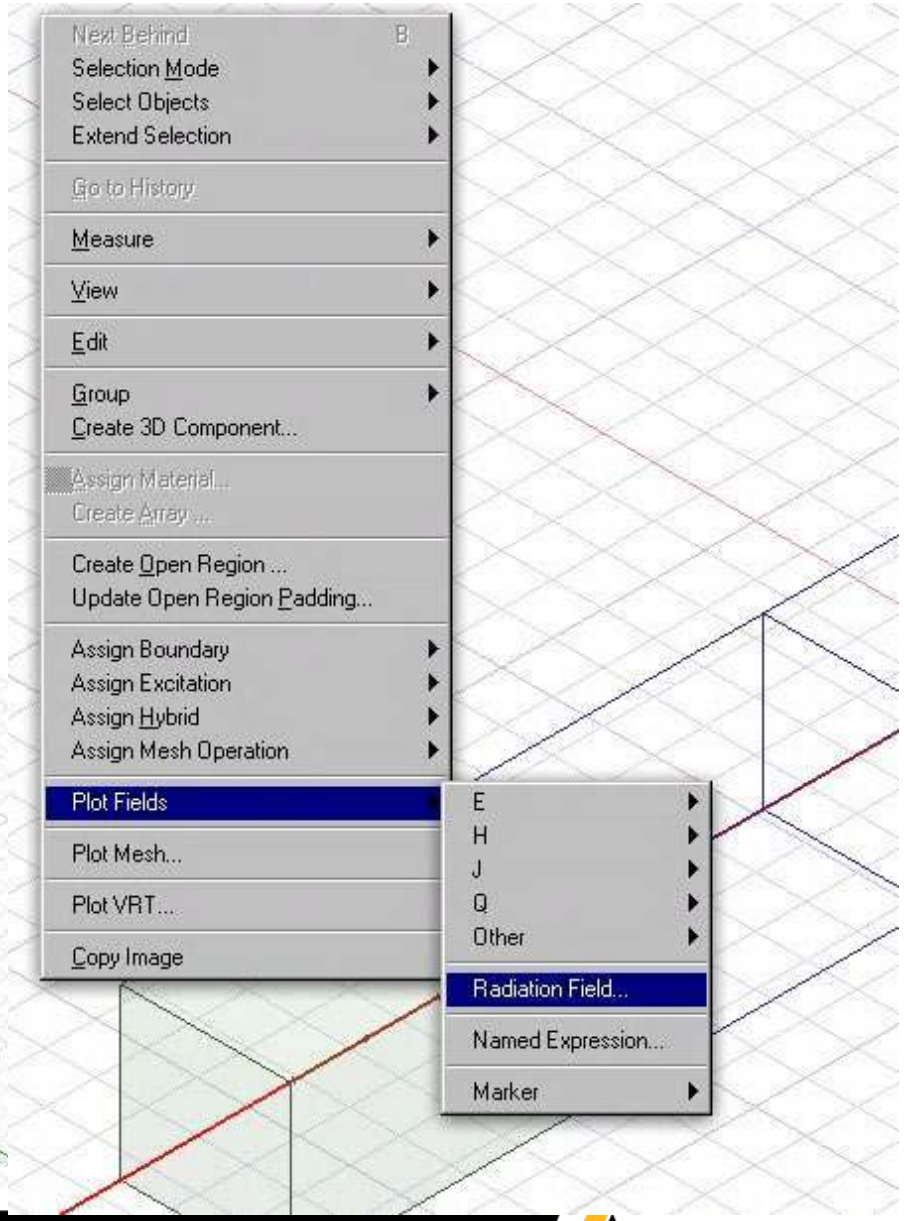
In the modeler window, right-click on the model and choose: “Plot Fields” -> “Radiation Field”

In the pop-up window that results, check the “Visible” box next to the plot you’d like to overlay. You may also adjust its scale and transparency.

Click “Apply”, then “Close.”







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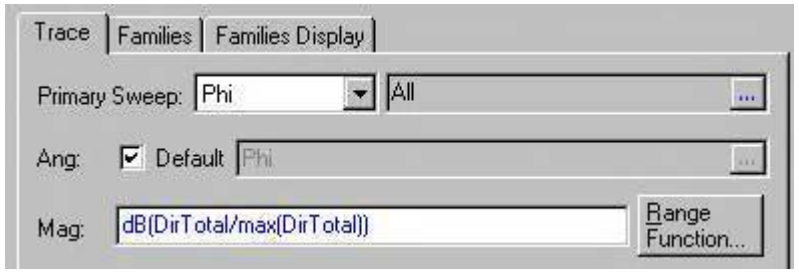


Step 4: Create 2D Radiation Plot

In the project manager, right-click on “Results” and choose: “Create Far Fields Report” -> “Radiation Pattern”

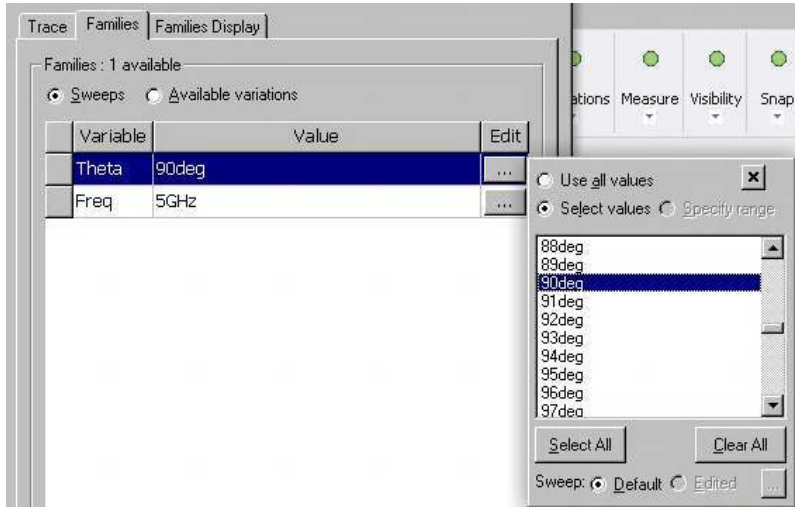
In the pop-up window that results, in the “Trace” tab, chose “Primary Sweep” of “Phi”.

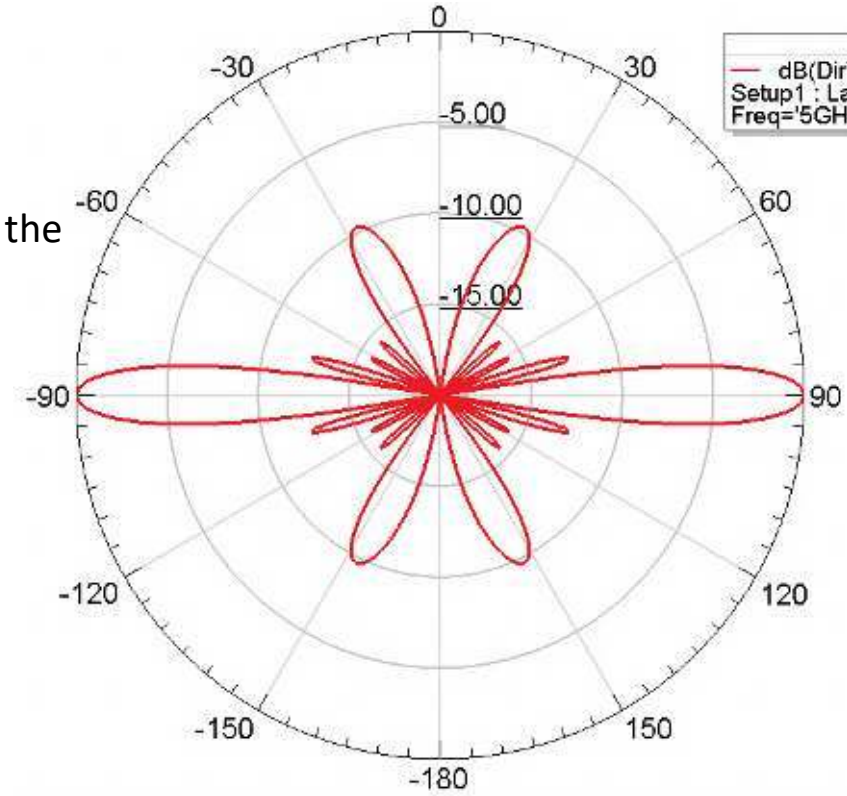
Type “dB(DirTotal/max(DirTotal))” in the Mag: field.

Under the “Families” tab, set the Theta value to 90 degrees.

Click “New Report,” then “Close.”

Note that you can change axis limits and font sizes by double-clicking on the axes of the plot.





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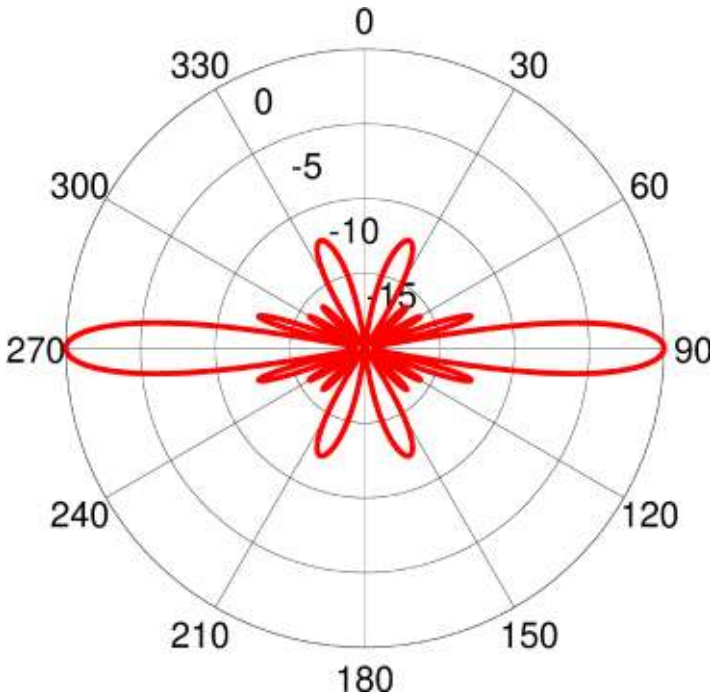
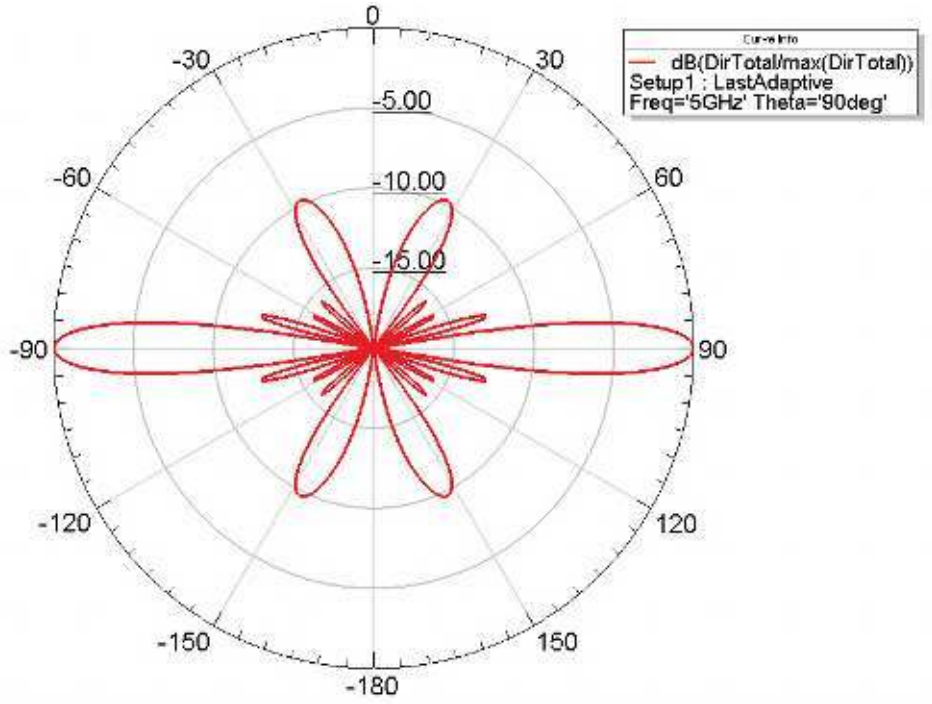
Step 4: Create 2D Radiation Plot

Note the high degree of agreement between the Matlab-generated plot on the left, showing the product of the array factor and the E-field for this array, and the HFSS-generated plot on the right.



Matlab-Calculated Directivity



HFSS-Simulated Directivity

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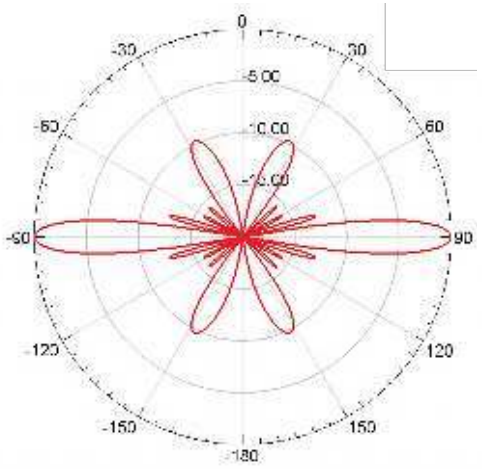
Step 5: Editing Sources

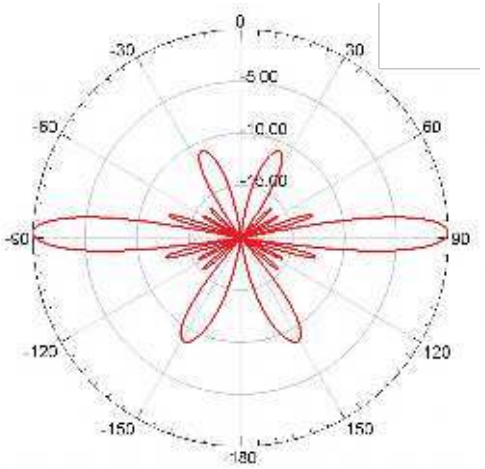
You may also edit the sources in post-processing, to see the effect of, for instance, a varying phase difference between the feed of neighboring elements. Since we set a variable phase shift, this may be easily accomplished by changing the value of "psi" in the "Variables" window. The plots will update to match.

Name	Value	Unit	Evaluated V...	Type
psi	0	deg	0deg	Post Processing

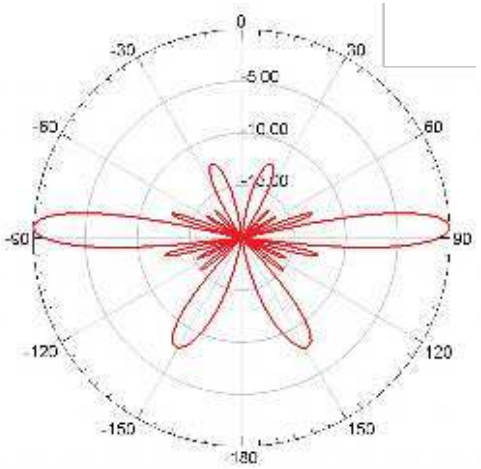
Variables



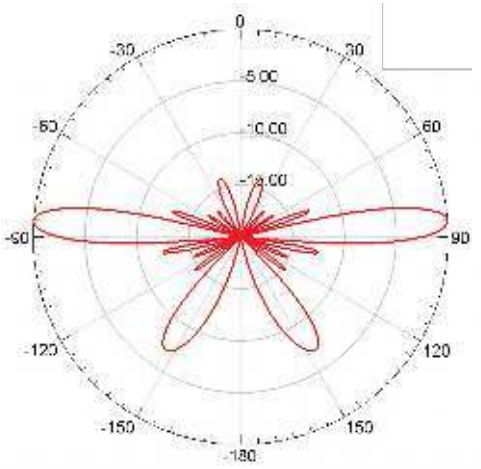
$\psi = 0°$



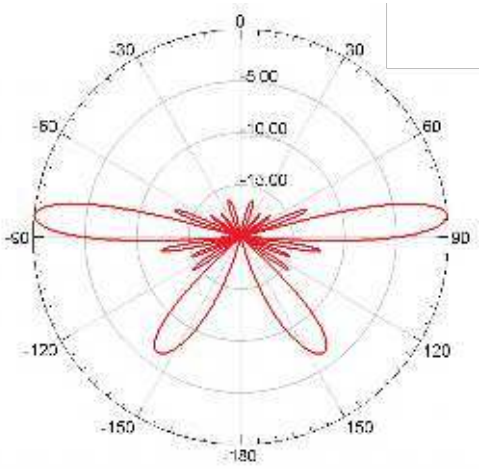
$\psi = 10°$



$\psi = 20°$



$\psi = 30°$



$\psi = 40°$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