# ANTENNAS AND WAVE PROPAGATION

# LAB ASSIGNMENT 3

# EXPERIMENT 3


## NAME: RAHIL SHARMA
## PRN: 18070123062
## BATCH: 2018-2022
## DIVISION: G2; EA 3


**AIM:** To obtain the radiation pattern and Gain.

**Theory:** In this experiment we will plot the graph between Antenna Radiation Pattern and Antenna Gain.

A radiation pattern defines the variation of the power radiated by an antenna as a function of the direction away from the antenna. This power variation as a function of the arrival angle is observed in the antenna's far field.

The term Antenna Gain describes how much power is transmitted in the direction of peak radiation to that of an isotropic source. Antenna gain is defined as the ratio between maximum the radiation intensity of a subject antenna in a given direction to the max. the radiation intensity of an isotropic antenna. When directivity converted to decibels we can define it as antenna gain

Gain G = Maximum radiation intensity from the subject antenna (Φs) / Maximum radiation intensity from the isotropic antenna (Φi)

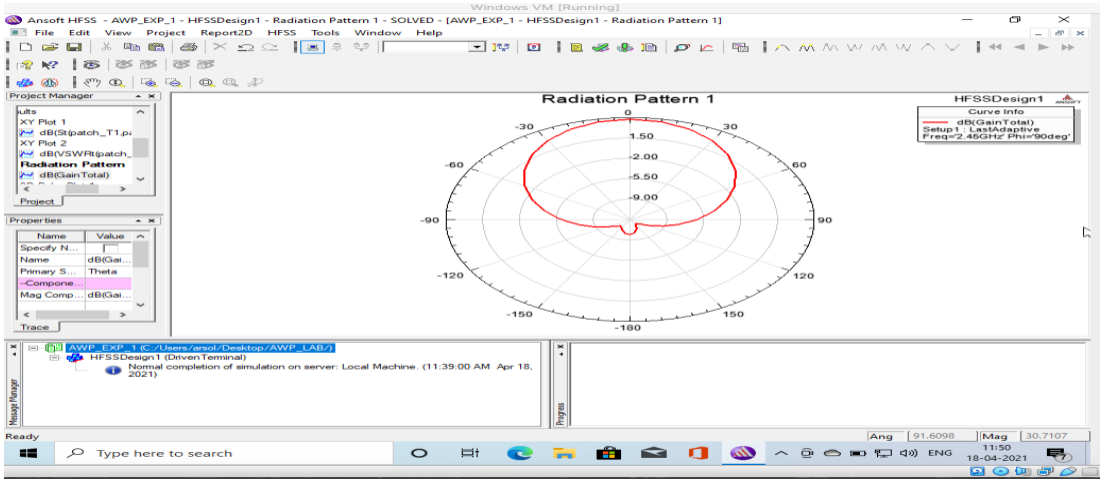
The gain of an antenna G = Antenna efficiency * Antenna directivity D

**Software Specifications:**
Operating System: Windows 10 Virtual Machine OS
Software: HFSS Version 13
KIT: Antenna Design Kit

**Procedure:**

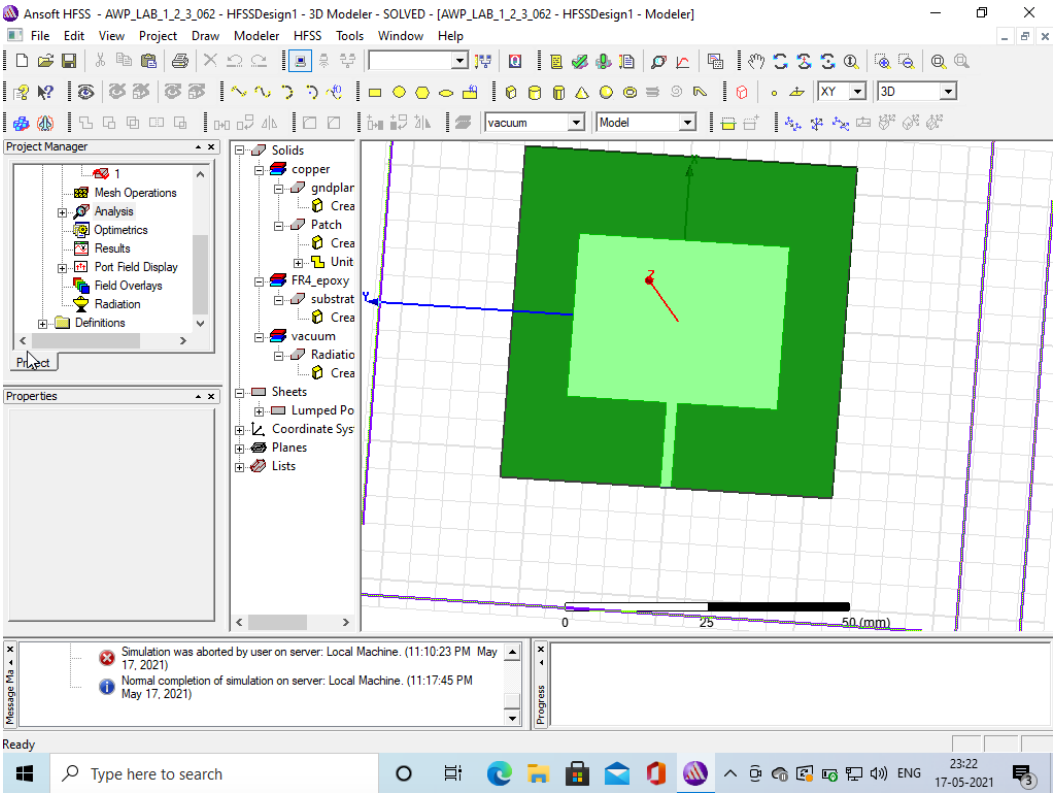
**Same design as Experiment 1 and Experiment 2 Continued:**

1. After plotting the Graph between Return Loss and VSWR we will now plot radiation pattern and Gain.
2. Now from the file menu under hfss click on results then select create far field reports and under this select Radiation Pattern.
3. In the dialogue box set the specifications as Category: Gain, Quantity: Gain Total and Function: dB.
4. Then click on the families option and select the Value of Phi as 90 deg. And then click on new report.
5. You will then get the Gain Plot and Radiation Pattern of your Antenna as shown below:

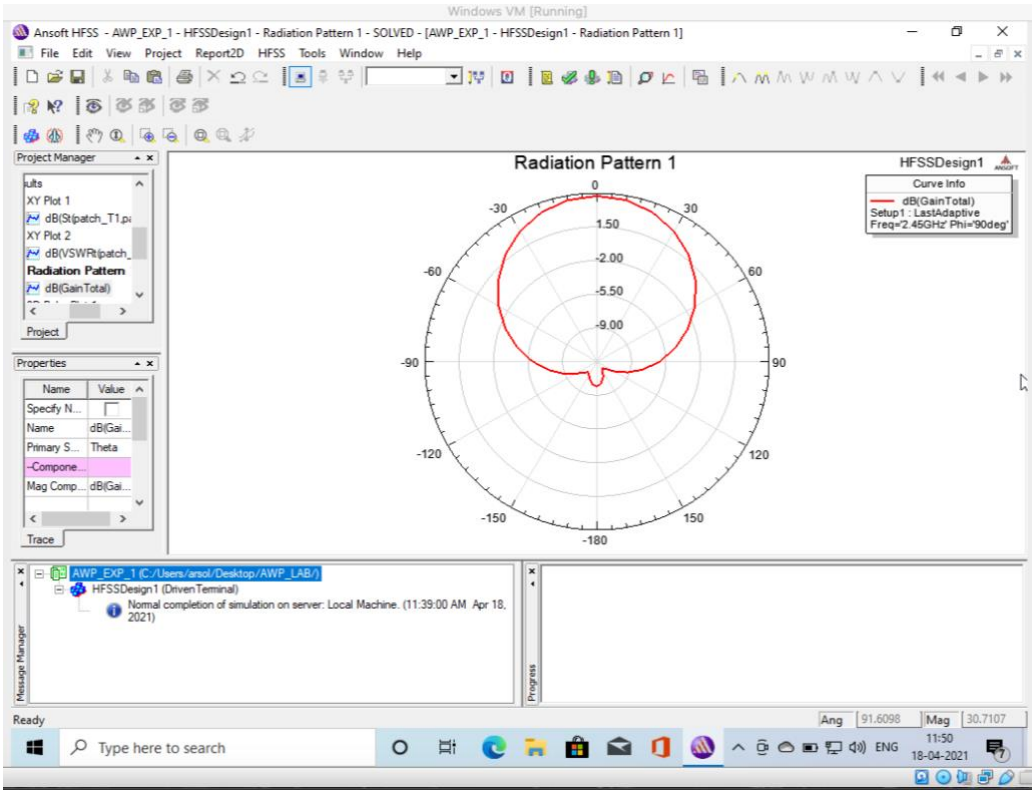


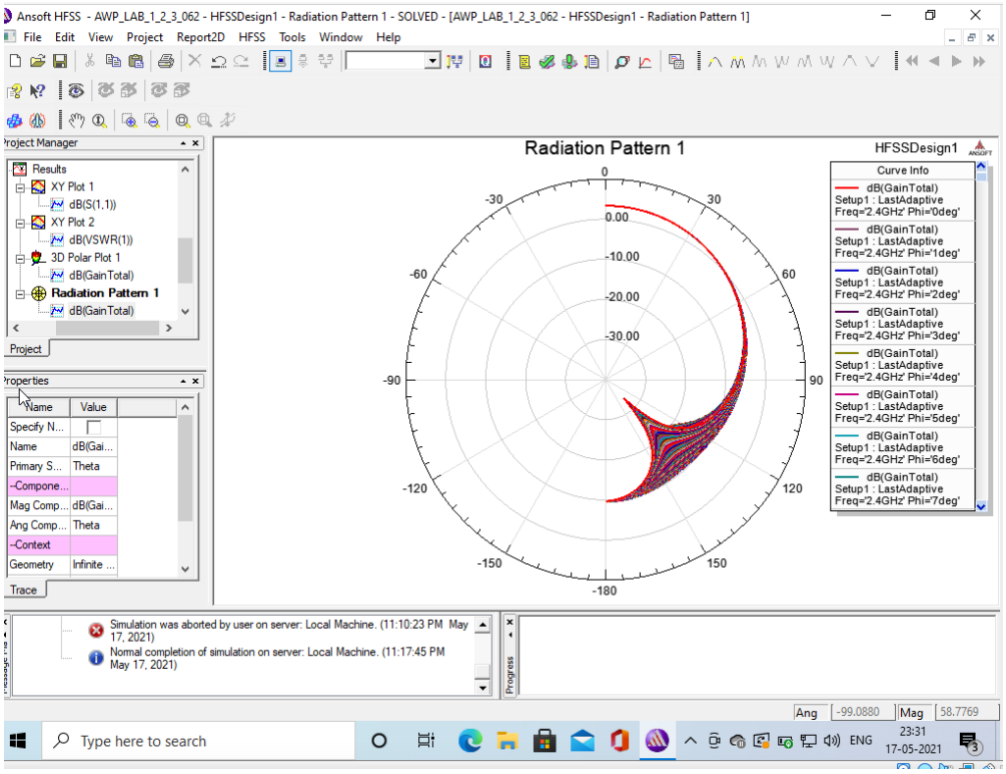
## FINAL OUTPUT OF THE EXPERIMENT:

- **Micro Strip Patch Antenna Design resonating at 2.4 GHz.**

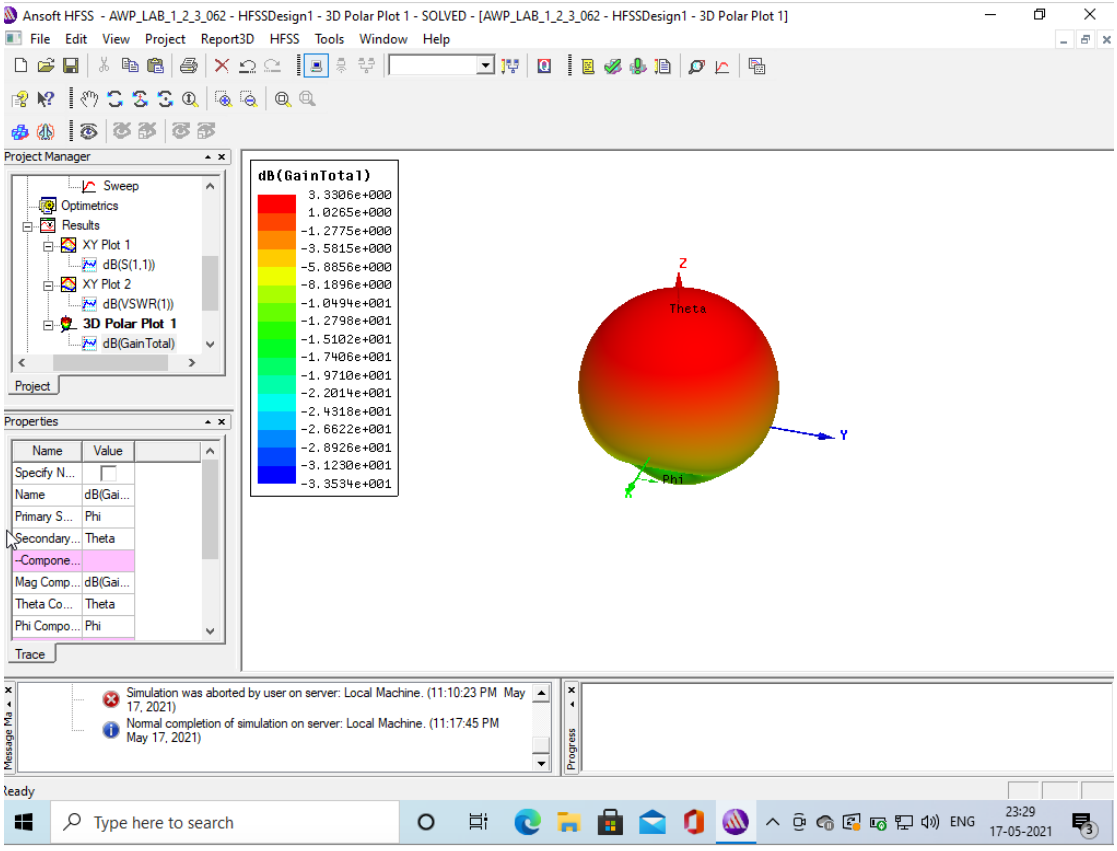


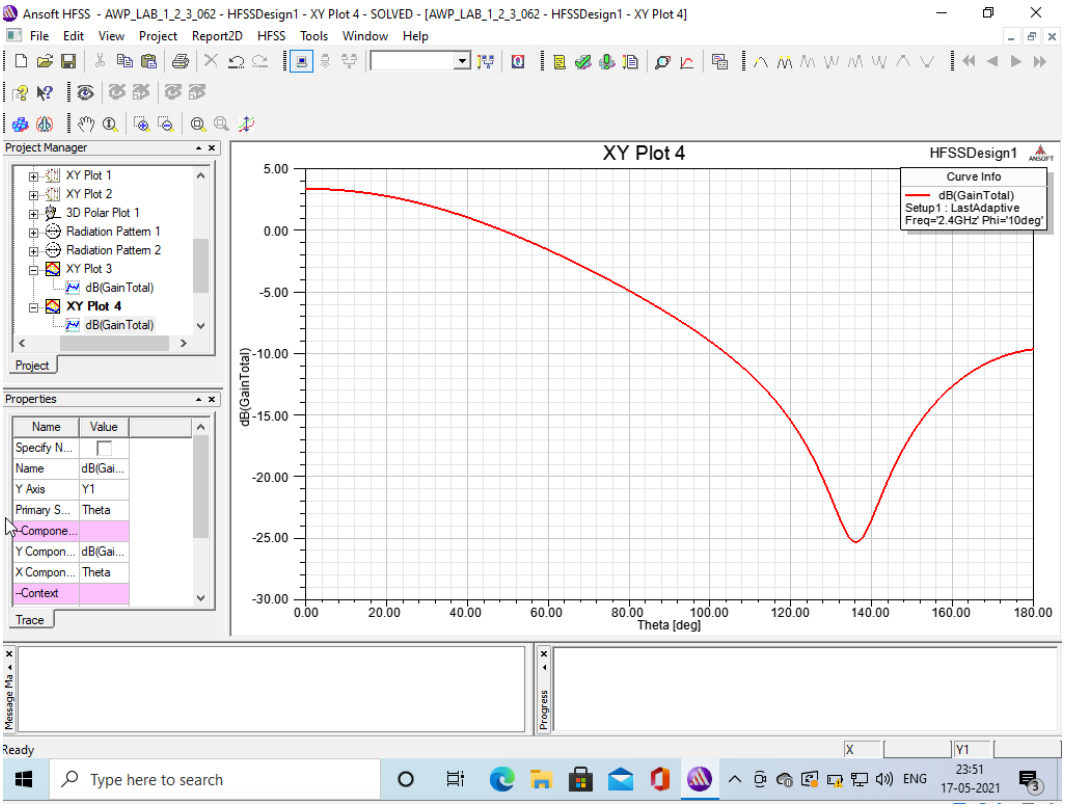

- **Radiation Pattern:**

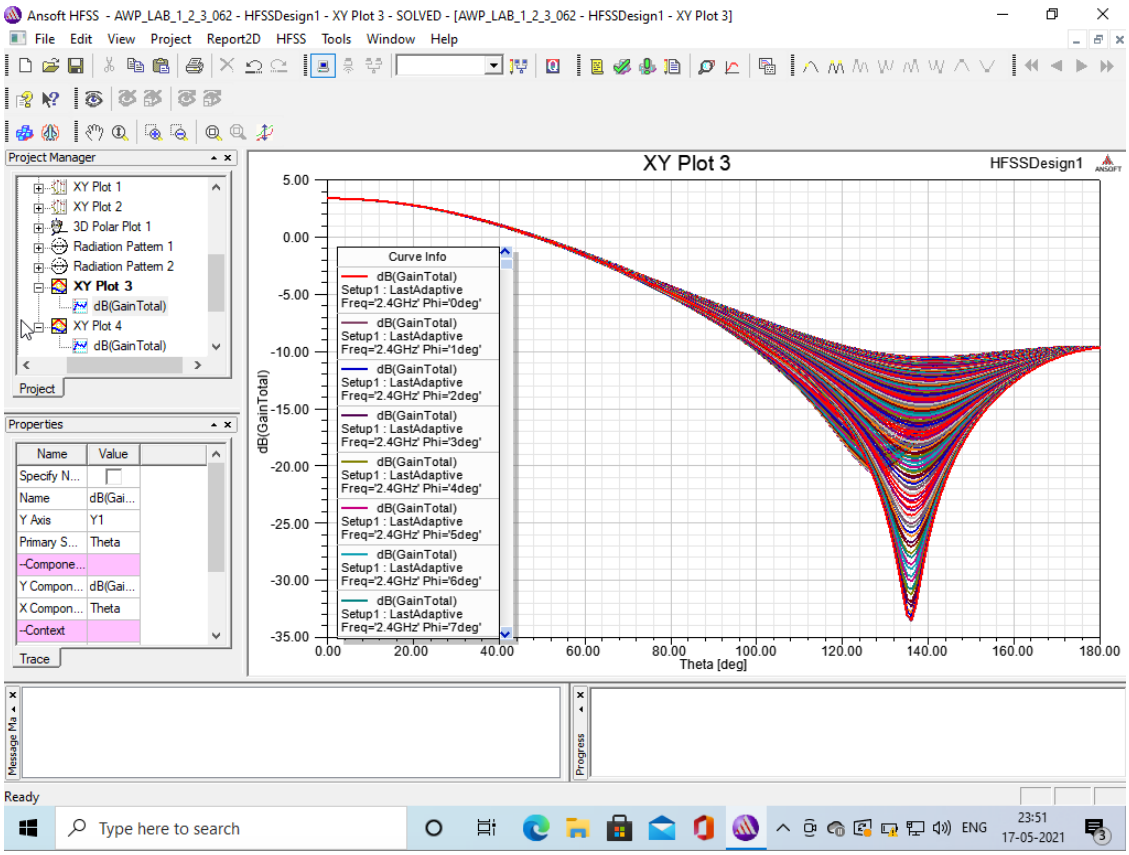



Ansoft HFSS - AWP_LAB_1_2_3_062 - HFSSDesign1 - Radiation Pattern 1 - SOLVED - [AWP_LAB_1_2_3_062 - HFSSDesign1 - Radiation Pattern 1]
File Edit View Project Report2D HFSS Tools Window Help
Project Manager
Results
XY Plot 1
dB(S(1,1))
XY Plot 2
dB(VSWR(1))
3D Polar Plot 1
dB(GainTotal)
Radiation Pattern 1
dB(GainTotal)
Project
Properties
Name Value
Specify N...
Name dB(Gai...
Primary S... Theta
-Compone...
Mag Comp... dB(Gai...
Ang Comp... Theta
-Context
Geometry Infinite ...
Trace
Radiation Pattern 1
HFSSDesign1
Curve Info
dB(GainTotal)
Setup1 : LastAdaptive
Freq='2.4GHz' Phi='0deg'
Freq='2.4GHz' Phi='1deg'
Freq='2.4GHz' Phi='2deg'
Freq='2.4GHz' Phi='3deg'
Freq='2.4GHz' Phi='4deg'
Freq='2.4GHz' Phi='5deg'
Freq='2.4GHz' Phi='6deg'
Freq='2.4GHz' Phi='7deg'
0
30
60
90
120
150
-180
-150
-120
-90
-60
-30
0.00
-10.00
-20.00
-30.00
Simulation was aborted by user on server: Local Machine. (11:10:23 PM May 17, 2021)
Normal completion of simulation on server: Local Machine. (11:17:45 PM May 17, 2021)
Progress
Ang -99.0880 Mag 58.7769
Type here to search
ENG
23:31
17-05-2021

- **Gain Plot**


Ansoft HFSS - AWP_LAB_1_2_3_062 - HFSSDesign1 - 3D Polar Plot 1 - SOLVED - [AWP_LAB_1_2_3_062 - HFSSDesign1 - 3D Polar Plot 1]
File Edit View Project Report3D HFSS Tools Window Help
Project Manager
Sweep
Optimetrics
Results
XY Plot 1
dB(S(1,1))
XY Plot 2
dB(VSWR(1))
3D Polar Plot 1
dB(GainTotal)
Project
Properties
Name Value
Specify N...
Name dB(Gai...
Primary S... Phi
Secondary... Theta
-Compone...
Mag Comp... dB(Gai...
Theta Co... Theta
Phi Compo... Phi
Trace
dB(GainTotal)
3.3306e+000
1.0265e+000
-1.2775e+000
-3.5815e+000
-5.8856e+000
-8.1896e+000
-1.0494e+001
-1.2798e+001
-1.5102e+001
-1.7406e+001
-1.9710e+001
-2.2014e+001
-2.4318e+001
-2.6622e+001
-2.8926e+001
-3.1230e+001
-3.3534e+001
Z
Theta
Y
Phi
X
Simulation was aborted by user on server: Local Machine. (11:10:23 PM May 17, 2021)
Normal completion of simulation on server: Local Machine. (11:17:45 PM May 17, 2021)
Progress
Ready
Type here to search
ENG
23:29
17-05-2021


Ansoft HFSS - AWP_LAB_1_2_3_062 - HFSSDesign1 - XY Plot 4 - SOLVED - [AWP_LAB_1_2_3_062 - HFSSDesign1 - XY Plot 4]
File Edit View Project Report2D HFSS Tools Window Help
Project Manager
XY Plot 1
XY Plot 2
3D Polar Plot 1
Radiation Pattern 1
Radiation Pattern 2
XY Plot 3
dB(GainTotal)
XY Plot 4
dB(GainTotal)
Project
Properties
Name Value
Specify N...
Name dB(Gai...
Y Axis Y1
Primary S... Theta
-Compone...
Y Compon... dB(Gai...
X Compon... Theta
-Context
Trace
XY Plot 4
HFSSDesign1
Curve Info
dB(GainTotal)
Setup1 : LastAdaptive
Freq='2.4GHz' Phi='10deg'
dB(GainTotal)
Theta [deg]
5.00
0.00
-5.00
-10.00
-15.00
-20.00
-25.00
-30.00
0.00
20.00
40.00
60.00
80.00
100.00
120.00
140.00
160.00
180.00
Message Ma
Progress
Ready
X
Y1
Type here to search
ENG
23:51
17-05-2021


Ansoft HFSS - AWP_LAB_1_2_3_062 - HFSSDesign1 - XY Plot 3 - SOLVED - [AWP_LAB_1_2_3_062 - HFSSDesign1 - XY Plot 3]
File Edit View Project Report2D HFSS Tools Window Help
Project Manager
XY Plot 1
XY Plot 2
3D Polar Plot 1
Radiation Pattern 1
Radiation Pattern 2
XY Plot 3
dB(GainTotal)
XY Plot 4
dB(GainTotal)
Project
Properties
Name Value
Specify N...
Name dB(Gai...
Y Axis Y1
Primary S... Theta
-Compone...
Y Compon... dB(Gai...
X Compon... Theta
-Context
Trace
XY Plot 3
HFSSDesign1
Curve Info
dB(GainTotal)
Setup1 : LastAdaptive
Freq='2.4GHz' Phi='0deg'
dB(GainTotal)
Setup1 : LastAdaptive
Freq='2.4GHz' Phi='1deg'
dB(GainTotal)
Setup1 : LastAdaptive
Freq='2.4GHz' Phi='2deg'
dB(GainTotal)
Setup1 : LastAdaptive
Freq='2.4GHz' Phi='3deg'
dB(GainTotal)
Setup1 : LastAdaptive
Freq='2.4GHz' Phi='4deg'
dB(GainTotal)
Setup1 : LastAdaptive
Freq='2.4GHz' Phi='5deg'
dB(GainTotal)
Setup1 : LastAdaptive
Freq='2.4GHz' Phi='6deg'
dB(GainTotal)
Setup1 : LastAdaptive
Freq='2.4GHz' Phi='7deg'
dB(GainTotal)
Theta [deg]
5.00
0.00
-5.00
-10.00
-15.00
-20.00
-25.00
-30.00
-35.00
0.00
20.00
40.00
60.00
80.00
100.00
120.00
140.00
160.00
180.00
Message Ma
Progress
Ready
Type here to search
ENG
23:51
17-05-2021

**CONCLUSION:** From this experiment we have learnt how to plot the Gain Plot and Radiation Pattern of a Micro Strip Patch Antenna. For a given frequency, the antenna's effective area is proportional to the power gain. An antenna's effective length is proportional to the square root of the antenna's gain for a particular frequency and radiation resistance. Thus, the gain of an antenna is the directivity multiplied by the radiation efficiency. In dB over isotropic (dBi), the gain is taken as 10 times the common logarithm of this quantity. Thus, a perfectly efficient isotropic antenna would have a gain of 0 dBi for all angles.