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Project Report

Antenna Design , Simulation And Fabrication

Project Report on ***Meandering Monopole*** *Antenna at the assigned frequency of 1.8* ***GHz***

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COURSE : ECL307 WAVEGUIDES AND ANTENNAS
DEPARTMENT OF ELECTRONICS AND COMMUNICATIONS ENGINEERING

AIM :

To Design , Simulate and Fabricate Meandering Monopole Antenna at 1.8 GHz frequency.

REQUIREMENTS :

- CST Studio for design and Simulation.
- Copper Wire
- Metal sheet for Ground plane.
- Connector
- Soldering Equipment

ABSTRACT :

->Meander line structure geometry helps in obtaining broadband performance in small antenna envelope. Meander lines increase effective electrical dimensions of the patch.

->The electrical characteristics of the proposed antenna appear to be attractive for mobile terminals and repeater applications.

->In a word, the main objective is to characterize trade offs and identify which antenna provides the best compromise among volume, bandwidth and efficiency.

->This, in turn, makes the antenna work at a lower range of frequencies without further increment or change in antenna dimensions

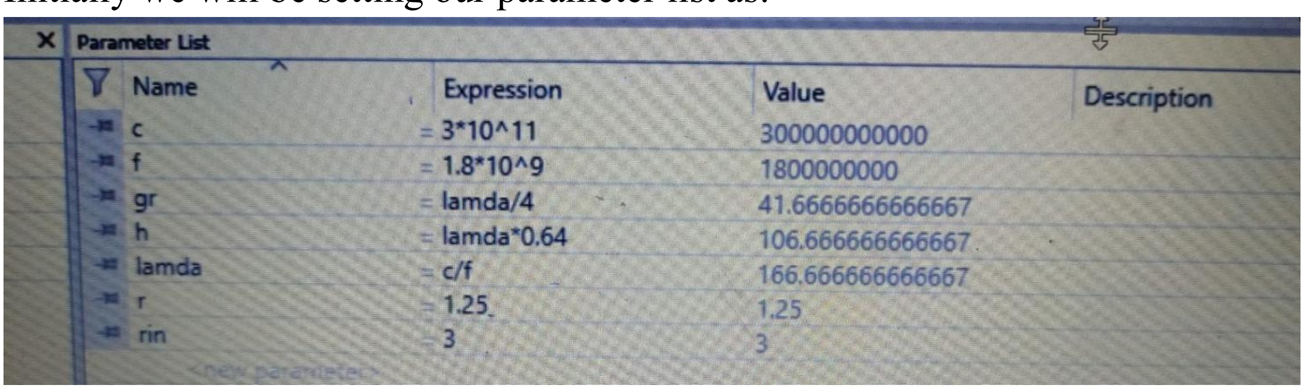
->Therefore, meander line antennas can be safely used in handheld mobile devices as it can cause lesser amount of damage from radiation to human bodies.

->Thus, the effective length of the antenna is reduced and the spacing between the meander sections (increasing the coupling) is decreased, thereby resulting in a net decrease in the operating frequency of the antenna . In addition, the coupling effect is proportional to the current amplitude. The meander section is therefore top-loaded for the purpose of decreasing the coupling effect

->The performance of each antenna is evaluated based on return loss, operational bandwidth, and radiation pattern characteristics. During our measurement, return loss is measured by reading the S11-port reflection coefficient on Vector Network Analyzer (VNA). This coefficient can be used to characterize how well the antenna is able to be efficiently fed. Operational bandwidth is measured as the frequency range over which the antenna keeps the value of Voltage Standing Wave Ratio (VSWR) or equivalently has -10dB return loss. An soft High Frequency Structure Simulator (HFSS) is used to simulate expected characteristics which are resonant frequency, bandwidth, VSWR, and radiation pattern. HFSS is used to provide a good guide for the antenna design before the actual prototype is manufactured. Simulated results are compared with results of measurement to point out the differences and help demonstrate the practical effects on antenna performance. Radiation pattern are measured to illustrate the effects of antenna miniaturization. All the above measurements are done in the anechoic chamber.

PROCEDURE :

- First creating the structural design using CST software.
- Initially we will be setting our parameter list as:



Parameter List

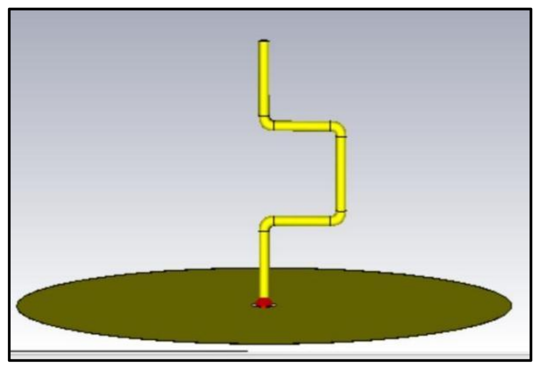
Name	Expression	Value	Description
c	= 3*10^11	300000000000	
f	= 1.8*10^9	1800000000	
gr	= lamda/4	41.6666666666667	
h	= lamda*0.64	106.666666666667	
lamda	= c/f	166.666666666667	
r	= 1.25	1.25	
rin	= 3	3	
<new parameter>			

- The meander-line antenna can be in a lamda/2 or lamda/4 ground plane format. Selecting the cylindrical shape for making monopole part. Setting the parameters accordingly.

- Following the shape of meander monopole antenna , we have made it with 4 turns and 9 solids in total 10 components including ground plane.

- We will be connecting solid cylindrical solids by using lofts in between by connecting their faces.

- Pick the two faces which are supposed to be joined together.



- We have completed our 3D design now we can start stimulation.

- After simulation we have to check s-parameter , surface current E-field H-field,farfield,farfield cuts, Gain,VSWR and directivity .

OBSERVATION :

Initially we have observed that on simulating our designed antenna , we are getting dip at 2.12 GHz instead of 1.8 GHz.
As per our previous learning , we noticed that in order to decrease the frequency we have to increase the height of antenna . So we have removed one solid and one corresponding loft with it.
What we observed is we are getting frequency shifted but the s parameter has also got shifted from -16 to -7 which has to be over 10 always for the system to be stable.

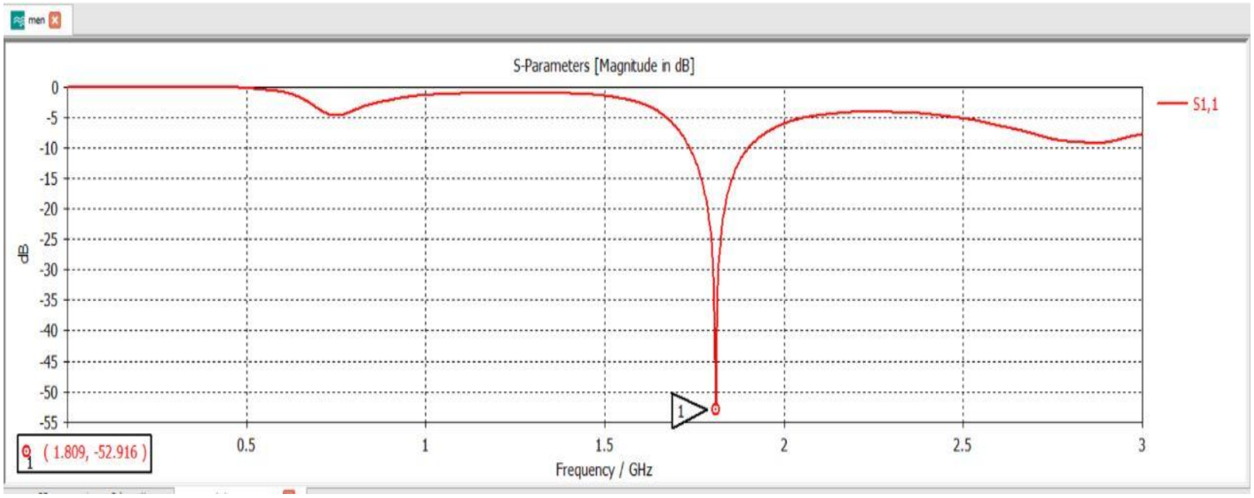
Then we have tried replacing the solid at the same place and now changing the value of h = lam to h = lam*0.8 .After making such changes what we observed is our s parameter is still -7 but the frequency got shifted to 1.66GHz .So we kept on changing the value of h in decreasing rate. But this was not serving the purpose. We were not able to see desired results .

So now instead of changing height of components , we had removed one component and added 1/3rd part of that solid into each vertical solid by keeping horizontal solid lengths same.
With these changes we could see the significant changes in s-parameter from -16 to -32 directly but no shift in frequency pattern.
So now we tried changing the value of h=lam to h=lam*0.8 , lam*0.75 , lam*0.70 and so on..

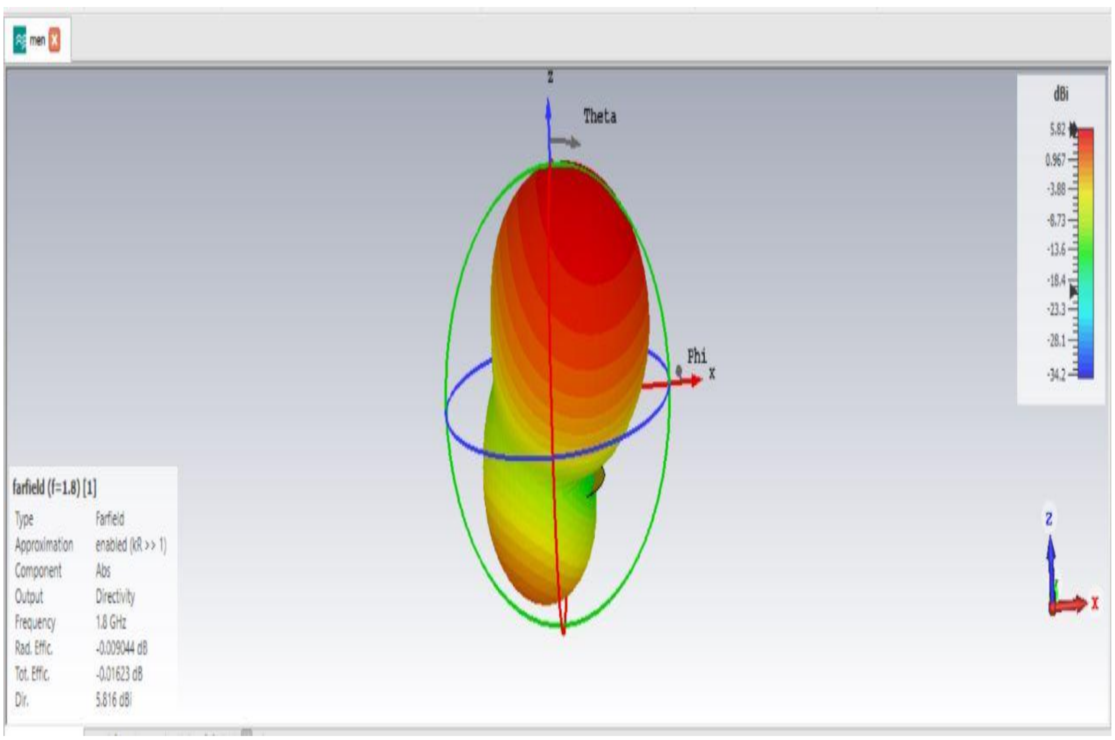
So finally at h=lam*0.64 we got the best suitable and desired result .
We got s-parameter dip upto -50 and also resonance at 1.809GHz and Gain of 5.816dbi.

VISUAL OBSERVATIONS :

1. **S-Parameter :**



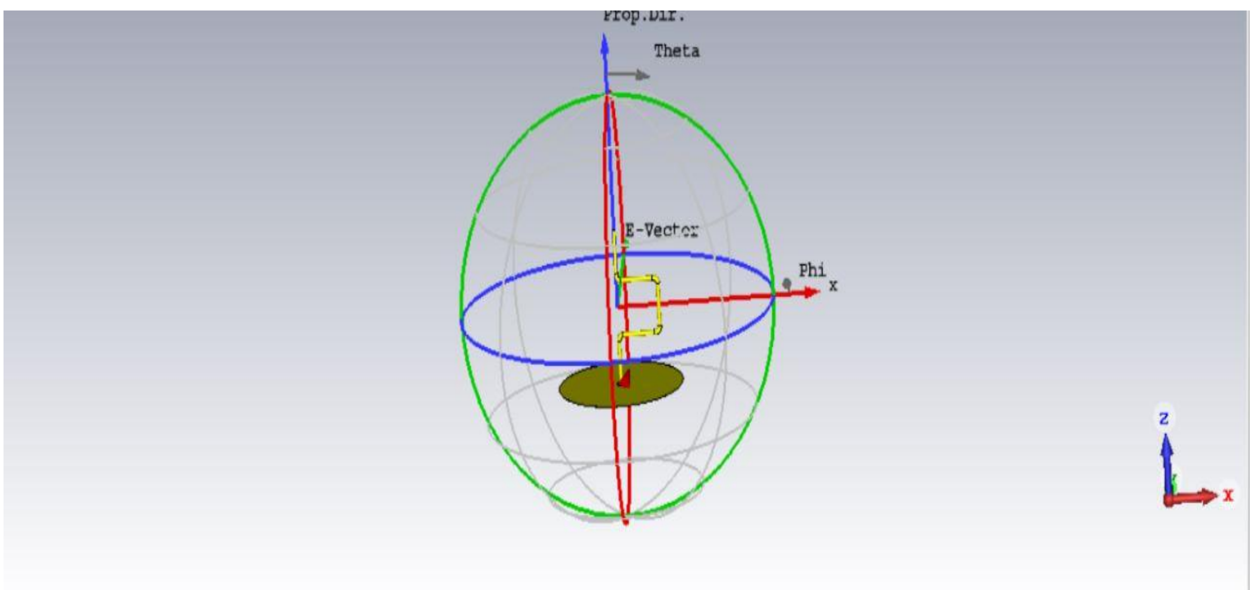
2. **Fairfield (f=2.4) :**



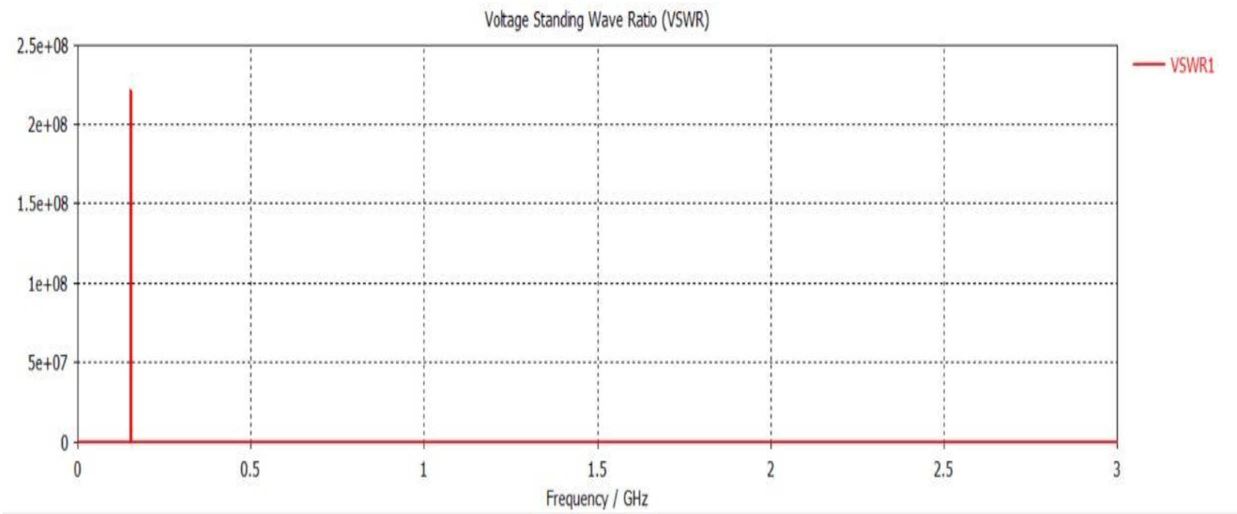
farfield (f=1.8) [1]

Type	Farfield
Approximation	enabled (kR >> 1)
Component	Abs
Output	Directivity
Frequency	1.8 GHz
Rad. Effic.	-0.009044 dB
Tot. Effic.	-0.01623 dB
Dir.	5.816 dBi

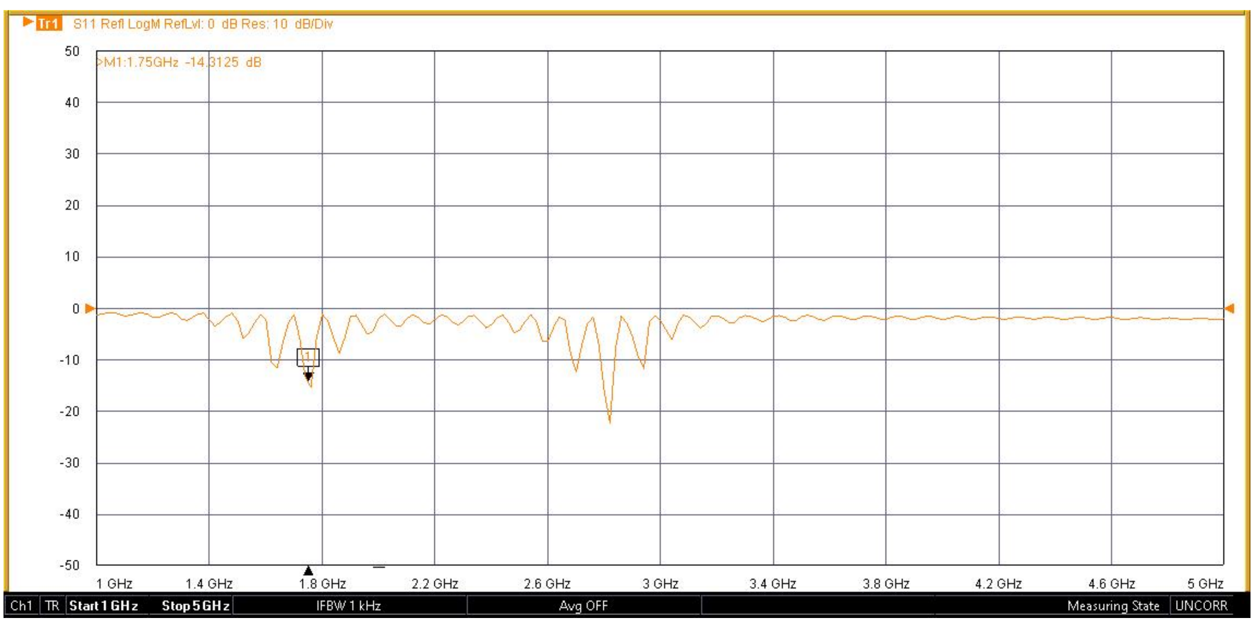
3. Farfield cuts :



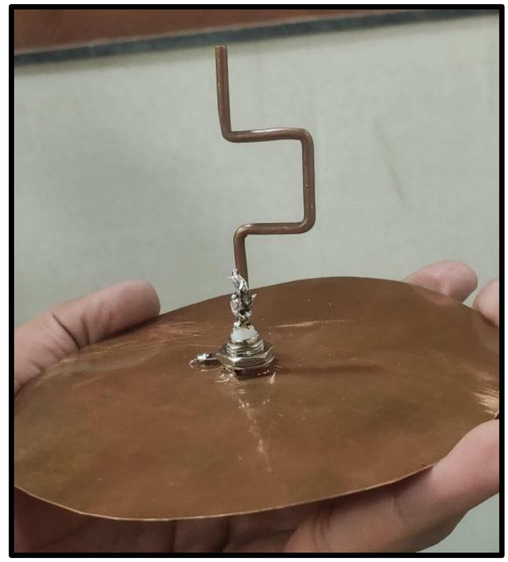
4. VSWR :



Final Result-



RESULT :



We have successfully designed , simulated , and fabricated the Meander Monopole Antenna at 1.8 GHz using CST Software. Also calculated and obtained various s-parameter , Axial Ration , Fairfield , H-field , VSWR & surface current. Also verified various observations practically in analog communications lab.