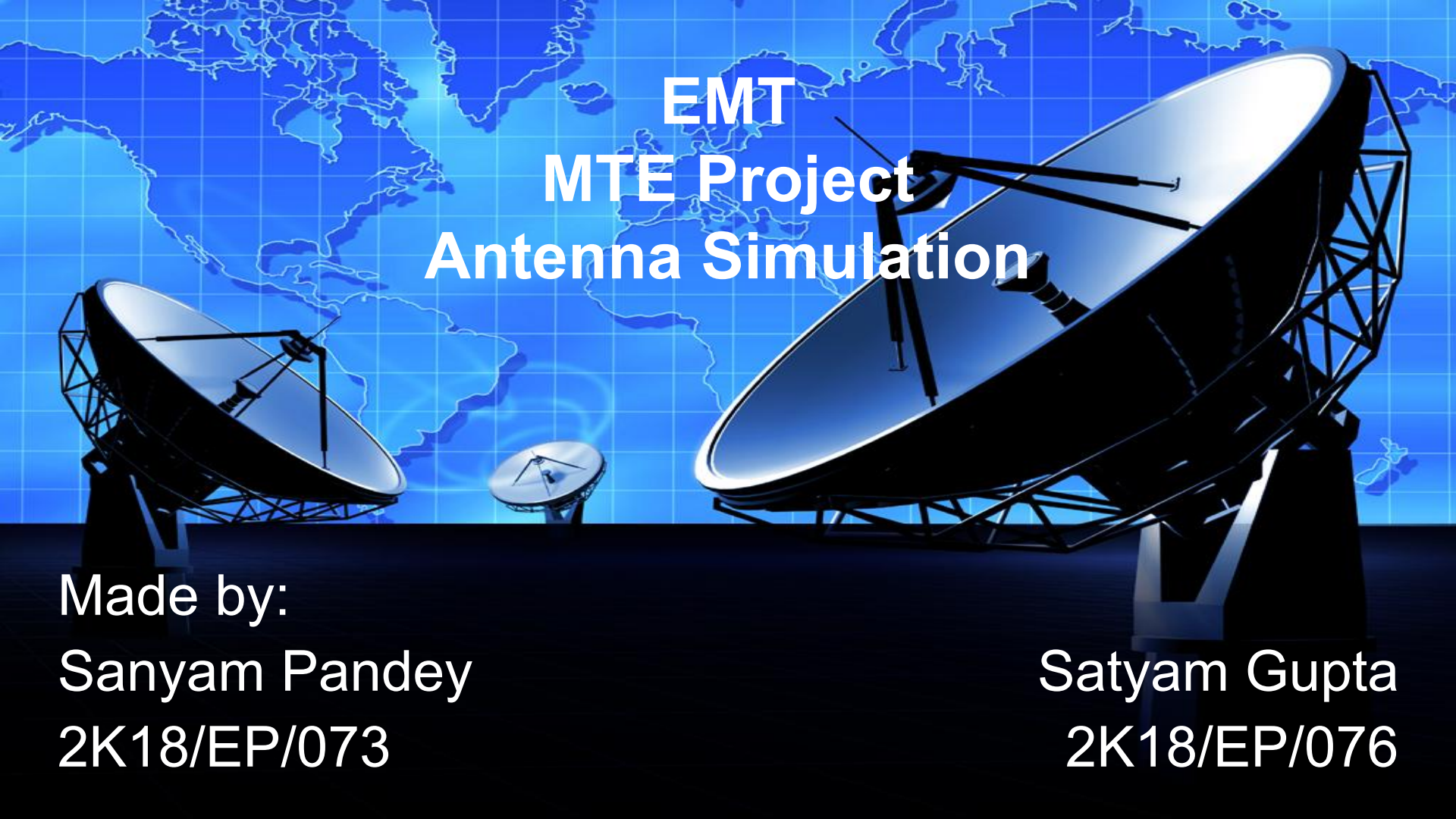

EMT
MTE Project
Antenna Simulation

Made by:

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2K18/EP/073

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Introduction

- In the field of communication systems, whenever the need for wireless communication arises, there occurs the necessity of an antenna. Antenna has the capability of sending or receiving the electromagnetic waves for the sake of communication, where you cannot expect to lay down a wiring system.
- An antenna is a device to transmit and/or receive electromagnetic waves.An antenna must be tuned (matched) to the same frequency band as the radio system to which it is connected, otherwise reception and/or transmission will be impaired
- The half wave dipole is formed from a conducting element which is wire or metal tube which is an electrical half wavelength long. The half wave dipole is normally fed in the middle where the impedance falls to its lowest. In this way, the antenna consists of the feeder connected to two quarter wavelength elements in line with each other.
- Micro strip antenna is a printed circuit which consists of a very thin metallic strip placed on a ground plane with a dielectric material in-between.Microstrip antennas are relatively inexpensive to manufacture and design because of the simple 2-dimensional physical geometry. They are usually employed at UHF and higher frequencies because the size of the antenna is directly tied to the wavelength at the resonant frequency

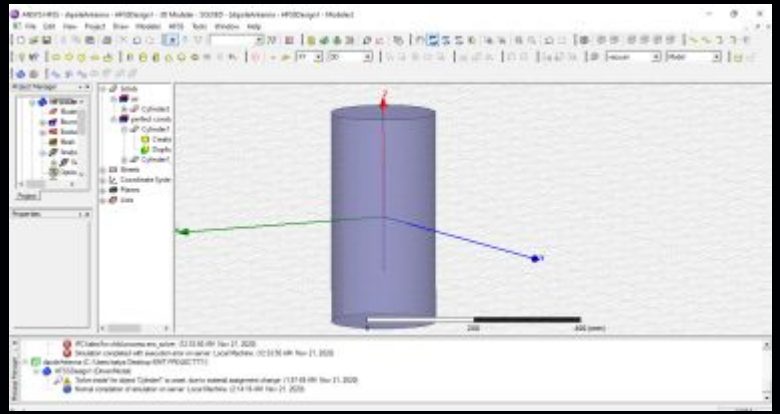
Software Used

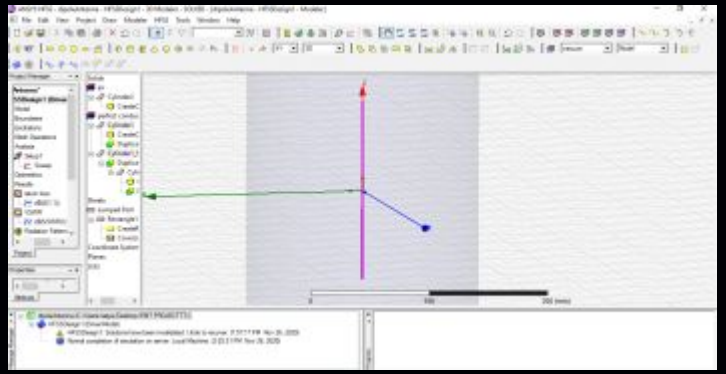
- For the simulation of our project we have used ANSYS HFSS.
  HFSS stands for high frequency structure simulator and is finite element method solver for electromagnetic structure.
- The basic concept of FEM can be thought of as splitting the computational domain into individual small patches and finding local solutions that satisfy the differential equation within the boundary of this patch. By stitching the individual solutions on these patches back together, a global solution can be obtained.
- The finite element used by hfss are tetrahedra and entire collection of tetrahedral is called mesh.Solution is found for the fields within the finite element and these fields are interrelated so that Maxwell's equations are satisfied across interelement edges ,yielding a field solution for the entire original structure.once the field solution has found the s matrix solution is determined.

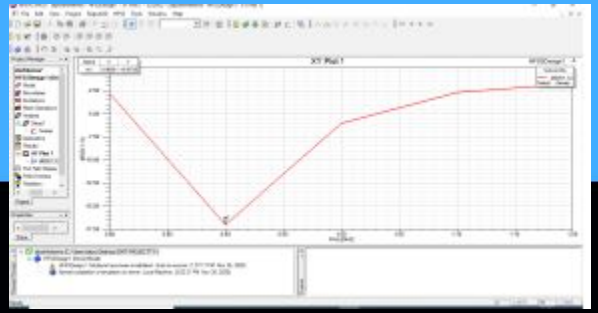
Dipole Antenna

We simulated a half - wavelength dipole antenna .

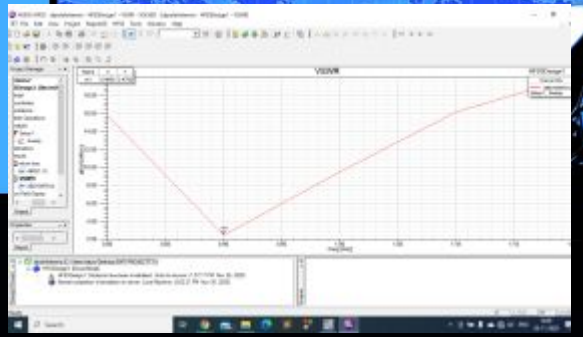
Frequency used is 1Ghz. The length of each of the conductors used is 75 mm.(The physical length of a half-wave dipole is slightly less than half a wavelength due to end effect.)



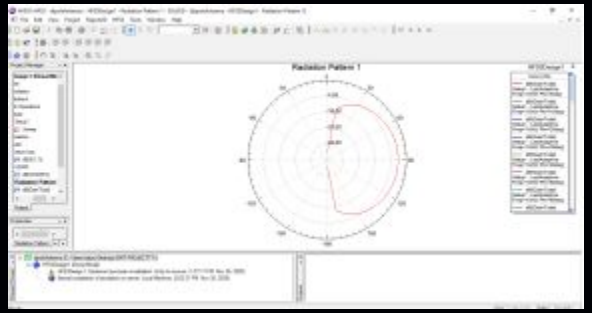




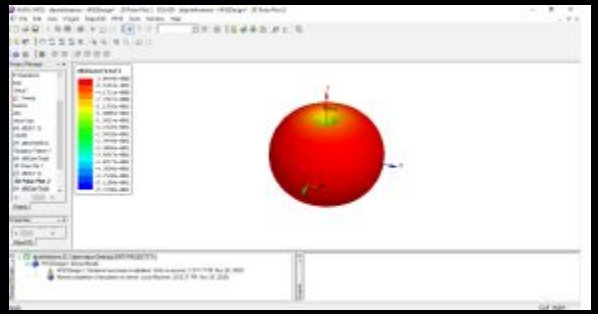
RETURN LOSS(S11 GRAPH)



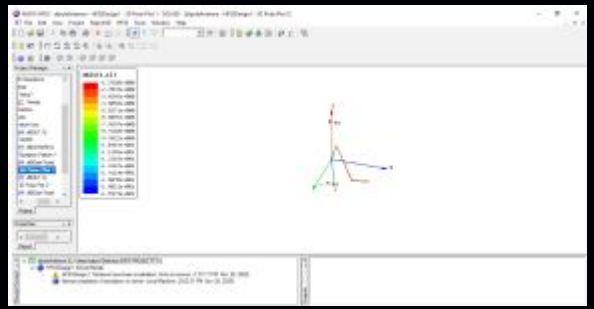
VSWR PLOT



RADIATION PATTERN 2D

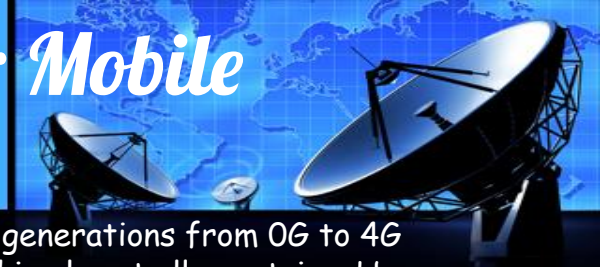


3-D GAIN

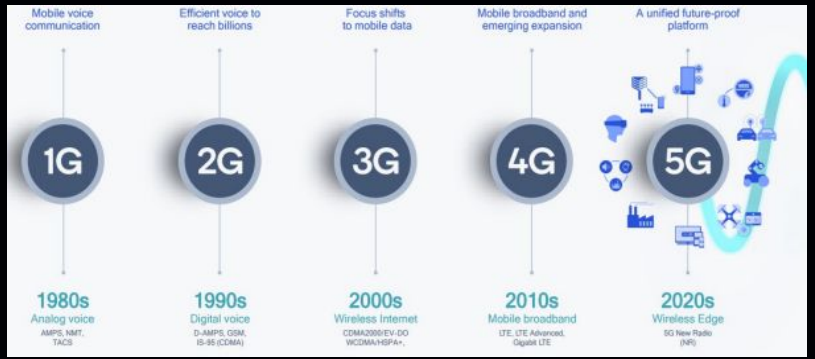


3-D RADIATION PATTERN

Micro Strip Patch Antenna for Mobile Communication.

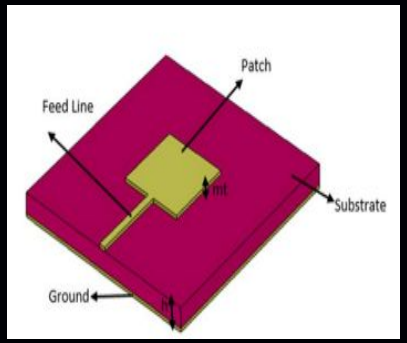


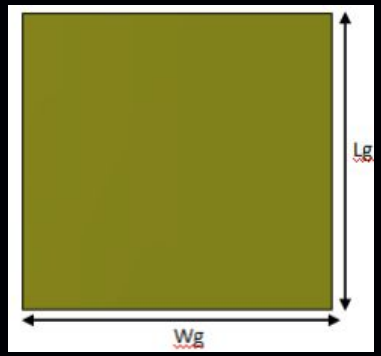
- In the past few years mobile wireless communication has experienced various generations from 0G to 4G technology.The 4G wireless communication systems has already been deployed in almost all countries. However 4G still cannot accommodate some challenges like spectrum crisis, high energy consumption, poor coverage,bad interconnectivity, poor Quality of Service (QoS) and flexibility . To address all these demands 5G wireless system are expected to be deployed in the future by 2020.To fulfill all the needs of fifth generation (5G) wireless system to facilitate higher data rate, better reliability, more connectivity, lower latency and improved security features wireless system designers need a new concept and design approach.
- The millimeter wave (mm-wave) frequencies are likely to use by 5G.Millimeter wave radio frequency can provide the basic ground for the new Generation (5G).Millimeter wave have unexploited spectrum (3GHz-300GHz) to fulfill the new generation needs. The spectrum of 5G application is 20-90GHz.. 5G antennas are designed at frequencies 28Ghz, 38GHz, 72GHz having bandwidths of 500 MHz, 1 GHz, and 2 GHz as they are all suitable for high data rate and low latency system .They are highly directional and obstacle sensitive due to narrow beam width they can be used for cellular applications

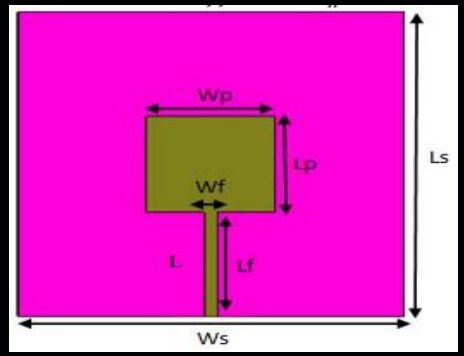


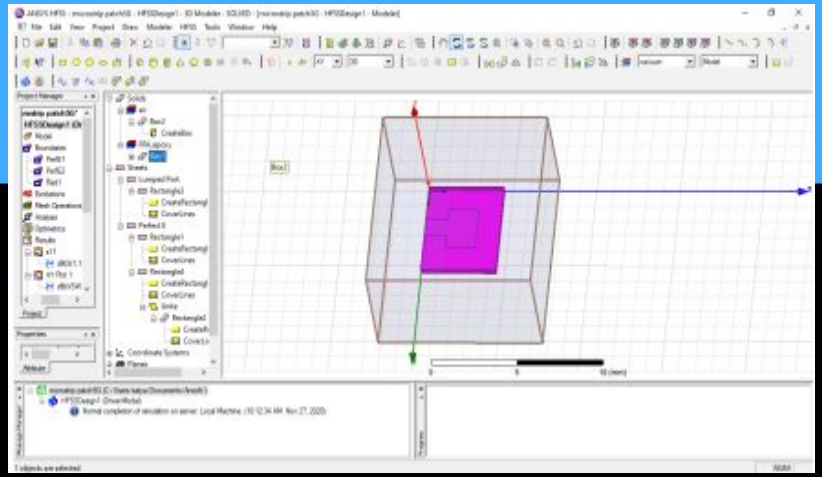
Antenna Design

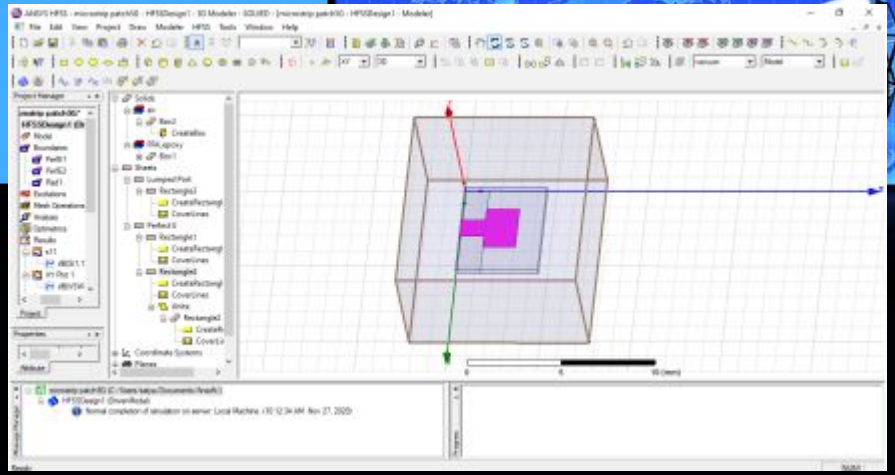
- Micro strip patch antenna with substrate dimension of Ls×Ws with fr-4 epoxy material having dielectric constant of 4.40, loss Tangent of 0.02. Height of substrate is o Dimensions used for substrate is 5mm×6mm. The dimensions used for ground is same as the substrate 5mm×6mm. M-line feed is used to design proposed micro strip patch antenna. The width of the feed is Wf (0.3mm) and length Lf (2.2mm). The selected dimensions (Lp×Wp) for the radiating patch are (2.33 mm× 3.26 mm).
- Many Substrates are available but we have used fr-4 epoxy cause it is cost effective along with low dielectric constant and has low moisture absorption.
- A different dielectric substance ROGER 5880 is also used in another version at similar frequency to determine which of these two is more efficient for mm wave transmission.

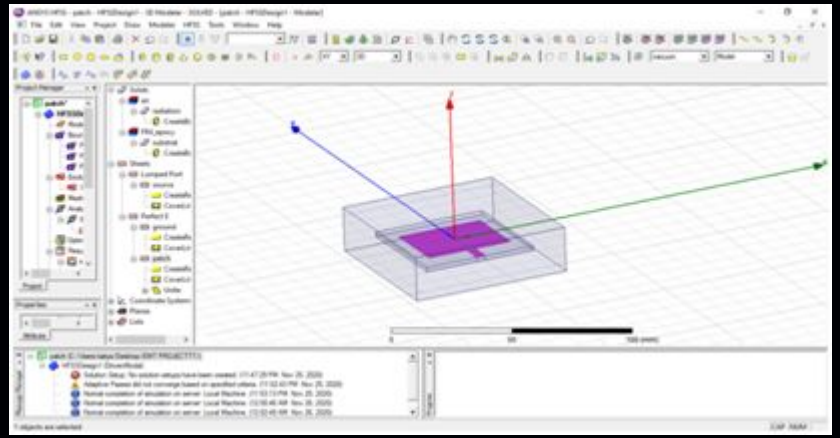




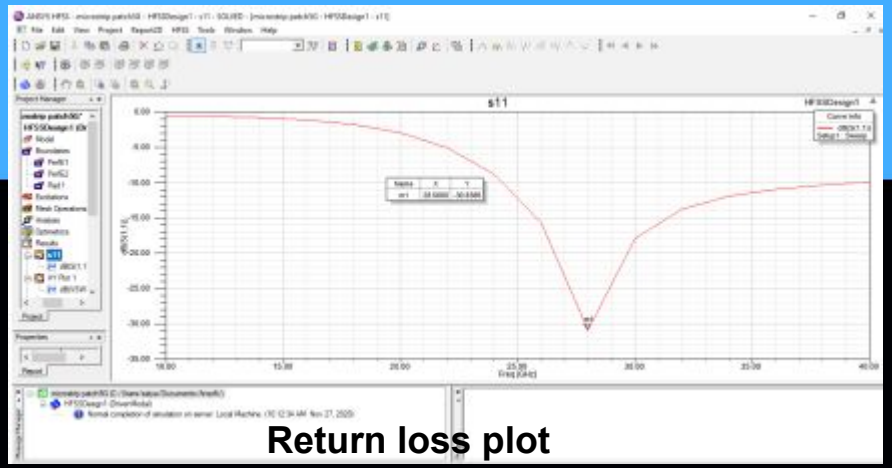




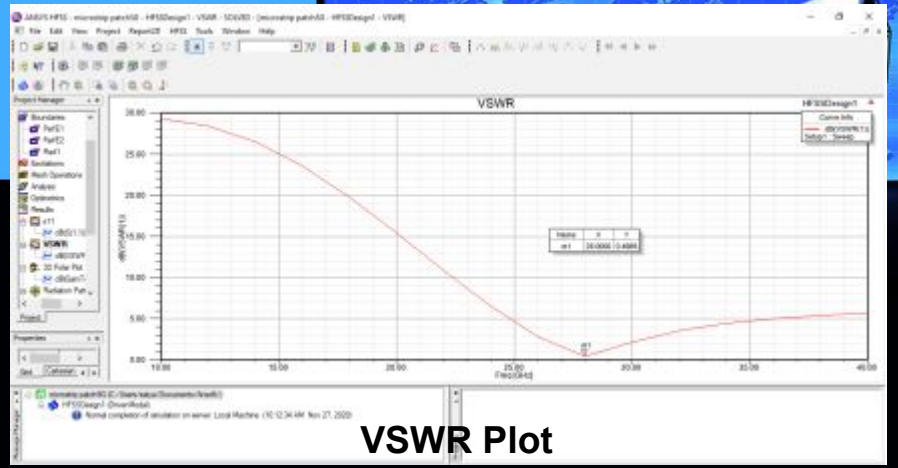




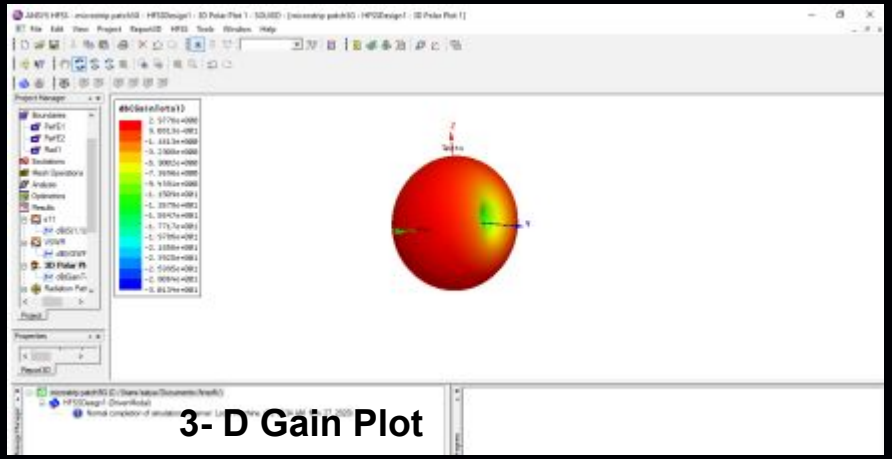
Parameters	Description	Value (mm)
Ls	Length of Substrate	5
Ws	Width of Substrate	6
H	Height of Substrate	0.508
Lp	Length of Patch	2.33
Wp	Width of Patch	3.26
Mt	Height of Patch	0.035
Wf	Width of Feed line	0.3
Lf	Length of Feed line	2.2
Wg	Width of Ground	6
Lg	Length of Ground	5



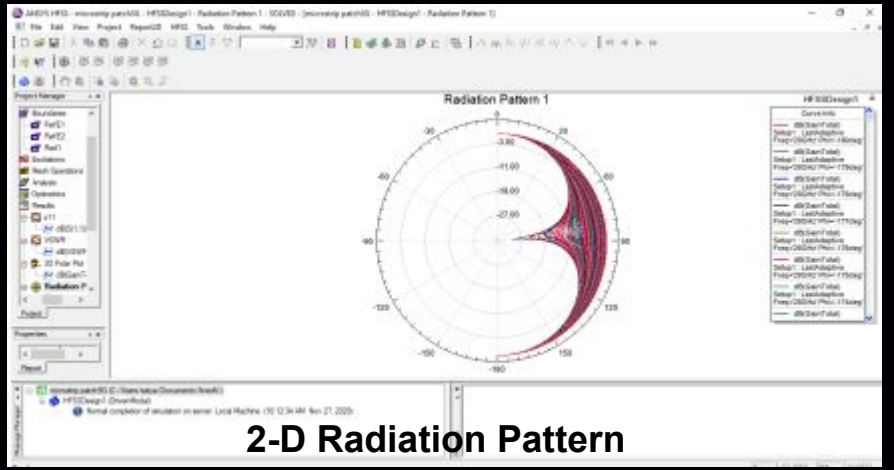
Return loss plot



VSWR Plot



3- D Gain Plot



2-D Radiation Pattern

Conclusion

- In the first simulation after analyzing all the graphs it may be deduced that the antenna is working on a different resonant frequency than the value fed in the simulator but it functions well for the solution frequency(1 GHz).

- In the second simulation ,it was found that the designed antenna support mm waves very well for a resonant frequency of 28 GHz and can be effectively used for 5G mobile applications. It was also observed that ROGER 5880 is a better material for substrate than fr-4 epoxy for the antenna because of its ability to transmit mm waves more effectively.Also fr-4 dielectric constant is frequency dependent(high with high frequency) and it can't support frequencies above 10 GHz quite appreciably whereas in case of ROGER 5880 it is designed for mm waves , has no moisture absorption and water retention and has quite low dielectric constant(2.2)

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