Experiment – 6: Simulation of half wave dipole antenna using Ansys HFSS

1. **Aim**: To design and analyze a half wave dipole antenna
2. **Objective**: Design, Simulate and Analyze a half wave dipole antenna using ANSYS.

3. **Requirements**
   ANSYS Software

4. **Pre-experiment Exercise:**

   Brief Theory

   The dipole antenna is cut and bent for effective radiation. The length of the total wire, which is being used as a dipole, equals half of the wavelength (i.e., $l = \lambda/2$). Such an antenna is called as half-wave dipole antenna.The range of frequency in which half-wave dipole operates is around 3KHz to 300GHz.

   It is a normal dipole antenna, where the frequency of its operation is half of its wavelength. Hence, it is called as half-wave dipole antennaAfter rectangular patch the next configuration is the circular patch (as shown in figure 1) which has varying applications as a single patch element as well as in arrays. The circular patch has only one degree of freedom to control i.e. radius of the patch.

Figure 1: Plane view of Half-Wave Dipole Antenna.

In order to design a rectangular microstrip patch, the following design procedure is used:

5. **Laboratory Exercise**

   A. Design Calculations:

Sr. No.	Parameter	Value
1.	Resonant Frequency (*f*o)	
2.	Radius of the dipole cylinder (*a*)	

B. Procedure:

1) Open HFSS and create new project
2) Create a substrate of required size.
3) Use to draw option to draw a Cylinder button from the toolbar.patch on the substrate, edit the parameters of the Cylinder patch.
4) The next step is to build the symmetric of dip1. To do that, Right -Click the drawing area and select Edit -> Duplicate -> Around Axis.
5) Select the required substrate from the library.
6) Create a Lumped Excitation Port and then draw the radiation box of required dimensions, also assign radiation boundaries.
7) Add the required simulation set up, proceed with validation check, save the file and simulate the dipole antenna structure.
8) Open the S_{11} graph and interpret the same, add markers to find the resonant frequency and the bandwidth.

6. Post Experiment Exercise:

6.1 Results:

Sr. No.	Parameter	Theoretical values	Simulation Result
1.	Resonant frequency (f_o)		
2.	Impedance Bandwidth		
3	VSWR Bandwidth		
4	Gain		

Radiation pattern description with diagram:

6.2 Conclusion

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6.3 Questions:

1. Explain types of dipole antenna.
2. Derive the expression for radiated power and radiation resistance of a dipole antenna.