DESIGN OF PROBE FEED PATCH ANTENNA AT 2.25GHZ FREQUENCY USING HFSS

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Abstract
A probe-fed patch antenna is studied by changing only the dielectric constants of the material such as polyethylene, silicon dioxide, silicon, Teflon. As it is difficult to build antenna and estimate physically we can simulate it using High Frequency Structure Simulator (HFSS). The main motto of the analysis is to provide improved transmission with wider bandwidth.
Keywords: **HFSS, Radiation pattern, PCB, Probe feed, Substrate, Boundaries, Excitation, Directivity.**

I. INTRODUCTION

An antenna is a specialized transducer that converts radio-frequency (RF) fields into alternating current (AC) or vice-versa. There are two basic types: the receiving antenna, which intercepts RF energy and delivers AC to electronic equipment, and the transmitting antenna, which is fed with AC from electronic equipment and generates an RF field

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

Microstrip antenna consists of a patch of metal foil of various shapes (a patch antenna) on the surface of a PCB, with a metal foil ground plane on the other side of the board. Most microstrip antennas consist of multiple patches in a two-dimensional array. The antenna is usually connected to the transmitter or receiver through foil microstrip transmission lines. The radio frequency current is applied (or in receiving antennas the received signal is produced) between the antenna and ground plane. Microstrip antennas have become very popular in recent decades due to their thin planar profile which can be incorporated into the surfaces of consumer products, aircraft and missiles; their ease of fabrication using printed circuit techniques

II. ANTENNA GEOMETRY

The antenna dimension and the structure of the single layer traditional Microstrip patch antenna with length = 10 cm, width = 9 cm, substrate thickness h = 0.32 cm. Coaxial probe-feed (radius=0.16mm) is located at W/2 and 5.5 mm below from top of the patch. Patch of 4 cm X 3 cm width etched on radiating patch.

III. DESIGN IMPLEMENTATION

In this paper Probe Feed Patch Antenna Design at 2.25 GHz frequency has been modelled and simulated. The patch is the dominant figure of Microstrip antenna, the other components are substrate and ground, which are 2 sides of patch antenna

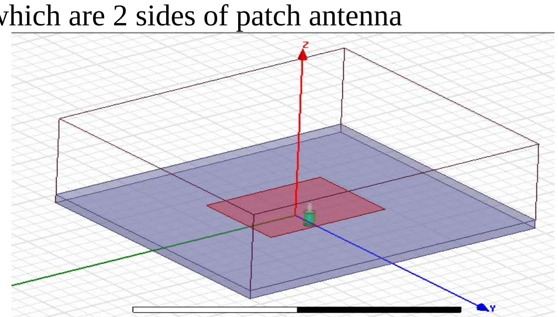

Fig.1 Probe Feed Patch Antenna

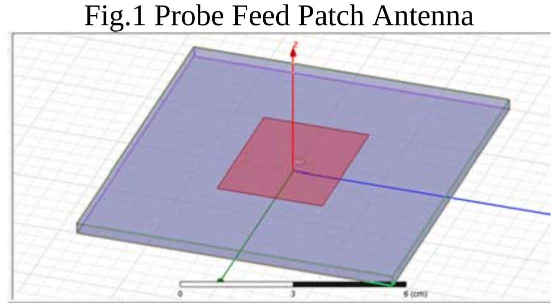

Fig.2 Patch

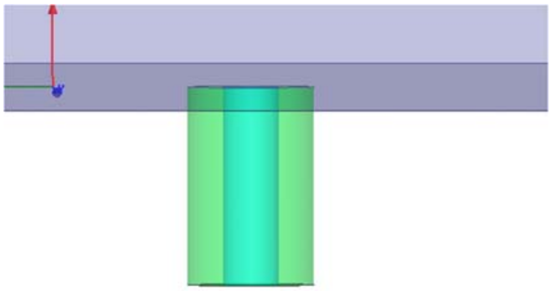

Fig.3 Coax and coax pin

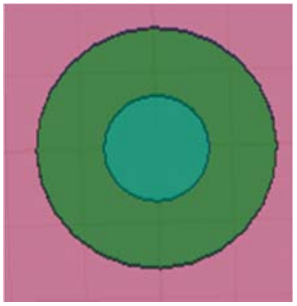

Fig.4 Wave port

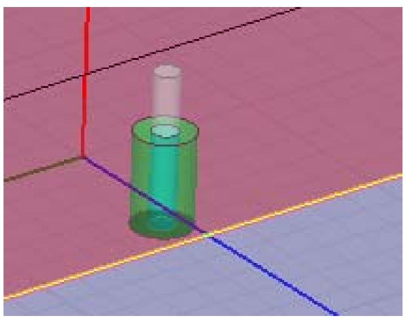

Fig.5 Probe

The above figure represents probe feed patch antenna and fig 1. explains about elements patch antenna. The design specifications are as follows:

IV. DESIGN CONSIDERATIONS

A. Sub1:-

Position:-
X: - "dX/2, Y: -dY/2, Z: 0.0"
" -5.0, -4.5, 0.0"
Size:-
dX: 10.0, dY: 9.0, dZ: 0.32

B. INF_GND :-

POSITION:-
X: -"DX/2, Y: -DY/2, Z: 0.0"
" -5.0, -4.5, 0.0"
SIZE:-
DX: 10.0, DY: 9.0, DZ: 0.32

C. PATCH:-[FIG 2]

POSITION:-
X: -"DX/2, Y: -DY/2, Z: 0.0"
" -2.0, -1.5, 0.32"
SIZE:-
DX: 4.0, DY: 3.0, DZ: 0.0

D. COAX:-[FIG 3]

POSITION:-
X: -0.5, Y: -0.0, Z: 0.0
RADIUS:-
DX: 0.16, DY: 0.0, DZ: 0.0
HEIGHT:-
DX: 0.0, DY: 0.0, DZ: -0.5

E. COAX PIN :-[FIG 3]

POSITION:-
X: -0.5, Y: -0.0, Z: 0.0
RADIUS:-
DX: 0.07, DY: 0.0, DZ: 0.0
HEIGHT:-
DX: 0.0, DY: 0.0, DZ: -0.5

F. PORT1:-[FIG 4]

POSITION:-
X: -0.5, Y: -0.0, Z: -0.5
RADIUS:-
DX: 0.16, DY: 0.0, DZ: 0.0

G. PROBE:-

POSITION:-
X: -0.5, Y: -0.0, Z: 0.0
RADIUS:-
DX: 0.07, DY: 0.0, DZ: 0.0
HEIGHT:-
DX: 0.0, DY: 0.0, DZ: 0.32

V. MATERIALS USED

The materials used for designing this patch antenna are defined below:
1) Rogers RT/duroid 5880:- This material is used to design Sub1, Inf_Gnd, Patch, Coax , Coax pin, Probe
2)Air:- This material is used to define the air space around antenna through which radiation pattern occurs

VI. ASSIGNING BOUNDARIES, EXCITATIONS AND RADIATION

Boundaries and excitations are assigned to get the outputs in the limited boundaries and excitations is used to define input to the antenna. Radiation is assigned to observe the radiation pattern of the antenna

. Inf_Gnd material is assigned with the boundaries of "Perfect E".

Port1 is assigned with the excitation of "Wave Port"

Air is assigned with the radiation of "Far Field Setup"

VII. SIMULATION RESULTS USING HFSS

The S-parameter,Y-parameters,Z-paramaters , Directivity , Radiation Pattern , Smith contour plot can be obtained using HFSS for the frequency of 2.25GHz . The results are shown below

A. S-parameter plot:-

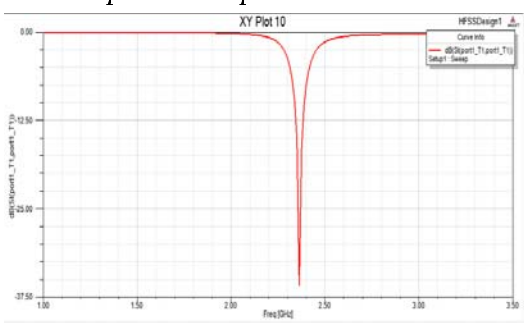

Fig.6 S-parameter plot

B. Y-parameter plot:-

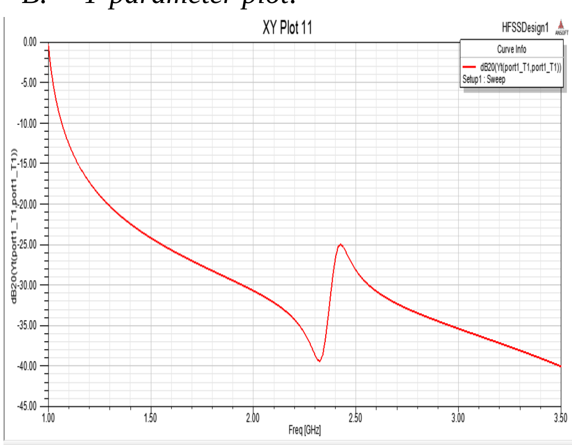

Fig.7 Y-parameter plot

C. Z-parameter plot:-

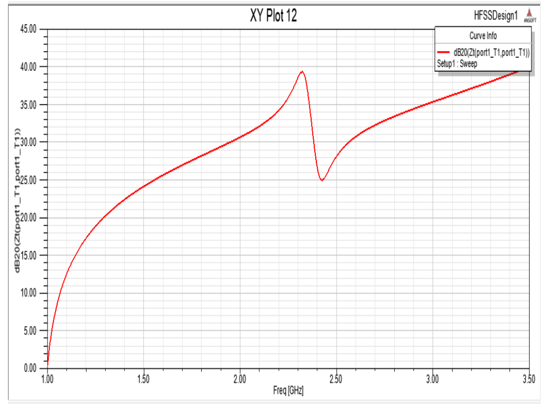

Fig.8 Z-parameter plot

D. Directivity:-

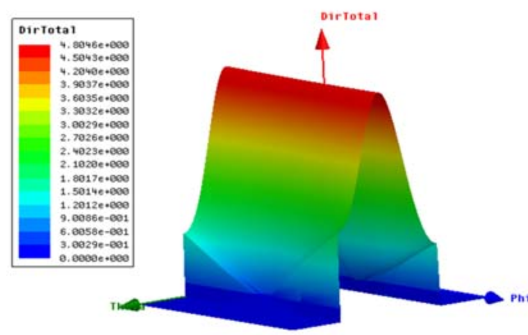

Fig.9 Directivity (3D polar plot)

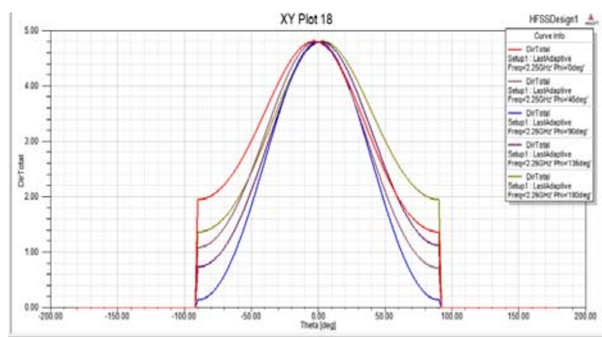

Fig.10 Directivity (rectangular plot)

E. Gain:-

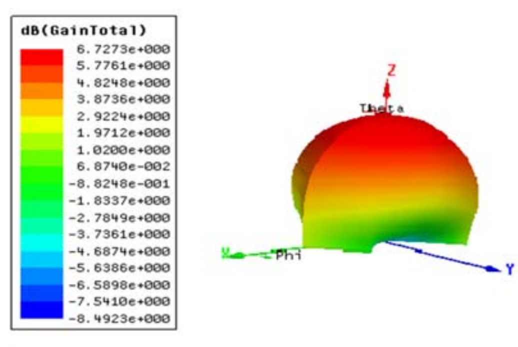

Fig.11 Gain (3D polar plot)

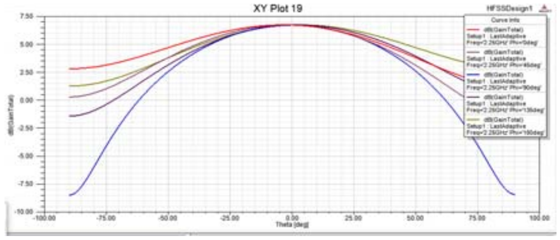

Fig.12 Gain (rectangular plot)

F. Smith Contour:-

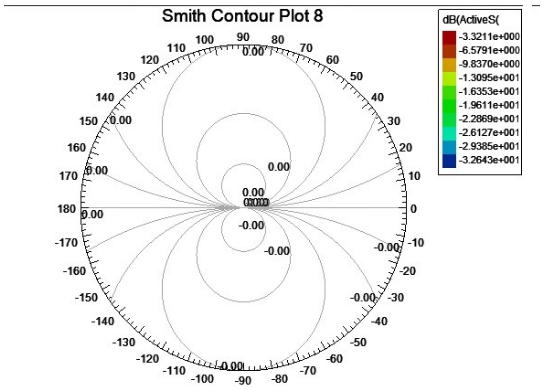

Fig.13 Smith Contour plot

VIII. CONCLUSION

To improve the better gain of different antennas and also to nullify the side lobes we can go for phase array antennas. This paper explains about the Probe Feed Patch Antenna using HFSS 13.0. By using this antenna we are able to generate Gain, Directivity, Parameters, Smith plot can be computed easily using this tool without any external equipment. The proposed antenna provides good performance in terms of gain

IX. FUTURE SCOPE

This antenna can be further used by using Array of Probe Feed Patch Antenna to improve the gain of the antenna and also make radiation pattern for longer distance. As these are light weight and easy to handle they can be used anywhere where there is use of antenna of larger frequencies. The frequency of this antenna can be further increased by changing the materials used for the design of antenna.

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