DESIGN AND SIMULATION OF MICROSTRIP PATCH ANTENNA FOR SHORT RANGE APPLICATIONS

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ABSTRACT

The rapid increase in communication standards has lead to great demand for antennas with low profile, size, and low cost of fabrication and ease of integration with feeding network.

In this paper, a light weight, compact, Micro strip patch Antenna of H-shape is proposed which is easy to integrate and cost effective. The verified parameters of patch antenna makes suitable for short range applications. Micro strip patch Antenna is mostly known for their versatility in terms of possible geometries that makes them applicable for different situations.

Patch antenna has a narrow bandwidth hence has a complexity in tunings. So there is a requirement to increase the bandwidth of patch antenna. In order to enhance the bandwidth, the design of small sized, low profile antenna is proposed for short range applications with coaxial feeding technique.

An soft HFSS employees the Finite Element Method (FEM), adaptive meshing and brilliant graphics to give unparallel performance and insight to all of the 2D and 3D EM problems. This paper presents a rectangular micro strip antenna with FSS and slotted patch to enhance bandwidth of 2.35GHz simple H-shaped rectangular micro strip patch.

KEYWORDS: *Micro strip antenna, coaxial feeding, Short range applications.*

1. INTRODUCTION

Antennas play a very important role in the field of wireless communications. Some of them are parabolic reflectors, patch antennas, slot antennas, and folded dipole antennas with each type having their own properties and usage. It is perfect to classify antennas as the backbone and the driving force behind the recent advances in wireless communication technology.

Micro strip antenna technology began its rapid development in the late 1970s. By the early 1980s basic Micro strip antenna elements and arrays were fairly well establish in term of design and modelling. In the last decades printed antennas have been largely studied due to their advantages over other radiating systems, which include: light weightiness, reduced size, low cost, conformability and the ease of integration with active device. A Micro strip patch antenna consists of a radiating patch on one side of a dielectric substrate which has a ground plane on the other side as shown in figure 1. The patch is generally made of conducting material such as copper or gold. The radiating patch and the feed lines are usually photo etched on the dielectric substrate. Micro strip patch antennas radiate primarily because of the fringing fields between the patch edge and the ground plane. Therefore, non-contacting. In the contacting method, the RF power is fed directly to the radiating patch using a connecting element such as a Micro strip line or probe feed. In the non-contacting scheme, electromagnetic field coupling is done to transfer power between the Micro strip line and the radiating patch this includes proximity feeding and aperture feeding. Micro strip antennas are characterized by a larger number of physical parameters than conventional microwave antennas. They can be designed to have many geometrical shapes

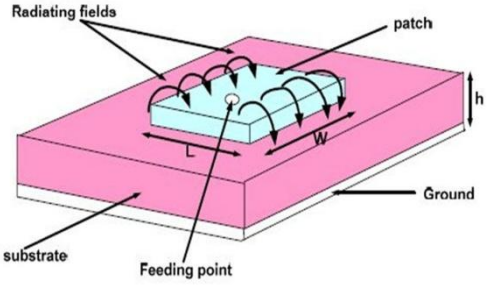

Figure 1: Micro strip patch Antenna

and dimensions but rectangular and circular Micro strip resonant patches have been used extensively in

many applications. In this paper, the design of probe feed H-shaped rectangular Micro strip antenna for short range applications is presented and is expected to operate within 2GHz - 2.5 GHz frequency span. This antenna is designed on a Rogers Duroid 5880 epoxy and its performance characteristics which include return loss, VSWR, and input impedance are obtained from the simulation.

2. ANTENNA GEOMETRY

The structure of the proposed antenna is shown in Figure 2.

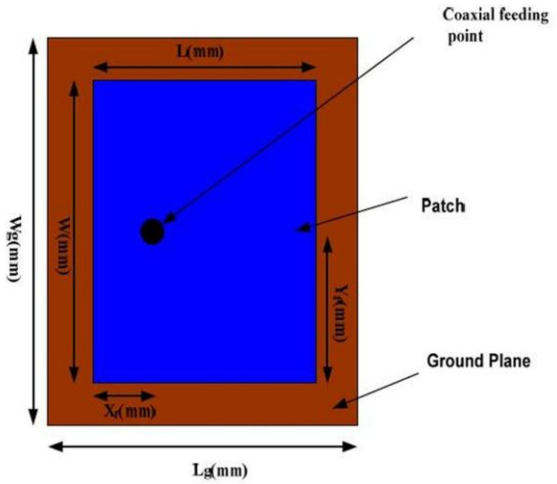

Figure 2: Dimensions of Rectangular patch Micro strip Antenna

For this patch, the length L of the patch is usually 0.3333λ< L< 0.5λ, where λ is the free-space wavelength. The patch is selected to be very thin such that t <<λ, where t is the patch thickness. The height h of the dielectric is usually 0.003λ<= h<= 0.05λ. Thus, a rectangular patch of dimension 40.1mm×31mm is designed on one side of Rogers Droid 5880 substrate of thickness 1.6mm and relative permittivity 4.4 and the ground plane is located on the other side of the substrate with dimension 50.32mm x 41.19mm. The antenna plate is fed by standard coaxial of 50λ at feeding location of 11.662mm by 20.286mm on the patch. This type of feeding scheme can be placed at any desired location inside the patch in order to match with the desire input impedance and has low spurious radiation.

3. PHYSICAL PARAMETERS OF ANTENNA

Antenna parameters can be calculated by the transmission line method.

3.1. Width of the patch

The width of the antenna can be calculated by the formula:

$$W = \frac{C}{2f_o\sqrt{\frac{\epsilon_r+1}{2}}}$$

3.2. Length of the patch

Length of the patch is given by

$$L = \frac{\lambda_0}{2} - 2\delta L$$

Where, δL is the dimension of the patch along its length that has been extended on each end.

3.3. Feed point

The feed position is given by (X_f, Y_f) where X_f and Y_f are given be equations:

$$X_f = \frac{L}{2\sqrt{\epsilon_{reff}}}$$

And

$$Y_f = \frac{w}{2}$$

3.4. Ground Plane Dimension

The ground plane dimensions is given by

$L_g = 6h + L$

$W_g = 6h + W$

3.5. Antenna Dimensions

The designed parameters and its dimensions are given in table 1:

Table 1Antenna dimensions

Parameters	Dimensions
Length	10cm
Width	9cm
Thickness	0.32cm
X size	4cm
Y size	3cm

4. SIMULATION RESULTS

The antenna is designed using an soft HFS simulator and the designed antenna is shown in figure 3.

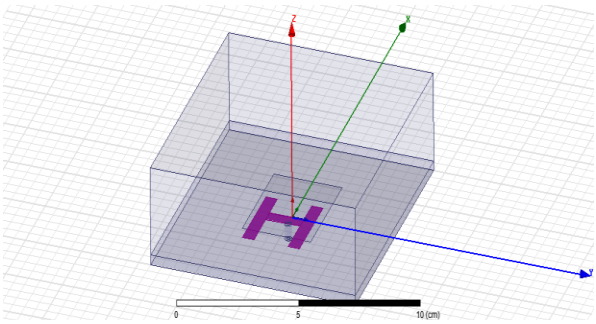

Figure 3: Design of H-Shaped Micro strip patch Antenna

4.1. Radiation Pattern

The radiation pattern obtained for the designed antenna is shown in figure 4:

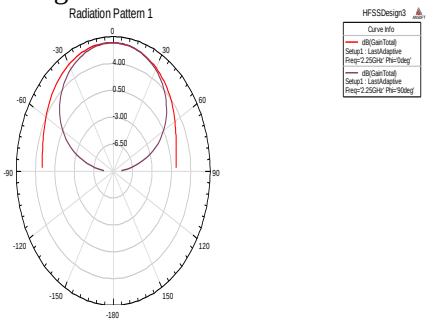

Figure 4: The radiation pattern for H-Shaped Micro strip patch antenna

4.2. Rectangular Plot

The rectangular plot for the micro strip patch antenna is shown in figure 5. It shows that the designed antenna operates at a frequency of 2.35GHz.

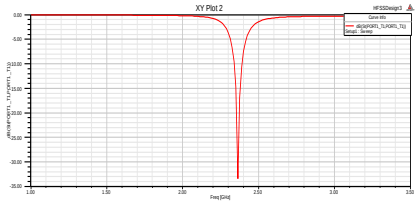

Figure 5: Rectangular plot of H-Shaped micro strip patch antenna

4.3. Polar Plot

The Polar plot for the micro strip patch antenna is shown in figure 6.

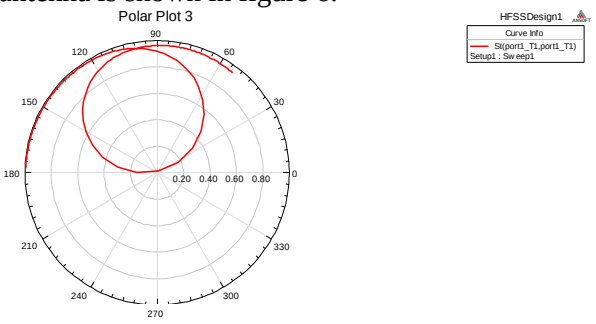

Figure 6: Polar plot of H-shaped Micro strip patch antenna

5. CONCLUSION

Thus an H-shaped Micro strip Patch Antenna at operating frequency 2.35GHz which is suitable for short range applications has been designed.

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