A NEW SINGLE BAND MICROSTRIP U-SHAPE PATCH ANTENNA

K HIMABINDU[1], S DHANASRI[2], G S ANIL KIRAN[3] and N JAYA BHARGAVI[4]
1Student, Dept of ECE , Aditya College of Engineering, Madanapalle. Email: himabindhu430@gmail.com
2 Student, Dept of ECE, Aditya College of Engg., Madanapalle. **Email:**s.dhanasri422@gmail.com
3 Student, Dept. of ECE, Aditya College of Engg., Madanapalle. **Email:**anilkiran403@gmail.com
4 Student, Dept. of ECE, Aditya College of Engg., Madanapalle. **Email:sai.bhargavi341**@gmail.com

ABSTRACT

Antenna plays a major role in wireless communications. The type of antenna includes parabolic reflectors, patch antennas, slot antennas, folded dipole antennas etc. Among those, most useful antennas at microwave frequencies (f>1GHz) are micro strip antennas also called patch antennas with a metal patch on top of grounded dielectric substrate. The patch may be in variety of shapes but rectangular and circular are most common.

In this paper the design of a new single band u-shaped micro strip patch antenna to operate at frequency of 2 to 3GHz with the thickness of 1.6mm and Rogers RT/duroid 5880 (tm) substrate with a dielectric constant which is approximately 4.4 is proposed. The feeding technique that offers an excess bandwidth of about hundreds of Mega Hertz is also proposed.

The simulation by using Ansoft HFSS verifies the parameters of the antenna. The antenna performance characteristics such as input impedance, VSWR, Return loss and current density are verified.

Keywords: Microstrip antenna, coaxial feeding ,HFSS

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.

Microstrip antenna technology began its rapid development in the late 1970s. By the early 1980s basic microstrip 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 (Pozar et al 1995). A microstrip 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. By using the patch the single band operation of the antenna is achieved. In general the single resonant frequency is associated with the size of the square patch.the single microstrip antenna with optimum dimensions has been fabricated as shown below fig

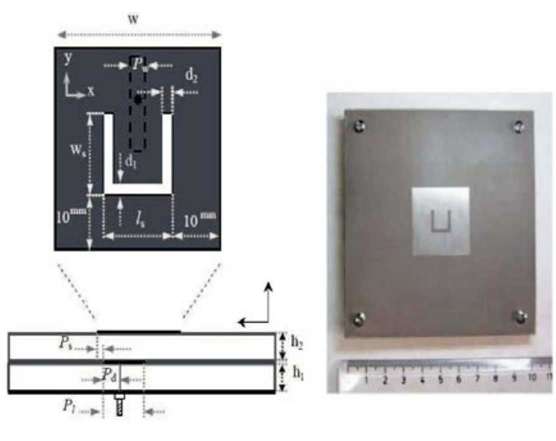

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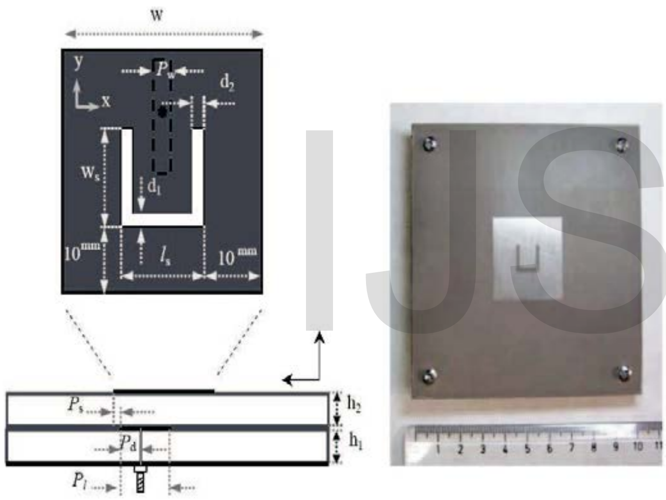
Figure 1: Microstrip U-shape patch Antenna

Microstrip antennas are characterized by a larger number of physical parameters than conventional microwave antennas. They can be designed to have many geometrical shapes and dimensions but rectangular and circular microstrip resonant patches have been used extensively in many applications. In this paper, the design of probe feed of a single U-shape microstrip antenna is for wireless applications is presented and is expected to operate within 2ghz - 3ghz frequency span. This antenna is designed for increasing the return loss, radiation pattern and bandwidth.

2. ANTENNA CONFIGURATION

The configuration of the microstrip antenna is shown in below figure2:



The substrate used for this design is RF-35 with relative permittivity of 3.5,loss tangent of 0.0018 and thickness of h1=h2=1.524mm.Dimensions of the ground plane are also 100mmX100mm.The optimum values of the structural parameters of the antenna are as follows.

w=30mm,ws=10mm,ls=10mm,d1=1.5 mm,d2=1.5mm

Pl=15mm,Pw=2.5mm,Ps=1.75mm,Pd= 7.05mm

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 dimensions 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

Parameter	Dimension
Length	40mm
Width	30mm
X_f	20.39mm
Y_f	15mm
L_g	58mm
W_g	48mm

4. SIMULATION RESULTS

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

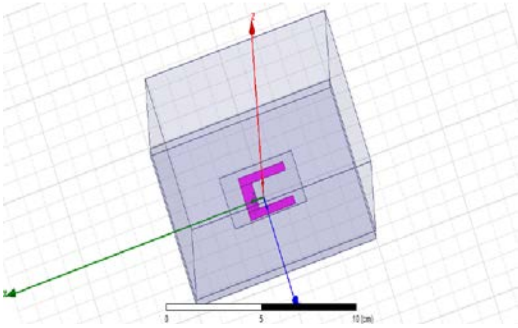


Figure 3: Designed Micro strip patch Antenna

4.1. Radiation Pattern

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

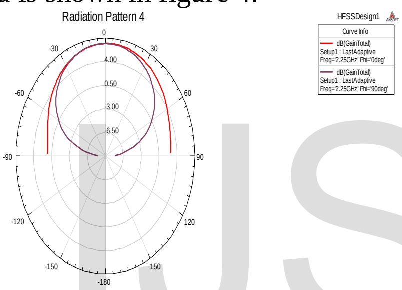


Figure 4: The radiation pattern for microstrip patch antenna

4.2. Rectangular Plot

The rectangular plot for the microstrip patch antenna is shown in figure 5. It shows that the designed antenna operates at a frequency of 2.36GHz.

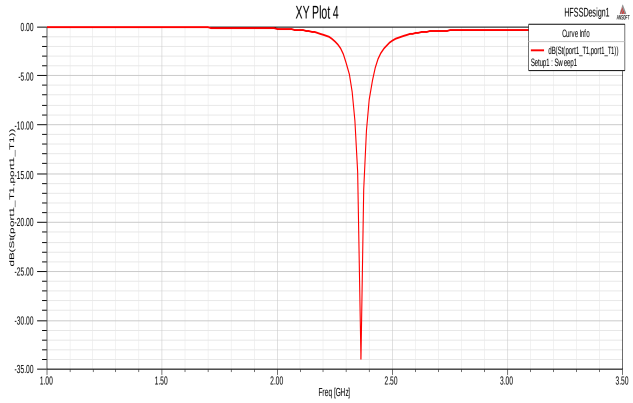


Figure 5: Rectangular plot of microstrip patch antenn

5. CONCLUSION

In this paper, the design of a new single band U-shaped patch antenna is presented that can operate at a frequency of 2.25GHz that gives better return loss, radiation pattern.

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