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MULTI-SLOT MICROSTRIP PATCH ANTENNA FOR MULTI-BAND APPLICATION

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Abstract: This paper proposes the micro strip antenna with multi-slot that can operated at 4 GHz. In this proposed method, h-slot and u-slot slots are considered and build on micro strip patch antenna. This process and simulation is done by using HFSS software. This proposed antenna of size 30mm x 35mm x 1.6mm, contains partial ground with dielectric medium and micro-strip patch antenna of rectangular shape .FR-4epoxy is used as dielectric material. This proposed antenna can achieve 19.920 dB and very good radiation pattern

Keywords: dielectric medium, HFSS software, micros trip patch

I. INTRODUCTION

Now a days wireless communication has created a large demand for wide band antennas as it satisfy the high gain and less bandwidth requirement and it covers wide information with all frequency ranges[1,3]. In the year of 2002, the federal commission has approved ultra-wideband technology with frequency range of 1-10GHz and the radiated power of 3dbm/MHz and the data rate of 110-200 Mbps for a distance of up to 10m. The advantages of using ultra-wideband technology is it has high data rate, less noise , minimum interface, high security, less complexity and low cost [2].

It is used in many different applications like Medical, Measuring instruments and military purposes. The ultra-wideband patch antennas can be made with different designs and with different dimensions depending upon the requirement [1]. They can be of many shapes circular, ellipse, triangle, strip type, rectangle. In this project we have used a rectangular shaped which helps to get the better results according to our desired output, as the rectangular slot can improve the bandwidth [4]. The main aim of the researchers is have band rejection capabilities for an ultra-wideband antenna in order to avoid the interface that occurs from the narrow band caused by the present antennas. This can be happened by using slots or patches or feeds or by the ground plane of different shapes. It can also be done by placing quarter wavelength slits. The patch antenna is associated with a small strip and aligned at angle of degree for radiation, these are made up of very small strips, using strip technique on a printed circuit board [5]. These antennas are widely used at microwave frequency ranges, these are of kind inbuilt antennas. The micro strip antennas has a patch which is made of thin metal plate which is placed on the top of the printed circuit board, and in the opposite side thin metal plate placed. Many strip antennas consist of number of patches with many dimensional arrays. The patch antenna is connected to either transmitter or receiver with the help of thin metal plate of conducting lines. When the voltage is applied between the antenna and the plane there is a signal received or transmitted.

This small patch antennas are becoming trending in the present years as they are very thin with easy accessible , which can be used easily in wide applications of medical instruments, in the clothing and in the aircraft and rockets. The use of the printed circuit board techniques has convenient and affordable. In this we can also add active components to have active antenna.

II. Antenna Dimensions:

The multi slot micro strip antenna upward view is shown in fig.1 The antenna dimensions of substrate is 30mmX35mm .The micro strip patch antenna is of width =15 mm and length=14.5 mm then the micro strip feedline is of $w_f=2.85$ mm and $l_f=13.5$ mm.The partial ground is of $w_g=30$ mm length $l_g=12.5$ mm.In the rectangular antenna. we take the side cuts in the rectangular micro strip patch antenna because the magnetic fields many causes the fringing fields .The cuttings are taken four sides of rectangular patch with $L_{cut}=L/W_{cut}=L/D$. All the curves are of equal cuts .The H-slot dimension are $C1 =7.77$ mm, $C2 =5.7$ mm, $C3 = 3.8$ mm, $D1= 1$ mm and $T1= 0.37$ mm.The U-slot dimension are $S1 = 5.63$ mm, $S2= 1.45$, $t1 = 0.31$ and $d1= 5$ in fig.2

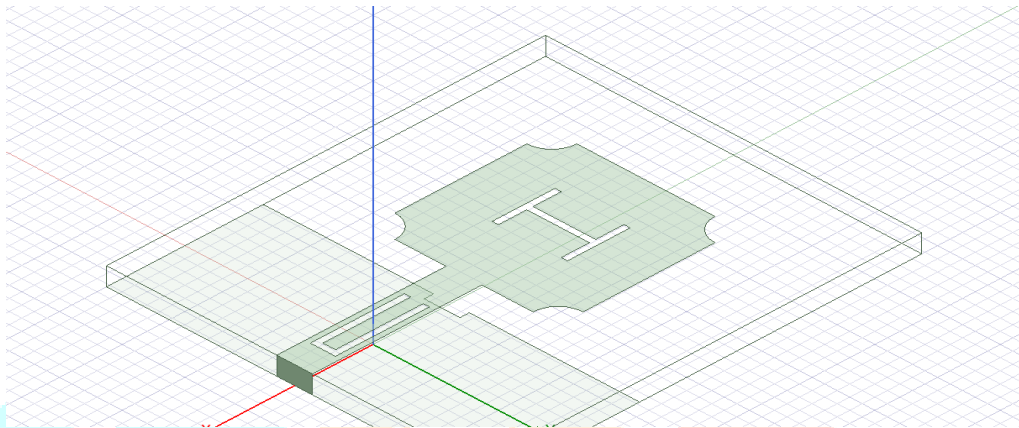


Fig 1: Top view of multi-slot micro strip patch antenna in HFSS

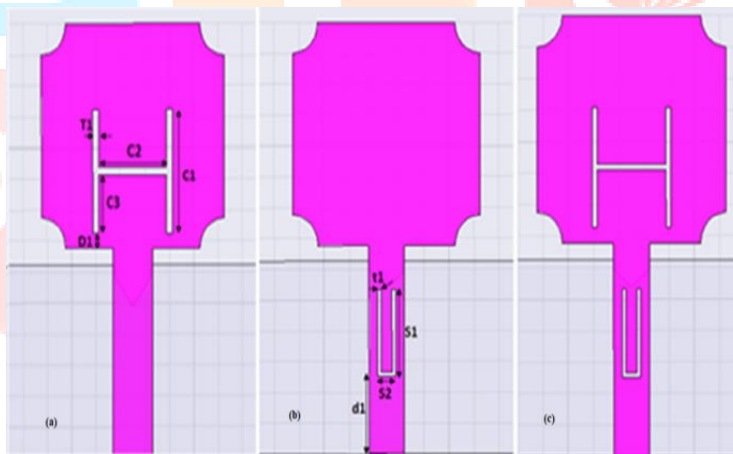


Fig 2: dimensions of H-slot and U-slot

The dimensional values of the proposed antenna design are represented in figure 2.

III. Design steps:

Figure 2 shows the design steps of the proposed micro patch antenna. At first step the ground is placed and the material is perfect E. And at second step the substrate material is FR4-Epoxy then after all the slots are placed then we give the material to patch as well as the feed line .The patch material is perfect E and feed line material is lumped port.

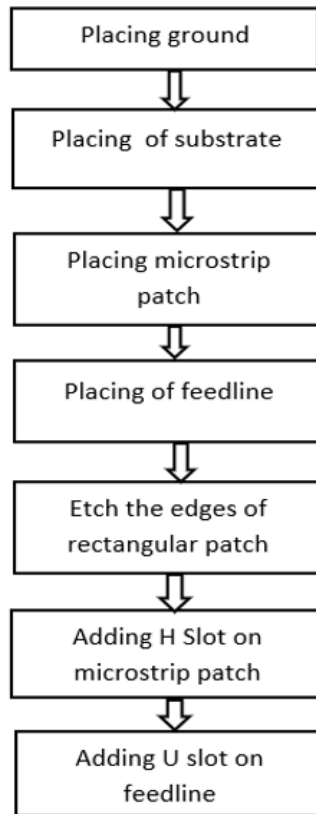


Fig. 3. Flow chart of the design step

IV Results:

The results of the proposed technique are discussed with the help of S Matrix and Radiation pattern.

S-parameter

In general, scattering parameter (S Parameter) is the graph drawn between the frequency (in GHZ) at x-axis and return loss (in dB) at y-axis which is shown in figure 4.

In s-parameter we have calculated return loss values is taken form the graph and reflection losses is taken form the reference table by using reflection losses

Bandwidth is calculate by frequency f2 and f1

$$B.W = f2 - f1 = 4.3-3.3 = 1.1GHZ$$

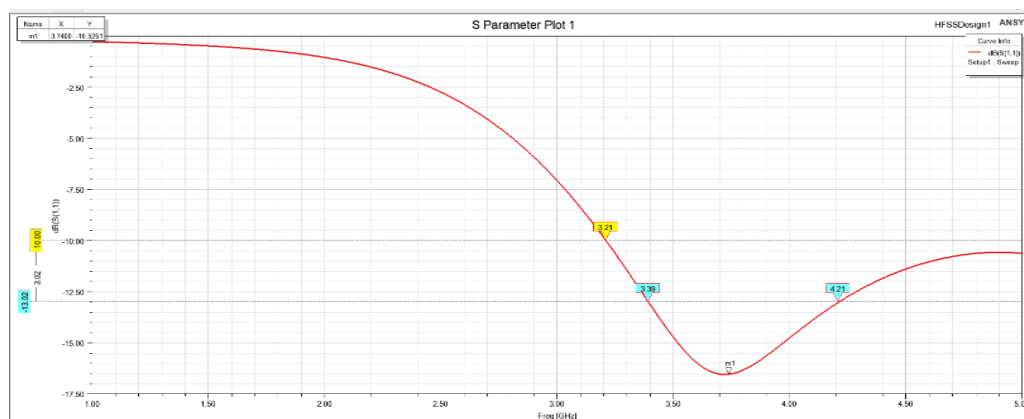


Fig: 4 S-parameter

The upper and lower cut-off frequencies are represented by blue dots in the figure 4.

Radiation pattern of antenna:

The radiation pattern is Omni directional .the radiation at red colour is high (i.e. maximum radiation) as the colour changing for red to blue colour the radiation is becomes low radiation. A plot of the gain as a function of direction is called the gain pattern or radiation pattern

$$\text{Gain} = 20 \log (\text{output voltage} / \text{input voltage})$$

Fig-5 Radiation pattern

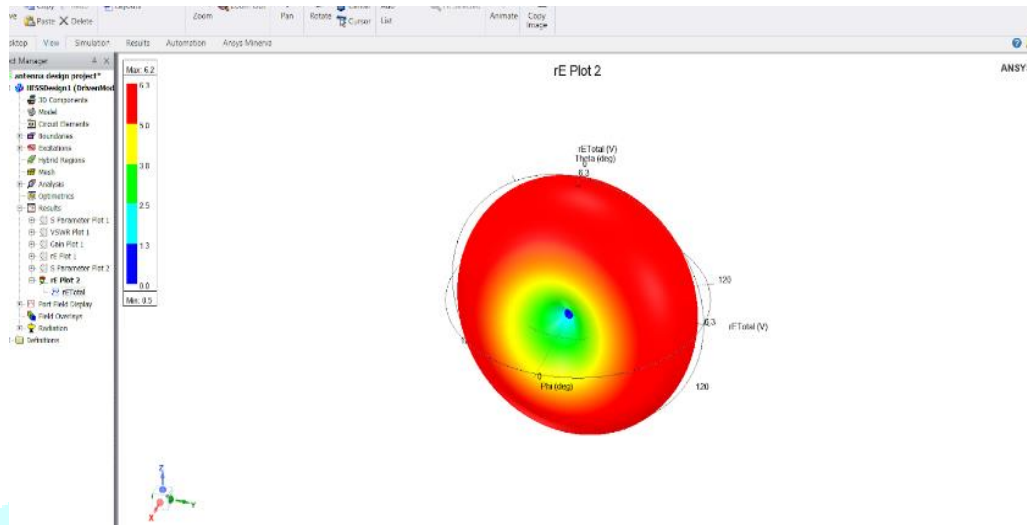


Table 1 shows the parameters and their values considered in the proposed multi-slot antenna.

Parameters	Values
Return loss	-16.526
Reflect loss	2.34
Radiation pattern	97.78%
Gain	97.78% (or) 19.920 dB
Bandwidth	1.1GHz

Conclusion:

Multi-slot micro strip patch antenna for multiband application is presented in this paper. As the name describe about multi slot here we have used two slots. The antenna size is of 30mm x 35mm x 1.6mm. These antenna radiates omnidirectional so it can be used wide range of applications. The operating frequency ranges are of 4GHz. This antenna has high gain and good radiation pattern. As the size of the antenna is very small it is convenient to use in multiband application like WIFI, WIMAX and Mobile antenna.

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