DESIGN AND ANALYSIS OF REDUCED SIZE H-CUT SHAPE MICROSTRIP PATCH ANTENNA

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ABSTRACT

Size reduction of microstrip antenna is very important design consideration. In this paper, I can design H-Cut shape microstrip patch antenna and hence the size of the antenna is reduced compared to an ordinary microstrip antenna with the same resonating frequency here, I can use 2.4GHz frequency for design of antennas. The antenna is simulated using High Frequency Structure Simulator (HFSS). The parameters like VSWR, Return loss, radiation pattern of ordinary microstrip antenna and H-Cut Microstrip Patch antenna are compared.

Keywords: Microstrip Patch Antenna, H-Cut Shape Patch Antenna, Hfss, Vswr, Return Loss, Radiation Pattern.

I INTRODUCTION

Microstrip antenna has many advantages like low cost, less size, light weight, dual and triple frequency operation. Because of less size of microstrip antenna it is used in many wireless applications like satellite communication system, Personal communication system and other wireless applications. In this paper, the main task is to implement more reduced sized microstrip patch antenna without degrading its radiation characteristics, VSWR, Return losses. During period of work first the ordinary microstrip antenna is designed for 2.4GHz then this antenna is simulated by using HFSS software. Then in next step the ordinary patch antenna is modified without changing its length and width and then again this antenna is simulated. Here, I can saw that the resonant frequency of modified antenna is reduced to 1.7GHz. But here I want to design the antenna for wireless band so in next step the Length and width of patch is reduced in such a way that antenna is operated in 2.4GHz band of frequency.

II DESIGNS AND ANALYSIS

The dimensions of the patch along its length have now been extended on each end by a distance ΔL, which is given empirically as: The effective length of the patch Leff now becomes:

$$L_{eff} = L + 2\Delta L$$

For a given resonance frequency f_0, the effective length is given by as:

$$L_{eff} = \frac{c}{2 f_o \sqrt{\varepsilon_{reff}}}$$

For a rectangular Microstrip patch antenna, the resonance frequency for any TMmn mode is given by as:

$$f_o = \frac{c}{2\sqrt{\varepsilon_{reff}}}\left[\left(\frac{m}{L}\right)^2 + \left(\frac{n}{W}\right)^2\right]^{\frac{1}{2}}$$

Where m and n are modes along L and W respectively. For efficient radiation, the width W is given as;

$$W = \frac{c}{2f_o\sqrt{\frac{(\varepsilon_r + 1)}{2}}}$$

2.1 Ordinary Antenna

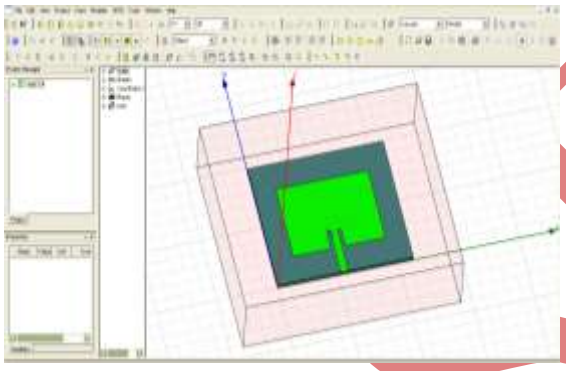

Figure 1.1 Simulation of Microstrip patch antenna at 2.4GHz frequency

Table 1: Antenna Dimension at 2.4GHz

PARAMETER	LENGTH	WIDTH	HEIGHT
SUBSTRATE	40MM	46MM	1.6MM
PATCH	28.9MM	38MM	0.05MM
FEED-LINE	10MM	5MM	0.05MM

The return loss for micro strip patch antenna is found to be -10dB as shown in Figure 1.2

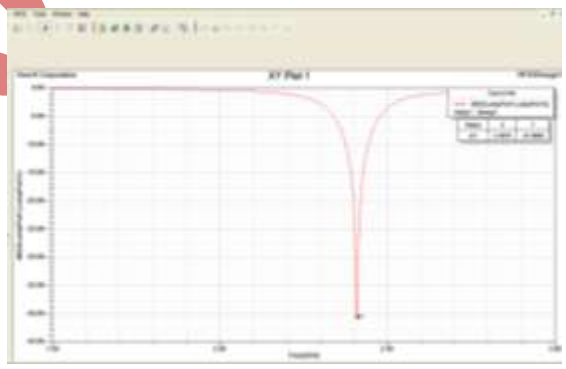

Figure. 1.2 Return Loss

Figure 1.3 Shows the 2 D Radiation Pattern of the Antenna.

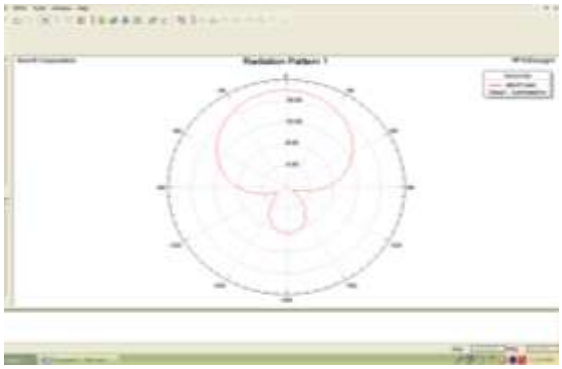

Figure 1.3 2D Radiation Patterns

Here ordinary antenna is design in HFSS software for AWS band fig. shows the radiation pattern, Return loss and VSWR of antenna and table shows the dimensions of the width length of patch here FR4 material is use as a dielectric because it has less cost. The height of FR4 is 1.5mm.Here substrate width=46mm and substrate length=40mm.

2.2 Ordinary Antenna is modified without Changing its Dimension (Cut)

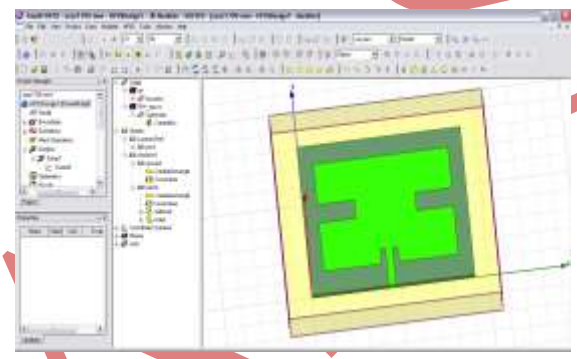

Figure 2.1 Simulation of Microstrip patch antenna at 1.7GHz frequency

Table 2: Modified Antenna Dimensions

ANTENNA WIDTH	38mm
ANTENNA LENGTH	28.9mm
SUBSTRATE HEIGHT	1.6mm

Here I can convert the ordinary antenna in to H Cut shape antenna without changing the dimensions of the antenna but because of this the resonant frequency of antenna is shifted to the 1.7 GHz approximately the figure shows the VSWR and return loss of the antenna.

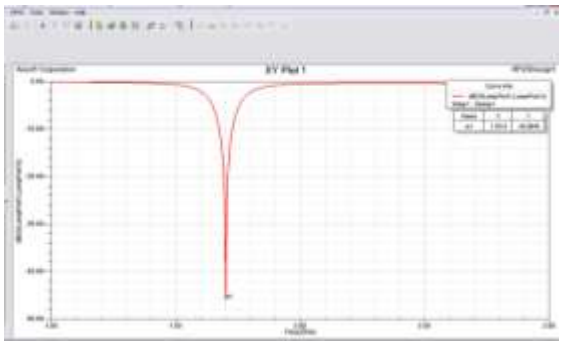

Figure 2.2 Return Loss

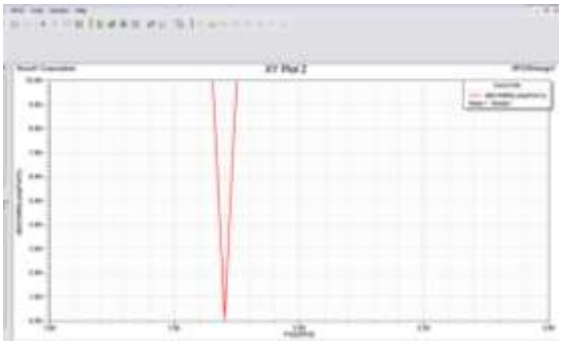

Figure 2.3 VSWR

2.3 Reduced size H-Cut Antenna

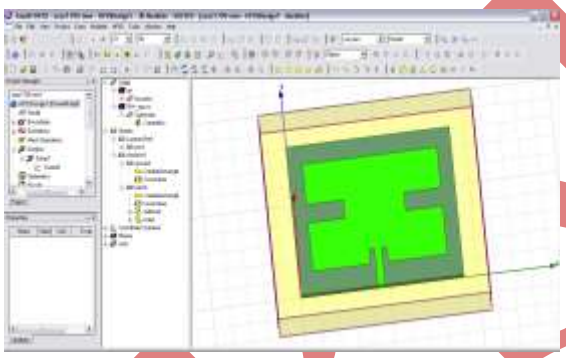

Figure 3.1 Simulation of Microstrip Patch Antenna With Reuced Size

Table 3: Modified Antenna Dimensions

ANTENNA WIDTH	27.25mm
ANTENNA LENGTH	23.9mm
SUBSTRATE HEIGHT	1.6mm

Here the width and length of patch is reduced this change in length is shown in table. And this antenna has resonating frequency 2.4GHz this is shown in VSWR and Return loss graph. Here substrate width is reduced to the 43mm and substrate length is reduced to the 38mm so total size and material cost of the antenna is reduced here.

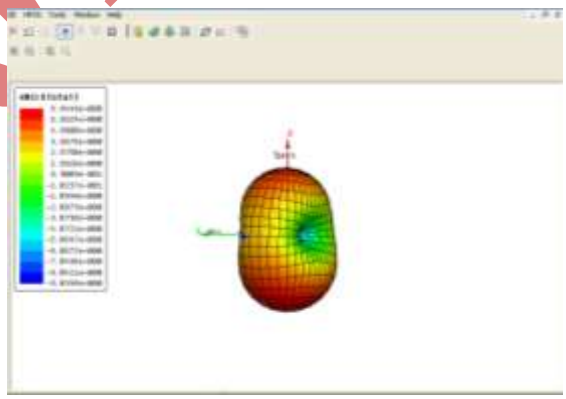

Figure 3.2 Radiation Pattern

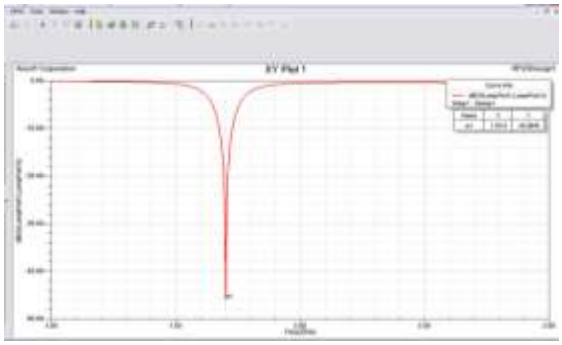

Figure 3.3 Return Loss

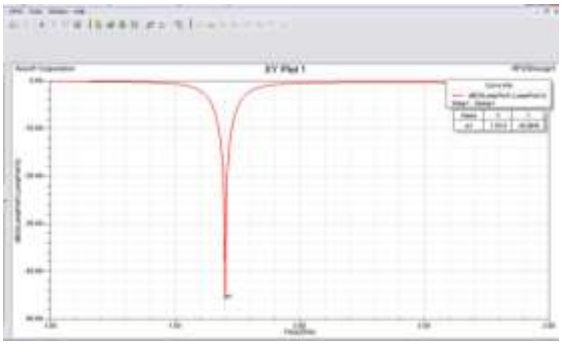

Figure 3.4 VSWR

III. CONCLUSION

This paper represents optimum design of rectangular microstrip patch antenna and here we say that if the rectangular microstrip patch antenna is converted into H- Cut shape antenna then size and cost of the antenna is reduced. The formulae for designing antenna are mentioned in paper. The results are simulated in HFSS.

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