ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 6, June 2014

Development of Trapezium Cut Shape Rectangular Microstrip Patch Antenna & Compare with Normal Microstrip Patch Antenna

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ABSTRACT: In this paper, we developed a trapezium cut shape microstrip patch antenna for the performance comparison with the normal microstrip patch antenna using the spectrum analyzer. The return loss of cross cut shape microstrip patch antenna designed at the resonant frequency of 2.41 GHz has been compared with the normal microstrip patch antenna at a substrate height of 1.58 mm. We get improvement in return loss. This paper shows the faithful return loss means we get dual band operation for the cross cut shape on the patch side and a very good practically value of VSWR obtain at the 2.41 GHz resonant frequency. These structures are simulated using IE3D version 12.29 Electromagnetic simulator of Zeland software incorporation.

KEYWORDS: Trapezium cut shape Rectangular Microstrip Patch Antenna, Return Loss, VSWR

I.INTRODUCTION

In the present era of wireless communication systems, RMPA plays a very important role. In modern wireless communication systems, the microstrip patch antennas are commonly used in the wireless devices. Therefore, the miniaturization of the antenna has become an important issue in reducing the volume of entire communication system.To meet these requirements, microstrip antennas can be used. Microstrip antennas are largely used in many wireless communication systems because of their low profile and light weight. In spite of having a lot of advantages (low profile, low cost and Omni directional radiation patterns etc.), it hassome drawbacks like narrow bandwidth and low gain.These antennas is conformable to planar and non-planar surfaces, simple and inexpensive to manufacture using modern printed-circuit technology, mechanically robust when mounted on rigid surfaces, compatible designs, and when the particular patch shape and mode are selected, they are very versatile in terms of resonant frequency. The currently popular antenna designs suitable for the applications of wireless local area network (WLAN) and world-wide interoperability for microwave access.

II. DESIGN SPECIFICATION

To design the patch antenna some parameters are necessary Such as – resonant frequency, dielectric constant, substrate Height. By using below mentioned formulas we are calculating the patch length, width, effective length, effective dielectric constant etc.

A. WIDTH OF METALLIC PATCH (W)

$$W = \frac{c}{2f_o\sqrt{\frac{(\varepsilon_r + 1)}{2}}} \tag{1.1}$$

Where,
c = free space velocity of light
ε_r = Dielectric constant of substrate

The effective dielectric constant of the microstrip antenna to account for fringing field is calculated from:

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$$\varepsilon_{reff} = \frac{\varepsilon_r + 1}{2} + \frac{\varepsilon_r - 1}{2}\left[1 + 12\frac{h}{W}\right]^{-\frac{1}{2}} \tag{1.2}$$

Length of metallic patch (L)

L = L_{eff} – 2ΔL ,

Where

$$L_{eff} = \frac{c}{2 f_o \sqrt{\varepsilon_{reff}}} \tag{1.3}$$

B. CALCULATION OF LENGTH EXTENSION

$$\Delta L = 0.412h \frac{(\varepsilon_{reff} + 0.3)\left(\frac{W}{h} + 0.261\right)}{(\varepsilon_{reff} \quad 0.258)\left(\frac{W}{h} + 0.8\right)} \tag{1.4}$$

C. FEEDING TECHNIQUES

Microstrip patch antennas can be fed by a variety of methods. These methods can be classified into two categories- contacting and non-contacting methods. The RF power is fed directly to the radiating patch using a connecting element such as a microstrip line. In the non-contacting scheme, electromagnetic field coupling is done to transfer power between the microstrip line and the radiating patch . The four most popular feed techniques used are the microstrip line, coaxial probe (both contacting schemes), aperture coupling and proximity coupling (both non-contacting schemes).

D. METHOD OF ANALYSIS

There are many methods of analysis for microstrip antenna. The most popular models are the transmission-line, cavity and full-wave. The transmission-line model is the easiest of all, it gives good insight and it is adequate for most engineering purposes and requires less computation. However, it is less accurate. The cavity model is more accurate and gives good physical insight but is complex. The full-wave models are very accurate, very versatile, and can treat single elements, finite and infinite arrays, stacked elements, arbitrary shaped elements and coupling. However, they are the most complex models and usually give less physical insight. Here we are using transmission-line model.

III. FIGURES AND TABLES

ABBREVIATION	MEASUREMENT(mm)
LENGTH	38.8
WIDTH	47.4
PATH LENGTH	37
PATH WIDTH	3.009

Leff = c

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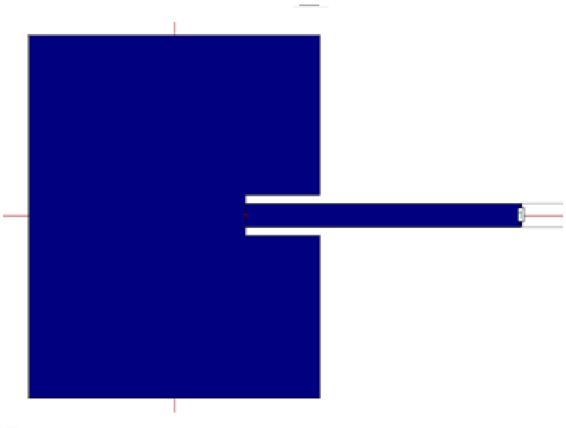

Figure 1: rectangular Microstrip patch Antenna

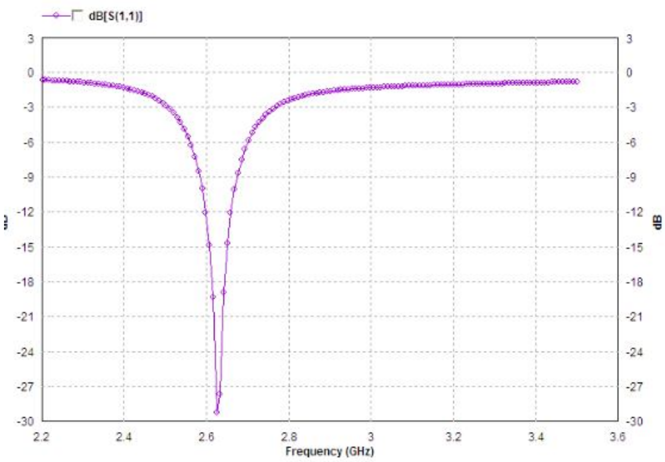

Figure 2: Return loss Of normal rectangular Microstrip Patch Antenna

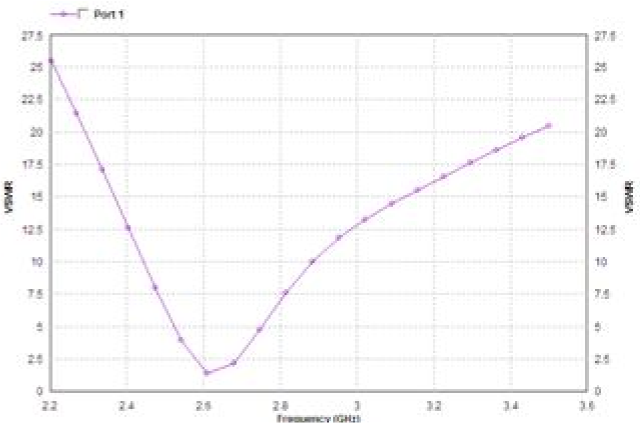

Figure 3: VSWR of rectangular Patch Microstrip Antenna

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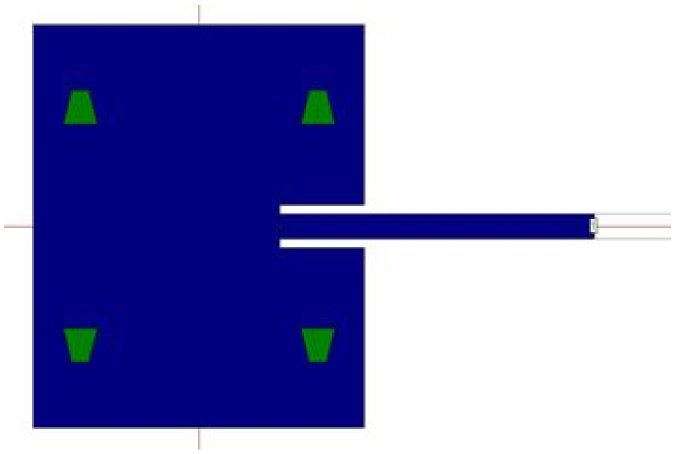

Figure 4: rectangular Microstrip Antenna with trapezium shaped cuts on ground

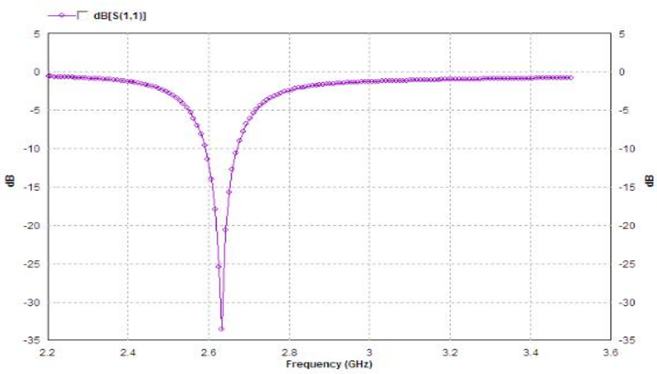

Figure 4: Return loss of rectangular microstrip antenna with trapezium shaped cuts on ground

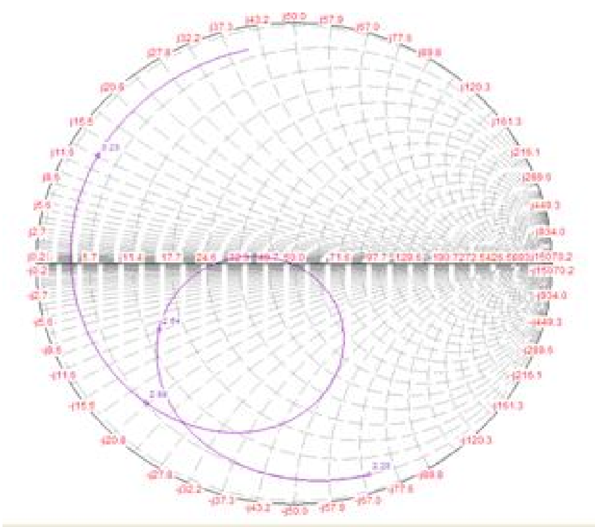

Figure 6: Smith Chart Of rectangular Microstrip Patch Antenna

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IV.RESULT

After designing and simulating the Antenna, ensuring that it operates at the desired frequency and recording its Return Loss. The Rectangular Microstrip Patch Antenna at a height of 1.58 mm from ground plane.. The Return Loss was obtained and been analyzed. The simulated results of rectangular Microstrip Patch Antenna with trapezium cut shape is shown in figure 4 and 2; Trapezium cut shape microstrip patch antenna at 2.41 GHz frequency simulation exhibits shows the return loss of -34dB dB and normal microstrip patch antenna shows another significant return loss of -29dB at same frequency. Other supporting plots for various parameters like VSWR , Smith Chart , are shown here that shows the quality of simulated antenna using metamaterial structure is improving without making variations in other parameters.

V.CONCLUSION

In this paper, we have investigated the enhancement of the rectangular Microstrip Patch Antenna performances using trapezium shaped cuts on ground. We have shown that a trapezium shape cuts on ground result in obtaining **SHARP** return loss at different frequencies. On making some variations in antenna parameters, gain can be improved upto desired limit but some practical limitation should be taken care while simulating the structure on IE3D Simulation Software.

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