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Compact Dual Band Slotted Microstrip Antenna for IEEE802.11b Applications

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Abstract: ***In this paper the slotted design of microstrip patch antenna is used to produce dual wide band which is suitable for IEEE802.11b application. By introducing the parallel slots, the two bands covering the range 2.25-2.55GHz (12.5%) and 1.57-1.68GHz (6.76%) are obtained. The antenna is fed by coaxial probe feeding technique. The microstrip patch is designed on the glass epoxy substrate having dielectric constant 4.2 and simulated on the IE3D Zeland software. It is compact antenna and suitable for the IEEE 802.11b applications. Simulation results with frequency responses and radiation patterns are presented and discussed.***

Keywords: Dual Band, WLAN and Slotted MSA.

I - INTRODUCTION

Microstrip patch antennas are widely used in wireless application due to great advantages such as low-profile, high transmission efficiency, light weight, low profile, conformal and planar structure, compactness, low cost and ease of integration with microwave circuit [1]. Now a days Compact microstrip antennas are getting much more attention due to the increase in demands of small size antennas used in personal and commercial purposes. In order to design a compact microstrip antenna at a fixed operating frequency higher dielectric constant of substrate must be used [2-4].

One more method of reducing the size of an antenna and for improving its performance by applying the meandering method to the ground plane of a microstrip antenna. On comparing with a similar significant patch meandering method for lowering the antenna's fundamental resonant frequency. The impedance bandwidth and antenna gain can be enhanced, which is a great advantage of this kind of ground-meandering method over the patch-meandering method. By stacking a parasitic patch on a microstrip patch antenna, the antenna with high gain or wide bandwidth can be realized. These characteristics of stacked microstrip antenna depend on the distance between a fed patch and a parasitic patch. When the distance is about 0.1λ (wavelength), the stacked microstrip antenna has a wide bandwidth [5].
There are various methods adopted to increase the bandwidth of microstrip antenna such as increase the substrate thickness, use of a low dielectric constant substrate, use of various feeding techniques and impedance matching use of slot antenna geometry and multiple resonators. But the bandwidth and size of the antenna is a mutually conflicting property that is improvement of one deteriorates the characteristics of others. However we have obtained a dual band with good efficiency and radiation characteristics.In this paper a dual band parallel slotted microstrip patch antenna is presented which gives a dual bandwidth of 12.50% & 6.76%.

II – ANTENNA DESIGN

To design the rectangular microstrip patch antenna, the length and the width are calculated as below equations.[1-4]

$$W = \frac{c}{2f\sqrt{(\varepsilon_r + 1)/2}} \qquad (1)$$

Where **c** is the velocity of light, ε_r is the dielectric constant of substrate, *f is* the antenna working frequency, W is the patch width, the effective dielectric constant and the length extension are given as,

$$\varepsilon_{eff} = \frac{(\varepsilon_r + 1)}{2} + \frac{(\varepsilon_r - 1)}{2}\left[1 + 10\frac{h}{W}\right]^{-\frac{1}{2}} \qquad (2)$$

$$\frac{\Delta l}{h} = 0.412 \frac{\left(\varepsilon_{eff} + 0.300\right)\left(\frac{W}{h} + 0.262\right)}{\left(\varepsilon_{eff} - 0.258\right)\left(\frac{W}{h} + 0.813\right)} \quad (3)$$

$$L = \frac{c}{2f\sqrt{\varepsilon_{eff}}} - 2\Delta l \quad (4)$$

In this paper, a compact slotted patch antenna having dimensions L×W has been designed on glass epoxy substrate having dielectric constant equal to 4.2. Figure1 shows the layout of a coaxial probe-feed slotted patch antenna.

First the ground plane of Length L and Width W is made and then a rectangular patch of same dimensions is designed above the ground plane to increase the bandwidth of microstrip antenna. The dual bands are obtained 12.50% and 6.76% which covers frequency range 1.57-1.68GHz and 2.25-2.55GHz.

Table 1. Antenna design parameters

Parameters	Value (mm)
ε_r	4.2
h	1.6
W	79
L	53
L_1	37
W_1	05
W_2	05

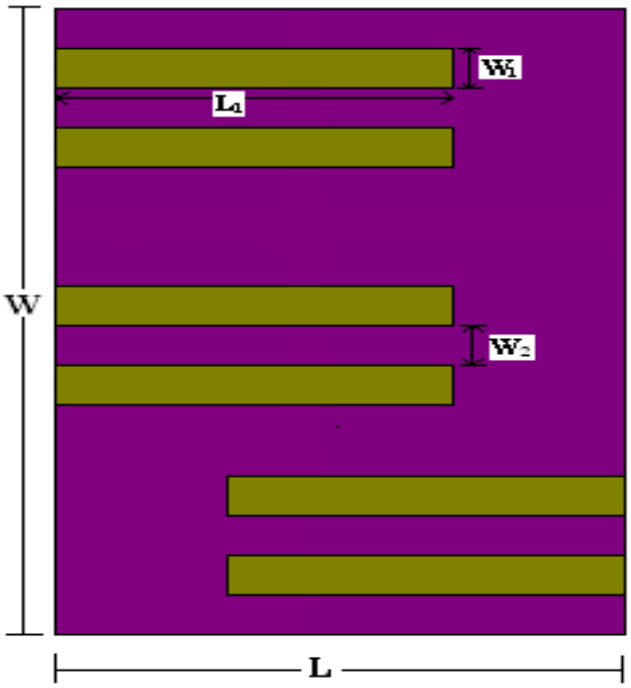

Figure 1. Geometry of proposed microstrip antenna.

III – RESULTS AND DISCUSSIONS

The resonant properties of the proposed antenna have been shown in figure 2 which shows the return loss graph of proposed microstrip antenna. The slotted antenna resonate at 1.65 GHz & 2.30 GHz frequency giving bandwidths of 12.5% and 6.76% (at- 10db Return loss & VSWR < 2).The proposed antenna gives a appreciably good efficiency of about 99%. Radiation characteristics of the proposed antenna are also better than the conventional microstrip antenna.
The proposed antenna is designed using slotted configuration to give broad dual bandwidths of 12.5% and 6.76%.The simple coaxial vertical probe feed is used as a feeding technique.

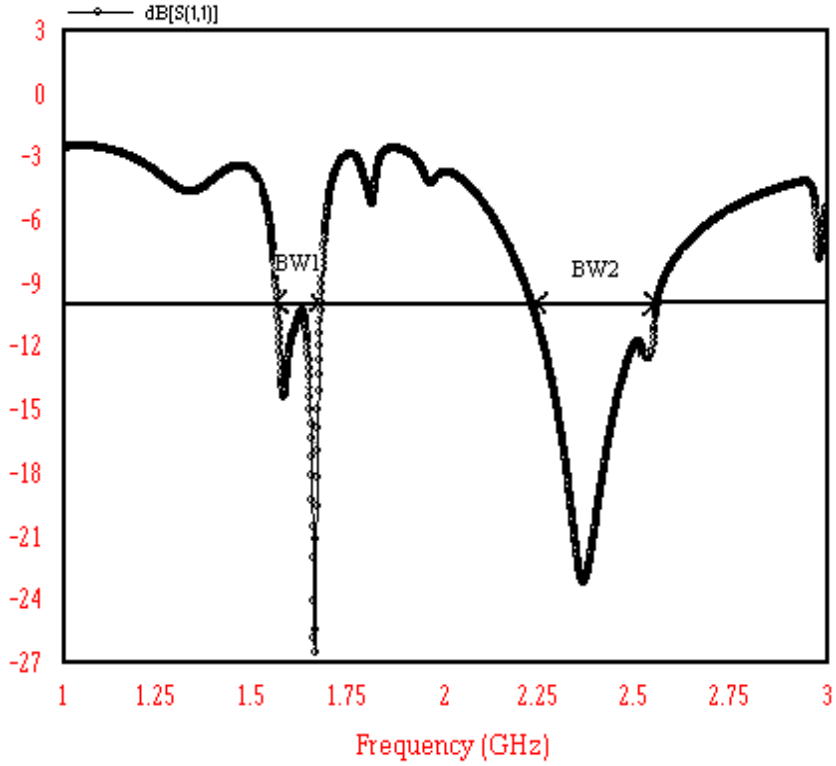

Figure 2. Return lossVs frequency plot of slotted microstrip antenna.

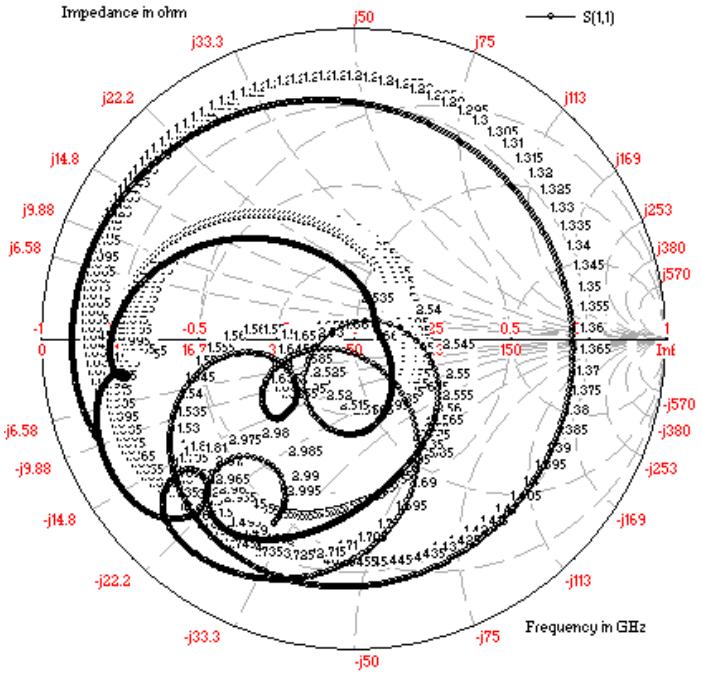

Figure 3. VSWR Vs frequency of slotted microstrip antenna.

IV – CONCLUSION

A dual band slotted microstrip antenna on glass epoxy substrate of dilectric constant 4.2 has been designed. Main parameters such as return loss, impedance bandwidth, gains and radiation patterns have been studied. The proposed antenna is designed using slotted configuration to give broad dual bandwidths of 12.5% and 6.76%.The maximum achievable gain of the designed antenna *is* 6 dBi with a appreciably good efficiency of 99%. The simple coaxial probe feed is used as a feeding technique.

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