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Compact Band Width Enhanced Microstrip Antenna for WLAN Applications

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ABSTRACT

In this paper a novel compact slit loaded inset fed microstrip antenna is presented. The antenna characteristics such as efficiency, radiation pattern and gain are presented in this paper. The proposed microstrip antenna has a wide bandwidth of 77.44% covering the frequency range from 1.099-2.488 GHz and gain of 6 dBi which is suitable for WLAN applications.

Keywords: Inset feed, Wideband, compact patch and Band Width

1. INTRODUCTION

The microstrip patch antennas are widely used in modern communication system due to low profile, low weight, low cost However, the antennas suffered from narrow bandwidth and low gain. Therefore, various techniques have been proposed in the literature to increase the bandwidth. These include cutting slots in the metallic patch in addition to the common techniques which are increasing patch height and decreasing substrate permittivity.

Numerous techniques have been presented to enhance the bandwidth for various communication systems. A single layer wide-band E-shape rectangular patch antenna with achievable good impedance bandwidth has been demonstrated [1] [2] [3].A new inverted multi-slotted shape patch antenna is investigated for the gain and bandwidth enhancement. The design employs the coaxial probe feeding, inverted patch, and multi-slotted patch techniques to meet the design requirement. [6]. While the bandwidth and the size of an antenna are generally mutually conflicting properties, that is, improvement of one of the characteristics normally results in degradation of the other. The antennas with E-H and LEE-H shaped patches have been investigated for 30% and 21.15% bandwidths respectively [7] [8].

In this paper, a novel inset feed patch antenna is investigated for the gain and bandwidth enhancement with compact size. The proposed antenna has been designed on glass epoxy substrate to give a wide bandwidth of 77.44% and maximum radiating efficiency of about 99%. The proposed patch antenna is designed and simulated on the Zealand IE3D software.

2. ANTENNA DESIGN

Figure1 shows Geometry of proposed microstrip antenna. It is seen that similar results for finite and infinite ground plane can be obtained if the size of the ground plane is greater than the patch dimensions.[11][12] Hence, for this design, the ground plane dimensions have given as 100×100mm and patch dimension 35.4×45.6mm.

The three essential parameters for the design of a microstrip patch antenna are frequency of operation (f_o), dielectric constant of the substrate (εr) and height of dielectric substrate (h).The dielectric material selected for proposed design is glass epoxy which has a dielectric constant of 4.4. A substrate with a high dielectric constant has been selected since it reduces the dimensions of the antenna. For the microstrip patch antenna is to be used in cellular phones, it is essential that the antenna is not bulky. [13][14][15] Hence, the height of the dielectric substrate is selected as 1.6mm. Hence, the essential parameters for the design are:

Table 1. Antenna design parameters.

Parameters	Value (mm)
h	1.6
Wg	100
Lg	100
L	35.4
W	45.6
L_2	27.7
W_2	04.0
L_1	02.0
W_1	06.0

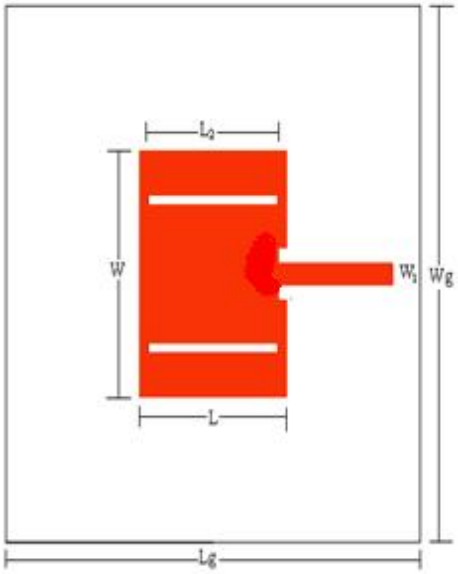

Figure 1: Geometry of proposed microstrip antenna

3. RESULT AND DISCUSSION

Figure 2 shows the return loss plot of proposed microstrip antenna. The proposed antenna resonates at 1.62 GHz frequency giving a wide band width of 77.44%. It is suitable for wide band operation. Figure 3 shows the smith chart & Figure 4 shows the 3D radiation pattern which is obtained from IE3D. Figure 5 shows elevation pattern gain display and Azimuth pattern gain display. The proposed microstrip antenna have high gain up to 6 dBi and good radiation efficiency of about 99% shown in figure 6 & figure 7.

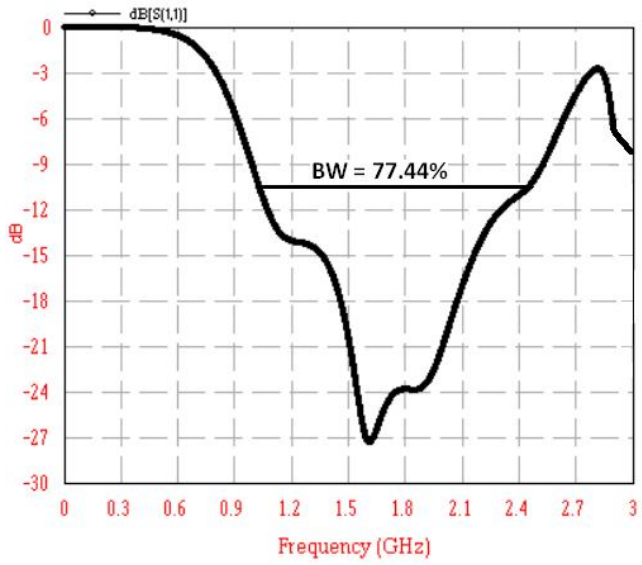

Figure 2: Return loss Vs frequency of proposed microstrip antenna

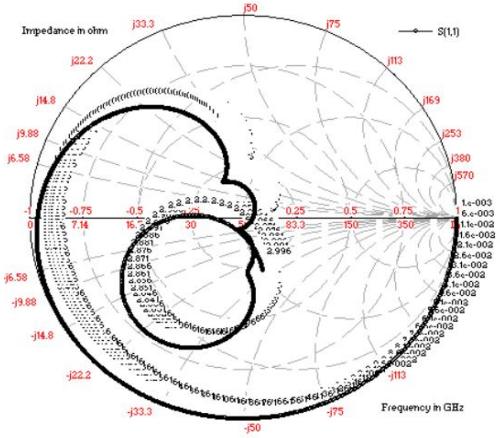

Figure 3: Smith chart plot of proposed microstrip antenna

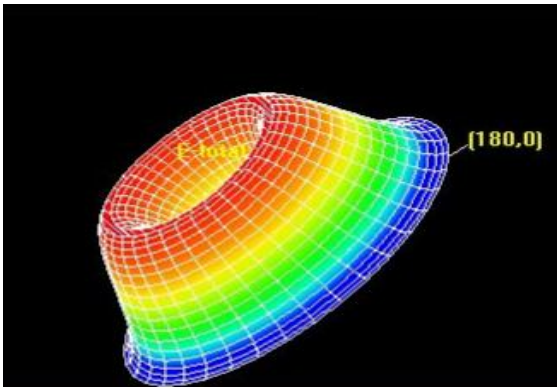

Figure 4: 3D radiation pattern of proposed microstrip antenna

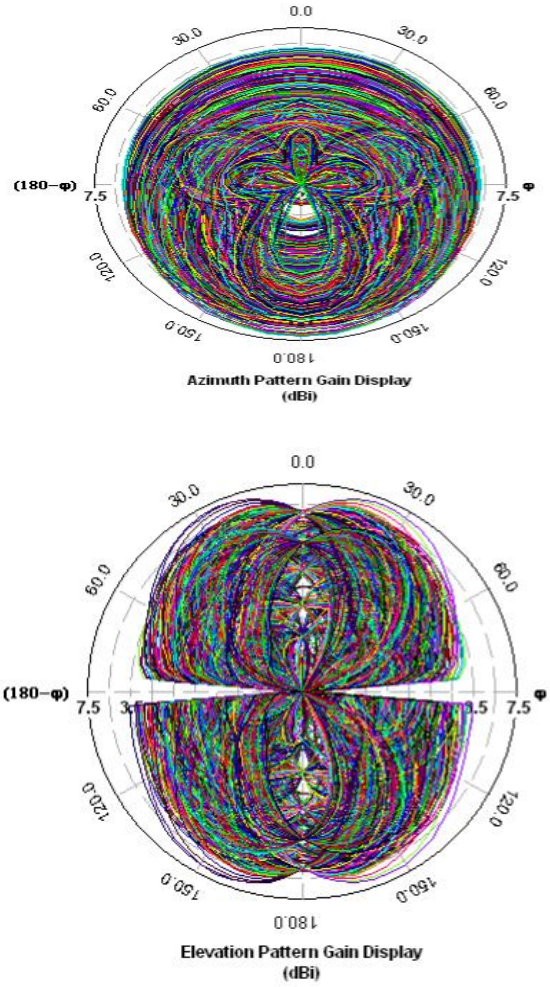

Figure 5: Elevation and Azimuth pattern of proposed microstrip antenna

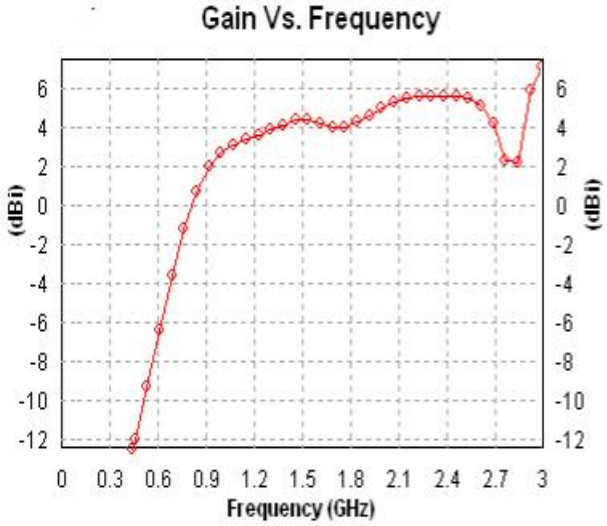

Figure 6: Directivity Vs frequency of proposed microstrip antenna.

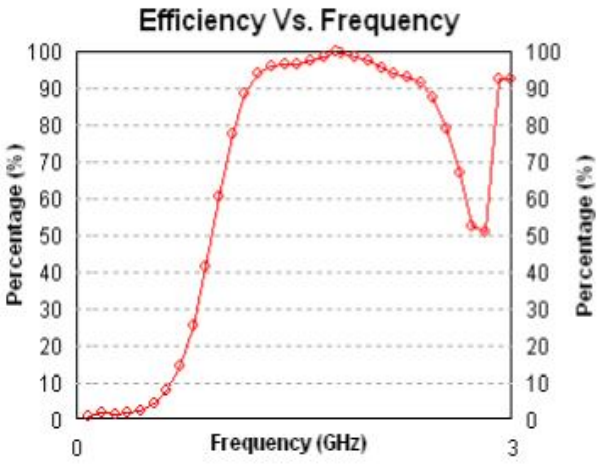

Figure 7: Efficiency Vs frequency of proposed microstrip antenna

4. CONCLUSION

The proposed antenna has been designed on glass epoxy substrate to give a wide bandwidth of 77.44% and maximum radiating efficiency of about 99%. The characteristics of compact patch antenna are studied and the antenna has been designed for WLAN application to operate in the frequency range of 1.099-2.488 GHz. The proposed microstrip antenna has high gain up to 6 dBi and good radiation efficiency of about 99%.

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