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Band Width and Gain Optimization of a Wide Band Gap Coupled Patch Antenna

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Abstract

Band Width and gain optimization of wide band gap coupled patch antenna, fed through a coaxial probe are presented. Using this novel technique the band width can be improved up to 85.21% covering the frequency range from 0.951-2.363 GHz and gain has been improved up to 5.8 dBi. This simulation is performed by using the commercially available IE3D simulator based on method-of-moments.

Keywords: Wideband, compact patch, gain and Band Width

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.[6-8] The major need for modern communication devices is to operate at wider band such as to support high speed internet, multimedia communication and similarly many more broadband services, this is achieved by using microstrip patch antennas, but inherently microstrip antennas are narrow band antennas. Therefore, numerous techniques have been presented to enhance the bandwidth for various communication systems. A single layer wide-band gap coupled patch antenna with achievable good impedance bandwidth has been demonstrated [3-5].Analysis of annular ring gap coupled patch antenna and slotted patch antenna are investigated for the gain and bandwidth enhancement. [1-2].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.

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 85.21% and maximum radiating efficiency of about 88%.

Antenna Design

Figure1 shows Geometry of proposed microstrip antenna. It is observed 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. Hence, for this design, the ground plane dimensions have given as 100×100mm and patch dimension36.7×45.6mm.

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 [11-14]. The parameters for the proposed design are given in table1:

Table 1. Antenna design parameters.

Parameters	Value (mm)
ε_r	4.4
h	1.6
Wg	100
Lg	100
S_1	2.0
D	24.46
L_1	36.70
W_1	45.60
W_2	37.60
Feed	(50,96)
L_F	5.0
W_F	25.20
Centre of circle	50,50

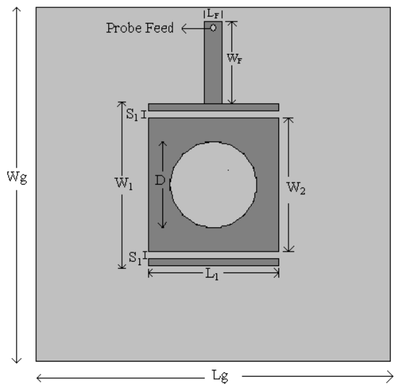

Figure 1: Geometry of proposed microstrip antenna

Result and Discussion

Figure 2 shows the return loss plot of proposed microstrip antenna. The proposed antenna resonates at 1.45 GHz frequency which gives wide band width of 85.21%. It is suitable for broad band operation. Figure 3 shows the smith chart & Figure 4 shows the 3D radiation pattern which is obtained from IE3D. Figure 5 shows directivity versus frequency plot which shows the directivity is about 6.7 dBi. The proposed microstrip antenna have high gain up to 5.8 dBi and good radiation efficiency of about 88% which is shown in figure 6 & figure 7.

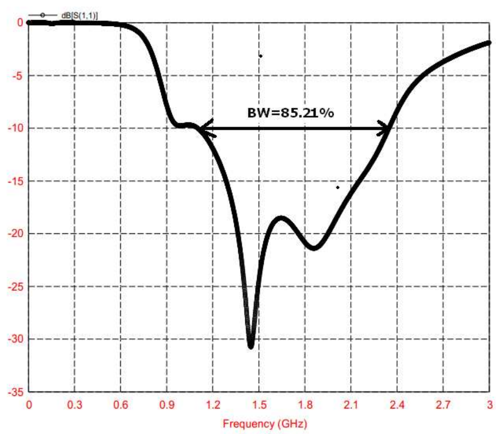

Figure 2: Return loss Vs frequency of proposed microstrip antenna

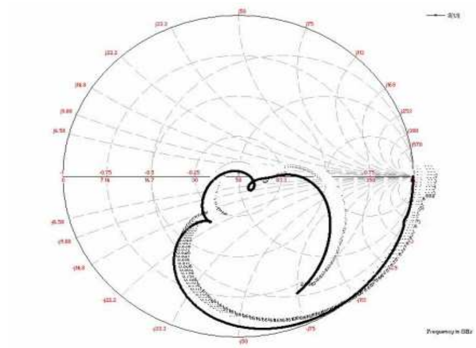

Figure 3: Smith chart plot of proposed microstrip antenna

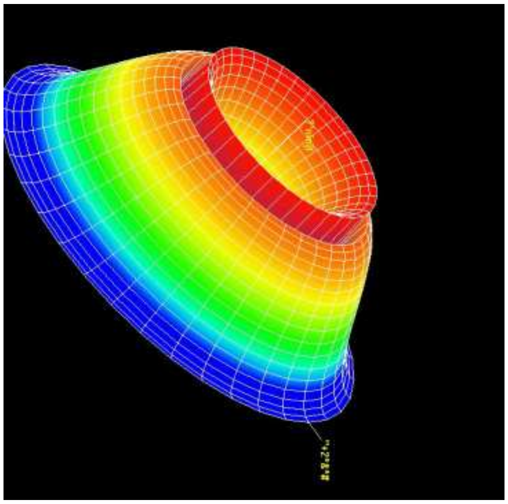

Figure 4: 3D radiation pattern of proposed microstrip antenna

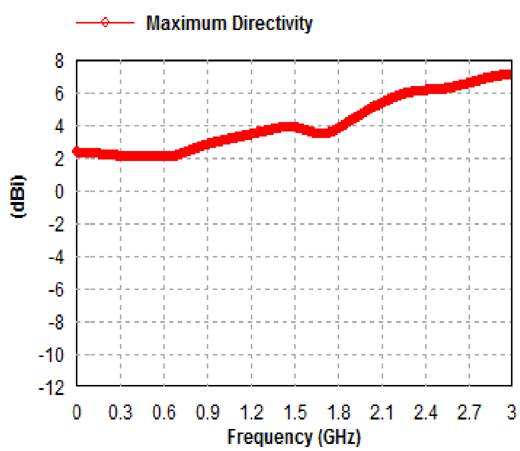

Figure 5: Directivity Vs frequency of proposed microstrip antenna

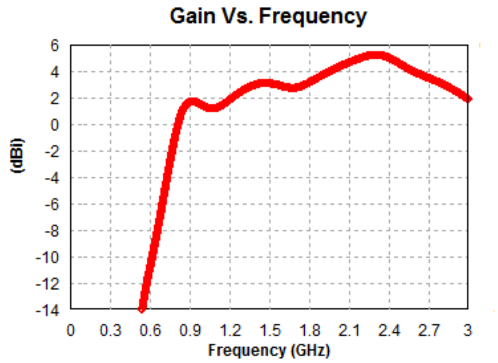

Figure 6: Gain Vs frequency of proposed microstrip antenna.

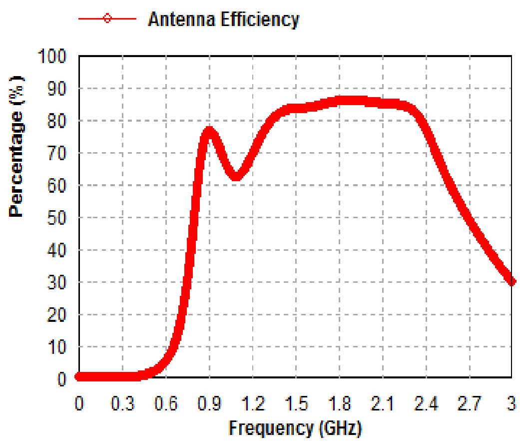

Figure 7: Efficiency Vs frequency of proposed microstrip antenna

Conclusion

The characteristics of compact patch antenna are studied and the antenna has been designed to operate in the frequency range of 0.951-2.363GHz.The proposed antenna has been designed on glass epoxy substrate to give a wide bandwidth of 85.21% and maximum radiating efficiency of about 88% high gain of about 5.8 dBi.

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