A STACKED SQUARE PATCH SLOTTED BROADBAND MICROSTRIP ANTENNA

P.K.Singhal, Bhawana Dhaniram, and Smita Banerjee

Department of Electronics
Madhav Institute of Technology & Science
GWALIOR-474005
INDIA
E-Mail: pks_65@yahoo.com
Fax: +91-751-2364648

ABSTRACT

This paper presents a double layered slotted square patch microstrip patch antenna with a single probe feeding to the lower patch. An input impedance bandwidth of 6.1GHz for VSWR ≤ 2 has been obtained from the proposed antenna. This bandwidth is achieved by using five slots in the lower patch & two walls between the patches.

1. INTRODUCTION

For decades the microstrip antenna has been intensively used due to its significant merits of small size, light weight, low profile and easy integration to circuits [1-3]. However, the microstrip antennas inherently have a narrow bandwidth. To overcome its inherent limitation of narrow impedance bandwidth, many techniques have been suggested e.g., for probe fed stacked antenna, microstrip patch antennas on electrically thick substrate, slotted patch antenna and stacked shorted patches have been proposed and investigated[4-6]. In general, the impedance bandwidth of a patch antenna is proportional to the antenna volume, measured in wavelengths. However, by using two stacked patches with the walls at the edges between the two patches, one can obtain enhanced impedance band width. There has recently been considerable interest in the two layer probe fed patch antenna consisting of a driven patch in the bottom and a parasitic patch [7-15].

In the present paper, a novel probe fed stacked square patch slotted wideband microstrip antenna is presented. The simulation of the proposed antenna has been carried out using IE3D software [16]. An input impedance bandwidth of 76.25% for VSWR$\leq$2 has been achieved. Radiation and other characteristics of the proposed antenna have also been investigated.

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2. ANTENNA DESIGN

Figure 1 shows the geometry of the proposed antenna. It is well known that the impedance bandwidth can be broadened by making use of stacked patch concept and slots are used to compact the microstrip patch antenna [2]. Also the bandwidth can be enhanced by using high permittivity. The choice of high permittivity substrate for the driven layer would be more suitable. The driven patch of size 20X20 mm^2 is fed by a probe and the parasitic patch is also of the same size. The driven and parasitic elements are placed slightly offset as shown in figure 1(a). The driven and parasitic elements are connected (shorted) through the metallic walls as shown in figure 1(b). The driven element has five square slots as shown in figure 1(a). The dielectric substrate used for the parasitic elements is slightly lossy. The values of various parameters involved in figure 1(a) are given in table 1.

Table 1: Dimensions of the proposed antenna

h1	2.524 mm
h2	5.75 mm
Permittivity of lower substrate	5.4
Permittivity of upper substrate	4
Loss tangent of lower substrate	0.002
Loss tangent of lower substrate	0.02
L	20 mm
L1	5 mm
Size of the square slot	2mmX2mm

3. RESULTS & DISCUSSION

The proposed antenna has been simulated using Zeland Software's IE3D simulation package [16]. Figure 2 shows the variation of VSWR with frequency. From frequency 4.95GHz to 11.05GHz the input VSWR is ≤2 i.e., the total input impedance bandwidth 6.10GHz is available from the proposed antenna which is remarkable. Figure 3 shows the variation of return loss with frequency. Minimum -14 dB return loss is available from the proposed antenna. Figure 4 shows the input impedance loci for the antenna. Figure 5 shows the radiation pattern at 7.95 GHz, the same radiation pattern has been obtained throughout the operating frequency band. Figure 6 shows the variation of directivity with frequency. Figure 7 shows the variation of antenna and radiating efficiency with frequency.

4. CONCLUSION

The design has demonstrated that square shaped stacked patch with slots and two walls at the edges can be used to form an antenna with the broad bandwidth of 76.25% furthermore, due to its compactness and broad bandwidth more applications can be anticipated.

ACKNOWLEDGEMENT

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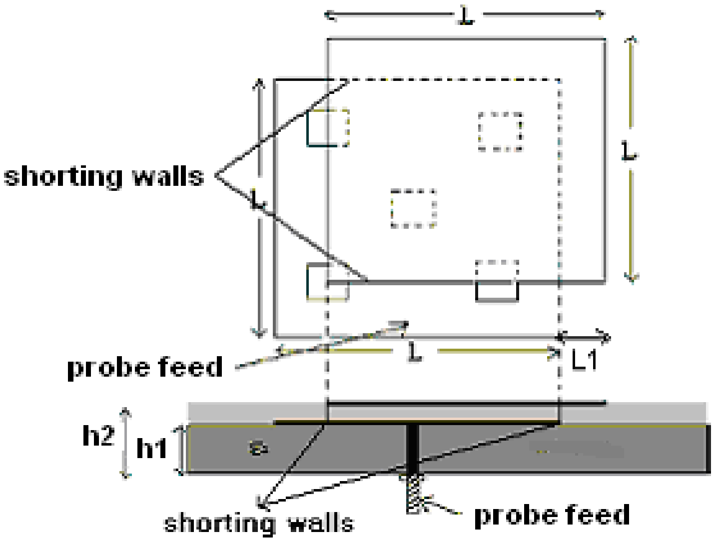

Figure 1(a): Top-view and Side-view of the proposed antenna

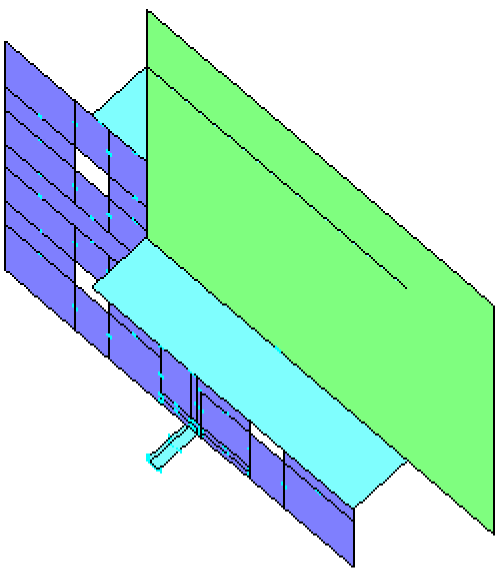

Figure 1 (b):3 -D View of the proposed antenna

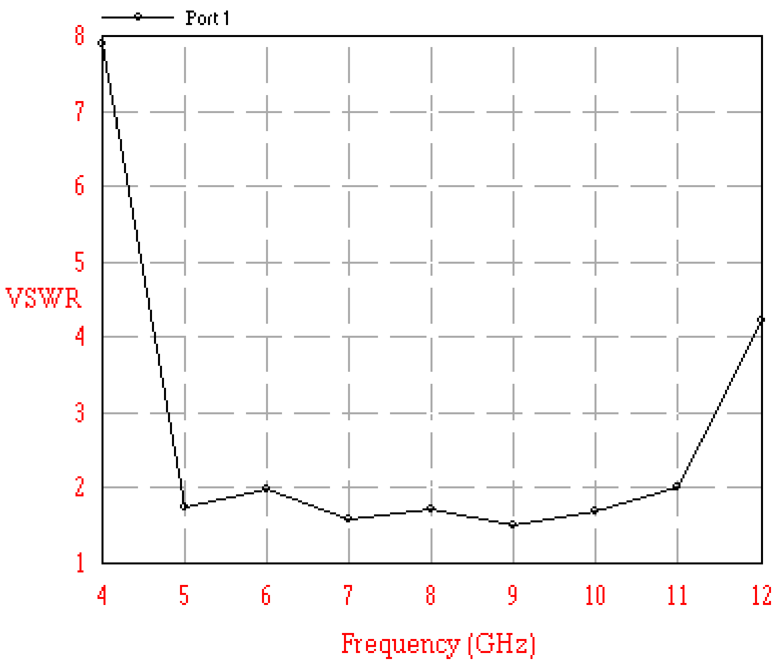

Figure 2: Variation of VSWR with Frequency

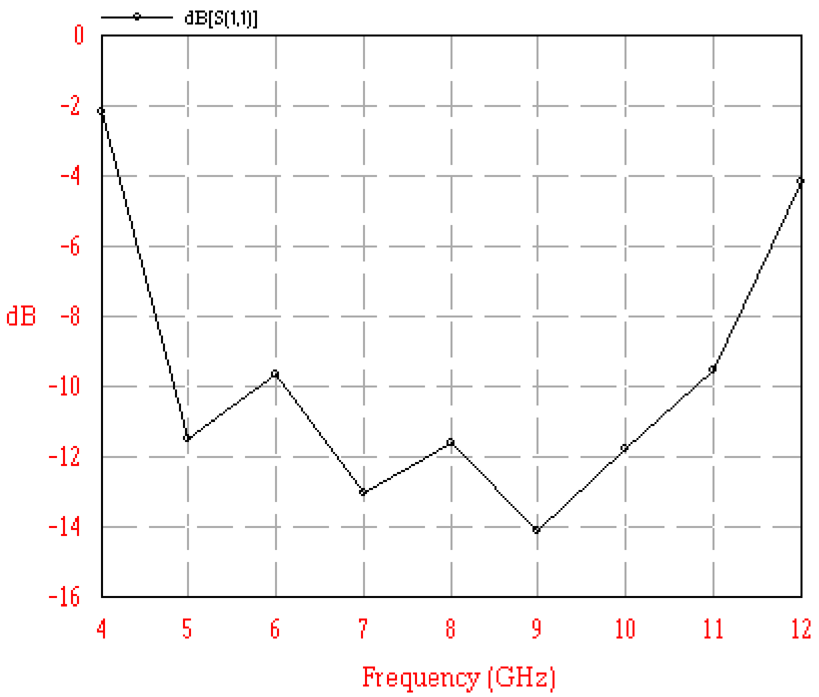

Figure 3: Variation of Return Loss with Frequency

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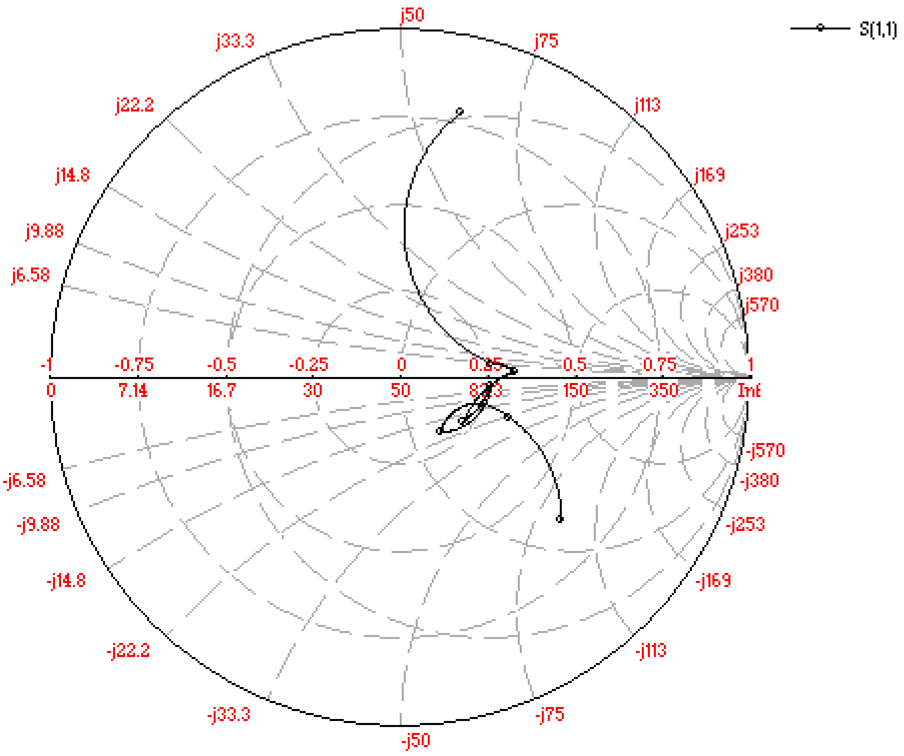

Figure 4: Input Impedance Loci

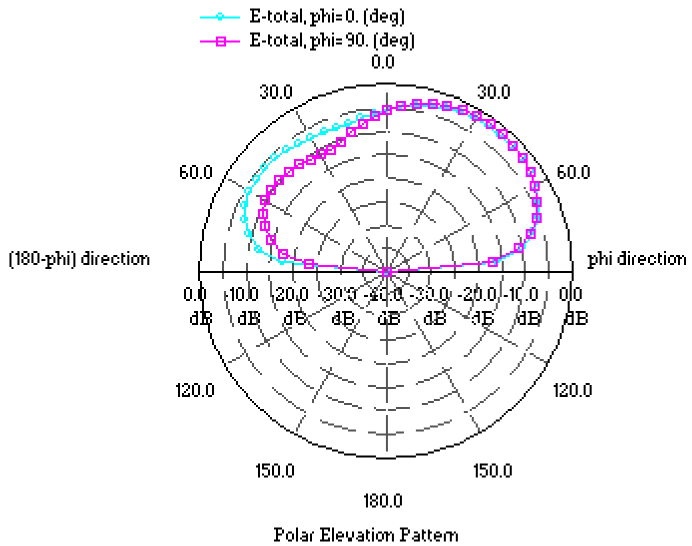

Figure 5: Radiation Pattern at 7.95GHz.

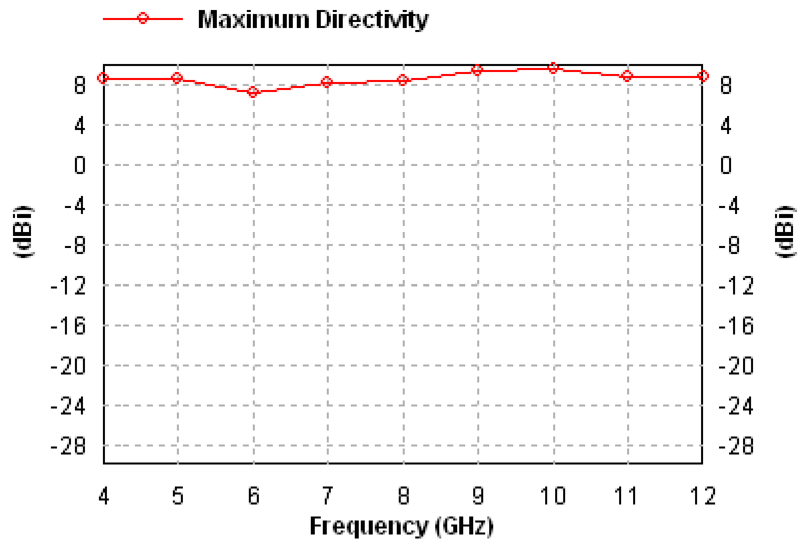

Figure 6: Variation of Directivity with Frequency

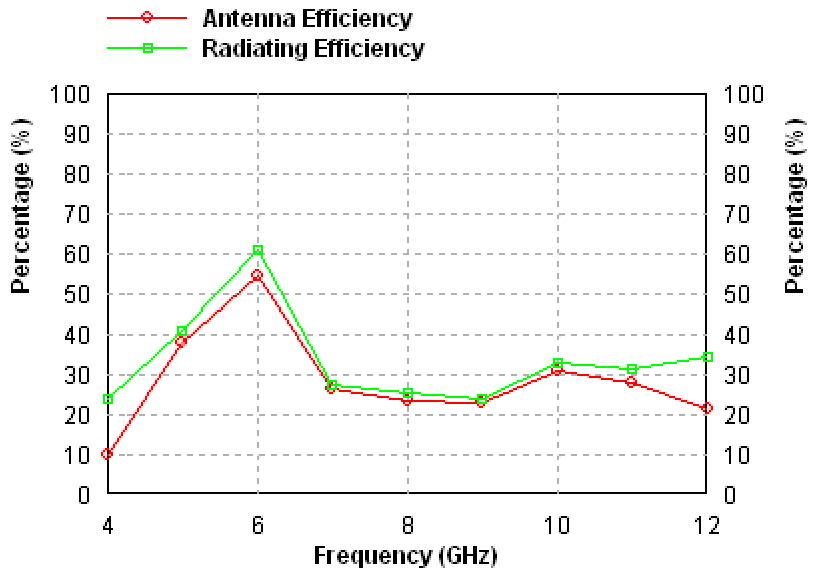

Figure 7: Variation of Radiating Efficiency and Antenna Efficiency with Frequency