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WIDEBAND SINGLE PATCH E-SHAPED COMPACT MICROSTRIP ANTENNA FOR WLAN

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ABSTRACT:
This paper presents a single wideband E-shaped compact microstrip antenna for WLANs operating in the 2.2 –2.5 GHz range. By using only single patch a high impedance bandwidth is achieved.The simulated impedance bandwidth (VSWR<2) is 17 %.This prototype antenna has a gain of dB.The back radiation lobe is also > 20 dB. This antenna is fed by a co-axial probe feeding. In this paper, the effects of different parameter of antenna are also studied.

Keywords: Microstrip, WLAN, VSWR, Bandwidth, HFSS

I. INTRODUCTION

A microstrip patch antenna is a type of antenna that offers a low profile, i.e. thin and easily manufacturability, which provides great advantages over traditional antennas [1-2]. However, patch antennas have a main disadvantage i.e. narrow bandwidth [3]. Researchers have made many efforts to overcome this problem and many configurations have been presented to extend the bandwidth. Patch antennas are planner antennas used in wireless links and other microwave applications.

An E-shaped patch antenna is easily formed by cutting two slots from a rectangular shape as shown in fig 1. By cutting the slots from a patch, gain and bandwidth of microstrip antenna can be enhanced. An E-shaped patch antenna is proposed in this paper. In this designed microstrip antenna the E-shaped patch is placed on the top of the dielectric sheet and the dielectric sheet is placed on a ground plane. In, an E shaped microstrip antenna is proposed, in which patch and the ground plane are separated by RT/Duriod 5880 spacer. Different techniques are used to overcome this narrow bandwidth limitation. These techniques include increasing the thickness of the dielectric substrate, decreasing dielectric constant [1]. These techniques have limitations like, excitation of surface waves and increase in antenna size. In wireless local area networks the antenna used is in PCMCIA format where a small size, low volume antenna is required. A rectangular patch with a U slot [3] embedded in it has been found to be a broadband antenna, and a single E-shaped patch with a height of 6.7mm provide bandwidth up to 16.4 %.

In this paper, we present a wideband single E-shaped microstrip patch antenna with compact size that provides a bandwidth (VSWR < 2) approximately equal to 16.4%. This bandwidth covers WLAN frequency bands (2.2 – 2.5 GHz. It is to be noted that the antenna height is less than 5mm, so this antenna can be conveniently used for WLAN adapter cards in PCMCIA format.

II. E-SHAPED MICROSTRIP PATCH ANTENNA

When two parallel slots are incorporated into the rectangular microstrip patch antenna, it becomes an E-shaped microstrip patch antenna [4]. The E-shaped microstrip patch antenna is simpler in construction. The geometry is shown in Fig.2.1 and Fig 2.2.

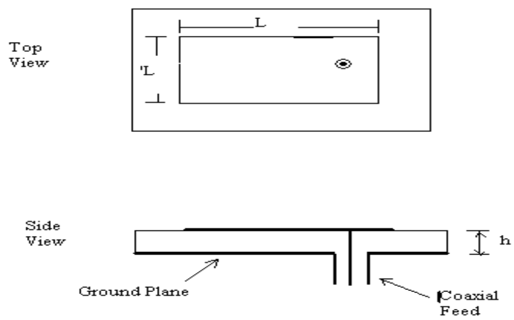


Figure 2.1 Microstrip Antenna Probe Fed

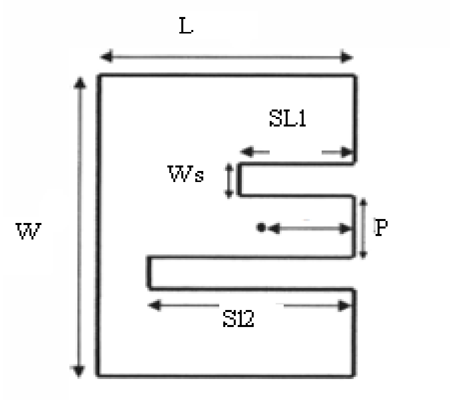


Figure 2.2 Geometry of the E-shaped microstrip Patch antenna with Probe Fed

The E-shaped microstrip patch antenna has width (W) and length L. Two slots of length S_{L1}, S_{L2} and width W_S are introduced symmetrically with respect to the probe position. The patch is fed at position P_0 by a coaxial probe. One dielectric substrate materials are used for fabrication of antenna element.

III. DESIGN OF SINGLE PATCH E SHAPED MICROSTRIP ANTENNA

The proposed antenna designed for 2.45 GHz frequency with E shaped [4]. The proposed antenna designed using probe fed simulated by HFSS'11. The dimensions of the optimized antenna element are given in Table 1.

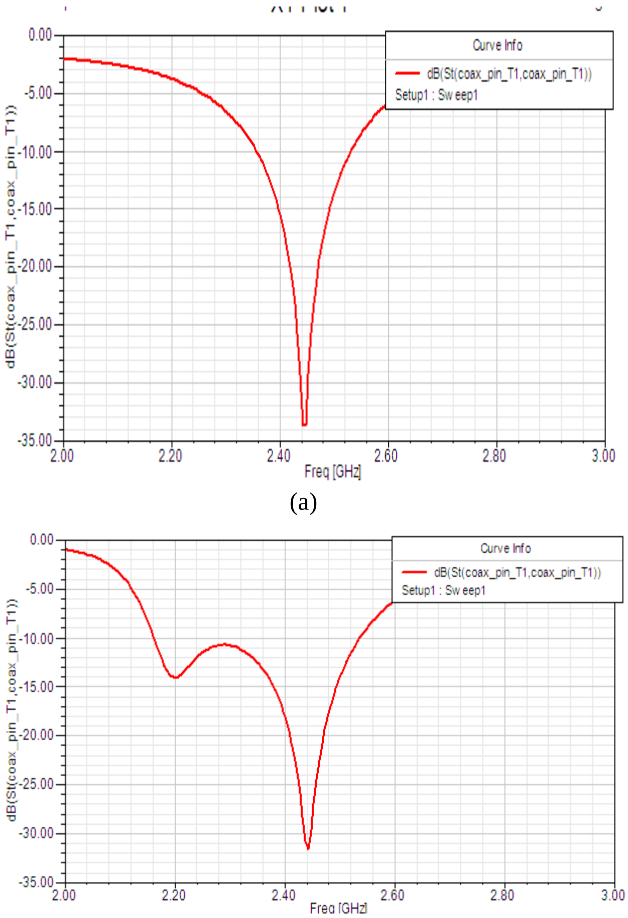
TABLE 1. THE DIMENSIONS OF THE E SHAPED PATCH IN MM

W	L	Ws	S_{L1}	S_{L2}	P	F	h	Ɛr
48	36	6.3	16	30	11.4	9	6.7	2.2

IV. SIMULATED RESULTS

This symmetrical E shaped patch antenna provided a 7.8 %(2.34- 2.53 GHz) impedance bandwidth with 5.8dB gain. The figure 4.1(a) and 4.2 (a) has shown the return loss in dB and smith chat for equal size of slots in patch. The E shaped patch antenna designed here has -33 dB return loss. The gain curve shown in figure 4.3 (a), this antenna provides good VSWR (~1.02).

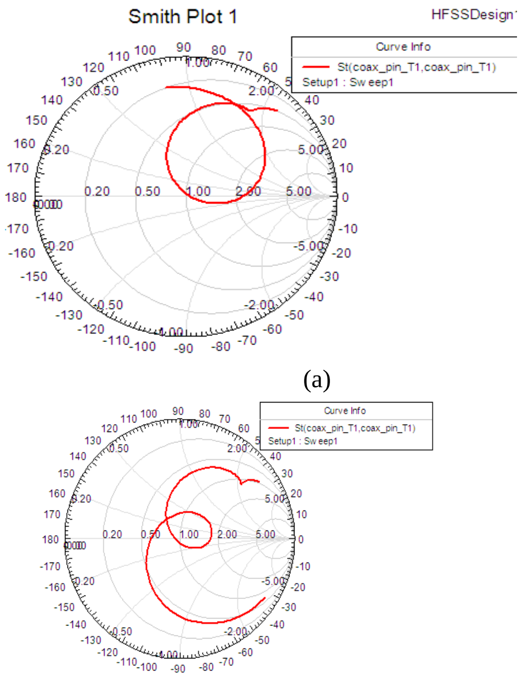
When the slot S_{L1} gets shorter, it forms the asymmetrical E shaped patch antenna as shown in fig 2.1 [5,6]. This unequal E shaped patch antenna provides circular polarization. This antenna provides 16.4 %(2.15 GHz-2.53 GHz) impedance bandwidth at -10 dB return loss and 6dB gain. The figure 4.1(b) and 4.2 (b) has shown the return loss in dB and smith chat for unequal length of slots in patch. The E shaped patch antenna designed here has near about (-32) dB return loss. The gain curve shown in figure 4.3 (b), this antenna provides good VSWR (~1.5)[8]. Table 2 shows all simulated results.



(a)

(b)

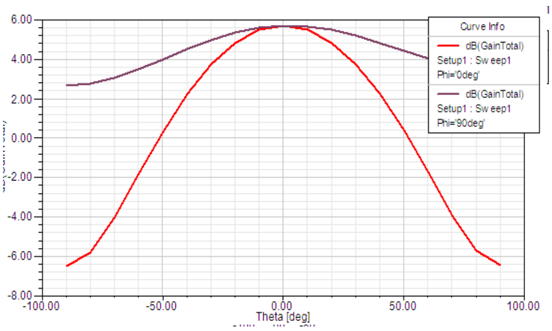
Figure 4.1 Simulated Return Loss S_{11} V/S Frequency

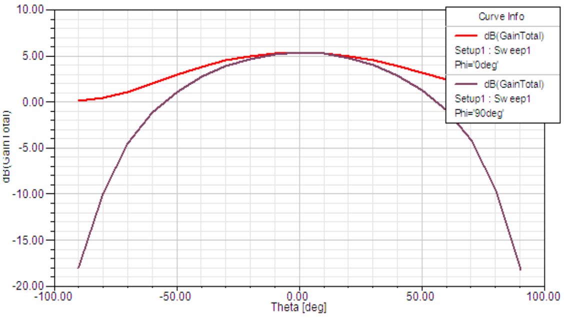


(a)

(b)

Figure 4.2 Smith Chart for E Shaped Patch Antenna

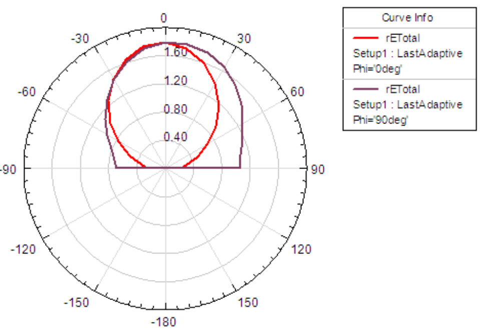




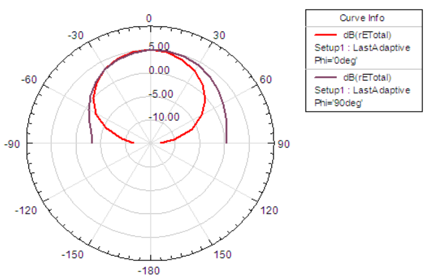
(b)

Figure 4.3 Simulated Gain Curve for E Shaped Patch

Figure 4.4 (a) and (b) are shown the radiation pattern of E patch antenna. 3 D gain plot described in figure 4.5 (a) and (b).

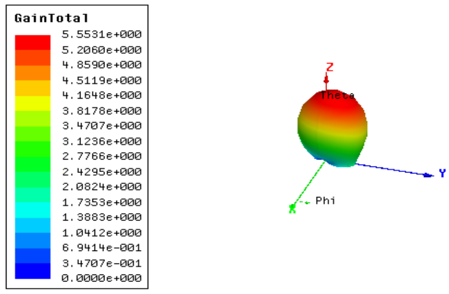


(a)

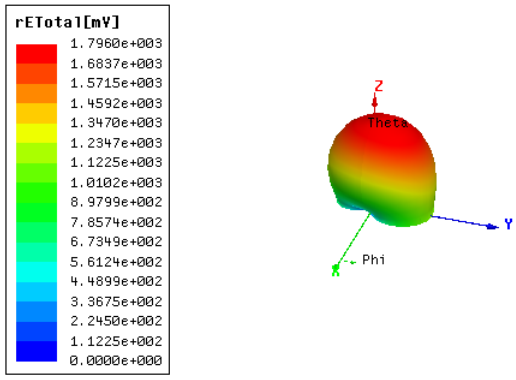


(b)

Figure 4.4 Radiation pattern of E Patch Antenna



(a)



(b)

Figure 4.5 3 D Gain Plot of E Patch Antenna

TABLE 2. SIMULATED RESULTS FOR PROBE FEED PATCH ANTENNA

	Frequency	Gain	Return Loss	Bandwidth
E Shaped Patch	2.45 GHz	5.6 dB	-33 dB	7.8 %
Unequal E Shaped Patch	2.43 GHz	6 dB	-31.2 dB	16.4 %

V. CONCLUSION

From the simulation analysis of the designed antenna it can be easily observed that the designed E-shaped microstrip antenna has good gain i.e. 6 dB and optimized return loss i.e.-45 db. The measured and simulated bandwidths are matched (approximately 17%). This antenna has good front to back radiation (FBR) ratio, and is equal to 20 dB. Without changing the permittivity and height of the substrates, the effect of various parameters of Eshaped patch antenna are studied.

This proposed microstrip antenna enhanced the impedance bandwidth and provides good matching. This antenna simulated by HFSS'11[7].

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