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Research Article

E–Shaped Coaxial Feed Microstrip Patch Antenna for WLAN and WIMAX Applications

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Abstract

In this paper, an E-shaped coaxial feed microstrip patch antenna has been presented. The proposed antenna is designed to operate between 5.725 to 5.85 GHz frequency bands. The Ansot's HFSS software has been used for designing the proposed antenna. The FR4 epoxy dielectric material of relative permittivity 4.4 and loss tangent of 0.0013 with the thickness of 1.6 mm is used as a substrate of the proposed antenna. High performance characteristics and good return loss values for 5.725-5.85 GHz frequency band have been obtained for the proposed antenna.

Keywords: *E-shaped, Coaxial feed, HFSS, WLAN and WiMAX.*

1. Introduction

Microstrip patch antennas are widely used in wireless communications due to their inherent advantages of low profile, less weight, low cost, and ease of integration with microstrip circuits (C. A. Balanis, 2007; R. Garg, 2001). However, the main disadvantage of microstrip antennas is the small bandwidth. Many methods have been proposed to improve the bandwidth (Lee, 1997; Jia-Yi Sze, 2000; Praveen Kumar Kancherla, 2013 Weigand, 2003; Uma Shankar Modani, 2013; Modani Uma Shankar, 2013). Some of the E-shaped patch antenna is presented in (M.T Ali, 2011; M.D Sharma, 2012; A. A. Deshmukh, 2012; Z. Faiza, 2012; M. T. Islam, 2009; B. Ramesh, 2013) Improvement of broader bandwidth becomes an important need for many applications such as for high speed networks.

Recently, high-speed wireless computer networks have attracted the attention of researchers, especially in the 5-6 GHz band (e. g. WiMax and IEEE 802.11a Indoor and Outdoor WLAN). Such networks have the ability to provide high- speed connectivity (>50 Mb/s) between notebook computers, PCs, personal organizers and other wireless digital appliances. Although current 5 GHz wireless computer network systems operate in the 5.15-5.35 GHz band, future systems may make use of the 5.72-5.85 GHz band in addition to the 5.15-5.35 GHz band, for even faster data rates. Many novel antenna designs have been proposed to suit the standard for high-speed wireless computer networks.

In this paper, a simple E-shaped microstrip patch antenna is presented. The Ansoft's HFSS which is the industry standard simulation tool for 3D full-wave electromagnetic field simulation based on Finite Element Method (FEM) has been used for simulation purposes

2. Antenna design

The side view of the proposed antenna structure has been shown in Fig. 1. The broad banding technique of slotting technique is used to improve bandwidth. In the first step a simple rectangular microstrip patch antenna has been taken. Size of the antenna is calculated from the basic patch antenna equations (C. A. Balanis, 2007) and appropriate changes have been done to make an E shape patch antenna. Coaxial feeding is chosen for the excitation of the proposed antenna.

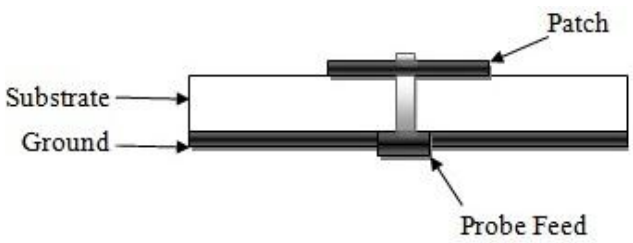

Fig.1 side view of the proposed antenna structure

Fig.2 shows the patch geometry of the proposed antenna. The proposed antenna with design parameters resonate at 5.725GHz to 5.85GHz has been shown in Table 1

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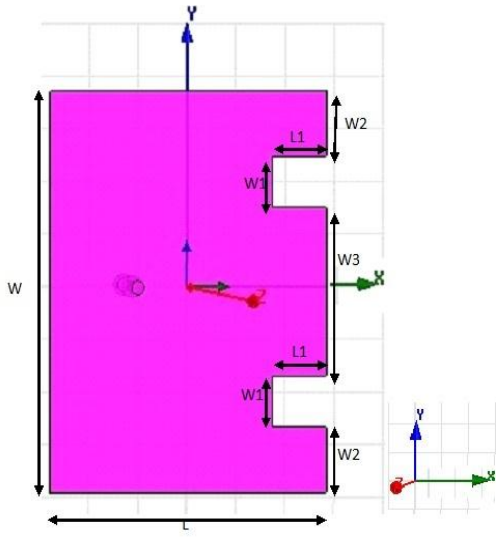

Fig.2 E-shaped patch

Table 1 parameter of the optimized e–shaped patch antenna

Parameter	Dimension (mm)
L	11.5
W	15.5
L_1	2.2
W_1	1.94
W_2	2.5
W_3	6.42
Ground	*L* x *W* = 21.46 x 25.47
Height	1.6

3. Results

From the Fig 3, the graph shows that the return loss below -10 dB is started from 5.7052GHz to 5.9603GHz which covers the entire range of WiMaX and WLAN applications. The bandwidth of the proposed antenna is 254.70MHz. Fig.4 shows that the circle is close to VSWR = 2 circle in the smith chart.

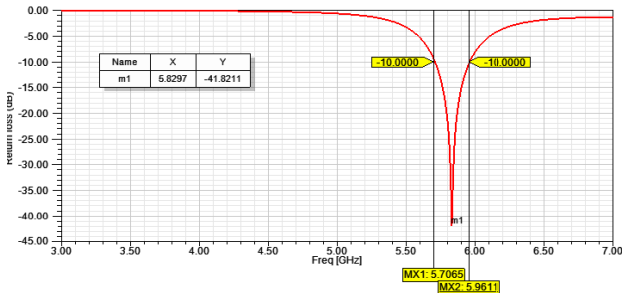

Fig.3 Return loss plot of optimized antenna E-shaped

The radiation pattern can be shown in Fig. 5 at the 5.725GHz frequency. The radiation pattern shows that the antenna radiates more power in a certain direction than another direction. As shown in Fig.5 the radiation pattern is almost in Omni directions.

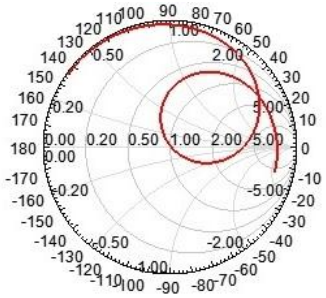

Fig.4 Smith chart of E-shaped patch antenna

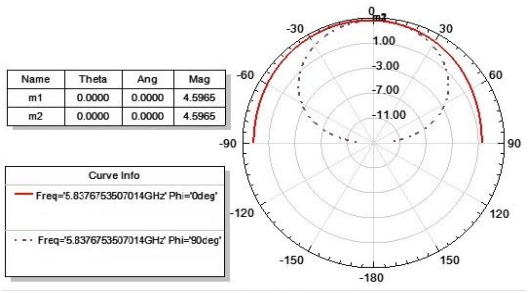

Fig.5 Radiation pattern of E-shaped patch antenna at 5.83 GHz

The 3D polar plot is shown in Fig.6 In the simulation an infinite ground plane was taken. The red color shows the maximum field intensity in the broadside direction. The polar plots shows that the proposed antenna have Omni directional radiation pattern.

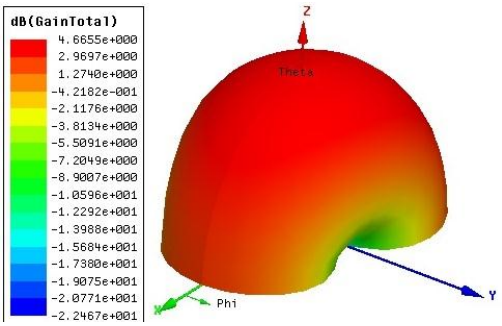

Fig.6 3D Polar plot of E-shaped patch antenna at 5.83GHz

From the Fig.7 we can be seen that the VSWR lies below the value 2 from 5.7052GHz to 5.9603GHz frequency.

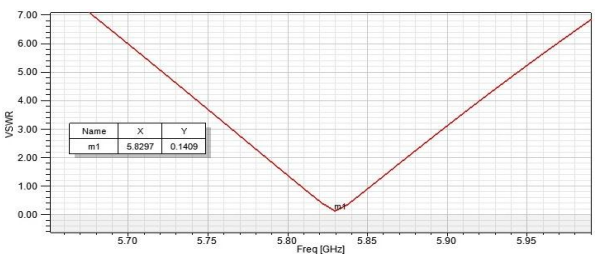

Fig.7 VSWR of E-shaped patch antenna

Fig.8. shows the variations in the gain with respect to frequency. It has revealed that the gain performance of the proposed antenna is satisfactory within the desired frequency range.

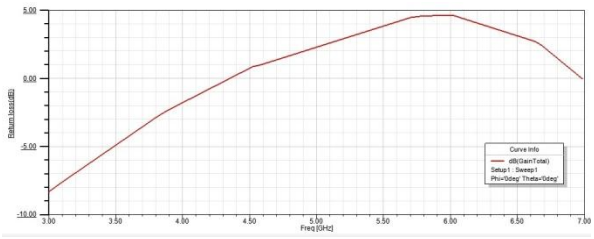

Fig.8 Gain Vs Frequency of E-shaped patch antenna

Conclusion

In this paper, an E-shaped patch antenna has been designed with coaxial feeding technique. Initially rectangular shape patch is simulated and return loss is plotted. The return loss plot of the proposed antenna has been shown that the antenna starts resonant from 5.7052GHz to 5.9603 GHz having return loss of -41.82 dB frequency band. So, the proposed antenna can be used for WiMaX, WLAN and other high speed wireless communications.

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