Design of Hexagonal Shaped Micro-Strip Patch Antenna Using CPW-FED

S. Gnanasowndari, R. Pradeepa, A. Ramya, J. Saranya
Department of Electronic and Communication Engineering, K. Ramakrishnan College of Technology, India

Article Info
Article history:
Received 13 February 2015
Received in revised form
20 February 2015
Accepted 28 February 2015
Available online 6 March 2015

Keywords
CPW Feed,
HFSS software,
UWB application

Abstract
Compact microstrip patch antenna using coplanar waveguide feed is proposed. To achieve wideband; a slotted hexagonal shaped patch antenna is simulated using HFSS software. The proposed antenna can be operated in frequency range of 2.3 GHz to 9GHz.This antenna can be used for UWB application.

1. Introduction

Nowadays, the need of wireless application has been increased. In wireless communication, electromagnetic wave plays vital role. The antennas are used to transmit or receive EM waves. Most of antenna designs are too difficult to fabricate and also impractical for many applications. The problem in fabricating a compact antenna with wideband or multiband application is still difficult for designers. It can overcome by microstrip patch antenna.

The microstrip patch antenna can be easily fabricated. A narrow band, wide beam antenna has low profile, low cost and produced omnidirectional radiation pattern. It can provide multi-band frequency operation, shape flexibility and feedline flexibility. The microstrip patch antenna consists of conducting patch on one side of dielectric substrate with ground plane on other side. It can be fabricated in printed circuit board and it has simple configuration. It has several advantages than other conventional antennas and widely used in several applications. The microstrip patch antenna has been used in satellite communication, RADAR, medical and scientific application, military application and industrial applications etc.

The antenna characteristics are resonant frequency, gain, directivity, return loss, VSWR and efficiency. The characteristics of antenna depend on design, substrate material and feeding techniques. In this paper, FR4 epoxy is used as a substrate material with the relative dielectric constant is 4.4. It is a popular material and it can withstand at high temperature. It can provide mechanical strength to the antenna.

The performance of antenna can also depend on feeding techniques. Here the CPW feeding is used. In this technique, the ground plane is etched on substrate material itself. So the size of the antenna is reduced. The advantages are low loss, miniaturized ultra-wideband antenna and high efficiency. It has minimum interference of spurious radiation. The impedance matching is achieved easily.

2. Antenna Design

Corresponding Author,
E-mail address:

The proposed design of the hexagonal slotted patch antenna is shown in Fig.1.

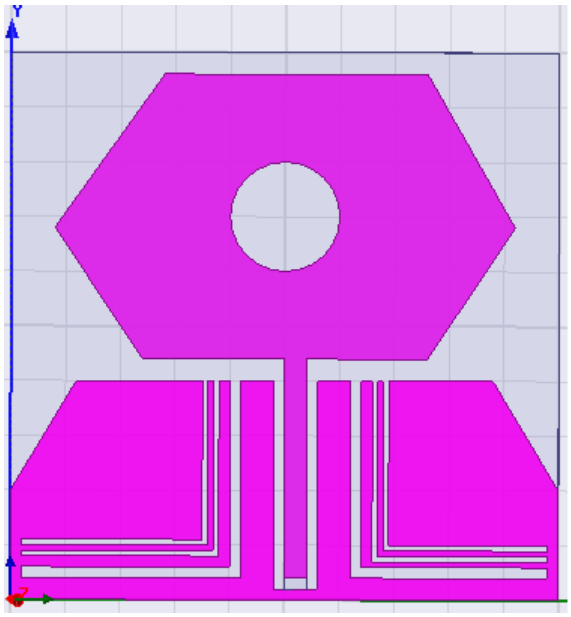

Fig: 1.

The slotted hexagon is printed on the FR4 substrate and ground plane is also etched on substrate itself. While we use CPW fed the ground plane and conducting patch are printed on the same side. The overall size will be reduced. So it is very compact.

FR4 epoxy substrate has low dielectric constant, so it provides the better efficiency and increased radiated power. The thickness of the substrate is an important parameter. The dielectric substrate of micro strip patch antenna with CPW fed is used in ultra wide band frequency range. The thickness of substrate is 1.6mm.

In order to increase the bandwidth of the micro strip patch antenna, so we have to lay some L slots in this hexagonal design in ground plane. By this design we can achieve the ultra wide band frequency. The RF power is fed

directly to the radiating patch using contacting element. Here we are using the copper for making radiating patch.

The micro strip patch antenna is simulated using High Frequency Structural Simulator software – version 13. HFSS software is a full wave electromagnetic simulator based on the finite element method. This method can be used to design 3D structure for various shapes. It has been widely used for designing RF/Wireless antenna, waveguide design and filters.

3. Results and Simulation

The simulated result of the hexagonal slotted patch antenna is shown in Fig.2.

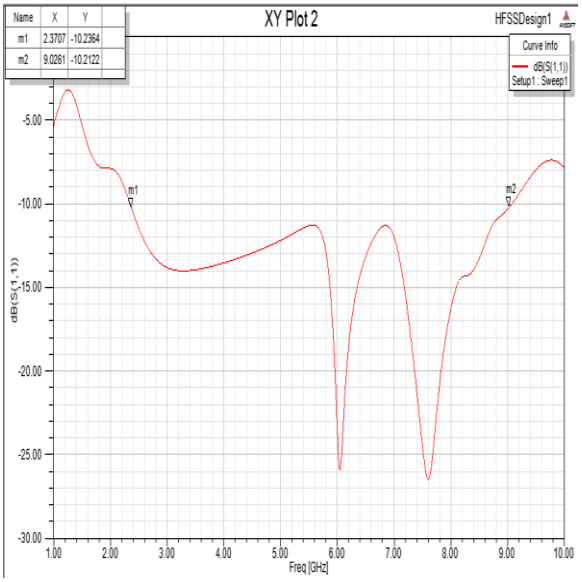

Fig: 2.

The frequency is an important parameter for designing any antenna. The simulated output can operated at the frequency range of 2.3GHz to 9GHz. The operating frequency can be observed below the reference line of -10 dB return loss. So that antenna works properly. All the characteristics of antenna such as directivity, radiation pattern, gain, return loss, bandwidth efficiency, VSWR, and resonant frequency can be analyzed using HFSS software. The fabricated antenna can be tested by using vector network analyzer.

This antenna covers the three band of application. That is L-band, C-band and X-band. The three frequencies are occurred between the range of 2GHz to 3GHz.It can be used for military application, GPS, Mobile phones. It also used in commercial application, and medical application. And many of the applications are microwave ovens, microwave devices, communication radio, mobile phones, wireless LAN, Bluetooth, ZigBee, GPS etc. Another application is long distance radio telecommunications.

4. Conclusion

We have presented the design of hexagonal shaped microstrip patch antenna which covers the spectrum of 2.3GHz to 9GHz frequency range. The design antenna shows a good impedance matching of 50 ohms at the center frequency. The advantage of low weight, low production cost, simple structure, broad bandwidth and no complicated feeding techniques. But one disadvantage is little bit fabrication difficult. Because slot can be used in this structure

References

[1] V. Jhariya, P. Jain, Designing of Rectangular Microstrip Patch antenna for C-band application

[2] R. P. Singh, Design of Microstrip Rectangular Patch Antenna for Wireless applications

[3] S. Malisuwan, J. Sivaraks, N. Tiamnara, N. Suriyakrai, A Broadband Rectangular Microstrip Patch Antenna for Wireless applications

[4] K. Gupta, K. Jain, P. Singh, Analysis and Design of Circular Microstrip patch antenna at 5.8GHz

[5] D. Shah, H. Aboti, C. Joshi, V. Sawant, Simulation and Analysis of Rectangular Micro-.Strip Patch Antenna for 1.9 GHz using IE3D

[6] S. Choudhary, P. Jain, CPW-Fed Microstrip Patch Antenna for WLAN Application at Resonant Frequency 2.3 GHz

[7] D. Rishishwar, Design of Rectangular Microstrip patch antenna at 2.4GHz