IOSR Journal of Electronics and Communication Engineering (IOSR-JECE)
e-ISSN: 2278-2834,p-ISSN: 2278-8735
PP 12-15
www.iosrjournals.org

A Compact Microstrip Antenna for C Band Applications

Anusha U[1], Dr. Lethakumary B[2]
[1](ECE Department, MTech MGUCE/Mahatma Gandhi University, Thodupuzha, Kerala, India)
[2](HOD, ECE Department, MGUCE/Mahatma Gandhi University, Thodupuzha, Kerala, India)

Abstract: *Microstrip Patch Antennas plays an important role in designing antennas due to its low cost, light weight etc. This paper deals with a compact microstrip antenna used for C- band applications. This paper deals with a monopole E-shaped patch antenna with rectangular slots and a defective ground structure. The antenna is radiated with the help of microstrip line feed. The proposed antenna is fabricated on FR4- substrate having a dielectric constant 1.6mm.The antenna radiates from 4.73 GHz– 9.98 GHz providing a percentage of 71.35%. The results are simulated in Ansys HFSS15 software. The simulated S_{11} is upto -51.18dB and provides good radiation pattern. The proposed antenna is analysed in terms of return loss (S_{11}), VSWR, Gain and Radiation pattern.*
Keywords: *C-band, E-shaped patch, HFSS15, Inset feed, Return loss*

I. Introduction

A wide and rapid growth in the field of wireless communication system is emerging recently. At present age all wireless equipment is equipped with Wi-Fi. In this scenario the mission is to provide good data communication with the use of compatible antenna system. Antennas used for wireless applications are compact in nature. Microstrip antennas are a better choice due its advantage such as low profile, light weight, simple and cheap to construct. The concept of microstrip antennas was proposed in 1953 by Deschamp. In early 1970s , Howell and Munson developed the first practical antenna. A Microstrip antenna comprises of a thin layer of conducting material on one side of dielectric substrate and a ground plane on the other side. The generally used patch is of any regular geometrical shapes. The main disadvantage of this type of antenna is its narrow bandwidth. This problem can be avoided to a greater extend by increasing the thickness of substrate, by using shorting pins, or by changing patch shapes[1].

The IEEEC-band frequency ranges from 4.0 to 8.0GHz which is followed by radar manufactures and users. This frequency and its slight variations are used for many satellite communications transmissions, some Wi-Fi devic-es, some cordless telephones and weather radar systems. By changing patch's shape by creating slots on a rec-tangular patch, an E-shaped patch is created inorder to provide larger bandwidth. A shorting pin technique can also be used in between ground and patch inorder to reduce the antenna size and increasing the bandwidth.[3] A novel triband E-shaped printed monopole antenna loaded with narrow slots has been presented in [5] which can be used in WLAN applications.By reducing the ground plane good returnloss was obtained..The methods cho-sen to make it monopole is presented in [8].

In the present paper rectangular slots made on an E-shaped patch provides a bandwidth of 71.35% i.e., from 4.73GHz to 9.98GHz. The design implementation is made on Ansys HFSS15. The patch is made on FR4 glass epoxy substrate with a dielectric constant of 1.6mm.The simulated S_{11} < -10 dB for the entire obtained frequency range. Also it has VSWR < 2 and has acceptable return loss, gain and directivity.

II. Antenna Design

The design equations for a rectangular patch antenna is as follows[2]
The width W is given by

$$W = \frac{c}{2f0\sqrt{\frac{\in +1}{2}}} \tag{1}$$

The dimensions of the patch along its length have now been extended on each end by a distance ΔL, which is given empirically by as:

$$= \frac{\in \quad W}{\in \quad W} \qquad (2)$$

The effective length of the patch Leff now becomes:
Leff = L + 2L (3)
For a given resonance frequency fo, the effective length is given by as:

$$\mathrm{eff} = \frac{c}{2fo\sqrt{\in}}$$

(4)

$\in$ is given by

$$\in = \in \quad \in \sqrt{} \quad W$$

(5)

Figure 1 shows the design of proposed antenna.The antenna is designed using Ansys HFSS15. The dimension of the patch is 13.2 mm x9.54mm. The substrate is made up of FR4 glass epoxy with dielectric constant of 4.4 having dimension 19mm x 18mm x 1.6mm. The rectangular slots are made inorder to provide better impedance matching. Feeding positions are varied and optimum location is found which covers the C band. A modified ground plane with dimensions 19mm x 5.4mm is implemented inorder to provide higher bandwidth. It was set with an air box and a virtual radiation to create far field radiation pattern and given an excitation. The dimensions of various parameters are given in TABLE 1.

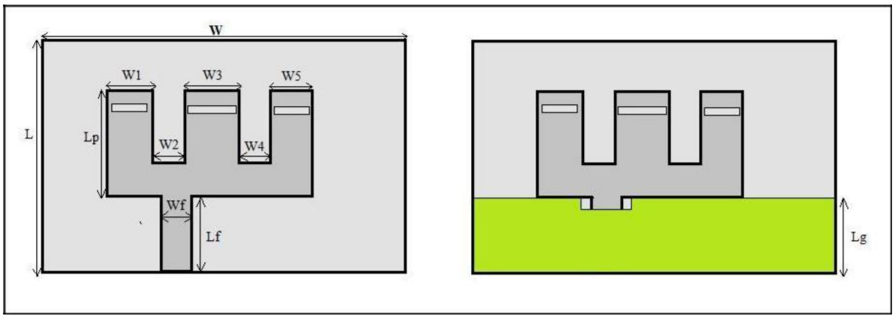

Figure 1: Top and bottom view of proposed antenna

TABLE 1: Dimensions of various parameters

Sl.No	Parameters	Dimensions (in mm)
1	Substrate	W = 19 L = 18
2	Patch	Wp = 13.2 Lp = 9.54 W1 = 3 W2 = 2.2 W3 = 2.8 W4 = 2.4 W5 = 3
3	Ground Plane	Wg = 19 Lg = 5.4
4	Feed Line	Wf = 3 Lf = 6.46

III. Results

A wideband characteristic for C band is obtained on simulating the proposed antenna. The antenna bandwidth is said to be those range of frequencies over which the RL is greater than -10 dB (-10 dB corresponds to a VSWR of 2). The simulated S_{11} (return loss) is less than -10dB for the obtained frequency range from 4.73 to 9.98 GHz. Also the VSWR is less than 2. The antenna shows an acceptable gain of 6.04 dB and directivity of 6.47dB.The S_{11} graph is shown in Fig 2.

A Compact Microstrip Antenna for C Band Applications

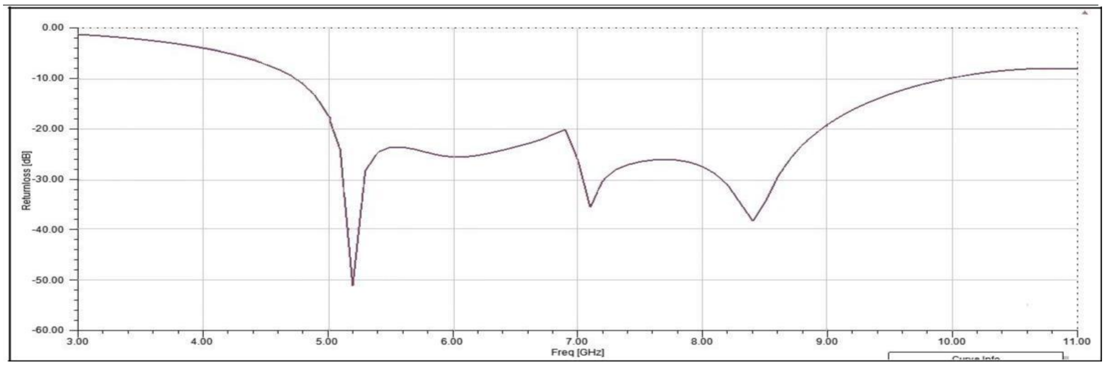

Figure 2 : Simulated S_{11} graph of the proposed antenna

Figure 3 shows the effect of adding slots on the arms.It is clear that on adding slots on three arms ,returnloss and bandwidth is good.Hence the model with slots on all arms is selected.

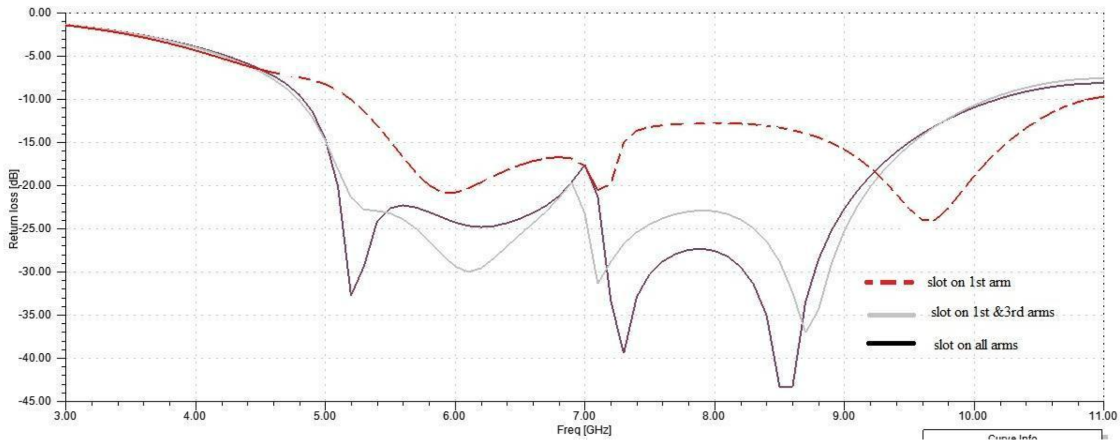

Figure 3 : Simulated S_{11} graphs on adding slots on arms of the antenna

Figure 4 shows the simulated radiation pattern of the antenna. Figure depicts a good radiation pattern in which the maximum gain is obtained in the broadside direction.

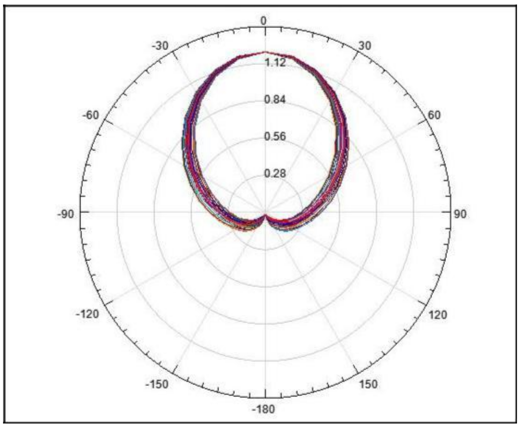

Figure 4: Radiation Pattern of the proposed antenna

IV. Conclusion

In this paper a compact microstrip antenna for C band application is proposed. It is inferred that a properly designed E shaped antenna with microstrip line feed provides a bandwidth of 5.25GHz (71.35% with operating frequency of 4.73GHZ to 9.98GHz) by reducing the ground plane and cutting slots on the arm of E-shaped patch. The substrate is kept 1.6mm.The antenna is suitable for C band applications such as Wi-Fi, satellite communications.

References

[1]. Girish Kumar,K.P.Ray,*Broadband Microstrip* Antennas ,I^st edition, Artech House , 2003.

[2]. C.A.Balanis.*Antenna Theory; Analysis and design*.Wiley-Interscience,third edition,John Wiley &Sons, 2005

[3]. A.C.O.Pedra,G.Bulla,P.Serafini and A.Salles,"Analysis of a Full E-Shaped Antenna",IEEE Trans 2015

[4]. S.S.Dubhele,Dr.B.G.Hogade,"Review on different E shaped microstrip antennas for better performance",IJSETR,vol 5 issue 3 march 2016

[5]. Sajad Mohammed Ali Nezhad, Hamid Riza Hassani,"A Novel Triband E-shaped Printed Monopole Antenna for MIMO applications", IEEE Antennas and Wireless Propagation letter, vol 9,2010.

[6]. Naresh Kumar Joshi, Kamal Kumar Verma," Broadband E-Shaped Microstrip Patch Antenna For Wireless Communication*"*, International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 National Conference on Emerging Trends in Engineering &Technology (VNCET-30 Mar'12).

[7]. Chitra Singh, R.P.S. Gangwar," Design and Analysis of a Compact Low Cost Patch Antenna for Different Wireless Operations", 978-1-4577- 0240-2/11/$26.00 ©2011 IEEE,pg 19-22.

[8]. K.P.Ray,"Design Aspects of Printed Monopole Antennas for Ultra-Wide Band Applications", International Journal of Antennas and Propagation Volume 2008