International Journal of Electronics Engineering (ISSN: 0973-7383)
Volume 11 • Issue 1 pp. 1028-1032 Jan 2019-June 2019 www.csjournals.com

Vertical Slot Loaded Square Monopole Microstrip Antenna for WLAN and Wi-max Applications

Basawaraj Patne[1], Nagraj Kulkarni[2] and S.N. Mulgi[3]

[1] Research Scholar Department of PG Studies and Research in Applied Electronics Gulbarga University, Kalaburgi
[2] Assistant Professor and Head Department of Electronics Government College(Autonomous), Kalaburgi
[3]Professor and Chairman Department of PG Studies and Research in Applied Electronics Gulbarga University, Kalaburgi
Principal Author E-mail : basawarajpatne@gmail.com

Abstract: In this communication a square monopole microstrip antenna is presented for triple band operation. A vertical slot of rectangular shape is loaded on the radiating patch. The antenna operates between the frequency range of 3.6 GHz to 8.13 GHz. The antenna has a structure of 80x80x1.6 cubic meters on glass epoxy substrate. The radiation characteristics of the antenna is linear and broadside with peak gain of 5.2dB. The design parameters are presented and the results of the antenna are discussed. This antenna may find its applications in WLAN and Wi-max systems.

Index Terms: Vertical Slot, Square monopole, Gain, Radiation.

I. INTRODUCTION

In recent years microstrip antennas are becoming popular because of their numerous inherent advantages like low profile, light weight, low fabrication cost, robustness, integrability with MMICs and ease of installation [1]. The modern communication systems such as, WLAN and Wi-Max use antennas operating at definite frequency bands. But an antenna operating at dual and triple band is more attractive to use the device for the desired applications such as transmit/receive purpose. In this study a simple square monopole microstrip antenna having a rectangular slots on the radiation patch is presented for triple band operation bearing good radiation characteristics. This kind of study is found to be rare in the literature.

II ANTENNA DESIGN

In this study the square microstrip antenna is considered as conventional antenna(CSMSA) shown in Fig. 1. The antenna is fabricated by using low cost glass epoxy substrate mateirial of relative permitivitty 4.2.

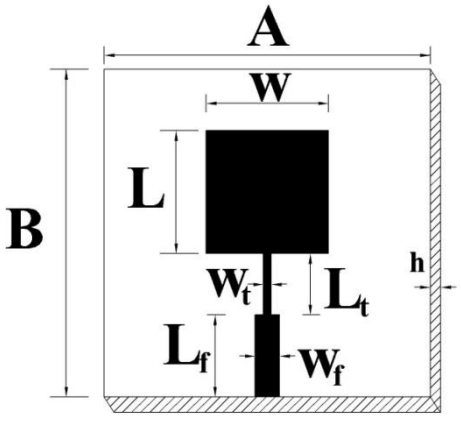

Figure-1 Conventional Square Microstrip antenna(CSMSA)

International Journal of Electronics Engineering (ISSN: 0973-7383)
Volume 11 • Issue 1 pp. 1028-1032 Jan 2019-June 2019 www.csjournals.com

The microstripline of length L_f and width W_f is used to supply the microwave energy to the antenna. A quarterwave transformer of length L_t = 1.26 cm and width W_t = 0.08 cm is used to match the impedamce between the microstripline and the patch. A 50Ω SMA connector is used to connect the microwave source. The proposed antenna is sketched using the computer software AUTO CAD to achieve better accuracy. Table-1 gives the design parameters of the antennas.

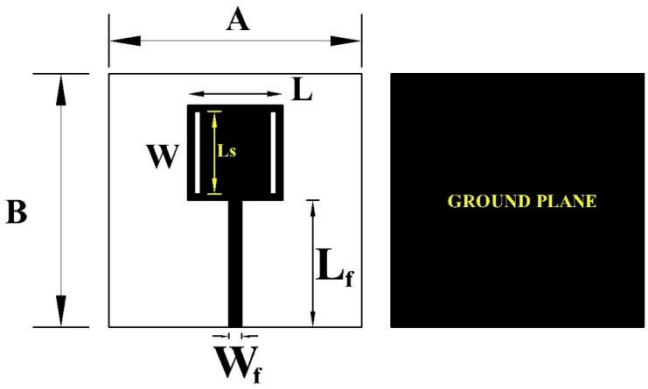

Figure-2 Structure of Vertical Rectangular slot loaded Square Monopole Microstrip antenna

Table-1 Design Parameters

Parameter	A	B	L=W	L_f	W_f	h
Dimension(cm)	8	8	2.39	1.27	0.32	0.16

Figure 2 shows the vertical rectangular shaped slot loaded square monopole microstrip antenna (VSMMSA). The full ground plane of CSMSA is maintained as it is. The vertical rectangular slot of length Ls whose dimension is taken equal to $\lambda_0/6$, where λ_0 is a free space wave length in cm corresponding to the designed frequency of 3.0 GHz. All other dimensions of the CSMSA are kept same for VSMMSA also.

III Results and Discussion

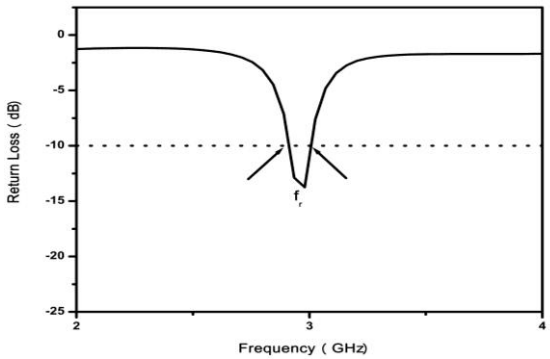

Figure-3 Return Loss versus frequency of the CSMSA

International Journal of Electronics Engineering (ISSN: 0973-7383)
Volume 11 • Issue 1 pp. 1028-1032 Jan 2019-June 2019 www.csjournals.com

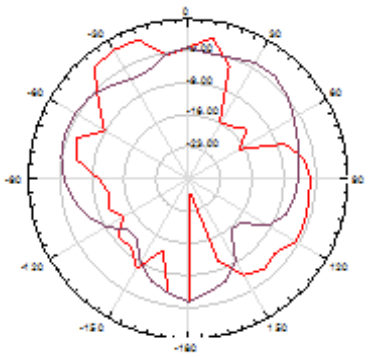

Figure-4 Typical Radiation Pattern of CSMSA

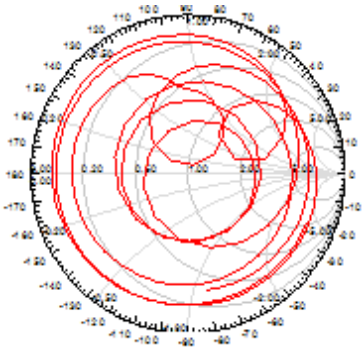

Figure-5 Smith Chart of CSMSA

Figure 3 shows the return loss versus frequency of CSMSA, it is designed for 3 GHz frequency and it is resonated at 2.98 GHz which is very close to the designed value. The impedance bandwidth of the conventional microstrip antenna is calculated by the relation

$$\text{Impedance bandwidth (\%)} = \frac{f_H - f_L}{f_C} \times 100\ \%$$

where f_H and f_L are the upper and lower cut off frequencies of the resonated band when its return loss reaches -10 dB and f_c is the centre frequency between f_1 and f_2. The impedance bandwidth of CSMSA is found to be 3.38%

Figure 4 and 5 show the radiation pattern and Smith Chart of the CSMSA . It can be noticed that the radiation is linear in nature and Smith chart shows good matching.

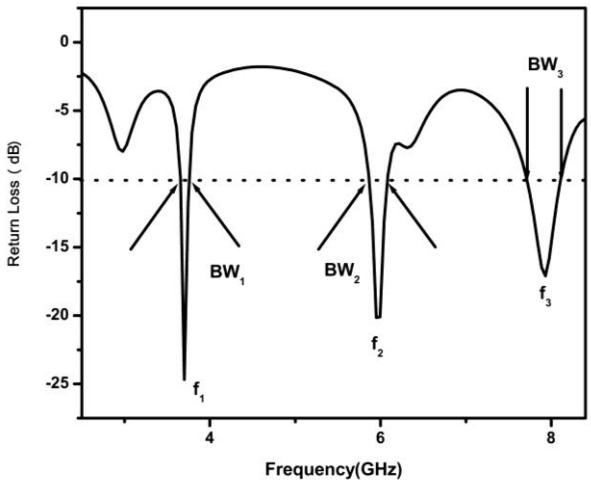

Figure 6 Return loss versus frequency of VSMMSA

International Journal of Electronics Engineering (ISSN: 0973-7383)
Volume 11 • Issue 1 pp. 1028-1032 Jan 2019-June 2019 www.csjournals.com

Figure 6 shows the return loss versus frequency of the VSMMSA , the antenna resonates for three modes f_1, f_2 and f_3 with their respective bandwidths BW_1= 4.9% (3.6GHz-3.78GHz) BW_2= 3.83% (5.88 GHz-6.11GHz) and BW_3= 5.42 % (7.71GHz-8.13GHz). The first band is due to the fundamental resonance of the patch. The second and third bands are due to the presence of the rectangular slots on the radiating patch. The frequency ratio f_2/f_1 of about 1.59 is achieved which shows the possible tunable property of the antenna.

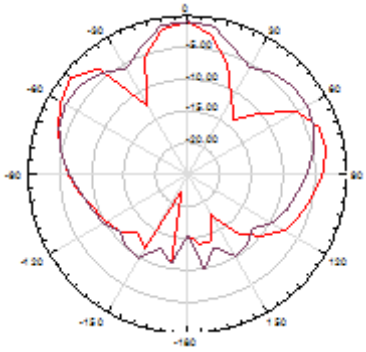

Figure-7 Radiation pattern of VSMMSA

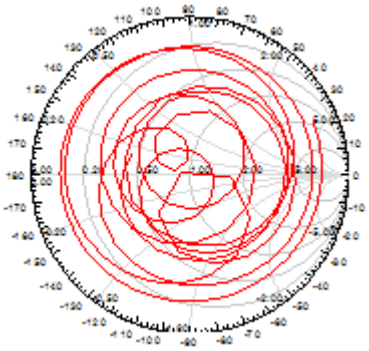

Figure-8 Smith Chart of VSMMSA

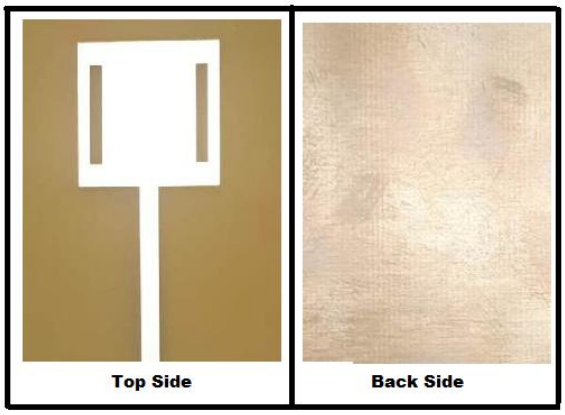

Figure-9 Photograph of VSMMSA

Figures 7 and 8 respectively show radiation pattern and Smith chart of the VSMMSA, it can be noticed that the radiation pattern is linear and broadside . The Smith chart shows loops at the center of the plot depicting the good matching concept. Figure 9 shows the Photograph of VSMMSA fabricated by photolithographic process utilizing modified glass epoxy material as substrate material.

IV Conclusion

The proposed antenna shows all the needs of the modern communication systems. The triple bands with impedance bandwidth of 5.42% is obtained. The linear and broadside radiation characteristics is achieved with maximum gain up to 5.2 dB. The antenna exhibits frequency ratio of 1.59 which gives the possible tenability. This antenna may find its applications in WLAN and Wi-Max applications.

References

[1] Constantine A. Balanis, Antenna Theory - Analysis and Design, John Wiley & Sons, Inc., New York, 1982.

[2] David M. Pozar and Daniel H.Schaubert, Microstrip Antennas: The Analysis and Design of Microstrip Antennas and Arrays, IEEE Antennas and Propagation Society, Sponsor, IEEE Press, Inc., New York, 1995.

[3] I. J. Bhal and P. Bhartia, Microstrip Antennas, Dedham, MA: Artech House, 1981.

[4] G. A. Deschamps, "Microstrip microwave antennas," presented at the 3rd USAF, Symposium on Antennas, 1953.

[5] Robert E. Munson, "Conformal microstrip antennas and microstrip phased arrays," IEEE, Trans. Antennas Propagat., vol. AP-22, no. 1, pp. 74-78, Jan. 1974.

[6] John Q. Howell, "Microstrip Antennas," IEEE, Trans. Antennas Propagat., pp. 90-93, Jan. 1975.

[7] Girish Kumar and K. P. Ray, Broadband Microstrip Antennas, Norwood, MA: Artech House, 2003.

David M. Pozar, Microwave Engineering, Addison Wesley Publishing Company, Inc. 1990.