IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319 5940

International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified
Vol. 5, Issue 7, July 2016

Design of Dual Band Microstrip Patch Antenna Using Proximity Feed for Wireless Applications

Meenu[1], Gaurav Monga[2]

Student of M.Tech, Dept of Electronics, JCDM College of Engg. Sirsa,India[1]

Assistant Professor,Dept of Electronics, JCDM College of Engg. Sirsa,India[2]

Affiliated to : Guru Jambheshwar University of Science And Technology,Hisar,India

Abstract: In this paper, the design of dual band microstrip patch antenna has been presented for technology oriented requirements of high speed wireless applications.The proposed antenna is excited using proximity coupling feed.The proposed antenna resonates at 2.4GHz and 4.65GHz . The E shaped slot on the upper stacked patch helps in improving the results. The designed antenna gives efficient results resonating at 2.4 GHz and 4.65 GHz. CST Microwave studio is used to design and simulate the proposed antenna structure.

Keywords: Dual band, Microstrip antenna, Proximity feed.

INTRODUCTION

Nowa days in modern communication system we need to develop small sized, light weight, low profile, and broad band antenna design for compact communication equipments.Microstrip patch antenna are used in various wireless applications. These antennas have many desirable features such as: lowprofile, light weight, and are easily fabricated by lithographic process or mechanical milling process. But the narrow bandwidth, lowgain, polarization impurity and impedance mismatching are becoming main drawbacks in the applications of the communication systems.In this paper we use the proximity coupled feed to improve the bandwidth, gain and directivity[1],[2].

Inthis configuration two-layer substrate with the microstrip line on the lower layer and patch antenna on the upper layer is used. The feed line terminates in an open and underneath the patch. This feed is better known as an "electromagnetically coupled" microstrip feed. Coupling between the patch and the microstrip is capacitive in nature[4] .

The substrate parameters of two layers can be selected to increase the bandwidth of the patch and to reduce the spurious radiations from the open end of the microstrip. For this the lower layer should be thin. The radiating patch being placed on the double layer gives a larger bandwidth.[2],[3],[5].

Design Geometry

The geometrical representation of the proposed design antenna is shown in fig.1. The antenna is mounted on fr4 substrate with thickness of 1.59mm. The antenna is fed by proximity feed .Synthesis and analysis of this proposed design was performed usingCST Microwave Studio 2012. In this section a Dual band antenna is defined which resonates efficiently attwo frequencies2.4GHz and 4.65GHz. In this design stacking is used, the size of the stacked substrate is different from the main substrates[11],[4]. The design of the antenna has patch width Wp of 39.43mm and the length of patch Lp is 31.16mm by using given steps of the antenna parameter calculation. The substrates used are of same material having dielectric constant of 3.38 and the height of the substrate is 1.524mm. The dimensions of the stacked patch are width Wp22.72mm and the length Lp is 17.72mm. The dimensions of the E shaped slots are given as thewidth of the upper slot is 9.5mm and the length of the slot is 3.425, the upper and the lowerslot are of same dimensions and the dimensions of the center slot is width 7.7mm and length2.75mm..The following table shows the various parameters of the designed antenna having E shaped slot:

Resonating frequency fr (GHz)	Feeding technique	Patch width Wp (mm)	Patch length Lp (mm)	Height of the substrate h (mm)	Dielectric constant (Ɛr)
2.4	Proximity	39.43	31.16	1.524	3.38
4.65	Proximity	22.72	17.72	1.524	3.38

The simulated design of the antenna is given in the Figure(fig 1) below

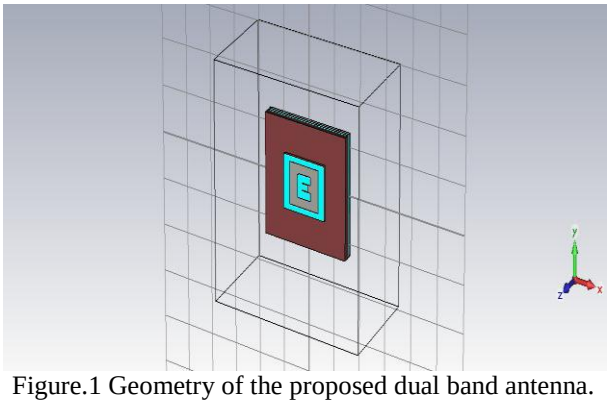

Figure.1 Geometry of the proposed dual band antenna.

IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319 5940

International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified
Vol. 5, Issue 7, July 2016

Simulation Results:

RETURN LOSS

The designed antenna gives excellent results of return loss that is at frequency 2.4GHz itgives the return loss of -26dB and at 4.65 GHz frequency it gives the return loss of -30dB where-10dB is acceptable for practical applications which shows that the above designed antenna isperfectly matched and the power lost is minimum. The simulated results of the return loss and given in the Figure below:

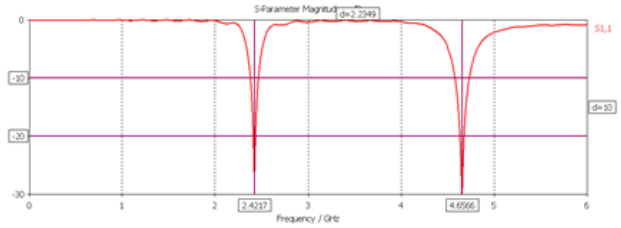

Figure (2) Simulated Return loss of Dual Band MSA at 2.4 GHz and 4.6 GHz.

VSWR

The value of VSWR for a good antenna is less than or equal to 2 for practical antennas[8], the designed antenna gives a VSWR of 1.2 at 2.4GHz and 1.1 at 4.65GHz, which is given below so that value defines that the antenna is perfectly matched

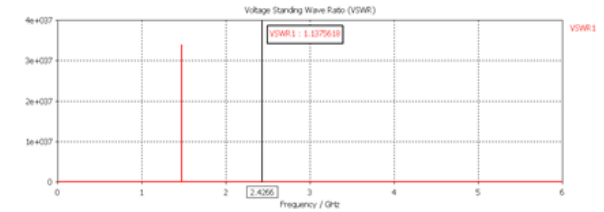

Figure 3 (a) VSWR at 2.4GHz

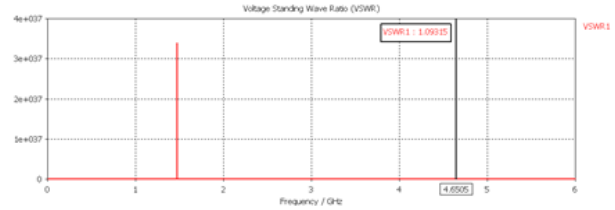

Figure 3 (b) VSWR at 4.65 GHz

Smith chart

The smith chart below shows two circles for two resonating frequencies. The circles passes through resistance 1 circle which shows that the antenna is perfectly matched and thus losses are minimum.

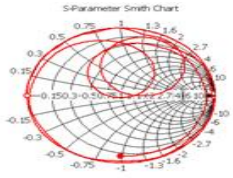

Figure (4) Smith Chart of Dual Band MSA at 2.4 GHz and 4.65 GHz.

Directivity

The simulated antenna design gives the directivity of 6.8 dB at 2.4 GHz and 5.4 dBi at 4.65GHz the simulated results of directivity are given in the Figure below.

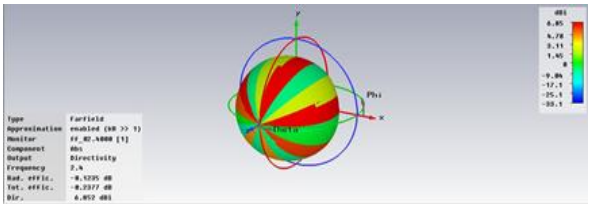

Figure 5(a)Directivity at 2.4GHz

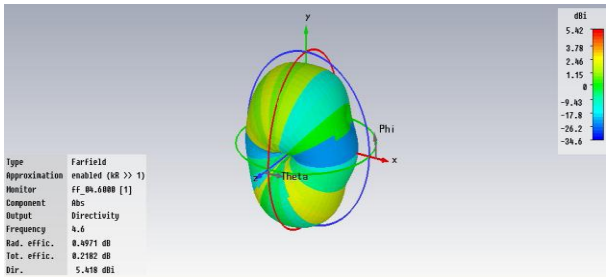

Figure 5 (b) Directivity at 4.65 GHz

Gain

Gain is a dimensionless quantity[2],[3].[13]. The simulation results of the gain are given in the Figure below and the gain obtained is 6.7 dB at 2.4GHz and 5.9 dB at 4.65GHz.

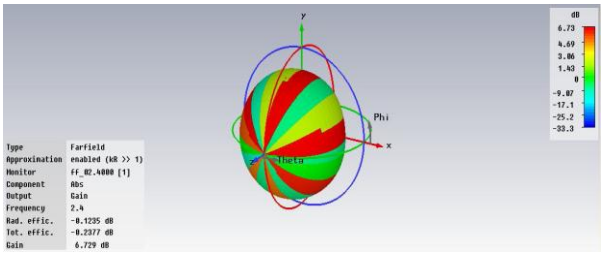

Figure 6(a) Gain at 2.4GHz

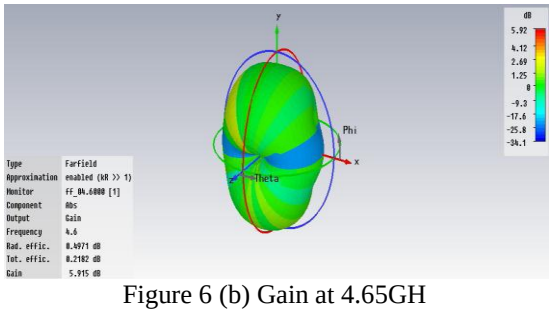

Figure 6 (b) Gain at 4.65GH

The results of the dual band antenna operating at 2.4 GHz and 4.65GHz are summarized in the following table:

Resonating frequency fr(GHz)	Return loss (dB)	Bandwidth (MHz)	VSWR	Directivity(dBi)	Gain (dB)
2.4	-26	90	1.2	6.8	6.7
4.65	-30	155	1.2	5.4	5.9

DOI 10.17148/IJARCCE.2016.57100

IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319 5940

International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified
Vol. 5, Issue 7, July 2016

CONCLUSION

The above designed antenna gives excellent results and covers two frequencies 2.4GHz and4.65GHz with efficient parameter values and can be used for various applications in military, RADAR and numerous other wireless applications. By the use of stacking ,the bandwidth of the antenna is increased but it also increases the size of the antenna.

REFERENCES

[1] Andrea Goldsmith, "Wireless Communications", Cambridge University Press, 2005.
[2] Theodore S. Rappaport, "Wireless Communication and Practice", Second Edition, 2002.
[3] Balanis, C.A., "Antenna Theory Analysis and Design", 3rd Edition. New Jersey, John Wileyand Sons, 2005.
[4] Garg, R., Bhartia, P. and Ittipiboon, A., "Microstrip Antenna Design handbook Boston: Artech, House", 2001.
[5] Randy BencroftMicrostrip Antenna, "The Analysis and Design of Microstrip Antennas and Arrays", Second Edition, 1995.
[6] G. Kumar and K. P. Ray, "Broadband Microstrip Antennas", Artech House, 2003.
[7] James, J. R., and P. S. Hall, "Handbook of Microstrip Antennas", vol. 1, London: Peter Peregrinus Ltd., 1989.
[8] Lee, H. F., and W. Chen, "Advances in Microstrip and Printed Antennas", New York, John Wiley& Sons, 1997.
[9] Waterhouse, R.B., "Stacked Patches Using High And Low Dielectric Constant Material Combinations," IEEE Transactions on Antennas and Propagation, vol.47, no.12, pp.1767-1771, Dec 1999.
[10] David Sinchez-Hemindez and Ian D. Robertson, "Analysis and Design of a Dual-Band Circularly Polarized Microstrip Patch Antenna" IEEE Transactions on Antennas and Propagation, issue 43, No2, February, 1995.
[11] C. H. Chan, Y. X. Yu and K. M. Luk, "Numerical Study of a Proximity-Coupled MicrostripAntenna with a Slot", Antenna and Propagation Society International Symposium, Montreal,Que., vol.4, pp. 2115-2118, 1997.
[12] W.K. Lo, C.H. Chan and K.M. Luk, "Circularly Polarized Microstrip Antenna Array Using Proximity-Coupled Feed", Electronics Letters, vol. 34, issue-23, pp. 2190-2191, 1998.
[13] S. Gao, and A. Sambell, "Broadband Proximity-Coupled Microstrip Antenna", Antenna and Propagation Society International Symposium, UK, vol.1, pp. 759-762, 2004.