International Journal of Research in Advent Technology (IJRAT) Special Issue
E-ISSN: 2321-9637
Available online at www.ijrat.org
*International Conference "*INTELINC 18*", 12th & 13th October 2018*

Design of h-Shaped Dual band Microstrip Patch Antenna For Wireless Application

K. Mahendran* and M. Suriya**
**Research Scholar, Department of Electronics and Communication Engineering, Annamalai University, Postal address: Assistant Professor, CK College of Engineering and Technology, Jayaram Nagar, Chellankuppam, Cuddalore-607003, Phone: 9698999699, E-Mail: srimahendrancs@gmail.com.*
***Final Year Student of Post Graduate, Department of Electronics and Communication Engineering, CK College of Engineering and Technology, Postal address: ME-II Year, CK College of Engineering and Technology, Jayaram Nagar, Chellankuppam, Cuddalore-607003, Phone: 8695830214, E-Mail: suriyamohandoss1030@gmail.com.*

Abstract - Microstrip antennas are broadly used in communication system. This Printed antennas provides attractive features like low profile, low weight and low cost. In wireless communication more than a single band application in a common antenna is likely to be wanted with the properties like similar radiation patterns in terms of main lobe direction and beam width, good impedance matching. To exhibit these features the h-shaped microstrip patch antenna is presented here, it is designed to operate in two frequencies such as 2.6 GHz and 4.2GHz with gain and bandwidth enhancement.

Keywords*:* h-Shaped patch, Microstrip antenna, Unequal h, Dual band application.

I .INTRODUCTION

In wireless applications various antennas are used for various applications with high gain and high bandwidth. This increases the uses of the wireless communication. For achieving all these features comprising in a single device, microstrip patch antenna is the good choice. The printed antenna is fabricated by Microstrip basics on a printed circuit board. These antennas are mostly operated in microwave frequencies. The printed antennae consists ground plane, a dielectric substrate on the ground and a patch which is a radiating part of the antenna is placed on the substrate. A microstrip antenna is available in several shapes, the rectangular shape MSA is widely used. Microstrip patch antenna, in their most basic form, benefits from their low profile, low cost, simplicity, and omnidirectional radiation pattern.

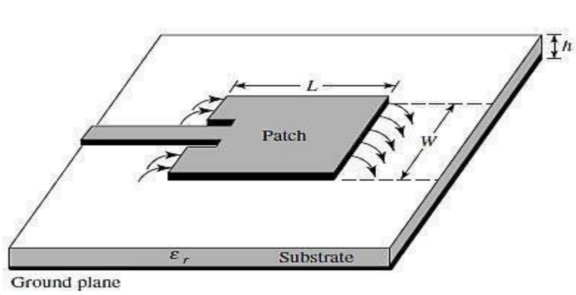

Fig. 1. Microstrip patch antenna

In some applications in wireless communications, it is desirable to design a patch antenna covering two or three frequency bands which are close to each other. Here an h - shaped antenna for 2.6-GHz and 4.2-GHz Dual-band wireless applications is presented. In the proposed antenna like other multifrequency antennas is capable of dual band operation.

II. PATCH ANTENNA

This antenna consists of a dielectric substrate with ground plane on one side and a conducting patch on the other side. The path gets radiated due to the fringing fields. Microstrip antenna's radiation arises from the fringing fields which are due to voltage distribution hence the radiation arises due to voltage distribution, so patch antenna is also called voltage radiators. The relative permittivity of the dielectric substrates determines the length of the patch. The conducting patch shape may be of various types. Basic shapes of are rectangle, circle, triangle, ring, square. Besides these shapes when a patch is designed with continuous structure It can be used as a radiating patch. Microstrip antenna is connected to transmitter or receiver by using a transmission line. The signal transmission or reception takes place between the patch and ground plane. Because of their thin profile narrower bandwidths, ruggedness Microstrip Antennae are used for various applications.

Patch of the Microstrip antenna may be of various shapes but if the patch is continuous then such design can be utilized as patch. In considerations of the various antenna parameters, slots can be given in the patch. Microstrip antenna can be fed by various feeding techniques such as line feed, inset feed, coaxial feed, and Proximity couple feed. Feeding is used to excite the patch to radiate by direct or indirect contact. Among them line feed and inset feed will be the better choice at high frequencies the h-shaped resonator structures is proposed, which is capable of switching between the broadside pattern and end-fire pattern.

III. DESIGN OF ANTENNA

The simulated structure of designed antenna is given in fig. An unequal h-shape is present in the center of the patch. The h-shaped patch antenna is advantageously small compared to the conventional rectangular patch for a given resonant frequency. It is well-known that a linearly polarized rectangular patch antenna laid in xy-plane, can be excited at the fundamental resonant mode. The h-shaped patch itself forms an Inset feed. Inset refers to the depth inside the patch. The Gain is more at the centre of the patch and also return loss which is more at the ends of the patch. At the ends of the conductor or conducting patch the current is less and such that impedance is more. On moving towards the centre improves the radiations as current increases.

By ohms law as the current increases, impedance gets reduced. So when the depth inside the patch is one quarter of the length of the patch then the impedance gets reduced by half providing a good radiation gain of the patch.

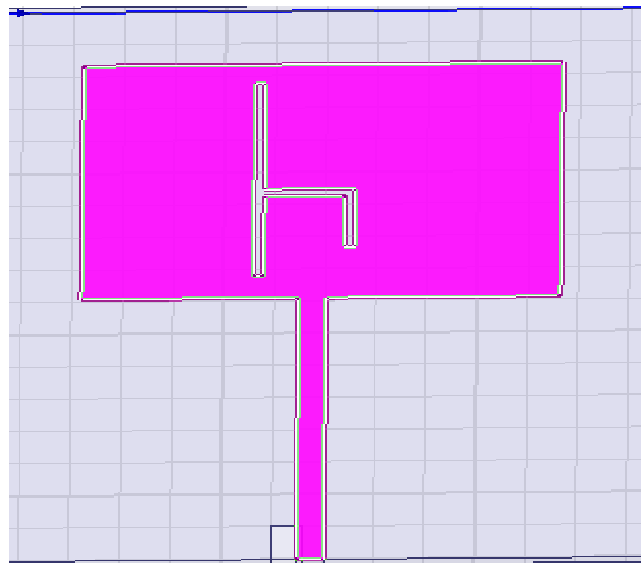

Fig. 2. Simulated structure of h-shaped antenna

The patch along with the unequal h-shape is fed to the feed line of the antenna. When the current is applied to the conducting patch an electric and magnetic fields are produced. The acceleration of charge carriers generates Electromagnetic waves around the antenna. The h-shape in the patch causes further changes in the movement of charge carriers. This makes the antenna to resonate with greater amplitude at two specific frequencies such as 2.6GHz and 4.2GHz respectively.

IV. SIMULATION RESULT

The Simulation results of proposed antenna including the resonant frequency plot and the VSWR plot are given below.

A. Return Loss

It is clear from the resonant frequency plot (return loss) shown in Fig.3.that it is a Dual band antenna with resonant frequencies 2.6 GHz and 4.2 GHz which covers the wireless application of Wi-Max and Satellite Applications respectively.

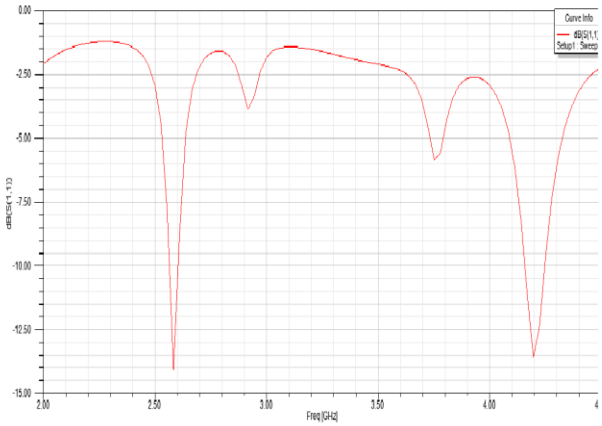

Fig. 3. Return loss of antenna

B. VSWR

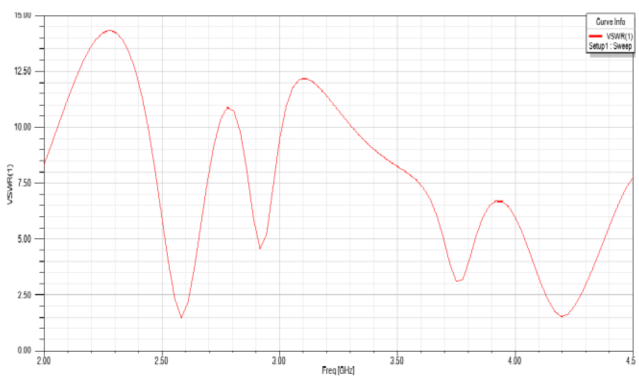

Fig.4. Plot of VSWR

Generally the VSWR should be below 2dB so that the antenna will consider to be as working. In the given fig.4 both the bands at 2.6GHz and 4.2 GHz are lie below 2dB which shows that the proposed antenna is properly working.

V. RESULT ANALYSIS

By analyzing all the simulated results, it is prove that the proposed antenna is operates on two frequencies such as 2.6 GHz and 4.2 GHz respectively this include Wi-Max and Satellite Applications. Hence it is a Dual band antenna. The study of tuning frequency in each band is presented with the achievable frequency range of the antenna. The operating frequencies can be adjusted independently within its achievable frequency ratio with good impedance matching.

VI. CONCLUSION

The compact Dual band h-shaped antenna fed by a microstrip line has been presented. This proposed antenna has a promising performance such as dual band, low profile, simple feed network, easy fabrication and low cost. The antenna geometry is simple and easy to fabricate and implement. Consequently, the proposed antenna is suitable for multi-frequency applications of wireless communication systems.

REFERENCES

[1] S. Maci and G. B. Gentili, "Dual-frequency patch antennas," *IEEE Antennas Propag. Mag.*, vol. 39, no. 6, pp. 13–20, Dec. 1997.

[2] S. A. Long and M. D. Walton, "A dual-frequency stacked circular-disc antenna," *IEEE Trans. Antennas Propag.*, vol. 27, no. 2, pp. 270–273, Mar. 1979.

[3] F. Croq and D. M. Pozar, "Multifrequency operation of microstrip antennas using aperture-coupled parallel resonators," *IEEE Trans. Antennas Propag.*, vol. 40, no. 11, pp. 1367–1374, Nov. 1992.

[4] K. Carver and J. Mink, "Microstrip antenna technology," *IEEE Trans. Antennas Propag.*, vol. 29, no. 1, pp. 2–24, Jan. 1981.

[5] B. Wang and Y. Lo, "Microstrip antennas for dual-frequency operation,"*IEEE Trans. Antennas Propag.*, vol. 32, no. 9, pp. 938–943, Sep. 1984.

[6] P. C. Sharma and K. Gupta, "Analysis and optimized design of single feed circularly polarized microstrip antennas," *IEEE Trans. Antennas Propag.*, vol. 31, no. 6, pp. 949–955, Nov. 1983.

[7] W. C. Mok, S. H. Wong, K. M. Luk, and K. F. Lee, "Single-layer single patch dual-band and triple-band patch antennas," *IEEE Trans. Antennas Propag.*, vol. 61, no. 8, pp. 4341–4344, Aug. 2013.

[8] Y. Chung, S.-S. Jeon, D. Ahn, J.-I. Choi, and T. Itoh, "High isolation dual-polarized patch antenna using integrated defected ground structure," *IEEE Microw. Wireless Compon. Lett.*, vol. 14, no. 1, pp. 4–6, Jan. 2004.

[9] C. Zhou, G. Wang, J. Liang, Y. Wang, and B. Zong, "Broadband antenna employing simplified MTLs for WLAN/Wi-MAX applications," *IEEE Antennas Wireless Propag. Lett.*, vol. 13, pp. 595–598, 2014.

[10] D. Schaubert, F. Farrar, A. Sindoris, and S. Hayes, "Microstrip antennas with frequency agility and polarization diversity," *IEEE Trans. Antennas Propag.*, vol. 29, no. 1, pp. 118–123, Jan. 1981.

[11] S. S. Zhong and Y. T. Lo, "Single-element rectangular microstrip antenna for dual-frequency operation," *Electron. Lett.*, vol. 19, no. 8, p. 298–300, Apr. 1983.

[12] W. F. Richards, S. Davidson, and S. A. Long, "Dual-band reactively loaded microstrip antenna,"

IEEE Trans. Antennas Propag., vol. 33, no. 5, pp. 556–561, May 1985.

[13] S. E. Davidson, S. A. Long, and W. F. Richards, "Dual-band microstrip antennas with monolithic reactive loading," *Electron. Lett.*, vol. 21, no. 20, pp. 936–937, Sep. 1985.

[14] W. Cao, B. Zhang, A. Liu, T. Yu, D. Guo, and X. Pan, "Multifrequency and dual-mode patch antenna based on electromagnetic band gap (EBG) structure," *IEEE Trans. Antennas Propag.*, vol. 60, no. 12, pp. 6007–6012, Dec. 2012.

[15] F. J. Herraiz-Martínez, D. Segovia-Vargas, L. E. García-Muñoz, and V. González-Posadas, "Dual-frequency printed dipole loaded with metamaterial particles," in *Proc. IEEE Int. Symp. Antennas Propag.*, San Diego, CA, USA, Jul. 2008, pp. 1–4.

[16] S. Zhu and R. Langley, "Dual-band wearable textile antenna on an EBG substrate," *IEEE Trans. Antennas Propag.*, vol. 57, no. 4, pp. 926–935, Apr. 2009.

[17] H.-X. Xu, G.-M. Wang, and M.-Q. Qi, "A miniaturized triple-band metamaterial antenna with radiation pattern selectivity and polarization diversity," *Prog. Electromagn. Res.*, vol. 137, pp. 275–292, 2013.

[18] H. Malekpoor and S. Jam, "Design of a multi-band asymmetric patch antenna for wireless applications," *Microw. Opt. Technol. Lett.*, vol. 55, no. 4, pp. 730–734, 2013.

[19] G. V. Eleftheriades, A. K. Iyer, and P. C. Kremer, "Planar negative refractive index media using periodically transmission lines," L-C loaded *IEEE Trans. Microw. Theory Techn.*, vol. 50, no. 12, pp. 2702–2712, Dec. 2002.

[20] S. Barth and A. K. Iyer, "A miniaturized uniplanar metamaterial-based EBG for parallel-plate mode suppression," *IEEE Trans. Microw. Theory Techn.*, vol. 64, no. 4, pp. 1176–1185, Apr. 2016.

[21] C. A. Balanis, *Antenna Theory: Analysis and Design*. Hoboken, NJ, USA: Wiley, 2005.

[22] J. K. A. Everard and K. K. M. Cheng, "High performance direct coupled Band pass filters on coplanar waveguide," *IEEE Trans. Microw. Theory Techn.*, vol. 41, no. 9, pp. 1568–1573, Sep. 1993.

[23] G. D. Alley, "Interdigital capacitors and their application to lumped element microwave integrated circuits," *IEEE Trans. Microw. Theory Techn.*, vol. 18, no. 12, pp. 1028–1033, Dec. 1970.

[24] R. C. Hansen, "Fundamental limitations in antennas," *Proc. IEEE*, vol. 69, no. 2, pp. 170–182, Feb. 1981.

[25] Girish Kumar and K.P.Ray, "Braodband Microstrip Antennas", Artech House Boston.

[26] Ali Fauzadi, Hamid Reza Hassani and Sajad Mohammad ali nezhad, "Small UWB Planar Monopole Antenna with Added GPS/GSM/WLAN Bands ", IEEE Transactions on Antennas and Propagations, Vol.60. No.6, June 2012.

[27] Guihong Li, Huiqing Zhai, Tong Li, and Xiaoyan Ma, "Design of a Compact UWB Antanna Integrated with GSM/WCDMA/WLAN Bands", Progress in Electromagnetics Research, Vol.136, pp.409-419, 2013.

[28] Peng Gao, Zhiqiang Li and Yi Zheng, "An Integrated UWB and Bluetooth Antenna with Dual WLAN Band-Notched", IEEE International conference on Ultra wide band, 2011.

[29] L. Xiong and P. Gao, "Dual-band Planar Monopole Antenna for Bluetooth and UWB applications with WIMAX and WLAN bandnotched", Progress In Electromagnetics Research Letters, Vol. 28, pp. 183-194, 2012.

[30] Sanjeev Kumar Mishra, Rajiv Kumar Gupta, Avinash Vaidya, and Jayanta Mukherjee, "A Compact Dual-Band Fork-Shaped Monopole Antenna for Bluetooth and UWB Applications", IEEE Antennas and Wireless Propagation letters, VOL. 10, 2011.

[31] M. Bod, H. R. Hassani, and M. M. Samadi Taheri , "Compact UWB Printed Slot Antenna With Extra Bluetooth, GSM, and GPS Bands", IEEE Antennas and Wireless Propagation letters, VOL. 11, 2012.

[32] S. D. Mahamine and R. P. Labade, "A 'Φ' Shaped Compact Dual Band Printed Monopole Antenna for Bluetooth and UWB Applications", IEEE International Conference on Industrial Instrumentation and Control (ICIC), pp.756-760, March 2015.s