The International Journal Of Engineering And Science (IJES)
|| Volume || 3 || Issue || 6 || Pages || 53-57 || 2014 ||
ISSN (e): 2319 – 1813 ISSN (p): 2319 – 1805

Gain Enhancement of Slotted Microstrip Patch Antenna using EBG

R. Dhanalakshmi, [1] Santhosh Kumar, [2] R. Srinivas, [3]
[1] M.Tech, IV SEM, Student of Dept of Electronics and communication, New Horizon College of Engineering
[2] Lecturer, Dept of Mechatronics, Acharya Institutes
[3] M.C.A, IV SEM, Student of Dept of Computer Science, Garden City College

----------**ABSTRACT**----------
This paper presents a micro strip patch antenna through EBG process with the slotting technique in order to enhance the gain. Performance parameters like Gain, VSWR, and Radiation pattern have been obtained for slotted Microstrip patch antenna through EBG. The statistical results show that the gain of the Slotted Microstrip Patch Antenna increases. The modelling of the proposed antenna and parameters evaluation of proposed antenna has been implemented in Finite Element Method (FEM) based software 'High Frequency Structure Simulation' (HFSS) ver. 10.0

KEY TERMS -- *Microstrip Patch Antenna, Gain enhancement. Voltage Standing Wave Ratio (VSWR)*

Date of Submission: 26 May 2014 Date of Publication: 15 June 2014

I. INTRODUCTION

The recent rapid progress in the field of wireless communication demands simple, small, reliable, economical, low profile and lightweight and mechanically robust antennas for various applications like mobile and satellite communication, phased array, electronic warfare, radar, missile telemetry, space and airborne microwave remote sensing systems etc. Microstrip Patch Antennas possess the above-mentioned desired properties [1]. So they are considered as a potential candidate for these purposes. Microstrip Patch Antenna consists of a radiating patch on one side of a dielectric substrate which has a ground plane on the other side [2].

Patch is generally square, rectangular, circular and elliptical. But the fields of application of these antennas are limited by their inherent disadvantage of relatively low Gain [3]. Several techniques are available in literature for improving the Gain of microstrip antennas [4-6]. Among them the slotting technique is simple to enhance the gain as compared to the other techniques because, it has the freedom to add desired slot on the radiating element of the microstrip antenna. The slots in the microstrip patches may be of various shapes [4-9] like U-slot, E- shaped slot, L-shaped slot, W-shaped slot etc. Based on the previous ideas, this paper presents synthesis of an antenna with L-shaped slot using Electronic Band Gap.

This paper is organized in four Sections. Following introduction in Section I, geometry of proposed antenna is discussed in Section II. Section III discusses the results of the proposed antenna. Section IV gives the conclusion.

II. ANTENNA DESIGN AND STRUCTURE

The rectangular and square patches are the basic and most commonly used micro strip antennas. These patches are used for the simplest and the most demanding applications. The square patch antenna has the advantage of their radiation. Effective dielectric constant & length is given as:

$$\varepsilon_{reff} = \frac{\varepsilon_r + 1}{2} + \frac{\varepsilon_r - 1}{2}\left[1 + 12\frac{h}{W}\right]^{-\frac{1}{2}}$$

$$\Delta L = 0.412h\frac{\left(\varepsilon_{reff}+0.3\right)\left(\frac{W}{h}+0.264\right)}{\left(\varepsilon_{reff}-0.258\right)\left(\frac{W}{h}+0.8\right)}$$

Where ε_{reff} = Effective dielectric constant

ε_r = Dielectric constant of substrate

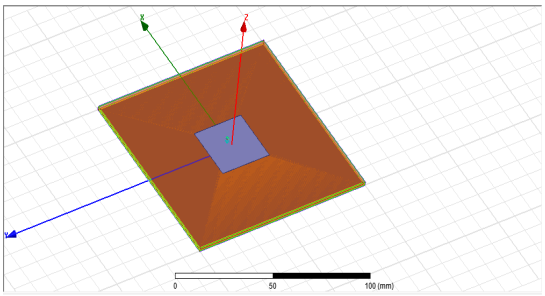
h = Height of dielectric substrate

W = Width of the patch

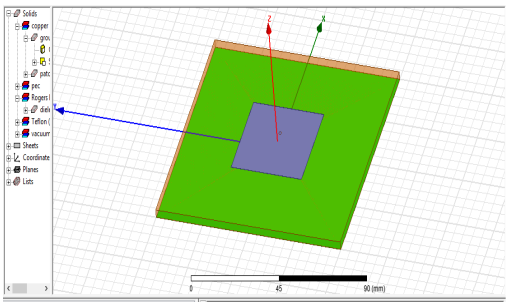
EBG is an artificially engineered meta-material with reference to frequency selective surfaces. They have wide variety of applications ranging from Radomes to public safety applications. Microstrip patch antenna is designed on different dielectric substrates such as, FR4 & Rogers with and without using EBG process and finally with slotting in order to enhance the gain.

The simulated results have been established correspondingly.

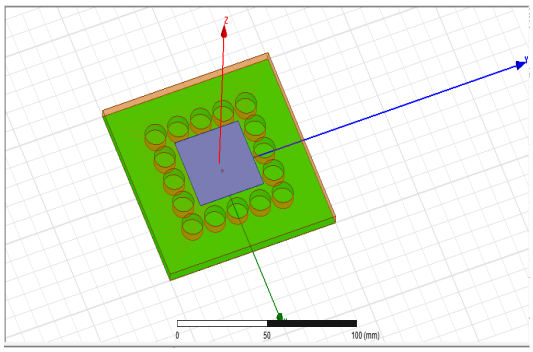
1) Design of Micro Strip Rectangular Patch without EBG



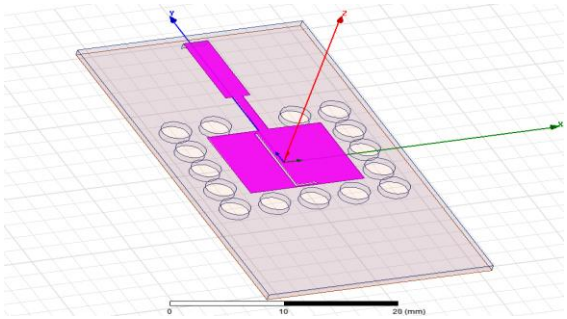
2) Rectangular Patch antenna on Roger substrate



3) Rectangular Patch Antenna with Cylindrical E B G on Roger Substrate



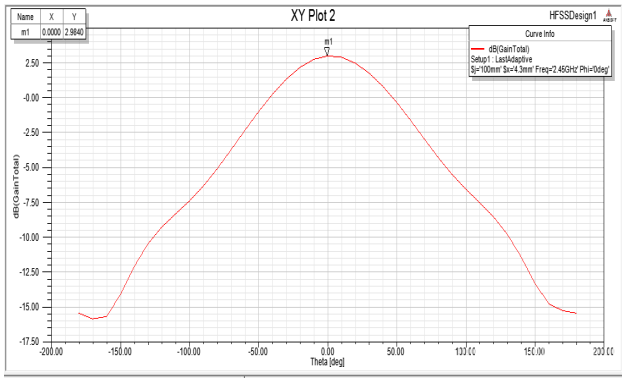
4) L – Slotted rectangular patch antenna with Cylindrical EBG



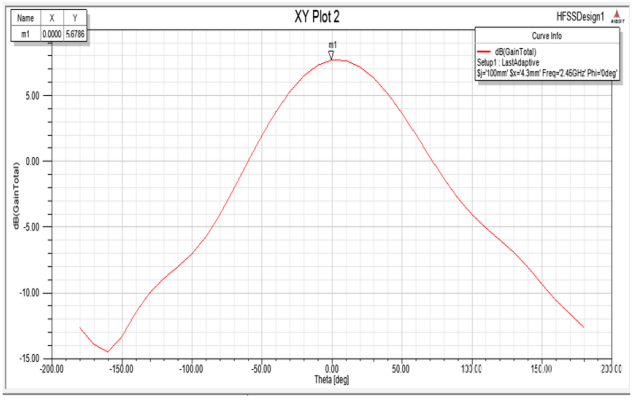
III. RESULTS AND DISCUSSIONS

In this section of paper, the simulated result shows the enhancement of gain of the Slotted microstrip patch antenna using EBG.

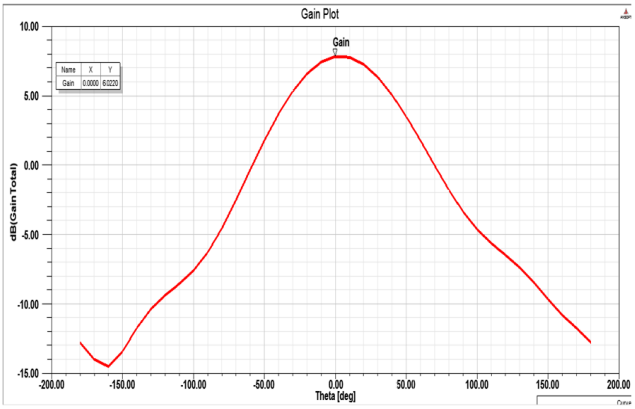
1) Simulated Gain Plot for Rectangular Patch Antenna without E B G on FR4 Substrate = 2.98 dB



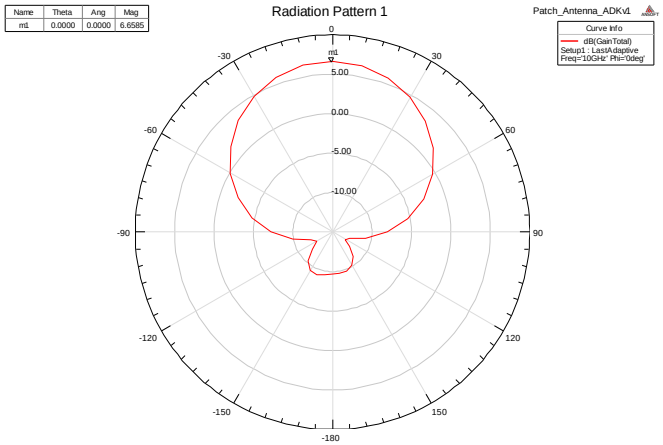
2) Simulated Gain Plot for Rectangular Patch Antenna without E B G on Roger Substrate = 5.6 dB



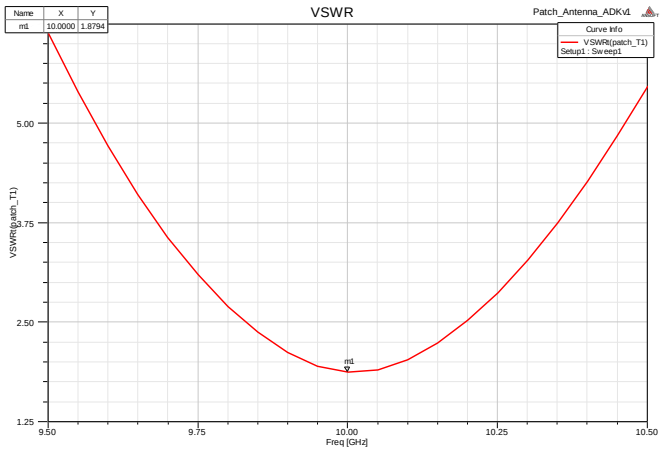
3) Simulated Gain Plot for Rectangular Patch Antenna with Cylindrical EBG on Roger Substrate = 6 dB



4) Radiation Pattern of L – Slotted Rectangular patch antenna using EBG = 6.658 dB



5) VSWR of L - Slotted Rectangular patch antenna using EBG at 10 GHz



IV. IV.CONCLUSION

The idea of Slotted Microstrip Patch Antenna using EBG is demonstrated in this paper. By using the EBG structure, the surface wave effect is reduced resulting to the improvement of the gain of the antenna. The proposed Slotting antennas are simple in design and fabrications. With Slotted Microstrip Patch Antenna by using EBG process the enhancement of Gain can be achieved.

REFERENCES

[1] Liao, W.-J., S.-H. Chang, and L.-K. Li, "A Compact Planar Multiband Antenna for Integrated Mobile Devices," Progress in Electro Magnetics Research, Vol. 109-116, 2010.

[2] Mu, X., W. Jiang, S-X. Gong, and F-W. Wang, "Dual Band Low Profile Directional Antenna with High Impedance Surface Reflector" Progress in Electro Magnetics Research Letters, Volume 25, 67-75, 2011.K. Elissa.

[3] H. H. Xie, Y.C. Jiao, K. Song, and B. Yang, "Miniature Electro Magnetic Band Gap Structure using Spiral Ground Plane", Progress In Electro Magnetics Research Letters, Vol. 17, pages 163-170, 2010.

[4] Tiang, J-J, M.T.Islam, N.Misran and J.S.Mandeep, "Circular Microstrip Slot Antenna for Dual-Frequency RFID Application", Progress in Electro Magnetic Research, Volume 120,499-512, 2011.

[5] Kim, S.-H., T. T. Nguyen, and J.-H. Jang, "Reflection Characteristics of 1-D EBG Ground Plane and its Application to a Planar Dipole Antenna," Progress in Electro Magnetics Research,Vol. 120, 51-66, 2011.

[6] Kin-Lu Wong, "Compact and Broadband Microstrip Antennas", Wiley-Inter Science, New York, 2002.

[7] Wen-shan Chen, Chien-Chin Huang, and Kin-Lu Wong, "Microstrip-Line-Fed Printed Shorted Ring-Slot Antennas for Circular polarization," Microwave and Optical Technology Letters, vol.31, No.2, pp.137-140,October 2001.

[8] J.Y. Sze and K.L. Wong, "Slotted Rectangular Microstrip Antenna for Bandwidth Enhancement", IEEE Transactions on Antennas & Propagation.,Vol. 48, No. 8, pp.1149-1152, Aug. 2000.

[9] Sanjeev kumar Sharma and Munish Rattan," Analysis of Broad Banding and Minimization Techniques for Square Patch Antenna" IETE Journal o Research, VOL 56, ISSUE 2, March 2010.