International Journal of Engineering &Technology, 7 (3.12) (2018) 140-143

International Journal of Engineering & Technology

Website: www.sciencepubco.com/index.php/IJET

Research paper

Design of Multiband Antenna for Wimax and WLAN Applications Using DGS

Banuprakash.R[1], GSPN Amith[2], Gagana N[3], Ravi AG[4], Pavanashree C[5]

[1]*Assistant Professor,*
[1,2,3,4,5]*Department of TE, BMSIT&M,* Bengaluru,India
**Corresponding Author Email: r.bhanuprakash@bmsit.in[1], amithgspn23@gmail.com[2], raviag37@gmail.com[3], pavanashreec@gmail.com[4]*

Abstract

In this paper, a multiband antenna with a micro strip feed line is presented. This antenna is designed on FR4 substrate with dielectric constant 4.4 having overall size of 20 × 20 × 1.6mm^3. The proposed antenna comprises defected ground structure with T and L shape slots to achieve multiband frequencies. This multiband antenna covers three different frequencies as 3.3 GHz, 3.85 GHz and 5.25 GHz. All of these frequencies are applicable for WiMAX and WLAN applications respectively. Return loss (S11), Gain and Radiation patterns are simulated and observed on HFSS.

Keywords: *Defective ground structure, WiMAX,WLAN.*

1. Introduction

With the rapid development of wireless communication systems in recent years, miniaturized antenna acquired demand to include as an internal antenna. Therefore, microstrip antenna has become the main drift of development. Antenna is a type of transducer which is used to convert electrical energy into RF energy. Antenna is a basic device for any communication setup [1].

These microstrip antennas are being used for various applications like Wi-MAX and WLAN applications mainly due to their low profile, low cost, light weight and easy fabrication. For these applications, microstrip patch antennas can be designed by placing a Periodic or Non periodic slots on ground plane called as Defective Ground Structure (DGS) [2-3].

A micro strip feed line can be used to feed the antenna in the design of multiband antennas for wireless applications. Wireless bands are Wi-MAX (3500-4500 MHz), WLAN (5100-5800 MHz) [4].Defective Ground Structure is a dynamic neighborhood of seek in the field of receiver and wave propagation.

2. Antenna Structure Design

A. Defected Ground Structure

Etched slots or defects on the ground plane of microstrip circuits are referred to as Defected Ground structure. Single or multiple defects can be made on the ground plane.

The utilization of DGS is invincible by the properties of the defects such as the shape, dimension, repetition etc. It has been used in the field of micro strip antennas for enhancing the bandwidth and gain. It is also used to suppress the higher mode harmonics, mutual coupling between adjacent element, and cross-polarization for improving the radiation characteristics of the microstrip antenna.

B. Design of the Antenna

In this multiband antenna square shape FR4 substrate with length 20mm, width 20mm and height of 1.6mm is considered. A rectangular patch is placed on the substrate as shown in the figure1.

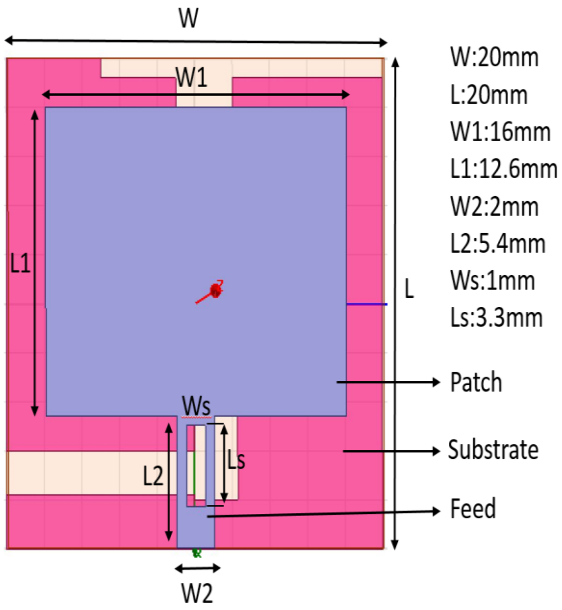


Fig. 1: Front view of an antenna

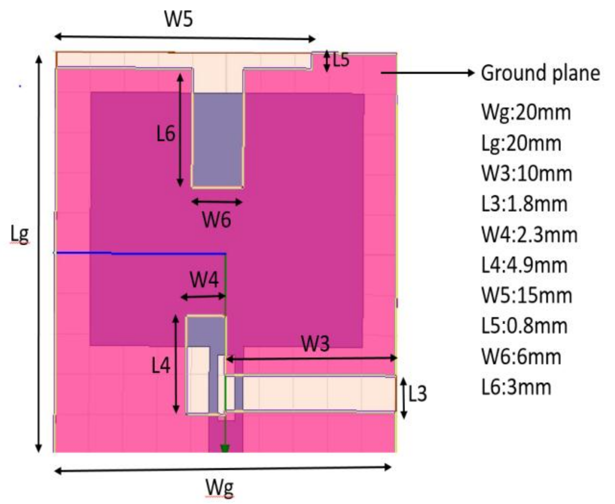


Fig. 2: Back view of an antenna

The L and T shape slots have been made in the ground plane to achieve multiple frequencies as depicted in the figure 2. All slot dimensions are balanced according to the length and width.

3. Simulation of Antenna and Result Discussions

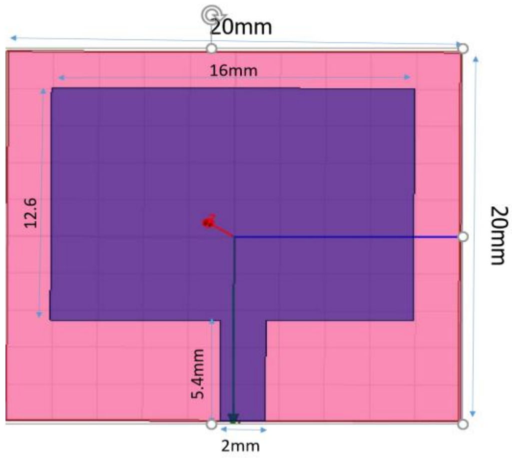


Fig.1: Front View of Antenna Without slots

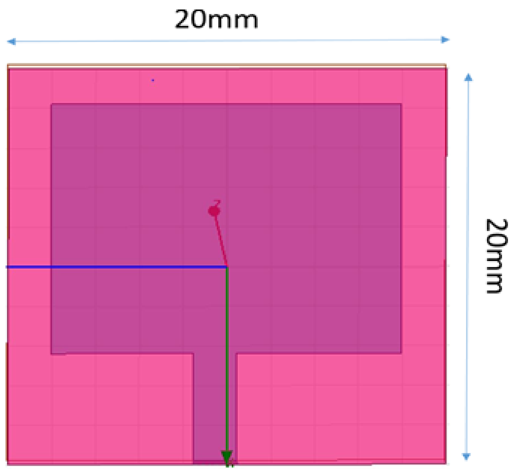


Fig. 2: Back View of the Antenna without slots

At the outset aerial deserted antenna is analyzed without DGS everywhere filler radiates at two bands 5.2GHz and 8.2GHz.

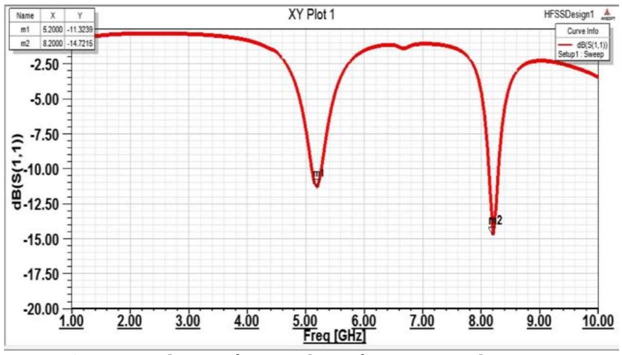


Fig. 3: Simulation of Return loss of Antenna Without DGS

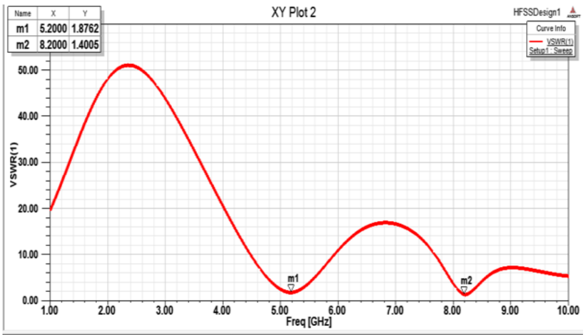


Fig.3: Simulation of VSWR of Antenna Without DGS

Since 5.2GHz is hold for WLAN application our aim is to keep grip of 5.2GHz and acquire other useful frequencies. This is completed according to the current distribution where slots are sliced in ground plane at less radiating part of 5.2GHz.

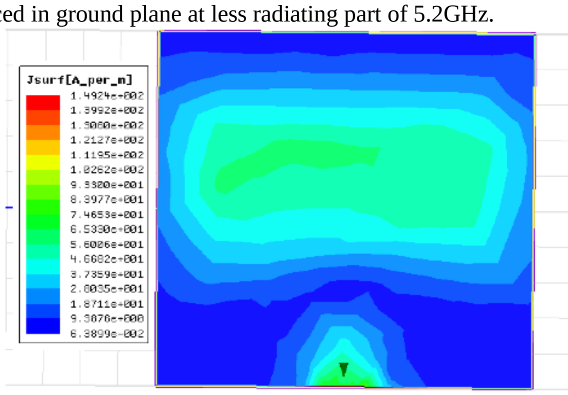


Fig.3: Current Distribution on ground plane at f:5.2 GHz.

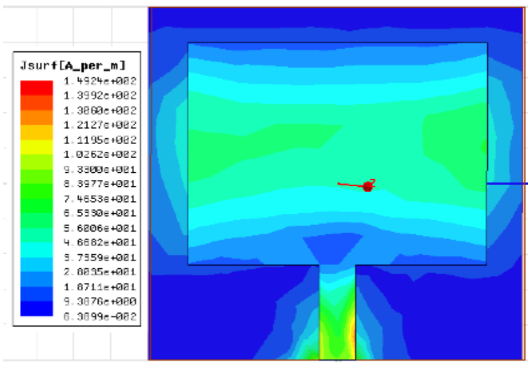


Fig. 4: Current Distribution on patch at f:5.2GHz.

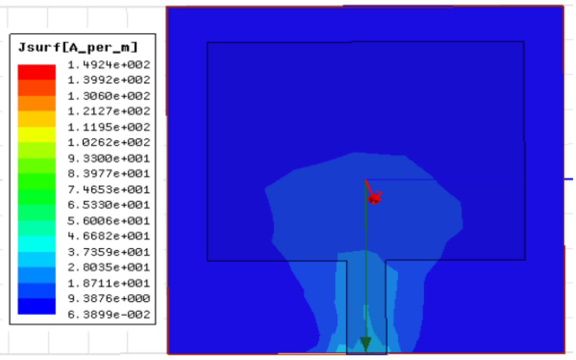


Fig. 5: Current Distribution on patch at f:3.3 GHz

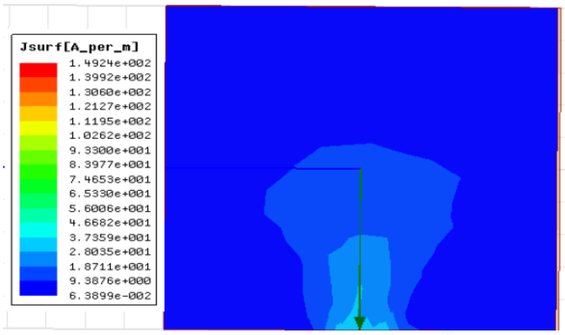


Fig. 6: Current Distribution on ground plane at f:3.3 GHz.

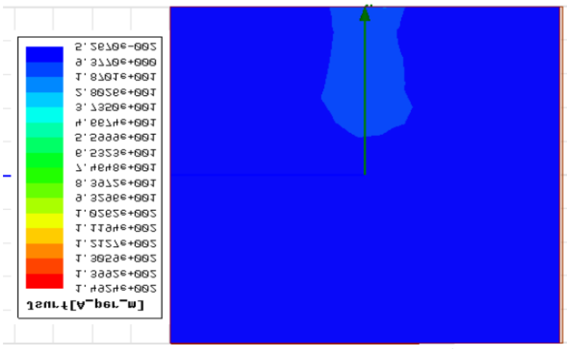


Fig. 7: Current Distribution on ground plane at f:3.8GHz.

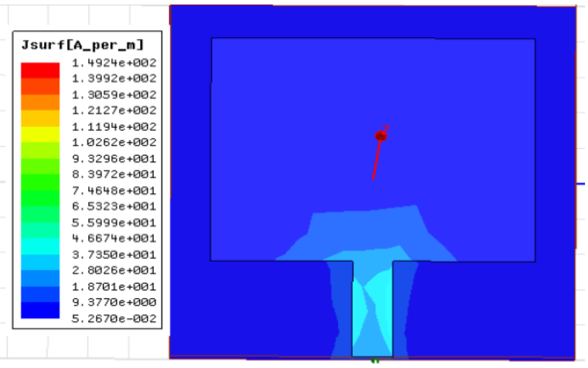


Fig. 8: Current distribution on patch at f:3.8GHz.

The length and width of the rectangular patch is (L1x W1) 12.6mm x 16mm. Each slot in ground plane is cut in order to obtain multiple frequency. Where L and T shape slots produce the frequencies that holds good for WIMAX applications and the slot on feed line (Ls x Ws) 3.3mm x 1mm is cut in order to obtain positive gain at 3.3GHz.

A. Return Loss

Here antenna is producing 5.25GHz where both L and T shape slots together produces 3.3 and 3.85GHz. For these frequencies the return loss is -20.25, -20.22, and -16.47 respectively .

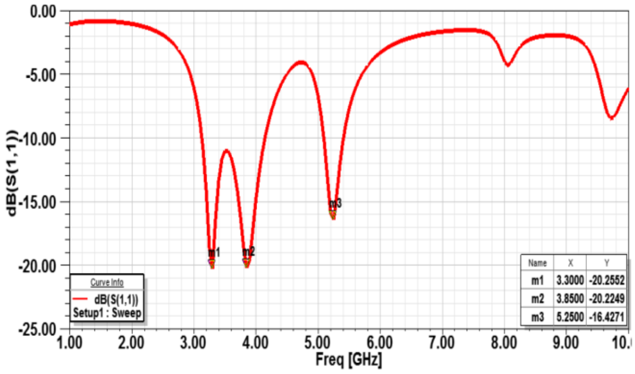


Fig. 11: Simulation of return loss of antenna with DGS

B. Radiation Pattern

Radiation pattern of an antenna shows E-plane and H-plane. We can also observe the co polarization and cross polarization of E and H planes. Here three different radiation patterns have been plotted with respect to three operating frequencies such as 3.3 GHz, 3.85 GHz and 5.25GHz.

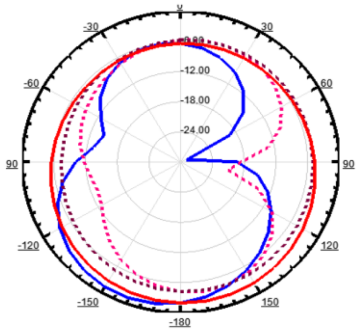


Fig.12: Radiation pattern at frequency 3.3GHz.

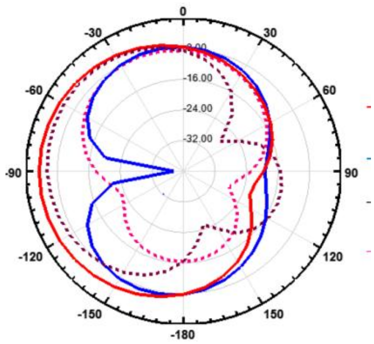


Fig.13: Radiation Pattern at frequency 3.85GHz..

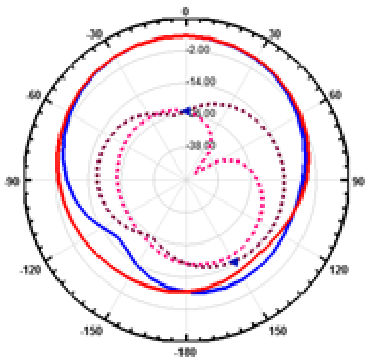
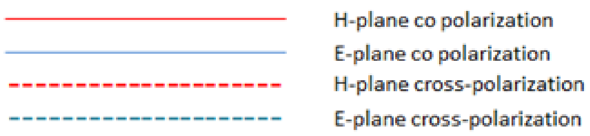


Fig.14: Radiation Pattern at frequency 5.25GHz



Gain of an antenna gives the degree of efficiency of the antenna and its directional capabilities. Here we observe 3.4dB at 3.3 GHz,-2.1dB at 3.3GHz and 2.185 dB at 5.25GHz respectively

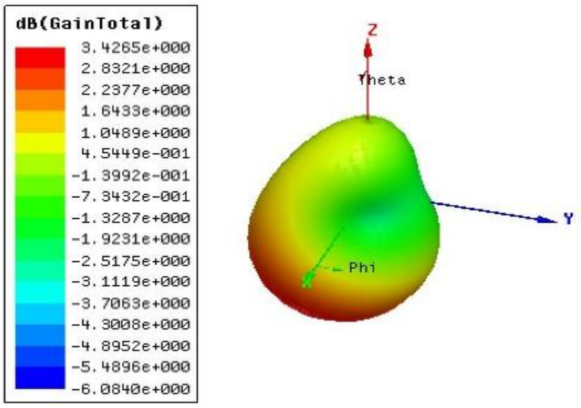


Fig. 15: Gain of antenna at frequency 3.3GHz

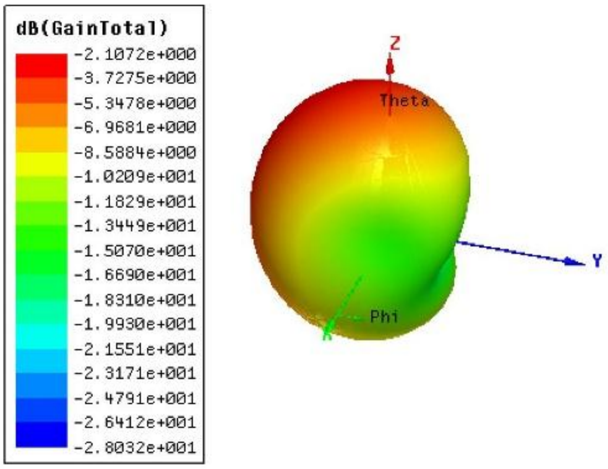


Fig. 16: Gain of antenna at frequency 3.85GHz

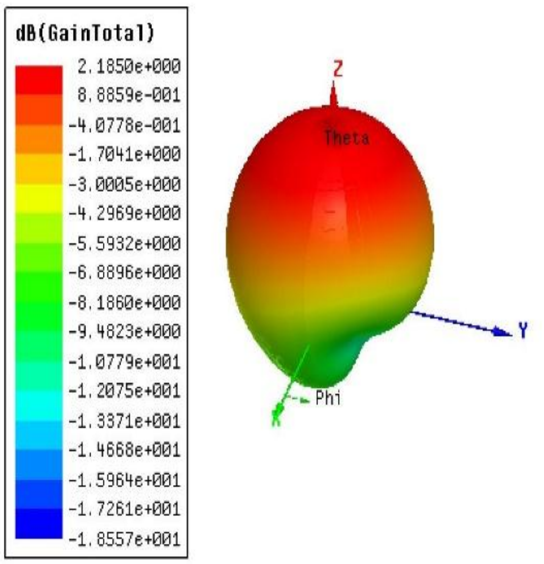


Fig. 17: Gain of antenna at frequency 5.25GHz

Parameters	Without Slot	With Slot
Frequency	3.3GHz,3.8 GHz,5.2GHz	3.3GHz,3.85GHz,5.25GHz
Gain	-1.99dB, -1.64dB, 2.11dB	3.42dB,-2.1dB,2.18dB

Fig. 16: Comparison table

4. Conclusion

The aim of this work is to design and simulate a multiband microstrip slot antenna with defective ground structure operating in three different frequency bands with microstrip feeding technique. For the realization of the antenna, L and T shape slot are made in ground plane. Designed Multiband Antenna resonates at 3.3 GHz,3.85 GHz and 5.25GHz with return loss -20.25 dB ,-20.22 dB and -16.42dB respectively with Gains of 3.42dB,-2.1dB and 2.18dB which is suitable for Wi-MAX and WLAN applications.

References

[1] Amiya B. Sahoo, Department of Electronics and Telecommunication Engineering, SSUT, 2017 2nd IEEE International Conference. Design of Multi-band Rectangular Patch Antennas using Defected Ground Structure (DGS).

[2] R.Er-rebyiy1,J.Zbitou1,A.Tajmouati1, M.Latrach2, A.Errkik1, L.El Abdellaoui1 . 1LMEET Laboratory FST of Settat, University of Hassan 1st Morocco 2Microwave Group, ESEO, Angers,France.2017 IEEE.A New Design of a Miniature Microstrip Patch Antenna Using Defected Ground Structure DGS.

[3] K. Akinwale Amusa Dept. of Electrical Electronics Engineering Federal University of Agriculture Abeokuta, 2017 IEEE 3rd International Conference. Effects of Slot Dimensions and Operating Frequencies on the Equivalent Magnetic Current Distributions in Slot Antennas.

[4] S. Imran Hussain Shah*, Shahid Bashir*, Syed Dildar Hussain Shah. University of Eng. & Technology, Peshawar, Pakistan, 2014 IEEE Compact Multiband microstrip patch antenna using Defected Ground structure (DGS).

[5] JOBINS GEORGE Assistant Professor ,Department of ECE Ilahia College of Engineering& Technology Muvattutupuzha, India. 2016 IEEE, Multiband Microstrip patch Antenna using parallel slots for wireless applications

[6] Bhanu Priya Kumawat(1), Santosh Meena(2), Sanjeev Yadav(3) Govt. Women Engineering College Ajmer, Rajasthan, India.2016. Square Shape Slotted Multiband Microstrip Patch Antenna Using Defect Ground Structure.

[7] L. Cheema, and K. K Sherdia, "Design of microstrip antenna with defected ground structure for UWB applications," International Journal of Advanced Research in Computer and Communication Engineering. July 2013.

[8] A. B. Sahoo, G. P. Mishra, M. R. Jena, and B. B. Mangaraj, "Optimal design and comparative study of circular patch antennas using different feeds for WLAN and WiMAX applications," International Journal on Communications Antenna and Propagation, vol. 6, no. 3, pp. 188-196, June 2016.