Volume 3, Issue 10, October 2013 ISSN: 2277 128X
International Journal of Advanced Research in Computer Science and Software Engineering
Research Paper
Available online at: www.ijarcsse.com

Design of Wideband Micro strip Patch Antenna Using Defected Ground Structure for Wireless Applications

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Abstract: ***This paper demonstrates the wideband microstrip patch antenna for wireless applications with high bandwidth, directivity and small size. The antenna has a bandwidth of 3.5 GHz (3.08 GHz – 6.58 GHz) which covers two bands in each of IMT/WLAN/WI-Max. The rectangular microstrip patch antenna has a defected ground with a pie slot (∏) and also slotting same (∏) shape in patch, substrate, a feed and reduced ground from two sides. The design is analyzed and simulated using CST Microwave Studio 2010 which. The antenna with defected ground structure has improved antenna performance.***

Index Terms – DGS, CST Microwave Studio 2010, ∏ shape slot, ∏ slotted patch, Microstrip line feed.

1. INTRODUCTION

Nowadays the communication plays an excellent role in the worldwide society and almost all the communication systems are changing rapidly from wired to wireless. Wireless communication is much more flexible way of communication and antenna is the most important part of it. Recently the microstrip antenna is very useful due to its low cost, ease of Installation and integration with feed networks, low profile and small size [1-9]. But the microstrip patch antenna has one serious drawback of narrow bandwidth as it limits the useful frequency band [2-3]. Several techniques have been used to enhance the bandwidth by interpolating surface modification into patch configuration. The most unique technique used to enhance the bandwidth and reduce the size of patch is to defect the ground. DGS is realized by etched periodic or non periodic defect in the ground plane [4]. Defected Ground Structure changes shielded current distribution in the ground plane which depends upon shape and dimensions of the defect. The impedance value and surface current of antenna is also influenced due to DGS structure. The DGS structure generally controls the excitation and electromagnetic waves propagated through the substrate [5-7]. It is very important that each different DGS produce different resonances and cut off frequencies that depends upon their geometry and size [6]. The bands for WLAN application are 2.4 GHz (2.400 GHz -2.484 GHz), 5.2 GHz (5.150 GHz- 5.350 GHz) and 5.8 GHz (5.725 GHz to 5.825 GHz). The WiMAX has three licensed bands 2.5 GHz (2.5-2.69 GHZ), 3.5 GHz (3.4-3.69 GHZ) and 5.5 GHz (5.25-5.85 GHZ) [8].The IMT has (2.700 GHz-2.900 GHz), (3.400 GHZ-4.200 GHz) and (4.400 GHz-4.900GHz). In this paper the wideband microstrip patch antenna for two bands in each of IMT/WLAN/WI-Max applications are designed and simulated using CST Microwave Studio.

2. GEOMETRY OF MICROSTRIP PATCH ANTENNA

In this antenna the relative permittivity = 4.4 of FR4 substrate has the thickness h=1.6mm. The length and width of the patch are given as L=18.76mm and W=27.84mm.The length and width of substrate are L=23.36mm and W=33.84mm respectively. The ground plane length and width dimensions are L=23.36mm and W=25.84mm respectively. The ground plane is reduced only width wise and pie (∏) shape DGS in the center of ground plane. The same pie (∏) shape slotting is in the center of patch. The pie shape dimensions are varied to meet the requirements. In this work contacting feeding method i.e microstrip line (50Ω) feed has been used. The edges along the width are known as radiating edges and along length are non radiating edges. The main concept behind the designed antenna is to enhance the bandwidth of antenna by DGS structure.

3. DESIGN PARAMETERS

The front view and rear view of proposed antenna is shown in Fig. 1 and 2 all simulation to design the wideband microstrip feed patch antenna for IMT/WLAN/WI-Max applications is completed by CST Microwave Studio Software.

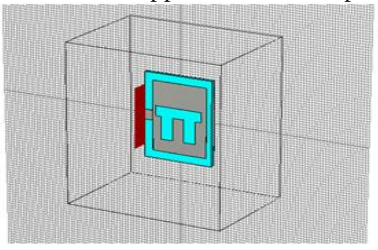

Fig. 1 Front view geometry of designed antenna

To get the accurate impedance match to the antenna the feed point location and dimensions have been optimized for the designed antenna. The parameters related proposed antenna are given as

Thickness of substrate = 1.6mm
Length of the patch = 18.76mm
Width of the patch = 27.84mm
Length of ground plane (Lg) = 23.36mm
Width of Ground plane (Wg) = 25.84mm
Length of substrate (Ls) = 23.36mm
Width of substrate (Ws) = 33.84mm
Relative permittivity = 4.4

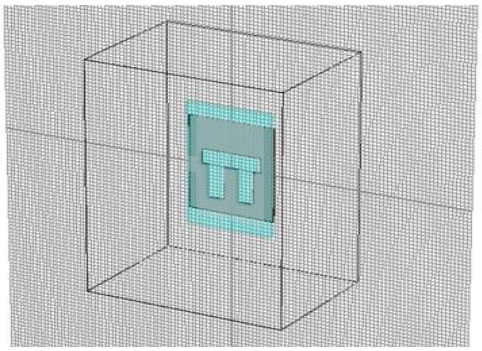

Fig. 2 Rear view geometry of designed antenna

4. SIMULATED RESULTS

Bandwidth

The designed antenna resonates at 4.83GHz and covers a wide bandwidth of 3.5 GHz. The bandwidth plot curve is shown in Fig. 3.

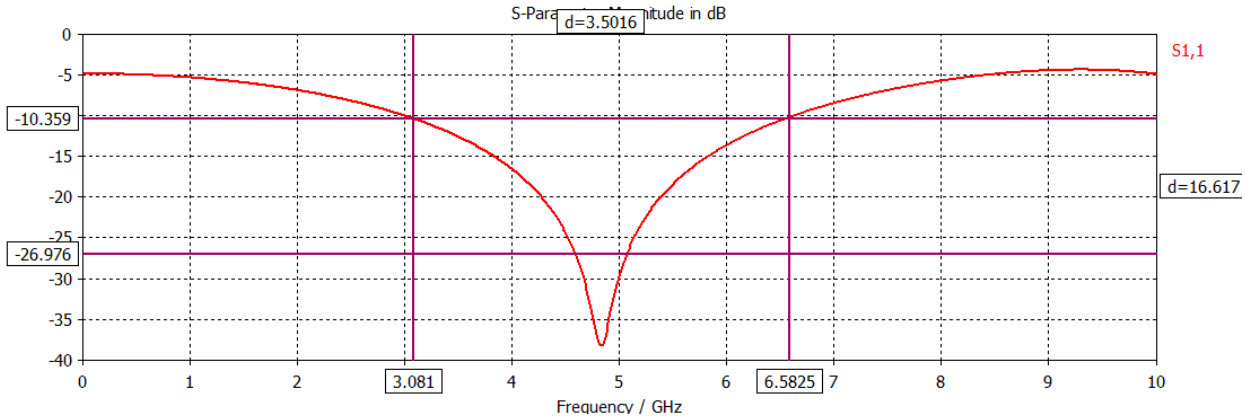

Fig. 3 Bandwidth Plot

Return Loss

The scattering parameter S11for the designed antenna is calculated and the plot of return loss is shown in Fig. 4.

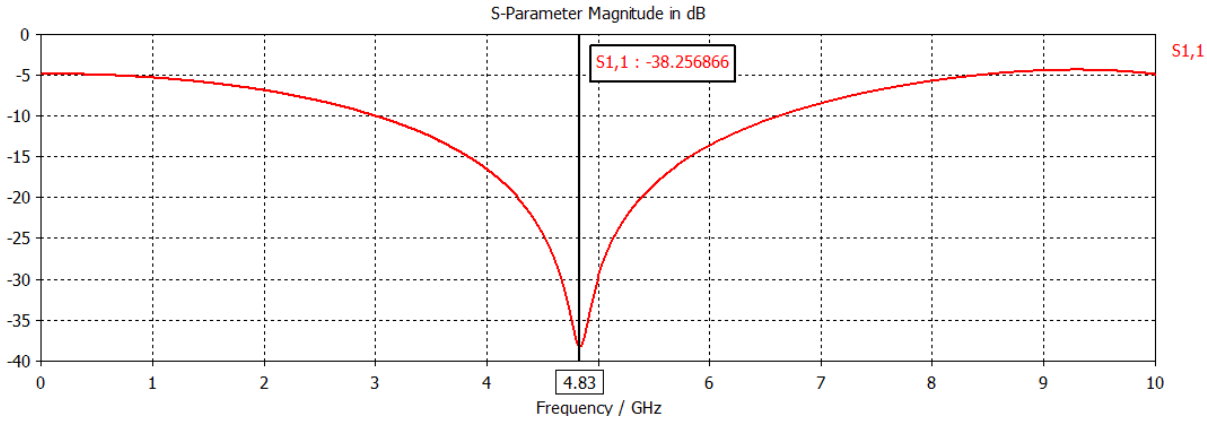

Fig. 4 Return Loss Curve

The value of return loss is -38.25dB for the designed antenna.

Smith Chart and VSWR

Smith chart represents the impedance matching. Fig. 5 shows impedance value.

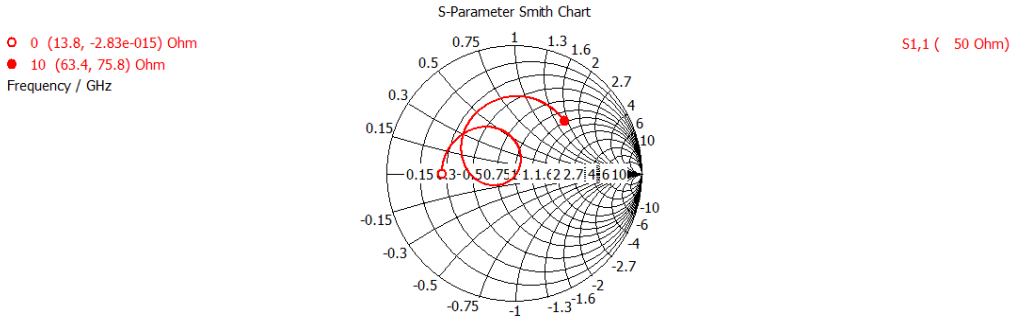

Fig. 5 Characteristic Impedance Curve

Voltage standing wave ratio shows the impedance mismatch. The designed antenna VSWR value 1:1.02 as shown in Fig. 6 its value must be lies in between 1 and 2.

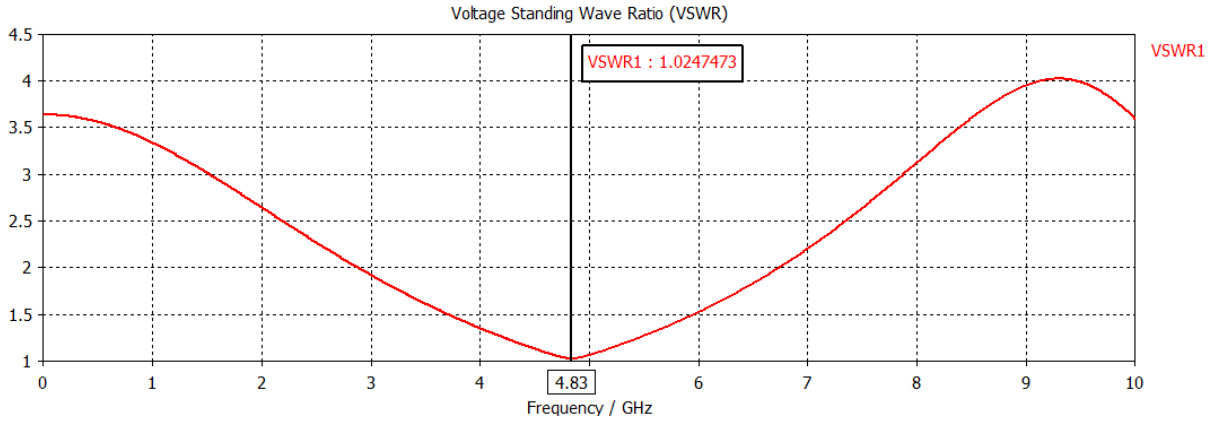

Fig. 6 VSWR Curve

Surface Current

The surface current shows the flow of current at the patch surface is shown in Fig. 7

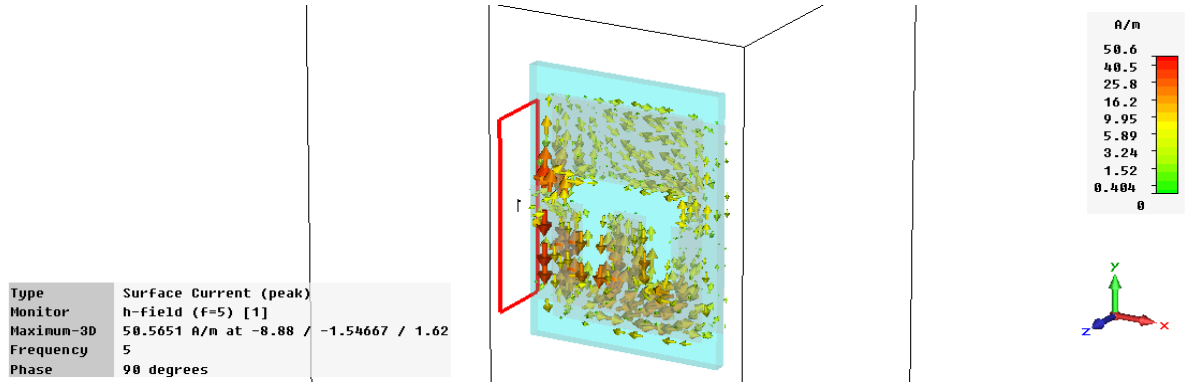

Fig. 7 Surface Current

Directivity

Directivity is the property of an antenna to focus all the energy in particular direction. The designed antenna has directivity value of 6.38dBi as shown in Fig. 8.

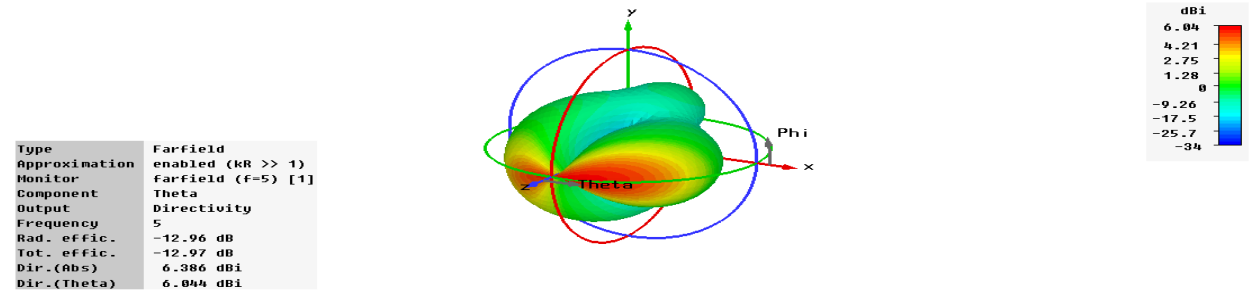

Fig. 8 Directivity Plot

5. CONCLUSION AND FUTURE WORK

The designed wideband rectangular microstrip patch antenna is operating in the frequency range of 3.08GHz – 6.58GHz covering IMT/WLAN/WI-Max standards. The antenna has a simple structure and easy the fabrication due to the use of FR4 substrate. The proposed antenna represents the better directivity and return loss. The other technique can be used to enhance the directivity and Gain is DGS with Meta materials structure and many more. Work is further going on to get even better results with good axial ratio.

REFERENCES

[1] Indrasen Singh, V.S. Tripathi, "Microstrip Patch Antenna and its Applications: a Survey" International Journals of Computer Applications in Technology, Vol. 2, No.5, pp. 1595-1599.

[2] Constantine A. Balanis, "*Antenna theory Analysis and Design*" 2nd edition, John Wiley and Sons, 2003, Vol14, pp 812. [3] K. L.Wong,"*Compact and Broadband Microstrip Antennas*" John Wiley & Sons, 2003.

[4] L. H. Weng, Y. C. Guo, X. W. Shi, and X. Q. Chen. 2008, "An Overview On Defected Ground Structure", Progress In Electromagnetics Research B, Vol. 7, pp. 173–189, 2008.

[5] Ashwini K. Arya, M.V. Kartikeyan , A.Patnaik "Defected Ground Structure in the perspective of Microstrip Antennas: A Review" frequenz, Vol.64, pp. 79–84,2010.

[6] Ashwini K. Arya, M.V. Kartikeyan , A.Patnaik ,"Micro strip patch antenna with Skew-F shaped DGS for dual band operation" Progress In Electromagnetics Research M, Vol. 19, pp. 147-160,2011.

[7] Rajeshwar Lal Dua, Himanshu Singh, Neha Gambhir, "2.45 GHz Microstrip Patch Antenna with Defected Ground Structure for Bluetooth" International Journal of Soft Computing and Engineering (IJSCE) ISSN: 2231-2307, Volume-1, Issue-6, January 2012.

[8] *http:en.wiki .edia.org/wiki/WiMAX/Wlan*.

[9] Patil V. P., "Enhancement of bandwidth of rectangular patch antenna using two square slots techniques" International Journal of Engineering Sciences & Emerging Technologies, ISSN: 2231 – 6604, Volume 3, Issue 2, pp: 1-12, Oct. 2012.

