International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Articles available online http://www.ijoer.in

Vol.3., Issue.5., 2015
(Sept.-Oct.)

RESEARCH ARTICLE

ISSN: 2321-7758

DUAL BAND BODY ANTENNA FOR C BAND APPLICATIONS

HITESH JOSHI[1], RAVINDRA PRAKASH GUPTA[2]
[1]Research Scholar, Pacific University, Udaipur (Raj.) India
[2]Professor & Principal, Manda Institute of Technology, Bikaner(Raj) India

HITESH JOSHI

RAVINDRA PRAKASH GUPTA

ABSTRACT

This paper presents design of body phased array using optimized dual frequency body patch antenna for C band focusing on 5 and 6 GHz frequency band. Inclusion of slots with near about symmetrical distribution on conducting plane and notches in both plane and defected ground structure and also changing feed position for impedance matching. Return loss of final design is -10.14 dB for 5.2 GHz frequency and VSWR of 1.89 and -15.49dB and VSWR of 1.54 for 6.4 GHz frequency. Proposed antenna gives dual band operation and shows good bandwidth and simulated results for two frequency bands.

Key Words — Body antenna, Patch, slot, DGS, feedline, notch, Body Area Network

INTRODUCTION

C band body radars work on a wavelength of 4-6 cm and a frequency of 4-6 GHz. Because of the wavelength and frequency, the antenna size does not require being very large. This makes C band radars compatible for body area network. Signal is easily attenuated; C band radar is best used for short range body signal observation. The frequency allows C band radars to generate a smaller beam width using a smaller body antenna. It not require more power compare the S band radar [1,2,11].

Body wireless communication requires many antennas to be worked together for scanning, tracking and other such needs for precision. Combination of more than one antenna can be called as array. The radiation pattern of a single element is relatively wide, low values of directivity (gain). So it is compulsory to design antennas with very high gains for long distance communication. This can possible by increasing the electrical size of the antenna. Enlarging the dimensions of single elements always leads to more directive characteristics. Next way to enlarge the dimensions of the antenna, without increasing the size of the single elements, is to make an assembly of radiating elements in a geometrical and electrical configuration. This new antenna, formed by multi-elements, is called to as an array. Generally the elements of an array are identical. But it is often convenient, simpler, and more practical. The single elements of an array may be of any form (wires, apertures, etc.) that we shift a baseband information signal to a frequency or frequencies suitable for electromagnetic propagation to the desired destination. Apart from that when we actually radiate energy in free space there are chances of mixing noise and also change in polarization resulting in undesired effects. This can be avoided by introduction of phase changes between each element of array. In other words by using phase changes at each element overall performance can be improved. Thus a concept of phased array helps in transmission and reception of signals. Phase changes can be introduced by numerous methods it can be by much different planar structure [7, 8, 9, 10].

DESIGN

Width=30.6mm and length= 27.40mm .

Here modification is done in two different plane i.e. on top plane and ground plane separately. For top plane four square slots of size 5mm x 5mm are made on upper portion of the rectangular patch antenna. Ground plane is made defected. Regular defected structure is introduced in ground plane.

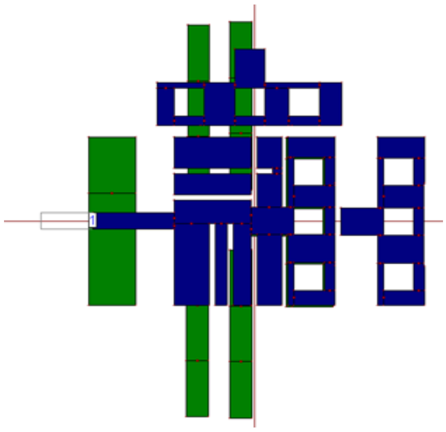

Fig. 1. Detail simulation window showing different dimensions of top conducting plane.

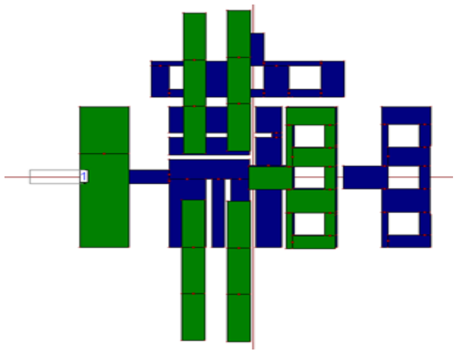

Fig. 2. Simulation window of defected ground structure for the proposed antenna

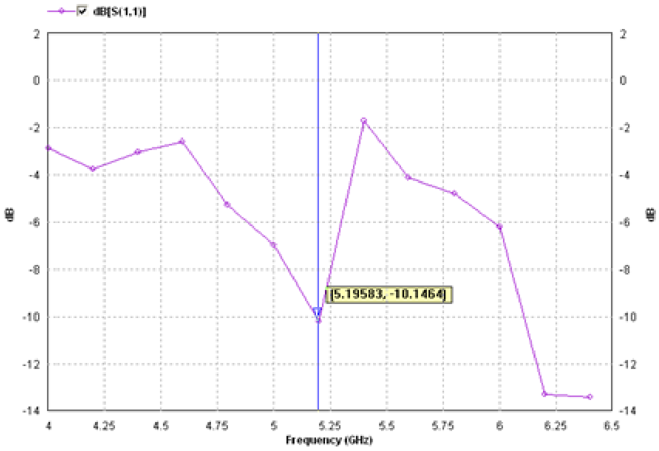

Fig. 3. Simulation of return loss for proposed antenna for 5.2 GHz

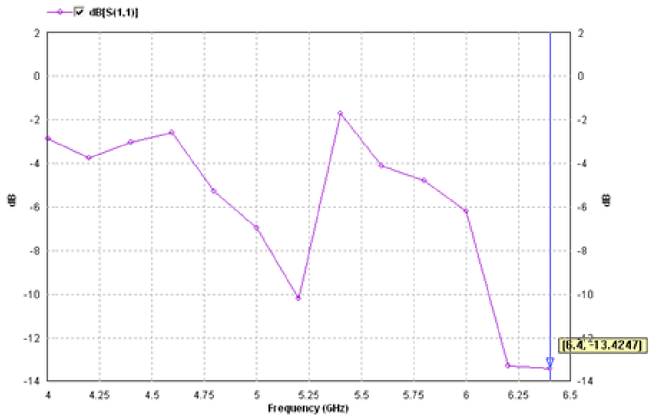

Fig. 4. Simulation of return loss for proposed antenna for 6.4 GHz

Return loss at 5.2 and 6.4 GHz was found to be -10.14dB and -13.42dB respectively.

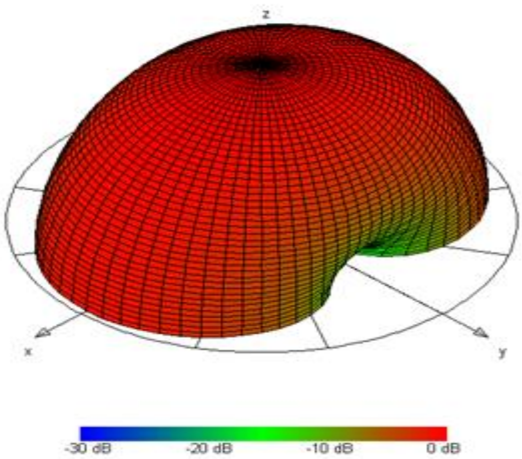

Fig. 5.Radiation pattern of antenna

The path that slots are used into the patch increases the resonant frequencies due to the change in the mean current paths of any resonant frequency (a mode). Dimension changing of a slot generate changes in the effective current way of a certain mode which in turn a shift in the resonant frequency. So the radiated fields are generated by the currents passes to the radiating edges of the patch, then vertical slots put close to these edges can handle the resonance frequency bands. Horizontal slots can be used to divide the patch into subsections which act as switches. These switches force the currents to travel through many ways according to the positions of the slots causing the antenna to resonant at different frequencies. The effect of the structure of the ground plane on the antenna performance is also controlled by mounting the proposed body antenna structure on either one of two different types of ground planes, the first is a conventional perfect electrical conductor (PEC) ground plane and the other is a defected ground structure (DGS). The DGS plane contain of an etched U shape. There advantages associated with using DGS planes. First, structures provide wider bandwidths with high gain and higher radiation efficiency. Second, these structures forbid the propagation of electromagnetic waves in a certain frequency band. Therefore, they can be used to block surface waves that usually corrupt antenna performance at a certain frequency band [4,10].

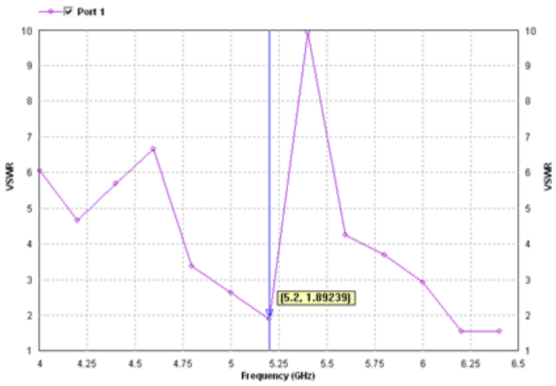

Fig. 6. Simulated VSWR of proposed patch antenna at 5.2 GHz

Bandwidth of first band was 1.28 GHz starting from 4.6GHz to 5.88 GHz. Similarly for second band bandwidth was 1.19 GHz starting with 7.29 GHz to 8.48GHz. More than 1 GHz bandwidth for two bands was achieved implying wideband applications.

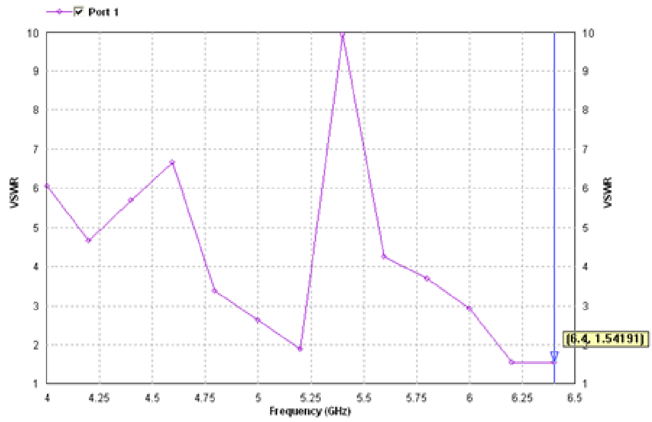

Fig. 7 Simulated VSWR of proposed patch antenna at 6.4 GHz

Measurement Results

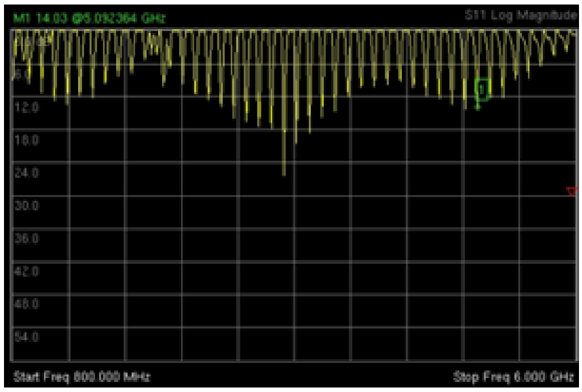

Fig. 8 Measured return loss at input port for 5.2 GHz antenna

Return loss was found to be -14.03dB at 5.2 GHz. Here there is improvement in measured result as compare to simulation.

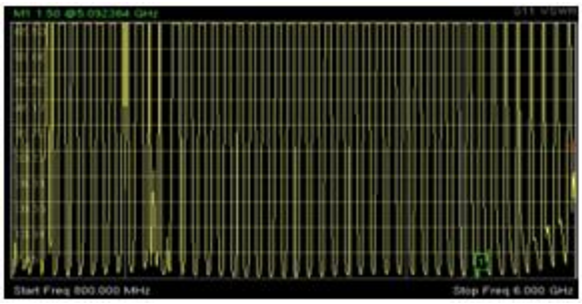

Fig. 9 Measured VSWR for 5.2 GHz antenna

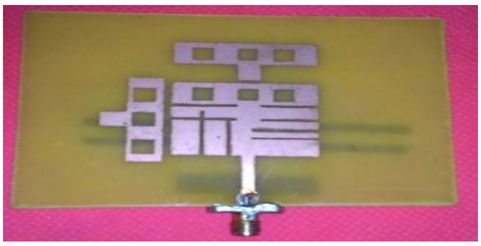

Fig. 10 Photograph for fabricated proposed antenna

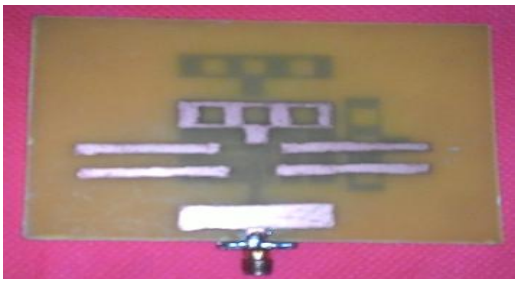

Fig. 11 Photograph for fabricated proposed antenna

Conclusion

Modified design of patch antenna with defected ground structure (DGS) and slots on conducting plane provides simulation results having return loss of -10.14 dB and VSWR of 1.89 for 5.2 GHz while -13.42 dB return loss and 1.54 VSWR value for 6.4 GHz frequency range. Measured return loss is -14.03 dB and VSWR of 1.50 for 5.2 GHz.

Acknowledgement

Authors like to give their thanks to 'Geetanjali Institute of Technical Studies', Udaipur (Raj.), India for the support.

References

Pozar, D. M., *Microwave Engineering*, 3rd edition, John Wiley & Sons, Inc 2004.

Balanis, C.A., Antenna Theory, 3rd edition, John Wiley & Sons, Inc 2004.

Chen, X. Q., X. W. Shi, Y. C. Guo, and C. M. Xiao, "A novel dual band transmitter using microstrip defected ground structure,"*Progress* In Electromagnetics Research, PIER 83, 1–11, 2008.

Oskouei, D., H. K. Forooraghi, and M. Hakak, "Guided and leaky wave characteristics of periodic defected ground structures," *Progress In Electromagnetics Research*, PIER 73, 15–27, 2007.

Fooks, E. H. and R. A. Zakarevicius, *Microwave Engineering Using Microstrip Circuits*, Prentice Hall, 1990.

M. Wegmuller, J. P. von der Weid, P. Oberson, and N. Gisin, "High resolution fiber distributed measurements with coherent OFDR," in *Proc. ECOC'00*, 2000, paper 11.3.4, p. 109.

H. Oraizi and M. S. Esfahlan," Miniaturization of Wilkinson power Dividers by using defected ground structure", *Progress In Electromagnetics Research Letters, Vol. 4, 113–120, 2008*SR.

"Stripline – like Transmission Lines for Microwave Integrated Circuits", Bharathi Bhat , Shiban K. Koul

J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68–73.

Ayman A. R. Saad, Elsayed E. M. Khaled, and Deena A. Salem," Wideband Slotted Planar Antenna with Defected Ground Structure", PIERS Proceedings, Suzhou, China, September 12{16, 2011.

Jerome Poguet, Andres Garcia, Jesus Vazquez, Jerome Marguet, Fabrice Pichonnat," Phased Array Technology Concepts, Probes and Applications", 8th ECNDT 2002.

G.Q. Liu and L.S. Wu," A Compact Microstrip Rat-Race Coupler with Modified Lange and T-Shaped Arms", Progress In Electromagnetics Research, Vol. 115, 509-523, 2011.

Saini, Prakash and Singh "Investigation of multiband microstrip line fed antenna using DGS technique for Wlan/wimax application" *International journal of computer,* Vol. 83-No.2, Dec 2013

Saini, Anand " Design and study multiband CPW fed microstrip patch antenna with dgs for wimax/wlan applications" *Proceeding in International conference on emerging trends in engg & Tech.*2013

Hitesh Joshi and R.P.Gupta "Body Antenna with DGS for Body centric wirless communication system" *Proceeding in International Journal of Antenna*, JANT, Vol. 1, 2015.

Author's Bibliography

Hitesh Joshi S/o Mr. D.S. Joshi is born on 12-10-1982. He completed his B. E in Electronics and Communication Engineering from Rajasthan University, Jaipur, India in year 2004, M.B.A. in HR from I.G.N.O.U. India in year 2009,M. Tech. in VLSI Design from Mewar University, Chittorgarh, India in year 2012 and Pursuing Ph. D. (Electronic and Communication) from Pacific University, Udaipur, India.

Dr. Ravindra Prakash Gupta S/o Mr. S.P. Gupta was born on 27-10-1973. He completed his B. E in Electronics Engineering from Marathwada University, Aurangabad in year 1998, M. Tech. in Electronic and Communication from Malviya National Institute of Technology, Jaipur, India in year 2004 and Ph. D.

(Electronic and Communication) from Bhagwant University, Ajmer, India in year 2012. Presently he is working as Principal and Professor at Manda Institute of Technology, Bikaner and previously at Maharishi Arvind College of Engineering and Research, Sirsi Road, Jaipur. His area of interests includes Signal Processing, Digital Communication, Wireless Communication, Wireless Sensor Networks, Design of Computer Network. He has more than 16 years Academic/Research experience. He has worked with the prestigious Military College of Telecommunication Engineering, Mhow, Indore, India. He is a Life-Member of Indian Society of Technical Education (ISTE), New Delhi and The Institution of Electronics and Telecommunication Engineers (IETE), New Delhi.. He has guided several projects and dissertations in B. Tech and M. Tech courses. He had published numerous International papers in India and abroad and guiding Ph. D. research scholars at reputed Universities. He has actively organized numerous National Conferences in the field of Engineering, Applied Sciences, Energy and Environment