ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 22, December 2017

Quad Band CPW fed DGS Antenna with Slot and Top Loaded Radiators in UWB Range

J.Gandhimohan[1], Dr.T.Shanmuganantham[2]
Ph.D Research Scholar, Department of Electronics Engineering, Pondicherry University, Puducherry, India [1]
Assistant Professor, Department of Electronics Engineering, Pondicherry University, Puducherry, India [2]

Abstract: The antennas proposed in this paper are consisting of the tapered patch radiator, square slot and rectangular radiator strip for good radiation performance at radiating frequencies in the UWB range. The proposed antenna has a capability to operate in the quad band of frequencies (3.2GHz, 4.1GHz, 5.7GHz and 10.6GHz) in the ultra wide band range is presented. The antenna has been top loaded with multiple rectangular radiator strips for radiating at quad band of frequencies in the UWB range. A novelty of this designed antenna is able to propagate multichannel (quad band) in the UWB range. The proposed antenna designed with substrate of FR4 with a planar size of 30mm × 41mm with a thickness of 1.6mm. The proposed antenna is a simplified model with a substrate εr=4.3 and 0.1mm of conducting layer. The feed point and Ground planes are separated by 0.35mm gap at both the sides. The feed line thickness is fixed to 2.5mm, to achieve better impedance matching at the operating frequencies. The final goal is to get antennas for quad band applications in wireless communication with a good return loss, VSWR, Gain and increased directivity in the UWB range. The reported simulation results of this antenna are the evidence for the high directionality with respect to conventional printed monopoles. It is examined that the printed monopole exhibits better return loss, gain, constant directivity and improved radiation pattern at an operating frequencies.

Keywords: CPW, UWB, compact, FCC, DGS, Quad, Slotted

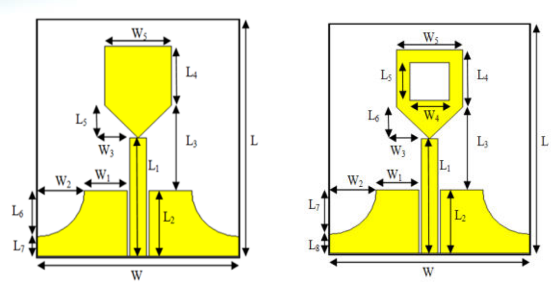
I. INTRODUCTION

The Federal Communication Commission declared that the frequency from 3.1GHz to 10.6GHz for ultra wide band application in the year 2002. For small distance communication CPW antennas find many advantages in remote sensing, low cost, less propagation power and improved data rate. Also the UWB antennas are plays a vital role in the sensor networks, imaging human parameters and wireless communications. In medical applications the miniaturized antennas are required for imaging cancer cells in the human breast and tumours. Due to this the varieties of CPW-fed antennas were proposed by the researchers. The CPW-fed antennas are having bidirectional radiation characteristics, as with micro-strip line excitation. The antennas proposed in this paper are consisting of the tapered patch radiator, rectangular slot and rectangular radiator strips for good radiation performance at various resonance frequencies in the UWB range. Arc shaped edge in the ground plane provides defective ground structure (DGS) for improved radiation performance. The Fig.1 (a)-(c) shows the structure of single (3.36GHz), dual (3.88GHz and 9.99GHz) and triple band (3.32GHz, 4.69GHz and 9.70GHz) antennas in UWB range. The proposed antenna in this paper finds quad band (3.2GHz, 4.1GHz, 5.7GHz and 10.6GHz) application in the UWB range.

II. OVER VIEW OF THE ANTENNA

An antenna with multiple resonances at the UWB range is essential when it's interacted with various applications. The CPW antennas placed below are simplified model with a substrate Er=4.3 and 0.1mm of conducting layer to represent the multiband function.

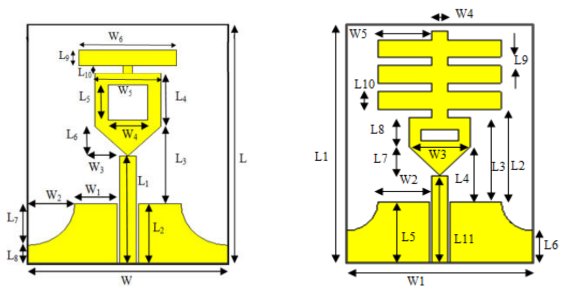
A. *Antenna Structures*



(a) Single band antenna (b) Dual band antenna

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 22, December 2017



(c) Single band antenna (d) Dual band antenna

Fig.1 Antenna Structures

III. THE ANTENNA DIMENSSIONS

The proposed quad band antenna shown in Fig.1(d) has feed point and Ground planes are separated by 0.35mm gap at both the sides. The feed line thickness is fixed to 2.5mm, to achieve 50ohm characteristic impedance at the resonant frequencies. The final goal is to get antennas for multiband applications in wireless communication with a good return loss, VSWR and increased directivity in the UWB range. The following parameters of the antennas are in mm.

L1=41;L2=14.5;L3=13;L4=8;L5=10.5;L7=5;L8=5;L9=1.5; L10=3;L11=15;W1=30;W2=8.4;W3=10;W4=2.5;W5=8.75;

IV. SIMULATIONS RESULTS

The return a loss of the proposed antenna shown in Fig.3 is compared with return loss of the single, dual and triple band antennas designed in UWB range. The return loss of the proposed antenna at UWB range with good VSWR is achieved. Simulated results of proposed quad band antenna shown below. It has good directivity and gain at these frequencies. It is observed that by etching the bottom edges of the rectangular patch, introducing slot at patch and top loading rectangular strip are acceptable transition from one resonant frequency to another has received. The impedance matching for wide range of frequencies is also good.

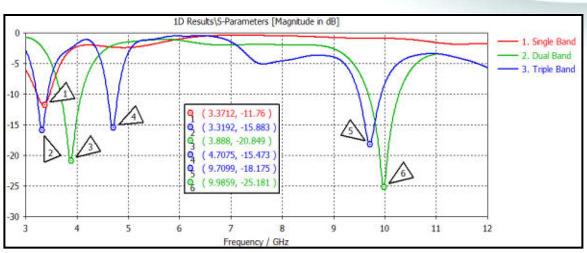


Fig.2 Return Loss of Single, Dual and Triple band Antenna

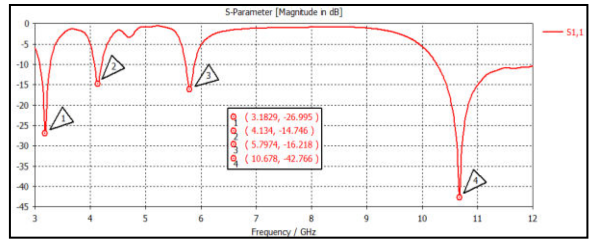


Fig.3 Return Loss of quad band Antenna

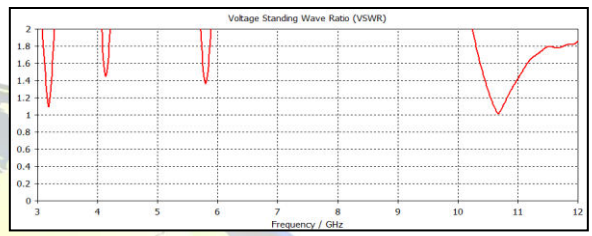
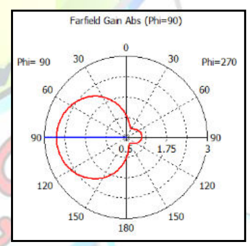


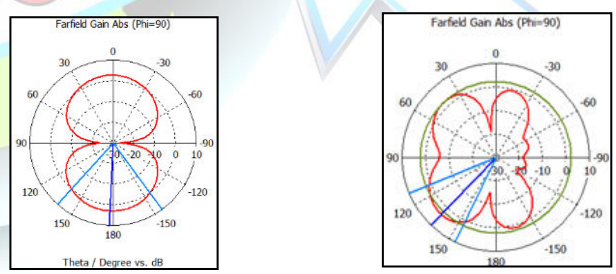
Fig.4 VSWR of quad band Antenna

A. *Radiation Patterns*



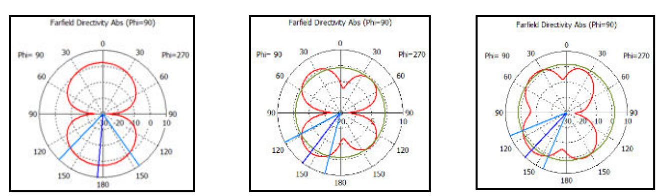
(a) At 3.36GHz

Fig.5 Single Band



(a) At 3.88GHz (b) At 9.99GHz

Fig.6 Dual Band



(a) At 3.32GHz (b) At 4.68GHz (c) At 9.70GHz

Fig.7 Triple Band

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 22, December 2017

The gain and directivity of the proposed quad band antenna are finds good in the measured simulated result shown in Fig. These frequencies are finds many applications in the wireless medical equipments like medical telemetry and wireless image scanning of human tissue. The simulated results are in good agreement.

The radiation patterns (E- and H-Plane) are plotted at this quad band of frequencies are shown in Fig.7 respectively. It's observed that the radiation patterns are broadside and bi-directional in the E-plane and nearly Omni-directional in the H-plane. The measured peak antenna gain at those frequencies is also in acceptable levels. The antenna parameters have to be adjusted to obtain a required radiation pattern.

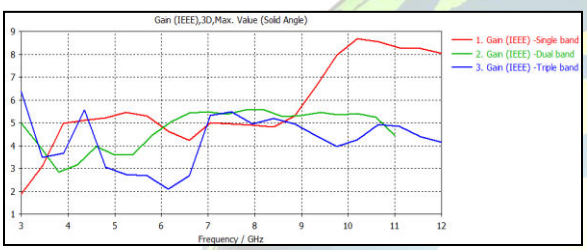


Fig.8 Gain vs Frequency of Single, Dual and Triple band Antennas

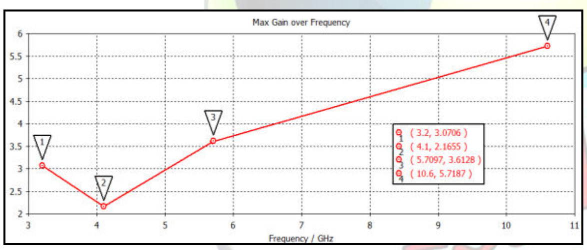
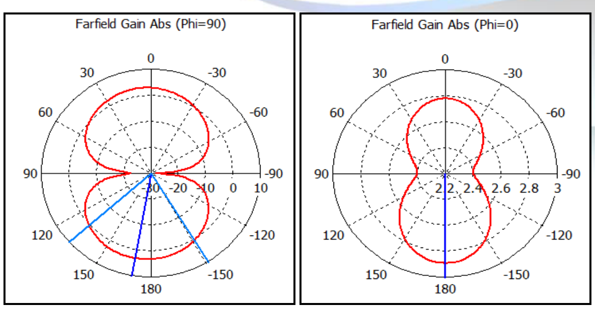
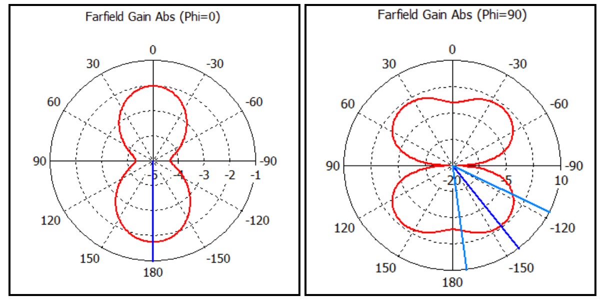


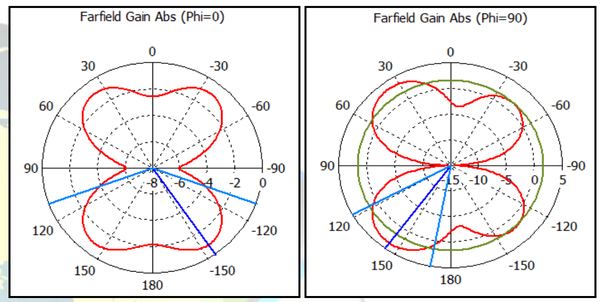
Fig.9 Gain vs Frequency of quad band Antenna



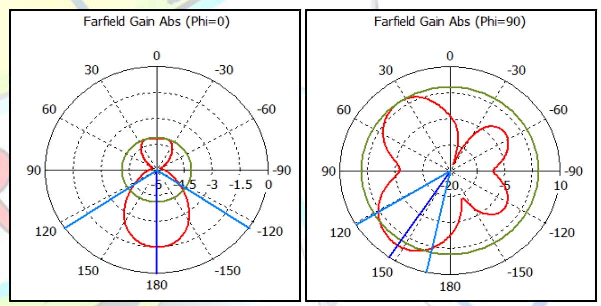
(a) At 3.2GHz



(b) At 4.1GHz



(c) At 5.7GHz



(d) At 10.7GHz

Fig.10 E-Plane and H-Plane patterns of quad band antenna

V. CONCLUSION

The properties of the compact, low-cost antennas for wireless communication at frequencies in the UWB range are analyzed, with added rectangular radiators at top in existing structure. The modified tapered rectangular patch with rectangular slot fed with 50Ω CPW line. The arc shaped edge at top corner of the ground plane gives partial defected ground structure. The reported simulation results of the proposed quad band antenna are the evidence for the high directionality with respect to conventional printed monopoles. It is examined that the printed monopole exhibits better return loss, constant directivity and improved radiation pattern at an operating frequencies. The VSWR,

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 22, December 2017

Return loss, Gain and directivity at (i) 3.2GHz is 1.10, -26.99dB, 3.07dB and 2.25dBi (ii) 4.1GHz is 1.45, -14.76dB, 2.17dB and 2.24dBi (iii) 5.7GHz is 1.38, -16.21dB, 3.61dB and 4.02 (iv) 10.6GHz is 1.02, -42.76dB, 5.72dB and 5.86dBi respectively.

ACKNOWLEDGMENT

This work is supported by the Pondicherry University, Puducherry and Pondicherry Institute of Post Matric and Technical Education, Puducherry to develop my academic and research knowledge by permitting me to do research work in the field of antennas.

REFERENCES

[1] T. Shanmuganantham, "Design of Single Band Microstrip Cat Patch Antenna for Radio Location", International Conference on Antenna Testing and Measurement Society (ATMS 2017), Hyderabad, 06-08 Feb. 2017.
[2] Padi Veda Sree, S. Ashok Kumar and T. Shanmuganantham, "Design of Implantable Patch Antenna at 915MHz ISM Band for Biomedical Application", International Conference on Antenna Testing and Measurement Society (ATMS 2017), Hyderabad, 06-08, Feb. 2017.
[3] B.Leena, S. Ashok Kumar and T. Shanmuganantham, "A Compact CPW Fed Antenna for Multiband Applications", IEEE International Conference on Control, Instrumentation, Communication & Computational Technologies (ICCICCT-2016), Noorul Islam University, DEC 2016.
[4] R. Azim, M. T. Islam and N. Misran, "Compact tapered shape slot antenna for UWB applications," IEEE Antenna and Wireless Propag. Lett., vol. 10, 2011, pp. 1190-1193.
[5] Deepanshu Kaushal, T. Shanmuganantham, Sajith K, "Dual Band Characteristics in a Microstrip Rectangular Patch Antenna using Novel Slot Technique", IEEE International Conference on Intelligent Computing, Instrumentation and Control Technologies (ICICICT), 06-07, July 2017.
[6] J. Gandhimohan, T. Shanmuganantham "CPW-fed Dual Channel Compact Antenna with two symmetrical Crescents", ***IEEE** Indian Antenna Week-2017*, DIAT, Pune, June 2017.

BIOGRAPHY

J.Gandhimohan has received his Diploma in Electronics and Communication Engineering in the year 1995 from Board of Technical Education, Tamilnadu. He has received his B.Tech in Electronics and Communication Engineering from Pondicherry Engineering College, Pondicherry University in the year 2000. He has completed his M.Tech in Electronics from Pondicherry University in the year 2012 and he has awarded gold medal for his outstanding performance in the post graduate studies. At present he is pursuing Ph.D research work under part-time mode with the specialization of Antennas in Pondicherry University, Puducherry. Presently he is working as Lecturer (Selection Grade) in Department of Electronics and Communication Engineering, Women's Polytechnic College, (Sponsored by Govt. of Puducherry), Puducherry. Email- gandhimohanj@gmail.com

Dr. T. Shanmuganantham is presently working as Assistant Professor in Department of Electronics Engineering, Pondicherry University, Puducherry. He has received his Bachelor of Engineering degree in Electronics and Communication Engineering from Madras University, Tamilnadu and M.E from Maduari Kamaraj University, Tamilnadu. He has also completed his Ph.D from National Institute of Technology (NIT), Trichy, and Tamilnadu. He has received gold medal for the best thesis during the research work at NIT, Trichy. He has published so many research papers in national and international journals and conferences. Also he is having life membership in the several Professional Societies. He has visited several National and foreign universities in his career as a resource person. Dr. T. Shanmuganantham is also a reviewer for the IEEE, Elsevier, Wiley, Springer, PIER, ICTACT, IETE journals of Research. Email- shanmugananthamster@gmail.com

