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A Microstrip Patch Antenna with EU Slot for Broadband Applications - Design and Simulation

S. Abdul Malik
Assistant Professor and Academic Section Incharge, Department of ECE
Santhiram Engineering College, NANDYAL, Kurnool (Dt), Andhra Pradesh India
malik.srec@gmail.com

Abstract **– Low asking price, minimal weight, soft profile antennas that are efficient of maintaining valuable performance are the main factors effecting design of antenna over a wide spectrum of frequencies. All these factors can be satisfied by Microstrip patch antenna. This paper presents design and simulation of a rectangular Microstrip patch antenna with EU slot. Antenna is designed around an operating frequency of 4.75 GHz uses EU slot microstrip patch antenna.**

Keywords **– VSWR, Reflection Coefficient, Microstrip Patch Antenna, Ansoft HFSS.**

I. INTRODUCTION

Microstrip patch antennas (also imperceptibly called patch antennas) are in the virtually common antenna types in serve today, specifically in the favourite frequency cordilleran belt of 1 to 10 GHz. This quality of antenna had its willingly intense development in the 1970s, as communication systems became common at frequencies to what place its measure and stance were absolutely useful. Patch Antennas are mostly used in microwave frequency region because of their computability with Printed Circuit Board (PCB) technology and its reticence in manufacture.

However, the baud rate and the measure of an antenna are consistently mutually irreconcilable properties, specially, modification of a well known of the characteristics normally results in disgrace of the other. Recently, all techniques have been approaching to raise the value of the bandwidth. While the antenna can be 3D in practice (wrapped during an disagree, for the graphic representation are constantly flat; Hence their other name, planar antennas. Note that a planar antenna is not perpetually a patch antenna. However, these antennas are commonly fabricated on thicker substrates (Darren & Aman, 2011). Utilizing the shorting pins or shorting walls on the unequal coat of crest of a E-shaped patch, U-slot patch, or L-probe engage patch antennas, wideband and dual-band impedance baud rate have been achieved by all of electrically tiny size Other techniques involves employing multilayer structures mutually parasitic patches of distinct geometries a well known as E, U and H shapes, which excites countless resonant modes.

The baud rate of rectify antenna cut back be increased individually height of the substrate or by decreasing the figure of the dielectric constant of substrate.

II. DESIGN OF PATCH ANTENNA

The HFSS exemplar of the base hit principle of patch antenna is shown in Figure 2.1. First of all told, the patch, the consume line and the much the same transformer was drawn and joined to constitute a single object. Then the FR4 substrate was situated below the above unit and an air box was placed completely the outside two parts. The 3D exemplar is accomplished according to the equations.

$$Width = \frac{c}{2f_0\sqrt{\frac{\varepsilon_R+1}{2}}};\ \varepsilon_{reff} = \frac{\varepsilon_R+1}{2} + \frac{\varepsilon_R-1}{2}\left[\frac{1}{\sqrt{1+12\left(\frac{h}{w}\right)}}\right]$$

$$Length = \frac{c}{2f_0\sqrt{\varepsilon_{reff}}} - 0.824h\left(\frac{(\varepsilon_{reff}+0.3)\left(\frac{W}{h}+0.264\right)}{(\varepsilon_{reff}+0.258)\left(\frac{W}{h}+0.8\right)}\right)$$

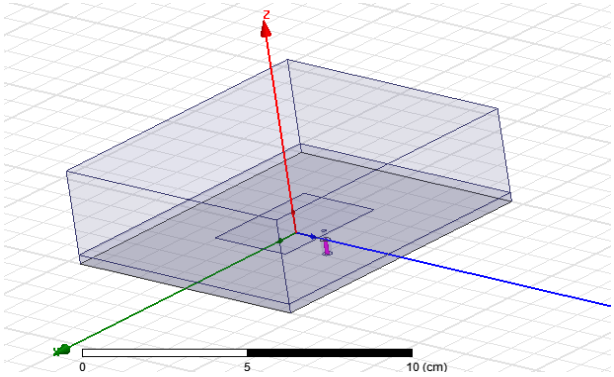

Fig. 2.1. Design of Coaxial Feed antenna

III. PROPOSED ANTENNA DESIGN

Microstrip patch antenna have been amply known for its advantages a well known as light weight, low fabrication charge, mechanically fit as a fiddle when mounted on stringent surfaces and capacity of duplex and triple frequency operations for the most part these features, focus many researchers to assess the performance of parch antenna in distinctive ways. However, shorten bandwidth came as the masterpiece disadvantage for this essence of antenna.

Several techniques have been applied to recuperate this problem a well known as increasing the substrate span, introducing parasitic elements i.e. co-planar or cluster configuration, or modifying the patch's arouse itself.

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Modifying patch's arouse includes designing an EU-shaped patch.

E Shape microstrip patch antenna with wideband engaged frequency for wireless consideration will give the broad bandwidth which is forced upon in distinct applications savour remote sensing, biomedical course, mobile radio, satellite communication etc. The antenna design is an emendation from immediate research and it is simulated by HFSS (High Frequency Structure Simulator) version 12 software. Coaxial feed or probe feed technique is used in the experiment.

The U alter slot in the radiating component tends to have wideband characteristics. It further suggests that a U shape slot introduces the capacitive principle in the input impedance to counterpoise the inductive element of the probe. Also to restore the increasing inductive effect merit to the slots, girth of the substrate is increased.

The antenna is constrained of a single patch on top, such layers of dielectric (air) and a vertical probe connected from ground to the upper patch.

From Figure 3.1. The main E shaped patch has Wa x La dimension while the outer patch has Wb x Lb dimension.

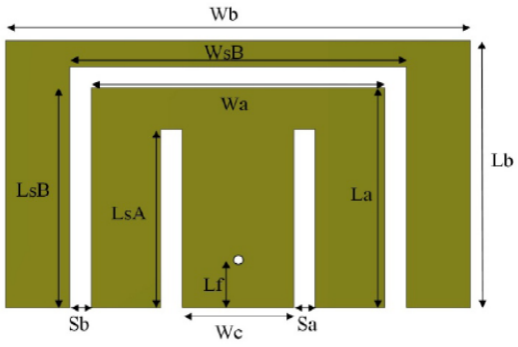


Fig. 3.1. Design of EU shaped patch antenna

Simulation of this antenna has been carried out in HFSS. The simulated design of patch antenna is shown below.

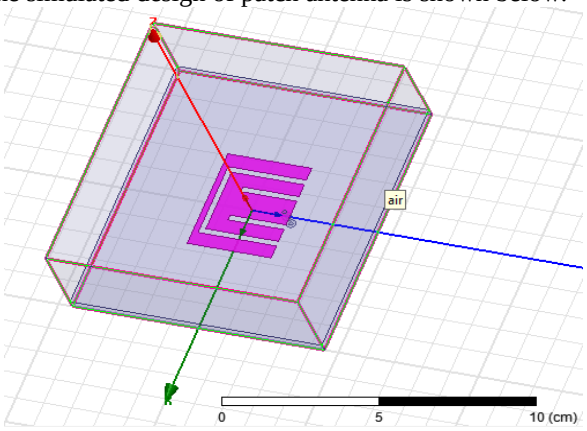
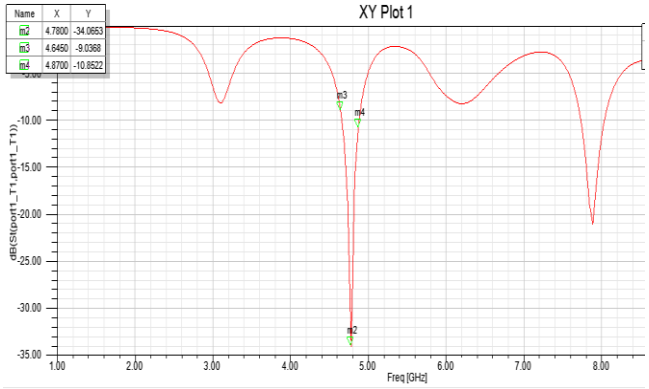


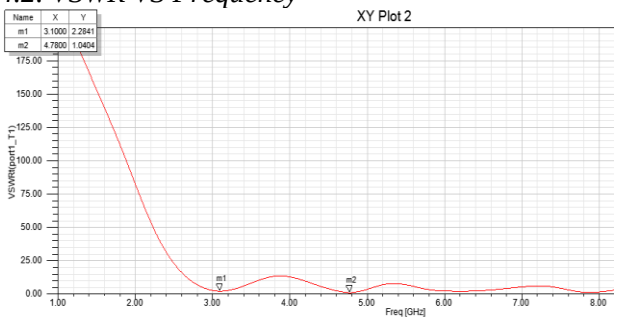
Fig. 3.2. EU Microstrip Patch Antenna

IV. Simulation Results of Rectangular Patch Antenna

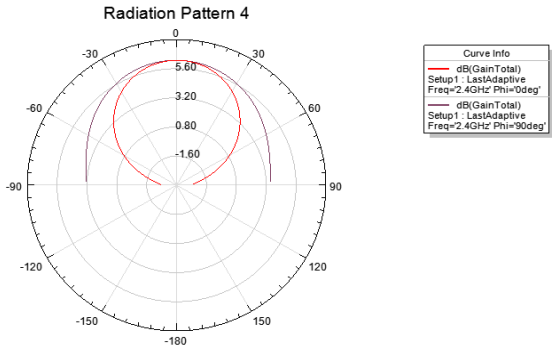
4.1. S11 Parameter



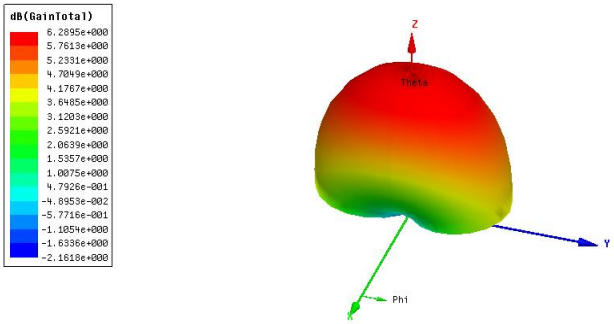
4.2. VSWR VS Frequency



4.3. 2D Radiation Pattern



4.4. 3D Radiation Pattern



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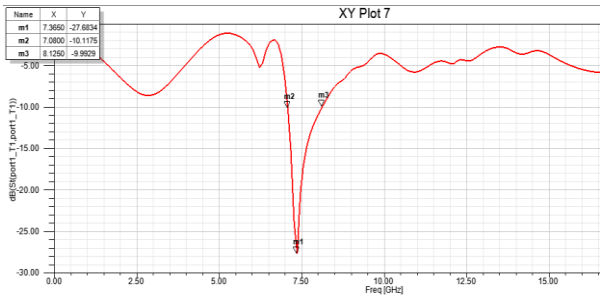
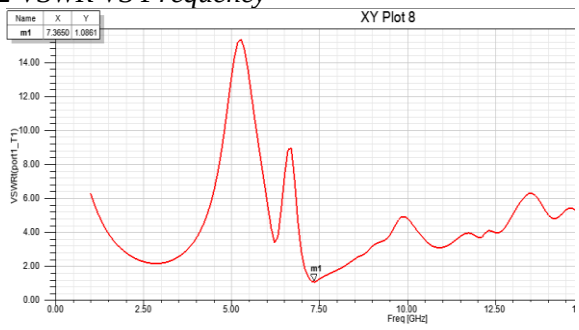
V. Simulation Results of Proposed EU Patch Antenna

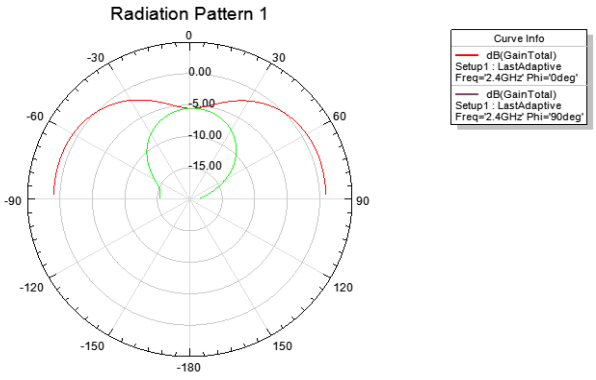
5.1. S11 Parameter



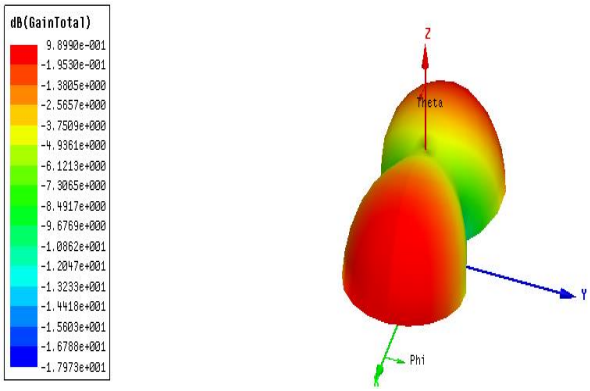
5.2 VSWR VS Frequency



5.3. 2D Radiation Pattern



5.4 3D Radiation Pattern



VI. Comparison of EU Slot Microstrip Patch and Rectangular Patch at Desired Frequency Range

Parameters	Rectangular Patch	EU Patch	Comments
GAIN IN 3D	6.28	9.81	GAIN IS HIGH
REFLECTION COEFFICIENT IN DB S11	-34	-27	REFLECTION COEFFICIENT IS LESS
VSWR	2.2	1.08	LOW VSWR GIVES BEST RESULTS
BANDWIDTH IN GHZ	0.225	1.1	BANDWIDTH IS HIGH

VII. CONCLUSION

EU-shaped wide band microstrip patch antenna via Air substrate has been designed, simulated, optimized and analyzed by HFSS (High Frequency Structure Simulator) software version 13.1. A parametric design is presented by the whole of the results headlining that the rectangular antenna bounce be operated at 4.64 GHz up to 4.87 GHz frequency band. This substantiate is an emendation when there is a EU slot from 7.08 GHZ to 8.12 GHz. Other parameters one as S11 and VSWR also have been improved. And also observed that the EU slot antenna has given best results when compared with rectangular patch antenna, where the gain and bandwidth is increased and VSWR is degraded and the Reflection Coefficient is found to be less.

References

[1] Antenna Theory and Design by Robert S. Elliot (Wiley Publications)
[2] Antennas for all Applications by John Krauss (Third edition TMH)
[3] Antenna Theory - Analysis and Design, Third Edition- Constantine A Balanis
[4] "Microstrip and Printed Antenna Design" by Randy Bancroft
[5] K. F. Lee, Ed., Advances in Microstrip and Printed Antennas, John Wiley, 1997.
[6] K.L. Wong, Design of Non planar Microstrip Antennas and Transmission Lines, John Wiley & Sons, New York, 1999.
[7] R. Garg, P. Bhartia, I. Bahl, and A. Ittipiboon, Microstrip Antenna Design Handbook, Artech House, 2001.
[8] D. M. Pozar and D. H. Schaubert, Microstrip Antennas: The Analysis and Design of Microstrip Antennas and Arrays.
[9] Willie W. Lu, ―An Open Baseband Processing Architecture for Future Mobile Terminals Design‖, IEEE Wireless Communications, April 2008.
[10] D. R. Jackson, S. A. Long, J. T. Williams, and V. B. Davis, "Computer- aided design of rectangular microstrip antennas".
[11] ERICSSON, 2009, "GSM Cell Planning Workshop", Ericsson Company, 2009.
[12] H. Pues and A Van de Capelle, "Accurate transmission-line model for the rectangular microstrip antenna".
[13] 3gamericas (2011). "Transition to 4G: 3GPP Broadband Evolution to IMT-Advanced", Rysavy Research/3G Americas. [Online] Available: www.rysavy.com/PR/3GA_PR_2010_09.pdf
[14] Sergey Makarov, Selected Lectures - Antennas. Worcester, United States of America: John Wiley & Sons Inc, 2011.

[15] International Conference on Advances in Communication and Computing Technologies (ICACACT) 2012 Proceedings published by International Journal of Computer Applications (IJCA)

[16] Fumiyuki Adachi, "Wireless past and Future: Evolving Mobile Communication Systems". IEICE Trans. Fundamental, Vol.E84-A, No.1, January 2013.

AUTHOR'S PROFILE

S.ABDUL MALIK - Rreceived the B.Tech. degree from Gulbarga University (KS) in ECE in 1990 and M.Tech. degree from Jawaharlal Nehru Technological University, Anantapuramu (AP), in DSCE in 2010.

From 1993 to till to date, he worked in teaching profession in different colleges in different positions. Now he is working as Assistant Professor in ECE department and discharging his duties as Acadamic Section In charge of the SREC. He has guided different B.Tech and M.Tech projects. He has published 10 papers in different publications.