International Journal of
Emerging Research in Management &Technology
ISSN: 2278-9359 (Volume-4, Issue-12)

Research Article | **December 2015**

Design of Microstrip Patch Antenna for Powering Drones

K. Rekha*, K. Shanthalakshmi
[1]PG Scholar, [2]Associate Professor,
[1, 2] Department of Electronics and Communication Engineering,
Adhiyamaan College of Engineering, Hosur,
Tamil Nadu, India

Abstract—

The microstrip antenna has been the most innovative area in the antenna engineering with its low material cost and easy to be fabricated which the process can be made inside universities. This paper focuses on the development of linear and circular polarized rectangular patch antennas that functions at 5.8 GHz. Two different feed types are used 1. Inset feed 2. Coaxial feed. The developed antennas can be used for microwave wireless power transmission system, working at 5.8 GHz, aimed at enabling the drones to be charged in flight. The proposed antenna's performance is analyzed using Ansoft-HFSS 13.0 software simulator.

Keywords— Circular Polarization (CP), Linear Polarization (LP), High Frequency Simulation Software (HFSS), drones, feed techniques.

I. INTRODUCTION

This Microstrip patch antennas has been widely used, particularly since they are light weight, compact and cost effective. The inset fed microstrip antennas provide a method for impedance control with a planar feed configuration. The coaxial feed is easy to fabricate and has spurious radiation. In our work, three antennas are to be designed, single transmitter antenna with linear polarization and two receiver antenna of linear and circular polarization.

II. TRANSMITTER SIDE

The type of antenna chosen for the transmitter is a microstrip patch which can easily be displayed in a planar array configuration in order to gain greater directivity. The single patch element was designed and simulated using Ansoft-HFSS 13.0 simulation software. The patch was excited using an inset feed. The single patch antenna presented a return loss of 3 dB at 5.8 GHz. The dimensions of the patch were further tuned to obtain better return loss.

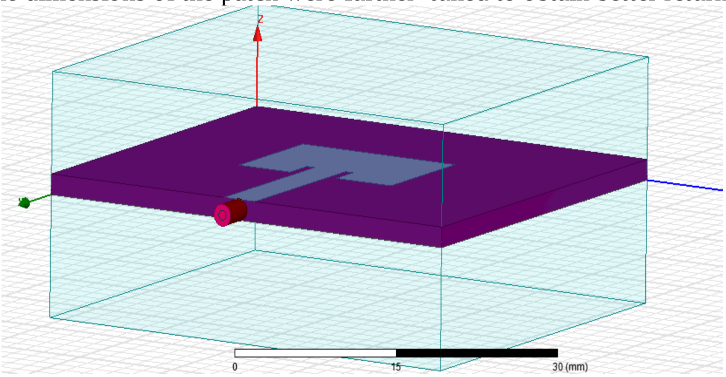

Fig.1 Transmitter antenna with inset feed

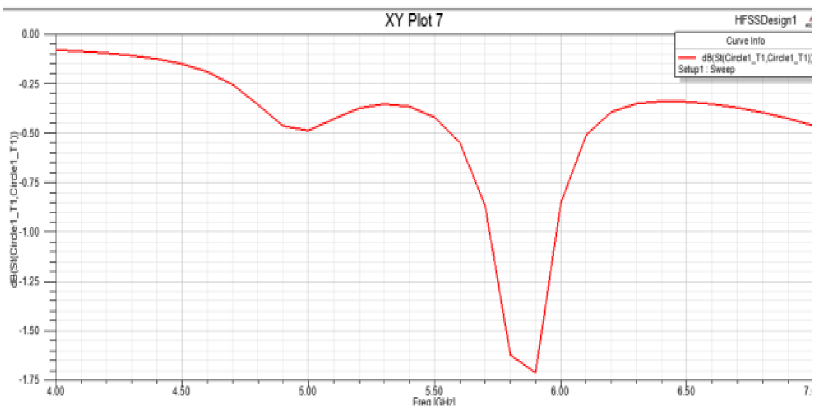

Fig.2 Return loss of the transmitting antenna

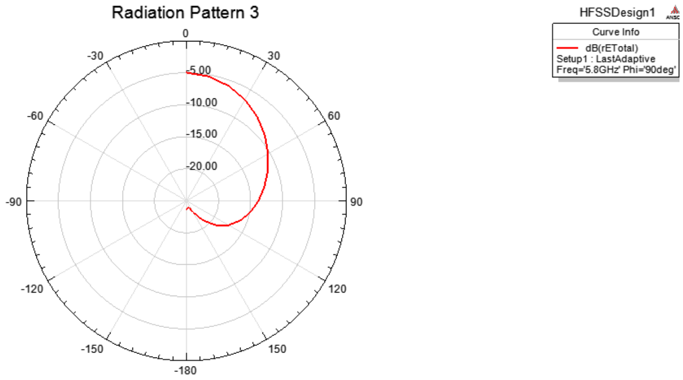

Fig.3 Transmitter antenna radiation pattern

Fig.4 Directivity of the transmitting antenna

III. RECEIVER SIDE

Two receiver antennas were designed, one with linear polarization and another with circular polarization to verify the effects of polarization mismatch. The antennas were designed to coaxial feed so that the rectifier circuit could be added at the back of the antenna. The simulated square patch antenna produced a return loss of 11 dB.

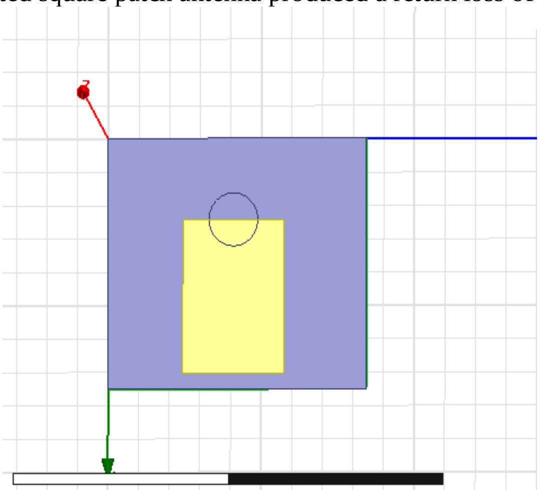

Fig.5 Top view of the LP receiver antenna

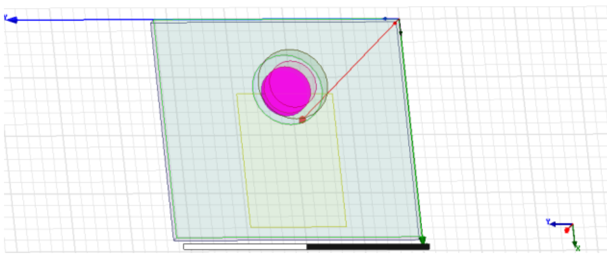

Fig.6 Coaxial feed of the LP receiver antenna

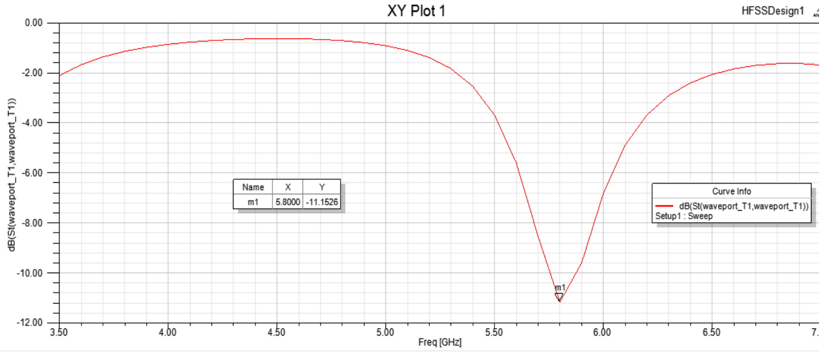

Fig.7 Return loss of the LP receiver antenna

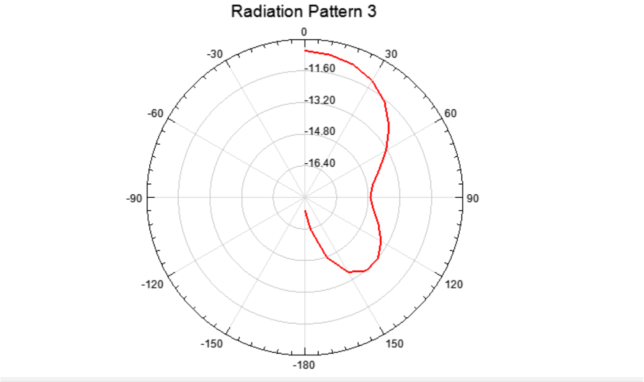

Fig.8 Radiation pattern of the LP receiver antenna

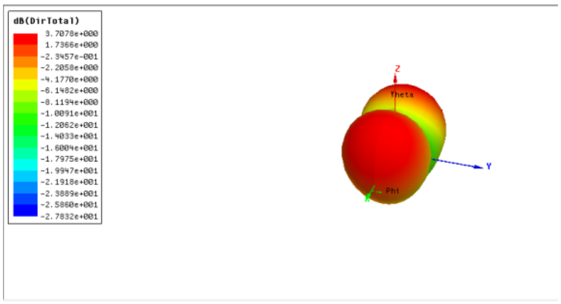

Fig.9 Directivity of the LP receiver antenna

For circular polarization, initially the antenna is designed to operate at 5.8GHz. To the single fed microstrip antenna perturbation segment is introduced to achieve circular polarization.

Two different ways to obtain circular polarization.

1. Dual feed circular polarization
2. Single feed circular polarization

The second method is chosen, since it is compact in structure, simple, easy to manufacture and. It eliminates the use of a polarizer.

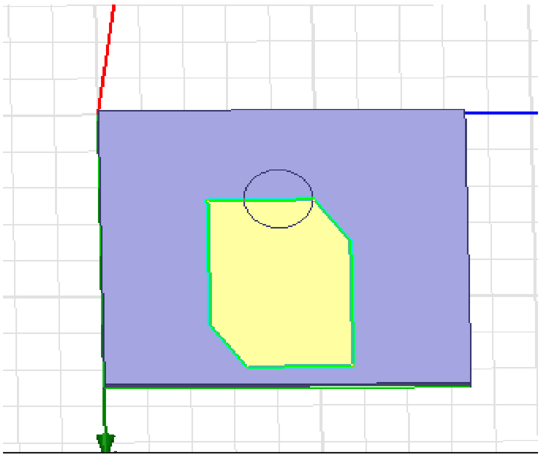

Fig.10 Circular polarization antenna

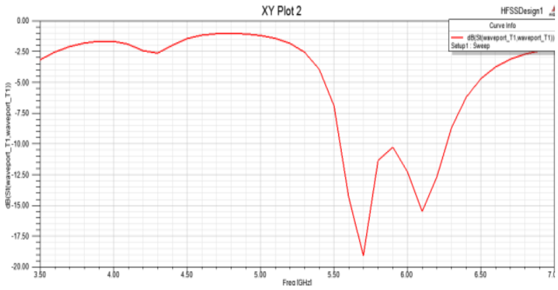

Fig.11 Return loss of CP receiver antenna

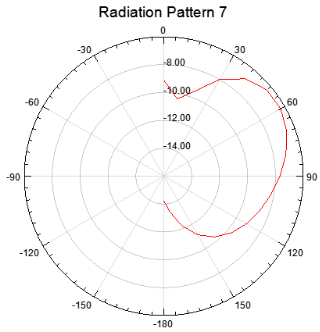

Fig.12 Radiation pattern of the CP receiver antenna

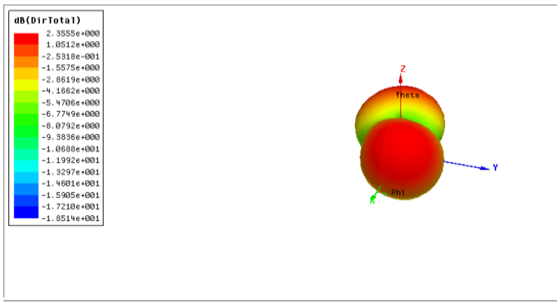

Fig.13 Directivity of CP receiver antenna

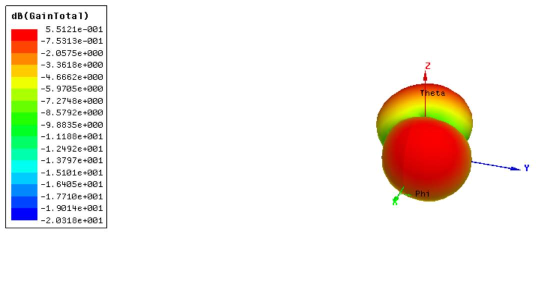

Fig.14 Gain of CP receiver antenna

IV. APPLICATION

The developed antennas are used for powering drones. These drones suffer few drawbacks of which their short flight time can be underlined. For most commercial application the maximum flight duration falls around a total of 15 minutes. In order to solve this limitation the microwave wireless power transmission system, working at 5.8GHz aimed at enabling drones to be charged in flight is used. Our designed antenna will be used in this wireless power transmission system for enabling drones to be charged in flight.

Fig.15 Example of drone charging through antennas in microwave power transmission.

V. CONCLUSIONS

The Microstrip patch antennas at 5.8GHz for powering drones application were designed and the proposed antenna performance is analyzed using Ansoft-HFSS 13.0 software simulator. The Gain is 5.512dB, return loss is 19dB and its general performance is within acceptable range. The main advantage of the designed antenna is low cost, easy fabrication.

VI. FUTURE WORK

The transmitter antenna should provide an extremely directive radiation pattern, in order to achieve this, the array of the antenna is to be made. Thus the greater directivity can be gained.

REFERENCES

[1] M.A. Othman, M. Snapper, M.Z.A. Abed Aziz, W.Y. Sam, Mohd Nor Hussein, Nornikman Hassan, Hamzah Asyrani Sulaiman, Mohd Muzafar Ismail, Mohamad Harris Misran, Maizatul Alice Meor Said, *5.8 GHz Rectangular Microstrip Inset Feed Patch Antenna,* Australian Journal of Basic and Applied Sciences, Special 2014, Pages: 604-611.

[2] Kuldeep Kumar Singh, Dr. S. C. Gupta, *Review and Analysis of Microstrip Patch Array Antenna with different configurations,* International Journal of Scientific & Engineering Research, Volume 4, Issue 2, February-2013.

[3] Nazish Irfan, Mustapha C. E. Yagoub and Khelifa Hettak, *Design of a Microstrip-Line-Fed Inset Patch Antenna for RFID Applications,* IACSIT International Journal of Engineering and Technology, Vol. 4, No. 5, October 2012.

[4] Mr. Sandeep Kumar, Mr. Subodh Kumar Tripathi, Mr. Nitin Kumar, Mr. Rachit Aggarwal, *Design Of Microstrip Square-patch Antenna For Improved Bandwidth And Directive Gain,* International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 Vol. 2, Issue 2, Mar-Apr 2012, Pp.441-444.

[5] M A Martin, A. I. Sayeed, *A Design Rule for Inset-fed Rectangular Microstrip Patch Antenna*, WSEAS TRANSACTIONS On COMMUNICATIONS, Issue 1, Volume 9, January 2010, ISSN: 1109-2742.

[6] M. K. A. Rahim, A. Asrokin1, M. H. Jamaluddin1, M. R. Ahmad1, T. Masril and M. Z.A. Abdul Aziz, *Microstrip Patch Antenna Array at 5.8 GHz for Point to Point Communication,* 2006 International Rf And Microwave Conference Proceedings, September 12 - 14, 2006, Putrajaya, Malaysia.

