International Journal of Electronics and Communication Engineering & Technology (IJECET)
Volume 7, Issue 3, May–June 2016, pp. 53–58, Article ID: IJECET_07_03_007
Available online at
http://www.iaeme.com/IJECET/issues.asp?JType=IJECET&VType=7&IType=3
Journal Impact Factor (2016): 8.2691 (Calculated by GISI) www.jifactor.com
ISSN Print: 0976-6464 and ISSN Online: 0976-6472

POLARIZATION RECONFIGURABLE ANTENNA

Dr.V.RajyaLakshmi
Anil NeerukondaInstitute of Technology and Sciences,
Visakhapatana,India

P.Devi
ANITS,Visakhapatana,India

ABSTRACT

The paper proposes polarization reconfigurable antenna that can change its polarization from Left Hand Circular Polarization(LHCP) to Right Hand Circular Polarization (RHCP) by using patch rotation technique. This antenna resonates at 5.65 GHz with a return loss of -17.86dB,-18.61, gain of 8.4dB and 5.7dB,axial ratio of 1.76dB and 2.25dB and VSWR of 1.29 and 1.26 for LHCP antenna and RHCP antenna respectively. The antenna can be used for RFID application.

Key words: Reconfigurable Antenna, LHCP,RHCP, Axial Ratio

Cite this Article: Raj yaLakshmi. V and Devi. P, Polarization Reconfigurable Antenna, *International Journal of Electronics and Communication Engineering & Technology*, **7**(3), 2016, pp. 53–58.
http://www.iaeme.com/IJECET/issues.asp?JType=IJECET&VType=7&IType=3

1. INTRODUCTION

The advancement in wireless communication requires the usage of reconfigurable antennas. The reconfigurable antenna can change its any one of its parameter (frequency, Polarization and Radiation Pattern) based on the appliation. The reconfigurable antenna is caterigorized into three types, based on the parameter it can change. The frequency reconfigurable antenna can change its operating frequency, Polarization reconfigurable antenna can change its polarization and the radiation pattern reconfigurable antenna can change its radiation pattern from one direction to another direction [1-3]. To improve the signal reception performance in multipath fading environment, the polarization reconfigurable antennas are considered. There are several methods to achieve the polarization diversity such as incorporating diodes on the structure, rotating the patch shape and changing the substrate characteristics.

A square patch antenna with a loop slots on a ground plane exhibits polarization reconfigurability from LHCP to RHCP by using two diodes which are placed on the two square loop slots on the ground plane [4].the Yatrium Garnet Iron (YIG) patch is placed on a Taconic TLY3 substrate can change its polarization from LHCP to RHCP by altering the incidence direction of the externalluy applied DC magnetic field to the patch [5]. A four arm sinuous antenna is fed to a four module photonic feed system, by changing the phase shift of a signals that are applied to the module, this sinuous antenna can change its polarization from LHCP to RHCP [6]. An annular slot ring with an arrow shaped coupling strip antenna sxhibits polarization reconfigurability by changing the state of the diode which is placed between the ground plane and arms of the coupling strip [7].PIN diodes are placed on both the truncated corners and the U-shaped slot on the square patch. The polarization reconfigurability is achieved by changing the state of the diode [8-9].

Two L-shaped slits are embedded into the square patch antenna and two PIN diodes are positioned in the end of the slits. This antenna can change its Polarization from linear to circular by controlling the state of the diode [10]. The antenna structure consists of two meandered monopoles and the feeding network uses the Wilkinson power divider, two- switchable 90^0 phase shifters. The PIN diodes are used to control the signal passing through the corresponding 90^0 phase shifters. Based on the state of the PIN diode, this antenna can change its polarization from LHCP to RHCP [11]. The truncated corners of the patch antenna can change its polarization by changing the position of PET transducer [12]. The proposed antenna can change its polarization from LHCP to RHCP by rotating the patch by 180^0 and this antenna can change its polarization without any change in its resonant frequency and it is used for RFID application (5.65GHz).

2. ANTENNA DESIGN AND SPECIFICATIONS

The polarization reconfigurable antenna structure is shown in the fig1. This antenna is placed on the Rogers RT/Duriod 5880(tm) substrate with a thickness of 0.381mm. The antenna structure consists of two truncated square-shaped patches which are seperated by a distance of 3mm. In this design the patch rotation technique is used i.e, different patch structures are placed on the substrate, by rotating the patch different structure is fed to the feed and this roatation will change the current direction on the antenna because the shape of the patch which was given to the feed is varied . in this design,by rotating the patch by 180^0 different structure is fed by the microstrip line which in turn changes the polarization of an antenna from LHCP to RHCP.

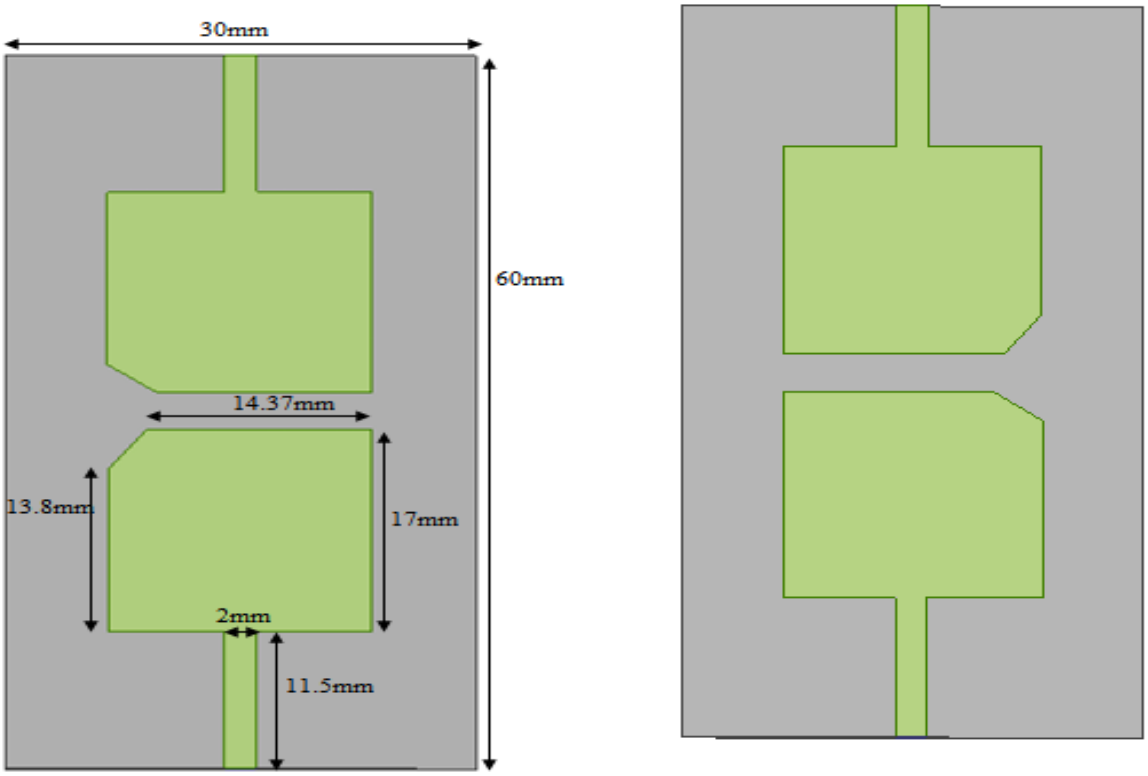

Figure 1 Polarization Reconfigurable Antenna design

When an antenna is in position1,it resonates at a frequency of 5.65GHz with a return loss of -17.86dB and an axial ratio of 1.76dB. In this case, the patch which is given to the feed line is an LHCP antenna because the current direction on the patch is in clockwise. When the patch is rotated by 180^0, i.e the antenna is in position2, in this case the antenna resonates at the same frequency 5.65GHz with a return loss of -18.61dB and an axial ratio of 2.25dB.when an antenna is in position2, it will act an RHCP antenna because the current direction on the patchi s in anticlockwise.

3. RESULTS

When the antenna is in position1 i.e. LHCP antenna has an axial ratio of 1.76dB ,return loss of -17.86dB,VSWR of 1.28, and gain of 8.4dB. When an antenna is in position2 i.e. RHCP antenna has an axial of 2.25dB, return loss of -18.61dB,VSWR of 1.26 and gain of 5.7dB. The return loss and the VSWR plots in both positions are shown in fig2 and in fig3 respectively. The radiation pattern,axial ratio plots are shown in fig 4 and fig5 respectively.

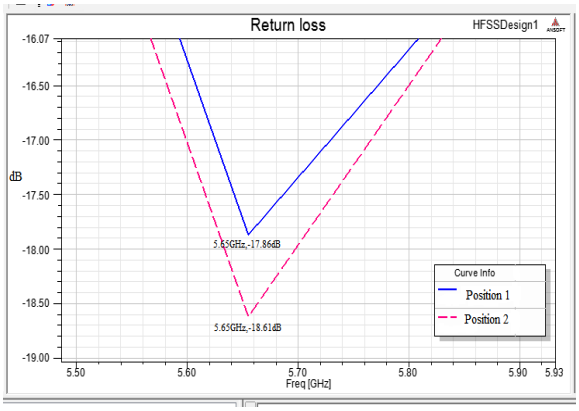

Figure 2 Return Loss

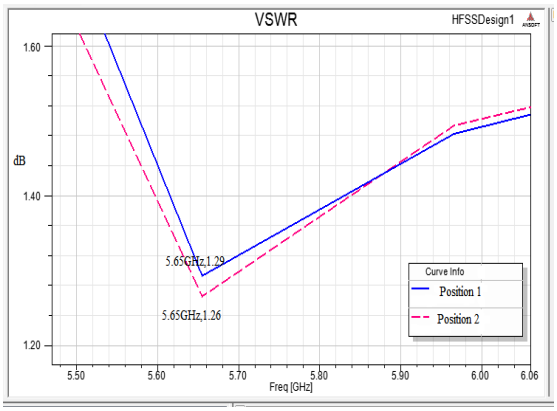

Figure 3 VSWR

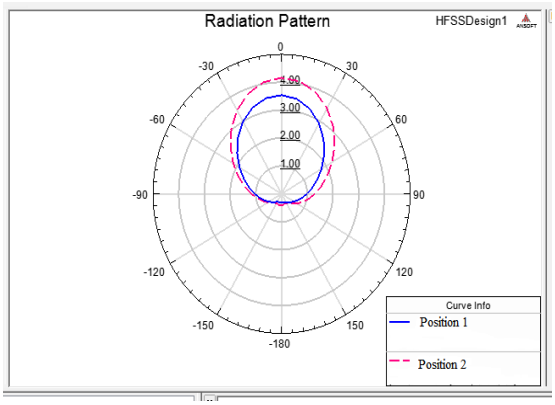

Figure 4 Radiation Pattern

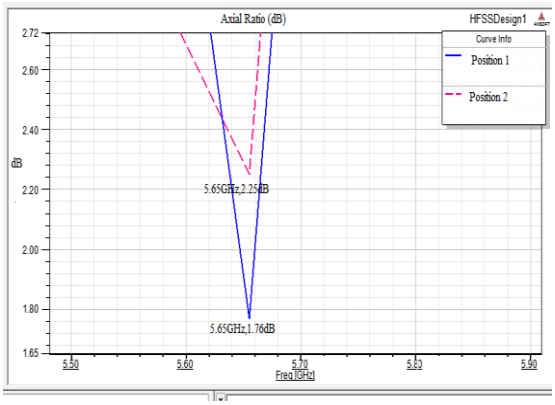

Figure 5 Axial Ratio

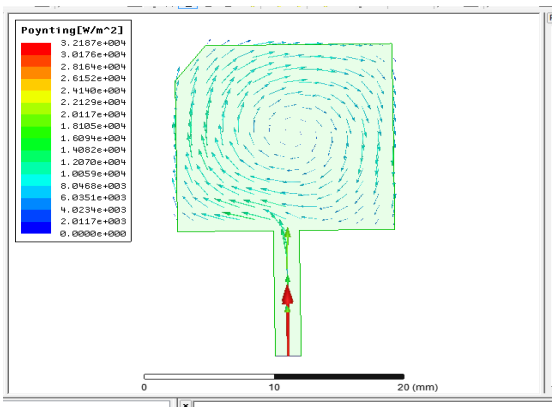

Figure 6 Surface current distribution of an LHCP antenna.

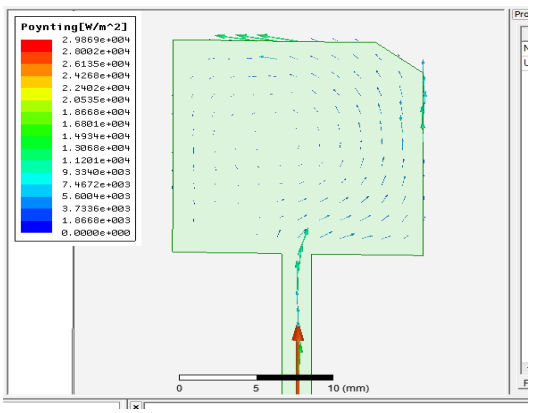

Figure 7 Surface current distribution of an RHCP antenna

The fig6 and fig7 shows the plots of current directions of both LHCP and RHCP antennas.The LHCP antenna has a gain of 8.4dB where the RHCP antenna has a gain of 5.7dB and their plots are shown in fig8 and in fig9 respectively.The results are summarized in Table1.

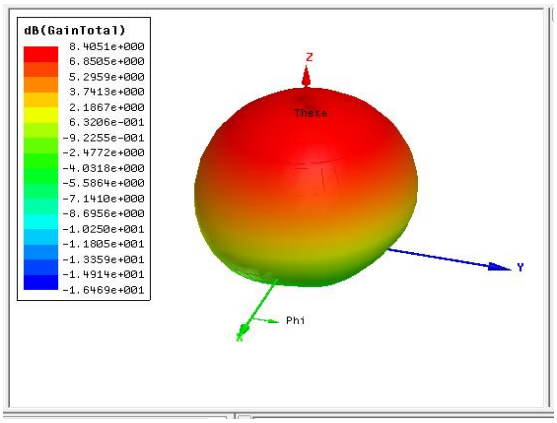

Figure 8.3 D gain plot of LHCP antenna

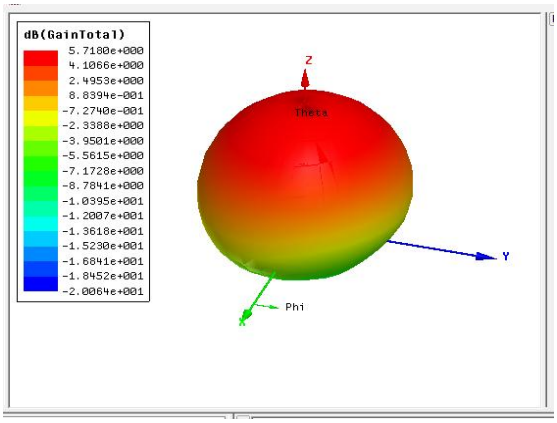

Figure 9.3D gain plot of RHCP antenna

Table1 Dummary of results

Parameter	LHCP	RHCP
Return loss	-17.86dB	-18.61dB
VSWR	1.29	1.26
Axial Ratio	1.76dB	2.25dB
Gain	8.4dB	5.7dB

4. CONCLUSION

Polarization diversity antenna operates is successfully designed at 5.65GHz frequency. The polarization diversity can be achieved by using patch rotation technique with the return loss of -17.86dB and -18.61dB at LHCP and RHCP respectively. This antenna is used to improve the signal performance in the multipath fading environment. It can be used for RFID application.

REFERENCES

[1] J.T.Bernhard. Reconfigurable Antenna. Sam rafeal.CA,USA,Morgan & claypool,2007.

[2] CG.Christodoulou.Y.Tawk,S.A.Lane, and S.R.Erwin, Reconfigurable antenna for wireless & space applications, Proc. IEEE, 100(7) ,pp 2250–2261,Jul.2012.

[3] R.L.Haupt and M.Lanagan, Reconfigurable antennas, IEEE Antennas & Prop. Mag., 55(1), pp 49–61,Feb 2013.

[4] Xue-Xia Yang, Bing-Cheng Shao, Fan Yang, Atef Z. Elsherbeni, Bo Gong, A Polarization Reconfigurable Patch Antenna with Loop Slot On The Ground Plane, IEEE Antennas and Wireless Propoagation Letters, Volume 11,2012.

[5] T.Zervos,A.A.Alexandridis,F.Lazarakis,M.Pissas,D.Stamopoulous,E.S.Angelopoulos,K.Dangakis, Design of A Polarization Reconfigurable Patch Antenna Using Ferrimagnetic Materials, Iet Microw. Antenna Propag., 2012. 6(2),P.P.158–164.

[6] Hossein Emami,Niusha Sarkhosh, Elias Roberto Lopez Lara and Arnan Mitchell, Reconfigurable Photonic Feed For Sinuous Antenna, Journal of Light Wave Technology, 3(16) Aug 15,2012.

[7] Teen-Sheen Ron, Wang-Lin Liu And Tsair-Rong Chen, Circular Polarization and Polarization Reconfigurable Designs For Annular Slot Antennas, IEEE Transations on Antenna and Propagation, 60(12), Dec 2012.

[8] Kyung Ho Chung, Yongsik Nam, Taeyeoul Yun and Jaeehoon Choi, Reconfigurable Microstrip Patch Antenna With Switchable Plarization, ETRI Tournal , 28(3), June 2006.

[9] Matthias,K.Fries,Mischa Grani And Rudiger Vahdieck, A Reconfigurable Slot Antenna with Switchable Polarization, IEEE Microwave and Wireless Components Letters, 13(11) Nov 2003.

[10] Y.L.Sng, Reconfigurable Patch Antenna For Polarization Diversity, IEEE Transactions on Antenna and Propagation, 56(9),Sept 2008.

[11] Yunfei Cao,S.W.Cheung, and T.I.Yuk, A Simple Planar Polarization Reonfigurable Antenna For GNSS/PCS, IEEE Transactions on Antennas and Propoagation, 63(2), Feb 2015.

[12] Neethu P S and Sudha T, A Novel Compact Single Fed Polarization Reconfigurable Antenna For Wireless Lan Systems, *International Journal of Electronics and Communication Engineering & Technology*, **5**(4), 2014, pp. 72–79.

[13] Ravindra Kumar Yadav, Jugul Kishor and Ram. Lal Yadava, Compensation of Dielectric Cover Effects on Cp Hexagonal Microstrip Antenna, *International Journal of Electronics and Communication Engineering & Technology*, **4**(1), 2013, pp. 43–54.

[14] Shih-Hsun Hu And Kaichang, A Novel Antenna with Switchable Circular Polarization, IEEE Antennas and Wireless Propagation Letters, Volume 6,2007.