International Journal of Research in Engineering and Science (IJRES)
ISSN (Online): 2320-9364, ISSN (Print): 2320-9356
www.ijres.org Volume 10 Issue 5 ǁ 2022 ǁ PP. 21-26

An Electronically Reconfigurable Microstrip Antenna with Switchable Slots for Polarization Diversity

Dr.M.Sarvanan[1], P.Mounika[1], T.Hemadhri[1], M.Ramprasad[1]
[1]*Department of Electronics and Communication Engineering, Veltech Rangarajan Dr. Sagunthala Institute of Science &Technology, chennai, TN, India;*

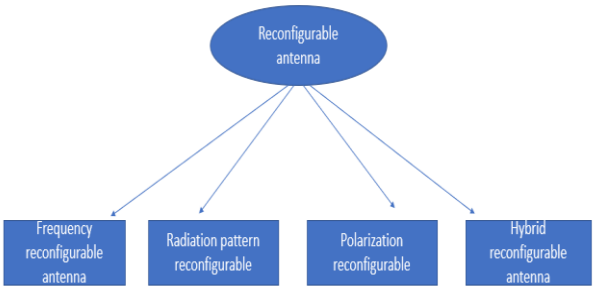
ABSTRACT
A single fed polarization reconfigurable antenna is presented. The antenna comprises of a square shaped radiating element along with reconfigurable feed network located at its centre. The four truncating corners is incorporated into a radiating element, and four Pin diode is utilized to switch the slot on and off. Which realizes the frequency diversity characterstics. The polar diversities among linear polarization (LP), left hand circular polarization (LHCP), right hand circular polarization (RHCP) are obtained by switching four pin diodes by controlling the resistance and capacitance of pin diodes, the polarization of the antenna can be switched between three states of polarization. The antenna is designed to operate at 2.45 Ghz ISM band and the antenna parameters are simulated using Ansys high frequency structure simulator.4
Keywords: *Polarization diversity, Reconfigurable antenna. Radiating element, ISM band*

Date of Submission: 07-05-2022 Date of acceptance: 22-05-2022

I. INTRODUCTION

In wireless transmission process applications, patch antennas e are very fair caused by their squat outline, flimsy, and easy manufacture. They are normally plot for single-mode working. that scatters mostly linear polarization. In current years, still, antenna order that use polarity divergence are obtain the approval caused by the growth of wireless transmission. In bandwidth wireless transmission systems for wireless local area networks (WLAN) application, they are used to alleviate the harmful dying motive by electric wave outcomes. In agile read/write electromagnetic stamping orders. polarization divergence antennas supply a strong distortion plan. They are also use to register frequency recover for magnify the method ability in space craft transmission systems. Pragmatic applications of this procedure have been described.

In this journal, we absent a tale antenna for polarization diverse ness a square patch antenna with shifting aperture that can attain right hand and left hand circular polarizations with a one feed port. Two sets of squared aperture are cut in the square patch, and four pin diodes are placed into the aperture to manage their distance. By switching the diodes on or off, either RHCP or LHCP can be acquire with the matching feed probe which is detect on the pitched rule of the patch. The rationality of this idea is revealed by exploratory outcome with short cross atomization in both RHCP and LHCP performance and linear polarization performance.



Polarization variety is widely utilized in current remote frameworks, it is exceptionally requested that multifunction reconfigurable radio wires should be exchanged in the middle polarization and radiation bar or polarization and recurrence. Barely any designs have been examined prior with capacities to switch among polarization and radiation design in more than one recurrence groups. Recurrence and polarization

exchanging in a discrete way utilizing p-I-n diodes or in a nonstop way utilizing varactor diodes had been introduced. Nonstop recurrence exchanging with polarization deftness had been gotten by a few creators, albeit these radio wires cover the entire working groups (transfer speed is wide) yet the pivotal proportion transmission capacity in a solitary exchanged band isn't sufficient, new remote advances require polarization variety with a wide hub proportion transfer speed in a solitary working band. In this paper we are going to use polarization reconfiguration. Polarization reconfigurable receiving wires are equipped for swapping among the several polarization models. The capacity of swapping along flat, erect and rotatory polarizations can be use to diminish polarity jumble adversity in versatile appliances. polarity reconfigurability can be given by swapping the consonance joining the several techniques of a multi models.

II. METHODOLOGY

2.1 Proposed Design

The schematic of the present antenna. The proposed microstrip antenna has a square patch truncating at the corners and the pin-diodes was inserted on it. To obtain the polarization characteristics (LP, LHCP, RHCP) four pin diodes was used, which is also known as switch Four pin diode was placed at four truncated corners of square patch and Linear , Right hand circular, Left hand circular polarizations was attained by shifting the diodes conditions on and off. Frequency diverse ness is reach to manage the electrical distance. As the electrical length increases the antenna resonates at low frequency. To turn on the diode the width of it taken as 1mm height as 1.6mm with minimum resistance of 50 ohms and inductance 1.8nh.

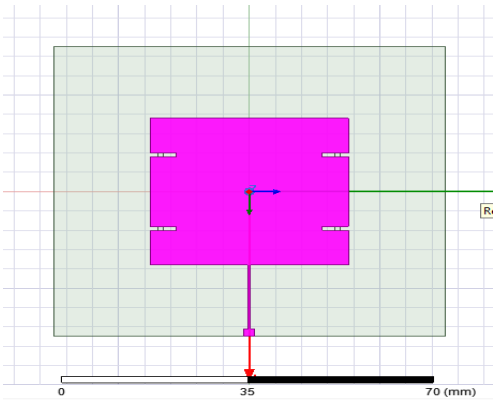
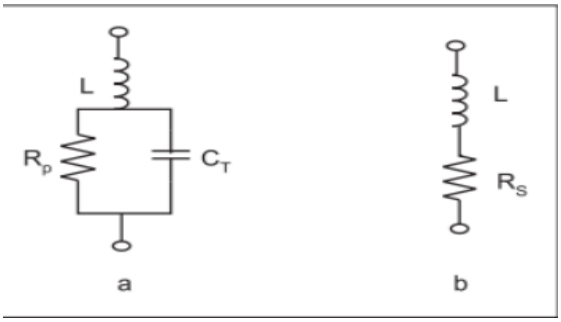


Fig 2.1 Block diagram

To turn off the diode the width of it taken as 1mm height as 1.6mm with maximum inductive resistance of 50 Mega ohms and maximum capacitive resistant of 0.35 Pf. When four slots

are on, The electrical length increases therefore antenna resonates at minimum frequency. If diode 1,3 is in on condition and diode 2,4 is in off condition, It exhibits LHCP obtained by method f corner truncation. If diode 2,4 is in on condition but diode 1,3 s in off condition, It exhibits RHCP obtained by method of corner truncation. When all diodes are in on condition, The electrical length increases therefore antenna resonates at minimum frequency and exhibits Linear polarization.Thus the polarizationn diversity obtained by switching the diodes on and off states.

2.2 Working Principle



PIN diodes were selected for the frequency convey performance, due to its quality formal segregation. The identical circuit of a PIN diode correlate with an inductance , for two conditions of the state, in sequence along a resistance for the on condition , and with the aligned relation of a capacitance and a resistance for the off condition. As stated by the maker, the diode variables are inductance(L)=1.8 nH, RS =50Ω, RP = 50 MegaΩ and CT =0.35pF. The Identical circuit of the diodes is shown in Figure1 for both states.Three prototypes of antennas (RHCP, LHCP and LP antenna) designed in the previous section were simulated on Ansoft hfss electronic suite.

2.3 Switching configuration of antenna

Table 3.1: Switching Configuration of Proposed Antenna

Diode 1	Diode 2	Diode 3	Diode 4	Exhibited polarization
ON	OFF	ON	OFF	LHCP
OFF	ON	OFF	ON	RHCP
ON	ON	ON	ON	LP

To turn on the diode the width of it taken as 1mm & height as 1.6mm with minimum resistance of 50 ohms and inductance 1.8nh. To turn off the diode the width of it taken as 1mm & height as 1.6mm with maximum inductive resistance of 50 Mega ohms and maximum capacitive resistant of 0.35Pf When four slots are on, The electrical length increases therefore antenna resonates at minimum frequency. If diode 1,3 is in on condition and diode 2,4 is in off condition, It exhibits LHCP obtained by method of corner truncation. If diode 2,4 is in on condition but diode 1,3 is in off condition, It exhibits RHCP obtained by method of corner truncation. When all diodes are in on condition, The electrical length increases therefore antenna resonates at minimum frequency and exhibits Linear polarization. Thus the emission multiplicity attained by shifting the diodes on and off states.

To tur

III. SIMULATION &EXPERIMENT RESULTS

VSWR Result:

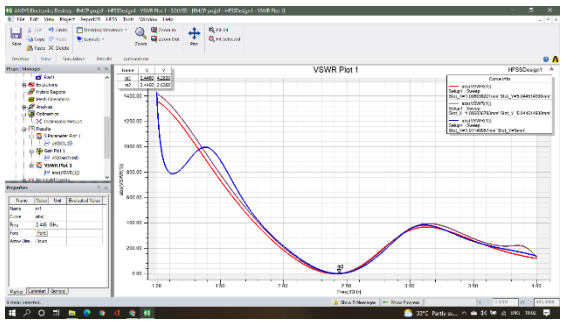


Fig 3.1: Measured VSWR of LHCP, RHCP and LP

Return loss:

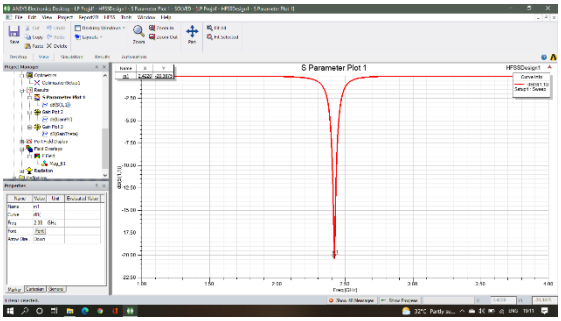


Fig 3.2: Measured return loss of LHCP, RHCP and LP.

Radiation pattern:

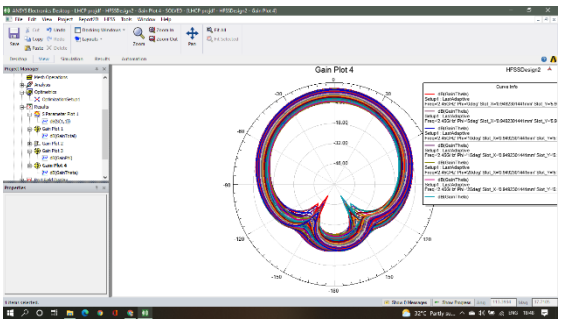


Fig 3.3: Radiation pattern of LHCP

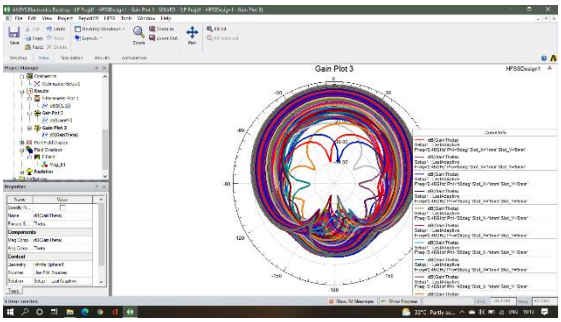


Fig 3.4: Radiation pattern of LP

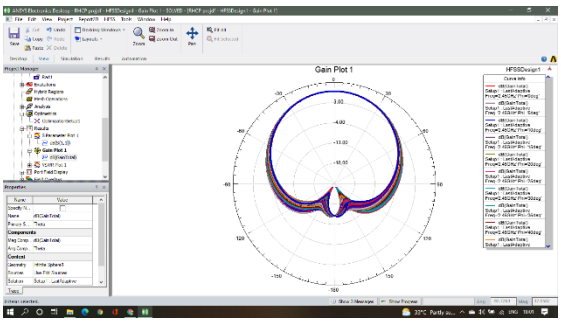


Fig 3.5: Radiation pattern of RHCP

IV. ANALYSIS OF POLARIZATION

Surface current distribution at 2.45 Ghz for three switchable polarization diversity at different phases like theta(0°) and phi (-180°) based on the on or off conditions the distribution of current surface differs for liner the current direction spreads overall surface where as lhcp and rhcp the current spreads to diode 1 and 3 resistance and inductance are given.

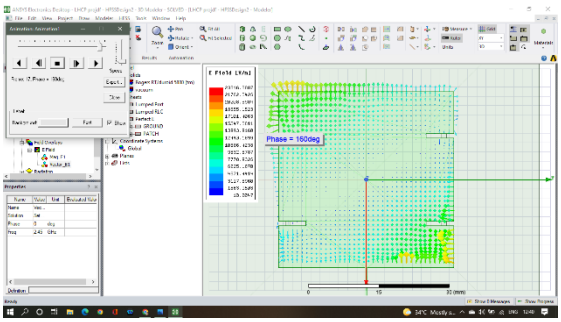


Fig 4.1: Electric field surface through LHCP

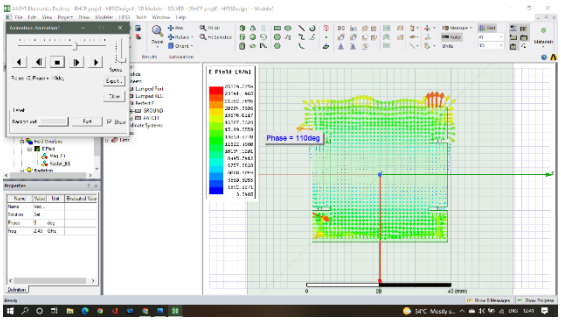


Fig 4.2: Electric field surface through RHCP

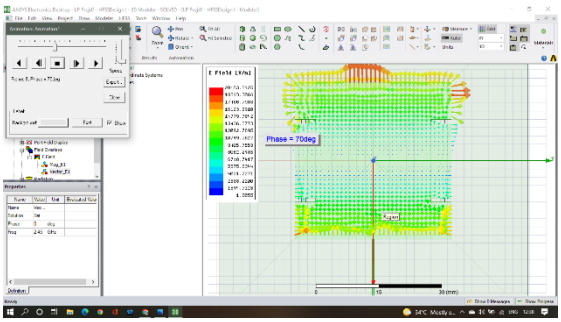


Fig 4.3: Electric field surface through LP

V. CONCLUSION

A Isolated feed used in electronically reconstruct antenna. it has been given in this paper. The given plan has a switchable polarizations using four truncating PIN diodes which exhibits three polarizations, LP, RHCP and LHCP. The radio wire can create direct and round polarization by managing the susceptibility conditions of four PIN diodes in the truncated slots in corners contrast to standard polarization multiplicity antennas. The density and polarization diverseness of this pattern. it provide some possible applications for radio communication. The prevalence characteristics of this antenna is noticed by switching a PIN diode in aperture located in the truncated corners of a radiating patch placed into a patch by giving on and off. The polarity variation is also acquired by shifting four PIN diodes on truncating corners in a quad patch on and off. This antenna can attain three quadratic polarities by shifting the PIN diode methods, and it has the lead of briefness un complicated fabrication.

REFERENCES

[1]. Mallat, N.K., Nouri, M., Aghdam, S.A., Zia, M.T., Harb, B. and Jafarieh, A.,"A dual circularly reconfigurable polarization patch antenna for fifth generation mobile communication systems" Progress In Electromagnetics Research 105, pp.73-84 2020.

[2]. Chen, Q., Li, J.Y., Yang, G., Cao, B. and Zhang, Z.,"A polarization-reconfigurable high-gain microstrip antenna." IEEE Transactions on Antennas and Propagation, 67(5), pp.3461-3466 2019.

[3]. Wu, F. and Luk, K.M.,"Single-port reconfigurable magneto-electric dipole antenna with quad□polarization diversity." IEEE transactions on antennas and propagation, 65(5), pp.2289-2296 2017.

[4]. McMichael, I.T., "A mechanically reconfigurable patch antenna with polarization diversity." IEEE Antennas and Wireless Propagation Letters, 17(7), pp.1186-1189 2018.

[5]. Al-Yasir, Y.I., Abdullah, A.S., Ojaroudi Parchin, N., Abd-Alhameed, R.A. and Noras, J.M., "A new polarization-reconfigurable antenna for 5G applications." Electronics, 7(11), p.293 2018

[6]. Row, J.S. and Huang, Y.J." Reconfigurable antenna with switchable broadside and conical beams and switchable linear polarized patterns." IEEE Transactions on Antennas and Propagation, 66(7), pp.3752-3756 2018.
[7]. Al-mallah, M.Y., Saleh, Z.I. and Faouri, Y.S.,"Two feed reconfigurable microstrip patch antenna for polarization diversity." IEEE Jordan International Joint Conference on Electrical Engineering and Information Technology (JEEIT) (pp. 118-120). IEEE 2019.
[8]. Nishamol, M.S., Sarin, V.P., Tony, D., Aanandan, C.K., Mohanan, P. and Vasudevan, K.,"An electronically reconfigurable microstrip antenna with switchable slots for polarization diversity." IEEE Transactions on Antennas and Propagation, 59(9), pp.3424-3427 2011.
[9]. Osman, M.N., Rahim, M.K.A., Gardner, P., Hamid, M.R., Yusoff, M.F.M. and Majid, H.A., "An electronically reconfigurable patch antenna design for polarization diversity with fixed resonant frequency." radioengineering, 24(1), pp.45-53 2015.
[10]. Mak, K.M., Lai, H.W., Luk, K.M. and Ho, K.L.,"Polarization reconfigurable circular patch antenna with a C-shaped." IEEE Transactions on Antennas and Propagation, 65(3), pp.1388-1392 2016.
[11]. Lin, W. and Wong, H.,"Polarization reconfigurable aperture-fed patch antenna and array." IEEE Access, 4, pp.1510-1517 2016
[12]. Hu, J., Hao, Z.C. and Hong, W.,"Design of a wideband quad-polarization reconfigurable patch antenna array using a stacked structure." IEEE Transactions on Antennas and Propagation, 65(6), pp.3014-3023 2017.
[13]. Zhong, L., Hong, J.S. and Zhou, H.C.,"A dual-fed aperture-coupled microstrip antenna with polarization diversity." IEEE Transactions on Antennas and Propagation, 64(10), pp.4524-4529 2016.
[14]. Kim, J. and Sung, Y., "Dual-band microstrip patch antenna with switchable orthogonal linear polarizations." Journal of electromagnetic engineering and science, 18(4), pp.215-220 2018
[15]. Li, W., Gao, S., Cai, Y., Luo, Q., Sobhy, M., Wei, G., Xu, J., Li, J., Wu, C. and Cheng, Z., "Polarization-reconfigurable circularly polarized planar antenna using switchable polarizer." IEEE transactions on antennas and propagation, 65(9), pp.4470-4477 2017.