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Design of reconfigurable multiband microstrip patch antenna

S.Ajeetha Chandhini
Dept of ECE
Loyola Institute Of tecnology
Chennai,India
s.ajeethachandhini@gmail.com

R.Deepa
Dept of ECE
Loyola Institute Of tecnology
Chennai,India
deepakala20598@gmail.com

K.Elizabeth Rani
Dept of ECE
Loyola Institute Of tecnology
Chennai,India
elirani4973@gmail.com

Ms.M.Alice Christy.M.E
Dept of ECE
Loyola Institute Of tecnology
Chennai,India
Alicechristy6008@gmail.com

***Abstract*—. In this present work annular microstrip patch antenna has been created having a rectangular patch and its simulation has been done. The substrate used is FR4 having dielectric constant of 4.4.The proposed work deals with the design of an antenna which can used for many application by configuring the design.The antenna can be used for various combination of wireless applications such as S,C,X frequency band in electromagnetic spectrum ,hence overcomes the disadvantage of Narrow Bandwidth of Microstrip patch Antenna. Now a days different antenna are preferred for different application. The size of the device is the important factor of consideration. The proposed technique is to make use of the frequency spectrum resources and work collectively well along with the current and future generation wireless device.In this work rectangular patch is designed with T shaped slots a Ansoft HFSS software and pin diode is used for reconfiguration. i.e. to select different frequency band depending upon the application needed. The slotted rectangular patch antenna is fed by a coaxial feedline matched with 50ohm impedance .Frquency diversity has been achieved by reconfiguration technique The main advantage of the design is compact in nature, portable and easy to fabricate.**

Keywords—FR-4,Reconfiguration,HFSS,Frequency diversity,Return loss.

I. INTRODUCTION

Even though the microstrip patch antenna has many attracting features the only disadvantage is their inherently Narrow Bandwidth.The proposed work mainly depends on increasing the number of resonant frequencies characteristic can be changed. In this proposed design five slots are inserted in single patch and reconfigurability is obtain by placing pin diode in middle of centre slot.

In this slotted rectangular patch antenna with single pin diodes inserted in slot is designed to obtain frequency diversity. By controlling biasing state of pin diodes Frequency diversity is obtained.

On the basis of frequency of operation, radiation pattern,polarization and composition, the reconfigurable antennas can be arranged in different classes.

II.Structure and operation of MPA

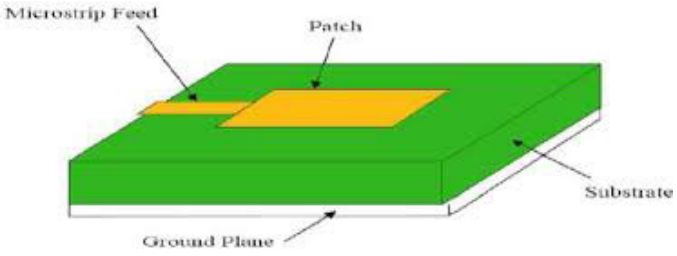

Fig1: STRUCTURE OF MPA

Microstrip patch antenna works based on the Fringing Effect.According to fringing theory ,the EM waves radiating from the patch couples with the ground plane.And also the EM waves from ground gets coupled with the conducting patch.At the edges of the patch the EM waves move into the Free space and then couples with the ground and vice versa.This effect is known as FRINGING EFFECT.

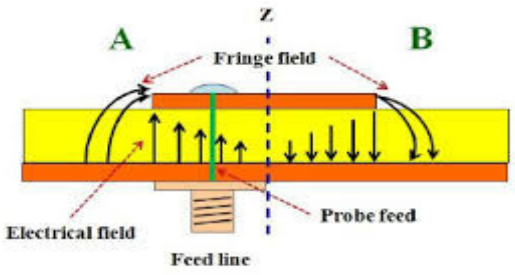

Fig2:FRINGING EFFECT

III.Pin diode operation

In many applications, it is necessary to switch the RF signal path to route and connect to different antennas. This need for more switching with higher performance is only growing with the development of MIMO, multiband wireless devices (5G), and other advanced technologies, especially for portable and battery-powered devices. However, unlike the PN diode, the PIN diode has an "intrinsic" layer sandwiched between its P and N layers. While the device physics are complex, the result is a controllable switching action with a twist

Fig3:Pin diodes in [a] Forward bias

[b]Reverse bias

The above figure shows the Equivalent circuit of PIN diodes under ON and OFF conditions

IV.ANTENNA DESIGN

Proposed antenna includes only one patch which is placed on FR4 substrate with relative permittivity of $\varepsilon_r = 4$ and height of substrate is height of 1.5 mm. To design this antenna High frequency structure simulator (HFSS, Ver. 13) software is used.

Elements	Dimensions[mm]
Substrate width	39.425
Substrate length	32.47
Patch width	30.425
Patch length	23.47

Table1:Dimensions of the patch

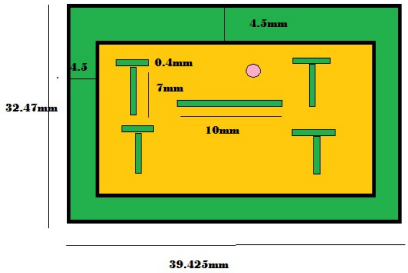

Fig4:Topview of MPA

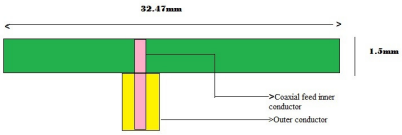

Fig5:Side view

The above figures shows the top and sideview of the designed T-slotted microstrip patch antenna .Slots are introduced to create multiple paths for the EM waves to propagate along different paths producing different operating frequencies.The important parameters such as return loss and VSWR are investigated.

The return loss and VSWR plots obtained by introducing these slots are as follows

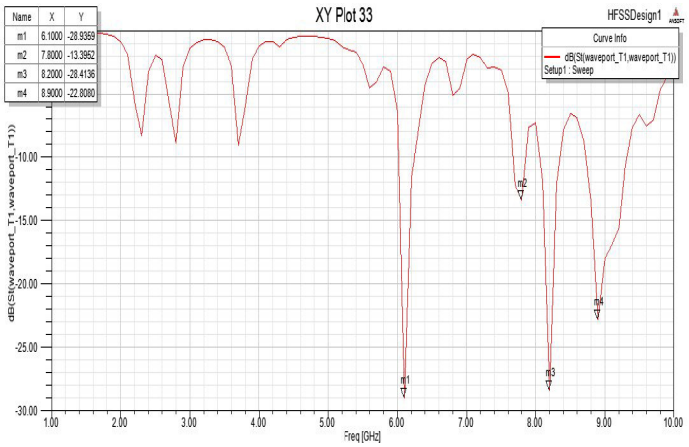

Fig6: Return loss VS freq plot of slotted MPA

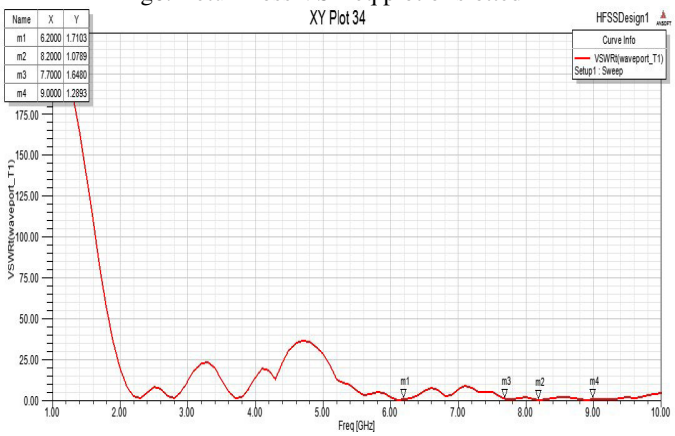

Fig7: VSWR Vs freq plot in slotted MPA

V.Pin diode biasing in slotted rectangular patch antenna

A PIN diode is a one kind of diode with an undoped, wide intrinsic semiconductor region between a P-type and N-type semiconductor region. These regions are normally heavily doped as they are used for Ohmic contacts.The wider intrinsic region is indifference to an ordinary p–n diode. This region makes the diode an inferior rectifier but it makes it appropriate for fast switches,attenuators, photo detectors and high voltage power electronics applications.Due to the large varying adaptive features of PIN diode it is inserted in the slots of rectangular microstrip patch antenna to obtain reconfigurability.

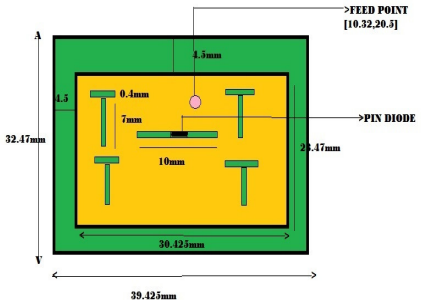

Fig8:PIN diode inserted MPA

CASE A:When diode is in ON condition

In this design, PIN diodes is inserted in-between a slot. Dimensions of Microstrip Patch Antenna are same . The position of pin diode inserted in rectangular-shape slot of Microstrip Patch Antenna. pin diodes are absent hence it can name as OFF state. '0' means pin diode is OFF and '1' means pin diode is in ON state.

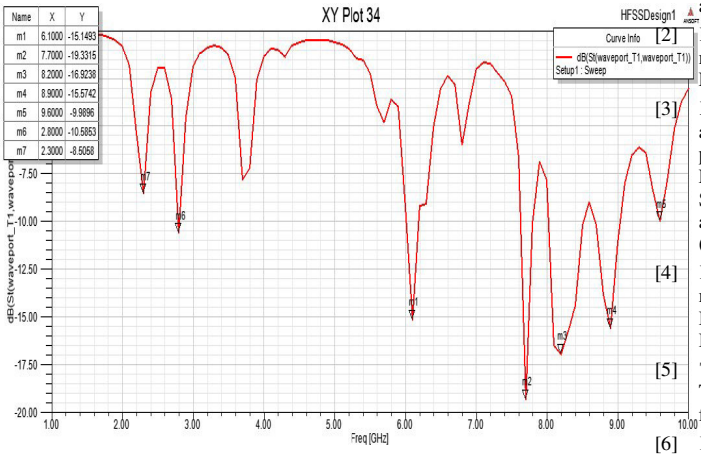

Fig9:Return loss Vs freq plot when D is ON

CASE B:When PIN diode is in OFF condition

The equivalent circuit of PIN diode under OFF status will be a parallel combinations of a capacitor and resistors in series with an inductor .The variation in operating frequencies with return loss is shown in the following figure.

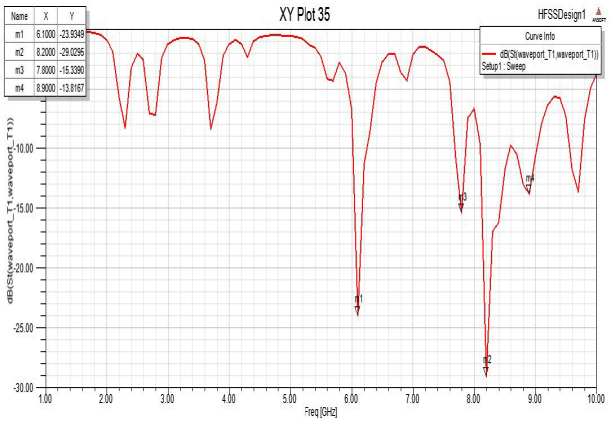

Fig10:Return loss Vs Freq when D is OFF

VI Conclusion

In this proposed antenna frequency reconfiguration is applied by using PIN diode as a switch in two biasing conditions.And the results are simulated and the important parameters such as return loss and VSWR is simulated and the results are displayed.This reconfigured microstrip patch antenna can be used for many wirelss applications.

REFERENCES

[1] Mandeep singh,Simranjit Singh,Hardeep singh"Multiband reconfigurable microstrip patch antenna for millimeterwave applications" 978-1-5386-7266-2/18/$31.00 ©2018 IEEE

[2] Ekata Singh,Anil Kumar"Design of frequency reconfigurable annular microstrip patch antenna using PIN diodes" 2018 Recent Advances on Engineering, Technology and Computational Sciences (RAETCS)

[3] Xiongwen"A dual band frequency reconfigurable MIMO patch slot antenna using reconfigurable feedline" This work was supported in part by the Key program of Beijing Municipal Natural Science Foundation under Grant 17L20052, in part by the Beijing Municipal Science & Technology Commission under Grant Z181100003218007, and in part by the National Nature Science Foundation of China (NSFC) under Grant 61771194.

[4] Dipali S. Yeole, Uday Pandit Khot "Reconfigurable multiband microstrip Patch antenna for Wirelss applications" IEEE International Conference On Recent Trends In Electronics Information Communication Technology, May 20-21, 2016,

[5] Tezpur University-Computer Science and Information Technology"Generalized formula for the determination of resonant frequency

[6] D.Orban and G.J.K.Moernaut, The basics of patch antenna,September 2009 edition of RF GLOBALNET

[7] Parveen Kumar Chakravarthi,Garima Saini"Design of reconfigurable Notch band antenna for UWB applications using PIN diodes" International Journal of Trends and technology in Computer Science[IJETTC]