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SLOTTED MICROSTRIP ANTENNAS FOR CIRCULAR POLARIZATION WITH COMPACT SIZE FOR RFID ,BLUETOOTH &S-BAND APPLICATIONS

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ABSTRACT:

Micorstrip patch antennas play a major role in day to day life. In this paper the designed microstrip patch antenna is compact sized with circular polarization for RFID applications. Different arbitrary shaped slots like square circle plus are used and parameters like return loss, gain and frequency are observed for each of the patches. All these are done using ANSOFT HFSS . The antenna is fabricated using duroid as dielectric substrate (relative permittivity =2.2, loss tangent=0.0004) and coaxial feed. These designed antennas are fabricated and used in real time applications.

Keywords: *Micorstrip patch, RFID ,ANSOFT HFSS.*

1. INTRODUCTION

Microstrip patch antennas are widely used now a days because of several advantages like compact size, ease of fabrication, lower cost etc .A patch antenna is a narrowband and wide beam antenna fabricated by etching the element pattern of antenna in a metal trace bonded to an insulating dielectric substrate, such as printed circuit board, with a continuous layer of metal bonded to the opposite of the substrate which forms a ground plane. The most used microstrip antenna is a rectangular patch because of ease of analysis and fabrication. The major advantage of using a rectangular patch is low cross polarization can be achieved. There are some operational disadvantages for these microstrip patch antennas like low efficiency, narrow bandwidth, low power handling capacity etc. The substrate used is RT-Duroid (relative permittivity=2.94 and loss tangent=0.0012).It has several advantages like low dielectric constant,loss tangent and low thermal coefficient.

Circular polarization is most desired type of polarization in current day wireless communications because of various advantages. This circular polarization provides flexibility in orientation of transmitter and receiver antennas. More over it can provide better mobility and reduction in multipath reflections which helps in increasing spectral efficiency, impedance and axial bandwidth of RF system. One more advantage of circularly polarized antennas is that they communicate better even with linear polarized antennas for some specific applications.

Sophisticated systems are able to support different applications operating at different frequencies. Hence this paper is focused on three different frequencies. Single band antennas based on circular polarization and diagonally symmetric strips have been covered in the literature, and the resonance frequencies of triple band are controlled based on the dimensions of the strips. Single band antennas have been demonstrated using circular, plus, square and ring shaped slots. However most of the triple band antennas are linearly polarized and the complexity of fabrication increases with complex structures in the design of antenna. Co-axial feed diagonally symmetric antenna for single band with slits on the patch and ground plane are available in the open literature. Although these structures give circular polarization at single band but for sophisticated systems we need multiband operating antennas. This paper reflects triple band circular polarization operations for RFID (RadiofrequencyIdentification),Bluetooth and S-band applications.

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2.ANTENNA GEOMETRY:

The layout of the proposed Circularly polarized antenna is shown in fig 1(a),1(b),1(c),1(d)

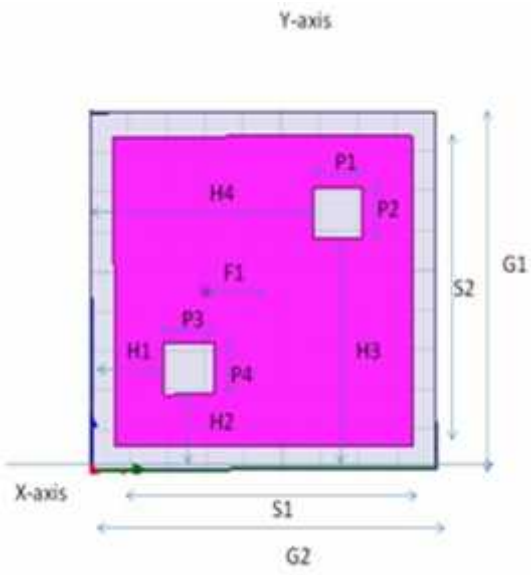

Fig 1(A)Diagonally Symmentric Slotted Microstrip Patch Antenna With Square Slot.

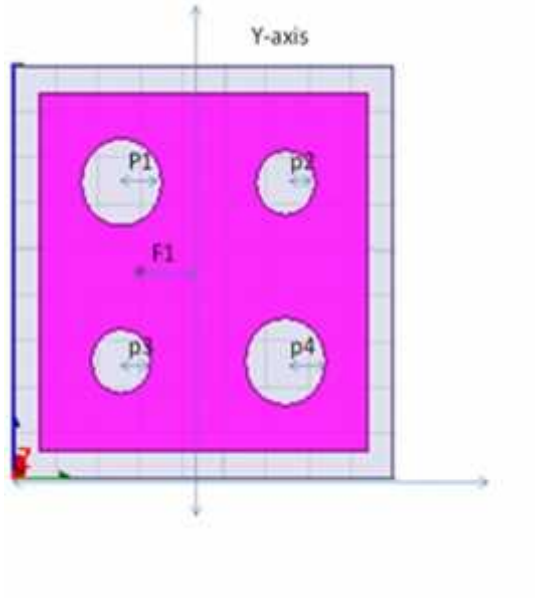

Fig.1(B)Diagonally Symmetric Slotted Microstrip Patch Antenna With Circles(Four Circles)

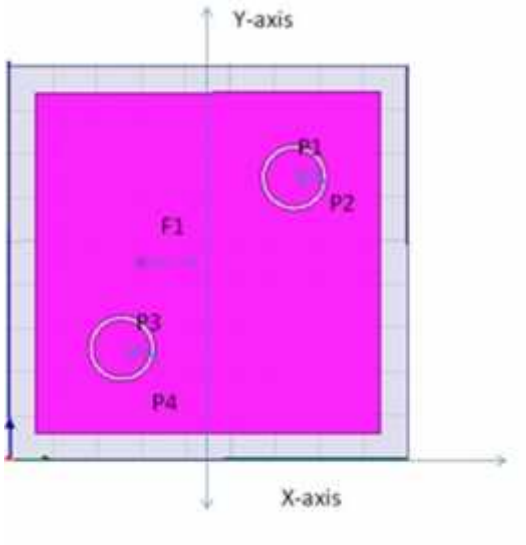

Fig.1(C) Diagonally Symmetric Slotted Microstrip Patch Antenna With Ring Slots

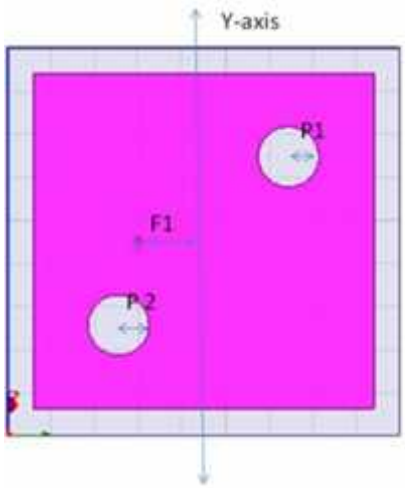

Fig.1(D) Diagonally Symmetric Slotted Microstrip Patch Antenna With Circular Slots

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3. DESIGN PROCEDURE:

Table 1(A) For Fig.1(A).

G1	G2	S1	S2	H1	H2	H3	H4
90	90	78	78	19	19	58	58

P1	P2	P2	P4
13	13	13	13

Table 1(A) For Fig.1(B).

P1	P2	P3	P4
7	9.25	9.25	7

Table 1(C) For Fig.1(C).

P1	P2
7	7

Table 1(D) For Fig.1(D).

P1	P2	P3	P4
6.5	7.5	6.5	7.5

The design specifications of the proposed model are shown in the table a. On the surface of the square patch circle, square and ring shaped slots are made to design the compact antenna for circular polarization radiation. To excite symmetric diagonally placed slits for good circular polarization radiation at triple band, proper symmetry of slots is implemented as shown in the figure. The antenna models are designed on RT-Duriod substrate of loss tangent 0.0012 and dielectric constant of 2.2.The overall dimension of the proposed antenna is around 90x90x5.5.To understand the mechanism of circular polarization of the proposed model the simulation is carried out in HFSS, and the designed models are shown in the figures.

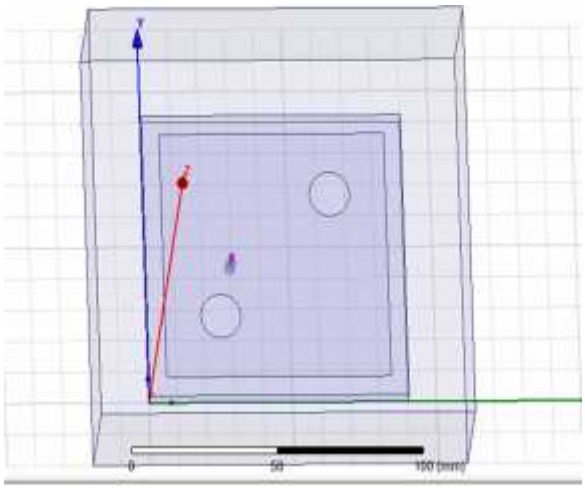

Fig 2(A) HFSS Design For The Circular Slotted Microstrip Patch Antenna

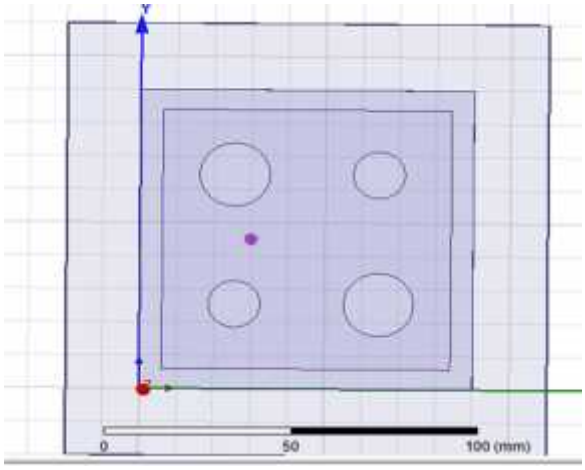

Fig 2(B) HFSS Design For The Four Circular Shaped Microstrip Patch Antenna

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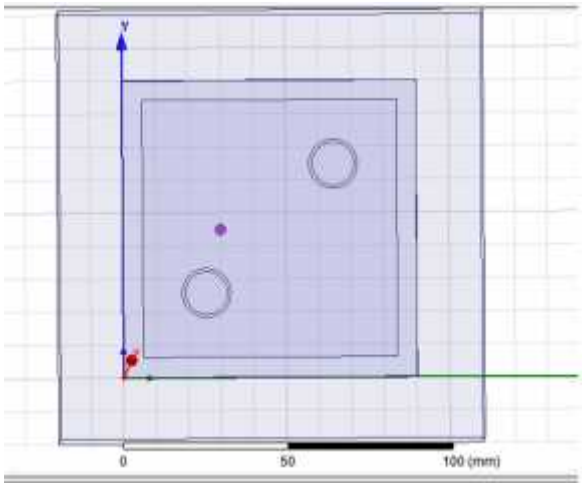

Fig 2(C) HFSS Design For The Ring Slotted Microstrip Patch Antenna

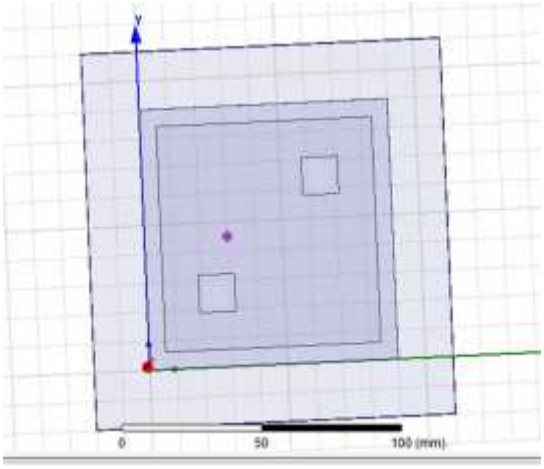

Fig 2(D) HFSS Design For The Square Slotted Microstrip Patch Antenna

4.RESULTS

The proposed antenna is designed in HFSS software and the reults are simulated and verified.This antenna can be used for three different frequencies as a good gain was observed at three different frequencies namely 1.2Ghz, 2.4Ghz, 3.7Ghz for circular slos(two), slots(four),1.2Ghz, 2.4Ghz,3.7Ghz for ring slot 1.2Ghz,3.7Ghz,4.4Ghz for circular, 1.2Ghz,2.4Ghz,3.7Ghz for square slot.The gain for each of the mentioned frequency is considerable and are mentioned in the table provided below.Good return loss is also observed for each slot as shown in the figure below.

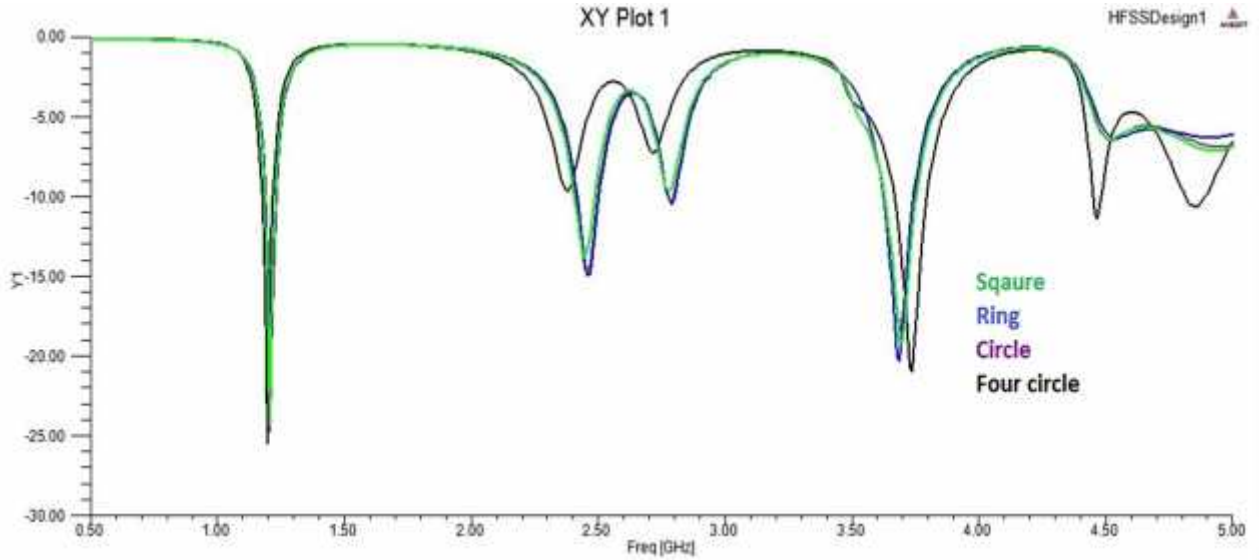

Fig 3 Return Loss For The All Slots

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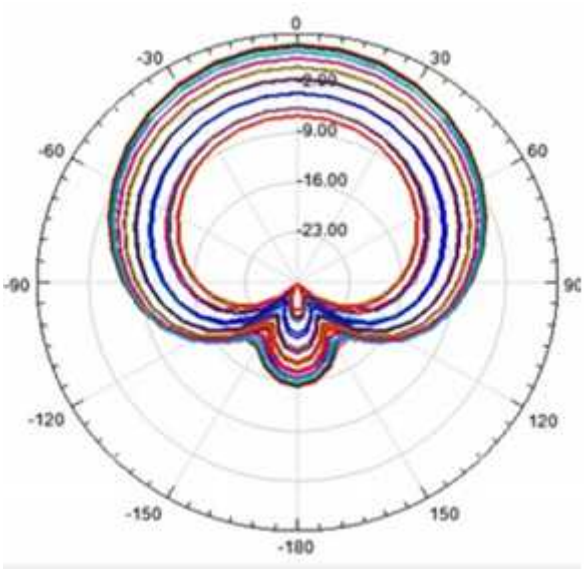

Fig 4(A) Radiation Pattern For Square Shaped Slots

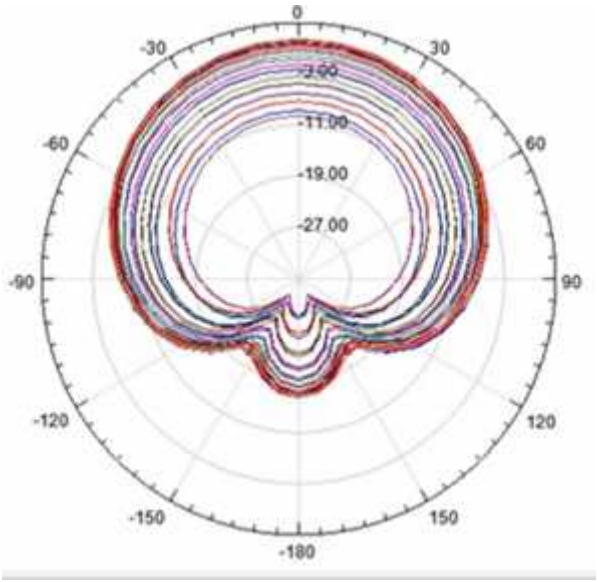

Fig 4(B)Radiation Pattern For Four Circular Shaped Slots

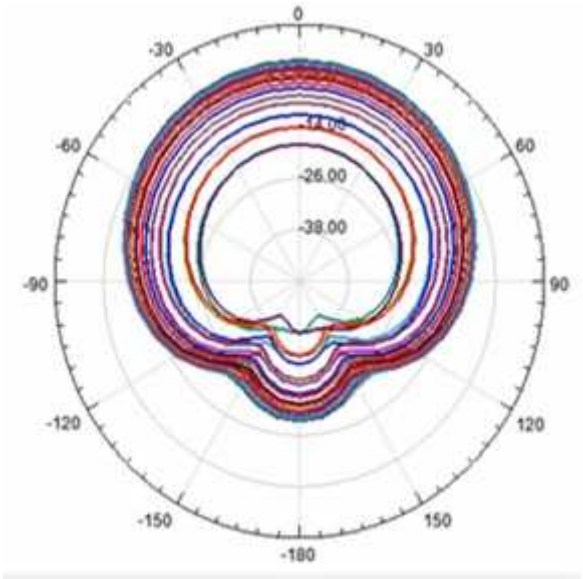

Fig 4(C) Radiation Pattern For Two Circular Shaped Solts

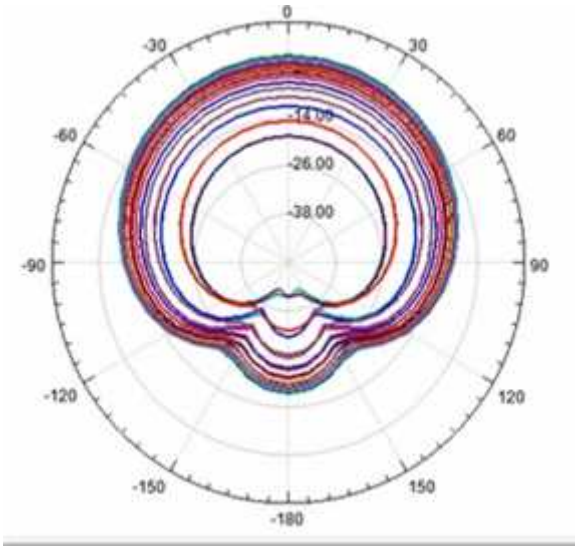

Fig 4(D) Radiation Pattern For Ring Shaped Slots

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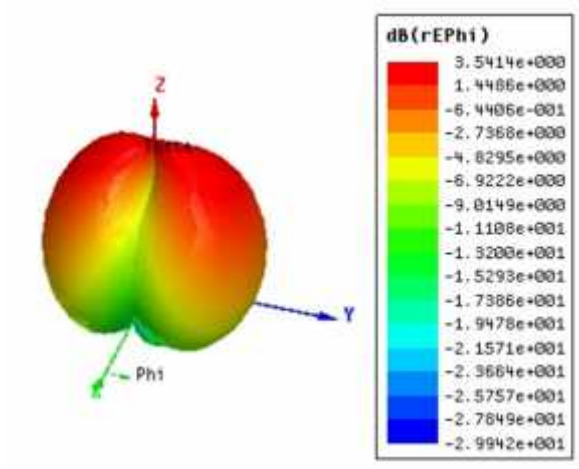

Fig 5(A) 3D Radiation Pattern For Square Shaped Slots

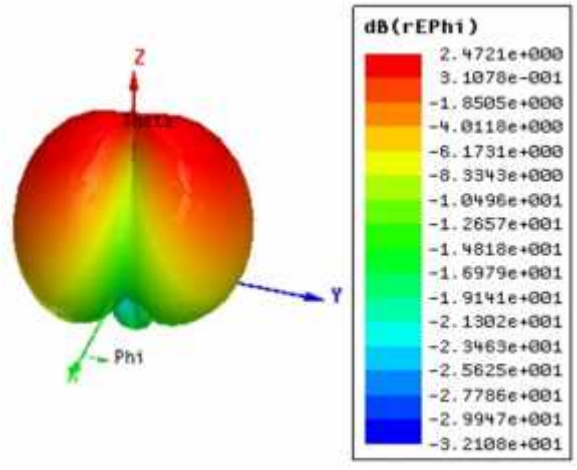

Fig 5(B) 3D Radiation Pattern For Four Circular Shaped Slots

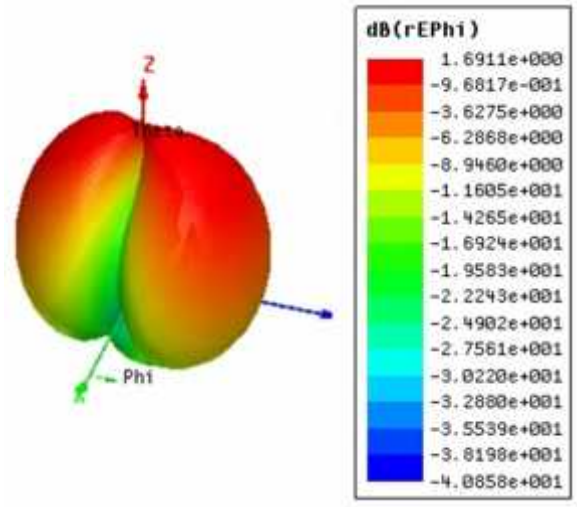

Fig 5(C) 3D Radiation Pattern For Two Circular Shaped Slots

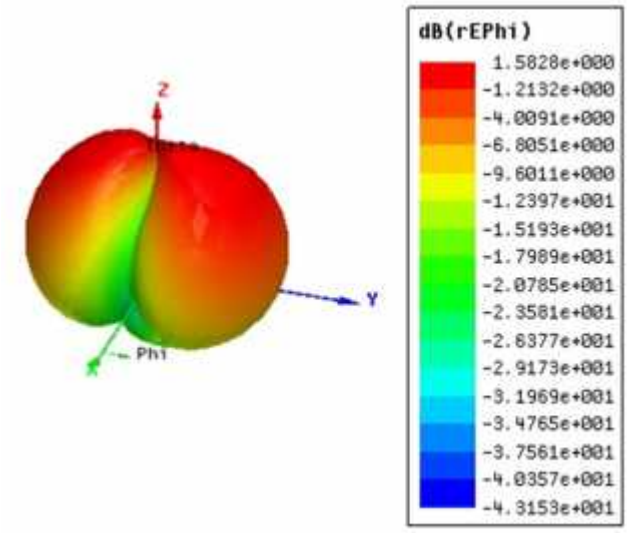

Fig 5(D) 3D Radiation Pattern For Ring Shaped Slots

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5.COMPARITIVE ANALYSIS

PATCH	RETURN LOSS	FREQ-1	FREQ-2	FREQ-3	GAIN-1	GAIN-2	GAIN-3
SQUARE	-23.73	1.208	2.4550	3.7055	3.0044	5.0936	8.6372
CIRCLE	-21.8231	1.2135	2.4642	3.7055	2.9688	4.9479	9.0184
FOUR CIRCLES	-21.6387	1.2040	3.7442	4.4720	2.9783	4.7439	7.9967
RING	-21.0918	1.2135	2.4693	3.7011	2.9774	5.0804	7.1831

6.FABRICATED ANTENNA AND ITS RESULTS

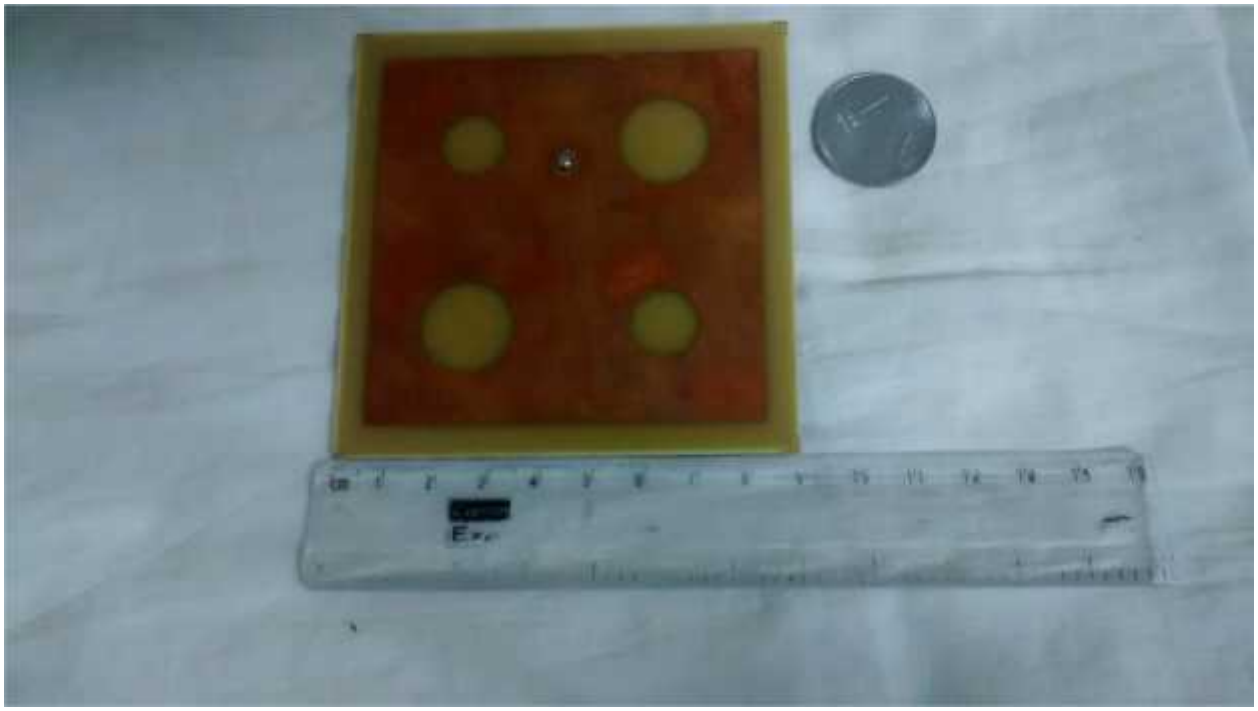

Fig 6(A)Fabricated Microstrip Patch Antenna With Four Circular Slots

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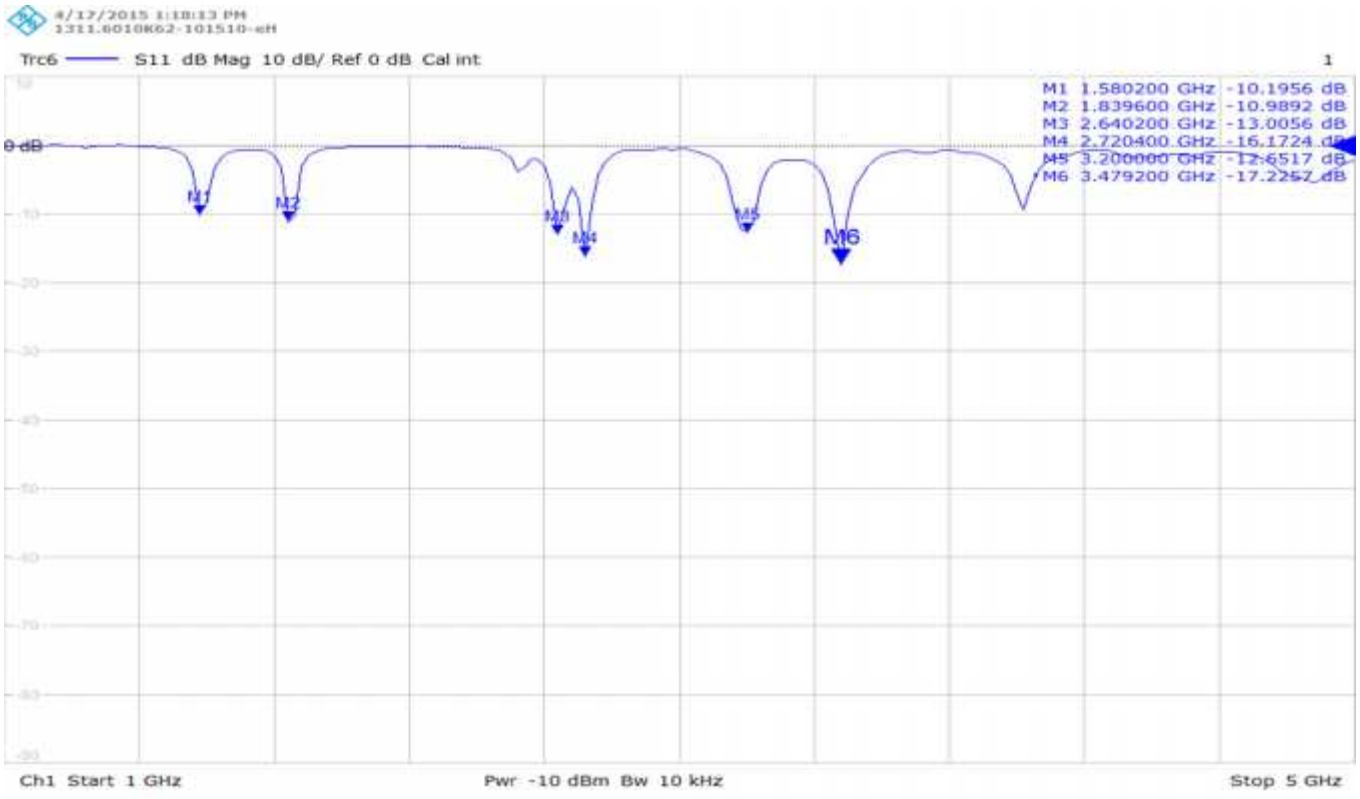

Fig 6(B) Return Loss

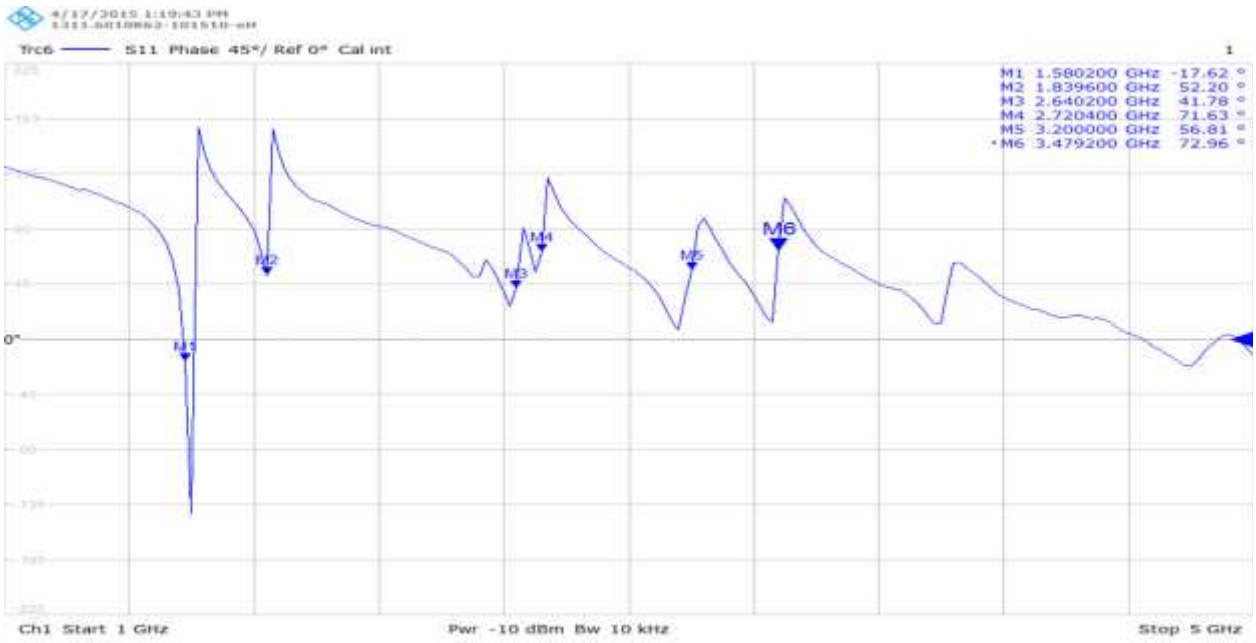

Fig 6(C)Phase

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Fig 6(D)SWR

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