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DESIGN OF DIAGONALLY SYMMETRICAL SLOTTING MICROSTRIP PATCH ANTENNA USING HIGH FREQUENCY STRUCTURAL SIMULATOR FOR S BAND APPLICATIONS

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Abstract— This paper presents slotted Microstrip patch antenna integrated with slot shapes of plus, Ring. Two different shapes of slots on patch are used for 'S' Band application. As a result the performance of antenna is improved compared to the antenna without slots. Different arbitrary shapes and parameters like return loss, gain, converged frequency are observed for each of the patches all these are done using Ansoft HFSS. The antenna is simulated using RT Duroid as dielectric substrate (Relative permittivity =2.2, Loss tangent =0.0004).
Keywords— Microstrip Patch Antenna, return loss, gain, Ansoft HFSS, Duroid, Dielectric substrate.

I. INTRODUCTION

Microstrip patch antennas are widely used in various applications because of low profile, low cost, light weight and conveniently integration with RF devices. The most used Microstrip antenna is a Rectangular Patch because of ease of analysis and fabrication.

Sophisticated systems are able to support different application operating at different frequency. Hence, this paper is focused on three different frequencies. Single Band antennas based on circularly polarization and diagonally symmetric strips have been converted in different shapes. The triple band antenna are controlled based on Plus and Ring slots. Co-axial feed diagonally symmetric antennas with symmetric strips have been simulated for S-band application.

II. ANTENNA GEOMETRY

The design specifications of proposed model are shown in Table 1. The antenna is etched on 78 x 78mm RT Duroid material with 2.2 (ε_r) dielectric constant and considerable loss tangent of 0.0012 with two different slot shapes like Plus and Ring. Proper symmetry of slots is implemented as show in figure (1) & (2). The overall dimensions of antenna are around 90 x 90 x 5.5mm. To understand the mechanism of the proposed model simulation is carried out in HFSS for radiation of antenna at 1.2 GHz to 4GHz.

Table 1. Design specifications of proposed antenna models respectively

Slot Shape	G_1	G_2	S_1	S_2	P_1	P_2	P_3	P_4
Plus	90mm	90mm	78mm	78mm	13mm	2mm	13mm	2mm
Ring	90mm	90mm	78mm	78mm	1mm	7mm	-	-

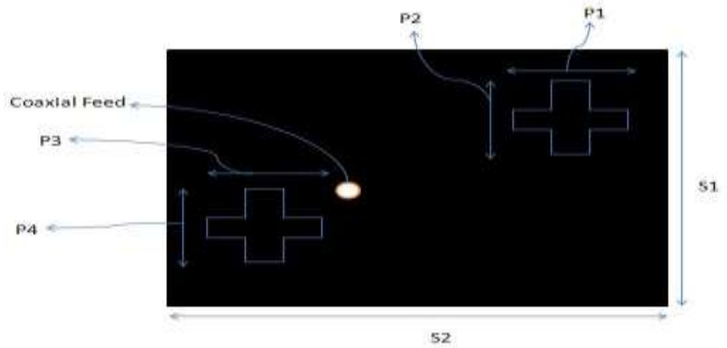

Figure 1. Diagonally symmetric slotted microstrip patch antenna with plus slots

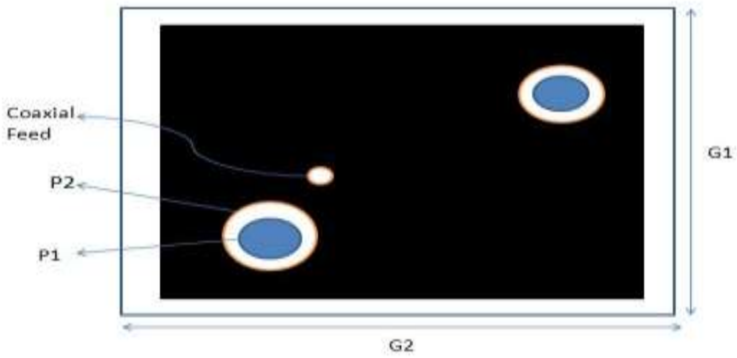

Figure 2. Diagonally symmetric slotted microstrip patch antenna with ring slots

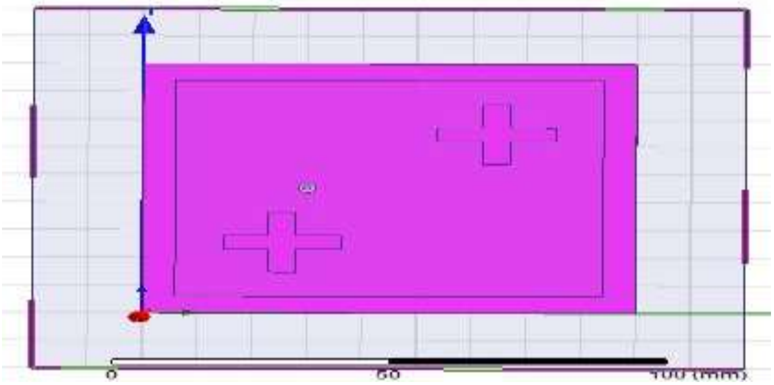

Figure 3. Diagonally symmetric slotted microstrip patch antenna with plus slots design in hfss

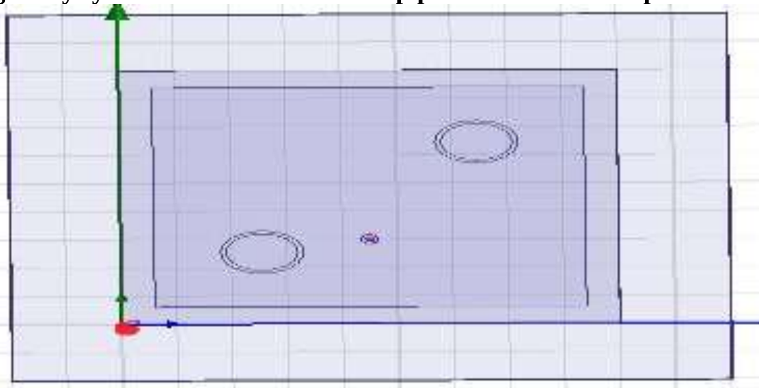

Figure 3. Diagonally symmetric slotted microstrip patch antenna with ring slots design in hfss

III. RESULTS AND DISCUSSIONS

The first step in designing of proposed antenna involves selection of conventional shapes as Ring and Plus which is diagonally symmetrical to axis of the antenna. The second step is applying these arbitrary shapes as patch of Microstrip Patch antenna for suitable converged frequency (S-Band). The result indicates, the antenna is converged at three different S-Band frequencies. The total performance of proposed antenna with symmetrical shapes is shown in table 2.

Table 2. The effect of different symmetrical shapes on antenna performance

Shape	Converged Frequency	Return Loss	Gain	Directivity	VSWR	No. of Bands
Diagonally symmetric plus	1.17GHz	-23.6dB	4.7478dB	4.8792dB	1.3493	3
	2.4GHz	-11.5dB	4.7478dB	4.8792dB	1.7285	
	3.65GHz	-30.5dB	4.7478dB	4.8792dB	1.0614	
Diagonally symmetric Ring	1.17GHz	-22.8dB	4.7207dB	4.8792dB	1.3	3
	2.4GHz	-14.9dB	1.0891dB	4.8792dB	2.3182	
	3.65GHz	-17.8dB	4.7207dB	4.8792dB	1.3	

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From the table2, one can noticed that antenna converges at three different frequencies in S-band range with favorable return losses for both Plus slot and Ring slot respectively. At converged frequencies, Gain of antenna shows good compromise with directivity and VSWR and Bandwidth. The VSWR for both symmetrical slots shows the better performance of antenna. The simulated results for return loss, Converged frequencies, Gain, Directivity and VSWR show in below figures.

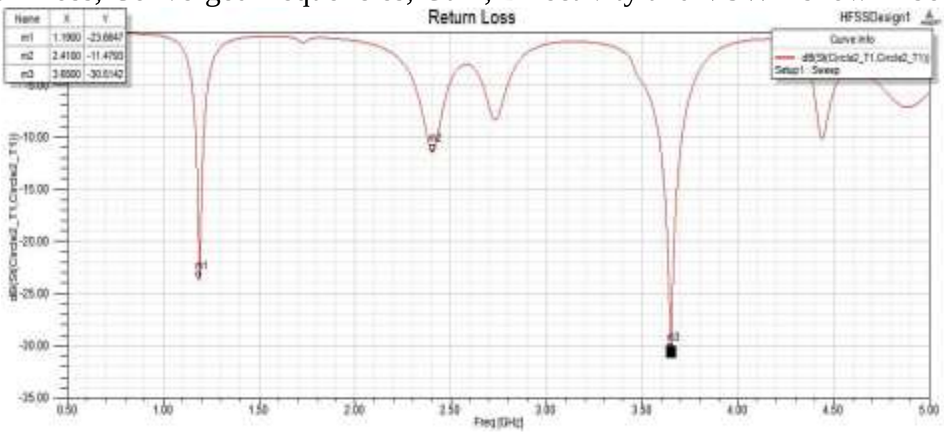

Figure 4.Return loss curve for diagonally symmetric plus slots for 3 frequencies

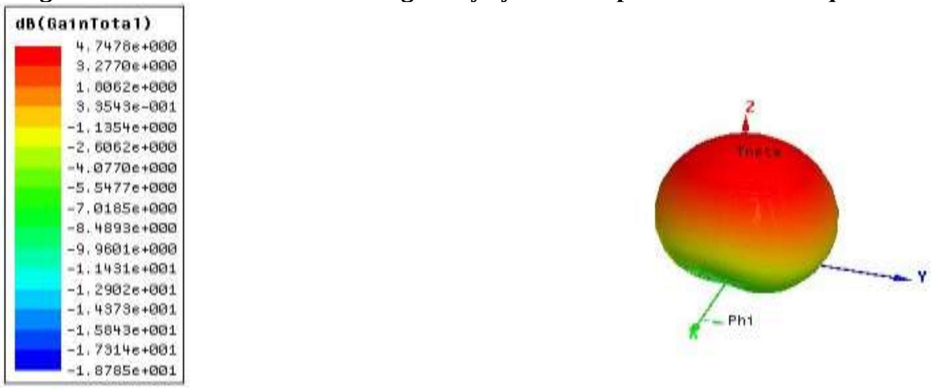

Figure 5.Gain for diagonally symmetric slotted microstrip patch antenna with plus slots at 1.17Ghz

Figure 6.Directivity for diagonally symmetric slotted microstrip patch antenna with plus slots at 1.17Ghz

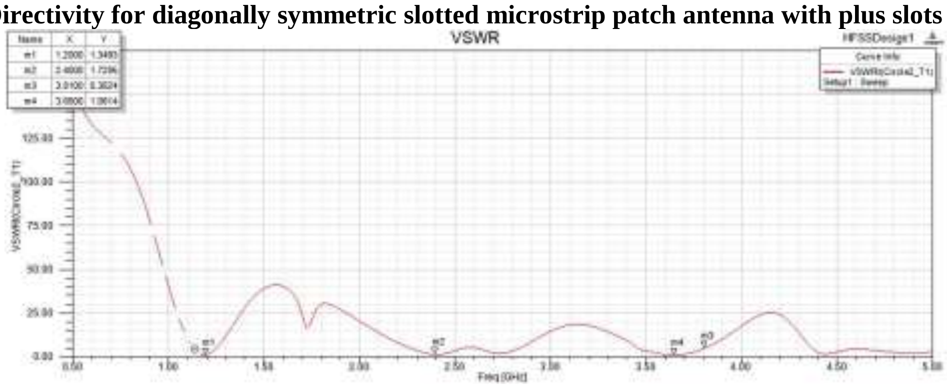

Figure 7.VSWR curve for diagonally symmetric plus slots for 3 frequencies

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Figure 8.Gain for diagonally symmetric slotted microstrip patch antenna with plus slots at 2.4Ghz

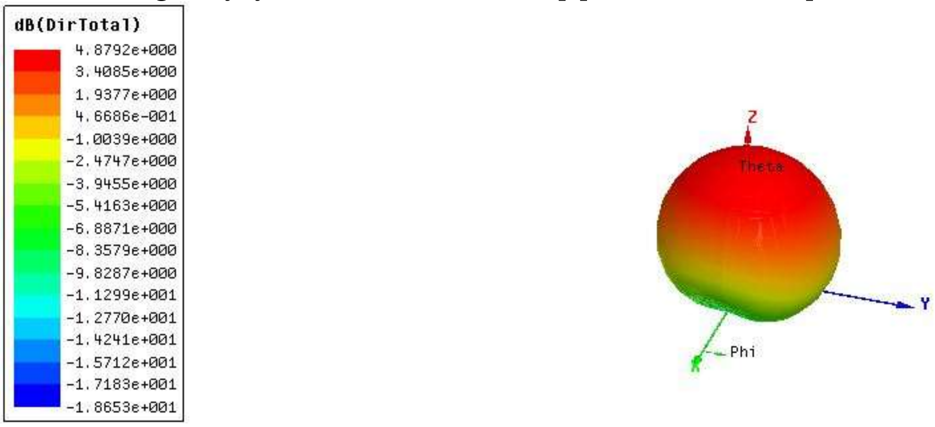

Figure 9.Directivity for diagonally symmetric slotted microstrip patch antenna with plus slots at 2.4Ghz

Figure 10.Gain for diagonally symmetric slotted microstrip patch antenna with plus slots at 3.7Ghz

Figure 11.Directivity for diagonally symmetric slotted microstrip patch antenna with plus slots at 3.7Ghz

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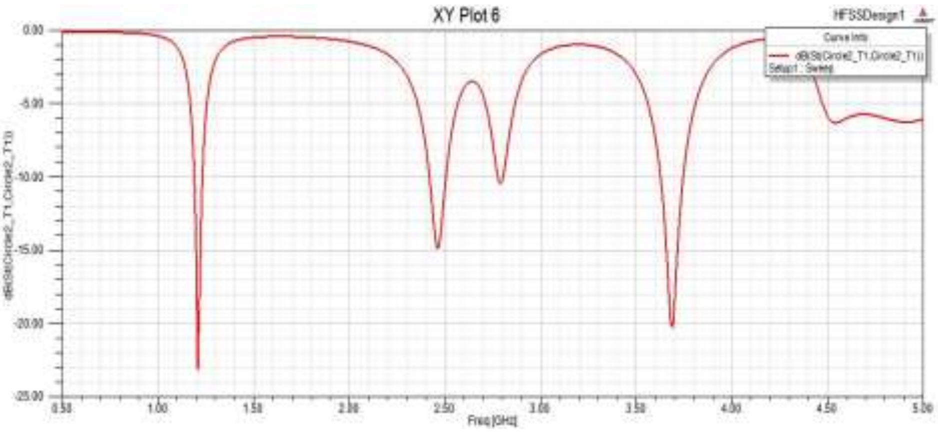

Figure 12. Return loss curve for diagonally symmetric Ring slots for 3 frequencies

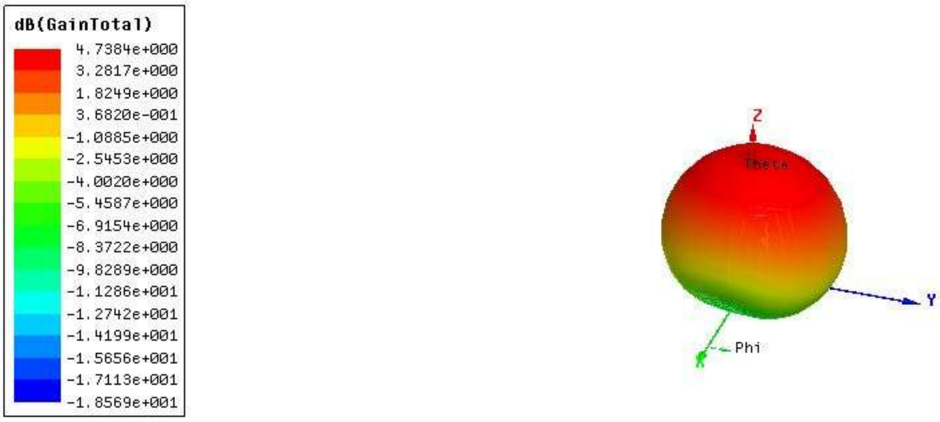

Figure 13. Gain for diagonally symmetric slotted microstrip patch antenna with ring slots at 1.17Ghz

Figure 14.Directivity for diagonally symmetric slotted microstrip patch antenna with ring slots at 1.17Ghz

Figure 15.Gain for diagonally symmetric slotted microstrip patch antenna with ring slots at 2.4Ghz

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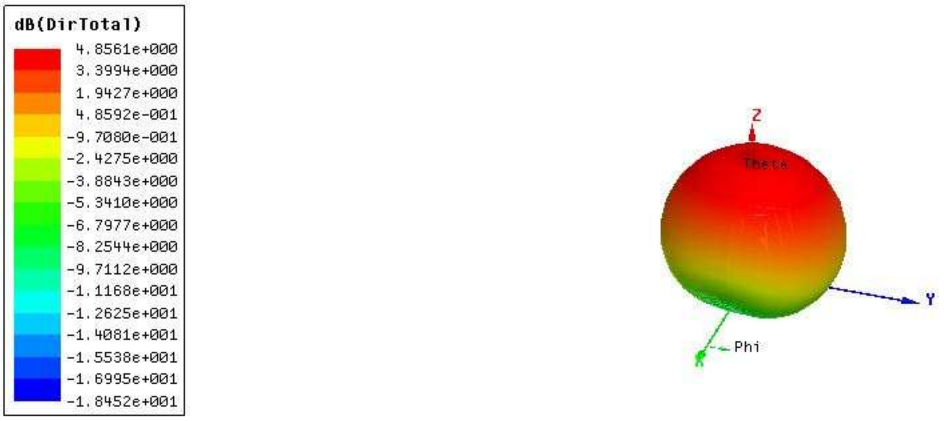

Figure 16 Directivity for diagonally symmetric slotted microstrip patch antenna with ring slots at 2.4Ghz

Figure 17.Gain for diagonally symmetric slotted microstrip patch antenna with ring slots at 3.7Ghz

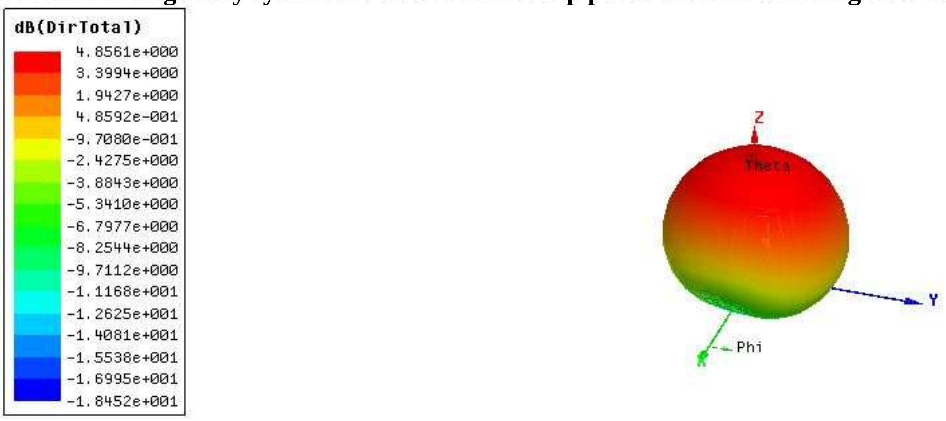

Figure 18 Directivity for diagonally symmetric slotted microstrip patch antenna with ring slots at 3.7Ghz

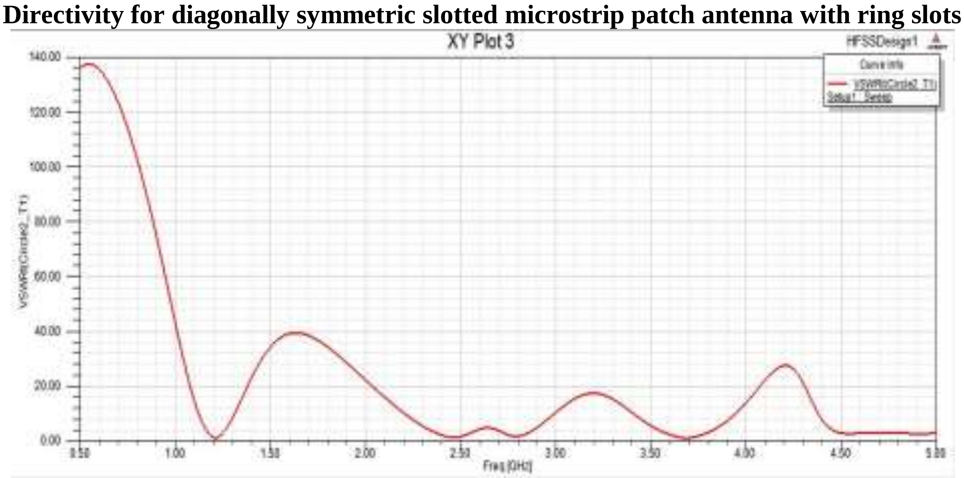

Figure 19.VSWR curve for diagonally symmetric ring slots for 3 frequencies

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IV. CONCLUSION

In this paper square Microstrip patch antenna etched on RT Duroid material with two symmetrical slot shapes (Ring, Plus) are designed and simulated for S-band application both slot shapes are diagonally symmetrical and having good compromise with antenna parameters. This design is quite effective for S-band applications maintaining considerable gain at converged frequencies. The results obtained in this work can be extended to different slot shapes with different orientations.

REFERENCES

[1] K.T Ahmed, M. B Hossain and M.J Hossain, "Designing a high bandwidth patch Antenna comparison with the former patch Antenna" Canadian journal on multimedia and wireless network Vol.2, No. 2 April,2011.
[2] S.K Behera, "Novel Tuned Rectangular Patch Antenna as a load for phase power combining" Ph.D Thesis, Jadavpur University, Kolkata, India.
[3] C. A Balanis, "Antenna Theory Analysis and Design" Wiley, 2nd edition, chapter 14. 1997
[4] J. R James and P. S Hall, "Handbook of microstrip Antennas" Volume 2. Peter Peregrinus Ltd, London, 1989

