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Various Design analysis of Microstrip patch embedded with Cylindrical Dielectric Resonator Antenna

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Abstract— **In this paper,investigations have been done on hybrid design of patch and DRA antenna.Various models of hybrid combination of Patch and DRA have been designed . The designconsists of cylindrical DRA antenna when patch is at the bottom of DRA. In the other design the patch is inserted at the top and bottom of DRA. In the third design investigations have been done whenDRA materialis added with silicon oil.It has been investigated that gain of antenna can be enhanced by employing dual combination of DRA and Patch. The gain of antenna increases from 3.443 dB to 9.47** dB.

Keywords: DRA,Patch,ReflectionCoefficien,Cylindrical,Radiation pattern

1. INTRODUCTION

The wireless communication field is very vast and growing with very fast pace. The need of antenna is an integral part of wireless communication. There have been revolutionary developments in this field in the last decade. The stringent requirements need advanced developments in this field of antenna having low profile, high gain and ultra large bandwidth with some amount of reconfigurability. A patch antenna is a narrowband, wide-beam antenna fabricated by etching the antenna element pattern in metal trace bonded to an insulating dielectric substrate, such as a printed circuit board, with a continuous metal layer bonded to the opposite side of the substrate which forms a ground plane. Common microstrip antenna shapes are square, rectangular, circular and elliptical, but any continuous shape is possible[1]. The DRA is an open resonating structure, fabricated from a low loss microwave dielectric material. Dielectric resonators (DR's) have proved themselves to be ideal candidates for antenna applications by virtue of their high radiation efficiency, flexible feed arrangement, simple geometry, small size and the ability to produce different radiation pattern using different modes[2][3][4].The major problem with DRA and patch is low gain.In this paper,it has been investigated that gain of antenna can be enhanced by employing dual combination of DRA and Patch.

The designed antenna are simulated using Ansoft High frequency simulator (HFSS)

The complete paper is organized as follows. Section 2 provides various antenna design structure. The discussion about the results have been presented in Section 3.The result is concluded in section 4.

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2. CYLINDRICAL DRA ANTENNAANTENNA DESIGN

Investigations have been done on various cylindrical DRA design. The design 1 consists of cylindrical DRA antenna when patch is at the bottom of DRA. In the other design the patch is inserted at the top and bottom of DRA. In the third design DRA materialis added with silicon oil.

2.1 DESIGN OF CYLINDRICAL DRA ANTENNA WHEN PATCH IS AT THE BOTTOM OF DRA

Figure. 1 presented the view of DRA Antenna. The design consists of PPR (Propylene Random Copolymer Pipes) tubes of heights (H=5 mm) and Radius (R=12 mm) and Permittivity (εr)=27.It is mounted on patch of Radius (R=12 mm).S_{11}Reflection Coefficient measured -15.04 dB at 5.7635 GHz as shown in Figure .2. Figure. 3 shows the gain of -3.443 dB at 5.8GHz.Impedence matching is there as shown in Figure.4.

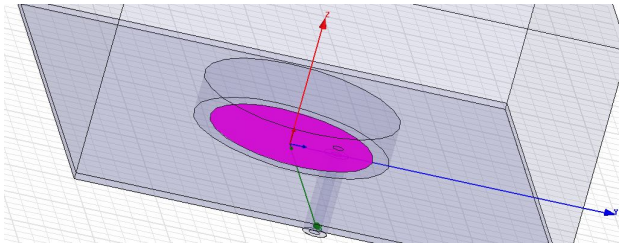

*Figure.*1 Design of cylindrical DRA antenna when patch is at the bottom of DRA

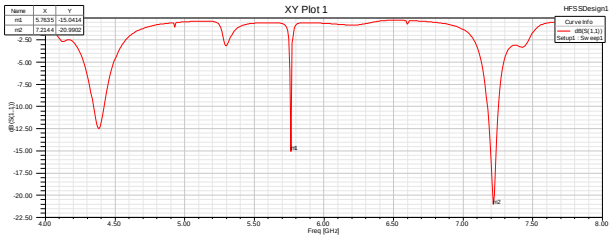

Figure. 2S_{11} Plotof *cylindrical DRA antenna when patch is at the bottom of DRA*

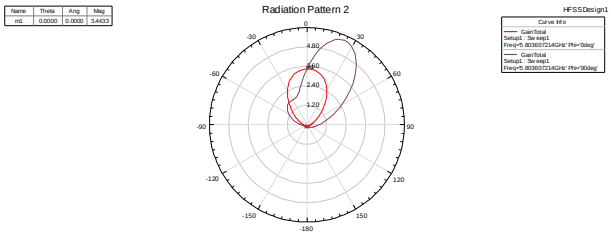

Figure.3 Radiation Pattern of *cylindrical DRA antenna when patch is at the bottom of DRA*

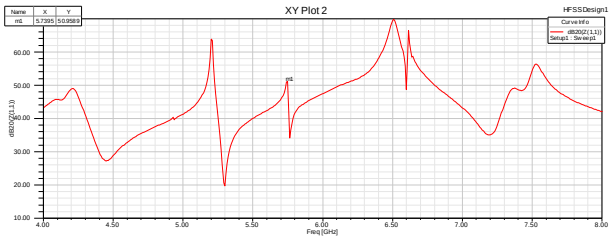

Figure .4 Impedance Plot of *cylindrical DRA antenna when patch is at the bottom of DRA*

2.2 DESIGN OF CYLINDRICAL DRA ANTENNA WHEN PATCH IS AT THE TOP AND BOTTOM OF DRA

Figure 5 shows the design of DRA antenna when patch another is inserted at the top of DRA.Figure .6 shows S_{11}Reflection Coefficient measured 17.18 dB at 6.7014 GHzand gain of 9.6078 dB. is shown in Figure. 7.

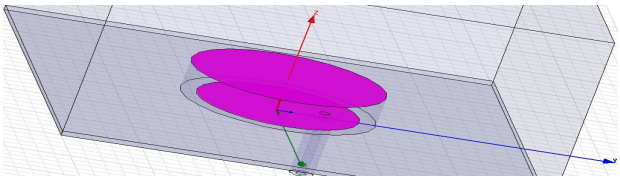

Figure 5. Design of cylindrical DRA antenna when patch is at the top and bottom of DRA

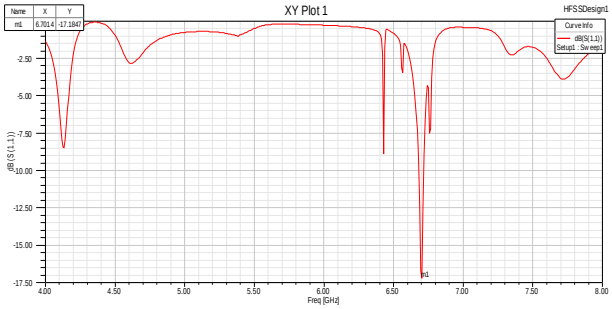

Figure .6 S_{11} Plot of cylindrical DRA antenna when patch is at the top and bottom of DRA

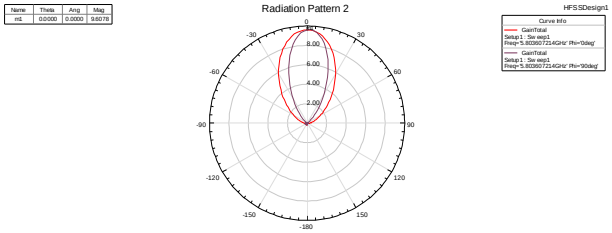

Figure.7 Radiation Pattern of cylindrical DRA antenna when patch is at *the top and* bottom of DRA

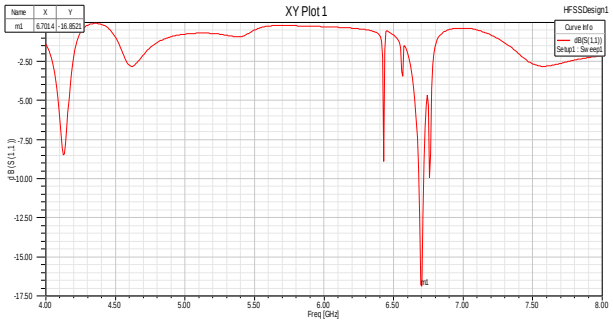

Figure 8. Impedance plot of cylindrical DRA antenna when patch is at *the top and* bottom of DRA

2.3 DESIGN OF CYLINDRICAL DRA ANTENNA WHEN PATCH IS AT THE TOP AND BOTTOM OF DRA AND DRA MATERIALADDED WITH SILICON OIL

For the further investigations, silicon oil is added in DRA.S_{11} Reflection Coefficient measured -16.8 dB.at 6.701 GHz is shown in Figure. 10 and Gain of 9.4764 dB is shown in Figure. 11.Impedence match plot is shown in Figure.12.

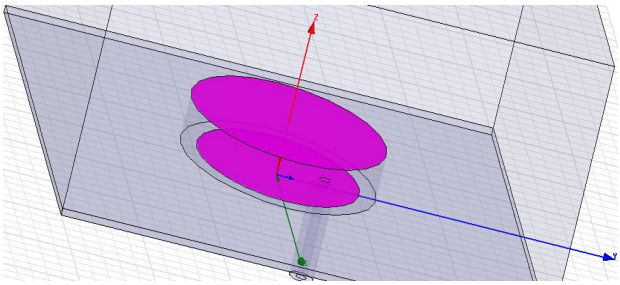

Figure. 9 Design of cylindrical DRA antenna when patch is at *the top and* bottom of DRA and DRA material added with silicon oil

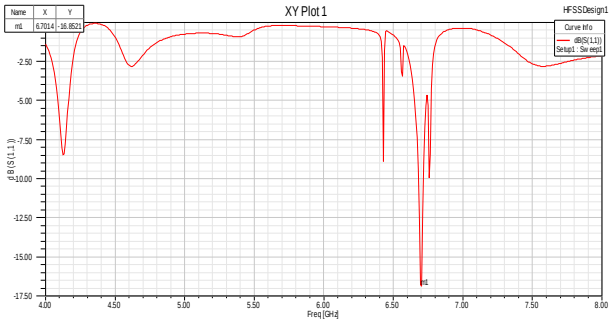

Figure. 10 S_{11}Plot of cylindrical DRA antenna when patch is at *the top and* bottom of DRA and DRA material added with silicon oil

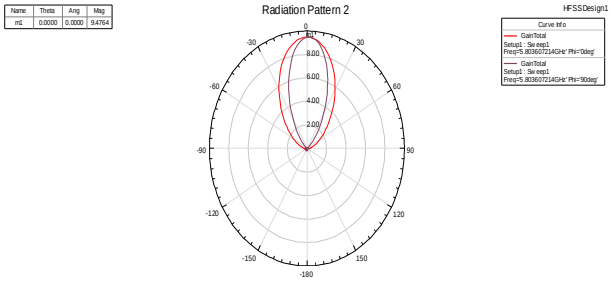

Figure. 11 Radiation Pattern of cylindrical DRA antenna when patch is at *the top and* bottom of DRA and DRA material added with silicon oil

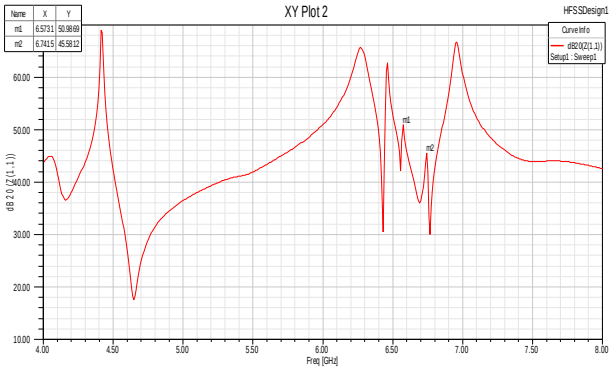

Figure.12 Impedance plot of cylindrical DRA antenna when patch is at *the top and* bottom of DRA and DRA material added with silicon oil

3. Results and Discussions

The various results of S_{11} Reflection Coefficient, resonating frequency and gain are summarized in Table 1. The gain of antenna can be enhanced by employing dual combination of DRA and Patch.The gain of antenna increases from 3.443 dB to 9.47 dB

S.NO	*Design Description*	S11(dB)	Resonating frequency(GHz)	Gain (dB)
1.	*Design of cylindrical DRA antenna when patch is at the bottom of DRA*	-15.4	5.7635	3.443
2.	*Design of cylindrical DRA antenna when patch is at the top and bottom of DRA*	-17.18	6.7014	9.6078
3.	*Design of cylindrical DRA antenna when patch is at the top and bottom of DRA and DRA material added with silicon oil*	-16.18	6.7014	9.47

4. Conclusion

This paper proposes the technique to enhance the gain of an antenna.Investigations have been done on hybrid combination of cylindrical DRA and patch antenna design . The design 1 consists of cylindrical DRA antenna when patch is at the bottom of DRA. In the other design the patch is inserted at the top and bottom of DRA. In the third design DRA material is

added with silicon oil. Most of the frequencies in GHz range have been sparingly used worldwide, though, this frequency band provides additional features like large bandwidth and high capacity. Major area of concern at these frequencies band is the high propagation losses, which can be overcome by high gain of the designed antenna. This kind of antenna can also be used where protection against environment is required.As a future work,investigations can be done on other shapes of DRA like hemispherical, cylindrical, rectangular, triangular. Investigations can also be done on other shapes of DRA.

REFERENCES

[1] C. A. Balanis, "Antenna Theory, Analysis and Design," John Wiley & Sons, New York, 1997

[2] A petosa, A. Ittipiboon, Y.M. M. Antar, D. Rossoe and M. Cuhaci, "Recent advances in dielectric resonator antenna technology," IEEE Antennas Propagat. Mag., Vol.40 pp 35-48 June 1998

[3] G.H. Huff, D. L. Rolando, P. Walters, and J. McDonald, "A Frequency Reconfigurable Dielectric Resonator Antenna using Colloidal Dispersions "in IEEE Antenna and Wireless Propagation Letters, vol. 9, 2010

[4] Petosa, A. Ittipiboon, and Y. Antar, "Broadband dielectric resonator antennas," in Dielectric Resonator Antennas, U.K.: Research Studies Press Ltd., 2003.