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Design and Analysis for Circular Microstrip Antenna Loaded by two Annular Rings

By Raed M. Shaaban, Zeki A. Ahmed & Wa'il A. Godaymi

University of Bashar

Abstract- In this paper presents design of circular microstrip antenna loaded by two annular rings**CMSAL2ARC**.The propose designed is simulated using the An soft High Frequency Structure Simulator Based on Finite Element Method (HFSS) commercial software. In this study using coaxial probe feed is designed and fabricated at 12 GHzresonance frequencies with a return loss of $-\mathbf{47.24}$. **dB** and simulated on an Arlon AD320A (tm) substrate with dielectric constant $\boldsymbol{\varepsilon}$r of 3.2 and substrate size of ($\mathbf{L_S}\times\ \mathbf{W_S}\times\ \mathbf{h}$) 29 × 24 × 1.79 mm3, disk patch radius($\mathbf{Rp}\ =\ \mathbf{8.\ 5}\mathrm{mm}$),and laded annular two rings($\mathbf{Ra}-\mathbf{b}\ =\ \mathbf{1.\ 5}\mathrm{mm}$).The antenna parameters is presented in this paper by introducing such as , where measured the bandwidths are $\mathbf{1.857GH_Z}$ or 15.47%, **VSWR**equal1.01 for 50Ω reference impedance and return loss is less than to -10d Band Gainare 20.33 dB.

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GJCST-C Classification: *J.5, H.5.5*

DESIGNANDANALYSISFORCIRCULARMICROSTRIPANTENNALOADEDBYTWOANNULARRINGS

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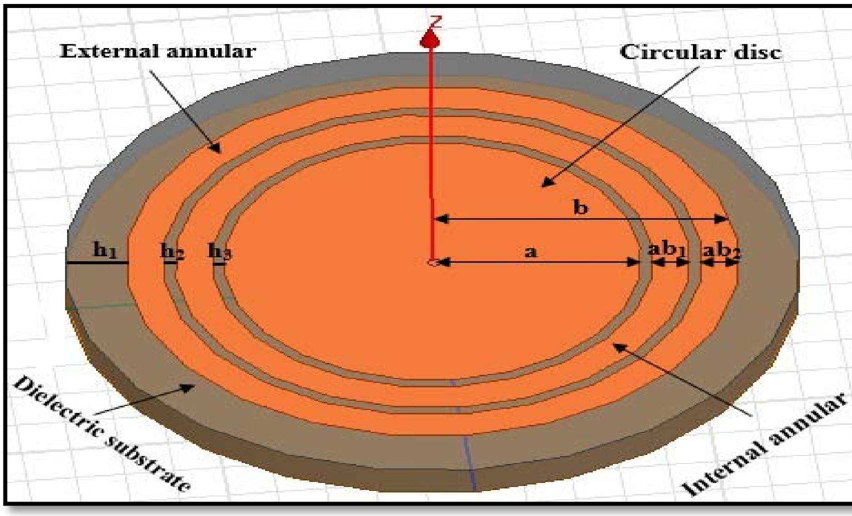
I. Introduction

In recent years the microstrip antenna is one of the most important types antennas that took a great interest in both theoretical, experimental researches and engineering applications due to light weight, small size and ease manufacturing. A microstrip antenna geometry consists of three main parts in its simplest case [1, 2]. The first part is a radiating patch, which is usually made from a good conductor materials printed on one side of a dielectric substrate, which is the second part. The third part is a ground plane, which is also made from a good conductor printed on the other side of the dielectric substrate [3, 4]. Also the microstrip possess a very narrow frequency bandwidth and low efficiency[5,6].There are be many methods that significantly reducing the effect of the problem mentioned above , and many research have devoted their studies to improve these coefficients[7,8]. Some of these methods by increasing the height of the substrate, changes in shapes of microstrip patch elements and microstrip slot antennas [9, 10], and using loaded to the patches as in proposed antenna (circular microstrip antenna loaded two annular ring).The analytic method used for the proposed antenna is depend on the simulated using the An soft High Frequency Structure Simulator Based on Finite Element Method (HFSS) commercial software .The used of software (HFSS) a simply study of the various antenna parameter and they are widely used in wireless communications[11,12]. However, in soft ware analysis, can be calculated bandwidth, directive gain, VSWR, real and imaginary parts input impedances and return loss.

II. Antenna Design

The loaded patch region for propose antenna configurations from a circular disc loaded with two conductor annular rings , as shown in Figure.(1), to be calculate the parameter.In following Figure shows the top view configurations of the $CMSAL2AR$C such as , circular disc radius is (a) and continue the coaxial feed location are location (x_f, y_2), the internal and external annular rings loaded are dimension (ab_1, ab_2)respectively, and the dielectric zones between conductor material patch are (h_1, h_2, h_3) the dielectric zones separating between the free space and external annularring , the dielectric zones separating between the external annularring and internal annularring ,and dielectric zones separating between internal annularring and circular disc. The different dimension to control of the electromagnetic calculation from by increases the antenna parameter when determined the optimal dimension to coupling electromagnetic of this antenna recorded in table (1).

Author α σ ρ: Department Physics, College of Science, University of Bashar, Basrah, Iraq. e-mails: mus.raad@yahoo.com



Figuar 1: CMSAL2AR microstrip antenna.

Table 1: List of designantenna.

Parameters	Values
Substrate material	Arlon AD320A (tm)
Substrate thickness h	$(2mm)$
Dielectric constant ε_r	(3.2)
Feed location (x_f, y_f)	$(-0.08a, 0.08a)$
Radius of the substrate (R_g)	$(15\ mm)$
Radius of the disk patch (a)	$(8.5\ mm)$
Annular ring width(ab_1=ab_2)	$(1.5\ mm)$
Resonant frequencies F_r	$(12\ GHz)$

III. Results and Discussion

The proposed design as shown in fig.2 explain electric and magnetic distribution on the patch has been simulated by using Ansoft simulation software High Frequency Structural Simulator $(HFSS)$ and the radiation pattern compared with theoretical studied based on method moment shown in Fig. (3) .in Figure (4) shown god matching that the real part of input impedance Z_{in} at resonant frequency (12 GHz) is approximately equal to50 Ω, while the imaginary part equal to zero. The $VSWR$ plot shown in Figure. (5) are 1.01 for resonant frequencies indicating the good matching conditions with single band frequencies.The simulation results for the CMSAL2AR shown in Figure. (6) the return loss parameter increasing in the bandwidth at resonates frequency $12\ GHz$ with a return loss of $-47.24\ dB$ where measured bandwidths for $-10\ dB$ reflection coefficient are $1.857\ GHz$ or 15.47% and directivity Gain are 20.33 dB shown in Figure. (7). The radiation pattern for propos antenna shown in figs. (8) and (9), both $2-D$ and $3-D$ clarifies a circularly polarized for CMSAL2AR.

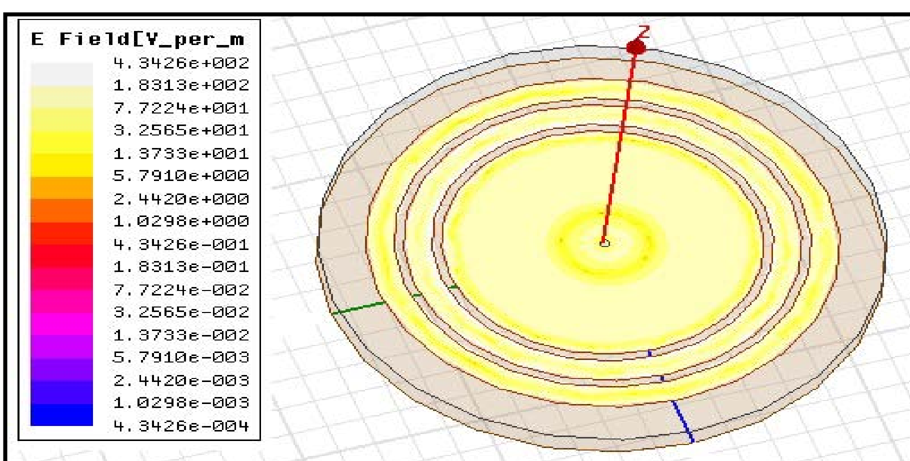


Figure 2: Electric and magnetic field distribution on the patches.

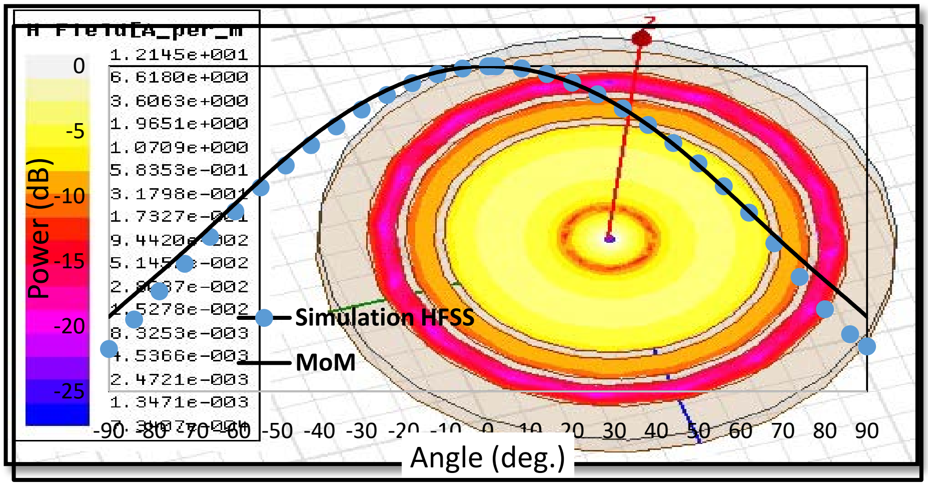


Figure 3: Compared with Simulator ($HFSS$) and theoretical radiation pattern.

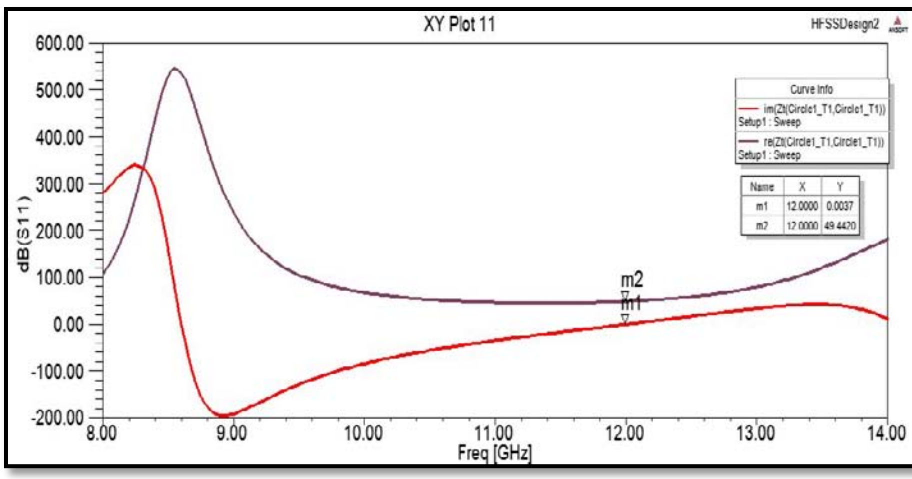


Figure 4: Variation of the real and imaginary part of input Impedance with the frequency.

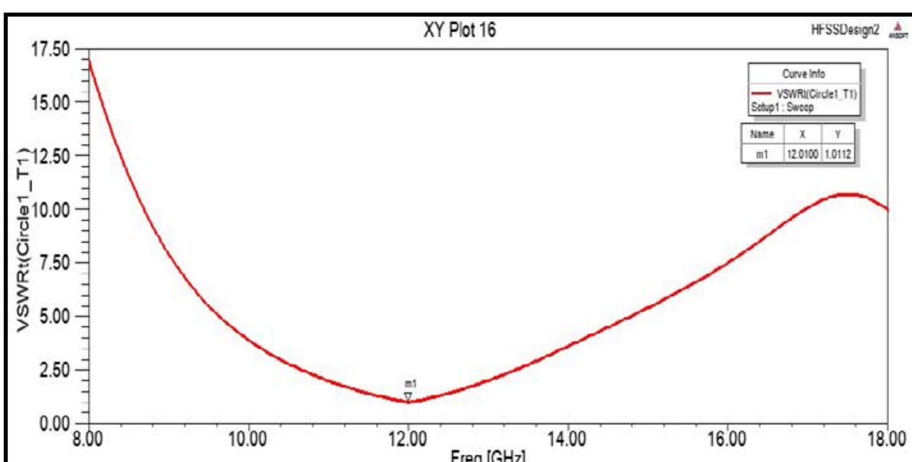


Figure 5: VSWR of the proposed antenna.

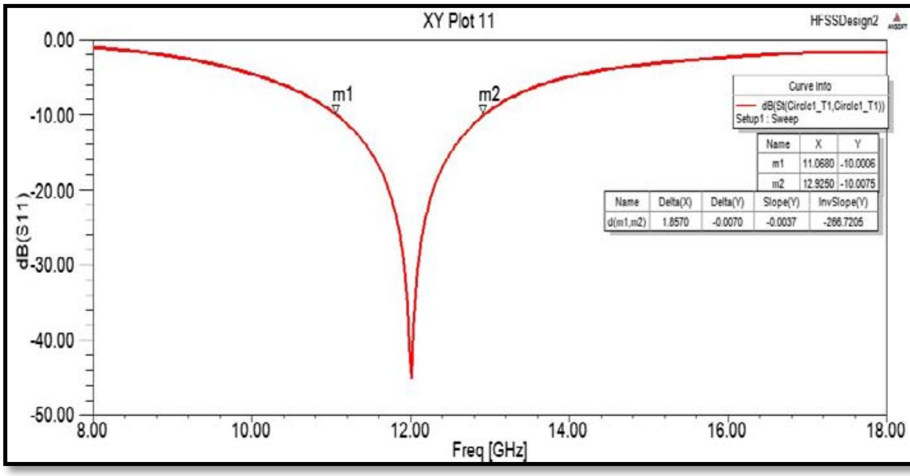


Figure 6: Return loss of proposed antenna.

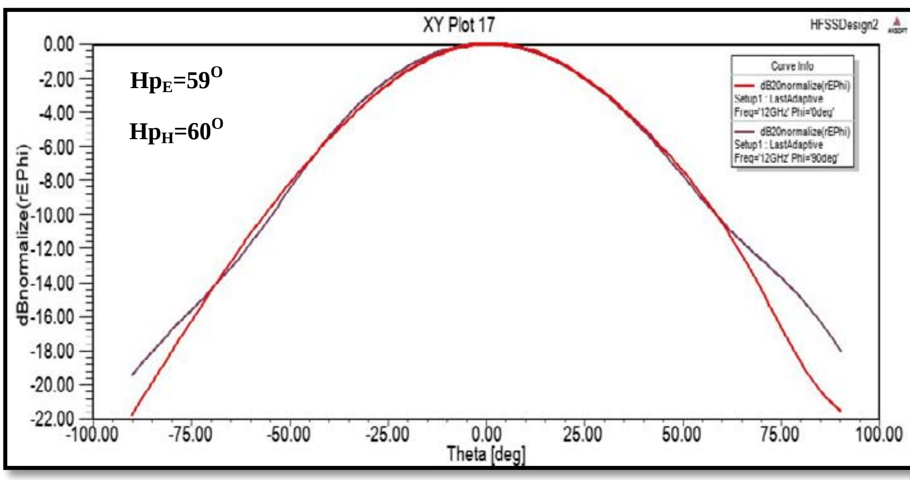


Figure 7: Radiation pattern of the design antenna at E-plane and H-plane.

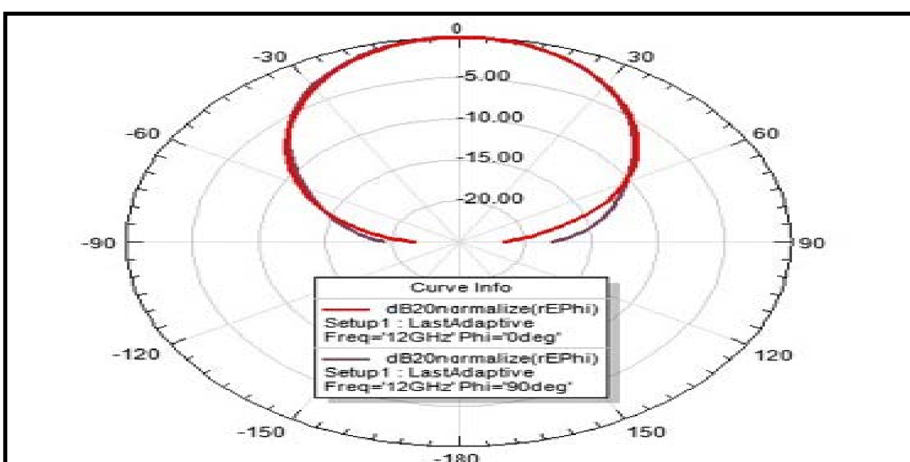


Figure 8: D Radiation pattern of the design antenna.

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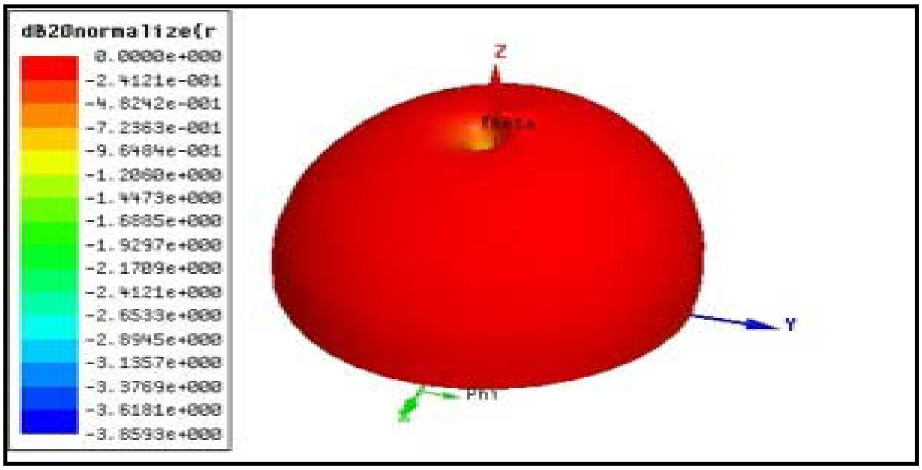

Figure 9: D Radiation pattern of the design antenna.

IV. Conclusion

In this paper *CMSAL2AR* is designed using the Ansoft High Frequency Structure Simulator Based on Finite Element Method (HFSS) commercial software. The radiation pattern a good agreement between theoretical result with experimental and simulated results.

The measured of bandwidths are 1.857 GHz or 15.47%, VSWR equal 1.01 for 50 Ω reference impedance and return loss is less than to -10dB and Gain are 20.33 dB.

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