



Implementation & Analysis of a Wideband Stacked Cylindrical Dielectric Resonator Antenna (WS-CDRA)

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Abstract: In this paper, a Wideband Stacked Cylindrical Dielectric Resonator Antenna (WS-CDRA), which is capable working in C-Band of Microwave region has been presented. Dielectric Resonator (DR) used as an antenna resonator is cylindrical in shape, hence modeled antenna design is termed as "Cylindrical DRA". Stack technique has been used to enhance the practical bandwidth of the antenna system synthesized. Coaxial probe fed method has been used to excite the antenna. Operational band for the implemented antenna system is found to be 2.513 GHz to 3.3758 GHz, having resonance at 2.7745GHz. Absolute gain of WS-CDRA obtained at 2.7745GHz is 5.983dB.

Keywords: Wideband, Dielectric Resonator, Dielectric Resonator Antenna, Reflection Coefficient, VSWR, Gain, Directivity

I. Introduction

In the past two decades, research work on DR has been tremendously increased. Its applicability to be used as DRA is increasing. [1] DRA offers many advantages over the conventional microstrip patch antenna. DRA offers low loss, high permittivity, light weight, and ease of excitation, low dissipation loss at high frequency, high radiation efficiency due to the absence of surface wave and conductor losses. Addition, to these features it also provides ease of coupling to commonly use feeding techniques. DR provides low conduction loss. It is being used in almost all the research field because of these features and advantages. Almost all the available shapes has been analyzed related to DRAs. It is being used as the alternative to construct the antenna for almost all the devices. [2-4]. Recently, hybrid dielectric resonator antennas have attracted extensive attention due to their dual band as well as wideband operation without increasing antenna volume. The hybrid structure is considered as the combination of a dielectric resonator antenna and another radiating resonator of the resonant feeding structure [5-9]. In this paper, Section I presents the introduction to the research work, Section II details the Antenna Implementation, Antenna Analysis has been described in Section III and further conclusion and references has been included.

II. Antenna Implementation

In this section; design, specification parameters of WS-CDRA has been described. Rogers RT Duroid 5880™ of dielectric constant 1.8 has been used as the ground plane or the substrate. Dimensions of WS-CDRA is given in Table 1. Coaxial probe fed excitation technique has been used to excite the radiating system. 3D View of implemented antenna has been depicted in Figure 1. Height of the base resonator is 22 mm and value of dielectric resonator is 14. Outer radius and height of the top resonator is kept half of the base resonator. Performance characteristics of the antenna has been described in detail in further section.

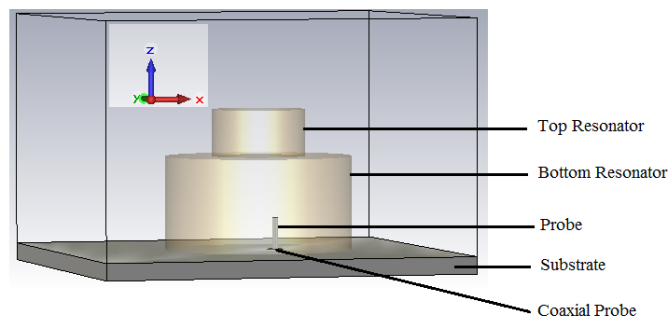


Figure 1 3D View of Wideband Stacked CDRA

Table 1 Antenna Specification Parameter

S. No	Description	Value (mm)
1.	Radius of Dielectric Resonator	4
2.	Height of Dielectric Resonator	22
3.	Dielectric Constant Resonator	10
4.	Ground Plane Range	88
5.	Ground Plane Height	2
6.	Co-axial Probe Offset	8
7.	Co-axial Probe Length	7.5
8.	Co-axial Probe Radius	0.63
9.	Radius Gap	2

III. Antenna Analysis

In this section, antenna performance analysis has been presented. Designed antenna has been simulated in CST Microwave Studio and the obtained characteristics parameters of the DBS-CDRA has been described.

A. Antenna Reflection Coefficient

It is observed from Figure 2 that WS-CDRA provides frequency range is C-band of Microwave Spectrum. It can be seen in Figure 2 that the wideband stacked CDRA resonates at the frequency, 2.7745 GHz having return loss of -40.111dB. Antenna offers bandwidth between frequency range 2.513 GHz to 3.3758 GHz for -10dB return loss.

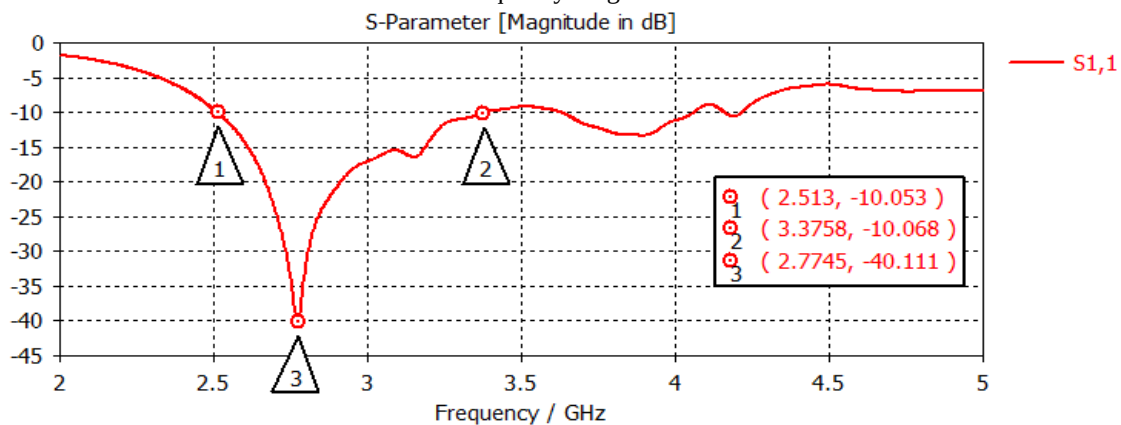


Figure 2 Return Loss of Dual-Band Stacked CDRA at Simulated Frequency, 2.45 GHz

B. Antenna VSWR

VSWR Vs Operating Frequency of the antenna has been shown in Figure 3. It is observed that at simulated frequency antenna has small value of VSWR ranging between 1 and 1.5. Value of VSWR at resonating frequency is found be 1.02.

C. Antenna Gain

Absolute gain of WS-CDRA at the simulated frequency of 2.45 GHz is shown in Figure 4(a). It is found to be 5.016dB. Figure 4(b) presents the absolute gain of WS-CDRA at the resonating frequency of 2.7745GHz, it is found to be 5.983dB.

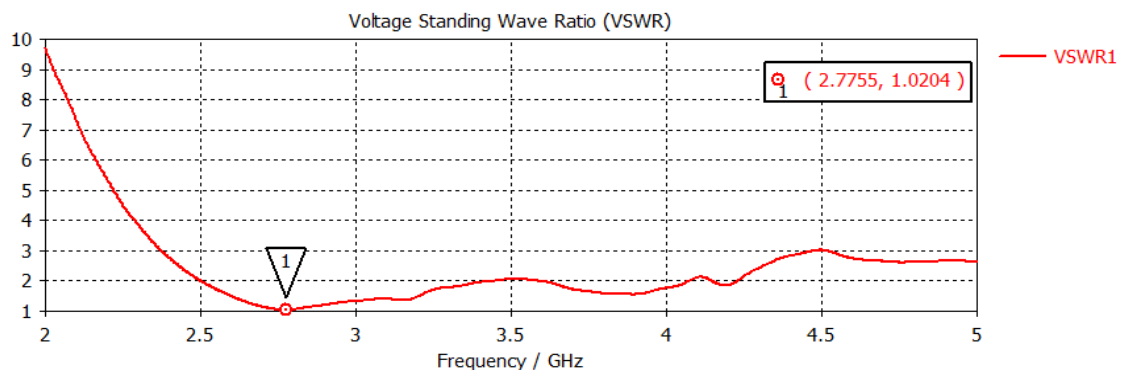


Figure 3 VSWR Vs. Frequency of Wideband CDRA

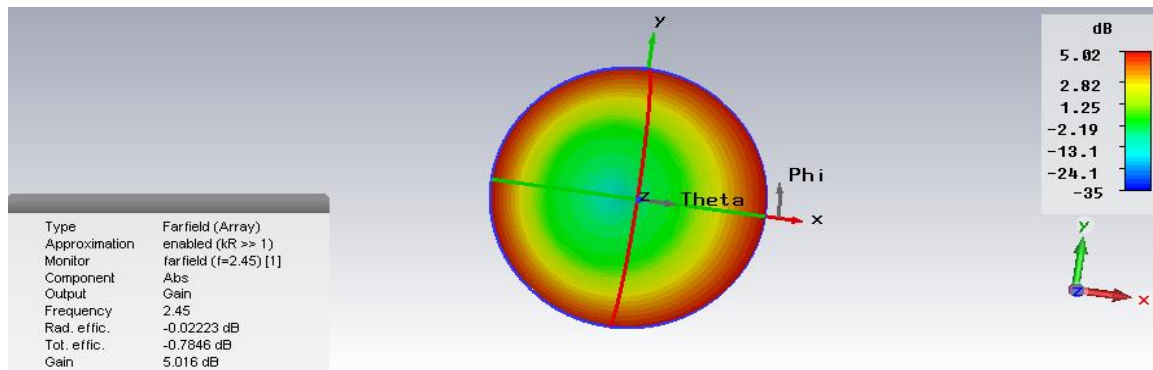


Figure 4 (a) Absolute Gain of Wideband CDRA at 2.45GHz

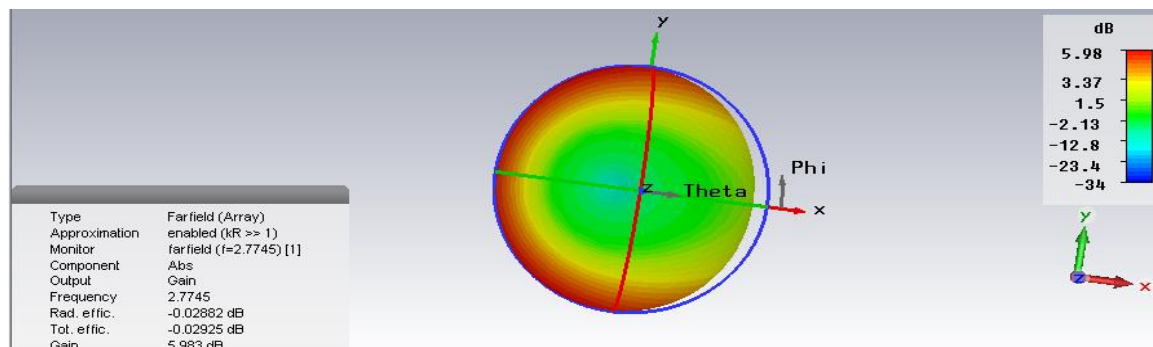


Figure 4 (b) Absolute Gain of Wideband CDRA at 2.7745GHz

D. Antenna Directivity

Directivity is a relative level of radiated energy to that of Omni-directional isotropic radiator. Figure 5 (a) shows the directivity of WSS-CDRA at the simulated frequency of 2.45GHz and the absolute value of directivity is found to be 5.039dBi. Figure 5 (b) shows the directivity of WS-CDRA at 2.7745GHz which is 6.012dBi.

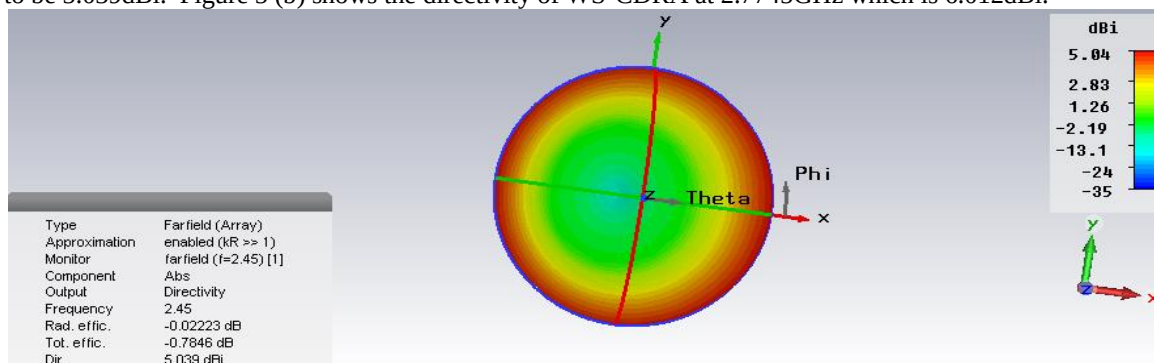


Figure 5 (a) Directivity of Wideband CDRA at 2.45 GHz

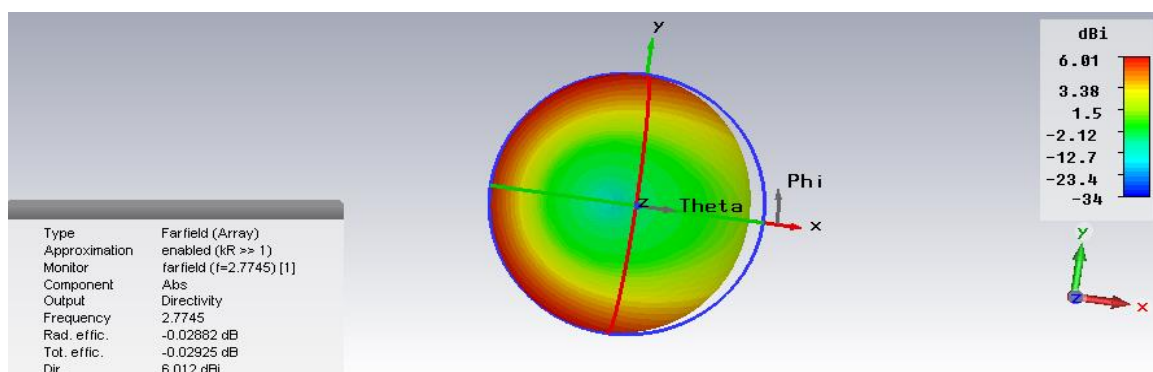


Figure 5 (b) Directivity of Wideband CDRA at 2.7745GHz

IV. Conclusion

In this paper, we have presented a wideband high gain CDRA. The synthesized WS-CDRA is capable of working in frequency range of 2.513 GHz to 3.3758 GHz for -10dB return loss. Antenna offers gain of 5.983dBi at resonance frequency, which makes this antenna suitable for wireless communication systems.

V. References

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