Research Article

A compact Octahedron Dielectric Resonator Antenna For S-Band Wireless Applications

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Article History: Received: 11 January 2021; Revised: 12 February 2021; Accepted: 27 March 2021; Published online: 23 May 2021

Abstract:The proposed Octahedron design measures a Wide Band incorporated Dielectric Resonator Antenna for S band application. The proposed design is a Octahedron shaped Dielectric Resonating Antenna. DRA is energized by utilizing molded gap. The recreation measure is finished with the assistance of CST Studio suite software. The transmitting structure is works for wideband operation between 2.1GHz to 4.1GHz. The transmission bandwidth is 2GHz and 2.7dB, 3.4dB and 4.6dB of gain observed by the proposed antenna at resonances 2.3GHz, 2.9GHz and 3.7GHz respectively and the Impedance value of the design is 49.8Ohms. The proposed Octahedron Dielectric Resonating radiator has good gain, efficiency, and stable radiation pattern and appropriate for S band application.

Keywords: Dielectric Resonator Antenna, Slot Antenna, Wide band, Reflection coefficient, S Band Applications.

1. Introduction

Remote correspondence framework is to a great extent com- prises of Reception apparatuses. For sending and accepting EM waves a few sorts of reception apparatuses are accessible. Miniature strip radio wire and DRA are two unique kinds of receiving wire broadly engaged by the radio wire specialists. There are numerous business applications for example, versa- tile radio and remote correspondence that utilization microstrip radio wire. Microstrip reception apparatuses have constraint in size, transfer speed and productivity. Also, DRA has its various alluring highlights over microstrip radio wire, for example, high increase, immaterial metallic misfortunes, adaptable to various excitation plans and more extensive impedance data transfer capacity [1]. In the beginning stage DRA was present- ed in 1983 by, S.A. Long et al.

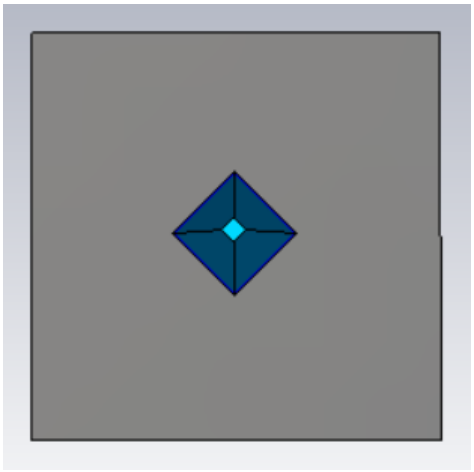
[2]. In open writing, dielectric resonator receiving wires are open in various shapes however three rudimentary shapes (modular investigation is known) are hemispherical, round and hollow and rectangular. Out of three rudimentary shapes, round and hollow shape is the most praising one in view of its smaller surface territory, broadened far-field example and simplicity of attainable quality in business market [3]. The regular DR reception appara- tus has high radiation proficiency that can be worked at mi- crowave to millimeter wave band correspondence frameworks. Dielectric resonator Antenna is usually utilized in light of the fact that they are straightforward to create and gives us more exten- sive opportunity to direct the full recurrence and quality factor. However, the high Q factor limited the transfer speed, which controls its utility as a receiving wire. Dielectric constants and quality factor are two dielectric properties of Dielectric Res- onator Antenna. The quality factor is an illustration of the receiv- ing wire misfortunes. [4]. In short time prior coordinated DRA have drawn enormous mindfulness on record of their double band and wideband activity even not amplifying radio wire size. The coordinated plan that to be considered as an association of DRA and one really transmitting resonator of the thunderous taking care of arrangement. By taking care of the transmitting resonators, a little estimated double band [7] – [9] or wideband
[10]– [16] incorporated DRA can be planned.

In the proposed work, DRA is energized by an opening coupled taking care of strategy. After a brief presentation in area 1, the entire examination paper is isolated into four areas. In segment II examined about design and investigation of the proposed radio wire. In segment III talked about the reenacted aftereffects of a coordinated Ring DRA. At last, this research work has been finished up in area IV.

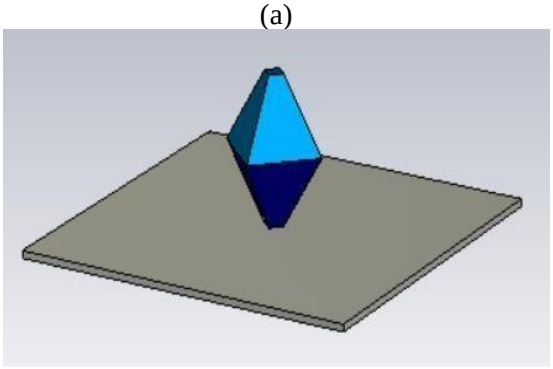
2. Antenna design and analysis

Figure 1 shows the top view and the isometric view of the 3- Dimensional rhombus shaped DRA, which consists of two cone shaped DRAs inverted and attached in a shape of rhom- bus and has 4 segment cuts which makes it look like a 3-Di- mensional rhombus as shown in figure 1. The area of the ground plane is 100mm x 100mm l[the below] mentioned speci- fication of the copper/PEC ground plane are 2.0mm of thick- ness. The rhombus shaped DRA antenna is excited by the di- electric feed line of length L_F. Rogers RT 6010 material is used for the designing of the proposed DRA its epsilon value is 10.2. The dielectric feed line is a method used to excite the DRA material. At a center frequency of 2.1GHz and 4.1GHz, this antenna has a bandwidth of less than 10dB input reflection coefficient.

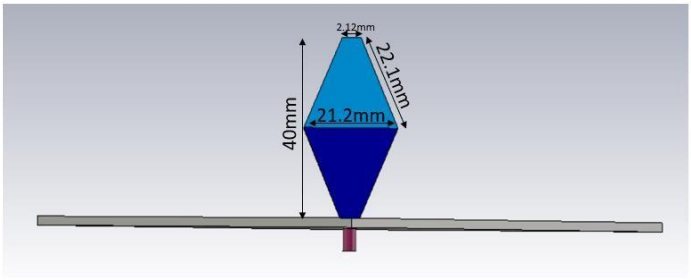
3. Optimized dimensions



(a)



(b)



(a)

Figure 1: Diagram of proposed design (a) top view (b) Isometric View (c) Optimized dimensions of the Antenna

4. simulation results

CST Studio simulation software has been used to conduct a parametric study of the proposed antenna. The return loss of the antenna is defined as the difference in dB between forward and reflected power, which is an essential antenna parameter. For the antenna to operate properly, the antenna loss must be less than -10 dB. The software gives the output of S11 parame- ters is shown in Figure 2. The frequency of the antenna is 2.3GHz, 2.9GHz and 3.7GHz.

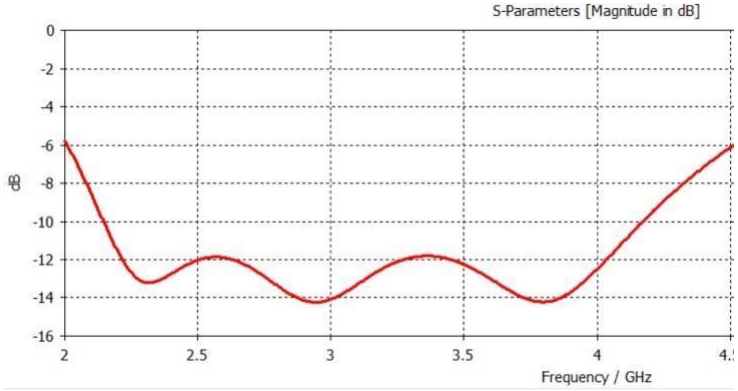


Figure 2: S11 of the Proposed DRA

Figures 4(a) 4(b) and 4(c) show the simulated far field pattern of the proposed antenna at desired resonant frequencies.

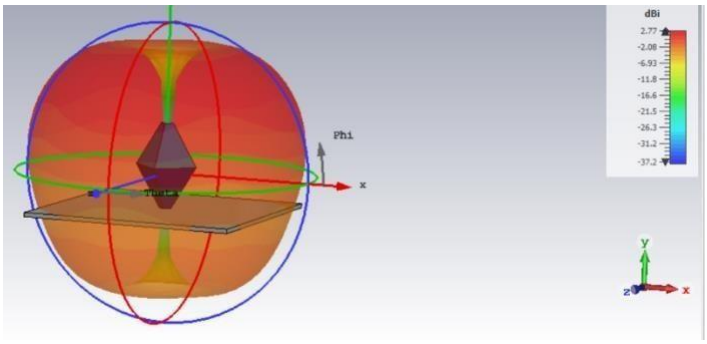


Figure 3(a): Simulated gain of the DRA at 2.3GHz

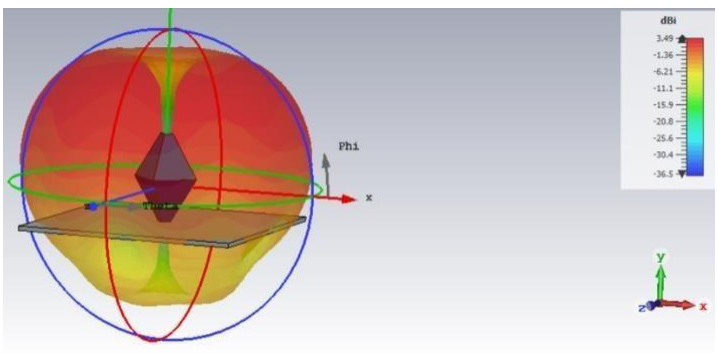


Figure 3(b): Simulated gain of the DRA at 2.9GHz

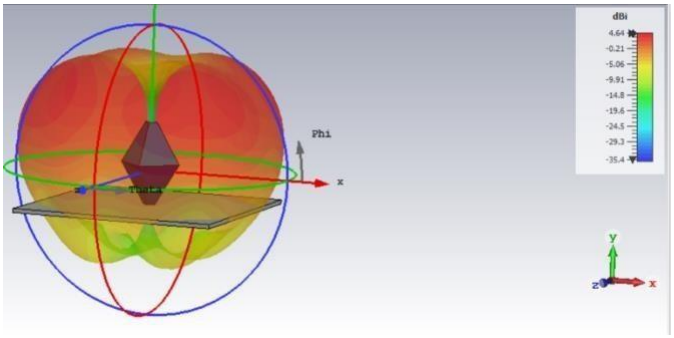


Figure 3(c): Simulated gain of the DRA at 3.7GHz

Figures 5(a) 5(b) and 5(c) show the radiation pattern of the pro- posed antenna at desired resonant frequencies.

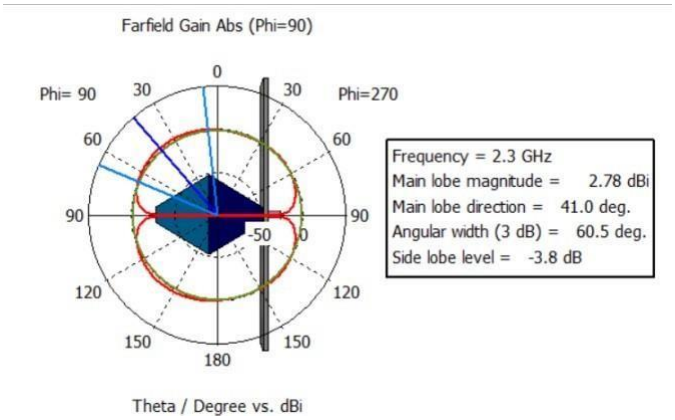


Figure 4(a): Radiation pattern of the DRA at 2.3GHz

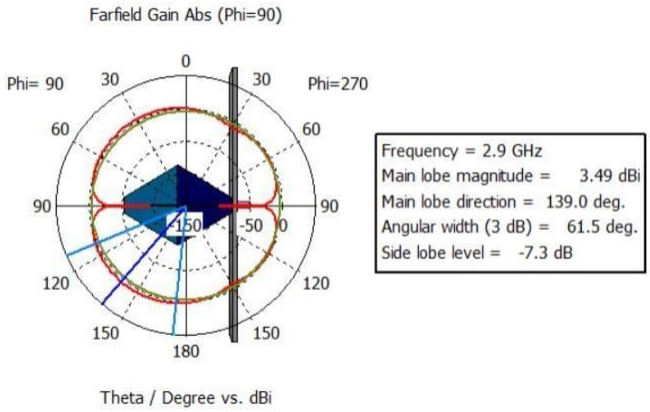


Figure 4(b): Radiation pattern of the DRA at 2.9GHz

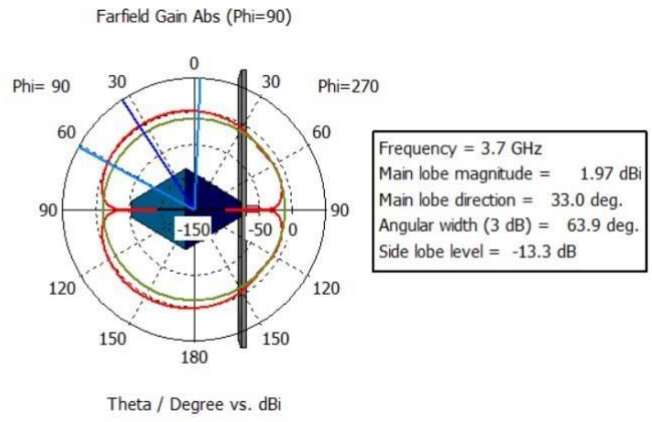


Figure 4(c): Simulated gain of the DRA at 3.7 GHz

VSWR is measured in decibels and ranges from one to two. The VSWR should be less than 2, indicating that the receiver has less standing wave reflections and hence transmits the most power to the intended receiver. In a standing wave pattern, the voltage standing wave ratio is the ratio of the maximum volt- age to the minimum voltage. The value of VSWR can be found at frequency 2.3GHz, 2.9GHz and 3.7GHz is 1.5635, 1.4897 and 1.4963.

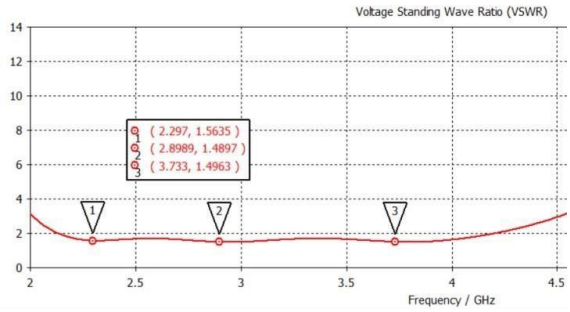


Figure 5: Variation of VSWR v/s Frequency

5. Conclusion

A wide band DRA is obtained in this article. The proposed antenna is a 3D Rhombus DRA antenna. The parametric study of the proposed DRA is carried out and analyzed. The anten- na's bandwidth is 2.0GHz, and the antenna's received gain at 2.3GHz, 2.9GHz and 3.7GHz is 2.7dB, 3.4dB and 4.6dB re- spectively. Impedance value of the antenna is 49.8 Ohms. The resonating frequencies are 2.3GHz, 2.9GHz and 3.7GHz. The material used as a DRA is Rogers RT 6010 and PEC for ground plane. The suggested antenna can be used for S band.

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