A REVIEW ON DUAL NARROWBAND IN DIELECTRIC RESONATOR ANTENNA

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ABSTRACT

Several narrowband antennas are presented for wireless application. This paper presents the review on dual band dielectric resonator antenna. Various designs of dual mode DRAs are derived in this paper. In this paper, a review on past work done discussed on dual narrow band in dielectric resonator antenna.

Keywords: Dielectric resonator antenna (DRA), Dual narrowband

I. INTRODUCTION

Before the introduction of the Dielectric Resonator Antenna, it was used for filter applications in microwave circuits. DRA have been proposed as an alternative to the conventional conductor antennas. In high frequency application, as the frequency increases, ohmic losses in conventional antenna increases. DRA has so many advantages features such as compact size, low loss, high efficiency, light weight, ease of excitation, feeding mechanism and versatility in the shape. DRA radiate throughout their entire volume and therefore the amount of energy radiated is larger than the energy stored in their near fields. The basic DRA structure is consist of a DR element of a specific shape. DRA excited by a single feed such as a micro strip line, coplanar waveguide, aperture or coaxial cable. For the simple geometry, permittivity of the DRA decreased to achieve wider bandwidth. The most common method of feeding mechanism is the aperture –coupled arrangement. There are three basic shapes available for common design, including rectangular, cylindrical, and spherical.

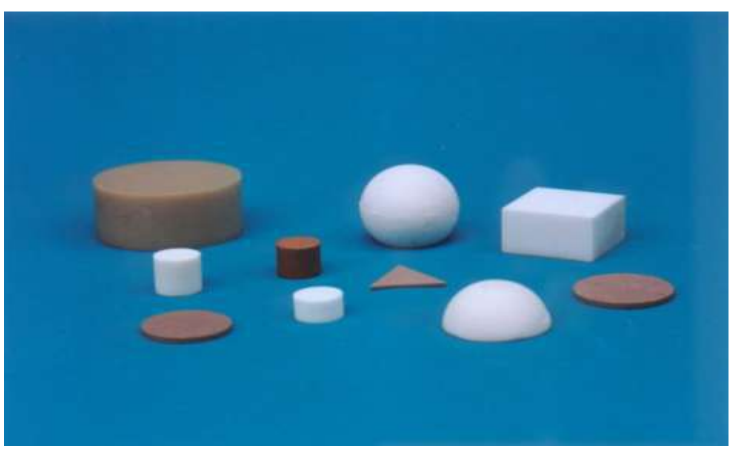

Figure 1 Various shape of DRA

There are various shapes of DRAs like rectangular, circular, triangular, spherical-cap, cylindrical-ring, hemispherical, etc. Figure 1 shows a photo of various shapes of DRAs. It was found that DRAs operating at their fundamental modes radiate like a magnetic dipole, independent of their shapes

II. MULTIBAND OPERATION

With the development of wireless communication systems, the compact and dual or multi-frequency are highly desirable. Recently, many investigations have been reported on DRAs with dual-frequency operation using various approaches. Dual mode excitation is hardly designed because the different modes in DRA are sensitive. And stacking two DRAs increases the size and the weight of DRA.

III. SINGLE AND DUAL BAND OPERATION

Two rectangular DRA were used to achieve dual band operation. The value of dielectric constant was 32. Micro strip line was used for feeding mechanism. For impedance matching, DR had to be offset in Y direction from the center of the slot. The values of resonant frequencies were 5.12 GHz and 6.15GHz [1].

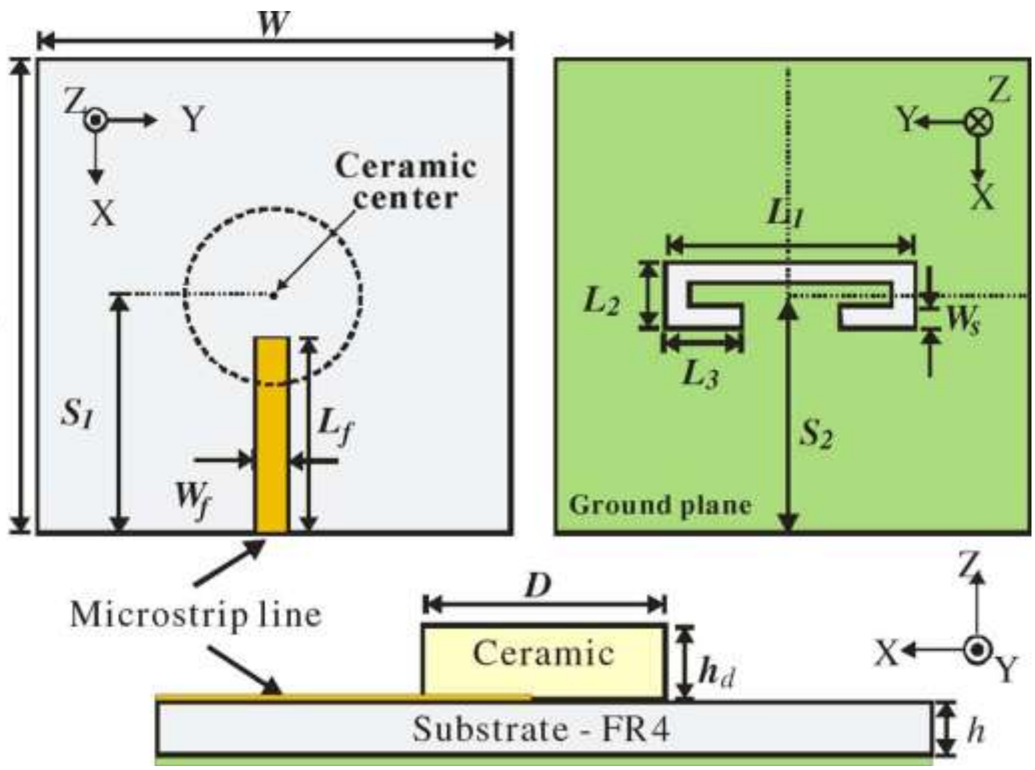

Figure 2 Top view and side view of the dual-frequency DRA [2].

In [2], represent the use of circular disk shape of DRA as shown in Figure 2. The value of Dielectric constant was 25. Micro strip line was used for feeding mechanism. The values of resonant frequencies were 2450 and 5640 MHz. A parasitic c-slot etched in the ground plane. The c- slot consists of three parts of a rectangular slot of length L_1, L_2 and L_3 and width 0.5 mm. the value of resonant frequencies were 3.456 and 4.797 GHz. It is observed that the resonant frequency of C-slot remain unchanged but the frequency of the DR decreased. It is also observed that the resonant frequency of C-slot remains unchanged and the frequency of DR decreased at ε_d was increased.

In [3], represent the use of circular disk shape of DRA as shown in Figure 3. The value of Dielectric constant was 27. The CPW inductive slot was used as the DR feeding mechanism. Resonant frequencies of DRA were 3456 and 4797 MHz. The centre point of DR was placed above the centre of the ground plane with offset distance S. S was used to adjust the coupling level between the two resonators. The positive S corresponds to moving up, and negative S corresponds to moving down. It is observed that the resonant frequency of the slot radiator increased as S increased from -5 to 5 mm. But the resonant frequency of the DR remains unchanged. For different ε_r, it is observed that the dual-bands decreased as ε_d was increased. The lower band was due to the CPW inductive slot while higher band was due to the DRA.

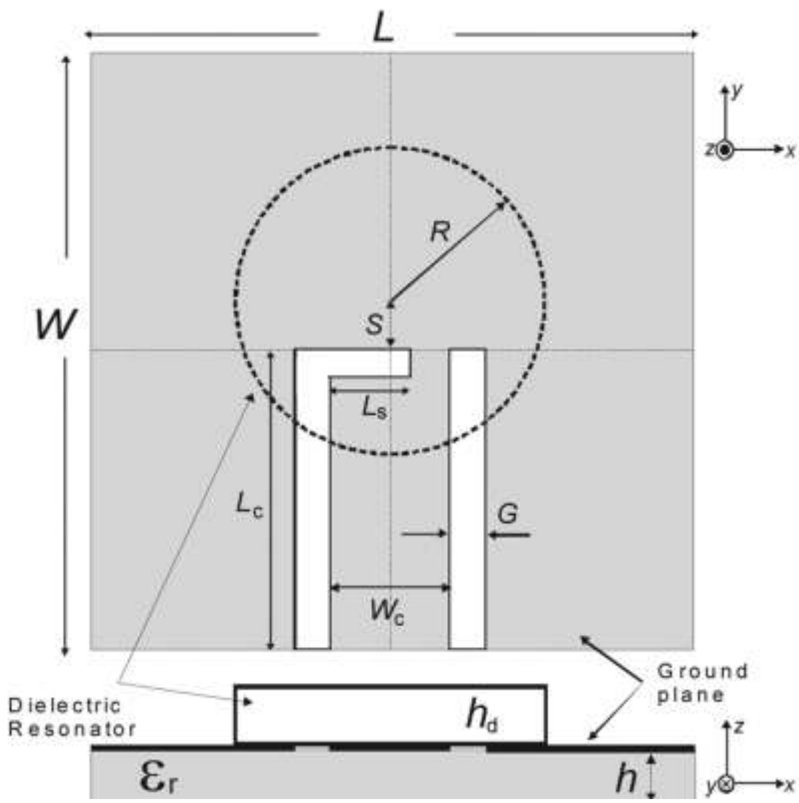

Figure 3 Top view and side view of the dual-frequency compact hybrid resonator Antenna [3].

In [4], represent the use of bridge shape DRA. The value of dielectric constant ε_r was 40. The coaxial probe was used for feeding mechanism. B-DRA was excited in its lowest order mode. It is observed that for low values of dielectric permittivity, the radiation patterns of the DRA were like monopole. Resonant frequency of DRA decreased as the permittivity increased. Dielectric constant for b-shaped DRA was 40, dielectric constant for RDRA was 10. 50 Ω micro strip line was used with width 2.4 and length 3.6 mm. It is observed that this design operate on dual frequency. Resonant frequencies were 3.5 and 5.5 GHz. These frequencies correspond to the frequency of the excitation of the b-DRA and RDRA. It is observed that variation of the width of RDRA has a significant effect on the resonance frequency of the second mode. The frequency of first resonant mode is slightly changed. For feeding aperture, micro strip line was used with width 24 mm and length 10 mm.

In [5], represent the use of rectangular shape of DRA. The value of dielectric constant was 90. Rectangular shorting strip and T-shaped shorting strip were used for feeding mechanism. The feeding mechanism adopts another T-shaped metal strip attached to the bottom force of the DRA and connected to the inner conductor of the coaxial prob. It is observed that the resonant frequency was mainly depended on the height H along the Z-axis and remain relative stable regardless of changed in length along the Y-axis. Because horizontal electric fields are distributed homogeneously along Y-axis no variation exists. The value of resonant frequency was 3.5 GHz. Now mode shows good radiation efficiency and broad side pattern as fundamental mode does.

In [6], represent the use of rectangular shape of DRA. The value of dielectric constant was 10. Experiment frequency was 1.74 GHz. Band width was 1.716- 1.767 MHz. Proposed mode was $TE^{X}_{\delta 01}$. 50 Ω micro strip line was used for feeding mechanism. Proposed RDRA with metal coating located at the centre of a square substrate of Ɛrs = 2.65. Reference antenna 1 had the same size DR as proposed one, but without metal coating. Reference antenna 2 worked at the same frequency as antenna 1, but in the new radiating mode. Comparing the proposed DRA to antenna 1, it is observed that both have different frequency. Due to two metal plates on the DR, the proposed antenna works at 1.71 GHz, much lower frequency. It is observed that changed in values of a,b resonant frequency of the mode remain almost constant. It is observed that change the value of b still has little effect on the frequency and increase of both a and b causes decrease of the frequency. To validate the theoretical analysis, the proposed DRA and reference antenna 1 were designed and measured. Feeding mechanisms of two antennas are different.

IV. DIFFERENT COUPLING METHODS

Different methods are used for exciting the antenna, which are coaxial probe, aperture coupling with micro strip line, aperture coupling with coaxial feed line, direct micro strip line, coplanar feed, slot line , micro strip line, T-shape metal strip and waveguide probe.

V. CONCLUSION

This paper presents the review on past done work in the field of dual band Dielectric Resonator Antenna. A brief description of the research works done in the field of dual band operation, different coupling method are presented here. A dual band antenna can replace two single band antennas of suitable operating bands.

REFERENCES

[1] Z. Fan and Y.M.M.Antar, "Slot-coupled DR Antenna for Dual-Frequency Operation", IEEE Transactions on antennas and propagation, Vol. 45, No. 2. pp. 306-308, 1997.

[2] H.M.Chen, Y.K.Wang, Y.F.Yin, S.C.Lin, S.C.Pan, "A compact dual band dielectric resonator antenna using parasitic slot", IEEE Antennas and Wireless Propagation Letters, Vol.8, pp. 173-176, 2009.

[3] Y.F.Yin, H.M.Chen, C.H.Lin, "Compact dual band hybrid dielectric resonator antenna with radiating slot", IEEE Antennas and Wireless Propagation Letters, Vol.8, pp. 6-9, 2009.

[4] Georgios Almpanis, Christophe Fumeaux, and Rüdiger Vahldieck, "Dual-Mode Bridge-Shaped Dielectric Resonator Antennas", IEEE Antennas and Wireless Prppagation Letters, Vol. 9, pp. 103-106, 2010.

[5] Yang Gao, Zhenghe Feng, and Li Zhan, "Experimental Investigation of New Radiating Mode in Rectangular Hybrid Dielectric Resonator Antenna", IEEE Antennas and Wireless Progation Letters, Vol. 10, pp. 91-94, 2011.

[6] Yang Gao , Zhenghe Feng , Fellow, IEEE, and Li Zhang , "Investigation of a New Radiating Mode and the Traditional Dominant Mode in Rectangular Dielectric Resonator Antenna", IEEE Antenna and Wireless Propagation Letters, Vol. 11, pp. 909-912, 2012.