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Dr. Md. Maqbool Hussain
 Department of Physics, R.D.S.
 College, Muzaffarpur, Bihar,
 India

Study of dielectric resonator antennas its applications for wireless communications

Dr. Md. Maqbool Hussain

Abstract

The dielectric resonator has high conducting boundary, which can radiate, and so it becomes an antenna, named Dielectric Resonator Antennas (DRAs). DRAs consist of dielectric materials in its radiating patch also called as dielectric resonators (DRs) on one side of the substrate .which has a ground plane on the other side. DRAs have several qualities, including high radiation efficiency, flexible feed arrangement, simple geometry and compactness. There are wide applications of DRAs and it can be designed for the communication, high impedance, low profile, high gain.

Keywords: dielectric Resonator Antennas, radiation efficiency, communication, low profile, high gain, feeding

Introduction

Wireless communication systems have progressed significantly over the last three decades, The great numbers of applications and wider approval ^[1, 11]; their requirements keep presenting more challenges to the transmitting antenna for microwave communities in terms of special requirements for antenna design, Arial are used as the front-end devices, and it is becoming more problematic to of satisfy the demanding requirements, such as miniaturised size, good performance and improved quality and radiation patterns ^[12, 18]. Recently, many new wireless system antennas have been derived from dielectric materials especially dielectric resonator antennas (DRAs), which offer potential for enhanced bandwidth performance ^[19, 21]. Dielectric resonators (DR) have primarily been used in microwave circuits for filters and oscillators ^[22, 23]. DRs were established to radiate many years ago, it is more recently that their use as an antenna radiator has developed Such devices were identified as DRA and for several years, their great advantages for a number of telecommunication applications have been identified, including low profile and low conductor loss ^[24, 25]. Several investigators attempts have been made to reduce the size of DRAs, especially to enable their use in mobile handsets. In this studies have covered wide frequency bands from high microwave frequencies to low bands. This paper starts with a review of research work on the use of DRAs and an evaluation of their important performance ^[26, 27]. A compact dielectric resonator antenna (DRA) with band-notched characteristics for ultra-wideband applications was designed, developed & tested ku-band spectrum bandwidth. The notch has been easily integrated into the feeding transmission lines

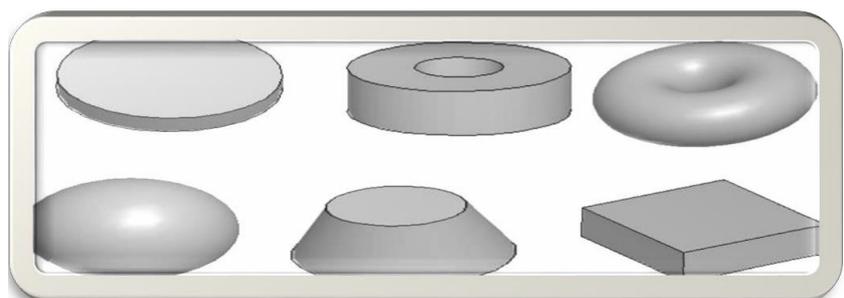


Fig 1: various shapes of dielectric resonators (DRs).

Correspondence Author:
Dr. Md. Maqbool Hussain
 Department, of Physics,
 R.D.S. College, Muzaffarpur,
 Bihar, India

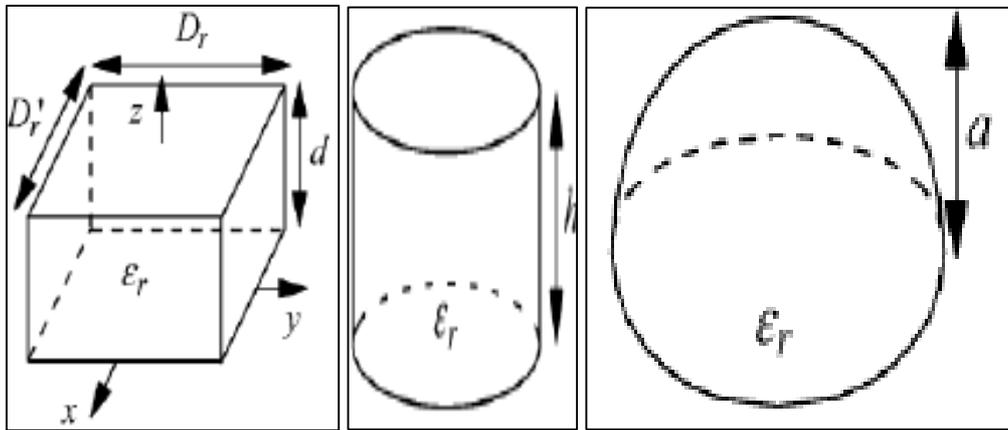


Fig 1.1: (a) rectangular (b) cylindrical (c) hemisphere

Important for the design of the DRA is depend on dimensional freedom. The geometries of circular cylinder,

rectangular cubic and spherical shapes, and their dimensions can be tuneable.

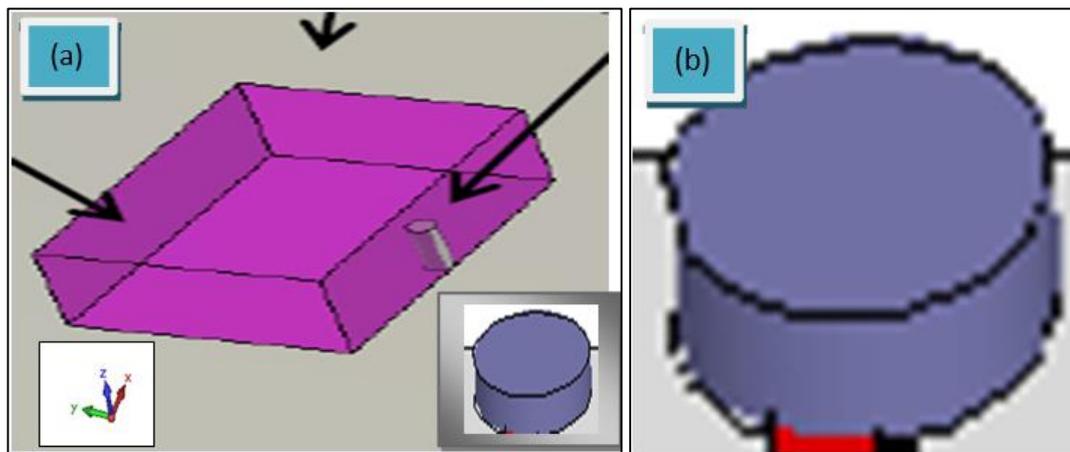


Fig 1.2: feeding in various shapes

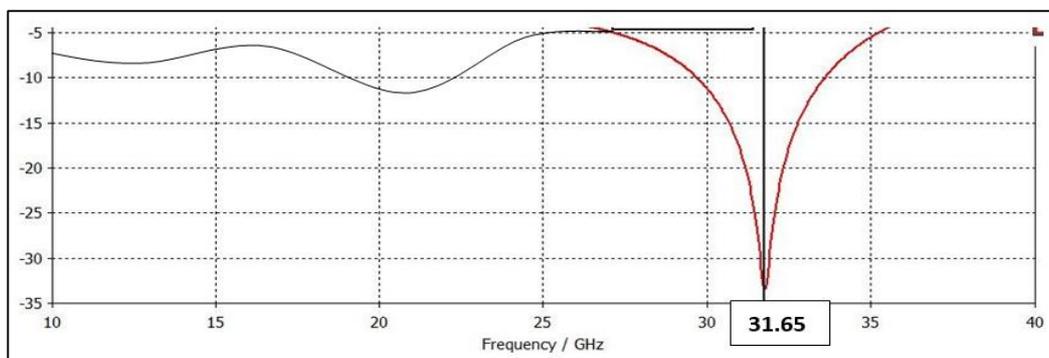


Fig 1.3: Return Loss of DRA

DRA Structure

The dielectric resonator is enclosed by a conductive boundary, it can radiate, and so it becomes an antenna. Figure 1.2 shows the geometry of the proposed rectangular DRA ($\epsilon_r=11.9$) A printed dra antenna with size of a substrate ($\epsilon_r= 2.8$) is placed on the top of the dielectric resonator. The DRA is fed may be used for probe, with a distance. The center of the DRA. The height of the feed probe above the ground plane has optimizing and structure parameters, DRA antenna can resonate at two different frequencies. The rectangular dielectric resonator provides the first resonance frequency f_1 the patch of the DRA resonates at the second frequency f_2 . The DRA has many advantages for same feeding circuit with various dielectric resonators.

Conclusion

In DRA which is composed of a probe-fed rectangular dielectric material and patch antenna on top. We have theoretically investigated the performance of Antenna parameters such as Return Loss, Bandwidth, Wavelength, Directivity and Radiation Efficiency. DRA antenna with compact size can provide high impedance value & improved antenna Bandwidth across the desired frequency bands, which are very attractive for WLAN applications. In addition, this way of attaching the DR presented the advantage of allowing reuse of the same feeding circuit with various dielectric resonators. In comparison with micros trip radiating elements, DRA radiators have better radiation efficiency and operate over wider bandwidths.

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