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A Wideband Multi Segment Dielectric Resonator Antenna

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***Abstract*—** The present work deals with the design of a wideband multi segment dielectric resonator antenna (DRA) that can be used for various applications.The proposed antenna resonates at a tri-band frequencies of 8.48GHz, 16.8GHz and 23.95GHz giving an impedence bandwidth of 62.99%.The tri-band DRA is excited by a coaxial-cable-feed.

Keywords- *DRA; multi segment; dielectric.*

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1.INTRODUCTION

Today there is a deep interest in antenna systems which operate at frequencies in the millimeter-wave region (100–300 GHz). Conventional metallic antennas suffer problems with regard to power losses, radiated power capabilities ,and fabrication difficulties when reduced to the sizes necessary to operate in this frequency band. These obstacles can be overcome if a simply shaped antenna with few conducting surfaces is designed. The dielectric resonator antenna(DRA) meets these requirements and has been shown to be a good choice for use in this band.

The use of the dielectric resonator as an antenna was originally proposed [1] in the 1980s and has since been the subject of many investigations. The dielectric resonator antenna has been evaluated for a number of different shapes ranging from rectangular parallelepipeds [2] to more elaborate configurations involving annular rings [3], stacks [4], parasitic strips [5], tetrahedrons[6], hybrids [7], and other configurations [8], [9]. The purpose for pursuing a wider bandwidth is increased functionality, including applications for ultra wideband and spread spectrum systems. The bandwidth limitation is regulated by the input impedance of the antenna and the radiation pattern.

In the present work, a multi segment DRA is designed, which is suitable for UWB (Ultra wide band) applications. The designed antenna resonates at a tri-band frequencies of 8.48GHz, 16.8 GHz and 23.95GHz giving an impedance bandwidth of 62.99%.

2. ANTENNA DESIGN

DRAs are nowadays, popular due to their attractive features like high radiation efficiency, low dissipation loss, small size ,light weight, and low profile [10]. Moreover, DRAs which posses a high degree of design flexibility, have emerged as an ideal candidate for wide band, high efficiency, and cost- effective applications. Recently more and more Ultra wideband antenna designs have been proposed. Especially stacking of two DRAs, DRAs separated by wall, antenna mounted on a vertical ground plane. The multi segment dielectric resonator antenna designed in this paper offers more impedance bandwidth compared to other dielectric resonator antennas fed by a coaxial probe [11].

The antenna geometry is shown in Fig.1, which is fed by a coaxial probe. The size of the substrate is 100×100 mm^2. The antenna is designed with the following dimensions: The size of DRA is 60×60 mm^2 with dielectric constant11.7. Here, the material used for the substrate has a low dielectric permittivity of 1.07 with a thickness of 1mm. The entire antenna system is fed with a coaxial probe of outer radius 2.5 mm and inner radius 0.95 mm at the location (6.5,0,0).The height of a probe is 22 mm.

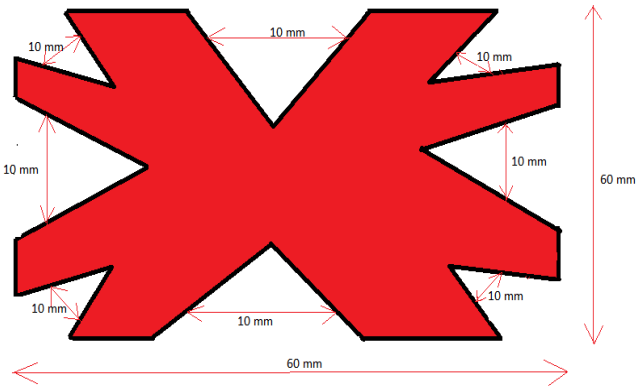

Fig 1:-Multi Segment DRA

All the dielectric resonator antennas designed in this paper are simulated with EM simulator. The antenna is simulated with a 100×100 mm^2 perfect electric conductor (PEC) ground plane radiating in a rectangular shaped cavity. Perfectly matched layers (PML) are used at the space boundary. Symmetry is used to decrease the solve time of

the solutions. The coaxial feed-port is modeled as a standard wave port.

3.SIMULATION RESULTS

The simulation results of return loss for the multi segment dielectric resonator antenna are shown in the Fig.2. The antenna resonates at a tri-band of frequencies 8.48 GHz,16.8 GHz and 23.95 GHz, with a return loss of -27.8 dB, -29.18 dB and -25.8 dB respectively giving an impedance bandwidth of 62.99%. Hence the proposed shape is much suitable for MIMO systems and WiMAX applications. The above bandwidth is obtained for VSWR ≤1.15. The VSWR plot of the proposed antenna is shown in Fig.3. The radiation patterns at both resonating frequencies are shown in the Fig.4respectively.

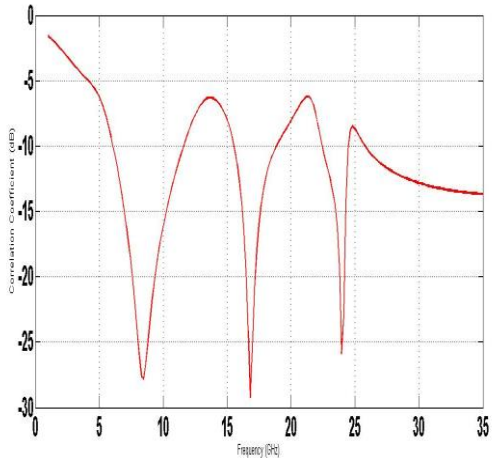

Fig.2:Return loss of Multi Segment DRA

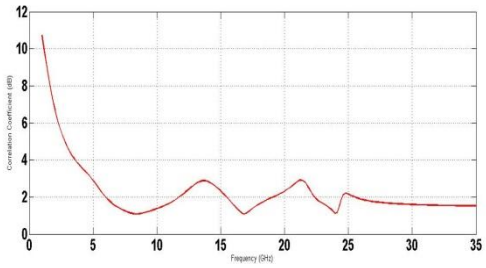

Fig.3:VSWR of proposed DRA

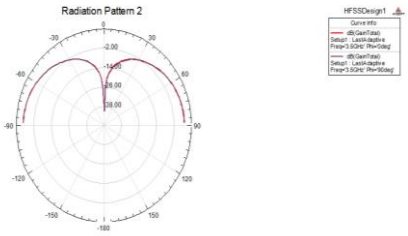

Fig.4:Radiation Pattern of proposed DRA

4.CONCLUSION

In this work, a multi segment dielectric resonator antenna fed by a coaxial probe feed is designed. The proposed antenna resonates at a tri band giving an impedance bandwidth of 62.99%.Hence, the proposed system can be used in many MIMO systems, where higher bandwidth and isolation is desired.

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