CHAPTER: 8

DIELECTRIC RING RESONATOR

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INTRODUCTION

Wireless communication technologies are shifting to higher frequency bands in microwave range to fulfilling the rising data demand like GSM shifting to FR2,FR4 band .DRA has a prominent feature like low loss ,highly efficient, highly efficient with any feeding mechanism. This design has strong potential for Ultra-wide band applications. DRA can be designed in many shapes to observe same frequency it can operate at millimetre frequency range .To investigate DRAs along with the respective design procedures such as determination resonant frequency, quality factor and dimensional parameters of spherical, cylindrical and rectangular r shapes.

Widely used RDRA technique in early detection of breast cancer tumour in women commonly known as microwave imaging is a painless , non-invasive, better sensitivity, cost effectiveness, lower detection, less time . Radiators are Any wireless system which converts the radio frequency signals into electromagnetic waves (EM) propagating through guided as well as unguided media and again convert incident EM waves to RF signal.

DRAs with respect to MSA ,thereby opening the new horizon in comparison to the traditional antennas suffering with lower gain, constricted bandwidth and surface wave losses. Dielectric Resonator Antennas possess the negligible conductor loss making it far by choice for millimetre wave antennas. DRA with partially metalized along with high permittivity can be utilized as small, low profile antenna at lower microwave frequency bands. It were analyzed in many shapes like cylindrical, hemi spherical and rectangular. Dielectric resonator of high permittivity (≥ 20) function as energy storing element rather than a radiator.

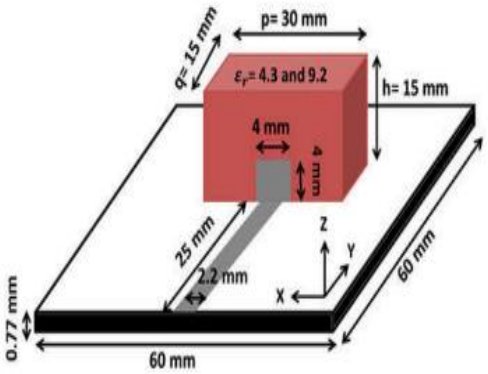

Figure 8.1 Dielectric ring resonator

FEATURES OF DRA

- DRA has high radiation efficiency, wideband characteristics, low dissipation loss and low cross polarization values .
- DR can be integrated with any kind of microstrip circuits and patch antennas, feeding mechanisms and also support various techniques such as arrays, Partial/defective ground structure etc.
- Several approaches to accommodate a particular or different group of above mentioned requirements.
- DRA is motivated by emerging demand of compact, highly efficient, ease of fabrication, high data rates, fast networks , cost effective microwave radiators employed in wideband and ultra-wideband devices.

DR normally were prepared of high-permittivity materials, having dielectric constant $\varepsilon > 20$. The Q-factor is typically ranges from 50 to 500, however can attain larger values up to 10,000.

Common coupling method used for DRA

1. Aperture Coupling
2. Probe Coupling
3. Microstrip line Coupling
4. Coplanar Coupling
5. Dielectric Image Guide (DIG) Coupling
6. Substrat

Table 8.2 -Comparison between DRA and Conventional Antenna MSA Shown Below

S. no.	Conventional Antenna (MSA)	Dielectric Resonator Antenna (DRA)
1.	MSA size ranges from $\lambda/2$ to $\lambda/3$, and the dielectric substrate thickness is in range of 0.003λ to 0.05λ.	DRA's size is proportional to $\lambda_o/\sqrt{\varepsilon_r}$ where λ_0 is the free space wavelength at resonant frequency
2.	Radiation Efficiency of microstrip is less of surface wave and conductor losses occurring due to presence of metal.	Absence of surface wave losses and very low conductor losses provides high radiation efficiency even when low dielectric material is used.
3.	Resonant frequency of the patch antenna is dependent on the patch length and dielectric constant of substrate.	Resonant frequency is dependent upon aspect ratio of DRA with fixed dielectric constant.
4.	Microstrip Patch is highly compatible with any feeding mechanism.	Variety of feeding mechanisms and their compatibility with contemporary fabrication technique make them ideal for communication devices.
5.	At higher microwave frequencies the sizes of MSA go beyond the practical limits.	The size of the DRA remains within practical limits at higher frequency as the aspect ratio and dielectric constant provides the antenna designer additional degrees of freedom..

CONCLUSION

The increasing demand for wideband antennas has led to the development of dielectric resonator antennas. They have greater design flexibility, ease of fabrication, low conductor loss, high efficiency, wide bandwidth, and compact size. DRAs can be excited by various feeding mechanisms and integrated with many devices.