CHAPTER: 10

WIDEBAND RDRA FED WITH EM COUPLING

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The detailed Mathematical analysis of RDRA is very complex and would be beyond the scope of this litureture work. However, detailed calculation of DRA parameters like quality factors, effective dieletric constant, resonant frequency has been presented with model simulations with different shapes.

Some of the Key Features Derived From Researches Are As Follows:

1. The DRA size proprtional to wavelength parameter "λ_o" which derived from the resonant or operating frequency and dielectric constant "ε_r"of the DR material used for fabrication by this relation $\lambda_o/\sqrt{\varepsilon_r}$.
2. The DRA operation depends upon the aspect ratio . The aspect ratio lies in its relation with the resonant frequency of the DRA along with radiation quality factor (Q-factor) for the greater flexibility to antenna designers.
3. Even at higher microwave frequencies, selecting the material for development of DRA results in higher value of radiation efficiencies with absence of surface waves and lower conductor loss.
4. A DRA can be developed from large range of dielectric constant materials (typically from 8 to 100) in contexting controlling their size an bandwidth.
5. DRA support several feeding mechanisms giving them an extra edge over the technology.
6. DRA can be used as radiator like short electric dipole or magnetic dipole or like monopoles according to various wireless device requirements.

Coupling theory with fed

In order to operate DRA in practical applications, it becomes imperative to couple EM energy into or out of the DRA with the help of single or multiple ports. The DRA performance is determined by parameters like the excited modes, frequency response and the extent of coupling. The coupling source is typically considered as an electric or magnetic current and by employing the reciprocity theorem .

electric source:

$$\chi \propto \int (E_{DRA}.J_s)dV \qquad (10.1)$$

and magnetic source:

$$\chi \propto \int (H_{DRA}.M_s)dV \qquad (10.2)$$

The coupling techniques influences the Q-factor of any DRA, so an external Q-Factor in terms of χ is given as:

$$Q_{ext} = \frac{Q}{\chi} \quad (10.3)$$

Coaxial Fed RDRA

The most common DRA coupling techniques is employing a probe or coaxial feeding .This fed consists of a central conductor pin, a dielectric material covering and the outer conductor similar to any coaxial line. A probe coupling placed in the region of high electric field inside the DRA to attain higher coupling efficiency. Connecting a metallic strip to the the probe generates more flexibility in the adjustment of the impedance by varying the width as well as length of the metallic strip.

Aperture Coupled Fed RDRA

This excited through a small rectangular aperture (slot) fed by microstrip line. The dimensions of slot are kept small so as to minimize the radiation spill over below the ground plane. In aperture coupling the feed network is located beneath the ground plane There introducing the significant isolation between the feed and the aperture. This leads to the reduction of any unwanted coupling in DRA. To increase the coupling the aperture has to be placed in the region of strong magnetic fields.

CPW Fed RDRA

CPW fed is commonly known a structure coupled through an open circuit coplanar waveguide feeding mechanism with DRA. The dimensions of the CPW feed can be increased significantly to obtain the desired impedance match simultaneously, keeping its dimensions small enough to reduce back lobe radiation from the DRA.

CONCLUSION

The chapter helped in the determination of radiating modes, Q-factor which are important parameters in DRA designing with different coupling mode. The main advantage of DRAs is that at same resonant frequency, DRAs with different dimensions can be developed by designer and this is based on the excitation of favorable radiating modes.

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