

# ABSTRACT

## DESIGN AND SIMULATION OF MULTIBAND COMPACT DIELECTRIC RESONATOR FILTER ON NOVEL DGS/EBG SURFACE

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Dielectric Resonators (DR) offer high-Quality factor, low loss, low volume and greater power handling capabilities. Microstrip filters are planar structures, but the quality factor of microstrip filters is low, while waveguide resonators filters offer high quality factor but occupy large volume. Dielectric Resonator filters loaded on microstrip line filter is a trade-off between waveguide resonators and microstrip line. In this research, we have used cylindrical shape Dielectric Resonators with high dielectric constant (mainly, 60 and 68). The microstrip line used is either FR4-epoxy or RT- Duroid.

In this research, we have designed and simulated a variety of filters (lowpass, band-stop and bandpass filters) operating at various resonant frequencies. These filters are designed by Defected Ground Structures (DGS), Defected Microstrip Structures (DMS), Dielectric Resonators loaded on microstrip line with and without DGS and/or DMS. First, in this thesis, design and simulation of low pass filters with various dumb-bell shaped DGS resonating at 4 GHz are presented. Also a band-stop filter (stop-band from 8.6 GHz to 10.7 GHz) having small patch on a triangular DGS with defect on strip of microstrip line has been designed and simulated. Further, we have designed and simulated low pass filters with array of arrow-head DGS having a cut-

off frequency of 5.8 GHz. Next in this thesis, we have proposed a dual band (low-pass and band-pass) Dielectric Resonator filter operating in the  $TE_{01\delta}$  modes. The bandwidth of the filter in low-pass and band-pass is 3.78 GHz and 960 MHz respectively.

Next, a dual band Dielectric Resonator loaded on microstrip line filter has been investigated. The bandwidth of both the bands are 2 GHz (8.4 GHz to 10.4 GHz) and 1.8 GHz (11.65 GHz to 13.45 GHz). Next, another low-pass filter with single DR is designed, simulated and fabricated. The pass-band of this filter is up to 3.3 GHz.

Further, a bandpass filter in which three cylindrical DRs are loaded on a microstrip line. The bandwidth of the filter is 1.8 GHz (from 9.9 GHz to 11.7 GHz).

A variable bandpass DR filter with Defected Ground Structure (DGS) has been also designed and simulated. The bandwidth of this filter can be varied from 1.2 GHz to 1.9 GHz by varying the width of terminator of high impedance line from 0.3 mm to 0.8mm. Further, a Dielectric Resonator bandpass filter with DGS and DMS. The simulated bandwidth of the filter is 950 MHz (from 1.4 GHz to 2.35 GHz). Both simulated and measured results are compared, and some deviation observed between the measured and the simulated results.

Next, a Dielectric Resonator (DR) band-stop filter using ring type DGS. This filter stops the frequencies ranging from 4.5GHz to 7.2GHz. The last filter is a dual-band Dielectric Resonator (DR) with DMS. The bandwidth of the first band-pass filter is 980 MHz (from 6.33GHz to 7.31 GHz), while the bandwidth of second band-pass filter is 400 MHz (ranging from 7.85 GHz to 8.25 GHz) and the stop bandwidth between the two pass-bands is 550MHz.