INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title: **INVESTIGATION ON DIELECTRIC RESONATOR AND DIELECTRIC LOADED ANTENNAS FOR DUAL-BAND AND WIDEBAND APPLICATIONS**

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SHORT ABSTRACT

In this thesis, an Equilateral Triangular shaped and a Rhombic shaped Dielectric Resonator Antenna (DRA), and their potential for dual-band and wideband applications have been investigated. Dielectric loading effects has been observed while designing practical DRAs presented in this thesis and in the context of this, an investigation on some of the aspects of dielectric loading effect is also presented. The investigations reported in this thesis have resulted into several contributions. The quality factor of an Equilateral Triangular shaped DRA operated in the dominant $TM_{10\delta}$ mode has been studied in detail. An expression for calculating the quality factor for this operating mode is also developed for most commonly used aspect ratios and the dielectric constant values used in the design of practical Equilateral Triangular shaped DRA. Further, this investigation has been extended to study the bandwidth performance for this dominant mode and relevant closed form expression for estimating the practical impedance bandwidth for this antenna geometry in this dominant operating mode is also presented. The Equilateral Triangular shaped DRA is also investigated for its potential as a dual-band antenna for WLAN application in the frequency bands of 2.4-2.5 GHz and 5.75-5.85 GHz. Two configurations of the dual-band Equilateral Triangular shaped DRAs are proposed, and their performances are compared with other dual-band DRAs reported in the literature. Based on various observations in the design of proposed dual-band antenna configurations, some of the challenges in the design of dual-band/ multi-band DRAs have also been highlighted. A Rhombic shaped DRA, having unequal diagonals, has been investigated and presented in this thesis. The dominant and a few of the higher order TE modes excited inside this basic antenna geometry have been identified through Eigen mode analysis with the aid of Electromagnetic simulations performed using CST Microwave Studio. Empirical formulae for calculating the resonant frequencies of these modes have been developed separately for the x- and y- polarized

cases, through curve-fitting approximations. Suitable feeding techniques that can be used for exciting these modes have also been presented. The nature of radiation characteristics of these modes have been studied to get an insight into the behavior of these modes excited inside such DRA. A prototype of this antenna has been fabricated and its performance is verified experimentally. A preliminary investigation on the special case of this antenna geometry with low profile configuration has also been presented. Further, by fine-tuning the feed position, the proposed Rhombic DRA is also found to exhibit wideband characteristics. Some aspects of dielectric loaded monopole antenna has also been investigated and presented in this thesis. This investigation includes the effect of size, shape, volume and dielectric constant of the dielectric load on the impedance bandwidth and radiation characteristics of a monopole antenna. Dual-band dielectric loaded monopole antennas for WLAN applications in the bands 2.4-2.5 GHz and 5.75-5.85 GHz have been proposed. Appropriate mathematical model and a closed form expression, useful in the design of such dual-band antennas have also been discussed.