Preface

Reconfigurable antennas (RA) have gained a lot of attention for its potential applications in devices with multiple wireless standards (WLAN, WiMax etc.). Reconfigurable antennas have the potential to deliver similar interchangeable performances as that of an antenna system with multiple driven elements. The thesis work discusses realizations of frequency and beam pattern reconfigurability in the planar antenna. Many techniques has been proposed to reconfigure the antenna radiation characteristics. However, reliability, design complexity, increased form factor and ease of integration to the antenna structure are some of the issues which needs special attention. Approaches are made for a reliable, compact and easily applicable reconfiguration technique. Recently, engineered materials and liquids, along with conventional electrical and mechanical methods are also investigated for their possible uses in the reconfiguration technique. The thesis work investigates the techniques for realizations of frequency and beam pattern reconfigurability in the planar antenna. The objective of the work is to develop simple and effective reconfiguration technique for enhanced antenna performance. Two methods are studied and developed for frequency and beam reconfiguration.

The first technique studied is based on an electrical approach, where PIN diodes are used as switching elements for its fast switching speed and low biasing voltage. A rectangular microstrip patch antenna designed using transmission line model (TLM) is modified by introducing meandered slots to its non-radiating edges. The effective length of the slots is varied using two PIN diodes to shift the resonant frequency of the antenna. A four stepped frequency reconfiguration, which covers a total bandwidth of 1.80 GHz, is obtained while maintaining consistency of the antenna beam pattern. A multi-stepped beam scanning system is implemented by introducing multiple strips as parasitic elements to each corner of a rectangular patch in a Yagi configuration. The strips are activated using PIN diodes to act as directing elements. The beam can be steered in 57 different directions. The consistency of performances in terms of gain, frequency of operation and directivity are confirmed.

Secondly, microfluidic channel based tuning mechanisms are developed for frequency and beam reconfiguration. The switching is achieved by introducing one of the liquids as ferrofluid and its position proximately controlled by electromagnets. The frequency

reconfiguration is based on a spatial variation of the dielectric constant of an engineered substrate with the embedded microfluidic channel, near the radiating edge of a patch antenna. The designed antenna can be reconfigured to operate at two distinct frequencies separated by a range of ~ 0.6 GHz with an almost stable radiation pattern and gain. Beam steering antenna is similar to the design used in the PIN diode based reconfiguration, the metallic strips are replaced by micro-channels filled with conductive liquid. The beam reconfiguration is carried out by changing the length of the conductive liquid. The beam can be steered in 19 different directions. Consistency of operational frequency, gain and directivity are verified. For all the designed antennas gain is above 3 dB and efficiency is above 50 %.