CHAPTER 6

CONCLUSION AND FUTURE SCOPE

The experimental and simulation studies on a novel dielectric resonator antenna with isosceles trapezoidal geometry are discussed. The characteristics of the antenna when excited with microstrip feed is described for different orientations by showing the reflection coefficient, 2D radiation pattern, half power beam width (HPBW), cross polar level, gain, input impedance, 3D gain pattern etc. The antenna performance is optimized for the feed location, offset length of the feed strip, dimensions of the slot in ground plane, slanted and parasitic strips etc. The radiation patterns for all the configurations are generally broadside, like a horizontal magnetic dipole.

Design 1-1 propose an antenna operating at a centre frequency of 2.46 GHz with a bandwidth of 11.6% and an average gain of 5.38. The antenna covers important application band of ISM: Bluetooth/ WLAN 2.4/ Wibree (802.11 b/g/n)/ ZigBee. As it is operating in the ISM band, it can as well be used in medical tomographic set up described in appendix-B.

In Design 3-1, the DR orientation is excited with microstrip feed and optimized for a position corresponds to dual frequency bands with good gain and polarization characteristics. In many cases dual frequencies are obtained by using either dual feed lines or a hybrid radiating structure, which may cause design complexity. But this antenna is unique in the sense that it is capable of producing dual frequencies with a single feed, without using any hybrid structure.
Most of the antennas adopt microstrip structures with two separate feeds excited by orthogonally polarized waves to realize the dual band and dual polarization function. Microstrip antenna has good performances in lower frequency, however in higher frequency, the radiation efficiency deteriorates apparently. Compared to the microstrip antenna, the radiation efficiency of the dielectric resonator antenna is as high as 95% even for frequencies up to 10 GHz, due to the absence of inherent conductor losses. Design 4-1 presents a dual band dual polarized (DBDP) antenna with a simple compact DRA with single feed alone. Here the single antenna substitutes the function of two separate antennae with different polarization and in that sense this is a compact and simple design. If the dimensions and permittivity of the DRA is varied along with the use of suitable impedance matching mechanisms, the proposed antenna can be tuned to use in the practical application bands such as the bands of 2.4/5 GHz WLAN etc.

In design 5-1, a new design of compact ITDRA with slotted ground plane is introduced. It is found that by properly embedding two pairs of narrow slots in the ground plane of an Isosceles Trapezoidal DRA, a wide band response is obtained. It also resulted in lowering of the antenna’s fundamental resonant frequency. A reduced antenna size at a fixed frequency can thus be achieved for the proposed design.

Design 5-2 is a modified wideband design of Design 5-1, where the shape of the slot is optimized as in the form of a fish bone structure and the orientation of the DR is also changed. Increase in bandwidth is the result of merging multiple resonances originated in close neighborhood by the slot provided in the ground plane. The antenna offer an impedance band width of 21.5% centered at 2.51GHz and covers important application bands viz. ISM: Bluetooth/ WLAN 2.4/ Wibree (802.11 b/g/n)/ ZigBee,
WiBro and DMB similar to the above design. Although the radiation characteristics are almost similar, the reflection characteristics are better in the case of Design 5-2 when compared to Design 5-1.

All configurations shows broad side radiation patterns with moderately good gain and half power beam width (HPBW). Hence it is observed that ITDRA can act as a suitable candidate for wireless communication where a compact antenna is required with wide range of applications like multi band operation, dual band dual polarization operation and wideband operations. The radiation pattern is observed to be broad at different frequencies. A comparison with the simulated results using HFSS is also done and the results are discussed. Mode analysis is done by sketching the field distribution on ITDRA using HFSS.

Main features of the work are:

- A new geometry, Isosceles Trapezoidal shaped DRA is introduced to the wireless communication system.
- The antenna can be used for designing dual band dual polarization operation with single feed.
- It can be used for Multi band operation.
- Can be used for Wide band application with slotted ground plane structure.
Wide band operation covers important application bands viz. ISM: Bluetooth/ WLAN 2.4/ Wibree (802.11 b/g/n)/ ZigBee, WiBro and DMB.

Slotted ground plane structure is resulted in reduced antenna size.

Gain of ITDRA is high compared to other shapes.

ITDRA excited by microstrip transmission line generally gives broadside radiation pattern as a horizontal magnetic dipole does.

6.1 SCOPE OF FUTURE WORK

The effect of material properties on antenna performance such as antenna gain efficiency, radiation pattern, band width etc. can be studied. The validity of ITDRA for circular polarization can be tested by giving two feeds simultaneously. Investigations can be carried out with probe feed and proximity feed for the performance of the antenna. Possibility of incorporating components like microwave diodes, inductors, capacitors etc. in the antenna, in order to modify its properties for the purpose of band notching, beam scanning etc. can be tried. Other feeding techniques such as slot feed and coplanar waveguide feed can be attempted as a better alternative to the microstrip feed.