Chapter 5

Conclusion and Future work

Research in UWB antenna is the in thing in both academia and industry owing to its advantage over narrowband system. In view of the wide variety of antennas found in the literature, two types of antennas monopole antenna and slot antenna have been identified. Three among them, printed tapered, step monopole and pentagon antennas were based on the monopole antenna that are formed by reducing the ground plane size and putting the ground and radiator on the same plane. The fourth antenna is based on the slot antenna which is a printed slot antenna where the slot is excited by a C shaped stub. All four antennas are suitable for portable UWB communication due to compact size. Parametric studies have been carried out to determine the effect of geometrical parameters on return loss and radiation characteristics. Band reject characteristics have been obtained by etching slots on the radiator or ground plane. This method has the advantage of reduced complexity in the design since they avoid the use of complex and extra circuitry which may not be suitable for portable applications due to the limited space availability. The performance of the antenna was numerically evaluated using a commercial three dimensional electromagnetic software CST based on the finite integration technique.

5.1 SUMMARY OF THESIS

A brief summary of the designed antenna are:

- Printed tapered antenna
  The antenna was designed to give wideband performance. This antenna mainly radiates from the transition region between the radiator and ground plane where the EM fields are confined. Compact size is achieved by truncating the low current region and wide bandwidth is achieved by applying both technique of tapering the antenna structure and beveling the ground plane using slot. The designed antenna has a
compact size of $18 \times 19 \text{ mm}^2$ and operates over the frequency band between 3.1-12 GHz for VSWR $< 2$ with a bandwidth of 110%. Narrow C shaped slots are engraved on the radiator to achieve band rejection. The antenna demonstrates band rejection performance in the frequency band of 5 to 6 GHz. The antenna exhibits omni-directional characteristics with average gain of 2.26 dB.

- **Step Monopole antenna**

A microstrip line fed dual band-reject UWB antenna with sharp band edge frequency of 3.1-10.6 GHz is delivered by a step monopole antenna. The antenna consists of a rectangular patch on the front side and a partial ground plane at the rear. A step is cut on the lower edge of the patch for impedance matching. A split ring slot etched on the radiating patch rejects WiMAX (3.3-3.8 GHz) band, and a pair of inverted S-shaped slot in the partial ground plane rejects WLAN (5-6 GHz) band. In order to eliminate the radiation outside the FCC specified 3.1-10.6 GHz band, a rectangular slot is etched on the ground plane below the feed line. The antenna exhibits ultra wide bandwidth of 109% except for the notch band. The radiation characteristics are consistent throughout the band.

- **Pentagonal antenna**

This radiator is a pentagonal structure with microstripline feed. Wide bandwidth is achieved by cutting a step in the radiator for gradual impedance transformation between the patch and the feedline. The gap between the feed and ground plane is also optimized for wideband performance. The designed antenna is a simple structure with wideband performance and omnidirectional characteristic.

- **Slot antenna**

A coplanar waveguide (CPW) fed UWB slot antenna with single band notch characteristics is presented. Ultra wide bandwidth of 3.01-10.6 GHz is achieved by
exciting the rectangular slot antenna with C-shaped stub. Band notch characteristic is achieved by etching a half wavelength slot. The performance of the antenna was investigated numerically and experimentally. Experimental results demonstrate that the antenna exhibits omni directional characteristics with the peak gain of 4.9 dBi and a gain variation of less than 2 dBi across the operating band. Planar configuration of this antenna with reconfigurable band rejection characteristics makes it attractive for UWB devices like USB dongle and laptops.

All the four antennas discussed provide ultrawide bandwidth. The radiation characteristics of printed tapered antenna did show distortion in radiation pattern with increase in frequency due to miniaturization. Step monopole antenna and slot antenna provide wide bandwidth with omnidirectional characteristics. All the results are within acceptable limits and can be used for IR-UWB applications.

5.2 Future Work

Some of the extension works that can be carried out:

Antennas can be developed on low loss substrates so that it can be integrated on to Microwave Integrated Circuits.

Time domain characteristics of the antenna can be evaluated through measurement.

UWB performance of the antenna can be analyzed theoretically using characteristic modes or spherical wave expansion to get better insight into the operating principles of UWB antennas.