CHAPTER- 7

CONCLUSIONS AND FUTURE SCOPE OF WORK

7.1 CONCLUSION

A series of studies on the three basic aspects of microstrip patch antenna have been investigated in this thesis. The first aspect is bandwidth (BW) enhancement, second is the gain enhancement and third is the design of compact microstrip antenna. To achieve all three aspects, different structures with modified radiating & ground planes have been described and investigated. The investigations are done both theoretically and experimentally. Theoretical investigation is done by using commercially available software ANSOFT- Version 2.2, based on the principle of method of moments (MOM). Experimental study is performed by Vector Network Analyzer and standard microwave test bench.

A single layer, microstrip antenna with three coplanar rectangular patches of slightly different dimensions has been designed. The staggering effect between the patches provides a wide bandwidth of 1.33 GHz (4.30 GHz-5.63 GHz) with a percentage BW of 27%. The antenna provides a stable radiation pattern along with average peak gain of 2.97 dBi.

Wideband microstrip patch antenna with an inverted U-shape slot on a rectangular patch has been designed. The proposed design exhibits a wider bandwidth of 2.37 GHz (5.93 GHz – 8.30 GHz) with a percentage BW of 33.31%. It exhibits a stable radiation pattern also.

Another wideband and high gain U-shape patch antenna has been investigated with circular shape as well as with square shape ground plane. The ground plane is modified by cutting an inverted U-shape slot just below the U-shape patch. Impedance bandwidth is varying inversely with variation of size of ground plane. Antenna with circular ground plane provides more impedance bandwidth compare to same sized square ground plane antenna. The designed antenna provides a maximum bandwidth of 86.79% (4.5 GHz - 11.4 GHz) and maximum peak gain of 4.1 dBi along with stable radiation pattern.

Higher gain along with multi frequency and compactness has been achieved by modifying a conventional hexagonal patch antenna. Six triangular slots have been cut on the ground plane, just below the six corners of the hexagonal radiating patch. Due to defective
ground surface (DGS) the proposed antenna shows multi resonating behavior at 2.8 GHz, 3.2 GHz and 5.0 GHz. It provides a reasonable size reduction of around 57%. The antenna also exhibits average measured peak gain of 4.51 dBi and maximum gain of 7.2 dBi.

Another high gain microstrip antenna has been designed using four narrow parasitic patches surrounding a square shape radiating patch. The proposed antenna exhibits a maximum peak gain of 7.85 dBi along with a favorable radiation pattern.

Finally a compact rectangular microstrip patch antenna for operation in Wi-MAX (3.1 GHz to 3.6 GHz) and WLAN (4.9 GHz to 5.9 GHz) band has been designed. Finger like slits are loaded on the radiating edges of the patch. The proposed antenna resonates at two different frequencies 3.0 GHz and 5.4 GHz compared to the single resonating (4.3 GHz) reference antenna and provides a size reduction of around 73.07%. First frequency band 3.05 GHz to 3.15 GHz and second frequency band 5.37 GHz to 5.5 GHz provided by the proposed antenna are within Wi-MAX and WLAN bands respectively.

7.2 FUTURE SCOPE OF WORK

There is no doubt that considerable scopes for further innovation and improvement exist in this work area. In this thesis different microstrip patch antennas have been designed by modifying radiating & ground planes to make it suitable for different applications. Structures have been developed and optimized by trial and error method using simulation and knowledge gathered through experience. Even extensive studies reveal that there is no definite method for predetermination of such optimal design. Efforts may be given to make a predetermined method by using artificial neural network or genetic algorithm.

In this dissertation only the flat substrate has been considered for design purpose. Every structure may be studied after bending the substrate with different radius of curvature. Theoretically this may be done with the help of simulation jobs.

Radiation beam as well as operating frequency band switchable microstrip patch antenna may be designed by properly choosing the feed point and varying the length of slot respectively.

Researchers may try to design microstrip antenna by using aluminum foil as metal. New fabrication process should be investigated so that precise antenna may be designed. This may reduce the cost of the microstrip antenna further.