ABSTRACT

Ultra Wide Band (UWB) technology is rapidly developing area in the field of Wireless Communication. There are many challenges in this field, one of the challenge is to design an antenna which covers the entire UWB frequency range, the another challenge is to design an UWB Multiple input-Multiple output antenna which will increase the channel capacity and will allow several users to access the various services at the same time. The objective of this thesis is to design UWB antennas that operates in the frequency range from 3.1 to 10.6 GHz and has band notched characteristics. Another objective is to design UWB MIMO antenna and UWB MIMO antennas with band notched characteristics. The thesis starts with designing and implementing UWB antennas with discussions covering their operation, electrical behavior and performance. UWB antennas are designed and analyzed using microstrip feeding technique and coaxial feed to achieve low profile and compatibility with Printed Circuit Board. Also, Different techniques for obtaining a bandstop function in the 5 to 6 GHz frequency band to avoid interference with other existing worldwide interportability for microwave access (WIMAX) systems are numerically and experimentally presented.

In Communication systems, Multiple Input–Multiple Output (MIMO) technology, which involves the use of multiple antennas at both the transmitter and receiver, is used to significantly enhance the data transmission performance and channel capacity. Antennas for this system are designed, to ensure that isolation between elements should be less than -15 dB. Thus, Antennas are typically placed apart from others at least half wavelength of the lowest operating frequency, and this could lead to increase in dimensions of MIMO antenna. Therefore, miniaturizing the antenna size and improving the isolation coefficients are the two most important aims for MIMO antennas. An Ultra Wide Band (UWB) multiple
input and multiple output (MIMO) antenna having shared radiator with dual band rejection characteristics is designed and analyzed. The proposed antenna is based on the concept of dual polarization. The antenna consists of two tapered Co-planer Waveguide (CPW) feeds printed on one side of the substrate and a circular shared radiator on the other side. The radiator is shared between two antenna elements. High isolation between the antenna elements is achieved by introducing a rectangular slot in the circular radiator and an inverted Y shaped stub on the ground plane at an angle of 45°. The designed antenna rejects the WiMAX and WLAN band of frequencies by employing Elliptical Split Ring Slots (ESRS) in the shared radiator. The diversity performance of UWB MIMO antenna is also studied. The antenna is fabricated on FR4 substrate and has a small size of 41 mm × 41 mm. The simulated and measured results are in good agreement which demonstrate its potential use in UWB portable devices. The challenge of multipath fading in Ultra Wide Band technology is removed with another MIMO antenna in the thesis. The high isolation among the antenna elements is a basic requirement for good diversity performance. To cope up with this challenge a uniplanar UWB MIMO antenna is designed and analyzed. This antenna can also be used for Wireless Personal Area Network (WPAN), Wireless Body Area Network (WBAN). It has single common circular radiator for both the antenna elements.

**Keywords:** Band-notched ultra-wideband (UWB) antenna, MIMO antenna, High isolation, notched characteristics.