The rapid growth of wireless technologies has drawn new demands for integrated components including antennas. In particular, miniaturization is necessary for achieving an optimal design of modern handheld wireless communication devices. Antenna on chip is a new mantra in the area of antenna research. Numerous techniques have been proposed by researchers for the miniaturization of microstrip patch antennas with multiband characteristics. For many years, various antennas for multiband operation have been studied and designed for communication and radar systems. One of the solutions for the multiband characteristics is the fractal antennas. The Fractal antennas are based on the concept of fractal geometries. Fractal structure is made in order to obtain reduced size multiband patch antenna. The use of fractal geometries in antennas have proved to be a good strategy in order to obtain log periodic multiband behaviour. This is mainly due to the self-similarity property of fractals which means that some of its parts have the same shape as a whole object but at different scales. In addition, due to the space filling properties of fractals are used in antenna miniaturization. The use of space filling curves increases the antenna’s electrical length. This allows low frequency operations. Therefore, the fractal geometry allows miniaturization of radiators with overall small dimensions and long electrical length. Thus, the miniaturization effect in fractal microstrip antenna is based on lengthening the surface current lines in the patch element. As a result, the electrical length of resonator is expanded and the entire structure is miniaturized. One of the crucial aspect of fractal antenna is to maintain the radiation pattern mainly shape and characteristics. The etching of the metal portion does affect the radiation properties of the antenna hence, is optimally done to ensure radiation properties. Fractals antennas have peculiar properties that make them suitable for applications where wideband and multiband are important parameters of the overall performance. In recent years, several fractal geometries have been introduced for antenna applications with varying degrees of success in improving antenna characteristics. Some of these geometries have been particularly useful in reducing the size of antenna, while other designs aim at incorporating multiband characteristics. The main objective of this thesis is to design, simulate, fabricate and test various fabricated antennas for wireless communication. In this thesis work diamond shaped fractal antenna, modified Minkowski fractal antenna and modified Sierpinski Carpet...
antenna have been proposed. The antennas are simulated using the IE3D electromagnetic simulator software. The designed antennas are fabricated and tested for bandwidth and return loss. The good agreements between simulated and measured results show that antennas are multiband in nature.

The diamond shaped antenna is based on the Sierpinski Carpet fractal structure. In terms of wavelength, the antenna size is $0.322\lambda$ at lowest frequency (where, $\lambda$ = wavelength at resonant frequency). Three measured resonant frequencies appeared at 3.215GHz, 4.143GHz and 5.261GHz for second iteration. The measured bandwidths are more than 100MHz respectively in these three frequency bands.

A modified Minkowski fractal antenna is also simulated and fabricated. The square patch has dimensions of 30mm x 30mm. In 1st iteration, two bands each have bandwidth more than 500MHz are obtained. The antenna with 2nd iteration resonates at three frequencies. The bandwidths obtained are 600MHz, 800MHz and 1000MHz at three respective resonant frequencies. The fabricated antenna is tested using site analyzer. The measured results show that the proposed antenna is appropriate for wireless communication.

A modified Sierpinski Carpet fractal antenna is also proposed to obtain multiband resonances for wireless communication. In terms of wavelength, the antenna size is $0.34\lambda$ at lowest frequency (where, $\lambda$ = wavelength at resonant frequency). The simulated resonant frequencies for this fractal antenna are 5.10GHz, 6.82GHz, 7.28GHz, 10.08GHz and 10.37GHz with a gain of 2.80dBi, 8.97dBi, 3.66dBi, 4.32dBi and 2.37dBi respectively. The observed directivity of the designed antenna is appreciable for wireless communication and the value of VSWR is low. Three measured resonant frequencies appeared for the second iteration. Thus, the designed and fabricated antennas are compact and multiband in nature and are suitable for wireless personal communication.