Abstract

The increase in demand for frequency bands to facilitate voice, data and video services have created the spectrum scarcity and forces the regulatory authorities to allow the unlicensed use of the spectrum. In 2002, FCC regularized the uses of 3.1-10.6 GHz spectrum with indoor and outdoor power spectral level mask. Nowadays, wireless communication systems require compact as well as wideband antennas. The compactness in design will assist in the integration of the proposed structures with portable systems. Design of a wideband antenna is very challenging as compared to narrowband antennas. The application of fractal geometry in antenna design resolve the above mentioned problems. The goal of the thesis is to analysis and design of wideband fractal antennas for portable UWB applications.

The use of fractals in antenna design improves several characteristics. The miniaturization and wideband characteristics are obtained due to fractals properties like self-similarity and space-filling, respectively. Furthermore, antennas achieve wideband phenomena due to multiple resonances offered by the fractals.

In the UWB antenna design, different fractal geometries such as Minkowski like, Minkowski, Sierpinski and Koch are used. Fractal application helps to achieve the desired miniaturization, wide impedance bandwidth and stable radiation pattern. With the application of different fractals, different antennas are proposed for concepts or techniques such as wideband with band-notch characteristics, reconfigurable band notch characteristics, reconfigurable narrowband characteristics, MIMO techniques and WBAN. The performance and characteristics of these antennas in frequency domain as well as in time domain are investigated to understand their behavior.

It is demonstrated that the introduction of fractals at the edges of monopoles or at the ground plane improves the impedance bandwidth of an antenna. To the best knowledge of our, application of fractal UWB antenna either to provide reconfigurability in design or for WBAN is not provided previously.

All the presented antenna structures are fabricated on different substrates (FR4 and Duroid) for different dielectric constants as well as thicknesses. It is demonstrated numerically and experimentally that the proposed antenna structures are suitable candidates for UWB applications.

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