Chapter 5

Fractal-Inspired Ultra-Wideband Diversity Slot Antenna for Wireless Communication Systems

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ABSTRACT

A novel compact ultra-wideband (UWB) multiple-input multiple-output (MIMO) slot antenna with band notch characteristics is presented for portable wireless UWB applications. The antenna comprises of co-planar waveguide feed (CPW) and two radiating monopoles oriented in orthogonal orientation for providing orthogonal radiation patterns. A Minkowski fractal parasitic stub along with a Minkowski fractal grounded stub has been placed at 45° between the monopoles to reduce the coupling between them, which in turn establishes high isolation between the radiators. An excellent band notch characteristic is obtained at 5.5 GHz by etching a modified E-shaped compact slot on the radiators. Results show that the designed antenna meets -10 dB impedance bandwidth and -17 dB isolation throughout the entire operating band (3.1 - 12 GHz). Novelty of this design lies in improving isolation using fractal which occupies less space in compared to other isolation mechanisms in MIMO structures. The simulated and measured results depict that the proposed antenna is convenient for MIMO diversity systems.

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INTRODUCTION

In digital communication systems, MIMO (Multiple Input Multiple Output) has created a revolutionary importance. All types of wireless technologies faced some difficulties such as multipath, signal fading, limited spectrum, interference etc. MIMO has solved most of the difficulties by providing higher data throughput to multipath, increase in range and reliability etc., without consuming additional spectrum. IEEE standard of MIMO technology is 802.11n. MIMO antenna introduces antenna diversity like pattern, polarization and spatial diversity to increase the transmitted signal power and to improve Signal to Noise Ratio (SNR). To increase the data rate in MIMO, spatial multiplexing is used. In addition beam forming is used to enhance the data rate. MIMO has a wide range of applications in mobile, Digital Television (DTV), Metropolitan Area Network (MAN), Wireless Local Area Network (WLAN) etc. Basically the system which have multiple transmit and multiple receive antennas is known as MIMO system. The wireless technology has remarkably improved the communication range and maximizes the capacity by using MIMO system. MIMO system analyses multi-path propagation by using different transmission paths to the receiver. These paths can be used to provide redundancy of transmitted data, which improves the reliability of transmission or by increasing the number of simultaneous transmitted data streams and increasing the data rate of the system. The capacity of these systems depends upon increasing the number of transmit antennas and also depends upon the number of receiving antennas, which must be greater than or equal to the number of transmitting antennas. So an enhancement in capacity means capability of faster communication and as a consequence this capacity improvement over conventional one-antenna systems has fuelled intense research interest in MIMO techniques, which results the development of MIMO systems.

Mathematically, the MIMO communication is performed through a matrix, so it may be possible to transmit multiple parallel signal streams or data streams simultaneously in the same frequency band and so that increase in spectral efficiency.

Figure 1. Block Diagram of a MIMO System
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