Dual-fed Single Microstrip Patch Antenna for Polarization and Angle Diversity Realization in MIMO Applications

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Utilizing multiple transmitting and receiving antennas in MIMO systems can greatly improve the performance of the current communication system. However, such a system is usually large which tremendously reduces its application in small portable devices. In this paper, we develop a novel micro-strip patch antenna design with two highly isolated feeds which is capable of radiating two orthogonal signals at same frequency. The two signals are different in polarization and radiation pattern so that polarization and angle diversity required by MIMO systems can be achieved. In designing such an antenna in this research, the theory of characteristic modes is used. Unlike previous work, this theory provides better insight into physical phenomena taking place on the microstrip patch antenna. Orthogonal current modes are identified and properly excited to radiate orthogonally polarized waves. High isolation between the feeds is achieved through properly locating the feed at the null field regions of the other feed. Prototypes are fabricated and measured. The results are compared to the simulated results from the HFSS.

In addition, in order to meet the bandwidth requirement for practical MIMO usage, investigations are also performed to improve the VSWR bandwidth of 2:1 of the antenna such that it covers the whole required frequency spectrum. Two frequency bands considered are WiFi band at 2.4 GHz and WiMAX band at 3.5 GHz with frequency spectrum of 83.5 MHz and ~200 MHz respectively. Furthermore, concern is also given to miniaturize the antenna and to make the design as simple as possible so that the design is integratable for practical purposes. Finally, a MIMO system is also constructed using the designed antenna to obtain channel measurements and correlation functions. Both line of sight (LOS) and Non-Line of Sight (NLOS) channel transfer coefficients are measured. The generalized capacity of the system is calculated to determine the MIMO system performance.