A Dual-Polarized Patch Antenna with Improved Bandwidth for Simultaneous Transmit and Receive (STAR)

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Growing numbers of wireless devices leads to more crowded radio spectra and network traffic. One solution to this problem is using simultaneous transmit and receive (STAR) antenna systems. STAR systems could theoretically double the spectral efficiency. To realize a STAR system, the system's transmit signals must not suppress its receive signals. Because the transmit signals are at least 10^6 times larger than the receive signals, the receive signals can be obscured by the transmit signals. Several designs utilize new techniques to isolate transmit and receive signals and reduce self-interference between them. Many of these designs exhibit good isolation but narrow bandwidth. This study proposes a microstrip antenna with good isolation that uses spiral parasitic structures to enhance the bandwidth.

In this paper, we present a dual-polarized patch antenna surrounded by four Archimedean spirals. The antenna is designed for 2.4-2.5 GHz ISM band. Simulation result of the design achieves wide bandwidth (about 95 MHz for reception and 135 MHz for transmission) and high isolation (S_{12} < -50 dB). The design is composed of two layers of substrates and a ground plane between them. The top side of the first substrate consists of the patch, spirals and a receiving port. The bottom side of the second substrate comprises a ring hybrid and a transmitting port. The patch-side substrate is thickened to widen the antenna bandwidth. Adding spirals as parasitic elements further improves the bandwidth because of the wideband characteristics of spirals. The fabricated design has a measured 100 MHz reception bandwidth and a 150 MHz transmission bandwidth. In addition to the bandwidth, the isolation of the design is contributed to the ring hybrid and separation of receive and transmit ports. The transmit port is connected to the difference port of the ring hybrid and the receive port attaches to the patch through a microstrip feedline. The top and bottom layers are bridged by two wires at the output ports of the hybrid without touching the ground plane. Other antenna parameters including gain, radiation patterns, cross polarization, and efficiency will be presented as well.