Compact Antennas with Reduced Self Interference for In-Band Full-Duplex Systems

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Current wireless communication systems operate in half-duplex mode, i.e. current wireless radios cannot transmit and receive at the same time and on the same frequency. In-band full-duplex wireless operation was generally assumed to be impossible due to the great difference in transmit and receive signal power levels. However, recent advances have shown that in-band full-duplex operation is feasible by applying and combining different self-interference mitigation techniques. Reducing self-interference will allow simultaneous transmission and reception at the same carrier frequency and therefore improve spectral efficiency. In this work, our aim is to propose a full duplex antenna system with high isolation. For a compact and power-efficient system, we consider the use of the 180^o hybrid.

In this study, we present two compact antenna systems for 2.4 GHz WLAN applications. The first design includes two closely spaced monopoles excited by the 180^o hybrid with dimensions 60 mm x 80 mm x 1.4 mm. The antennas are placed geometrically symmetric to improve isolation. The difference input port of the hybrid is used as the transmit port while the sum input port is connected to the receive port. The dimensions of the antenna and the hybrid are optimized using a parametric study to obtain high isolation and good radiation characteristics at 2.4 GHz. The antenna exhibits high isolation characteristics (S_{21} < -40 dB) suitable for cancelling the transmitter interference on the receiving port. The second design includes a square patch excited along the two axes to generate two transmitted signal which are polarized perpendicular to each other. The antenna is fed by an optimized wideband 180^o hybrid coupler printed on a layer below the ground layer. The antenna has dimensions of 50 mm x 50 mm x 1.9 mm and isolation less than -50 dB within the band of interest. Results regarding antenna parameters such as bandwidth, gain, radiation patterns will be presented.