

## **A Dual-Polarized Patch Antenna for In-Band Full-Duplex Communications**

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The increasing numbers of consumer wireless communication devices demanding access to the wireless frequency band are filling up the frequency spectrums established for their use. Contemporary devices must transmit and receive either at different frequencies or at different times to avoid the transmitted signal interfering with the received signal. These multiple-input multiple-output designs are reaching their limit, but new designs are significantly reducing the amount of this self-interference, making the possibility of simultaneous transmit and receive antennas more likely. This study proposes a compact microstrip design with high isolation between its two ports, helping to accomplish in-band full-duplex operation.

We present a patch antenna with probe feeding that has high isolation ( $S_{21} < -55$  dB) and low cross polarization (approximately -20 dB) for use in a full-duplex system. The design consists of two substrate layers and a ground plane in between. A patch is printed on one substrate opposite the ground and a ring hybrid (180° hybrid) is printed on the opposite side of the second substrate. The ring hybrid receives the signal to be transmitted at its difference input and feeds it to the patch via probes at the output ports that go through the substrates without coming into contact with the ground plane. The receive signal is taken directly off of the patch. This design blocks any radiation that may be on the ring hybrid from affecting the patch, and the hybrid aids in causing greater isolation ( $S_{21} < -65$  dB) at a particular frequency based on dimensions. The separation of the receiver and transmitter in this fashion also causes the ports to both be linearly polarized but the transmitter in the horizontal and the receiver in the vertical, causing high isolation and low cross polarization at all frequencies. Parameters of interest such as impedance matching, bandwidth, gain, radiation patterns, efficiency, and envelope correlation coefficient will be presented along with the critical parameters of isolation and cross polarization.