In-Band Full-Duplex Antenna with High Duplex Isolation

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Realization of in-band full-duplex communications is a very important element for next generation wireless technology. By allowing simultaneous transmission and reception of signals in the same frequency band, wireless performance could be dramatically improved.

One of major challenges in implementing an in-band full-duplex radio solution is to obtain high isolation between Tx and Rx RF chains. In previous solutions, high isolation was often realized using a dual-polarized antenna pair by placing two identical antennas orthogonal to each other. However, these conventional dual-polarized antennas have balanced-feed structures that increase the complexity, cost, size, and/or weight of the total feed structure. For example, it typically requires a hybrid or a balun to feed the antennas. Unfortunately, hybrids or baluns can not only introduce additional insertion loss in the Tx chain, but also increase noise figure in Rx chain.

To address these challenges a new antenna concept and design was investigated for implementation in an in-band full-duplex proof-of-concept (POC) system. The new antenna design has a simple feed configuration that does not require a hybrid or a balun to feed the antennas. The antenna POC was developed and demonstrated with a high duplex isolation level (> 60 dB). It consists of an antenna pair with two different monopole-type antennas which are orthogonally polarized to each other and collocated on the same PCB plane with a very simple feed structure as shown in Fig. 1. Measurement results showed that the antenna has more than 60-dB duplex isolation, uni-directional patterns with realized gain of 3 – 5 dBi (total radiation efficiency: Tx antenna: 92%, Rx antenna: 80%), and large half-power beamwidth of ~160°. The overall size of the antenna in the current POC system is only $0.6\lambda_0 \times 0.7\lambda_0 \times 0.1\lambda_0$ at the center frequency.

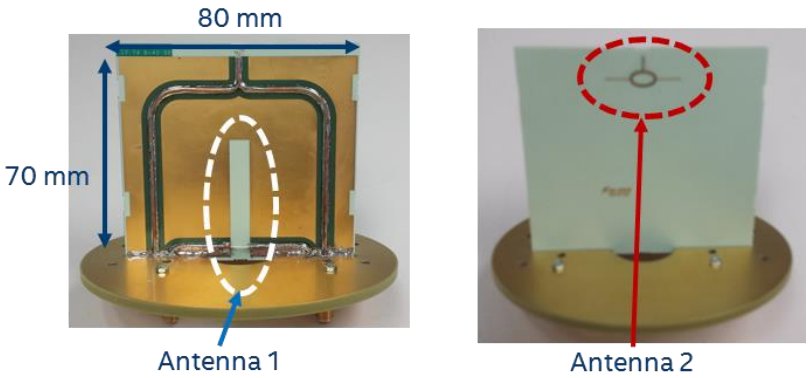

Figure 1. Front view (left) and back view (right) of the proposed antenna PoC.