Front-End Isolation Circuit for Aperture-Level STAR Arrays

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Typical existing T/R modules are not designed for simultaneous transmit and receive (STAR) operation, which improves information capacity in wireless communication systems. The required T/R isolation is in the range of 125-150dB, depending on the application. Radar applications for increased sensitivity and lower probability of detection demand as much as 200dB of isolation (Kolodziej, K. E., Cookson, A. U., & Perry, B. T. (2020). Adaptive learning rate tuning algorithm for RF self-interference cancellation. *IEEE Transactions on Microwave Theory and Techniques*, *69*(3), 1740-1751.). Using antenna isolation, as well as analog front-end and digital baseband cancellation, limited isolation of around 120dB is achieved at best.

In this paper, we consuder aperture-level STAR, where sensing of the self-interference at the receive elements is performed, so that it can be cancelled with minimal degradation in noise and sensitivity in the receive path. The redeisged front end element consists of a switch and feedback network implemented in a Qorvo 250-nm GaN on SiC monolithic microwave integrated circuit (MMIC) at 3 GHz. The circuit has minimal additional footprint and allows the transmitted signls to be sampled and used for digital cancellation of the received signal. We present a single-pole double-throw switch design that can be integrated with a low-noise amplifier in the receive path. This circuit accomplishes the minimal required isolation between the relevant front-end T/R circuit ports. The system-level tradeoffs, and MMIC design will be detailed.

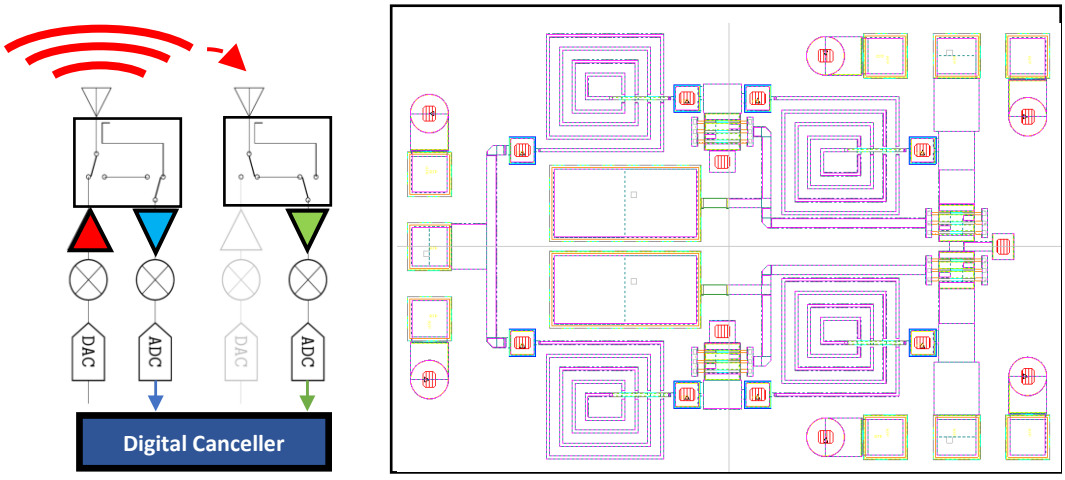

Figure 1: (a) Block diagram of the coupling and cancellation between the transmiting and receiving antenna elements in an aperture-level STAR array. (b) GaN MMIC layout of a 3 GHz single-pole double-throw switch for sensing and sampling transmit element leakage.