

# 2020 Research Day

## A Configurable Quadrature Balanced Switched-Capacitor Transmitter for Full Duplex and Half Duplex Wireless

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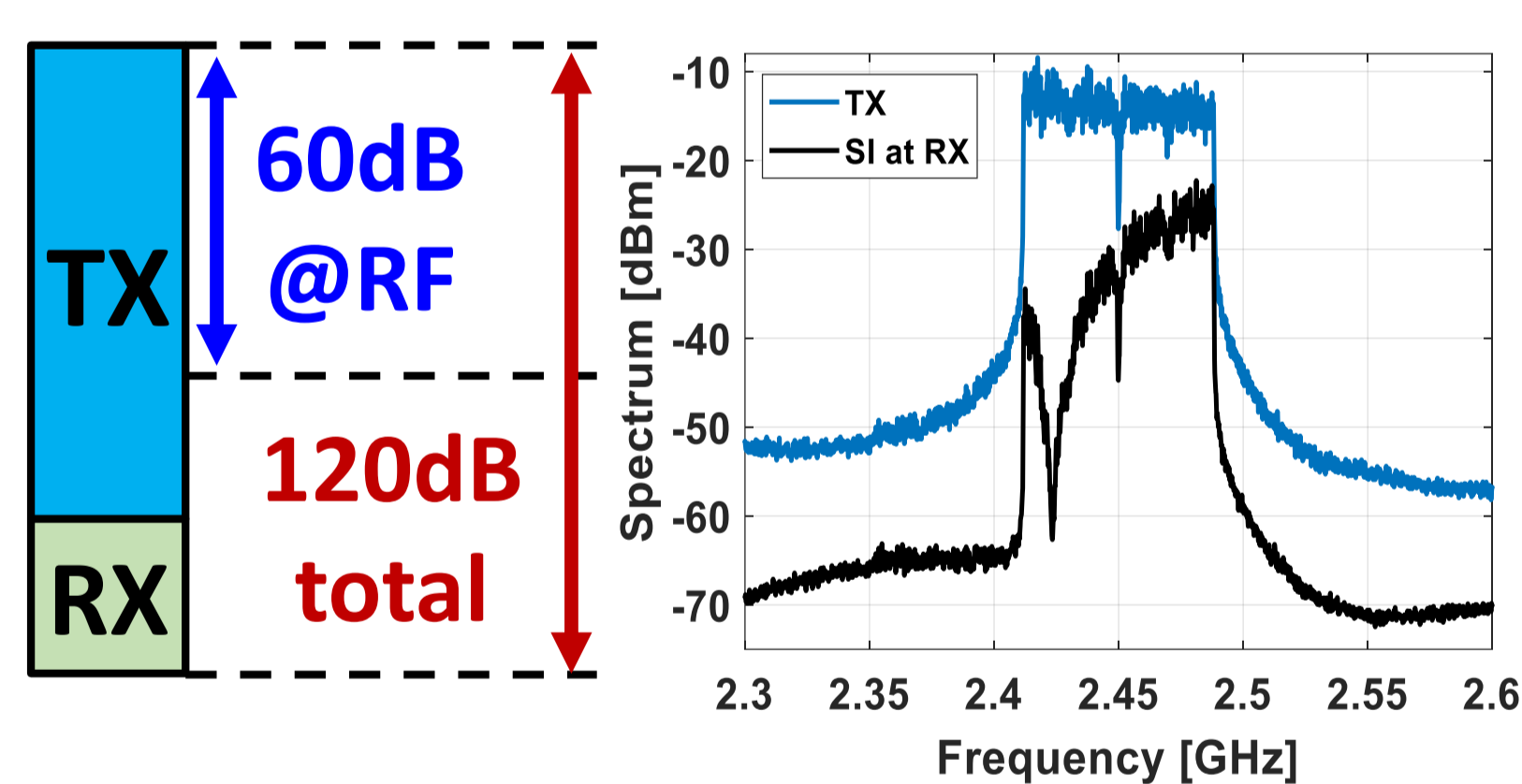
<sup>2</sup> Toga Networks, a Huawei Company

### Motivation

- Simultaneous transmission and reception at the same carrier frequency band
- 2 × data throughput

### Introduction

The main challenge in realizing a single antenna FD transceiver is the elimination of the strong interference that imposes the powerful transmitter to its own receiver while maintaining the system energy efficiency for wideband channels.



### Method

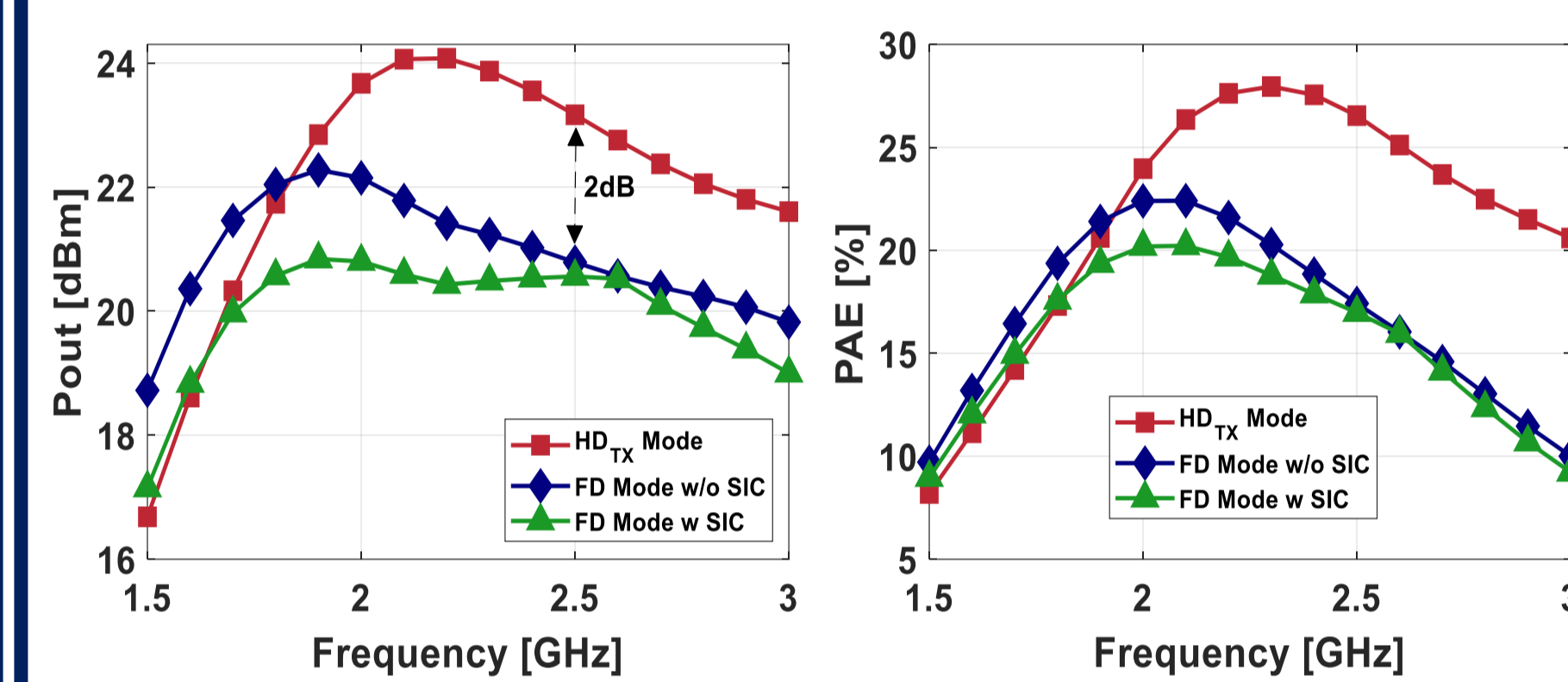
- Active pre-PA digital cancellation signal injection facilitates phase and amplitude equalization over wide bandwidth channels.
- An integrated quadrature coupler allows for an additional 3dB TX power and enables low TX and RX losses along with phase noise suppression at RX.
- SNR degradation of the RX path depends on the reflectivity of the sub-PAs. High reflectivity is achieved by the low output impedance of the switched-capacitor architecture.

### Chip Design

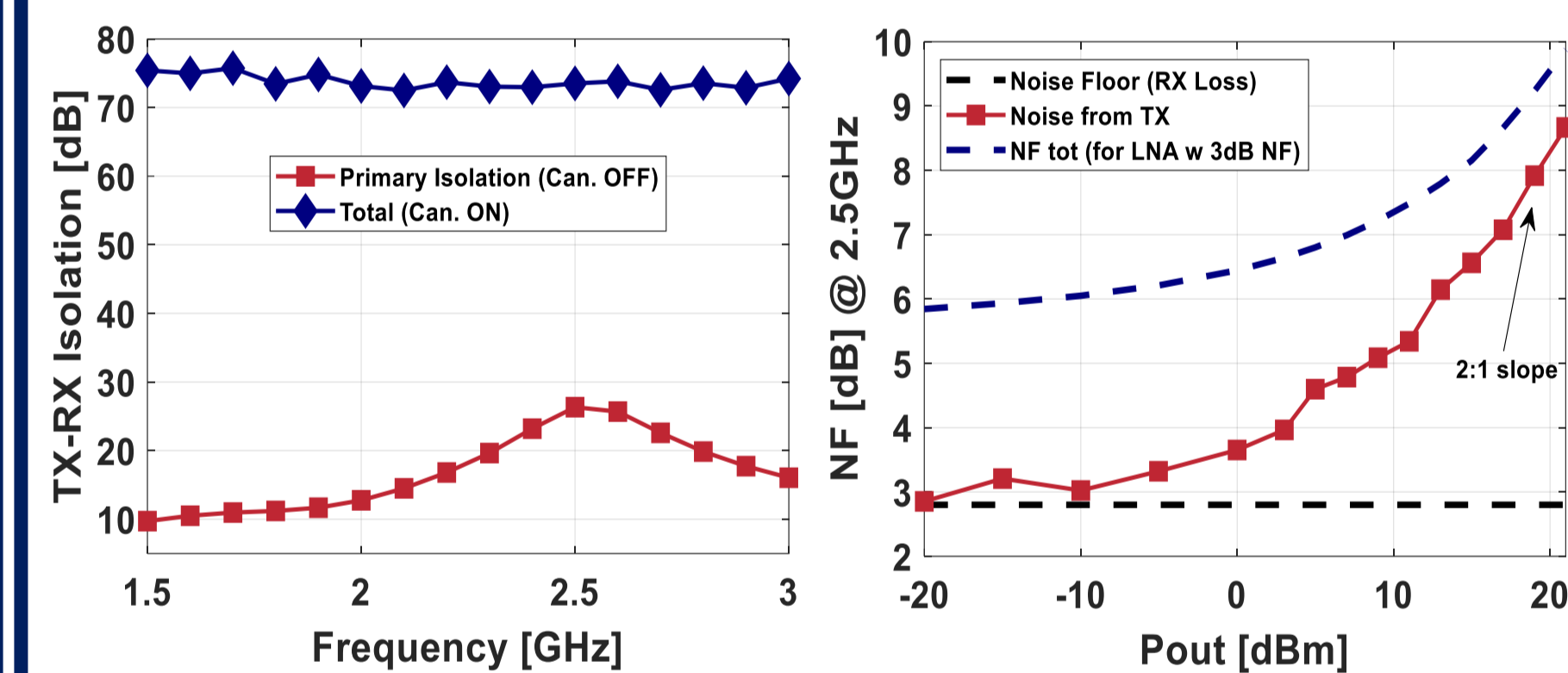
- Switched-capacitors topology
- Shared IQ PA cells
- 11-bit resolution
- Phase-noise suppression at Rx
- 5-bit MSB/LSB decoders
- High-speed deserializer
- High Tx power capability
- Frequency tunable
- Wideband operation
- FD/HD mode select
- Clock polarity select
- Digital time controller
- 65nm CMOS tech
- Size 1.6mm<sup>2</sup>

### Measurements

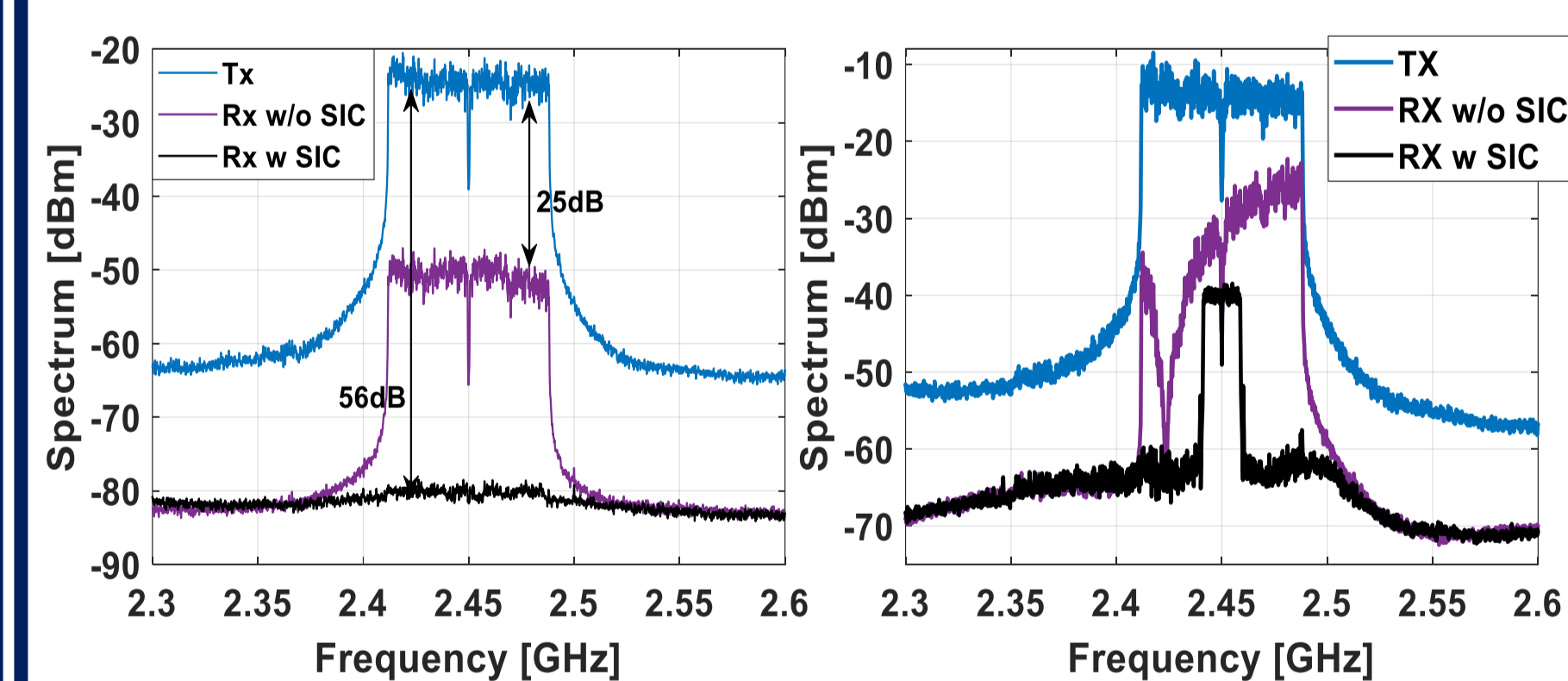
- 23dBm/21dBm Tx power with 26.5%/17.4% PAE at 2.5GHz in HD<sub>TX</sub>/FD modes



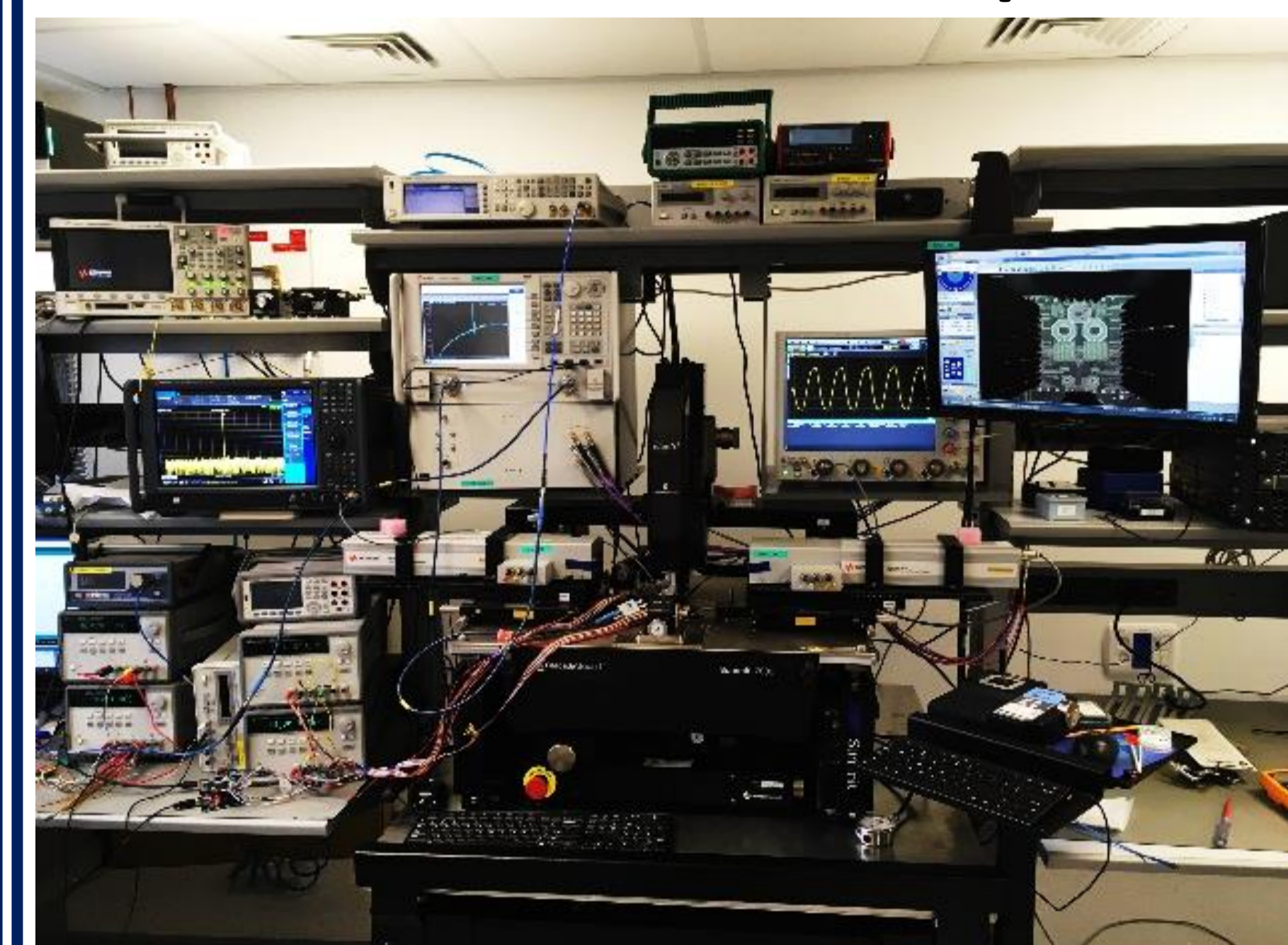
- >72dB of self-interference cancellation within the frequency range of 1.5-3GHz
- 2dB NF hit at 13dBm TX



### Modulated Signals

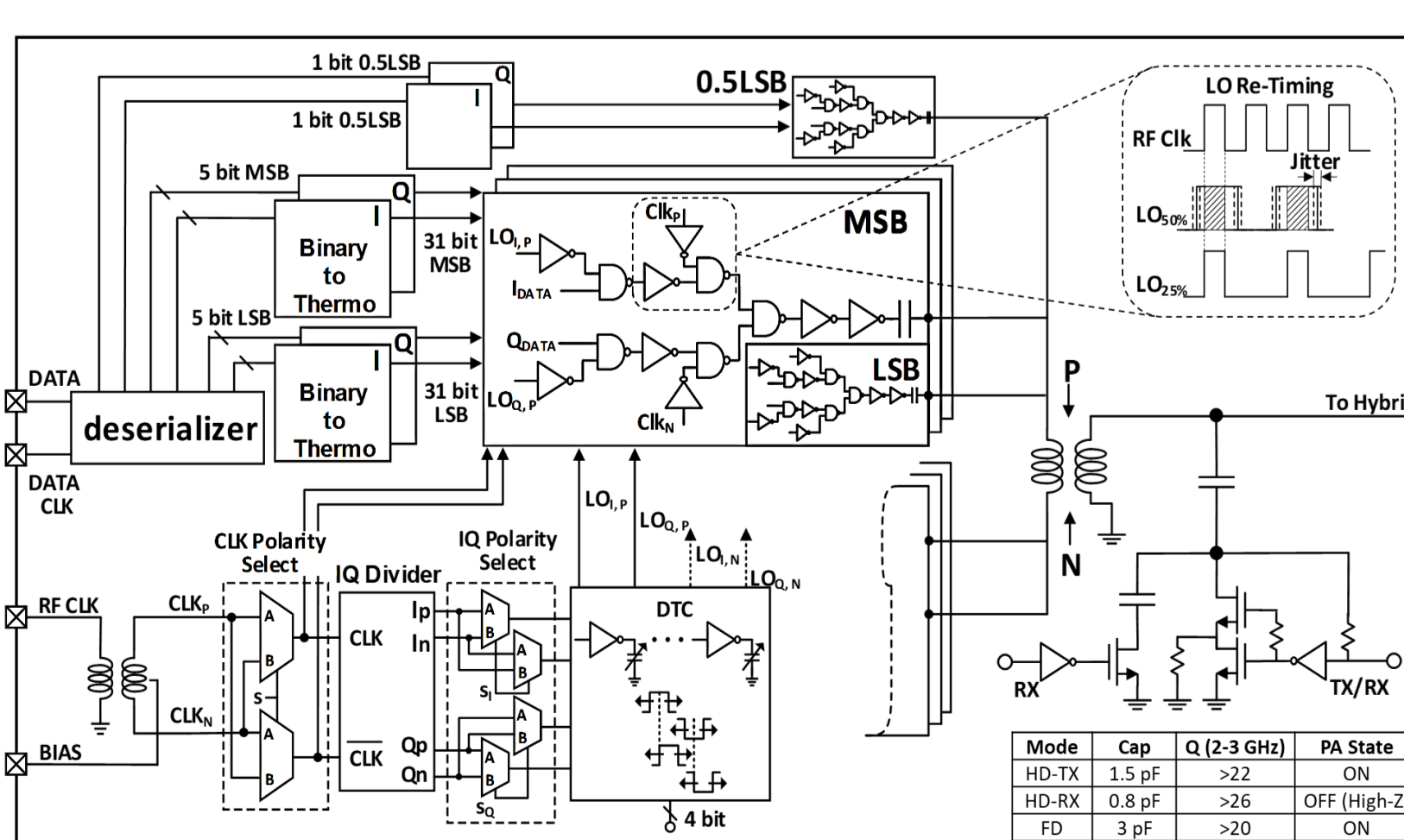
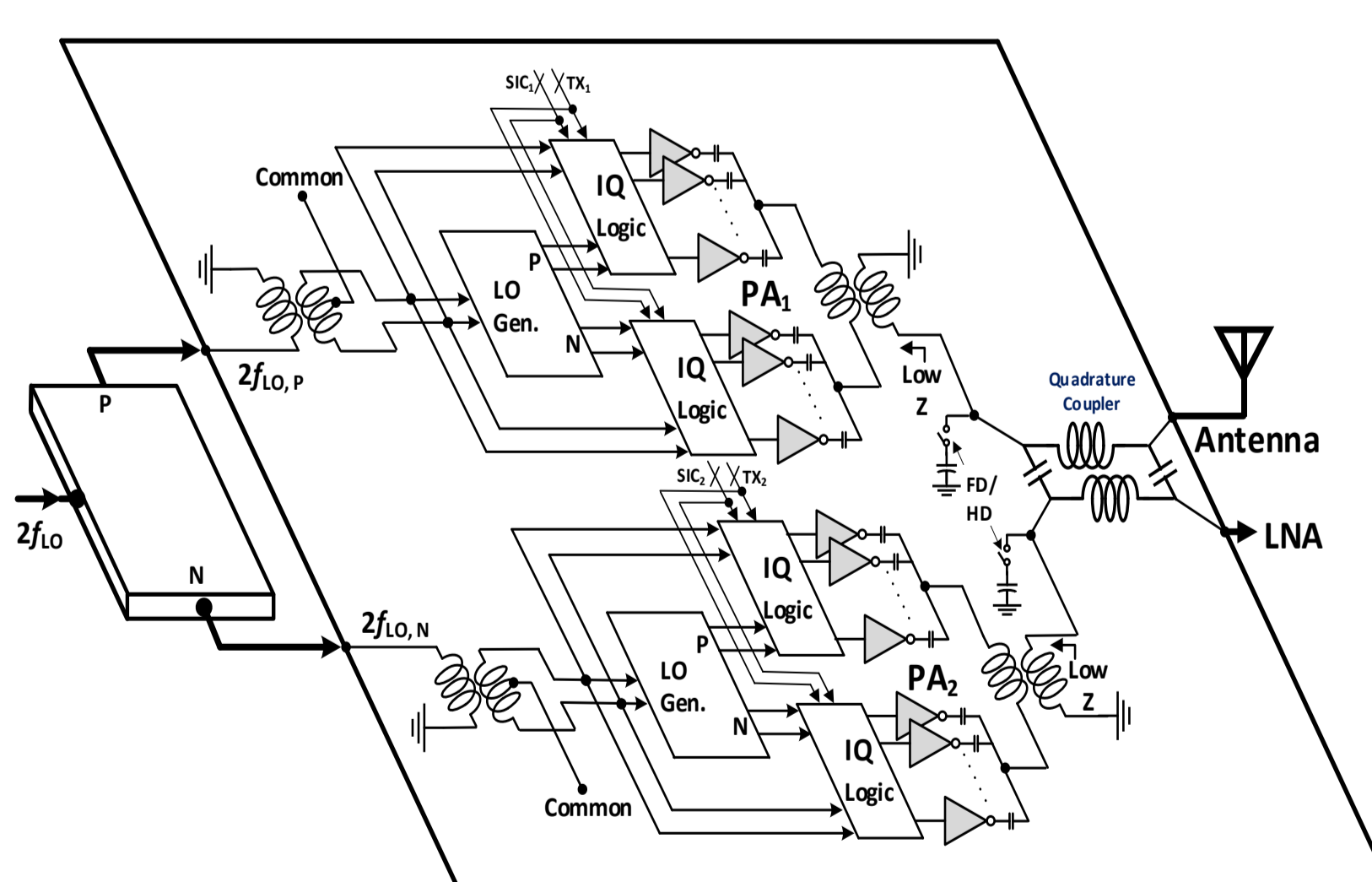
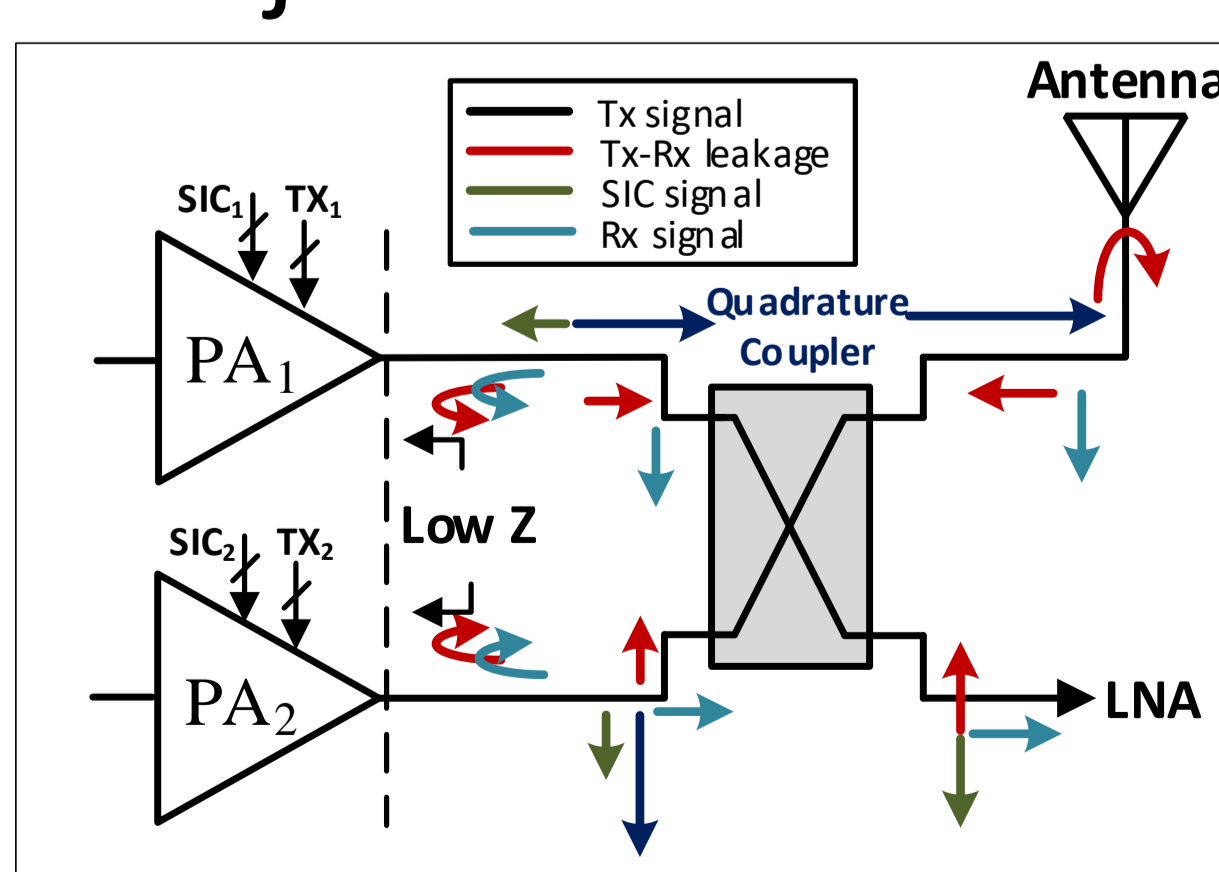


### Measurement setup



### Tx Architecture

The quadrature balanced switched-capacitors power amplifiers provides a built-in TX-RX isolation and a pre-PA self-interference cancellation signal injection mechanism.



### Chip Micrograph

