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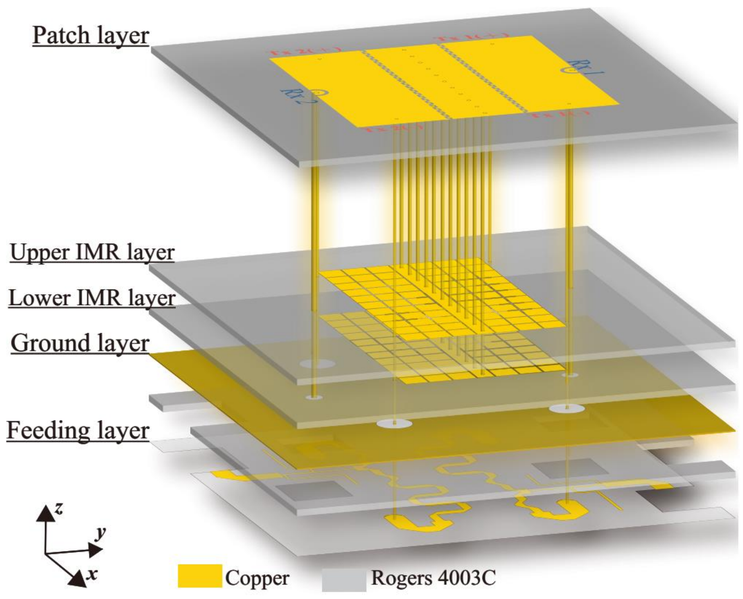
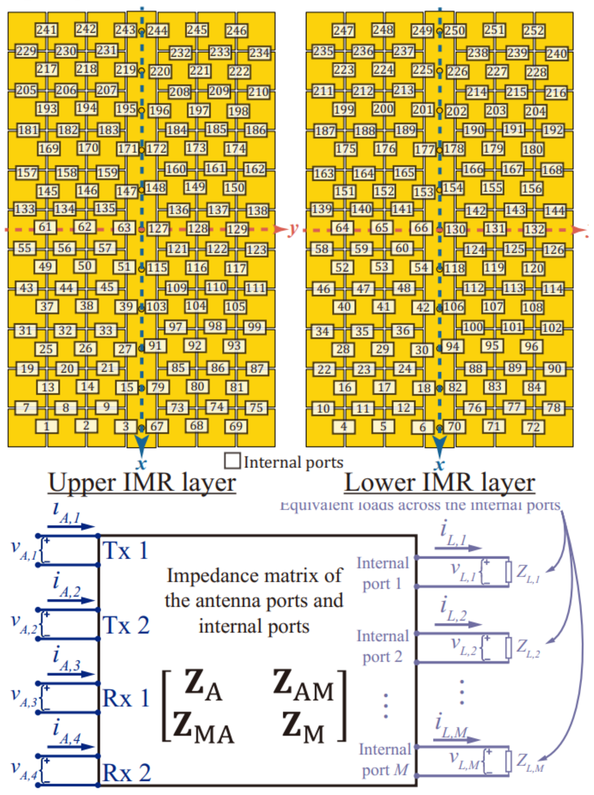
A Compact 2×2 In-Band Full-Duplex MIMO Antenna with Shared Aperture and Co-Polarization

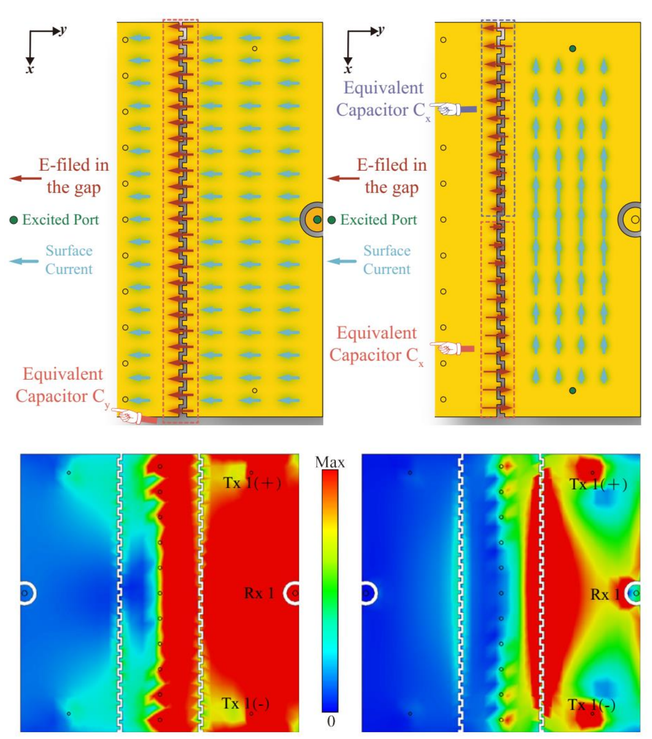
Prof. Ross Murch's Research Group (Honorable mention award in IEEE AP-S/URSI 2024)



In-band full-duplex (IBFD) antennas have been proposed for next-generation wireless communication as they can increase system throughput by up to two times. In this work, a compact multiple-input multiple-output (MIMO) IBFD antenna featuring two co-polarized transmit (Tx) ports and two co-polarized receive (Rx) ports is proposed. Isometric view of the proposed antenna is shown.

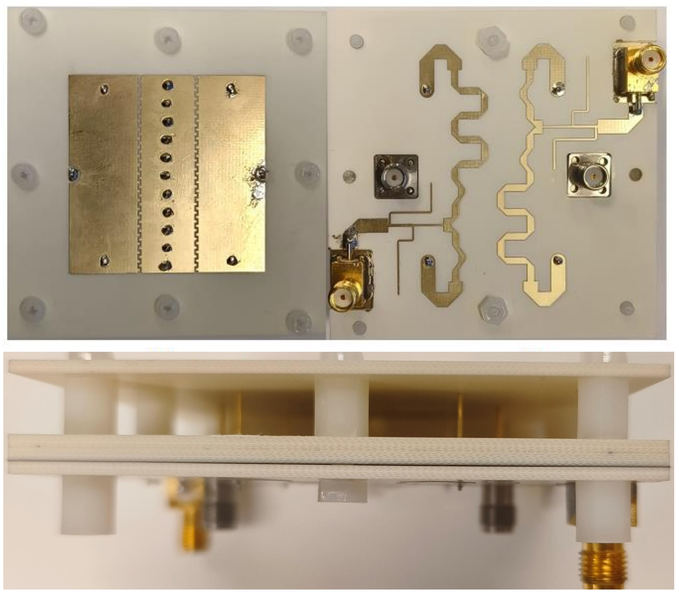


A novel "inverted mushroom" (IMR) structure is introduced at the antenna's center to suppress the Tx ports MC and ensure effective radiation for Rx ports.

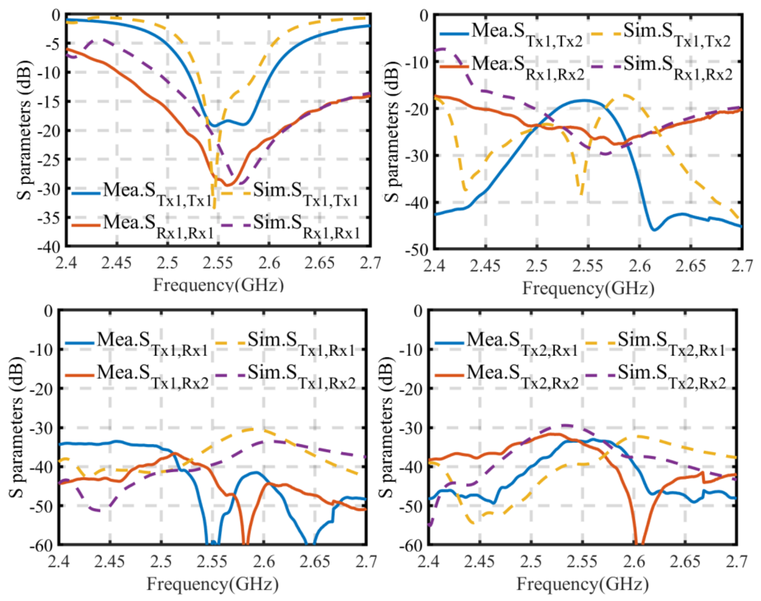


To integrate all four ports within a single antenna aperture of 0.38λ × 0.38λ × 0.11λ, polarization-dependent "teeth-like" gaps are proposed to protect Tx ports from IMR influence while maintaining the normal operation of Rx ports.

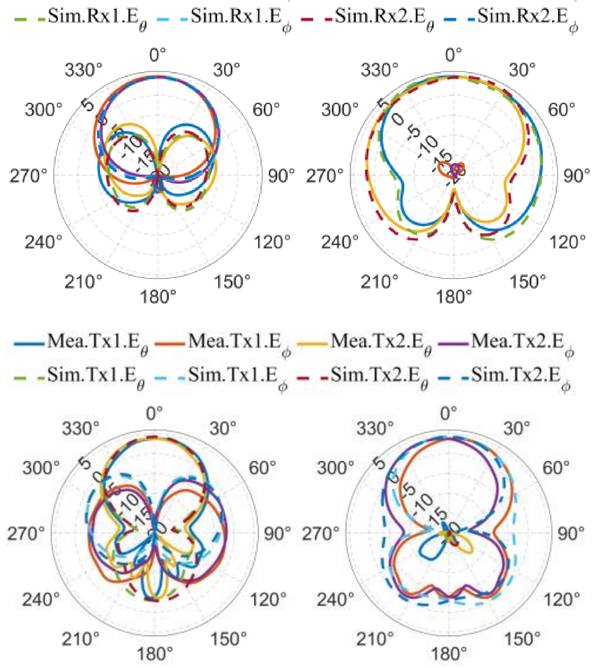
Simulation and Experimental Results



Photograph of the fabricated antenna, including top view, bottom view and cross-section view. The return loss of the IBFD antenna is measured by a VNA and the radiation patterns are measured in the anechoic chamber.



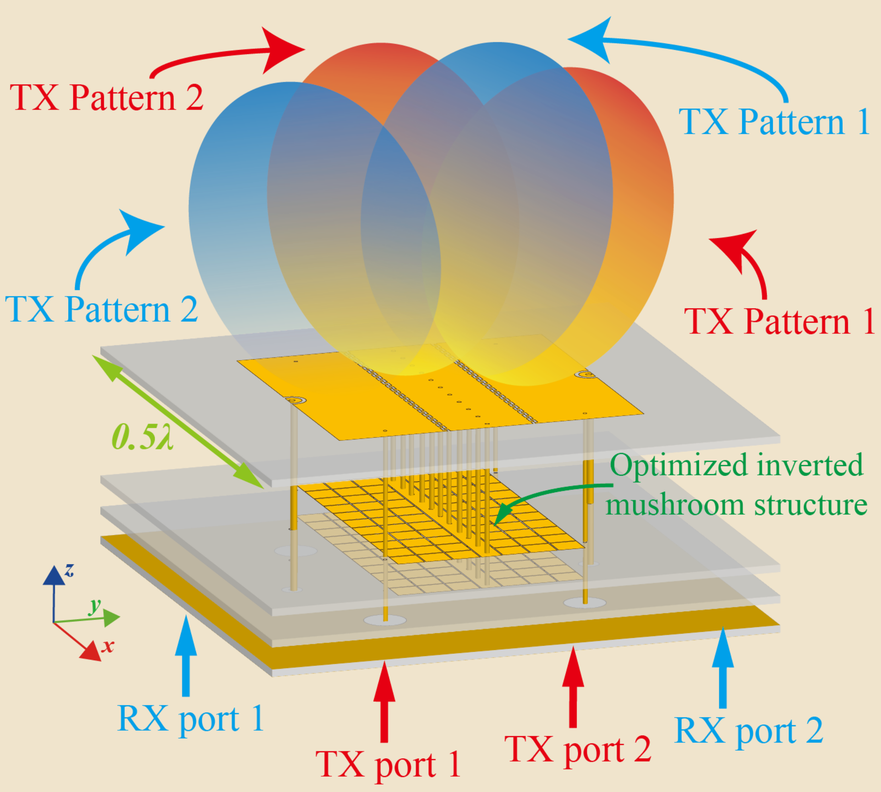
The measured operating bandwidth (return loss < -10 dB for all ports) ranges from 2.52 GHz to 2.6 GHz. The fabricated and measured proposed antenna exhibits over 32 dB self-interference (SI) isolation between Tx and Rx ports and less than -18.2 dB mutual-coupling (MC) within Tx and Rx pairs.



Good agreement between the simulated and measured results is observed, with all Tx/Rx ports radiating in the broadside direction and displaying a minimal squint angle.

The proposed compact MIMO IBFD antenna features two co-polarized Tx and two co-polarized Rx ports with all radiation patterns in the broadside direction. The introduction of an optimized IMR structure at the antenna's center effectively reduces Tx ports MC and ensures efficient radiation for Rx ports. Additionally, polarization-dependent "teeth-like" gaps are implemented to shield Tx ports from the influence of the IMR while maintaining the normal operation of Rx ports. The antenna's design successfully achieves over 32 dB SI isolation between Tx and Rx ports and better than -18.2 dB MC within Tx and Rx pairs. By increasing the number of highly isolated ports from two to four, the proposed antenna demonstrates its potential for application in MIMO IBFD systems.

General concept of the proposed IBFD MIMO antenna



Our Related Publication

1. J. Rao, R. Murch, "A Compact 2×2 In-Band Full-Duplex MIMO Antenna with Shared Aperture and Co-Polarization," 2024 IEEE International Symposium on Antennas and Propagation and North American Radio Science Meeting.

Acknowledgment

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