

(SD2021-267) Improving the Range of WiFi Backscatter Via a Passive Retro-Reflective Single-Side-Band-Modulating MIMO Array

Tech ID: 32667 / UC Case 2021-Z08-1

BACKGROUND

Wi-Fi is the most ubiquitous wireless networking technology for IoT in homes, offices, and businesses. Since the power of Wi-Fi transceivers (10s-to-100s of mW) can be prohibitively high for emerging classes of IoT devices (which desire $<100\mu\text{W}$), recent work has suggested piggybacking baseband signals from the IoT device directly on top of incident Wi-Fi signals generated by access points (APs) via Wi-Fi-compatible backscatter modulation, where as low as $28\mu\text{W}$ of active power has been demonstrated. However, the major limitation of this approach is range.

TECHNOLOGY DESCRIPTION

To increase range over the present limitation, researchers from UC San Diego developed a design that improves on this. In applications where there is sufficient area for multiple antennas, a second design is also proposed that utilizes a passive MIMO-based approach. Specifically, these two designs are fabricated in a single Wi-Fi-compatible IC that employs: 1) a non-absorbing termination approach that enables fully-reflective SSB backscatter modulation, improving measured gain by 4dB and range to 13m; and 2) an entirely passive MIMO antenna array that steers a directional beam back to the AP in a retro-reflective manner while maintaining SSB operation via an IQ-modulated Van Atta array, improving measured gain by 15dB and range to 23m towards pragmatic adoption in home and office environments.

APPLICATIONS

This technology realizes the benefits of MIMO into a Wi-Fi-compatible backscatter system by leveraging the concept of a Van Atta retro-reflector, which reflects incident waves back to their source in a fully passive manner.

In cases where the Wi-Fi source (for example a cellular phone) is within 5m of the tag, communication to an access point $>30\text{m}$ away is possible with the single-antenna fully-reflective termination approach.

INTELLECTUAL PROPERTY INFO

This patent-pending technology improves the state-of-the-art technology of extremely low power WiFi and enables it to work 3x range (30 meters) compared to previous generation. UCSD is seeking companies interested in

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OTHER INFORMATION

KEYWORDS

Radio frequency, Propagation losses, Transceivers, Solid state circuits, Wireless fidelity, Backscatter, MIMO communication, wireless LAN, backscattering tag, single-side band modulation, modulated signals, nonabsorbing termination, Wi-Fi transceivers, IoT device, Wi-Fi-compatible backscatter modulation, piggybacking baseband signals, path loss, Internet of Things

CATEGORIZED AS

- **Communications**
- **Wireless**

RELATED CASES

2021-Z08-1

commercial development. Please contact UCSD's Office of Innovation & Commercialization for licensing terms.

RELATED MATERIALS

► [M. Meng et al., "12.2 Improving the Range of WiFi Backscatter Via a Passive Retro-Reflective Single-Side-Band-Modulating MIMO Array and Non-Absorbing Termination," 2021 IEEE International Solid- State Circuits Conference \(ISSCC\), 2021, pp. 202-204, - 01/31/2021](#)

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