Project title: **24 GHz RX-TX Antenna System with Improved Inter-port Isolation**

Project type: **Bachelor Semester Project (8 credits) or Master Semester Project (10 credits) or Master Thesis Project (30 credits)**

Faculty and Laboratory: STI, Microwaves and Antennas Group (MAG)

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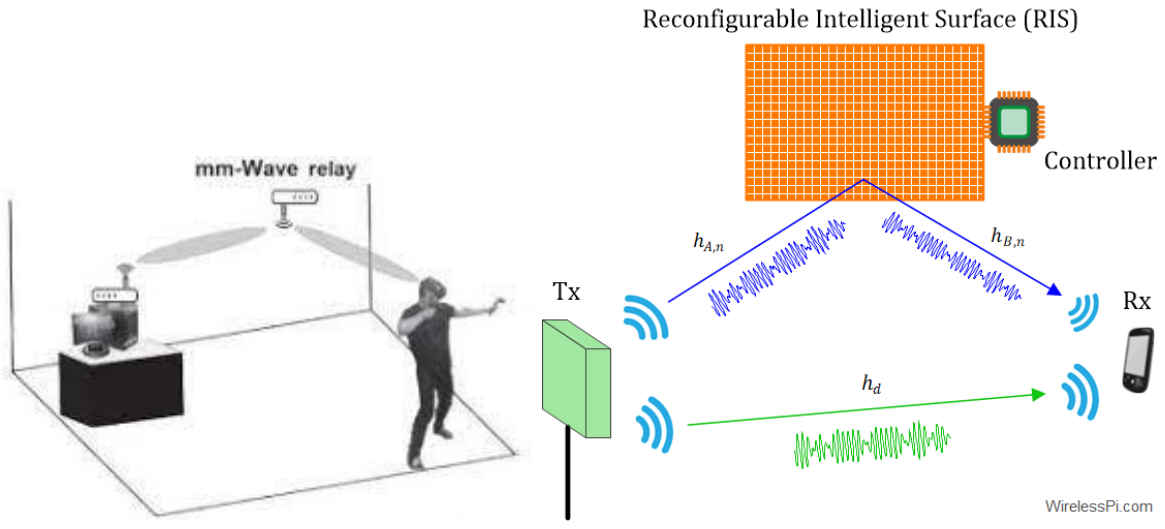
Project Description

One of the major concerns in any mm-Wave links is the higher path loss level in these bands, which needs to be overcome. One possible solution is to use a densely deployed system, however, this will increase the total cost of the system as a variety of electronics need to be used in these systems. Aligned with this need, research studies have been done to overcome this issue by improving the signal level before it reaches its final destination. mm-Wave relays and Reconfigurable Intelligent Surfaces are one of these possible solutions. Nevertheless, to boost the signal, it is important to preserve the isolation level between the receiver and transmitter unit in a co-located system. The system will be used in a relay or boosting unit which amplifies the input signal using the receiver antenna on the system and delivers the power through the TX antenna on the same system. Generally, the received signal will be less than -20 dBm while the output signal will need to be as high as 20 dBm, this brings the necessity of having at least 40 dB inter-port isolation for the co-located system.



Project Goal

The goal is to design a co-located antenna system to sustain at least 40 dB inter-port isolation using only passive circuitries at 24 GHz. The co-located system can be used in a variety of applications such as radar, full duplex communication, and IoT application. No active components will be used and there will be no amplification of the signal at this stage for the project.

Student Tasks

- Study inter-port isolation concept and state of art for mm-wave applications
- Design antenna system with inter port isolation higher than 40 dB
- Fabrication and validation (if time permitted)

Type of Work

- Theory 30%
- Simulation 30%
- Measurement 20%
- Documentation & Reporting 20%

Related works

Z. Wei, X. Zhu, S. Sun, Y. Jiang, A. Al-Tahmeesschi and M. Yue, "Research Issues, Challenges, and Opportunities of Wireless Power Transfer-Aided Full-Duplex Relay Systems," in IEEE Access, vol. 6, pp. 8870-8881, 2018, doi: 10.1109/ACCESS.2017.2779607.

H. Nawaz and I. Tekin, "Dual-Polarized, Differential Fed Microstrip Patch Antennas With Very High Interport Isolation for Full-Duplex Communication," in IEEE Transactions on Antennas and Propagation, vol. 65, no. 12, pp. 7355-7360, Dec. 2017, doi: 10.1109/TAP.2017.2765829.

N. M. Tran, M. M. Amri, J. H. Park, D. I. Kim and K. W. Choi, "Multifocus Techniques for Reconfigurable Intelligent Surface-Aided Wireless Power Transfer: Theory to Experiment," in IEEE Internet of Things Journal, vol. 9, no. 18, pp. 17157-17171, 15 Sept.15, 2022, doi: 10.1109/JIOT.2022.3195948.

N. M. Tran, M. M. Amri, J. H. Park, D. I. Kim and K. W. Choi, "Reconfigurable-Intelligent-Surface-Aided Wireless Power Transfer Systems: Analysis and Implementation," in IEEE Internet of Things Journal, vol. 9, no. 21, pp. 21338-21356, 1 Nov.1, 2022, doi: 10.1109/JIOT.2022.3179691.

Q. -C. Ye, Y. -M. Zhang, J. -L. Li, G. F. Pedersen and S. Zhang, "High-Isolation Dual-Polarized Leaky-Wave Antenna With Fixed Beam for Full-Duplex Millimeter-Wave Applications," in IEEE Transactions on Antennas and Propagation, vol. 69, no. 11, pp. 7202-7212, Nov. 2021, doi: 10.1109/TAP.2021.3109592.