

Introduction

- ❖ Large bandwidth operation to support higher data rate demand
- ❖ Shared-aperture antenna with multiple broadband techniques and decoupling methods
- ❖ Beam steering capability

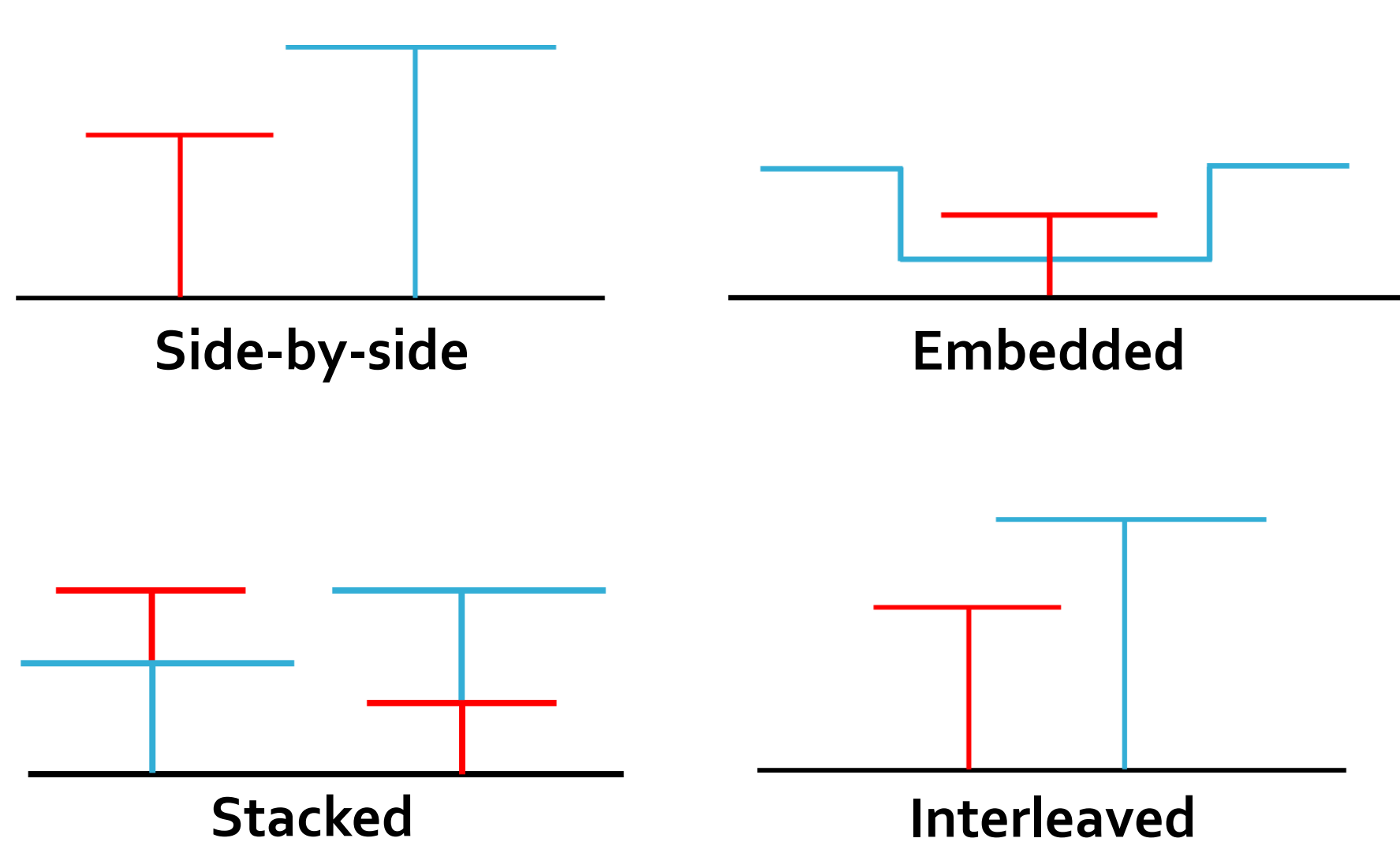
Shared-Aperture Antenna Advantages

- ❖ Compact size, reduce cost and space
- ❖ Increased spectrum utilization efficiency

Challenges

- ❖ Cross-band coupling interference
- ❖ Impedance mismatch
- ❖ Isolation deterioration between ports
- ❖ Distortion of radiation patterns

Classification of Shared-Aperture Antennas

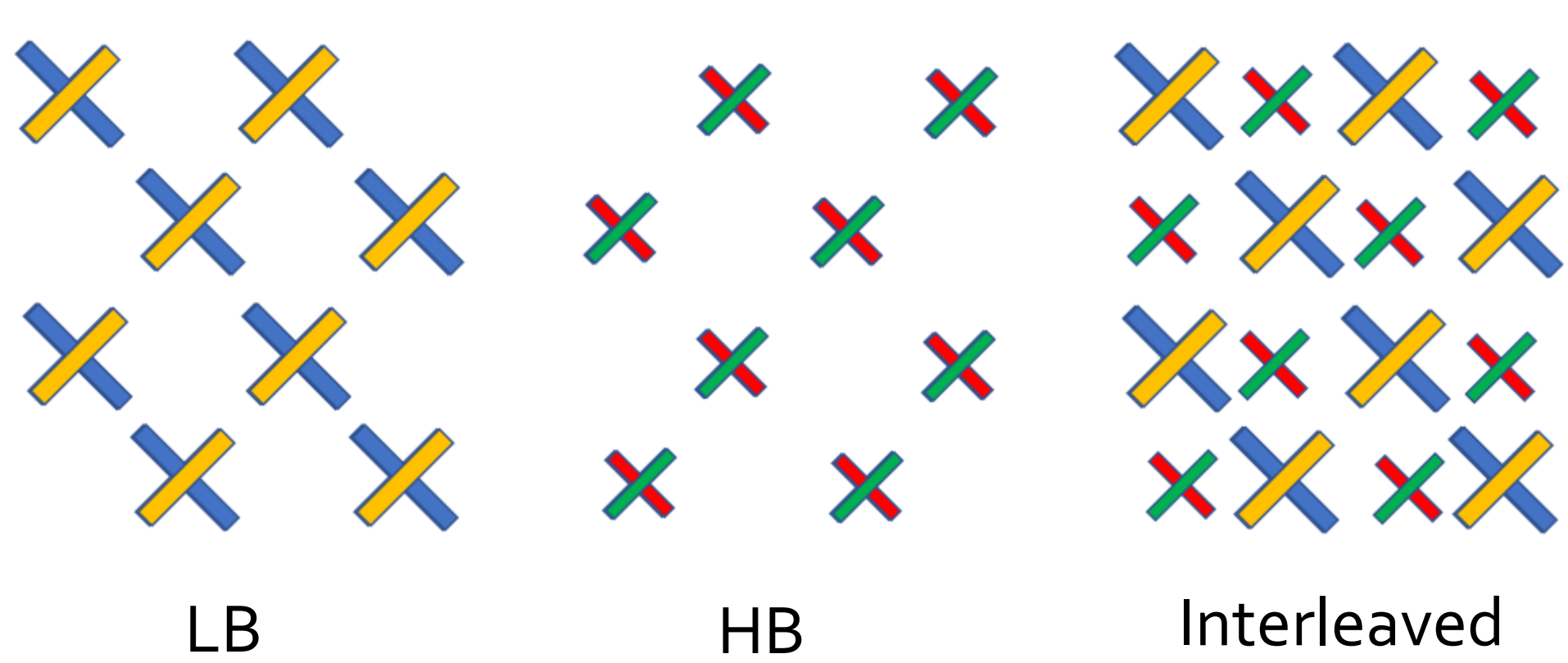


Limitations of different schemes

- ❖ Side-by-side: large size
- ❖ Embedded: small frequency ratio
- ❖ Stacked: high profile
- ❖ Interleaved: scattering

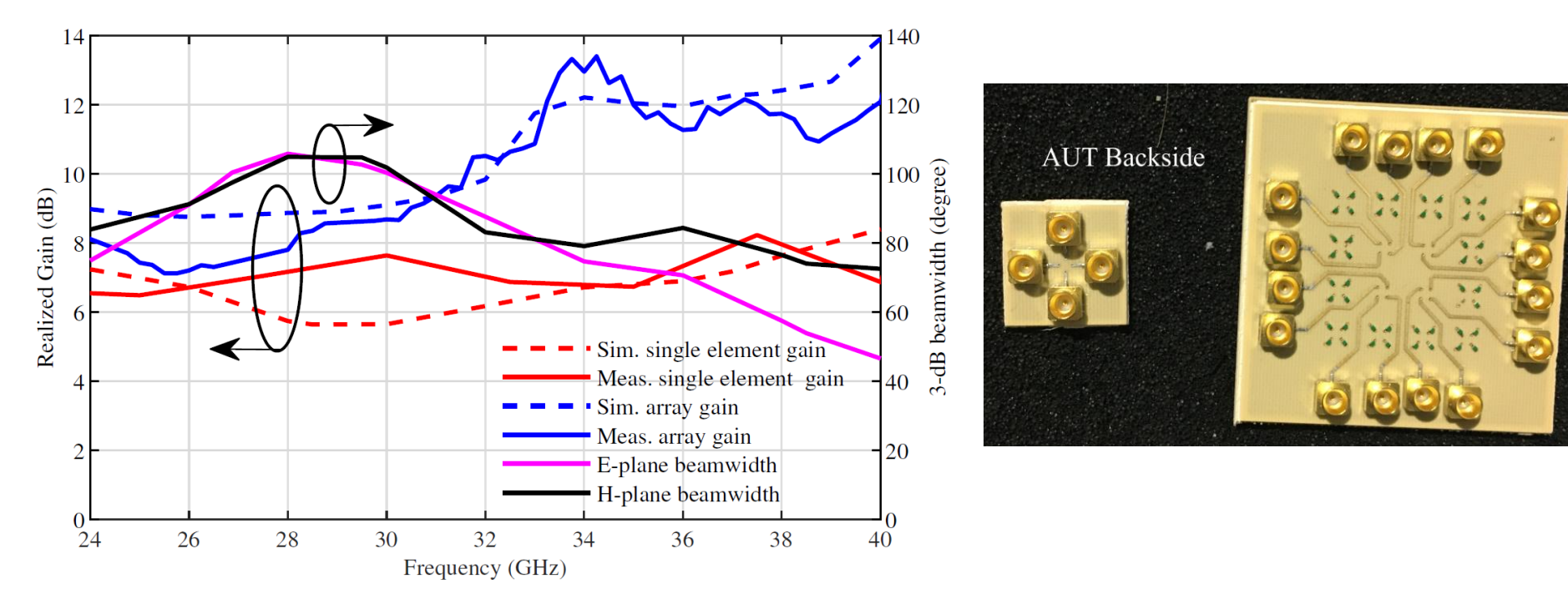
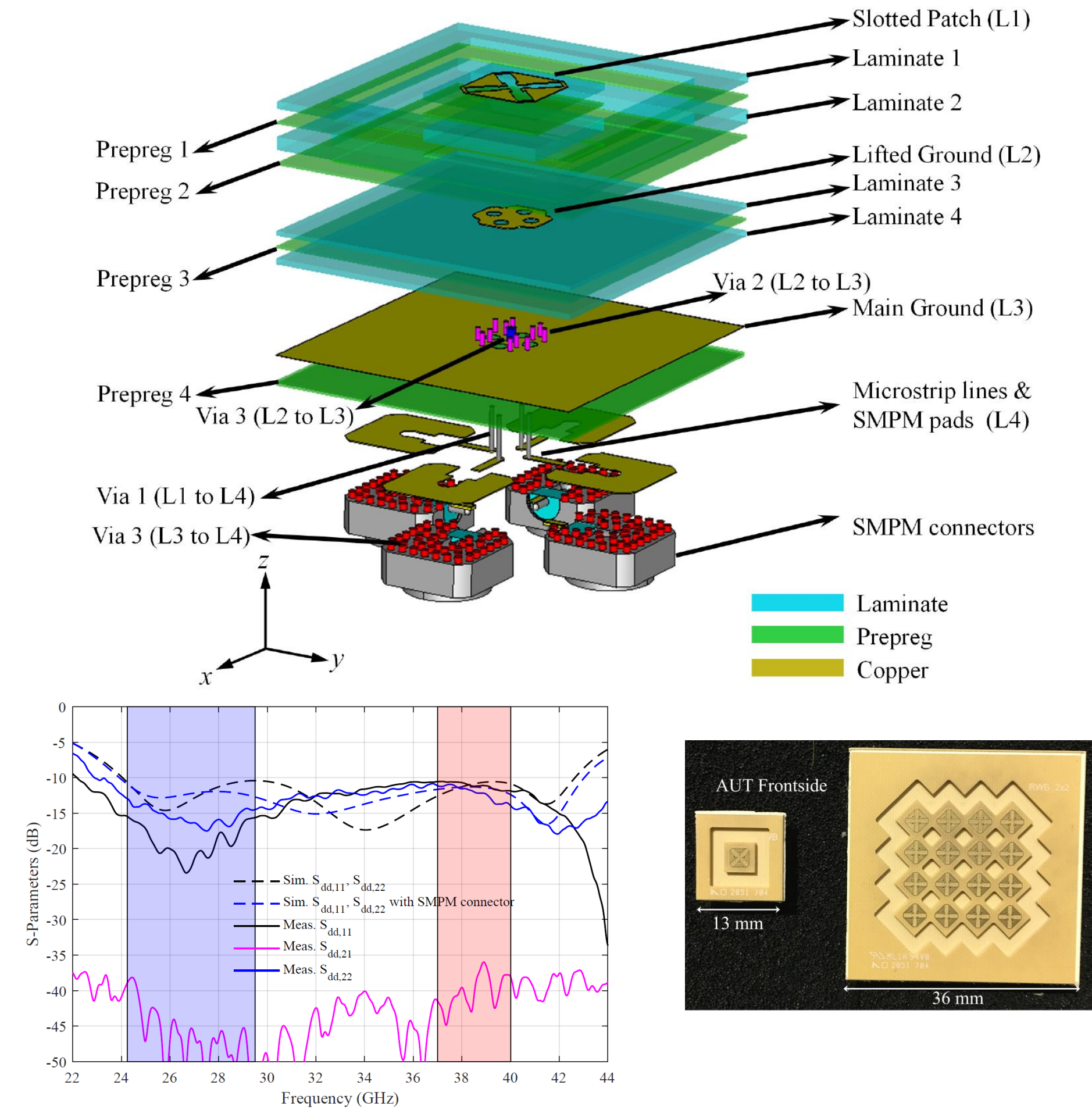
Objectives

- ❖ FR1 (Sub-6 GHz); FR2 (24.25-71 GHz); extension frequency range 7-24 GHz
- ❖ High gain (single element)
- ❖ High cross polarization discrimination
- ❖ Arrays with wide angle beam steering capability
- ❖ Potential shared-aperture scheme



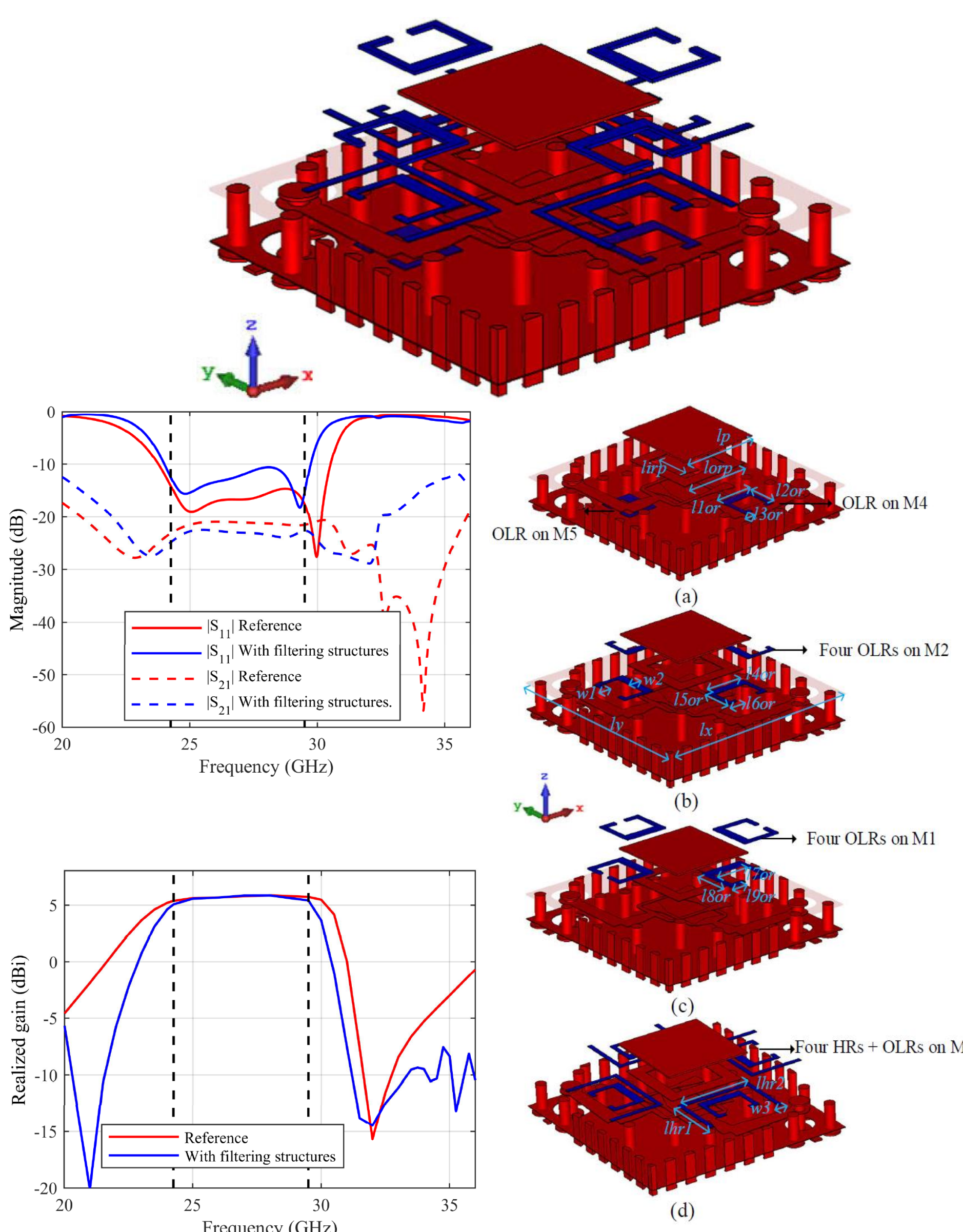
Our Works

- ❖ Broadband 57% impedance bandwidth of 24-43 GHz (differential-fed)



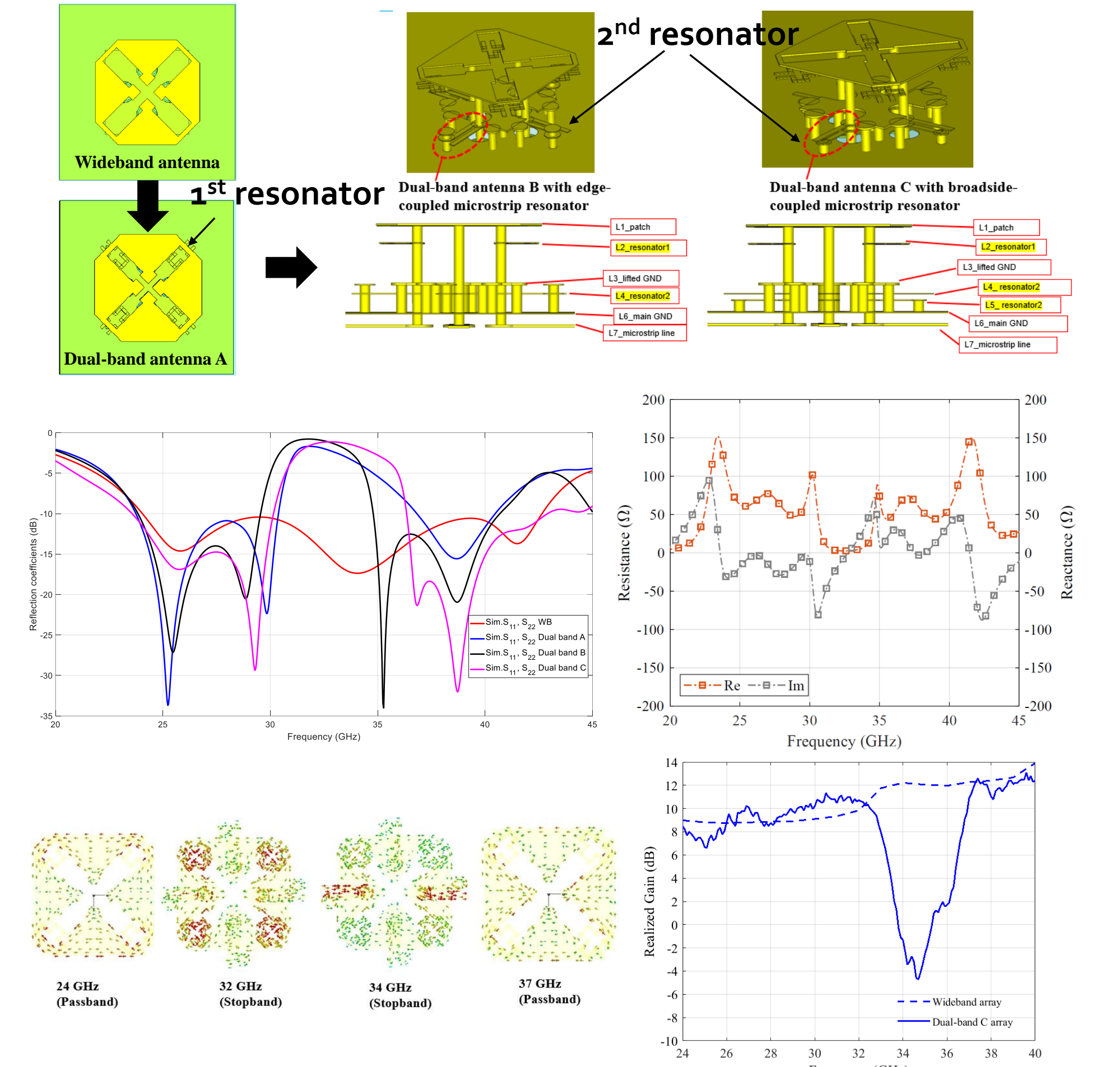
Chen, Jiangcheng, Markus Berg, Kimmo Rasilainen, Zeeshan Siddiqui, Marko E. Leinonen, and Aarno Pärssinen, "Broadband Cross-Slotted Patch Antenna for 5G Millimeter-Wave Applications Based on Characteristic Mode Analysis," IEEE Transactions on Antennas and Propagation, vol. 70, no. 12, pp. 11277-11292, 2022.

- ❖ Broadband 20% impedance bandwidth (single-ended) with Open-Loop (OLRs) and Hairpin (HRs) Resonators



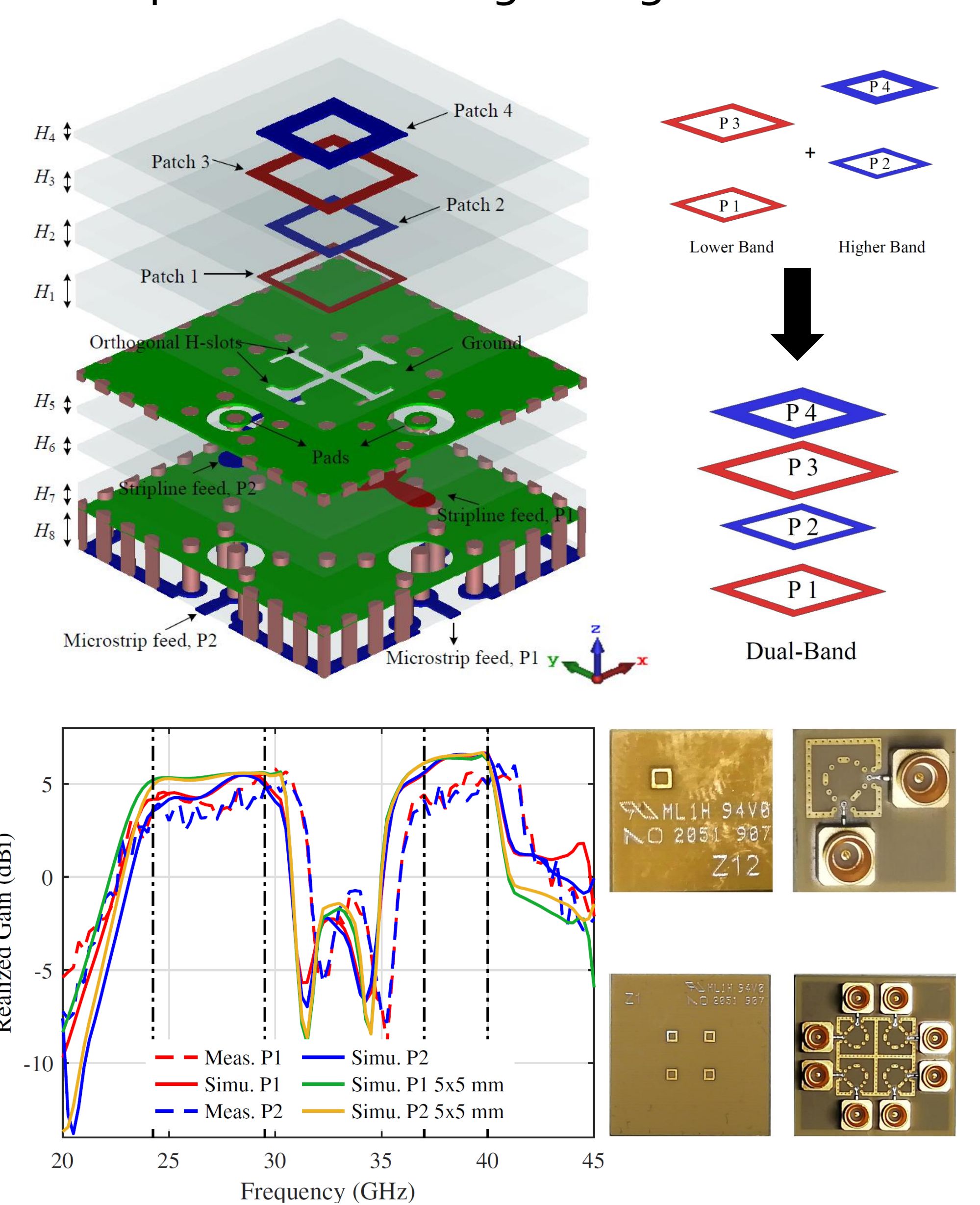
Siddiqui, Zeeshan, Marko Sonkki, Kimmo Rasilainen, Jiangcheng Chen, Markus Berg, Marko E. Leinonen, and Aarno Pärssinen, "Dual-polarized filtering antenna for mm-wave 5G base station antenna array," In 2021 15th European Conference on Antennas and Propagation (EuCAP), pp. 1-4, IEEE, 2021.

- ❖ Dual band (differential-fed) with band stop filtering response



J. Chen and M. Berg, "Multi-band antenna arrangement," U.S. Patent 11,276,923 B2, Mar. 15, 2022.

- ❖ Dual-band (single-ended) with filter like response in stacking configuration



Siddiqui, Zeeshan, Marko Sonkki, Kimmo Rasilainen, Jiangcheng Chen, Markus Berg, Marko E. Leinonen, and Aarno Pärssinen, "Dual-Band Dual-Polarized Planar Antenna for 5G Millimeter-Wave Antenna-in-Package Applications," IEEE Transactions on Antennas and Propagation (Early Access 2023).

Future Works

- ❖ Potential antenna design structure (FR1: interleaved, FR2: stacking)
- ❖ Multiband coverage enhancement
- ❖ High port-to-port isolation and low inter element mutual coupling
- ❖ Wide angle beam steering $\pm 60^\circ$
- ❖ AiP applications (FR2)