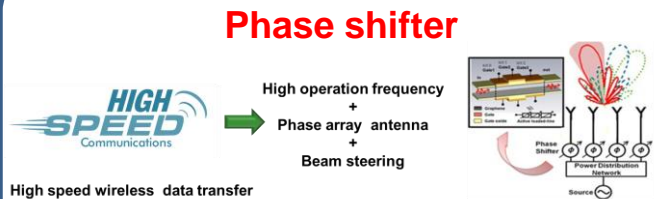


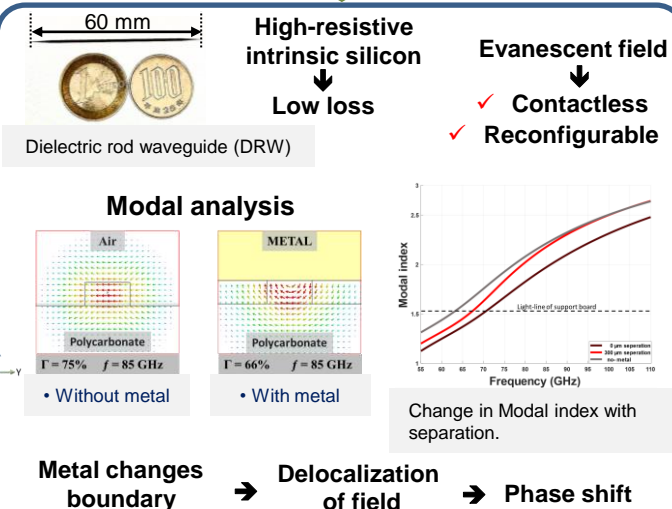
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MOTIVATION

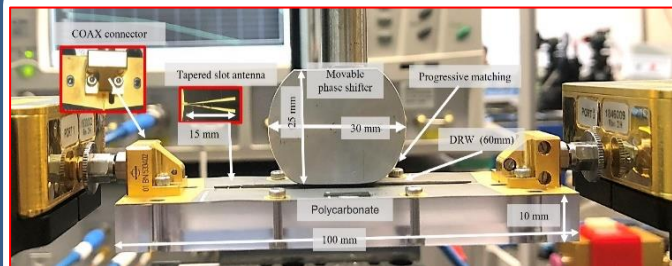


- ✓ A broadband phase shifter for phase array antenna and beam steering.
- ✓ Traditional phase shifter are lossy, lower phase shift and expensive [1].

CONCEPT



EXPERIMENT

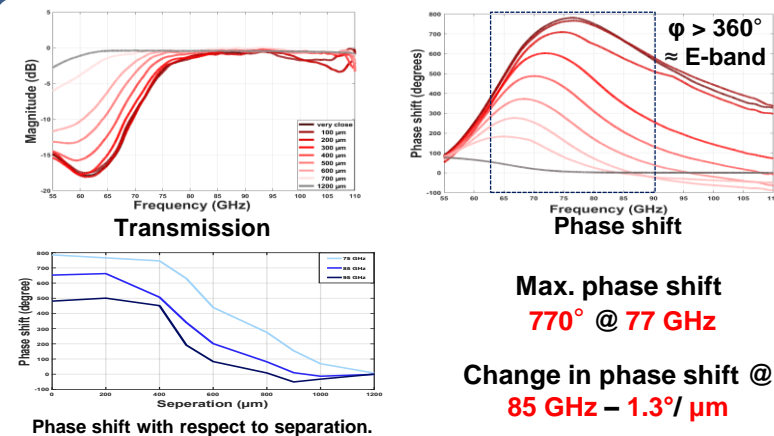


- ❖ Millimeter-wave VNA → COAX W1 → TSAs for broadband operation [2,3].
- ❖ Metal block is curved at the edges for progressive matching.
- ❖ High-precision linear translation stage to introduce metal block to DRW.
- ❖ Polycarbonate board, holds waveguide, COAX W1 and TSAs all together.
- ❖ All obtained results are normalized against the measured response without metal block.

## Benefits:

- ❖ A longer interaction length → higher degree of phase shift.
- ❖ Progressive matching → effective coupling.

MEASUREMENTS



CONCLUSION

- ✓ **Contactless, Non-Resonant Broadband Phase Shifter featuring:**
  - ❖ Demonstration of mm-wave phase shifter → maximum of 770° at 77 GHz & minimum of 360° over 65-100 GHz.
  - ❖ Non-resonant → broad bandwidth.
  - ❖ No doped semiconductors → low loss.
  - ❖ Development of integrated terahertz-range phase shifters → towards terahertz phased array antenna.

## Reference

1. I. P. Kaminow, et al., "Thin- film LiNbO<sub>3</sub> electro-optic light modulator," Applied Physics Letter, May 1973.
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3. D. Headland et al., "Broadband liquid sensing of sealed microfluidic channel using mm-wave dielectric rod waveguide," IRMMW-THz, Aug. 2022.

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