WASSAP - Wireless At Sub-mm waves: Signals, Antennas and Photonics

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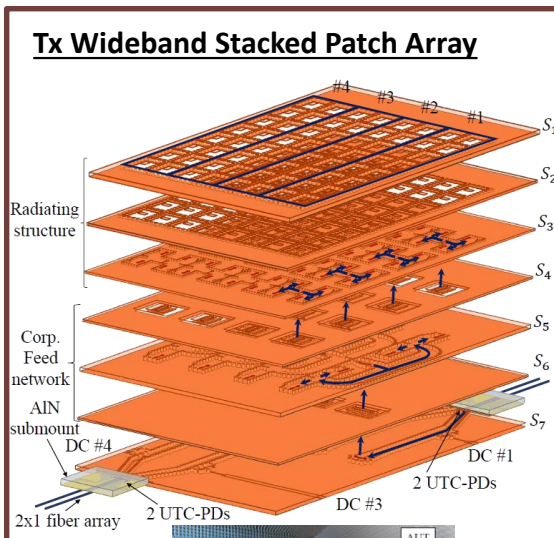
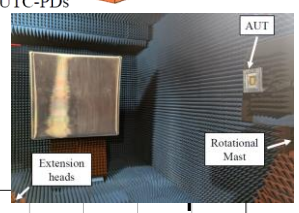
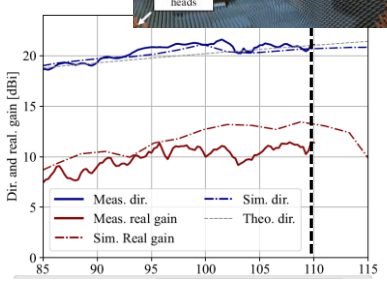
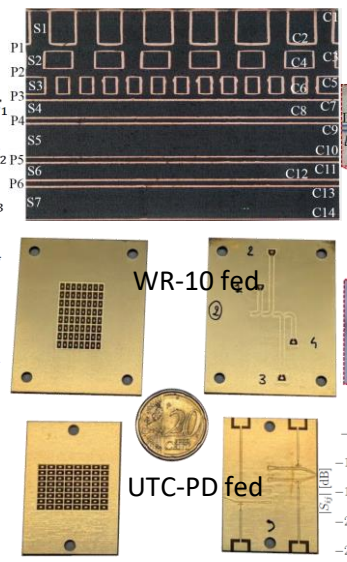
WP1: Design and fabrication of photonic transmitting antenna arrays

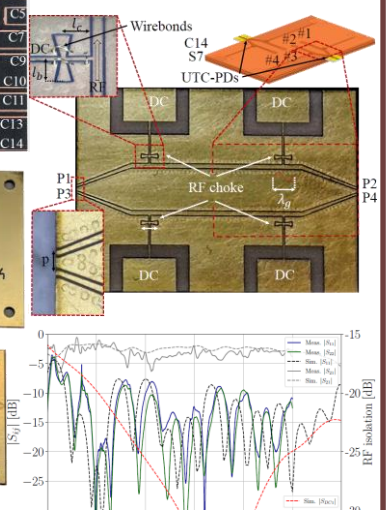
Tx Wideband Stacked Patch Array



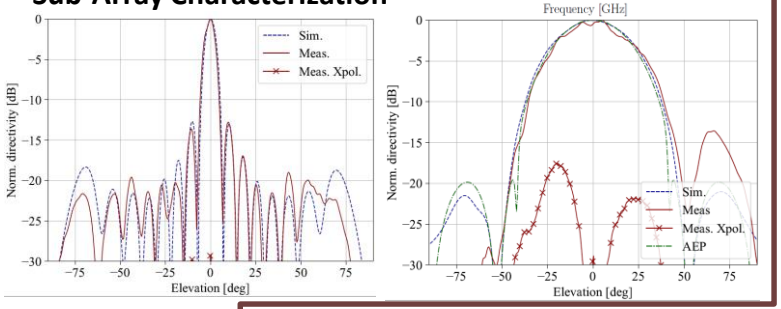








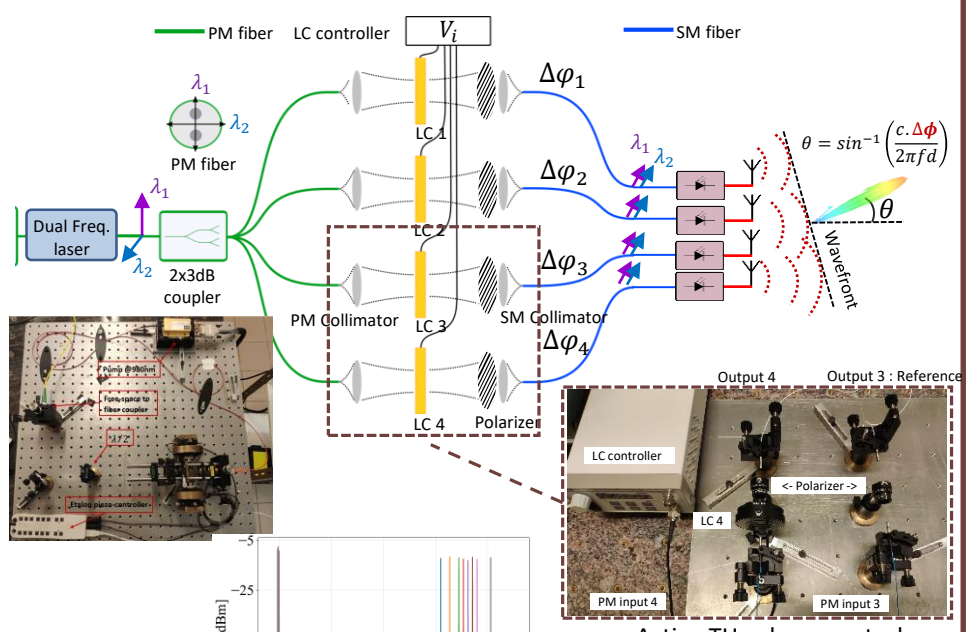
Sub-Array Characterization

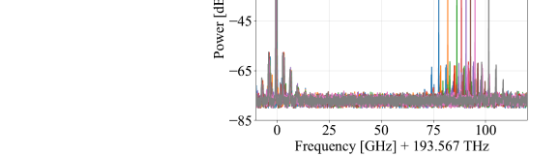


- Large gain bandwidth ~ **25 GHz**
- Standard but complex HDI PCB process
- Beam scanning capabilities up to +/- 10°

WP2: Design and implementation of photonic sub-systems.

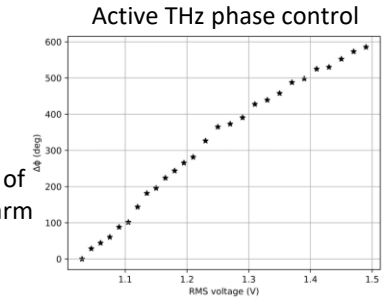
Optical beam forming network



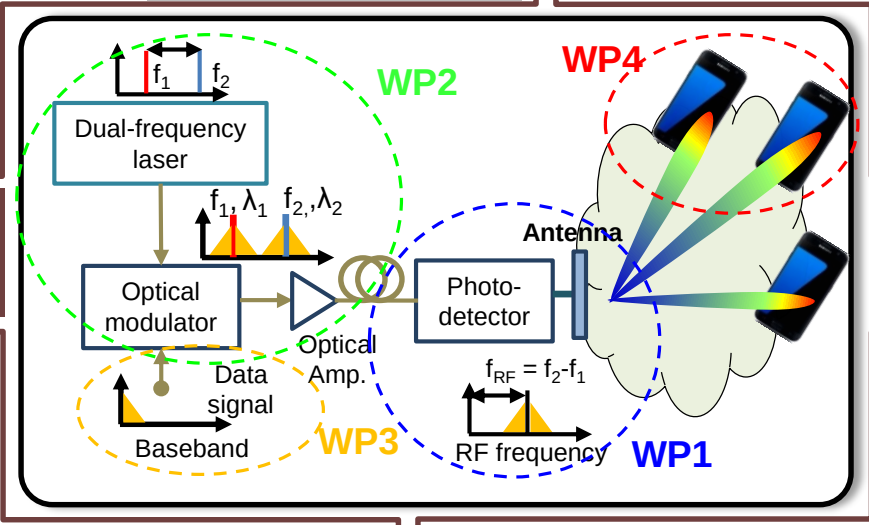


Tuning by adjusting the tilt angle of the etalon on the extraordinary arm

Active THz phase control

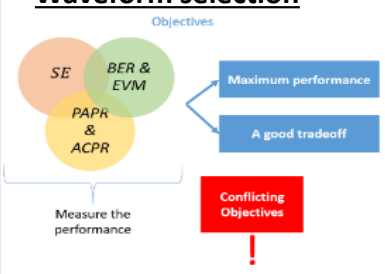


- Easy and stable THz phase control
- Frequency/phase independence: Multi-carrier capable
- Photonic Integrated Circuit (PIC) compatible



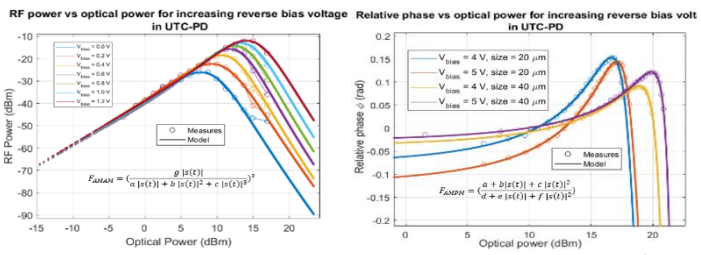
WP3: Signal processing, modulation and waveforms

Waveform selection



Comparison metrics:
- Bit Error Rate (BER),
- Peak-to-Average Power Ratio (PAPR),
- Adjacent Channel Power Ratio (ACPR),
- Spectral Efficiency (SE),
- Error Vector Magnitude (EVM).

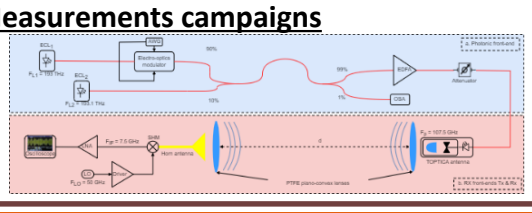
Photodiode non-linearity



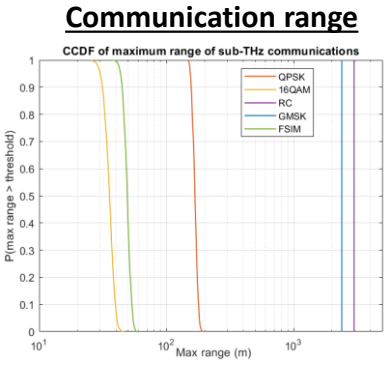
Waveforms against non-linearity:
- CPM: robust,
- FSIM: highly vulnerable,
- M-QAM: vulnerable.

Signal parameters:
- Fc = 107.5 GHz
- B = 11 GHz

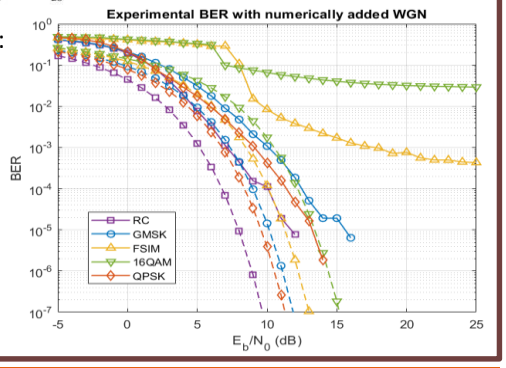
Measurements campaigns



Communication range



Experimental results [1]



WP4: System demonstrations

Phase-less Near-field antenna measurements [2]

Interests:
- Amplitude measurement only
- Fixed device under test
- OTA meas. of modulated signal
- Beamforming measurement

(a) Reconstructed phase (Left) and theoretical phase (Right)
(b) Reconstructed 3D radiation pattern

(Left) Reconstructed normalized far-field in E-Plane and (Right) H-Plane

Wireless coherent near-field live transmission [3]

References

[1] P. Desombre, H. Farès and Y. Louët, "Continuous Phase Modulation Proposal for Photonics-Wireless Sub-THz Transmissions, " *IEEE Access*, vol. 12, pp. 100217-100229, 2024
[2] M. Mehraz, F. Gallée, "Impact of measurement parameters on antenna radiation pattern reconstruction using phaseless iterative technique," *IEEE Conf. Antenna Meas. Appl.*, Genoa, 2023.
[3] J. Taillieu et al., "High Data-Rate Sub-THz Coherent Near-Field Wireless Links Enabled by Spline-Profile Bessel Launchers," *18th Eur. Conf. Antennas Propag. (EuCAP)*, Glasgow, UK, 2024, pp. 1-4.