

WP1: Design and fabrication of photonic transmitting antenna arrays

Tx Wideband Stacked Patch Array

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

Gain and directivity at 0°, 5° and 10° steering angle

Radiation pattern at 0°, 5° and 10° steering angle

Tx Narrowband Modulated Metasurface Array

3dB gain bandwidth ~ 5 GHz

Gain over frequency and elevation angle

H plane radiation pattern - Scanning plane

- Low manufacturing complexity
- Easily upscalable gain in both planes

WP2: Design and implementation of photonic sub-systems.

Optical beam forming network

Active THz phase control

Measured RF phase offset according to liquid crystal RMS voltage at $F_0 = 12$ GHz

- Easy and stable THz phase control
- Frequency/phase independence : Multi-carrier capable
- Photonic Integrated Circuit (PIC) compatible
- Coming improvement : Phase locking of each arm for long term stability

WP3: Signal processing, modulation and waveforms.

Waveform selection

Objectives: SE, BER & EVM, PAPR & ACPR

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.

Measurements campaigns

WP1: Design and fabrication of photonic beam-steerable transmitting antenna array

WP2: Design and implementation of photonic sub-systems

WP3: Signal processing, modulation and waveforms

WP4: System demonstrations

WP4: System demonstrations

Near-field antenna measurements

1- Type of scan and path description

2- Phase-less processing

3- Near-field to far-field (FEKO)

Wireless coherent near-field live transmission

- Error free 90 GHz link at both 15.5 Gb/s with QPSK waveform and 7.3 Gb/s with RC waveform
- Bandwidth limited by the non-uniform power emission of the THz emitter
- Incoming demonstration with homemade THz source with higher power and linearity for 100m+ links with beam steering capabilities