WE2B-3

High Capacity Dual-Polarization THz-Wireless Transmission in the 300 GHz Band using a Broadband Orthomode Transducer

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    1. Experimental Setup
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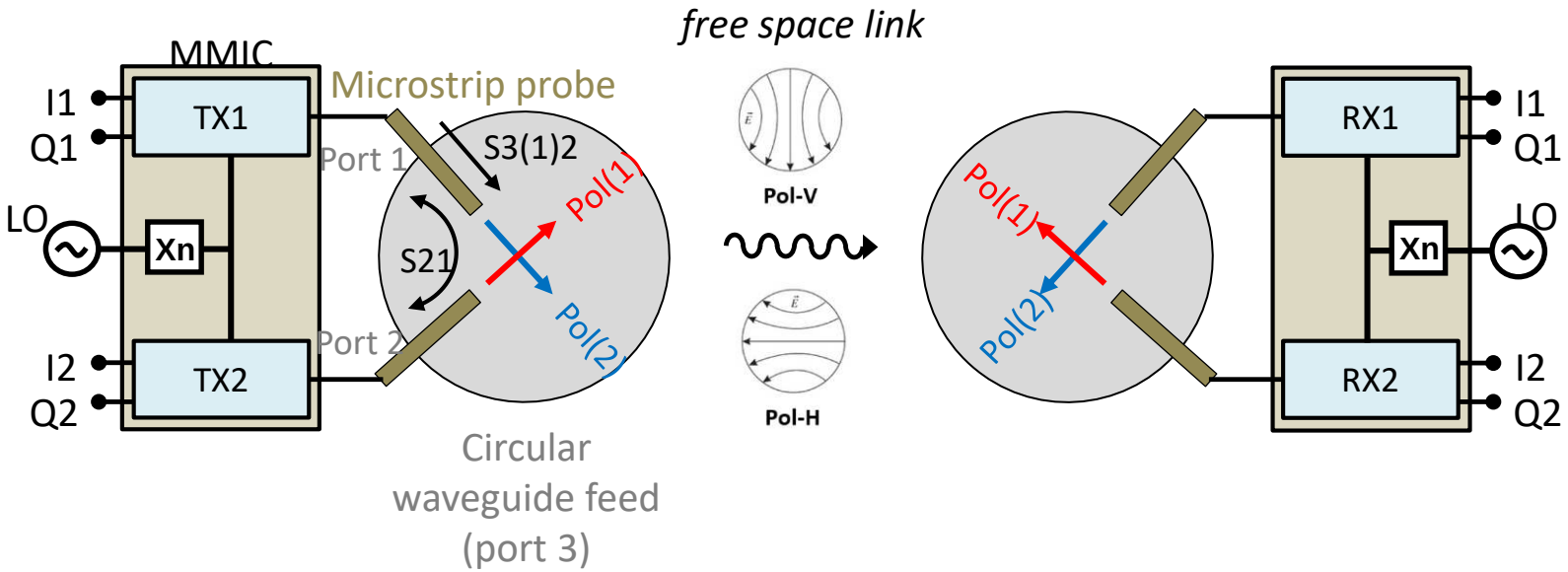
Introduction

- Dual polarization transmission allows doubling the capacity
- Broadband Orthomode Transducer (OMT) is a key component for high-capacity THz-wireless transmission
  - Enables multiplexing/demultiplexing of two orthogonal polarizations

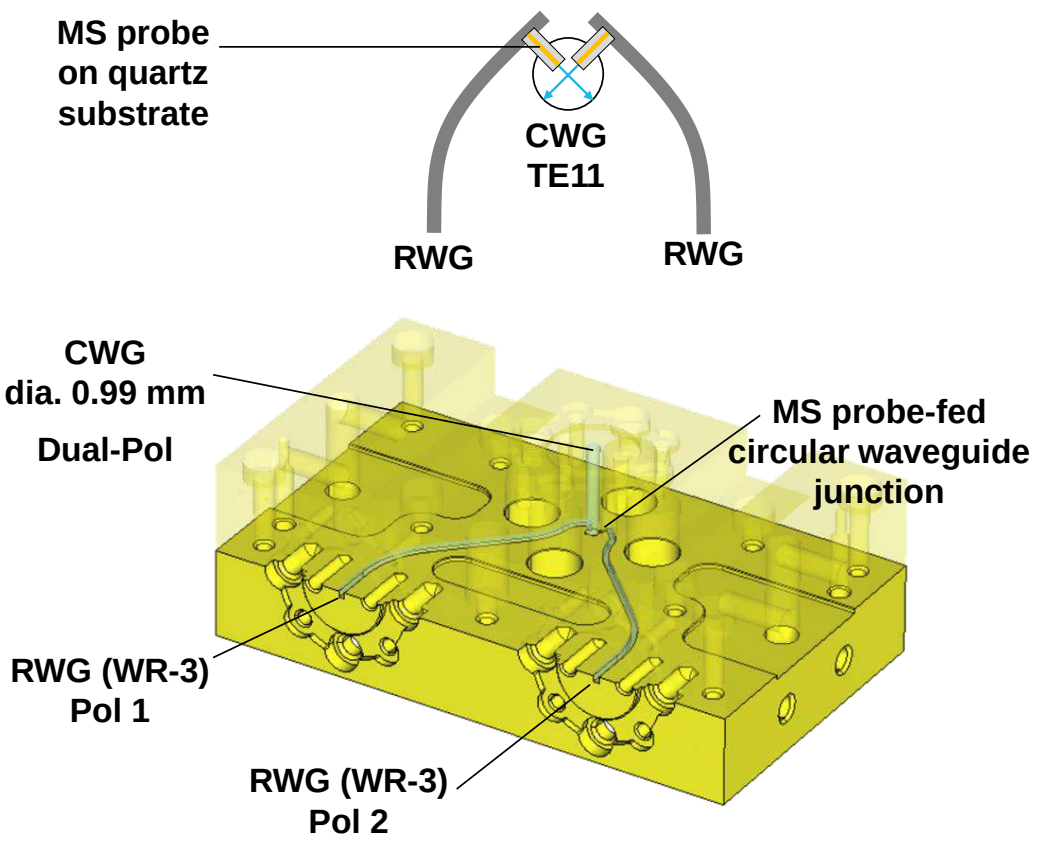


Introduction

- Different solutions for OMTs that require rather complex 3D-machining for fabrication
  - e.g. T-junction OMTs, Boifot OMTs , turnstile junction OMTs
- Recently: multi-layer 2.5D-silicon micromachining and additive 3D fabrication
- Microstrip-probe fed circular waveguide (CWG) junctions have been mostly used at lower frequencies so far
- This paper: microstrip-probe fed CWG junction OMT in transmission test in the 300 GHz band with a capacity of up to 100 Gbps

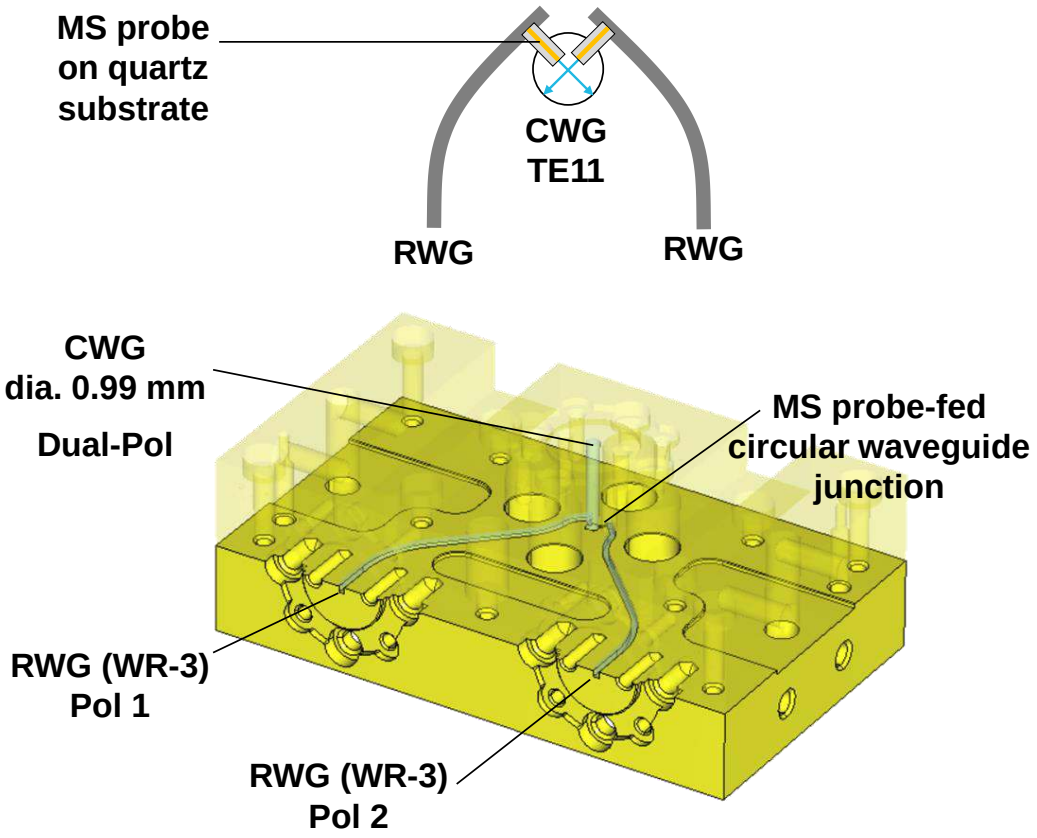
Broadband Orthomode Transducer

- Concept:
  - Connects two WR-3 rectangular waveguide (RWG) ports (TE10 mode) with a circular waveguide (CWG) port (TE11 mode)
  - Transition between the RWG modes and CWG modes is accomplished by two microstrip probes



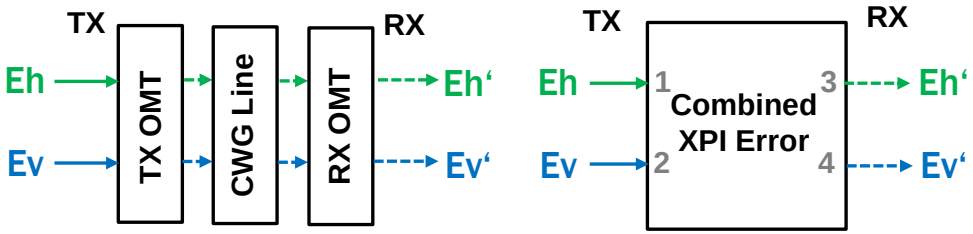
Broadband Orthomode Transducer

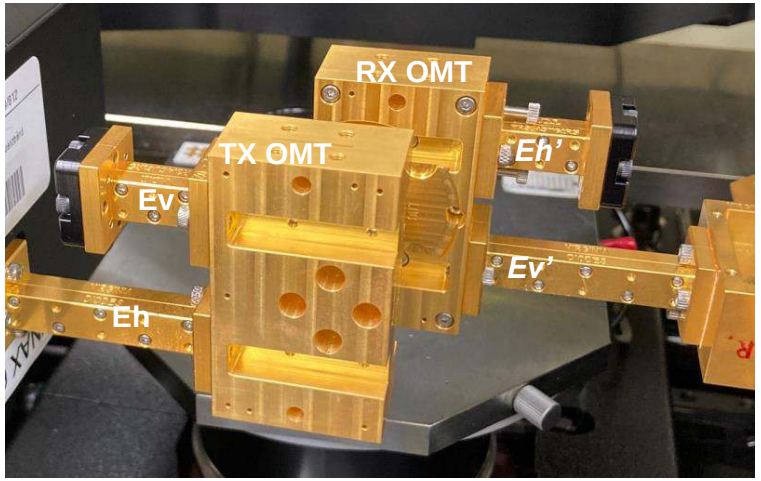
- Advantages:
  - OMT of this work shows small insertion losses by asymmetrically feeding the back-shorted circular waveguide
  - Cross polarization performance is improved by probe and backshort optimization

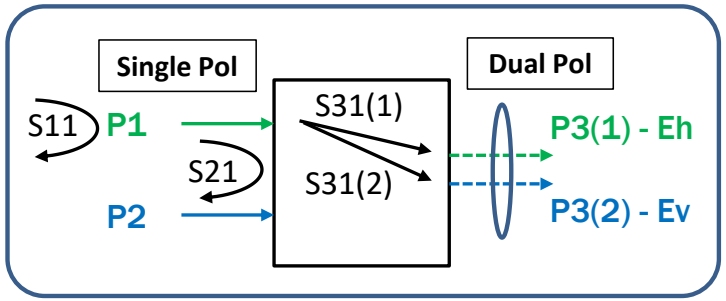


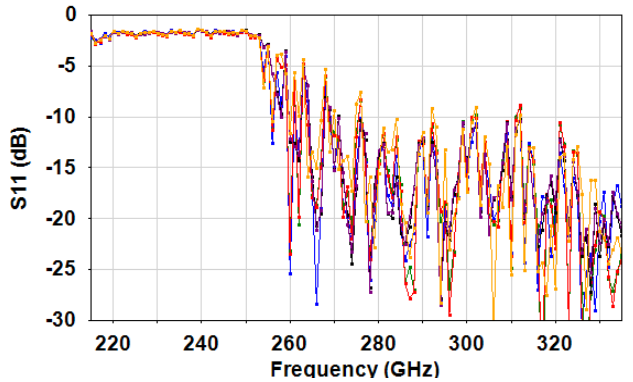
Broadband Orthomode Transducer

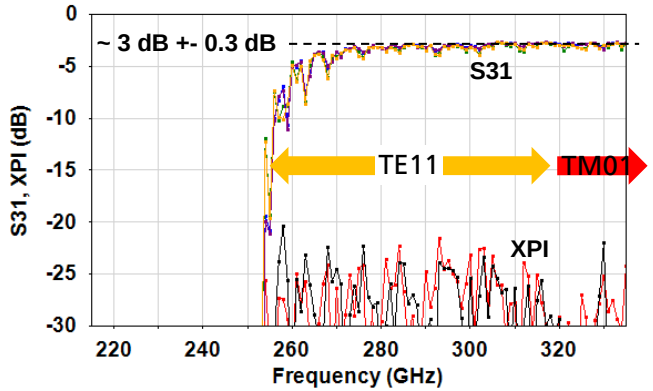
- S-parameter characterization measurement (B2B config.)
  - bandwidth > 40 dB, 3 dB insertion loss, polarization crosstalk < -25 dB





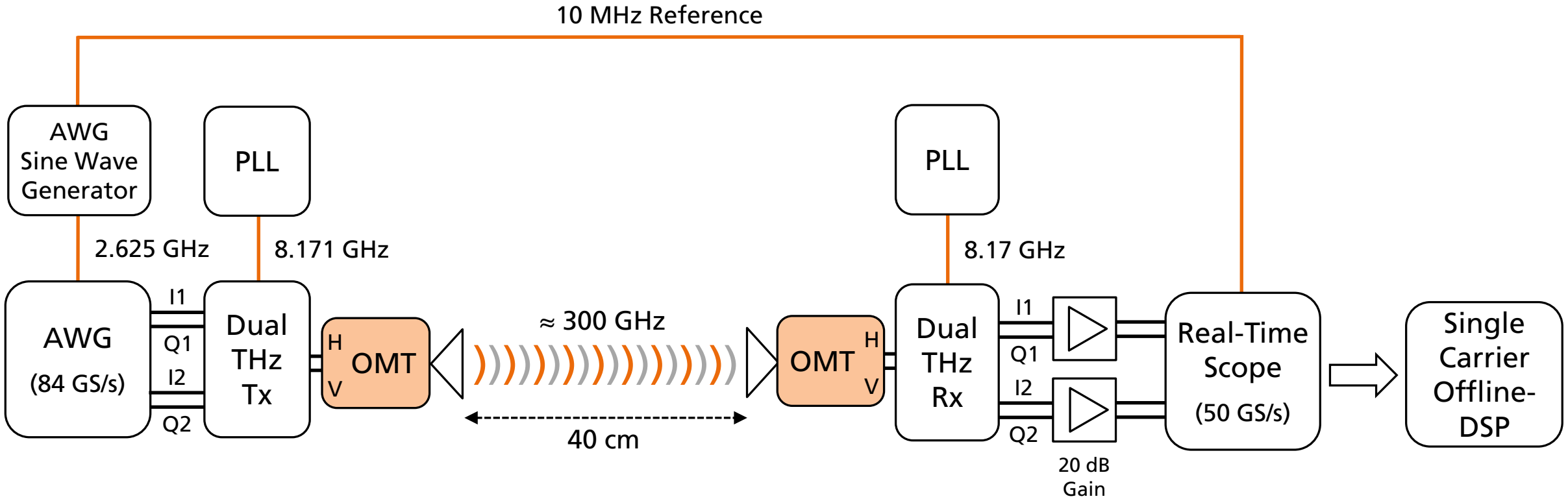






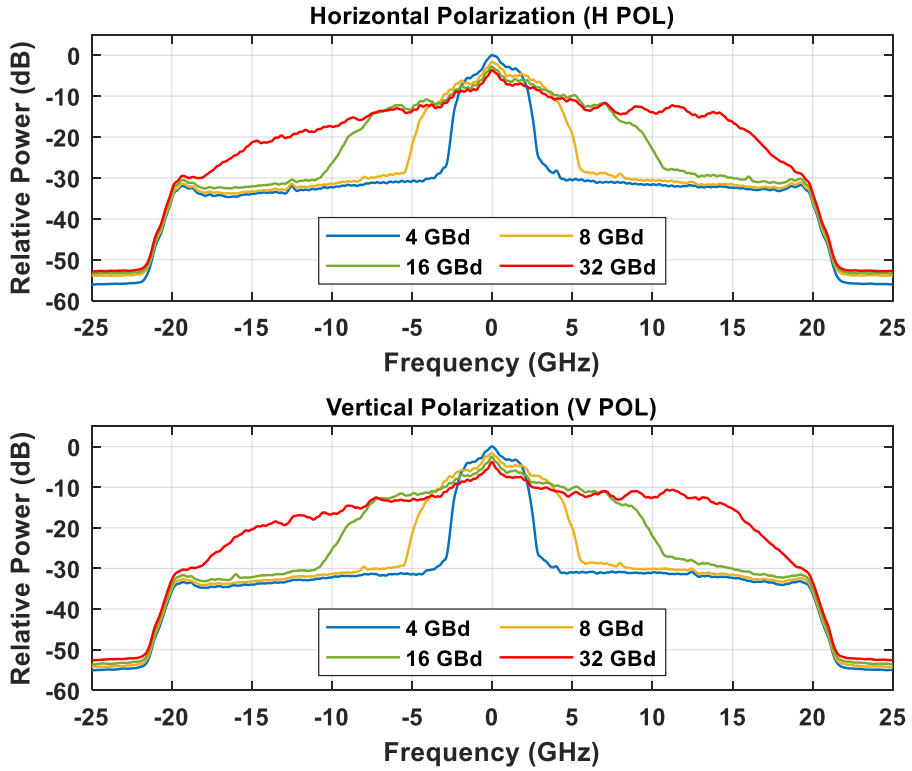
Transmission Experiment

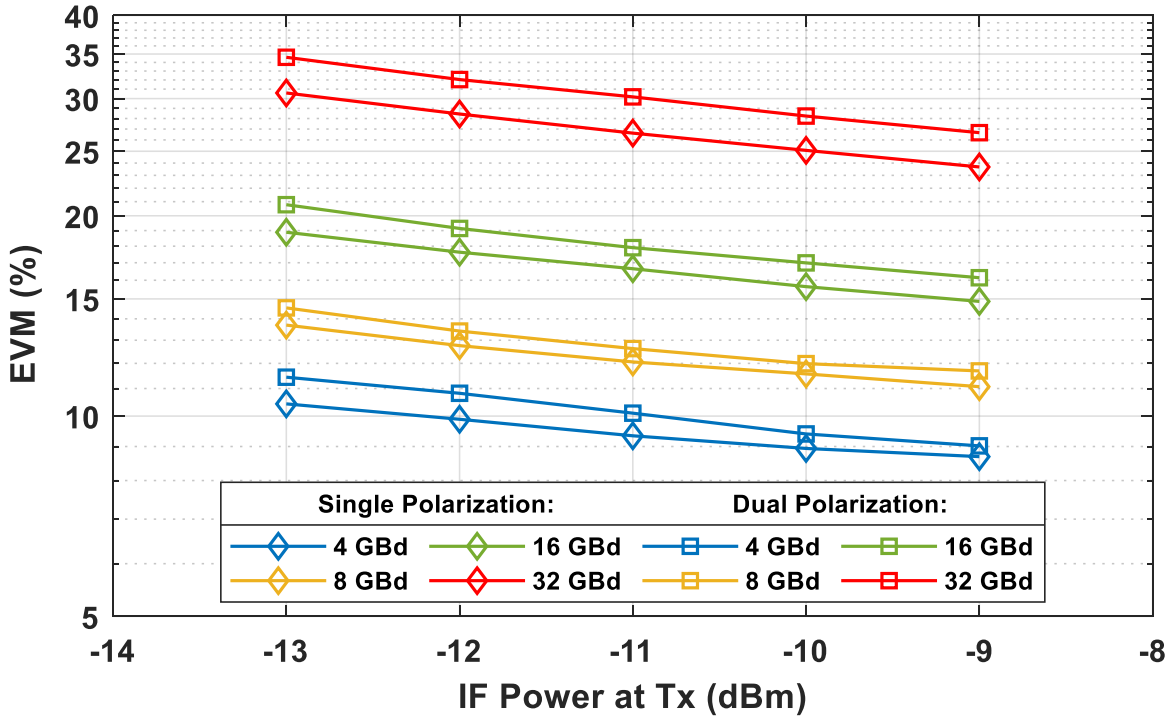
- Experimental setup for symbol rates up to 32 GBd
  - for P2P measurements with dual Tx and Rx modules including OMT
  - allows for single and dual polarization measurements



Transmission Experiment

- Measurement results (Dual Pol. vs. Single Pol.)
  - only small degradations in EVM due to cross-polarization effects





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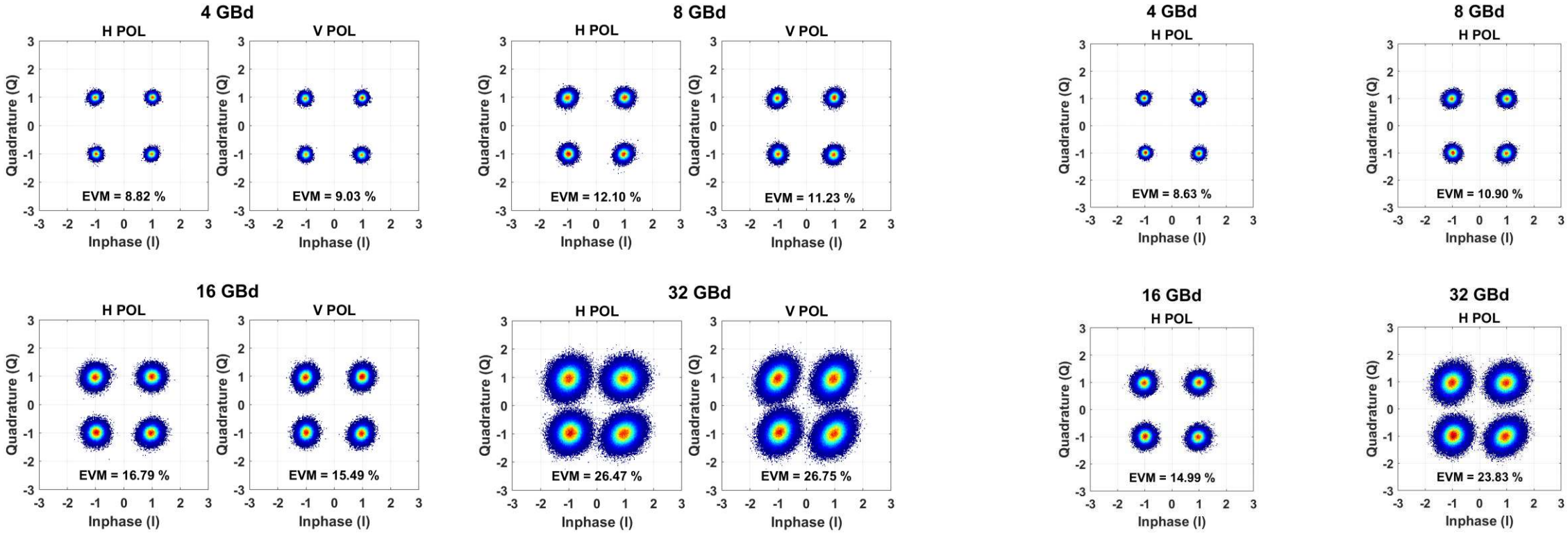

Comparison

- Transmission experiments:

Parameter	This work	Ref. [1]
Carrier Frequency	294 GHz	302 GHz
Data Rate	100 Gbps	10 Gbps
Distance	40 cm	10 cm

- OMT:

Parameter	This work	Ref. [2]
Principle of Operation	Microstrip-probe fed CWG junction	Turnstile-junction
Frequency Range	270 - 320 GHz	220 - 330 GHz
Bandwidth	> 40 GHz	40 GHz
Insertion Loss (avg.)	3 dB	0.3 dB
Cross Polarization Interference (avg.)	> 25 dB	60 dB

[1] S. Haussmann et al., "Polarisation Multiplex in 300 GHz Wireless Communication Link using Orthomode Transducer" (2022)

[2] A. Gomez-Torrent et al., "Compact Silicon-Micromachined Wideband 220–330-GHz Turnstile Orthomode Transducer" (2019)

Conclusion

- high-capacity dual-polarization broad-band transmission in the 300 GHz band has been presented
- while using a new orthomode transducer with > 40 GHz bandwidth, < 3 dB linear loss and < -25 dB polarization crosstalk
- net bit rates of > 100 Gb/s using 4QAM modulation with symbol rates of up to 32 GBd reached
- comparison to single-polarization system measurements show only a small performance degradation due to polarization crosstalk

Thank you for your attention.

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