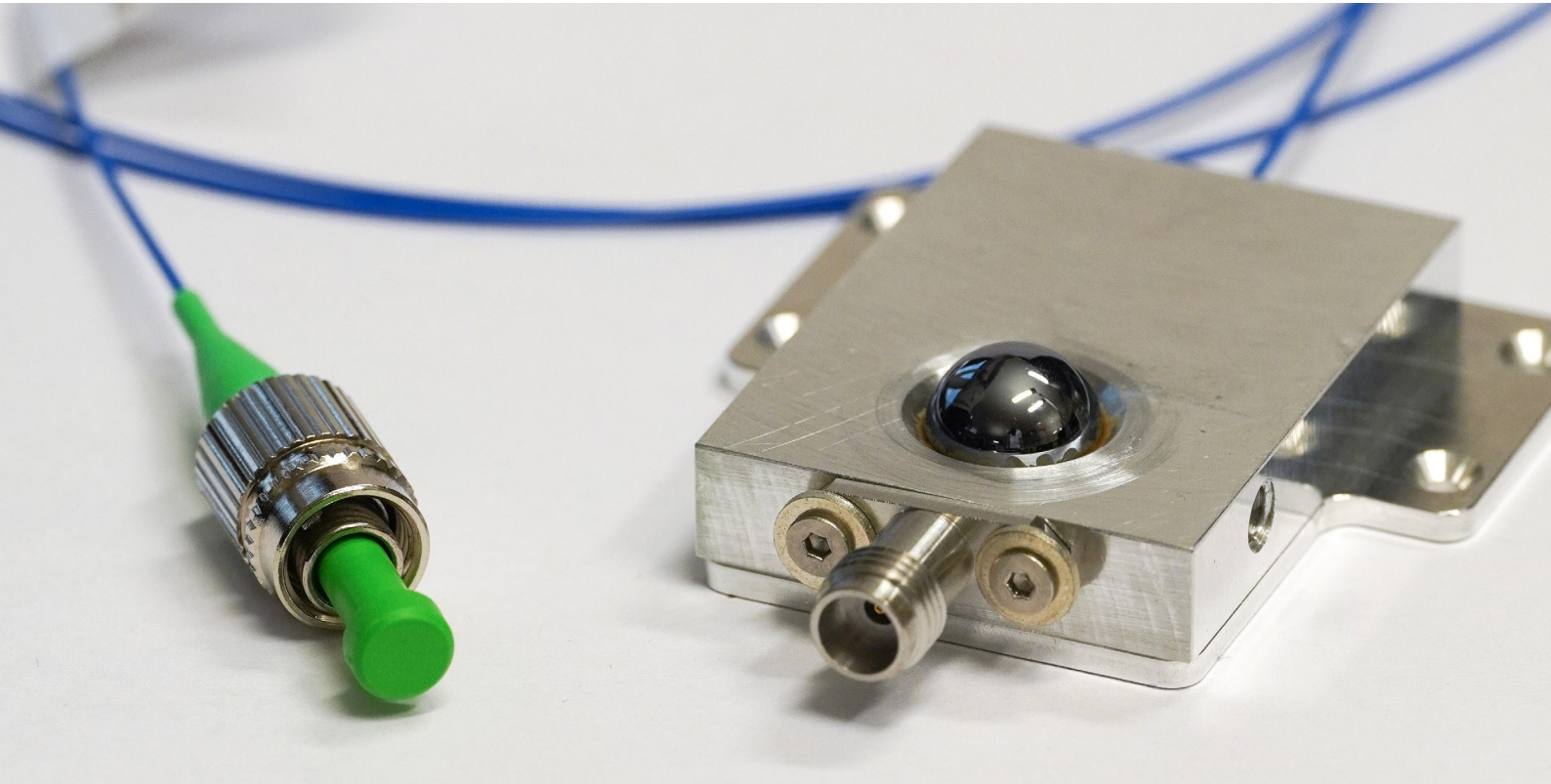


PHOTONIC HETERODYNE RECEIVERS FOR CONTINUOUS WAVE TERAHERTZ APPLICATIONS



AT A GLANCE

Heterodyne receivers enable communication and sensing at intermediate frequencies up to 40 GHz and carrier frequencies from 0.1 THz to 5 THz



Features

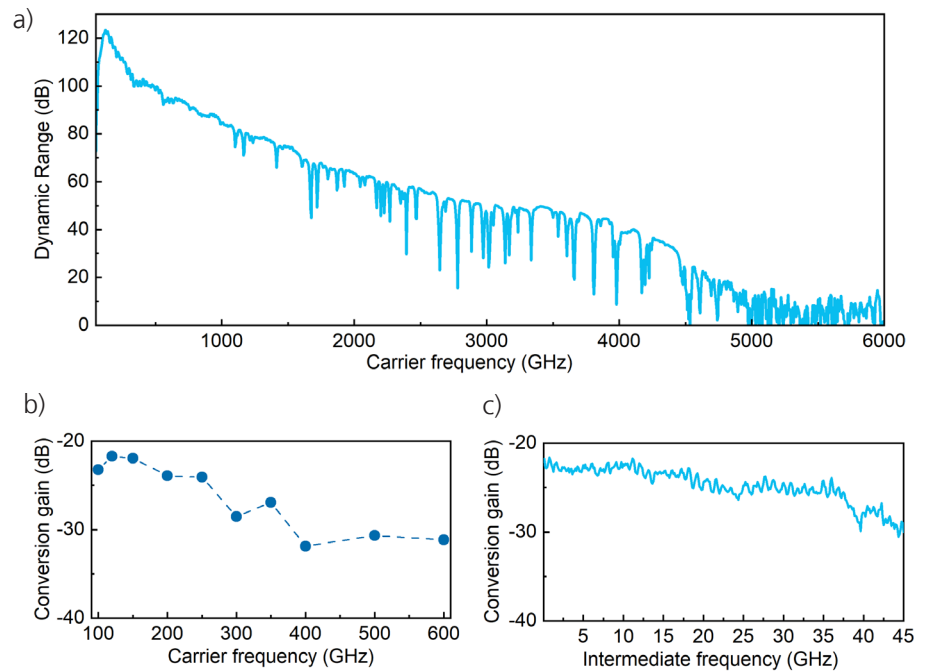
- Operation from 0.1 to 5 THz
- 40 GHz IF-output with 1.85 mm connector
- Conversion gain of up to -22 dB
- Robust housing, fiber coupling and bias-free

Applications

- mmWave and THz communication
- Ultra-broadband agile channel sounding and ranging
- Ultra-wide frequency hopping
- Spectroscopy

Technical Background

Photoconductive terahertz receivers are photomixers that use an optical beating as a local oscillator, enabling continuous operation from 100 GHz to 5 THz. As core elements of photonic THz systems, they are proven in non destructive testing and spectroscopy. Leveraging recent advances in materials and high frequency design at Fraunhofer HHI, our heterodyne photomixers deliver high intermediate frequency bandwidth and unmatched carrier agility, opening new capabilities for 6G communications and sensing.



Performance of HHI's heterodyne THz receiver: a) Dynamic range in sensing applications from 0.1 THz to 5 THz, b) Conversion gain over carrier frequency at 8 GHz IF-frequency and c) Conversion gain over IF-frequency for 120 GHz carrier frequency

Specifications

- Conversion gain -22 dB at 120 GHz
- IF bandwidth 25 GHz (3 dB)
40 GHz (6 dB)
- Carrier frequency range 0.1 to 5 THz
- Optical wavelength (LO) 1.55 μm
- Sensitivity $>0.24 \text{ fW/Hz}$



Dr. rer. nat. Robert Kohlhaas
Hybrid Integration and Sensing

Phone +49 30 31002 407
 robert.kohlhaas@hhi.fraunhofer.de

Fraunhofer Heinrich Hertz Institute
 Einsteinufer 37, 10587 Berlin
 Germany

www.hhi.fraunhofer.de/phs

M. Deumer et al., „Ultra-Broadband Photonic Receiver for (Sub-) THz Communication Between 100 and 600 GHz Enabling Line Rates Up to 84 Gbit/s,” in IEEE Transactions on Terahertz Science and Technology, vol. 16, no. 1, pp. 35-41, Jan. 2026