

Why Fraunhofer IAF?

Together with national and international partners from academia, research and industry, Fraunhofer IAF plays a leading role in the development of customized high-frequency MMICs, modules, and subsystems for various applications. Thanks to the expertise of its researchers, its large network, and its unique research infrastructure, the institute covers the entire value chain from epitaxy, technology, modeling, MMIC and module design, characterization, assembly up to the implementation in subsystems.

In addition, Fraunhofer IAF has decades of experience in running complex international research projects and collaborations with customers from industry. This enables an equally efficient and flexible cooperation in the application-oriented research and development of innovative electronics technologies as well as in the customized implementation of orders.

What we offer:

- Epitaxy of III-V compound semiconductors according to customer specifications
- Process development and processing of wafers to transistors and integrated circuits
- Simulation-based design and realization of semiconductor devices
- High-frequency measurements, characterization of circuits, material analysis
- Application-specific development of modules and demonstrators

We will be happy to present our research activities and services in the field of high-frequency electronics to you in person.



Contact

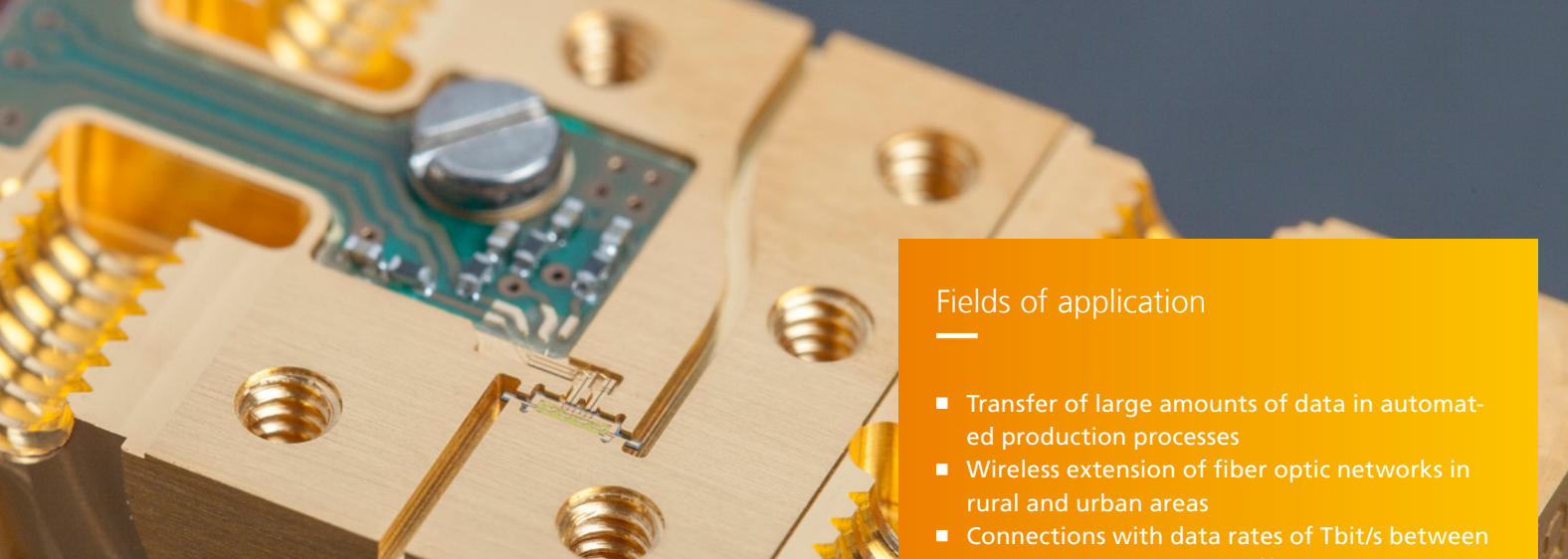


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Fast transmission of large data amounts

Directional radio links for
Industry 4.0 and 5G/6G



Fields of application

- Transfer of large amounts of data in automated production processes
- Wireless extension of fiber optic networks in rural and urban areas
- Connections with data rates of Tbit/s between data centers and within office buildings

InGaAs mHEMT and GaN HEMT devices for THz frequencies

Fraunhofer IAF develops wireless technologies operating within the millimeter-wave and terahertz (THz) frequency band from 100 up to 800 GHz. The institute realizes future solutions for industrial applications and mobile communications networks of the fifth and sixth generation (5G/6G).

Mobile data traffic is growing exponentially, which means that ever greater volumes of data must be made available at remote locations, terrestrially or via satellite, but also for a limited time at local hot spots. Researchers of Fraunhofer IAF realize compound semiconductor devices for radio cells, network nodes, or “super-bandwidth” wireless connections that reach aggregated transmission rates up to several terabytes per second (Tbit/s). These developments facilitate the establishment of novel applications like virtual reality and artificial intelligence, in professional and everyday life.

MMICs and modules for communications

In order to reach broadest bandwidths and highest power levels for tomorrow’s challenges in communications, Fraunhofer IAF researchers work on highly integrated THz monolithic microwave integrated circuits (MMICs) and transmission modules. The MMICs and modules are based on indium gallium arsenide (InGaAs) metamorphic high-electron-mobility transistor (mHEMT) or gallium nitride (GaN) HEMT technologies.

The devices and systems manufactured at the institute feature compactness, energy-efficiency, and lightweight.

Examples

- 140 GHz (D-band) transmitter module with integrated mHEMT components for 5G/B5G/6G communication (figure on the right)
- 300 GHz power amplifier for THz radio links (figure above)
- THz front-end modules comprising power amplifier MMICs with 25 dB power gain from 285 to 335 GHz

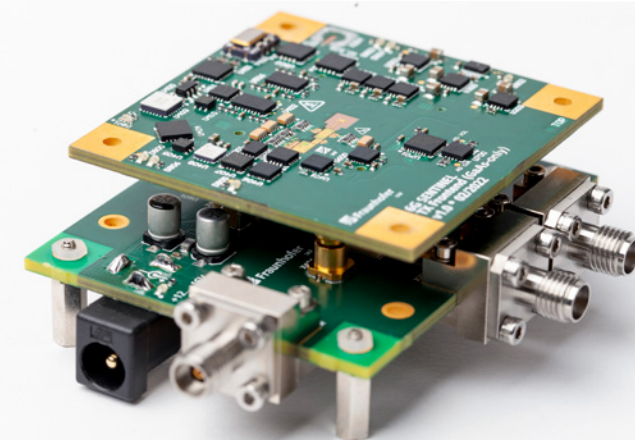
High-frequency measurement facilities

Fraunhofer IAF features a variety of advanced measurement systems for the characterization of integrated circuits and high-frequency modules, e. g., low-noise and power amplifiers, mixers, frequency multipliers, oscillators, switches, and phase shifters:

- S-parameters up to 1.1 THz
- Load-pull up to 110 GHz
- Noise parameters up to 50 GHz
- Noise figure up to 750 GHz
- Power up to 500 GHz
- Intermodulation up to 330 GHz

The measurement laboratory of Fraunhofer IAF enables investigations under realistic operating conditions in possible 6G frequency bands:

- Carrier frequencies up to 500 GHz
- Complex modulation schemes
- Symbol rates up to 32 GBaud and data rates up to 64 Gbit/s



140 GHz (D-band) transmitter module, developed at Fraunhofer IAF