

## 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.

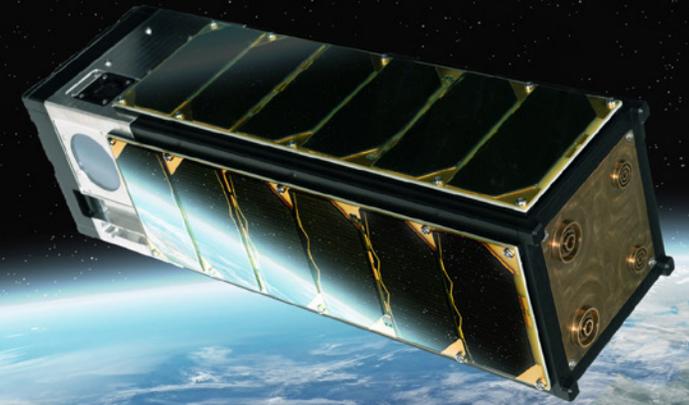
In addition, Fraunhofer IAF has decades of experience in running complex international research projects and collaborations with customers from industry. This enables an equally efficient and flexible cooperation in the application-oriented research and development of innovative electronics technologies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

© sdecoret – stock.adobe.com/ Fraunhofer IAF



## Contact

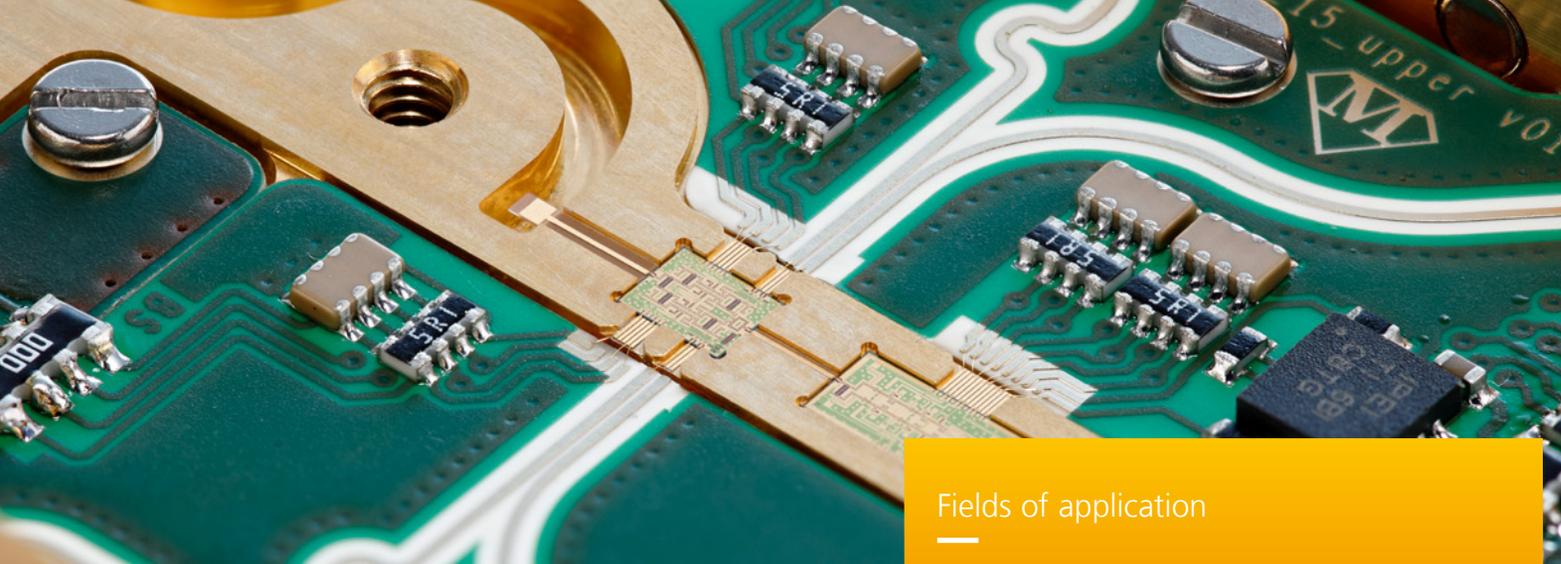


Dr. Sébastien Chartier  
Head of Business Unit  
High Frequency Electronics  
Phone +49 761 5159-446  
electronics@  
iaf.fraunhofer.de

Fraunhofer Institute for Applied  
Solid State Physics IAF  
Tullastrasse 72  
79108 Freiburg, Germany  
[www.iaf.fraunhofer.de/en](http://www.iaf.fraunhofer.de/en)

High data rates — low-noise power efficiency

Satellite communication  
in Q-, E- and W-band



## Extremely low-noise data transmission

Data links from space are becoming increasingly important for communication applications. Fraunhofer IAF develops technologies for the frequency ranges in the Q-, E- and W-band in order to provide high data rates and extremely low-noise data transmission in satellite communications.

### Increasing demand for higher data rates

Due to limited bandwidth, meeting the growing demand for higher data rates in very high throughput satellite systems becomes increasingly difficult. Therefore, the use of higher carrier frequencies is being targeted. The Q-band (33–50 GHz), E-band (60–90 GHz) and W-band (75–110 GHz) work well for satellite communications applications. However, there has been a lack of technology and hardware. Realizing high-performance monolithic microwave integrated circuits (MMICs) and modules, Fraunhofer IAF meets the needs of tomorrow's satellite communications systems.

### Fields of application

- Satellite-to-satellite, satellite-to-ground and satellite-to-aircraft communication links
- Extrapolation of channels for future data transmission
- Climate and Earth observation

### Robust designs for demanding space applications

Fraunhofer IAF offers fully in-house development and manufacturing of MMICs and modules for receivers, transmitters, amplifiers and mixers based on its innovative (metamorphic) high-electron-mobility transistor (mHEMT, HEMT) technologies using gallium nitride (GaN) and indium gallium arsenide (InGaAs).

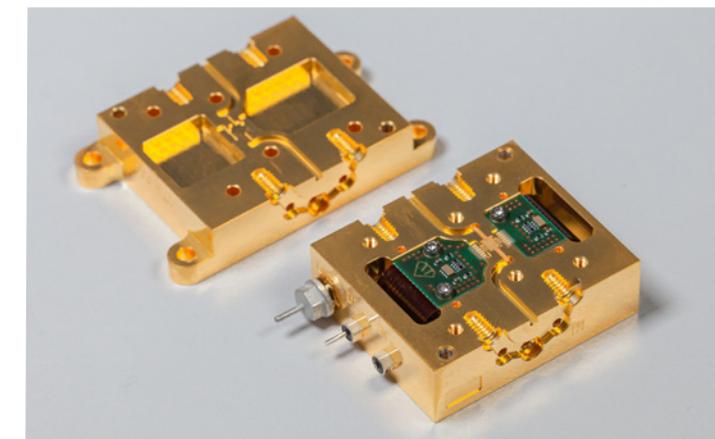
### Features

- High transmission power for long range
- Very low noise for high sensitivity
- Large bandwidths for high transmission rates
- Compact design to reduce size and weight

### Development examples

Several collaborations with space agencies in the fields of channel extrapolation, data transmission, or climate and Earth observation in the last decade have proven the high performance levels, efficiency and robustness of Fraunhofer IAF technology and hardware. Current development examples show the institute's capabilities:

- Low-noise monolithic microwave amplifiers in the frequency range from 54 to 243 GHz for modern weather satellites [project MetOp-SG]
- Integrated active W-band receive front-end with operating frequency of 81 to 86 GHz for high data rate transmission or long-distance data transmission at low power consumption (target noise < 3.5 dB) [project BEACON]
- Transmitter module for verification of E-/W-band communication link combining 50 nm InGaAs mHEMT technology for multiplier, mixer and drive amplifier with 100 nm GaN HEMT technology for power amplifiers (E-band: 71–76 GHz, data rate: 7 Gbit/s, Tx power: 33 dBm 2 W, receiver noise figure: 2 dB) [project EIVE]
- TRX module for satellite and RX module for ground station in order to perform channel propagation measurements in Q-/W-band (37/75 GHz) [project ARTES]



*Medium power amplifier (MPA) for use in E-band, developed at Fraunhofer IAF*