Fraunhofer IIS

Fraunhofer Institute for Integrated Circuits IIS

Fraunhofer's Contribution to Next Gen SatCom Systems

5G/6G-NTN and mioty® for Satellite IoT Systems

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01

Introduction to Fraunhofer Society and Fraunhofer IIS

The Fraunhofer-Gesellschaft

At a glance

Mission: Applied research

Applied research focusing on key future-relevant technologies and the commercialization of findings in business and industry. A trailblazer and trendsetter in innovative developments.

> 30,800 employees

76 institutes and research units

€ 3.0 billion business volume
€ 2.6 billion contract research

Base funding from Germany's federal and state governments

Industrial contracts and publicly-funded research projects

Fraunhofer IIS

Fraunhofer Institute for Integrated Circuits IIS

Fraunhofer Institute for Integrated Circuits IIS

Introducing the institute

Fraunhofer Institute for Integrated Circuits IIS

- Founded: 1985
- Largest of 76 Fraunhofer institutes
- Over 1100 employees
- Budget of approx. 200 Mio EUR per year
- Applied research institute

- Non-profit organization
- Mostly financing based on (industry) projects
- Headquarters in Erlangen
- 15 more sites in Germany

02

RF and SatCom Systems Department

We connect people and things everywhere using satellite communications and customized antenna systems in future networks.

Our Mission,
Department RF & SatCom Systems

Department RF und SatCom Systems

Clustering of R&D Activities

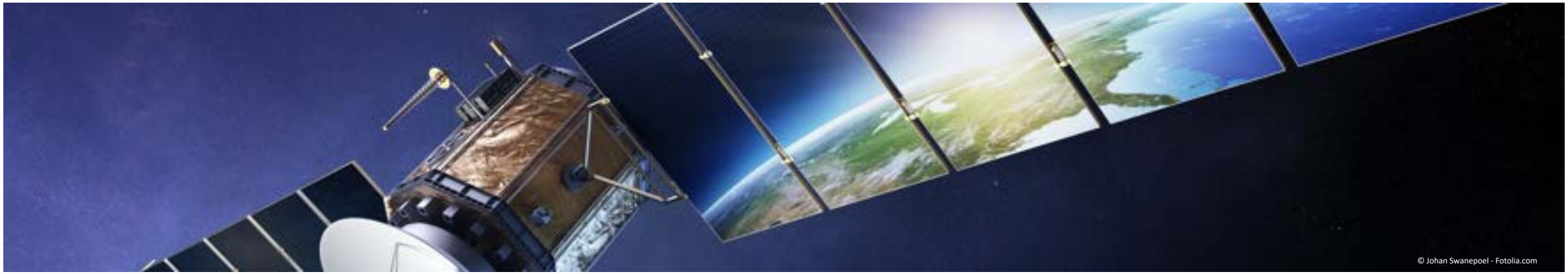
NTN (Sat-5G)

Sat-IoT

High Throughput Systems

Antennas

On-Board Processing



03

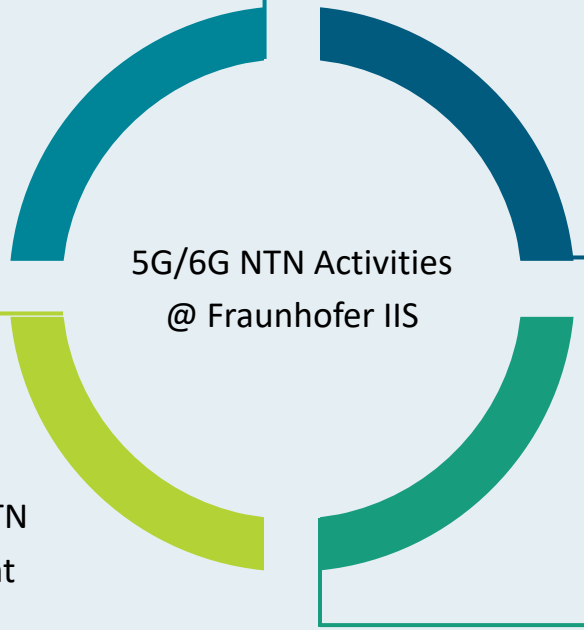
5G/6G NTN Activities

5G/6G NTN Activities

Fraunhofer IIS

3GPP Standardization
Following RAN1 - RAN3 activities and actively contributing to standard with several standard relevant patents

Consulting for Companies
e.g. definition, design and implementation of 5G/6G NTN systems for different use-cases & roadmap development



System Level Simulations & Emulations
5G BAVARIA Test Center - enables system & performance testing in the early stages of developing 5G components, systems and applications.

Implementation and Demonstration
Based on OAI, with our NTN extensions
Live Demonstrations over real satellite systems

(*) Logo from https://openairinterface.org/

04

Our (Sat) IoT Solutions

mioty®

Terrestrial IoT Solution of Fraunhofer IIS

- IoT technology: Long history at IIS („Smart Metering“)
  - mioty® / TS-UNB
- LPWAN system (terrestrial) up to 30 km
- TS-UNB → ETSI standard TS103357
- ALOHA based access technology
- Telemetry data transmission
  (10-245 Bytes per telegram)
- Supporting bidirectional communication
- ISM frequencies: e.g. 868/915 MHz [EU/US]
- Small bandwidth (typ. 200 kHz)
- Up to 3.6 million messages/day @ PER <1%
- Low computing power for receiving and decoding possible (e.g. based on Raspberry Pi 4)
- Energy efficient sensor nodes
- Low-cost devices (COTS, multi source)
- mioty™ alliance established in 2020 (mioty-alliance.com)

mioty® / TS-UNB
Details

Telegram splitting & code rate 1/3

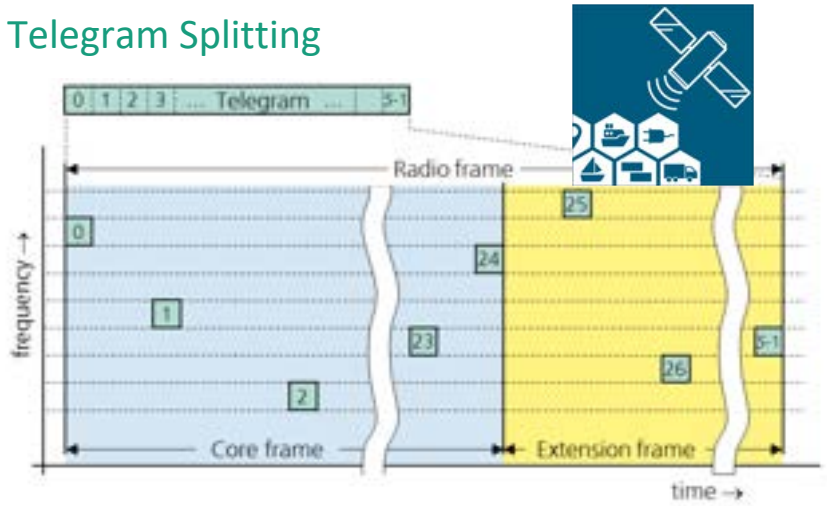
- Robust against in-band interference
- High capacity → massive number of devices
- High energy efficiency → long lifetime

COTS parts / SDR platform (multi source) → low cost sensor nodes

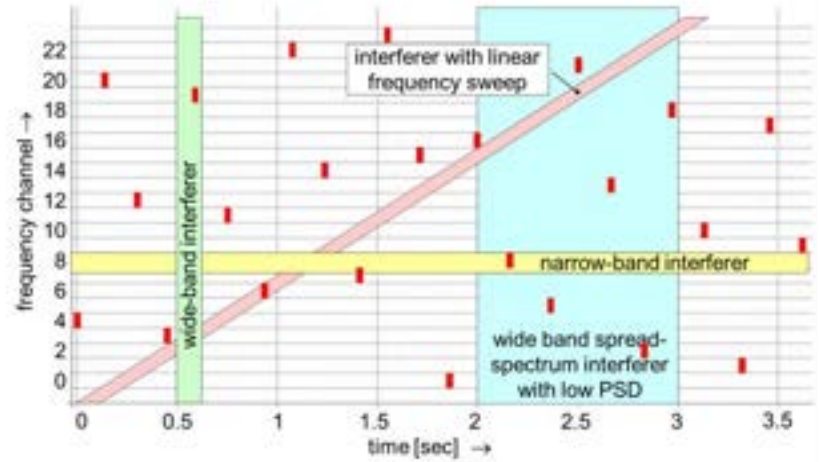
Entire value chain available: System development, incl. sensor connectivity, gateway, cloud service etc.

High market readiness incl. industrial cooperation

Telegram Splitting



Interference Scenarios

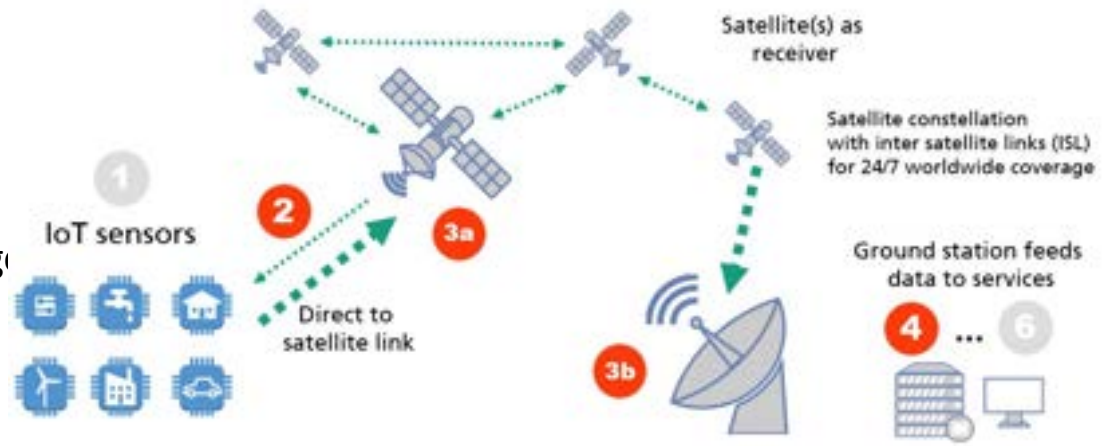


From Terrestrial to Satellite IoT

„mioty® over Satellite“ IoT at Fraunhofer IIS

Reuse of proven terrestrial LPWAN technology

- Smart metering → Low data rate / small message sizes
- Massive machine type communication (mMTC)
- Technical boundaries of terrestrial IoT systems (Limited cell size / coverag & Availability
- Integration in existing mioty® value chain/eco system
- IoT for GEO and LEO scenarios



Satellite IoT at Fraunhofer IIS – our competences

- Air interface and waveform development and advancement
- System design assessment & optimization
- Antenna and demonstration platform development

Next steps (technology aspects)

- Demonstrations of mioty® in a LEO satellite environment

Looking for partners and satcom/IoT operators

From Terrestrial to Satellite IoT

Why mioty® for satellite IoT networks?

KPI System Capacity:
3.6M Messages/day/200kHz/beam

Multi-source transceiver hardware

Energy efficiency
Long battery lifetime of nodes

High market readiness, entire value chain available → mioty® alliance

Robust against Doppler and interference
Developed in ESA and DLR projects

Easily adaptable & scalable to specific satellite scenarios

LPWAN protocol with highest system capacity
→ mioty® for large roll-outs
See mioty® comparison study by TU Ilmenau (on next slide);

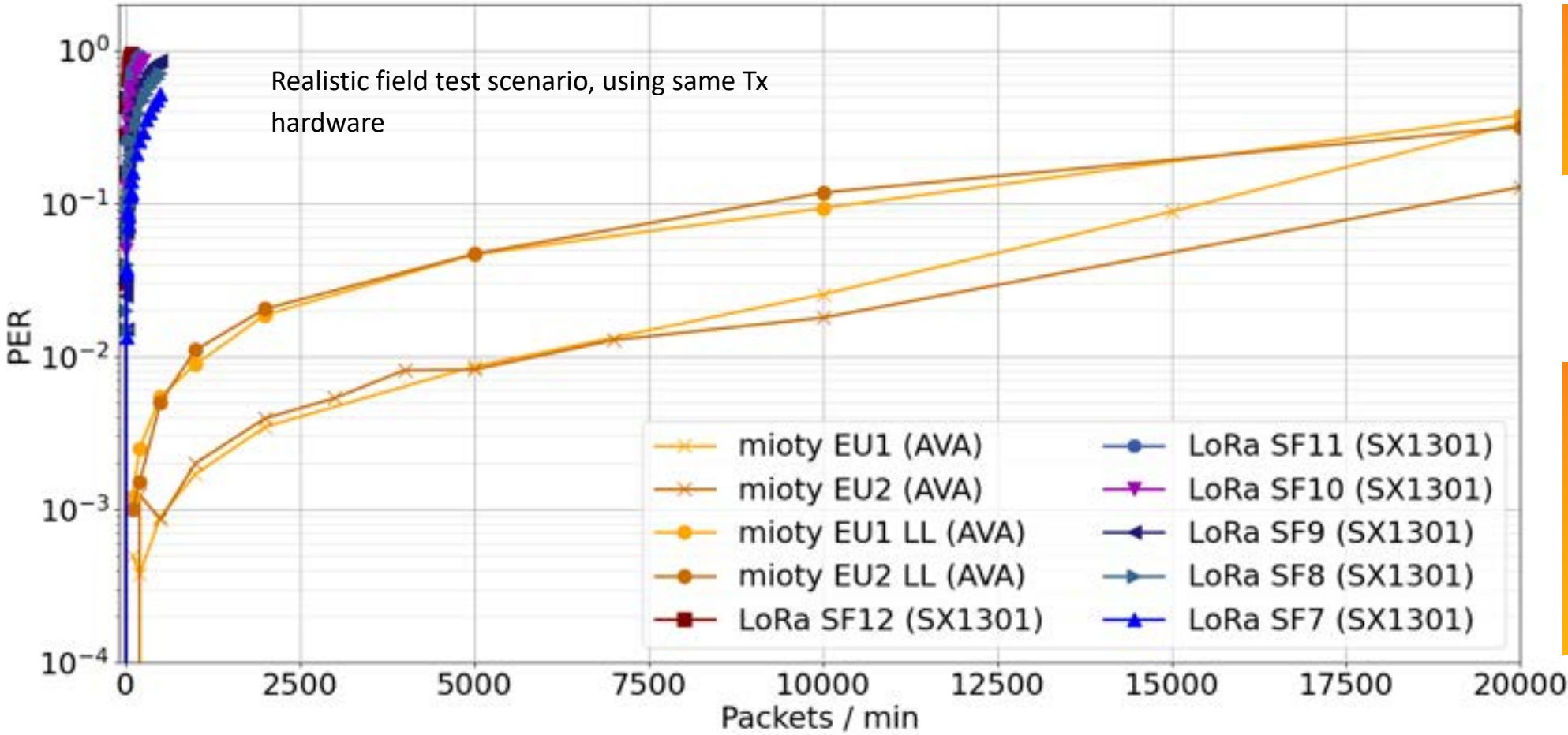
Low-cost nodes

Open ETSI standard
TS-UNB, vendor independent

mioty® Comparative Study Report (mioty® vs LoRa) by TU Ilmenau

System Capacity as KPI

Reference: https://mioty-alliance.com/mioty-vs-lora-study-report/



mioty® is suitable for large roll-outs

Realistic Field Test scenario
→ Do not trust field trial results with few devices

05

Outlook & Summary

Summary and Outlook

Our Offer:

Fraunhofer supports national and international SatCom players in:

- Consulting
- System Design
- R&D in SatCom
- Test & Verification

1 **System Capacity is key feature** for successful SatCom business cases

2 **Open Communication Standards** in IoT and NTN e.g. 3GPP/ETSI/DVB (not proprietary solutions)

3 **Hybrid networks**: merge of terrestrial and satellite networks; Requires flexibilization and **dynamic spectrum sharing**

4 **AI, Distributed Computing & Satellite Swarms**

References

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8. Mioty® vs LoRa study report https://mioty-alliance.com/mioty-vs-lora-study-report/

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