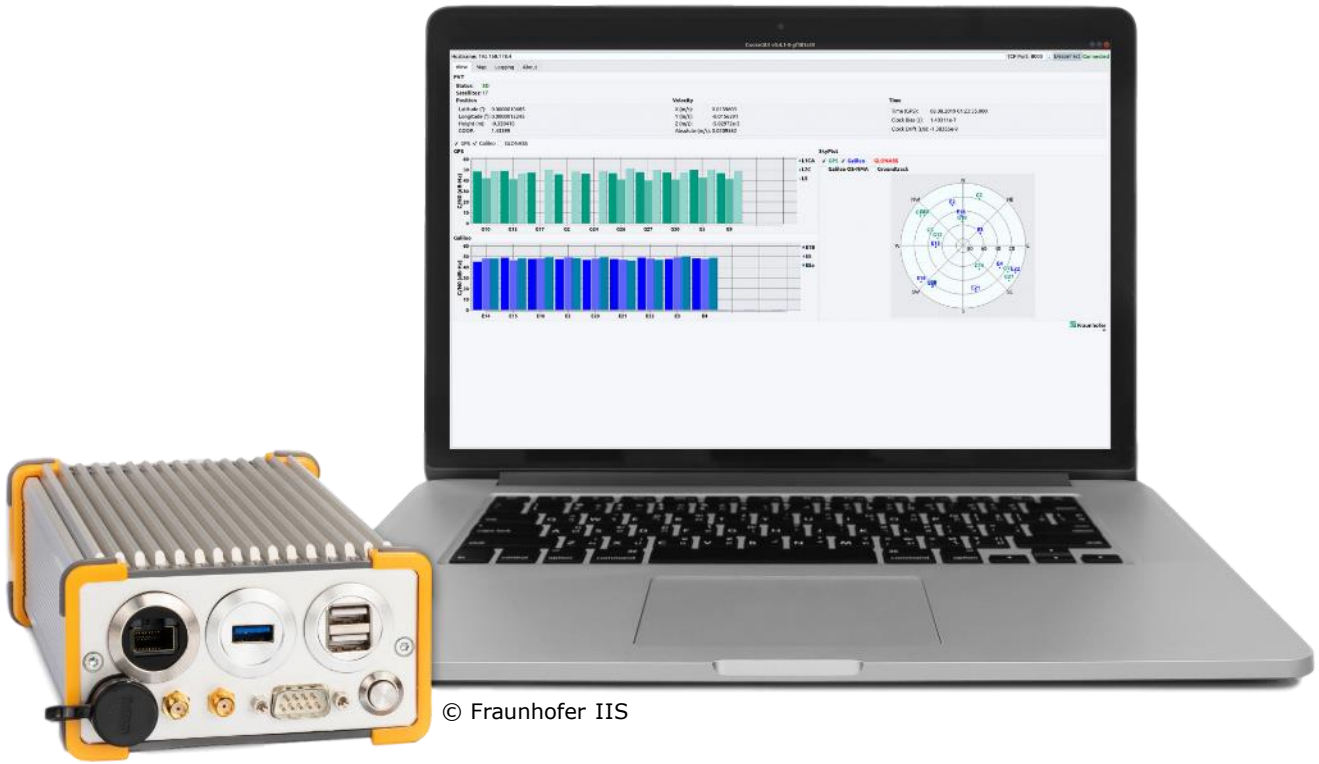
# GOOSE©: a flexible GNSS Rx for the Alps



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# Company Profile

**TeleOrbit GmbH** is a privately owned engineering, marketing, and sales company providing innovative satellite navigation technologies and solutions incorporating satellite navigation, satellite communication and geoinformation.

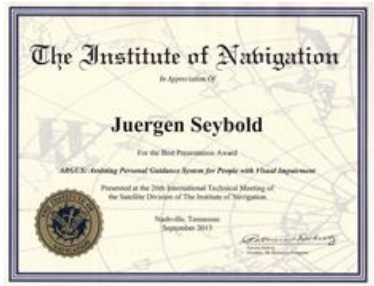
**TeleOrbit GmbH** closely cooperates with its strategic technology partner **Fraunhofer IIS,** Nürnberg, Germany mainly in the areas of GNSS project and product development.

We are marketing & sales partner of **HERE Global B.V.,** Eindhoven, Netherlands, **IZT GmbH,** Erlangen, Germany, and **OHB Digital Solutions GmbH,** Graz, Austria.

**TeleOrbit** sells GNSS technologies, operates GNSS based services, and provides project and quality management as well as consultancy and IPR management support.

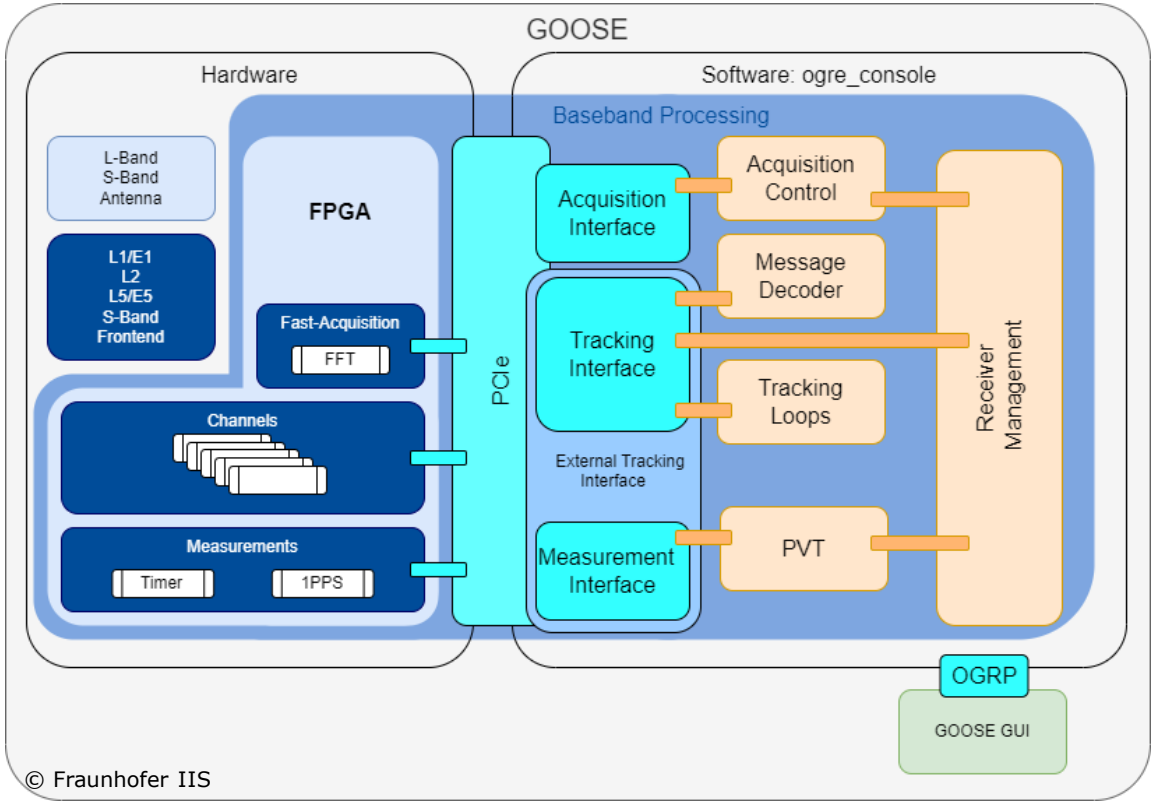
**TeleOrbit** established a powerful and efficient **distributor network** for most important **Asian & Pacific** and **American** regions.



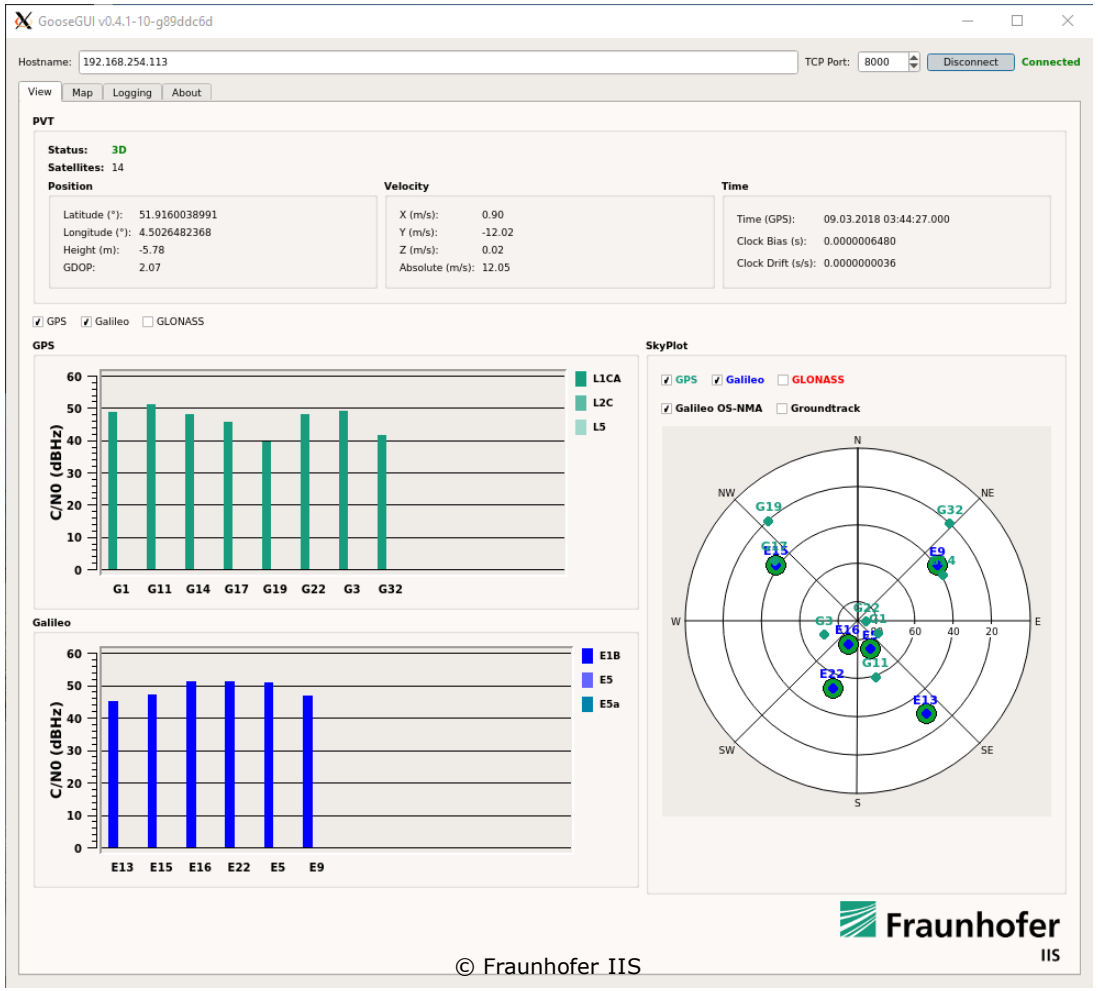


# GOOSE© - Introduction




- GOOSE© is a unique
  - **triple frequency** FPGA-based GNSS receiver incl.
  - Galileo **OSNMA** and
  - **L5/E5** direct tracking, with
  - **record and replay** capability for real-world and simulated GNSS signals including jamming and spoofing.
- Open Software Interface
- Continuous development of new innovative features and improvement of GOOSE© capabilities

# GOOSE© - OSNMA



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## GOOSE© - OSNMA

(Open Service – Navigation Message Authentication)

- GOOSE© allows to receive and compute a Galileo OSNMA-only PVT
- Enables the Analysis and Test of Authentication Techniques and Navigation Solutions with a Hybrid SW receiver
- **Benefit:** improved resilience against spoofing (partially also jamming) attacks due to loss of authenticated PVT and resulting alarm message



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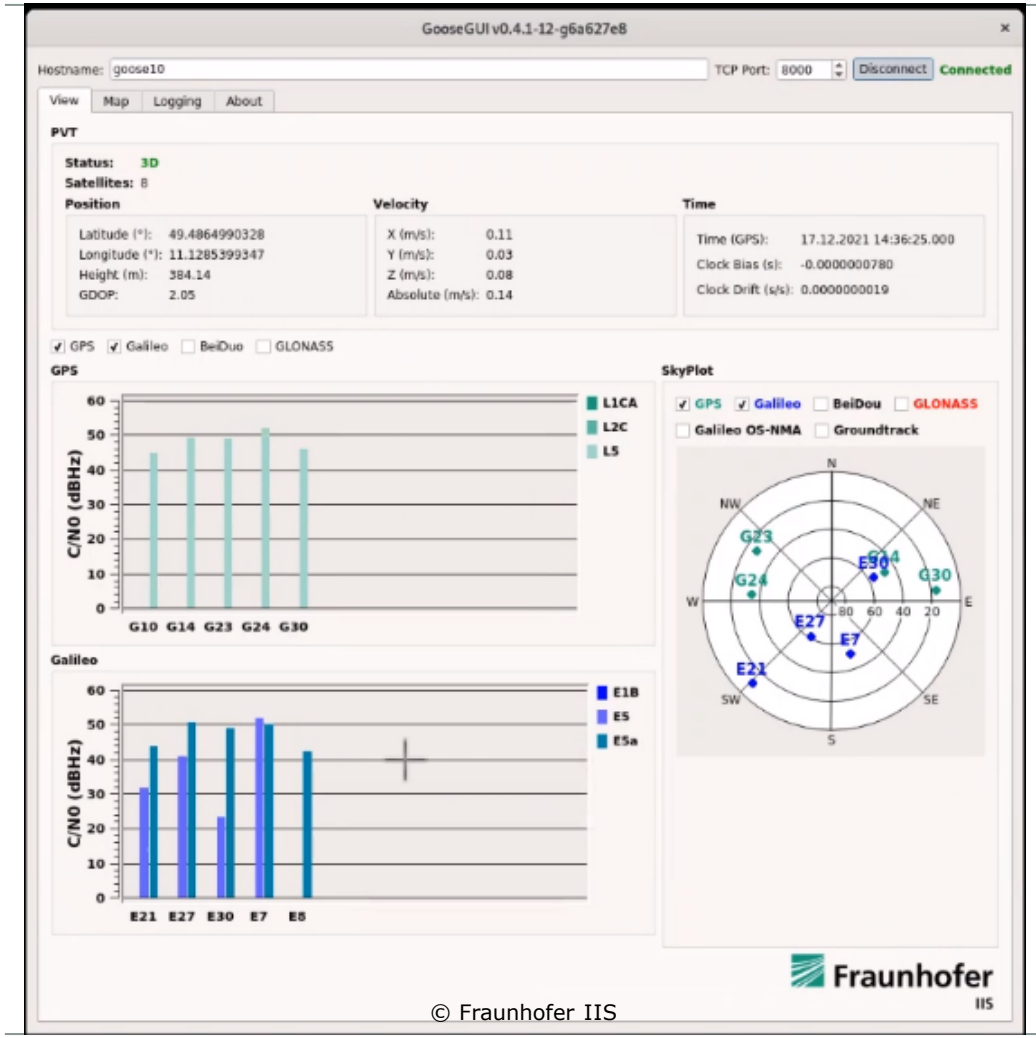
# Direct Tracking of Wideband Signals (L5/E5 & E5 AltBOC)



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- GOOSE© includes the direct acquisition and tracking of wideband signals in the GPS L5 and Galileo E5 frequency band.

- GOOSE© supports the tracking of the E5 AltBOC pilot component (E5A-Q and E5B-Q).
  This gives the user pseudorange measures with a higher precision thanks to BOC modulation.
  Combined with E5A-I ephemeris data a PVT calculation is possible.

# Direct Tracking of Wideband Signals (L5/E5 & E5 AltBOC)

## Advantages and potential use case (example)

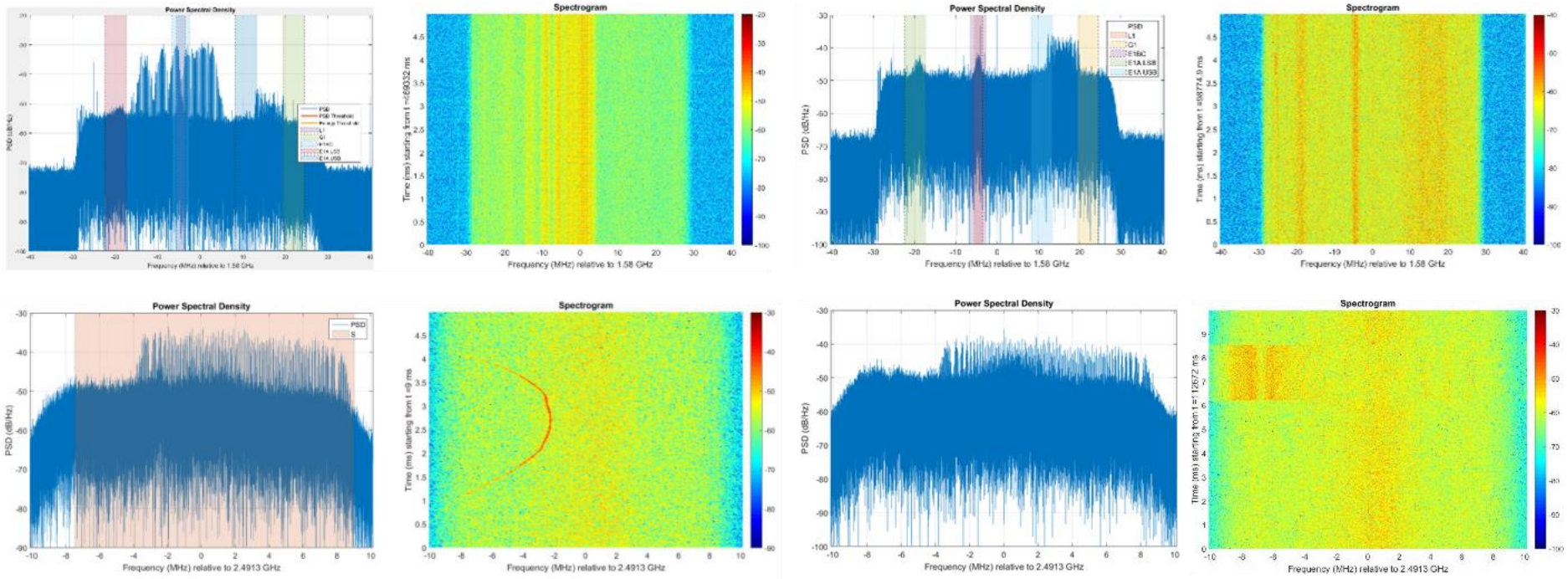
- E5 AltBOC features a very low noise figure at centimetre level (see example below)
- It allows for better mitigation of multipath effects (➔ useful in urban but also natural canyons and valleys)
- Robust against cheap GPS, Galileo, GLONASS, Beidou L1-band jammers

**Example** (Article "Exploiting the Galileo E5 Wideband Signal", Prof. Hein, InsideGNSS, 03/09/2012):

- "Detection position change in a moving structure (= rock glacier) over an extended period of time"
- 70 cm motion p.a.
- After 64 days GPS L1 ~30 cm of error, Galileo E5 ~5 cm of error; glacier moved 11 cm during that period.

# GOOSE© - Record and Replay ➔ Signal Quality Mapping

- GOOSE© offers record and replay capability for real-world and simulated GNSS signals including jamming and spoofing
- Record in the field and replay in the lab
- Use Case: Signal Quality Mapping

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# GOOSE© - Outlook ➔ Vector Tracking, NavIC S-band

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**GOOSE©-NavIC** (NAVISP EL2)

- Customer interest in S-band capable solution for Asian market, especially India and new markets like South Korea.
- Result is the current project which adds a fourth channel to GOOSE© for the S-band and a dedicated combined L-/S-band antenna.

**GOOSE©-VTL** (NAVISP EL1)

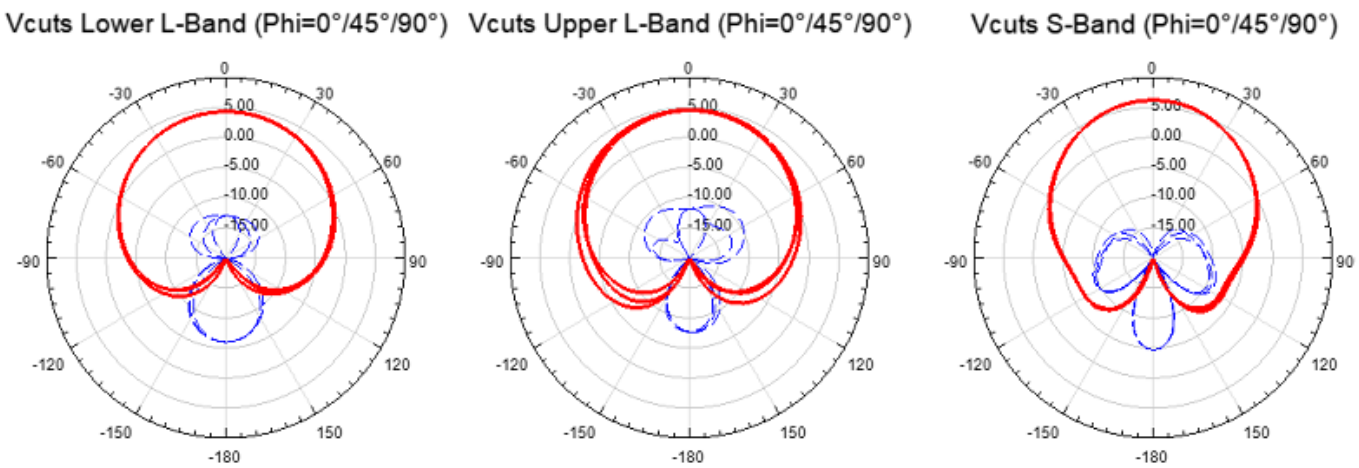
- "Deeply Coupled GNSS Vector tracking loop robust solution for autonomous vehicles"
- Extend and improve current vector tracking implementation
- Optimise IMU/INS integration ➔ deep coupling

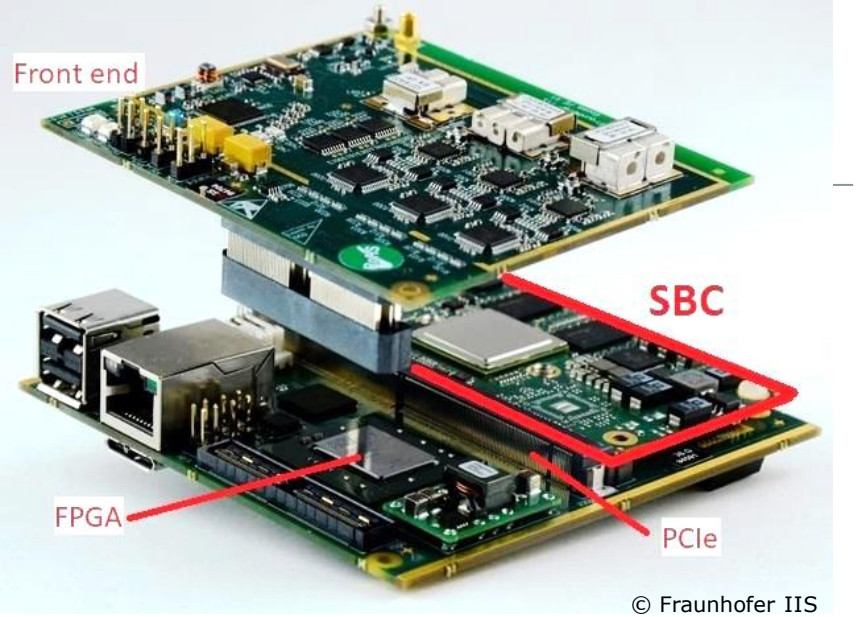
# GOOSE© – NavIC

## Key Features of the Product

The key features of the later product are:

- L-Band and S-Band antenna combination for GNSS L-band and NavIC S-Band
- Quad-band high sensitive low noise frontend with anti-jamming capability
- Flexible solution to guarantee the reception of the new NavIC signals
- High precision professional NavIC receiver also for monitoring stations
- Possibility to also address mass-markets with the NavIC technology using Fraunhofer ASICs (PASCAL and GUaRDIAn)

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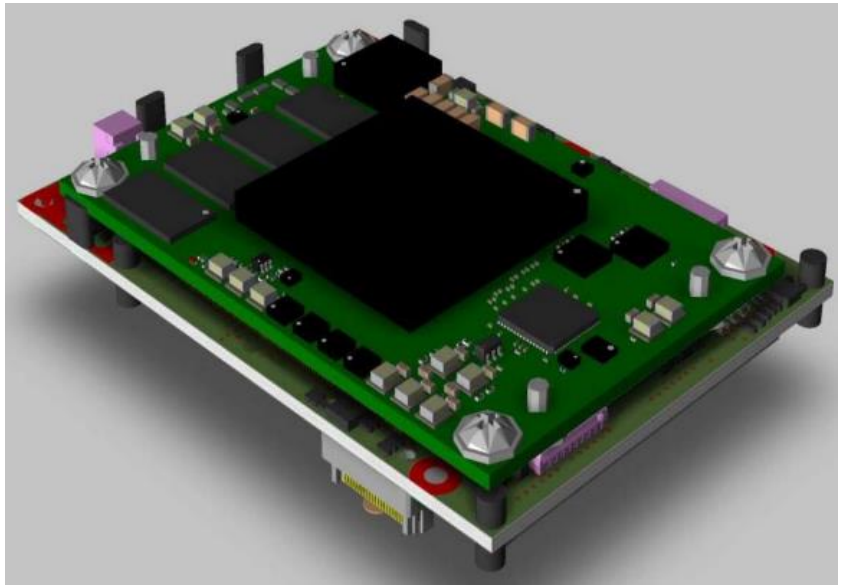

TeleOrbit

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# THANK YOU!

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