

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







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

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Position Latitude (°): 49.4864990328 Longitude (*): 11.1285399347 Height (m): 384.14 GDOP: 2.05	X (m/s): 0.11 Y (m/s): 0.03 Z (m/s): 0.08 Absolute (m/s): 0.14		Time Time (GPS): 17.12.2021 14:36:25.000 Clock Bias (s): -0.0000000780 Clock Drift (s/s): 0.000000019	
7 GPS 🖌 Galileo 📄 BeiDuo 🗌 GLONA 1995	55		SkyPlot	
60 50 10 20 610 614 623 624 630		L1CA L2C L5	Galileo OS-NMA Groundtrack	
E21 E27 E30 E7 E5		E18 E5 E5		
			🖉 Fraunhofer	

- 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





GOOSE[©] - Outlook → Vector Tracking, NavIC S-band



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)

Vcuts Lower L-Band (Phi=0°/45°/90°) Vcuts Upper L-Band (Phi=0°/45°/90°)

Vcuts S-Band (Phi=0°/45°/90°)





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THANK YOU!

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