

LEORIX Single-Frequency Multi - Constellation GNSS Receiver

LEORIX, the RUAG Space single-frequency GNSS Receiver for LEO applications provides an excellent on-board real-time navigation solution accuracy of below 1 meter based on an arbitrary mix of GPS and GALILEO space vehicles.



Based on dedicated RF- and Mixed-Signal ASICs as well as the AGGA-4 ASIC, LEORIX is able to use the following signals:

- GPS C/A on L1
- Galileo E1 B/C

Main Features

- Selective RF-filter and low-noise amplifier for improved performance figures
- Accurate force model-based orbit propagator
- Advanced Kalman filtering and single-frequency ionospheric correction allow for high on-board navigation performance
- Flexible acquisition and tracking concept providing:
 - single frequency signal processing of up to 12 satellites
 - Sliding search window for minimized acquisition times
 - Doppler-based loop aiding
- Configurable data rate per measurement type
- Autonomous start-mode determination for minimized time-to-first-fix
- Powerful parameter interface supports changes in standby and operational mode
- Additional data products provide excellent visibility of receiver internals
- Low mass and power consumption

Data Products

- Navigation solution based on GPS/GALILEO constellations
- Generation of the PPS signal synchronized to GPS/GALILEO second
- Carrier phase measurements for each tracked signal
- code phase measurements for each tracked signal
- Support data:
 - Tracking state
 - GDOP
 - Carrier to noise (C/N) measurement of each tracked signal
 - Noise measurements of the RF down-conversion chain
 - Satellites in view status
 - Satellite navigation message

Interfaces

- TC/TM interface: MIL-STD-1553B or UART (RS-422) or SpaceWire
- PPS output nom/red/test (RS-422)
- Primary power interface 28 V unregulated
- ON/OFF high level command interface or autostart upon voltage application
- Thermistor TM interfaces
- External USO input available

On-board Navigation Solution Accuracy

- Position: 1.0 m 3D rms
- Velocity: 2 mm/s 3D rms
- Time offset 1PPS (1σ): < 50 ns (typ. 25ns rms)

Data outputs

- L1 carrier phase error < 1.2 mm rms
- E1 carrier phase error < 1.8 mm rms
- L1 C/A code measurement error < 0.7 m rms
- E1 code measurement error < 0.7m rms

Time to first fix

- Warm start < 90 s
- Cold start < 15 min GPS; <40 min GALILEO

Physical / Environment

Electronic box:

- Size: 280x240x81 mm³ ; Weight: 3.0 kg
- Operating temperature: -30° C to +60° C (qualification level)
- Minimum switch-on temperature: -40° C (qualification level)
- Radiation: suitable for orbits between 300 and 1500km, any inclination
- Power consumption: 15 W avg.

Antenna (recommended for LEO):

- Patch Excited Cup antenna:
- Size: Ø 144 mm, h: 36,5 mm ; weight: 215 g

Programs/Heritage

RUAG has delivered 22 flight models of the heritage receiver, a GPS Precise Orbit Determination Receiver based on AGGA-2 and LEON ASICs:

- for the Swarm earth-observation mission of ESA, which is based on three satellites flying in formation with a common launch in 2013
- for the Sentinel-1, Sentinel-2 and Sentinel-3 A/B satellites of ESA's and the European Commission's Copernicus program (6 satellites)
- for the ESA/JAXA mission Earthcare
- for NASA's mission ICESat-2

Currently, 18 of these 22 delivered flight models have been launched and are operating flawlessly in orbit to the full satisfaction of the Customers.

For the successor, the PODRIX, LEORIX and GEORIX GNSS receivers, many flight model orders have been received. First flight models have already been delivered.