

# PODRIX Multi - Constellation Precise Orbit Determination GNSS Receiver

PODRIX, the RUAG Space multi-frequency GNSS Precise Orbit Determination Receiver for LEO applications provides an excellent on-board real-time navigation solution accuracy of below one meter based on an arbitrary mix of GPS and GALILEO space vehicles. With Precise Orbit Determination (POD) based on on-ground post-processed receiver dual frequency data, a satellite position measurement accuracy of a few centimeters can be achieved.



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

- GPS C/A on L1
- GPS L2C-M and L2C-L
- GPS L5 I/Q
- GPS P(Y) on L1 and L2 processed by means of codeless tracking scheme (using the AGGA-2 ASICs)
- Galileo E1 B/C
- Galileo E5a I/Q

- 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
- Monitoring of external ultra-stable oscillator (USO) long term drift possible
- Low mass and power consumption

## Main Features

- Antenna with improved gain and multipath suppression performance
- Selective RF-filter and low-noise amplifier for improved performance figures: these two features enable long tracking arcs especially important for POD processing
- Advanced code-phase and carrier-phase processing
- Accurate force model-based orbit propagator
- Advanced Kalman filtering allows high on-board navigation performance
- Flexible acquisition and tracking concept providing:
  - dual-frequency signal processing of up to 18 satellites or
  - single frequency signal processing of up to 24 satellites
  - Sliding search window for minimized acquisition times
  - Doppler-based loop aiding
  - Highly configurable due to numerous parameters like tracking loop filter order and bandwidth, integration time, discriminator type

## 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/N0) measurement of each tracked signal
  - Noise measurements of each 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 ( $1\sigma$ ) : < 50 ns (typ. 25 ns rms)

## Instrument data outputs

- L1 carrier phase error < 2 mm rms
- L2 carrier phase error for P(Y) < 10 mm rms
- L2 carrier phase error for L2C < 3 mm rms
- L5 carrier phase error < 1.6 mm rms
- E1 carrier phase error < 2.7 mm rms
- E5a carrier phase error < 1.8 mm rms
- L1 C/A code measurement error < 1.3 m rms
- L1&L2 P code measurement error < 2.7 m rms
- L2C code measurement error < 1.2 m rms
- E1 code measurement error < 1.1 m rms
- E5a code measurement error < 0.24 m rms

All values for elevation >15°

## Time to first fix

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

## Physical / Environment

### Electronic box:

- Size: 280x240x81 mm<sup>3</sup> ; Weight: 3.0 kg
- Operating temperature: -30° C to +60° C (qualification level)
- Minimum switch-on temperature: -40° C (qualification level)
- Radiation: Cumulative dose > 50 kRad (Si)
- Latch-up threshold > 70 MeV/mg cm<sup>2</sup>
- Power consumption: 15 W avg.

### Antenna:

Patch Excited Cup antenna with optimized multi-path performance:

- Size: Ø 200 mm, h: 87 mm ; weight: 735 g

Other antennas available upon request

## Programs

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 a three satellite constellation 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.