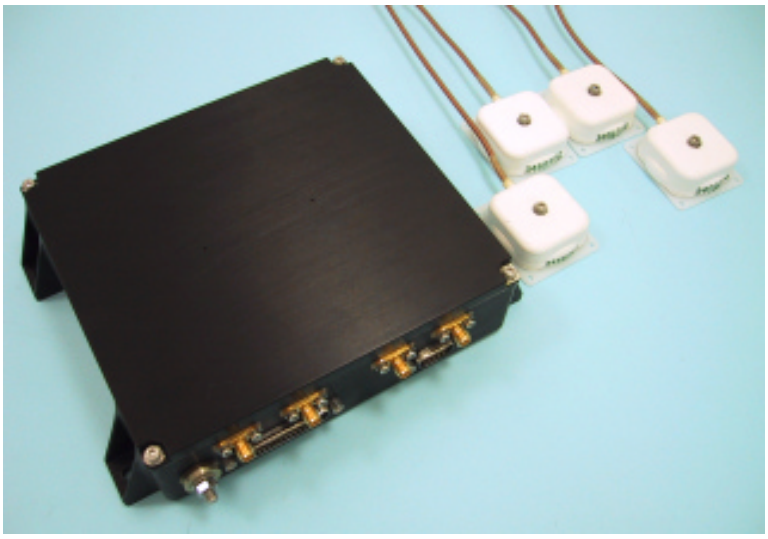
SSTL SGR
Space GPS Receiver

The SGR (Space GPS Receiver) is a spacecraft orbit/attitude determination sub-system designed for small applications. The SGR provides GPS standard time, position, velocity and attitude measurements in a compact and low power unit at low cost.

Description

The Global Positioning System (GPS) consists of a constellation of 24 satellites at an altitude of 20,000km and can be used for positioning on land, at sea, in air or in space. The SGR receives and decodes the L-Band signals from four or more GPS satellites and through ranging techniques is able to calculate the position of the spacecraft to an accuracy of the order of 15 metres, and can also be used to determine accurate velocity and time. Through the use of interferometry techniques with multiple antennas, the phase differences measured can be used to determine the attitude of the spacecraft to a high accuracy.

Surrey Satellite Technology Ltd (SSTL) is a leading manufacturer of small satellites and sub-systems. SSTL has built and launched some 20 satellites since UoSAT-1 in 1980. The SGR combines SSTL's knowledge of spacecraft sensors and systems with the latest advances in terrestrial GPS technology to offer a sophisticated spacecraft navigation system.



SGR-20 Space GPS receiver and four antennas

Features

- **SGR chipset** is based on high performance commercial MITEL Semiconductors GPS chipset and ARM60B 32 bit RISC processor
- **Radiation** susceptibility of parts has been evaluated in a joint SSTL/ESA programme. The SGR has been designed to be tolerant to radiation and has countermeasures against Single Event Upsets and Latch-ups (SEU/SEL).
- **Telemetry and telecommand** independent from the primary processor is provided by a separate TTC Node
- **Primary interfaces** to the SGR comprise of RS422 (point-to-point) and CAN bus (multi-node Controller Area Network)
- **Code** stored in Flash memory to enable rapid booting and future functional upgrades
- **Windows** program provided to monitor and control the SGR and to view and process logged data from the SGR.
- **Testing and PA** plans available. Environmental and Acceptance Testing and PA plans can be tailored to suit customer.

Specifications

- Up to 24 channels receiving L1 C/A code
- Options for up to 4 antennas
- Time (UTC): 1μs
- Position (2σ): 15 m
- Velocity (2σ): 1.5 ms^{-1}
- Attitude determination: approx. 0.5º (Contact SSTL for details)
- Dynamic Capability: 8 kms^{-1}, 2 g
- Time to First Fix: Typically 60 s warm start; 3.5 minutes cold start.
- Interfaces: RS422, CAN, up to 9 pulse per second (PPS) signals

Options

- SGR-10: 2 Antennas; position, velocity, time
- SGR-20: 4 Antennas; position, velocity and time; attitude determination
- SGR-05: 1 antenna; position, velocity and time (separate data sheet available)

Qualification

- SGR-10 Flown on TMSAT-1, Tsinghua-1, Tiungsat-1, (launched 1998, 2000)
- SGR-20 Flown on UoSAT-12 (launched 1999)
- SGR Selected for Alsat, UK-DMC, Biltensat, Topsat (Launching 2002 onwards)
- SGR selected for ESA's PROBA mission (to be launched mid-2001) and International Space Station Application
- SGR-05 demonstrated on SNAP-1 (launched 2000)

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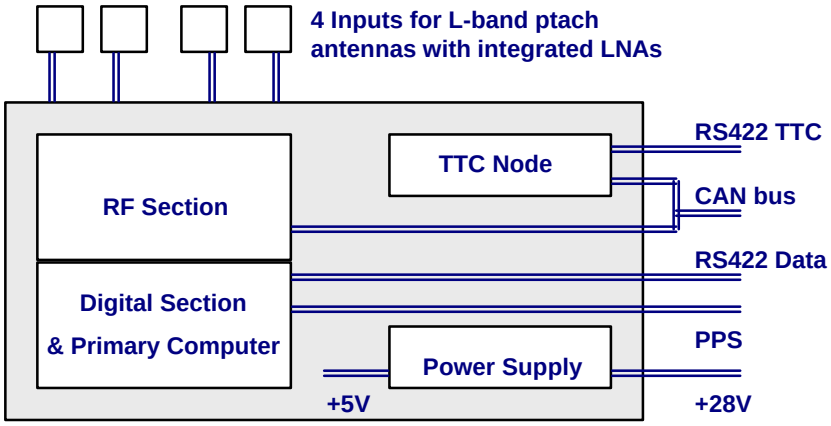
Application / Performance

- SSTL-provides patch antennas and Low Noise Amplifiers (LNAs). The LNAs may be integrated or separate from antennas.
- The SGR may be operated from 5 V, bypassing its power supply and reducing power consumption.
- Programmable binary data interface to tailor data rates according to application.
- Typically onboard orbit knowledge can be obtained to within several metres from 24 hours data. SSTL can provide expert advice on orbit determination solutions using the SGR.
- Pulse per second output can provide means to synchronise host satellite clocks to within one microsecond of UTC.
- Attitude is determined from GPS signal phase differences measured between antennas. This leads to special requirements for antenna placement and environment. Contact SSTL for details.



Block Diagram of SGR-20

UoSAT-12 Operational Performance

The operation of the SGR on UoSAT-12 has resulted in a number of significant milestones:

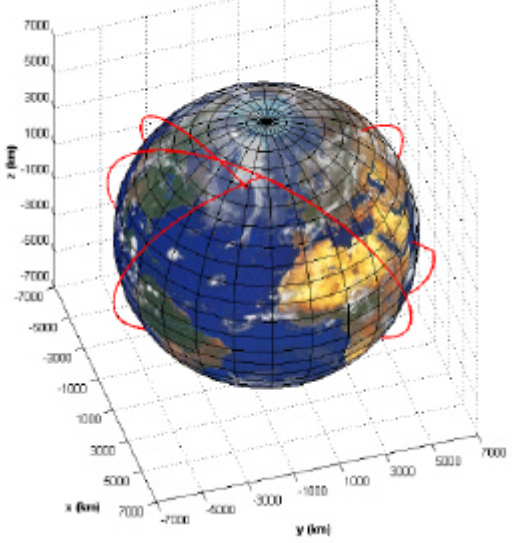
•12 GPS satellites tracked simultaneously

•Time to first fix of under 4 minutes from cold start

•Simultaneous tracking of 24 channels of phase differences for attitude determination

•Long term autonomous orbit maintenance demonstrated using SGR and propulsion system

Flight Data from the SGR-20 on UoSAT-12



Other SSTL Products

•Complete satellite missions including turnkey systems and know-how transfer

•Units for C&DH, Power, Comms & AOCS sub-systems and various Payloads

•Space technology design, analysis and manufacture

affordable access to space

Environmental (Acceptance Level)

- Random Vibration: 15 g
- Thermal: -20º C to +50º C
- EMC: as per MIL-STD-462D
- Radiation: - Cumulative dose >10 kRad (Si)

Physical Characteristics

- SGR 10 & 20 Dimensions:
  160 x 160 x 50 mm or
  295 x 160 x 35 mm
- SGR-10 & 20 Mass: 1 kg
- SGR-05 OEM Dimensions:
  100 x 60 x 15 mm
- SGR-05 OEM Mass: 50 g

Power Supply

- SGR-20 Power Consumption: 5.5 to 7 W (28 V)
- Power Supply: 28 V or 5 V (Contact SSTL for options)

Contact

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