CENTER FOR REMOTE SENSING, INC.

Multiband (L_1, L_2, L_5) Multichannel GPS Signal Generators

(GPSS-MB-006-06; GPSS-MB-007-06)

The GPS Signal Generator from CRS, Inc. provides live RF signals at navigational frequencies (L_1, L_2, and L_5) suitable for Hardware in the Loop (HWIL) signal generation.

These self contained units provide high-fidelity multichannel C/A, P(Y), and M code signals at L_1, L_2, and L_5 bands. Up to 12 or 16 satellites are supported. It also generates WAAS and SBAS signals. The signal generator is available in both rack-mountable and tabletop configurations.

Almost unlimited user motions can be specified. A user friendly GUI allows various complex motions with high dynamics up to 20,000 g to be specified. It allows a variety of environmental and receiver antenna models. The exceptional performance (at the lowest cost) is attained by the use of most recent electronics, which was impossible even a few years ago.

The signal generator utilizes software-based architecture providing unprecedented accuracy and flexibility, and unlimited vertical and horizontal upgrade.

The software based system provides ease of user interaction through a windows interface. The interface provided familiarity to the users and is backward compatible to some of the earlier generation simulators. The "scenarios' developed over the years can be reused.

The windows interface (SigSim™) generally runs in a separate PC. [Specialized simulators are available where this is integrated within the simulator.] API to this interface can be provided enabling users to write their own programs to control the simulator. Remote control and remote operation is provided.

A novel feature of these simulators is the ability to model a variety of environmental related effects.

- Performance
  - Flexible Software-based Design
    - 12 to 24 independent channels
    - GPS – L_1, L_2, and L_5: all C/A, P(Y), M, and L_2C signals
    - SBAS – support at L_1, WAAS, EGNOS
- High Accuracy
  - Code: < 1 mm
  - Differential Phase: < 1 mm
- Complex Scenarios
  - High Dynamics – suitable for EKV, satellite, projectiles, aircrafts (200 km/s; 20,000 g)
  - Arbitrary motion (6 DOF)
  - Independent controls over all aspects of antennas and platforms
- HWIL control – fixed latency between 2 to 5 ms
- Comprehensive Models
  - Constellation
    - Full Control; definition and modeling
    - Navigation message bits, HOW, TLM, and sub-frame error data.
  - Waveforms
    - Full controls (independent) over waveform errors, nav bits
    - Clock errors
  - Environment
    - Ionosphere/Troposphere/Scintillation

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Advancing Technology

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- Antenna
  - Gain and Phase (3-D), Real-time, Lever Arms
  - Both Satellite and Receiver Antennas
- Multipath
  - Dynamic
- Terrain Obscuration
  - Dynamic

- Operation and Control
  - Manual
    - Menu-based
    - Script file based
    - Interactive (Real-time)
  - HWIL
    - Real-time execution (2 ms latency)
  - Remote Control
    - External control via Ethernet
  - API
    - For user programmability
- Real-time Display
  - Satellite Constellation
  - Ground Trajectory
  - User motion parameters (6 DOF)
  - Individual Antennas
- Other Facilities
  - Comprehensive Logging
  - Remote Control via Ethernet
  - Digital Output
  - 1 PPS in/out
  - 10 MHz / 10.23 MHz operation
  - Large Dynamic Range ~ 80 dB / 120 dB
  - API for user interface

Signal Dynamics

- **Velocity**: ± 800 km/s
- **Acceleration**: ± $2x10^5$ m/s^2
- **Jerk**: ± $2x10^5$ m/s^3

RF Output

- -130 dBm at 50 ohms
- **Dynamic Range:** 80 dB
- **Level Resolution**: 0.01 dB
- **Level Accuracy**: ± 0.1 dB RSS
- **Spurious (max)**: < -50 dBc
- **Harmonics (max)**: < -60 dBc
- **Phase Noise (max)**: < 0.02 Rad RMS
- **VSWR**: 1.5:1

Clock

- **Internal**: 1 X 10^{-10}/day
- **External Input**: 10 MHz/10.23 MHz

Waveform

- GPS C/A code with data at 50 bps
- GPS P, P(Y) optional *
- GPS L2C, L5 code
- GPS M (optional) *

* Requires DoD authorization for P(Y) and M codes (GPSS-MB-007-06).
[Civilian applications using C/A and P code and M-noise (GPSS-MB-006-06)]

Optional

- **Glonass**: all signals L1, L2
- **Galileo**: all signals L1, E5, and E6
- **Jammer**: 24 independent jammer signals with selectable waveforms and dynamics
- **LAAS**
- **Built in Windows PC**
- **Ruggedized Version**

The Most Advanced Navigation Simulation

- *Comprehensive*
- *Accurate*
- *Flexible*
- *Versatile*
- *User Friendly*
- *Modular*

* Detailed specifications and options are in Attachments for General Specifications for CRS Simulators.