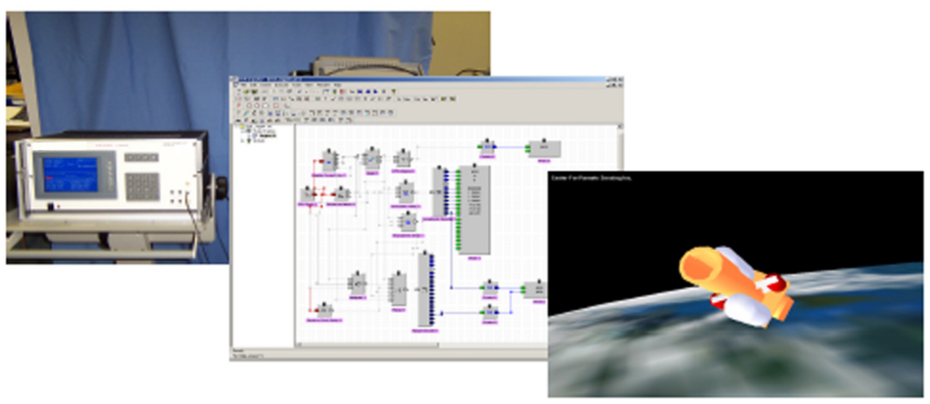
Core Scientific Systems Private Ltd.

CoreSSPL

MULTI CHANNEL MULTI-CONSTELLATION CIVILIAN SIGNAL GENERATORS (GPS, GLONASS, GALILEO)

(GNSS-CIV-01-09,GPS-CIV-01-08,GAL-CIV-01-08,, GLO-CIV-01-08)



USES OF THE GNSS SIGNAL GENERATORS

These signal generators are modular and allows one to develop comprehensive simulation of different constellations (GPS, Galileo, Glonass, EGNOS, SBAS, etc.), their interactions and navigation using multiple constellations. An independent jammer/interface simulator module is available, enabling integration of different modules and provide performance metrics. Some of the simulators provide multiple outputs representing simulation of phase array antennas. The most notable features of these simulators are:

- Precision and accuracies of code and phase
- Versatility, comprehensiveness, and flexibility of the user interface.
- Operational ease and convenience
- Adaptation for specialized situations
- Comprehensive models for UUT, environment, and constellations.

CRS provides the most advanced signal simulators for GPS, Galileo, Glonass, and other navigation signals (EGNOS,SBAS) in space. These signal generators produce the most accurate generation of RF signals at the receiving antenna ports. The simulators provide far superior perfor mances compared with any other RF signal simulator. The superiority of performance is evidenced in terms of accuracy, flexibility, comprehensiveness, versatility, upgradeability, and ease of operation and maintenance. The exceptional performance (at the lowest cost) is attained by the use of most recent electronics, which was impossible even a few years ago.

These simulators were developed to meet the challenging requirements of current and future navigational systems associated with new and flexible waveforms, high dynamics, versatile platform motions, complex environments associated with multipaths, interfering sources, and ionospheric scintillations, plasma effects, and so-on. Customized models are easily incorporated.

All of these RF signal generators simulate real time RF signals using software radio architectures and techniques pioneered by CRS. All the signal parameters are modeled with extremely high precision and the analog portion is kept at a minimum. Software-based architecture allows utilization of the same or similar hardware platform and allows the simulation of different constellations saving hardware investments.
These signal generators provide flexibility and capabilities to the user by leveraging a novel graphical user interface to configure, control, and monitor the operation real-time signal generator with fast multiprocessors that can be reconfigured.

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CIVILIAN SIGNAL GENERATOR

The software-based architecture allows for the insertion of various signal conditions and degradations that are not possible with conventional simulators. The flexible software based system also provides unprecedented accuracies, performances, and capabilities
and ensures continuity and future upgrades. Modular approach allows various signal generators (simulators to be provided with common and similar performances and user interfaces.

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.

The simulator can model various effects such as:

- Scintillations
- Interference and jamming; narrowband, wideband, directional
- High-dynamics; specified orbits
- Plasma effects; re-entry bodies
- Obscuration
- Multipath effects
- Ocean scattering
- Ionospheric Effect

An exhaustive set of models representing various applications is provided as standard for the user interaction through SigSim™ (the standard windows software). SigSim™ software utilizes the most topical software development techniques yet made fully compatible with the inter-faces and data files for simulators of older generations. The software-baesd architecture allows additions of new models extremely easy. Application Program Interface (API) is provided to facilitate these processes.

Because of the software-based architecture, a similar hardware system can be used to generate different constellations. Amounts of hardware and software requirements are customized based on the user requirements. Some standard configurations include GPS only, Galileo only, Glonass only, or multiconstellation units.

GPS L_1/L_2
(GPSS-CIV-01-08)

This self contained unit simulates high-fidelity L_1 C/A and L_2C signals for up to 12 satellites. It offers the highest fidelity, most comprehensive software control over all simulation parameters, and is highly affordable. The system architecture and associated control software are derived from CRS's comprehensive wavefront simulator and provide features not previously available in civilian class simulators. Notable hardware performance specs are:

- Code error < 1 mm
- Differential Phase error < 0.1 mm
- Faithful representation of high dynamic situations (600 km/s, 20,000 g) due to 96 bits of internal accuracy.

Software control over the various simulation parameters is unprecedented and allows full control over constellation, waveform, data bit, envi-ronment, and user motion parameters. The user interface was developed with quick "time to simulation" in mind and is extremely configurable for the advanced user. The menu and script based features provide the user with quick access to real-time controls, display options, and task scheduling.

GALILEO E1/E5
(GALS-CIV-01-08)

The ability of the simulator to independently generate data and pilot signals gives the user complete control over the transmitter waveforms, allowing full coherent and non-coherent simulations to be performed. This self contained unit simulates high-fidelity E1 data+pilot and E5 data+pilot signals for up to 12 satellites. It offers the highest fidelity, most comprehensive software control over all simulation parameters, and is highly affordable.

The system architecture and associated control software are derived from CRS's comprehensive wavefront simulator and provide features not previously available in civilian class simulators. Notable hardware performance specs are:

- Code error < 1 mm
- Differential Phase error < 1 mm
- Faithful representation of high dynamic situations (600 km/s, 20,000 g) due to 96 bits of internal accuracy.

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GLONASS L_1
(GLO-CIV-01-08)

Similar to the above only L_1 band Glonass signals.

SOFTWARE INTERCHANGABLE CONSTELLATIONS
(GNSS-CIV-01-09)

Combinations of different combinations of GNSS signals (GPS, Galileo, Glonass, and more) are available in a standard hardware framework with two sets of independent channels for each frequency (16 channels in each set). They can be configured to operate with different combinations.

- Performance
  - Flexible Software-based Design
    - 12 to 36 independent channels
    - GPS – L_1, L_2
    - Glonass - L_1
    - Galileo - E1, E6, E5
    - SBAS – support at L_1, WAAS, EGNOS
- High Accuracy
  - Code: < 1 mm
  - Differential Phase: < 0.1 mm
- Complex Scenarios
  - High Dynamics – suitable for EKV, satellite, projectiles, aircrafts (600 km/s; 20,000g)
  - Arbitrary motion (6 DOF)
  - Independent controls over all aspects of antennas and platforms
- 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 Antenna
    - Gain and Phase (3-D), Real-time, Lever Arms
  - Multipath
    - Dynamic
  - Terrain Obscuration
    - Dynamic
- Operation and Control
  - Manual
    - 12 to 36 independent channels
    - Menu-based
    - Script file based
    - Interactive (Real-time)
  - Remote Control
    - External control via Ethernet
- Real-time Display
  - Satellite Constellation
  - User motion parameters (6 DOF)
  - Individual Antennas
- Other Facilities
  - Remote Control via Ethernet
  - Digital Output
  - 1 PPS in/out
  - 10 MHz

SIGNAL DYNAMICS

- Velocity: ± 600,000 m/s
- Acceleration: ± 200,000 m/s2
- Jerk: ± 200,000 m/s3

RF OUTPUT

- -130 dBm at 50 ohms
- Dynamic Range: 80 dB (up to 160 dB, option)
- Level Resolution: 0.1 dB
- Level Accuracy: ± 0.1 dB RSS
- Spurious (max): < -70 dBc
- Harmonics (max): < -50 dBc
- Phase Noise (max): < 0.015 Rad RMS
- VSWR: 1.5:1

CLOCK

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

WAVEFORM

- GPS C/A code L1 and L2C
- Glonass L1
- Galileo E1, E5

OPTIONAL

- Glonass L_1 and L_2
- Upgradable to L_5

THE MOST ADVANCED NAVIGATION SIMULATION

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

**** For more detailed specifications see Appendix.***

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