CENTER FOR REMOTE SENSING, INC.

Software Radar Simulator/Emulator

(SRSE-01-10)

Software Radar Simulator and Emulator (SRSE) is a software simulation/emulation toolset used for the design, development, and performance estimation of existing or future radars of various kinds. It is based on generalized radar architecture and allows the user to configure the radar hardware, processing parameters, and environmental and target parameters/properties to be inputted in a user friendly GUI.

The software simulator computes the interaction of the radar waveform with the media and the target and returns all the relevant parameters of the radar return signals. The return signal parameters are visualized and logged in a manner analogous to hardware-based operating radar.

The simulation code operates on a sample by sample basis and once the simulation is completed, the code may be transported to real time hardware resulting in operational radar or real time radar emulators. It utilizes menu-based operator console and a schematic based configuration system. The schematic based configuration management is performed using the IMPULSE™ architecture. It runs in a Windows® PC with high end graphics capability.

It is versatile and various modules are available for specialized types of radars including bistatic, space and air-borne radars, SAR. Various meteorological radars, atmospheric radars, target tracking and surveillance radars, OTH, etc. Phase Array and MIMO capabilities are built in the generalized system.

FEATURES:

- Simulation and Emulation of various radar systems including hardware and configurations, environment, and targets
- Allows various configurations, waveforms, media, and target to be emulated using friendly GUI and schematic based configuration generators.
- Provides all final and intermediate products (waveforms, I&Q's, power, phase, spectra, autocorrelations, selection, target tracks, etc.) for monitoring and validation.
- Numerous Radar types covered; including target tracking radars, SAR as well as atmospheric and meteorological radars such as ST, MST, and ISR.
- Radar Parameters: including all timing, waveforms, Tx and Rx channels, independent antenna elements, RF, IF frequencies, bandwidth, digitization parameters including noise, jitter, processing parameters from demodulation, beamforming, pointing, antenna pointing, scanning, and final proc-

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essing including target tracking and track fusion.
- Environment:
  - Propagation Model – Atmospheric effects – boundary layer, troposphere, ionosphere, rain, cloud, and fog
  - Clutter Model – land clutter, sea-slate, littoral conditions
  - Multipath – scattering from arbitrary targets
- Target Models
  - E.M. Scattering models from various targets
  - Terrain data and target models for SAR
  - Atmospheric targets including stratosphere, troposphere, ionosphere including incoherent scatter
  - Rain models as targets
- Operates in Windows® PC (with optional add-on processing board and data logger)
- Application Programming Interface (API) allows users to interface customized modules
- Utilizes IMPULSE™ framework for configuration management (see IMPULSE™ brochure)
- Utilizes validated codes and data for various models.

EXAMPLES OF SOME RELEVANT CONTROL PARAMETERS:

- Timing
- Waveform
- RF frequencies, frequency agility
- IF frequencies
- Bandwidth
- No. of Tx, Rx elements
- Power
- Antenna parameters
- ADC sampling rate
- ADC bit depth
- No of targets
- RCS, Range, target motions
- Scanning, Tracking, Imaging Modes
- Dwell, No. of independent beams
- IF Processing
  - Matched Filtering (demodulation)
  - Digital Filtering
  - Decimation
  - Noise
  - Jitter
  - I&Q generation
- Baseband Processing (General Radar)
  - Power, Phase
  - FFT filter—Doppler
  - Echo Selection
  - Track estimation
  - Pointing Directs Tx, Rx
  - Dwell time
  - Scan Rate
- MIMO
  - No. of Waveform M, No. of Transmit elements N, No. of Receive elements J
  - Phase for each Tx elements
  - Phase for each Rx element for beam forming
  - Phase for each waveform or to control time
  - Receive Array combination
  - DOA estimation (beam formed)
  - STAP
  - Independent control over Tx and Rx beams and number of beams