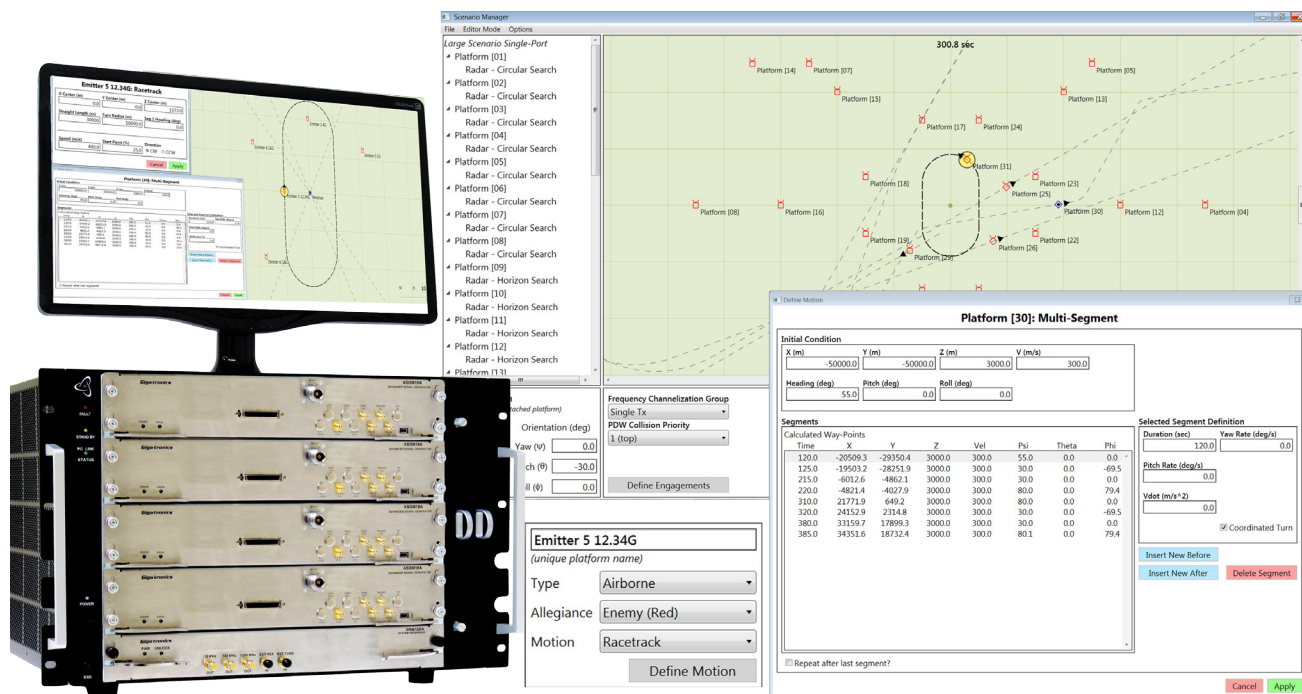# Real-Time Threat Emulation System

- **Up to 30 simultaneous emitters and platforms**
- **Easy scenario creation**
- **10 ns PDW timing resolution**
- **Pulse density 1 MPPS per channel**
- **PDW data recording**

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Overview

The Giga-tronics Real-Time Threat Emulation System (TEmS) is a bench-top environment simulation tool for testing and evaluating Electronic Warfare (EW) and radar equipment. By emulating multiple, simultaneous emitters realistic environments can be created for direct-injection or free-space radiation into a receiver under test.

TEmS combines emitter characteristics with platform kinematics to form a real-time signal environment in 3D battlespace. The signal environment can be used for emulating target-rich scenarios or for creating multi-channel angle of arrival (AoA) wavefronts which are needed for validating target detection and tracking algorithms.

TEmS integrates with the Giga-tronics ASGM18A AXIe Advanced Signal Generator and SRM100A AXIe System Reference module to form a phase-coherent emulator that expands in channel count as requirements grow. Multiple emitters can be created from a single channel ASGM18A module provided no two emitters overlap in time. For emitters that overlap, additional ASGM18A generator modules can be added to cost-effectively expand the threat density of the signal environment.

Scenario Visualization and Data Collection

The TEmS graphical user interface allows the operator to see a real-time presentation of the platforms, emitters and System Under Test (SUT) involved in a scenario. Users can pre-run scenarios to understand how well the simulated engagement meets mission parameters including dropped pulses or pulses that fall below the SUT receiver's detection threshold. A user can easily re-designate a different platform and receiver location to be the SUT to understand the composite RF environment from the perspective of any of the defined mobile or fixed platforms in the scenario. The TEmS user interface dynamically displays how each platform moves through the battlespace and the orientation and relative positions of each platform and emitter at all times.
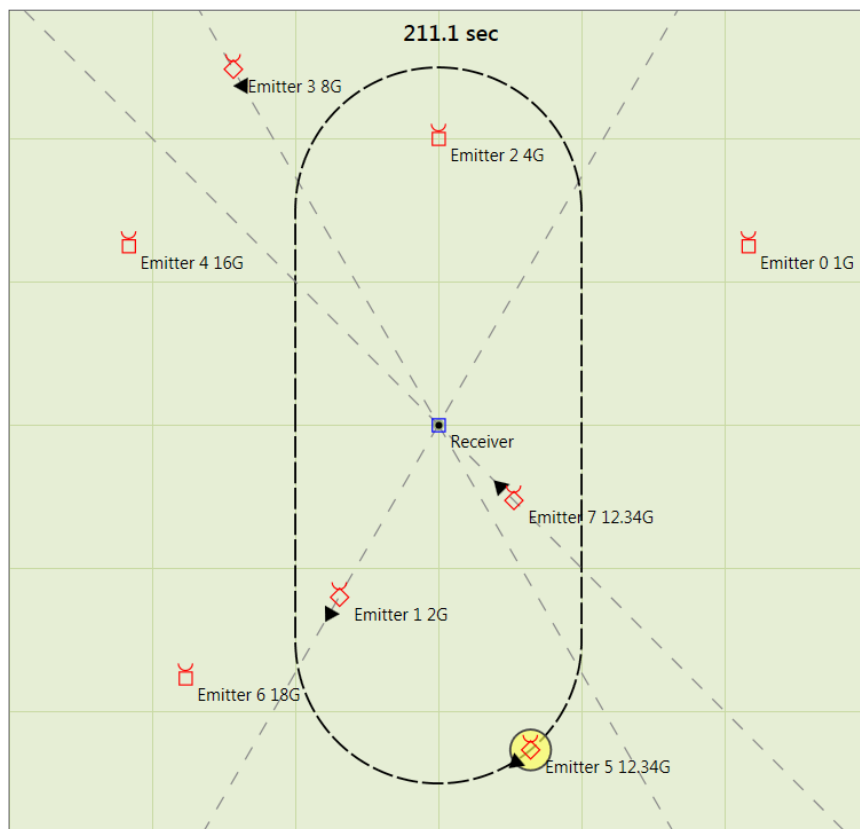

Figure 1 TEmS user interface dynamically displays how each platform moves through battlespace

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Comprehensive Emitter Definition

Emitters can be defined along a number of dimensions to emulate not only the type but specific behavior of an emitter of interest. Such defining characteristics include:

- Radar mode and sub-frame structure
- Sub-frame start time, trigger and duration
- Antenna transmit and receive gain, transmit power, pattern and polarization
- Beam Scan type with Az and El limits
- Transmit pulse parameters and modulation

In addition to providing a starter library of unclassified emitters, the XML file format ensures that your threat library will be easily transferred to future systems without having to deal with proprietary file formats.

Figure 2 TEmS Emitters Configuration Editor

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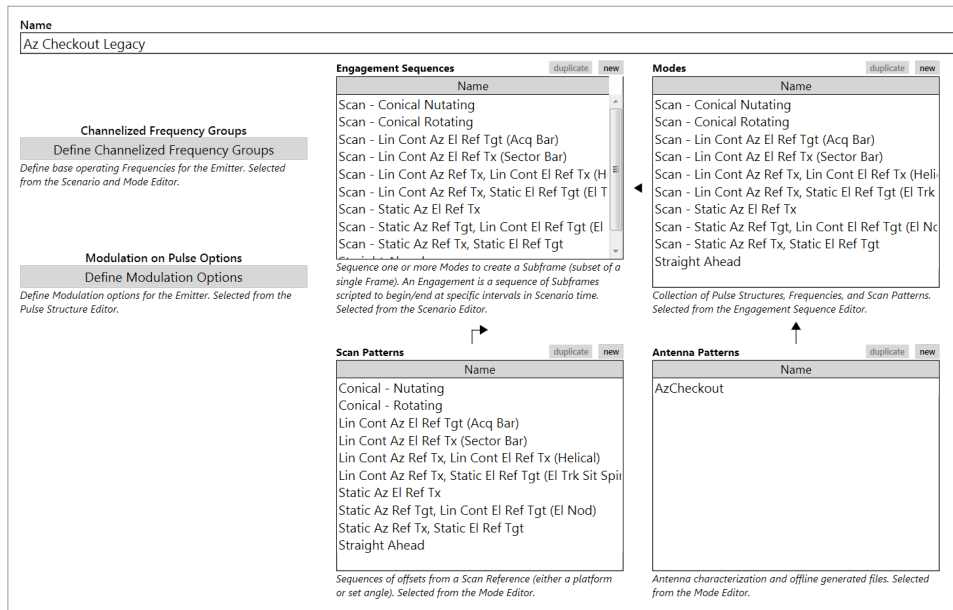go-asg.gigatronics.com

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Platform and Allegiance Setup

The TEmS gaming area accommodates land, airborne and sea-based platforms with definable allegiance for easy viewing on the scenario map. Kinematics for each platform is easily configured using rectangular coordinates or by choosing one of the predefined paths.

Figure 3 – Real-time display showing platform kinematics, platform type and allegiance

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Easy Receiver Setup

The system under test can be configured as either a single-port/multiple RF channel receiver for emulating high density RF environments or as a multi-port/single RF channel receiver for emulating the receipt of phase-coherent waveforms across multiple receive elements or apertures. Both applications utilize the ASGM18A generator modules' frequency agility to quickly reconfigure the test setup. Users can also define a minimum threshold sensitivity to match that of the receiver in the system being tested to eliminate pulses from being generated that would otherwise never be detected by the actual system under test, thereby maximizing the pulse density in the simulated RF environment.
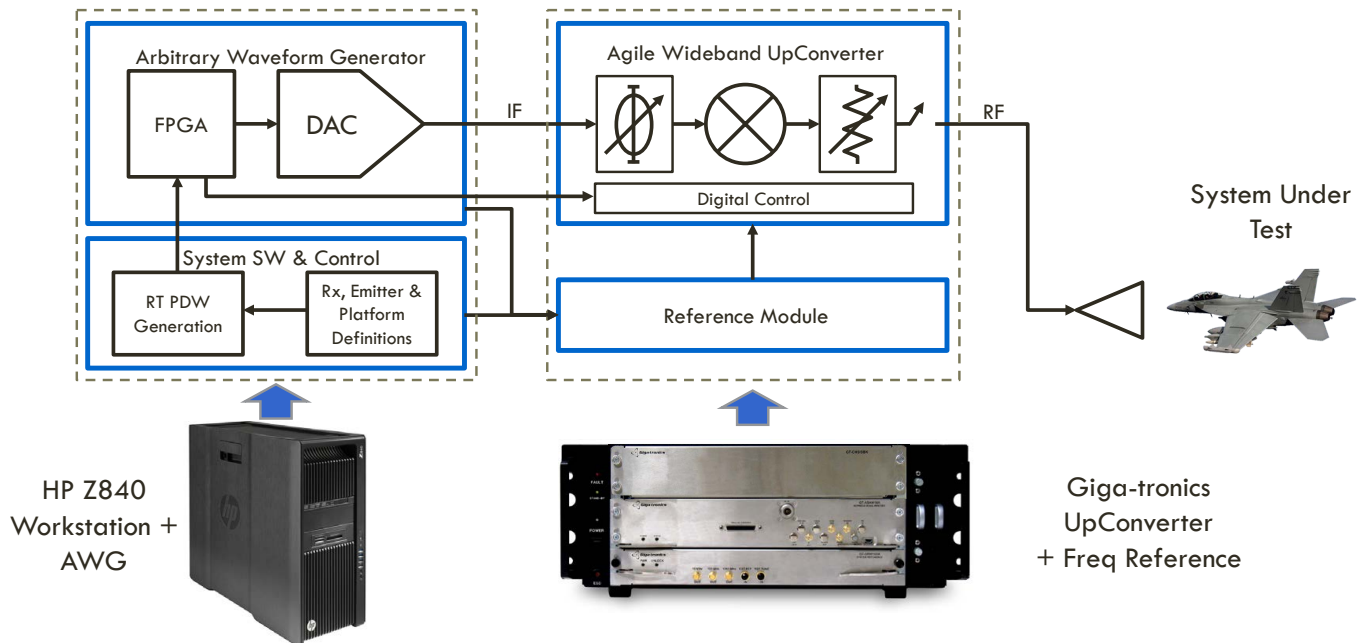
Figure 4 – The TEmS system functional blocks are similar to that of modern EW Systems

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Features

Emitters

Types	Legacy (Continuous) and Frame Based
Frame Length Range	Unlimited
Number of Frames	Unlimited
PRI Range	Unlimited
PW Range	10 ns to 200 ms, plus CW
Pulse Modulation	LFM, PSK, FSK, QAM and custom IQ
Emitter Modes	Single Pulse, Pulse Groups, CW and Dynamic
Single Pulse Definition	Staggered PW, Jittered PW, Frequency Agility, Variable Start Time
Pulse Group Definition	Staggered PW & PRI, Jittered PW & PRI, PRI Drift, Frequency Agility, Variable Start Time
Azimuth Scan Limits	-180 to 180 degrees
Elevation Scan Limits	-90 to 90 degrees
Az / El Orientation	Coupled or Independent
Az / El Offsets	Relative to Reference Platform or Emitter Orientation
Antenna Scan Types	Static, Linear Continuous, Discrete Map and Conical
Antenna Polarizations	Vertical, Horizontal, RHC, LHC
Antenna Pattern	User Defined

Receiver

Type	Single-Port/Multi-Channel or Multi-Port / Single-Channel
Antenna Polarizations	Vertical, Horizontal, RHC, LHC
Antenna Pattern	User Defined

Platforms

Types	Airborne, Land and Sea-based
Allegiance	Enemy (red), Friend (blue), Neutral (gray)
Motion	Fixed, Constant Heading, Generic Turn, Dynamic G Sine Weave, Constant G Sine Weave, Split-S, Race Track, Multi-Segment
Max Speed	3000 m/s

Senario Management

Modes	Editor, Pre-Run and Simulation
PDW Collections	Includes PDW statistics at IF and RF for each emitter number, channel number and frame number. IF PDWs include ToA, delta ToA, PW, Doppler and IF phase. RF PDWs include ToA, RF Center frequency, and RF Channel phase
Run-Time PDW Statistics	PDWs generated by Emitter and RF channel accounting for dropped pulses and those that do not meet receiver threshold requirements

Gaming Area

Model	Flat Earth 500 km x 500 km
Position Resolution	1 cm
Max Altitude	200 km

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Digital Waveform Generator

Max Pulse Density	1 MPPS Per Channel
PDW Timing Resolution	10 ns
Max Bandwidth	10 MHz (up to 1 GHz with External AWG)
Real-Time Parameter Control	via Parallel 50-pin BCD Interface

System Controller

HP Z840	Windows 7 Pro, 64 bit
RAM	64 GB
Reflective Ring Memory	GE 5565

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Selection Guide by Applications

Model Number	APPLICATION			OPTIONS			
	Real-Time Synthesizer	AXIe Companion	Real-Time Threat Emulation	OPT-ATT Electronic Step Attenuator	OPT-UP1 1200 MHz IF Input	OPT-BCD Parallel BCD Input	OPT-TCI TEmS Control Interface
ASGM18A 100 MHz to 18 GHz Advanced Signal Generator Module	●	●	●	●	●	●	●
ASAM18A 500 MHz to 18 GHz Advanced Signal Analyzer Module	●	●				●	
SRM100A System Reference Module	●	●	●				
CHSIS2A / CHSIS4A 2-Channel or 4-Channel AXIe System Chassis	●	●	●				
CHSISBK AXIe Blank Module: 2-Slot	●	●	●				
ONS On-Site System Configuration Service	●	●	●				
TEmS Threat Emulation Software and Control System			●				

Ordering Information

Model Number	Description

ASGM18A
    OPT-ATT
    OPT-UP1
    OPT-BCD
    OPT-TCI
	AXIe Advanced Signal Generator: 100 MHz to 18 GHz
	    Electronic Step Attenuator
	    1200 MHz IF Input
	    Parallel BCD Input
	    TEmS Control Interface

ASAM18A
    OPT-BCD
	AXIe Advanced Signal Analyzer: 500 MHz to 18 GHz
	    Parallel BCD Input

SRM100A	AXIe System Reference Module: 10 MHz, 100 MHz, 1200 MHz
CHSIS2A	2-Channel AXIe System Chassis (4U) (For 1 or 2 channel systems)
CHSIS4A	4-Channel AXIe System Chassis (7U) (For 1 to 4 channel systems)
CHSISBK	AXIe Blank Module: 2-Slot cover for Airflow Management and Backplane Termination
EWS20	Extended 2 Year Warranty
EWS40	Extended 4 Year Warranty
Consultancy	Professional Consultation

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Standard Warranty

Giga-tronics warrants to the Customer that all manufactured products conform to published specifications and are free from defects in material and workmanship for one year. The period begins on the date of shipment and only applies to normal operation of the product within the appropriate service condition. Giga-tronics shall have no responsibility hereunder for any defect or damage caused by improper storage, improper installation, unauthorized modification, misuse, neglect, inadequate maintenance, accident, or any part which has been repaired or altered by anyone other than Giga-tronics or its authorized representative, or not in accordance with Giga-tronics furnished instructions. https://go-asg.gigatronics.com/warranty

Extended Warranty

Extended warranty (Service and Calibration) can only be purchased at time of ordering or within 30 days after the ship date. Service for extended warranties will be performed by Giga-tronics Incorporated, its Microsource subsidiary; or, an authorized Giga-tronics Service Center. Prices do not include freight, insurance, handling, taxes, duties or any other related shipping charges. Extended warranty service and extended calibration options are based on the original ship date of the product. Extended calibration option requires that units be calibrated annually, if applicable. https://go-asg.gigatronics.com/warranty

American Systems Registrar, LLC certified ISO 9001:2008
Certification: https://go-asg.gigatronics.com/quality

ISO 9001:2008

Giga-tronics Support Services

At Giga-tronics, we understand the challenges you face. Our support services begin from the moment you call us. We help you achieve both top-line growth and bottom-line efficiencies by working to identify your precise needs and implement smart and result orientated solutions. We believe and commit ourselves in providing you with more than our superior test solutions. For technical support, contact:

Phone: +1 925.328.4650 | Email: asg-info@gigatronics.com

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