"Radar Simulator"

Brief

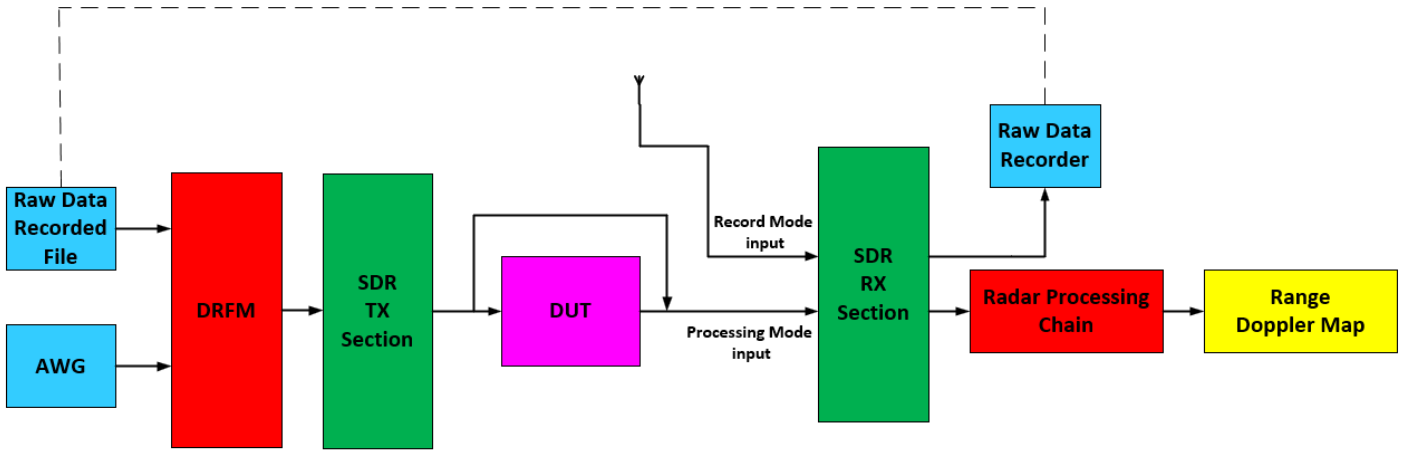
"Radar Simulator" (RS) is a test equipment that simulates Radar operation.
The RS evaluates the operational efficiency of RWR/ESM/ELINT and EW systems.
The RS creates an Electro-Magnetic dense operational scenario based on the generation of multisource emitters (including HRR and FMCW Radars) using an AWG or playback by a Digital RF Memory (DRFM) a high bandwidth high-resolution recorded file of a real operational arena that includes a mixture of electromagnetic signals including Radars and communication links.

The RS provides a real operational scenario for testing RWR/ESM/ELINT systems.
In addition, EW systems can be tested against several synthetic radar signals (generated by an AWG) or against real operational radars (a real operational arena recorded file playback by a DRFM). The RS provides a real-time Radar processing chain. The processing chain includes cross-correlation of the original Radar signal with the EA techniques provided by the tested systems, Doppler processing, and Constant Failure Alarm Rate (CFAR).

The "RS" outputs include Range and Doppler profiles and a "Range Doppler" map.
The low SWAP RS can be installed on various small aerial platforms for a real operational environment system performance evaluation.

System Description

The following figure describes the simulator's operational block diagram:



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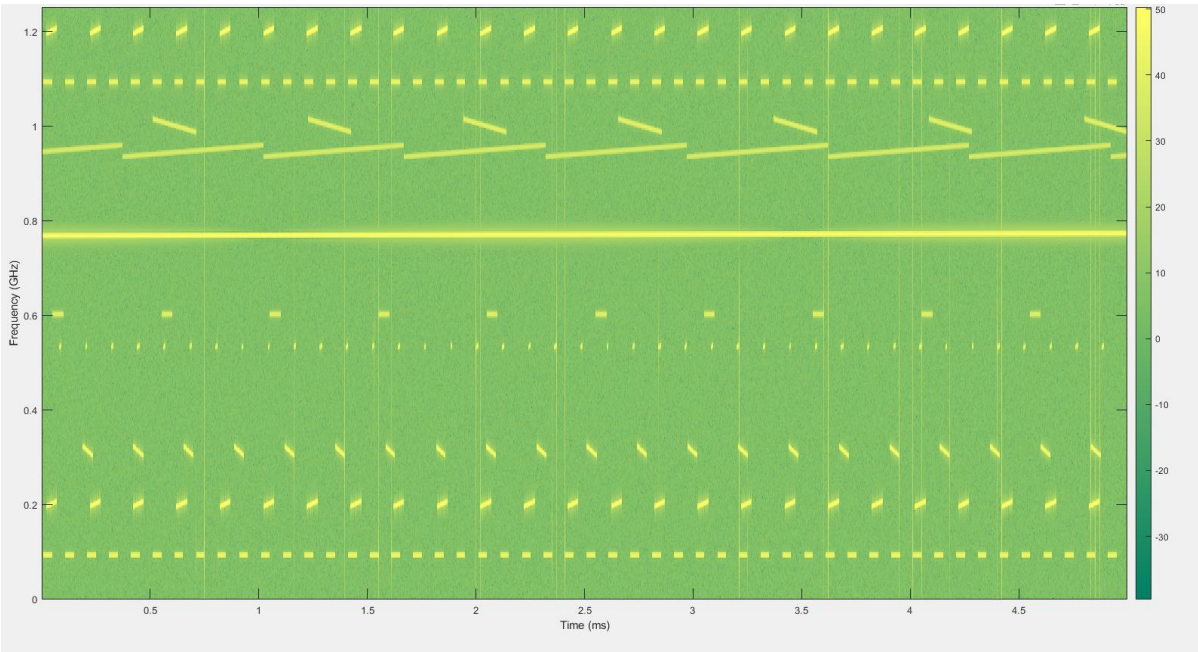
Arbitrary Waveform Generator (AWG)

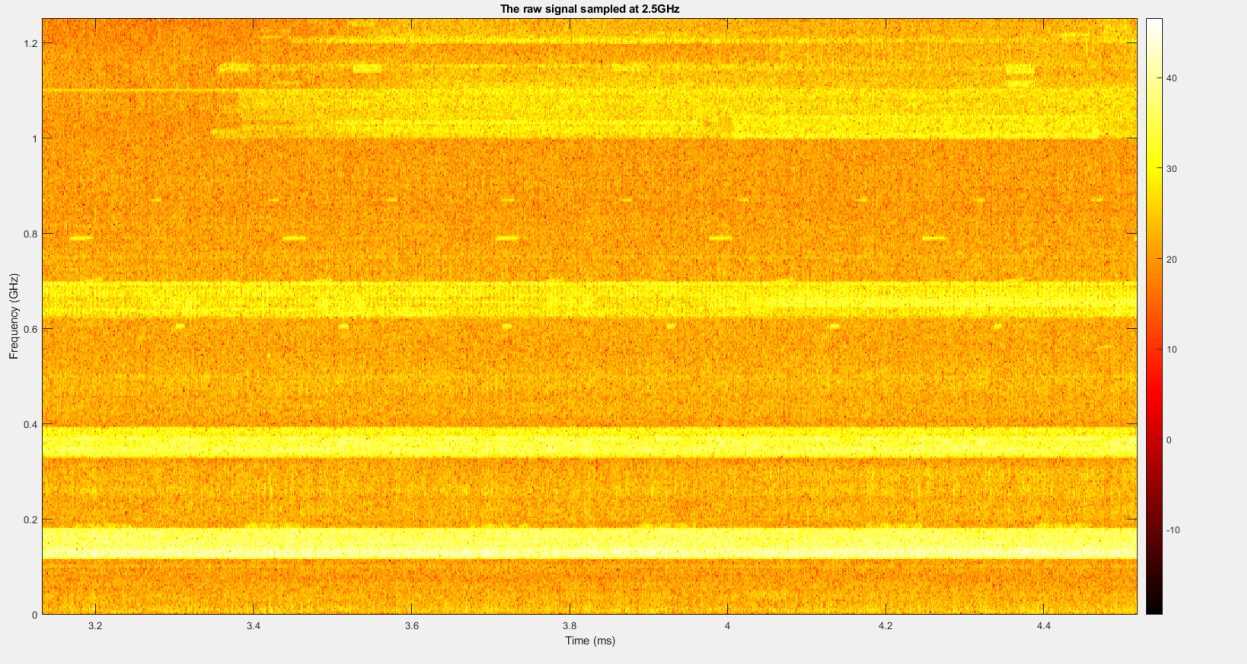
The AWG is a software tool that generates binary files for playback by the DRFM.
The binary file may include a couple of Radar signals.
All Radar's parameters are configurable by a friendly Graphical User Interface.
The following figure describes a spectrogram of 10 Radars operating simultaneously:



As can be observed from the figure the radar types include a standard pulse radar, Chirp radars, Barker radars, CW, and FMCW radars.

Raw Data file

The raw data file is generated by recording the output data from High Sample Rate, and High-Resolution multi-bit Analog to Digital Converter (ADC).
The ADC is a part of the Software Define Radio (SDR) RX section.
The following figure describes a spectrogram of real Raw Data records that includes both Radars and communications activities.



DRFM Section

The DRFM section reproduces the bin files that were created by the AWG or were recorded by the Raw Data Recorder.

Software Define Radio (SDR)

The SDR incorporates two sections: transmit section and receive section.

The transmit section includes a high-speed sampling bitrate and high-resolution digital-to-analog converter followed by a wide band RF tunable Front End. The transmit section is fed by the DRFM (bin files) and produces an RF signal modulated by the bin file information.

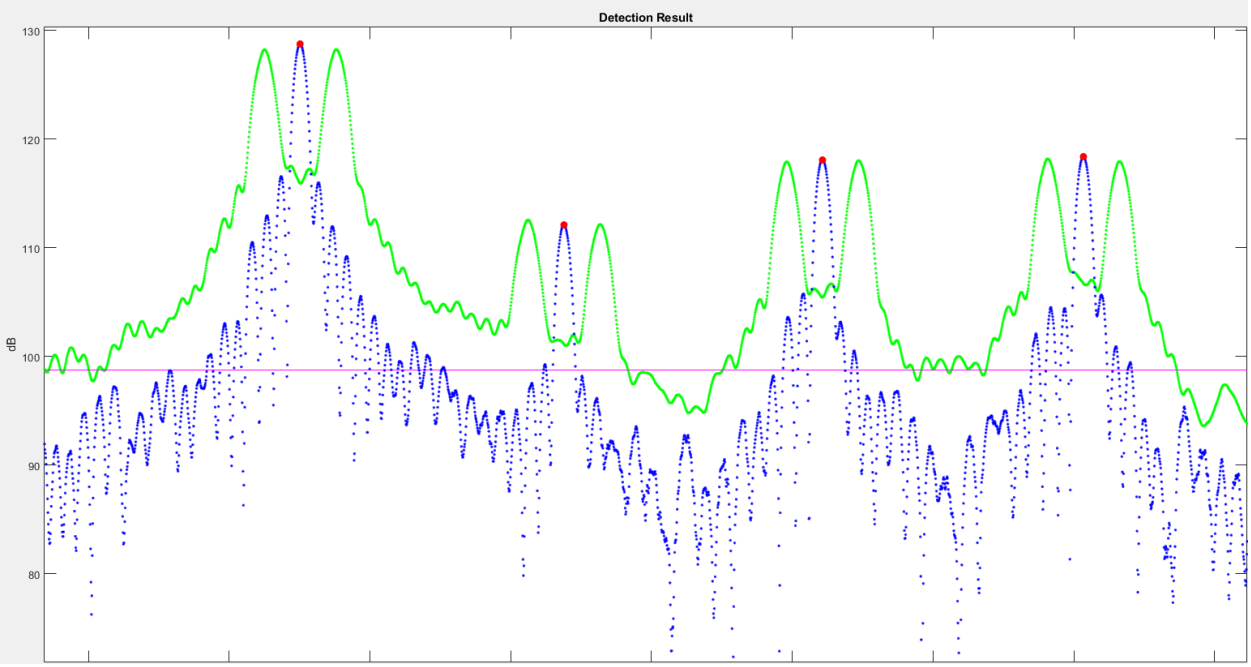
The receive section includes a wide band RF tunable Front End followed by a high-speed sampling bitrate and high-resolution analog-to-digital Converter (ADC).
The ADC output is routed to a different location in the SDR according to the section's operational mode.
In the "Record Mode", the received data will be routed to the Raw Data Recorder (a part of the "System on Chip" that is included in the SDR).
In the "Processing Mode", the data will be routed to the real-time Radar's processing chain for EW system operation validation.

Raw Data Recorder

The Raw Data Recorder record stores binary files that were received and digitized by the SDR's receiver section.
The recorded files can be played back by the DRFM for Device Under Test (DUT) performance evaluation.

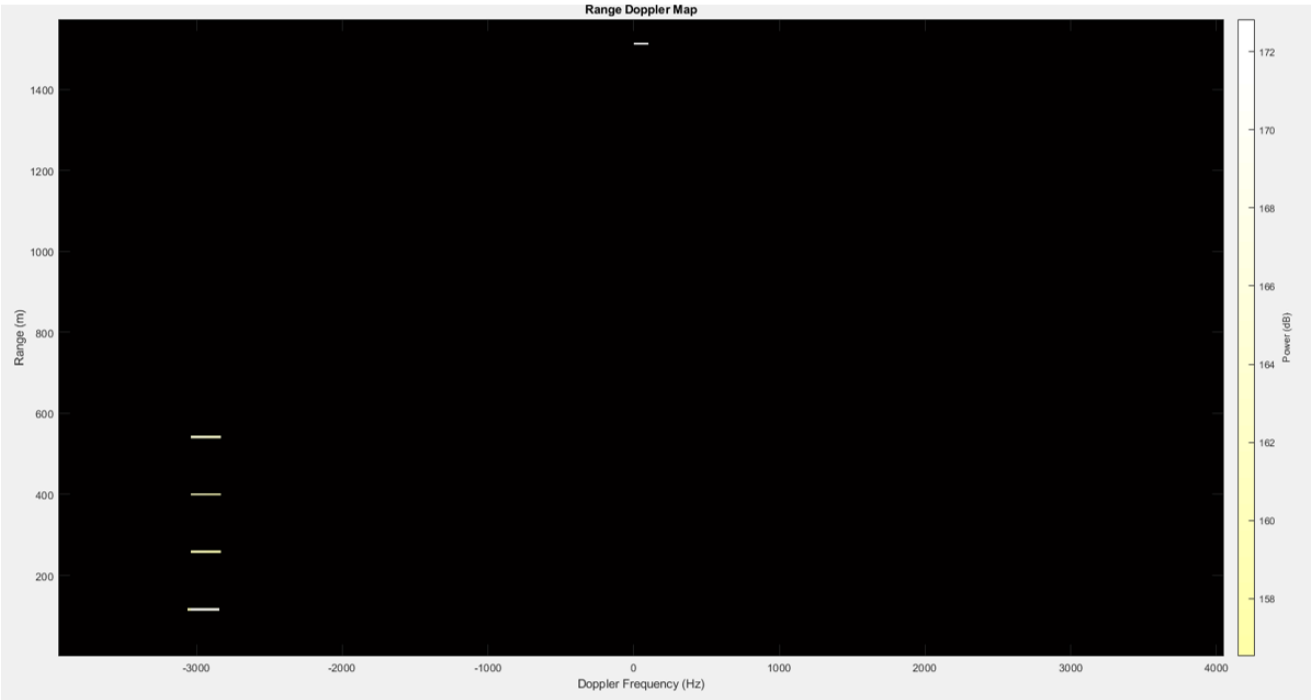
Radar Processing Chain

The Radar processing chain performs all the process activities that are implemented by an operational Radar.
The activities include cross-correlation of the replica (matched filter) of the Radar signal with the transmitted signal produced by the DUT EW system. In addition, a CFAR algorithm is implemented on the cross-correlation output. A Doppler shift is calculated for every target that passed successfully the cross-correlation and CFAR processing.
The following figures describe the range targets profile after cross-correlation and CFAR processing:



Range Doppler Map

The Range Doppler map provides the results of the Radar's processing chain.
The results of the processing chain indicate the quality and integrity of the DUT's EA techniques. The following figure describes the Range Doppler map output of five targets with different Doppler shifts.



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System Specifications

SDR Performance

	Feature	Value	Units	Notes
	RF Specifications			
1	RF Operational Band	0.05 - 18	GHZ	
2	Instantaneous Bandwidth	1.25	GHZ	
3	Max input Power	-10	dbm	
4	Input / Output Return Loss	-10	db	
	Conversion Specifications			
5	ADC sample Rate	2.5	GS/s	
6	ADC Resolution	12	bit	
7	DAC sample Rate	2.5	GS/s	
8	DAC Resolution	14	bit	

DRFM Performance

	DRFM Specifications	Value	Units	Notes
1	Operational Rate	2.5	GS/s	
2	Reproduction Bandwidth	1.25	GHZ	
3	Memory depth	125	ms	@maximum rate
4	Operational Modes	Signal Reproduction		

AWG Performance

	AWG Specifications	Value		
1	Number of Emitters	10		
2	Emitter controlled parameters	Frequency, PW, PRI, AMP, Internal modulation		
3	Emitter Types	CW, FMCW, Pulse, Chirp, and Barker		

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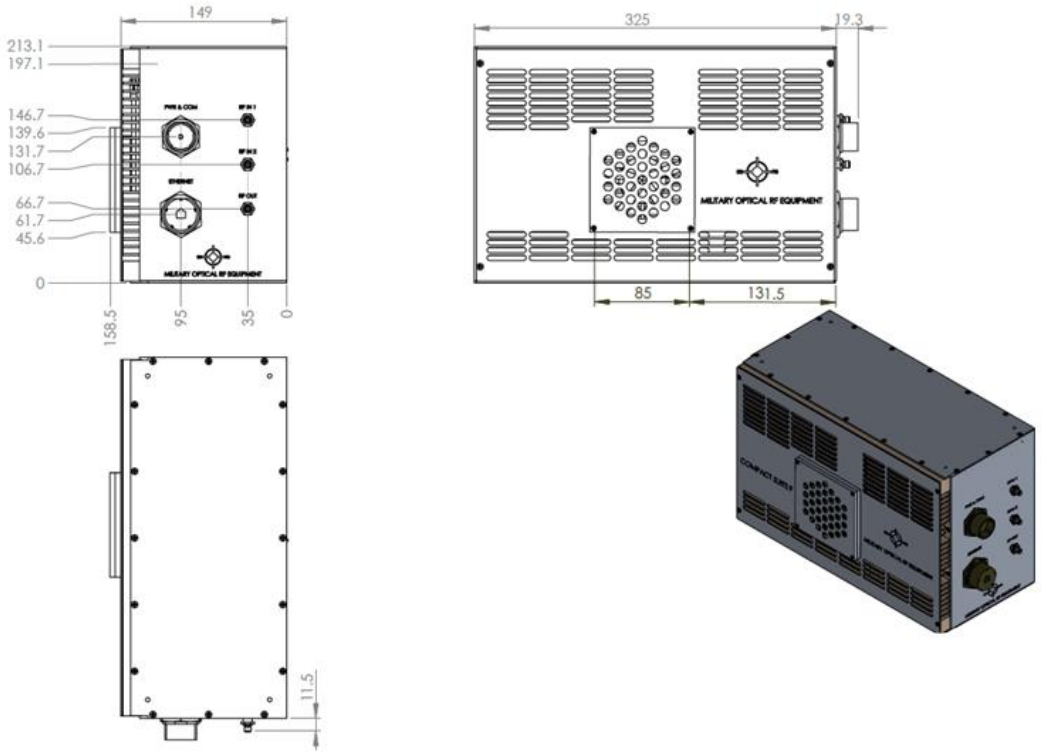
Mechanical Dimension



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