Signal Generator for High Density Electronic Warfare Simulation

Decrease size, increase capability

Keysight's SWAP-C optimized Electronic Warfare (EW) Threat Simulator solution based on the new M9484C VXG Signal Generator with Signal Descriptor Word (SDW) and Virtual Channel options, offers a revolutionary way to generate complex, high-fidelity EW RF simulations with pulse-on-pulse signals, CW and other interferers. The solution allows for single port to four ports on the bench or can be integrated into full scale threat simulator solutions to increase signal complexity, channels, and ports. All ports can be used for Angle of Arrival*[1] or independently tuned to separate carrier frequencies.

[1] AOA Calibration may require additional calibration software/hardware. Contact Keysight representative for more details on accuracy and requirements.

KEYSIGHT

Industry Leading Signal Generation Capabilities

The M9484C VXG Vector Signal Generator provides the industry's first vector signal generator with up to 54 GHz frequency range and 2.5 GHz of modulation bandwidth in a single instrument, or up to 110 GHz with the V3080A frequency extender and 5 GHz with channel bonding, to enable your next breakthrough. The proprietary next generation DDS DAC enables a phase coherent architecture to allow:

- Up to 2 or 4 RF outputs in a single instrument which can be tuned at the same carrier frequency for AOA test or independently tuned up to 54GHz or 20GHz respectively.
- Each RF output has 2.5GHz of modulation bandwidth which enables up to 8 virtual channels which can be used to create pulsed signals, communications signals, or CW interference.

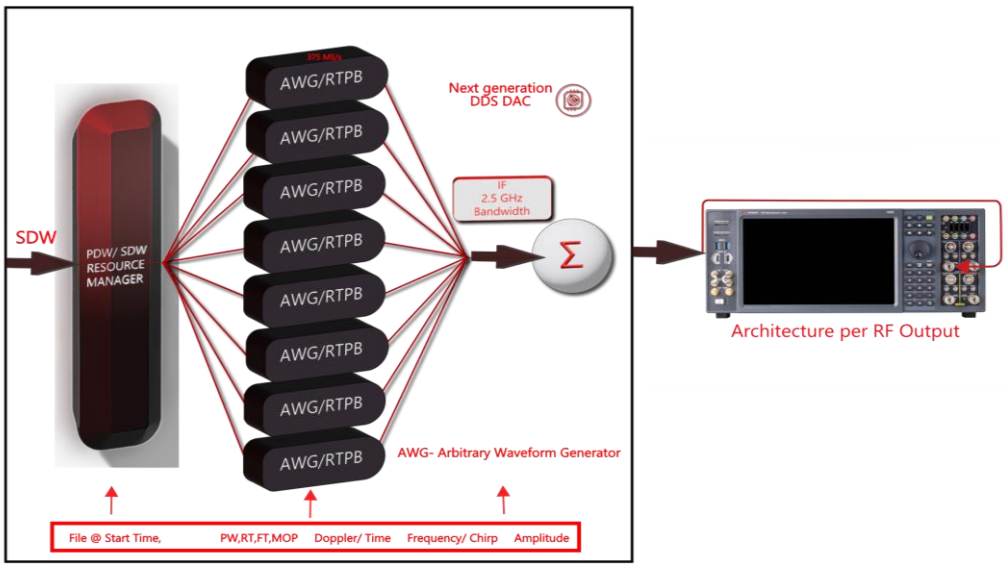

Figure 1. Keysight proprietary DDS based DAC enables up to 8 virtual channels, per 1 RF output. All RF outputs can be independently RF tuned with 2.5 GHz of modulation bandwidth per output.

Complex Scenario Generation with Virtual Channels

The M9484C Signal Descriptor Word interface enables users to stream complex signal types to each RF output. Each RF output on the source can generate up to 8 simultaneous signals that are independently controlled within the 2.5GHz bandwidth, including: agile pulsed signals, communication interferers and CW signals out of one RF output port[2]. This can then be scaled up to 4 RF output ports in one instrument, up to 20 GHz for angle of arrival or independently tuned outputs.

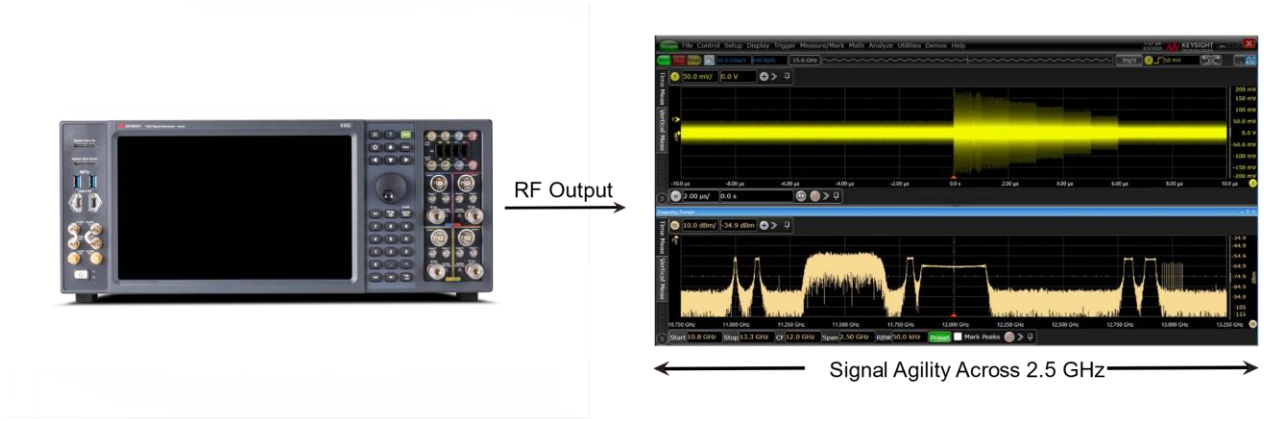

Figure 2. Example scenario with 8 different signal types including pulsed emitters, communication interferers, etc., all being generated from one RF output.

[2] Requires option SDW and 8CH, not compatible with 8SG.

Flexible High-Density Simulation

The solution can be used in different configurations for maximum signal generation flexibility to utilize the asset for multiple test cases. Signals can overlap in both time and frequency, making it possible to generate high-density and complex simulations.

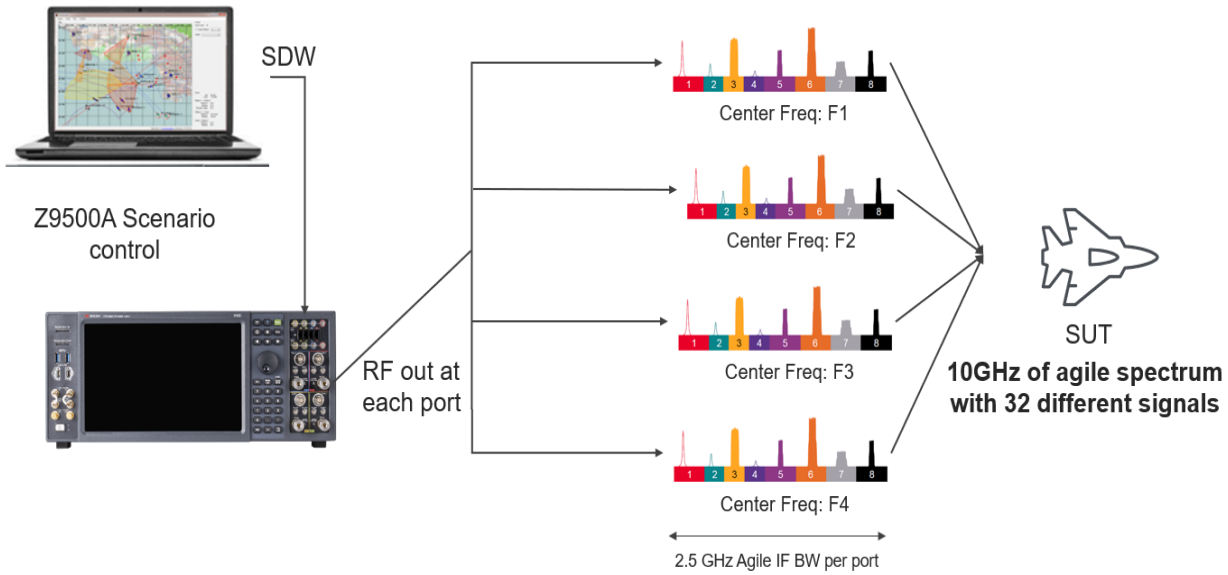

Figure 3. Up to 4 independently tuned RF ports with different IF corrections applied. Signals can overlap in both time and frequency.

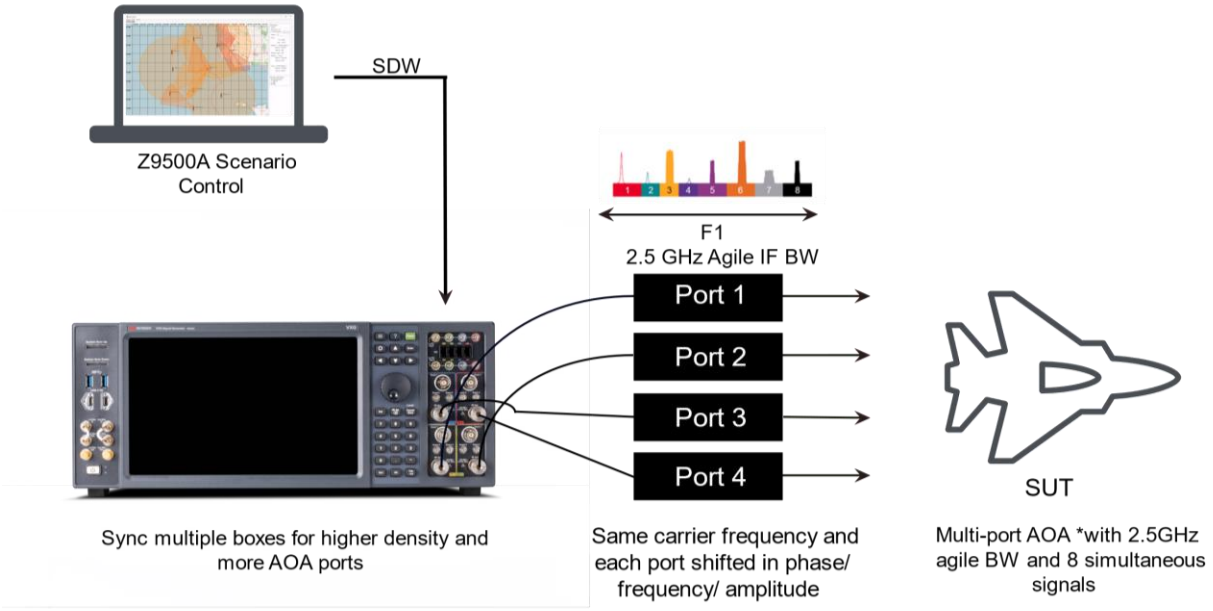

Figure 4. Up to 4 ports in one instrument with the ability to scale

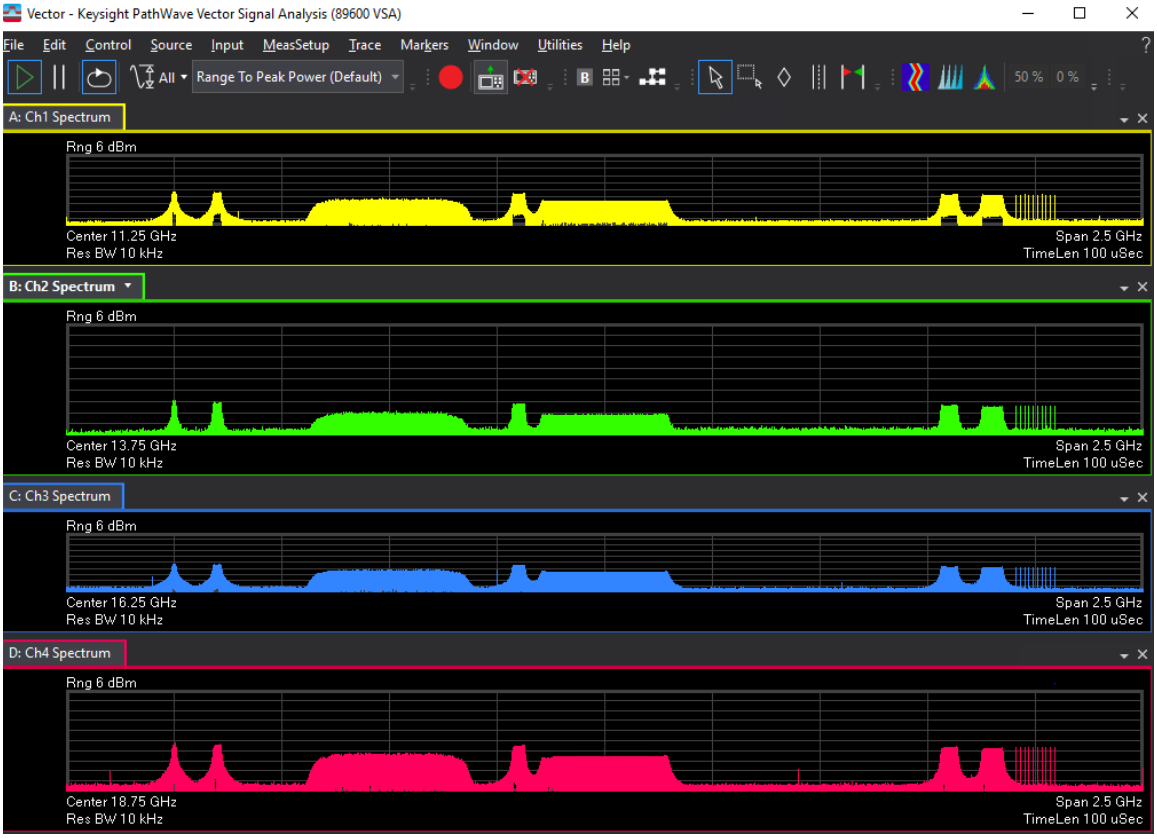

Figure 5. Example scenario with 8 different signal types including pulsed emitters, communication interferes, etc. duplicated across 4 M9484C VXG RF output ports all independently tuned.

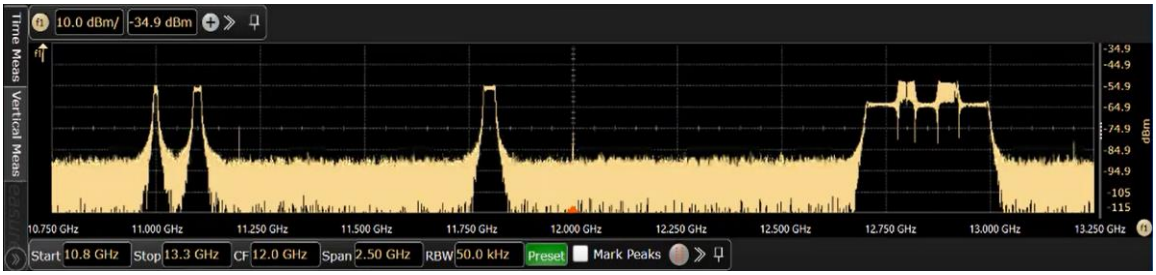

Figure 5. Signals can overlap both in timing and frequency, here is an example of a wideband chirp centered around the same frequency as two smaller chirped signals.

Threat Simulation Integrated Solution

There is flexibility in instrument control either using the SDW streaming interface to integrate into your customized test setups or with the Keysight EW Threat Simulation Software. Keysight EW Threat Simulation software is a dynamic threat generation software which creates complex threat environments and automatically controls angle of arrival, pulse, and signal arbitration with an open plugin architecture. The open architecture allows for legacy threat database imports, customized plugins for workflow optimization and navigation data input.

Figure 6. Benchtop Threat Simulation solution with up to 4 RF ports that can generate up to 8 pulse-on-pulse or other signal types with 4 AOA ports up to 20GHz.

Figure 7. M9484C VXG RF output of 6 pulse-on-pulse scenario with comms interferers

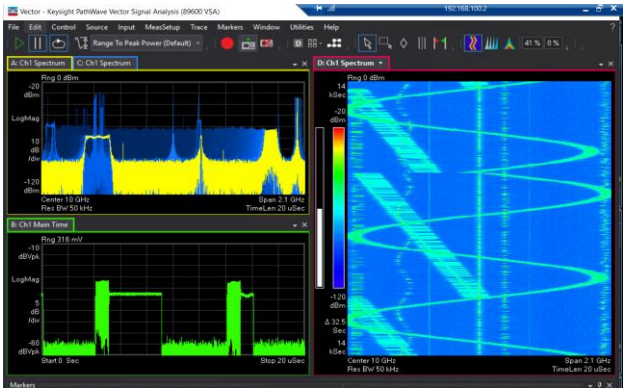

Figure 8. M9484C VXG RF output frequency domain capture

Configure Hardware for EW Threat Simulation

Below are the recommended and required options for EW Threat Simulation, see the M9484C Configuration Guide for additional options.

Select number of RF output channels (Ports)

Configuration	Required options	Descriptions	Additional information
One RF Output Channel (Port)	M9484C-001	Add channel one	Required for all configurations
Two RF Output Channels (Ports)	M9484C-001 M9484C-002	Add channel one Add channel two	
Four RF Output Channels (Ports)	M9484C-001 M9484C-002 M9484C-003 M9484C-004	Add channel one Add channel two Add channel three Add channel four	Not compatible with 532, 544, 554

Select frequency range (ordered once per RF port)

Configuration	Description	Additional information
Frequency options (must select one; option will be duplicated on all channels)		
M9484C-506	CW frequency range, 9 kHz to 6 GHz	Type-N (f) RF output connector Not compatible with 1EH
M9484C-508	CW frequency range, 9 kHz to 8.5 GHz	Type-N (f) RF output connector Not compatible with 1EH
M9484C-514	CW frequency range, 9 kHz to 14 GHz	3.5 mm (m) RF output connector
M9484C-520	CW frequency range, 9 kHz to 20 GHz	3.5 mm (m) RF output connector
M9484C-532	CW frequency range, 9 kHz to 31.8 GHz	1.85 mm (m) RF output connector Not compatible with 003, 004
M9484C-544	CW frequency range, 9 kHz to 44 GHz	1.85 mm (m) RF output connector Not compatible with 003, 004
M9484C-554	CW frequency range, 9 kHz to 54 GHz	1.85 mm (m) RF output connector Not compatible with 003, 004

Select digital channels and SDW streaming[3]

To enable SDW streaming and virtual channels:

- Select an SDW option for each RF channel output
- Select a virtual channel option each RF channel output, if no virtual channel option is selected the default is 1 virtual channel digital stream

Configuration	Description	Additional information
M9484CU-827	Add signal descriptor word streaming to RF channel output 1 (SDW)	
M9484CU-828	Add signal descriptor word streaming to RF channel output 2 (SDW)	
M9484CU-829	Add signal descriptor word streaming to RF channel output 3 (SDW)	
M9484CU-830	Add signal descriptor word streaming to RF channel output 4 (SDW)	
M9484CU-811	Add 2 virtual channels for SDW streaming to channel 1 (2CH)	Requires SDW option M9484CU-827
M9484CU-812	Add 2 virtual channels for SDW streaming to channel 2 (2CH)	Requires SDW option M9484CU-828
M9484CU-813	Add 2 virtual channels for SDW streaming to channel 3 (2CH)	Requires SDW option M9484CU-829
M9484CU-814	Add 2 virtual channels for SDW streaming to channel 4 (2CH)	Requires SDW option M9484CU-830
M9484CU-815	Add 4 virtual channels for SDW streaming to channel 1 (4CH)	Requires SDW option M9484CU-827
M9484CU-816	Add 4 virtual channels for SDW streaming to channel 2 (4CH)	Requires SDW option M9484CU-828
M9484CU-817	Add 4 virtual channels for SDW streaming to channel 3 (4CH)	Requires SDW option M9484CU-829
M9484CU-818	Add 4 virtual channels for SDW streaming to channel 4 (4CH)	Requires SDW option M9484CU-830
M9484CU-819	Add 8 virtual channels for SDW streaming to channel 1 (8CH)	Requires SDW option M9484CU-827
M9484CU-820	Add 8 virtual channels for SDW streaming to channel 2 (8CH)	Requires SDW option M9484CU-828
M9484CU-821	Add 8 virtual channels for SDW streaming to channel 3 (8CH)	Requires SDW option M9484CU-829
M9484CU-822	Add 8 virtual channels for SDW streaming to channel 4 (8CH)	Requires SDW option M9484CU-830

[3] ITAR Export controlled options

Additional options for EW VXG-C test and evaluation

Configuration	Description	Additional information
Bandwidth, Memory, and Harmonic Options (R25 is required for SDW Streaming, option to be duplicated on all RF output channels)		
M9484C-R25	RF bandwidth, 2.5 GHz with 256 MSa memory	Required
M9484C-M20	Baseband generator memory upgrade to 2048 MSa	Recommended
M9484C-1EH	Improved harmonics below 3.8 GHz	Recommended, not compatible with 506, 508
Reference options (must select one; option to be duplicated on all RF output channels)		
M9484C-500	High performance reference	Requires ST5
M9484C-600	Enhanced high performance reference	Requires ST6
Phase noise options (must select one; option to be duplicated on all RF output channels)		
M9484C-ST5	Low phase noise	Requires 500
M9484C-ST6	Enhanced low phase noise	Requires 600
Channel synchronization		
M9484C-PCH	Phase coherency for N channels	Requires 002

Select EW Threat Simulation View Software[4]

See Keysight EW Threat Simulation View Technical Overview for more information, additional options and feature sets.

Z9500A Keysight EW Threat Simulation View

Model number	Description	Software support duration
Z9500A-1FP	Node-locked perpetual license bundle includes UXG (Y9500EMBC) and PC (Y9500APPC) licenses	Includes 1-year KesightCare software support subscription
Z9500A-1TP	Transportable perpetual license bundle includes UXG (Y9500EMBC) and PC (Y9500APPC) licenses	Includes 1-year KeysightCare software support subscription
Z9500A-1FL	Node-locked subscription license bundle includes UXG (Y9500EMBC) and PC (Y9500APPC) licenses	1-year subscription license with KeysightCare support included

[4] Simulation View software is ITAR export controlled

Summary

The M9484 VXG with SDW streaming addresses the evolving needs of EW Test and Evaluation, with flexible and scalable options with the ability to test in lab with limited space or address fully capable threat simulation systems. Keysight provides an end-to-end threat simulation solution for all test levels including fully integrated systems with industry leading thermal control and automated calibration.

For more insights on how to accelerate EW Test and Evaluation across your workflow, check the following links:

Keysight Technologies Electronic Warfare Test and Evaluation Solutions: https://www.keysight.com/us/en/assets/7018-06406/brochures/5992-3476.pdf

X-Series Agile Signal Generators UXG: https://www.keysight.com/us/en/products/signal-generators-signal-sources/x-series-agile-signal-generators-uxg.html