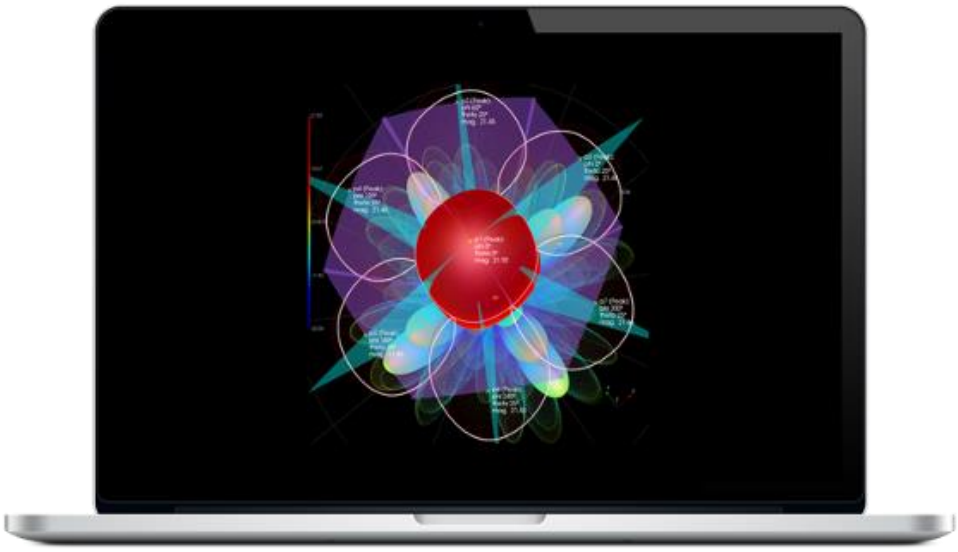
PathWave System Design (SystemVue)

One environment for system architecture, design, and verification

Introduction

RF system design challenges include mmWave frequencies, multiple antennas, complex modulation, beam steering, and sophisticated algorithms. Rough estimates, figures and formulas on spreadsheets, and internal or custom tools have trouble keeping pace.

PathWave System Design (formerly SystemVue) brings teams multi-domain modeling and simulation in one collaborative design environment for complex RF systems. It goes beyond math-based modeling with a complete RF-aware design workflow, plus decades of Keysight measurement science in RF instrumentation, ready for any system architect.



KEYSIGHT

PATHWAVE

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Why RF System Design Teams Choose PathWave System Design

- Most advanced virtual prototyping and design platform for complex RF systems
- Faster simulation speed in time and frequency domains with near-circuit-level fidelity
- Real-world libraries for radar, EW, satellite, phased array, 5G NR, Wi-Fi, and more
- Integrations with ADS, MATLAB® and STK
- Seamless AI ML integration

Physical prototyping, especially for large, complex systems, is expensive and time-consuming. However, even if an organization has an outstanding track record of RF system design, investors and government agencies are less and less willing to fund development without seeing a prototype. In a major shift, the United States Department of Defense (DoD) has outlined its Digital Engineering Strategy. Calling for digital system representations in its acquisition and procurement processes, DoD looks to encourage prototype repeatability, capture proof-of-performance sooner, and speed up communication across stakeholders. Prototype complex RF systems and create new breakthroughs.

How do system engineering teams quickly demonstrate concepts and show ways to address challenges without too much speculative spending?

PathWave System Design is the most advanced virtual prototyping and design platform available for RF system architects, array antenna designers, RF module designers, DSP engineers, and system test engineers. It shares data with many enterprise tools for modeling and analysis of coverage scenarios, RF propagation and channels, antenna design, and baseband signal processing. Teams can drill down into part of a design, reducing complexity, simulate with higher fidelity, and bring results back into the system model.

Adding PathWave System Design to a system engineering workflow can get virtual RF system prototypes up and running faster, with improved accuracy. Teams can explore ideas and have answers for risks earlier. System architects proficient in PathWave System Design see new ways to solve difficult design challenges, opening doors to development breakthroughs in future technologies for complex RF systems.

Core Simulators

PathWave System Design (SystemVue) stands at the forefront of system-level design and simulation software tailored to empower RF and baseband system architects. This software encompasses a spectrum of simulation technologies, traversing baseband and RF domains while seamlessly transitioning between frequency and time domains. Key components include the **Data Flow** and **Spectrasys** simulation cores, alongside our cutting-edge **Phased Array** analysis and the unique **WhatIF** frequency planner. This technical overview provides insight into PathWave System Design's core functionalities and transformative capabilities, demonstrating its key role in advancing system-level design for RF and baseband systems.

Data Flow

The Data Flow analysis of RF systems can be carried out using either Data Flow models alone or integrating Spectrasys RF and Phased Array Analysis architectures. Data Flow is also engineered to compute baseband system responses efficiently. It provides engineers with the tools to design and analyze digital signal processing (DSP) and fixed-point implementations, a natural choice for hardware description and verification. Tailored for mixed baseband and RF systems with dynamic characteristics with Data Flow simulations, designers can systematically investigate and enhance the system's design topology to align with their precise specifications.

Data Flow is grounded in Synchronous Data Flow (SDF), widely recognized as the most mature model of computation within the data flow paradigm. Building upon SDF, Timed Synchronous Data Flow (TSDF) further refines the process. In TSDF, data sample flow is envisaged as discrete-time signals or sampled counterparts of continuous-time signals.

Spectrasys

Spectrasys is a spectral propagation engine and root cause analysis tool that supports both behavioral and measurement-based modeling, considering bidirectional spectrum propagation within the design. This advanced broadband RF line-up tool maintains a comprehensive record of individual spectra, enabling designers to identify spurious signals and their origins. It offers interactive budget diagrams and cascaded measurement tables. It outperforms conventional tools like spreadsheets, mathematical software, and circuit simulators by providing precise treatment of RF effects while significantly accelerating simulation speed compared to traditional nonlinear techniques, which often require convergence criteria. The advantages of employing Spectrasys over traditional simulation techniques include bandwidth calculations for all spectra, broadband noise, analysis of behavioral phase noise effects, multiple path analysis, and signal leakage path analysis.

What IF

What IF is a frequency planner that pinpoints optimum intermediate frequencies. It is a revolutionary technique that streamlines the time-consuming process of spurious searches, reducing it from weeks and days to mere hours and minutes. This highly efficient method allows users to visualize the spurious performance of all Intermediate Frequencies (IF) on a single graph, identifying spurious-free regions and accommodating multiple frequency band conversions to a unified IF frequency. Users can assess performance trade-offs across different IFs, gaining control over mixer requirements and specifications by pinpointing all spurious offenders. This cutting-edge approach calculates spurious responses and their amplitudes based on mixer characteristics, system frequencies, bandwidths, and desired IF bandwidths. Notably, simulation speed is significantly accelerated through the elimination of conventional sweep analysis.

Phased Array

The phased array analysis simulation engine, built on Spectrasys technology, along with the RF phased array models, allows designers to create and simulate phased array systems easily. Although a phased array system can have hundreds or thousands of parts and paths, the special "smart" RF Phased Array models allow you to create the system as a simple single chain. Under a Phased Array simulation, the RF Phased Array models, as well as other RF models used in the design know how to replicate themselves to match the number of paths at any point in the system based on the splitter/combiner stages before and after them. This allows a very easy and compact representation of the system no matter how many elements the antenna has. The alternative is to explicitly draw all paths and manually combine/split them, which would be very time-consuming and error-prone even for moderate-sized systems and impossible for large systems. In addition, Phased Array Analysis provides a rich set of predefined measurements for system evaluation, encompassing electronic and 3D beam pattern measurements, empowering designers with a comprehensive toolbox to assess and fine-tune their phased array systems efficiently.

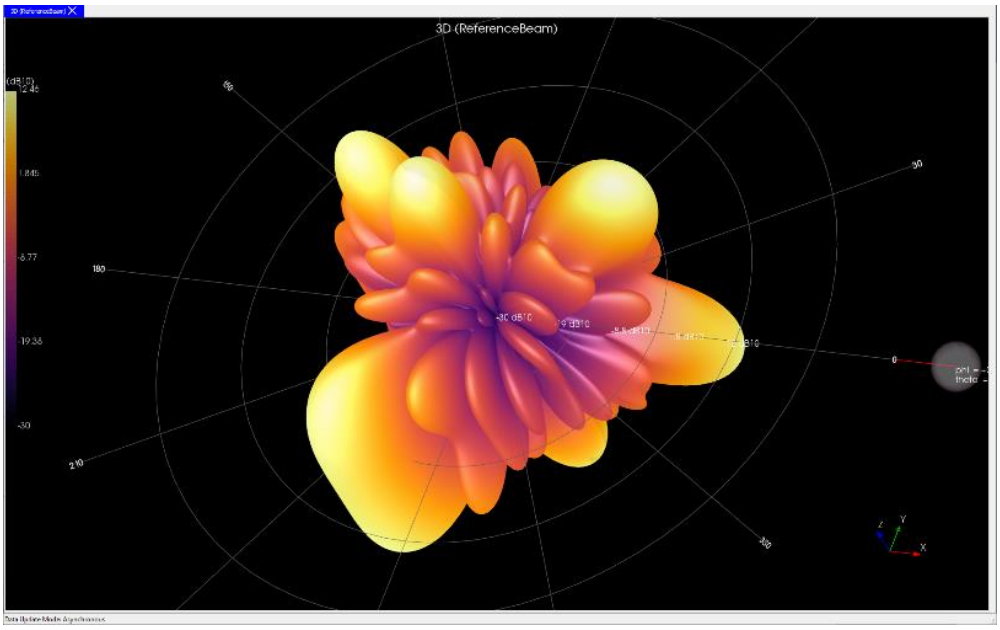

Figure 1. Phased array antenna beam pattern

Integrated Design Environment

Expand PathWave System Desing application reach.

PathWave System Design provides effortless integration with a wide array of Keysight's software and other enterprise applications, including Signal Studio, VSA, X-App, EXata Network Modeling, Matlab®, Ansys STK, and seamless links to Keysight's cutting-edge instruments, thereby broadening the scope of its applications.

With seamless integration to Signal Studio and VSA software, users harness the measurement science as Keysight instruments, ensuring a unified design and test workflow. This integration eliminates disparities between the design phase and prototype testing, streamlining the process for greater efficiency and accuracy.

Data sharing with enterprise design and verification tools:

- Baseband algorithm design and modeling (MATLAB®, Python)
- RF and mmWave circuit design (ADS, RFIC Design)
- Scenario and channel modeling (STK, Wireless InSite®)
- Network modelling (EXata)
- Instrument software: Signal Studio, X-App and Vector Signal Analysis (VSA)
- Open APIs for modeling and additional workflow customization

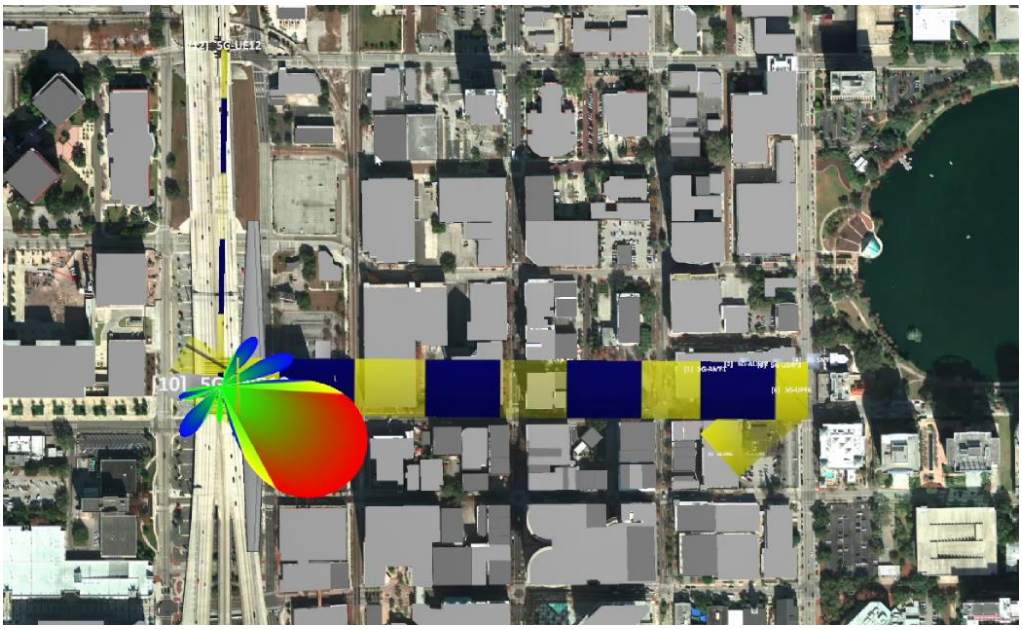

Figure 2. PathWave System Design beamforming inside EXata Network Modeling

Tools for the ADS Circuit Designer

Inside PathWave Advanced Design System (ADS).

System architects aren't the only ones who can harness the power of RF-aware system-level simulation. Connecting PathWave System Design with companion circuit-level RF design tools adds near-circuit-level simulation accuracy.

RF System Explorer

Unite system design and circuit design.

RF System Explorer (RFSE) is an advanced RF system architecture tool that brings the diagnostic prowess of Spectrasys directly to circuit designers in ADS, empowering you to quickly identify and address root causes of performance issues that traditional methods struggle to detect. Imagine having the ability to diagnose complex RF analog effects, including elusive spurious origins, with ease and precision.

Create superior RF circuit architectures at the onset. Leverage the invaluable insights offered by this advanced line-up tool during the early stages of your design process, ensuring optimal architectural choices, frequencies, and component partitioning accounting for crucial RF effects and providing interactive graphical diagnosis,

RFSE excels in generating Extracted Behavioral Models (EBMs) from ADS circuit designs and brings them to system-level analysis, enabling a seamless transition uniting circuit design and system design. RFSE streamlines your circuit design workflow, saving you time and enhancing overall performance. Meet system specifications from behavioral models to circuit-level implementations and know earlier the effect of your circuit design on the overall system performance.

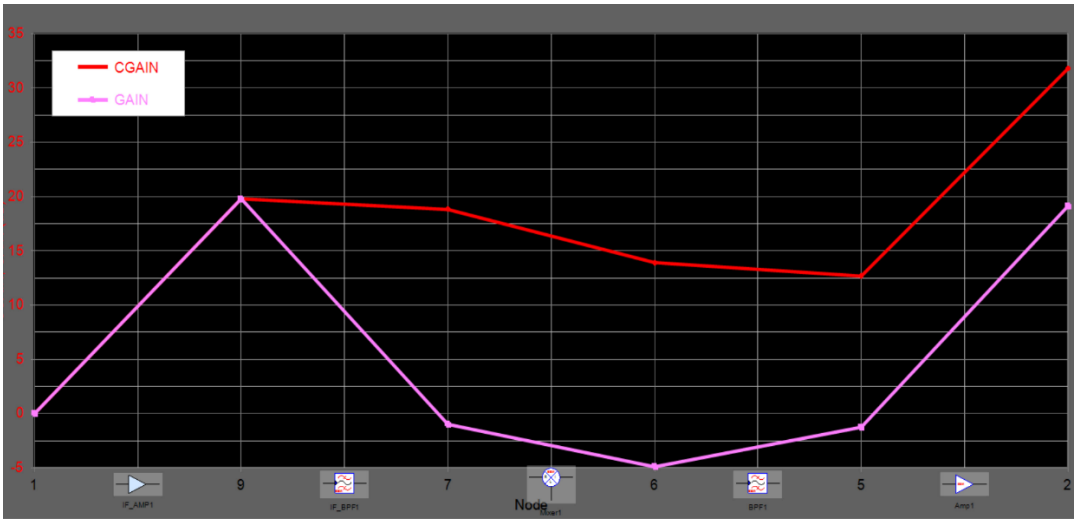

Figure 3. RF System Explorer budget plot

DPD Explorer

Revolutionize PA Design predicting performance after DPD.

Digital Pre-Distortion (DPD) stands as a cornerstone in wireless communication systems, crucial for enhancing the efficiency of Power Amplifiers (PAs) by mitigating distortion in their non-linear operating regions. Enter DPD Explorer, a groundbreaking solution designed specifically for circuit-level PA designers, transforming their workflow. This innovative tool captures amplifier nonlinearity, crafting pre-distortion algorithms.

Experience a paradigm shift in PA design with DPD Explorer, where designers gain rapid insights into PA performance metrics like ACPR and EVM, anticipating what their end customers will actually experience. Leveraging the same measurement algorithms as the PNA-X in the lab, this tool ensures trusted simulation-hardware comparison. DPD Explorer sets itself apart with the introduction of the Dynamic Gain Model, addressing non-linear memory effects in broadband topologies such as GaN Doherty. With compact waveforms enabling unparalleled simulation speed and streamlined DPD optimization, this tool revolutionizes the entire PA design process. Integrated into ADS, the preferred tool for circuit designers, DPD Explorer boasts an intuitive GUI, minimizing the learning curve for an efficient and user-friendly design experience. Elevate your PA design capabilities with DPD Explorer.

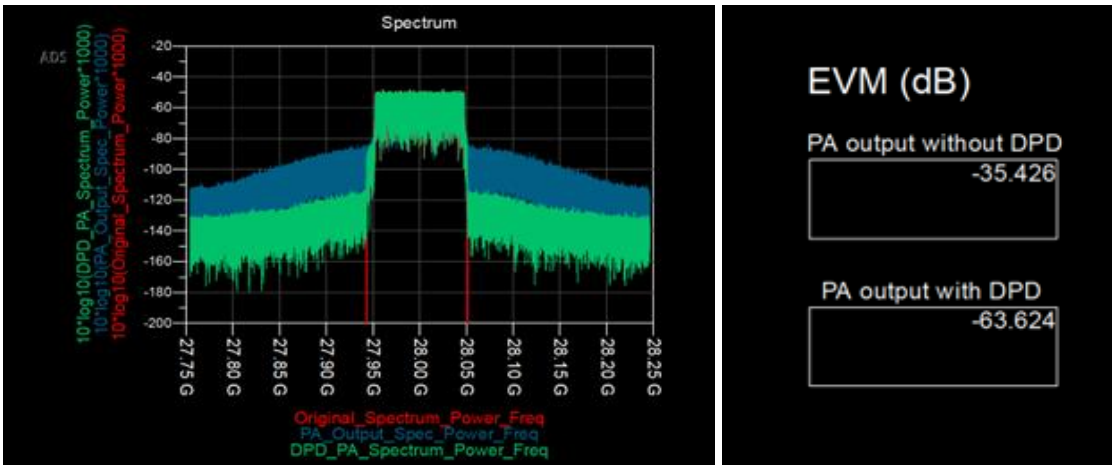

Figure 4. DPD Explorer spectrum plot (left) and EVM measurements in ADS data display (right)

Virtual test benches

Bring modulated waveform analysis to transistor-level simulation.

Virtual Test Benches (VTBs) bring modulated waveform analysis to transistor-level simulation inside ADS and PathWave RFIC Design (Golden Gate).

A VTB, as a Data Flow design, is specifically engineered to rigorously validate circuit performance within its design and simulation ecosystem. It's created by a system designer within the Data Flow environment but serves as an invaluable tool for circuit designers operating within the ADS or RFIC Design environments. VTBs not only streamline the validation process but also enhance the synergy between system and circuit design, fostering a more efficient and integrated design workflow.

AI ML Integration

Accelerate 6G research.

Advancing 6G wireless communication research, the exploration of an AI-native air interface gains momentum. In 3GPP Release 18, the focus shifts to leveraging AI and ML to enhance the 5G New Radio (NR) air interface, shaping wireless communication standards. Keysight, leading 6G research and development, introduces a dedicated interface in PathWave System Design for AI/ML. This pioneering capability integrates features supporting AI/ML-based algorithms. PathWave System Design not only imports AI/ML models but also serves as a tool for creating data to train neural networks. This dual-use model empowers users to generate data for training NN, enhancing the versatility and impact of Keysight's solution.

The AI/ML interface within PathWave System Design serves as a unifying platform, bringing together communication systems teams and AI/ML experts. This integration fosters seamless collaboration, breaking down silos and enhancing the collective expertise of teams. By providing a common ground for communication and understanding between domain-specific professionals and AI/ML specialists, the interface promotes synergy, thereby boosting overall team performance. This collaborative environment significantly reduces time to market, allowing for more efficient and streamlined development processes. Keysight's commitment to bridging the gap between communication systems and AI/ML domains ensures that diverse teams can leverage their collective strengths, ultimately contributing to accelerated innovation and successful project outcomes.

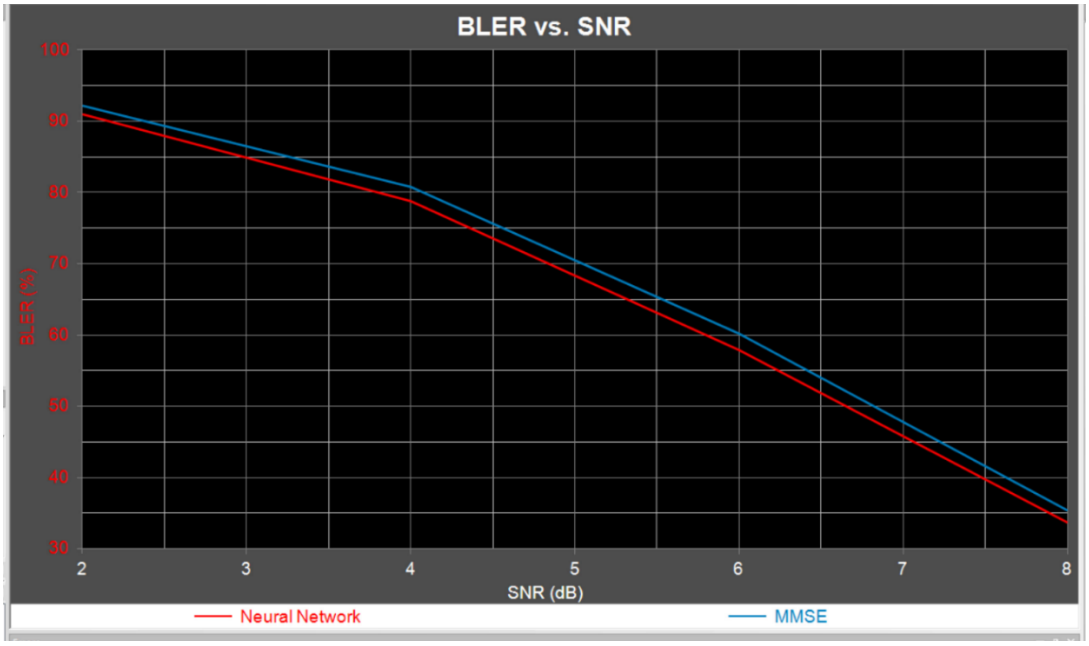

Figure 5. BLER vs. SNR performance comparison

Wireless Libraries

Innovate faster with PathWave System Design libraries.

PathWave System Design excels with elements like high-density antenna arrays, complex modulation and waveforms, and state-of-the-art signal processing. Design teams can use built-in libraries of generic and specification-compliant processing blocks, or they can bring their own MATLAB®, C++, or HDL code into PathWave System Design for simulation with RF system models.

PathWave System Design boasts extensive wireless communications libraries covering a spectrum of critical areas, including Radar, 5G NR, DVB-S2/S2X, Wireless Connectivity and Digital Modem. Users can confidently evaluate their designs using complex, industry-relevant communication standards.

PathWave System Design Verification Libraries comprise compiled sources, receivers, function blocks, and reference designs precisely aligned with emerging specification's physical layers. These robust tools facilitate the creation, analysis, and reception of PHY waveforms and test vectors, allowing for comprehensive validation of system architecture and algorithms down to the block level. These libraries offer seamless co-design capabilities with test equipment and hardware development boards via native TCP/IP connectivity, accommodating both baseband and modulated-carrier signals.

In tandem, PathWave System Design Exploration Libraries, an extension of the Verification Libraries, present an open platform for innovative PHY designs. They provide native source code for PHY blocks and in-depth documentation on relevant standards, offering system architects and algorithm developers a strong foundation for pioneering new platforms and facilitating open-standard comparisons. These exploration libraries are versatile, merging compiled models for simulation speed with the flexibility to incorporate user-supplied IP, making them indispensable tools for cutting-edge standard development and an excellent resource for learning and productivity enhancement.

Complete PathWave System Design library descriptions are available online at:
www.keysight.com/find/system-design-libraries

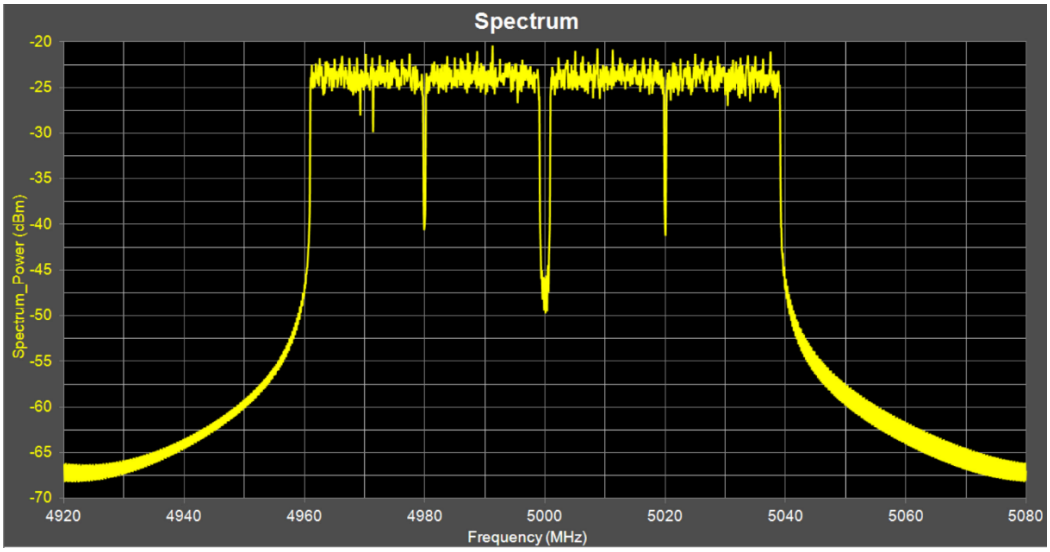

Figure 6. Spectrum of an 802.11be signal

Radar

Unleash innovation in aerospace defense.

Aerospace Defense (AD) Designer is reshaping AD analysis, offering an accelerated experience. With an intuitive AD Editor, a powerful AD Visualizer, and a robust system design technology, it provides efficiency and precision in a single package.

The AD Editor, with an intuitive GUI, simplifies the intricate task of configuring AD scenarios, ensuring a smooth and accessible user experience. Complemented by the visionary AD Visualizer, which offers a 3D graphical view for spatial comprehension, and powered by the comprehensive PathWave System Design AD library, this tool redefines precision in AD simulations.

In addition to predefined configurations for common AD analyses, the AD Designer provides users with complete configurability, allowing for modifications to meet unique requirements. Application-specific templates act as dynamic starting points, further expediting the innovation process. With its user-friendly interface and versatile capabilities, Aerospace Defense Designer accelerates the analysis of complex AD scenarios, providing users with the flexibility needed to tailor designs with precision and efficiency.

- Pulsed and pulsed-doppler (PD) radar architectures for telemetry and EW applications
- Multi-static radars with multiple TX and RX locations, including motion (vehicle/ship/air/space-borne)
- MIMO radars for increased range resolution and robustness
- Advanced mission planning and analysis through links to STK from AGI, an Ansys Company
- Frequency-modulated continuous-wave (FMCW) radars for automotive applications
- Signal generation for embedded simulators and test & measurement applications
- Numerous other radar examples such as ultra-wideband, synthetic aperture, and digital array radars
- Employing rise/fall time modeling and PRF staggering enables the creation of realistic and adaptable radar pulsed signals, enhancing their authenticity and flexibility in diverse operational scenarios

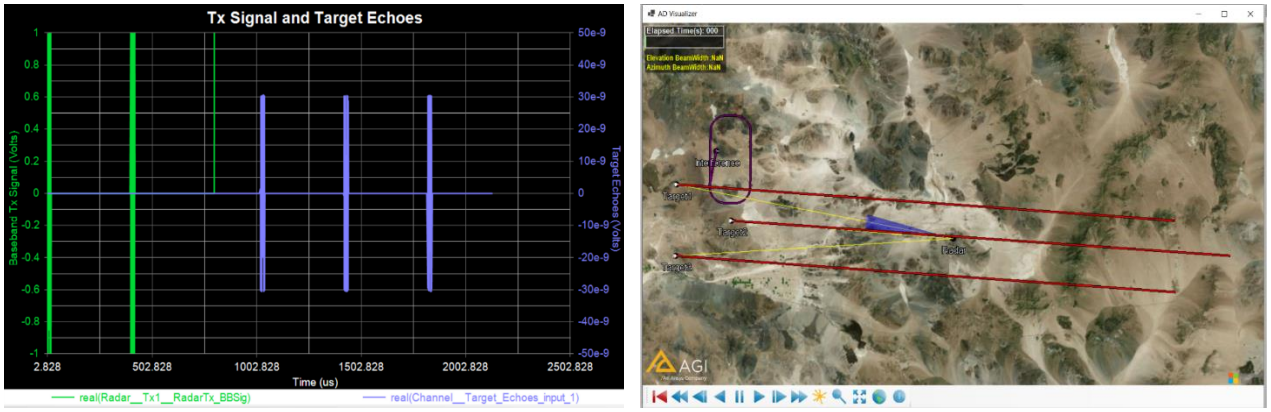

Figure 7. Radar Tx signal and echoes (left) and AD visualizer (right)

Automotive

Drive success in radar development.

Transform automotive radar design with PathWave System Design complete set of tools for waveform generation, signal modulation, antenna modeling, channel simulation, and signal processing. Simplify the development and verification process, allowing engineers to seamlessly connect different models and establish unique automotive radar simulation scenarios. With a focus on accuracy and efficiency, PathWave System Design Automotive Radar Library includes comprehensive models covering transmit signal generation, transmit channel and antenna, target and environment, receiver channel and antenna, and signal processing.

Designed to meet the evolving challenges of modern radar design, the PathWave System Design provides practical workspace examples, such as linear FMCW multi-target detection and automotive radar 3D scans, facilitating the transition from simulation to pilot and prototyping. By enabling hardware connectivity to Keysight test equipment, including arbitrary waveform generators, vector signal generators, and vector signal analyzers, the library allows users to correlate simulations with measured data. Whether you are developing algorithms for direction of angle (DOA) and phase comparison or simulating complex scenarios involving phased array analysis, beamforming, and over-the-air (OTA), the Automotive Radar Library, integrated with the PathWave System Design platform, empowers users to bring their design ideas into real-world automotive radar scenarios, minimizing design risks and driving test scenarios.

By seamlessly importing channel response files from Ansys HFSS SBR+, our platform brings complex scenario modeling to MIMO automotive radar architectures in PathWave System Design.

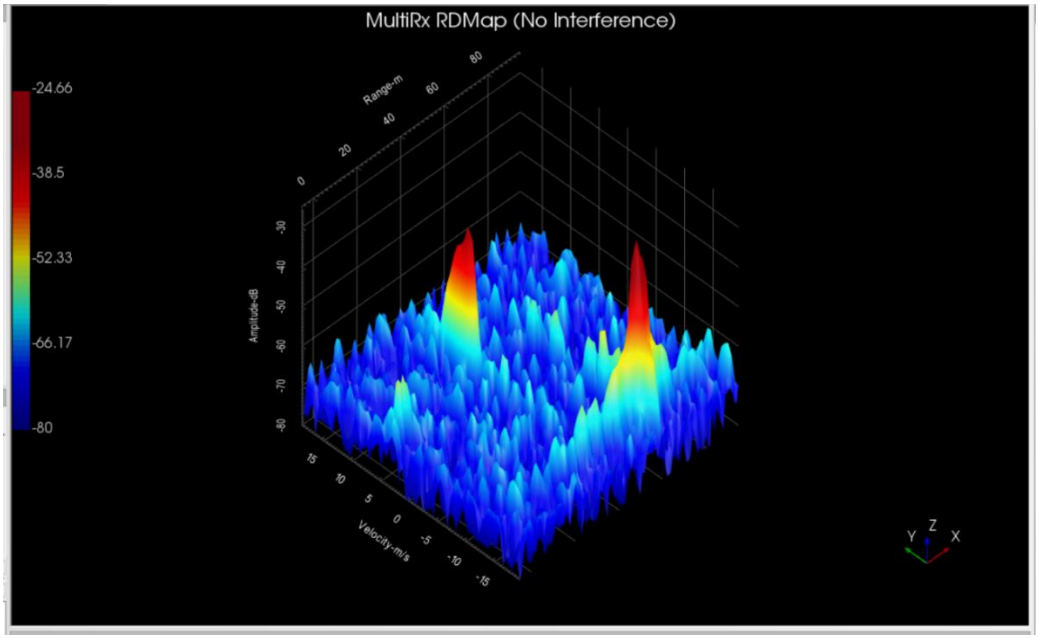

Figure 8. Radar range-doppler plot

Wi-Fi and Connectivity

Achieve Wi-Fi and connectivity design excellence.

PathWave System Design Wi-Fi and Connectivity Library is a game-changer, offering a holistic solution for RF and baseband system designs in Wi-Fi and connectivity chipset applications. This comprehensive bundle integrates advanced simulators for RF, communications/DSP, and phased array, providing a versatile platform for system modeling. With an extensive library of reference signals tailored for Wi-Fi, *Bluetooth*, and GPS, designers gain a competitive edge in accuracy and efficiency. The inclusion of the DPD Design Kit enables precise Digital Pre-Distortion modeling for optimal RF system performance. Enhancing the offering, the integration of end-to-end digital testbenches, utilizing Signal Studio as the IQ source and VSA or X-apps for signal analysis, ensures a thorough evaluation of systems, making it an indispensable toolkit for engineers navigating the complexities of Wi-Fi and connectivity system design.

- Wi-Fi 7 (802.11be)
- *Bluetooth*
- Zigbee and 802.15.4
- GNSS data links

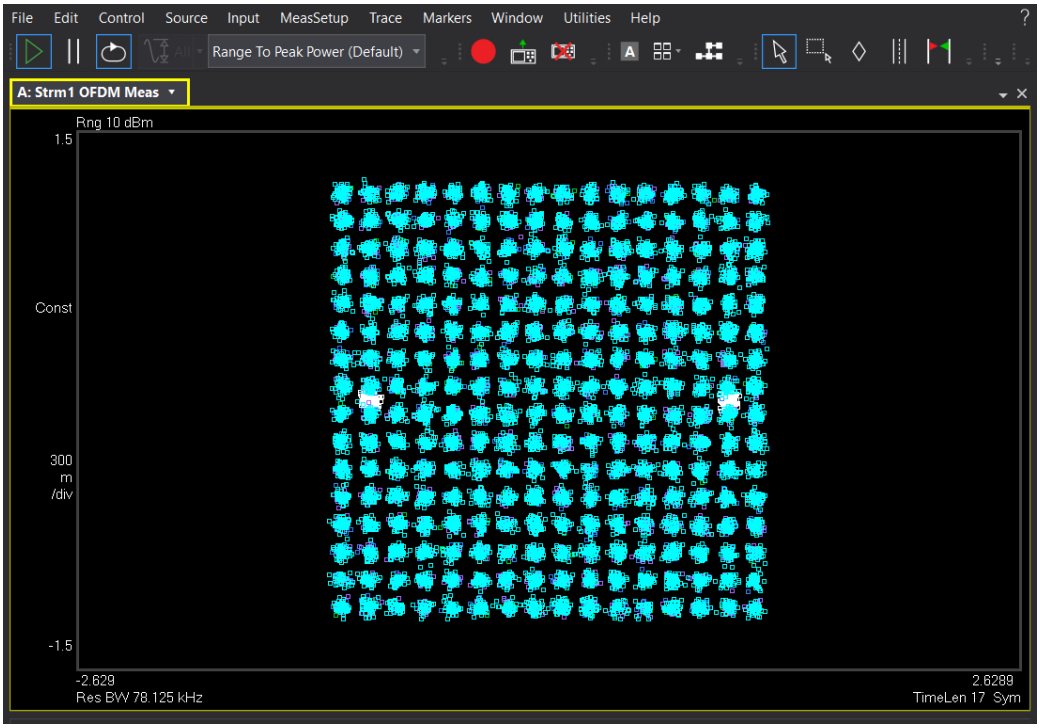

Figure 9. A Wi-Fi 7 signal constellation

5G & Cellular

The next level of cellular system simulation.

Our holistic solution redefines cellular innovation by offering a complete system simulation environment for RF, comms/DSP, and phased array applications. Boasting reference transmitters and receivers for leading cellular standards such as 5G NR and LTE Advanced, the tool encompasses full physical layer reference architectures. With an emphasis on modern cellular communication applications like 5G, mmWave, and O-RAN, PathWave System Design integrates RF, Comms/DSP, and Phased Array simulators. With the 5G and Cellular Library and the DPD Design Kit engineers are empowered with a comprehensive RF model-based engineering flow for evolving cellular communication technologies.

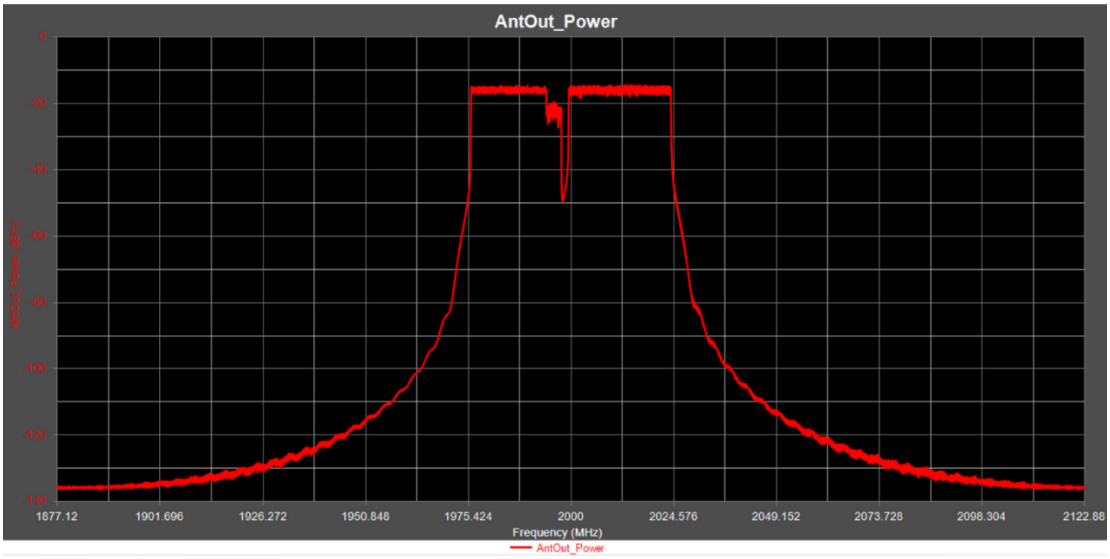

Figure 10. Spectrum of an FR1 5G NR signal with two numerologies

Aligned with 3GPP Release 17, this advanced system design solution introduces a spectrum of enhancements, from the refined NTN Channel model to beamforming connectivity and data export functionalities tailored for Drive-Test applications. With a focus on multi-channel configurations, propagation modeling, and seamless integration with the PROPSIM channel emulator, the platform exemplifies a new era in system simulation.

- Supporting 5G NR physical layer channels and signals reference DSP models for:
  - 3GPP TS 38.211 Physical Channels and Modulation
  - 3GPP TS 38.212 Multiplexing and Channel Coding
- 3D MIMO channel based on 3GPP TR 38.901
- Over-the-air (OTA) simulation for 5G NR mmWave
- Multi-antenna system architectures, including baseband, RF and hybrid beamforming structures
- Link level performance evaluation by incorporating user antenna element pattern as well as beam pattern files from Keysight EDA EM Design (EMPro), Ansys HFSS, or CST Studio Suite®

- Venture into 6G research, where the fusion of Artificial Intelligence (AI) and Machine Learning (ML) reshapes the landscape of communications air-interface technologies. The 5G and Cellular Library includes AI and ML example workspaces:
  - **NR_CSI_Feedback_Codebook:** Demonstrates link-level simulation of CSI feedback to enhance throughput, while also saving CSI feedback information without compression (perfect) for AI-based CSI feedback training.
  - **NR_CSI_Feedback_NN:** Shows a pretrained Neural Network model used for CSI feedback.
  - **NR_CSI_Feedback_TransNet: Illustrates** the use of a pretrained TransNet model for CSI feedback compression.
  - **AI_ChannelEstimation:** Evaluates the performance of an NR receiver model utilizing a pretrained neural network model for channel estimation, comparing it with conventional MMSE channel estimation.
  - **Generate Training Data:** Generates training data for a neural network model to learn from MMSE channel estimation patterns, aiming to replace conventional MMSE channel estimation in the NR receive model.

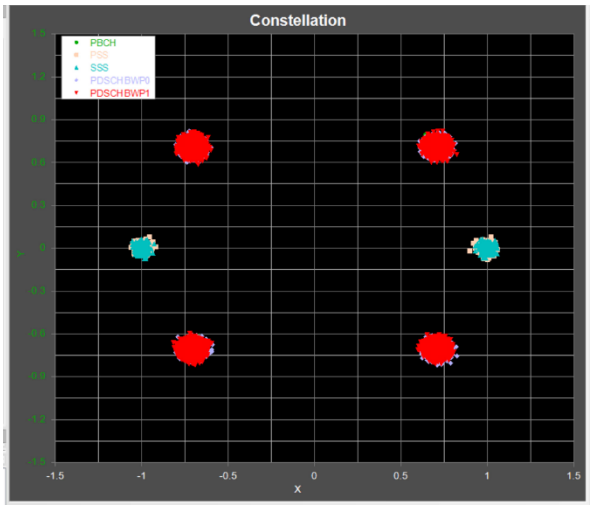

Figure 11. Color-coded constellation of a 5G NR downlink signal as shown by the NR_DL_EVM sink

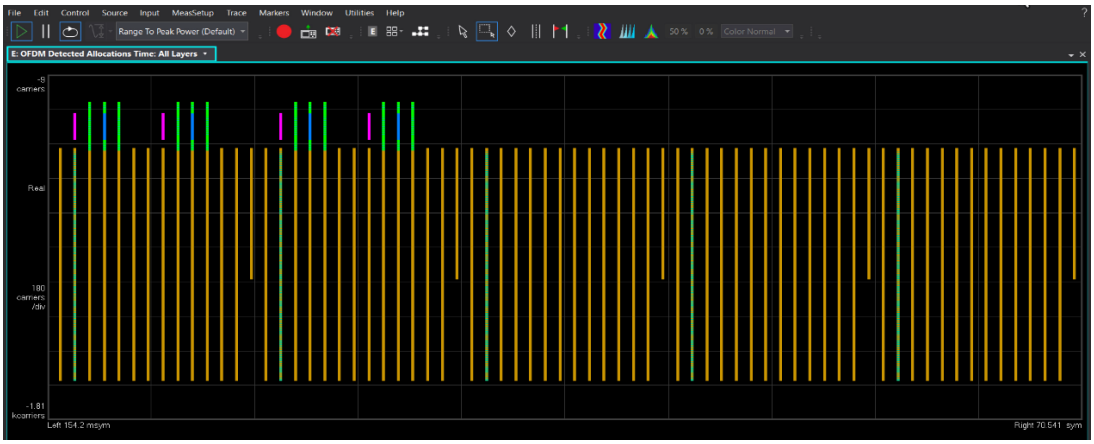

Figure 12. Color-coded representation of a 5G NR downlink signal structure, illustrating the subcarriers versus symbols grid as displayed by the VSA sink in PathWave System Design

Satellite

Soar beyond Earth.

Unlocking the potential of non-terrestrial applications, our system design solutions provide the tools necessary to validate designs and demonstrate feasibility.

Anchored by the advanced 5G NR NTN Channel Model Kit, tailored to 5G non-terrestrial networks and adhering to TR 38.811 standards, it seamlessly integrates into PathWave System Design for efficient link-level simulations. This comprehensive solution enables a shift-left approach, expediting time-to-market and enhancing product quality. Architects harness the full scope of non-terrestrial networks with PathWave System Design's 3GPP release 17 compliant NTN channel model.

Our DVB-S2/S2X testbenches, powered by Keysight's Signal Studio and Vector Signal Analysis (VSA) software, simplify signal generation and analysis while bridging simulation and hardware testing gaps with a common measurement science. Additionally, our SatCom Channel Model Kit ensures simulation accuracy across different satellite links, supporting GEO, MEO, LEO, and Airborne platforms for DVB and general SatCom applications.

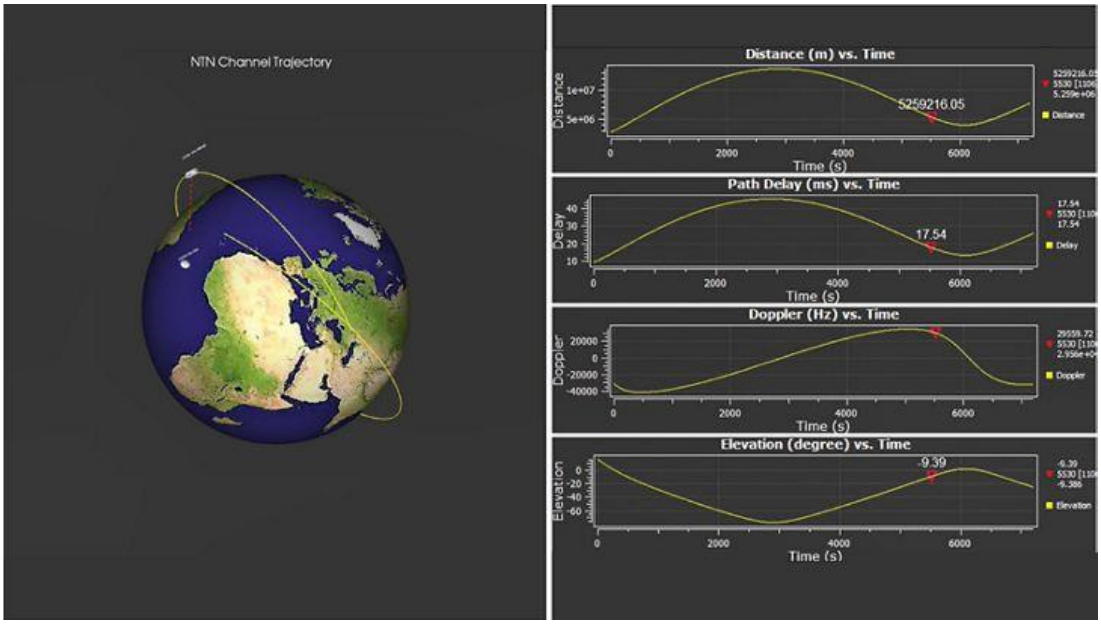

Figure 13. 5G NTN channel trajectory display with playback mode

RF System Library

High fidelity RF modeling.

The RF Design Library is your go-to resource for Spectrasys and WhatIF simulations, offering an extensive array of components for RF system architecture design, all with behaviors and RF effects modeled. Optional libraries are available from Keysight, as well as vendor-specific libraries from Analog Devices, Mini-Circuits, X-Microwave, Qorvo, and others. Open interfaces allow building models from datasheets using Sys-parameters, S- and X-parameters.

Algorithm Design Library

Comms and dsp proficiency.

The Algorithm Design Library is your one-stop solution for data flow simulation needs, offering a vast array of essential components. From communication and signal processing to math operations, analog/RF functions, filters, adaptive equalizers, sources, and sinks, we've got you covered. Additionally, our library includes instrumentation parts for seamless integration with instruments and Keysight 89600 VSA software, Signal Studio and X-Apps.

Digital modem:

- 3D Over 40 digital modulation formats for MilCom and SatCom
- Over-the-air (OTA) simulation for 5G NR mmWave
- Multi-antenna system architectures, including baseband, RF and hybrid beamforming structures

AMI Models

Simplify high-speed digital simulation.

The W4511E PathWave AMI Modeling Kit simplifies the creation of transportable AMI models for high-speed digital simulation. With this kit, you can efficiently build and generate IBIS-AMI models for your Serializer/Deserializer (SerDes) chips and modules, enhancing your high-speed digital (HSD) simulations.

- Implement optimized architecture as an executable specification
- Ensure standard compliance with the IBIS AMI wrapper
- Generate all necessary files royalty-free for distribution

Craft custom C++ models for over 100 dynamic signal processing blocks, tailored to directly integrate into your software ecosystem with the PathWave C++ Code Generation Kit. Explore the expansive world of algorithmic blocks from PathWave System Design, expertly crafted for versatility across diverse applications. Embrace your design prowess with a comprehensive suite of DSP components, primed for compilation and ready to fuel your next breakthrough.

Ordering Information and Licensing

For teams performing high-frequency RF design and simulation, PathWave System Design is licensed in two-part bundles with a design core license and a simulator license. Enterprise installations can optimize licensing based on core access counts and specific simulation capability needs for team members.

Model	Name	Description
W4800B	PathWave System Design Core	Schematic capture, data plotting, and MATLAB code support
W4801B	PathWave System Design Core + RF	Adds RF Analysis simulation elements with Spectrasys, WhatIF, linear simulation, and RF component model libraries
W4802B	PathWave System Design Core + Comms/DSP	Adds timed dataflow simulation, with libraries for DSP elements, digital modulation, SerDes, MIMO, and legacy cellular specifications
W4803B	PathWave System Design Core + RF + Comms/DSP	Allows RF Link to connect timed dataflow analysis with accurate, high-fidelity RF system models
W4804B	PathWave System Design Core + RF + Comms/DSP + Phased Array	Adds advanced Phased Array simulation for both RF and Comms/DSP applications using beamforming

For teams performing algorithm design in MATLAB, PathWave System Design simulation engines integrate with MATLAB and Simulink, letting algorithm designers call PathWave System Design workspaces and libraries directly within the MATLAB environment.

Model	Name	Description
W4806B	PathWave System Design Algorithm Core	RF and Comms/DSP Schematic capture, data plotting, and MATLAB code support

PathWave System Design is available on a subscription basis with periods of 6, 12, 24, or 36 months. Complete ordering details are available in the PathWave System Design Configuration Guide online at: www.keysight.com/find/system-design-config

Resources

For more information

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Or, visit these online resources:

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- Software Downloads: www.keysight.com/find/system-design-downloads
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- LinkedIn Users Group: www.keysight.com/find/system-design-linkedin