Gain Flexibility across Formats and Frequencies

IN SDR DEVELOPMENT AND DEPLOYMENT

Agilent Technologies

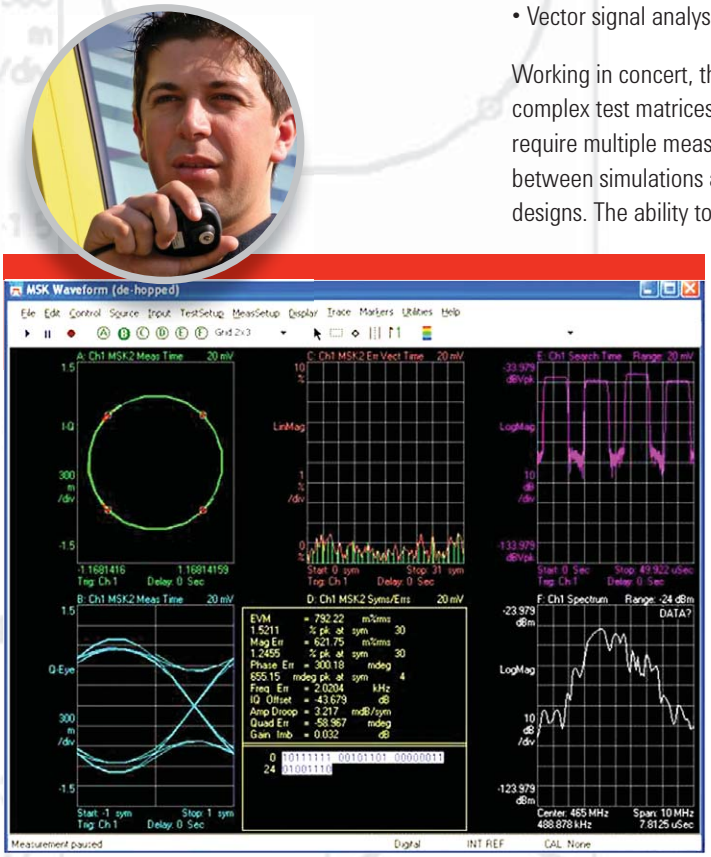
Gain Flexibility across Formats and Frequencies

SOFTWARE-DEFINED RADIO (SDR) TECHNOLOGIES are providing a foundation for seamless interoperation between diverse communication systems. Through dependable communication links, SDR will enable successful cooperation between military services and public-safety agencies that face evolving missions. In the commercial world, demand continues to grow for seamless global communication that delivers voice, data and video—anytime, anywhere, and across disparate formats.

Today, seamless interoperation is easy to envision but difficult to achieve. For developers, the challenges range from algorithm and waveform (physical layer) development to handset and base station deployment. Fast, successful implementation requires deep visibility into SDR components, circuits, subsystems and systems—and the waveforms they carry. This is Agilent's focus: We are uniquely able to help you go from concept to deployment—rapidly—with an end-to-end approach that spans four key areas:

- Development and simulation environments
- Baseband, IF and RF measurements
- Digital and mixed-signal measurements
- Vector signal analysis (VSA) and signal generation software

Working in concert, this flexible set of analysis tools enhances your ability to quickly satisfy complex test matrices that span multiple formats, frequency ranges and bandwidths—and require multiple measurements in each operating mode. For example, our flexible connection between simulations and actual measurements enables wider and deeper visibility into SDR designs. The ability to make consistent, comparable signal-quality measurements across the analog and digital domains provides faster, deeper insights into the effects of internal signal quality on transmitted waveforms.



The instruments themselves embody the "software defined" concept: Many provide the ability to add individual measurement applications, test specific communications formats and run software applications inside the instrument. They also provide the speed, performance and flexibility you need to deal with evolving SDR technologies: greater frequency bandwidths, wider IFs, adjustable and adaptable components, and multiple operating modes. Ultimately, our measurement and analysis capabilities give you the flexibility to achieve rapid deployment of secure, interoperable SDR systems for military, satellite and commercial applications.

Whether you're creating or leveraging next-generation communication technologies, Agilent can provide the flexibility you need to accelerate your development process and ensure successful interoperation.

Follow the Common Thread

IN SDR DEVELOPMENT, a common thread runs through the physical layer: it's the required set of waveforms that you and your team define, design, verify and test. When you create and deploy new waveforms, your overall process probably includes the following key steps: algorithm development; algorithm implementation; analog implementation (baseband, IF and RF); and digital and mixed-signal implementation. Agilent's end-to-end SDR solution helps you every step of the way.

A common platform

We provide a common platform for design, simulation, testing and analysis. It starts with a design and simulation environment that also includes software-defined instruments. Our test equipment—baseband, RF, digital and mixed-signal—enables characterization of real signals across a broad range of frequencies with wide bandwidth, and in the digital realm. For deeper insights, our VSA software also runs within many of those same instruments.

An easy way to build waveforms

To help you model and evaluate waveform performance, we combine DSP, analog and RF modeling in one environment. You can also incorporate legacy waveform intellectual property (IP) within the model, whether you work with VHDL, m-code, C/C++ or actual measurements. These waveforms can be used throughout your design to provide stimuli to digital and analog RF subsystems in simulations and hardware implementations.

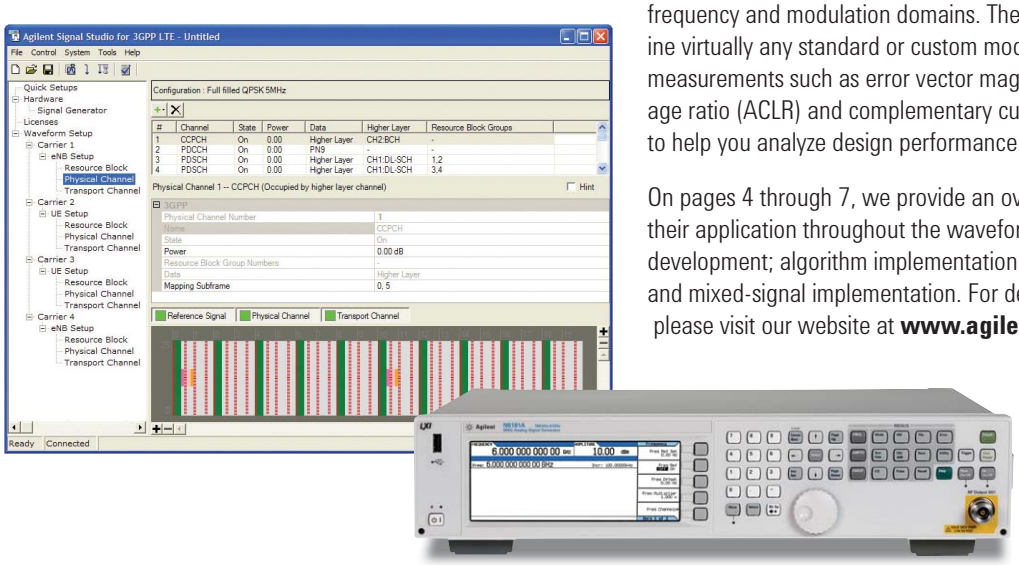
A fast path to prototyping

Our solution provides easy creation of fixed-point algorithms, generating fully synthesizable, hierarchical RTL-level Verilog and VHDL code that is bit-true and cycle-accurate. This work can be leveraged into your measurements when you start turning on prototype hardware.

A way to verify final waveforms

Create custom signaling scenarios—including impairments—and then make measurements on hardware or simulations directly from the simulation/modeling environment. For deep analysis of actual signals, our VSA software lets you characterize signal behavior in the time, frequency and modulation domains. The VSA capability can be used to examine virtually any standard or custom modulation type, and can perform essential measurements such as error vector magnitude (EVM), adjacent-channel leakage ratio (ACLR) and complementary cumulative distribution function (CCDF) to help you analyze design performance.

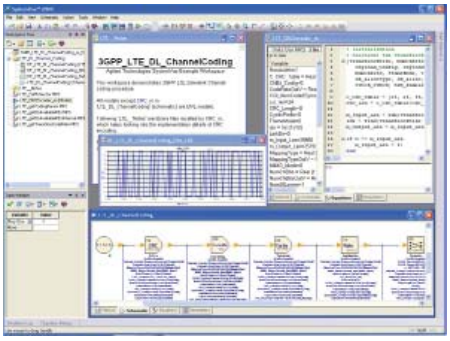
On pages 4 through 7, we provide an overview of these flexible solutions and their application throughout the waveform development process: algorithm development; algorithm implementation; analog implementation; and digital and mixed-signal implementation. For detailed product information, please visit our website at **www.agilent.com/find/SDR.**



Algorithm development

Transform waveform ideas into reality

The ability to efficiently define critical algorithms and top-level system behavior depends on software tools that close the gap between waveform concepts and working prototypes. Agilent's electronic design automation (EDA) tools do that and more. For algorithm development, Agilent SystemVue connects system design with textual modeling of algorithms in a natural mathematical format.



Agilent SystemVue 2009

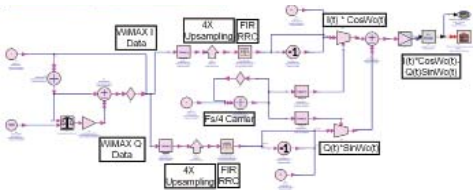
SystemVue is a great standalone platform for conceptual design. It enables system architects and algorithm developers to innovate in the physical (PHY) layer of SDR systems. SystemVue helps you quickly develop and prototype algorithms through a simple, intuitive user interface. Hardware code generation is compatible with VHDL and Verilog HDL formats.

- Enables top-down design for waveform development
- Offers verification libraries for advanced waveforms, including LTE and WiMAX™
- Provides tight integration with Agilent instrumentation
- Excels at RF system analysis and modeling

Algorithm implementation

Define the architecture and verify your waveform

Algorithm implementation is easier with flexible tools that take you through the crucial steps: defining the architecture; partitioning the hardware, software, digital and RF elements; defining block behavior; designing and laying out circuits; and exploring possible tradeoffs in digital implementation. Throughout this process, the Agilent Advanced Design System (ADS) helps you save time by letting you mix simulated and real-world elements—signals, system blocks, instrumentation and analysis tools.



Agilent ADS

Our ADS software is the industry leader in high-frequency design. Its comprehensive set of simulation technologies spans the frequency, time, numerical, physical and electromagnetic domains. In the ADS environment, SDR developers can fully characterize and optimize their designs and waveforms.

- Easily move from algorithmic representation to implemented waveform
- Include simulated and actual elements as needed during the development process
- Maintain integrity within a given implementation flow
- Verify devices, algorithms and waveforms

Once you've created your waveform and have begun to test prototypes, you can use the waveforms as inputs to FPGAs or ASICs in concert with digital, baseband and RF instrumentation.

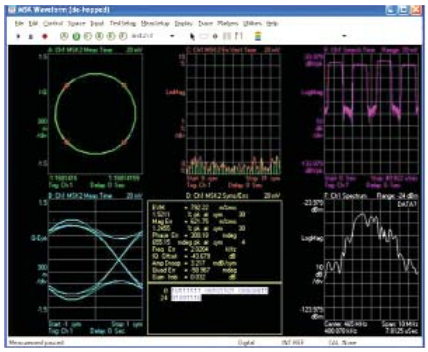
Accelerate baseband, IF and RF implementation

As modulation formats become more complex, new approaches to measurements will provide useful insights into signal quality. One example is "use representative" signals that excite transmitter and receiver circuits in ways they will experience in actual deployment. Agilent offers software and instrumentation that span the analog and digital domains, and provide links to our design and simulation tools.

MXA signal analyzer

Eliminate the compromise between speed and performance with the MXA signal analyzer. A variety of X-Series measurement applications run inside the instrument: LTE, W-CDMA, TD-SCDMA, WiMAX and more. For advanced signal and modulation analysis, the Agilent 89600 Series VSA software (89601A) can also be operated within the analyzer.

- 30 to 300% faster than other spectrum and signal analyzers
- 0.23 dB absolute amplitude accuracy
- +15 dB third-order intercept (TOI)
- –154 dBm/Hz displayed average noise level (DANL)



VSA software

The 89600 Series VSA software provides superior general-purpose and standards-specific signal evaluation and troubleshooting tools. Use these tools to dig into your signal and gather the data you need to successfully troubleshoot PHY-layer signal problems. The VSA software is compatible with more than 30 Agilent instruments—signal analyzers, scopes, logic analyzers, RDX platform—and can run within those instruments, on a server, or standalone on a PC.

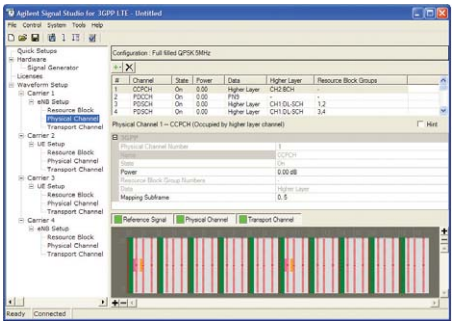
- High-resolution signal analysis
- Advanced general-purpose modulation analysis: AM/FM/PM, 2FSK to 1024QAM
- Standard-specific analysis coverage including WiMAX, WLAN, 3GPP, LTE and ultra-wideband (UWB)
- Extensive suite of time-domain tools for burst analysis
- DistortionSuite for analysis of amplifier linearity

MXG RF signal generator

Quickly and easily create performance-optimized wireless reference signals for component-level parametric test, baseband subsystem verification, receiver performance verification, and advanced functional evaluation. The Agilent MXG offers scalable performance easily tailored for the stringent test requirements of components and devices used in SDR systems. With vector signal generation up to 6 GHz, and the MXG ATE for automated test environments, you can configure the MXG to fit your specific test needs.

- Greater than +30 dBm output power
- <–73 dBc 3GPP W-CDMA ACLR at +5 dBm output power (one carrier) and <–66 dBc (four-carrier)
- ≤1.2 ms switching speed for frequency, amplitude and waveform changes (in SCPI mode)
- Compatible with Signal Studio software to generate modulation-specific signals

Accelerate baseband, IF and RF implementation



Signal Studio software

Agilent Signal Studio provides a suite of flexible, easy-to-use, standards-based signal-creation tools that will cut the time you spend on signal development. They also provide validated and performance-optimized reference signals to help you characterize, evaluate and fine-tune your designs. Signal Studio runs on signal generators and the PXB MIMO receiver tester, and supports a variety of cellular and wireless formats.

- Create reference signals for SDR simulation and verification
- Create virtually distortion-free test signals for component analysis
- Create calibrated additive signal impairments for receiver-tolerance evaluation

PXB MIMO receiver tester

In multiple-input/multiple-output (MIMO) systems, the Agilent PXB helps you minimize design uncertainties and rework. It does this by simulating real-world conditions that quickly test MIMO receivers beyond standard requirements, helping you validate design robustness earlier in the development cycle. The scalable PXB platform is designed to meet future needs and formats through simple, cost-effective upgrades.

- Generates standards-compliant baseband signals including LTE, Mobile WiMAX™, W-CDMA and GSM/EDGE
- Advanced channel emulation with predefined configurations for 2x2, 2x4 and 4x2 MIMO
- Comprehensive channel correlation settings including antenna set-up and custom correlation matrix

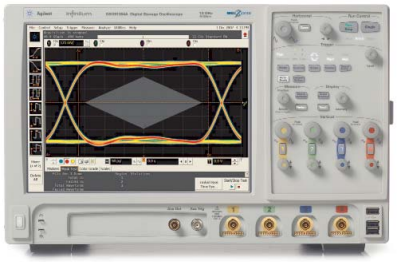
E3238S signal intercept and collection system

Designed to quickly detect signals, the E3238S provide unmatched speed when you need to find spurious signals. As you put your radio through its paces, the E3238S can automatically detect and log signals in a frequency range of interest.

- Exceptionally fast sweeps through wideband stepped-FFT technique
- Fast categorization and selection of signals using audible, visual and analytic tools
- Improve productivity by automating common setups and processing tasks

Leverage your expertise into the mixed-signal domain

In today's SDR designs, the transition from analog to digital technologies is moving closer and closer to the antenna. As a result, developers face an increasing number of digital signals that represent what were once analog signals. To help you understand and verify signal quality in this environment, Agilent offers flexible measurement tools and probing solutions that provide cross-domain links between digital and analog measurements. These tools also include links to our design and simulation tools as well as the 89600 VSA software and Signal Studio signal-generation software.



90000 Series oscilloscopes

The DSA90000A digital signal analyzer (DSA) is an oscilloscope measurement system optimized for the debugging and validation of designs based on today's higher data rates and serial buses. The system is built around a four-channel Infiniium DSO90000A Series scope and the InfiniiMax probing system. The DSA helps you preserve design margins by providing the industry's lowest noise floor, lowest jitter measurement floor, lowest trigger jitter, and flattest combined frequency response of scope and probe.

- 2 GHz bandwidth upgradeable to 13 GHz
- 40 GSa/s with one or two channels, 20 GSa/s with all four
- Memory depth of 64 Mpts at 4 GSa/s
- Trigger jitter of less than 500 fs

16900 Series modular logic analysis system

The Agilent 16900 Series logic analysis system provides high-performance, system-level debugging of digital designs. You can customize a system for your specific needs with innovative probing, high-performance measurement modules and application-specific analysis tools. All modules are tightly integrated to provide time-correlated, cross-domain measurements.

- Two- and six-slot modular systems (16901A, 16902B)
- Timing/state and pattern-generation modules available
- Can run 89601A VSA software inside the instrument
- 15-inch color touch-screen display (1024x768 resolution)

Active probes

Get greater insight with Agilent active probing solutions. We offer ultra-low capacitive loading (< 0.15 pF) and high sensitivity to ensure minimum disturbance at gigabit speeds. Choose from midbus probes, flying-leads probing solutions, and dynamic probes for Altera and Xilinx FPGAs

Midbus/soft-touch

- Probe directly on boards without an adapter
- Perform chip-to-chip protocol measurements

Flying leads

- Acquire signals from randomly located parts within your target
- Connect to IC pins, traces, pads, vias, etc., with compatible accessories

Altera & Xilinx dynamic probes

- Access multiple internal FPGA signals per dedicated debug pin
- Make incremental measurements in seconds without changing design timing
- Measure in either state (synchronous) or timing (asynchronous) mode

Get the details— and enhance your flexibility

WITH OUR END-TO-END APPROACH TO SDR DEVELOPMENT, Agilent is uniquely able to help you gain flexibility across diverse communication formats and frequency ranges. To learn more, please visit our SDR website. It offers a wealth of additional information that will help you achieve the visibility you need to ensure successful interoperation. Download white papers that offer useful ideas and perspectives on SDR (registration required). Register for webinars that provide new ideas you can apply immediately. Read all of the details in product brochures, data sheets and SDR application notes found on **www.agilent.com/find/sdr.**

- *Making RF Measurements on Digital Serial Data with Agilent's Signal Extractor and the 89600 VSA*, Pub No. 5989-5290EN
- *Software Defined Radio Measurement Solutions.* Pub No. 5989-6931EN

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Printed in USA, July 27, 2009
5990-4146EN

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