Agilent EEsof EDA Design Technology

Agilent Technologies

Innovating the HP Way

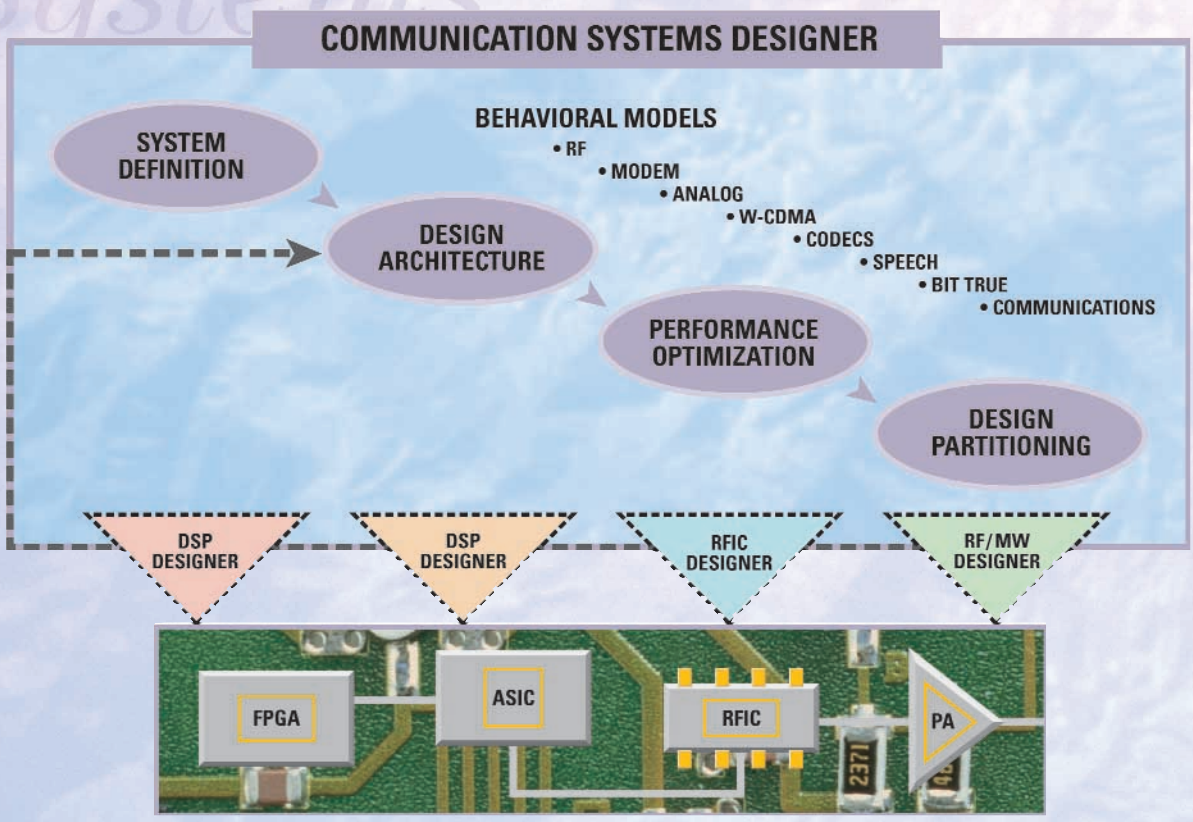
Empowering Engineers to Create Their Best Mixed-Signal Designs

Today's communication systems engineers have to make more choices than ever for design implementation. Cost and size reductions and performance improvements of DSP and RF components offer many different partitioning choices between digital and analog functions.

At the same time, companies are facing the demands of the competitive marketplace: product performance, time to market, and production cost. To meet these challenges, many leading companies are relying on design automation tools from Agilent EEsof EDA to bring their communication designs into reality.

Integrated Top to Bottom System Design

Traditional design methods often lack the full range of technologies to develop communication system products. This is in part because advanced IC technology now allows for greater integration of analog, DSP, and RF hardware. Design tools must integrate a corresponding range of mixed-signal implementation technologies. Communication Systems Designer was built from the ground up to address the mixed-signal design challenges of getting competitive communication products to market.



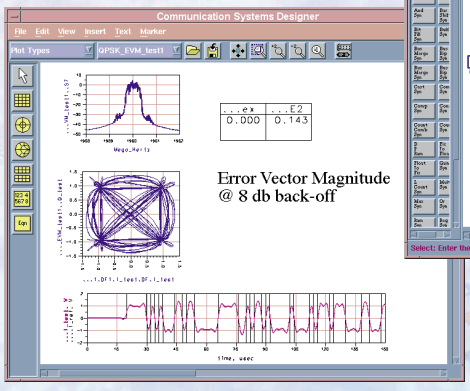
At its core, Communication Systems Designer has simulation and modeling technologies that support mixed-signal design. The patented simulation technologies include Ptolemy for DSP, Circuit Envelope for complex analog and RF designs, and Harmonic Balance for modulated RF subsystems. The design process is facilitated by a broad array of DSP, analog, and RF behavioral models–each with multiple levels of abstraction.

System engineers can work with familiar units and parameters because the simulation and modeling technologies support time, frequency, and mathematical domains as well as concepts such as power, voltage, and current.

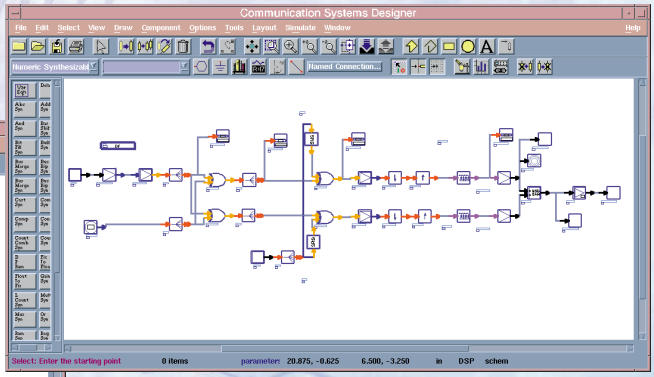
A Flexible Design Environment

The project design environment manages the simulation and modeling technologies, empowering engineers to focus on their design tasks instead of the design tool. For example, a high-level schematic is built from a wide range of analog, digital, and DSP parts and is directly available for analysis. The task of selecting the correct simulator for each subsection of the design is automatically performed behind the scenes by the software.

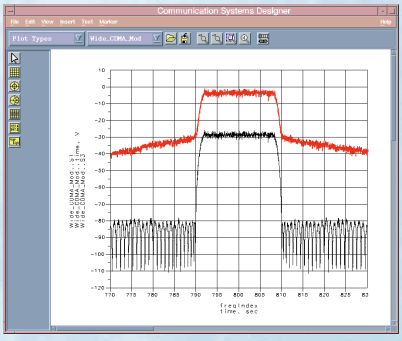
This unprecedented integration of technologies enables quick, detailed partitioning of the analog, RF, and DSP subsections of communication designs. This design environment is shared with all modules of Agilent Advanced Design System, thereby facilitating team design concepts that are critical to reducing design iterations and speeding time to market.



Analysis of GSM signal quality including RF amplifier effects



Top-level system study of third-generation 16 MHz wideband CDMA modulator and RF amplifier



16 MHz wideband CDMA transmit spectrum with nonlinear amplification

The Critical Difference: Making the Right System-Level Decisions Early in the Design Process

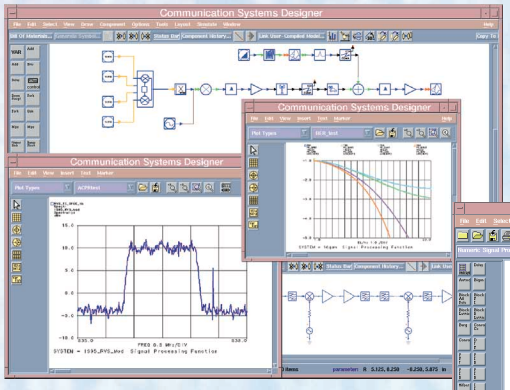
Optimizing the System Architecture

Effective system-level design must include meaningful models for each component of the system. For example, mobile wireless communications products require RF and DSP technology to generate reliable wireless links across diverse propagation environments. To make the best top-level design choices for the system architecture, designers need to assess the impact of each choice in terms of both performance and cost.

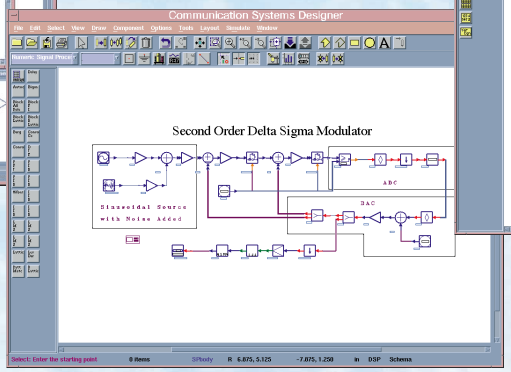
However, it is risky to make these critical implementation choices without first accurately modeling the physical layer; this includes the propagation channel, unavoidable RF degradations, and performance of DSP algorithms. In Communication Systems Designer, users have access to over 1500 behavioral models, including a comprehensive set of communication systems building blocks. System designers can now evaluate a candidate signal processing algorithm while including realistic models of the analog channel, including fading, phase noise, and interference.

Once the system architecture is chosen and analyzed, the next step involves exploring the range of design performance. This is accomplished with performance optimization—a powerful, automated technology that employs a variety of statistical methods to find the design parameters that yield the best design.

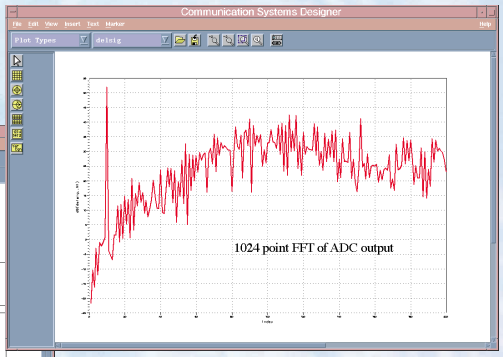
To find the optimum design candidate, Communication Systems Designer's automated simulation process varies selected model parameters in order to meet the performance goals set by the designer. Using top-level simulation and optimization studies to guide critical design choices, companies gain an advantage over the competition by delivering superior low-cost products to market faster.



Communication system models include: forward error correction functions and phase-locked loop components, matrix math models, floating and fixed point DSP models, and a complete set of RF and analog models.



Behavioral-level model of second order delta-sigma analog-to-digital converter.



Output spectrum of delta-sigma converter

Modeling RF Systems with Speed & Accuracy

To create communication systems with market winning performance, engineers need tools that analyze the subtle RF system interactions that can make or break a design. Unlike traditional RF system design methods that typically rely on overly simplistic spreadsheets to compute gain and power budgets, Communication Systems Designer provides in-depth RF analysis capabilities to uncover and correct system problems before they delay the project.

Engineers can now precisely analyze the effects of impedance mismatches, isolation, harmonics, intermodulation, and noise—even in tough-to-analyze designs with parallel signal paths or feedback. This powerful design capability puts the engineer back in control of the RF system to produce competitive designs.

Optimizing for Maximum Performance

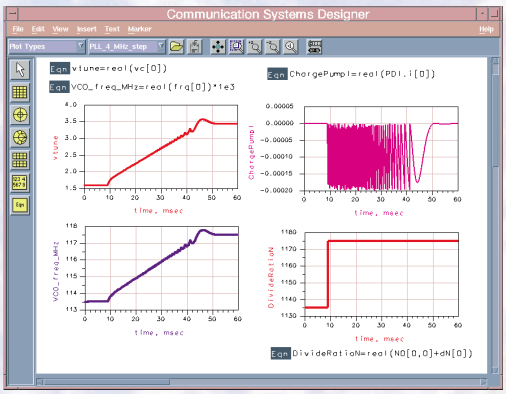
To help engineers create their best designs, Communication Systems Designer also includes a powerful set of optimizers. This helps designers change the individual model parameters of the system to meet target performance measures such as BER, error vector magnitude, adjacent channel rejection, and spurious free dynamic range.

These optimizers can vary both discrete and continuous parameters of circuit and system models to meet the desired performance goals. To aid in BER simulations, there is a fast estimation algorithm called improved importance sampling. This BER measurement calculates BER 100 to 1000 times faster than Monte Carlo methods in high-performance systems with very low error rates.

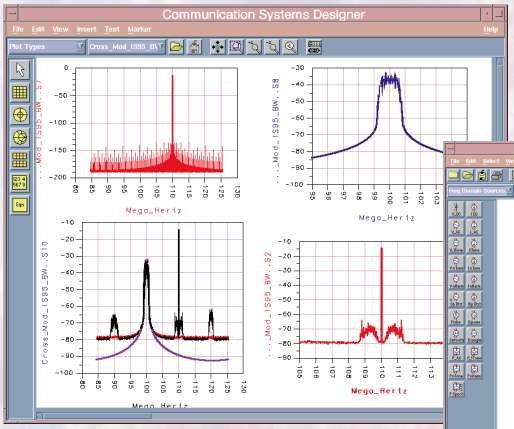
Leveraging Proprietary Models

In many cases, engineers rely on proprietary behavioral models as an integral part of the system-level design process. For many companies, developing intellectual property represents a significant investment in time and money and often provides a strong competitive advantage. Communication Systems Designer includes a model development kit so designers can quickly and easily convert C and C++ source code into a model for use in the simulator. In addition, a bi-directional MATLAB® interface is available, as well as an integration module for Alta's SPW™ tool.

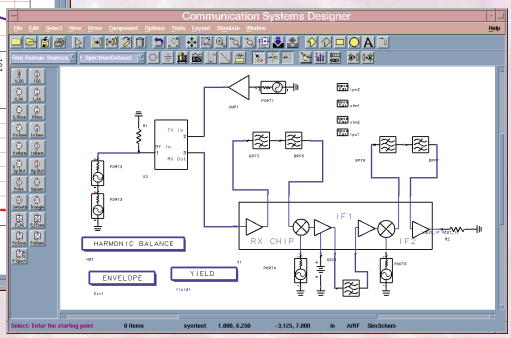
When there is a large volume of intellectual property to integrate, Agilent's team of experienced solution services engineers are available to help bring your existing models and algorithms into Communication Systems Designer. This allows design teams to focus on new projects while still leveraging existing intellectual property.



RF system lock time of a 5th-order DECT PLL including tuning, voltage, charge pump output, and VCO frequency versus time



Cross modulation studies on ANSI J-STD-018 PCS band receivers



Top-level model of PCS band mobile receiver includes image noise contribution and intermodulation products.

Optimized for Performance and Yield, Designs are Ready for Implementation

Linking to Test Instrumentation

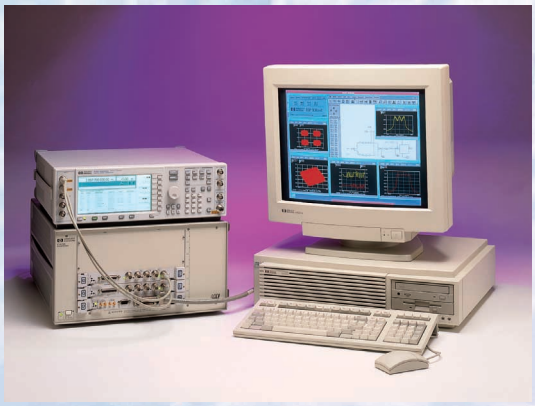
Communication Systems Designer not only helps designers speed the design process, but also offers valuable benefits during hardware integration by providing an interface to test instrumentation. With built-in links to spectrum analyzers, network analyzers, and microwave transition analyzers, engineers can capture signals for use in the simulator or generate new signal formats quickly and easily.

In addition, there is an interface to the Agilent E1445A arbitrary waveform generator and to the Agilent 89400 series vector signal analyzers to further help the transition from design to hardware prototype. The ability to emulate hardware or capture measured signals for use in the simulator allows virtual integration of hardware before prototypes are made.

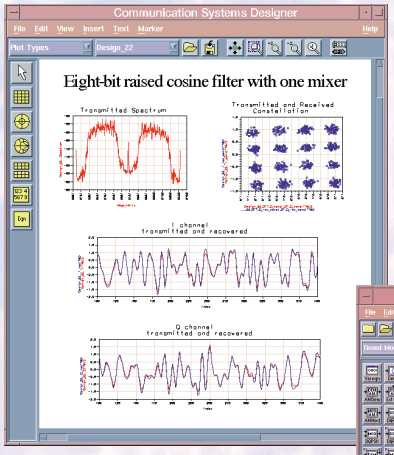
Easy Path to Implementation

Once the system design phase of a project is completed, a specification-compliant design exists that has been optimized for performance and manufacturing yield. This design has been further partitioned into the DSP, analog, and RF sections and is ready for PCB or IC implementation.

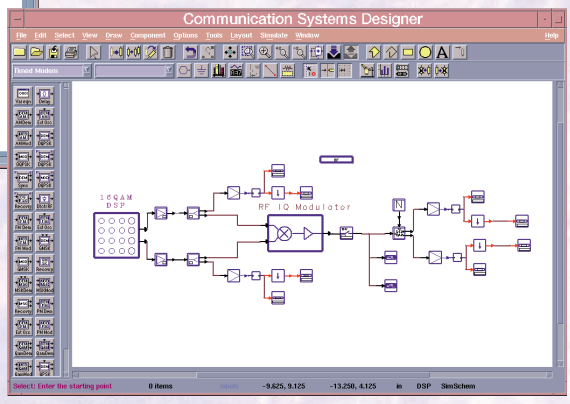
Because Advanced Design System includes RFIC Designer, DSP Designer, Microwave Circuit Designer, and RF Board Designer for detailed PCBs or ICs, the partitioned design passes seamlessly into the implementation phase. All products share a common database, user interface, and data display that facilitates implementation, whether performed by a design team or an individual engineer.



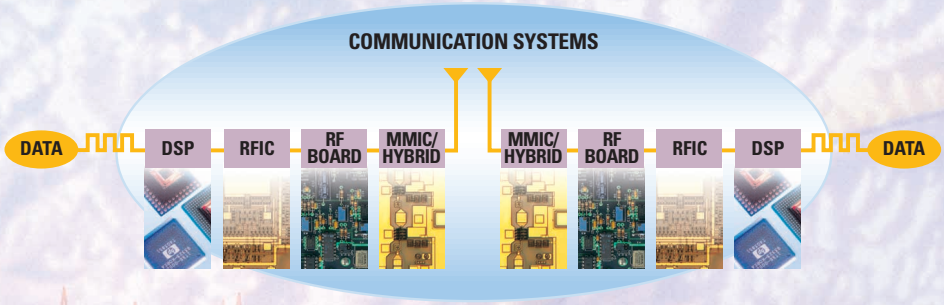
Study the effects of modulation formats on RF hardware. Use links to the Agilent E1445 arbitrary waveform generator to create baseband IQ waveforms; then use that output to drive the ESG series of RF signal generators.



System studies of 16 QAM modulator impairments: output spectrum before RF bandpass filtering and output constellation (top plots) as well as baseband I and Q transmitted and received waveforms.



Functional verification at the system level using co-simulation between numeric DSP 20 Mbit/sec 16 QAM modulator and RFIC IQ modulator.



Agilent Communication Systems Designer is part of Agilent Advanced Design System, which lets you simulate the entire communications signal path from input bits to output bits—with powerful tools for DSP, RFIC, RF board, MMIC/hybrid, communication systems, and planar EM—all in a single design environment.

Mixed-Signal Design Verification

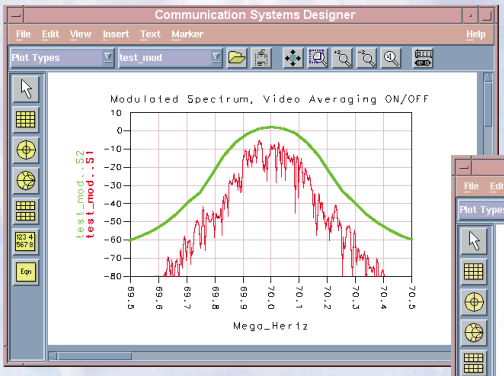
Advanced Design System's capability to mix system and circuit levels of abstraction adds powerful verification capability to the engineers' toolset. Any of the DSP, analog, or RF models in the high-level design can be swapped out and re-analyzed with the detailed transistor-level implementations of that block.

This empowers designers to verify that the actual implementation of a block will work properly and meet specifications when integrated with the entire system. This error-correcting verification step is available for designs spanning circuit-level RF mixers, amplifiers, and filters to fixed-point digital filters and other DSP algorithms.

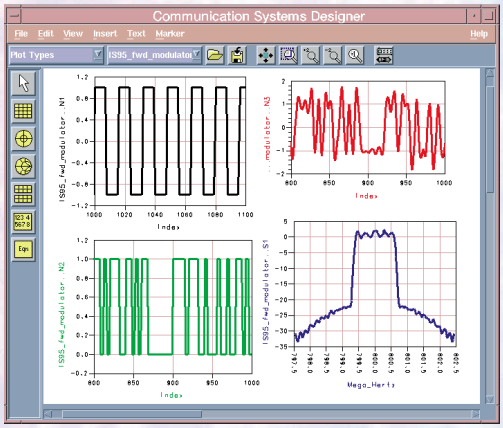
Bringing the Best Ideas into Reality

Communication Systems Designer helps new engineers gain design insight and lets experienced engineers reach new levels of productivity.

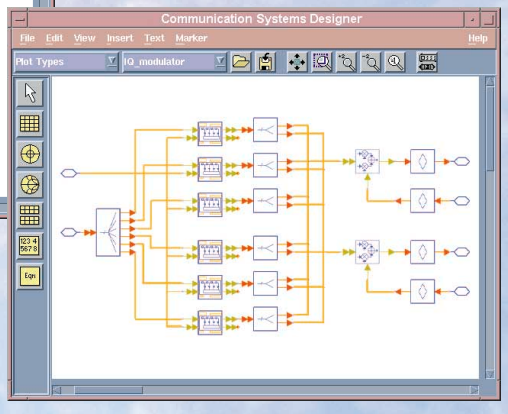
Pick the platform of your choice; Communication Systems Designer runs on laptops, PCs, and UNIX workstations.



Communication Systems Designer includes pre-built measurements such as this spectrum measurement with and without video averaging.



Template for making IS-95 CDMA measurements including adjacent channel power



W-CDMA block diagram of the adaptive antenna array for third-generation mobile communications development.

Product Design Suites

Agilent Communication Systems Designer combines leading edge RF, analog, and DSP technologies with accurate models in dedicated packages tailored for today's communication systems designers. These cost-effective solutions are available in both node-locked or network-licensed configurations on PC and UNIX systems.

	UNIX	PC
Communication Systems Designer	——	**E8850A**
Design Environment	——	E8900A
Data Display	——	E8901A
RF System Simulator	——	E8853A
RF System Models	——	E8854A
Communication Systems Designer Pro	**E8851A/AN**	**E8851A/AN**
Design Environment	E8900A/AN	E8900A/AN
Data Display	E8901A/AN	E8901A/AN
Ptolemy Simulator	E8823A/AN	E8823A/AN
RF System Simulator	E8853A/AN	E8853A/AN
RF System Models	E8854A/AN	E8854A/AN
Statistical Design	E8824A/AN	E8824A/AN
Communication Systems Designer Premier	**E8852A/AN**	**E8852 A/AN**
Design Environment	E8900A/AN	E8900A/AN
Data Display	E8901A/AN	E8901A/AN
Ptolemy Simulator	E8823A/AN	E8823A/AN
RF System Simulator	E8853A/AN	E8853A/AN
RF System Models	E8854A/AN	E8854A/AN
Statistical Design	E8824A/AN	E8824A/AN
Antenna & Propagation Models	E8856A/AN	E8856A/AN
Ptolemy Matrix Models	E8826A/AN	E8826A/AN

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Phone or Fax
United States:
(tel) 1 800 452 4844

Canada:
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(fax) (905) 206 4120

Europe:
(tel) (31 20) 547 2323
(fax) (31 20) 547 2390

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Australia:
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(fax) (61 3) 9210 5947

New Zealand:
(tel) 0 800 738 378
(fax) (64 4) 495 8950

Asia Pacific:
(tel) (852) 3197 7777
(fax) (852) 2506 9284

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