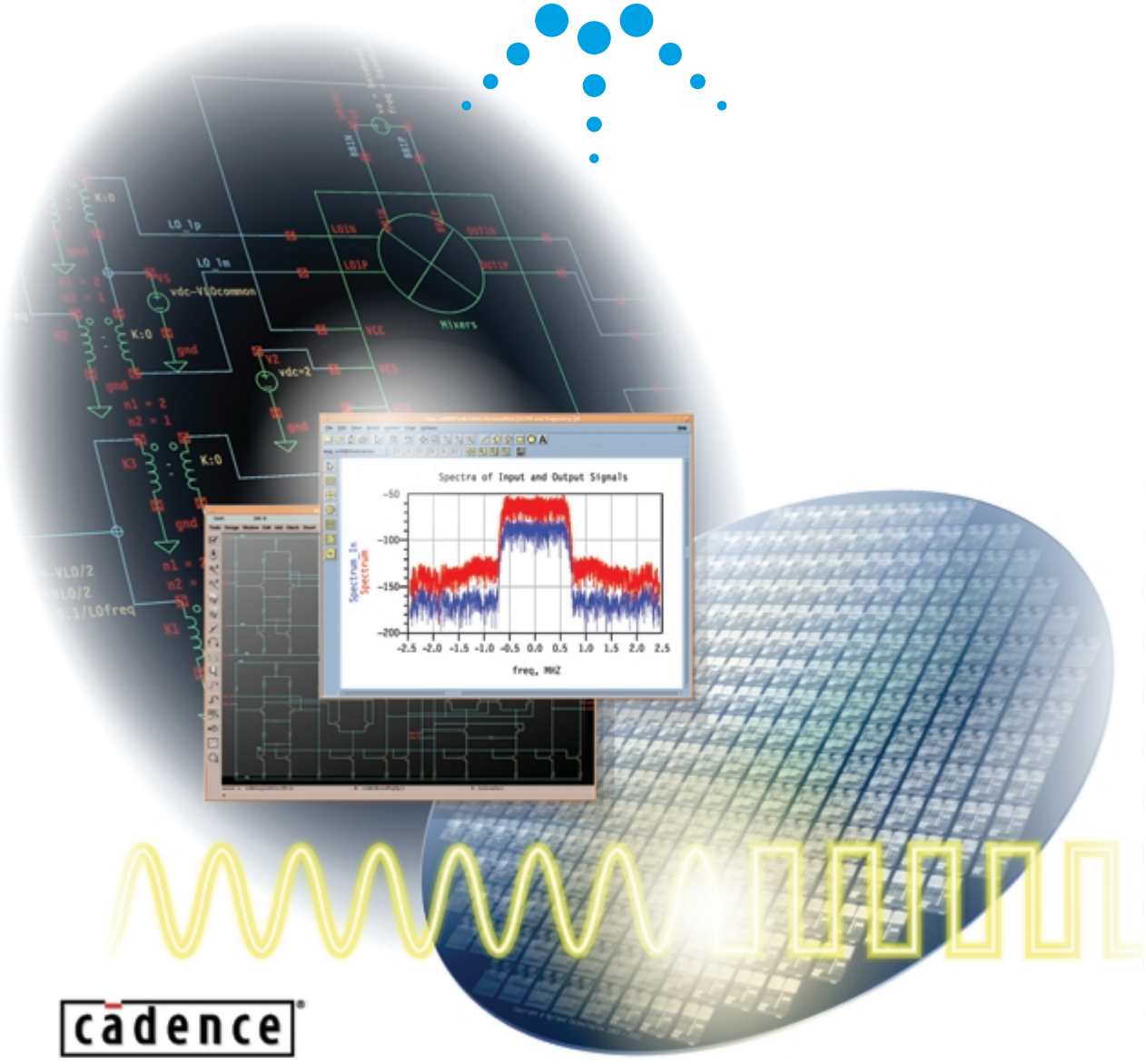
RF Design Environment

World Class RF/Mixed-Signal IC Design Technology Integrated into your Design Flow

Agilent EEsof EDA



cadence

Agilent Technologies

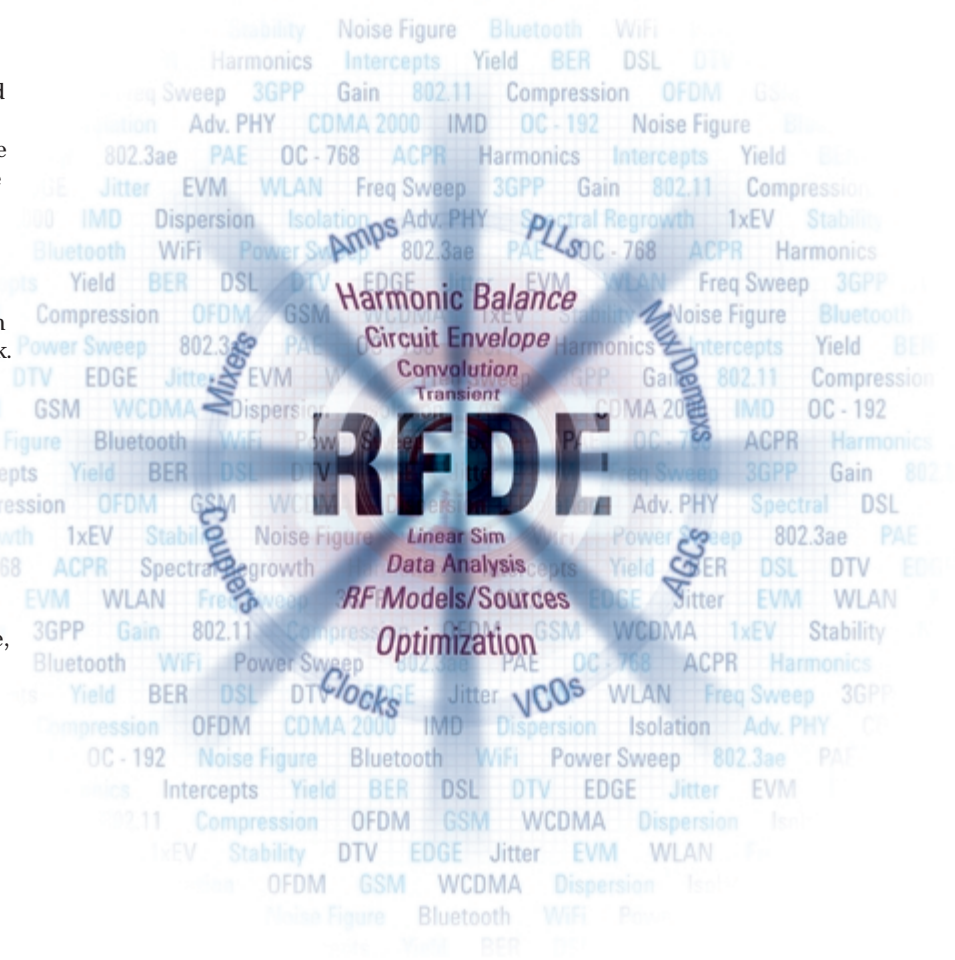
RF Design Environment

Premiere Product of the Cadence/Agilent Alliance

Encouraged by industry's top IC suppliers, Agilent and Cadence continue to develop more tightly integrated and advanced solutions for large-scale RF/Mixed-Signal IC design. The initial result of this collaboration is RF Design Environment (RFDE) – a platform uniting Agilent's leading wireless and wireline simulation technologies, model sets, and waveform viewing capabilities with the industry-standard IC design flow from Cadence. Analog/mixed-signal designers now have direct access to an all-inclusive, RF and high-speed design solution from within Cadence Design Framework II.

Improved Design Productivity

As data rates, carrier frequencies, and specification complexities increase, so does the designer's need to utilize a broader range of fast and accurate EDA tools. RFDE enables Agilent's proven frequency-domain and mixed-domain simulation, statistical design, optimization, and post-simulation analysis capabilities from within the familiar Cadence framework.



Agilent's simulation technology produces fast measurements for typical high-frequency applications. Increased simulation speed makes complex analyses and optimizations practical, providing greater insight into circuit behavior. Combining RFDE with reliable time-domain simulation technology from Cadence, gives IC designers the complete set of analysis capabilities required for today's challenging large-scale RF/mixed-signal designs. No matter what the design standard, circuit, or requirement, adding RFDE to the design flow reduces costly design iterations and shortens your design cycles.

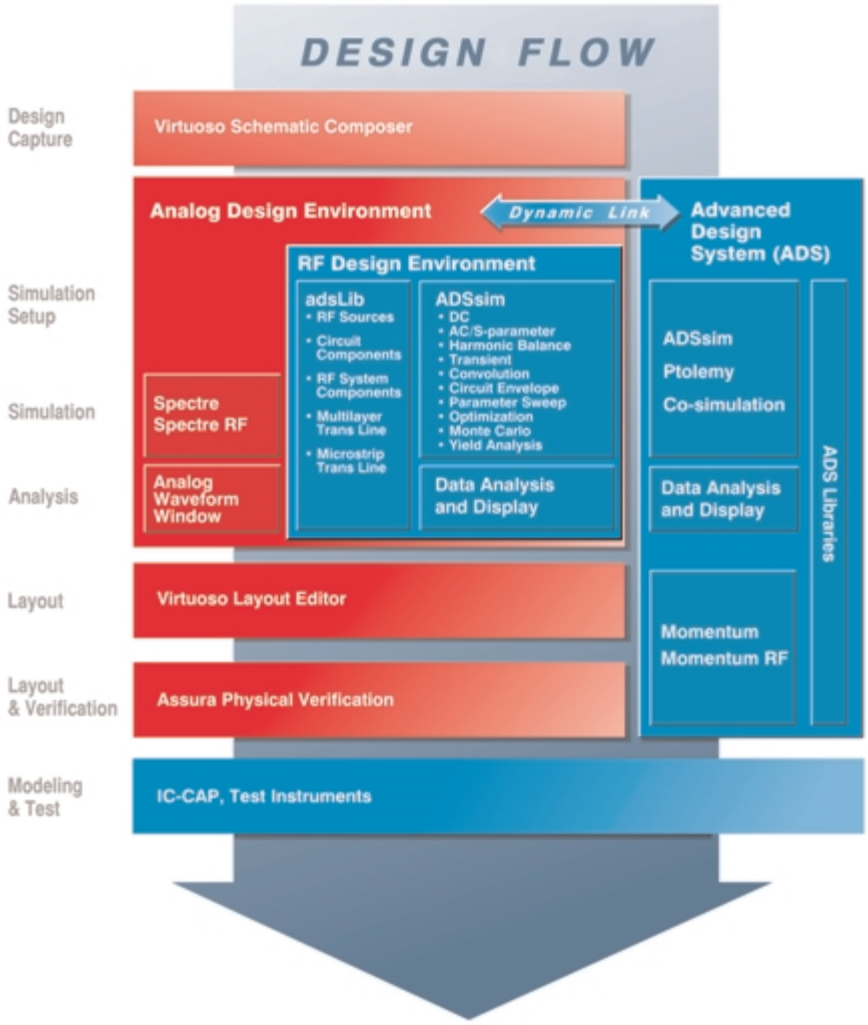
Built on a Proven Foundation

RFDE is a unique combination of proven simulation and integration technologies. The RF simulation engine (ADSsim), component and model libraries (adsLib), and post-simulation analysis and display engines come from the Advanced Design System (ADS) platform. They are the result of twenty years of innovation by Agilent EEsof EDA, a true leader in high-frequency design software. Co-developed by Agilent and Cadence, the integration technology is built on the solid foundation of Agilent's RFIC Dynamic Link (introduced in 1999), and adds support for many familiar Cadence simulation features such as DC annotation, snapshot mode, direct plot, and circuit probing.

Complete RF/Mixed-Signal IC Design Flow

RFDE is part of a comprehensive RF/MS IC design flow, from design capture to prototype test. Designs initially are created in Cadence Virtuoso Schematic Composer. A schematic test bench is then created with RFDE, using sources and other components from adsLib. Advanced simulation options, including optimization, parameter sweeps, pre-configured measurements, and statistical analysis are available when the simulator is chosen. Simulation results are viewed using Agilent's rich set of data display capabilities. After the IC layout is complete, extracted parasitics can be re-simulated and analyzed within RFDE.

Additional parasitic and passive layout component modeling is performed using the ADS Momentum and MomentumRF simulators. Co-simulation with the Agilent Ptolemy system simulator (accessed through RFIC Dynamic Link) is used to verify that overall system behavior matches specification. Final prototype measurements, and additional circuit and device modeling, are performed with Agilent test equipment and IC-CAP software.



Training, Support, and Service – When and Where You Need It

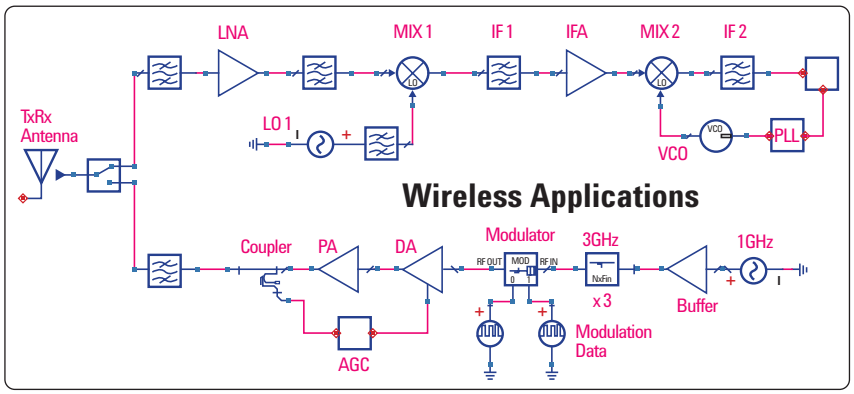
Support for RFDE is provided through Agilent's world-class, global technical support organization. Agilent's experienced application and technical support engineers are dedicated to addressing the special challenges of high frequency design. Product, application, training, and support information is also available 24 hours a day from Agilent EEsof EDA's up-to-date and comprehensive website, **www.agilent.com/find/eesof.**

"We've been partnering both with Cadence and Agilent to provide ST designers with a best-in-class RF design flow. I'm very pleased to see that RFDE gives us a single design solution that will enhance designer productivity and therefore accelerate time to market for our products."

***Philippe Magarshack**, R&D Group VP, STMicroelectronics*

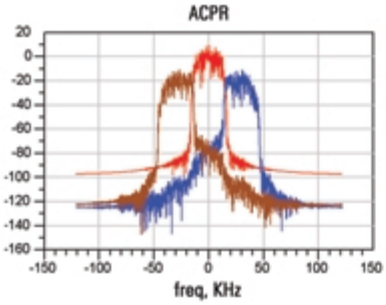
Your Applications are Covered

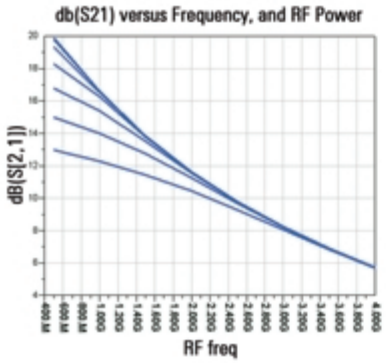
RFDE gives large-scale RF/Mixed Signal IC designers complete access to a broad range of powerful simulation, statistical design, optimization, and post-simulation analysis technologies from Agilent EEsof EDA. The additional capabilities allow you to examine complex high-frequency and high-speed effects early in the design process.

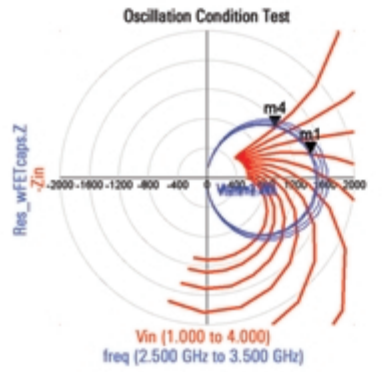


Amplifiers

- ACPR, EVM
- Harmonic Load Optimization
- Noise and Stability Circles
- RF Conversion Gain
- PAE
- Multi-Tone Response

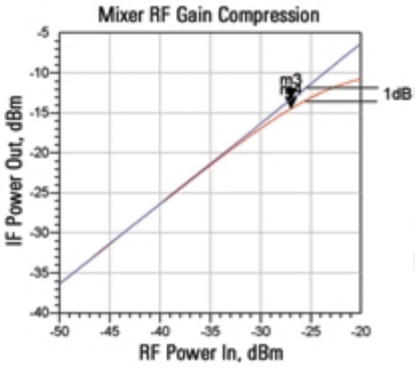


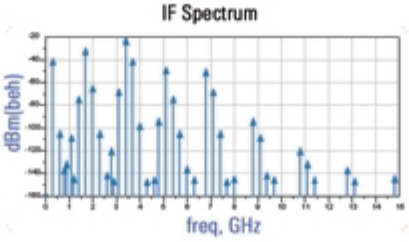


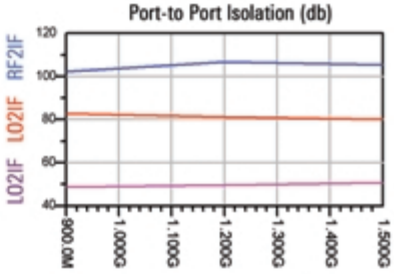


Mixers/Multipliers

- Conversion Gain versus Frequency
- Conversion Gain versus Power
- RF Compression
- Noise Figure versus Swept Parameters
- IF Spectrum
- Intermodulation Distortion
- Isolation versus Swept Parameters

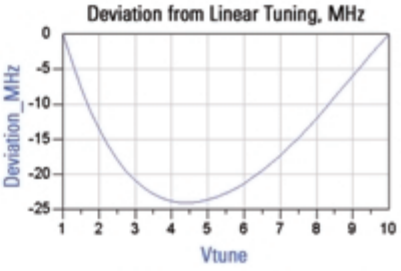


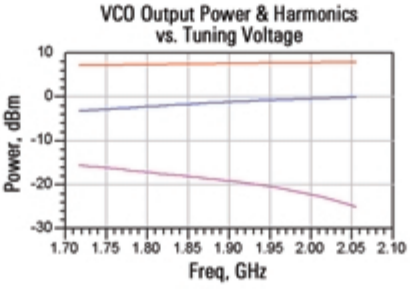


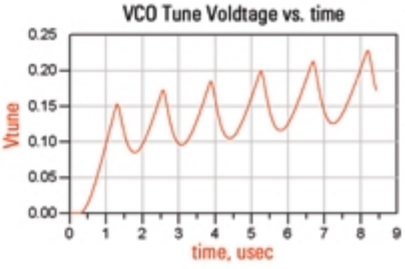


Oscillators/VCOs

- Phase Noise Contributors
- Startup Time
- Deviation from Linear Tuning
- Harmonics versus Frequency
- Tuning Linearity





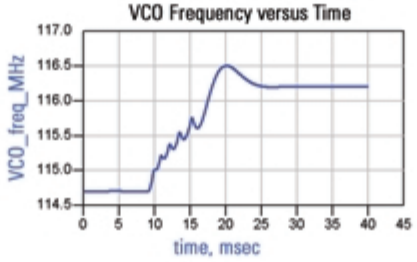


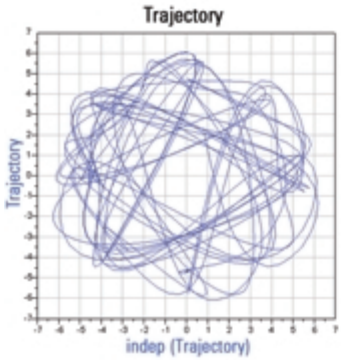
Fast Simulations for Every Specification

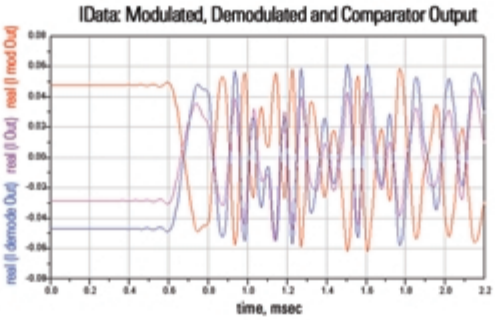
AGCs, PLLs, Modulators

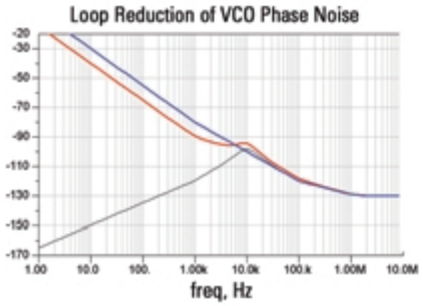
(Phase/Frequency/Amplitude Loops)

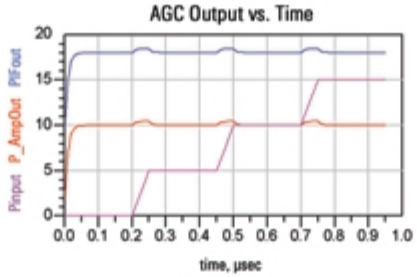
- Frequency Response
- Loop Gain
- Response Time
- Dynamic Range
- Step Response Time
- Phase Margin
- Unity Gain Frequency





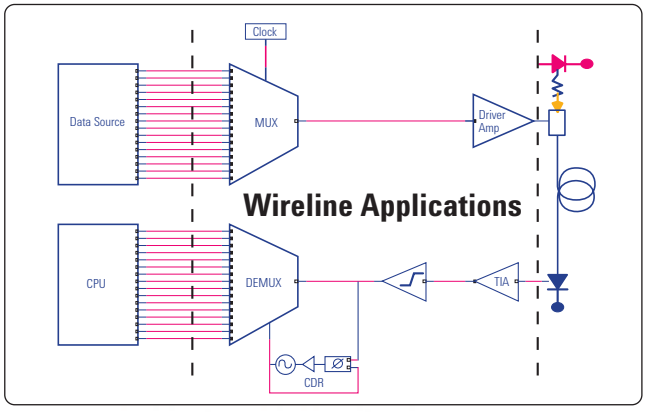






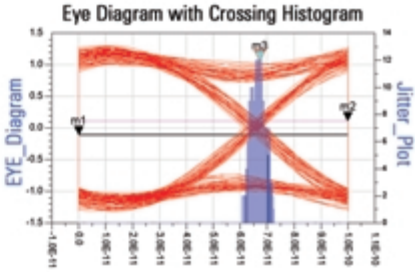
"We are pleased to see the first results of the alliance between Cadence and Agilent. We believe their tightly integrated combination of RF and mixed-signal IC design flow methodologies can help to reduce the industries time-to-market for complex systems-on-chips."

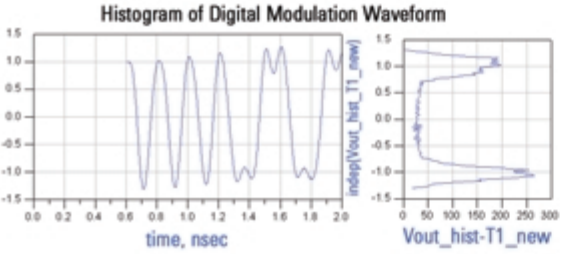
***Jim Caravella**, Manager, Analog Design Kits, Motorola*



Muxs, Demuxs

- High-Speed Gain
- Jitter
- Eye Diagrams
- BER
- Clock Distribution





Clocks, CDRs

- High-Speed Gain
- Jitter
- Eye Diagrams
- Group Delay

Advanced Technology

Advantages of Frequency and Mixed-Domain Technology

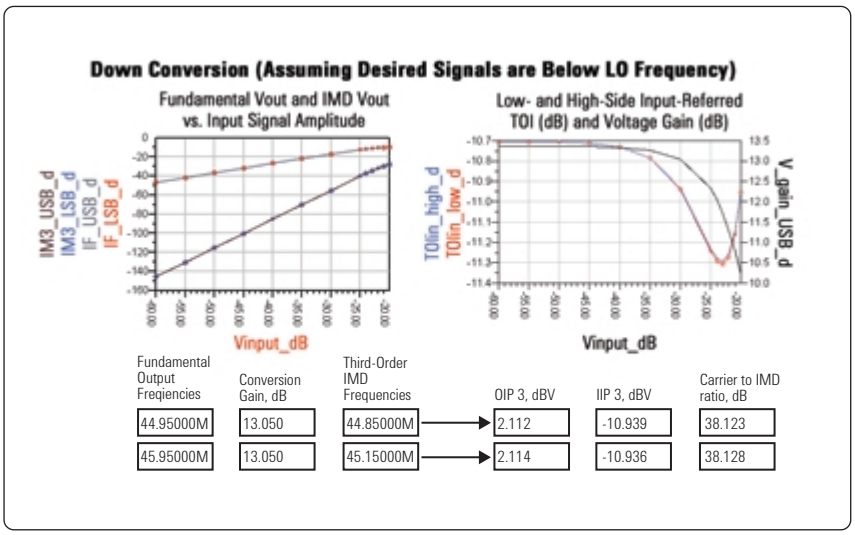
Traditional analog IC design flows are based on time-domain simulation technology. RFDE adds the frequency- and mixed-domain simulation capabilities required for today's most complex RF design problems. These simulators provide fast and extensive characterization for applications such as amplifiers, mixers and oscillators, VCOs, PLLs, AGCs, and modulators. Frequency- and mixed-domain simulation is efficient for sweeping power or frequency, and for examining critical effects such as IMD, noise figure, dispersion, and compression. Fast simulation under arbitrary multi-tone excitation makes optimization, yield analysis, and design centering practical for even the most challenging circuits.

Harmonic Balance

This simulator directly computes the steady-state frequency spectrum, and is best applied to circuits with non-linear applications where multiple signals mix or compress. Harmonic Balance is best suited for:

- Designs with frequency conversion.
- Swept frequency analysis.
- Mixer and amplifier noise analysis.
- Analyzing inter-modulation distortion (IMD).
- Designs with frequency-dependent models (dispersion).
- Frequency-dependent parameter optimization.

Agilent's Harmonic Balance engine was first introduced in the 1980s, and its speed, accuracy, and convergence is being continually improved. Recent innovations include Krylov solvers and pre-conditioners that greatly increase the circuit size and signal non-linearities that Harmonic Balance can address. Another recent breakthrough is the method for sequencing transient and Harmonic Balance simulations when examining digital waveforms in circuits such as frequency dividers and PLLs.



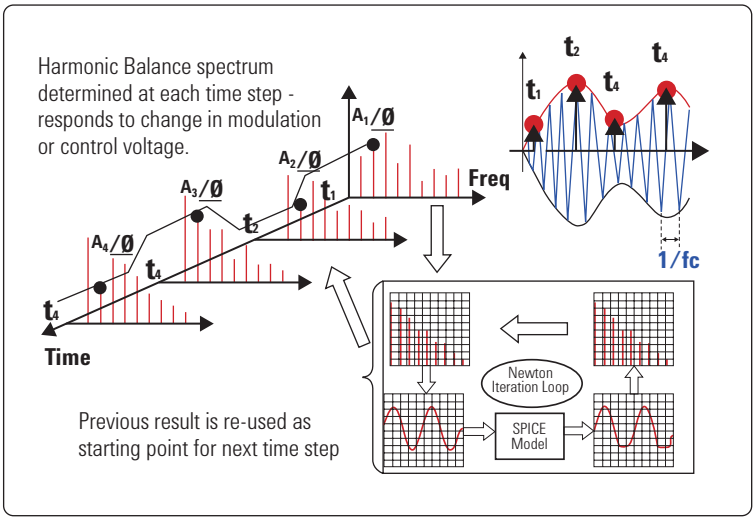
"80% of our wireless designers come from an analog, time-domain background. Providing frequency-domain technology to them is critical."

***Naotoshi Higashiyama**,*
Division Expert,
Analog IC Development,
NEC Compound Semiconductor Devices

Circuit Envelope

Circuit Envelope excels at frequency- and time-domain analysis, by operating in the frequency domain and making calculations only around the frequencies of interest. This patented simulation technique is extremely fast and efficient when analyzing the digitally modulated signals found in high speed and wireless circuits, including:

- Pseudo-random digitally modulated signals.
- VCO, AGC and PLL transient response.
- High-order mixer IMD.
- ACPR, EVM, and PAE optimization.

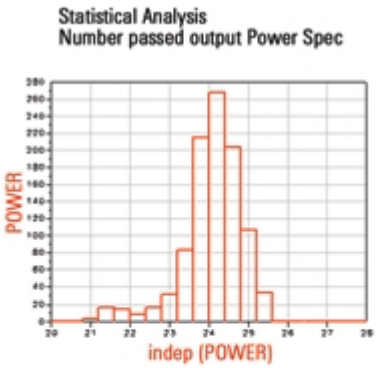


Convolution

Convolution is an advanced frequency-domain extension to time-domain simulation that enables direct simulation of dispersive, frequency-dependent components (distributed elements and parasitics, S-parameter data files, transmission lines, and so on) during a time-domain analysis.

Optimization and Statistics

All of Agilent's simulators include easy-to-use parameter sweeps, optimization, sensitivity analysis, and yield analysis. These capabilities combine to provide added design insight. They help designers recognize and account for manufacturing process variations early in the development cycle.



Statistical Analysis
Number of Monte Carlo trials = 1000
Number Failed = 24
Number Passed = 976
Yield = 97.6%

Num Fail	Num Pass	Yield
24.000	676.00	97.600

RF Models and Libraries

Simulation results are only as accurate as the models and libraries used to produce them. RFDE provides access to a rich adsLib model set, including:

- Agilent EEsof ADS component libraries.
- RF circuit/system models for mixed-signal verification.
- Transmission line models.
- Signal sources.
- Microstrips, and multilayer interconnect components.

A growing number of leading foundries offer design kits for Agilent simulators.

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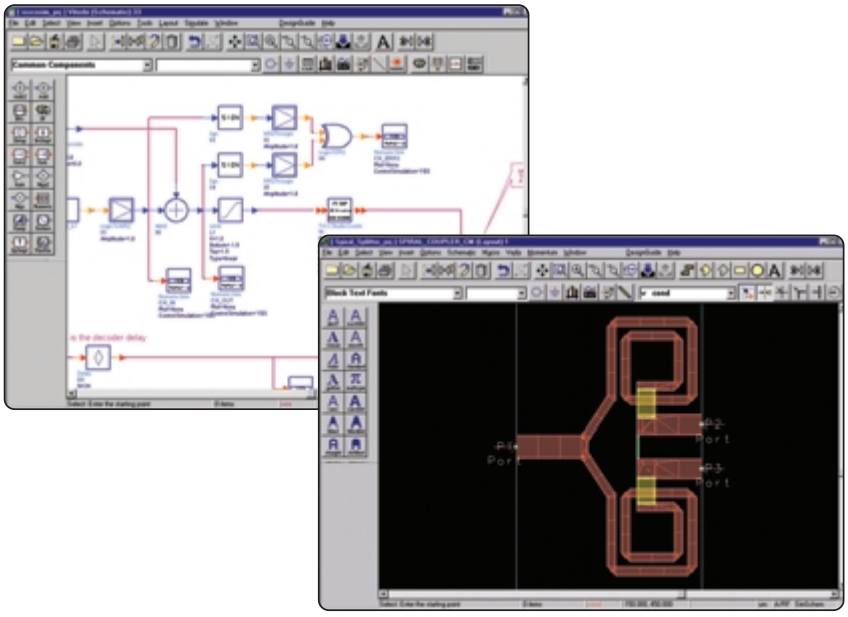
Ptolemy and Momentum

RFIC Dynamic Link provides access to the ADS platform and other Agilent EEsof EDA technologies not yet linked by RFDE. Momentum is a 2.5-D, electromagnetic (EM) simulator for examining on-chip and off-chip high-frequency EM effects. Ptolemy is Agilent's advanced system simulator, adding tops-down design and bottoms-up verification capability. Ptolemy and Momentum are the enablers for Co-simulation with Layout Components and HDL Co-simulation. Both simulators are supported by an extensive set of system design and behavioral model libraries.



RF Design Environment Bundles

RFDE Wireless Pro	RFDE Wireline Pro	RFDE Premier	
			RFDE Integration
x	x	x	Cadence Analog Design Environment Integration
x	x	x	Dynamic Link to ADS
			Simulation Capabilities (ADSsim)
x	x	x	Data Analysis and Display
x	x	x	Parameter Sweep
x	x	x	Parameter Optimization
x	x	x	Monte Carlo/Yield Analysis
x	x	x	DC Analysis
x	x	x	AC Analysis
x	x	x	S-Parameter Analysis
x	x	x	Small-Signal Noise Analysis
x	x	x	Transient Analysis
	x	x	Transient Analysis with Convolution
x		x	Harmonic Balance Analysis
x		x	Transient Assisted Harmonic Balance Analysis
x		x	Nonlinear Noise Analysis
x		x	Phase Noise Analysis
		x	Circuit Envelope Analysis
			Library Components (ADSlib)
x	x	x	Frequency-domain sources
x	x	x	Time-domain sources
x	x	x	Modulated sources
x	x	x	Noise sources
x	x	x	Voltage/Current controlled sources
x	x	x	Lumped components
x	x	x	Transistor components
x	x	x	Data Items (S-parameter files)
x	x	x	Microstrip T-Lines
x	x	x	Multilayer T-Lines
	x	x	Passive RF components (bond wires, transformers)
		x	Filter components
		x	Amplifier components
		x	Mixer components
		x	PLL components

RFDE Premier+ adds the following ADS licenses:

- ADS Project Design Environment
- Ptolemy Simulator (RF/baseband co-simulation)
- Antenna & Propagation Models (use with Ptolemy)
- Momentum Simulator (for modeling of passive layout structures)
- Momentum Visualization
- Momentum Optimization
- ADS Layout (for setting up Momentum simulations)
- GDSII Translator (for importing layout elements from Cadence into ADS Layout)

RFDE and ADS can be used together with the Dynamic Link capability, which is included in each of the RFDE seats.

Works with Cadence versions 4.4.5 and 4.4.6
Available on HP-UX, Sun and IBM platforms:

- HP-UX 11.0x
- Solaris 2.6, 2.7 and 2.8
- IBM AIX 5.2

Designed for use with the following Cadence Products:

- Virtuoso Schematic Composer
- Analog Design Environment

For more information about Agilent EEsof EDA visit: **www.agilent.com/find/eesof**

For more information about Cadence Design Systems products visit: **www.cadence.com**

For more assistance with your test and measurement needs visit: **www.agilent.com/find/assist**

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