

# Agilent EEsof EDA

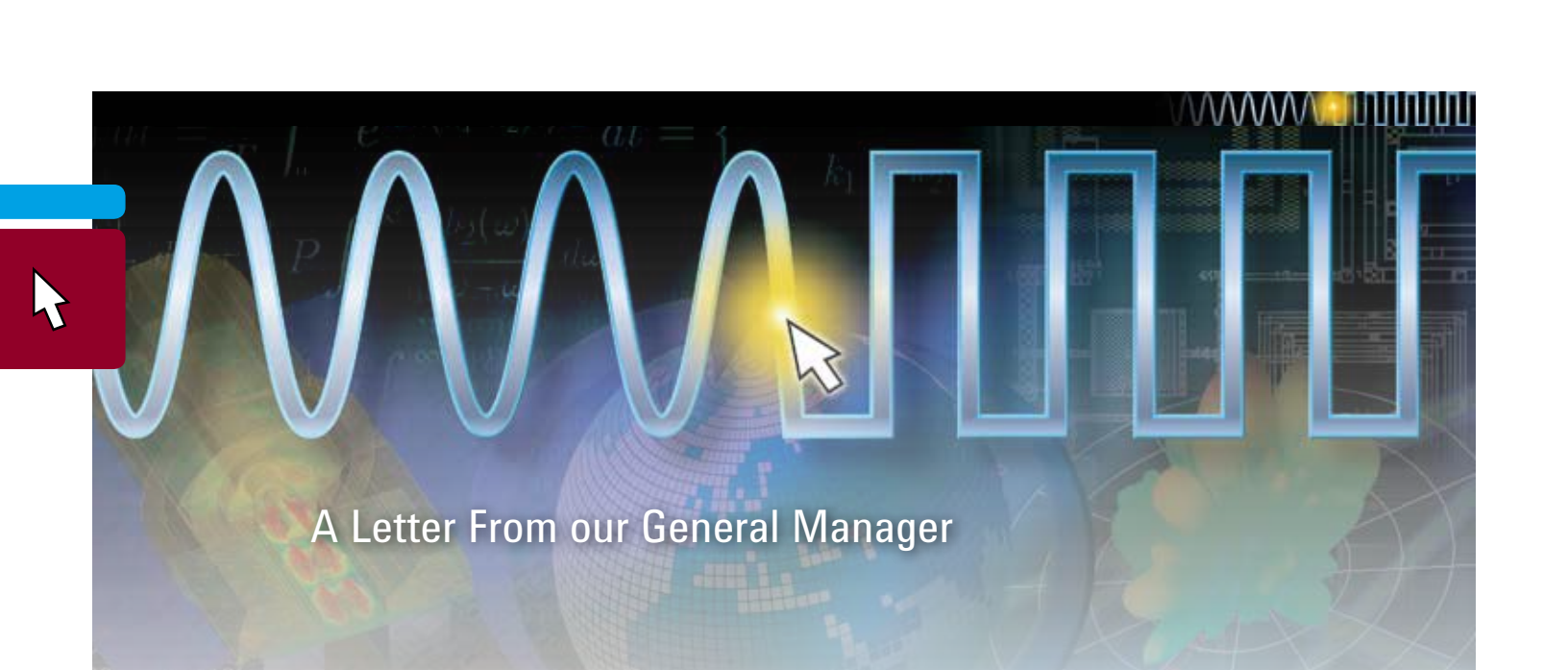
*Premier Communications  
Design Software*

C A T A L O G

*Anticipate — Accelerate — Achieve*



**Agilent Technologies**



## A Letter From our General Manager



Dear Valued Customer,

I am pleased to present this new edition of the Agilent EEs of Electronic Design Automation (EDA) Software Catalog. Agilent's design software gives you the competitive advantage you need to make better communications products faster.

As you look through it, I hope you'll find the EDA tools required for your design needs. Our tools are optimized for microwave and RF, high-speed, device modeling, and system applications. We offer a wide range of fully integrated solutions to dramatically improve productivity and significantly reduce costs.













Give us your feedback; we count on it to ensure that we continue to meet your requirements. I hope you will look to Agilent's innovative products and solutions to help you achieve your business results.

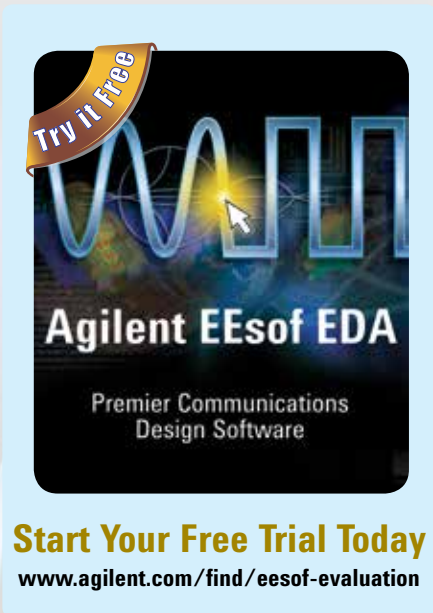
Sincerely,



Todd Cutler  
General Manager  
Agilent EEs of EDA

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The graphic features a dark background with a glowing blue sine wave on the left and a glowing blue square wave on the right. A mouse cursor is positioned over the square wave. A gold ribbon in the top left corner says "Try it Free". The text "Agilent EEsof EDA" is prominently displayed in white, with "Premier Communications Design Software" below it. At the bottom, it says "Start Your Free Trial Today" and provides the URL "www.agilent.com/find/eesof-evaluation".

# Offering Design Software for Complete Flow Solutions

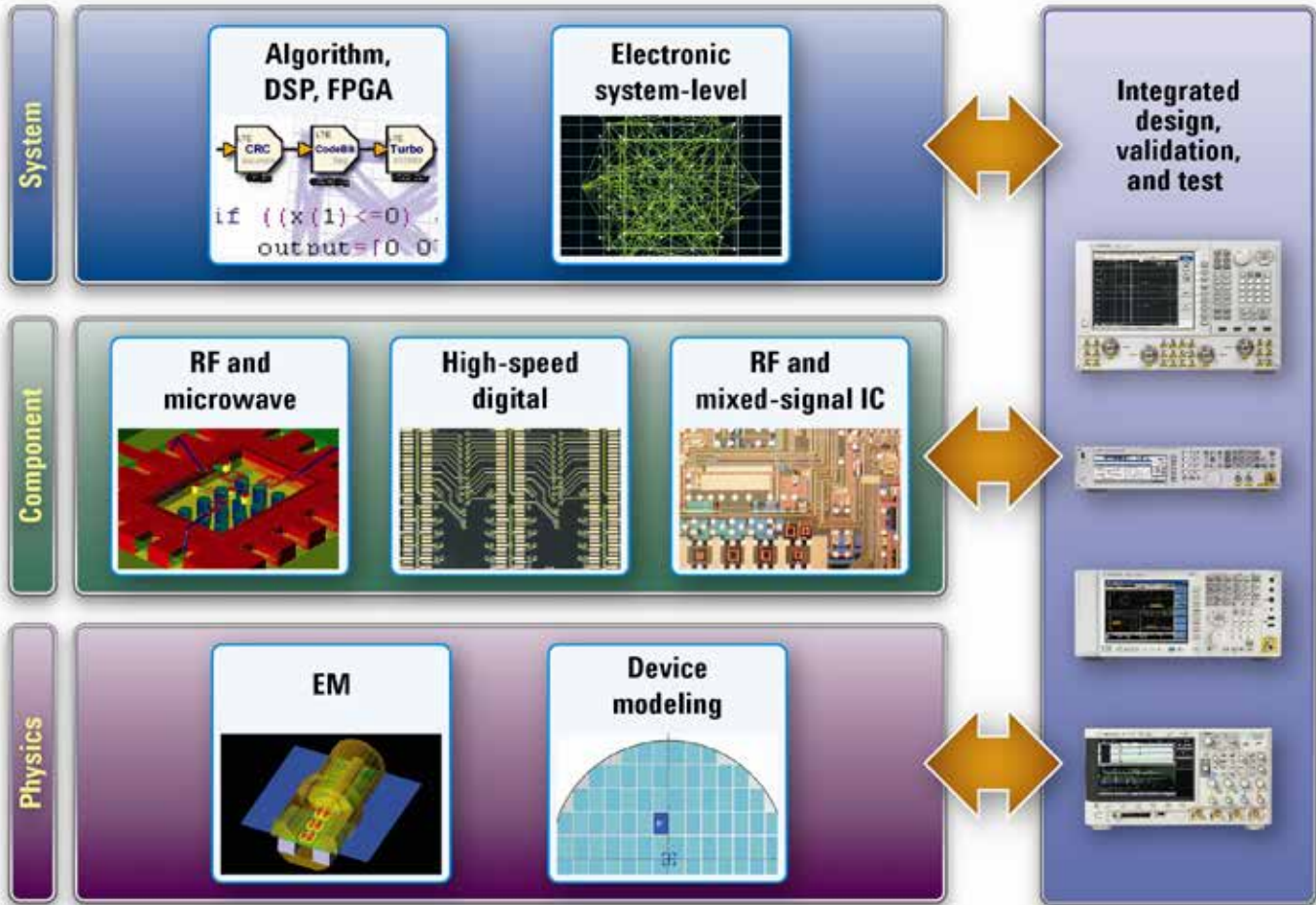


Figure 1. Agilent EESof EDA is the leading supplier of Electronic Design Automation (EDA) software for communications designs.

Agilent EESof EDA is the leading supplier of Electronic Design Automation (EDA) software for communications product design. High-frequency, high-speed, device modeling, signal-processing and RF circuit design engineers create better products faster using design flows built on our system, component, and physics-level design tools. We offer complete design integration for products such as cellular phones, wireless networks, radar, satellite communications systems and high-speed digital wireline designs. Applications include electronic system level (ESL), high-speed digital, RF-Mixed signal, device modeling, RF and Microwave design for commercial wireless, aerospace, and defense markets. Our software is compatible with and is used to design Agilent's own test and measurement equipment.

All of our EDA software bundles are scalable to offer you the widest variety and most flexible plans available to work within your design flow and your budget. As your design needs grow, you can add simulators, models and libraries as you require them. We are dedicated to providing the right software and support to increase your design productivity and advance your long-term success.



**Agilent EESof**  
**68%**

Figure 2. Agilent EESof is the leading provider of RF Design and Simulation tools.\*

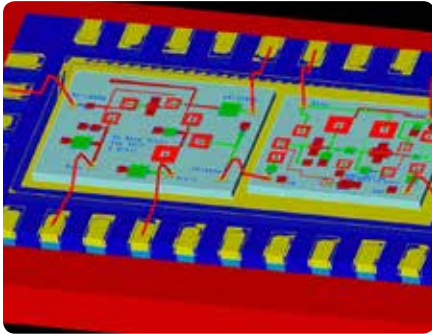
\* Gary Smith EDA's 2012 market share report.

# The Industry's Leading Technology, and Much More



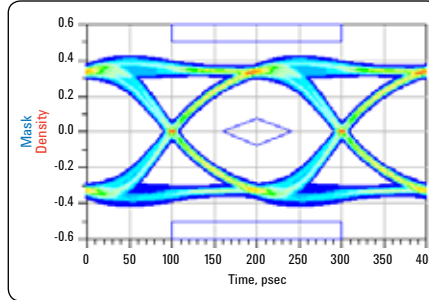
# We Go Wherever the Communication Signal Goes

## RF & Microwave Design



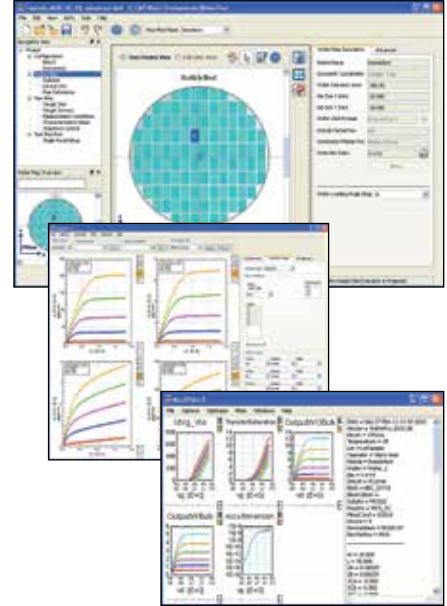
Agilent's RF and Microwave design and simulation tools provide the most complete solution for creating robust designs with first pass success and high yield in MMIC, RF-Mixed Signal IC, RF board, RF SiP and RF Module technologies.

## High-Speed Digital Design and Simulation

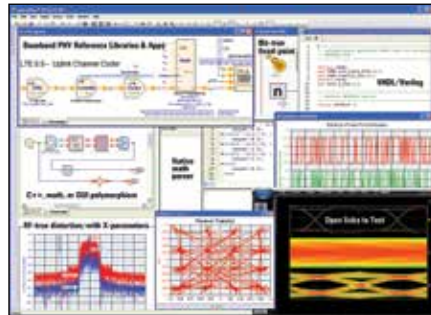


Agilent's high-speed digital design & simulation tools, such as ADS, EMPro & SystemVue, provide the most complete solution for multigigabit/s chip-to-chip links such as PCI Express®, DDR3, HDMI, USB 3.0, SAS, and 10G Ethernet.

## Device Modeling and Characterization



## Electronic System-Level (ESL) Design



ESL design tools enable designers of high-performance PHY's in emerging wireless communications systems, LTE, LTE-A, MIMO, DPD, satellite & radar systems, and SDR to make optimum use of the latest RF/Analog and DSP techniques.

Agilent provides premier solutions for modeling and characterization of CMOS and III-V devices, including automated measurements, accurate device model extraction, comprehensive model qualification, PDK validation and comprehensive modeling services.

# World-Class Products Enabling the Entire Communications Design Flow



**Advanced Design System (ADS)** is the industry's leading RF, microwave & high speed digital electronic design automation software for wireless communications and networking, aerospace and defense, and signal integrity applications.



**Genesys** is an affordable, accurate, easy-to-use RF and microwave simulation software created for the circuit board and subsystem designer.



**Electromagnetic Professional (EMPro)** is the first 3D Electromagnetic EM simulation software platform that completely integrates 3D EM simulation and the ADS circuit simulation software.



**Integrated Circuit Characterization and Analysis Program (IC-CAP)** is the industry standard for DC and RF semiconductor device modeling. IC-CAP extracts accurate compact models used in high speed/digital, analog and power RF circuit design applications.



**SystemVue** is an electronic system-level (ESL) design tool that enables system architects and algorithm developers to innovate the physical layer (PHY) of next-generation wireless and aerospace/defense communications systems.



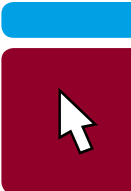
**Model Builder Program (MBP)** is a one-stop solution that provides both automation and flexibility for silicon device modeling. MBP includes powerful, built-in characterization and modeling capabilities as well as an open interface for modeling strategy customization.

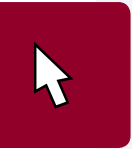


**GoldenGate** is an advanced simulation and analysis solution for integrated mixed signal RFIC designs. GoldenGate RFIC software is fully integrated into the Cadence Analog Design Environment (ADE).



**Model Quality Assurance (MQA)** provides the complete solution and framework to fabless design companies, IDMs, and foundries for SPICE model library validation, comparison, and documentation.





# Making your job easier with worldwide technical support and resources

## Overview

Agilent Technologies is committed to customer satisfaction. We are dedicated to providing the right software, support, and consulting solutions to increase your engineering productivity and advance your long-term success.

Whether you are a novice or an experienced user, Agilent EEsof EDA's customer support offerings are designed to help you every step of the way. They include: regular software and manual updates; worldwide technical support via phone, email and the web; and access to our Knowledge Center.

## Web-based support

The Agilent EEsof EDA support web site, featuring the Knowledge Center, is an around-the-clock resource for designers. The Knowledge Center contains thousands of support documents and hundreds of downloadable examples created by our support and application engineers to supplement the examples and documentation supplied with the software.

Hot-Fixes containing updates to previously released software versions are available for download within the Knowledge Center. The My Knowledge Center feature in the Knowledge Center enables you to submit and manage on-line support cases and any related defect and enhancement requests. A robust search function lets you quickly find available on-line solutions and sort by date. The Knowledge Center also includes free recorded Technical Info Sessions and introductory e-Learning Short Courses. You will need a valid support contract to access the Knowledge Center. For more information, visit [www.agilent.com/find/eesof-knowledgecenter](http://www.agilent.com/find/eesof-knowledgecenter)

## Worldwide phone support

Agilent EEsof regional technical support teams are experienced with all products and supported platforms. Teams are staffed with highly trained engineers; most have extensive design experience and hold advanced engineering degrees. Whether you have a hardware installation question or a complex circuit or system problem, your call is routed to a specialist whose goal is to get you back to work as quickly as possible.

## Local language support

Agilent EEsof EDA has dedicated support engineers in many countries to provide you with local language support, including English, Japanese, Korean, Mandarin, French, German, and Dutch. Phone support is available Monday through Friday worldwide (excluding regional holidays) during local business hours.

## Significant software updates

Agilent EEsof EDA regularly enhances and upgrades its design software. You can expect significant updates that include new features, user interface enhancements, defect fixes, Service Packs, and up-to-date application examples for today's design needs. By using the latest software technology as soon as it becomes available, you can keep your productivity at a maximum. See Agilent EEsof EDA's most recent software updates on the web.

[www.agilent.com/find/eesof-support](http://www.agilent.com/find/eesof-support)

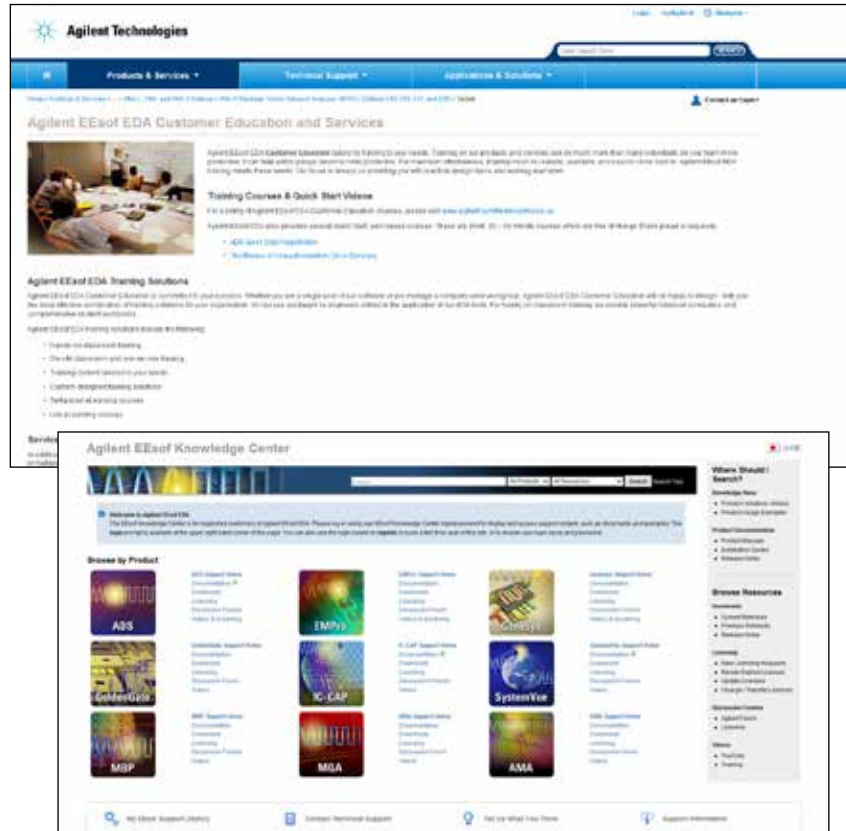




# Solution Services

Leverage Agilent's broad expertise through custom solution services. We offer services to speed your MMIC, RFIC, RF board/module, or system-level designs, including:

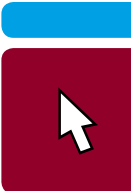
- **Device Modeling**  
We can quickly characterize and extract industry-standard models for your device, and then (optionally) provide test structure and device layout design services.
- **Process Design Kits**  
Let us create or extend your custom PDK elements or libraries.
- **High-Speed Digital**  
Leverage our expertise with developing and fine-tuning AMI models, or learn how to cut through gigabit design challenges with optimal use of Agilent EEsof tools for HSD applications.
- **Digital Pre-Distortion (DPD)**  
We can help automate measurement setup and execution through custom scripting and integration of third-party tools for control of equipment.
- **Simulation Assistance**  
Eliminate trial and error. Get expert coaching and learn best practices for complex circuits or systems.
- **Design Process Consulting**  
Let us perform an analysis of your design flow and make recommendations that will save you time and money.
- **Electronic System-Level (ESL)**  
Agilent consultants can help reduce the gap between design and test - as we work with you to integrate hardware measurements into system simulations.



## Automatic case tracking

Every call we receive is important. Our integrated case tracking system helps ensure that you receive the individual care you deserve.

Each case is assigned a tracking number and given a priority based on its specific details. If research is required for your answer, the tracking system lets you easily request a status report on your call, either by phone or through the Knowledge Center. Our escalation process ensures critical issues receive proper attention and timely resolution.



# Accelerate Your Design Process With Agilent EEsof Foundry Partners

The Widest Choice of Foundry Process Design Kits (PDKs) and Component Vendor Libraries Gives You the Most Accurate Designs

When choosing a high-frequency electronic design automation (EDA) tool, it is critical to consider how to obtain models from foundries and component manufacturers in order to successfully complete your design cycle. Agilent EEsof EDA is committed to ongoing partnerships with foundries and vendors to provide the most accurate models to help speed your designs to manufacturing. Agilent EEsof has the largest number of high-frequency foundry partners providing PDKs for today's popular foundry processes.

## Foundry Partners

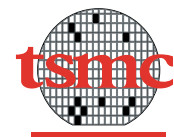
IC foundries offer semiconductor processes that are characterized by PDKs containing active and passive device simulation models for IC design. You typically find complete, front-to-back ADS PDKs including DRC rules and Momentum stack-up files for all GaAs, InP and GaN processes, but also for a broad range of SiGe and RF-CMOS processes.

For front-end only design and simulation, there is also broad range of corresponding ADS PDKs for CMOS processes available. In addition, you can still work in ADS using native Cadence Virtuoso PDKs through the ADS "Dynamic Link" option.

### GaAs, InP and GaN Foundries for MMIC Design



### SiGe and CMOS foundries for RFIC Design





*Agilent EEs of EDA actively engages with component manufacturers to create model libraries that provide access to the latest models and technologies, including:*

Analog Devices	KOA Speer	Samyoung
Avago	Metelics	Siemens
AVX	Mini-Circuits	Taiyo Yuden
Banpil	Mitsubishi	TDK
CEL	Modelithics	Temwell
Coilcraft	Motorola	TFT
Cyntec	Murata	TI
DT Micro	NEC	Toshiba
DuPont	Panasonic	
Freescale	Polyfet	
Hittite	Samsung	
Johanson	Samtec	

**For an updated list, refer to:**  
[www.agilent.com/find/eesof-vendor-libraries](http://www.agilent.com/find/eesof-vendor-libraries)

## Agilent EEs of EDA solutions enabled in Cadence Virtuoso PDKs

Beyond ADS, when you are working in the Cadence® Virtuoso® platform for large-scale RFIC design, you will also find Agilent's GoldenGate RFIC Simulation Software for circuit simulation, analysis and verification and Agilent's Momentum 3D Planar EM Simulator natively supported in the corresponding Virtuoso PDKs. Both solutions are seamlessly integrated into the Cadence Virtuoso Platform. GoldenGate is able to simulate directly using Spectre® models within the Cadence Virtuoso PDKs. So no modifications to the Cadence PDK are required. Momentum requires a substrate stack-up file that is mapped to Cadence Virtuoso PDK layers.

## Component Vendor Partners

Agilent EEs of EDA teams up with leading component manufacturers worldwide to provide more than 100,000 part libraries. Approximately 90% of the libraries come with layout footprints for a fast track to physical hardware. The wide variety of libraries includes active circuit and system components, passive components, and high-speed connectors.

Component manufacturers provide their ADS-compatible model libraries as downloads from their websites. You download the latest component libraries without being dependent on the ADS software release schedule, and you have access to manufacturing components much earlier in the design cycle. Models are easy to install in ADS.

In addition, many more component vendors offer S-parameter libraries in the s2p Touchstone format established by Agilent EEs of EDA for download and simulation within ADS and the Genesys RF and Microwave Design Software.

## RF-CMOS foundries for RFIC Design



# Get the Latest Information With Agilent EEs of Online

## Stay Up-to-Date With the Monthly Agilent EEs of EDA Newsletter

Interested in finding out the latest news regarding Agilent EEs of EDA tools and applications? Be sure to sign up for our monthly newsletter.

- Product announcements, revisions, new releases
- Application related materials
- New videos and upcoming webcasts
- Upcoming training events and trade shows
- Recent press releases, magazine articles

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[RF Design Tips, Tricks and Tutorials](#)

ADS Users' RF & Microwave Designs & Applications

[www.rf-design-tips.com](http://www.rf-design-tips.com)

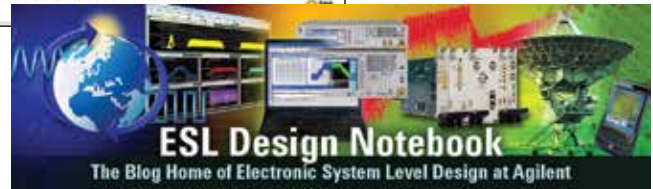
[Signal Integrity](#)

On High Speed Digital Chip-to-Chip Links  
<http://signal-integrity.tm.agilent.com>

## View our Innovations in EDA Webcast On-Demand Library

Agilent EEs of EDA's Innovations in EDA webcast series is important to designers who may not have time or budget to attend continuing education classes on the latest design tools and techniques. Here's a quick way to invest in your future and update your technical knowledge through these valuable webcasts streamed conveniently to your desktop.

[www.agilent.com/find/eesof-innovations-in-eda](http://www.agilent.com/find/eesof-innovations-in-eda)



# Join Our Online Discussion Communities

Connect with Agilent EEsof in our online communities

Agilent EEsof EDA is committed to building long-term relationships with its customers and has built online communities just for you. We invite you to ask questions and search for answers in our technical forums and participate in our LinkedIn User Group discussions.

Link with Agilent on 

Agilent ADS Users Group

[www.agilent.com/find/eesof-ads-linkedin](http://www.agilent.com/find/eesof-ads-linkedin)

Agilent Device Modeling User Group

[www.agilent.com/find/eesof-device-modeling-linkedin](http://www.agilent.com/find/eesof-device-modeling-linkedin)

Agilent SystemVue Group

[www.agilent.com/find/eesof-systemvue-linkedin](http://www.agilent.com/find/eesof-systemvue-linkedin)

Agilent Genesys User Group

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See Agilent on 

Subscribe to the Agilent EEsof YouTube Channel

We have over 270 videos available for you to watch. Watch our product overview videos, check out our design flows, see expert presentations and explore some of the new features available to help you in the latest product release. Agilent EEsof EDA is also available on Youku.

**YouTube:** [www.agilent.com/find/eesof-videos](http://www.agilent.com/find/eesof-videos)

**Youku:** [www.agilent.com/find/eesof-videos-youku](http://www.agilent.com/find/eesof-videos-youku)

## Agilent forums



### Agilent Forum Categories

- ADS Forum
- Device Modeling Forum
- EMPro Forum
- Genesys Forum
- GoldenGate Forum
- SystemVue Forum

Follow Agilent EEsof in Social Media

Stay up-to-date with Agilent EEsof wherever you are on the web. Follow us to get the latest on upcoming webcasts and tradeshows, product and industry news, new application notes, and more. You can find us on Facebook, Twitter, and Google+.

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Like the SystemVue page

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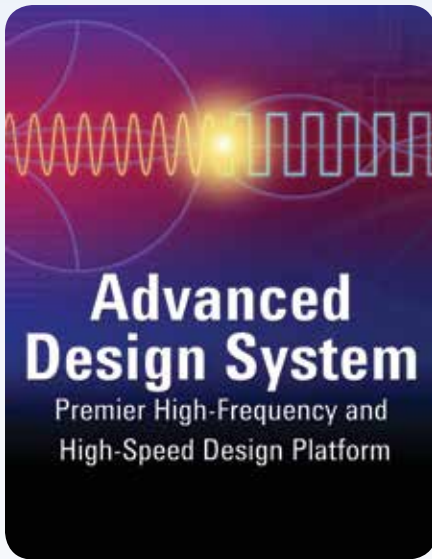


# Advanced Design System

## Powerful. Easy. Complete.

**Advanced Design System (ADS)** is the world's leading electronic design automation (EDA) software for RF, microwave, and high speed digital applications. In a powerful and easy-to-use interface, ADS pioneers the most innovative and commercially successful technologies, such as X-parameters\* and 3D EM simulators, used by

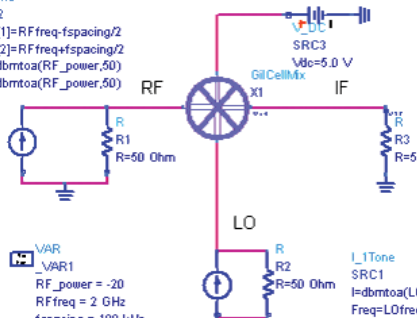
leading companies in the wireless communication and networking and aerospace and defense industries. For WiMAX,™ LTE, multi-gigabit per second data links, radar, and satellite applications, ADS provides full, standards-based design and verification with Wireless Libraries and circuit-system-EM co-simulation in an integrated platform.



**Advanced Design System**  
Premier High-Frequency and High-Speed Design Platform

These two sources create signals at RF +/- fspacing/2, so the tone spacing is fspacing.

```
L_nTone
SRC2
Freq[1]=RFfreq-fspacing/2
Freq[2]=RFfreq+fspacing/2
I[1]=dbmtoa(RF_power,50)
I[2]=dbmtoa(RF_power,50)
```



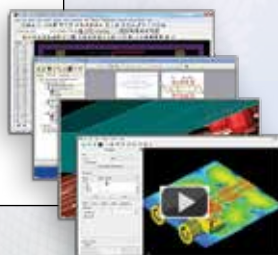
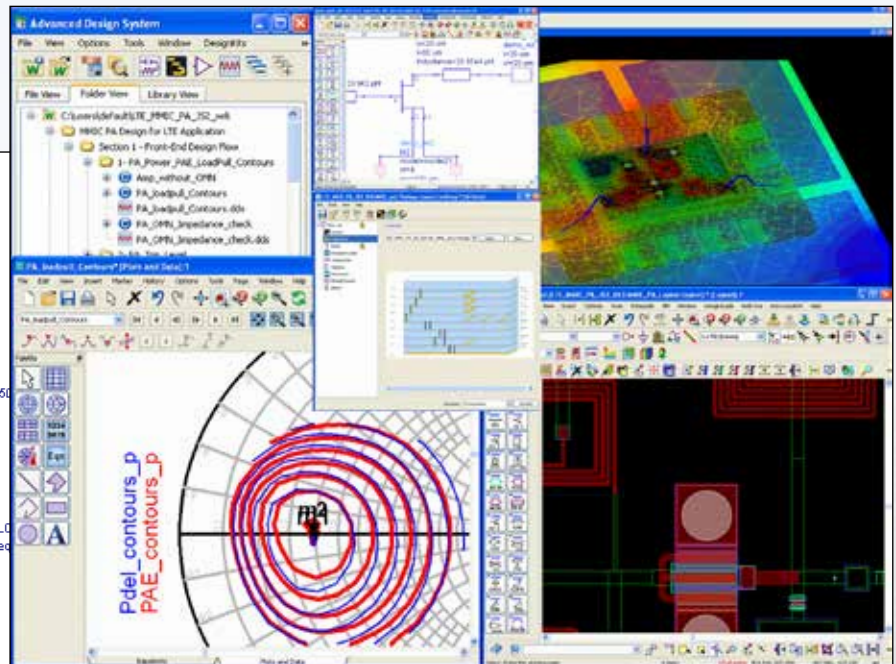
```
VAR
VAR1
RF_power = -20
RFfreq = 2 GHz
fspacing = 100 kHz
extrpts = 3
numpts = 20
LO_power = -5
LOfreq = 1750 MHz
tstop = (numpts*extrpts)*tstep
tstep = 1/(fspacing/2)*numpts
```

**ENVELOPE**

```
Env1
MaxOrder=4
Freq[1]=LOfreq
Freq[2]=RFfreq
Order[1]=5
Order[2]=2
SweepOffset=extrpts*tstep
Stop=tstop
Step=tstep
```

**PARAMETER SWEEP**

```
ParamSweep
Sweep2
SweepVar="RF_power"
SimInstanceName[1]="Env1"
SimInstanceName[2]=
SimInstanceName[3]=
SimInstanceName[4]=
SimInstanceName[5]=
SimInstanceName[6]=
Start=-50
Stop=-20
Step=10
```



### Watch videos...

Watch our **30 second videos** to learn about popular usability innovations we've made in ADS to increase your productivity.

[www.agilent.com/find/eesof-ads-30-second-demos](http://www.agilent.com/find/eesof-ads-30-second-demos)

\*X-parameters™ is a trademark of Agilent Technologies, Inc. The X-parameter format and underlying equations are open and documented.

# Design With Confidence

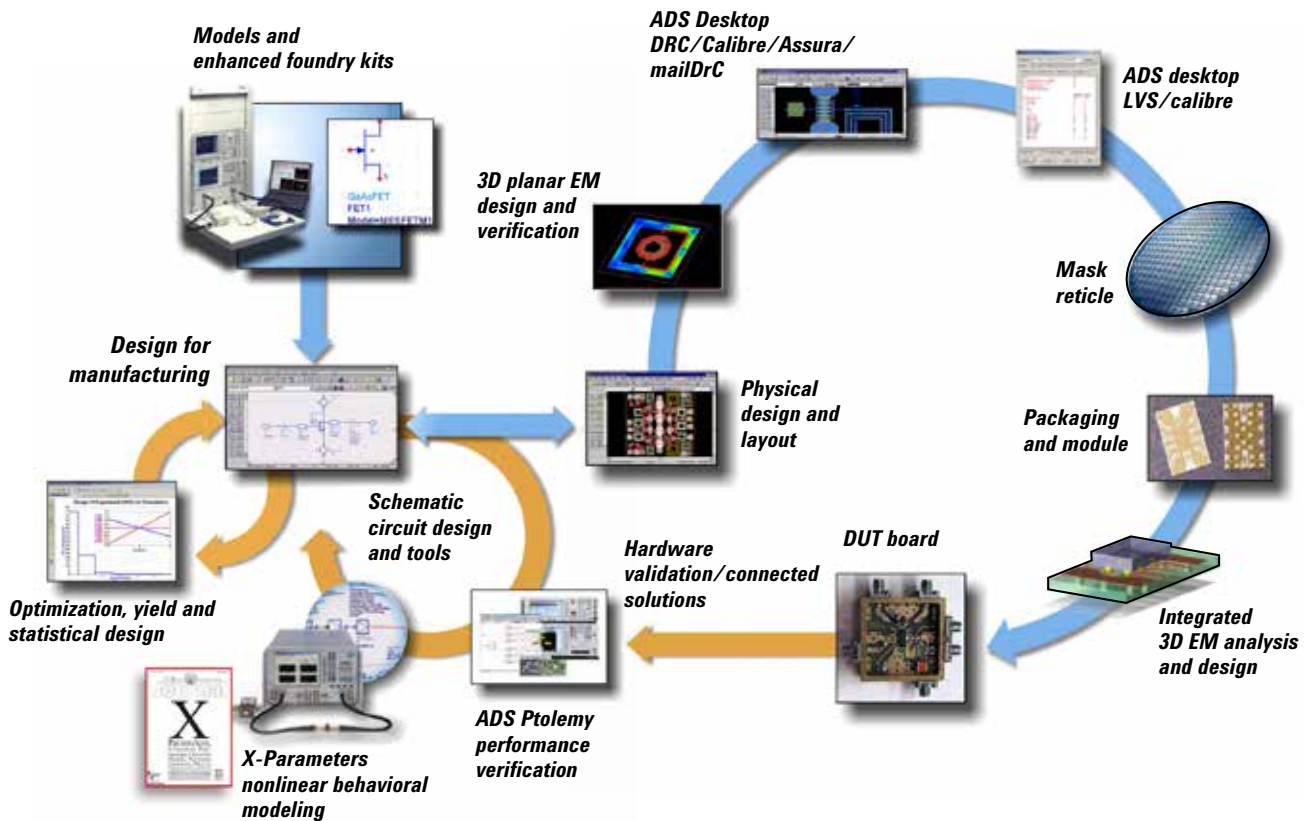
Anticipate success with fast, accurate, and easy first-pass simulations

## ADS key highlights

- Complete set of fast, accurate and easy-to-use simulators enable first-pass design success
- Easy-to-use, application-specific DesignGuide encapsulate years of expertise
- Exclusively endorsed by leading industry and foundry partners
- Complete schematic capture and layout environment
- Innovative and industry-leading circuit and system simulators
- Direct, native access to 3D planar and full 3D EM field solvers
- Broadest RF and MW process design kit (PDK) coverage, endorsed by leading foundry and industry partners
- EDA and design flow integration with companies such as Cadence, Mentor and Zuken
- Optimization Cockpit for real-time feedback and control when using any of 12 powerful optimizers
- X-parameter model generation from circuit schematic and Agilent's Nonlinear Vector Network Analyzer (NVNA) for nonlinear high-frequency design
- Up-to-date Wireless Libraries for design and verification of the emerging wireless standards

## RFIC and MIMIC foundry partners

Agilent EEs of EDA works closely with foundries to offer you high-frequency PDKs in Si, SiGe, GaAs, InP and GaN processes. Complete front-to-back ADS PDKs, including DRC rules and Momentum stack-up files, for all GaAs, InP and GaN processes, as well as a broad range of SiGe and RF-CMOS processes are available.



*The ADS platform comprises solutions for design entry, synthesis, system, circuit, 3D EM simulation, analysis/post processing, and a complete flow to manufacturing. It easily integrates with the designers' enterprise IC or PCB framework.*

# Complete Design Flow

Create robust designs with first pass success and high yield

## Innovative and industry-leading simulation technologies

Figure 1

- S-parameter linear frequency-domain simulator
- Harmonic balance nonlinear frequency-domain simulator
- Circuit envelope hybrid time-/frequency-domain nonlinear simulator
- Transient/convolution time-domain simulator
- Momentum 3D planar EM simulator
- Finite Element full 3D EM simulator
- X-parameter generator simulator
- Signal Integrity Channel simulator
- Agilent Ptolemy system simulator

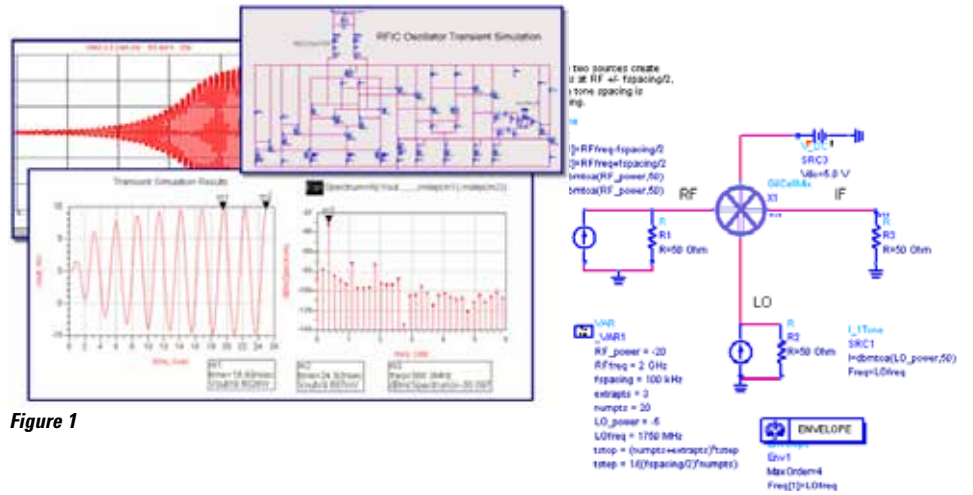


Figure 1

## Post processing with Data Display

Figure 2

A powerful Data Display capability allows you to learn about your design's performance by post-processing and analyzing the data without re-running simulation. Countless built-in functions simplify the process. For added flexibility, you can even write your own functions.

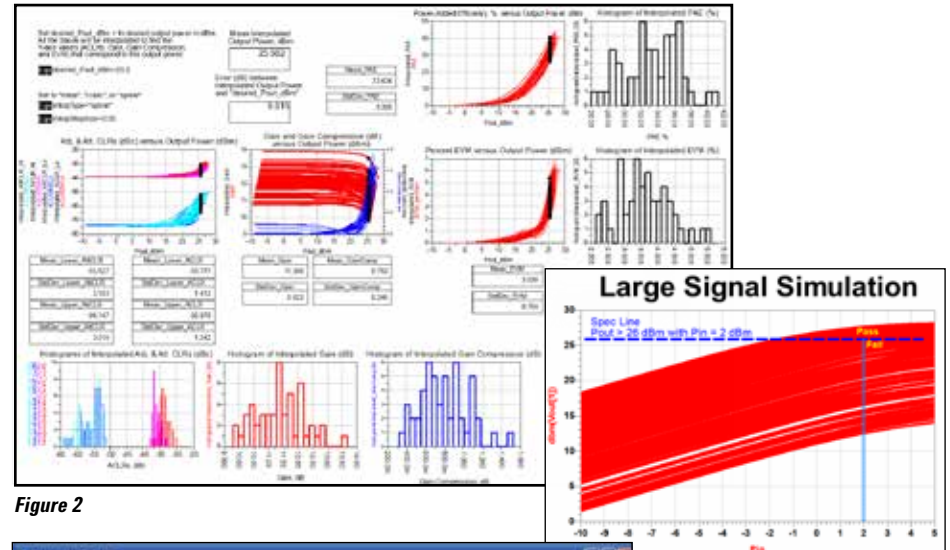


Figure 2

## Optimizing your design

Figure 3

Once your initial design is done, ADS optimizers can further improve its nominal performance. The ADS optimization cockpit provides an interactive environment with multiple optimization variables, interactive tuning and progress controls. Using it, you can achieve optimal performance while gaining design insight into the optimized variables versus the goals.

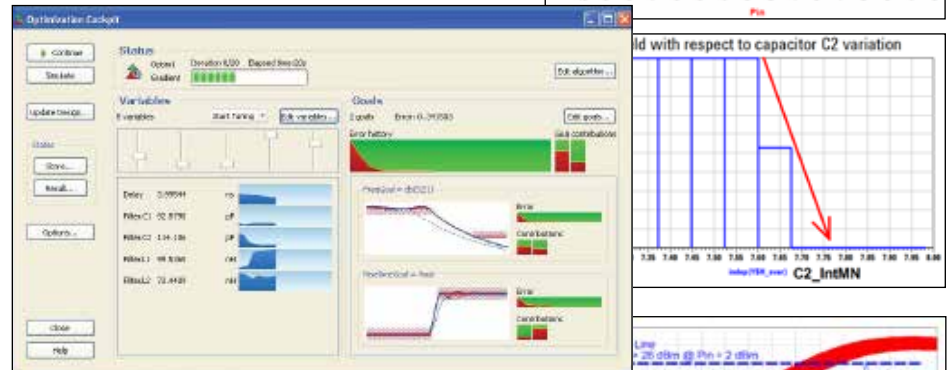


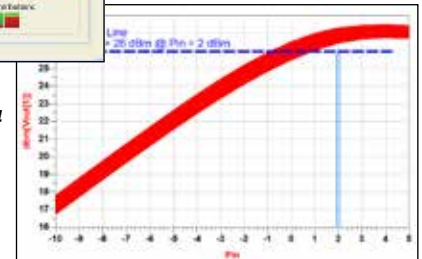
Figure 3

## Making your designs more robust

Figure 4

ADS features unique and easy-to-use statistical tools to pinpoint problems during design. Yield sensitivity histograms help identify the most sensitive design components and how best to set their specifications to improve manufacturing yield.

Figure 4





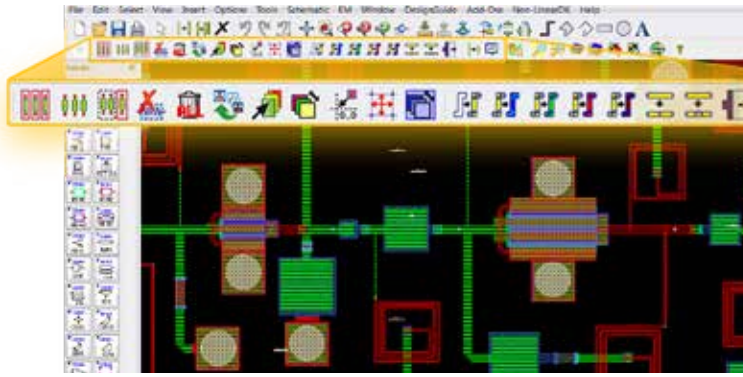


Figure 5

## Easy layout in your foundry's specific process

Figure 5

ADS offers a full-featured tool for generating production-ready RF layouts. With the largest number of fully endorsed foundry design kits, ADS helps you layout your design in your foundry's specific process. The MMIC Toolbar and layout command line editor, available in all enhanced foundry PDKs, ensures layout editing commands are easily accessible and provide a full suite of layout verification tools.



Figure 6

## Catch errors early with ADS desktop DRC and LVS

Figure 6

ADS Desktop design rule check (DRC) enables you to determine whether your physical layout satisfies foundry design rules. Use ADS Desktop layout vs. schematic (LVS) to verify no discrepancies exist between the layout and schematic, to identify missing components and easily find and correct connections in your schematic or layout. ADS also supports DRC/LVS with Calibre and Assura directly from the ADS cockpit.

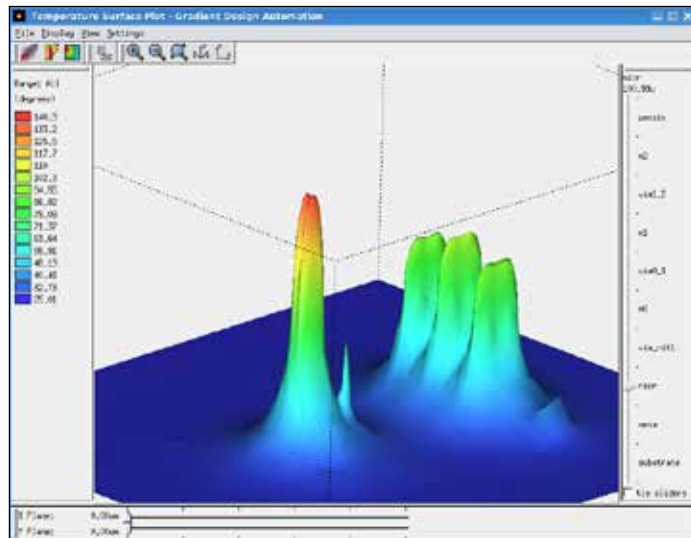


Figure 7

## Integrated Electro-Thermal Solver

Figure 7

ADS provides a full 3-D thermal solver that is tightly integrated with the ADS layout environment and circuit simulators. Simply add the Electro-Thermal controller to the ADS schematic, start a circuit simulation and the integrated thermal solver will run in the background. No more manual export of IC layouts to stand-alone thermal solvers; no more manual import of temperature data into the circuit simulators.

## Innovative multi-technology capability

Figure 8

ADS capabilities enable tradeoffs to be made interactively on the IC, laminate, packaging, and printed circuit boards being designed or co-designed together. Circuits designed in multiple technologies can be combined and simulated at both the circuit and full 3D EM level.

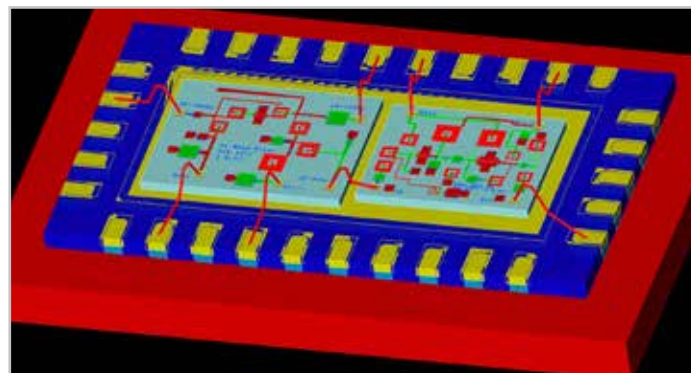


Figure 8



## Integrated EM

EM modeling and simulation environment is integrated with ADS design flow



### Momentum 3D planar EM simulator

Figure 9

Agilent's Momentum is the leading 3D planar EM simulator used for passive circuit modeling and

analysis. It accepts multilayer design geometries and uses frequency-domain Method of Moments (MoM) technology to accurately simulate complex EM effects (including coupling and parasitic), improving performance and increasing confidence that manufactured products will meet specifications.

Momentum features the latest NlogN and multi-threading solver algorithms to deliver the fastest, highest capacity 3D planar EM simulation. Integrated with ADS, it allows EM simulation (along with circuit and system co-simulation or co-optimization) to account for proximity or radiation effects of planar structures. Results can be visualized as surface currents or radiated fields for insight into the location of problem areas.

### Finite element method simulator

Figure 10

The Agilent FEM simulator element provides full-wave 3D EM simulation capabilities to both ADS and its companion 3D EM simulation software, Electromagnetic Professional (EMPro). FEM is a frequency-domain technique that can handle arbitrary shaped structures, employing both direct and iterative solvers, and linear and quadratic basis functions, to solve a broad range of problems.

FEM is integrated into the ADS design flow to enable seamless co-simulation of arbitrary components. This allows the effects of 3D components, previously difficult or tedious to include in a design simulation, to be naturally accounted for without leaving the circuit design flow. It is especially convenient for RF module designs where 3D interconnects and packaging must be simulated along with the circuit.

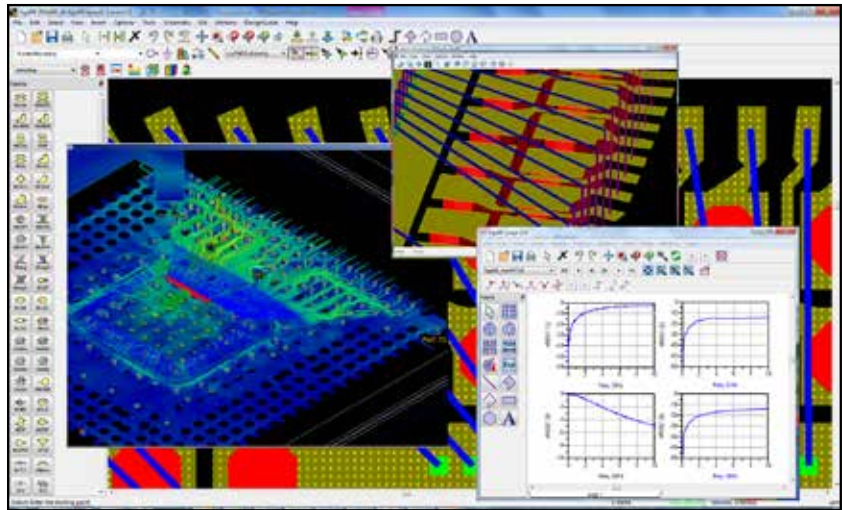


Figure 9

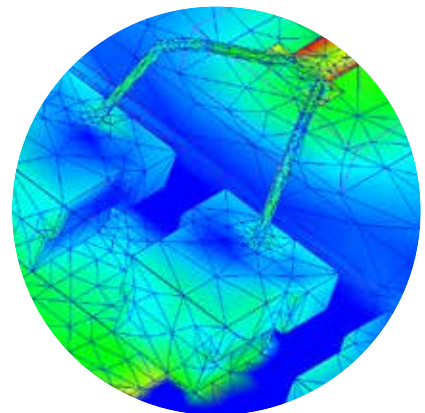
### Advanced model composer

Momentum and FEM are paired with Agilent's parameterized passive model generation capability, Advanced Model Composer (AMC). AMC allows you to create EM-based custom libraries of 3D models not available in standard simulation libraries. AMC libraries retain the accuracy of EM simulation, but simulate and optimize at the speed of circuit simulation through smart interpolation across the parameterized EM database.

*Momentum provides the most efficient and fastest 3D planar EM simulation capability, integrated with ADS through a common design entry, simulation and optimization user interface.*

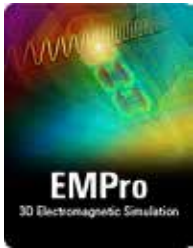
Figure 10

*Agilent's FEM simulator includes both direct and iterative solvers, and linear and quadratic basis functions, to solve a broad range of problems.*



# Integrated EM

Create custom 3D components for simulation with ADS layout designs



## EMPro—The ADS companion 3D EM simulation software

Figures 11 & 12

EMPro is a 3D modeling and simulation environment for analyzing the 3D EM effects of high-speed and RF/microwave components. EMPro features:

### Common database integration with ADS

3D objects in EMPro can now be saved as ADS libraries, containing cells for use directly in ADS. For example, an SMA connector cell created in EMPro will have an emModel view that can be placed directly in an ADS schematic and used for circuit/EM co-sim, and a layout view that can be placed on an ADS layout design (e.g., PCB layout) for full 3D simulations in ADS.

### Full 3D drawing environment

EMPro provides the flexibility of drawing arbitrary 3D structures and the convenience of importing existing CAD files. You can create 3D shapes, add material properties, set up simulations, and view results—all within the EMPro environment.

### High capacity time- and frequency-domain simulation technology

3D structures can be analyzed in EMPro using the same FEM simulator available in ADS. For electrically large problems, such as antennas and some signal integrity analyses, the Finite Difference Time Domain (FDTD) simulator can be used.

Figure 11

EMPro's 3D components can be simulated together with 2D circuit layouts and schematics within ADS, using EM-circuit cosimulation.

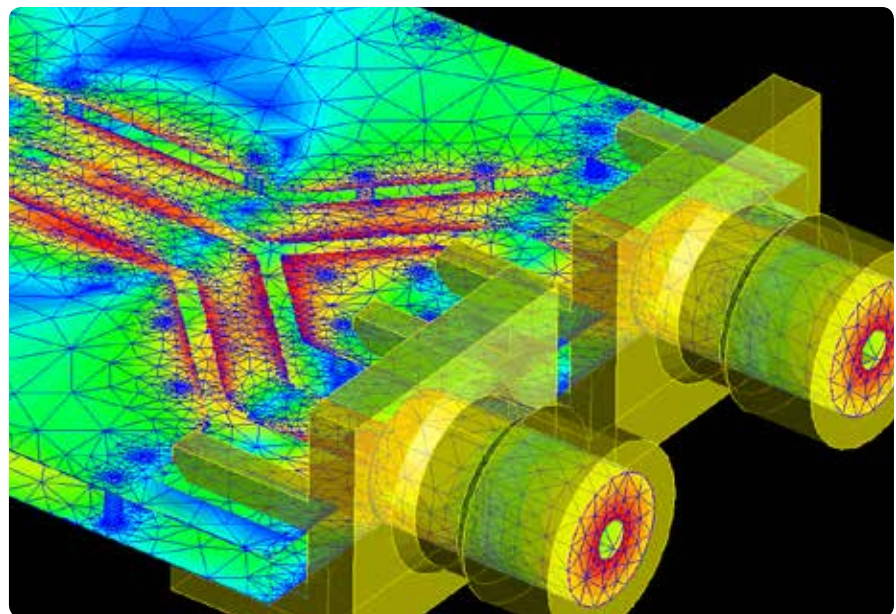
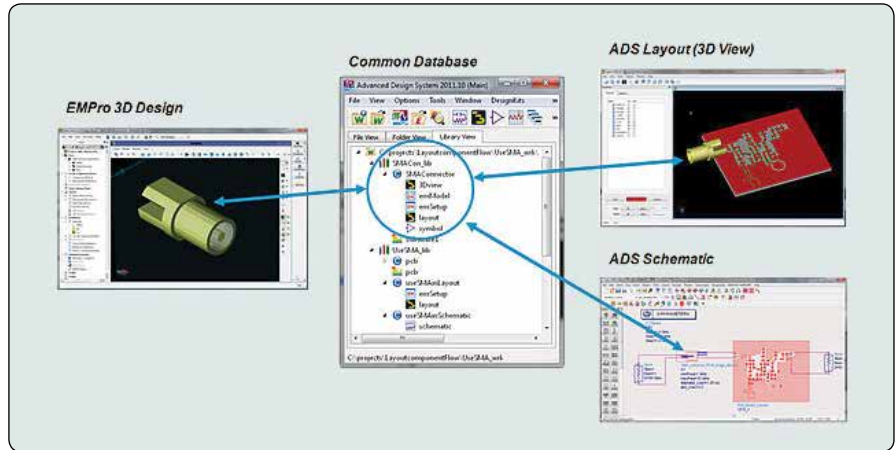


Figure 12

EMPro's 3D EM technologies complement 3D planar simulators such as Agilent Momentum for connectors, packaging and RF components.



## Most Complete Solution

Industry-leading tools for your high-frequency and high-speed applications

### RF & Microwave Design Flows

Agilent's RF and microwave design and simulation tools provide the most complete solution for creating robust designs with first-pass success and high yields. ADS provides accurate models and powerful simulation technologies for circuit-to-system-level designs. Seamlessly integrated circuit and EM simulation tools flow from schematic entry to production and verification. A complete set of the most accurate wireless verification tools in ADS provides true circuit verification to all wireless standards.

### RFIC/MMIC Design

**Figure 13**

ADS provides the most complete set of advanced simulation tools, seamlessly integrated into a single environment that flows from schematic entry to tape-out and packaging. These tools enable you to verify, prior to fabrication, that your RFIC/MMIC meets all specifications in its final package.

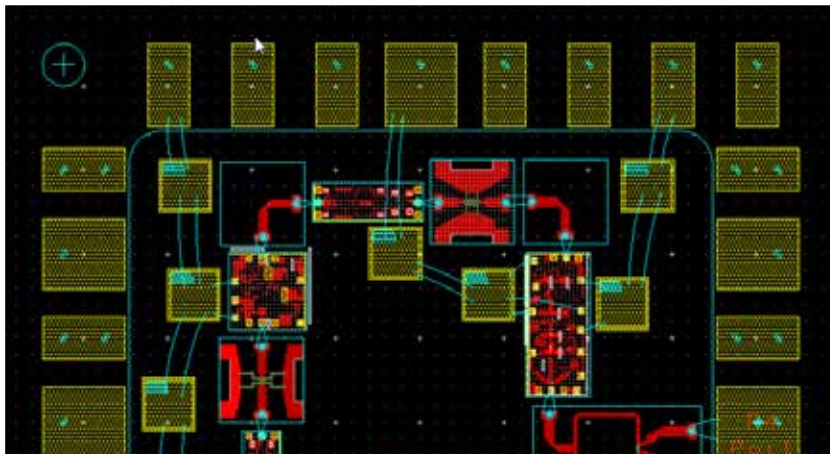
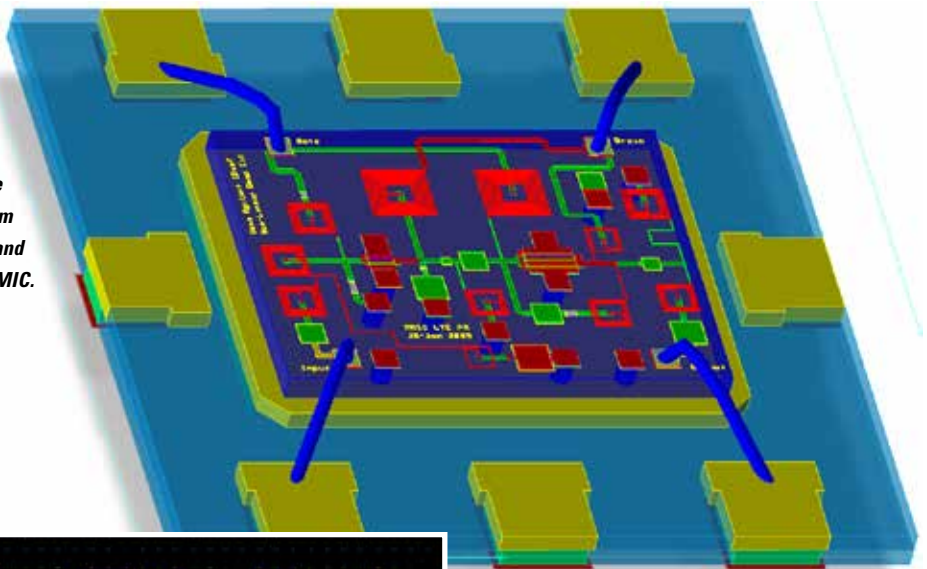
All major MMIC foundries offer complete front-to-back ADS PDKs, and also a broad range of SiGe/BiCMOS and CMOS-SOI PDKs are available.

### RF Module Design

**Figure 14**

As the market and technology leader in RF module design solutions, Agilent EEs of EDA offers the best co-design platform and methodologies for designing RF modules with high confidence. ADS offers designers the best way to reduce risks of design failure due to unexpected parasitics.

**Figure 13**  
*ADS offers a complete set of advanced simulation tools, seamlessly integrated into one single environment, which flows from schematic entry to production and packaging of the MMIC.*



**Figure 14**  
*ADS offers designers the best solutions and methodologies for confidently designing RF modules.*

# Most Complete Solution

Accelerate your design with the industry's most complete set of simulation tools and model libraries

## High-Speed Digital Design

**Figure 15**

ADS offers two bundles that put applicable simulators, libraries and capabilities into the hands of high-speed digital engineers. SystemVue generates IC models compliant to the IBIS-AMI standard. ADS provides the most complete data link analysis for standards like PCI Express®, Ethernet, DDR, HDMI, and USB. It enables complete chip-to-chip link analysis by co-simulating individual components, each at its most appropriate level of abstraction (link, circuit, layout, or geometry). S-parameter models, based on frequency-domain measurements, can be accurately imported into time-domain circuit and channel simulations, avoiding causality and passivity issues. Ultra-low BER contours can be generated in seconds, not days, resulting in dramatically reduced product design cycles.

## RF Board Design

ADS provides proven board design solutions with very accurate models and simulation technologies covering circuit, EM and system level designs. It offers the widest variety of synthesis capabilities to explore alternatives quickly and balance RF performance, parts count and board area, within seconds, while also helping designers assess the cost-effectiveness of making versus buying a commercial component.

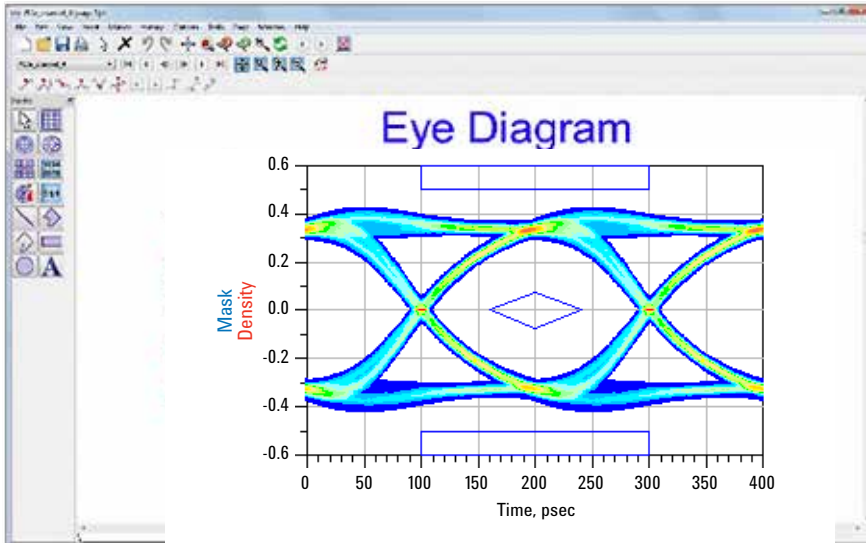
Accurate model libraries in ADS support different simulation domains for various applications. Behavioral models (important for initial system-level designs) can be extracted from datasheets, measurement or simulation. ADS's robust layout artwork translators ensure a smooth hand-off to PCB manufacturing for RF board designers.

**Agilent EESof EDA actively engages with component manufacturers to create model libraries that provide access the latest models and technologies, including:**

Analog Devices	KOA Speer	Samyoung
Avago	Metelics	Siemens
AVX	Mini-Circuits	Taiyo Yuden
Banpil	Mitsubishi	TDK
CEL	Modelithics	Temwell
Coilcraft	Motorola	TFT
Cyntec	Murata	TI
DT Micro	NEC	Toshiba
DuPont	Panasonic	
Freescale	Polyfet	
Hittite	Samsung	
Johanson	Samtec	

**For an updated list, refer to:**

[www.agilent.com/find/eesof-vendor-libraries](http://www.agilent.com/find/eesof-vendor-libraries)



**Figure 15**

**The ADS Eye Probe diagram allows you to calculate parameters using algorithms drawn from those on Agilent instruments.**



## Integrated Solutions

Achieve enterprise-wide integration with your design process



### Design Flow integration— partners for complete success

Agilent EEsof EDA aligns with key EDA vendors and frameworks to provide enhanced solutions that complement your investment. The open and flexible ADS environment ensures that a wide range of design flows are supported. ADS supports design flows based on a Cadence, Mentor or Zuken flow, for example, using industry-standard formats. Our expanding list of partners goes well beyond standard relationships and is part of an ongoing effort to provide best-in-class tools and technology that work in an integrated environment.

### Easy links to instrumentation reduce design time and risk

Figure 16

The integration of ADS with Agilent test instrumentation enables the seamless sharing of signals, measurements, algorithms, and data between the virtual software and physical hardware domains. Designers use this linkage to simulate and evaluate design trade-offs and what-ifs, and then turn the simulated signal into an RF test signal on the bench for hardware test. Conversely, designers can take the measured output signal from the device-under-test and bring it into ADS for additional analysis in the simulation environment.



Figure 16

Use the 89600 VSA software to directly compare simulations in ADS to measured results using identical algorithms and assumptions.

# X-Parameters

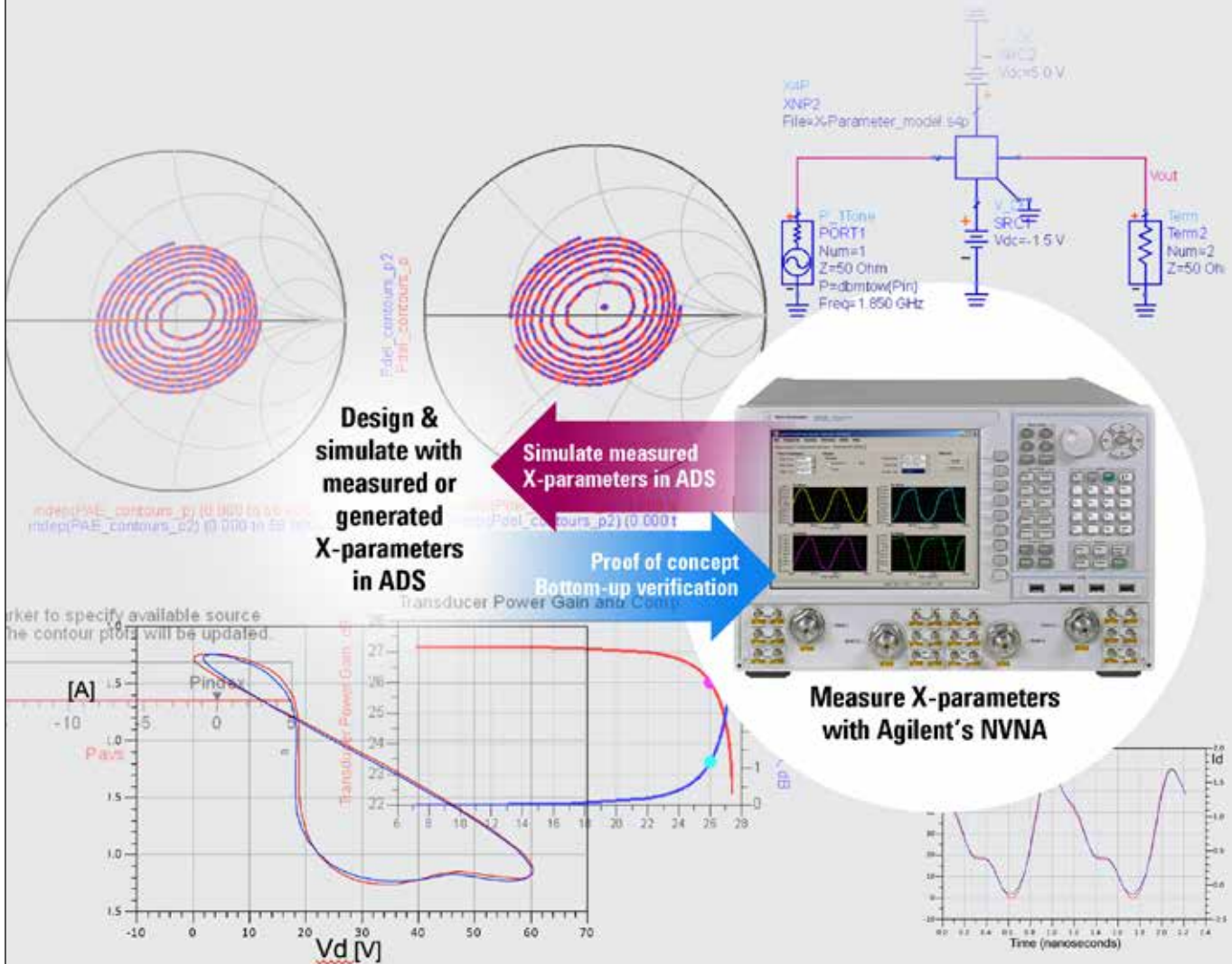
## Accurate nonlinear models

### Enable rapid design optimization

In high-frequency and high-speed designs, X-parameters overcome the system-level inaccuracies that often occur when using overly simplified behavioral models to simulate complex, nonlinear circuits. The use of X-parameters produces highly accurate nonlinear models—from either measurements or simulations—that can be passed through the design chain for quick and accurate simulation and optimization of system-level performance.

### X-parameters:

- Are applicable to both large-signal and small-signal conditions, and for linear and nonlinear components
- Characterize—at all ports—the amplitude and relative phase of harmonics generated by components under large input power levels
- Correctly characterize impedance mismatches and frequency-mixing behavior to allow accurate simulation of cascaded nonlinear X-parameter blocks such as amplifiers and mixers



Purchase what you need today;  
add greater functionality  
as your needs evolve



### ADS product structure and options summary

ADS can be ordered in value-priced bundles for simplicity and convenience, or in **Environment + Element** building blocks for greater flexibility.

									Mature Wireless Libraries
								Agilent Ptolemy	Agilent Ptolemy
						FEM Simulator	Circuit Envelope	Circuit Envelope	Circuit Envelope
					Circuit Envelope	EMPro Core	Transient Convolution	Transient Convolution	Transient Convolution
			Transient Convolution	Harmonic Balance	Harmonic Balance	Harmonic Balance	Harmonic Balance	Harmonic Balance	Harmonic Balance
	Harmonic Balance	Momentum G2	Momentum G2	Momentum G2	Momentum G2	Momentum G2	Momentum G2	Momentum G2	Momentum G2
Transient Convolution	Layout	Layout	Layout	Layout	Layout	Layout	Layout	Layout	Layout
Core	Core	Core	Core	Core	Core	Core	Core	Core	Core
W2210	W2202	W2203	W2211	W2205	W2216	W2215	W2214	W2207	W2208
1	2	3	4	5	6	7	8	9	10

#### ADS Environment + Elements

Configure a flexible ADS package that's right for you. Choose an ADS **Environment** plus any combination of the following individual **Element** building blocks.

#### ADS Core Environment

- W2200 ADS Core
- W2201 ADS Core + Layout

#### EM Simulation Elements

- W2341 Momentum G2
- W2343 Momentum Turbo
- W2342 FEM Simulator

#### Circuit & System Simulation Elements

- W2300 Harmonic Balance
- W2301 Circuit Envelope
- W2302 Transient/Convolution
- W2306 Linear Simulator Element
- W2312 Transient Distributed Computing 8-pack
- W2324 High Capacity Layout Pre-processor
- W2349 Electro-Thermal Simulator
- W2500 Transient/Convolution GT

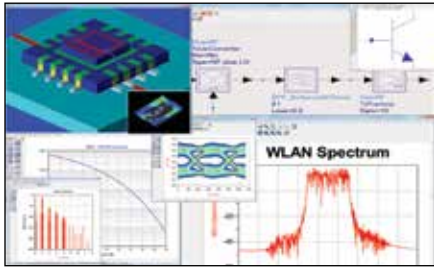
- W2361 Agilent Ptolemy
- W2362 RF Architect & Synthesis Model & Library Elements
- W2304 Verilog-AMS Compiler
- W2305 X-Parameter Generator
- W2363 Mature Wireless Library
- W2364 2G/3G Wireless Library
- W2365 Wireless Networking Library
- W2366 Integrated Wireless Library
- W2367 WiMedia Wireless Library
- W2368 3GPP-LTE Wireless Library
- W2369 WWAN Wireless Library
- W2371 Asia DTV Wireless Library

#### Additional Recommended Products

- W2401 EMPro Core Environment
- W2402 EMPro Core + FEM



# ADS Simulation Elements

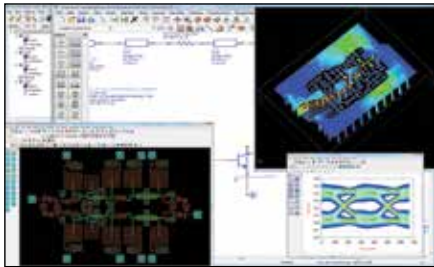


## W2200BP Advanced Design System (ADS) Core

High-frequency design software, simulation and synthesis package providing tuning, optimization and statistical design support for RF, Microwave, MMIC, or RFIC design flows at the enterprise level.

## W2300EP Harmonic Balance Element

Provides analysis of nonlinear circuits excited with multi-tone sources, and extensive, preconfigured simulation setups useful in amplifier, RF, microwave, oscillator and custom circuit designs.



## W2305EP X-Parameter Generator

Enables MMIC, RF-SIP and RF module design houses to build accurate, pre-prototype models of nonlinear devices (e.g. power amplifiers, front-end modules and transceivers).

## W2306EP Linear Simulator Element

The Linear Simulator Element is a frequency-domain circuit simulator that analyzes a large variety of RF and microwave circuits operating under linear conditions.

## W2301EP Circuit Envelope Element

Provides efficient simulation technique for complex digitally modulated RF signals in addition to templates for designing linearizers, RF Systems, and PLL Systems.

## W2302EP Transient Convolution Element

Advanced time-domain simulator that includes IBIS I/O Models, Signal Integrity verification, Broadband and High-Frequency SPICE simulation.

## W2312EP Transient Convolution Distributed Computing 8-pack

The ADS Transient Convolution Distributed Computing 8-pack accelerates signal integrity batch-mode parameter sweeps on workstations connected to a distributed computing cluster.

## W2500EP ADS Transient Convolution GT

Accelerate ADS Transient Convolution on NVIDIA GPU-enabled Computers.

## W2303EP Verilog-A Element

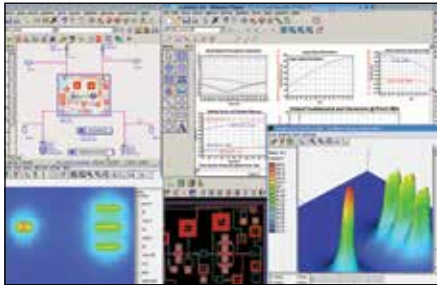
Enables the simulation of Verilog-A models in ADS and GoldenGate. This compiler-based solution results in simulation times comparable to built-in models.

## W2304EP Verilog-AMS Element

Simulates end-to-end system behavior with analog and digital components.



## ADS Simulation Elements

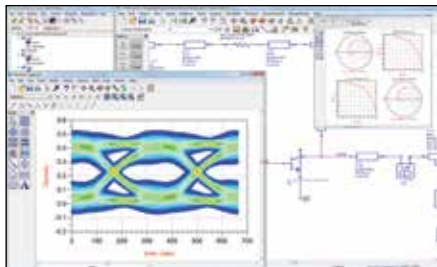


### W2321EP Layout Element

Comprehensive physical design environment specifically geared for high-frequency circuit development, including artwork translators for DXF, Gerber, IGES and GDS-TT formats.

### W2322EP Gerber Union Element

Layout artwork translation tool designed to convert Gerber files into clean layout artwork for EM analysis by the Momentum 3D planar EM design and verification tool.



### W2324EP High Capacity Layout Pre-processor Element

The W2324 High Capacity Layout Pre-processor Element for Advanced Design System.

### W2341EP Momentum G2 Element

3D planar electromagnetic (EM) simulator used for passive circuit analysis. Also includes modules for animating current flow in conductors and slots, circuit optimization and analytical modeling.

### W2342EP Agilent FEM Simulator Element

Integration of a full 3D FEM solution into the Advanced Design System (ADS) flow.

### W2343EP Momentum Turbo Element

Accelerates Momentum G2 simulation by over 6x via parallel computing on up to 8 nodes of a compute cluster. Useful for large simulations of complex boards or packages for signal integrity applications.

### W2349EP ADS Electro-Thermal Simulator Element

Integration of a full Electro-Thermal solution into the Advanced Design System (ADS) flow.

### W2361EP Ptolemy Element

System-level simulation and design solution for synchronous and timed-synchronous dataflow, model analysis/optimization, HDL Cosim, and Digital, 802.xx, Antenna, Radio and *Bluetooth*<sup>®</sup> design models.

### W2362EP RF Architect & Synthesis Element

Unique RF Architecture Design tools that transfer RF schematics into ADS, where system implementation and performance can be verified.

### W2363EP Mature Wireless Libraries Element

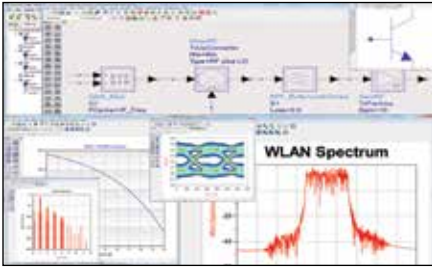
Provides PHY level systems/models that conform to Wireless Connectivity Standards providing "Golden Reference" models to simulate and verify algorithm and system performance early in the design phase.

### W2364EP 2G/3G Cellular Libraries Element

Provides PHY level systems/models that conform to Wireless Connectivity Standards providing "Golden Reference" models to simulate and verify algorithm and system performance early in the design phase.

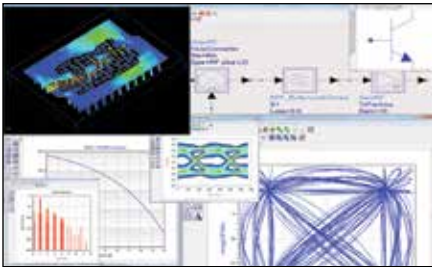


## ADS Simulation Elements



### W2365EP Wireless Networking Libraries Element

The ADS Wireless Networking Libraries Element is a collection of wireless networking standards from WLAN to Mobile WiMax (but not including WiMedia) for the development of the RF-PHY of wireless networking equipment that are compatible with multiple available signals; and to verify effects of heterogeneous networking signal interference.



### W2366EP Integrated Wireless Libraries Element

The ADS Integrated Wireless Libraries Element is a comprehensive collection of 15 Agilent wireless libraries covering all 2G/3G/3.9G cellular standards from GSM to 3GPP LTE; all wireless networking standards from WLAN to Mobile WiMax and WiMedia and Digital TV standard (but not including VWAN which is restricted to members of the Wireless HD consortium).

### W2367EP WiMedia Wireless Library Element

Provides preconfigured simulation setups, signal sources, and fully coded BER analysis for simulation of the circuitry used in WiMedia based products.

### W2368EP 3GPP-LTE Wireless Library Element

Provides signal processing models and preconfigured setups that comply with 3GPP requirements for the ADS.

**Try it Free**

**Advanced Design System**  
Premier High-Frequency and High-Speed Design Platform

**Start Your Free Trial Today**  
[www.agilent.com/find/eesof-evaluation](http://www.agilent.com/find/eesof-evaluation)



# Advanced Design System Platform Support Roadmap

Agilent EEsof EDA reviews hardware and operating system support on a regular basis and updates the information as it becomes available. Not all product releases are supported on all platforms and/or operating system combinations.

Operating system	Windows	Windows	Windows	Windows	RedHat Linux	RedHat Linux	RedHat Linux	SuSe Linux	SuSe Linux	SuSe Linux	Solaris
32/64 bit	32/64	32/64	32/64	32/64	32 <sup>1</sup> /64	32 <sup>1</sup> /64	32 <sup>1</sup> /64	32/64	32 <sup>1</sup> /64	32 <sup>1</sup> /64	64
Version	XP	Vista	7 Enterprise	8 Enterprise	RHEL4	RHEL5	RHEL6	SLES9	SLES10	SLES11	10
ADS 2011	Supported	Supported <sup>2,3</sup>	Supported	Not supported	Supported <sup>2</sup>	Supported	Not supported	Supported <sup>3</sup>	Supported	Not supported	Supported <sup>3</sup>
ADS 2012	Supported <sup>2</sup>	Not supported	Supported	Not supported	Supported <sup>3,4</sup>	Supported <sup>4</sup>	Supported <sup>4</sup>	Not supported	Supported <sup>4</sup>	Supported <sup>4</sup>	Not supported
ADS 2013 <sup>1</sup>	Supported <sup>3</sup>	Not supported	Supported	Supported	Not supported	Supported <sup>4</sup>	Supported <sup>4</sup>	Not supported	Supported <sup>4</sup>	Supported <sup>4</sup>	Not supported
ADS 2014 <sup>1</sup>	Not supported	Not supported	Supported	Supported	Not supported	Supported <sup>4</sup>	Supported <sup>4</sup>	Not supported	Supported <sup>4</sup>	Supported <sup>4</sup>	Not supported

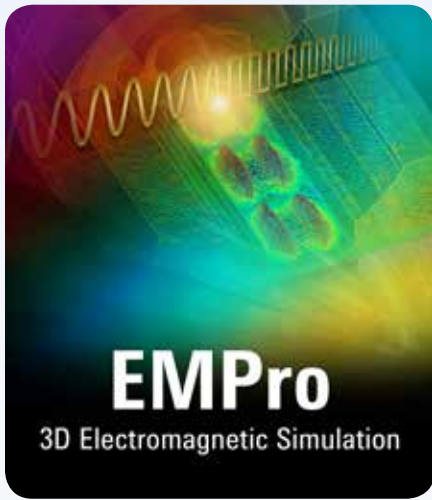
<sup>1</sup> Tentative Plan

<sup>2</sup> Customer demand for this OS is declining or is expected to decline. Agilent EEsof EDA recommends customers upgrade to another supported OS.

<sup>3</sup> This will be the last release for this OS. Not recommended for new designs. Agilent EEsof EDA support for this operating systems will be discontinued.

<sup>4</sup> 32 bit Linux support ends for all releases that ship after June 2012.

View the General Agilent EEsof EDA Roadmap | [www.agilent.com/find/eesof-platforms](http://www.agilent.com/find/eesof-platforms)



# Electromagnetic Professional (EMPro)

## 3D Electromagnetic Modeling and Simulation Environment Integrated with your ADS Design Flow

EMPro is a 3D modeling and simulation environment for analyzing the 3D electromagnetic (EM) effects of high-speed and RF/microwave components. EMPro features a modern design, simulation and analysis environment, high capacity time- and frequency-domain simulation technologies and integration with ADS, the industry's leading RF/microwave and high-speed design environment.

### EMPro delivers the following key capabilities:

#### Modern, Efficient 3D solid Modeling Environment

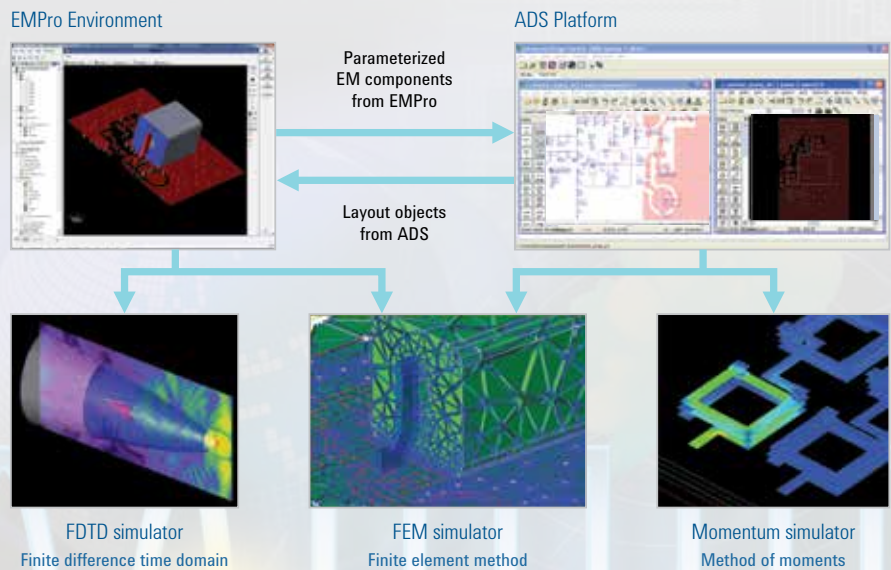
EMPro provides the flexibility of drawing arbitrary 3D structures and the convenience of importing existing CAD files. You can create 3D shapes, add material properties, set up simulations, and view results—all within the EMPro environment.

#### Time- and Frequency-Domain Simulation Technology

3D structures can be analyzed in EMPro using the same FEM simulator available in ADS. FEM is a frequency-domain technology widely used for RF/microwave applications. For electrically large problems, such as antennas and some signal integrity analyses, the finite difference time domain (FDTD) simulator can be used.

#### Integration with ADS

Parameterized 3D components can be created in EMPro and placed in a layout design in ADS. The 3D FEM simulator in ADS can then be used to simulate the combination of the 2D layout and the 3D EM component.



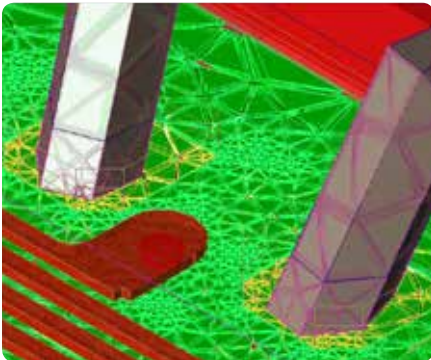
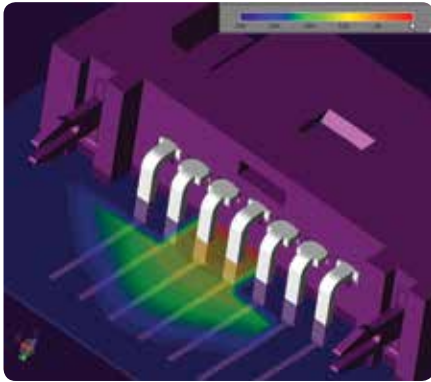
**Figure 1.** Agilent provides multiple EM simulation technologies integrated with the ADS design flow.



# EMPro Simulation Capabilities



There are several different technical approaches to EM simulation, each with their own advantages in certain application areas. The most established 3D EM simulation technologies are FEM and FDTD. Both of these technologies are available in EMPro.



## Finite Element Method

FEM is a frequency-domain technique that can handle arbitrary shaped structures such as bondwires, conical shape vias and solder balls/bumps where z-dimensional changes appear in the structure. FEM solvers can also simulate dielectric bricks or finite-size substrates.

FEM is based on volumetric meshing where the full problem space is divided into thousands of smaller regions and represents the field in each sub-region (element) with a local function. The geometric model is automatically divided into a large number of tetrahedra, where a single tetrahedron is formed by four equilateral triangles. This collection of tetrahedra is referred to as the finite element mesh. The Agilent FEM simulator includes both direct and iterative solvers, and both linear and quadratic basis functions, to solve a broad range of problems. The same FEM simulator is available in both EMPro and ADS.

## Finite Difference Time Domain

As with FEM, the FDTD method is based on volumetric sampling of the electric and magnetic fields throughout the complete space. Whereas FEM meshes consist of tetrahedral cells, FDTD meshes are typically built from rectangular (Yee) cells. The FDTD method updates the field values while stepping through time, following the electromagnetic waves as they propagate through the structure. As a result, a single FDTD simulation can provide data over an ultra-wide frequency range.

Because of its simple, robust nature and its ability to incorporate a broad range of linear and nonlinear materials and devices, FDTD is used to study a wide range of applications, including: antenna design, microwave circuits, bio/EM effects, EMC/EMI problems, and photonics. FDTD is an inherently parallel method and therefore lends itself very well to the processing capabilities of the most recent advances in CPU (general-purpose processors) and GPU (graphics processors) hardware.

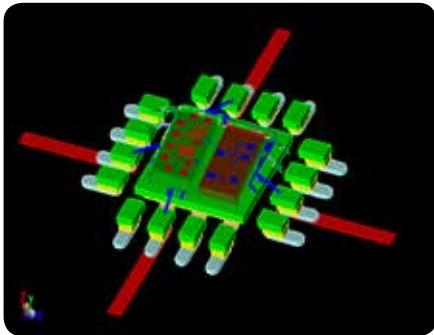
Table 1. Summary comparison of FEM versus FDTD

FEM	FDTD
Frequency domain method	Time domain method
Tetrahedral mesh cells	Rectangular mesh cells
Good for high-Q structures	Good for broadband applications, physical transitions
Fast for multi-port simulations	Each port requires additional simulation
Based on solving matrix equations; best for electrically small problems	Based on iterative time stepping; less memory intensive for electrically large problems
Multi-threaded; problems can be divided and run in parallel on multi-core CPUs	Highly multi-threaded; problems can be divided and run in parallel on multi-core CPUs and on large GPU cards



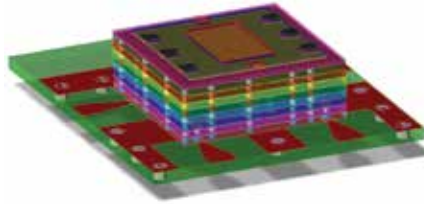
# Typical EMPro Applications

## IC Packages



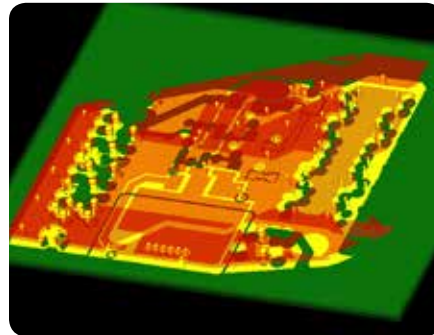
The performance of an RFIC, monolithic microwave integrated circuits (MMIC), high-speed IC, or system-in-package (SIP) is directly impacted by the effects of packaging, including wire bonds and solder balls/bumps. Traditionally, designers had to draw and analyze packages in a separate, 3D EM tool and then laboriously import the results back to the IC or SIP circuit-design environment for a combined analysis. With EMPro, you can efficiently create 3D package structures that can be combined with 2D circuit layouts in ADS. This allows co-design of the IC, package, laminate, and module with circuit simulation and 3D EM simulation in a streamlined design flow.

## Multi-Layer RF Modules



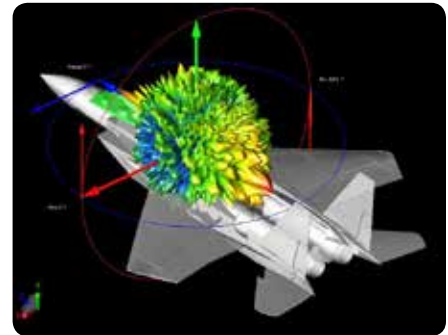
RF modules typically are constructed from multi-layer ceramic or laminate dielectric material with embedded RF passive components between the layers. Such dielectric brick structures cannot be accurately solved by planar EM simulators, which assume infinite dielectric layers and do not account for edge proximity fringing. The embedded RF components are drawn by RF circuit layout macros which would be very time consuming to reproduce in a standalone 3D EM tool. Full 3D EM simulation integrated within the circuit design flow is the ideal solution for these applications.

## PCB Design



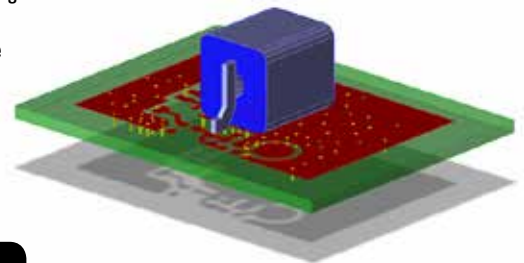
With data rates increasing, PCB traces must now be analyzed as RF transmission lines. 3D EM technologies complement 3D planar simulators such as Agilent Momentum for high speed signal integrity analysis, EMI/EMC, and PCB interfaces to connectors and packages.

## Aerospace/Defense



FDTD simulation has extremely high capacity and can handle large problems found in aerospace/defense applications. For example, FDTD can be used to optimize antenna placement in aircraft and perform Radar Cross Section analysis.

## RF Components



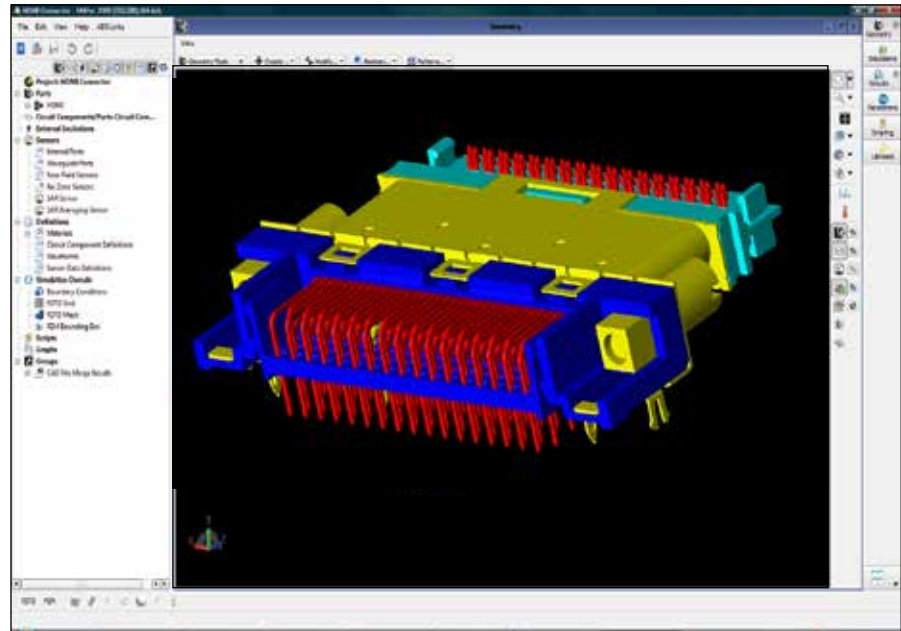
RF board designs include 3D components and connectors that need to be characterized to high frequencies. Components such as resonators are sensitive to interactions with the surrounding PC board traces and vias. Such 3D components can be created and simulated in EMPro and then combined with a board layout in ADS for complete 3D EM simulation.



## Typical EMPro Applications

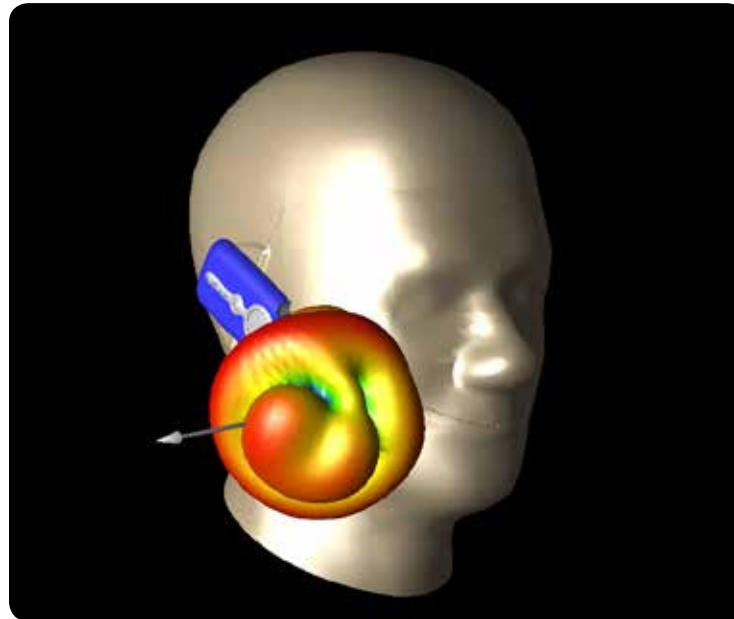
### High-Speed Connectors

High-speed connector types such as SATA and HDMI now support Gbits/s data throughput. High frequency S-parameter models of connectors can be generated in EMPro and cross-verified with both the FEM and FDTD simulators to give designers twice the confidence in 3D EM simulation accuracy. The models can then be included in an ADS design kit that can be distributed and installed into ADS as a connector library for use in signal-integrity analysis and design of high-speed serial channels.



### Handset Antennas

A critical design task in the development of cellular and networking products is maximizing antenna performance while minimizing antenna size. EMPro can simulate the antenna in realistic surroundings, including the phone components, housing and even the human hand and head. Compliance testing can also be performed, such as specific absorption ratio (SAR) and hearing aid compatibility (HAC).



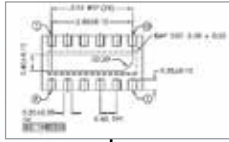


# EMPro Environment Overview

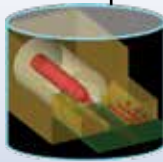
## Geometry Modeling

- Arbitrary 3D structures can be created using the powerful EMPro drawing environment.
- Alternatively, structures can be imported from other CAD environments. Supported file formats include: ACIS, IGES, DXF, STEP, ProE, SolidWorks, ODB++ and others.
- Material properties are assigned to imported or drawn 3D objects using a simple drag-and-drop from an extensive material database onto the 3D objects. Once assigned, the material properties are memorized for subsequent CAD imports, enabling even faster simulation setup.

Draw from spec

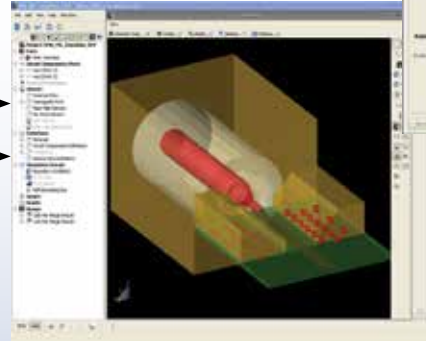


OR



Import CAD file

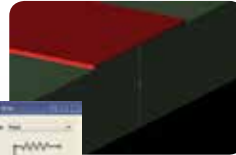
Define materials



## Port/Sensor Setup

- General voltage and current sources can be placed on the object and the source impedance defined.
- Additionally, for FDTD simulations, external plane wave and Gaussian beam sources can be set up. Sensors are also set up to detect near-field and far-field voltages, currents and field quantities. Special SAR and HAC sensors can be added for compliance testing.
- For FEM simulations, waveguide ports can be set up.

Define internal ports (FDTD, FEM)



OR

Define waveguide ports (FEM)



Define sensors

## Mesh Setup

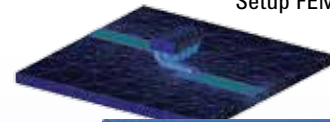
- For FDTD simulations, a rectangular mesh is generated based on the shapes of the objects. Initial mesh is automatically generated to optimize accuracy and simulation time. Fixed point meshing automatically aligns the mesh with object boundaries. Users can tune the mesh to make further trade-offs between accuracy and speed.
- In a similar fashion, a tetrahedral mesh is generated for FEM simulations. The mesh is optimized for speed/accuracy through a process of automatic adaptive refinement.

Setup FDTD grid/mesh



OR

Setup FEM mesh



# EMPro Environment Overview

## Simulation Setup

- Either FEM or FDTD simulation can be selected.
- For FEM, a frequency plan is created. Direct and iterative solvers are available and multi-threading capability on a multi-core CPU can be selected.
- For FDTD, multi-threading capability on a multi-core CPU or GPU card(s) can be selected.

Setup simulation

FDTD



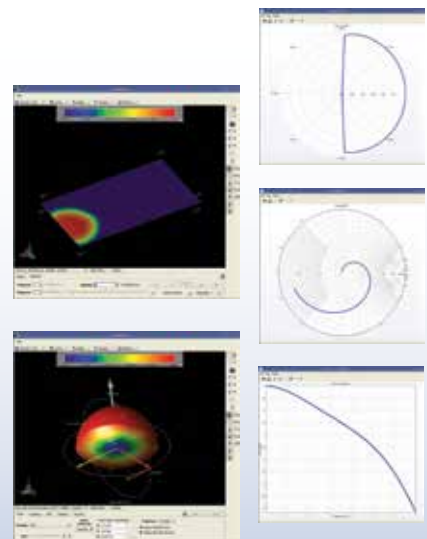
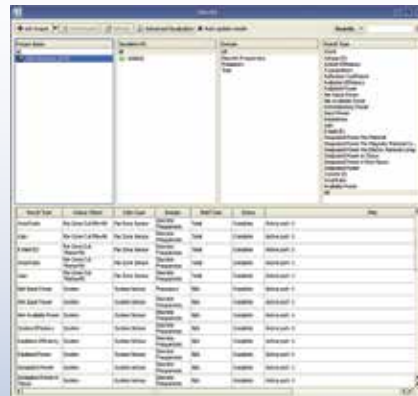
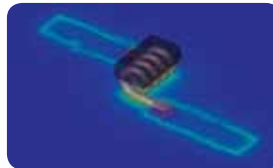
FEM



## Results Post-Processing and Viewing

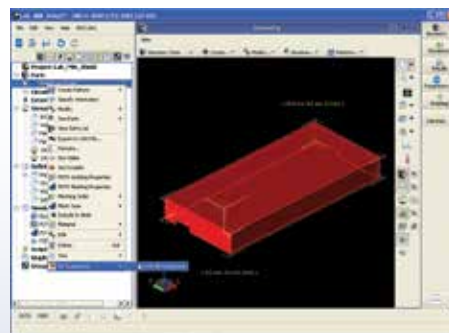
- S-parameter data can be plotted and compared with data from other projects.
- Advanced visualization of fields is available, including cut-plane views.
- Connectivity View can be used to find design errors, where small gaps between conductors might not be visible otherwise.
- Python scripting can be used for advanced post processing, and for automating simulations.

View results

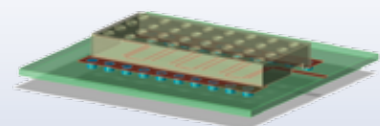
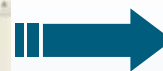


## Export 3D EM Component to ADS

- 3D structures such as packages, shields, connectors, and surface-mount components can be exported from EMPro to ADS, so that these structures can be simulated together with a 2D circuit layout.
- Components can be parameterized in EMPro to enable sweeps and optimization in ADS.
- The same FEM simulator is used in both EMPro and ADS to simulate the standalone component and the combination of the component and ADS layout.



Export to ADS



# EM Applications Center

Have you ever wanted a centralized place to find application examples for Agilent’s EM tools? Agilent EEsosof’s “EM Applications Center” is a centralized site that hosts EM related application examples that can be sorted by application, simulator technology or product platform. Each example has a complete description and links to additional information. We continue to port more applications into the EM Applications Center on a regular basis. The application examples highlight Agilent’s broad range of EM simulation technologies:

- **Momentum** – 3D planar technology based on Method of Moments, available with the ADS, Genesys and GoldenGate platforms
- **FEM** – full 3D frequency domain technology based on Finite Element Method, available with the ADS and EMPro platforms
- **FDTD** – full 3D time domain technology based on Finite Difference Time Domain, available with the EMPro platform

<http://www.agilent.com/find/eesof-em-applications-center>

## Overview Video

<http://www.agilent.com/find/eesof-empro-overview>

## Tutorials

<http://edocs.soco.agilent.com/display/eesofkc/EMPro+Video+Tutorials>



# EMPro Product Configuration

EMPro can be purchased as individual UI and simulator elements, or pre-configured bundles.

EMPro bundles are comprised of:

- W2401 EMPro core environment, which enables you to create and import arbitrary 3D structures, and
- Simulator elements, each of which provides specific capabilities.

EMPro bundles			
EMPro elements	W2402B	W2403B	W2404B
W2401 EMPro core element	√	√	√
W2342 Agilent FEM simulator element	√	-	√
W2405 Agilent FDTD simulator element	-	√	√

# EMPro 3D EM Simulation Platform Support Roadmap

Agilent EESof EDA reviews hardware and operating system support on a regular basis and updates the information as it becomes available. Not all product releases are supported on all platforms and/or operating system combinations.

Operating system	Windows	Windows		Windows	Windows	RedHat Linux		RedHat Linux		RedHat Linux	
	32/64 bit	32	64	32/64	32/64	32	64	32	64	32	64
Version	XP	Vista		7 Enterprise	8 Enterprise	RHEL4		RHEL5		RHEL6	
EMPro 2008	Supported	Not supported	Supported	Not supported		Supported		Not supported		Not supported	
EMPro 2009	Supported	Supported	Supported	Not supported		Supported		Not supported		Not supported	
EMPro 2010	Supported	Supported		Supported	Not supported	Supported		Not supported		Not supported	
EMPro 2011.02/04	Supported	Supported		Supported	Not supported	Supported		Not supported		Not supported	
EMPro 2011.07/11/12	Supported	Supported		Supported	Not supported	Supported		Supported		Not supported	
EMPro 2012	Supported	Not supported		Supported	Not supported	Not supported	Supported	Not supported	Supported	Not supported	Supported
EMPro 2013 <sup>1</sup>	Supported	Not supported		Supported	Supported	Not supported		Not supported	Supported	Not supported	Supported
EMPro 2014	Not supported	Not supported		Supported	Supported	Not supported		Not supported	Supported	Not supported	Supported

Operating system	Novel Linux	Novel Linux		Novel Linux		Solaris
	32/64 bit	32	64	32	64	32/64
Version	SLES9	SLES10		SLES11		10
EMPro 2008	Not supported	Supported		Not supported		Not supported
EMPro 2009	Not supported	Supported		Not supported		Not supported
EMPro 2010	Not supported	Supported		Not supported		Not supported
EMPro 2011.02/04	Not supported	Supported		Not supported		Not supported
EMPro 2011.07/11/12	Not supported	Supported		Not supported		Not supported
EMPro 2012	Not supported	Supported		Not supported	Supported	Not supported
EMPro 2013 <sup>1</sup>	Not supported	Not supported	Supported	Not supported	Supported	Not supported
EMPro 2014	Not supported	Not supported	Supported	Not supported	Supported	Not supported

**EMPro**  
3D Electromagnetic Simulation

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# SystemVue

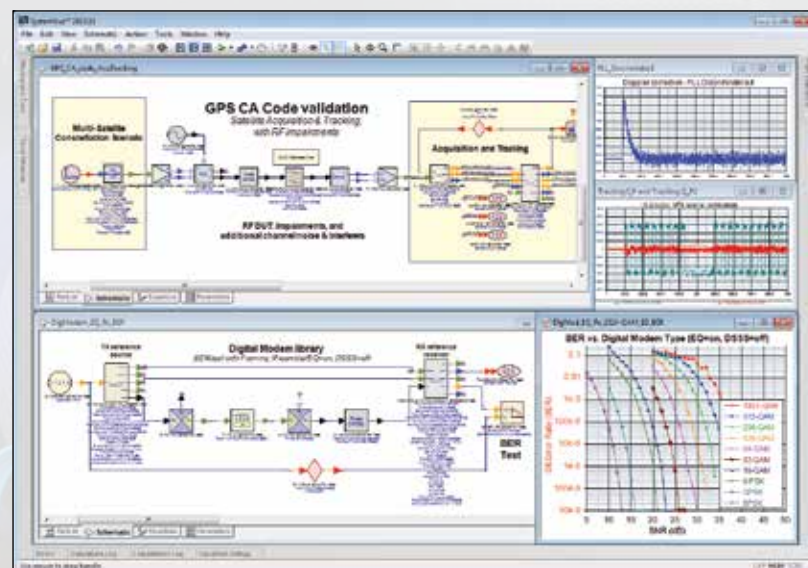
## Electronic System Level Design

SystemVue is a focused EDA environment for electronic system-level (ESL) design that allows system architects and algorithm developers to innovate the physical layer (PHY) of next-generation wireless and aerospace/defense communications systems. It provides unique value to RF, DSP and FPGA/ASIC implementers who rely on both RF and digital signal processing to deliver the full value of their hardware platforms.

SystemVue replaces general-purpose analog, digital and math environments by offering a dedicated platform for ESL design and signal processing realization. SystemVue “speaks RF,” cuts PHY development and verification time in half, and connects to your mainstream EDA flow.

### Key Benefits

- Best-in-class RF fidelity among today’s baseband/PHY environments, which allows baseband designers to virtualize the RF and eliminate excess margin
- Superior integration with test accelerates real-world maturity and streamlines your model-based design flow, from architecture to verification
- World-class reference IP puts Agilent instrument-grade interoperability and Layer 1 compliance inside your block diagram, before you have hardware
- Unified, open, polymorphic modeling simplifies tool flow, reduces department costs and supports a customizable, vendor-neutral environment
- Priced for networked workgroups to maximize design re-use and capitalize on baseband and RF synergies



SystemVue is a multi-domain modeling & verification cockpit for electronic system-level (ESL) design.

# SystemVue Environment

## W1461BP SystemVue Communications Architect

The W1461 SystemVue Communications Architect is the core environment, with essential simulators and libraries. It includes many capabilities that are not found in other system-level communications design tools, or are only available as added-cost options. Optional capabilities are also available.

### Core environment

- Easy to use, multi-threaded, advanced Windows® application
- Polymorphic design entry supports “model-based design” flow (GUI blocks, language-based C++ or math, VHDL, Verilog, and SystemC)
- Scripting, graphs and file I/O streamline verification tasks
- Easily encapsulate existing IP from a variety of formats into one flow
- Priced and licensed attractively for networked workgroups

### Custom C++ model development interface

- Build floating-point and fixed-point models in C++
- Debug models using standard familiar Microsoft® Visual Studio® interface
- Use built-in code generation to export Win32 DLL models to other applications, including Agilent ADS

### Native .m math language modeling and debugger

- Native support for hundreds of comms-oriented math functions, syntax
- Text and GUI interfaces for easy model creation, simulation and verification
- Familiar command-line interface, interactive debugger and TCP/IP links
- Direct integration of MATLAB as a supplemental equation parser

### High-performance dataflow simulation engine

- Supports complex RF envelope carriers, timed synchronous dataflow and dynamic dataflow for high-performance modern PHY's with RF effects.
- Advanced Scheduler with native multi-rate allows complex topologies
- Multi-threaded for faster simulation on multi-core CPUs
- Free support for external co-simulation, such as ModelSim and Aldec Riviera-PRO

### Model physical layer effects with versatile block sets

- Approximately 300 simulation blocks included in the base platform
- Handles analog effects such as phase noise, S-parameters, zero IF DC offsets, frequency-dependence, and more (Additional support for X-parameters\* and GoldenGate “fast-envelope” model is available through the W1719 option)

### Links to measurement and hardware verification

- SCPI and IVI instrument interaction over TCP/IP embedded directly within dataflow simulations, or from a command line.
- Re-use the same verification set-ups, scripts, test vectors, and wireless IP as you move from algorithm into test
- Integrated with other Agilent measurement software applications, such as 89600 VSA, FlexDCA, I/O Libraries, and Command Expert
- Includes free, flexible blocksets and application examples for signal generation of OFDM, Zigbee, and other formats

### Digital filter synthesis

- Direct analysis and implementation of fixed point FIR filters
- FIR, IIR and analog communications filter types
- Instantiate filters directly from system-level blocks with a mouse click

# SystemVue Libraries

Libraries (included free with the SystemVue environment)

SystemVue includes blocks that are only available as added-cost options in other environments. These blocks are listed below, for easy comparison with other system-level tools:



Add-on libraries (optional)

### W1904EP/ET adaptive equalization library

Library of adaptive-equalization blocks that allow system designers to work with already-corrected channel performance. The blocks also serve as algorithmic references to test user-developed models and hardware implementations.

### W1905EP/ET radar model library

Provides signal processing reference models for exploring trade-offs in radar system architectures for Pulsed Doppler, FMCW, Digital Array, Synthetic Aperture, and UWB Radars. Enables scenario modeling by adding targets, clutter, fading, noise, interferers, and the RF effects necessary for realistic system analysis and early R&D verification using connections to live test equipment.

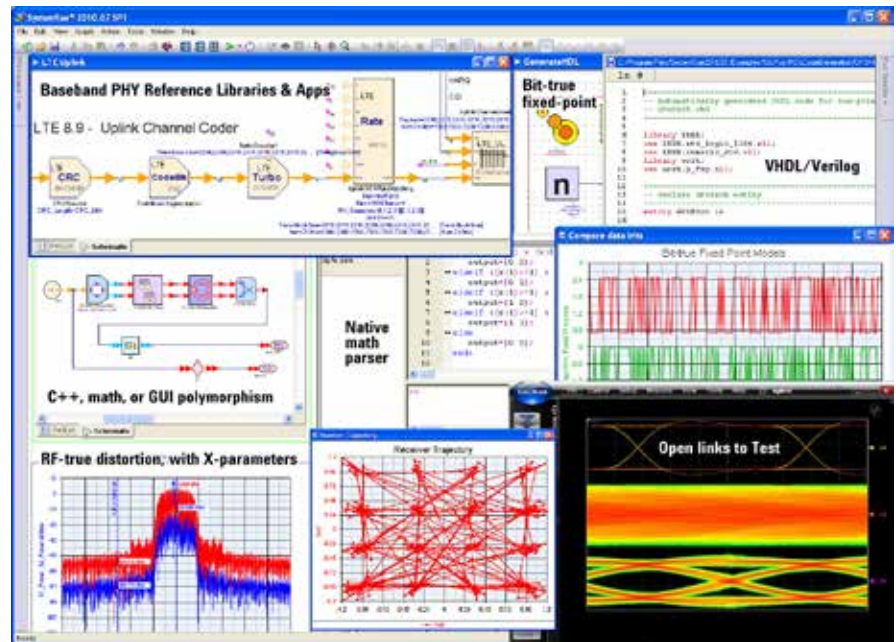


Figure 1. SystemVue provides a unified, ESL design front-end for high-performance communication system architectures. It overcomes limitations of general-purpose hardware EDA and math/programming tools, and is fast, easy and affordable.



# SystemVue Design Kits and Application Personalities

Application personalities and design kits can be added to SystemVue to accomplish deeper analysis and/or implementation tasks, for both RF system architectures and digital hardware design. They can be added to any SystemVue environment.

## W1713EP/ET SerDes Models

Model set that helps gigabit SerDes architects to investigate PHY-level signal processing for maximum interconnect performance. Includes optical SerDes models.

## W1714EP/ET AMI model generator

Includes the gigabit SerDes simulation models of the W1713, and also generates simulation models compliant with the IBIS AMI standard, for use in channel simulators throughout the signal integrity community. (Note: requires W1718).

## W1715EP/ET MIMO channel builder

Models full WINNER and WINNER-II channel fading for 4G link-level simulation and throughput scenarios. Allows fully-configurable 8x8 MIMO array needed for LTE Advanced, with importation of 2D antenna patterns for realistic MIMO OTA with crosstalk and propagation effects. Supports beamforming synthesis to create directional base station patterns.

## W1716EP/ET digital pre-distortion builder

Improve ACLR  $\geq 20$  dB (typical) for 4G waveforms using the latest DPD modeling techniques, transcending 3G bandwidth limitations and hardware implementation. Extracts Volterra, Memory Polynomial, or Look-up Table models using real modulated waveforms, then builds baseband pre-distortion network to mitigate nonlinearities and memory effects. Integrates with either wideband test equipment or RF EDA software, such as Agilent ADS/GoldenGate.

## W1717EP/ET hardware design kit

Provides a hardware design flow option for FPGA rapid prototyping and algorithm validation. Includes a bit-true, cycle accurate fixed-point library (formerly W1903), and HDL code-generation of hierarchical RTL-level VHDL and Verilog that remains target-neutral. Also allows incorporation of user-contributed HDL IP, then connects to Altera Quartus Pro II and Xilinx ISE for convenient 1-step code generation & synthesis from the SystemVue GUI. W1717 also enables realtime "Hardware-in-the-loop" (HIL) co-simulation with Xilinx Virtex 6 development boards over PCIe, such as the popular ML605.

## W1718EP/ET C++ code generator

Generates transportable, license-free C++ models from the SystemVue interface, allowing you to connect your PHY algorithms to design, implementation, and verification tools on other platforms and OS's. Works with virtually any platform, and integrated especially well with Microsoft Visual Studio.

## W1719EP/ET RF system design kit

Adds an RF System personality and dedicated spectral-domain simulator to enable round-trip RF system architecture design and verification. Perform meaningful RF architecture studies with accurate analog effects, while enabling RF block-level models to be used seamlessly at a higher system level. Then perform bottom-up verification using X-parameters (ADS) and fast circuit envelope models (GoldenGate) in fully-coded PHY simulations in dataflow. Enables Baseband and System modelers to take advantage of RF architectures, without requiring deep knowledge of analog design tools and techniques.



# SystemVue Baseband Exploration and Verification Libraries

## SystemVue baseband verification libraries

Baseband verification libraries provide compiled sources, receivers, function blocks, and reference designs that adhere to the physical layer of modern emerging standards. They are used to create, examine and receive PHY waveforms and test vectors at various locations in a system diagram in order to exercise system architectures and algorithms, down to the block level. With native TCP/IP connectivity, they also support co-design with test equipment and hardware development boards for both baseband and modulated-carrier signals.

SystemVue's standards-based baseband PHY libraries help you quickly create and verify algorithms and high-performance system architectures with confidence, so that they will work in the real world.

### W1910EP/ET LTE baseband verification library

The W1910 provides over 100 highly-parameterized functional blocks for source, coding and receiver verification, according to 3GPP LTE release 9.1. Supports closed-loop throughput measurements with active HARQ, FDD, TD-LTE, and MIMO modes. The W1910 supports Win32 DLL code-generation (for exporting models to other platforms), and also interoperates Agilent 89600 VSA and Signal Studio personalities for LTE.

### W1911EP/ET WiMAX™ baseband verification library

The W1911 provides over 75 highly-parameterized functional blocks for source, coding and receive functions. Helps you gain confidence in compliance and interoperability with WiMAX specifications in IEEE 802.16e-2005.

### W1914EP/ET DVB-x2 baseband verification library

The W1914 provides a configurable IP reference for SatComm transmit sources, so that you can verify baseband receiver architectures and algorithms for Digital Video Broadcast (DVB-S2 and DVB-T2) and ISDB-T compliant signals.

### W1915EP/ET mmWave WPAN baseband verification library

The W1915 provides a configurable IP reference for 60 GHz wireless personal area network (WPAN) systems, including TX/RX reference designs for 802.11ad and 802.15.3c physical layers, enabling closed-loop BER and RF verification.

### W1916EP/ET 3G baseband verification library

The W1916 provides over 300 highly-parameterized functional blocks for source, coding and receiver verification for multi-standard radio (MSR) designs requiring references for GSM, EDGE, CDMA, CDMA2000®, WCDMA, HSDPA, HSUPA, and dual-carrier HSPA+.

### W1917EP/ET WLAN baseband verification library

The W1917 provides parameterized functional blocks for MIMO source, coding and receiver verification for IEEE 802.11ac Draft 2.0. Also provides full blocksets and reference designs for 802.11a/b/g/n.

### W1918EP/ET LTE-Advanced baseband verification library

The W1918 includes the W1910 LTE library (3GPP Release 9.1), and also adds over 60 new blocks and MIMO reference designs for 3GPP Release 10 (LTE-Advanced).

### W1919EP/ET GNSS baseband verification library

The W1919 models baseband RX, TX, and scenarios for the GPS satellite navigation standard. Modulation sources for Beidou, GLONASS, and Galileo also included.

## SystemVue baseband exploration libraries

Exploration libraries build on top of verification libraries. They provide source code, in addition to the compiled simulation models, allowing rapid investigation, troubleshooting and verification of innovative PHY designs. With working reference designs, preconfigured test benches and block-by-block “golden references,” architecture and hardware designers can use the same tool for model-based design and continue directly into hardware verification with test equipment. Exploration libraries are a tremendous learning and productivity tool.

Note: For W1912ET and W1913ET special licensing please contact your Agilent field sales representative for more information.

### W1912ET LTE baseband exploration library

Provides source code for blocks in the W1910 LTE baseband verification library for 1 year and includes a 1 year license for the W1910ET. Support for additional standards may be optionally available; please inquire.

### W1913ET WiMAX baseband exploration library

Provides source code for blocks in the W1911 WiMAX baseband verification library for 1 year and includes a 1 year license for the W1911ET.

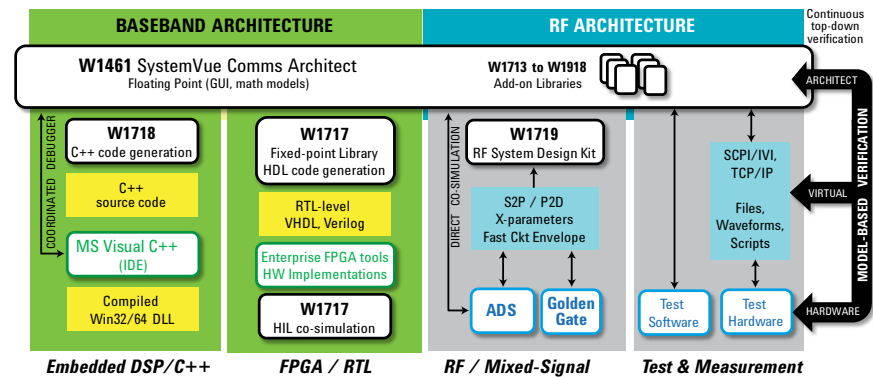


Figure 2. The W1465 SystemVue System Architect bundle provides design and verification options across multiple disciplines such as C++, FPGA, RF, and Test & Measurement. This allows enterprise workgroups to share specifications, data, and licenses across a common environment.

## Education and Services

SystemVue-related training and custom consulting services can be delivered at your site, or at a convenient location near you. Typical services are listed below. Also, annual support maintenance is recommended for all SystemVue products, since the software is typically updated twice per year, and significant new capabilities become available within the base platform and libraries.

### SystemVue Training Classes

- “SystemVue Fundamentals” (2 days)
- “Digital Pre-Distortion” with the W1716 (2 days)
- “Radar Signal Processing” with the W1905 (2 days)
- “IBIS AMI Modeling” with the W1714 (2 days)
- “Fundamentals of DSP for Digital Comms” (3 days, N3520A/B)
- “DSPedia” comms tutorials and examples (self-paced DVD, N3520M)

### SystemVue Consulting Services

- Start-up assistance
- Custom training, including applications and libraries such as LTE, DSSS, etc
- Custom model development, such as IBIS AMI
- Automation with test equipment
- Integration with 3rd party applications, such as STK 10.0
- Selected C++ source code, IP access
- Additional topics, as arranged

# SystemVue Bundles and Licensing

SystemVue may be purchased as the W1461BP SystemVue Core environment plus a series of individual modules, or in any of the available bundles. Explore SystemVue configurations online at:

[www.agilent.com/find/eesof-systemvue-configs](http://www.agilent.com/find/eesof-systemvue-configs)

Model/module	W1461BP Communications Architect	W1462BP FPGA Architect	W1464BP RF System Architect	W1465BP System Architect
W1461BP SystemVue Communications Architect (core environment)				
Graphical environment, scripting	•	•	•	•
Native math algorithm modeling, debug	•	•	•	•
Dataflow simulator, and co-simulation	•	•	•	•
C++ modeling, VisualStudio integration	•	•	•	•
~300 blocks, including OFDM, Zigbee, Digital Modulation	•	•	•	•
Digital Filter tool	•	•	•	•
Instrument connectivity, scripting	•	•	•	•
Optional SystemVue libraries and application personalities				
<a href="#">W1713 SerDes models</a>				
<a href="#">W1714 AMI model generator (note 3)</a>				
<a href="#">W1715 MIMO channel builder</a>				
<a href="#">W1716 Digital pre-distortion builder</a>				
<a href="#">W1717 Hardware design kit (note 2)</a>				
<a href="#">W1718 C++ code generator</a>				
<a href="#">W1719 RF system design kit</a>				
<a href="#">W1904 Adaptive EQ library</a>				
<a href="#">W1905 Radar model library</a>				
<a href="#">W1910 LTE baseband verification library</a>				
<a href="#">W1911 WiMAX baseband verification library</a>				
<a href="#">W1912 LTE baseband exploration library (note 4)</a>				
<a href="#">W1913 WiMAX baseband exploration library (note 4)</a>				
<a href="#">W1914 DVB-x2 baseband verification library</a>				
<a href="#">W1915 mmWave WPAN baseband verification library</a>				
<a href="#">W1916 3G baseband verification library</a>				
<a href="#">W1917 WLAN baseband verification library</a>				
<a href="#">W1918 LTE-Advanced baseband verification library</a>				
<a href="#">W1919 EP/ET GNSS baseband verification library</a>				

**Notes:**

- Both perpetual licenses (BP, EP suffix) and time-based (BT, ET suffix) licenses are available, in either nodelocked or floating configurations. Contact your local Agilent EDA representative for configurations and pricing.
- The W1717 hardware design kit now includes the W1903 fixed-point library. The W1903 library is no longer available as a separate library.
- The W1714 AMI model generator requires the W1718 C++ code generator. The W1714 also includes the W1713.
- These products require custom quotation



## ESL Applications Center

Have you ever wanted a centralized place to find application examples for Agilent's ESL tools? Agilent EEsosof's "ESL Applications Center" is a centralized site that hosts ESL related application examples that can be sorted by application, design function or product area. Each example has a complete description and links to additional information. We continue to port more applications into the ESL Applications Center on a regular basis. The application examples highlight Agilent's broad range of ESL applications, design functions and product areas:

- **Applications** – Wireless, Digital Pre-Distortion (DPD), Satellite, Radar, Military Communications (Mil Comms), Test, digital signal processing (DSP) and field-programmable gate arrays (FPGA).
- **Design Functions** – PHY system architecture, RF system architecture, RF hardware design, PHY system verification, baseband hardware design, and baseband algorithms.
- **Product Area** – The SystemVue environment, RF/Spectrasys, algorithms, libraries, Advanced Design System (ADS) & GoldenGate, ESL partners, and instruments.

## ESL Design Notebook

The ESL Design Notebook blog highlights applications, news, and opinions from a cross-discipline, system-level approach to design and verification in communications and defense. Electronic System Level (ESL) design is a larger term used by EDA industry regarding top-down, structured design methods, primarily for digital designs. In this blog, the term "ESL" focuses on boundary areas where this enterprise design paradigm meets RF, Wireless Test, and complex Physical Layer (PHY) standards. By applying and connecting these additional domains to mainstream ESL, new value is unlocked for emerging Communications and Defense.

## ESL Applications

<http://www.agilent.com/find/eesof-esl-applications-center>

## ESL Design Notebook

<http://www.agilent.com/find/eesof-esl-design-notebook>

# SystemVue Platform Operating System Roadmap

Agilent EEsof EDA reviews hardware and operating system support on a regular basis and updates the information as it becomes available. Not all product releases are supported on all platforms and/or operating system combinations.

Operating system	Windows	Windows	Windows	RedHat Linux	SuSe Linux	Solaris
32/64 bit	32/64 <sup>1</sup>	32/64 <sup>2</sup>	32/64 <sup>3</sup>	32/64	32/64	32/64
Version	XP Professional	Vista	7 Enterprise	RHEL5/6	SLES10/11	10
SV2007 and earlier ("SV classic")	Supported	Not supported	Not supported	Not supported	Not supported	Not supported
SV2008 SV2009	Supported <sup>2</sup>	Supported	Not supported	Not supported	Not supported	Not supported
SV2010 SV2011	Supported <sup>3</sup>	Supported	Supported	Not supported	Not supported	Not supported
SV2010 SV202	Supported	Support ending	Supported	Not supported	Not supported	Not supported

<sup>1</sup> For Windows XP, SystemVue runs in 32-bit compatibility mode on 64-bit platforms.

<sup>2</sup> SystemVue 2012.06 marks the end of Windows Vista support.

<sup>3</sup> For Windows 7, SystemVue runs natively in 64-bit or 32-bit modes.

## OS Platform support for older ADS releases and the General Agilent EEsof EDA Roadmap

[www.agilent.com/find/eesof-platforms](http://www.agilent.com/find/eesof-platforms)

[www.agilent.com](http://www.agilent.com)  
[www.agilent.com/find/eesof](http://www.agilent.com/find/eesof)



**SystemVue**  
Electronic System-Level Design

**Start Your Free Trial Today**  
[www.agilent.com/find/eesof-evaluation](http://www.agilent.com/find/eesof-evaluation)

For more information about SystemVue, please visit:

**Product information**

[www.agilent.com/find/eesof-systemvue](http://www.agilent.com/find/eesof-systemvue)

**Product Configurations**

[www.agilent.com/find/eesof-systemvue-configs](http://www.agilent.com/find/eesof-systemvue-configs)

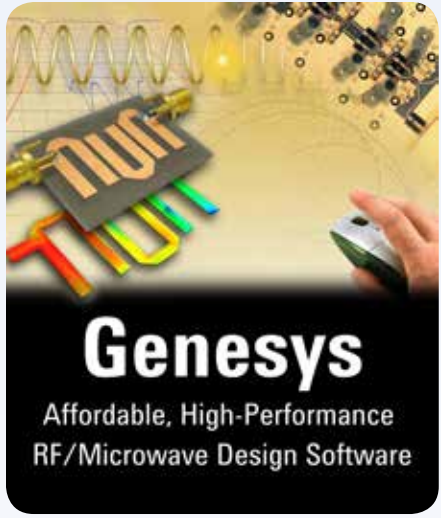
**Downloads**

[www.agilent.com/find/eesof-systemvue-latest-downloads](http://www.agilent.com/find/eesof-systemvue-latest-downloads)

**Helpful Videos**

[www.agilent.com/find/eesof-systemvue-videos](http://www.agilent.com/find/eesof-systemvue-videos)





# Genesys

## Affordable. Accurate. Easy-to-Use

Agilent Genesys is an affordable, accurate, easy-to-use RF and microwave simulation tool created for the circuit board and subsystem designer. Providing the optimal balance of capabilities with ease-of-use, designers can quickly attain the skills necessary to operate the tool while realizing unbeatable engineering productivity in the shortest time possible. Genesys is available in 6 different languages (English, Japanese, Korean, Chinese simplified, Chinese traditional and Russian), further adding to its ease of deployment and global collaboration by engineers and technicians alike.

### An integrated electronic design automation (EDA) environment for RF/microwave circuit board and subsystem designers

Genesys is endorsed by an installed base of over 5,000 satisfied RF and microwave designers worldwide, many of whom have been loyal repeat customers over the past 25 years. Genesys incorporates breakthrough nonlinear X-parameter simulation and is backed by Agilent's extensive industry-wide expertise in RF/microwave design, instrumentation and support. As a proven safe investment, Genesys literally pays for itself through cost savings within its first year of deployment as a personal engineering tool. As your requirements expand to include enterprise level design of RF/high speed boards, MMICs or multi-technology RF system-in-package (SIP) modules, Agilent protects your Genesys investment by providing full trade-up credit towards its even more capable ADS.

### The core capabilities of Genesys can be extended with additional simulation building blocks into powerful and affordable bundles.

#### Genesys Configuration Overview

Genesys offers the highest engineering design productivity by providing:

- Industry's widest coverage of RF and microwave circuit synthesis capabilities
- Fastest RF system architecture and frequency planning tools
- Time- and frequency-domain circuit simulation with optimization
- Fast, memory-efficient 3D planar electromagnetic (EM) simulation
- Accurate and convenient X-parameter nonlinear circuit and system simulation







#### Genesys Core Environment

All Genesys configurations start with the prerequisite Genesys core environment, which is itself a full-featured design bundle. Additional capabilities can then be added to extend its functionality to include:

- Filter and circuit synthesis
- RF system architecture
- Nonlinear circuit simulation (DC, time- and frequency-domains)
- 3D planar EM simulation

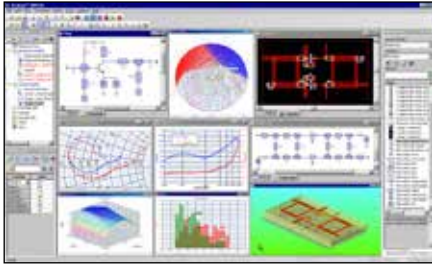
### Key building blocks

Genesys bundles are comprised of one or more of these building blocks.

-  **Core** – Design environment, linear and statistical simulators, optimizer, layout, 3D viewer, instrument links
-  **Filter and match** – Filter and matching circuit synthesis for lumped and distributed networks
-  **Synthesis** – Synthesis for passive and active components, includes filter and match
-  **Circuit** – Circuit DC, time- and frequency-domain nonlinear simulators
-  **System** – System architecture and frequency planning simulators
-  **EM** – 3D planar electromagnetic simulator (Momentum GXF)



## ■ Genesys Core Building Block



[www.agilent.com/find/eesof-genesys-core](http://www.agilent.com/find/eesof-genesys-core)

### Design environment

- Integrated, easy-to-use Windows®-based graphical user environment for hierarchical design creation and management; available in six major languages worldwide
- Scripting from Visual Basic, C++, VBScript or JScript for automation of Genesys to perform custom or repetitive tasks
- LiveReport for creating auto-updating and interactive design documentation
- Export Genesys designs for use in Agilent ADS in design collaboration

### Fast linear simulation and powerful optimization

- Interactive tuning for quick insights
- Fast and robust design optimizer
- Linearizes nonlinear components at their DC bias before linear simulation.

*NOTE: Full DC analysis requires Harbec/Cayenne*

### Statistical simulation

- Monte Carlo yield analysis
- Graphical and spreadsheet report

### Data manipulation and display

- Data sets for persistent storage of simulation and measurement data for post-processing and display to eliminate wasteful re-simulation
- Mathlang language for powerful Matlab® custom equations, functions and data processing capabilities
- Flexible data display and analysis with rectangular, polar, Y/Z Smith, histogram, 3D-parametric plots, and instrument-style marker readouts
- Interactive 3D viewer for EM surface currents and antenna far-field patterns

### RF/microwave layout and artwork translators

- Create layout from schematic, imported artwork, or direct drawing for EM simulation and board fabrication
- 3D viewer for layout with interactive rotation, zoom, vertical stretching, and cut planes to verify correct geometry before fabrication
- Full library of pad/package layout footprints
- Import /export masks and drill files in popular printed circuit board (PCB) formats (e.g., Gerber, DXF/DWG, and GDSII) for PCB board realization on fast prototyping machines or chemical etching

### Libraries of simulation models and parts

- Full libraries of accurate high-frequency physical models with automatic discontinuities
- Over 30,000 linear, nonlinear and system parts libraries

### Testlink

- Captures measured data directly into Genesys for simulation and display on network analyzers, impedance analyzers, oscilloscopes, vector/spectrum analyzers, semi-conductor analyzers, and power meters
- Supports over 140 instruments from more than 14 equipment manufacturers

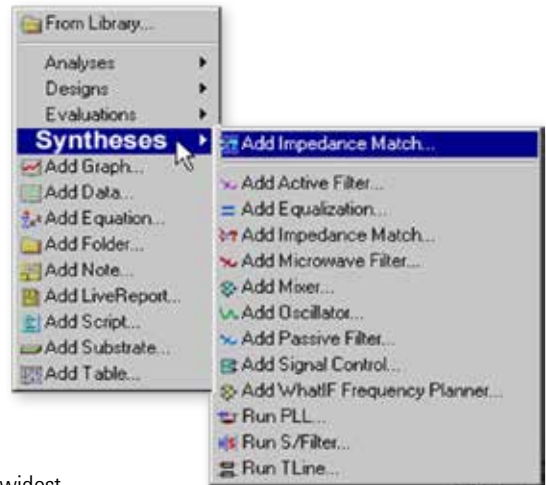
[www.agilent.com/find/eesof-genesys-testlink](http://www.agilent.com/find/eesof-genesys-testlink)





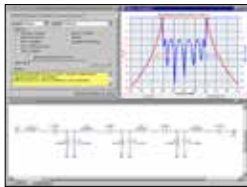
## Genesys Synthesis

Genesys provides the industry's widest coverage of passive and active circuit synthesis capabilities. The synthesis modules create high-performance circuits, accelerate routine design tasks from hours to minutes, and enable fast make-or-buy decisions on RF components. All 11 synthesis modules are included in the Genesys Synthesis building block. An economical subset containing the 4 most popular synthesis modules is the "filter and match" building block.



Improve productivity with the industry's widest coverage of RF and microwave circuit synthesis capabilities in Genesys.

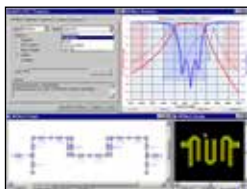
## Filter and Match Building Block



### Filter synthesis

Classical lumped filter synthesis for RF applications. This module is the single highest-selling synthesis module from our Genesys product line.

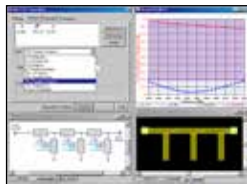
[www.agilent.com/find/eesof-genesys-filter](http://www.agilent.com/find/eesof-genesys-filter)



### M/filter synthesis

Distributed filter synthesis for microwave applications with over 60 topologies, including automatic layout for subsequent EM analysis. Synthesizes high-performance microwave filters and assists make-versus-buy decisions.

[www.agilent.com/find/eesof-genesys-m-filter](http://www.agilent.com/find/eesof-genesys-m-filter)



### Match synthesis

Synthesizes impedance-matching networks over narrow/broad frequency bands with lumped/distributed components and complex frequency-dependent loads.

[www.agilent.com/find/eesof-genesys-match](http://www.agilent.com/find/eesof-genesys-match)



### Advanced transmission line synthesis

Synthesizes 13 types of transmission lines with lump-distributed circuit conversion and automatic discontinuity insertion. Converts ideal electrical designs to physical implementation such as microstrips and striplines on your choice of substrate.

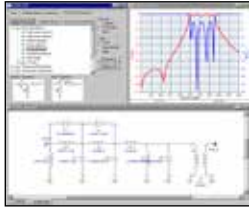
[www.agilent.com/find/eesof-genesys-advanced-t-line](http://www.agilent.com/find/eesof-genesys-advanced-t-line)







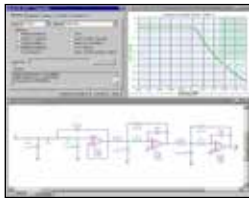
## ■ Synthesis – Includes Filter and Match



### S/filter synthesis

Advanced lumped LC and distributed filter direct synthesis for customized frequency-response shaping by interactive placement of transmission zeros. Comes with over 200 interactive lumped and distributed topological transforms for high-performance custom filter realization.

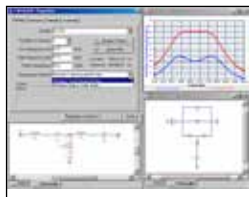
[www.agilent.com/find/eesof-genesys-s-filter](http://www.agilent.com/find/eesof-genesys-s-filter)



### A/filter synthesis

Active op-amp filter synthesis with over 30 active topologies. Use for IF, video, baseband frequencies, and control applications such as power control and AGC circuits.

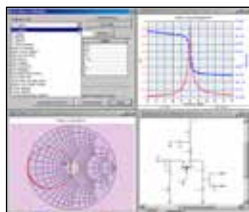
[www.agilent.com/find/eesof-genesys-a-filter](http://www.agilent.com/find/eesof-genesys-a-filter)



### Equalize synthesis

Synthesizes equalization networks to compensate for linear phase distortions in the circuit or system that impacts modulation fidelity such as error vector magnitude (EVM), video, and audio fidelity.

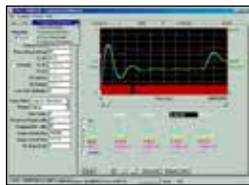
[www.agilent.com/find/eesof-genesys-equalize](http://www.agilent.com/find/eesof-genesys-equalize)



### Oscillator synthesis

Explore 19 RF oscillator topologies from classical L-C, transmission line, SAW, crystal, cavity, and coaxial hybrid. Recommended companion to the Harbec or Cayenne circuit simulators.

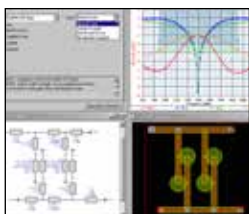
[www.agilent.com/find/eesof-genesys-oscillator](http://www.agilent.com/find/eesof-genesys-oscillator)



### PLL synthesis

Phase-locked loop (PLL) synthesis of analog loop filters and 5 setup wizards to design frequency synthesizers and phase/frequency modulators/demodulators.

[www.agilent.com/find/eesof-genesys-pll](http://www.agilent.com/find/eesof-genesys-pll)



### Signal control synthesis

Synthesizes a variety of lumped and distributed couplers (10 types), splitters (10 types), Baluns (5 types), and attenuator (2 types) circuits that control RF signal flow.

[www.agilent.com/find/eesof-genesys-signal-control](http://www.agilent.com/find/eesof-genesys-signal-control)



### Mixer synthesis

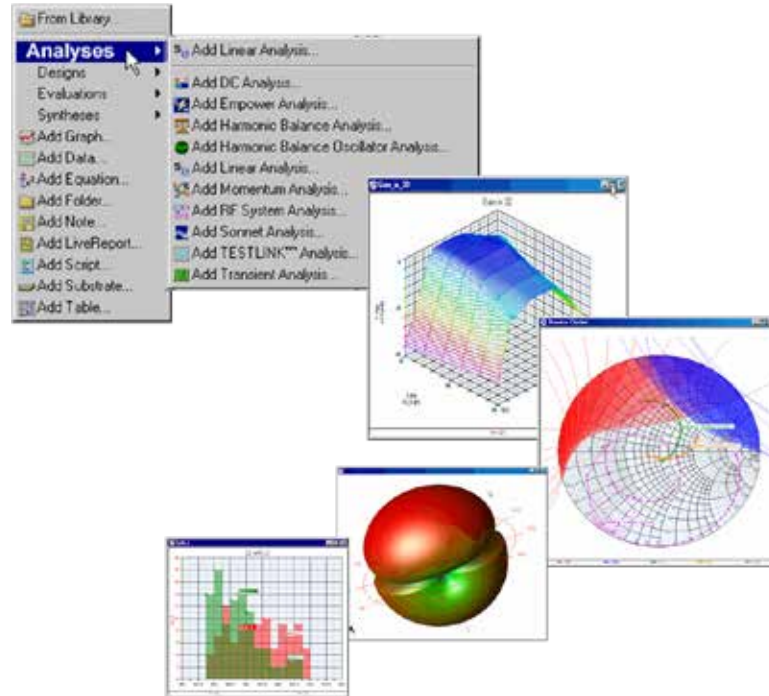
Explore a range of performance trade-offs between 11 RF mixer topologies based on BJTs, FETs and diodes from diode rings to Gilbert cells. Design companion to the Harbec circuit simulator.

[www.agilent.com/find/eesof-genesys-mixer](http://www.agilent.com/find/eesof-genesys-mixer)

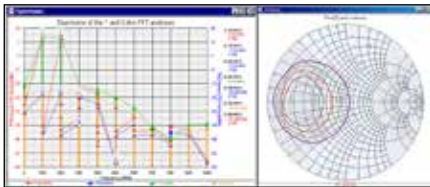


## Genesys Simulation

Genesys offers comprehensive circuit, system and electromagnetic simulation capabilities that are provided in the following 3 building blocks which are used to construct powerful and economical Genesys RF and microwave board design bundles.



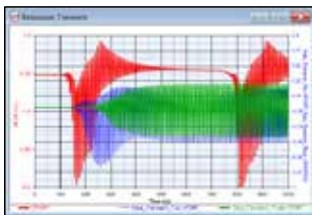
## ■ Circuit Building Block



### Harbec

Harmonic balance, nonlinear frequency-domain circuit simulation and optimization that calculates harmonic spectrum at any circuit node, IP3, compression, efficiency, conversion gain, phase noise, load pull contour, large-signal oscillator, amplifier, or mixer. Indispensable tool for RF/microwave and DC bias designs with active transistors, diodes, and components. Harbec now incorporates Agilent's breakthrough nonlinear X-parameters simulation technology for convenient and accurate nonlinear circuit designs with X-parameter models of transistors and RFICs.

[www.agilent.com/find/eesof-genesys-harbec](http://www.agilent.com/find/eesof-genesys-harbec)



### Cayenne

Spice simulation for RF circuits that works from the same schematic and RF physical models as Harbec. Includes convolution algorithm to use S-parameters and frequency-domain transmission-line models in accurate time-domain transient simulations of high-speed signal paths. Includes full DC analysis and optimization of DC voltages and currents

[www.agilent.com/find/eesof-genesys-cayenne](http://www.agilent.com/find/eesof-genesys-cayenne)



### Advanced modeling kit

Verilog-A modeling allows you to add robust, custom nonlinear models to Genesys Harbec and Cayenne using the industry's most popular analog behavioral-modeling language. Custom nonlinear models are fast transportable and extend Genesys for new applications such as MEMS and electro-optics.

[www.agilent.com/find/eesof-genesys-amk](http://www.agilent.com/find/eesof-genesys-amk)



## System Architecture

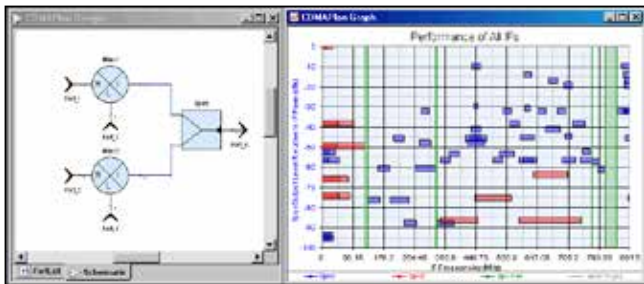
The Genesys system building block includes Spectrasys, a powerful RF system architecture and diagnostic simulator, and WhatIF, an innovative frequency planning simulator that instantly identifies spurious-free bands when designing frequency conversion systems.



### Spectrasys

Interactive RF system architecture tool that diagnoses the source of analog impairments such as spurious frequency mixing and mismatch ignored by spreadsheets, with superior ease-of-use. Integrates with circuit synthesis, circuit simulation, optimization, statistics, and EM simulation. Spectrasys now comes with sweep plots to quickly identify and track spurious signals in swept analysis of multi-conversion systems. It also incorporates breakthrough nonlinear X-parameters simulation technology for convenient and accurate system design with nonlinear X-parameter models of system blocks such as amplifiers, mixers or transceiver RFICs.

[www.agilent.com/find/eesof-genesys-spectrasys](http://www.agilent.com/find/eesof-genesys-spectrasys)



### WhatIF

Unique, graphical frequency-planning tool that quickly identifies spurious-free bands across a wide bandwidth involving multiband conversions to a common IF, using realistic mixers. Useful for designing multiband down-converters with high- and low-side LO's. A natural companion to Spectrasys.

[www.agilent.com/find/eesof-genesys-whatif](http://www.agilent.com/find/eesof-genesys-whatif)

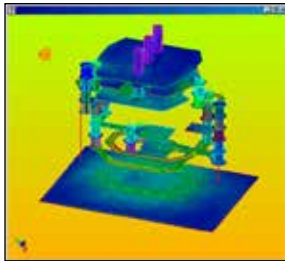




## EM Simulation



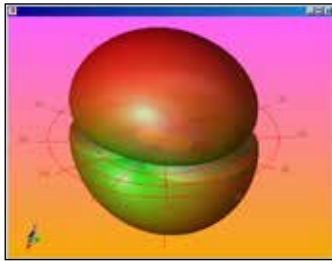
The Genesys EM block includes Momentum GXF, the most advanced 3D planar electromagnetic simulator in the industry, along with Momentum GX, EMpower and links to Agilent EMPro full 3D-EM simulator and Sonnet.



### Momentum GXF

Highest-performance, integrated 3D planar EM simulator with superset capabilities of Momentum GX, including fast multi-threaded simulation on multicore processors, quadrangle mesher and highly memory-efficient NlogN solvers. Offers the highest speed and capacity for 3D planar EM simulation to analyze complex multilayer layouts or large planar-antenna arrays. It is typically 20x faster than EMpower.

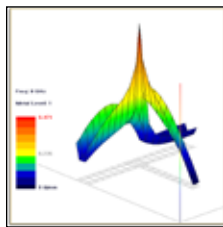
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### Momentum GX

High-performance, integrated 3D planar EM simulator based on method-of-moments with efficient polygonal meshing of curved and straight geometries. Momentum GX solves a much wider variety of larger problems, faster, using far less memory than traditional rectangular-grid EM solvers. It is typically 5x faster than EMpower. Interactive 3D viewer for surface currents and antenna far-field opens up design insights and is indispensable for troubleshooting.

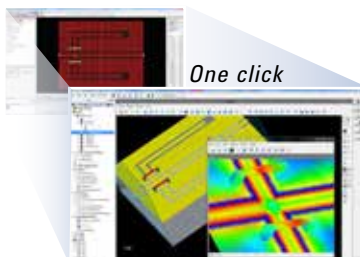
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### EMpower

An integrated 3D planar EM simulator based on method-of-lines for analyzing smaller planar layouts that fit on a rectangular grid mesh. Lower performance, capacity, and versatility than Momentum GX.

[www.agilent.com/find/eesof-genesys-empower](http://www.agilent.com/find/eesof-genesys-empower)



### Agilent EMPro link

Agilent EMPro analyzes non-planar 3-D electromagnetic effects such as packaging, shielding and integration of circuit with waveguides. In a single click, Genesys exports its planar RF/microwave layout, along with ports and substrate material properties to EMPro for immediate simulation. Eliminates tedious manual re-entering of 3D structures, EM port locations and material properties.

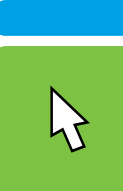
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## Co-Simulation

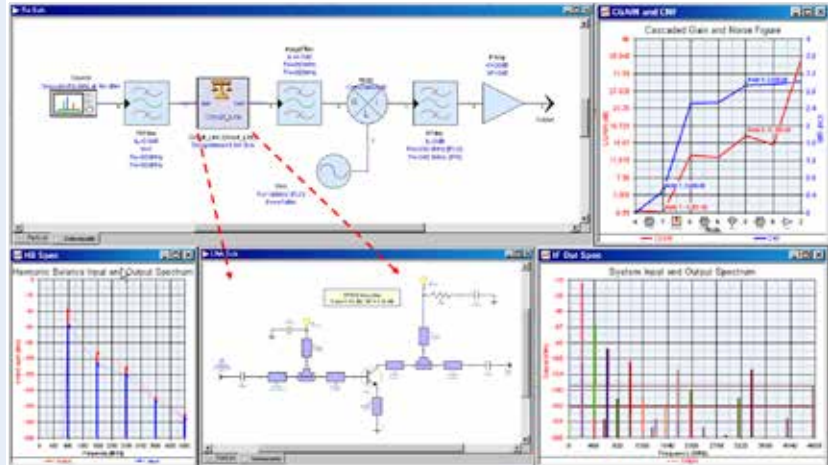
The already powerful system, circuit and electromagnetic simulators can also be used together to analyze, tune and optimize your designs in a single pass. This eliminates tedious and error-prone manual translation of data between simulators.



### Circuit-System Co-Simulation



Enables nonlinear circuit parameters to be tuned and optimized to system specs in one pass. It eliminates tedious, non-interactive and error-prone creation of inaccurate system behavioral models from circuits to perform circuit-system verification.



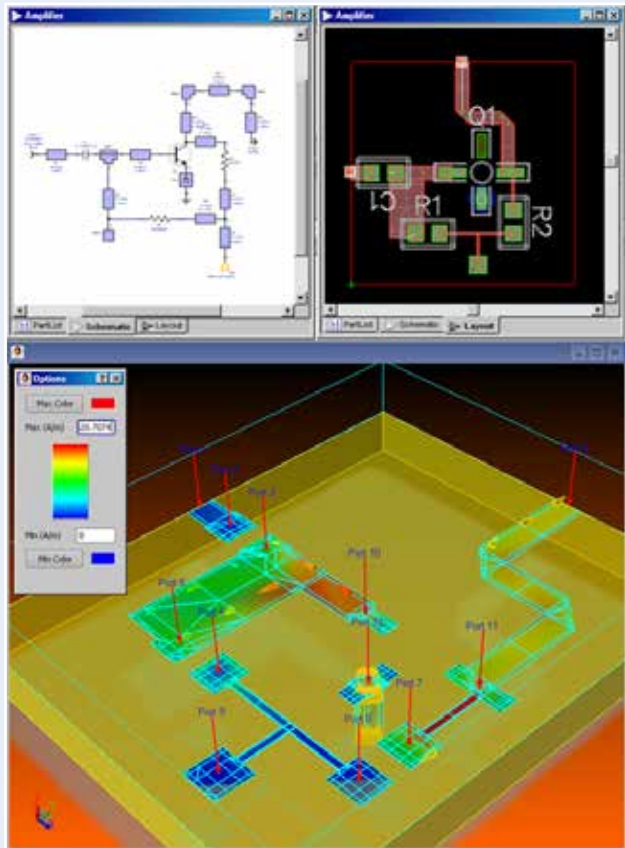
### Circuit-EM Co-Simulation



Automatically includes the physical effects of board layout in both linear and nonlinear circuit simulations.

It enables you to identify and fix circuit performance degradation caused by undesired proximity coupling, resonance and reflection from your RF board layout.

3D interactive viewing of animated surface current flows help you pinpoint the location of these problems without guesswork..





## Getting the Most Value From your Agilent Genesys Software



Agilent has a worldwide network of trained professionals to help you be effective in using and deploying Genesys sooner. An annual software maintenance subscription is an affordable assurance that you will always be up-to-date with the latest software capabilities and bug fixes. It comes with highly-com-

petent Agilent phone and email support, as well as unlimited 24/7 access to the Agilent Knowledge Center for solutions to thousands of engineering questions.

Training is recommended to bring all designers up to a similar skill level and to

get the most out of Genesys for productive teamwork and organizational effectiveness.

If you have an old outdated Genesys, you can always upgrade it to the latest version to protect and enhance your original investment at minimum cost.

## Support, Training and Upgrade



### Software maintenance subscription and technical support

*Genesys software support option*

- Annual software maintenance subscription keeps your software fresh with the latest enhancements, applications, defect fixes, operating system, and hardware support.
- Provides access to the Agilent technical support network worldwide through email, tele phone, and the 24/7 Agilent Knowledge Center.
- Software on current maintenance can be enhanced, upgraded to a floating license, re-hosted, or transitioned to Agilent ADS.
- Typically, there are about two software releases of Genesys per year.

**[www.agilent.com/find/eesof-support](http://www.agilent.com/find/eesof-support)**



### Genesys concepts - training class

*N3244A*

Three-day, hands-on Genesys training class, updated for the current release. Can be delivered at Agilent training site (N3244A), or at your site (N3244B).

**[www.agilent.com/find/eesof-genesys-class](http://www.agilent.com/find/eesof-genesys-class)**



### Genesys software upgrade

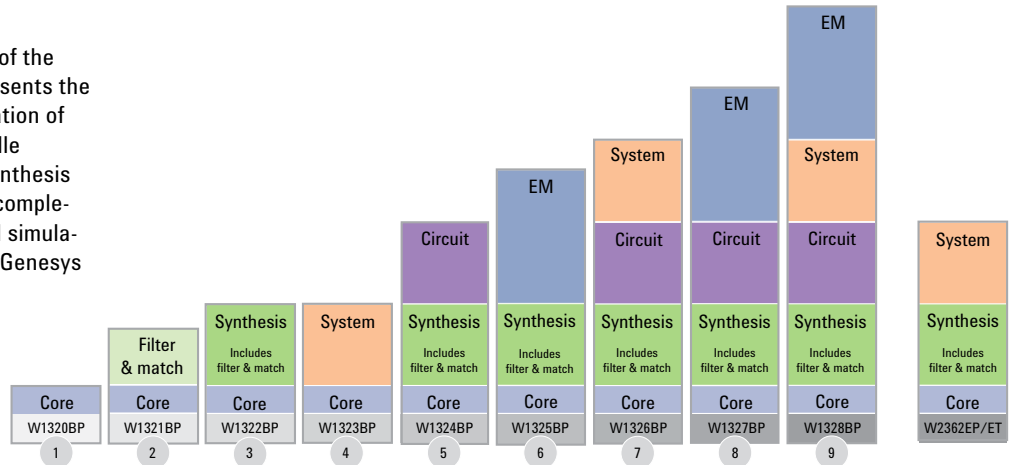
*W1401R*

If your Genesys is outdated, you can upgrade to the latest version at very low cost to preserve your investment in this valuable tool.



# Genesys Bundles

Genesys may be purchased in any of the 9 preconfigured bundles that represents the most popularly purchased combination of capabilities. For ADS users, a bundle containing Genesys system and synthesis capabilities is specially created to complement ADS nonlinear circuit and EM simulators. It can also run as standalone Genesys software.



Genesys Bundle Name:	Genesys core W1320BP	Genesys core, filter, match W1321BP	Genesys core, synthesis W1322BP	Genesys core, system W1323BP	Genesys core, synthesis, circuit W1324BP	Genesys core, synthesis, EM W1325BP	Genesys core, synthesis, circuit, system W1326BP	Genesys core, synthesis, circuit, EM W1327BP	Genesys core, synthesis, circuit, system, EM W1328BP	ADS RF architect and synthesis element W2362EP/ET
<b>Environment</b>										
Genesys core Environment	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Testlink	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
<b>Synthesis</b>										
Filter		Y	Y		Y	Y	Y	Y	Y	Y
M/filter		Y	Y		Y	Y	Y	Y	Y	Y
Match		Y	Y		Y	Y	Y	Y	Y	Y
Advanced Tline		Y	Y		Y	Y	Y	Y	Y	Y
S/filter			Y		Y	Y	Y	Y	Y	Y
A/filter			Y		Y	Y	Y	Y	Y	Y
Equalize			Y		Y	Y	Y	Y	Y	Y
Oscillator			Y		Y	Y	Y	Y	Y	Y
PLL			Y		Y	Y	Y	Y	Y	Y
Signal control			Y		Y	Y	Y	Y	Y	Y
Mixer			Y		Y	Y	Y	Y	Y	Y
<b>Circuit simulation</b>										
Harbec					Y		Y	Y	Y	
Cayenne					Y		Y	Y	Y	
Advanced modeling kit					Y		Y	Y	Y	
<b>System simulation</b>										
Spectrasys				Y			Y		Y	Y
WhatIF				Y			Y		Y	Y
<b>EM simulation</b>										
Momentum GXF						Y		Y	Y	
Momentum GX						Y		Y	Y	
EMpower						Y		Y	Y	
Sonnet Link						Y		Y	Y	
<b>Training &amp; upgrade</b>										
N3244A/B Genesys 3-day hands-on training	Don't forget to sign up for training!									
W1401R Genesys Upgrade	You can always upgrade & refresh your old Genesys to these latest capabilities									

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## Genesys Licensing Options

License type	Node-locked	Networked
Perpetual license	<ul style="list-style-type: none"><li>• A node-locked perpetual license is locked to a USB key or PC LAN physical address</li><li>• You own the license and this is the most cost-effective option for the long term</li><li>• The node-locked perpetual license is the most popular option</li></ul>	<ul style="list-style-type: none"><li>• The networked perpetual license enables convenient sharing by users across a network</li><li>• Costs about 30% more than node-locked perpetual license</li><li>• Suitable for larger companies and requires network license server administration</li></ul>
Subscription (time-based) license	<ul style="list-style-type: none"><li>• The node-locked time-based license is locked to a USB key or PC LAN physical address</li><li>• Usage expires after the 12-months time-based license period</li><li>• Costs about 1/3 of a perpetual license including support; suitable for projects with tight cash flows</li></ul>	<ul style="list-style-type: none"><li>• The networked time-based license enables convenient sharing by users across a network</li><li>• Costs about 30% more than a node-locked time-based license</li><li>• Suitable for larger companies who need to optimize cash flows</li><li>• Requires network license server administration</li></ul>

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## Securing Your Genesys License



Genesys licenses can be secured to your personal computer's (PC) local area network (LAN) physical address or a universal serial bus (USB) hardware key serial number.

**LAN Physical Address** – When secured to your computer LAN physical address, the danger of losing the small USB hardware key is eliminated and your license enables you to start using Genesys just like any other software on your PC.

**USB Hardware Key** – When secured to a USB hardware key, you have the convenience of license portability to run Genesys on different computers. However, you may risk losing the USB key which then prevents you from using Genesys.



# Genesys Platform Operating System Roadmap

Agilent EESof EDA reviews hardware and operating system support on a regular basis and updates the information as it becomes available. Not all product releases are supported on all platforms and/or operating system combinations.

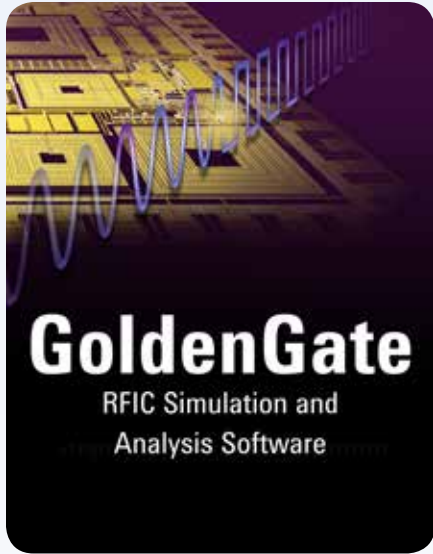
Operating system	Windows	Windows	Windows	RedHat Linux	SuSe Linux	SuSe Linux	Solaris
32/64 bit	32/64	32/64	32/64	32/64	32/64	32/64	32/64
Version	XP Professional SP3	Vista Business	7 Professional and Ultimate	RHEL4	SLES9	SLES10	10
Genesys 2006	Supported	Not supported	Not supported	Not supported	Not supported	Not supported	Not supported
Genesys 2007 Genesys 2008 Genesys 2009	Supported <sup>2</sup>	Supported	Not supported	Not supported	Not supported	Not supported	Not supported
Genesys 2010	Supported <sup>3</sup>	Supported	Supported	Not supported	Not supported	Not supported	Not supported
Genesys 2012	Supported	Supported	Supported	Not supported	Not supported	Not supported	Not supported

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# GoldenGate RFIC Solutions

## The Best-in-Class Circuit Simulation Software for RFIC Design and Verification

**GoldenGate** is the most trusted simulation, analysis and verification solution available for integrated RF circuit design within Cadence Virtuoso. It is an integral part of Agilent's Silicon RFIC solution that also includes:

- ADS for small-scale RFIC front-to-back implementation
- Momentum and EMPro for on- and off-chip electromagnetic analysis
- SystemVue and Ptolemy wireless test benches for system-level verification

This suite of products links the RF system, subsystem, and component-level design and analysis as part of a unique and comprehensive RFIC design offering.

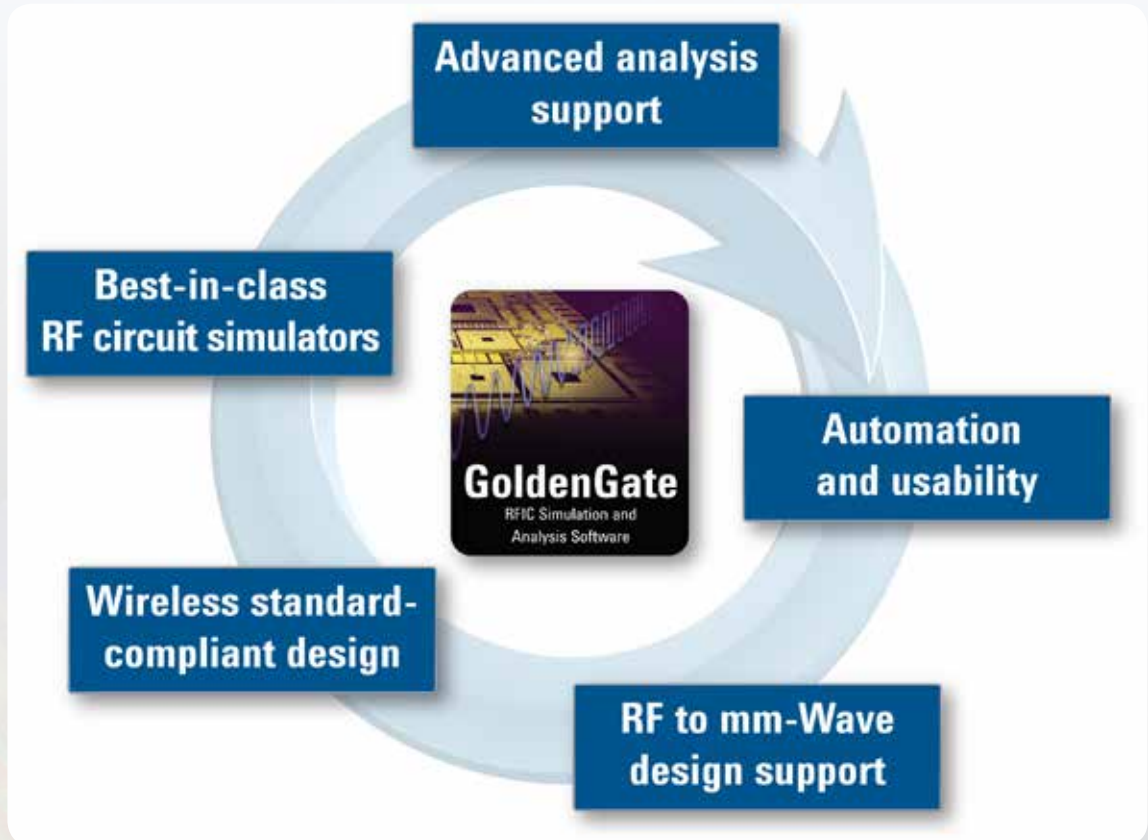


Figure 1.

*While GoldenGate offers traditional analog simulators, it also goes beyond innovative RF simulation technology to provide a variety of solutions for designing, analyzing and verifying integrated RF circuits.*

# Comprehensive RFIC Design and Verification Solution

**GoldenGate** offers unique simulation algorithms that enable full characterization of transceivers prior to tape-out.

The industry's most advanced set of steady-state and envelope solvers allow design teams to confidently tackle even the most challenging radio designs. GoldenGate is seamlessly integrated into versions 5.x and 6.x of the Cadence Virtuoso design environment.

## GoldenGate RFIC Solutions —Powerful Simulation and More

**Best-in-class RF circuit simulator** provides the most advanced steady-state and envelope solvers for design and verification of RFICs within the Cadence Virtuoso environment.

**Advanced analysis support** offers a wide variety of capabilities to fully explore, analyze and optimize designs, before tape-out, minimizing the time and expense of re-spins.

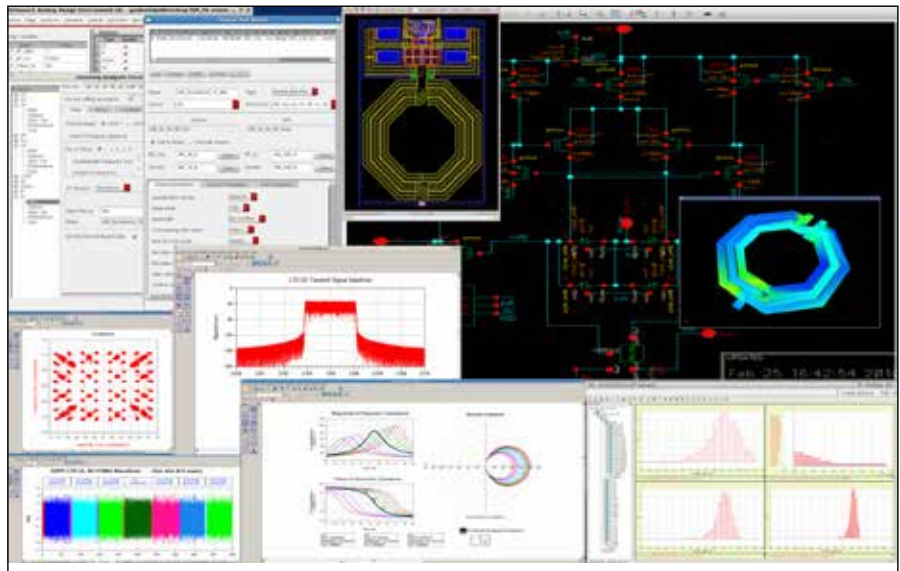
**Automation and usability** features accelerate design and verification by providing a number of tools on top of ADE-L and ADE-XL.

**RF to mm-Wave design support** provides the best performance, capacity and accuracy for RF to millimeter-wave (mm-Wave) applications.

**Wireless standard-compliant design** capability couples the power of system- and circuit-level simulators with a comprehensive library of standard-based wireless verification intellectual property (IP) to accelerate validation of complex RFICs.

Figure 2.

*GoldenGate is the industry's best-in-class simulator, providing the most advanced steady-state and envelope solvers for design and verification of radios within the Cadence Virtuoso environment*



# Leading the Way in RF Circuit Simulation

Widely known for its advanced steady-state and envelope solvers, GoldenGate also provides a full set of analog and application-specific analyses. Additionally, GoldenGate supports X-parameter\* simulation and generation, which allows designers to capture the nonlinear behavior of active components in a standard format. X-parameters hide IP while enabling fast, accurate simulation within GoldenGate, ADS or SystemVue.

GoldenGate also enables mixed-signal co-simulation between its transient and envelope transient analyses with third-party digital simulators — an especially critical capability given the increasingly mixed-signal and digital content of today's RFICs. Agilent EEs of EDA works closely with RFIC Foundries to ensure GoldenGate covers all relevant models and is continually qualified against new and updated process nodes to ensure silicon-accurate results.



## RFIC Circuit Simulation Overview

- Unmatched Harmonic-Balance and Envelope-Transient analyses
  - Steady-state solvers include: harmonic balance, time balance, time shooting, and hybrid solvers
  - Envelope hybrid time-/frequency-domain nonlinear simulator
- Comprehensive set of analyses
  - DC, AC, noise, S-parameters, transient
  - Large-scale S-parameters, transient noise, sensitivity, as well as Bode, Nyquist and eigenvalue stability analyses
  - Transistor-level integer-N PLL verification
  - Intermodulation distortion and gain compression
- Agilent X-parameter support
- Mixed-signal co-simulation support
- Extensive foundry-verified model library
  - HICUM, MEXTRAM, VBIC, BSIM, BSIMSOI, HISIM, GAASFETs, JFETs, and more

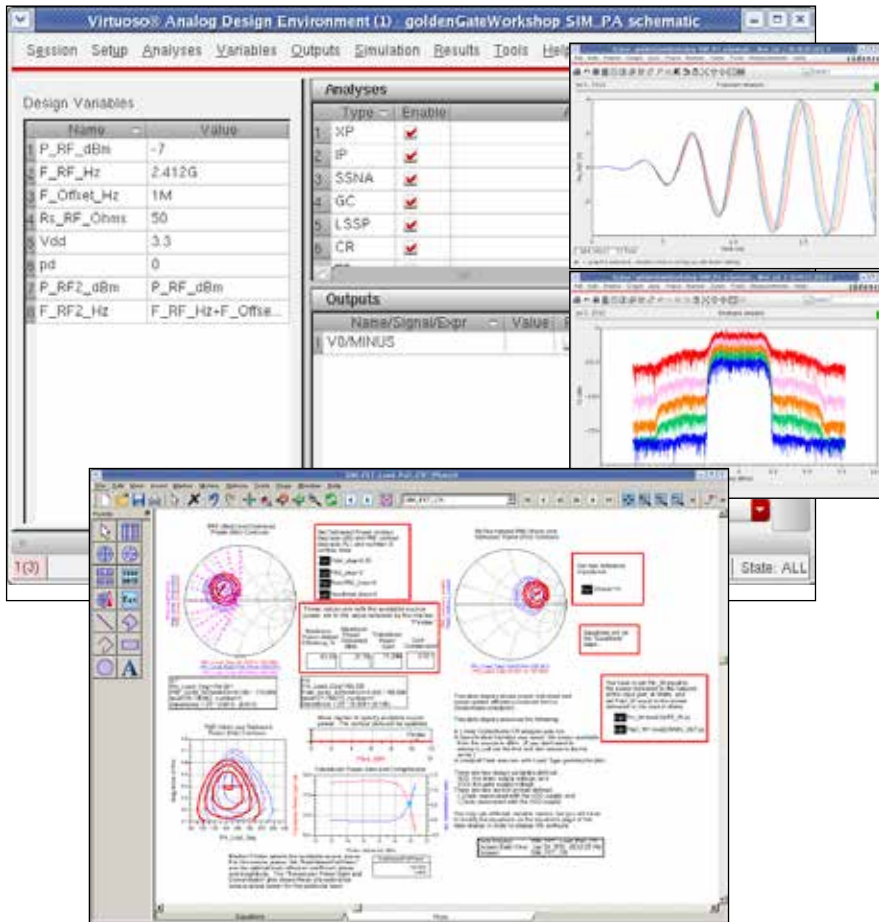


Figure 3.

**GoldenGate is directly integrated within the Cadence Virtuoso environment to provide standard application development environment (ADE) functionality plus many unique RF capabilities.**

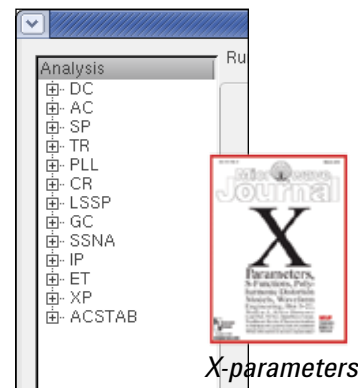


Figure 4.

**GoldenGate provides a full complement of analyses including X-parameter simulation and generation.**

\* X-parameters is a trademark of Agilent Technologies. The X-parameter format and underlying equations are open and documented. For more information, visit: [www.agilent.com/find/eesof-x-parameters-info](http://www.agilent.com/find/eesof-x-parameters-info)

# Making Designs More Robust

GoldenGate features a suite of automation tools that enable design teams to quickly analyze and diagnose problem areas early in the design cycle, and fully optimize circuit performance. It also tightly integrates easy-to-use tools such as multi-dimensional sweeps, optimization and load-pull analysis.

GoldenGate's broad range of powerful, easy-to-use statistical tools helps pinpoint problems during the design phase. Advanced Monte Carlo algorithms speed trials while reducing the number required. Yield sensitivity histograms help identify critical design components. This information allows designers to make the design adjustments necessary to improve manufacturing yield.

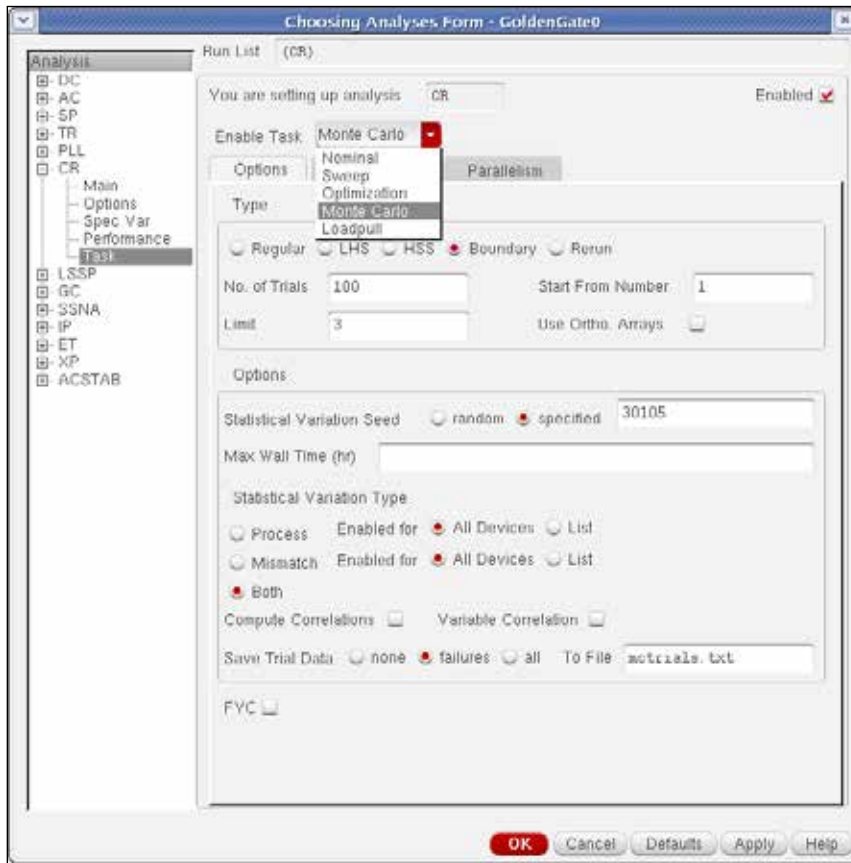


Figure 5.

The Choosing Analyses Form simplifies the setup of advanced analyses. The Task field provides access to a variety of multiple-run simulations including Monte Carlo analysis. Fast Yield Contributor (FYC) analysis is a unique capability which enables very fast computation of device-level contributions within Monte Carlo analysis.

## Advanced Analysis Overview

- Multi-dimensional sweeps with unmatched speed and convergence
- Digital state sweeping for operational mode performance, calibration and control sequences
- Extensive load-pull setup and plotting capabilities
- Advanced Monte Carlo sampling algorithms
  - Latin Hypercube
  - Hammersley Sequence Sampling
  - Boundary Mode and Orthogonal Arrays
- Fast yield and mismatch analyses for DC, AC, SP, SSNA, and CR
  - Full contribution table
- Powerful optimization engine
- Unique transistor-level integer-N PLL simulator
  - Steady-state circuit characteristics including deterministic noise
  - Random jitter and noise with contributors

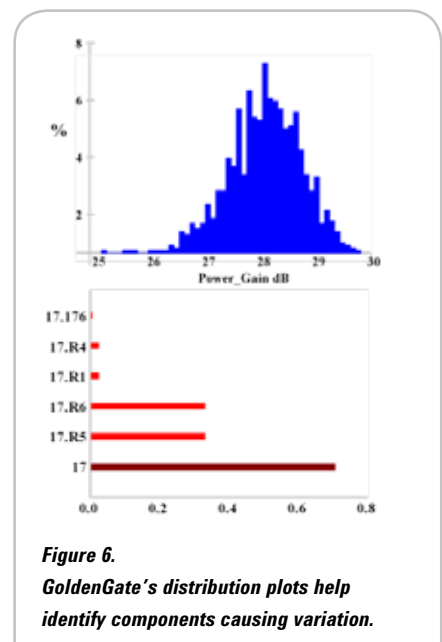


Figure 6. GoldenGate's distribution plots help identify components causing variation.

# Automation Tools for Accelerating the Design Cycle

Design verification of today's RFICs can be tedious and time-consuming. GoldenGate accelerates this task with a number of powerful tools that allow designers to set up and run distributed simulations. These tools enable the quick analysis and display of massive amounts of data, and can be used within Virtuoso, operated separately or integrated with other third-party products.

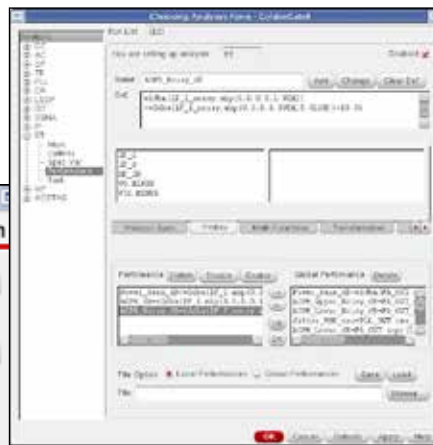
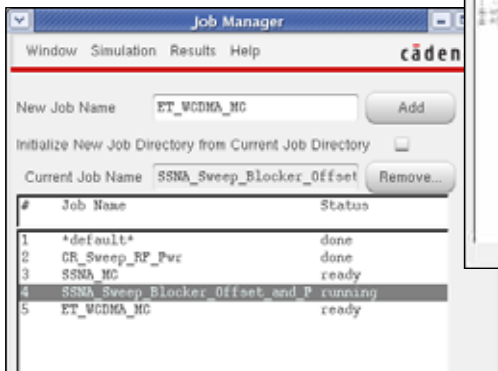
GoldenGate offers a variety of post-processing solutions and functionality beyond support of the Cadence ADE plotting capabilities. The Performance Editor and ADS Data Display include large repositories of built-in expressions. Data Display's flexibility allows designers to create advanced plots (e.g., load-pull contours, gain circles or eye diagrams) or even write their own functions.



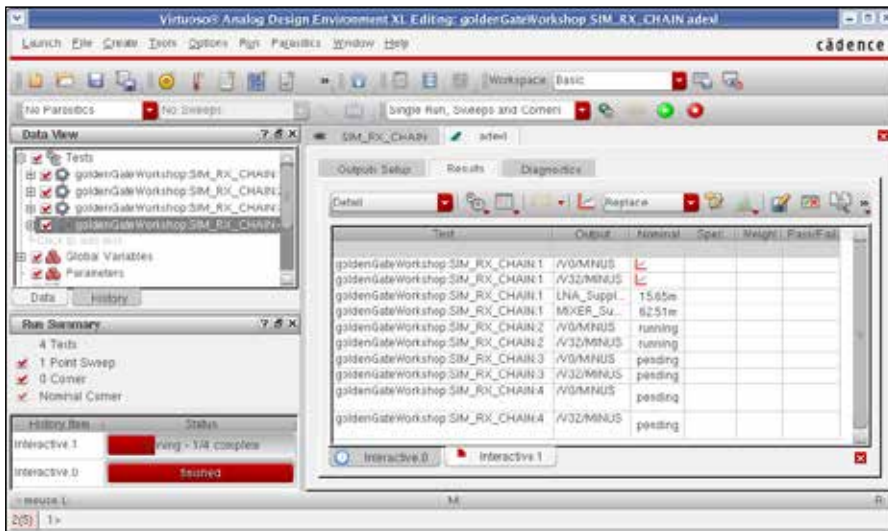
## Automation and Usability Overview

- Choosing Analyses Form – Simplified setup plus direct access to multi-dimensional sweeps, optimization, Monte Carlo, or load-pull
- Job Manager – Launch and monitor multiple ADE states simultaneously
- Sim Manager – Environment beyond ADE to run multiple simulations
  - Monte Carlo
  - PVT corners
  - Parallel sweeps on different machines
- Performance Editor – Easily represent significant circuit metrics
- ADS Data Display – Comprehensive plotting environment for wireless and wireline applications
- Automated Simulations – Calculate EVM, ACPR, gain compression, IPN, and load-pull contours
- Virtuoso Integration – Supports ADE-L and ADE-XL setup and post-processing capabilities
  - Results Browser
  - Calculator
  - Wavescan
  - ViVa
  - Ocean

**Figure 7.** Job Manager allows designers to launch and monitor multiple ADE states at one time.



**Figure 8.** Use the Performance Editor's built-in functions to calculate important figures-of-merit.



**Figure 9.** GoldenGate supports the ADE-XL cockpit and also provides a variety of other tools to set up, launch and analyze parallel verification runs including corners.

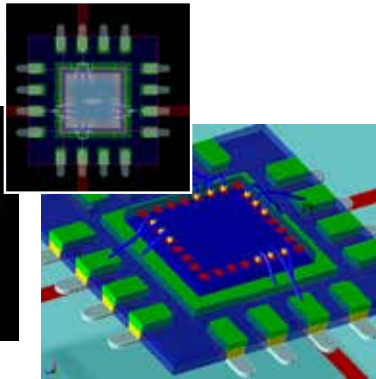
# Optimizing RFICs from RF to mm-Wave

By leveraging the powerful ADS model library, GoldenGate accurately models the effects of integrating microwave components with silicon RFICs within the Cadence Virtuoso environment. Its transient and envelope-transient engines handle very large S-parameter blocks, beyond the frequency-domain, using multi-threaded convolution techniques.

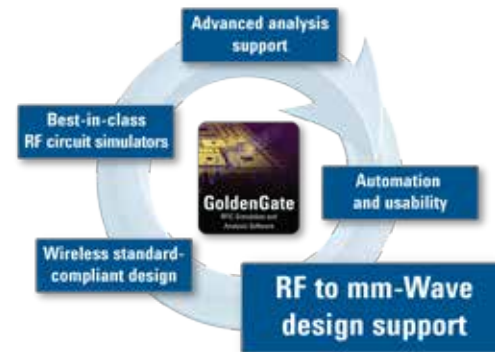


**Figure 10.**  
GoldenGate provides access from within Virtuoso to over 150 passive and distributed elements.

Tight links to the ADS common Open Access database allow designers to include IC content within the complete module design inside ADS or to perform more complete package characterization.



**Figure 11.**  
Perform end-to-end EM verification within the ADS platform and leverage unique capabilities like the ADS QFN Designer.



## RF to mm-Wave Design Overview

- Accurately model the effects of microwave components and parasitic elements on silicon or SiGe chips
- Momentum in Virtuoso enables silicon-accurate 3D planar EM simulation at nanometer scales
- Over 150 ADS models:
  - Lines, bends, tees, and more
  - Bond wires with coupling
  - Other passive elements
- Tight links into ADS provide easy access to go beyond the IC
- ADS Data Display provides extensive plotting options
- Robust convolution engine ensures accurate results when using frequency-dependent components in a transient engine

## Integrated with the Momentum 3D Planar EM Simulator

### Popular 3D planar EM simulator:

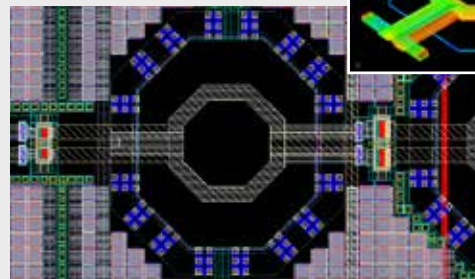
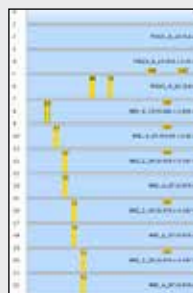
- Advanced NlogN and multi-threading solver algorithms for optimal speed, accuracy and capacity
- Arbitrary polygonal meshing with reduction
- Thick metal analysis of sidewall currents and efficient via modeling account for skin and proximity effects

### Silicon-accurate nanometer RFIC process support:

- Automated layout pre-processing like via array merging
- Dummy metal fill and process scaling support
- Boolean layer operation for native MIM capacitor support

### Cadence Virtuoso integration:

- Seamlessly integrated into Cadence Virtuoso versions 5 and 6
- Broad PDK support for Momentum stack-up files and layout simplification routines
- 3D Viewer with embedded visualization of surface currents or radiated fields
- Broadband SPICE Model generation for efficient time-domain simulation



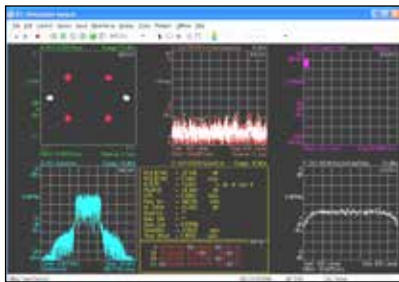
### Going beyond 3D planar:

- Fast, direct bond wire support
- Through Silicon Via modeling support
- Virtuoso export to EMPro for full 3D EM simulations



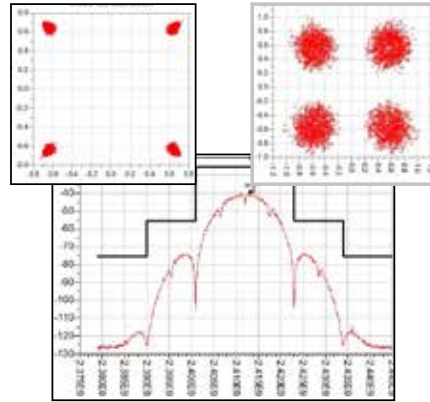
# Assuring System-Level to Circuit-Level Wireless-Standard Compliance

GoldenGate features links to system-level analysis—from architectural exploration up to full co-simulation with data flow engines—for verification of the complex measurements required by today’s wireless standards. These scalable links support various levels of interaction ranging from simple input/output file exchange to powerful integration with Agilent test equipment, ADS Ptolemy and SystemVue.



**Figure 12.** Links with SystemVue provide access to Agilent’s powerful VSA instrument software.

GoldenGate integrates with SystemVue via model exchange or full co-simulation and with ADS Ptolemy through easy-to-use Virtual Test Benches. Such flexibility makes it ideal for a range of uses, whether performing architectural exploration, block-level specification refinement or complete standard-compliant system tests (e.g., EVM or BER).



**Figure 13.** GoldenGate lets designers investigate the impact of blockers on system-level metrics directly in Virtuoso.



## Wireless Standard Compliance Overview

- Full radio functionality verification using Agilent’s extensive standard-compliant wireless libraries through scalable links to test equipment and ESL platforms
- Multiple links with SystemVue
  - Fast Circuit-Envelope (FCE) model export to SystemVue
  - Full GoldenGate – SystemVue co-simulation
- ADS-Ptolemy co-verification through Virtual Test Benches
- Links to Agilent test equipment
  - Stimuli creation through Signal Studio
  - Standard-compliant post-processing in Agilent’s Vector Signal Analyzer (VSA) software
- Avoid overdesigning RFICs
  - Impairments of “as designed” RFICs visible to system engineer
  - Low barrier for RF verification engineer to access standard-compliant modulated signals

## SystemVue Links with RFIC Implementation

### SystemVue overview:

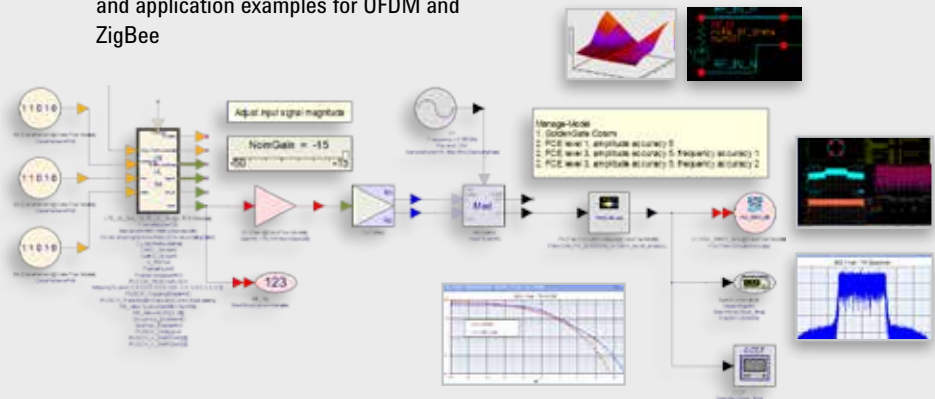
- Complete ESL design environment
- Enables system architects and algorithm developers to innovate wireless and communication systems physical layers (PHYs)

### SystemVue wireless library support:

- Standard-based baseband PHY libraries covering all emerging standards (e.g., LTE, LTE-Advanced, 3G, WiMAX™, WLAN, WPAN, DVB-x2, and Radar)
- Includes full access to reference blocksets and application examples for OFDM and ZigBee

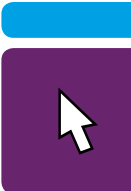
### Links to GoldenGate:

- Complete co-simulation
- FCE model export for accurate modeling of RF impairments in system-level verification





# GoldenGate Product Configuration



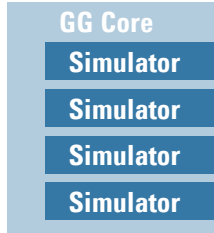
## GoldenGate Core Bundles

**GoldenGate Solo** is the baseline product providing one user one simulation per license. **GoldenGate Quadpack**, for Power Users, offers one user four simulations per license.

Most GoldenGate functionalities are covered by the core bundles with only X-parameter generation and co-simulations requiring additional licenses.

### W2010 GoldenGate Solo

### W2001 GoldenGate Quad



## GoldenGate Add-on Elements

**GoldenGate** offers cost-effective parallel licenses for running massive parallel simulations. It requires either a Solo or Quad license. The **X-parameter Generation** license for GoldenGate is the same as for ADS.

- W2008 GoldenGate Parallel Simulator
- W2305 X-Parameter Generator Element

## GoldenGate Co-Simulation Elements

**GoldenGate** allows co-simulation with the Ptolemy and SystemVue data flow engines, as well as third-party digital simulators, via the following licenses:

- W2304 Verilog-AMS Element
- W2361 Ptolemy Element
- W1464 SystemVue RF System Architect

Note: Please refer to the ADS-Ptolemy and SystemVue product pages for details on numerous wireless libraries.

## Momentum Elements and Bundles

Access to **Momentum** in Virtuoso is enabled through one of the following licenses:

- W2341 Momentum Element
- W2203 ADS Core, Layout, Momentum

## GoldenGate Co-Simulation Elements

**GoldenGate/ADS Combo Bundles** provide flexible access to a variety of Agilent EEs of EDA. **GoldenGate/ADS Combo Bundles** are working in.

- W2218 GoldenGate Solo, ADS Core & Circuit Sim
- W1112 GoldenGate Quad, ADS Core, Circuit Sim, Layout, Momentum, Ptolemy
- W2013 GoldenGate Quad, ADS Core, Circuit Sim, Layout, Momentum, Ptolemy, Matured Wireless Libs



# GoldenGate Platform Operating System Roadmap


Agilent EESof EDA reviews hardware and operating system support on a regular basis and updates the information as it becomes available. Not all product releases are supported on all platforms and/or operating system combinations.

Operating system	RedHat Linux		RedHat Linux		RedHat Linux		Suse Linux		Suse Linux	
	32	64	32	64	32	64	32	64	32	64
Version	RHEL4		RHEL5		RHEL6		SLES9		SLES10	
GoldenGate 2011.02 (4.5.x)	Supported		Supported		Not supported		Supported	Not supported	Supported	Not supported
GoldenGate 2011.10 (4.6.x)	Supported		Supported		Not supported		Supported	Not supported	Supported	Not supported
GoldenGate 2012.10 (4.7.x)	See Note 1	Supported	See Note 1	Supported	See Note 1	Supported	Not supported	Not supported	See Note 1	Supported

Operating system	Suse Linux		Solaris	Cadence
	32	64		
Version	SLES11		10	DFII Versions
GoldenGate 2011.02 (4.5.x)	Not supported		Supported	Supported
GoldenGate 2011.10 (4.6.x)	Not supported		Not supported	Supported
GoldenGate 2012.10 (4.7.x)	See Note 1	Supported	Not supported	Supported

Not 1: Supported on special request in 2012.10 (4.7.0) only. Will be unsupported in update releases.

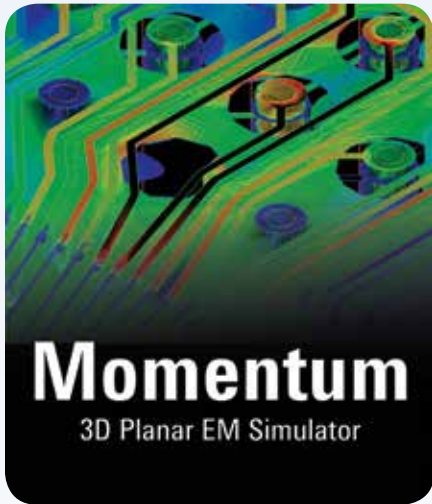
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# Momentum 3D Planar EM Simulator

Momentum G2 is the improved, second generation release of the powerful Momentum 3D planar electromagnetic simulator from Agilent EEs of EDA, the technology and innovation leader in high-frequency high-speed electronic design automation (EDA). Momentum G2 is seamlessly integrated into the Advanced Design System (ADS), the only design simulation platform that enables the co-design of IC, package and board in high-frequency and high-speed applications. It seamlessly integrates system, circuit, and full 3D electromagnetic simulation with Agilent's test instrumentation, resulting in repeatable, first-pass electronic design success.

Momentum G2 is an advanced Method of Moment (MOM) 3D planar electromagnetic simulator. It is enhanced with the latest NlogN and multi-threading solver algorithms to deliver the fastest and highest capacity 3D planar EM simulation possible. It is integrated with ADS and allows electromagnetic simulation along with circuit and system co-simulation or co-optimization to account for proximity or radiation effects of planar structures such as traces or printed antennas. Visualization of the results in terms of surface currents or radiated fields provides insight that helps determine the location of problem areas.

Momentum G2 is paired with Agilent's parameterized passive model generation capability, Advanced Model Composer (AMC). AMC allows you to create EM based custom libraries of planar 3D models such as transitions, discontinuities or passive components not available in the standard simulation libraries because of novel geometries or dimensions beyond the range of validity. AMC libraries retain the accuracy of EM simulation but simulate and optimize at the speed of circuit simulation through smart interpolation across the parameterized EM database.

Momentum Turbo further accelerates the simulation of Momentum G2 by over 6x through parallel computing on up to eight nodes of a compute cluster. This is especially useful for large simulations of complex boards or packages for signal integrity applications.



### The Momentum G2 Element includes:

- Method of Moment (MOM) 3D planar electromagnetic simulator engineered for speed and capacity through advanced NlogN solver technology.
- Multi-threaded 32 or 64-bit simulation using up to eight threads for additional speed.
- Advanced Model Composer to create custom parameterized EM-based component libraries for fast simulation and optimization.
- Visualization of surface currents and planar antenna radiation in 3D space.
- Optimization of parameterized geometries together with circuit and system components.
- Generates layout look-alike components in schematic for error-free hookup with circuit or system components.
- User selectable microwave full-wave or faster RF quasi-static mode EM simulation.
- Adaptive frequency sweep to automatically and quickly find all resonant frequencies across the full simulation frequency band.
- Arbitrary polygonal meshing with adaptive mesh reduction for optimal speed, accuracy, and capacity.
- SI/PI Analyzer with easy setup of net-based, connection-oriented simulations for signal and power integrity
- Frequency-dependent dielectric loss model
- Advanced conductor surface roughness model
- Efficient bond wire model
- Efficient via model

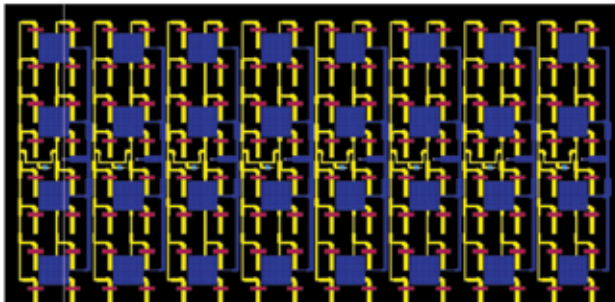
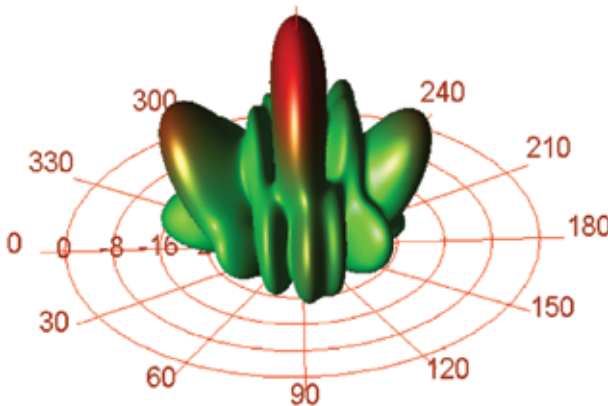
- Thick metal analysis of side wall currents and couplings.
- EM excitation from any circuit or system simulation node.
- Drive Momentum Turbo (E8919) parallel simulations on compute clusters for over 6x additional acceleration.

Momentum G2 requires the Layout Element W2321 as the 2D drawing environment.

### Momentum Turbo Element details:

- Distributes a frequency sweep over up to eight nodes of a computer cluster.
- Requires separate compute cluster management system such as LSF and SunGrid.
- Requires Momentum G2 as the master simulator.

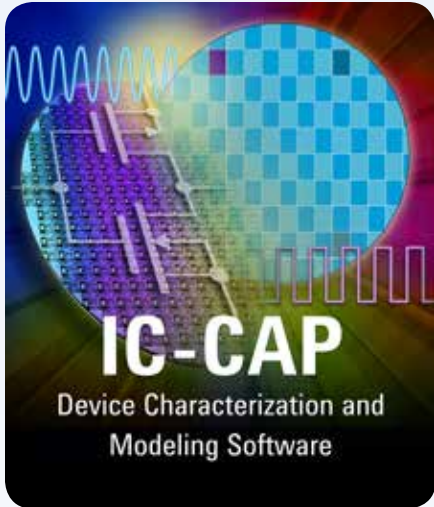
Unlike other planar stand-alone EM simulators with restrictive rectangular grid meshes or socket-based integration with inconsistent user interfaces, Momentum G2 and Momentum Turbo provide the most efficient and fastest 3D planar EM simulation capability, integrated with Advanced Design System through a common design entry, simulation and optimization user interface. This guarantees you to consistently deliver optimal designs at peak efficiency.



Use Momentum Turbo to quickly analyze large planar phased-array antennas through multi-threaded parallel simulation with optimized NlogN algorithm and adaptive frequency sweep.

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[www.agilent.com/find/eesof-momentum](http://www.agilent.com/find/eesof-momentum)  
[www.agilent.com/find/eesof](http://www.agilent.com/find/eesof)





# IC-CAP Device Modeling Software

## A Complete Device Modeling Solution

IC-CAP (Integrated Circuit Characterization and Analysis Program) is the industry standard software for DC and RF semiconductor device characterization and modeling. IC-CAP extracts accurate compact models for use in high speed/digital, analog and power RF applications. IC-CAP offers device engineers and designers a state-of-the-art modeling tool that fills numerous modeling needs, including automated instrument control, data acquisition, parameter extraction, graphical analysis, simulation, optimization, and

statistical analysis. All of these capabilities are combined in a flexible, automated and intuitive software environment for efficient and accurate extraction of active, passive and user-defined devices and circuits. Today's most advanced semiconductor foundries and Integrated Device Manufacturers (IDMs) rely on IC-CAP for modeling silicon CMOS, Bipolar, compound gallium arsenide (GaAs), gallium nitride (GaN), and many other device technologies.

### Key Features

- Open software architecture enables you to achieve maximum accuracy by integrating your own modeling expertise and methodologies, and provides ultimate flexibility to create and automate measurement, extraction and verification procedures.
- Turnkey extraction solutions for industry standard CMOS models, such as BSIM3/BSIM4, PSP, HiSIM, and HiSIM\_HV minimize the learning curve and maximize model accuracy.
- Unique nonlinear high-frequency modeling with Agilent NeuroFET, Root models, high frequency BJT, MESFET, PHEMT, and state-of-the-art VerilogA models.
- Direct links to most commercial simulators (e.g., ADS, HSPICE, Spectre, and ELDO) ensure consistency between extracted models and the simulators used by circuit designers.
- The most advanced and complete on-wafer automated measurement and characterization environment with IC-CAP Wafer Professional.
- Powerful data handling capabilities.

### Complete and Accurate Parameter Extractions for Semiconductor Device Modeling


The semiconductor industry faces continuing challenges to maximize product performance and yield, decrease time-to-market, and reduce production costs. As device geometries get smaller, the need to use accurate models and to control statistical variations in device processing performance becomes ever more important. Typical circuit operating frequencies continue to advance well into the RF and microwave frequency range. Accurate device models are critical to circuit simulation convergence and accuracy. Circuit designers need models that can accurately predict device behaviors at DC, as well as in the RF and microwave regions.

capabilities. For circuit designers, both capabilities are a requirement for determining nominal performance, as well as extreme or worst-case behaviors.


The amount of data measured for device modeling purposes has been increasing exponentially. With modeling measurement taking several hours, or even days, it is important to be as efficient as possible, without compromising measurement accuracy. Measurement control software must work in conjunction with the prober native control software, as well as with each instrument, to allow automated measurements across temperature.

Different process technologies require a variety of models that can be quickly adapted to the unique processes. Modeling software must therefore, be able to provide modeling engineers with the flexibility to modify and extend model parameters beyond those offered by standard models. To optimize performance and control variations, device designers and process engineers need both accurate models and statistical analysis





# IC-CAP Addresses These Challenges and Provides Significant Competitive Advantages to Companies Within the Semiconductor Industry.



IC-CAP modeling software offers modular products so that you can choose precisely the modules required for your particular modeling scenario. Central to the IC-CAP platform is the IC-CAP software environment, which supports graphical analysis, programming via parameter extraction language, and custom model and user interface development. An analysis module is required in most modeling applications for simulation, optimization and interfacing to external simulators. IC-CAP supports an extensive list of measurement instruments including DC, LCRZ and RF.

## The Most advanced Automated Measurement Solution

With IC-CAP Wafer Professional (WaferPro), IC-CAP provides the most advanced solution for device modeling automated measurement. A dedicated test plan environment within the IC-CAP Platform allows the test engineer to measure and post process data using a variety of Agilent and third-party instrumentation.

## Accurate Agilent Proprietary and Industry Standard Models

IC-CAP contains accurate models for building and maintaining up-to-date model libraries. Within a single environment, you can use IC-CAP to automate measurements, simulate device performance, extract data, optimize model parameters, perform statistical analysis, and generate worst-case models. IC-CAP provides extraction routines for industry standard, as well as Agilent proprietary models for diodes, BJT, MOSFET, MESFET, HEMT, noise, thermal models, and others. Extraction modules offer complete DC to RF parameter extraction capabilities. In addition, IC-CAP supports models and extraction routines that are developed by third parties, as well as numerous other simulation software packages, to accommodate a wide range of customer requirements. IC-CAP also supports the use of VerilogA models.

## RF and Microwave Modeling Capabilities

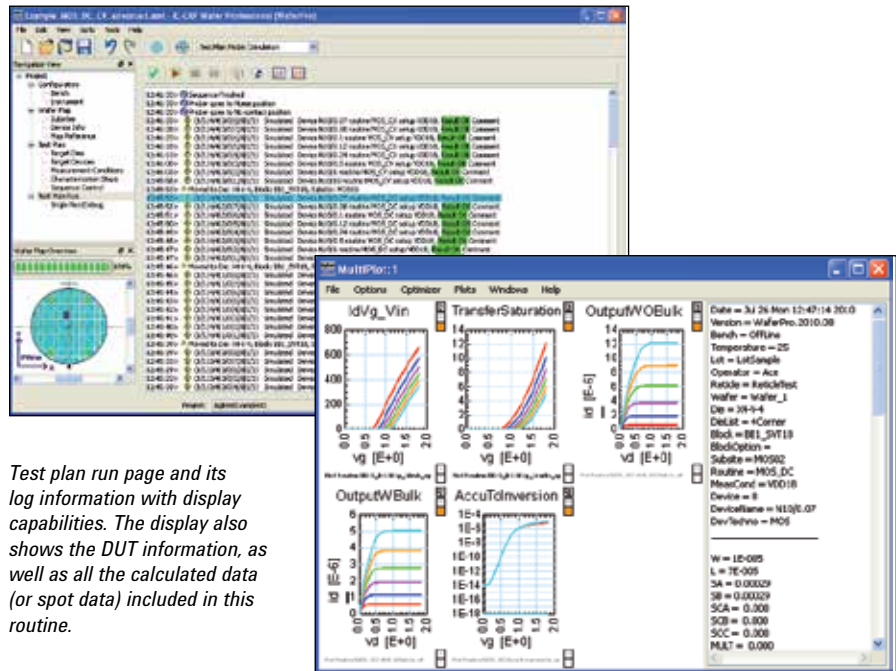
Accurate modeling of RF effects requires reliable measurement data. Building on proven strengths in RF and microwave test and measurement, Agilent EEs of EDA provides configurations for a variety of RF instruments such as the Agilent PNA, PNA-X and ENA series. IC-CAP RF extraction modules for proprietary and industry-standard models include RF-dependent parameter extraction, ensuring your models are suitable for high-frequency circuit simulation.

## The Most Flexible Software Environment

IC-CAP operates in an open and flexible software architecture. Although we provide turnkey modeling solutions for many industry standard and proprietary models, most measurement and extraction algorithms can be modified by the user. Using the IC-CAP parameter extraction language (PEL) or the new Python programming environment, you can define and add your own models or extraction methodologies directly into IC-CAP. When necessary, the IC-CAP open measurement interface allows you to write your own measurement drivers to control instruments. It is also possible to design custom modeling packages for others to use by implementing custom user interface dialogs with IC-CAP GUI Studio.

# Making Measurements With IC-CAP

Successful device modeling requires accurate measured data and a thorough understanding of the complex integration between the measurement hardware and the modeling software. The IC-CAP software is a powerful modeling tool that automates Agilent instruments and systems. Its measurement interface provides turn-key measurement drivers for a variety of single instruments and modeling systems configuration for DC, CV and RF measurements. The measured data is collected and stored in IC-CAP and can be directly used for parameter extractions and optimizations of compact device modeling. See Table 1 on page 8 for a list of supported instrument drivers.



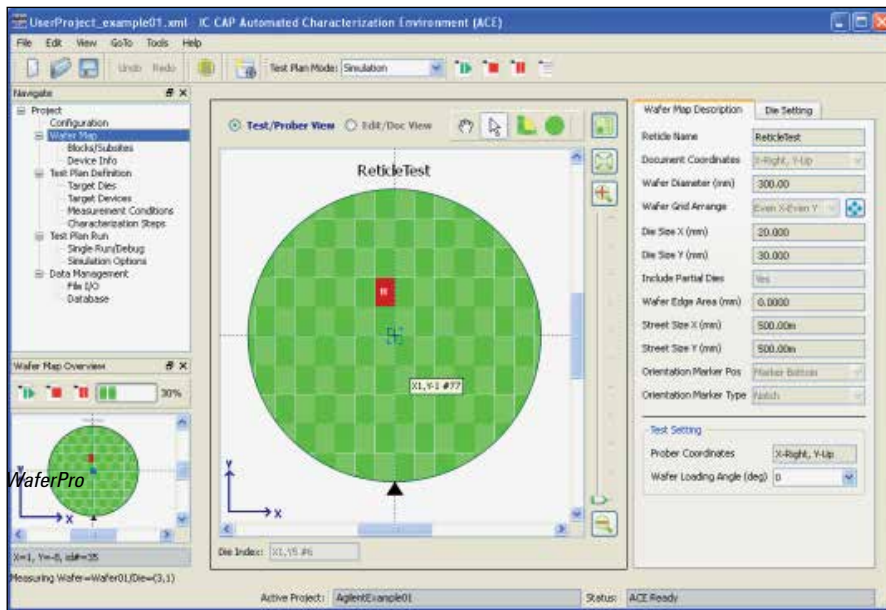
*Test plan run page and its log information with display capabilities. The display also shows the DUT information, as well as all the calculated data (or spot data) included in this routine.*

## IC-CAP Wafer Professional

In addition to the comprehensive built-in instrument library, IC-CAP's newest product addition, WaferPro, provides the ability to drive Agilent measurement equipment (from top bench instruments to parametric testers), as well as third-party probers, switch matrices and thermal chucks to execute efficient, automated on-wafer measurements across temperature. IC-CAP WaferPro is integrated into the IC-CAP platform and takes advantage of its powerful measurement and programming environment to enable a custom library of efficient measurement routines (e.g., adaptive measurement algorithms) that can greatly reduce the overall measurement time. Since the measurement routines are in the IC-CAP environment, either simple or complex post processing (such as calculation of spot measurements or figures of merit, RF de-embedding and direct extraction), can be applied to measured data before data is

saved. Data are saved in either file or SQL Database formats. Sweep data are typically saved to IC-CAP MDM file format, while spot measurements are saved to Excel .csv files. To achieve the most efficient data query and import of high volume measured data, data can be saved into SQL Database file. IC-CAP provides a dedicated API to query and import data back into IC-CAP. See Table 2 on page 8 for a list of probers, switching matrixes and thermal chucks supported by WaferPro.

## Making Measurements With IC-CAP *continued*



### IC-CAP DataPro

After collecting and storing data to file or SQL Database, IC-CAP Data Selection and Processing tool (DataPro) allow users to find the golden/typical die for modeling. DataPro applies statistical analysis on measured data and/or on custom key figures of merit (such as gm, ring oscillator freq. etc.) and based on

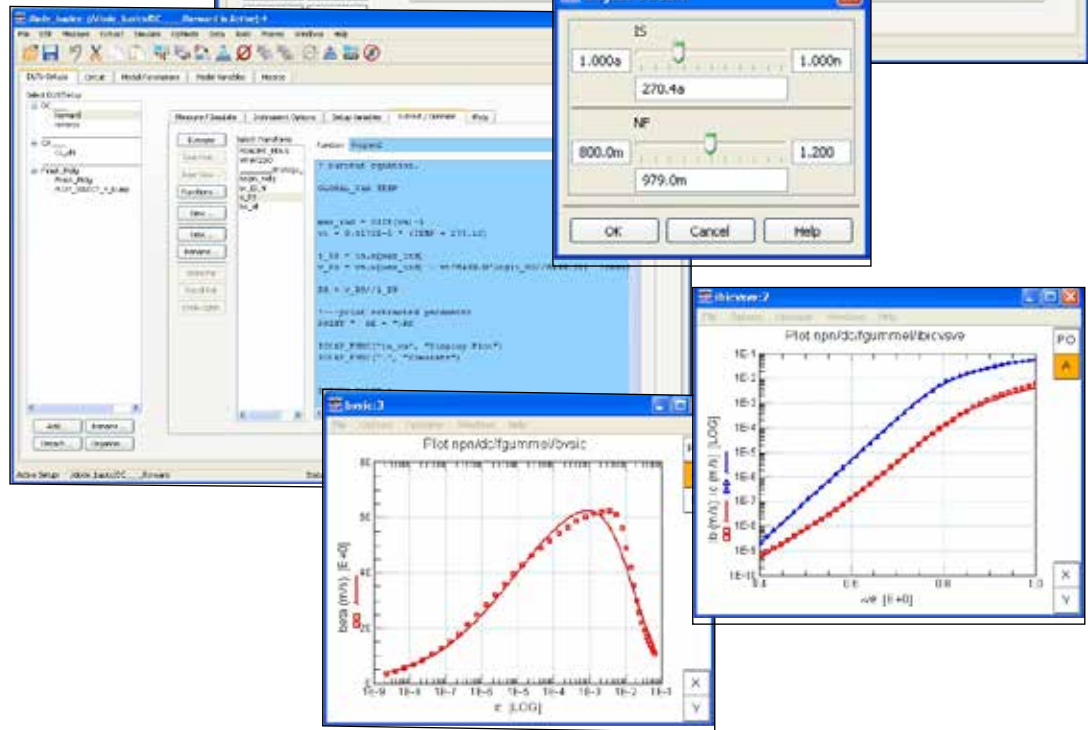
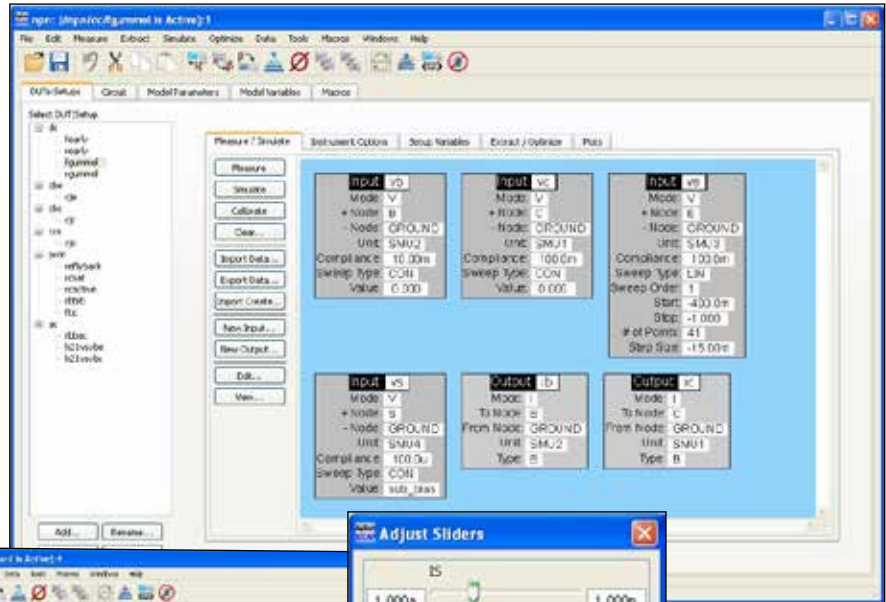
statistical distribution and variances, outliers can be identified and excluded from further analysis. The typical (mean) and corners data are identified and their data can be exported to other tools for target, typical or corner modeling.



# Extracting Models With IC-CAP

A typical modeling procedure involves selecting a model based on the device technology and its final circuit application (e.g., DC, high frequency or both), making the necessary measurements to characterize a device or a set of devices, and then applying an extraction algorithm to calculate the model parameters to minimize discrepancies between measured and simulated data. This last step is achieved by either calculating the parameters using built-in or custom model equations from measured data, or by using tuning or optimization techniques.

IC-CAP provides the platform and tools engineers need to develop their own extraction methodologies. Turnkey modeling extraction packages for users who need to be up and running extracting models by day one are provided by both Agilent and third-party vendors.



## Extracting Models With IC-CAP *continued*

### The IC-CAP Platform Provides the Following Key Tools:

#### Advanced graphical user interface (GUI)

The IC-CAP GUI enables you to create and manage measurement and modeling projects, and read, organize and display data using single or multiple plot window displays. Multiplot windows allow for an unlimited number of plots, easy navigation and zooming capabilities.

PEL and python programming measured or simulated data is organized in IC-CAP Measured or simulated data is organized in IC-CAP units called “setups.” Each setup provides the ability to post-process and display data. Data post processing is done real time using PEL or Python. IC-CAP PEL is a simple to learn language that is similar to HP Basic while Python is a modern, object oriented and very powerful language that maximizes speed and productivity.

These powerful interpreted languages can be used to manipulate data, and create extraction and measurement algorithms within the IC-CAP environment.

Both PEL and Python allow you to interactively develop new models and extraction routines, and modify existing extraction modules, making IC-CAP an extremely open and flexible working environment. code outside the IC-CAP environment.

#### Efficient data management

The IC-CAP Data Manager allows you to import/export data in an ASCII file format. This format, which has extension .mdm, is now recognized as a standard in the device modeling community and many measurement tools export data into this IC-CAP unique format. Data in other file formats such as .csv, .s2p, and .xls can also be written and imported. The new IC-CAP SQL Database link allows saving measured data into SQL Database and later import data back into IC-CAP for modeling.

#### Wide choice of industry standard simulators

Each IC-CAP project can simulate a user-defined netlist, which typically includes the model card and optionally, a subcircuit to be extracted. The IC-CAP simulator engine creates and maintains a Parameter Table based on the model and subcircuit parameters.. IC-CAP includes three SPICE simulators and provides direct links to several external simulators (listed in Table 3). The analysis license includes the ability to simulate linear and transient analysis with the powerful Agilent ADS simulator at no extra charge.

#### Powerful optimizers

IC-CAP contains 13 optimization algorithms. Using a combination of different optimization algorithms can be a real advantage when it comes to enhancing the model’s fit. A large number of parameters can be optimized to a large number of weighted data sets. In addition, to automated optimizers and manual tuners, which can be invoked by PEL, a powerful tool called Plot Optimizer makes dynamic interactive optimization easy. The Plot Optimizer is a user interface that enables you to quickly set up all parameter optimization tasks on the fly. You can open the Plot Optimizer from every IC-CAP plot and automatically load the target and simulated data for a quick tuning and optimization.

#### Automation with macros

Tasks within an extraction, or even entire extraction routines, can be automated with macros. A macro is a single programming routine that executes a series of IC-CAP commands, functions, PEL programs, or calls to the user environment. With macros, extraction techniques developed in R&D can be automated and leveraged to your production areas where minimal user interaction and high productivity are desired.

#### IC-CAP GUI Studio

The GUI Studio adds powerful capabilities for custom graphical user interface development to the highly flexible IC-CAP software environment. IC-CAP Studio provides users with the ability to directly create UIs tailored and customized for specific contexts and users. An engineer uses IC-CAP Studio to develop a user interface that automates and simplifies an entire measurement or extraction process flow. The customized and optimized UI modeling environment can then scan then be shared and exchanged with other colleagues or outside customers who can easily comprehend the flow and quickly perform the necessary measurement and extraction steps.

# Extracting Models With IC-CAP *continued*

## CMOS Modeling

IC-CAP provides powerful turnkey extraction packages for all CMC industry-standard CMOS models: BSIM3, BSIM4, BSIMSOI, PSP, HiSIM, and HiSIM\_HV. The CMOS Extraction packages all share a common architecture, which makes it possible to use the same measured data to extract different CMOS models.

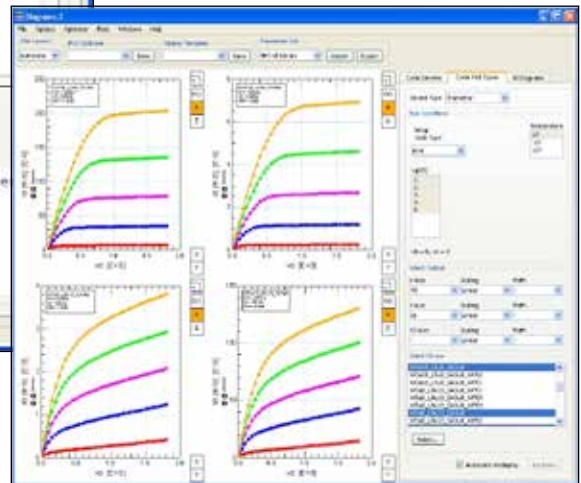
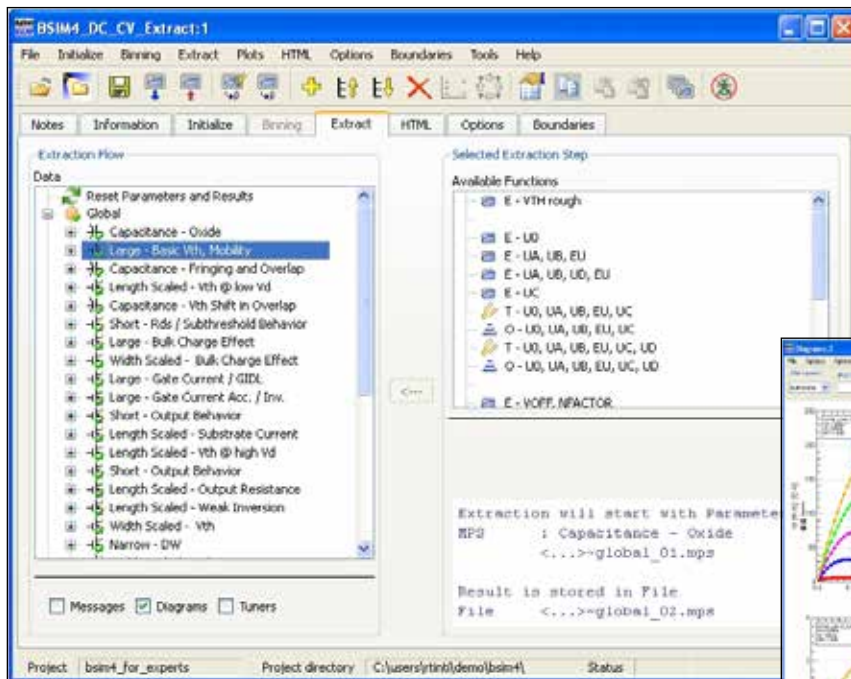
The packages provide the following key features:

- DC, CV and temperature dependent modeling with geometry scaling and binning.
- New user interface makes CMOS modeling easy and convenient.
- Open and flexible extraction methodologies. All packages come with a robust extraction methodology that can be highly customized to adapt to specific process technologies.

- Where fine-tuning and optimization is necessary, the extraction process guides you through predefined optimizer and tuner steps.
- Powerful multiplot data display allows users to create and customize plots, including geometry and temperature scaling plots.
- Automatic generation of complete model documentation in HTML format.
- Automatic failure tracking and reporting during measurement and extraction process.
- Highly accurate RF extraction methodologies with enhanced, scalable RF gate and substrate resistance models.
- Target modeling capabilities. Target modeling allows users to extract a preliminary model based on targets (spot data) or re-center an existing model to match new process specs.
- Corner modeling extraction. Based on process parameters statistical variations and the typical extracted library, this package allows the user to extract corner libraries for a CMOS process. The final library can then be verified for a range of devices, temperatures and bias conditions on all supported simulators.

The CMOS extraction packages are regularly updated to support the latest model versions. Please check the web for updated information on supported versions and simulators.

In addition to the CMC compact models, IC-CAP provides legacy extraction packages for the NXP's MOS Model 9, UCB level 2, 3 models, and the data-based Root MOS Model. Please see Table 4 for a complete list of CMOS modeling packages and their product numbers.



## Extracting Models With IC-CAP *continued*

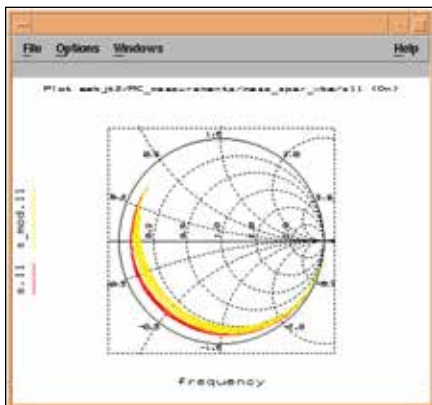
### BJT Modeling

BCTM VBIC BJT Model in blue since it is a product. Model VBIC is an abbreviation for the Vertical Bipolar Inter-Company, a public domain model developed by the Bipolar Circuits and Technology Meeting (BCTM) consortium. It models quasi saturation, avalanche, and substrate effects. The latest release includes self-heating effects.

#### High frequency BJT modeling package

This package includes extractions for the Gummel-Poon model, which has been the industry standard model for BJT devices for decades. The package includes a special version of the GP model extraction, which is well suited for RF applications. Here, CV measurements are replaced with S-parameter measurements, making the junction capacitance extraction more convenient and accurate. Improved methods for extracting ideality, base resistance and reverse early voltage are also included. In addition to the standard GP, the package offers extraction for the Agilent EEBJT2 model, a modified GP model to improve the accuracy of both AC and DC behavior.

This Package also includes the extraction of the MEXTRAM CMC Industry standard bipolar model. Its extraction has been implemented in IC-AP through work jointly carried out by Philips/NXP Research Labs, TU Delft and Agilent EEsof EDA. Extensively used within Philips/NXP, the model has proven to be extremely robust and accurate.



### MESFET Modeling

The High Frequency MESFET and PHEMT Modeling Package includes extractions for the following models:

#### Angelov-GaN model

Modeling Gallium Nitride (GaN) devices is challenging due to the impact of trapping and thermal effects on the device electrical characteristics. Standard GaAs models are not accurate enough for this type of device. The Angelov-GaN model, developed by Prof. I. Angelov at Chalmers University of Technology, is quickly establishing itself as the industry's solution. Agilent's W8533 IC-CAP Angelov-GaN extraction package provides a dedicated software environment that allows users to perform the necessary measurements and extraction of the Angelov-GaN model. Typical DC and network analyzers are supported for making DC and S-parameters measurements and de-embedding. A convenient user interface lets users execute a step-by-step extraction flow to extract the model parameters. A turn-key flow provided in the package enables complete customization. Simulations are performed using Agilent ADS.

#### Curtice, Statz MESFET models

The package includes extraction routines for three popular industry-standard MESFET models: the Curtice quadratic, Curtice cubic and Statz (Raytheon). The differences between the three models are in the empirical relationships that describe the DC and AC characteristics of the device. IC-CAP extracts the model parameters from a combination of DC and S-parameter measurements.

### EEFET3/EEHEMT1 models

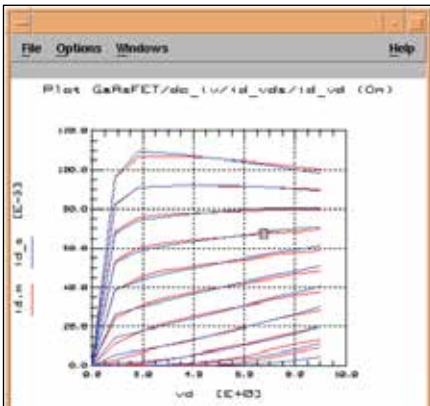
These are empirical, nonlinear models for general GaAs FET or HEMT applications, including large-signal, three-terminal IC and packaged devices. They accurately model DC and bias-dependent S-parameters, time delay, sub-threshold current, and dispersion of  $R_{ds}$ . Also included is the drain current model based on Agilent EEsof EDA original equations and advanced models for  $C_{gs}$  and  $C_{gd}$ , including transcapacitance effects. Static self-heating effects in drain current are also taken into account. The modules provide highly automated parameter extraction techniques with package parasitics extracted automatically. HEMTs are similar to MESFETs, but with one distinguishing difference in the behavior of  $G_m$  versus  $V_{gs}$ . EEHEMT1 is a superset of EEFET3 and has a set of analytic functions for modeling the  $G_m$  compression of a HEMT.

## Extracting Models With IC-CAP *continued*

### Root MESFET/HEMT Models

These are process and technology independent, data-based models for large-signal, three-terminal applications. They model nonlinearities of GaAs FETs and HEMTs, including frequency dispersion. These models are scalable for varying geometries and feature automated data acquisition as well as high-speed model generation.

The Root MESFET/HEMT model creator is included in the Root Models generator software license.



### Agilent NeuroFET Model

The NeuroFET is a measurement-based model that uses Artificial Neural Network (ANN) to describe the device measured states, charges and currents. The ANN is made up of simple, interconnected functions, called neurons, with weighted connections. These functions are infinitely differentiable, providing a good distortion behavior and they also work well on the boundaries and outside the measured regions resulting to a better convergence behavior in the simulator.

Advantages of the NeuroFET:

- Usable for all bias condition (even  $V_{ds} \leq 0$  as may happen in switches)
- Improved DC and RF convergence, compared to table-based models
- Improved distortion simulation at low amplitude, compared to table-based models
- More accurate S-parameters vs. bias
- Better PAE simulation
- The model is general and works for HEMT, FET

The IC-CAP NeuroFET Extraction package controls the necessary data acquisition (DC and S-parameters measurements that are necessary to extract the model), includes some basic deembedding). The ANN training is then accomplished through a specific error optimization procedure. The output model file can then be simulated via ADS within the IC-CAP environment. The model can be verified by comparison to the original data or if available, to other measured data, such as non linear measurements (not provided).

### Third-Party Models

#### Open framework and coding provides flexible development environment

The unique open and flexible IC-CAP framework enables third-parties to design and develop models and related extraction packages that work as add-ons in the IC-CAP environment. This is possible thanks to the IC-CAP GUI Studio and PEL capabilities. IC-CAP GUI Studio and PEL enable third parties to design and implement custom extraction packages, with specific user interfaces and related extraction routines.

BSIMSOI3v2 and EKV 2.6 Extraction Packages are available from ADMOS  
[www.admos.de](http://www.admos.de)

HiCUM and VBIC Extraction Toolkits are available from X-MOD  
[www.xmodtech.com](http://www.xmodtech.com)

# Product Configuration

## The IC-CAP Product Includes 5 Major Components:

- IC-CAP Core Environment
- IC-CAP Simulation and Analysis
- IC-CAP Instrument Connectivity
- IC-CAP Wafer Professional (WaferPro)
- IC-CAP Data Processing and selection (DataPro)

IC-CAP is available as a complete Modeling Platform Bundle or as individual modules to give you the flexibility of choosing the exact modeling capabilities you need. In addition to the suite, the IC-CAP WaferPro Measurement Bundle is also now available and provides all the capabilities to make on-wafer automated measurements. In addition to these 5 base components, turnkey extraction modules are available (see Table 4).

### Agilent W8500 IC-CAP Modeling Platform Bundle

The Agilent W8500 modeling suite provides the basic tools you need to start measuring and modeling devices and circuits. The modeling suite consists of the following components:

- W8501 Core environment
- W8502 Simulation and Analysis
- W8520 Instrument Connectivity

The modeling bundle lets you set up custom extraction routines, measure data using instrument drivers, analyze results, perform simulations, and optimize extracted parameters. Hundreds of modeling examples are available at no extra cost as a starting points to build and design your own extraction toolkits.

### Agilent W8511 IC-CAP Wafer Professional Measurement Bundle

The W8511 provides the ability to run automated DC, CV and RF measurement on-wafer using WaferPro. It includes the following components:

- W8501 Core Environment
- W8520 Instrument Connectivity
- W8510 IC-CAP Wafer Professional (WaferPro)

IC-CAP WaferPro works within, and in conjunction with, the IC-CAP platform and lets users create and execute automated test plans. See the W8510 WaferPro section below for more details. Note that this bundle does not include the W8502 Simulation and Analysis which must be added to run the test plan in simulation mode.

### Agilent W8501 IC-CAP Core Environment

The W8501 is the IC-CAP framework. It allows you to perform mathematical transforms, customize plots, write and Python macros, create extraction routines using PEL, and write user-defined functions using the C programming language. An extensive function library is included. Also included is IC-CAP Studio, which allows you to develop custom graphical user interfaces.

The W8501 also provides a new PEL API to query IC-CAP SQL Database and quickly import selected data into the IC-CAP environment.

### Agilent W8502 Analysis Module

The analysis module is the IC-CAP simulator engine that provides the ability to simulate device or circuit performance using the default simulator ADS, the built-in SPICE simulators or by linking to a wide range of other external simulators. The ability to simulate linear (DC, CV and AC) and transient simulation with ADS is included. Links to other (SPICE) simulators can be added using the IC-CAP open simulator interface. Please refer to the web for a complete list of supported simulator links and their versions.

### Agilent W8520 Instrument Connectivity

Measurement drivers allow IC-CAP to control and automate the measurement instruments required to characterize your device or circuit. Table 1 lists the wide range of Agilent instruments that are supported with built-in drivers. All C-V, DC, AC, Time Domain and Noise instrument drivers are included in this license.

In addition to turnkey built-in drivers, users can add links to other instruments using the IC-CAP open measurement interface or using PEL to send write/read commands to any instrument connected to the GPIB bus.



## Product Configuration

### Agilent W8510 Wafer Professional (WaferPro)

IC-CAP WaferPro is a powerful test plan suite specifically designed for on-wafer DC/CV and RF measurements. WaferPro allows users to create and execute automated test plans by managing wafer map and device information, measurement routines and conditions. WaferPro includes several built-in measurement routines, yet is flexible enough for users to customize the measurement and calculation of post-processed data. Measured sweep data is saved to IC-CAP MDM files, while spot measurements are conveniently saved to .csv files (MS Excel Comma Limited Files). For high volume applications, WaferPro can also save data to IC-CAP SQL Database. The SQL Database has been specifically designed to store on-wafer measurement data and has a built-in flexibility to accommodate a variety of custom data. SQLite and MySQL are supported. WaferPro supports all IC-CAP instruments, including the Agilent Parametric 407x and 408x Parametric Test Systems and a variety of industry-standard fully and semi-automated probers. See Table 2 on page 8 for a list of Probers, Switch Matrixes and thermal Chucks supported by WaferPro.

### Agilent W8503 Data Selection and Processing

IC-CAP Data Selection and Processing tool (DataPro) is a separate toolkit that applies statistical analysis on selected measured data and based on statistical distribution and variances, identifies golden and corner dies. DataPro can import data directly from WaferPro (either file-based or database) or from simple IC-CAP project format. Statistical analysis can be applied to either sweep or spot type of measurements.





## Product Configuration – Measurement Drivers



Table 1. Supported measurement drivers in IC-CAP W8520 Instrument Connectivity licence.

W8520 Instrument Connectivity Drivers	Instrument supported
LCRZ measurement drivers	Agilent E4991A impedance analyzer Agilent E4980A Precision LCR meter Agilent 4194 impedance analyzer <sup>1</sup> Agilent 4271 1 MHz dig. capacitance meter <sup>1</sup> Agilent 4275 multi-frequency LCR meter <sup>1</sup> Agilent 4280 2 MHz capacitance meter <sup>1</sup> Agilent 4284 precision LCR meter Agilent 4285 precision LCR meter Agilent 4294A precision LCR meter
DC measurement drivers	Agilent B1500A Semiconductor Device Analyzer Agilent B1505A Power Device Analyzer/ Curve Tracer Agilent E5270 Series parameter analyzer: E5270B , E5272A, and E5273A Agilent B2900 Series Precision Source/Measure Unit Agilent 4156x semiconductor parameter analyzer Agilent 4140 pA meter/DC voltage source <sup>1</sup> Agilent 4141 DC source/monitor <sup>1</sup> Agilent 4142x modular DC source/monitor Agilent 4145x semiconductor parameter analyzer <sup>1</sup> Agilent 4155x semiconductor parameter analyzer
AC measurement drivers	Agilent PNA Series Agilent PNA-X Series (S-parameters, gain compression and intermodulation) Agilent ENA Series Agilent E8356A 10 MHz to 3 GHz <sup>1</sup> Agilent E8357A 10 MHz to 6 GHz <sup>1</sup> Agilent E8358A 10 MHz to 9 GHz <sup>1</sup> Agilent N5250A Millimeter-wave PNA, 10 MHz to 110 GHz Agilent 3577 network analyzer <sup>1</sup> Agilent 8510 network analyzer Agilent 8702 network analyzer <sup>1</sup> Agilent 8719 network analyzer Agilent 8720 network analyzer Agilent 8722 network analyzer Agilent 8753 network analyzer
Time domain measurement drivers	Agilent 54121T-54124T digitizing oscilloscopes <sup>1</sup> Agilent 54510 digitizing oscilloscopes <sup>1</sup> Agilent 54750 TDR oscilloscope <sup>1</sup> Agilent 8130 pulse generator <sup>1</sup> Agilent 8131 pulse generator <sup>1</sup>
Noise measurement drivers	Agilent 35670A dynamic signal analyzer





Table 2a. WaferPro supported Probers

Wafer Probers - Tokyo Electron (TEL)
Cascade PS21
Cascade Summit 12K
Suss PA300
Accretech UF3000
Tokyo Electron (TEL) P8 and P12

Table 2b. Switching Matrix

Switching Matrix
Agilent HP4070 1
Keithley 707/708
Agilent HP4080 1
Agilent B2200

Table 2c. Thermal Controllers

Thermal Controllers
Accretech
Cascade Summit
Cascade PS21
Temptronic TP032A
Tokyo Electron (TEL)

Table 3. Supported Simulators

Simulator	Company	Licences Required
ADS (hpeesofsim)	Agilent EESof	Included in the W8502 Analysis Module are linear, transient and Verilog-A simulations)
MMSIM (SPECTRE)	Cadence	License required
HSPICE	Synopsys	License required
SABER	Synopsys	License required
ELDO	Mentor Graphics	License required
Spice3, spice2, PSPICE, HSPICE	Various	Still included W8502 Analysis Module, however, these simulators are no longer actively supported (legacy simulators)

## Product Configuration – Extraction Packages

### IC-CAP extraction modules and model generators

The modules listed in Table 4 include all of the measurement setups, mathematical transforms, extraction routines, and documentation required to perform extractions with IC-CAP.

Table 4. Extra packages

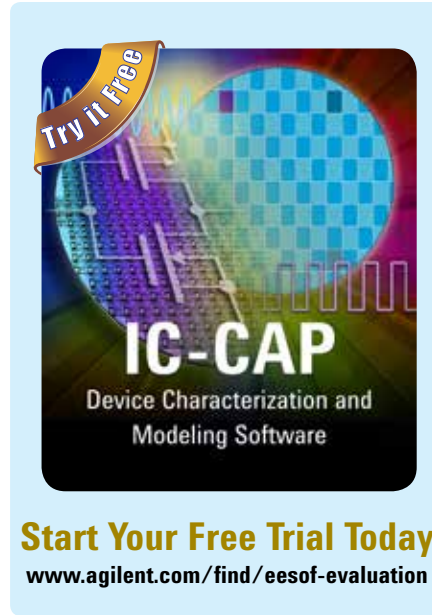
Device Technology	Product Number	Model Extraction Package
CMOS	W8553	UCB BSIM3, Target and Corner Modeling
	W8554	UCB BSIM4, Target and Corner Modeling
	W8550	PSP Extraction, Target and Corner Modeling
	W8551	HiSIM2 Extraction, Target and Corner Modeling
	W8555	HiSIM_HV Extraction, Target and Corner Modeling
	W8560	HiSIM2 & HiSIM_HV, Target and Corner Modeling
	W8552	UCB BSIMSOI, Target and Corner Modeling
	W8532	Agilent Root MOS
BJT & HBT	W8541	Agilent HBT
	W8540	High Frequency BJT (EEBJT2) Gummel-Poon & MEXTRAM
	W8542	VBIC
MESFET & HEMT	W8530	Curtice, Cubic Curtice, Quadratic Statz-Pucel (Raytheon) EEFFET3, EEHEMT1
	W8531	NeuroFET
	W8532	Agilent Root MESFET/HEMT
	W8533	Angelov-GaN
Diode	W8532	Agilent Root diode

## Licensed software

Each IC-CAP module is available in two license versions:

1. A node-locked version allowing the software to execute only on a single workstation or a PC.
2. A network-licensed version for execution on multiple workstations or PCs on a network, allowing various workgroups to share the software.

Both licenses use the FLEXlm license management system. These two license options can be mixed freely. For example, a node-locked license of an instrument driver package can reside on a workstation or PC in the lab, while a network license for the analysis module can be shared among a group of engineers for data analysis.



**Try it Free**

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Device Characterization and Modeling Software

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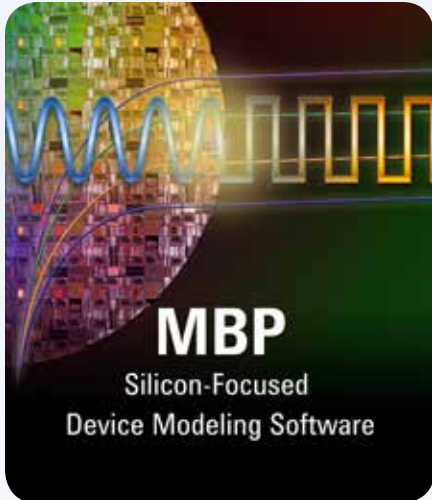
## IC-CAP Platform Support Roadmap

Agilent EEsof EDA reviews hardware and operating system support on a regular basis and updates the information as it becomes available. Not all product releases are supported on all platforms and/or operating system combinations.

Operating system	Windows	Windows	Windows	Windows	RedHat Linux	RedHat Linux	RedHat Linux	Solaris	Solaris
32/64 bit	32	32	32	32	32/64	32/64	32/64	32/64	32/64
Version	XP SP2	XP SP3	Vista	7 Enterprise	RHEL4	RHEL5	RHEL6	10	11iPA-RISC
IC-CAP 2011	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Supported	Dropped
IC-CAP 2012.01	Not supported	Supported	Supported	Supported	Supported	Supported	Not supported	Supported	Dropped
IC-CAP 2013.01	Supported	Supported	Not supported	Supported	Supported	Supported	Not supported	Dropped	Dropped
IC-CAP 2013.XX	Supported	Supported	Not supported	Supported	Not supported	Supported	Supported	Dropped	Dropped
IC-CAP 2014	Not supported	Not supported	Not supported	Supported	Not supported	Supported <sup>4</sup>	Supported <sup>4</sup>	Dropped	Dropped

*Starting with IC-CAP 2013, we will no longer release IC-CAP on the Solaris (SUN OS) Platform.*

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# Model Builder Program (MBP)

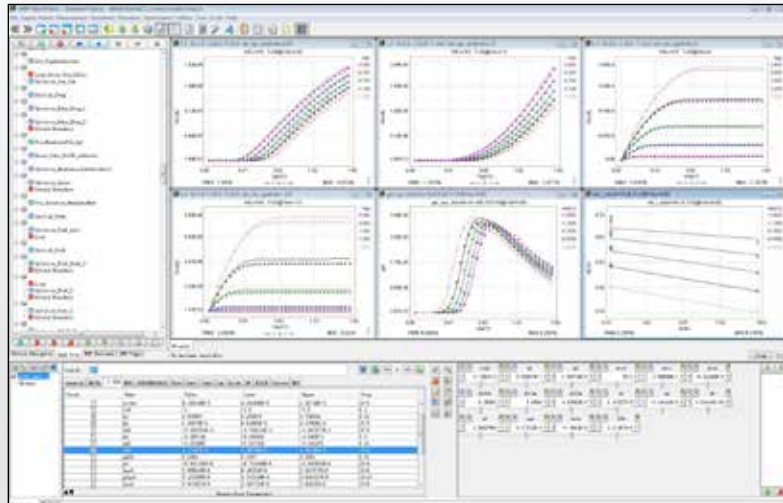
## Complete Silicon Turnkey Device Modeling Platform

Model Builder Program (MBP) is a complete modeling solution that integrates device simulation, model parameter extraction and optimization. MBP supports all popular compact models including the latest BSIM-CMG, BSIM-IMG, and BSIM6 for DC, AC and RF applications. MBP also supports the macro (subcircuit) model and Verilog-A model.

MBP provides automatic extraction. The open interface enables optimization flow customization, device target definition and the ability to define GUI operations. With its superior optimization technology and advanced features, MBP provides the most comprehensive, accurate and efficient modeling solutions, especially for silicon devices.

### Key Features

- Fully automated BSIM3, BSIM4, BSIMSOI, PSP, HiSIM2, HiSIM\_HV, GP, VBIC, and MEXTRAM model extraction and optimization flows
- Support for the latest BSIM6 versions and advanced MGFET models (BSIM-CMG and BSIM-IMG)
- Open interface enables users to customize modeling flows and internal functions using scripting
- Built-in macro model optimization capabilities incorporating HV and layout effect modeling
- The industry's most complete variation modeling solution with both the BPV and PCA based variation model automated extraction flows
- Reliability package to support industrial MOSRA and TMI aging models
- Equipped with superior optimization technology balancing speed and accuracy
- Excellent usability with a friendly user interface, efficient model file management and model library support
- Integrated modeling data flow across Agilent's device modeling platform



The main GUI of MBP



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## MBP Specifications

OS and Simulators	Models	Supported Operations	
Windows and Linux HSPICE and Spectre	MOSFET	<ul style="list-style-type: none"> <li>Automatic model extraction and optimization</li> <li>Macro model optimization</li> <li>Intermediate Variables such as (Vth vs. L, Idsat vs. T, etc) optimization</li> <li>Model extraction based on Design Spec (No IV/CV is needed)</li> <li>Model library import, optimization and export</li> <li>Both internal and external simulators available</li> <li>Model tweaking for both global and binning model</li> <li>Model file management and conversion between simulator formats</li> <li>Scripting capability</li> </ul>	
			<ul style="list-style-type: none"> <li>BSIM3</li> <li>BSIM4</li> <li>BSIM6</li> <li>PSP</li> <li>HiSIM2</li> <li>HiSIM_HV</li> </ul>
	SOI		<ul style="list-style-type: none"> <li>BSIMSOI3</li> <li>BSIMSOI4</li> </ul>
	MGFET		<ul style="list-style-type: none"> <li>BSIM-CMG</li> <li>BSIM-IMG</li> </ul>
	BJT		<ul style="list-style-type: none"> <li>GP (Gummel Poon)</li> <li>VBIC</li> <li>MEXTRAM</li> <li>HiCUM</li> </ul>
	Diode (level 1,3) and Juncap2		
	Resistor (R2 and R3)		
	Inductor		
	MOSVAR and MIM capacitor		
	JFET		
Sub-circuit modeling	<ul style="list-style-type: none"> <li>High voltage</li> <li>Layout effect</li> <li>RF model</li> </ul>		
Monte-Carlo model	<ul style="list-style-type: none"> <li>Process variation</li> <li>Mismatch</li> </ul>		

### Optimizer

- Superior optimization technology balancing speed and accuracy
- Internal optimizer supports the optimization of general models, subcircuit models, Design Spec, and Intermediate variables

### Task Tree

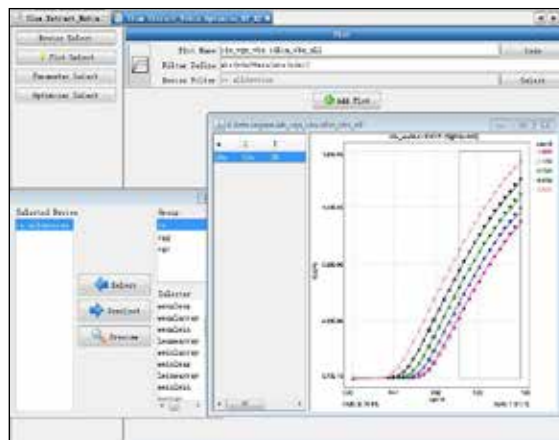
- Automatic extraction and optimization steps are implemented for all industry standard models
- Customize the extraction and optimization flow using simple Java programming

### GUI-based Custom Model Extraction Environment

- Fully interactive GUI to adjust an automated model extraction flow
- No coding or compilation is required
- Extraction step adjustment supported for data/region selection, model parameters, graphs and optimizer settings

### Macro Modeling

- MBP provides the fastest optimization speed for macro modeling
- Equipped with predefined templates for high voltage device modeling and layout effect modeling such as STI and WPE
- Enables optimization of macro variables and model parameters together at fast speed
- Supports all popular simulator formats



## IMV and DP

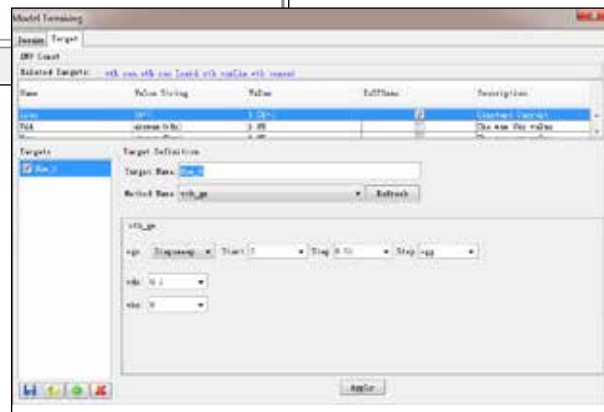
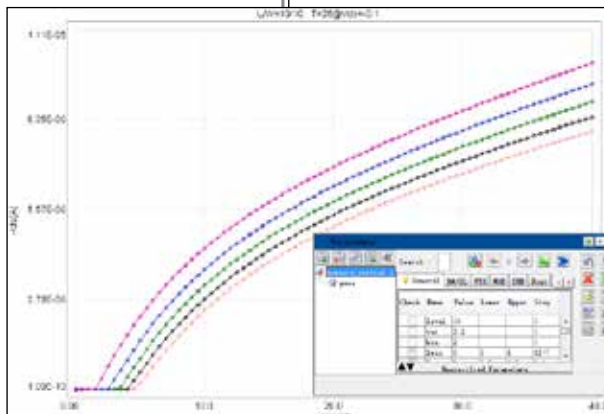
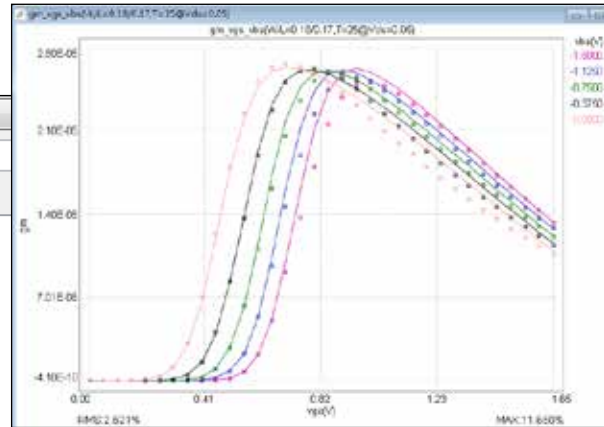
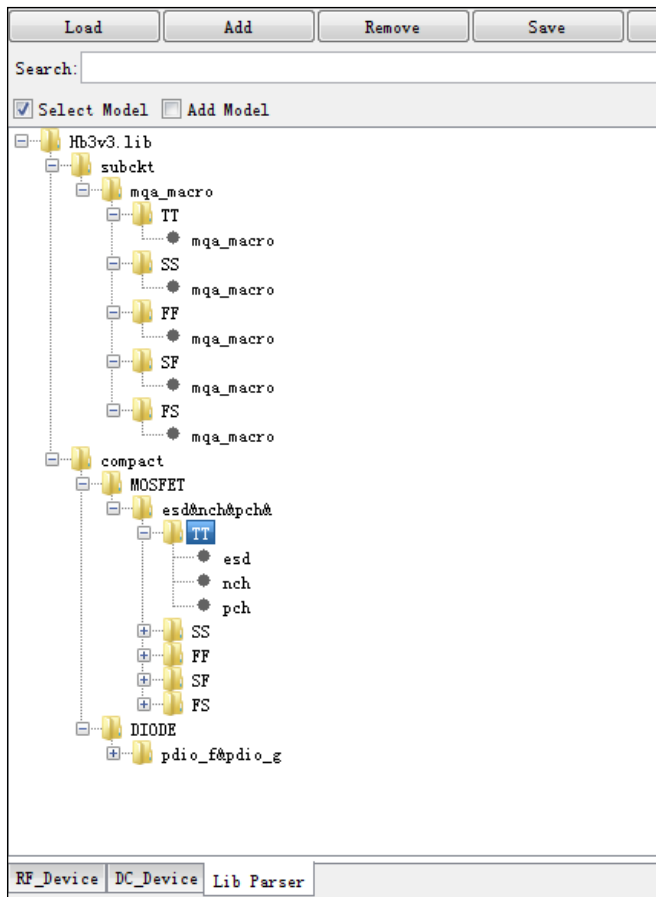
- MBP enables users to optimize on Vth, ldsat, loff or any device targets of user defined vs. W/L/T. For example, NLX, DVT0, and DVT1 can be optimized directly on Vth vs. L curve at different Vbs
- MBP enables loading Device Parameter data and using it as a target to tweak model parameters

## Model Tweaking

- The smart model tweaking module enables easy model retargeting according to new specifications
- Supports both the model card and model library
- Supports tweaking binning model library without damaging the continuity

## MBP Script

- MBP script enables GUI operation application, plot manipulation, data re-organization, IMV target definition, and extraction flow customization



## Lib Parser

- Directly import and export model libraries of HSPICE and Spectre format
- Load and tune model libraries directly

## Best Usability

- Flexible and simple device navigation
- Equation viewer enables easy debugging of model issues on the fly
- Easy parameter selection and optimization
- Model comparison function enables in-progress model comparison during model extraction process
- Error monitor provides global view of fitting error.
- Data checking module guarantees data integrity
- MBP's internal functions can be customized, such as math transforms and RMS definitions through the open interface

Threshold voltage

$$V_{th} = VTH0 + (K1 \sqrt{\Phi_s} - V_{bseff} - K1 \sqrt{\Phi_s}) \sqrt{1 + \frac{LPEB}{L_{eff}}} - K2 \cdot V_{bseff}$$

P1  
 $3.7238E-1 = 3.73069E-1 + (5.05957E-1 \times \sqrt{8.66981E-1} - 0 - 5.05957E-1 \times \sqrt{8.66981E-1})$

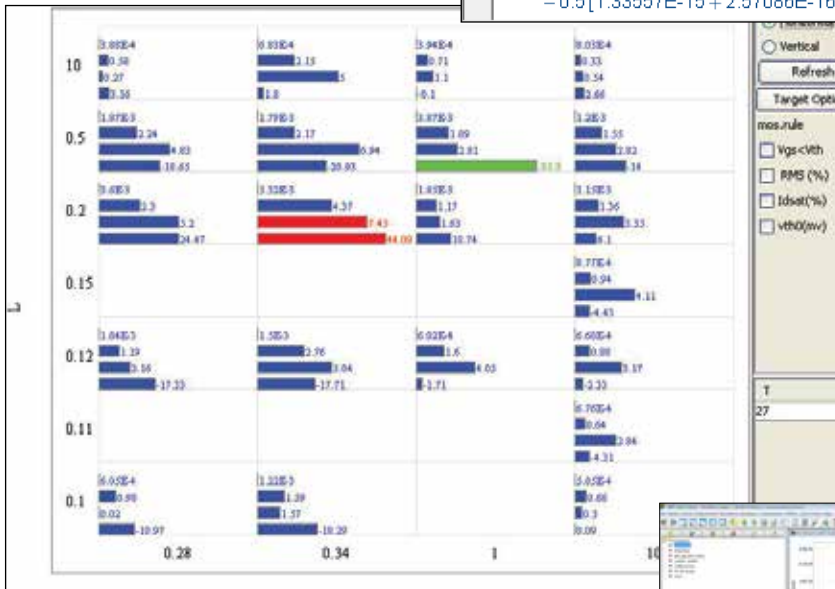
P1  
 $3.7238E-1 = 3.73069E-1 + (4.71106E-1 - 4.71106E-1) \times 1.00134E0 - 0 + 4.54364E-4 + (-9.85866E-3) - 0.5[1.33557E-15 + 2.57086E-16] \times 1.85935E-1 - 1.71391E-15 \div 4.71137E-2$

P2  
 $3.72346E-1 = 3.73069E-1 + (5.05957E-1 \times \sqrt{8.66981E-1} - 0 - 5.05957E-1 \times \sqrt{8.66981E-1})$

P2  
 $3.72346E-1 = 3.73069E-1 + (4.71106E-1 - 4.71106E-1) \times 1.00134E0 - 0 + 4.54364E-4 + (-9.85866E-3) - 0.5[1.33557E-15 + 2.57086E-16] \times 1.85935E-1 - 1.71391E-15 \div 4.94894E-2$

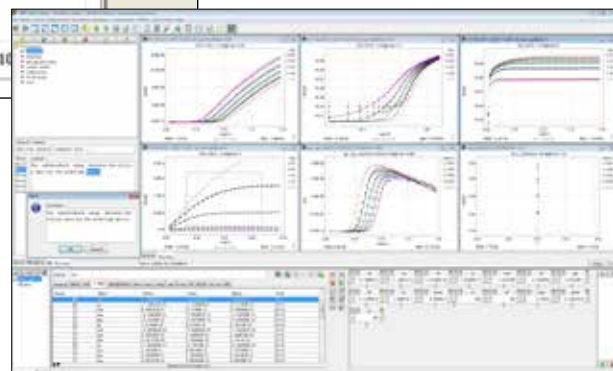
P3  
 $3.72312E-1 = 3.73069E-1 + (5.05957E-1 \times \sqrt{8.66981E-1} - 0 - 5.05957E-1 \times \sqrt{8.66981E-1})$

P3  
 $3.72312E-1 = 3.73069E-1 + (4.71106E-1 - 4.71106E-1) \times 1.00134E0 - 0 + 4.54364E-4 + (-9.85866E-3) - 0.5[1.33557E-15 + 2.57086E-16] \times 1.85935E-1$



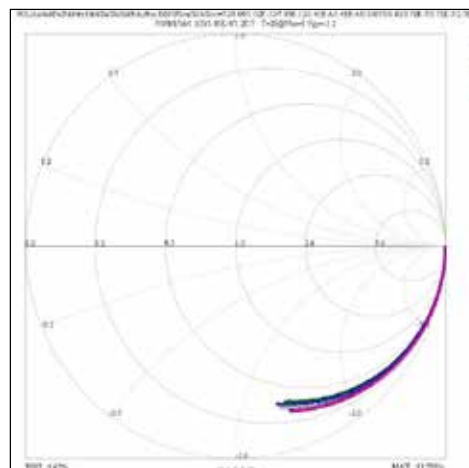
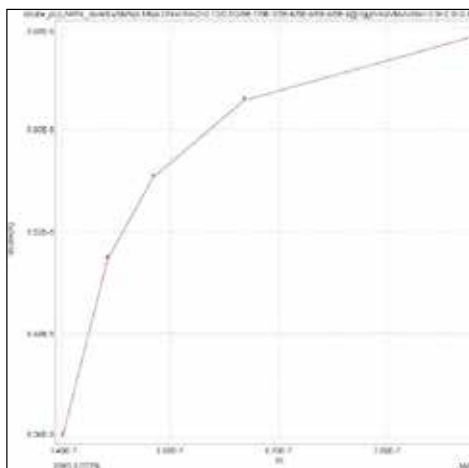
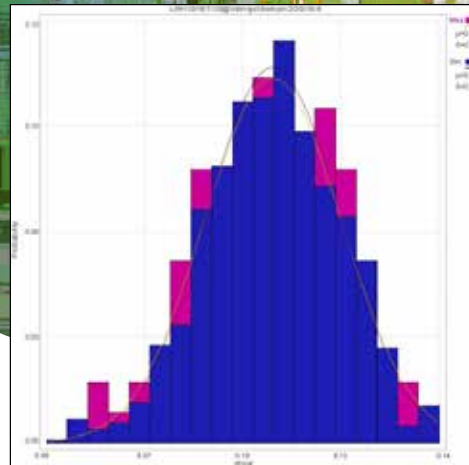
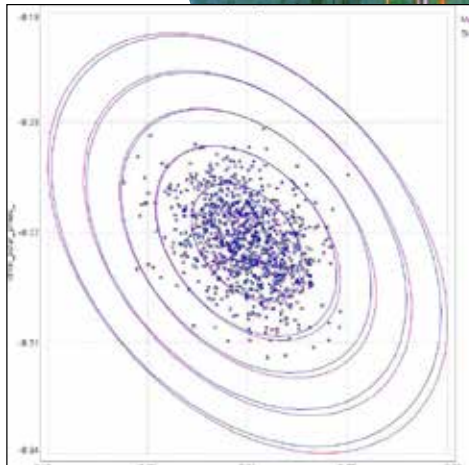
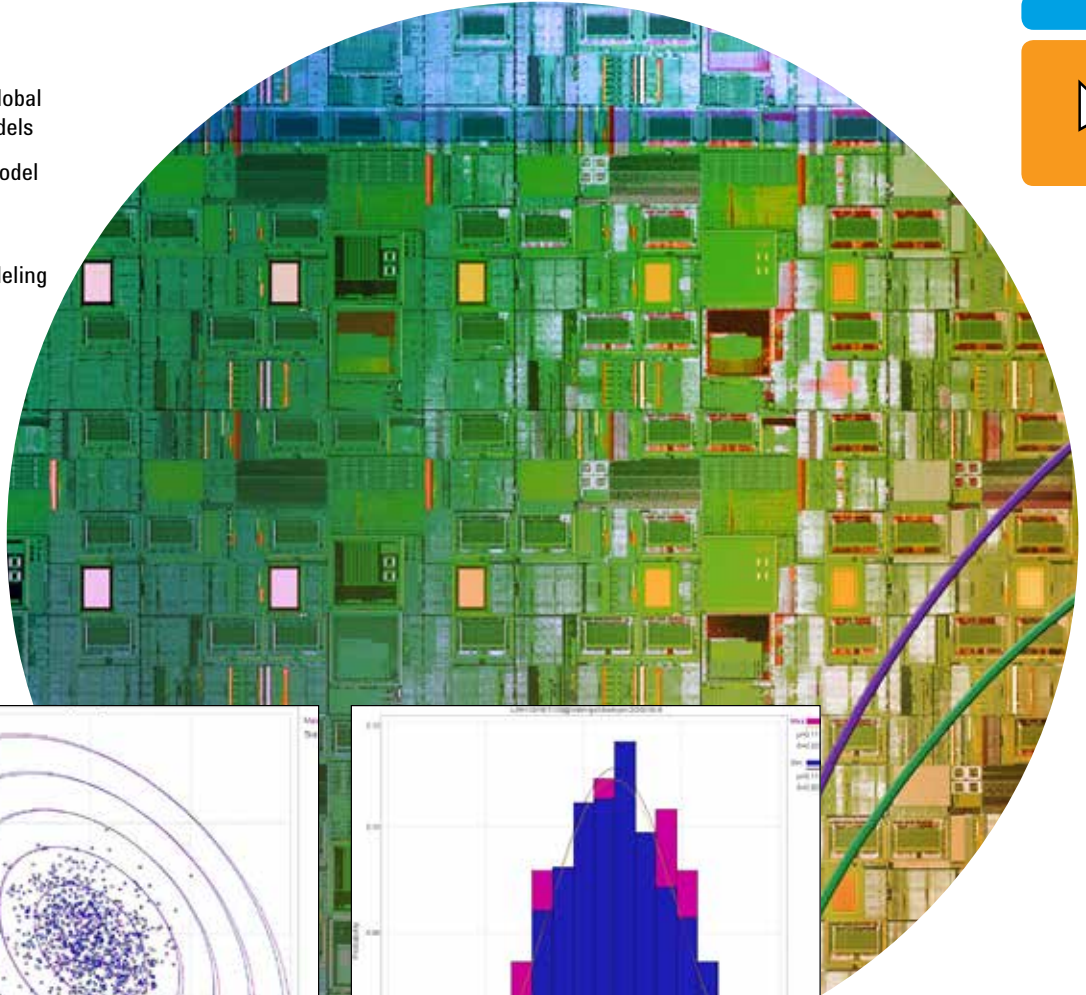
## Modeling SOP Enablement

- Allows to set model extraction policies
- Improves efficiency in team collaboration during model extraction iterations
- Allows for standardized model review process
- Helps the modeling team improve customer communication and shorten project turn-around time



## Comprehensive Modeling Package

- Monte-Carlo model support for global variation and local mismatch models
- Complete PCA-based variation model extraction flow to support N/P correlation
- RF module enables accurate modeling of devices for RF applications
- State-of-the-art subcircuit modeling approach for high voltage device modeling
- Stress (layout dependent effects) module enables parallel simulation
- Circuit-based model extraction base on the figure of merits of benchmark circuit (ex. RO stage delay, dynamic power, leakage power)



## Product Structure

**Model Builder Program (MBP)** is a one-stop solution that provides both automation and flexibility for silicon device modeling.

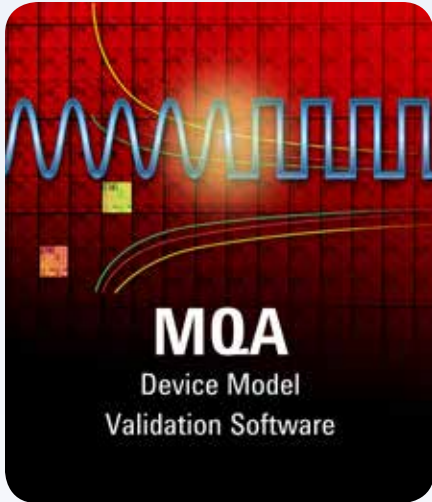
**Core Environment** includes all the necessary components for data loading, model simulation, parameter extraction, model generation and reporting. Simulation can be performed by either the internal engine or external simulators (e.g. HSPICE, Spectre). The extraction

packages for BSIM3, BSIM4, GP bipolar, resistor, capacitor, diode, JFET and macro model are included by default.

- W8601EP/ET Model Builder Program Core Environment

Models	Description	Modules
CMOS Modeling	General extraction package for the BSIMSOI, PSP, HiSIM2, HiSIM_HV, BSIM6, BSIM-CMG, BSIM-IMG, and Level 66 HVMOS models.	<ul style="list-style-type: none"> <li>• W8602EP/ET MBP BSIMSOI Model Generation Software</li> <li>• W8603EP/ET MBP PSP Model Generation Software</li> <li>• W8604EP/ET MBP HiSIM2 Model Generation Software</li> <li>• W8605EP/ET MBP HiSIM_HV Model Generation Software</li> <li>• W8615EP/ET MBP BSIM6 Model Generation Software</li> <li>• W8616EP/ET MBP BSIM-CMG Model Generation Software</li> <li>• W8617EP/ET MBP BSIM-IMG Model Generation Software</li> <li>• W8618EP/ET MBP MOS66 Model Generation Software</li> </ul>
BJT Modeling	General extraction package for the VBIC, HICUM, and MEXTRAM bipolar models.	<ul style="list-style-type: none"> <li>• W8606EP/ET MBP VBIC Model Generation Software</li> <li>• W8607EP/ET MBP HICUM Model Generation Software</li> <li>• W8609EP/ET MBP MEXTRAM Module Generation Software</li> </ul>
CMOS and BJT Modeling	General extraction package for the popular CMOS (PSP, BSIMSOI, HiSIM2, and HiSIM_HV) and BJT (VBIC, HICUM, and MEXTRAM) models.	<ul style="list-style-type: none"> <li>• W8624EP/ET MBP Silicon Model Extraction Package</li> </ul>
Stress Modeling	Complete flow for layout-dependent stress effect model generation and optimization.	<ul style="list-style-type: none"> <li>• W8611EP/ET MBP Stress Model Extraction Software</li> </ul>
RF Modeling	RF parameter extraction packages for MOSFETs, BJTs, capacitors, diodes, inductors and resistors	<ul style="list-style-type: none"> <li>• W8612EP/ET MBP RF Model Extraction Software</li> </ul>
Verilog-A Model Support	Support for Verilog-A model loading and tweaking	<ul style="list-style-type: none"> <li>• W8613EP/ET MBP Verilog-A Model Support Software</li> </ul>
Reliability Modeling	Extraction packages for MOS Reliability Analysis (MOSRA) and TSMC Model Interface (TMI) aging model generation	<ul style="list-style-type: none"> <li>• W8614EP/ET MBP Reliability Module MOSRA - TMI Software</li> </ul>
Statistical Modeling	Statistical and mismatch model extraction packages for MOSFETs, BJTs, resistors and capacitors.	<ul style="list-style-type: none"> <li>• W8620EP/ET MBP Statistical Model Generation Software</li> </ul>
Viewer Module	A graphical user interface (GUI) that enables you to view model simulation results and generate reports.	<ul style="list-style-type: none"> <li>• W8619EP/ET MBP Viewer Software</li> </ul>





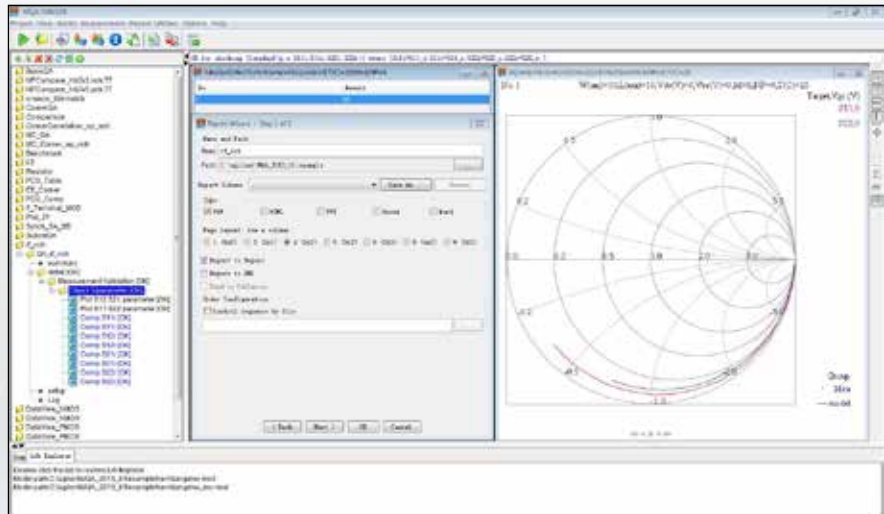
# Model Quality Assurance (MQA)

## Industry Standard SPICE Model Signoff and Acceptance Platform

Model Quality Assurance (MQA) is a collection of comprehensive SPICE model validation procedures, interfaces and utilities that provide the ability to thoroughly check SPICE model quality and automate QA and reporting procedures for both silicon and III-V technologies. Given today's deep submicron process technologies and increasing model complexities, validating SPICE models is a significant challenge and can be very time consuming. However, SPICE modeling engineers and model users still want the models to be thoroughly checked and the model characteristics to be easily obtained. MQA satisfies this critical industry requirement by rigorously checking the model quality, plotting model characteristics, and customizing the output targets with its comprehensive checking rules while employing easy-to-use interfaces and utilities.

### Key Features

- Integrates a comprehensive set of rules to ensure SPICE model quality while overlaying measurements to simulation results
- Fast results and turn-key operations
- Rules and checking functions are flexible and fully customizable; supports Perl and TCL as Scripted-rule
- Quick measurement QA, model comparison and corner model QA
- Powerful plotting functions and utilities
- Open interface enables flexible support of models, simulators and checking routines
- Powerful report generation
- Easy sharing of model information
- Powerful equation viewer
- Model Tweaking function
- Quick check syntax and link in library
- Support of Load Sharing Facility (LSF)
- Complete parallelism support on different levels: simulator level, rule level and project level
- Supports QA projects using different versions of a simulator
- Native support of IC-CAP mdm data and MySQL/SQLite database



The main GUI of MQA

# MQA

MQA is a unique software product developed to solve the following problems:

<p>SPICE model validation is becoming increasingly important and significantly more difficult. This is because:</p>	<p>Model validation encompasses much more than just overlaying the measurement results to simulation results of the model</p>	<p>Model validation should be automatic and customizable</p>
<ul style="list-style-type: none"> <li>As the channel scales down, second-order physical effects make device modeling more complex.</li> <li>Macro models and binning models have been used extensively. Validating these models is much trickier than global models.</li> <li>A natural consequence of foundry business requires a better way of communicating between modeling engineers and designers. Designers often need to check whether the models satisfy their requirements for some specific circuit design needs.</li> <li>What appears to be a good model for certain application can turn out to be a terrible one for other applications.</li> </ul>	<ul style="list-style-type: none"> <li>After all, measurement is limited to the number of physical devices in the test structure and the resolution of instruments.</li> <li>Model validation should include the following checks:             <ul style="list-style-type: none"> <li>Accuracy of the model (compare with measurement)</li> <li>Completeness of the model (have all the major physical effects important to the design been modeled?)</li> <li>Mathematical robustness of the model (no kink in first and second derivative)</li> <li>Capability of the model to predict physical trends (very important in design optimization)</li> <li>Model simulation results using benchmark circuits</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>The quality can only be guaranteed after fixed QA procedures are in place.</li> <li>Manually validating a model is nearly impossible considering the large number of checks for different device sizes, temperatures, and bias conditions.</li> <li>Model reporting is often time-consuming and should be expedited.</li> <li>Model QA routines often change with model modifications; a customizable QA platform is needed.</li> <li>QA tools should help users debug model issues and point out potential problems.</li> </ul>

## Model QA

Check model completeness

- Are  $I_{sub}$ ,  $I_{gate}$ ,  $1/f$  noise, etc. covered in the model?

Model parameter range check

Check the trend of model characteristics

- Verify that the trends of  $I_{dsat}$ ,  $V_{th}$ ,  $G_m$ ,  $G_{ds}$ , vs  $W/L/T$  are correct

Check numerical robustness of the model

- Any kinks in  $G_m$  or  $G_{ds}$  curves?

Check bin continuity

Check benchmark circuit performance

- Ring Oscillators for example
- Users can input their own circuits

Calculate point simulation value according to user's specification

Check model accuracy with the measurements

Compare model performance of different models, such as:

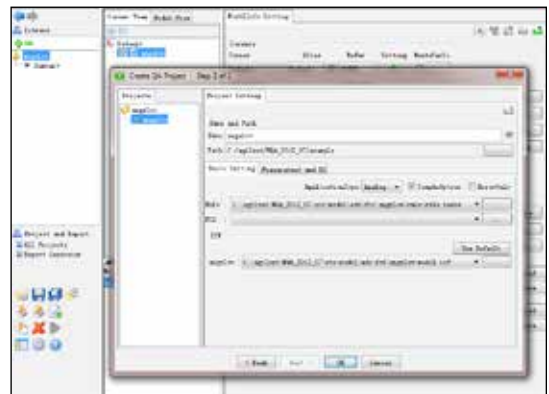
- HSPICE model with Spectre model
- BSIM3v3 model with BSIM4 model
- Macro model with its core model
- Check and compare different process corners

Check analog/RF design targets using special routines

- Smith and polar chart plotting

Check the trend of network parameters

- Load-pull and harmonic balance simulation and plotting
- Thermal noise characterization



## Measurement QA

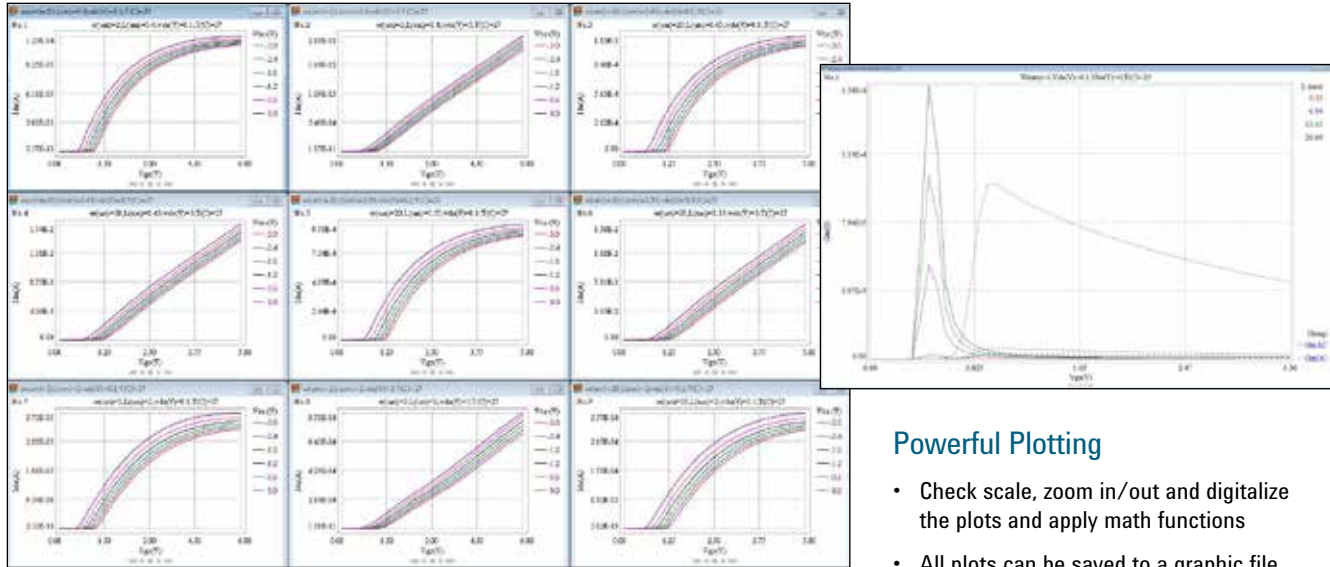
- Quick display of measured device geometry and bias condition
- Plot measured device characteristics
- Check the trend of  $I_{dsat} \cdot L$ ,  $I_{dsat}/W$  and  $V_{th}$  to detect bad measurements

## Customizable Checking Rules

- Customize checking criteria and define sweeping range
- Add your own rules and check new targets

## Scripted-rule (Perl and TCL), supports

- Cascaded analysis (AC, DC)
- Easily plug in existing user scripts
- Flexible/complex data calculation
- Create user-defined tables freely



## Powerful Model Reporting

MQA is equipped with a powerful report module:

- Easily output all desired tables and plots to a report format of the user's choice (i.e. Word, Excel, PowerPoint, HTML, PDF or OpenOffice)
- Easily output all existing MQA plots to a report.
- Report content is rule driven and user customizable

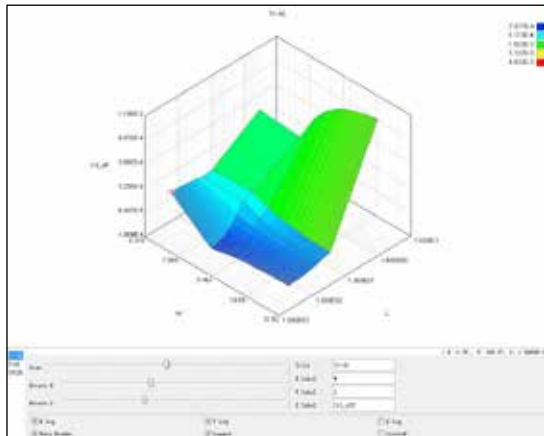
## Open Interface

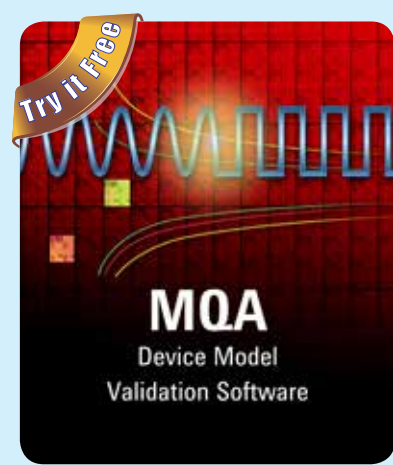
MQA provides an open interface for advanced users to utilize their own math functions and data process functions. The open interface can also be used to create a SPICE interface for in-house simulators.

- Implement more math functions with little programming
- Customize/add RMS functions of your preference
- MQA's Java interface has its own engine that enables users to edit, compile and debug their own programs.

## Powerful Plotting

- Check scale, zoom in/out and digitalize the plots and apply math functions
- All plots can be saved to a graphic file
- The curves can also be displayed in a table
- Plot Smith Chart, polar chart and noise figure
- Easily view the previously generated results
- Generate 3D plots





**MQA**  
Device Model  
Validation Software

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## Equation Viewer

This feature outputs model equations and automatically calculates the parameter values, OP values and intermediate variable values in the equations. This helps users to easily debug model issues and saves effort compared to calculating these values using other means (such as Excel).

The Equation Viewer window displays the following equation for Threshold voltage:

$$V_{th} = V_{th0} + K_{1a}\sqrt{\Phi_s - V_{bseff}} - K_{2a}V_{bseff} + K_{1a}\sqrt{\left(1 + \frac{700}{L_{eff}}\right)\sqrt{\Phi_s} + (K_3 + K_{2b}V_{bseff})\frac{T_{eff}}{W_{eff} - W_0} - \Phi_s} - D_{VT0w}\left(\exp\left(-D_{VT1w}\frac{W_{eff}L_{eff}}{2f_{sw}}\right) + 2\exp\left(-D_{VT1w}\frac{W_{eff}L_{eff}}{f_{sw}}\right)\right)(V_{bi} - \Phi_s) - D_{VT0}\left(\exp\left(-D_{VT1}\frac{L_{eff}}{2f}\right) + 2\exp\left(-D_{VT1}\frac{L_{eff}}{f}\right)\right)(V_{bi} - \Phi_s)$$

The interface also shows a graph of current (I) versus voltage (V) and a table of parameter values.

## Model Tweaking

MQA enables you to tweak the model parameters and see the impact on the model performance. This allows for model adjustment in order to adapt to a specific use.

## Lib Explorer

Lib Explorer is an efficient way to clearly present and setup model libraries; all along, making QA work easy and straightforward. Within Lib Explorer, libraries are presented in a tree hierarchy, model configuration and settings can be done quickly, QA and Report projects are globally organized, and all effort can be saved, reused and accumulated.

## Support ET

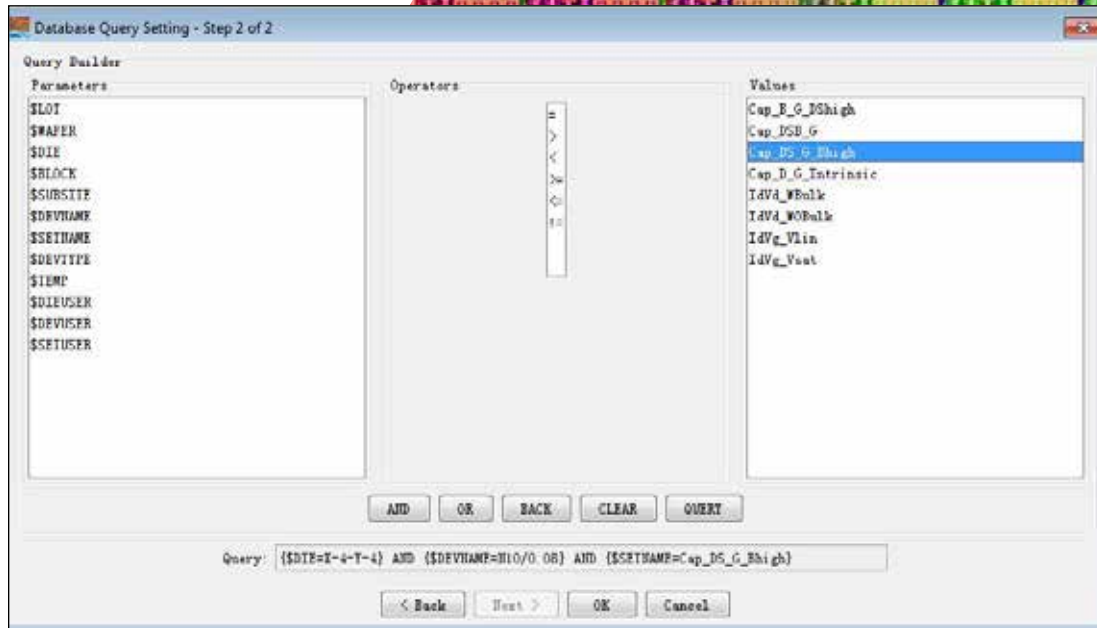
MQA enables you to load ET/PCM data and compare it with your simulation. The ET data can be overlaid with many simulation results in MQA.

## Lib Test

The Lib Test option in MQA provides you with a convenient method to do the quick checking on model libraries in batch. You can easily find the errors in the library file such as syntax errors, undefined parameters, incorrect links, etc. Lib Test supports all types of device models and can recognize HSPICE and Spectre libraries automatically.

## Integrated Data Flow

MQA supports IC-CAP mdm data files and MySQL/SQLite database natively. It enables a seamless data flow across Agilent's device modeling platform.



## Speedup by Parallelism Support on Multiple Levels

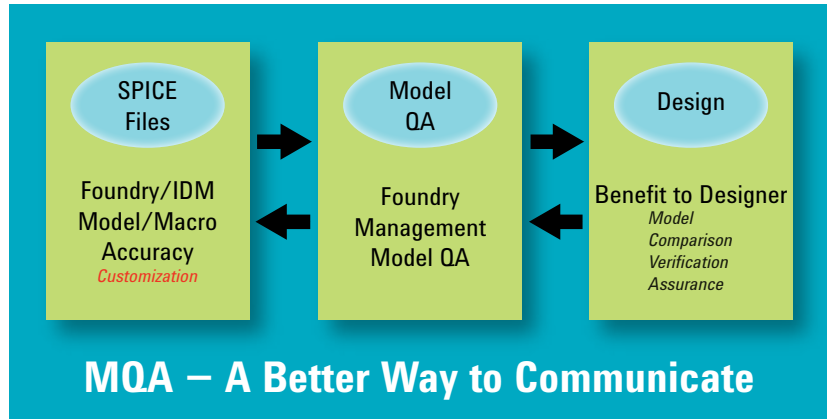
MQA supports LSF and multiple level parallelism including simulator level, rule level and project level. It maximizes the model QA speed by allowing the user to efficiently utilize the hardware and license resources.

## Differentiation Factors of MQA Versus Other Tools

- MQA is driven by built-in rules established with state of the art modeling expertise.
- The simulation is not limited by a measurement data point, so the validation can check very fine bias steps to validate the quality of the model.
- The built-in check function makes automatic model validation possible.
- Special functions are available to check the binning model and macro model.
- MQA can also check measurements.
- Different benchmark circuits for different design applications.
- Customizable validation criteria for different design applications.
- Special functions to check different process corners.
- Easily add user-specified rules with open user interface.
- MQA enables you to make plots that are not available in other modeling tools.

## Supported Model Formats and Platforms

- Global model, binning model, and macro (sub-circuit) model
- III-V FETs, HEMTs and HBTs
- MOSFETs (BSIM3v3, BSIM4, BSIM6, BSIMSOI, PSP, HiSIM2, HiSIM\_HV), MGFETs (BSIM-CMG and BSIM-IMG), diodes, BJTs (GP, VBIC, HiCUM, MEXTRAM), and passive devices (resistors, capacitors and inductors)
- Support platforms: Windows and Linux
- Supported simulators includes ADS, GoldenGate, HSPICE, Spectre, Eldo, FineSim, SmartSpice, AFS, SPICE3, etc.



## Product Structure

**Model Quality Assurance (MQA)** provides the complete solution and framework to fabless design companies, IDMs, and foundries for SPICE model library validation, comparison, and documentation.

### Core Environment

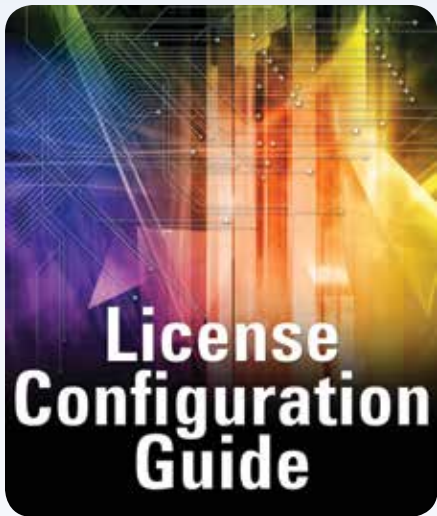
The main platform to perform SPICE model validation, comparison and documentation. MQA Core supports the validation of popular models (e.g. BSIM3, BSIM4, BJTs, diodes and passive devices) and the simu-

lation of mainstream simulators (e.g. ADS, GoldenGate, HSPICE, Spectre, Eldo, FineSim, SmartSpice, AFS, SPICE3, etc.).

- W8644BP/BT Model Quality Assurance Core Environment

Models	Description	Modules
CMOS Model Validation	The products listed below enable BSIMSOI, PSP, HiSIM2, HiSIM_HV, BSIM6, BSIM-CMG, BSIM-IMG model QA with comprehensive built-in rules.	<ul style="list-style-type: none"> <li>• W8632EP/ET MQA BSIMSOI Model Support</li> <li>• W8633EP/ET MQA PSP Model Support Software</li> <li>• W8634EP/ET MQA HiSIM2 Model Support Software</li> <li>• W8635EP/ET MQA HiSIM_HV Model Support Software</li> <li>• W8637EP/ET MQA BSIM6 Model Support Software</li> <li>• W8638EP/ET MQA BSIM-CMG Model Support Software</li> <li>• W8639EP/ET MQA BSIM-IMG Model Support Software</li> </ul>
BJT Model Validation	The product listed below enables VBIC model QA with comprehensive built-in rules.	<ul style="list-style-type: none"> <li>• W8636EP/ET MQA VBIC Model Support Software</li> </ul>
Script Interface	The products listed below supports TCL & Perl script-based rule files.	<ul style="list-style-type: none"> <li>• W8641EP/ET MQA TCL Support Software</li> <li>• W8642EP/ET MQA Perl Support Software</li> </ul>
Viewer Module	The product listed below enables results viewing and report generation of plots and tables generated by MQA.	<ul style="list-style-type: none"> <li>• W8640EP/ET MQA Viewer Site Software</li> </ul>

For more information on Agilent EEsosf EDA's Model Quality Assurance (MQA), visit: [www.agilent.com/find/eesof-mqa](http://www.agilent.com/find/eesof-mqa)



# License Configuration Guide

This guide provides an overview of licensing options which can help a user choose the appropriate product and license configuration that best suits their needs.

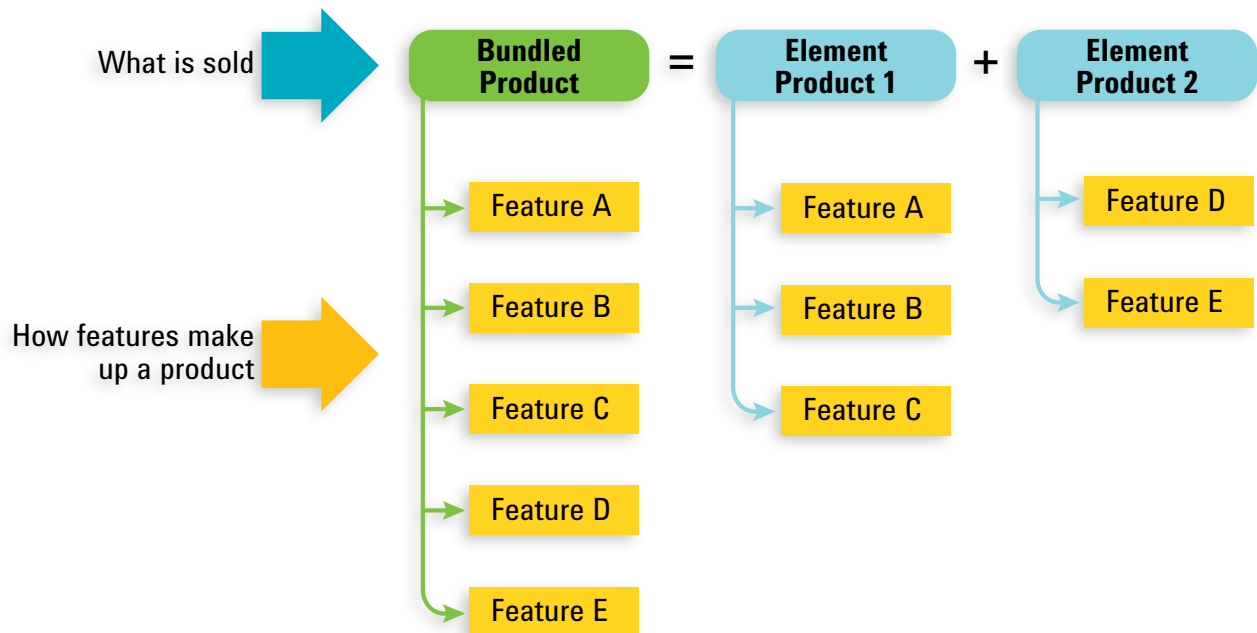
## License Types

Agilent EEsof provides software products in either a floating or node locked license configuration. Node locked and floating licenses are available either as perpetual or time based products.

## Product Structure

Agilent EEsof product structure consists of licensed elements and bundles. A bundle is a collection of licensed product element(s) designed to service a user's workflow. A bundle includes a product environment (UI) and numerous packaged features, and is a cost effective way of providing a broad range of capabilities to a user at an attractive price. Any feature accessed in a bundle will reserve the rest of the features in that bundle for the specific user.

An element is a collection of feature(s) designed for a specific task (e.g. a harmonic balance simulator element), and is typically used to extend product capability. An element reserves all features contained within it for the specific user. The relationship between bundles, elements, and features is shown in the figure below:



## License Counting or Job Control

All Agilent EEsof licenses are counted at the product license level. Simulators and certain models/libraries are counted job controlled features—a fixed count is assigned to the feature to regulate concurrent usage of the license. GUI features are not job controlled, and users can have multiple UI windows opened up simultaneously if they want.

The table below outlines the trade-offs between bundle only configurations and those configurations that utilize elements with bundles.

### Bundle and Element Product Trade-Offs

Description	Pros	Cons
Bundle only configuration	<ul style="list-style-type: none"> <li>Reserves the entire bundled feature set for a user—access to all packaged features is guaranteed</li> <li>Less license administration burden—fewer products to manage</li> <li>May require less trips to license server for processes containing multiple features</li> <li>Typically less expensive for customers with small seat counts</li> </ul>	<ul style="list-style-type: none"> <li>If a user needs to run multiple concurrent jobs (simulations) an additional bundle may be needed to fulfill the feature request</li> <li>Less flexibility to customize a configuration</li> <li>Less efficient if a feature rich bundle is only utilized for a small subset of features</li> <li>Typically more expensive for larger seat count installations</li> </ul>
Baseline bundle with augmenting elements	<ul style="list-style-type: none"> <li>More flexibility to customize a configuration</li> <li>More practical to run distributed simulations which need multiple simulation features</li> <li>More cost effective for customers with moderate to large seat counts like enterprise configurations</li> </ul>	<ul style="list-style-type: none"> <li>May require additional trips to license server for processes containing multiple features</li> <li>Maybe more expensive to implement for small design groups</li> </ul>





## Product Configuration Best Practices

For optimum performance, Agilent EEsof recommends the following:

1. For larger installations we recommend the use of a baseline product bundle complemented by appropriate product elements to extend capability.
2. For node locked licenses or small groups using floating licenses, we recommend the use of product bundles that contain a complete feature mix that will provide the capability needed at the lowest cost.
3. Users should reduce or eliminate mixing of bundle types from the same product family. Try to decide on one base bundle that meets the design community needs. This provides the most robust behavior, user sessions are launched immediately without user intervention, and there is less chance of license denials if there is a feature contained in one bundle that is not included in other bundles.
4. If certain design groups need to utilize a specific group of products separately from other groups, there are several recommendations. First, products can be installed on an individual server and the Agilent EEsof license wizard set up to only point to that primary server. Second, Flexera license file options can be used to include or exclude product use by individual user.
5. When using a bundle + elements configuration, make sure there are ample licenses of simulator and model set/library elements on the server. These products contain job controlled features, and additional purchased elements can help prevent license denials.
6. It is highly recommended that customers do not mix different versions of licenses for the same products on the same license server. Under certain circumstances this can increase the number of license queries to the server, significantly slowing the license search process — especially on global servers. In addition, the different product versions being served could consume licenses meant to support a specific product version, which could accelerate license denials for that version. Agilent recommends updating all licenses on a server to the same current version, or distributing the different versioned licenses on separate servers. Please refer to the Agilent EEsof License Administration Guide for more detailed recommendations.

## Multi-Core CPU Support

Agilent EEsof utilizes job control to manage concurrent feature usage (as opposed to CPU core counting). This enables users to exploit the capability of multi-core computers without needing additional licenses.

Remote and distributed simulation is supported. If a user has a floating license, the user may run a simulator feature that is part of a product bundle on a remote host.





## Remote and Distributed Simulation



For cost effectiveness, special product elements have been constructed to speed up simulation “sweeps”. These elements act as simulation accelerators. They consist of a distributed “N” pack (N is the number of parallel jobs that can be run) licenses which simulate as children alongside a standard simulator license. Distributed N pack licenses cannot run without a standard simulator license. LSF and Grid compute cluster managers are supported with distributed N packs along with job queuing. Generally speaking, distributed simulation “N” packs are effective in those cases where a sweep needs to be done and each sweep point takes more than 5 minutes to simulate. Please refer to applicable product documentation for more detailed information.

Supported operating systems	Supported license server configurations
<p>The generalized roadmap for Agilent EEsof operating system support is provided in the link below. Please refer to the individual product requirements for additional details.</p> <p><a href="http://www.agilent.com/find/eesof-os-roadmap">www.agilent.com/find/eesof-os-roadmap</a></p>	<p>Agilent EEsof supports all popular license server configurations supported by FlexNet. This includes single license servers, distributed license servers, and redundant servers. Single license servers are used for simple installations that do not require back-up. Distributed license servers distribute licenses over multiple machines. This may be done for one or all of the following reasons:</p> <ol style="list-style-type: none"> <li>1. Assign one group to a pool of licenses</li> <li>2. Provide usage overflow/peak use support</li> <li>3. Improve license serving reliability</li> </ol> <p>When the utmost in license server reliability is required, redundant or “Triad” servers are typically used.</p>

## Agilent EEsof Product Structures

Agilent EEsof product structures are available for viewing through the main Agilent EEsof website located here:

[www.agilent.com/find/eesof](http://www.agilent.com/find/eesof)

## License Dependencies

Agilent EEsof products contain a broad range of capability, and some functions/features have a license dependency to other related products. A list of these product dependencies are provided through the link below.

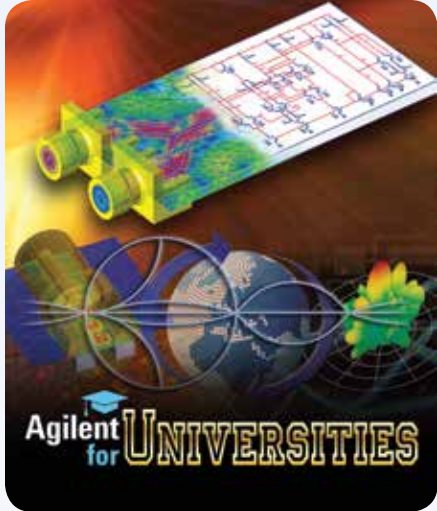
[www.agilent.com/find/eesof-license-dependencies](http://www.agilent.com/find/eesof-license-dependencies)  
(Requires Knowledge Center Login)

**Try it Free**

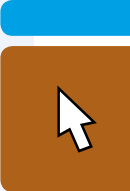
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# Education and Research for the Next Generation



## Our Commitment to You...

There is no better way for students to prepare for the real world than building skills that will be in demand wherever their talent and interests lead. That is one of the many reasons why Agilent EEsof EDA, the leading supplier of Electronic Design Automation (EDA) software for communications product design, has supported Universities worldwide for over twenty five years with programs that make our products easy to integrate into engineering studies.

### Premier

As the world's premier measurement company, Agilent works in close collaboration with engineers, scientists and researchers around the globe to meet the communications, electronics, life sciences and chemical analysis challenges of today and tomorrow. Agilent is committed to providing innovative measurement solutions that enable our electronics and bio-analytical customers and partners—the leaders in their fields—to deliver the products and services that make a measurable difference in the lives of people everywhere.

### Reliable

Agilent works closely with academia, government, and industry to provide the tools that enable development of new technology and supports the scientific process of investigation, discovery and analysis by providing reliable measurement solutions.

### Committed

We are committed to making an ongoing contribution to academia by stimulating education and research, in areas of importance to the next generation of engineers' future contributing time, and expertise to research programs and teaching tools.



# Agilent EEs of EDA University Educational Support Programs

The Agilent EEs of's University Educational Support Program offers full versions of Agilent EEs of software to qualified academic institutions for instructional use. This software, the same as used in industry, creates a full RF-EDA experience to help students develop skills that will serve them throughout their careers. A working knowledge of Agilent EEs of's design tool capabilities allows students to enter the workforce as industry-ready engineers. Additionally, the software enables professors to encourage student creativity and students to capture and present that creativity in a form that's

recognized and trusted in conference papers, presentation and proposals.

The University Support Program is available to qualifying institutions offering academic instruction in electrical engineering, RF and communications system design, electromagnetic analysis, high-speed digital design and device modeling. Agilent EEs of EDA provides resources for Educators, Researchers, and Students.



Worldwide education program in over 850 locations

## Educational Support Programs for Educators

### Resources for Students



As a university educator, your route to building skills with Agilent EEs of EDA products begins with your local Agilent EEs of Field Engineer and/or our University Program Manager. Participation in our

Academic Licensing program is provided at nominal cost to the University. Access to download and install software releases, find information on hotfixes, patches, and add-on software as well as installation and licensing instructions is available on the educators resource page.

### Dreamcatcher University

Courseware includes teaching slides, lab exercises and reference design files. It has been made available specifically for educators and students involved with the Agilent EEs of EDA University Educational Support Programs. The course provides complete educator resources for:

- RF/MW & Wireless Comms
- Digital & Embedded Systems
- General Electronics



[www.agilent.com/find/dreamcatcher](http://www.agilent.com/find/dreamcatcher)



### Qualify for Agilent EEs of educational support

It's easy to find out if your University can qualify. Just contact your local Agilent EEs of Field Engineer and request a University Application, and be prepared to share some plans on how Agilent

EEs of EDA products will be used in your classroom and RF/Microwave program.

Agilent EEs of EDA's program for classroom use of our products in Higher Education has expanded to include major additions to product families. Our programs feature fully operational versions of our commercial products and are available to qualifying institutions offering academic instruction in:

- Microwave and RF Circuit Design
- Communications System design
- Electromagnetic Analysis
- Signal Integrity
- Device Modeling

[www.agilent.com/find/eesof-university](http://www.agilent.com/find/eesof-university)

# Educational Support Programs for Students

## Resources for Students



As a university student you are eligible for the Agilent EEsof Student License Program which offers access to Agilent EEsof's

EDA tools for use on a student's personal computer. These licenses allow students to access Agilent EEsof EDA tools anyplace and anytime. Students attending universities participating in the Agilent EEsof EDA University Educational Support Program can request licenses by completing and submitting a Student License Request form on our website.

### University to industry transition

Assistance Licenses. If you are graduating, take advantage of Agilent EEsof EDA's University-to-Industry Transition Assistance Program—please note that the software is provided to you so that you can keep your skills and expertise in our products current while you search for employment. To request your free transition, complete and submit a University-to-Industry Transition Assistance License Request on our website.

### E-learning courses for ADS

Gain confidence at your leisure using our self-paced e-Learning courses. The courses contain narrated slides, videos showing the Advanced Design System (ADS) in action and step-by-step lab exercises (PDF format) that you can print out and perform. Begin, stop, and start learning again at your own pace as the system will remember where you left off. You can also complete individual sections of the course as required for your review. Learn the basics of ADS design and simulation and gain confidence in using the industry's leading RF/MW design software.



### Student license program

Agilent EEsof's University Educational Support Program

offers full versions of Agilent EEsof software to qualified academic institutions for instructional use. This software, the same as used in industry, creates a "Full RF-EDA Experience" to help students develop solid skills that will serve them throughout their career. With a working knowledge of the full capability range of Agilent EEsof's design tool capabilities, students are able to enter the workforce with skills highly valued by industry leading employers. The "Full RF-EDA Experience" also enables professors to more effectively encourage student creativity and allows that creativity to be captured and presented in a form that's immediately recognized and trusted in conference papers, presentation and proposals. (*The student license program is offered in the Americas, Europe and Japan.*)

This program provides access of EEsof software on student's personal computers which allows students to use EEsof software without having to use university lab computers or to login to the university system to access EEsof license servers. The licenses allow students access to EEsof software anyplace and anytime—licenses are to be used for classroom purposes only and not for commercial use. Students can request licenses by completing and submitting the Student License Request form available on our website.



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# Educational Support Programs for Researchers

## Resources for Researchers



As a researcher you are eligible to utilize Agilent's large selection of resources for university researchers and those working in university incubators. Resources

include emerging business assistance, application notes in all areas of Test and Measurement, valuable links to research sites, tools to help you locate and track grants and other funding sources.

As a University Researcher, your route to building skills with Agilent EEsof EDA products begins with your local Agilent EEsof Field Engineer and/or our University Program Manager. Participation in our Academic Licensing program is provided at nominal cost to the University.

### University relations

The Agilent for Universities home page provides world wide higher education support with a view into the programs of greatest interest to university faculty, students and staff. Learn more about our latest research collaborations, research grants, PhD fellowships, Agilent Thought Leader Program, research tools, education support, recruiting of top university talent, and philanthropy.

### Researcher discounts

As a research institution you can take advantage of Agilent's EEsof's 50% discount on products and support. When used in conjunction with Agilent EEsof's time-based licenses, this discount allows access to a wide variety of EDA tools with minimal costs and no long term commitments. This combination of time-based licenses and discounts is ideal for time limited research projects.

Students and educators attending universities participating in our Agilent EEsof EDA University Educational Support Program have access to our Agilent EEsof Knowledge Center database. The web-based Knowledge Center is an around-the-clock resource for comprehensive support information and downloadable examples for all our products. It hosts software updates and has a tracking feature that makes it easy for you to submit and manage support cases and related enhancement requests. The search feature makes it easy to find and sort through available solutions by date, popularity, or user ratings. The Knowledge Center also contains product discussion forums that put you in touch with other users, support engineers, and product developers. On the Knowledge Center login page. Click the Register Button to request an account.

[www.agilent.com/uni\\_relation/index.shtml](http://www.agilent.com/uni_relation/index.shtml) <https://edocs.soco.agilent.com/login.action>

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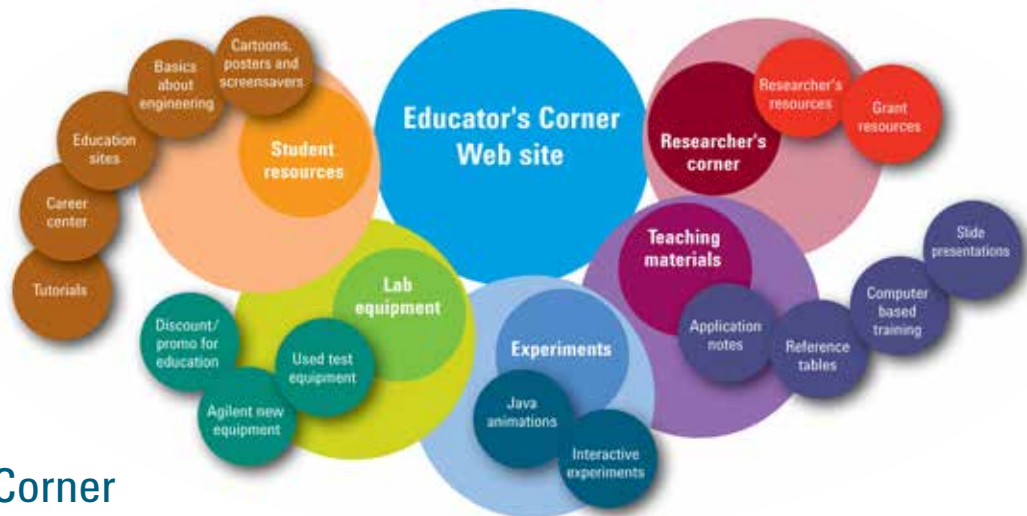
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## Resources for Lecturers Researchers and Students



### Educator's Corner

[www.agilent.com/find/edu](http://www.agilent.com/find/edu)

Free resources are available from the Educator's Corner Web site, which contains downloadable teaching materials, experiments, information about lab equipment, and more.

#### Free resources from Educator's Corner Web portal

Educator's Corner is a dedicated Web site that provides a one-stop education resource to lecturers, researchers and students looking to enhance their higher education curriculum and research capabilities. Various tools and resources can be downloaded for free.

- Teaching tools
- Lab experiments
- Java animations
- Computer based training
- Application notes
- Webcast seminars
- Journal articles
- Engineering cartoons
- Student resources
- Information on educational discounts and promotions

[www.agilent.com/find/edu](http://www.agilent.com/find/edu)

#### Research partnerships and collaboration

As the world's premier measurement company and a committed global citizen, Agilent takes an active role in supporting higher education and research.

We are committed to furthering science and technology by developing strategic partnerships with universities and research labs worldwide. We work with these universities to develop technology in areas of mutual interest.

[www.agilent.com/find/research](http://www.agilent.com/find/research)



#### Jobs for students and new graduates

Agilent builds relationships with universities to recruit top talent college hires. Each year, we hire hundreds of the best students around the world for internships and full-time employment. The new ideas that college hires bring to Agilent challenges the status quo by testing long-held beliefs. This clash of ideas ignites the spark of innovation.

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#### Special programs, promotions and discounts

Agilent collaborates with universities and creates special programs to meet their needs: assistance with laboratory openings, mutual positive exposure through communications, and industry networking opportunities.

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## Technical Support Contact Information

### Customer history

All the information you need on your software licenses and your support contract is located in Agilent Software Manager (ASM).

### Submit a case via My Knowledge Center

If you have a valid support contract, you can use My Knowledge Center to submit new cases as well as view and edit your existing cases.

[www.agilent.com/find/myeesofknowledgecenter](http://www.agilent.com/find/myeesofknowledgecenter)

### Send us email

email us at [eesof\\_bsc@agilent.com](mailto:eesof_bsc@agilent.com)

Please include your CPU ID, along with the product name, product version, and operating system you are using.

### Call us

If you wish to speak to the support team directly, please dial one of the following numbers and ask to be connected to one of our Agilent EEsof support engineers.



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