Agilent EEsof EDA
Antenna Modeling Design System

Technical Overview

A Dedicated 3D Electromagnetic Design, Modeling, and Verification Tool for Antennas and Antenna Systems

- Import, mesh, and simulate entire wireless appliance
- Verify antenna compliance with industry standards, including MIMO, SAR, and HAC
- Reduce design risk and costs with first-pass success prior to physical testing

Agilent Technologies

Overcome Antenna Design and Configuration Challenges with AMDS

Wireless appliance designers face the challenge of fitting multi-band antennas into ever smaller and more stylish packaging that appeal to fashion conscious consumers, while complying with regulatory, operator and end-user demands for radiation safety and performance quality.

AMDS is the only 3D full wave electromagnetic antenna design and simulation tool specifically developed to enable antenna and industrial designers to overcome this challenge.

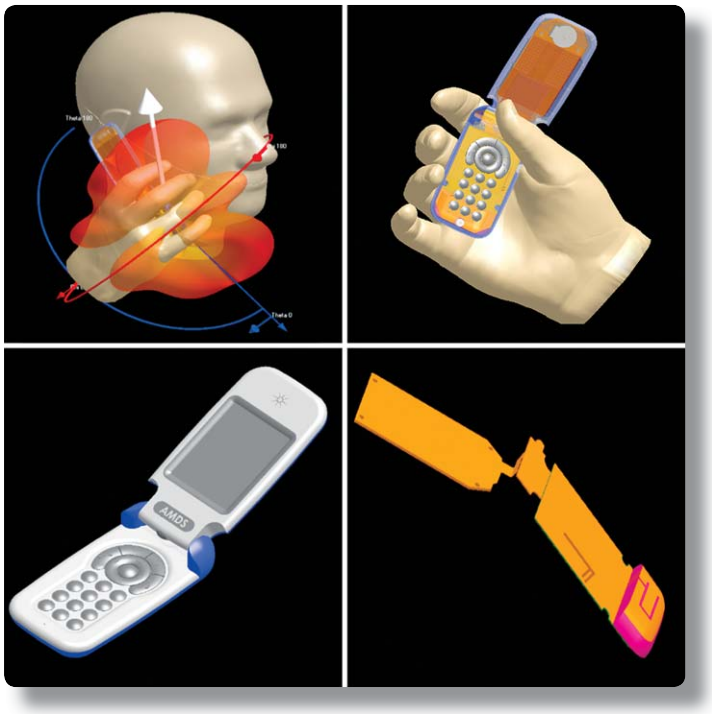
AMDS efficiently imports, meshes, and simulates the entire wireless appliance, including the surrounding, real-world environment, to verify its compliance with standards such as specific absorption rate (SAR), hearing aid compatibility (HAC), and multiple-input/multiple-output (MIMO) antenna systems.

AMDS reduces design cycle times and reduces design risks up front, before slow and expensive physical testing.

AMDS:

- Efficiently imports CAD data from product designers and eliminates time-consuming EM modeling redefinition between antenna and product designers.
- Guarantees antenna compliance to standards such as SAR, HAC, over-the-air, and optimizes performance for MIMO by analyzing antenna placement and diversity within the entire physical wireless appliance.
- Optimizes end-user product performance by simulating the real world interaction of the human body and including it in the antenna EM simulation.

AMDS provides the capability to simulate antenna structures and their placement within the appliance, in conjunction with the presence of the real-world proximity effects of the human head and hand. This capability is critical to determining parameters such as detuning and sensitivity. The result is a design that meets or exceeds regulatory and end-user performance requirements, while minimizing the risks of downstream failures in prototype testing.

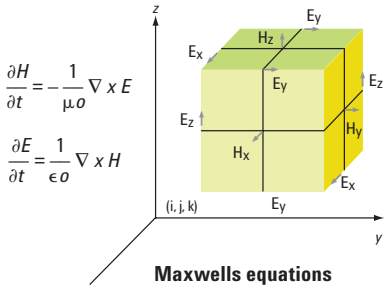


Simulate the effects of hand and head on the antenna performance (top), complete wireless appliance (bottom left), and on formal GSM and Bluetooth antenna on ground plane (bottom right).

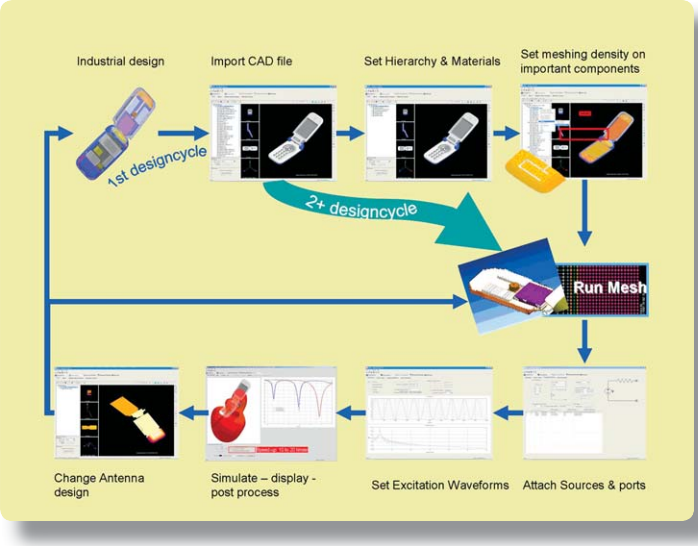
A Full-Wave 3D EM Simulator Based on Finite Difference Time Domain Technology

Finite difference time domain (FDTD) technology provides a full-wave solution to the 3D EM problem. It handles arbitrarily shaped 3D metals and dielectrics with a high degree of complexity. The inherent simplicity of its meshing and equation set provides:

- Computational efficiency over finite element method (FEM) or method of moment (MoM) techniques.
- High-speed wideband analysis in a single simulation run.
- Fast simulations enabled by hardware graphical processor cards and multi-threading.



Maxwells equations and typical discretized FDTD implementation.



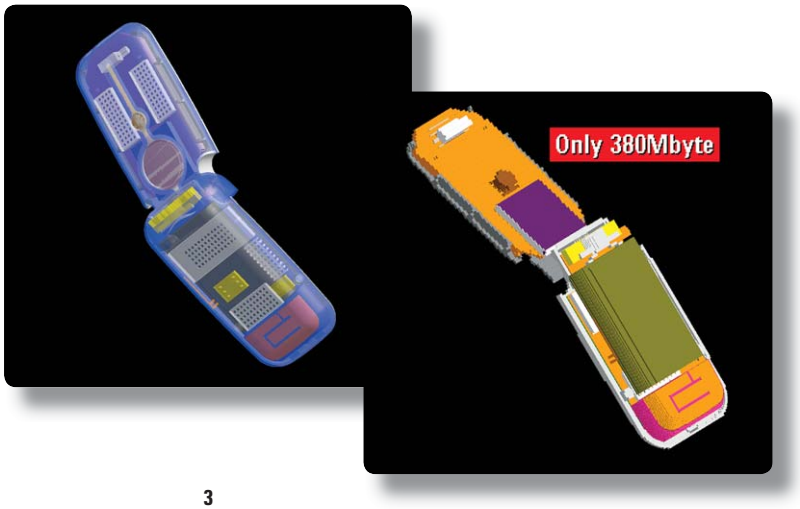
The AMDS design flow.

Enhancing Interaction Among Designers

The AMDS intelligent CAD data interface seamlessly imports and exports complete wireless appliance structures created by industry-standard CAD packages.

Unlike traditional 3D-EM tools, where each import requires at least half a day of manual simulation parameter redefinition, the AMDS hierarchical import algorithm requires only a first-time definition. Thereafter, iterations in physical product shape, and antenna placement analyses can be performed repeatedly without the time and error associated with manual redefinition.

The AMDS state-of-the-art design management functionality ensures smooth iterations between antenna and industrial designers, resulting in the best looking as well as highest performing wireless appliances.



A mobile phone design imported into AMDS.

Conformal GSM and Bluetooth antenna meshed with shielding, battery, and ground planes signal routing.

Simulate without compromise

Today's wireless appliances can include displays, cameras, speakers, batteries, and multi-antenna systems for phone, Bluetooth, WLAN, radio, and GPS.

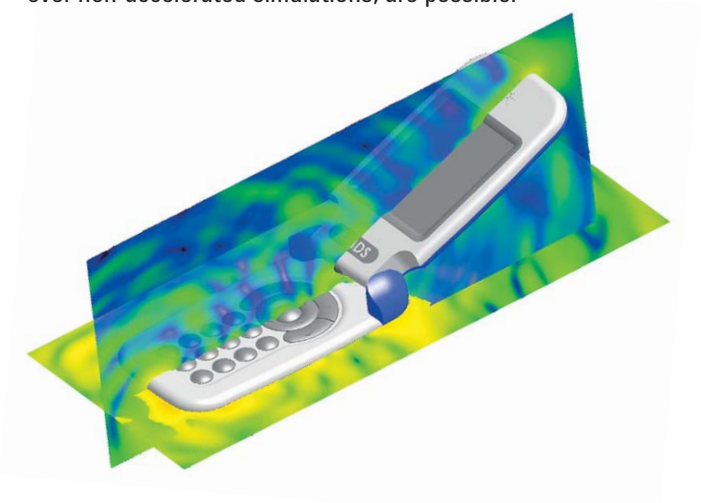
All these elements must be considered in EM simulations, but antenna designers, faced with limitations in computation time and available computer memory, often comprise accuracy for speed. These limitations can result in a risky and time consuming reliance on physical prototype testing.

AMDS eliminates the need to compromise on accuracy by quickly and efficiently importing, meshing, and simulating not just the wireless appliance but the surrounding real-world environment and proximity to the human body.

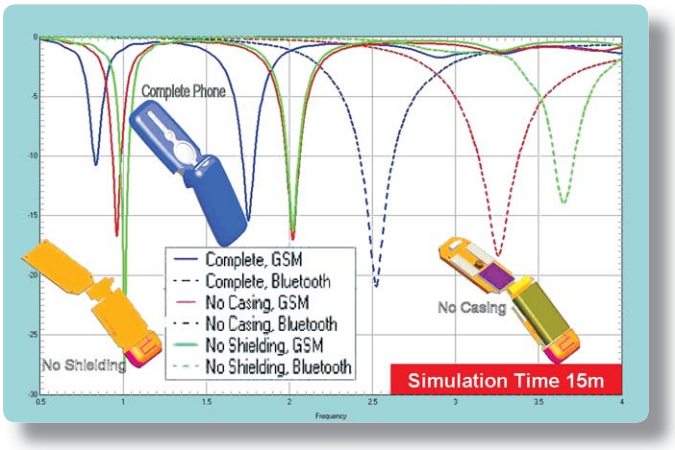
Speed Up the Design Cycle

In this complete cell phone example, a complete wideband simulation was made in approximately 15 minutes and consumed less than 400 Mb of memory. This fast cycle time allows designers to simulate various phone setups to assure optimal performance in a variety of circumstances. AMDS is designed to take advantage of the latest developments in multi-processor and multi-core platforms for even faster computations. It also can use message passing interface (MPI) technology to to solve very large problems.

Agilent's partnership with Acceleware (www.acceleware.com) provides access to the latest hardware acceleration engines. Speed enhancements of up to 35 times, over non-accelerated simulations, are possible.



E field on two perpendicular surfaces.

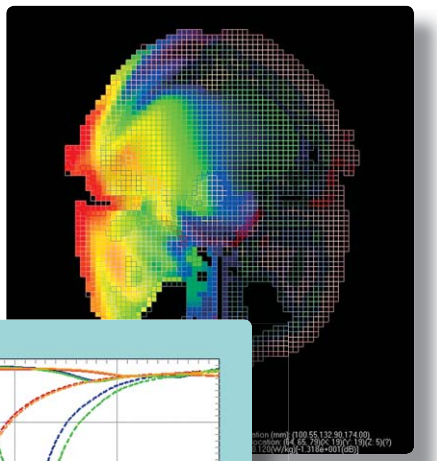


S11 parameters showing the influence of various components of the wireless appliance.

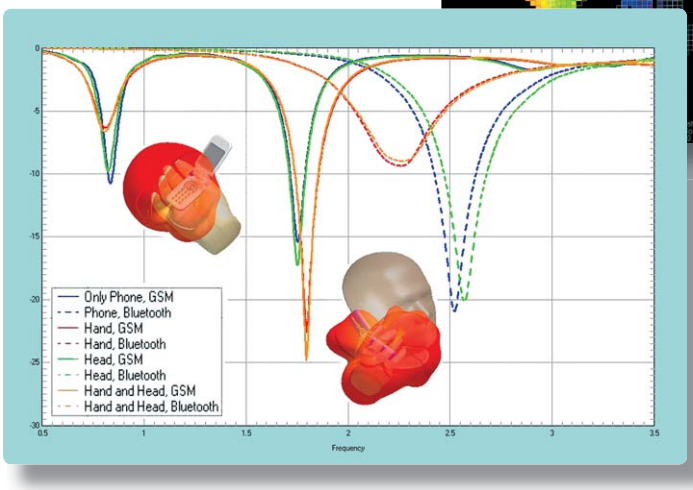
First-pass compliance with regulatory and real-world performance

Simulate over-the-air performance with AMDS to meet the specifications of network providers and regulatory committees for your wireless appliance. AMDS simulations and post-processor data displays are fine-tuned to the needs of industry-leading mobile phone manufacturers.

AMDS includes a wide set of human-body phantoms containing the latest standard anthropomorphic model (SAM) standards, along with SAR and bio-temperature calculations, to meet the industry's highest benchmark specifications. Simulation time for a typical handheld wireless appliance next to the SAM head is less than 30 minutes.

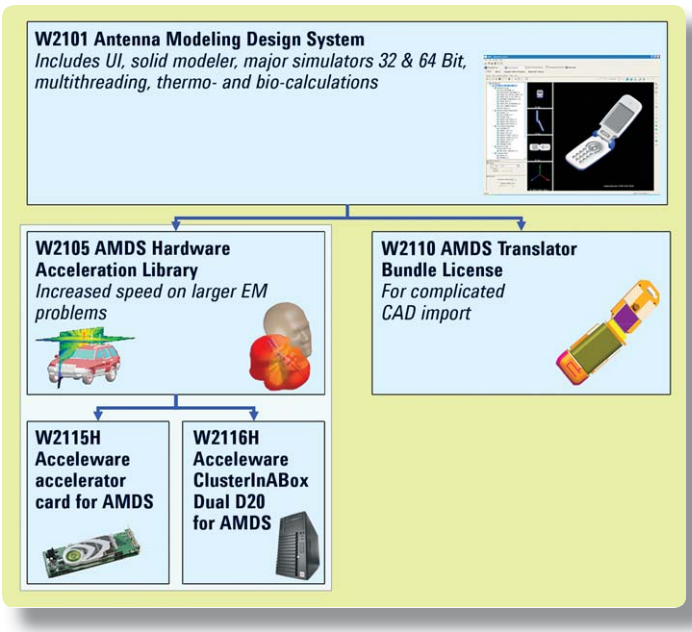


A one-gram average SAR in plane of peak temperature rise.



S11 parameters showing the influence of hand and head on Bluetooth and GSM antenna performance.

AMDS Configuration



Key Simulation Engine Features

Materials
- Lossy dielectric/magnetic
- Frequency-dependent dielectric/magnetic
- Anisotropic magnetized ferrite
- Anisotropic dielectric (full tensor)
- Thin wires with different radii
- Surface impedance
- Non-linear dielectric
- Non-linear magnetic

Sources/loads/ports
- Voltage/current sources with series/parallel RLC
- Passive/active ports
- Non-linear capacitors
- Static solver for initial condition charging
- Time-controlled on/off switches
- Multi-port S-parameters vs. frequency
- Multi-port S-parameters — steady state
- Multi-port calibration
- Port impedance vs. frequency
- Port impedance — steady state
- Incident plane wave
- Sine and modulated Gaussian beam
- VSWR

Far zone data
- Transient far zone — specific angles
- Steady state far zone patterns
  - Directivity, gain, polarization, ludwig ii/iii transforms
- Antenna correlation
- Circular polarization
- Radar cross section
- Total scattered field
- 3D far zone patterns

Special boundary conditions
- Liao, PMC, PEC, outer boundaries
- Periodic boundary conditions with arbitrary phase shift
- PML outer boundaries with adjustable thickness

Parallelization and speed-up
- Automatic convergence check for optimum run times
- Multithreading (4x, 8x, 16x, . . .)
- MPI multiprocessor (distributed memory clusters)

Biological calculations
- Specific absorption rate (SAR)
  - Thermal simulation using the bio-heat equation
  - Calculate 1 and 10 grams SAR averages per C95.3
  - Whole body SAR average
  - Location of peak SARs
  - Adjust SAR levels for specified input power
  - Planes of SAR for color display
  - SAM phantoms CAD file

Key Geometric Modeling Features

Geometry generation
- Dimension-based 3D solid modeler
- Dimension-based 2D modeler
- Copy-move-scale-rotate
- 3D rectangular arrays of objects
- 3D polar arrays of objects
- Shells solid objects
- Boolean operations
- Mesh view
- Mesh edit
- Sweep/rotate/extrude bodies of revolution
- 2D scripting/macros

CAD import/export
- Hierarchical CAD management
- Import SAT files
- Scale/position imported objects
- 3D Voxel-based importing
- Selective import of multiple objects in CAD File

Meshing/viewing
- Fast meshing algorithm (FMA)
- Automatic/manual control of mesh parameters
- Fast 3D mesh viewing

Post-processing
- Color display of 2D fields/currents
- Color display of 2D steady state E, B fields
- Color display of 3D steady state surface currents
- Color display of 2D SAR values
- Export geometry/field display to JPG file
- Movie sequence of transient fields vs. time
- Export movie sequence as an MPEG file
- Near zone fields/currents vs. time
- Impedance, S-parameters vs. frequency
- Plot results from other AMDS projects
- Export plots to postscript files
- Polar plot antenna patterns
- Smith chart impedance plots
- FFT of transient results
- Export Touchstone files

Options

W2110 AMDS Translator Bundle	Import STEP, IGES, Pro-E, DXF, STL files, export SAT, STEP, IGES files
W2105 AMDS Hardware Acceleration Library	Software libraries
W2115H Acceleware Accelerator card for AMDS	Hardware accelerator card
W2116H Acceleware ClusterInABox Dual D20 for AMDS	Hardware ClusterInABox Dual D20 Workstation

World-Class Support, Training, and Services

All Agilent EEsof EDA products are backed by a world-class team of experienced application and technical support engineers who are dedicated to providing the right software, support, and consulting solutions to increase engineering productivity and long-term success. We offer worldwide, local-language, technical support via telephone, fax, e-mail, and the worldwide web.

In addition, our web-based Agilent EEsof 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 lets you quickly find available solutions and sort through them 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. And, you can get training when and where you want it through e-learning short courses and technical information sessions.

www.agilent.com/find/eesof-knowledgecenter

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