RFPro

Electromagnetic (EM)–Circuit co-simulation environment for RF circuit designers

Introduction

Keysight RFPro is an EM (electromagnetic) design environment for RF circuit designers. It automates EM-circuit co-simulation to account for EM effects on RF circuit performance in 3D IC layouts, packaging, interconnects, transitions, and PCB boards. RFPro enables interactive access to EM analysis for tuning and optimization of RF circuits during design just like circuit simulators.

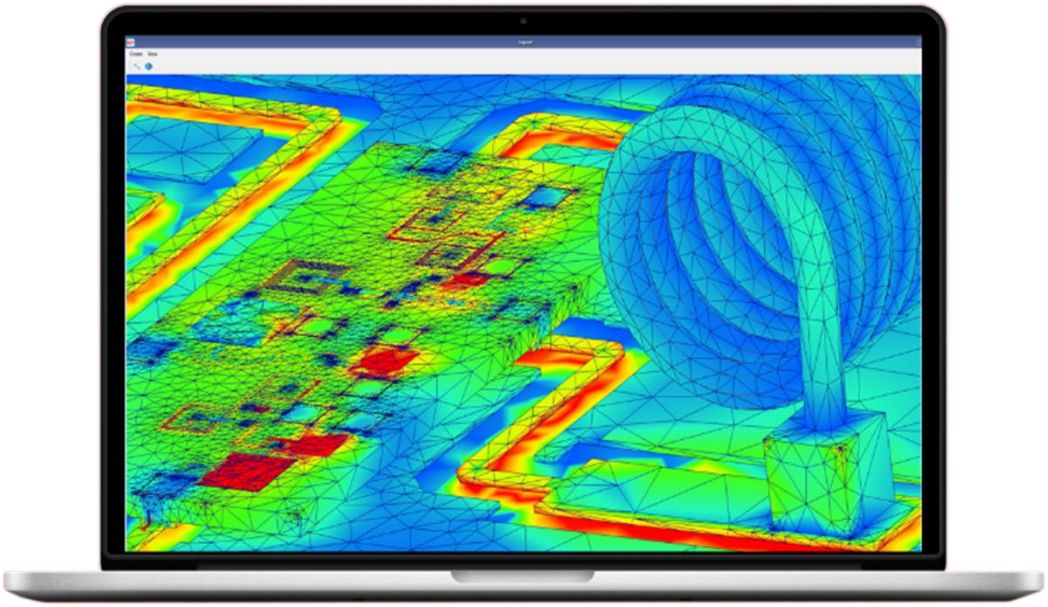


Figure 1. RFPro automates EM-circuit co-simulation for interactive tuning and optimization to account for EM effects of physical structures on RF circuit performance in RF Modules, RFICs, MMICs and RF Boards.

> Using these tools to eliminate one design spin in the fab can save us $1.5M in expenses and 14 months of development time.
>
> **Keysight High Frequency Technology Center R&D**

KEYSIGHT

RFPro Capabilities for RF Circuit Designers

Integration

- IC and packaging EM-circuit analysis in single environment with interactive 3D view
- Same interface for Keysight ADS, Cadence Virtuoso, Synopsys Design Compiler & Mentor Tanner
- Preserves OpenAccess (OA) design database integrity with no need for file translations
- Maintains full traceability of EM data origin from design changes and simulator used

Solver

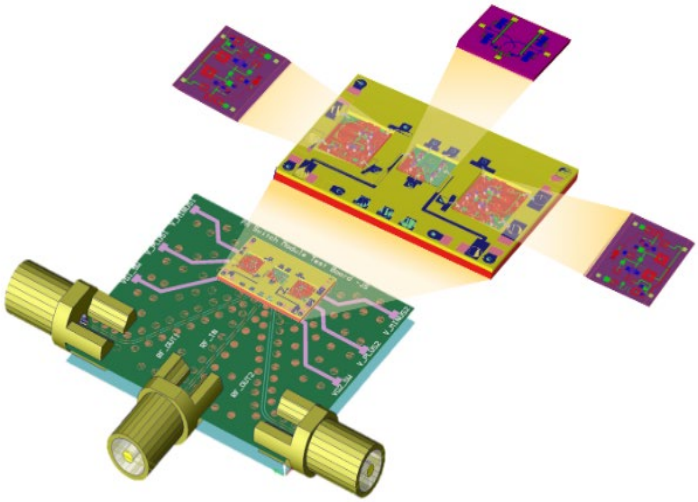
- Full 3D FEM and planar 3D Momentum solvers from same environment
- Automatic expert setup of EM and EM-circuit analysis ensures trustworthy results
- Sweep physical and electrical parameters easily from same environment
- Same interface to launch HFSS solver

Layout

- Interactive EM simulation on any section of layout without manual isolation (“cookie cut”).
- No need to manually extract EM and circuit components for separate simulation.
- Automatic data stitching of EM ports to circuit nodes for error free EM-circuit co-simulation.

RFPro Application Examples

Here are some current application examples that RFPro and ADS are deployed to develop complex multi-technology designs that must consider EM effects of the physical structure along with circuit component behavior to make them work.



Complex RF Module and Evaluation Board

Figure 2. RFPro preserves design database integrity and traceability to any design changes because no manual “cookie-cutting” and exporting to a separate EM simulator is needed. Keysight ADS enables error-free assembly and 3D routing of complex multi-technology RF module, including its PCB eval board for in-situ EM-circuit simulation by RFPro.

5G/6G Antenna-Circuit Interactions

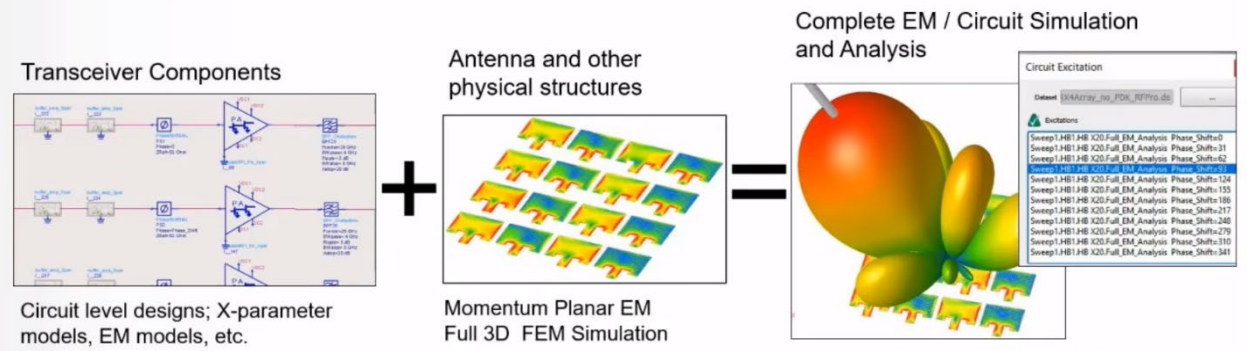


Figure 3. Nonlinear circuit excitation of integrated phased array antenna in RF module analyzes impedance change vs. beam scan angle in RFPro EM-circuit co-simulation.

60GHz WiGig Wafer Level Packaging with Integrated Antenna

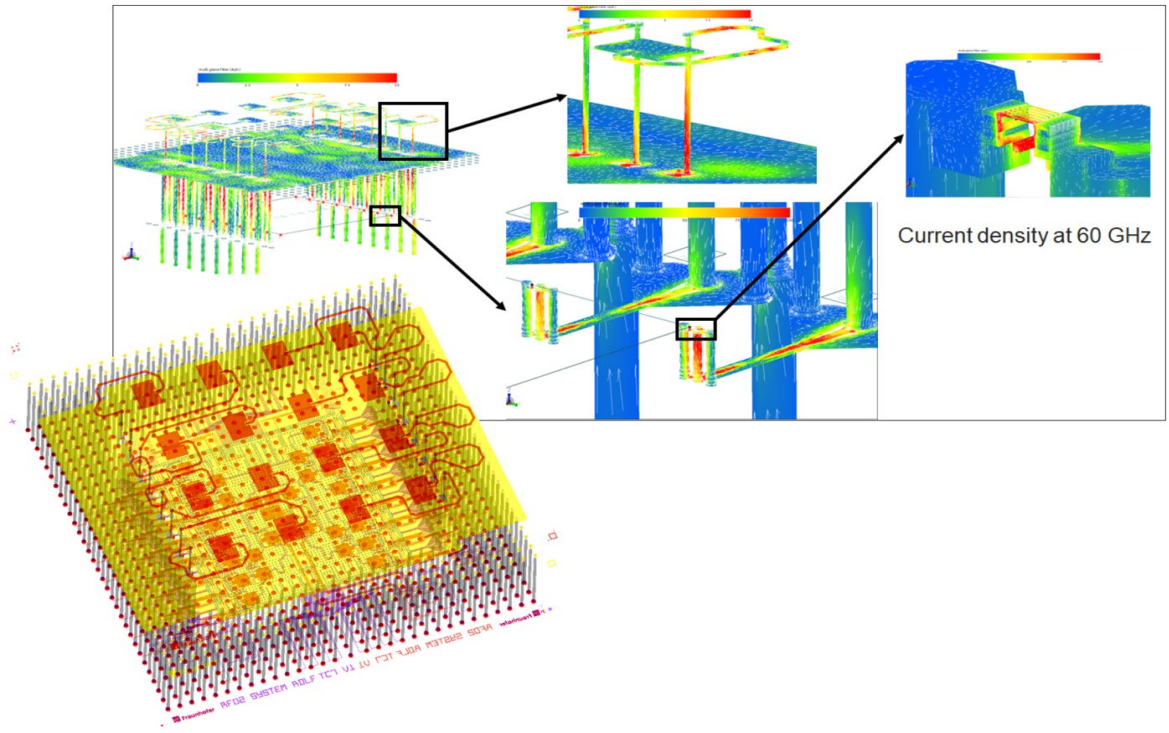


Figure 4. Multi-technology 60 GHz WiGig module with beam forming IC, 3D feed network and phased array antenna packaging are assembled in ADS for EM analysis of any chosen RF signal paths with RFPro automatic net extraction.

Acknowledgement: *Designed by Fraunhofer Institute and fabricated by Global Foundries.*

MEMs switch and Evaluation Board

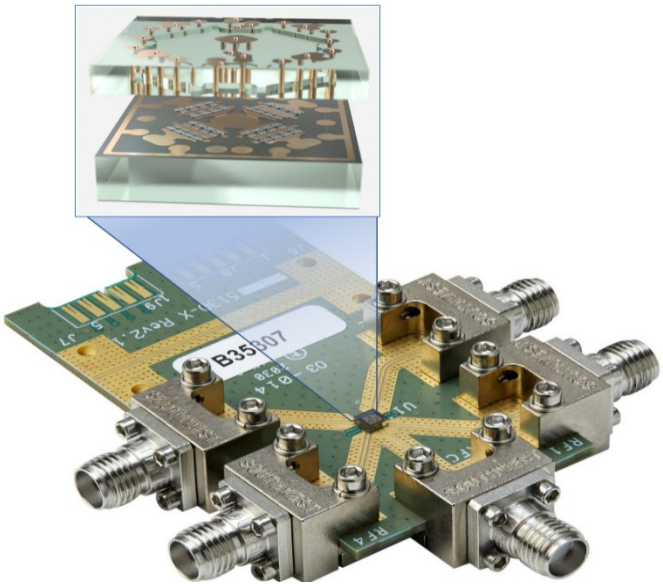


Figure 5. Ultra-low loss MEMs switch integrated onto PCB evaluation board with dimensions ranging from microns to centimeters is efficiently meshed and accurately simulated with RFPro to achieve one-pass success.

Acknowledgment: *Designed and fabricated by MenloMicro.*

Complex RF Module Assembly

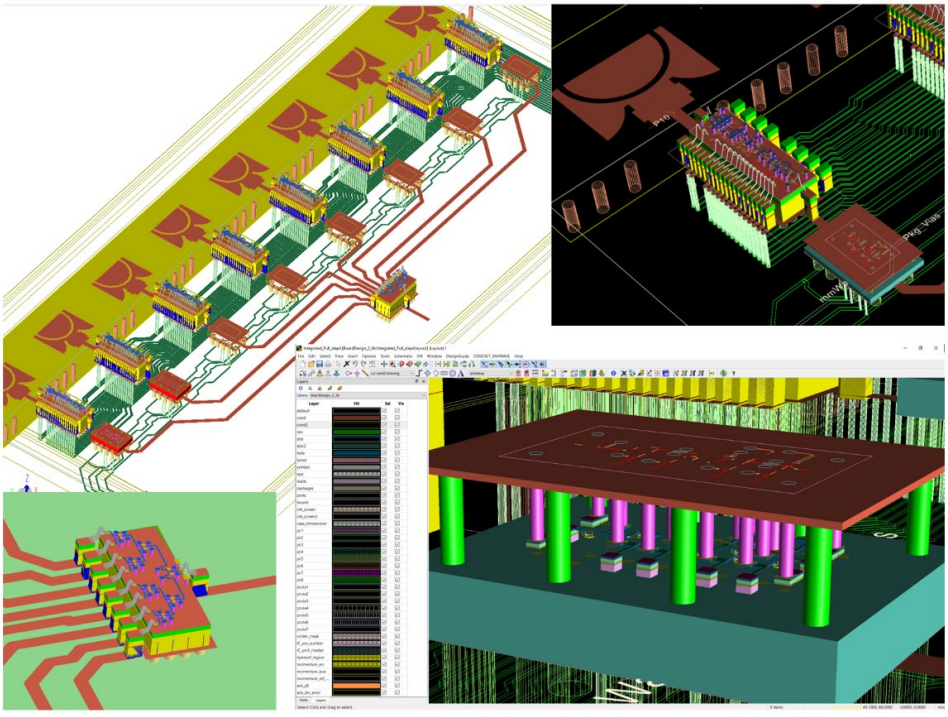


Figure 6. Complex multi-technology RF module containing RFICs, MMICs, packaging, laminates, antennas, and PCBs are assembled in Advanced Design System (ADS) for RFPro EM simulation of any selected RF paths without traditional manual "cookie-cutting."

RFPro Product Configurations

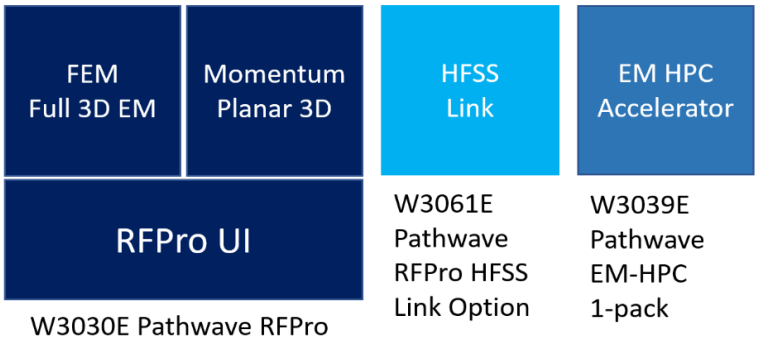


Figure 7. RFPro includes Full 3D FEM and Planar 3D Momentum solvers launched through an intelligent RFPro UI to automate EM-circuit analysis. EM parallel high performance computing accelerators can be added to speed up simulation from 5x to 20x. HFSS link enables HFSS as a solver (separate license required).

RFPro Bundles and Element as upgrades for Momentum, HFSS, Virtuoso, Custom Compiler and Tanner users

- RFPro **bundles** along with powerful ADS multi-technology 3D assembly layout for RF modules and RF packaging:
  - W3604B PathWave ADS Core, EM Design, Layout, RFPro
  - W3606B PathWave ADS Core, EM Design, Layout, RFPro, RF Ckt Sim
  - W3607B PathWave ADS Core, EM Design, Layout, RFPro, RF Ckt Sim, Sys-Ckt Verification
  - W3608B PathWave ADS Core, EM Design, Layout, RFPro, RF Ckt Sim, Sys-Ckt Verification, VTBs
  - W3615B PathWave ADS Core, EM Design Core, Layout, RFPro, HB
- RFPro **element** W3030E shown in Figure 6 is purchased as an add-on element to an existing ADS, Virtuoso, or Custom Compiler environment
- RFPro EM **HPC accelerator** W3039E enables parallel EM simulation to speed up analysis. Multiple accelerators can be added to increase speedup from 5x to 20x depending on nature of problem.

Take the Next Step with RFPro

For more information or to request a free trial of RFPro and ADS, visit

- https://www.keysight.com/zz/en/lib/resources/software-releases/whats-new-in-rf-microwave.html
- https://www.keysight.com/products/W3030E

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