

PCB Design Leveraging RF/Microwave Expertise in AWR Software

Designers face multiple challenges when incorporating RF/microwave, analog, and digital design elements together on the same PCB. These multi-layer PCBs, which are commonly used in next-generation commercial and military applications, are densely populated with high-speed data lines and RF circuitry and are prone to coupling/crosstalk and other parasitic behavior that can impair system performance. To successfully integrate RF/microwave content and mixed-signal designs, PCB layout tools and RF circuit design software must exchange design data efficiently. Cadence® AWR Design Environment® software offers an RF/microwave intellectual property (IP) creation platform with import and export functionality to provide a pathway to and from Cadence Allegro® or OrCAD® PCB design tools.

RF/Microwave IP Integration

RF/microwave designers use schematic capture to place active and passive components within a network. Unlike analog and digital designs, which use parasitic extraction after layout, these designs typically include closed-form transmission line models (such as microstrip and stripline) explicitly in the schematic to account for RF behavior much earlier in the design process. Electromagnetic (EM) analysis is also used to characterize structures and validate the overall design. In this way, the electrical and physical designs are concurrently implemented. The AWR Design Environment provides the platform for RF/microwave design entry, circuit/system/EM analysis, and optimization.

The result is an electrical design with the layout and PCB stackup information necessary to ensure accurate prediction of the manufactured device's performance. Transferring this layout and stackup information into the Cadence PCB layout and routing platform eliminates the need for manual design re-entry, thus saving time, costs, and the potential for errors.

Features

- ▶ Linear/nonlinear frequency-domain simulation for RF/microwave circuit design
- ▶ Schematic-driven RF-aware design with integrated EM extraction technology
- ▶ Parametric studies with optimization, tuning, and yield analysis

Benefits

- ▶ Reduce design time with a comprehensive workflow that supports data exchange between RF/microwave and PCB design tools
- ▶ Maximize engineering productivity with design automation and a user-friendly interface for engineers of all skill levels
- ▶ Eliminate costly design respins through accurate design verification

RF/Microwave PCB Verification

RF/microwave PCB verification is enabled by importing an IPC-2581 file into AWR® Microwave Office® software through the PCB import wizard. Powerful editing features prepare the structure for EM analysis using the AWR AXIEM® simulator. Designers are able to select traces, layers, and board regions and specify exactly which layers, nets, and board areas to analyze. They can also easily omit manufacturing details that do not impact electrical behavior.

The AWR AXIEM simulator uses the method-of-moments (MoM) technique to analyze distributed PCB components, transmission lines, and layer-to-layer PCB interconnects like vias. Designers extract S-parameters directly and visualize fields/currents to identify parasitic coupling, resonances, and other concerns that could lead to design failure.

Features

- ▶ Full-wave planar MoM technology with advanced hybrid adaptive meshing
- ▶ Time-saving PCB import wizard technology
- ▶ Layout editor with shape modifiers/de-featuring for fast EM simulation
- ▶ Field visualization and post-processing

Benefits

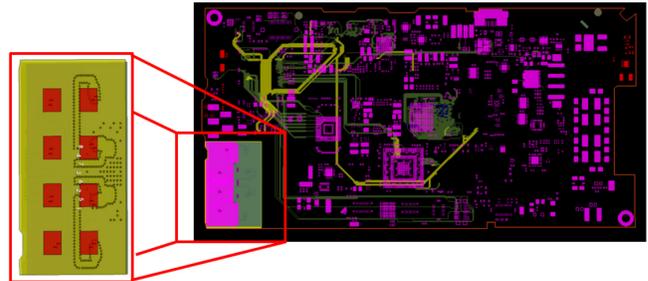
- ▶ Reduce design time with a comprehensive workflow that supports data exchange between RF/microwave and PCB design tools
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Conclusion

At higher operating frequencies, the physical details of circuit components and signal traces will impact electrical performance and must be considered as part of the design process. Electronics can appear to behave in unpredictable ways at radio and microwave frequencies, often seeming to violate basic electrical principles such as Ohm's law. EM analysis based on layout and stackup information is commonly used by RF/microwave designers to understand how physical design impacts electrical behavior.

With RF-aware simulation tools, engineers eliminate wasted cycles trying to design and troubleshoot front-end components and related integration challenges. In addition, EM analysis plays a critical role in design verification of all high-speed mixed-signal traces. The state-of-the-art RF/microwave capabilities within Cadence's AWR software product portfolio help engineers ensure successful wireless design and integration.

AWR software helps engineers save valuable time to market when designing and integrating RF/microwave content into their chip, package, and PCB-based designs. To learn more, contact your local sales representative or get started with a software evaluation today at awr.com/tryawr.



Integrated mmWave IP (antenna array in the red popout) on a mixed-signal PCB