



# Agilent Advanced Design System Helps SiGe Semiconductor get Virtual Samples to the Marketplace Fast

## Case Study



*“ADS is a very flexible tool. The fact that we were able to use it to design our IC, embed it in a PCB environment, and use the system level simulation to see the effect of our IC in a general model of our customer’s transceiver has given us a competitive advantage.”*

**Marquis Julien, IC Design Manager, SiGe Semiconductor, Inc.**

### The Customer

SiGe Semiconductor designs radio frequency and mixedsignal integrated circuits specifically designed to serve the broadband and wireless markets. The company commercializes the advantages of silicon germanium design technology to offer high performance, low power consumption and low-cost integrated circuits to customers who design system-level products.

### The Challenge

When *Bluetooth* systems were first tested in real-world environments, interference from the crowded frequency band, as well as from static barriers like walls, significantly degraded performance. SiGe Semiconductor recognized this opportunity to use a SiGe process to develop a power amplifier that would boost the *Bluetooth* system’s signal integrity and enhance its immunity to interference.

SiGe Semiconductor was faced with the challenge of getting this power amplifier to market, even as the *Bluetooth* standard was being revised. It was important to have a product that would work early in the *Bluetooth* deployment stage and in a variety of applications.

### The Solution

“For our business in developing a power amplifier for the *Bluetooth* market (2.4 GHz), we needed a fast and reliable simulation algorithm for high frequency and large signal operation. Agilent provided this capability in their ADS product, allowing us to easily simulate our IC,” said Marquis Julien, IC Design Manager. “Also, ADS PCB components such as transmission lines and SMT libraries allowed our IC model to be embedded in the PCB environment. We were not able to find as comprehensive a product from other companies.” ADS was the front-end design tool for simulating and optimizing the IC. Incorporating realistic PCB lines and SMT components for more accurate simulation of the operating environment gave SiGe greater confidence in their design.

**CUSTOMER:** SiGe Semiconductor, Inc., [www.sige.com](http://www.sige.com)

**CHALLENGE:**  
To get to market early with a silicon germanium *Bluetooth*® power amplifier that worked in a variety of applications

**SOLUTION:** Use of Agilent Advanced Design System for RFIC design, including the surrounding PCB components, and encoding IP for delivery of “virtual” samples to customers

**RESULTS:** Very successful introduction of power amp IC that includes:

- Over 30 customer design wins
- Product of the Year award
- 40% share of *Bluetooth*
- Class 1 power amp market



**Agilent Technologies**

After the back-end design was completed in Cadence, ADS was again used for post-layout verification by incorporating parasitic extraction results. ADS was also used to lay out and generate Gerber files for manufacturing the evaluation PCBs.

"Using ADS has improved the productivity of our engineers. It is easy to set up a test bench for an initial feasibility study and quickly create a schematic. Ultimately, this shortens the design phase. When the product operation is verified to match simulation, it is easy to use ADS to tune the design for future iterations and products," said Julien.

## The Results

As part of any successful product introduction, a supplier must provide sample parts. ADS allowed SiGe Semiconductor to go a step beyond this by offering their customers encoded ADS models of the IC. "We gave our customers the opportunity to simulate their design with our part, which in turn accelerated their time-to-market," said Julien. "We have beaten several competitors to the marketplace as result of having these virtual samples."

The family of Class 1 *Bluetooth* power amplifiers designed using ADS include:

- PA2423G, introduced as the world's smallest flip chip solution
- PA2423L, introduced as the world's smallest fully encapsulated package solution
- PA2423MB, an 8-lead MSOP two-stage power amp operating from a single 3.3-volt supply.

According to SiGe Semiconductor, the success of these ICs in the market includes:

- A growing customer base of over 30 companies,
- Integration into qualified *Bluetooth* end products already available to users,
- A Product of the Year award (PA2423MB) by *Wireless Design and Development* magazine, in 2000.

With this power amp family, SiGe has captured a 40% share of the total market for *Bluetooth* Class 1 power amplifiers (Cahner's In-Stat, 2001).

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Marquis Julien



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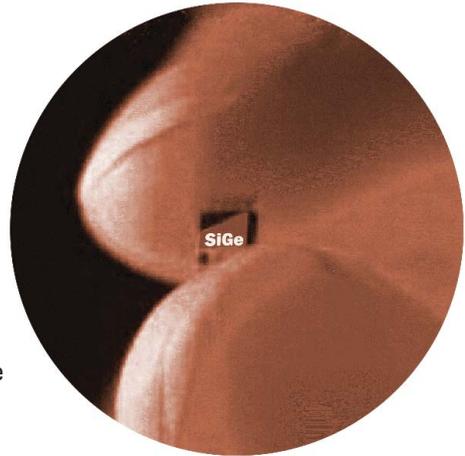


Photo of SiGe Semiconductor's PA2423MB Class 1 *Bluetooth* Power Amplifier

*Bluetooth* is a trademark owned by the *Bluetooth* SIG, Inc.

For more information about SiGe Semiconductor's *Bluetooth* power amplifiers, visit: <http://www.sige.com>

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