

Cambridge Consultants Develops WiMAX Test Bench for Aspx Semiconductor with MATLAB®

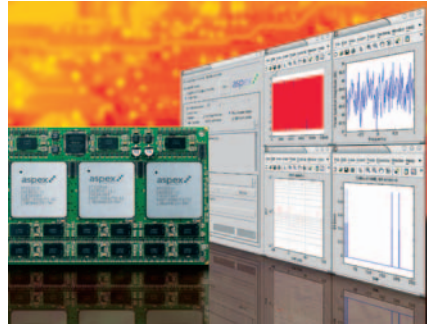
Worldwide Interoperability for Microwave Access (WiMAX) has the potential to provide fast, inexpensive wireless Internet access across kilometers instead of meters. Developers of WiMAX base stations, however, are faced with the challenge of developing technology as standards evolve.

To accommodate emerging IEEE 802.16 standards, Aspx Semiconductor developed a scalable, software-based solution around its Linedancer processors that implements the WiMAX physical layer (PHY) for multiantenna base stations. Aspx contracted Cambridge Consultants to build a test bench for its WiMAX PHY platform that verifies and demonstrates its implementation. Using MATLAB®, Cambridge Consultants developed the test bench in just seven weeks.

“MATLAB was the obvious solution for this effort,” says Robert Tan, principal engineer at Cambridge Consultants. “It enabled us to rapidly create a prototype of a WiMAX transmitter and then implement a much more detailed bit-accurate model of the physical layer.”

THE CHALLENGE

For Aspx to demonstrate its WiMAX PHY platform at an upcoming conference, Cambridge Consultants needed to develop the test bench in seven weeks. In this tight timeframe, Cambridge Consultants had to develop an entirely new standards-compliant WiMAX transmitter model and an interface to the Aspx Accelera card, which implemented a WiMAX receiver. Just as importantly, they needed to create a graphical user interface (GUI) for the model, so Aspx could demonstrate their board running WiMAX at the conference and enable customers to run test scripts and analyze test results.



WiMAX simulation test bench.

“We needed to verify and demonstrate that the Aspx PHY implementation met specifications. It was vital that our model tested the WiMAX receiver and enabled vendors to see the results,” explains Tim Fowler, business development manager at Cambridge Consultants. “The GUI needed to display what was happening in the test environment as it was sending data to the receiver and analyzing the response.”

THE SOLUTION

Cambridge Consultants used MATLAB to develop the complete test bench and demonstration environment—including the GUI, transmitter model, and hardware interface—for the Aspx WiMAX PHY implementation.

To meet Aspx’s deadline, Cambridge Consultants partitioned the effort into four subprojects: the WiMAX transmitter model, the GUI, medium access control (MAC) layer scripting, and low-level C code for interfacing with the Accelera card.

Cambridge Consultants developed a prototype of the transmitter using MATLAB and algorithms for fast Fourier transforms and a Reed-Solomon encoder from the Signal Processing Toolbox.

THE CHALLENGE

To develop a comprehensive and entirely new simulation test bench for multiantenna WiMAX base stations in seven weeks

THE SOLUTION

Use MATLAB to rapidly model and simulate WiMAX subscriber transmissions, develop a GUI for test scripting and test result analysis, and integrate with WiMAX PHY hardware—in just seven weeks

THE RESULTS

- Project delivered ahead of schedule, in seven weeks
- Unit testing simplified
- Customer confidence increased

“This approach got us up and running very quickly. We built a model that produced the right kind of spectral output in a couple of days,” notes Tan.

Elaborating on this prototype, the engineers used MATLAB to develop a faster, bit-accurate model. They then verified the model’s functionality using test vectors specified in the IEEE 802.16d standard.

Instead of developing their own text-based scripting language to define test scenarios, Cambridge Consultants used the MATLAB language as a built-in scripting mechanism to drive the model with MAC layer messages. MATLAB scripts also enabled Aspx to conduct sophisticated burst sequences to test their receiver with more than just minimum specifications.

Engineers used MATLAB development tools to design the GUI, which provides an interface for scripting and shows test results. The GUI displays MATLAB plots of the results, including bit-error rates, transmitter output, the power spectrum magnitude, and the receiver’s signal-to-noise ratio.

To interface with the Accelera card on a Linux system, Cambridge Consultants wrote custom C code that they compiled into a MEX-file (MATLAB executable). The transmitter model running in MATLAB on a Windows system called this code directly to send and receive data from the card.

Cambridge Consultants is using MathWorks tools on a variety of projects and is continuing to partner with Aspx on broadband wireless initiatives.

“We had to develop a WiMAX transmitter model within seven weeks. With MATLAB, we rapidly built a prototype, developed an accurate physical layer model, interfaced with hardware, and worked effectively in a multiplatform environment. MATLAB was the best tool for this project.”

Robert Tan, Cambridge Consultants

THE RESULTS

■ **Project delivered ahead of schedule.**

“With MATLAB, we completed the project a week ahead of schedule, despite the short deadline,” says Tan.

■ **Unit testing simplified.**

“MATLAB enabled us to test the model independently from the construction of the MAC scripting and the GUI. We also validated all the parts of this project without constructing additional test tools,” reports Tan. “MATLAB testing and debugging facilities accelerated the development of the test bench and proved that it was what our customer needed.”

■ **Customer confidence increased.**

“The test bench has enabled us to demonstrate our WiMAX PHY software running on the Linedancer device. Our customers are very familiar with MATLAB, and that makes it easier to illustrate the value of our product to our customers,” says Jacqui Adams, product marketing manager at Aspx Semiconductor. “The MATLAB test bench gives our customers confidence that they can integrate Linedancer into their development environments.”

To learn more about Cambridge Consultants, visit www.cambridgeconsultants.com

To learn more about Aspx Semiconductor, visit www.aspx-semi.com

APPLICATION AREAS

- Algorithm development
- Data analysis
- Modeling and simulation

PRODUCTS USED

- MATLAB
- Signal Processing Toolbox

www.mathworks.com