

The MathWorks in the Communications Industry

Organizations in the communications industry worldwide rely on MathWorks products and services throughout their design, implementation, and testing processes to explore ideas, model systems, generate code, and test and verify hardware and software.

Algorithm Development

Engineers use the MATLAB® and Simulink® families of products to develop, debug, and test filter, modulation, error-correction, and other algorithms. Core activities supported include:

- Rapid algorithm development and exploration
- Fixed-point algorithm development
- Data analysis and visualization

System Modeling and Design

Using Simulink and Model-Based Design, designers perform end-to-end simulations of communications systems. Simulink supports key system-level engineering tasks, including:

- BER, SNR, and related studies
- End-to-end physical- and MAC-layer simulation
- Fixed-point, bit-accurate system simulation
- Analog, digital, and mixed-signal modeling
- RF analysis and design

Implementation

Using the system models created in Simulink, engineers rapidly build prototypes and deploy them onto a range of FPGA, DSP, and GPP platforms. They rely on MathWorks and partner products for:

- Rapid prototyping
- Production code generation and deployment to hardware targets
- Software-in-the-loop and processor-in-the-loop testing

Testing

MathWorks products enable engineers to verify that the actual system performance matches the simulated system performance and to analyze, test, and debug their designs. Key activities include:

- Test vector generation
- Data acquisition and instrument control
- Post-test data analysis and visualization
- Verification of RTL and C-code implementation

Customer Successes

BridgeWave Communications simulated, tested, and implemented a high-capacity wireless Ethernet link, achieving flawless hardware prototype performance and cutting development time by 50%.

Broadcom reduced development time by 50% when they developed algorithms and systems and generated test vectors for the VHDL implementations of WCDMA chips for 3G mobile devices.

ETRI developed and proved a 4G mobile telecommunications system for implementation on an FPGA, with a 50% reduction in development time over their previous C-based methods.

Motorola reduced simulation time from hours to minutes for mixed-signal simulation of phase-locked loops, used for carrier tracking, threshold extension, linear demodulation, amplitude detection, and synchronization.

Vodafone developed an onboard road-usage charging system based on GPS and GSM/GPRS and implemented it on an ARM-based microprocessor, completing the project in 12 months instead of an estimated 18 months.

Learn how these and other communications companies are using MathWorks products:
www.mathworks.com/comms/userstories

"MATLAB is an ideal environment for developing and understanding our algorithms. Simulink integrates well with MATLAB and lets us produce a design that looks very similar to what we end up with ultimately in hardware." — Francis Swarts, Broadcom

**"The Simulink models exceeded our project specifications for required simulation speed.
Accurate simulations can now be measured in minutes rather than hours or days."**

— Yuan Yuan, Motorola

MathWorks Products for Communications

MathWorks products enable communications engineers to design, develop, and simulate complex systems, including base-stations, handsets, switches and routers, and broadcasting systems, as well as software, digital, and analog components.

The MathWorks core products are **MATLAB**, a programming environment for data analysis and algorithm and application development, and **Simulink**, a block diagram environment for multidomain simulation and Model-Based Design.

Additional products for communications include:

Communications Blockset

Design and simulate the physical layer of communication systems and components

Distributed Computing Toolbox

Run MATLAB and Simulink applications on a computer cluster

Instrument Control Toolbox

Control and communicate with test and measurement instruments

Link for ModelSim

Cosimulate and verify VHDL and Verilog using ModelSim

Real-Time Workshop

Generate optimized, portable, and customizable code from Simulink models

RF Blockset

Design and simulate the behavior of RF systems and components in a wireless system

Signal Processing Blockset

Design and simulate signal processing systems and devices

SimEvents

Design and simulate discrete-event-driven systems

Simulink Fixed Point

Design and simulate fixed-point systems

Simulink Verification and Validation

Develop designs and test cases mapped to requirements and measure test coverage

Stateflow

Design and simulate event-driven systems

See a complete listing of MathWorks products for communications, including embedded targets for TI, Motorola, Altera, and Xilinx chips:

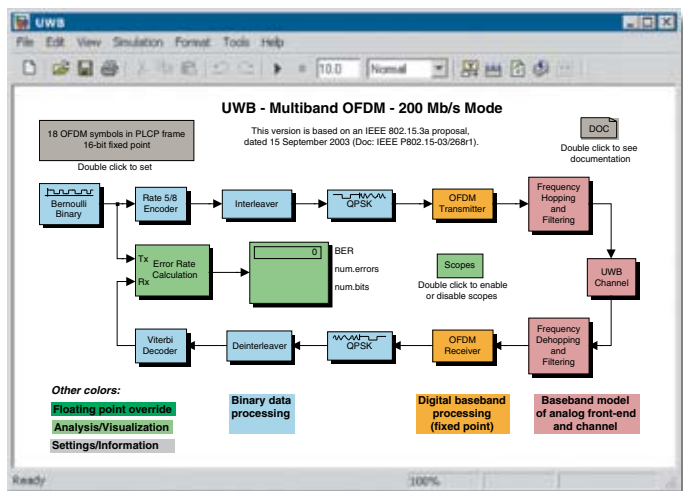
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Resources and Support

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- **THIRD-PARTY PRODUCTS AND SERVICES**
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A fixed-point model of the physical layer of ultra wideband (UWB) built with the Signal Processing Blockset. The model enables engineers to assess how fixed-point data types affect end-to-end system performance.