

# VisSim/Comm™ 7

## Communication System Design Software

VisSim/Comm is a Windows-based simulation environment for modeling end-to-end communication systems at the signal or physical level. With its full complement of communication blocks and powerful, time-domain simulation engine, VisSim/Comm provides fast and accurate solutions for analog, digital, and mixed-mode communication systems.

### Integrated development environment

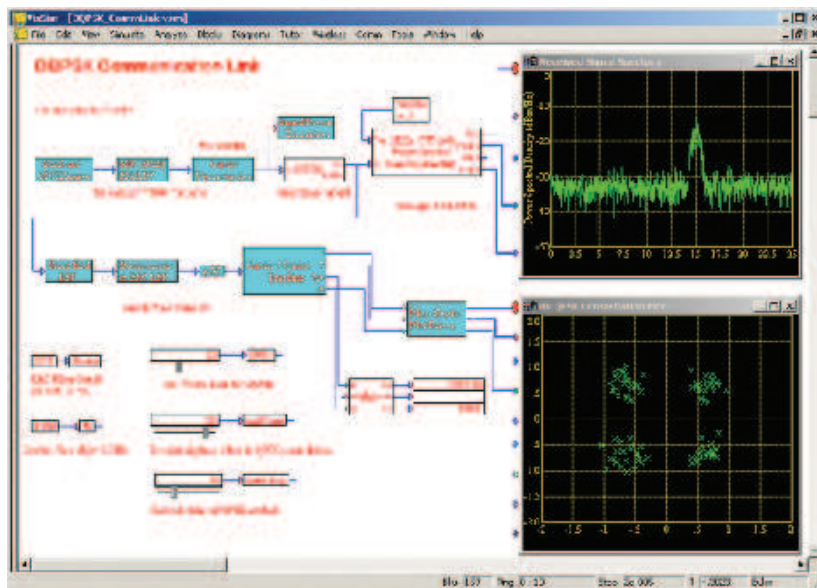
Using VisSim/Comm, you can seamlessly move among the stages of model construction, simulation, optimization, and validation. This means that you can simulate and view signal waveforms at any phase of the communication system chain.

### Intuitive block diagram interface

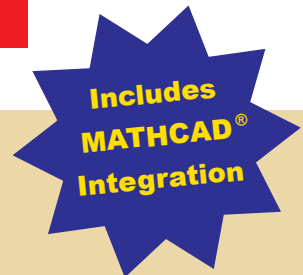
VisSim/Comm's intuitive block diagram interface makes it easy to build, modify, and maintain even the most complex system models. Simply drag blocks off the Blocks and Comm menus and wire them together with the mouse. This means that all your modeling and simulation tasks can be completed without writing a line of code.

### Integrated VisSim Viewer

VisSim/Comm includes the VisSim Viewer, a run-time, view-only version of VisSim. The Viewer allows you to share your models with individuals not licensed to use VisSim. The Viewer preserves model integrity by prohibiting recipients from changing wiring and block diagram structure. The Viewer does provide the flexibility for recipients to change block and simulation parameters to test different design scenarios.



DQPSK communication link with full simulation of carrier and symbol receiver tracking loops.



### Modeling Highlights

- Drag-and-drop block diagram construction
- 200+ communication and mathematical blocks
- Analog, digital, and mixed-mode communication system design
- Large model development
  - Explorer window for easy navigation
  - Hierarchical design with password protection
  - Embedded diagrams
  - Wire checking
  - Connector labels
  - Global, local, and scoped variables
  - Search utility
- Analog and digital modulators and demodulators
- Adaptive equalizers
- Encoders and decoders
- Vector and matrix operations
- Gaussian noise, fading, and multipath channels
- Filter design support
  - FIR (lowpass, highpass, bandpass, bandstop, Gaussian, Hilbert, and user-defined)
  - IIR (Bessel, Chebyshev, Butterworth, inverse Chebyshev, and elliptic)
  - Pulse shaping filters
  - Raised cosine and root raised cosine
  - Arbitrary magnitude and phase
  - Filter response viewer
  - Decimating FIR filters
- Phase-locked loops
- Distortion true RF elements
- Complex math operators
- Complex envelope representation
- Little and big endian representations for binary files
- Data I/O in ASCII, .M, .MAT, .WAV formats
- DLL interface to create custom blocks in C, C++, Fortran, or Pascal
- DDE with Copy Link and Paste Link
- Multi-document interface
- Multi-level undo and redo
- Windows Clipboard support

### Simulation Highlights

- Continuous-time, discrete-time, and hybrid simulation
- Interactive, batch, auto-restart, and single step execution modes

## Simulation Highlights

- Euler, trapezoidal, and Runge Kutta 2nd integration algorithms
- Error highlighting
- Range checking on communication blocks
- Estimation functions for BER, average power, mean, variance, correlation, and delay
- Automated BER generation
- MatLab interface for .MAT and .M files
- Look-up table wizard
- Global variables
- Signal probes
- Pushbutton conversion of s- and z-domain transfer functions
- Multi-rate capability
- Parameter optimization
- Implicit system solvers

## Visualization Highlights

- Interactive plots
  - Basic time domain, XY, frequency, and discrete plots
  - Phase scatter plots
  - Eye plots
  - BER curves
  - Complex FFT plots with averaging
  - External hold capacity
  - Multi XY traces
  - Log, semi-log, dB, and linear scales
  - Multi-plot windows
  - Automatic Y scaling and selectable time axis scaling
  - Full control of X and Y axis ranges
  - Over plotting and zooming
  - Read coordinates mode
  - Data I/O in ASCII, .M, and .MAT formats
- Filter Response Viewer
- Graphic and line animation
- Dynamic strip charts, bar graphs, needle meters, and histograms

## General Highlights

- Integrated VisSim Viewer
- String processing
- WMF format support
- Global, local, and nested path aliases
- Mathcad 2000 integration

## Comm and Standard Block Sets

The Comm block set includes over 200 block functions in the following categories:

- Channels
- Complex Math
- Decoders
- Demodulators
- Digital Elements
- Encoders
- Estimators
- Filters
- Modulators
- Multirate Support
- Operators
- Phase-Locked Loops
- RF Components
- Signal Sinks
- Signal Sources
- Vector Operators

In addition to the Comm blocks, VisSim/Comm also offers over 100 mathematical, engineering, and scientific blocks for linear, nonlinear, continuous, discrete, multi-rate, SISO, MIMO, and hybrid system design. These blocks are in the following categories:

- Animation
- Annotation
- Arithmetic
- Boolean
- DDE
- Integration
- Linear Systems
- MatLab Interface
- Matrix Operations
- Nonlinear
- Optimization
- Random Generator
- Real Time
- Signal Consumer
- Signal Producer
- Time Delay
- Transcendental

## VisSim/Comm Options

**VisSim/C-Code** Translates VisSim models into highly optimized, ANSI C code that can be immediately put to use in a variety of applications or customized to meet specific design requirements.

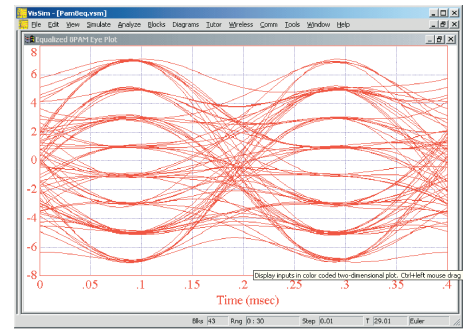
**VisSim/Comm DSP** Rapidly prototypes communication systems to DSPs or embedded systems.

**VisSim/Comm Red River** Supports real-time data acquisition from Red River Digital Tuner cards.

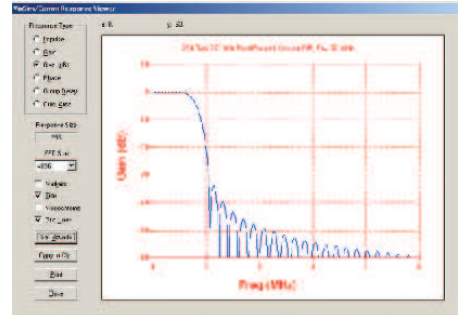
**VisSim/Comm Turbo Code** Supports modeling of PCCC Turbo Codes, including the UMTS specification.

**VisSim/Comm Wireless LAN** Supports simulating 802.11a/b/g, Bluetooth, and Ultrawideband designs.

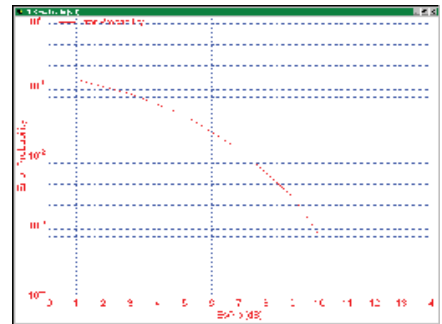
**VisSim/Comm Personal Edition** Entry-level version of VisSim/Comm offering much of the functionality of VisSim/Comm, with these limitations: no userFunction or embed block, some restrictions on Comm blocks, and limited to 100 blocks per diagram.



Equalized 8-level PAM signal.



Gain response of Root Raised Cosine Lowpass FIR using VisSim/Comm Filter Viewer.



BER curve.

## Communications Block Library

### Channels

Add. White Gaussian Noise (Complex & Real)  
Binary Symmetric Channel  
Jakes Mobile\*  
Mobile Fading Channel\*  
Multipath  
Propagation Loss\*  
Rice/Rayleigh Fading  
Rummler Multipath  
Saleh-Valenzuela (Complex & Real)\*  
TWTA  
Vector AWGN

### Complex Math

Addition  
Complex to Mag/Phase  
Complex to Real/Imag  
Conjugate  
Division  
Inverse  
Mag/Phase to Complex  
Multiplication  
Power  
Real/Imag to Complex  
Square Root

### Demodulators

DPSK Detector (2,4,pi/4,8\*,16\*,32\*)  
FM Demodulator  
IQ Detector\*  
PPM Demodulator  
PSK Detector (2,4,8\*,16\*)  
PAM Detector (2,4,8,16)  
QAM Detector (16,32,64\*,128\*,256\*)

### Digital Elements

Accumulate and Dump  
Binary Counter  
Bits to Symbol  
Buffer and Unbuffer  
Divide by N  
D Flip Flop  
JK Flip Flop  
Mux/Demux\*  
Packet Timing\*  
Parallel to Serial  
Pulse Extend  
Queue\*  
Serial to Parallel  
State Machine\*  
Symbol to Bits

### Encoders and Decoders

Block Interleaver  
Convolutional Encoder  
Convolutional Interleaver\*  
Depuncture\*  
Gray Decoder  
Gray Encoder,  
Hamming Decoder  
Hamming Encoder  
**Manchester Encoder**  
Puncture\*  
Reed-Solomon Decoder  
Reed-Solomon Encoder  
Trellis Decoder\*  
Trellis Encoder\*  
Viterbi Decoder (Hard & Soft)

### Estimators

Average Power (Complex & Real)  
BER Control (#Errors)  
BER Curve Control  
Bit/Symbol Error Rate  
Complex Correlation\*  
Correlation\*  
Delay Estimator  
Event Time  
File Correlation (Complex & Real)\*

Frequency Counter  
Mean  
Median\*  
Min/Max  
Variance  
Vector Correlation\*  
Weighted Mean\*

### Filters

Adaptive Equalizer (Complex & Real)  
**Discrete Equalizer (Complex & Real)**  
File FIR  
FIR  
IIR  
MagPhase\*  
Pulse Shaping Filter  
Sampled File FIR\*  
Sampled FIR\*  
**Variable Spaced Equalizer (Real & Complex)**

### Fixed Point

**Fixed Point FIR**  
**Fixed Point IIR**  
**Fixed Point VCO (Real & Complex)**

### Instruments

BER Curve Display  
Oscilloscope Display  
Spectrum Analyzer Display (Complex & Real)

### Modulators

AM  
**ASK**  
DPSK (2,4,pi/4,8\*,16\*,32\*)  
FM  
FSK  
IQ\*  
MSK  
PM  
PAM (4,8)  
PPM (Real)  
PSK (2,4,8\*,16\*)  
QAM (16,32,64\*,128\*,256\*)  
SQPSK

### Multirate Support

Clock Edge\*  
Clock Extend\*  
Interpolator\*

### Operators

A/D Converter  
Compander  
Complex Exponential  
Complex FFT, IFFT  
Conversions  
D/A Converter  
Delay (Complex & Real)  
Gain (dB)  
Integrate & Dump (Complex & Real)  
I/Q Mapper\*  
Max Index  
Modulo  
Oscilloscope (Core)  
Phase Rotate  
Phase Unwrap\*  
Polynomial  
Spectrum Analyzer (Complex & Real)  
Subsample  
Vector FFT

### Phase-Locked Loops

Charge Pump  
PLL Loop Filters (2nd & 3rd\* order)  
Type 2 Phase Detector  
Type 3 Phase/Frequency Detector  
Type 4 Phase/Frequency Detector\*

### RF Components

Amplifier

Antenna\*  
Attenuator  
Cable\*  
Coupler  
Double Balanced Mixer\*  
RF Conversions  
RF Gain  
Splitter/Combiner  
Switch  
Variable Attenuator\*

### Signal Sinks

File Write  
File Value

### Wave Write

### Signal Sources

Complex Tone  
File Data  
Frequency Sweep  
Impulse  
Impulse Train  
Noise  
PN Sequence  
Poisson Arrivals\*  
Random Distribution  
Random Seed  
Random Signals  
Rectangular Pulses  
Sinusoid  
Spectral Mask\*  
VCO (Complex & Real)  
Vector Constant  
Walsh Sequence\*  
**Wave Data**  
Waveform Generator

### Vector Operators

Matrix to Vector  
Subvector  
Vector Bits to Symbols  
Vector Demux  
Vector Merge  
Vector Mux  
Vector Symbols to Bits  
Vector to Matrix

\* Not included with VisSim/Comm PE

**Bolded block names** are new in version 7

## Technical Overview

### Types of Systems

- Analog, Digital, and Mixed-mode communication systems

### Operating Systems

- Windows 2000, Me, XP, or Vista

### Technical Specifications

Max. blocks	500K*
Max. plots	500K*
Max. integrators	500K*
Max. data points	200K
Integration methods	3
Numeric precision	IEEE 64-bit
Data file form	ASCII, .M, .MAT, .WAV
ABCD state-space form	.MAT, .M

\* Max blocks, plots, and integrators is 100 in VisSim/Comm PE

**Visual Solutions**  
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Modeling The Future