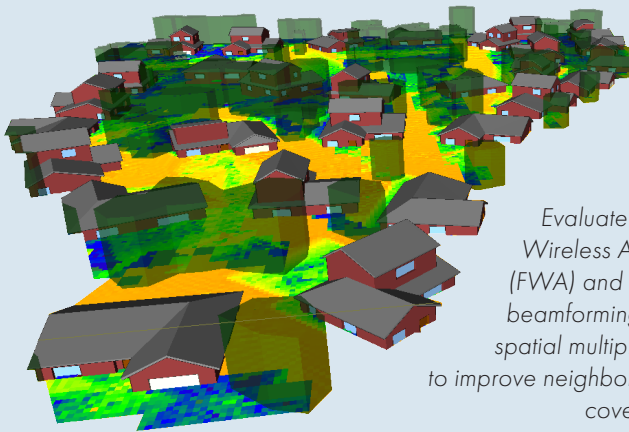


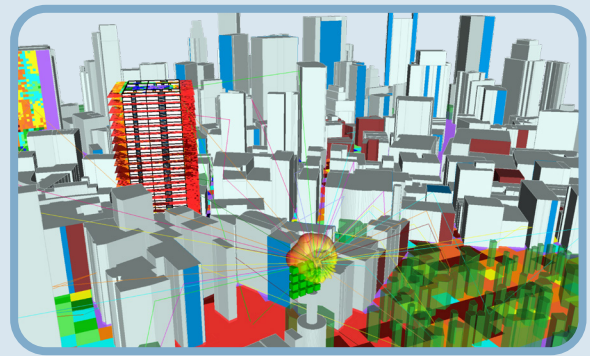
# Wireless InSite® 3D Wireless Prediction Software

**Wireless InSite** is site-specific radio propagation software for the analysis and design of wireless systems for communication, networking, sensors, and other applications in urban, indoor, or rural environments. Its focus is accuracy, providing full 3D ray-tracing simulations that can predict detailed channel information critical for new technologies in 5G and WiFi, while applying innovative optimizations and accelerations to ensure reasonable run times.

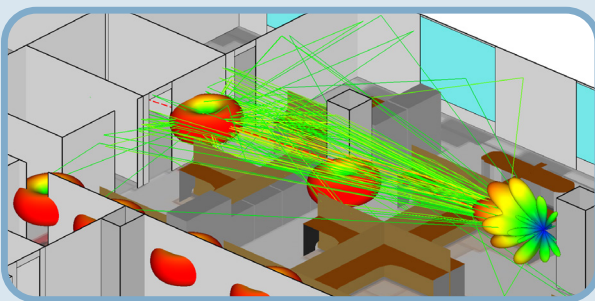
- Assess the performance of new device designs in realistic environments
- Analyze key channel and signal characteristics for RF and mmWave frequency bands
- Simulate MIMO and massive MIMO
- Predict coverage from base stations and access points in complex indoor and outdoor scenes
- Evaluate wireless backhaul solutions
- Capture complex scattering at higher frequencies
- Optimize antenna coverage



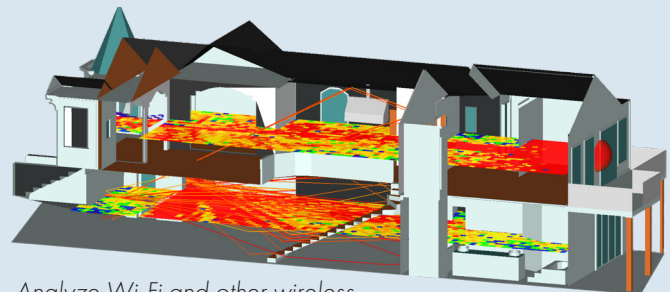
*Evaluate Fixed Wireless Access (FWA) and apply beamforming and spatial multiplexing to improve neighborhood coverage.*



*Predict coverage and multipath for small cell using massive MIMO.*



*Analyze device performance for mmWave systems in indoor scenes with diffuse scattering effects.*



*Analyze Wi-Fi and other wireless systems in realistic indoor environments.*

## Multiple Versions for Various Needs

### Wireless InSite Standard

Suite of propagation models based on high-fidelity two-dimensional and three-dimensional ray-tracing. Supports urban and indoor wireless, and longer-range rural applications.

### Wireless InSite Professional

Bundles high-fidelity models from the Standard Version with fast ray-based and empirical models. Also includes additional specialized capabilities, such as:

- Diffuse scattering, enabling the capture of signal contributions from rough surfaces
- Engineered Electromagnetic Surface (EES) capability, allowing modeling of passive EM metasurfaces designed to enhance wireless signal coverage
- Adjacent path generation (APG) run-time optimization
- APIs for select models, allowing users to develop custom applications

### Wireless InSite MIMO

Bundles the features in the Professional version with MIMO capabilities, including MIMO array builder, optimized MIMO simulation, throughput and comms analysis, and channel results analyzer. Calculate MIMO channel, including degradation due to mutual coupling between antennas. Apply beamforming, spatial multiplexing, and diversity techniques to improve performance and predict throughput from multiple MIMO streams.

Wireless InSite Versions Comparison			
	Standard	Professional	MIMO
X3D Ray Model (GPU)	•	•	•
Full 3D Propagation Model	•	•	•
Urban Canyon Ray Model (2D)	•	•	•
Vertical Plane Ray Model (2D)	•	•	•
Free Space	•	•	•
Triple Path Geodesic		•	•
Hata/COST Hata		•	•
Vertical Plane Urban Propagation		•	•
Walfisch-Ikegami		•	•
C++ API to Calculation Engine		•	•
Engineered Electromagnetic Surfaces (EES)		•	•
Adjacent Path Generation (Optimization)		•	•
Diffuse Scattering		•	•
MIMO Antenna Designer			•
MIMO Simulation Optimization			•
MIMO Beamforming/Spatial Multiplexing			•
MIMO Channel Outputs			•
MIMO Throughput/Comms Analysis			•

## Wireless InSite Key Features and Outputs

### Modeling Capabilities

- Accurate, accelerated 3D ray-tracing model (X3D) captures antennas, polarization, phase, and multipath in detail
- Supports outdoor, indoor, outdoor-to-indoor, and indoor-to-outdoor
- Special features including foliage and atmosphere
- Suite of models providing fast 2D methods and empirical models for quick analysis
- Monte-Carlo and frequency sweeps capture parameter variations with a single ray-trace
- Comms analysis computes SINR, throughput, and BER

### MIMO Analysis

- Optimized calculations handle large arrays to support massive MIMO
- Beamforming, spatial multiplexing, and diversity capture MIMO improvements to channel response
- Communications analysis computes SINR, throughput, and BER for MIMO streams, as well as total for MIMO channel

### Acceleration and Optimization

- GPU acceleration and multi-threading
- Optimal algorithms for processing and handling complex geometry
- Geometry caching reduces run times for subsequent simulations

### Materials and Environment

- Ability to model dielectric properties of construction materials, including multi-layered materials

- Engineered Electromagnetic Surfaces (EES) model: used to enhance wireless signal coverage for 6G
- Diffuse scattering using Lambertian or directive scattering models
- Atmospheric absorption in X3D ray model extends to mmWave and above
- Soil material properties, including built-in models based on sand, silt, and clay percentages
- User-defined, tabulated reflection and transmission coefficients
- Models for foliage penetration loss

### Imports and Databases

- Global geodata available
- Geometry importers for buildings, floor plans, and objects
- Measured or custom antenna patterns
- USGS foliage and terrain

### Outputs and MIMO System Outputs

- Received power, path loss\*
- Visualize propagation paths
- Field outputs
- Time-of arrival\*
- Direction-of-arrival/departure\*
- RMS delay spread\*
- Angle spread of arrival/departure\*
- MIMO H-Matrix\*
- Complex impulse response\*
- Signal-to-interference-plus-noise\*
- Throughput and capacity\*
- Bit Error Rate (BER)\*

\*included in MIMO channel data outputs

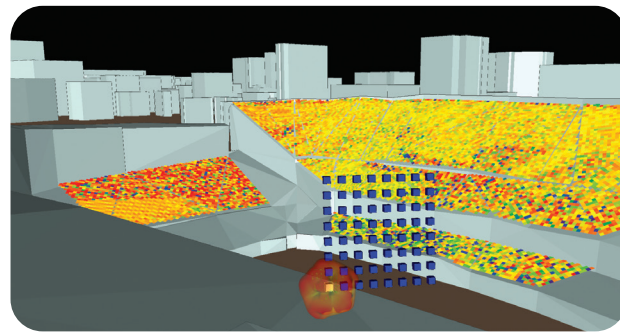
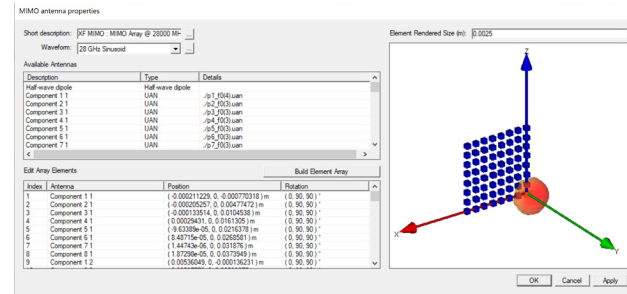


## Wireless InSite MIMO

Wireless InSite offers a unique capability for optimized simulation of 5G MIMO systems.

### Analytic or Imported MIMO Antennas

- Build MIMO antennas and arrays with arbitrary patterns, rotations and spacings
- Alternatively, import from measurements or full-wave solver, such as Remcom's XFDTD®

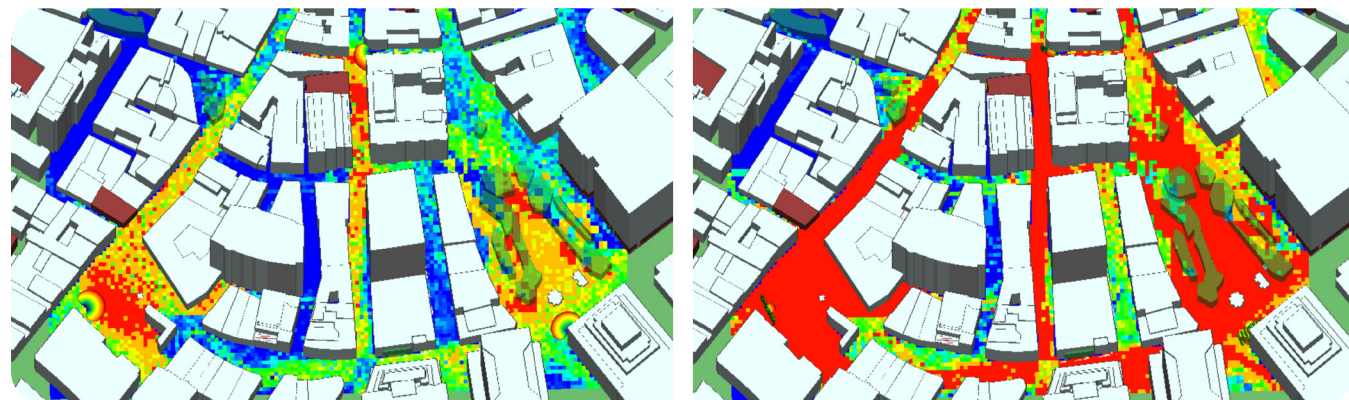


### Accurate, Optimized MIMO Channel Prediction

- GPU ray-tracing with MIMO optimizations rapidly predict precise paths from each Tx element to each Rx element
- Maintains relative positions of antenna elements along routes
- Predict complex impulse response, H-matrix, time and direction of arrival/departure, RMS delay spread, angle spread

### MIMO Beamforming, Spatial Multiplexing, and Comms Analysis

- MIMO beamforming, spatial multiplexing, and diversity techniques applied to compute enhancements to channel and characteristics of MIMO data streams
- Predict throughput, capacity, and bit error rate for various wireless access methods
- Export results for custom post-processing

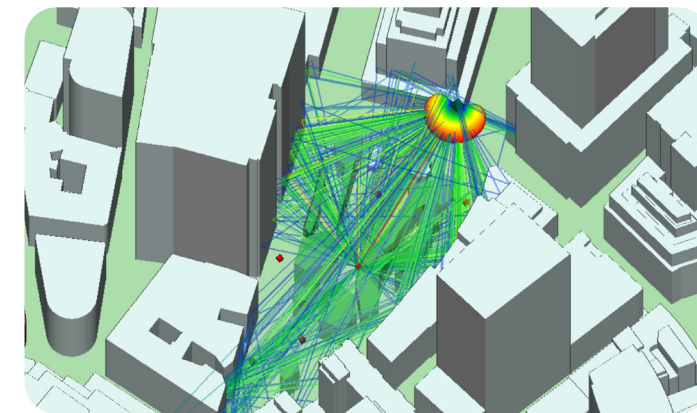
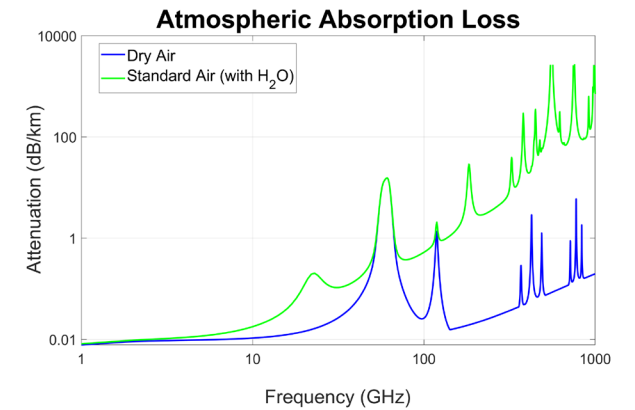


Massive MIMO Beamforming (right) shows significant improvement to throughput over sector horns (left)

## Advanced Features for Emerging Wireless Technologies

### Atmospheric Absorption for mmWave+

- Incorporates key absorption bands due to oxygen and water vapor resonances
- Loss determined from user-specified temperature, pressure and humidity
- Absorption model valid up to 1 THz, allowing for LOS calculations (direct path only) above mmWave

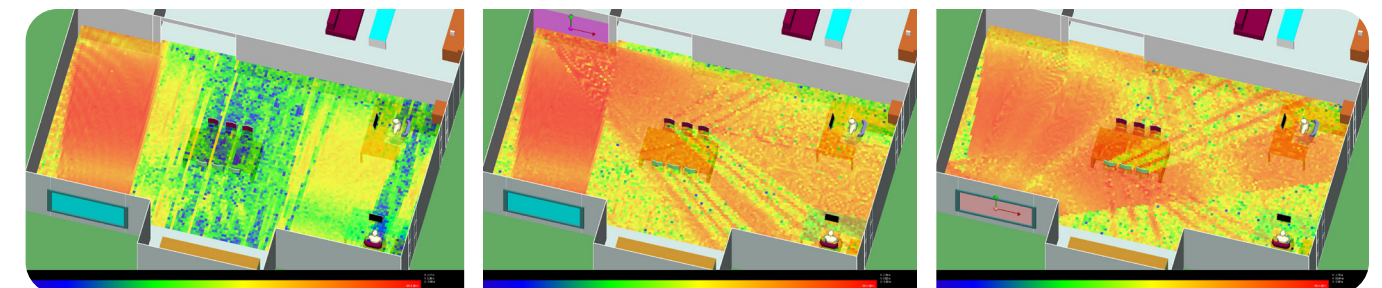


### Diffuse Scattering

- Simulates scattering caused by roughness of modeled surfaces
- Increasingly important as frequency increases
- Multiple models allow scattering to be omnidirectional, or to have directive and backscattered lobes
- Increases delay and angle spreads, as well as cross-polarized power

### Engineered Electromagnetic Surfaces (EES)

- Models passive metasurfaces designed to optimize wireless communication by manipulating how signals propagate through an environment
- Supports gratings or diffusers on reflective or transmissive surfaces
- Provides a way to analyze improvements to coverage from either a static EES or a single configuration of a metasurface-based Reconfigurable Intelligent Surface (RIS)



Initially, coverage is mostly through window to left side of room

Placing a diffuser EES on far wall (left) or window (right) spreads coverage more uniformly throughout room

# Our Family of Products

Remcom has been leading the EM market with innovative simulation and wireless propagation tools for over 25 years.

## Remcom Simulation Platform

Remcom's Simulation Platform unites WaveFarer® and XFDTD® for seamless analysis of radar returns and full-wave simulation in a common user interface.

### XFDTD®

General purpose 3D EM simulation solver that simplifies analysis of a wide variety of applications.



### WaveFarer®

High-fidelity radar simulator for drive scenario modeling at frequencies up to and beyond 100 GHz.



### Wireless InSite®

Suite of ray-tracing models and high-fidelity EM solvers for analyzing site-specific radio wave propagation and wireless communication systems.



### XGTD®

High frequency GTD/UTD software for analyzing antenna systems on complex objects such as vehicles and aircraft.



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