Multipath Fading Simulator

WAVE-3G SIM

Micronetics WAVE-3G SIM is a universal simulator for research, development and production of 3G and next-generation wireless communication systems.

The WAVE-3G SIM Multipath Fading Simulator incorporates the latest technologies for simulating mutipath fading and injecting Additive White Gaussian Noise (AWGN) to test existing and next-generation communication systems with unprecedented levels of accuracy and repeatability.

WAVE-3G SIM creates a real-world wireless environment for evaluating performance of a communication system with confidence and ease. Meeting or exceeding the requirements of current and proposed air interface test standards, WAVE-3G SIM is perfectly suited for system development and type approval testing.

Wireless communication channels between a base station and mobile station are characterized by multipath fading, Doppler shift, path loss, delay spread and random noise. These impairments significantly distort the original signal, which make it difficult for the receiver to demodulate the signal properly. By simulating these effects in a controlled lab environment, design and test engineers can thoroughly test, troubleshoot and improve the system design enabling it to be more robust and error-free.

Using state-of-the-art digital signal processor (DSP) technology, WAVE-3G SIM provides improved multipath fading simulation enabling more confidence in test results. With its internal digital power meter and built-in noise source, a single instrument provides accurate and repetitive multipath fading and carrier-to-noise setting ability. With its unique modular architecture and cost-effective configuration, WAVE-3G SIM is an ideal instrument for next-generation communication system testing.

WAVE-3G SIM simulates channel characteristics for wireless communication systems and standards including:

- **Cellular and PCS**
- **3GPP/W-CDMA/GSM**
- **cdma2000/CDG/IS-95**
- **IMT-2000**
- **Wireless LAN**
- **Smart Antennas**
- **Wireless Local Loop**
- **Cordless Telephone**
- **CATV/HDTV**

Major Features:

- Complete channel simulation including multipath fading and AWGN in one instrument
- Compatible with 3GPP (UMTS/GSM) and cdma2000 (CDG/IS-95) test standards and more
- Fully digital implementation using latest DSP technology resulting in high accuracy and repeatability
- Flexible and powerful real-time dynamic fading environment for moving propagation and birth-death propagation conditions
- User-defined I/Q impairment and internal calibration capabilities for chipset design and test
- Modular architecture for flexible test system configuration with complementary purpose-built RF instruments
- Built-in Industry standard fading profiles
- Allows user definable profiles
- Controlled via Windows® GUI or GPIB

Applications:

- **Mobile Phone Test**
- **Base Station Test**
- **Product Development**
- **Laboratory Research**
- **Design Verification Test**
- **System Performance Evaluation**
- **Type Approval Test**
- **Quality Assurance**

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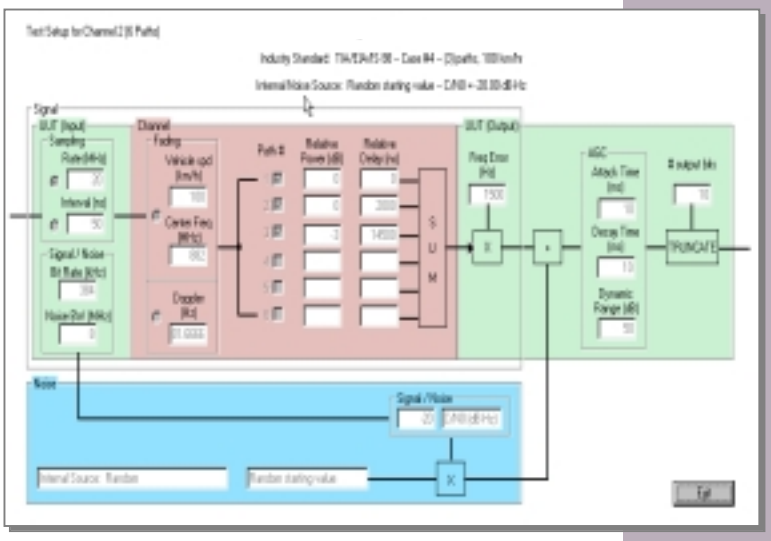
MICRONETICS TEST SOLUTIONS

Description

WAVE-3G SIM simulates multipath fading and Additive White Gaussian Noise (AWGN) impairments using the latest digital implementation. It has both digital and analog baseband I/Q inputs and outputs. Combined with complementary vector signal generators, complete RF testing is available as an option. Based on 16-bit DSP technology, Rayleigh fading is accurately modeled on 6 or 12 paths, resulting in consistent and repeatable results.

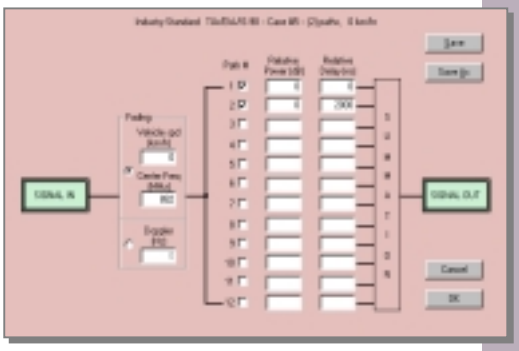
Doppler, frequency offset and automatic gain control (AGC) are implemented through a state-of-the-art microprocessor. In addition, a 42-bit length pseudo random source generates true white Gaussian noise. An internal digital power meter measures the faded signal power and noise, and sets the desired carrier-to-noise ratio (C/N or Eb/No). The final output combines the faded signal and AWGN for various test conditions.



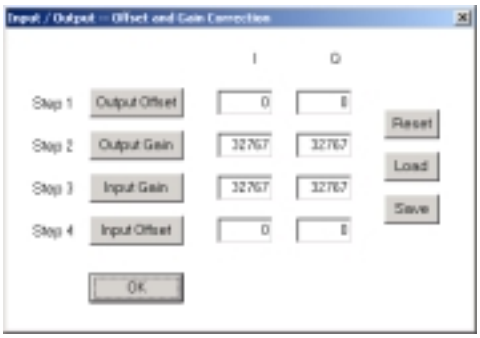
Industry Standard and User Defined Fading Models

Pre-configured channel models based on industry standards such as cdma2000 and 3GPP enable you to benchmark your product's performance quickly and effectively. Using an intuitive graphical user interface based on Windows®, you can easily add user-defined channel models to conduct more comprehensive tests.

Dynamic channel simulation interface also allows easy editing of fading parameters such as delay variation over time for each path to perform moving propagation and birth-death propagation tests.



I/Q Impairment and Calibration Routine



For baseband modem chipset designers, deliberately introducing I/Q impairments can stress test a chipset's performance. Fine I/Q balancing capability can also be used to compensate for input and output signal offsets, as well as for internal calibration routines.

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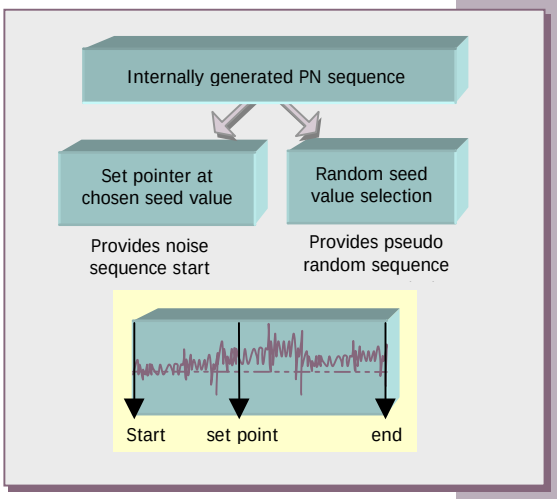
Built-in Digital Noise Generator

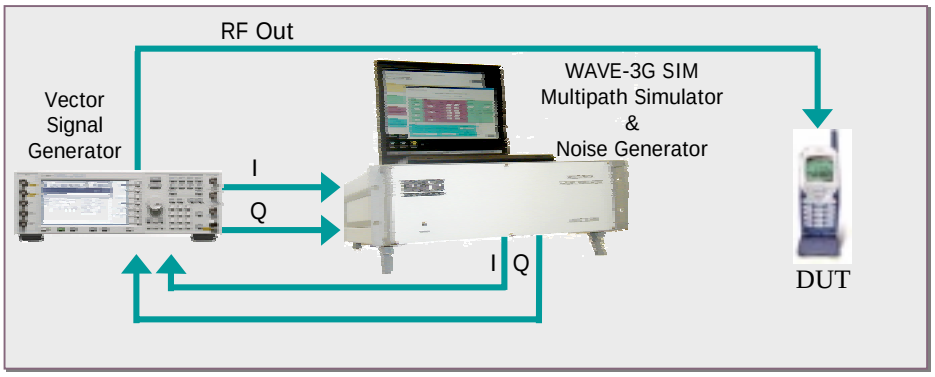
WAVE-3G SIM's Built-in Digital Noise Generator allows generation of various forms of noise impairments to test the robustness of system design. Designed as a dual-mode noise generator, either user-defined or internally generated noise values such as impulse or white Gaussian noise (AWGN) can be injected into the system. In addition, when performing tests using the internally generated pseudorandom number sequence, you can choose random seed value or select exact noise sequence to be repeated for fine troubleshooting. This is an essential tool for developing noise cancellation techniques and determining system performance.



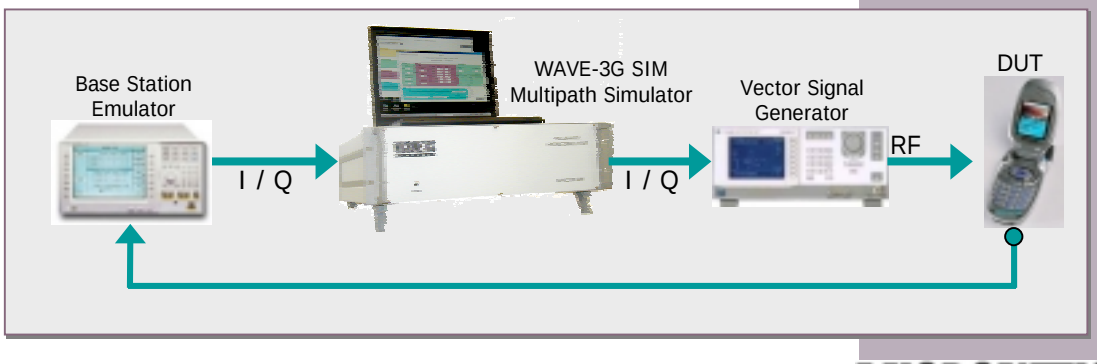
Applications:

3G User Equipment Testing

WAVE-3G SIM is a truly modular system that can be creatively configured to perform many receiver tests with minimum amount of investment in test instruments. By integrating with a vector signal generator, WAVE-3G SIM can be used for demodulation tests under fading conditions at baseband or RF.



Combining WAVE-3G SIM with a Base Station Emulator and Vector Signal Generator yields a powerful and comprehensive 3G mobile test solution. Since a digital power meter enables accurate and repeatable C/N settings even with multipath faded signals, your FER or BLER measurement confidence level is high. This allows shorter test times and better design decisions.



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Specifications:

RF bandwidth (-3 dB): 16 MHz
Number of paths per channel: 6 or 12 paths per channel

Digital Modulation

Input/Output signal	Selectable from 4 to 16 bits (in 2-bit increments)
Sampling rate	Up to 30 MHz (user supplied digital clock, TTL input, other levels available)

Analog Modulation

I/Q modulation inputs	14 bit samples
Sampling rate	20 MHz
Input/Output impedance	50 Ω, BNC or SMA Connector
VSWR (DC to 20 MHz)	< 1.2:1
Input voltage	4.4 V peak-to-peak
Output voltage	3.1 V peak-to-peak
Input I/Q offset (50Ω)	
Setting range	±600 mV
Resolution	72µV (4 bits)
Input I/Q gain	
Setting range	0 to 100%
Resolution	0.01%
Output I/Q offset (50Ω)	
Setting range	±2.2V
Resolution	272 µV (4 bits)
Outputs I/Q gain	
Setting range	0 to 100%
Resolution	0.01%

Multipath Fading

Path attenuation	
Range	0 dB to 72 dB (Digital); 0 dB to 60 dB (Analog)
Resolution	0.01 dB
Accuracy	0.01 dB at -31.5 dB, 0.1 at -51.5dB 1.0 at -71.5dB (Digital) 0.05 dB at -40dB, 0.5 at -60dB (Analog)
Path Delay	
Range	0 to 100 ms
Resolution	0.05 ns
Accuracy	0.01 ns
Doppler Shift	
Frequency range	±0.1 Hz to ±2000 Hz
Resolution	10^{-7} Hz
Speed range (fc=900 MHz)	±0.1 to ± 2300 km/hr
Rayleigh Fading	
Repeat interval	>17520 hours
Deviation from theoretical	
CPDF for P_{ave} =0 dB (mean power level)	
Path atten. from	
–30 dB to +10 dB	±0.4 dB
–30 dB to -20 dB	±0.3 dB
Level crossing rate accuracy	
Path atten. from	
–30 dB to +3 dB	<±1.4 %
Moving delay mode	
Period of oscillation	
10^{-3} rad/sec	1 to 100 for one path
Number of moving paths	1 to 6
Birth-death propagation	
Number of active paths	1 to 6

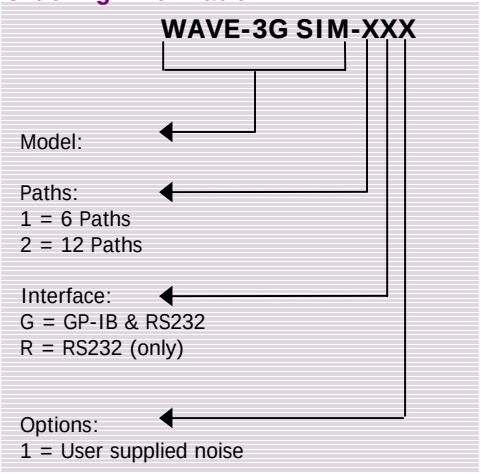
Digital Noise Generator (AWGN)

PN sequence	Random (60 hr. repeat intervals)
Distribution density	Gaussian, statistically independent for I & Q
Crest factor	16.7 dB
C/N	
Max Noise Power Level	-68 dBm/Hz (I,Q baseband) -65 dBm/Hz (RF, assuming unity gain)
Resolution	0.01 dB
Accuracy	±0.1 dB

General System Specifications

Power Requirements	
Voltage	100-120 VAC 220-250 VAC, auto sensing
Frequency	47-60 Hz
Operating environment	
Temperature	5° to 40° C
Humidity range	20 to 80% RH
Dimensions	20"D x 17"W x 5.25" H (3U) (508mm D x 432 mm W x 133 mm H)
Weight	30 lbs. (13.6 kg)
Control interfaces	PC-based control program (Win98/2000/NT), RS-232 GP-IB

Ordering Information



RF Interface Solutions

RF integrated solutions are available up to 6.2 GHz; contact factory for additional information

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