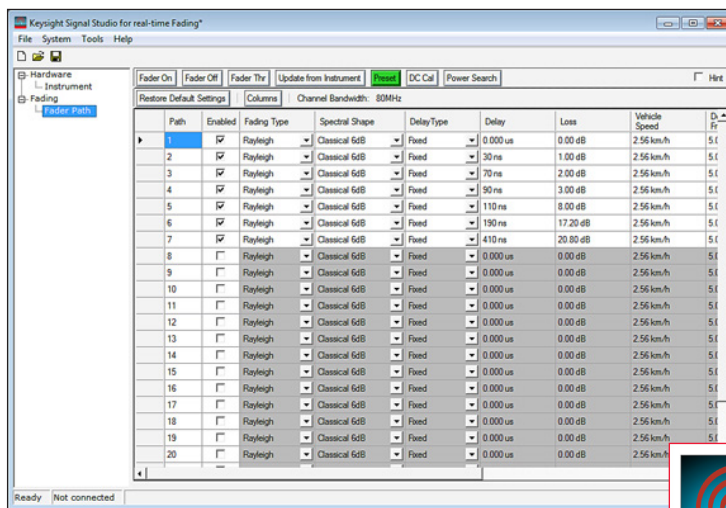


Keysight Technologies

Signal Studio for Real-time Fading

N7605B

Technical Overview



- Apply real-time fading on signals for receiver test and configure fading flexibly on all fading parameters
- Select from different fading types, including Rayleigh, Rician, Suzuki, log normal, pure Doppler, and constant phase to simulate different propagation environments
- Use preconfigured setups for all important digital communication standards: W-CDMA, HSDPA, HSUPA, COST 259, TD-SCDMA, cdma2000@, cdmaOne, 1xEV-DO, GSM, EDGE, WLAN, TETRA, DVB, LTE
- Add AWGN (Option 403 on N5172B EXG/N5182B MXG X-Series signal generators) with calibrated S/N to the signals
- Accelerate the signal creation process with a user interface based on parameterized signal configuration and tree-style navigation

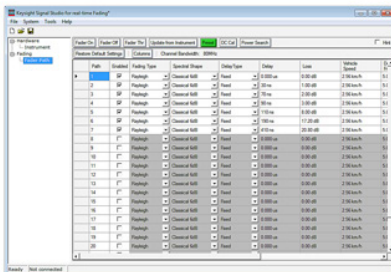
Introduction

A fading channel emulator allows engineers to comprehensively evaluate wireless communication systems by predicting their performance in response to real-world conditions. The Keysight N7605B Signal Studio for real-time fading software together with an N5172B EXG/N5182B MXG vector signal generator provides a comprehensive diagnostic toolset for designing and verifying wireless signal processing devices. This solution applies real-time fading to a baseband signal in a single general-purpose signal generator.

Receiver test in dynamic environments for early R&D and performance verification

N7605B Signal Studio for real-time fading software is a powerful tool for verifying your cellular communications, WLAN, digital video/audio, or satellite/military communication receiver designs. Use this software to fade your digital baseband signals and apply AWGN, and to convert the faded and noisy signals to RF frequencies in the N5172B EXG/N5182B MXG vector signal generator. Preconfigured fading profiles simplify initial setup, or you can choose user-defined fading profiles to meet your specific test needs.

- Conformance test under fading conditions of receivers, during RF/baseband integration and system verification
- Verifications of the baseband subsystems, in the process of chip design and integrated circuit development.



N7605B Signal Studio for Real-time Fading running in a PC



N5172B EXG/N5182B MXG

Top Features

Powerful support on different fading types

The ability to simulate different fading profiles is essential for evaluating receiver performance in a variety of environments. The N7605B can support the following fading types:

- Rayleigh – small-scale multipath scattering
- Rician – Rayleigh with a direct ray
- Log normal – large-scale free-space path loss
- Suzuki – Rayleigh with log normal
- Pure Doppler – frequency shift due to motion

Path	Enabled	Fading Type	Spectral Shape	Delay Type	Delay	Loss	Vehicle Speed	D.F.
1	<input checked="" type="checkbox"/>	Rayleigh	Classical 6dB	Fixed	0.000 us	0.00 dB	2.56 km/h	5.0
2	<input checked="" type="checkbox"/>	Pure Doppler	Classical 6dB	Fixed	30 ns	1.00 dB	2.56 km/h	5.0
3	<input checked="" type="checkbox"/>	Rician	Classical 6dB	Fixed	70 ns	2.00 dB	2.56 km/h	5.0
4	<input checked="" type="checkbox"/>	Suzuki	Classical 6dB	Fixed	90 ns	3.00 dB	2.56 km/h	5.0
5	<input checked="" type="checkbox"/>	Rayleigh	Classical 6dB	Fixed	110 ns	8.00 dB	2.56 km/h	5.0
6	<input checked="" type="checkbox"/>	Rayleigh	Classical 6dB	Fixed	190 ns	17.20 dB	2.56 km/h	5.0
7	<input checked="" type="checkbox"/>	Rayleigh	Classical 6dB	Fixed	410 ns	20.80 dB	2.56 km/h	5.0
8	<input type="checkbox"/>	Rayleigh	Classical 6dB	Fixed	0.000 us	0.00 dB	2.56 km/h	5.0
9	<input type="checkbox"/>	Rayleigh	Classical 6dB	Fixed	0.000 us	0.00 dB	2.56 km/h	5.0
10	<input type="checkbox"/>	Rayleigh	Classical 6dB	Fixed	0.000 us	0.00 dB	2.56 km/h	5.0
11	<input type="checkbox"/>	Rayleigh	Classical 6dB	Fixed	0.000 us	0.00 dB	2.56 km/h	5.0
12	<input type="checkbox"/>	Rayleigh	Classical 6dB	Fixed	0.000 us	0.00 dB	2.56 km/h	5.0
13	<input type="checkbox"/>	Rayleigh	Classical 6dB	Fixed	0.000 us	0.00 dB	2.56 km/h	5.0
14	<input type="checkbox"/>	Rayleigh	Classical 6dB	Fixed	0.000 us	0.00 dB	2.56 km/h	5.0
15	<input type="checkbox"/>	Rayleigh	Classical 6dB	Fixed	0.000 us	0.00 dB	2.56 km/h	5.0
16	<input type="checkbox"/>	Rayleigh	Classical 6dB	Fixed	0.000 us	0.00 dB	2.56 km/h	5.0
17	<input type="checkbox"/>	Rayleigh	Classical 6dB	Fixed	0.000 us	0.00 dB	2.56 km/h	5.0
18	<input type="checkbox"/>	Rayleigh	Classical 6dB	Fixed	0.000 us	0.00 dB	2.56 km/h	5.0
19	<input type="checkbox"/>	Rayleigh	Classical 6dB	Fixed	0.000 us	0.00 dB	2.56 km/h	5.0
20	<input type="checkbox"/>	Rayleigh	Classical 6dB	Fixed	0.000 us	0.00 dB	2.56 km/h	5.0

Flexible configuration on different Doppler spectrum shapes

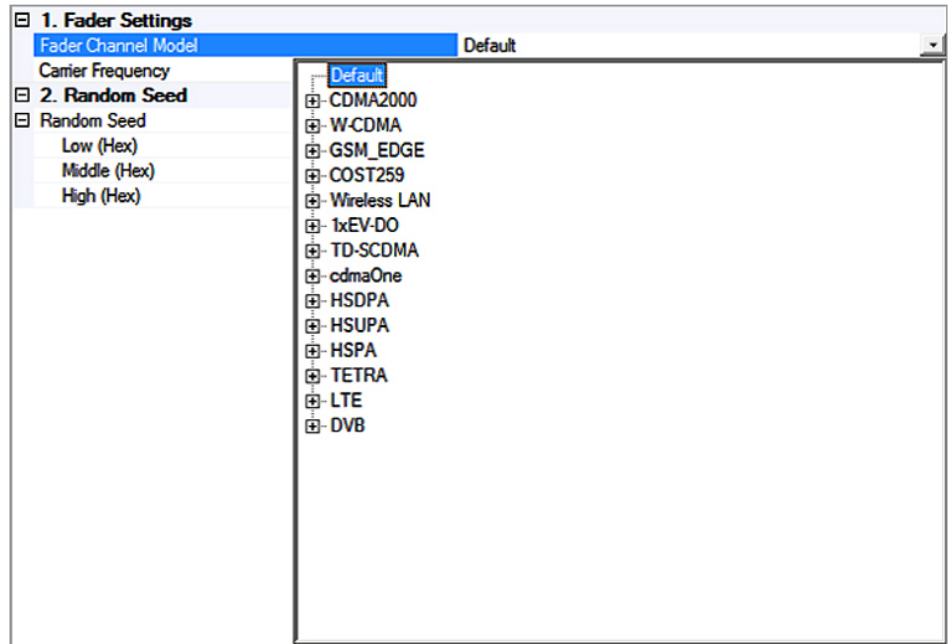
Doppler spectrum shape is another important part to simulate different fading scenarios. The N7605B supports the following Doppler spectrum shapes, enabling you to simulate the environments required for the test.

- Classical 3 dB
- Classical 6 dB
- Flat
- Rounded
- Jakes Classical
- Jakes Rounded
- Half Bathtub
- Jakes Half Bathtub

Path	Enabled	Fading Type	Spectral Shape	Delay Type	Delay	Loss	Vehicle Speed	D.F.
1	<input checked="" type="checkbox"/>	Rayleigh	Classical 6dB	Fixed	0.000 us	0.00 dB	2.56 km/h	5.0
2	<input checked="" type="checkbox"/>	Rayleigh	Classical 6dB	Fixed	30 ns	1.00 dB	2.56 km/h	5.0
3	<input checked="" type="checkbox"/>	Rayleigh	Flat	Fixed	70 ns	2.00 dB	2.56 km/h	5.0
4	<input checked="" type="checkbox"/>	Rayleigh	Rounded	Fixed	90 ns	3.00 dB	2.56 km/h	5.0
5	<input checked="" type="checkbox"/>	Rayleigh	Jakes Classical	Fixed	110 ns	8.00 dB	2.56 km/h	5.0
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12	<input type="checkbox"/>	Rayleigh	Classical 6dB	Fixed	0.000 us	0.00 dB	2.56 km/h	5.0
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Predefined fading profile setups

Predefined setups for common wireless and digital video formats are included with the software to simplify test preparation. You can modify these standard profiles to provide custom configurations for simulating specific environments.



Add AWGN with ease and accuracy

Add noise on the faded signals easily on the N7605B. You can set the signal-to-noise ratio, carrier bandwidth, noise bandwidth and many other parameters on the user interface of the software.

3. Real-time AWGN Setup	
Real-time AWGN	Off
Power Control	Total
Carrier to Noise Ratio Format	C/N
Eb/No	0.00 dB
Carrier to Noise Ratio	0.00 dB
Carrier Power	0.00 dBm
Total Noise Power	0.00 dBm
Channel Noise Power	0.00 dBm
Carrier Bandwidth	1 Hz
Noise Bandwidth	1 Hz
Carrier Bit Rate	1 bit/s
MUX	Sum

Key Specifications

Simulate real-world conditions to test multi-format receivers more quickly and validate design robustness earlier in the development cycle with the EXG/MXG signal generator.

Number of faders	1
Paths per fader	6 paths @ 160 MHz 12 paths @ 80 MHz 24 paths @ 40 MHz
Power accuracy	See N5182B MXG/N5172B EXG data sheet for performance details.
Predefined channel models	W-CDMA, HSDPA, HSUPA, COST 259, TD-SCDMA, cdma2000®, cdmaOne, 1xEV-DO, GSM, EDGE, WLAN, TETRA, 802.16 OFDM, 802.16 OFDMA, LTE (includes high speed train), MBRAI models for DVB-T and DVB-H
Random seed	89 bits
Fading types	Pure Doppler, Rayleigh, Rician, Suzuki, log normal
Spectral shape	Classical 3 dB, classical 6 dB, flat, rounded, Jakes classical, Jakes rounded, Gaussian, Half Bathtub, Jakes Half Bathtub
Rayleigh distribution	0.5 dB from -30 to + 10 dB of mean power level deviation from CDF, filtered noise
Rician	
Power ratio (k) range	-84 dB to 84 dB
LOS AoA	0 to 180°
Path delay	0 to 2.5 ms
Resolution	0.1 ns
Phase shift	0 to 360°
Resolution	0.01°
Path loss	0 to 84 dB
Resolution	0.01 dB
Vehicle speed ¹	0 to 864 km/h @ 2 GHz
Resolution	0.01 km/h
Doppler frequency ¹	0 Hz to 1.6 kHz
Resolution	0.001 Hz
Angle of arrival (AoA)	-360 to 360°
Resolution	0.01°
Angle of departure (AoD)	-360 to 360°
Resolution	0.01°
AoA Azimuth spread	0.01 to 180°
Resolution	0.01°
AoD Azimuth spread	0.01 to 180°
Resolution	0.01°
Log normal	
Standard deviation	0 to 12 dB
Decorrelation length	1 m to 1 km

1. Doppler frequency of vehicle speed is coupled to the carrier frequency setting.

Software Licensing and Configuration

Signal Studio offers flexible licensing options, including:

- **Fixed license:** Allows you to create unlimited I/Q waveforms with a specific Signal Studio product and use them with a single, specific platform.
- **Transportable/floating license:** Allows you to create unlimited I/Q waveforms with a specific Signal Studio product and use them with a single platform (or PC in some cases) at a time. You may transfer the license from one product to another.

The table below lists fixed, perpetual licenses only; additional license types may be available. For detailed licensing information, please refer to the Licensing Options web page at www.keysight.com/find/SignalStudio_licensing

N7605B signal studio for real-time fading

Model-Option	Description
Connectivity	
N7605B-3FP	Connect to N5182B/72B MXG/EXG signal generator
Capability	
N7605B-EFP	Basic real-time fading

For detailed configuration assistance, refer to the Signal Studio Configuration Assistant web page at:
http://rfmw.em.keysight.com/wireless/helpfiles/all-in-one_config_asst/ssconfig.html

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Additional Information

Related literature

Refer to the following N5172B EXG and N5182B MXG data sheets for hardware specifications.

N5172B X-Series vector signal generator,
Data Sheet, 5991-0039EN

N5182B X-Series vector signal generator,
Data Sheet, 5991-0038EN

Web

Find additional product-related information at www.keysight.com/find/n7605b



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