F8820B PROPSIM FS16

Radio channel emulator

Real-World Performance Testing in the Lab

PROPSIM FS16 emulates real-time dynamic radio channels between transmitters and receivers. The channel fading test configurations required in wireless testing across 5G, WLAN, aerospace, satellite and defense applications. The solutions support configurations up to 256 fading channels in a single unit and up to 1024 fading channels in a multi-unit configuration.

The PROPSIM FS16, a compact and cost-effective choice for 5G NR MIMO and MIMO OTA fading testing in FR1, FR2 and FR3 frequency bands. It integrates smoothly with Keysight's network emulation solutions and mmWave over-the-air test solutions. Additionally Keysight's PROPSIM F64 RF channel emulator supports fading capacity needs that extend beyond the configurations.

Take testing to the next level

The PROPSIM FS16 offers high modularity with flexible uni- and bidirectional operation of each RF port for cost effective fading performance testing of:

- 5G Advanced and prototyping 6G. Wi-Fi 7 and prototyping Wi-Fi 8. UWB and Bluetooth LE
- Aerospace and Airborne radios and Non-Terrestrial Networks (NTN)

The wide RF range - from 3 MHz up to 53 GHz - and ultrawide instantaneous signal bandwidth support enables users to implement realistic and repeatable lab-based testing for:

- Tactical MANET/Mesh radio systems
- Mixed terrestrial, aerospace, and satellite radio systems

KEYSIGHT

Definitions and Conditions

PROPSIM FS16 will meet its specifications when

- The PROPSIM hardware is within its calibration cycle.
- The PROPSIM hardware has been stored at an ambient temperature within the allowed operating range for at least six (6) hours before being turned on; if it had previously been stored at a temperature range inside the allowed storage range, but outside the allowed operating range.
- The test set has been turned on for at least 60 minutes.
- No other application or 3rd party software is running simultaneously with PROPSIM running view on the PROPSIM integrated PC windows operating system.

Specifications

Specifications describe the performance parameters covered by the product warranty and are valid from 15 to 30 °C unless otherwise noted.

Typical

Typical describes additional product performance information that is not covered by the product warranty. It is performance beyond specifications that 95 percent of the units exhibit with a 95 percent confidence level. This data does not include measurement uncertainty, and is valid only at room temperature, 23 °C.

Nominal

Nominal values indicate expected performance or describe product performance that is useful in the application of the product but are not covered by the product warranty.

Key Capabilities and Features

Key capabilities and features (requires applicable configuration and options)

RF port configurations in a single F8820B unit	Configurations**: F8820BC02, F8820BC04, F8820BC08, F8820BC12 and F8820BC16**
	• RF Ports: from 2 RF In/Out + 2 RF Out, up to 16 RF In/Out + 16 RF Out. All SMA-female connectors.
	  ○ RF range up to 3 MHz (*) – 7250 MHz
	
	Configurations: **F8820BH02, F8820BH04, F8820BH08, F8820BH12 and F8820BH16**
	• RF Ports: from 2 RF In/Out, up to 16 RF In/Out. All SMA-female connectors.
	  ○ RF range 7.25 GHz – 18 GHz
	
	Configurations**: F8820BM04, F8820BM08, and F8820BM16**
	• 2, 4, 8 RF In/Out + 2, 4, 8 RF Out ports and 2, 4, 8 RF In/Out ports. All SMA-female connectors.
	• 2, 4, 8 RF In/Out + 2, 4, 8 RF Out ports RF range up to 3 MHz – 7250 MHz
	• 2, 4, 8 RF In/Out ports RF range 7.25 GHz – 18 GHz
	
	(*) RF range edge

MIMO fading channels	Up to 256 digital channels in single unit Up to 1024 fading channels in multi-unit configuration (4) Note, the most complex fading channel combinations within available TRX ports, RFLOs and digital fading channels may not be supported due to too complex data routing requirement in base band. User must always check the fading channel configurations with PROPSIM emulator and standard tools software if complex fading channel configuration is supported or not.
MIMO emulation	Arbitrary MIMO and multi-link topologies. Single F8820B unit: MIMO testing from 2x2bi, 4x4bi up to 8x8bi F8820BC16 MIMO OTA 2x16, 4x16 and 8x16 up to 16x16uni
Mesh and MANET emulation	Up to 16 radios full mesh emulation Note, the maximum number of radios depends on the bandwidth and channel model characteristics and may not be supported due to too complex data routing requirement in base band. User must always check the fading channel configurations with PROPSIM emulator and standard tools software if complex fading channel configuration is supported or not.
Multi-band and Carrier Aggregation support	Contiguous and non-contiguous band combinations up to 1600 MHz OBW.
Internal RF band combination into single RF port	Up to 8 RF bands with RF ports supporting 450 – 7250 MHz. Up to 2 RF bands with RF ports 7.25 – 18 GHz, up to 8 RF band with F9510C Antenna Interface Unit.
RF local oscillators	Up to 8 Independent RFLO's in single chassis
Frequency conversion e.g., from band A to band B	Yes. Requires minimum two RFLOs
Fading paths per fading channel	Up to 48
Minimum delay	< 1.8 µs, MIMO single Channel Unit topologies (@200 MHz BW) < 1.0 µs, with -SD1 option single Channel Unit topologies (@200 MHz BW)
Maximum delay	335 µs standard feature Options: • With -ED1 option 1500ms, Aerospace emulation mode (*) • With -ED2 option 100 ms, terrestrial long delay option (*) (*) One digital channel per TRX channel supported when -ED1 or -ED2 option is active.
Doppler emulation	Up to ± 1.5 MHz, requires F882SATxA option

Input power measurement	Continuous and RF burst- triggering input power measurements NR and LTE RSRP signal measurement
Automatic input level setting	Continuous and RF burst modes
Interference sources	**CW** Independent uncorrelated sources at each output port Adjustable frequency offset Absolute and SNR based level settings **AWGN** Independent uncorrelated sources at each output port User adjustable BW and frequency offset Absolute and SNR based level settings **Arbitrary Waveform interference** Independent PathWave Signal Generation generated waveforms. Possibility to split/combine and add fading impairments to interference sources. Supports user defined and standard-based modulations, bursts, modulated pulses, chirps and many more.
Test setup calibration	Integrated test setup amplitude and phase calibration. • Phase amplitude alignment with loop back connection (*) • Automated Response correction with external VNA instrument 3GPP NR and LTE DL signal-based input phase alignment (*) Available above 110MHz
Uplink and downlink separation	Integrated uplink and downlink separation
User definable input/ output ports	User-defined active connector settings
PROPSIM software and channel models	PROPSIM Standard Tools software includes • 3GPP 5G NR TDL channel models for FR1 and FR2 testing • LTE, WCDMA, GSM and Static Butler Satellite and Aerospace Tools software includes • Aerospace model editor • Satellite paths with terrestrial multipath components Channel Studio GCM Tool supports • 3GPP TR38.901, TR36.873, WINNER and SCME • Ray-tracing data import • 3D Antenna pattern inclusion into the channel model • Custom test topology creation for massive MIMO, Device-to-Device (D2D), Vehicle-to-everything (V2X) • MIMO OTA channel models (CTIA/3GPP/CCSA) Channel Studio NTN Tool for satellite scenarios and 3GPP NTN models according 3GPP TR38.811 Channel Studio WLAN Tool includes 802.11ax/be channel models Channel Studio RF Field-to-Lab Tool for 5G and LTE High-Speed Train channel model pack (mobile network operator test plan)
Fast fading profiles	PROPSIM Standard Tools software: Constant, Rayleigh, Rice, Nakagami, Lognormal, Suzuki, Pure Doppler, flat, rounded, Gaussian, Jakes, Butterworth, user-defined, and CIR data from 3rd party simulation tools Each digital channel can be set for independent fading profile (delay, doppler, amplitude, correlation)
Pathloss/Shadowing	PROPSIM Standard Tools software with Shadowing option • Each RF channel independently, 100 dB dynamic range • Each digital fading channel independently, 60 dB dynamic range
Delay profiles	PROPSIM Standard Tools software: Constant, sliding delay, 3GPP birth-death, 3GPP sliding delay group, user- defined, delay profiles from 3rd party simulation tools, ray-tracing applications Each digital fading channel has independent delay setting

RF Characteristics

RF characteristics (requires applicable configuration and options). Typical values.

Operating frequency range	**F8820BCxx options** • Opt-R60 450 – 6000 MHz • Opt-R72 450 – 7250 MHz • Opt-R04 3 - 450 MHz (*), (**) With external Hardware M1740A: 24.25 GHz to 29.5 GHz, 37 GHz to 43.5 GHz (**) With external Hardware M1742A: 10 to 32 GHz (**) With external Hardware M1749B: 24.5 to 53 GHz (**) **F8820BMxx options** RF ports 1-16 (lower connector row) • Opt-R60 450 - 6000 MHz • Opt-R72 450 - 7250 MHz • Opt-R04 3 - 450 MHz (*), (**) With external Hardware M1740A: 24.25 GHz to 29.5 GHz, 37 GHz to 43.5 GHz (**) With external Hardware M1742A: 10 to 32 GHz (**) With external Hardware M1749B: 24 to 53 GHz (**) (*) 3 MHz is the RF range edge (*) F882SATxA operation supported above 140 MHz (**) Requires Opt.-R60 or -R72 for operation RF ports 17-24 (upper connector row) • Opt-R18 7.25 - 18 GHz **F8820BH option** • Opt-R18 7.25 - 18 GHz
Instantaneous signal BW	Instantaneous signal bandwidth F8820B options • Opt-010 100 MHz, max. 16 TRX channels. • Opt-020 200 MHz, max. 16 TRX channels. Extended bandwidth options (*) • Opt-EX1 400 MHz, max. 8 TRX channels • Opt-EX2 600 MHz, max. 4 TRX channels • Opt-EX3 800 MHz, max. 4 TRX channels • Opt-EX4 1200 MHz, max. 2 TRX channels • Opt-EX5 1600 MHz, max. 2 TRX channels (*) Extended BW operation is specified for frequencies above 450 MHz. (*) Extended BW use with F882SATxA requires external VNA for precise response correction. (*) Opt-EX3 operation with Opt-R18 requires external F9510C accessory unit (*) Opt-EX2, -EX4, and -EX5 not supported with Opt-R18
RF input level	+35 dBm peak, up to 100 - 7250 MHz +15 dBm peak, below 100 MHz +30 dBm peak, 7.25 - 18 GHz
RF output level	RF In/Out port • +5 dBm peak, 100 - 6000 MHz • +2 dBm peak, 6 - 7.25 GHz • +10 dBm peak, 7.25 - 16 GHz • +2 dBm peak, 16 - 18 GHz RF Out port • +15 dBm peak, 100 - 6000 MHz • +12 dBm peak, 6 - 7.25 GHz Peak output value refers to instantaneous output level peak value that occurs when fading profile and modulated signal peaks sums up. Static peak level is 2 dB less. Values above with Opt-020.

Frequency response flatness	± 0.5 dB typical
RF output level accuracy	< ± 0.5 dB at center frequency, typical
Output noise floor, output level ≤ –40 dBm	< -170 dBm/Hz, (output level ≤ -40 dBm), typical < -160 dBm/Hz below 30 MHz, (output level ≤ -40 dBm), typical
RF input/output level setting resolution	0.1 dB
RF output gain setting range	RF In/Out port • +5…-100 dB, 100 - 6000 MHz • +2…-100 dB, 6 - 7.25 GHz • +10…-75 dB, 7.25 - 16 GHz RF Out port • +15…-100 dB, 100 - 6000 MHz
VSWR all RF ports	3 MHz to 700 MHz < 1.8, nominal 700 MHz to 2 GHz < 1.3, nominal 2 GHz to 7.25 GHz < 1.5, nominal 7.25 GHz to 16 GHz < 2.0, nominal
Crosstalk between TRX ports	< -100 dB
Residual EVM	< -49 dB RMS typical, 5G NR 100 MHz, 1024QAM, 3.5 GHz < -47 dB RMS typical, 5G NR 100 MHz, 1024QAM, 15 GHz < -47 dB RMS typical, 802.11ax 160 MHz, 1024QAM, 5.815 GHz < -45.5 dB RMS typical, 802.11be 320 MHz, 4096QAM, 6.905 GHz Note 1: Residual EVM is the EVM contribution added by the PROPSIM instrument to the input signal. Note 2: 802.11ax/be measurement settings: 16 data OFDM symbols, Phase tracking from pilots only, EQ training preamble only, Channel estimation filter Wiener (DS 0.001)

Signal capture and signal playback (requires applicable configuration and options)

Signal capture	Up to 16 simultaneous and phase coherent captures File formats: Keysight PathWave 89600 VSA, WaveJudge Wireless Analyzer software and open format. Maximum instantaneous signal BW 100/200 MHz.
Capture triggering	Single trigger from GUI / SCPI / LVTTL (BNC-port). User adjustable trigger delay ±1000 ms. Emulation time based
Signal waveform playback	Up to 16 simultaneous and phase coherent sources Supports Keysight PathWave Signal Generation waveforms. Maximum instantaneous signal BW 100/200 MHz.
Playback triggering	Single trigger from GUI / SCPI / LVTTL (BNC-port). User adjustable trigger delay 5 µs … 1000 ms
Playback and capture memory	2000 ms (BW 100 MHz) dedicated memory per each RF port.

Instrument specifications

Remote control	ATE SCPI commands via Ethernet connection PROPSIM plugin for the Keysight Test Automation on PathWave (TAP)
Time base	Standard frequency reference 10 MHz, nominal. Maximum frequency drift ± 0.1ppm/2 years Warm-up time 30 min
Synchronization	HW trigger port for emulation start/stop. Synchronization ports for multiple PROPSIM hardware units UTC-time trigger to start the emulation synchronously with other instruments in the system using the same network time reference. Uses Network Time Protocol (NTP) for adjusting the system time. Corrected time is used in all timestamps across the system. UTC synchronization precision with a low stratum level NTP server is < 20ms (typical)
Other interfaces	10 MHz reference IN and OUT. LAN 1 Gbps, 6x USB, 2x Display port. Removable SSD Drive
Voltage and frequency	110/230 VAC, 50/60 Hz
Power consumption	FS16, 16 TRX Channels 1500 W max
Current consumption	Max 15A
Dimensions (H x W x D)	293 mm x 435 mm x 610 mm (mm, millimeters). Fits in 19-inch rack.

PROPSIM FS16 can be ordered with a normal front panel or a rack mount front panel. For detailed product configuration items and product support services please contact your sales representative for required options and pricing.

F8820B Configuration Examples (16 RF Ports)

F8820BC16

F8820BH16

F8820BM16

For detailed product configuration items, product support services, options, and pricing, please contact your sales representative.

Keysight 5G Solutions

Keysight's industry-first 5G end-to-end design and test solutions enable the mobile industry to accelerate 5G product design development from the physical layer to the application layer and across the entire workflow from simulation, design, and verification to manufacturing, deployment, and optimization.

Keysight offers common software and hardware platforms compliant to the latest 3GPP standards, enabling the ecosystem to quickly and accurately validate 5G chipsets, devices, base stations, and networks, as well as emulate subscriber behavior scenarios. Additional information about Keysight's 5G solutions is available at www.keysight.com/find/5G.

- For more information about PROPSIM Channel Emulation Solutions, visit http://www.keysight.com/find/PROPSIM
- For more information on F8820B PROPSIM FS16 Channel Emulator, visit https://www.keysight.com/product/F8820B/
- For more information on PROPSIM Platforms, visit https://www.keysight.com/us/en/products/channel-emulators/propsim-platforms.html
- For more information about Keysight's PathWave, visit http://www.keysight.com/find/pathwave
- For more information on the M1740A mmWave transceiver, visit http://www.keysight.com/find/m1740a
- For more information on the M1742A Transceiver 10-32 GHz, visit M1742A Transceiver
- For more information on the M1749B Transceiver 24-53, visit https://www.keysight.com/us/en/product/M1749B

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