

SPIRENT WIRELESS CHANNEL EMULATOR

SR5500 Wireless Channel Emulator

The SR5500 re-creates RF fading and interference effects for testing SISO and MIMO wireless receivers. An advanced fading engine ensures accurate testing of sophisticated technologies like LTE, HSPA, HSPA+, EV-DO, WLAN and WiMAX.

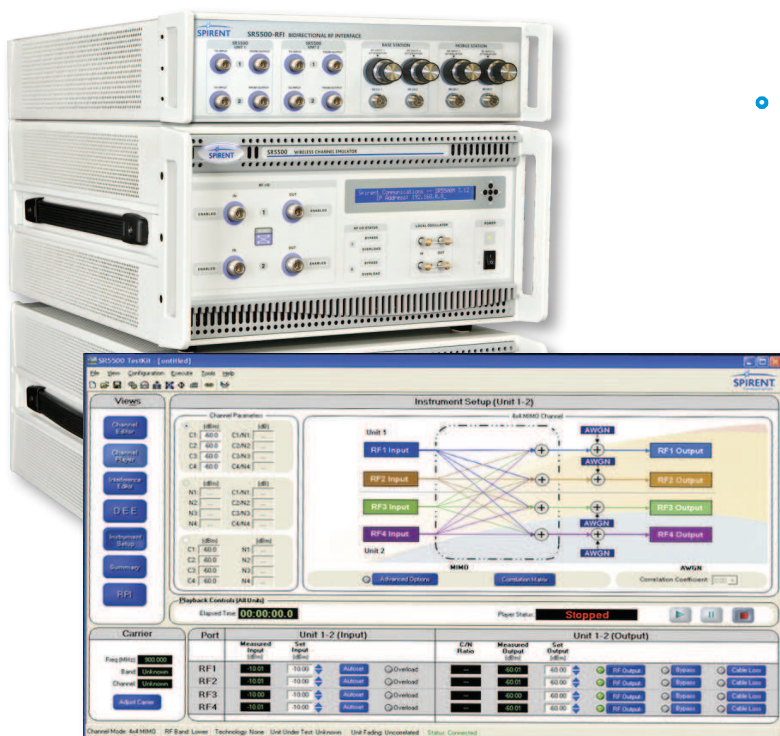
APPLICATIONS

- Research and Development
- Design Verification
- Conformance Testing
- Performance Testing (Virtual Drive Testing)
- Product Evaluation
- Base Station, Node-B and Terminal Device Testing
- Diversity, MIMO and Beamforming
- LTE, GSM, GPRS, EDGE, WCDMA, HSPA and HSPA+
- CDMA2000 1X and EV-DO
- WiMAX (802.16) Fixed and Mobile
- Spatial Channel Modeling (SCM, SCME, and WINNER/WINNER-II)

The SR5500 provides extremely realistic yet repeatable emulation of RF channel conditions for testing modern wireless receivers. The emulator replicates real-world fading, spatial channel conditions, MIMO and SISO channels, Additive White Gaussian Noise (AWGN) and much more, making it possible to isolate performance issues early in the development and design verification cycle. The SR5500 is the most flexible channel emulator ever offered. It can be tailored to fit today's requirements and budgetary business cases, yet its future-proofed modular architecture ensures that it will be ready to meet your needs in years to come.

FEATURES & BENEFITS

- *Maximize the return of your test equipment investment* with Spirent's exclusive building-block approach - enables flexible re-use of system modules
- *Bring the "real world into the lab"* - Spirent's exclusive Fading Lab & Virtual Drive Test provides a cost-controlled yet accurate and repeatable alternative to field testing..
- *Reduce risk* with a proven turnkey platform, designed and supported by wireless experts and industry leaders; the industry's first choice in large new technology deployments (LTE, CDMA 1X, EV-DO, EV-DO Rev A, HSPA, etc.)



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Today's wireless industry faces many uncertainties, including a quickly-evolving technology front. Responsible test plans require efficient, customizable integrated solutions that can address both current and future needs without incurring unnecessary risks. To accelerate time to market without forgoing accuracy, Spirent's unique real-world emulation continues to be the first choice in test plans.

MAXIMIZING THE RETURN ON YOUR TEST EQUIPMENT INVESTMENT

The SR5500 system can be purchased as a system solution or a fully modular solution. The only difference is that the modular version allows each SR5500 module to be run under its own GUI. While each module can be run independently in either case, the modular solution allows any module or set of modules to run under a separate GUI.

The integrated system solution

The SR5500 system solution makes use of one primary unit and one or more secondary modules. Unlike pre-racked fading "systems", each module can be either independently controlled or used as part of a synchronized MIMO/bi-directional channel emulation solution. And unlike other monolithic faders, the SR5500 System Solution can be upgraded if you need each module to have the "brains" to interface with a separate GUI... for occasional use in separate labs, for example. Spirent's System Solution eliminates the risk that the fading solution you choose today might be obsolete tomorrow.

Spirent SR5500 system solutions are the perfect answer when you require the best in professional fading and RF emulation today, and your test benches are co-located so they can connect to a single Ethernet interface. For owners of existing SR5500 Wireless Channel Emulators, the system solution also provides a budget-friendly upgrade to higher-order MIMO or bi-directional testing. Best of all when your needs expand, secondary modules can easily be upgraded to full stand-alone capability.

Some engineers like to personally choose the RF "plumbing" required for bi-directional testing. For those who do not, the optional RF Interface integrates all the circulators and splitters necessary for integrated bi-directional MIMO testing, and adds precise "dial-in" attenuation on a per-path basis.



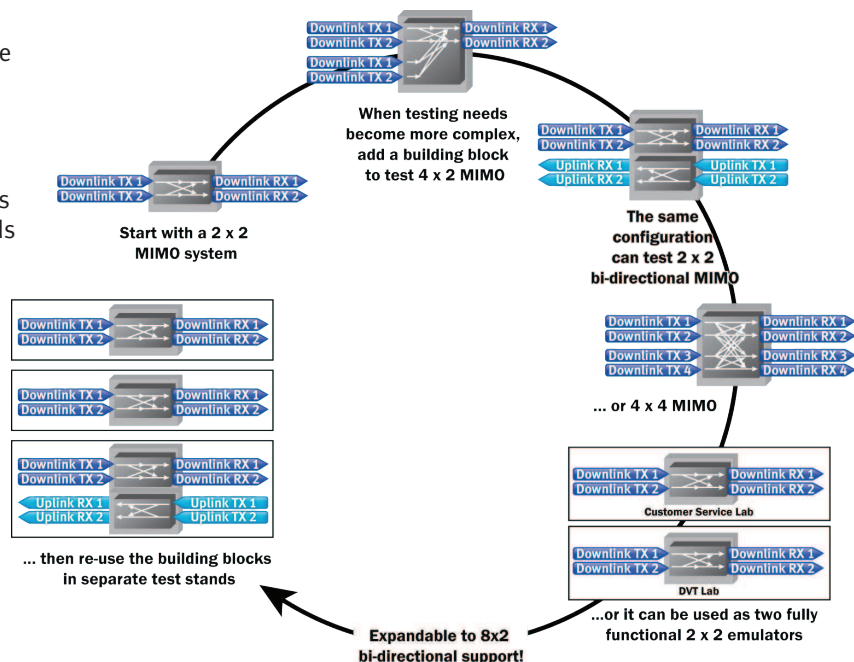
The RF Interface turns multiple SR5500 modules into an integrated bi-directional MIMO test station.

The modular SR5500 solution

Sometimes you need the flexibility to test with multiple systems, each with fewer channels, but located in separate labs. The exclusive modular architecture of the SR5500 makes sure that you can concentrate fading power when you need it, but re-configure as quickly and as often as you need to.

For example, one day you might need a completely synchronized 8x2 bi-directional MIMO environment for prototype testing in an Advanced Projects lab. The next day you might need independent 2x2 MIMO test stands in separate labs. With the SR5500's "building block" architecture you can seamlessly move between multiple simple test stands and the more concentrated capability of a complex integrated system. No matter what configuration you deploy, you'll have a single intuitive interface that easily makes use of all the SR5500's unique advanced features.

Whether you choose a fully modular solution or a pre-configured static system solution, your turnkey SR5500 system will be up and running and ready to go upon delivery.



MINIMIZE BUSINESS AND TECHNOLOGY RISKS

Support and Expertise

The SR5500 team includes industry experts and leaders who have dedicated many years to the study of the wireless physical layer. Our close relationships with key industry drivers and our involvement with standards organizations make certain that your SR5500 will have the feature set you need, when you need it. Spirent's wireless expertise extends far beyond the radio link, ensuring that channel emulation accounts for all the factors that affect real-world operation. Key areas of Spirent Physical Layer expertise include:

- CDMA
- W-CDMA
- WiMAX
- High-data-rate technologies [EV-DO & HSPA(+)], LTE, MIMO
- Beamforming
- Spatial channel modeling
- Over-the-air (OTA) testing, and much more

No matter what technology you're working with, Spirent has qualified experts to make sure that your testing meets your intentions, and that you'll have the features you need when you need them.

Spirent's rich history of leadership in wireless development has established the SR5500 as the most accurate, efficient, easy-to-use solution available.

Spirent's Channel emulation history

When a fader is used in an initial large-scale technology deployment, "getting it wrong" can make or break a business. In these cases the selection of a fading emulator includes research, rigorous evaluation and head-to-head comparative evaluations.

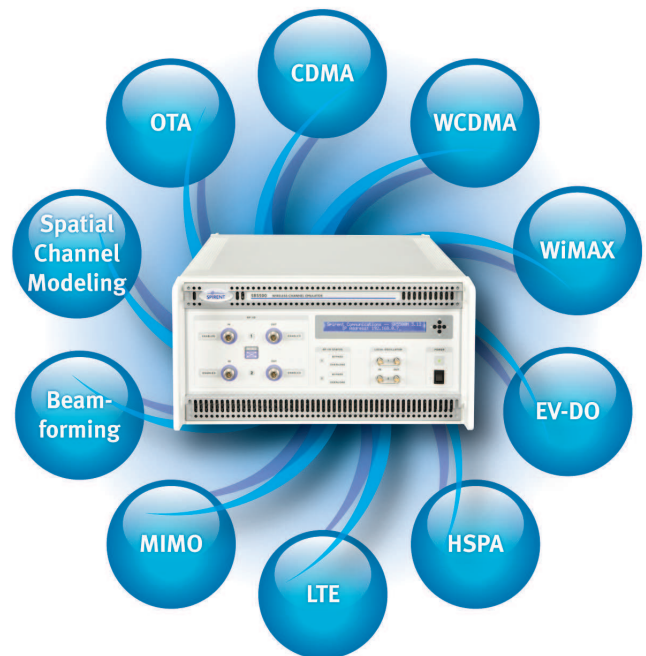
Spirent fading emulators were chosen for the world's most important rollouts of new wireless technologies, including the first commercial deployments of 1x CDMA, WCDMA, FOMA, HSPA, WiMAX, and several revisions of EV-DO. They were also behind the development of the first RX Diversity device, the first Smart Antenna system, the first MIMO proof-of-concept system, and are currently used in developing LTE base stations and devices.

Spirent's leadership in channel modeling has led to many industry firsts, including: the first emulator to integrate I/O power meters for accuracy, the first integrated AWGN, the first modular RF channel emulation system, the first dynamic correlation modeling and much more.

When your business depends on the quality of information you provide, remember that the SR5500 is always the first choice in business-critical deployments.



Spirent actively participates in dozens of industry-leading organizations; here are just a few.



Spirent fading emulators were behind the world's most important wireless technology rollouts.

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BRINGING THE REAL WORLD INTO THE LAB

Virtual Drive Test

Spirent's Virtual Drive Test lets you create or re-play dynamic mobility scenarios in your lab. Virtual Drive Test is more than a way to control the costs of drive-testing. Unlike drive-testing in the field, Virtual Drive Test provides a precise and repeatable environment.

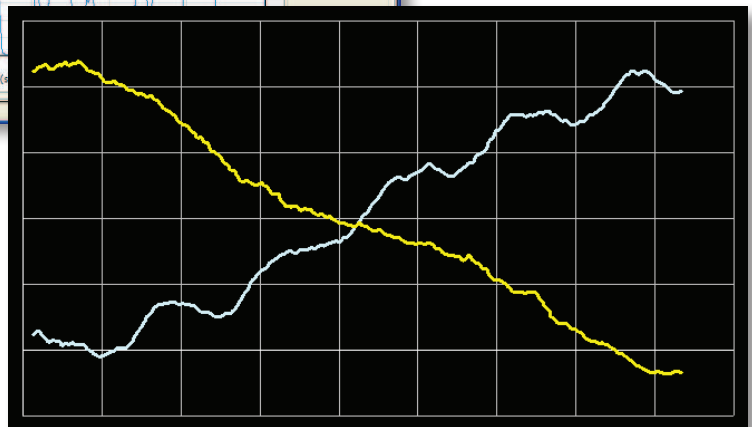
Virtual Drive Test uses Spirent's exclusive Dynamic Environment Emulation (DEE) real-time engine to add automated control of rapidly-changing environmental channel parameters. Handover conditions, drive-test scenarios, and any other *dynamic* scenario can be easily created.

Sometimes you absolutely need to test under the conditions defined by an actual drive-test route. Spirent's exclusive VDT-Conversion Tool takes data captured with a cellular scanner and lets you re-create the RF environment in your lab.

We all know that MIMO and Diversity systems are dependent on the physical orientations of mobile devices. Have you considered the importance of testing under realistically time-varying orientations (in other words, motion scenarios)? We have. The SR5500's Dynamic Correlation is ready to help you find those motion-based glitches you might have missed otherwise.



Spirent's VDT-Conversion Tool makes it easy to "play back" an RF environment captured with a scanner.



SCM/SCME CORRELATION MATRIX GENERATOR

The included SCM/SCME Correlation Matrix Generator lets you create customized spatial channel models in minutes. You enter a few key parameters such as antenna spacing, angles of arrival/ departure and angular spreads, and it generates correlation matrices that can be plugged directly into the SR5500's software.

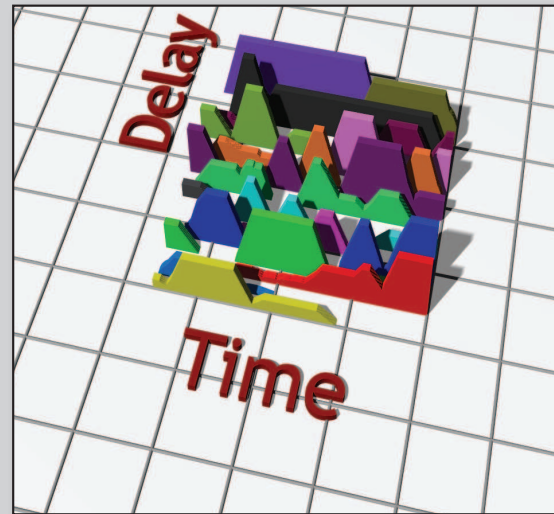
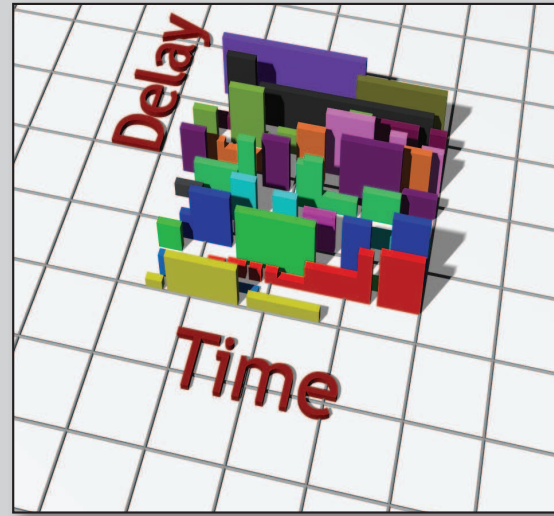
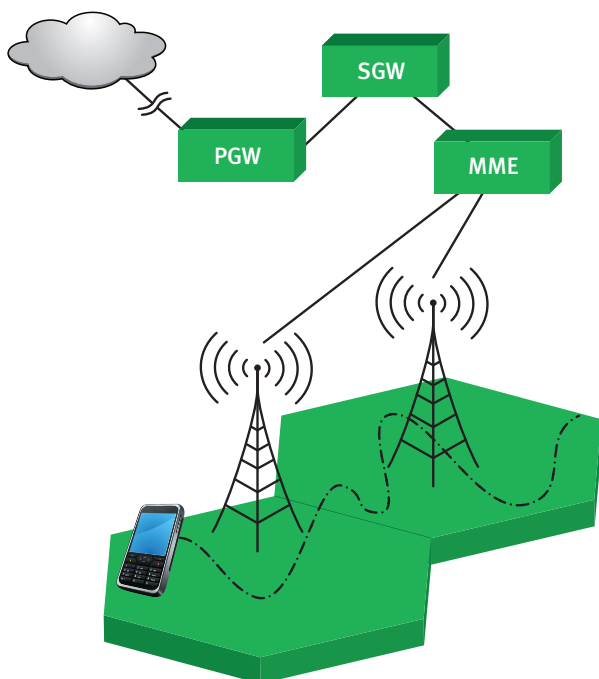
DYNAMIC SCM/SCME

The SR5500 is ready to meet the demands of time-evolving spatial channel models such as those imposed by the WINNER II interim channel models specification.

In order to more realistically test receivers using spatial channel models, the industry has developed a series of channel modeling scenarios that emulate the evolution of a connection session over time. One scenario, called "drop modeling", is implemented in the SCM. In drop modeling the RF channel behaves as if the receiver suddenly "dropped" from one physical location and re-appeared in another. These models don't entirely reflect the more accurate scenario and its effect on small-scale parameters such as delays and angles-of-departure. The SR5500 can, of course, implement this required yet artificial approach.

In the interest of better testing, some advanced groups such as WINNER have proposed the execution of "time-evolving" channel modeling. A much more accurate approach, its use has been limited by the abilities of many channel emulators. Of course, with the SR5500's DEE, none of this is a problem. The SR5500 easily and automatically handles the required smooth transitions that stump other emulators.

In fact, the SR5500 is also unique in that both drop models and time-evolving models can be customized. With DEE, you are not stuck with whatever time-based scenario someone else thought was important.



The SR5500 easily generates drop models (top) and time-evolving models (bottom).

Dynamic motion can cause unique momentary RF conditions. Find out if your design is up to it... before deployment.

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FADING LAB

The pace of the wireless industry often changes your plan. Urgent test requirements come out of nowhere; you can't risk having a job to do and no way to do it, even when that job requires a new or customized fading model. The SR5500 is the first and only channel emulator to offer both a real-time engine and a fading-data playback engine, ensuring that you don't risk running into a testing requirement your fader can't deliver.

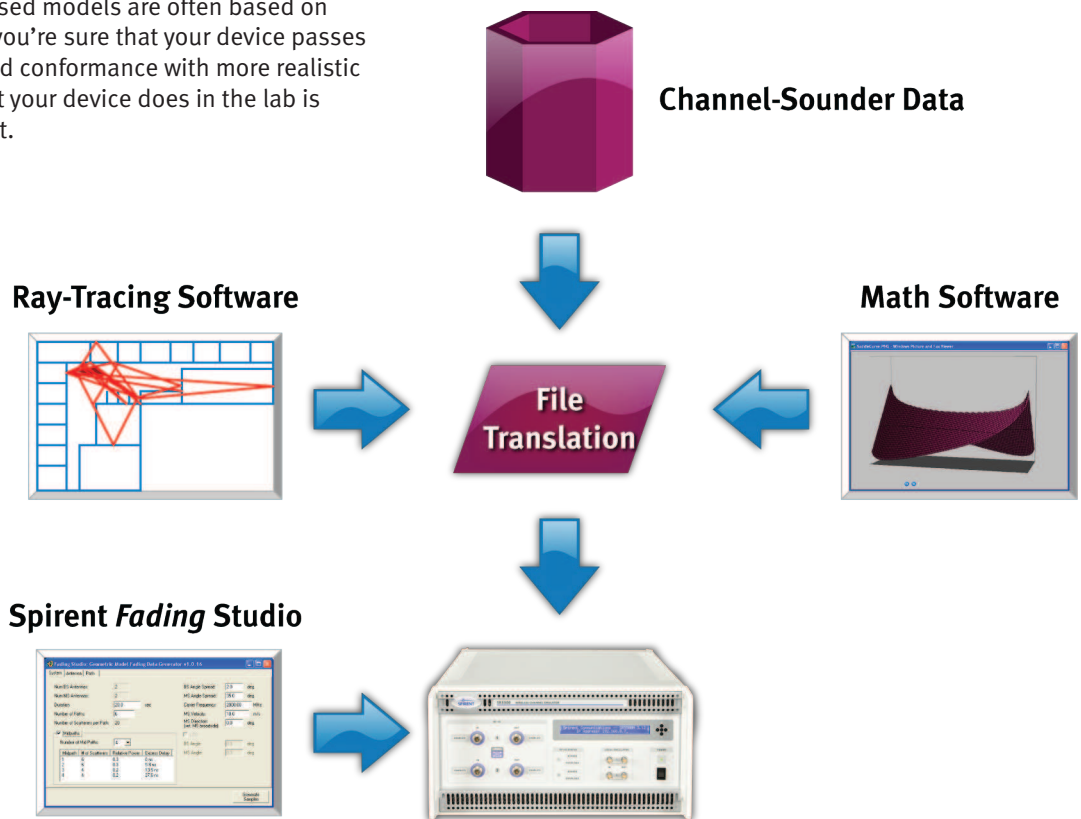
Spirent's Fading Lab adds the flexibility to "play back" custom fading data available from a wide variety of sources. Input data can be:

- Captured by a channel-sounding system
- Generated in standard mathematical software
- Generated by ray-tracing software or custom software

Whether captured via a channel sounder or created in mathematical software, RF data captured as a file can be "played back", ensuring accurate reproduction of the RF channel conditions you need.

Fading Lab includes Fading Studio, Spirent's exclusive model-generation platform. Now you can easily execute complex spatial channel modeling scenarios. SCM and SCME models are all right at your fingertips and ready to run.

Go beyond the standards by using Fading Studio to create more realistic models. Standards-based models are often based on simplistic assumptions. Once you're sure that your device passes conformance testing, go beyond conformance with more realistic models. Be confident that what your device does in the lab is what it will do after deployment.



Spirent's Fading Studio lets you create complex customized geometric models (i.e. spatial channel models) by entering a few parameters.

TECHNICAL SPECIFICATIONS

RF Inputs	Scalable from 2 to 16	
RF Outputs	Scalable from 2 to 16	
Digital Channels	Scalable from 2 to 64	
RF Configurations	SISO, SIMO, MISO, MIMO, and Beamforming <ul style="list-style-type: none"> • 2x2, 4x4, 4x1/1x4, 4x2/2x4 uni- or bi-directional • 8x1/1x8, 8x2/2x8 uni- or bi-directional 	
Bandwidth	26 MHz	
Crest Factor	+15 to +35 dB (0.1 dB resolution)	
RF Input	Frequency Range (w/ 6-GHz-EX option)	400 – 2700 MHz 3300 – 3850 MHz 4100 – 6000 MHz
	Measurable Level Range	+5 to -50 dBm
	Level Resolution	0.01 dB
	Damage Level	> +20 dBm
Input Power Meter	Modes	<ul style="list-style-type: none"> • Continuous • RF Burst-triggering for gated signals • Settable duty cycle
RF Output Level	Max/Min Range	-20 to -110 dBm (RMS) [-30 to -110 dBm without extended output power option]
	Maximum output power (peak)	+ 8 dBm (using the calculation method used by other test equipment manufacturers)
	Resolution	0.01 dB
	Accuracy	± 1 dB
Noise Floor	Typical values at 2.1 GHz	-167 dBm/Hz @ -43dBm output power -171 dBm/Hz @ -50dBm output power -174 dBm/Hz @ -65dBm output power
Residual EVM	Better than -36 dB typical per sub-carrier, measured at -50 dBm output power; actual value depends upon signal format, symbol rate, etc.	
RF Port VSWR	Better than 1.5:1	
Independent Paths	up to 24 paths per channel (768 total paths)	
Relative Path Delay	0 – 2000 μs, 0.1 ns resolution	
Relative Path Loss	0 – 32 dB	
Insertion Loss	0 dB @ input power ≤ -30 dBm	
Dynamic Standard	Channel Parameters	<ul style="list-style-type: none"> • Sliding Delay (moving propagation) • Birth-death Delay • 3GPP High-Speed Train (HST) profiles • Log Normal (shadow Fading)
Dynamic Environment Emulation	Controllable Parameters	State duration, channel output level, AWGN on/off, C/N, path on/off, relative power and delay, LOS AoA, K factor, frequency shift, Doppler velocity, MIMO branch phase and power imbalance.
	Channel Model Update Rate	100 times per second
	Mode	MIMO, dual and single channel mode; RX and TX diversity modes
	Triggering	Triggered Play, Free Run
Standards-Based Models	LTE, WiMAX, UMTS, CDMA2000®, WLAN, GSM, SCM/SCME, and pre-standard models available from Customer Service Center	
Other Models	SCM, SCME, WINNER and WINNER-II models; custom geometric channel models	
Fading Engine Type	Fading Engine 1:	Real-time generation of fading environment
	Fading Engine 2:	Fading Lab (Fading Data Playback) engine

TECHNICAL SPECIFICATIONS (CONT'D)

Real-time Fading	Types	Rayleigh, Rician, Pure Doppler, Frequency shift, Phase shift
	Fading Velocity	Up to 5396.26 km/h @ 400 MHz; Resolution of 0.1 km/h
	Repetition Interval	> 24 hours
	Relative Phase	0 – 360 degrees, 0.1 degree resolution
	Rician K factor	-30 to +30 dB
	Level Crossing Rate (LCR) Accuracy	$\pm 2.5\%$ deviation from theoretical LCR curve of the simulated vehicle velocity
	Fading Power Spectrum	Classical 6 dB, Flat, Classical 3 dB, Rounded, Rounded 12 dB
	Correlation	Envelope and Component; Complex correlation is included with MIMO option
Log-Normal Fading	Log-Normal Rate	0.00 to 20.00 Hz
	Standard Deviation	0 to 12 dB
MIMO Option	Modes	Up to 8 x 2 bi-directional
AWGN (option)	C/N Ratio	-30 to +32 dB
	Accuracy	± 0.1 dB for -20 to 15 dB ratios
	Bandwidth	up to 26 MHz
	Fidelity	Meets or exceeds all 3GPP, 3GPP2, WLAN, WiMAX, and LTE requirements
	Sequence Duration	> 2 hours
	Settable Modes	C/N, C/No, Eb/No
Fading Lab (option)	Play back fading data collected via a channel sounder or synthesized in software	
Control Interface	Ethernet or GPIB	
Other	10 MHz internal reference accuracy	1 ppm, can be locked to external reference
	AC Power	250 watts typical steady state 45 watt maximum additional for 6 GHz Option
	Dimensions	19-inch rack mountable Height/Width/Depth: 8.75"/16.88"/21" (22.22 cm/42.88 cm/53.34 cm)
	Weight	65 pounds (29.5 kg)

ORDERING INFORMATION

Due to the wide range of available system configurations, please contact your regional Spirent sales representative for detailed ordering information.

SPIRENT GLOBAL SERVICES

Spirent Global Services provides a variety of professional services, support services and education services — all focused on helping customers meet their complex testing and service assurance requirements. For more information, visit the Global Services website at www.spirent.com/gs or contact your Spirent sales representative.

AMERICAS 1-800-SPIRENT • +1-818-676-2683 • sales@spirent.com

EUROPE AND THE MIDDLE EAST +44 (0) 1293 767979 • emeainfo@spirent.com

ASIA AND THE PACIFIC +86-10-8518-2539 • salesasia@spirent.com