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SPIRENT Communications Inspired Innovation

Wireless Channel Emulation

SR5500 WIRELESS CHANNEL EMULATOR

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

APPLICATIONS

- Research and Development
- Design Verification
- Conformance Testing
- Product Evaluation
- System Optimization
- System Performance Characterization
- Base Station, Node-B, and Terminal Device Testing
- Diversity
- MIMO
- Beamforming
- Spatial Channel Models
- GSM, GPRS, EDGE, HSPA, HSPA+ and LTE
- CDMA2000 1X, EV-DO and UMB
- WiMAX (802.16) Fixed and Mobile
- WLAN (802.11)



The SR5500 emulates wideband radio channel characteristics such as time-varying multi-path delay spread, fast fading, shadow fading and channel loss for advanced receiver implementations using diversity, beamforming and MIMO. The emulator replicates real-world spatial channel conditions, making it possible to isolate performance issues early in the development and design verification cycle. Additive White Gaussian Noise (AWGN) further enhances the real-world conditions emulated by the SR5500.

BENEFITS

- *Confidence in test results* – The industry's cleanest channel and most statistically accurate fading lead to the most dependable and repeatable test results. Test next-generation, high-order-modulation schemes with confidence.
- *Efficient setup with less chance of error* – Pre-configured fading models are ready to run. An intuitive interface minimizes errors, decreasing the chance of erroneous results.
- *Modularity* – A 2-channel, 24-path system can scale up to 8 RF I/O ports, 16 digital channels, and 384 paths running under a single GUI. Re-use SR5500 "building blocks" to create multiple independent test setups.

KEY FEATURES

- Advanced user interface makes testing efficient and less susceptible to operator error
- Superior channel fidelity to evaluate higher-order modulation schemes and minimize unwanted distortion
- Real-time channel model generation with low repeat intervals ensures validity of results
- Optional AWGN provides extremely accurate C/N ratios
- Pre-loaded fading models accessed via a powerful GUI
- Dynamic Environment Emulation (DEE) for fast, dynamic control of channel parameters
- Modularity enables setups from 2 to 8 RF channels with synchronous operation for testing MIMO, multi-cell, beamforming or bi-directional scenarios

UNSURPASSED ACCURACY

A key SR5500 value proposition is in the fading engine, where it really counts.

The design of a channel simulator must control instrument parasitics like phase noise, spurious signals and poor channel flatness, so that only controlled impairments are applied to the signal. Residual EVM of the SR5500 exceeds the requirements of any known wireless test standard.

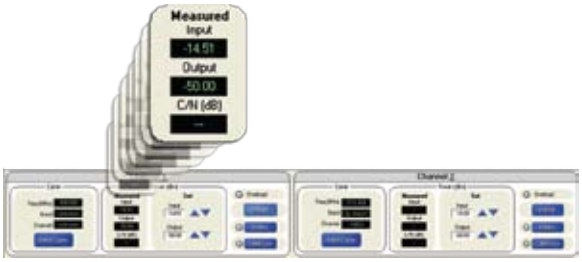
Real-Time Fading Engine

Accurate receiver testing requires real-time creation of the channel's dynamic parameters. For example, consider a "buffer playback" system that repeatedly plays back a 10-minute sequence of fading coefficients. Running a ten minute test twelve times is not the same as running a two-hour test with a non-repeating fading sequence. This has a significant effect on the statistical confidence of test results.

"Buffer playback" systems introduce errors by failing to meet statistical requirements due to finite sequence lengths of the playback memory. The SR5500's real-time fading engine accurately generates fading coefficients in real time, eliminating this systematic error.

Integrated Power Meters

To ensure the accuracy of signal levels and carrier-to-noise ratios, each channel has an independent, real-time digital power meter at both the input and output. Bursty signals as well as constant-envelope signals can be measured and their levels set with a high degree of precision – critical when testing near receiver performance breakdown limits.



Each RF port has a digital power meter at both the input and output

Integrated AWGN for Accuracy

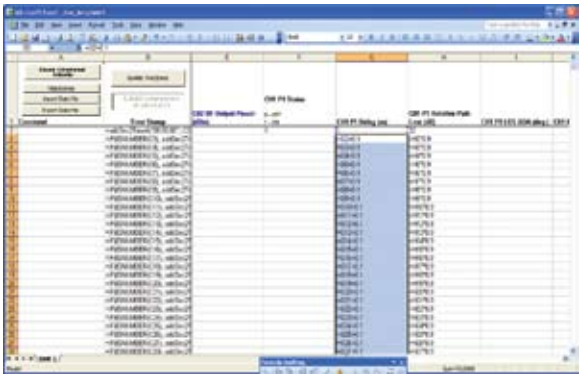
An optional all-digital baseband AWGN generator meets the requirements of all wireless test standards requiring multi-path fading and AWGN. This integrated impairment eliminates the need for external measuring equipment on the bench. More importantly, it provides a level of C/N precision (~ 0.1 dB accuracy) that can't be matched by a peripheral noise source.

These key performance attributes are not always apparent at the point of sale, but form the basis of Spirent's approach to channel emulation. Hundreds of repeat customers have benefited from the difference made by experience and attention to detail.

DYNAMIC ENVIRONMENT EMULATION (DEE)

Spirent's DEE permits you to customize and automate testing by creating a controllable dynamic environment. A simple Excel spreadsheet becomes a powerful control script that manipulates power, delay, fading and other parameters on a per-channel or per-path basis. DEE offers more complete control of environmental parameters than any other dynamic channel emulation available.

Wireless systems are being deployed for use in high-velocity scenarios, such as high-speed "bullet" trains. Testing requires a fine level of time resolution and accuracy. With state durations down to 10 ms, DEE can be used to automate testing for the most demanding deployments.



With DEE, a simple spreadsheet becomes a powerful control script

INTUITIVE USER INTERFACE

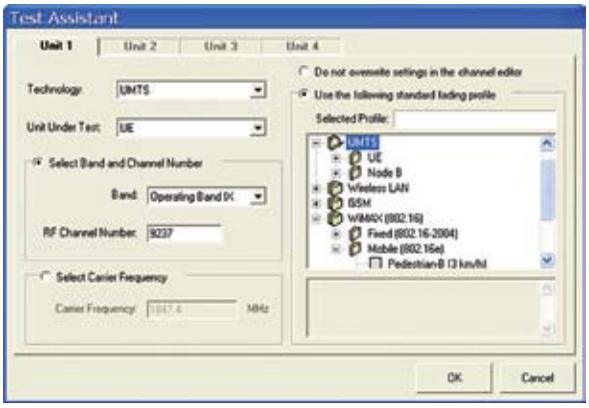
TestKit SR5500 software has been designed to create the most intuitively useful control environment available.

The complexities of simulating a wireless environment are presented as a logical flow, and even the most complex emulations can be set up with a few mouse clicks and minimal keyboard interaction. Thanks to the real-time fading engine, there's no need to wait for a fading profile to compile. For many test scenarios, this can cut the test session time in half.

The Test Assistant Wizard

Spirent's exclusive Test Assistant helps you set up a standards-based scenario with a few mouse clicks.

One click selects the technology being tested. A second selects the type of device under test, and a third selects the channel number. The fourth mouse click selects desired fading model, and the last starts the simulation.



The SR5500 Test Assistant setup wizard

Automatic Parameter Checking

The TestKit software validates input selections and entries by checking dependencies within related parameters. When dependencies exist, the software will offer to adjust dependent parameters at the time of entry, and allow the user to choose whether or not to make the change. Details like this help to avoid common but critical setup mistakes.

TestKit SR5500 graphically provides real-time feedback from the fading engine, providing a visual check during test execution.

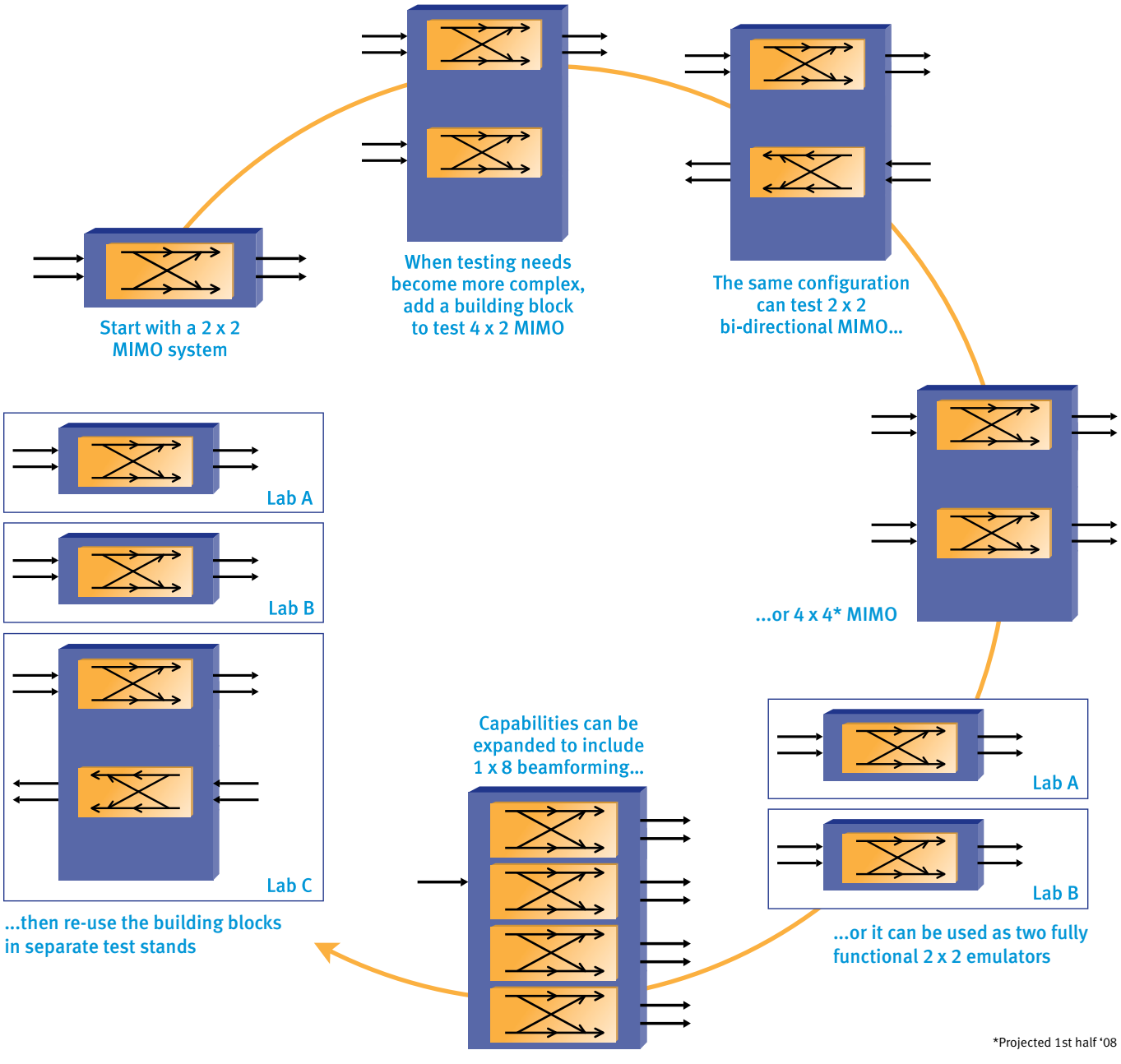


TestKit SR5500 continually provides visual feedback

MODULAR ARCHITECTURE

SR5500 “building blocks” can be combined to provide up to 8 RF I/O ports and 16 synchronous channels (384 paths), letting you add system capacity as your needs become more complex. A single user-friendly GUI controls the system, no matter how much capability has been added.

Each building block can be used as a fully functional SR5500 with 2x2 MIMO capability. Additional building blocks can be added for more complex MIMO testing. As testing needs change, these units can be easily separated to create different or multiple independent test stations.



*Projected 1st half ‘08

PROGRAMMABLE INTERFACES

Application Programming Interface (API)

The SR5500 API is an ideal way to implement software control of the SR5500, and can be accessed via .NET and COM programming environments. An SR5500 (or multiple SR5500s) can be readily controlled and monitored using Visual Basic, Visual C++, LabView, LabWindows, TestStand programs and scripts.

Extensive hyperlinked help ensures that coding is economical and functional. Programming examples are also available.

Remote Programming Interface (RPI)

The SR5500 RPI provides a clean, simple script-based command set for TCP/IP or GPIB control of the SR5500. Users of the TAS4500 fading emulator now have a straightforward way to convert existing code and take advantage of the SR5500's superior RF channel emulation.

The RPI can be used with any IP or GPIB interface, allowing programmed SR5500 control from any machine running any operating system. Perl scripts under UNIX/Linux or VB scripts under older versions of Windows can all harness the power of the SR5500 system.

Spirent is a contributing member to the industry's leading standards bodies

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TECHNICAL SPECIFICATIONS

The following specifications describe warranted performance over the temperature range 0 – 40° C and include a 30-minute warm-up time from ambient conditions.

RF Inputs	2 (inter-unit synchronization allows up to 8)	
RF Outputs	2 (inter-unit synchronization allows up to 8)	
Digital Channels	2 per unit (4 with MIMO Option, future expansion to 8)	
RF Configurations	SISO, SIMO, MISO, MIMO (2x2, 2x4, 4x2, 4x4), and Beamforming	
Bandwidth	26 MHz	
RF Input	**Frequency Range**	400 – 2700 MHz
	(w/ 6-GHz-EX option)	3300 – 3850 MHz, 4100 – 6000 MHz
	Level Range	+5 to -32 dBm @ 400 to 2700 MHz
	(w/ 6-GHz-EX option)	-5 to -32 dBm @ 3300 to 3850 MHz
	(w/ 6-GHz-EX option)	-5 to -32 dBm @ 4100 to 6000 MHz
	Level Resolution	0.1 dB
	Damage Level	› +20 dBm
Input Power Meter	**Modes**	Continuous RF Burst-triggering for gated signals Settable duty cycle
RF Output Level	**Range**	-30 to -110 dBm @ 400 to 2700 MHz
	(w/ 6-GHz-EX option)	-35 to -110 dBm @ 3300 to 3850 MHz
	(w/ 6-GHz-EX option)	-40 to -80 dBm @ 4100 to 6000 MHz
	Resolution	0.1 dB
	Accuracy	± 1 dB
Residual EVM	Better than -36 dB, typical per subcarrier measured at -50 dB output power; actual value depends upon signal format, symbol rate, etc.	
RF Port VSWR	Better than 1.5:1	
Independent Paths	24 (24 paths per channel w/ MIMO option)	
Relative Path Delay	0 – 2000 µs, 0.1 ns resolution	
Relative Path Loss	0 – 32 dB	

Technical specifications are subject to change without notice.

Dynamic Power Delay Profiles	Birth-death, Sliding (moving propagation) Supports dynamic change of path number, relative power and delay	
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, and Doppler velocity
	Channel Model Update Rate	100 times per second
Standards-Based Models	WiMAX, UMTS, CDMA2000®, WLAN, GSM, and pre-standard models available from Customer Service Center	
Fading Engine Type	Real-time generation of fading environment	
Fading	**Types**	Rayleigh, Rician, freq shift, phase shift
	Fading Velocity	0.1 to 2398.33 km/h @ 900 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	‹ ± 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	**Fading Rate**	0.00 to 20.00 Hz
	Standard Deviation	0 to 12 dB
MIMO Option	**Modes**	Baseline 2x2 Modularily expandable to uni/bi-directional 2x4, 4x2, 4x4
AWGN Option	**C/N Ratio**	-30 to +32 dB
	Accuracy	±0.1 dB for -20 to 15 dB ratios
	Bandwidth	26, 13, 6.5, 3.25, 1.625 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
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

- Wireless Channel Emulator:
  P/N SR5500M-24
- MIMO w/ 24 paths per channel
  and Complex Correlation (Option):
  P/N SR5500-MIMO
- Dual Channel AWGN Source (Option):
  P/N SR5500-AWGN
- SR5500 6 GHZ Extended Frequency
  (Option):
  P/N SR5500-6GHZ-EX

Please see your Spirent Regional Sales Manager for help in selecting the configuration that best meets your needs.

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.spirentcom.com/gs or contact your Spirent sales representative.

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