SPIRENT WIRELESS CHANNEL EMULATOR

VR5 HD Spatial Channel Emulator

The VR5 is the world's most advanced platform for creating realistic RF environments used to test high-antenna-count wireless receivers in MIMO and beamforming technologies. New paradigms in RF design and ease-of-use ensure accurate testing of sophisticated technologies like LTE and LTE-Advanced (including TD-LTE), HSPA(+), EV-DO and advanced Wi-Fi technologies.

APPLICATIONS

- Research and Development & Design Verification
- Performance Testing (Virtual Drive Testing)
- Product Evaluation
- Base Station and Mobile Device Testing
- MIMO Over-the-Air (OTA) Testing
- Diversity, MIMO and Beamforming
- Wi-Fi Testing (802.11n, 802.11 ac)LTE (including FDD, TD-LTE & LTE-Advanced), WiMAX, GSM, GPRS, EDGE, WCDMA, HSPA(+), CDMA2000/EV-DO
- Spatial Channel Modeling (SCM, SCME, and WINNER/ WINNER-II)

The VR5 HD replicates the real-world fading, noise and complete spatial channel conditions of even the most complex wireless channels, making it possible to isolate performance issues early in the development and design verification cycle. The VR5 is the ideal choice when you need to test with high-antenna-count MIMO and beamforming scenarios.

The VR5 platform implements proven, customer-driven Spirent channel emulator features on a future-proofed hardware and software platform. For example, Dynamic Environment Emulation (DEE), Spirent's VDT Conversion Tool and MIMO OTA Environment Builder are available on the VR5.

Wide bandwidths, unparalleled RF density and envelope-pushing channel fidelity are added to create the most advanced and future-proofed fading platform available. Now complex MIMO-OTA scenarios with many antennas and spatial channel models (SCMs) can be set up in no time. Now bi-directional scenarios and complex beamforming scenarios can be run without external "RF plumbing" hardware.

FEATURES & BENEFITS

- *Simplified testing* – VR5 keeps receiver testing simple, preventing setup errors… no matter how many antennas are involved in the forward-looking technologies you're working on.
- *The real world in your lab* – From captured drive-test scenarios to the most complex MIMO scenarios, the VR5 brings real-world RF scenarios to your test lab.
- *Maximum effectiveness of your resources* – Even the most complicated test cases can be set up and run, quickly and correctly, by your least inexperienced team members.

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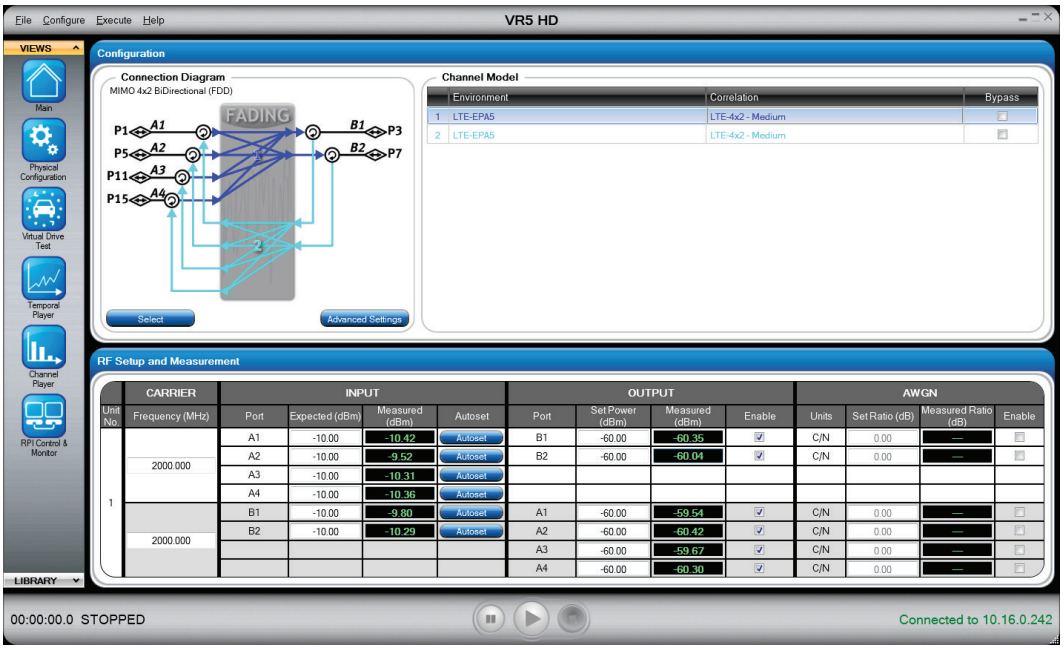
Spirent's years of experience have taught us that testing loses a lot of value when the process is too complex… errors are made, anomalies go unnoticed and testing is sometimes not completed because of the time required to set it up. Even worse, a series of time-consuming tests might be completed before someone notices an error in the setup.

The potential problems become even more apparent when dealing with a complex RF environment. Basic testing should not require an expert; advanced testing might, but it should never require expertise in using the tool.

This is why the VR5 GUI has been carefully designed around years of feedback from channel emulator users.

The VR5 can implement bi-directional testing (up to and including 4x4 bi-directional MIMO scenarios) in a single 6U component, requiring no external combiners, splitters or circulators. Options enable 8x2 MIMO Beamforming, automated phase calibration (e.g. for TD-LTE and Wi-Fi testing) and much more.



Configurations include block diagrams showing internal connections and internal circulators/combiners/splitters.

Every interface between the system and the user was designed to provide pure information in a clear and consistent way. Once the user picks a network configuration to emulate, the GUI tailors itself to present block diagrams and clear, concise informational and input fields.

The VR5's built-in touchscreen offers both detailed control and immediate feedback. Now you can view graphical readouts of the fading models being run (even while running Dynamic Environment Emulation), time-history charts of the levels measured by independent input and output power meters and much more.

Finally, the VR5 offers the most complete selection of ready-to-run standard models. Most test cases can be set up with just a few mouse clicks. The intuitive system interface means that you can train personnel to run tests in a matter of minutes, letting your experts concentrate on other challenges.

SPIRENT®

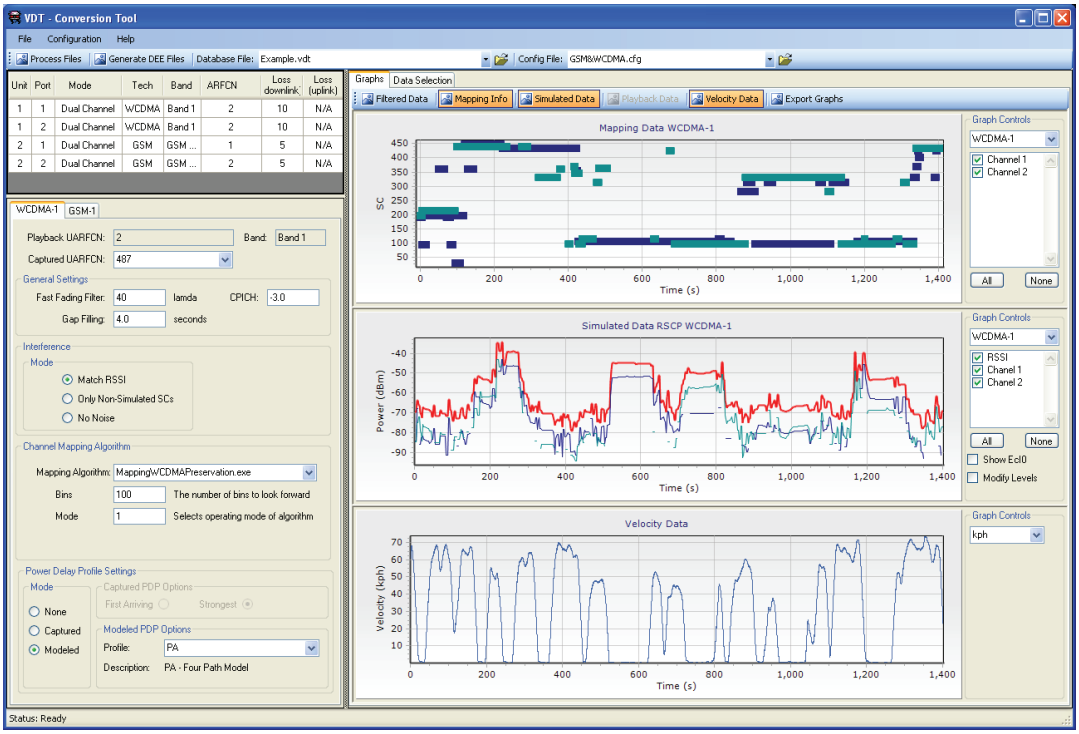
THE REAL WORLD IN YOUR LAB

The VR5 HD Spatial Channel Emulator is more than just a fader. Like the SR5500 before it, the intent of the VR5 is to bring the real world into the lab and provide an absolutely realistic emulation of the real-world RF environment. This is no easy task. A realistic RF channel emulation is affected by a variety of factors: how RF parameters are captured or generated, what characteristics are important to the testing at hand, etc.

We all know that MIMO 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, non-standard mobility scenarios)? We have. The VR5's Dynamic Correlation is ready to help you find those motion-based glitches you might have missed otherwise.

The VR5 was also designed with Over-the-Air testing in mind. Spirent experts have been working behind the scenes for years, investigating the underlying elements of OTA testing. While much of this research has been shared with the wireless community, the VR5 is the first channel emulator designed with MIMO OTA testing in mind.

Spirent also offers support for OTA channel mapping and the creation of custom Spatial Channel Models (as well as custom non-standard spatial channel models). The result is the most straightforward possible implementation of this highly useful but complex testing technology.



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

MAXIMIZING RESOURCE EFFECTIVENESS

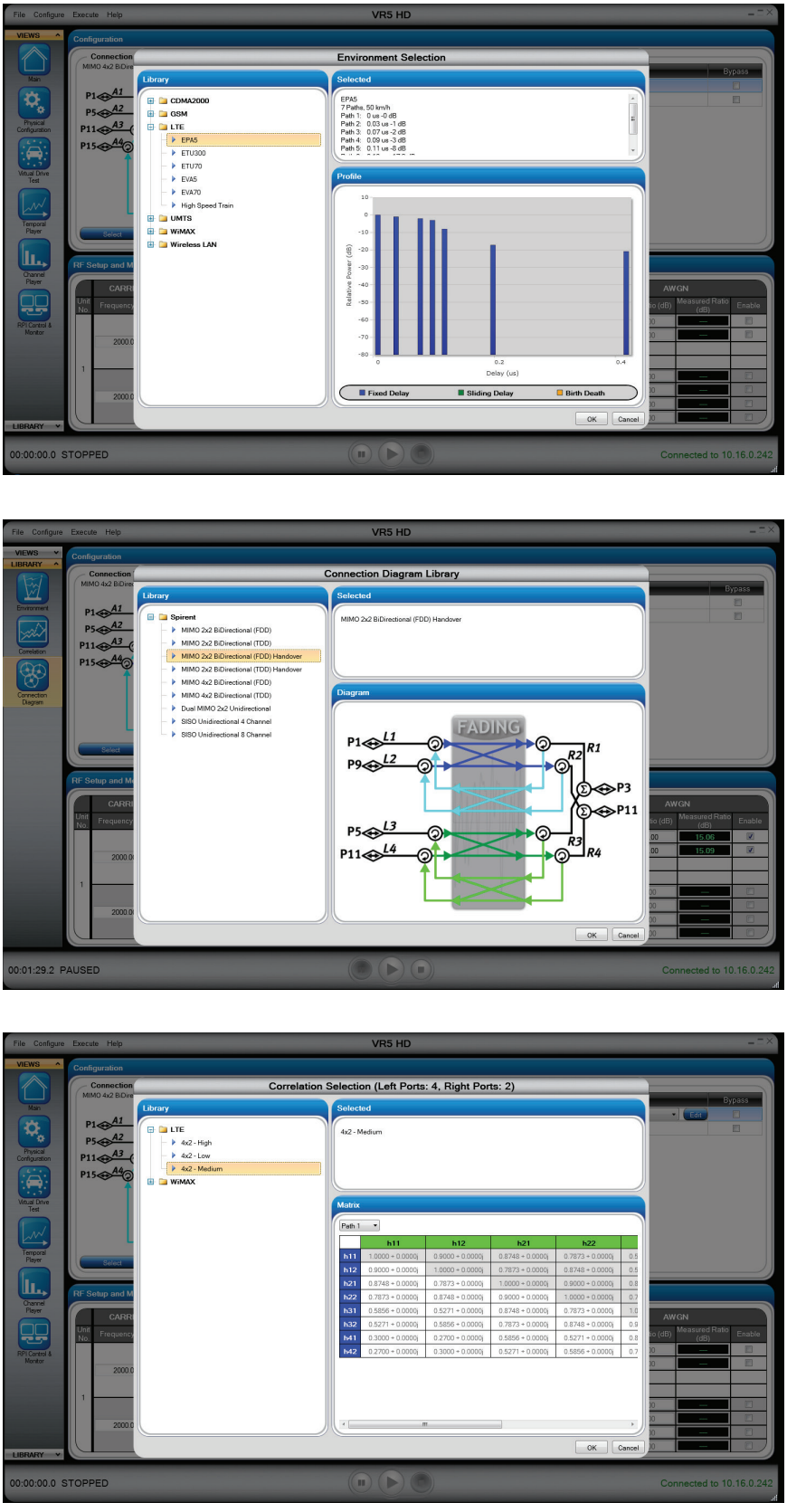
The VR5 makes short work of even the most complex RF scenarios so that you and your team spend more time testing and less time preparing to test. Most testing can be set up with just a couple of mouse clicks using drop-down boxes. In fact, your test operator doesn't even need to understand the finer details of RF and fading. The VR5 is designed so that standards-based testing or regression testing can be successfully and efficiently performed by even the least experienced member of your team.

When your situation demands a complicated custom dynamic scenario, it can be implemented in a few minutes using spreadsheet software (rather than spending a few days writing scripts). And when an expert is required, Spirent's support team, always a phone call away, gives you access to the industry's most experienced and respected fading experts.

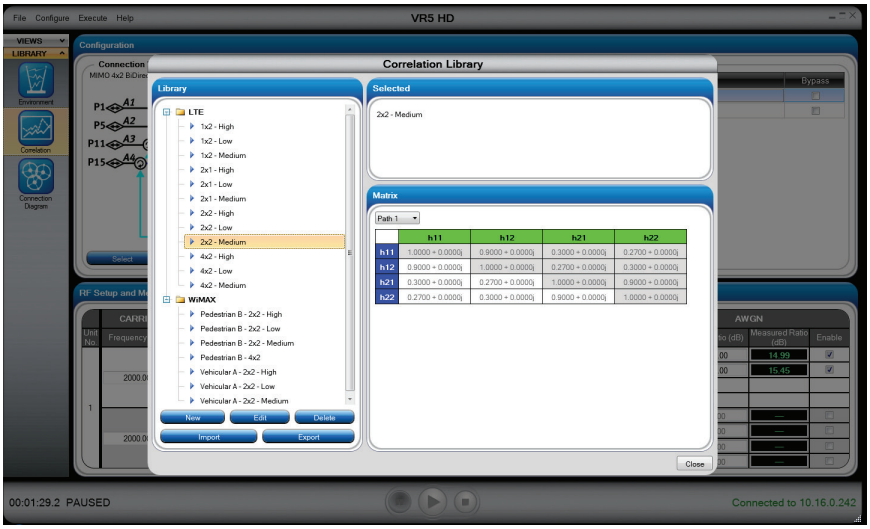
The VR5 was designed to address one more resource-saving request from the industry: it is a highly optioned product so that you only purchase the instrument options you need right now. If you need a channel emulator to test 2x2 MIMO with 40 MHz bandwidth today, but you suspect that you may need to test higher orders of MIMO such as 4x4 or 8x4 with 100 MHz bandwidths in the future, the VR5 can be readily and easily upgraded to meet your requirements as they unfold.

This future-proofed system is also designed with next-generation wireless in mind. The platform is the industry's first choice in LTE Advanced, addressing Carrier Aggregation and the increasingly-demanding MIMO and beamforming requirements associated with upcoming technologies.

Finally, Spirent's global network of service and metrology laboratories ensure that no matter where your VR5 is when you need help, our staff of experts can offer the industry's best turnaround times… so your team spends more time testing and less time waiting.



Complex setups become simple. Just choose a configuration from a drop-down box.



While most testing can be set up with a few mouse clicks, the GUI provides all the low-level control needed for the most advanced testing.

The VR5 provides comprehensive real-time graphical feedback, helping ensure that a setup error doesn't go unnoticed.

The VR5 GUI graphically delivers a wide selection of critical feedback. In this example (created in DEE) a DUT is run through handover scenarios as noise ratios gradually change.

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TECHNICAL SPECIFICATIONS

RF Configurations	• Support from SISO, 2x2 up to 8x4 with bi-directional fading • Multiple VR5s can be synchronized for more complex custom connection setups. • Multi-band carrier aggregation for LTE-A is supported internally	
RF Inputs	8	
RF Outputs	8	
RF Local Oscillators	4 – up to four independent carrier frequencies	
Digital Channels	32	
Bandwidth	Up to 100 MHz	
RF Input	Frequency Range	380 – 3850, 4100 – 6000 MHz
	Input Level Range	-50 to +15 dBm (< 4 GHz) -40 to +15 dBm (4 - 6 GHz)
	Level Resolution	0.1 dB
	Damage Level	+33 dBm (peak)
Input and Output Power Meters	Modes	• Continuous • RF Burst-triggering for gated input signals
RF Output Level	Max/Min Range	-110 to -20 dBm (RMS, <4 GHz) -110 to -30 dBm (RMS, 4-6 GHz) (Up to +5 dBm peak power)
	Resolution	0.1 dB
Residual EVM	-40 dB typical	
Residual Noise	Better than -165 dBm/Hz at a set output level of -45 dBm	
RF Port VSWR	1.5:1	
Independent Paths	Up to 24 paths per digital channel	
Delay	0 to 4000 µs, 0.1 ns resolution	
Relative Path Loss	0 – 40 dB	
Dynamic Channel Parameters	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, power imbalance, and correlation
	Channel Model Update Rate	100 times per second
	Start Method	Triggered (hardware/software), Free Play
	Play Method	Run for N loops, Wrap Around
Standards-Based Models	LTE, Wi-Fi (802.11n, 802.11 ac), IMT-A, WiMAX, UMTS, CDMA2000®, HSPA, GSM, SCM/SCME (ITU-R M.2135), WINNER, Butler	
Custom Models	Easy-to-use interface allows the user to create custom channel models or edit any of the above standard channel models	

TECHNICAL SPECIFICATIONS (CONT'D)

Real-time Fading	Types	Rayleigh, Rician, Pure Doppler, Frequency Shift, Phase Shift
	Fading Doppler	Up to 4000 Hz
	Repetition Interval	› 7 days
	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	Programmable complex correlation between paths
AWGN (Option)	C/N Ratio	-40 to +32 dB
	Accuracy	±0.1 dB
	Bandwidth	Up to 100 MHz
	Settable Modes	C/N, Eb/No
Control Interface	• Touchscreen front panel-based GUI • PC-based GUI • Remote programming through Ethernet	
Other	10 MHz internal reference accuracy	1 ppm, can be locked to external reference

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.

SPIRENT®

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