

# WSA5000

## Wireless Signal and Spectrum Analyzer

100 kHz to 8 GHz / 18 GHz / 27 GHz

### Featuring

- Real-Time Bandwidth (RTBW) up to 100 MHz
- Spurious Free Dynamic Range (SFDR) up to 100 dBc





## Overview

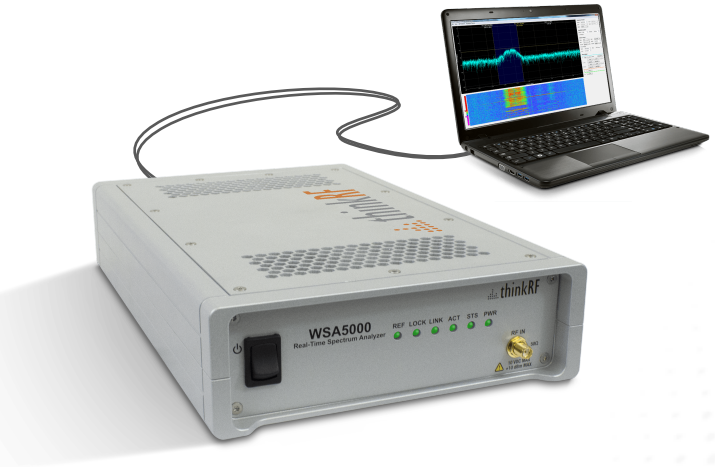
### ThinkRF's 10x Better Solution

ThinkRF makes possible the cost-effective testing and monitoring of billions of wireless devices.

Using patented innovation, ThinkRF's WSA5000 wireless signal and spectrum analyzer has the performance of traditional high-end lab spectrum analyzers at a fraction of the cost, size, weight and power consumption and is designed for distributed deployment.

The WSA5000 Wireless Signal Analyzer has a highly optimizable software-defined radio receiver coupled with real-time digitization and digital signal processing. This enables wide bandwidth, deep dynamic range and 27 GHz frequency range in a small one-box platform.

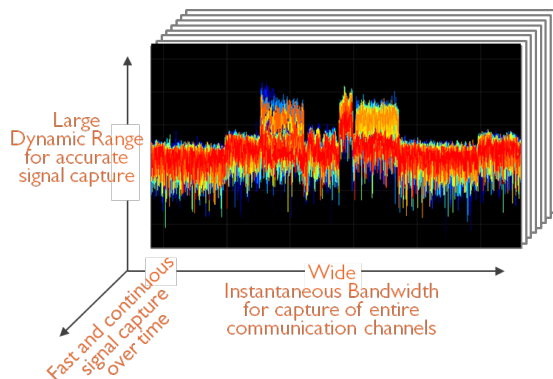
On top of this market disruptive platform, ThinkRF provides a rich set of standard APIs and programming environments for easy and quick use with existing or new test and monitoring applications.



## WSA5000 Performance

### Large Frequency Range

The frequencies and bandwidths of commercial wireless systems have been increasing steadily to accommodate the growing demand for larger data rates. The WSA5000 supports frequency ranges from 100 kHz up to 27 GHz which enables testing of modern systems and doesn't exclude tests such as third-order intercepts.



### Wide Instantaneous Bandwidth

Modern waveforms such as 802.11ac standard utilize waveforms that occupy up to 80 MHz in bandwidth and LTE-Advanced aims to utilize bandwidths of up to 100 MHz. The WSA5000 provides up to 100 MHz of instantaneous bandwidth in its direct conversion mode.

### Deep Dynamic Range

RF measurements for characterizing IP3 generally require a dynamic range of around 100 dB. The WSA5000 supports multiple ADCs thereby providing wide IBW with 70 dB dynamic range and a narrow IBW with 100 dB dynamic range.

### Real-Time Acquisition Memory and Trigger Capability

Modern waveforms such as those associated with the wireless LAN standards utilize packet-based signaling techniques. The WSA5000 enable real-time capture of multiple data packets by providing real-time hardware-based frequency domain triggering capability in conjunction with real-time memory storage of up to 128 million samples.

### Fast Scan Speed

Scan speed determines how fast the analyzer can jump from analyzing one set of frequencies to another set. The WSA5000 has fast setup times and provides sophisticated capture control.

### Small Size, Weight, and Power

The WSA5000 has a length and width less than a sheet of paper, weighs less than 3 kg and consumes less than 20 W of power making it a fraction of the size, weight and power of traditional lab spectrum analyzers.

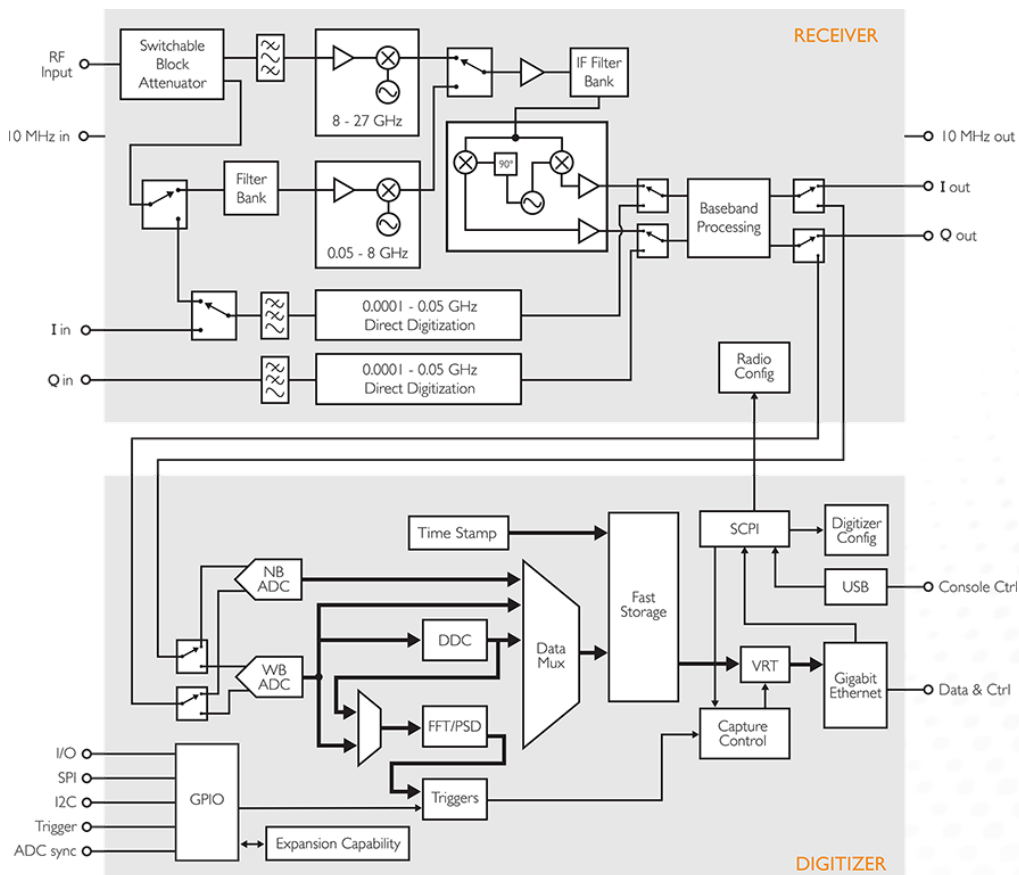


## WSA5000 Architecture

### The Receiver

The WSA5000 has a patented hybrid receiver consisting of a super-heterodyne front-end with a backend that utilizes an I/Q mixer similar to that in a direct-conversion receiver. Depending on the frequency of the signals being analyzed, one of three receiver signal processing paths is selected. Signals in the frequency range 100 kHz to 50 MHz are directly digitized, while all other signals are translated to the frequencies of the first IF block via one of the two signal processing paths.

The IF block consists of a bank of multiple surface acoustic wave (SAW) filters. Depending on the mode of operation, i.e. super-heterodyne or homodyne, either one or both outputs are utilized to process either 40 MHz or 100 MHz instantaneously. The IF analog outputs are digitized using one of two ADCs: a 125 MS/s sampling rate with a typical dynamic range of 70 dB; or a 300 kS/s sampling rate with a typical dynamic range in excess of 100 dB.



### The Digitizer

The digitized signal is real-time and continuously processed. The WSA5000 provides digital signal processing including optional digital down conversion; FFT and optional frequency domain triggering; sophisticated capture controlled; and optionally stored in fast local memory for subsequent forwarding or streaming across the Ethernet.

User configurable sophisticated capture control combined with fast deep caching enables fast signal searches, sweeps, triggering and captures of only the signals of interest.

The WSA5000 digitizer has an embedded microprocessor with a Linux OS and control, management and remote maintenance application. It supports the SCPI standard for user control and VITA VRT for data path.

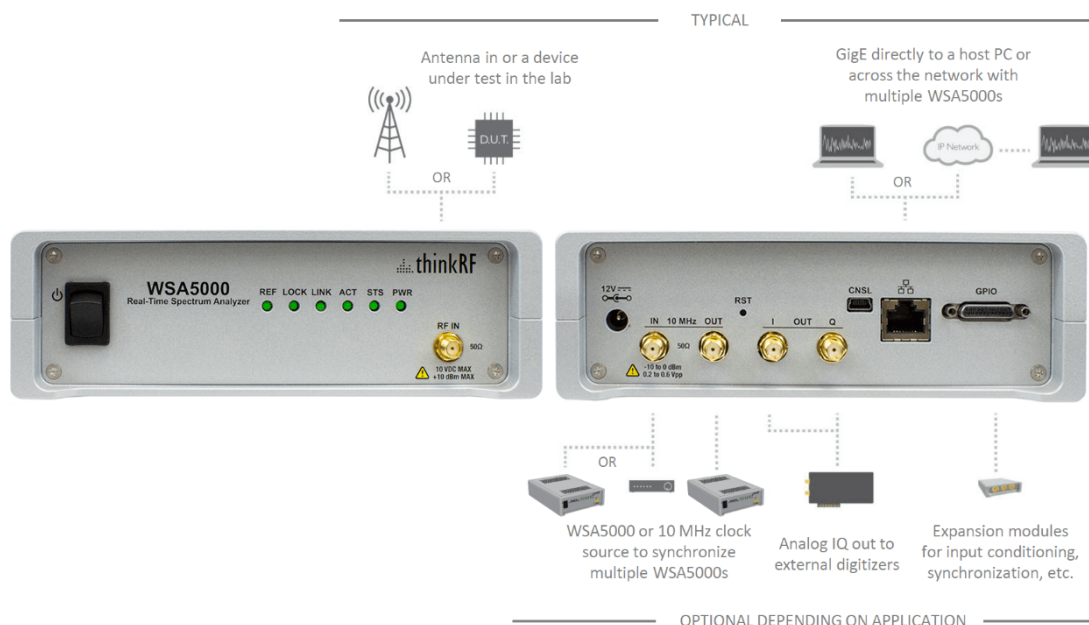


## WSA 5000 Extensible Hardware Interfaces

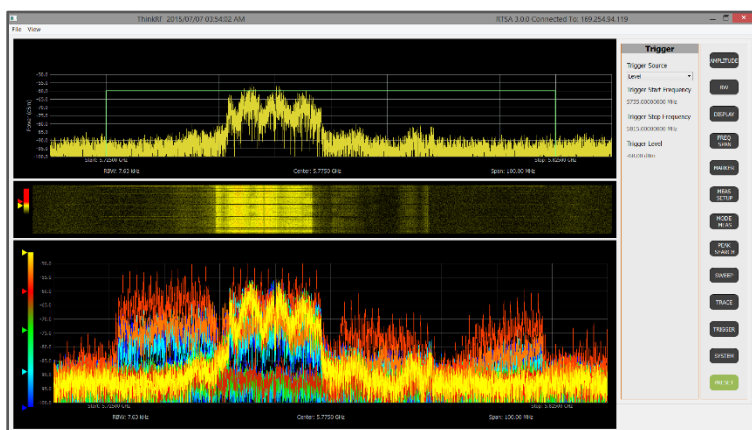
Whether you're looking for a high-powered receiver to integrate with your existing digitizer solution or you need powerful, cost-effective spectrum analyzer hardware to pair with your software, the WSA5000 Wireless Signal Analyzer is a universal and versatile platform designed for use across wireless industries and applications.

- 10 MHz input and output clock references for multi-unit synchronization

- Analog I/Q output enables OEM high speed digitizers
- GPIO for external triggers 10/100/1G Ethernet port for control and networking
- +12 V DC power input allowing automobile sources and personal mobility with an external battery
- External support for 80 MHz and 160 MHz RTBW (optional)
- External local oscillator inputs for phase-coherent radio front-ends (not shown and optional)



## RTSA v3 Real-Time Spectrum Analysis Application



By utilizing the power of the WSA5000, the RTSA v3 application has all the standard features you expect from a traditional lab spectrum analyzer as well as powerful features such as real-time triggering.

The RTSA v3 will run on any Windows PC. Simply install the software and connect your device through an Ethernet or Internet connection and you're ready to get started.

With the RTSA v3's simple and intuitive user interface you'll be using your new device in no time.



## WSA 5000 APIs and Programming Environments

By supporting a rich set of industry-leading standard protocols, the WSA5000 can easily integrate into your new or existing applications.



### Python™ and PyRF development framework

PyRF enables rapid development of powerful applications that leverage the new generation of measurement-grade software-defined radio technology. It is built on the Python Programming Language and includes feature-rich libraries, example applications and source code and is openly available, allowing commercialization of solutions through BSD open licensing.



### NI LabVIEW®

Easily and quickly integrate the WSA5000 into your existing or new NI LabVIEW® based acquisition, measurement, automated test and validation systems.



### MATLAB®

ThinkRF provides MATLAB® drivers for connecting to ThinkRF's WSA5000 Wireless Signal Analyzers and MATLAB® program code examples to get you started towards developing your own.



### C/C++ Drivers and DLL

Underneath our rich set of APIs and programming environments is the C/C++ driver and DLL which abstracts the SCPI command and VITA VRT dataflow from the WSA5000. The C/C++ driver is openly available to you in source code allowing commercialization of solutions through BSD open licensing.

## SCPI

### SCPI and VITA VRT

Compliance with standard protocols provides you both multi-vendor independence and device interoperability.



The WSA5000 supports the Standard Commands for Programmable Instruments (SCPI) for control and the VITA-49 Radio Transport (VRT) protocol for data flow. ThinkRF provides extensive documentation and examples for programming and interfacing at the SCPI and VITA-49 VRT level.





### Real-time spectrum analyzer mode with ThinkRF RTSA v3 software

Display Modes	Real-time Spectrum Real-Time Spectrogram Real-Time Persistence Spectrum Real-Time I and Q	
Real-time bandwidth (RTBW)	0.1 / 10 / 40 / 100 MHz	
Probability of Intercept (POI)	$\geq 25.552 \mu\text{s}$ signal duration $\leq 17.360 \mu\text{s}$ signal duration	for 100% POI for 0% POI
Spurious free dynamic range (SFDR)	$\geq 60 \text{ dBc}$ (nominal) $\geq 70 \text{ dBc}$ (nominal) $\geq 100 \text{ dBc}$ (nominal)	100 MHz RTBW 10 / 40 MHz RTBW 0.1 MHz RTBW
Data Acquisition		
A/D Converter Sampling Rate and Resolution	125 MS/s, 12 bit 300 kS/s, 24 bit	10 / 40 / 100 MHz RTBW 0.1 MHz RTBW
FFT lengths	128 to 524288 in powers of 2	
Resolution Bandwidth (RBW)		
Range	0.24 kHz to 976.56 kHz 0.62 Hz to 2543.12 Hz	10 / 40 / 100 MHz RTBW 0.1 MHz RTBW
Windowing	Hanning	
Traces	6	Clear/Write, Trace Average, Max Hold, Min Hold
Markers	12	Peak Search, Next Peak, Next Left/Right, Center
Modes	Normal (Tracking), Delta, Fixed	
Marker Frequency Resolution	0.01 Hz	
Triggers	1	Real-Time Level Trigger
APIs	Python™ LabVIEW MATLAB® C/C++ SCPI	PyRF RTSA LabVIEW Base Development System for Windows MATLAB® Release 2014b ISO/IEC 14882:2011 IEEE 488.2 - Standard Commands for Programmable Instruments
Record/Playback Preferences	VITA Radio Transport (VRT) Save/Load Settings	VITA-49.0 – 2007 Draft 0.21 Save settings for easy recall
Export Data	CSV	Comma Separated Values

### Frequency

Frequency Ranges		
Sweep/RTSA Mode (100/40/10/0.1 MHz)	50 MHz to 8 GHz, 18 GHz or 27 GHz	Non-tunable
Baseband Mode	100 kHz to 62.5 MHz	
Frequency Reference	$\pm 1.0 \times 10^{-6}$ per year $\pm 1.0 \times 10^{-6}$ per year	Aging Accuracy + aging
Tuning Resolution	1 Hz	

### Amplitude

Amplitude Accuracy 25 °C ± 5 °C	± 2.00 dB typical ± 2.75 dB typical	100 kHz to 3 GHz >3 GHz to 8 GHz
Amplitude Ranges		
Measurement Range	DANL to maximum safe input level	
Attenuator Range	0 or 20 dB 0 to 25 dB in 1 dB steps	8 GHz only (Front-end Attenuation) 18 and 27 GHz only (IF Attenuation)
Maximum Safe RF Input Level	+10 dBm, 0 V DC	



### Spectral Purity

SSB Phase Noise	at 1 GHz (as an RTSA)	(phase noise of LO measured at 1 GHz)	Carrier Offset
25 °C ± 5 °C, typical	-80 dBc/Hz typical	-85 dBc/Hz typical	100 Hz
	-90 dBc/Hz typical	-90 dBc/Hz typical	1 kHz
	-97 dBc/Hz typical	-105 dBc/Hz typical	10 kHz
	-102 dBc/Hz typical	-115 dBc/Hz typical	100 kHz
	-123 dBc/Hz typical	-143 dBc/Hz typical	1 MHz

Displayed Average Noise Level (DANL)	408	408-P, 418	427	Frequency
25 °C ± 5 °C, typical	- 151 dBm	- 164 dBm	- 162 dBm	100 MHz
	- 151 dBm	- 163 dBm	- 162 dBm	500 MHz
	- 150 dBm	- 161 dBm	- 160 dBm	1000 MHz
	- 149 dBm	- 152 dBm	- 144 dBm	2000 MHz
	- 145 dBm	- 157 dBm	- 157 dBm	3000 MHz
	- 140 dBm	- 155 dBm	- 154 dBm	4000 MHz
	- 142 dBm	- 149 dBm	- 145 dBm	5000 MHz
	- 134 dBm	- 143 dBm	- 143 dBm	6000 MHz
	- 134 dBm	- 149 dBm	- 143 dBm	7000 MHz
	- 131 dBm	- 163 dBm	- 158 dBm	8000 MHz
		- 162 dBm	- 158 dBm	9000 MHz
		- 162 dBm	- 157 dBm	10000 MHz
		- 160 dBm	- 160 dBm	11000 MHz
		- 158 dBm	- 154 dBm	12000 MHz
		- 156 dBm	- 146 dBm	13000 MHz
		- 155 dBm	- 150 dBm	14000 MHz
		- 159 dBm	- 147 dBm	15000 MHz
		- 155 dBm	- 150 dBm	16000 MHz
		- 152 dBm	- 145 dBm	17000 MHz
		- 149 dBm	- 147 dBm	18000 MHz
			- 147 dBm	19000 MHz
			- 151 dBm	20000 MHz
			- 146 dBm	21000 MHz
			- 145 dBm	22000 MHz
			- 149 dBm	23000 MHz
			- 151 dBm	24000 MHz
			- 148 dBm	25000 MHz
			- 143 dBm	26000 MHz
			- 133 dBm	27000 MHz

Third Order Intercept/(TOI)	at 1 GHz	+12 dBm, typical
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### General Specifications

PC Required	
Operating System	Windows XP (32 bit) Window 7, 8 and 10 (32 or 64 bit)
RAM	2 GB
Hard Disk	1 GB

Status Indicators	PLL Lock / 10 MHz reference clock status Ethernet Link and Activity status CPU and Power status
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Connectors	
RF In	SMA female, 50 Ω
10 MHz Reference In and Out	SMA female, 50 Ω
Analog I and Q Out	SMA female, 50 Ω
10/100/1000 Ethernet	RJ45
USB Console	mini-USB
GPIO	25-pin male D-Subminiature
Coaxial Power	Type A: 5.5 mm OD, 2.5 mm ID



### General Specifications

#### Physical

Power Supply	+12 V DC	
Power Consumption	18 W	
Operating Temperature	0 °C to +50 °C	
Range	-40 °C to +85 °C	
Storage Temperature Range		
Size	269 x 173 x 61 mm (10.58 x 6.81 x 2.40 inches)	with mounting feet (shipped installed on unit)
	269 x 173 x 55 mm (10.58 x 6.81 x 2.15 inches)	without mounting feet
Weight	2.7 kg (6 lbs.)	

### Regulatory Compliance

RoHS Compliance	RoHS/RoHS 2	
Marks	CE	European Union
EMC Directive 2014/30/EU	EN 61326-1:2013	Electromagnetic Compatibility
Low Voltage Directive 2006/95/EC	EN 61010-1:2010 Class 1	Safety

### Ordering Information

8 GHz RTSA	WSA5000-308	100 kHz to 8 GHz, RTBW up to 10 MHz *
8 GHz RTSA	WSA5000-408	100 kHz to 8 GHz, RTBW up to 100 MHz
18 GHz RTSA	WSA5000-418	100 kHz to 18 GHz, RTBW up to 100 MHz
27 GHz RTSA	WSA5000-427	100 kHz to 27 GHz, RTBW up to 100 MHz
8 GHz Preamp	WSA5000-408-P	8 GHz spectrum analyzer with 100 kHz to 100 MHz RTBW with pre-amp and additional preselect filtering. Applicable only to the WSA5000-408.
80 MHz and 160 MHz RTBW Support	WSA5000-xxx-WBIQ **	External support for 80 MHz Super-Heterodyne and 160 MHz Zero-IF RTBW. The RTBW of 160 MHz is intended for IQ out only. The internal digitizer remains at 125 MSa/s.
External Local Oscillator Support	WSA5000-xxx-ELO **	External Local Oscillator inputs for phase-coherent radio front-ends
High IF	WSA5000-xxx-HIF **	Radio receiver front-end with IF output between 800 and 2500 MHz. When this option is selected, the lower IF outputs at 0 or 35 MHz or the RF digitization will not be available.
80 MHz and 160 MHz RTBW and External Local Oscillator Support	WSA5000-xxx-WBIQ-ELO **	Radio receiver front-end support for external Local Oscillator inputs and 80 MHz Super-Heterodyne and 160 MHz Zero-IF RTBW. The instantaneous BW of 160 MHz is intended for IQ out only. The internal digitizer remains at 125 MSa/s.
Software Included	RTSA	Real-Time Spectrum Analyzer software
Rack Shelf	WSA5000-RACK-SHELF	19" rack shelf supports two horizontally mounted WSA5000s
External Battery	EXTERNAL-BATTERY	20,000 mAh 12 V / 1.5 A battery, >3.5 hours typ.

\* The 308 does not include 10 MHz Out or I/Q Out

\*\* xxx = 408, 418 or 427 for 8 GHz, 18 GHz, or 27 GHz models respectively

## Contact us for more information

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