Product Brochure and Technical Datasheet

ThinkRF R5550

Real-Time Spectrum Analyzer

9 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

- Beautifully designed, lightweight, and silent

- GigE networked and remote deployable

thinkRF™

Overview

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

Built on innovative software-defined radio technologies, the ThinkRF R5550 Real-Time Spectrum Analyzer has the performance of traditional lab-grade spectrum analyzers at a fraction of the cost, size, weight and power consumption.

Designed for distributed deployment in the lab, in the field, or in a vehicle, the portable, fanless ThinkRF R5550 provides the benefits of a high-performance software-defined RF receiver, digitizer and analyzer.

The R5550 analyzer is silent, lightweight, and offers improved spectral performance in a more rugged form factor.

Based on an optimized software-defined radio receiver architecture coupled with real-time digitization and digital signal processing. This enables wide bandwidth, deep dynamic range and 27 GHz frequency range in a small, stylish one-box platform.
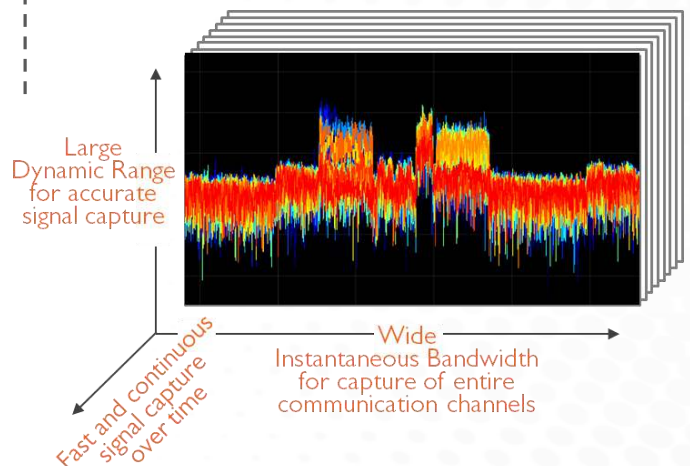
On top of this market disruptive platform, ThinkRF provides a rich set of standard APIs and programming environments for easy and quick use with existing or new test and monitoring applications.

Conduct deeper analysis

Networked and remote deployable

PC-driven for increased functionality

Rich support for APIs and applications

Large Dynamic Range for accurate signal capture

Fast and continuous signal capture over time

Wide Instantaneous Bandwidth for capture of entire communication channels

™

R5550 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 R5550 supports frequency ranges from 9 kHz up to 27 GHz which enables testing of modern systems including tests such as third-order intercept.

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 R5550 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 R5550 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 R5550 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 R5550 has fast setup times and provides sophisticated capture control.

Small Size, Weight, and Power

The R5550 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-grade spectrum analyzers.

R5550 Architecture

The Receiver Front End

The R5550 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 9 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 IF 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.

Availability depending on the product models.
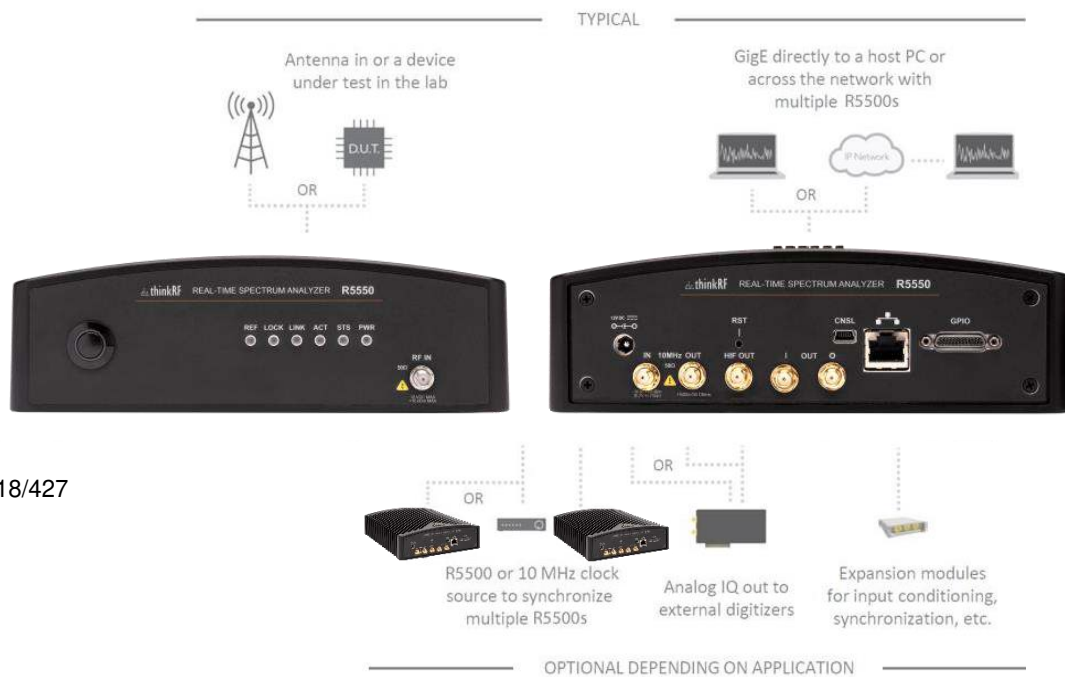Refer to the product's datasheet.
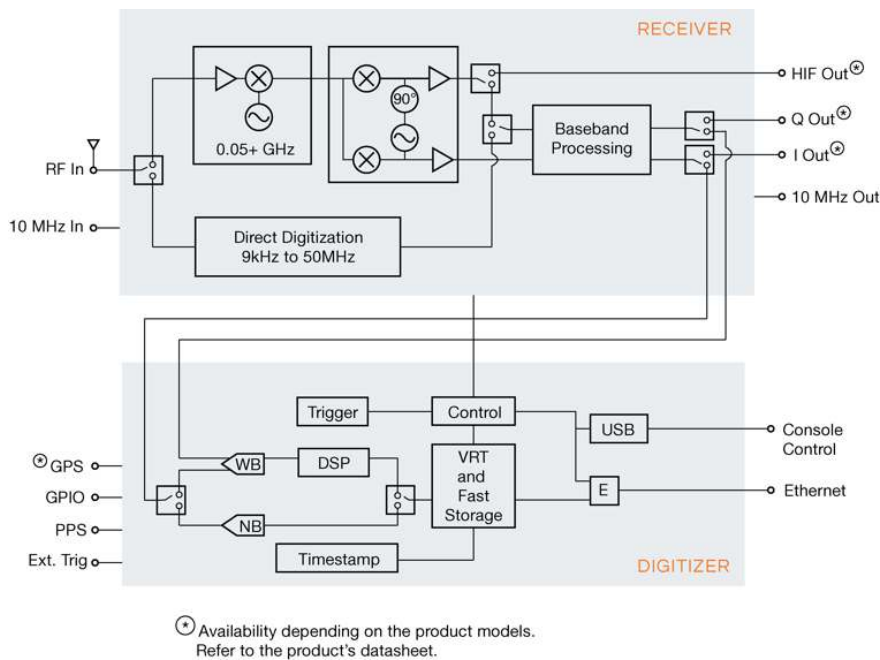
The Digitizer

The digitized signal is continuously processed in. The R5550 provides digital signal processing including optional digital down conversion; 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 R5550 digitizer has a dual-core embedded microprocessor with operating system, control, management and remote maintenance application. It supports the SCPI standard for user control and VITA VRT for data path.

Antenna in or a device under test in the lab

GigE directly to a host PC or across the network with multiple R5500s

R5550-408/418/427

R5500 or 10 MHz clock source to synchronize multiple R5500s

Analog IQ out to external digitizers

Expansion modules for input conditioning, synchronization, etc.

OPTIONAL DEPENDING ON APPLICATION

R5550 Extensible Hardware Interfaces

Whether you're looking for a flexible receiver to integrate with your existing digitizer solution or you need powerful, cost-effective spectrum analyzer hardware to pair with your software, the R5550 Real-Time Spectrum 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 and HIF outputs enable 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)

R5550 Spectrum Analysis Applications

ThinkRF S240v5 Real-Time Spectrum Analysis Application Software

By utilizing the power of the R5550, the S240v5 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 S240v5 is designed to run on 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 S240v5's simple and intuitive user interface you'll be using your new device in no time.
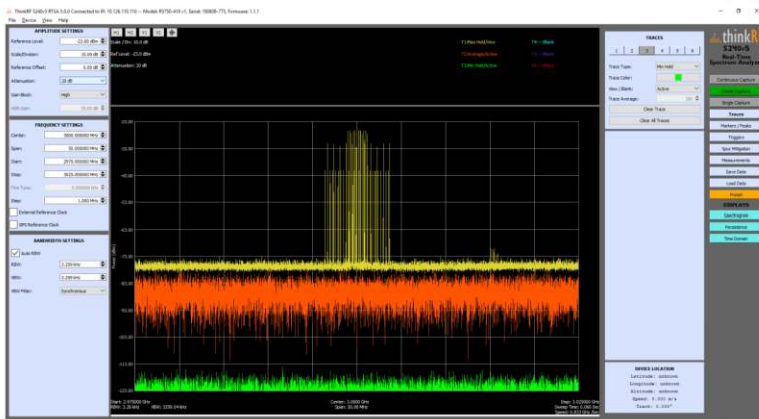
Keysight 89600 VSA®

Support for the Keysight 89600 VSA provides a comprehensive set of software tools for demodulation and vector signal analysis enabling users to monitor complex waveforms in more locations.

R5550 APIs and Programming Environments

By supporting a rich set of industry-leading standard protocols, the R5550 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 R5550 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 R5550 Real-Time Spectrum 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 R5550.

R5550 Standard Protocols

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

SCPI and VITA VRT

The R5550 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.

RF and Digitization Specifications

Frequency		
Frequency Ranges	9 kHz to 8, 18 or 27 GHz	
Frequency Reference	±1.0 ppm	Accuracy at room temperature
	±1.0 ppm 0°C to 55°C	Stability over temperature
	±1.0 ppm per year	Aging
Real-time bandwidth (RTBW)	0.1 / 10 / 40 /100 MHz	
Probability of Intercept (POI)	≥ 25.552 µs signal duration	For 100% POI
	≤ 17.360 µs signal duration	For 0% POI
Spurious free dynamic range (SFDR)	60 dBc (typical)	100 MHz RTBW
	70 dBc (typical)	10 / 40 MHz RTBW
	100 dBc (typical)	0.1 MHz RTBW

Amplitude		
Amplitude Accuracy 25 °C ± 5 °C	± 2.00 dB typical	50 MHz to 27 GHz
Measurement Range Attenuator Range	Amplitude Ranges DANL to levels in figure below 0 to 30 dB in 10 dB steps	R5550-408 (8GHz) 8 GHz only
Maximum Safe RF Input Level	+10 dBm, 10 V DC	

Maximum input amplitude level for R5550-408
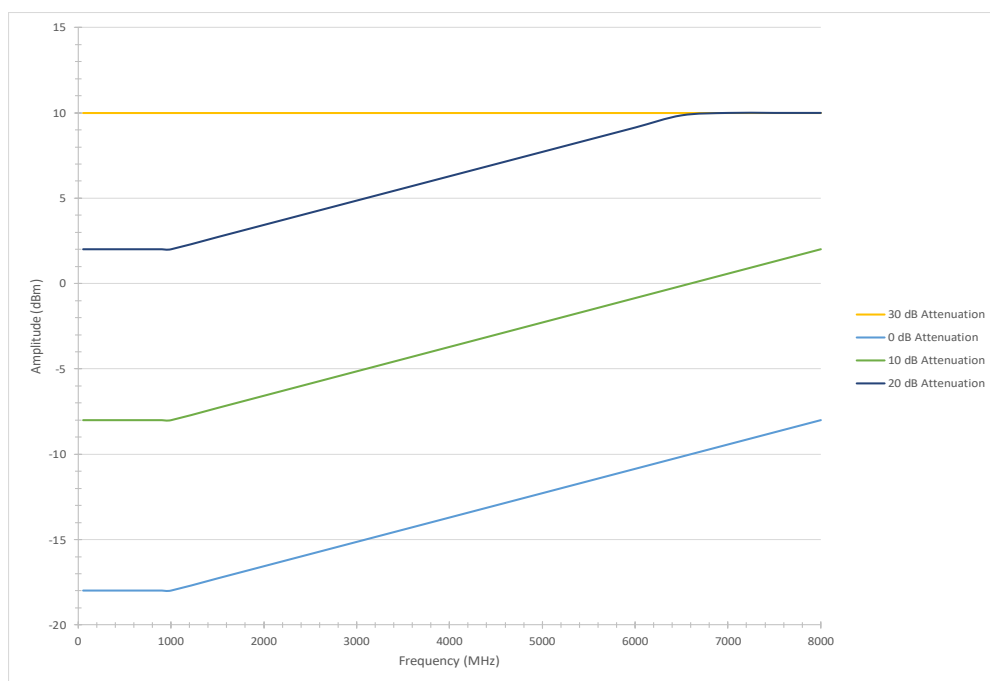
Maximum input amplitude level for R5550-408 for different input attenuation levels (typical).

RF and Digitization Specifications

Displayed Average Noise Level (DANL)

At 25 °C ± 5 °C, typical

Frequency (GHz)	8 GHz (typical)	18 GHz (typical)	27 GHz (typical)
0.1 GHz	- 157 dBm/Hz	- 161 dBm/Hz	- 160 dBm/Hz
0.5 GHz	- 155 dBm/Hz	- 160 dBm/Hz	- 159 dBm/Hz
1 GHz	- 156 dBm/Hz	- 160 dBm/Hz	- 159 dBm/Hz
2 GHz	- 154 dBm/Hz	- 154 dBm/Hz	- 153 dBm/Hz
3 GHz	- 152 dBm/Hz	- 158 dBm/Hz	- 157 dBm/Hz
4 GHz	- 151 dBm/Hz	- 162 dBm/Hz	- 162 dBm/Hz
5 GHz	- 150 dBm/Hz	- 158 dBm/Hz	- 158 dBm/Hz
6 GHz	- 149 dBm/Hz	- 157 dBm/Hz	- 157 dBm/Hz
7 GHz	- 150 dBm/Hz	- 153 dBm/Hz	- 155 dBm/Hz
8 GHz	- 144 dBm/Hz	- 160 dBm/Hz	- 161 dBm/Hz
9 GHz		- 158 dBm/Hz	- 161 dBm/Hz
10 GHz		- 160 dBm/Hz	- 161 dBm/Hz
11 GHz		- 156 dBm/Hz	- 160 dBm/Hz
12 GHz		- 158 dBm/Hz	- 157 dBm/Hz
13 GHz		- 151 dBm/Hz	- 157 dBm/Hz
14 GHz		- 154 dBm/Hz	- 154 dBm/Hz
15 GHz		- 160 dBm/Hz	- 157 dBm/Hz
16 GHz		- 157 dBm/Hz	- 157 dBm/Hz
17 GHz		- 150 dBm/Hz	- 156 dBm/Hz
18 GHz		- 144 dBm/Hz	- 156 dBm/Hz
19 GHz			- 149 dBm/Hz
20 GHz			- 154 dBm/Hz
21 GHz			- 153 dBm/Hz
22 GHz			- 152 dBm/Hz
23 GHz			- 153 dBm/Hz
24 GHz			- 155 dBm/Hz
25 GHz			- 153 dBm/Hz
26 GHz			- 150 dBm/Hz
27 GHz			- 148 dBm/Hz

Third Order Intercept (TOI) at max gain	+12 dBm, typical	At 1 GHz (R5550-408 only)

Spectral Purity

SSB Phase noise	With External 10MHz oscillator	Without External 10MHz oscillator	Carrier Offset
25°C ± 5°C	-90 dBc/Hz	-90 dBc/Hz	100 Hz
At 1 GHz	-93 dBc/Hz	-92 dBc/Hz	1 kHz
Measured locked to an external 10MHz oscillator and measured with external oscillator not present	-98 dBc/Hz	-99 dBc/Hz	10 kHz
	-106 dBc/Hz	-109 dBc/Hz	100 kHz
	-120 dBc/Hz	-118 dBc/Hz	1 MHz

Digitization

Data Acquisition

A/D Converter Sampling Rate and Resolution	125 MS/s,14 bit	10 / 40 / 100 MHz RTBW
	300 kS/s, 24 bit	0.1 MHz RTBW

Sweep Rate	Up to 28 GHz/s @ 10 kHz RBW	40 MHz IBW
Stream Rate (directly from device)	360 Mbit/s	

General Specifications

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
HIF Out	SMA female, 50 Ω
10/100/1000 Ethernet	RJ45
USB Console	Type B mini
GPIO	25-pin male D-Subminiature
Power	Coaxial Type A: 5.5 mm OD, 2.5 mm ID

Status Indicators

PLL Lock / 10 MHz reference clock status	Refer to R5550 User Manual
Ethernet Link and Activity Status	
CPU and Power Status	

Power

Physical Power Supply	Use AC Wall Power Adaptor provided	Input AC 120V-240V/Output +12V
Power Consumption	23W with Power Adaptor provided (418, 427)	At room temperature
	17W with Power Adaptor provided (408)	

Physical

Operating Temperature Range	0°C to +50°C	
Storage Temperature Range	-40°C to +85°C	
Warm up time	30 minutes	
Size	257.3 x 193.7 x 66 mm (10.13 x 7.63 x 2.61 inches)	With mounting feet
	257.3 x 193.7 x 60 mm (10.13 x 7.63 x 2.36 inches)	Without mounting feet
		Located on back end-plate
Weight	2.7 kg (6 lbs.)	
Security	Kensington Security Slot	

Regulatory Compliance

RoHS Compliance	RoHS	
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
FCC		

Environmental

Humidity & Temperature:	MIL-STD-PRF-28800 Class 2
• Non-Operating Temp	• Non-Operating Temp (3.8.2.1)
• Operating Temp	• Operating Temp (3.8.2.2)
• Relative Humidity	• Relative Humidity (3.8.2.3)
Shock & Vibration:	MIL-STD-PRF-28800 Class 2
• Vibration Limits	• Vibration Limits (3.8.4.1)
• Sinusoidal Vibration	• Sinusoidal Vibration (3.8.4.2)
• Shock Functional	• Shock Functional (3.8.5.1)
	• Bench Handling (3.8.5.3)

Software Specifications

S240v5 Real-Time Spectrum Analysis Software		
Resolution Bandwidth (RBW)		
Span	50 kHz to 8/18/27 GHz	Depending on Span setting
	1 Hz to 488.28 kHz	0.1 MHz RTBW
Windowing	Hanning	
Power Measurements	Channel Power, Occupied Bandwidth	
Traces	6	Clear/Write, Trace Average, Max/Min Hold
Markers	12	
Modes	Normal (Tracking), Delta, Fixed	
Marker Frequency Resolution	1 Hz	Peak Search, Next Peak, Next Left/Right, Center
Record/Playback	Power Spectral Data with Time Stamp, Context	CSV format, optional saving duration
Configurations	Save/Load Settings	Save settings for easy recall
APIs and Protocols		
Python™	PyRF	
LabVIEW	LabVIEW (Version 2014 and up)	
MATLAB®	MATLAB® (Version 2014b and up)	
C/C++	ISO/IEC 14882:2011	
SCPI	IEEE 488.2 - Standard Commands for Programmable Instruments	
VRT	VITA-49 Radio Transport	
HiSLIP	TCP/IP-based Hi Speed LAN Instrument Protocol by IVI Foundation	
Recommended PC		
Operating System	Windows 7, 8, 10 (32 or 64)	For best performance, a dedicated PC is recommended
Minimum RAM Size	4 GB	
Minimum Free Hard Disk Space	2 GB	
Ethernet Port	1 GigE	
Display Resolution	1920 x 1080	

Ordering Information

Base Units	Part Number	Description
8 GHz RTSA	R5550-408	9 kHz to 8 GHz, RTBW up to 100 MHz
18 GHz RTSA	R5550-418	9 kHz to 18 GHz, RTBW up to 100 MHz
27 GHz RTSA	R5550-427	9 kHz to 27 GHz, RTBW up to 100 MHz
8 GHz RTSA	R5550-408-WBIQ	9 kHz to 8 GHz, RTBW up to 160 MHz, Wideband option
18 GHz RTSA	R5550-418-WBIQ	9 kHz to 18 GHz, RTBW up to 160 MHz, Wideband option
27 GHz RTSA	R5550-427-WBIQ	9 kHz to 27 GHz, RTBW up to 160 MHz, Wideband option

Ordering Information

R5550 Power Plug Options	Description	
0	North American power plug (115 V, 60 Hz)	
1	Universal Euro power plug (220 V, 50 Hz)	
2	United Kingdom power plug (240 V, 50 Hz)	
3	Australia power plug (240 V, 50 Hz)	
4	Switzerland power plug (220 V, 50 Hz)	
5	Japan power plug (100 V, 50/60 Hz)	
6	China power plug (50 Hz)	
7	India power plug (50 Hz)	
Accessories		
Software Included	S240v5	Real-Time Spectrum Analysis Software
Rack Shelf	R5500-RACK-SHELF	19" rack shelf supports two horizontally mounted R5550s or R5500s
Vehicular Power Conditioner	P120-012	

Contact us for more information on 5G applications

www.thinkrf.com
sales@thinkrf.com
+1.613.369.5104

thinkRF

74-0092-191125