thinkRF™ R5750

Real-Time Spectrum Analyzer

with Global Navigation Satellite System (GNSS) for positional and temporal information

9 kHz to 8 GHz / 27 GHz

COMPACT & LIGHT DESIGN

257.3 x 193.7 x 60 mm
(10.13” x 7.63” x 2.36“)
2.54 kg (5.6 lbs)

SILENT

Fanless design for quite operation

NETWORKING CAPABILITY

Designed for remote deployment

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OVERVIEW

R5750
Real-Time Spectrum Analyzer
with GNSS

Compact, fanless, networked and remote deployable real-time spectrum analyzers with GNSS

1

9 kHz to 8 or 27 GHz

2

0.1 / 10 / 40 / 100 MHz
Real-time bandwidth (RTBW)

3

Up to 28 GHz/s @ 10 kHz RBW
Sweep Rate

4

20 W @ 12V input power consumption

5

257.3 x 193.7 x 60 mm
(10.13" x 7.63" x 2.36")
Compact

6

2.54 kg (5 lbs)
Light

The performance of traditional lab-grade spectrum analyzers at a fraction of the cost, size, weight and power consumption.

thinkRF™ makes the cost-effective testing and monitoring of billions of wireless devices possible. Using innovative software-defined radio technologies, the thinkRF R5750 Real-Time Spectrum Analyzer with GNSS has the performance of traditional lab-grade spectrum analyzers at a fraction of the cost, size, weight and power consumption.

The sleek, lightweight, and fanless thinkRF R5750 analyzer provides the benefits of a high-performance software-defined RF receiver, digitizer and analyzer along with integrated GNSS technology offering location and time information.

The R5750 Real-Time Spectrum Analyzer is 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, one-box, stylish platform. Designed for stand-alone, mobile, remote and/or distributed wireless signal analysis, the R5750 analyzer can be deployed as a single unit or a network of radio sensors, making it ideal for monitoring, management and surveillance of transmitters, whether they are in-building or spread across a geographic area.

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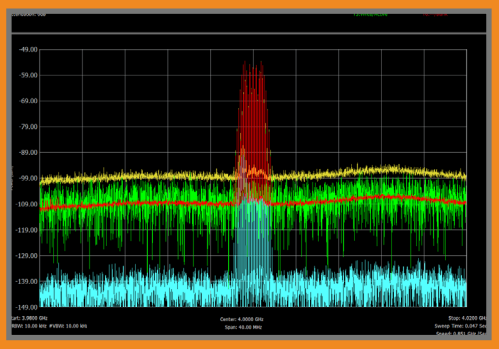
PERFORMANCE

R5750 Real-Time Spectrum Analyzer (RTSA)

1 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 R5750 supports frequency ranges from 9 kHz up to 27 GHz which enables testing of modern systems including tests such as third-order intercept.



2 WIDE INSTANTANEOUS BANDWIDTH

Modern waveforms such as 802.11ac standard utilize waveforms that occupy up to 80 MHz in bandwidth and LTE-Advanced utilizes bandwidths of up to 20 - 40 MHz. The R5750 provides up to 100 MHz of instantaneous bandwidth in its direct conversion mode.

3 DEEP DYNAMIC RANGE

RF measurements for characterizing IP3 generally require a dynamic range of around 100 dB. The R5750 supports multiple ADCs thereby providing wide IBW with 70 dB dynamic range and a narrow IBW with 100 dB dynamic range.

4 REAL-TIME ACQUISITION MEMORY AND TRIGGER CAPABILITY

Modern waveforms such as those associated with the wireless LAN standards utilize packet-based signaling techniques. The R5750 enables 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 64 million samples.

5 GLOBAL NAVIGATION SATELLITE SYSTEM (GNSS)

The integrated GNSS capability allows location coordination activities with a number of different satellite constellations, including GPS/QZSS, GLONASS, and BeiDou. Location, position and time are sent through VRT packets along with time-stamping, frequency reference and data output for captures.

6 SMALL SIZE, WEIGHT, AND POWER

The R5750 has a length and width less than a sheet of paper, weighs less than 3 kg and consumes less than 25 W of power making it a fraction of the size, weight and power of traditional lab-grade spectrum analyzers.

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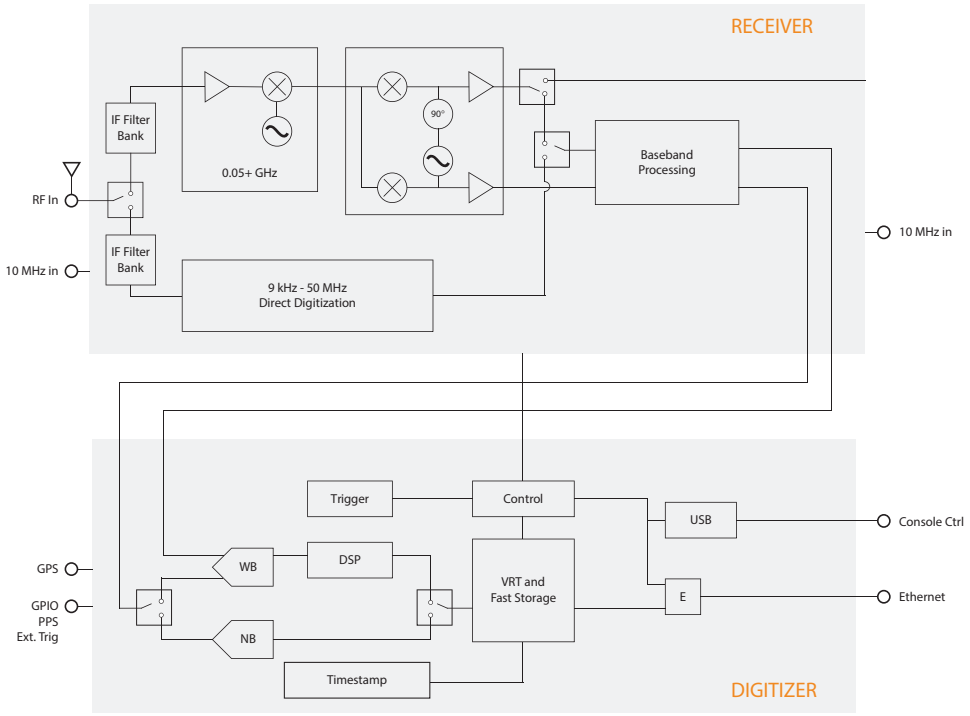
ARCHITECTURE

R5750 Real-Time Spectrum Analyzer (RTSA)

The Receiver Front End

The R5750 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 Zero-IF, 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 continuously processed in. The R5750 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 R5750 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.

* thinkRF expects this performance by design in 90% of the units produced. Variability is possible from unit to unit.

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ARCHITECTURE

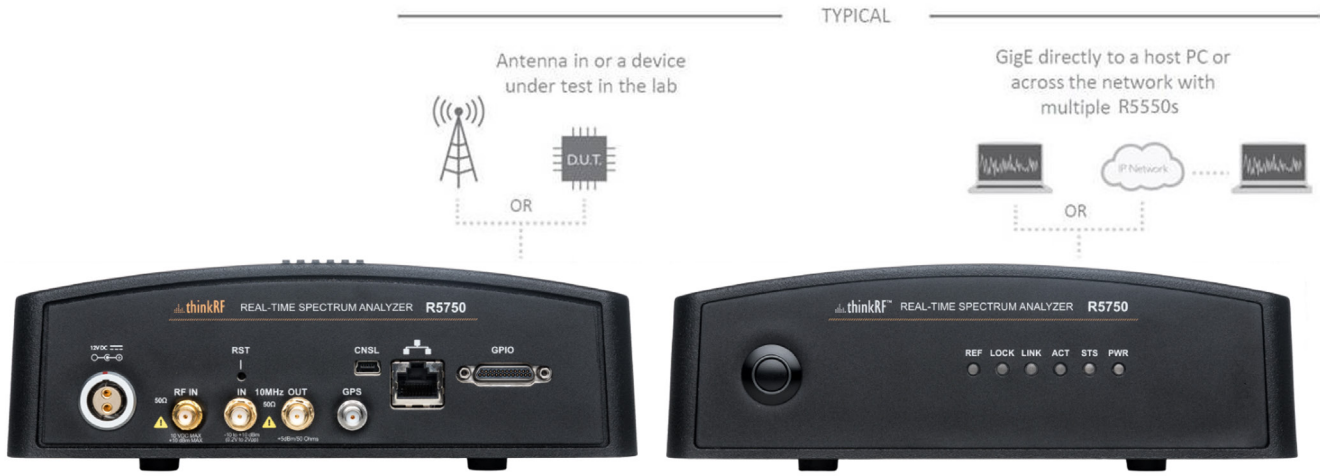
R5750 Real-Time Spectrum Analyzer (RTSA)

The R5750 hardware largely consists of:

- a hybrid super-heterodyne, direct-conversion and direct-digitization RF receiver front-end (RFE)
- 10 MHz input and output clock references for multi-unit synchronization
- a GNSS module with embedded 10 MHz reference clock source for long term stability and to compensate for the ageing effect
- a 125 MSamples/sec 14-bit wideband (WB) ADC with a dynamic range of greater than 70 dB
- a 325 kSamples/sec 24-bit narrowband (NB) ADC with a dynamic range in excess of 100 dB
- an FPGA with built-in dual-core ARM®-based processor and embedded digital signal processing (DSP) logic
- 128 MB of internal DDR3 for data storage
- GPIO port for external triggers and sweep synchronization
- 10/100/1G Ethernet port for control and network interface
- +12 V DC power input allowing automobile sources and personal mobility with an external battery

Extensible Hardware Interfaces

If you're looking for a powerful, cost-effective spectrum analyzer hardware to pair with your software, the R5750 Real-Time Spectrum Analyzer is a universal and versatile platform designed for use across wireless industries and applications.



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APPLICATIONS

R5750 Real-Time Spectrum Analyzer (RTSA)

S1000 Spectraware Real-Time Spectrum Analysis Application Software

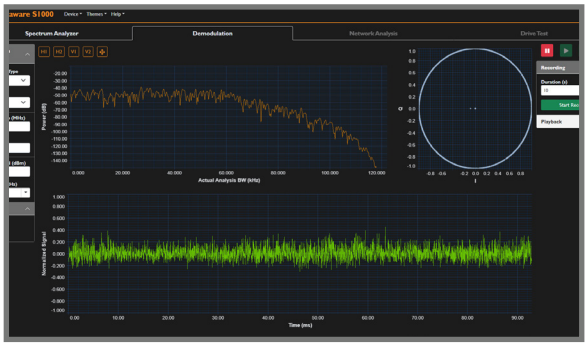
The thinkRF™ S1000 Spectraware software harnesses the power of the thinkRF Real-Time Spectrum Analyzers to provide all the visualization capabilities you'd expect, while still being cost-effective and easy to use. The intuitive graphical user interface (GUI) has been designed with the end-user in mind, focusing on center, span, start and stop coupled mode rather than on RFE mode as its primary control model, simplifying the user experience and keeping the view of the spectrum front and center.

AUTOMATIC MEASUREMENTS

The S1000 supports two standard measurements that are critically important for users analyzing modern devices and signals such as Wi-Fi, Bluetooth, and cellular standards such as 3G/4G/5G/LTE.

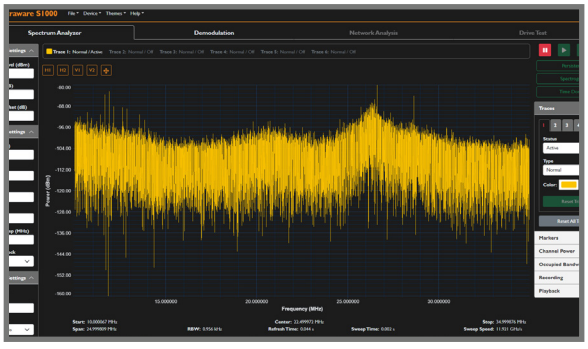
The Channel Power measurement determines the power contained within a channel bandwidth. The Occupied Bandwidth measurement determines the bandwidth which contains a percentage of the total integrated power of the signal, centered on the assigned channel frequency.

DEMODULATION FOR DEEPER SIGNAL ANALYSIS



Conduct both spectrum and signal analysis and extract the original information-bearing signal from the carrier wave with demodulation capabilities. Gapless streaming allows seamless playback of demodulated audio which can be amplified from 0% - 300%. View Constellation, Frequency Domain, and Time Domain graphs in the clean, professional interface and record and play back streams with full demodulation and graphing support.

PERFORMANCE YOU NEED



All functions have been made easily accessible in an intuitive soft menu on the right-hand side of the display. Commonly used settings including Amplitude, Frequency and Bandwidth, are presented on the left and are always available to the user.

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APIS - PROGRAMMING ENVIRONMENTS

R5750 Real-Time Spectrum Analyzer (RTSA)

By supporting a rich set of industry-leading standard protocols, the R5750 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 R5750 into your existing or new NI LabVIEW® based acquisition, measurement, automated test and validation systems.

MATLAB®

thinkRF provides MATLAB® APIs for connecting to thinkRF's R5750 Real-Time Spectrum Analyzers and MATLAB® program code examples to get you started towards developing your own.

C/C++ APIs and DLL

Underneath our rich set of APIs and programming environments is the C/C++ API and DLL which abstracts the SCPI command and VITA VRT dataflow from the R5750.

STANDARD PROTOCOLS

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

SCPI and VITA VRT

The R5750 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.

HiSLIP

The R5750 supports HiSLIP, which is an industry standard TCP/IP-based protocol for remote instrument control of LAN-based test and measurement instruments.

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RF and Digitization Specifications

Frequency

Frequency Ranges	9 kHz to 8 / 27 GHz	
Frequency Reference	±1.0 ppm ±1.0 ppm 0°C to 55°C ±1.0 ppm per year	Accuracy at room temperature Stability over temperature Aging
Real-Time Bandwidth (RTBW)	0.1 / 10 / 40 / 100 MHz	
Spurious Free Dynamic Range (SFDR)	60 dBc (typical*) 70 dBc (typical*) 100 dBc (typical*)	
Image Rejection	60dB (typical*)	

10 MHz Disciplined Oscillator

Frequency Accuracy (Lock to GNSS)	± 0.005 ppm	
Frequency Accuracy (Holdover, 24 hrs)	± 0.100 ppm	

Amplitude

Amplitude Accuracy (25 °C ± 5 °C)	± 2.00 dB typical*	50 MHz to 27 GHz
Attenuator Range	0 to 30 dB in 10 dB steps	
Maximum Safe RF Input Level	+10 dBm, Max DC: 10 V	

Displayed Average Noise Level (DANL | at 25 °C ± 5 °C, typical*)

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

* thinkRF expects this performance by design in 90% of the units produced. Variability is possible from unit to unit.

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RF and Digitization Specifications

Displayed Average Noise Level (DANL | at 25 °C ± 5 °C, typical*)

Frequency (GHz)	8 GHz (typical*)	27 GHz (typical*)
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

Spectral Purity

SSB Phase Noise	Offset	
25°C ± 5°C	100 Hz	-90 dBc/Hz
At 1GHz, measured with	1 kHz	-92 dBc/Hz
external oscillator not	10 kHz	-99 dBc/Hz
present	100 kHz	-109 dBc/Hz
	1 MHz	-118 dBc/Hz

Digitization

Data Sampling Rate and Resolution	125 MS/s,14 bit 300 kS/s, 24 bit	10 / 40 / 100 MHz RTBW 0.1 MHz RTBW
Sweep Rate	Up to 37 GHz/s @ 10 kHz RBW	40 MHz IBW
Stream Rate	Up to 555 Mbit/s	

Global Navigation Satellite System (GNSS)

Global Positioning System (Concurrent reception of up to 2 GNSS)

GNSS Types supported	GPS, GLONASS, BeiDou				
GNSS Antenna Power	3.3 V, 50 mA				
Time to first fix, maximum	From 2 sec (hot) to 36 sec (cold start), -130 dBm input signal power				
Horizontal positional accuracy (CEP, 50%, 24 hours Static, -130 dBm, >6 SVs)	GPS & GLONASS	GPS & BeiDou	GPS	GLONASS	BeiDou
	2.5 m	2.5 m	2.5 m	4.0 m	3.0 m
Data Timestamp Resolution	8 ns				

* thinkRF expects this performance by design in 90% of the units produced. Variability is possible from unit to unit.

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Spectral Purity on GPS Disciplined Oscillator

Freq=10.000000MHz Jitter=0.6ps (Typ, 10Hz-1MHz)

Offset	Phase Noise
10 Hz	-101 dBc/Hz
100 Hz	-125 dBc/Hz
1 kHz	-144 dBc/Hz
10 kHz	-155 dBc/Hz
100 kHz	-156 dBc/Hz

General Specifications

Connectors		
RF In	SMA female, 50 Ω	
10 MHz Reference In and Out	SMA female, 50 Ω	
10/100/1000 Ethernet	RJ45	
USB Console	Type B mini	
GPIO	25-pin male D-Subminiature	
GNSS Antenna Port	SMA female, 50 Ω (Active 3.3VDC)	
Power	LEMO Connector, female	
Status Indicators		
PLL Lock / 10 MHz reference clock status Ethernet Link and Activity Status CPU and Power Status	Refer to the R5750 User Manual	
Power		
Physical Power Supply	Use AC Wall Power Adaptor provided	Input AC 120V-240V / Output +12V
Power Consumption	25W with Power Adaptor provided (427)	At room temperature
Can also be used with the thinkRF P120 - Vehicular Power Conditioner		
Physical		
Operating Temperature Range	0°C to +50°C	
Storage Temperature Range	-40°C to +85°C	
Warm up time	30 minutes	
Dimensions	257.3 x 193.7 x 66 mm (10.13” x 7.63” x 2.61”) 257.3 x 193.7 x 60 mm (10.13” x 7.63” x 2.36”)	With mounting feet Without mounting feet
Weight	2.54 kg (5.6 lbs) 2.72 kg (6 lbs)	408 427
Security	Kensington Security Slot	Located on back end-plate

General Specifications

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 3	
Shock & Vibration	MIL-STD-PRF-28800 Class 2 MIL-STD-PRF-28800 Class 3	
S1000 Real-Time Spectrum Analysis Software		
Resolution Bandwidth (RBW) Range Windowing	1 Hz to 488.28 kHz Hanning	
Traces	6	Clear/Write, Trace Average, Max Hold, Min Hold
Markers Modes Marker Frequency Resolution	12 Normal (Tracking), Delta, Fixed 0.01 Hz	 Peak Search, Next Peak, Next Left/Right, Center
GNSS Tracking Display (R5750 only)	Real time GPS data, updates every second	
Save/Load Data Configurations	Power Spectral Data with Time Stamp, Context Save/Load Settings	CSV format, optional saving duration Save settings for easy recall
Export Data	CSV	Comma Separated Values
Demodulation Audio Signal Displays	FM 0%-300% IQ Constellation Frequency Domain Time Domain	With Record/Playback Host PC sound card
APIs and Protocols		
Python™	PyRF RTSA	
LabVIEW	LabVIEW Base Development System for Windows (version 2014 and up)	
MATLAB®	MATLAB® Release 2014b - 2019b	
C/C++	ISO/IEC 14882:2011	
SCPI	IEEE 488.2 - Standard Commands for Programmable Instruments	
VRT	VITA-49 Radio Transport	
HiSLIP	IVI TCP/IP-based protocol v1.0	

General Specifications

Recommended PC	
Operating System	Windows 10 (32 or 64)
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	R5750-408	9 kHz to 8 GHz, RTBW up to 100 MHz
27 GHz RTSA	R5750-427	9 kHz to 27 GHz, RTBW up to 100 MHz

R5750 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	S1000	Real-Time Spectrum Analysis Software
	APIs	
Rack Shelf	R5750-RACK-SHELF	19" rack shelf supports two horizontally mounted R5750s

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CONTACT US TODAY
FOR A FREE DEMO!

thinkRF™ R5750

Real-Time Spectrum Analyzer

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74-0056-250213

Intellectual Property - Patents
The thinkRF R5750 product line is protected by patents, (US8,675,781, US9,197,260, US9,350,404, US8,886,794) in the United States. This information is provided to satisfy the patent marking provisions including, but not limited to, the patent marking provisions of the America Invents Act (AIA) and is intended to serve as notice under 35 U.S.C. § 287(a), as amended by Section 16 of the AIA. Additional patents may be pending in the United States and/or elsewhere.