thinkRF™ R5550
Real-Time Spectrum Analyzer

9 kHz to 8 GHz / 18 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

R5550
Real-Time Spectrum Analyzer

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

1

9 kHz to 8, 18 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 (5.6 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. Built on innovative software-defined radio technologies, the thinkRF R5550 Real-Time Spectrum Analyzer has the performance of a traditional lab-grade spectrum analyzer 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.

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PERFORMANCE

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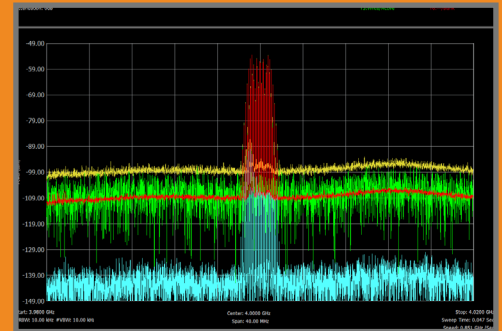
2 WIDE INSTANTANEOUS BANDWIDTH

Modern waveforms such as 802.11ac standard utilize waveforms that occupy up to 80 MHz in bandwidth and LTE-Advanced aims to utilize bandwidths of up to 100 MHz. The R5550 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 R5550 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 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 64 million samples.

5 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.

6 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.

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ARCHITECTURE

R5550 Real-Time Spectrum Analyzer (RTSA)

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 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.
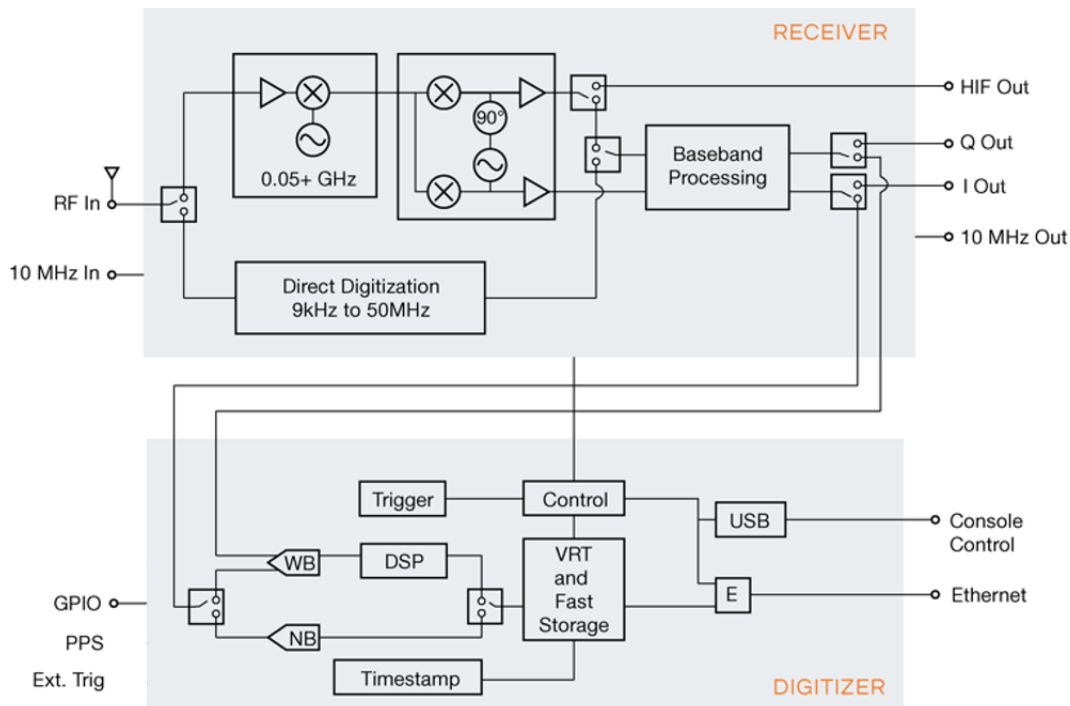
The Digitizer

The digitized signal is continuously processed in. The 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.

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ARCHITECTURE

R5550 Real-Time Spectrum Analyzer (RTSA)

The R5550 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
- Analog I/Q and HIF outputs enable OEM high speed digitizers
- 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
- GPIO 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
- External support for 80 MHz and 160 MHz RTBW (Optional - WBIQ Option)

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.

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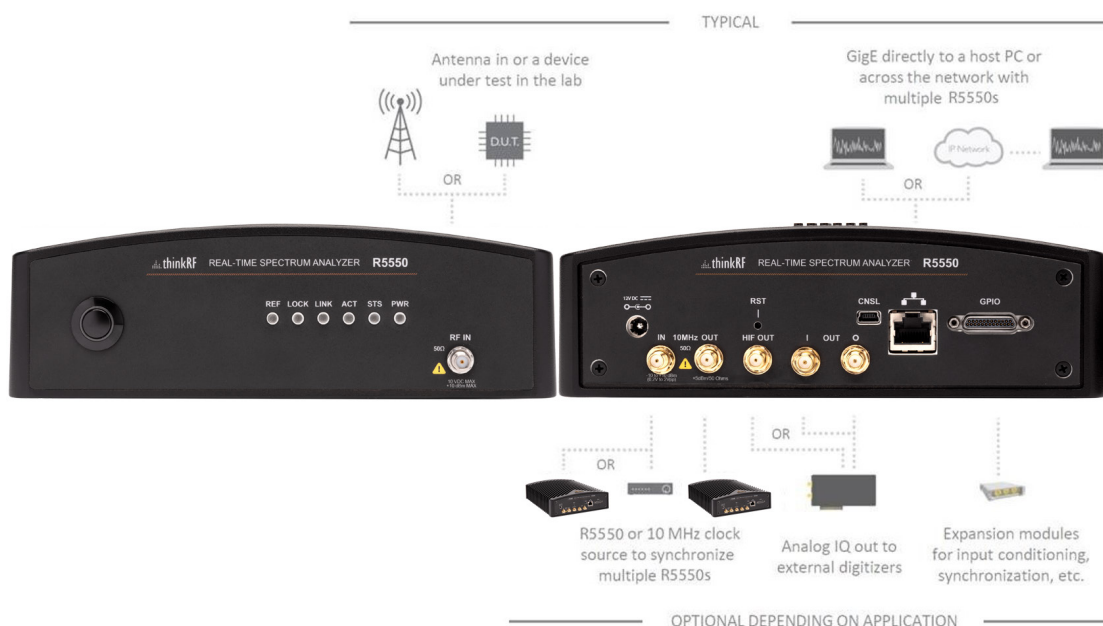
APPLICATIONS

R5550 Real-Time Spectrum Analyzer (RTSA)

S240 Real-Time Spectrum Analysis Application Software

By utilizing the power of the R5550, the S240 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 S240 is designed to run on Windows PC. Simply install the software and connect your device through an Ethernet, network switch or direct connection and you're ready to get started.

With the S240's simple and intuitive user interface you'll be using your new device in no time.
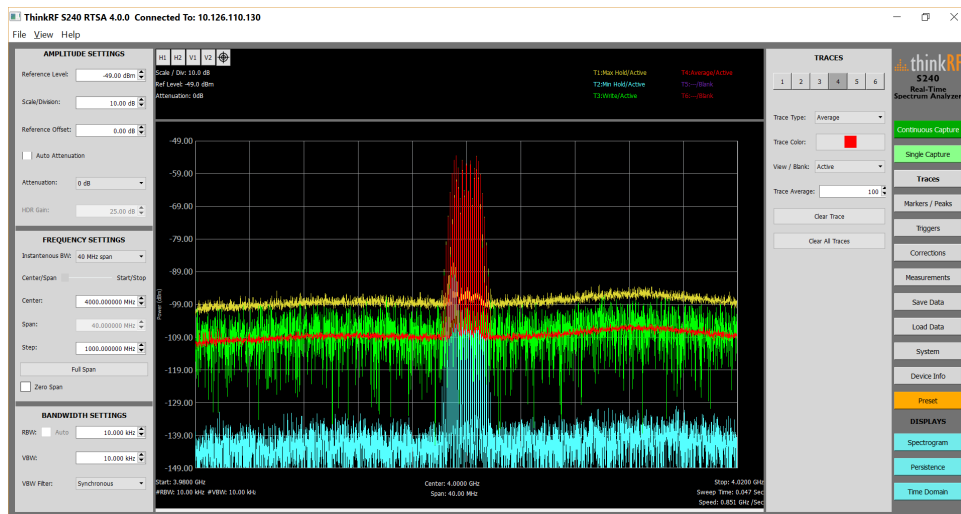
Keysight 89600 VSA®

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.

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APIS - PROGRAMMING ENVIRONMENTS

R5550 Real-Time Spectrum Analyzer (RTSA)

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® APIs 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++ 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 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.

HiSLIP

The R5550, with firmware 1.6.1 or higher, 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 / 18 / 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)	100 MHz RTBW 10 / 40 MHz RTBW 0.1 MHz RTBW

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	
See the graph below for R5550-408 Maximum Safe RF Input Level	+10 dBm, Max DC: 10 V	For 30 dB attenuation

Maximum safe RF input level for R5550-408 for different input attenuation settings and frequencies.

Legend:
- 30 dB Attenuation
- 20 dB Attenuation
- 10 dB Attenuation
- 0 dB Attenuation

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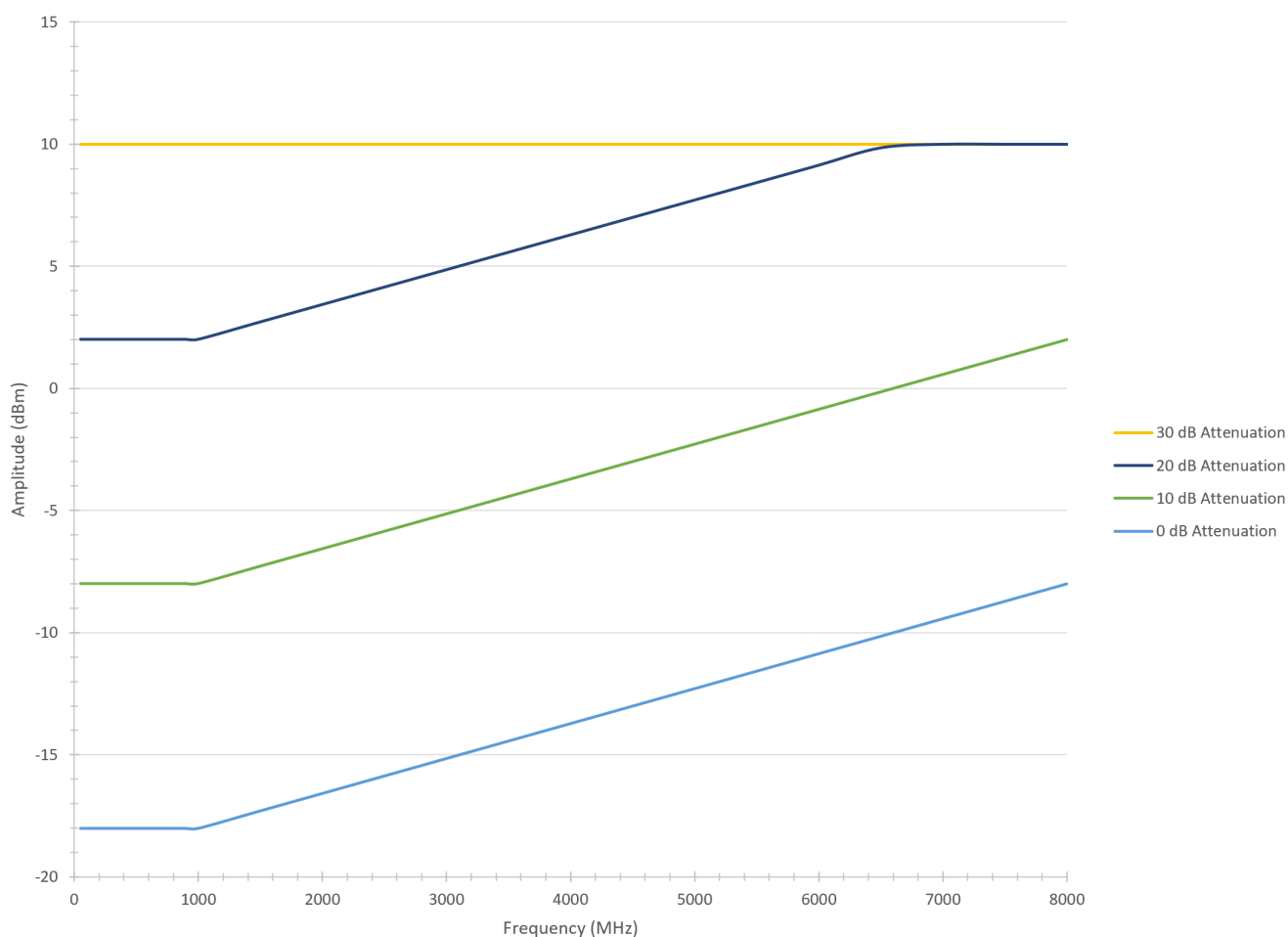
RF and Digitization Specifications

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	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

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RF and Digitization Specifications

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 28 GHz/s @ 10 kHz RBW	40 MHz IBW
Stream Rate	Up to 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 Ethernet Link and Activity Status CPU and Power Status	Refer to the R5550 User Manual

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) 17W with Power Adaptor provided (408)	At room temperature

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

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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 2	
Shock & Vibration	MIL-STD-PRF-28800 Class 2 MIL-STD-PRF-28800 Class 3	

S240 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

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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	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

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	S240	Real-Time Spectrum Analysis Software
	APIs	
Rack Shelf	R5550-RACK-SHELF	19" rack shelf supports two horizontally mounted R5550s or WSA5000s
Vehicular Power Conditioner	P120-012	

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