



# RSA5000 Series

## Real-time Spectrum Analyzer

- Ultra-Real technology
- Frequency: up to 6.5 GHz
- Displayed average noise level (DANL):  $< -165$  dBm (typical)
- Phase noise:  $< -108$  dBc/Hz (typical)
- Level measurement uncertainty:  $< 0.8$  dB
- 6.5 GHz tracking generator
- Min. RBW 1 Hz
- EMC filter and quasi-peak detector
- Various measurement functions
- Multiple measurement modes
- Up to 40 MHz real-time analysis bandwidth
- Multiple trigger modes and trigger masks
- Density, Spectrogram, and other display modes
- PC software options
- 10.1" capacitive multi-touch screen, supporting touch gestures
- USB, LAN, HDMI and other communication and display interfaces

# RSA5000 Series Real-time Spectrum Analyzer



Product Dimensions: Width × Height × Depth = 410 mm × 224 mm × 135 mm

## UltraReal

Based on the Ultra-Real technology, the high-speed real-time measurement mode allows you to acquire the signals in the analysis bandwidth seamlessly and make data analysis. It also provides various display modes, such as Spectrogram, Density, and PVT. Besides, FMT function is also available.

The Ultra-Real technology has the following features:

- **Seamless analysis**
  - Seamless I/Q data acquisition in the analysis bandwidth
  - Seamless spectrum analysis
- **FMT**
  - Frequency mask trigger (FMT) to trigger the measurement by sporadic or transient events in the spectrum
- **Composite displays**
  - Spectrogram for gap-free display of the spectrum
  - Density for you to visualize how frequently signals occur

## ► Specifications

Specifications are valid under the following conditions: the instrument is within the calibration period, is stored for at least two hours at 0°C to 50°C temperature, and is warmed up for 40 minutes. Unless otherwise noted, the specifications in this manual include the measurement uncertainty.

**Typical:** characteristic performance, which 80 percent of the measurement results will meet at room temperature (approximately 25°C). This data is not warranted and does not include the measurement uncertainty.

**Nominal:** the expected mean or average performance or a designed attribute (such as the 50 Ω connector). This data is not warranted and is measured at room temperature (approximately 25°C).

**Measured:** an attribute measured during the design phase which can be compared to the expected performance, such as the amplitude drift variation with time. This data is not warranted and is measured at room temperature (approximately 25°C).

**NOTE:** All charts in this manual are the measurement results of multiple instruments at room temperature unless otherwise noted. The specifications (except the tracking generator specifications) listed in this manual are those when the tracking generator is off.

## Measurement Mode

Measurement Mode
General-Purpose Spectrum Analyzer (GPSA)
Real-time Spectrum Analyzer (RTSA)

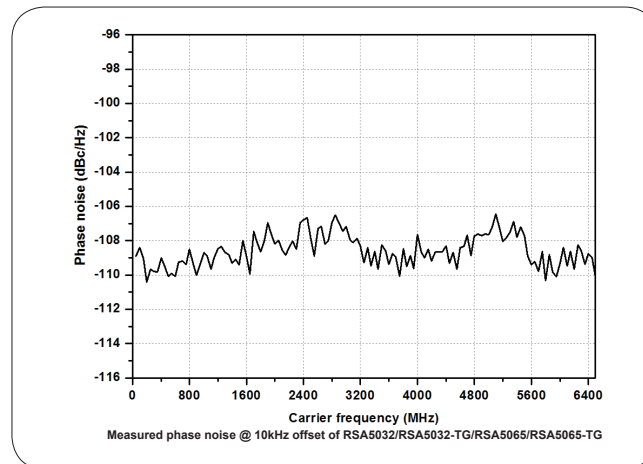
## All Measurement Modes

Frequency		
	RSA5032	RSA5032-TG
		RSA5065
		RSA5065-TG
Frequency Range	9 kHz to 3.2 GHz	
		9 kHz to 6.5 GHz
Internal Reference Frequency		
Reference Frequency	10 MHz	
Accuracy	±[(time since last calibration × aging rate) + temperature stability + calibration accuracy]	
Initial Calibration Accuracy	Standard	<1 ppm
	Option OCXO-C08	<0.1 ppm
Temperature Stability	0°C to 50°C , with the reference 25°C	
	Standard	<0.5 ppm
	Option OCXO-C08	<0.005 ppm
Aging Rate	Standard	<1 ppm/year
	Option OCXO-C08	<0.03 ppm/year

## GPSA Mode

### Frequency

Frequency Readout Accuracy		
Marker Frequency Resolution	span/(number of sweep points - 1)	
Marker Frequency Uncertainty	$\pm(\text{marker frequency readout} \times \text{reference frequency accuracy} + 1\% \times \text{span} + 10\% \times \text{resolution bandwidth} + \text{marker frequency resolution})$	
Frequency Counter		
Resolution	1 Hz	
Uncertainty	$\pm(\text{marker frequency readout} \times \text{reference frequency accuracy} + \text{counter resolution})$	
Frequency Span		
Range	0 Hz, 10 Hz to maximum frequency	
Resolution	2 Hz	
Uncertainty	$\pm\text{span}/(\text{number of sweep points} - 1)$	
SSB Phase Noise		
20°C to 30°C, $f_c = 500$ MHz		
Carrier Offset	1 kHz	<-95 dBc/Hz (typical)
	10 kHz	<-106 dBc/Hz, <-108 dBc/Hz (typical)
	100 kHz	<-106 dBc/Hz, <-108 dBc/Hz (typical)
	1 MHz	<-115 dBc/Hz, <-117 dBc/Hz (typical)

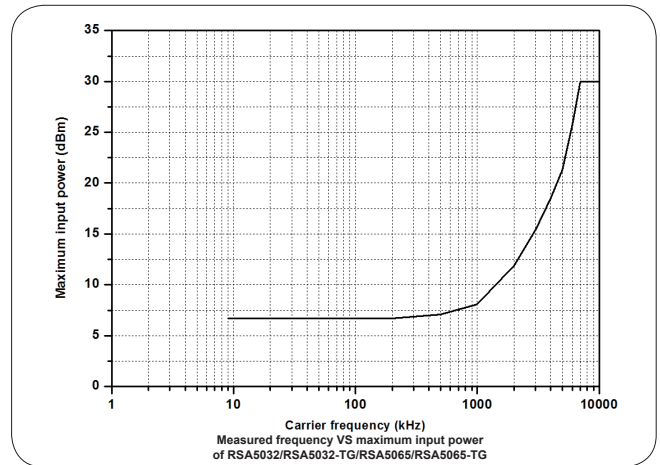
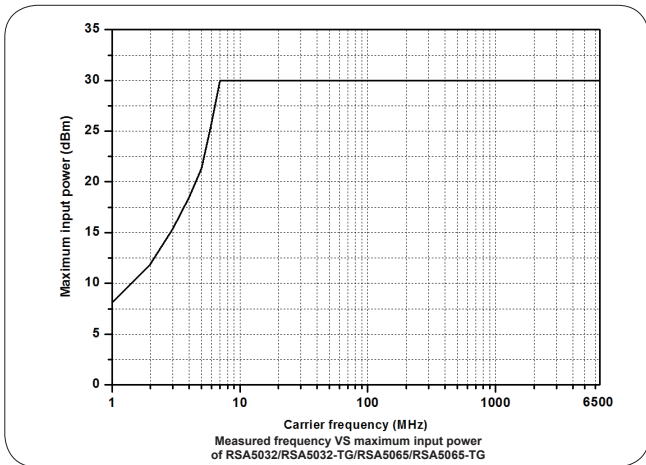


Residual FM		
20°C to 30°C, RBW = VBW = 1 kHz		
Residual FM	<10 Hz (nominal)	
Bandwidth		
Set "Sweep Time Rule" to "Accy"		
Resolution Bandwidth (-3 dB) <sup>[1]</sup>	1 Hz to 10 MHz, in 1-3-10 sequence	
RBW Accuracy	<5% (nominal)	
Resolution Filter Shape Factor (60 dB: 3 dB)	<5 (nominal)	
Video Bandwidth (-3 dB)	1 Hz to 10 MHz, in 1-3-10 sequence	
Resolution Bandwidth (-6 dB)	200 Hz, 9 kHz, 120 kHz, 1 MHz	

Note: [1] When the tracking generator is enabled or in zero span mode, the available range of RBW is from 1 kHz to 10 MHz.

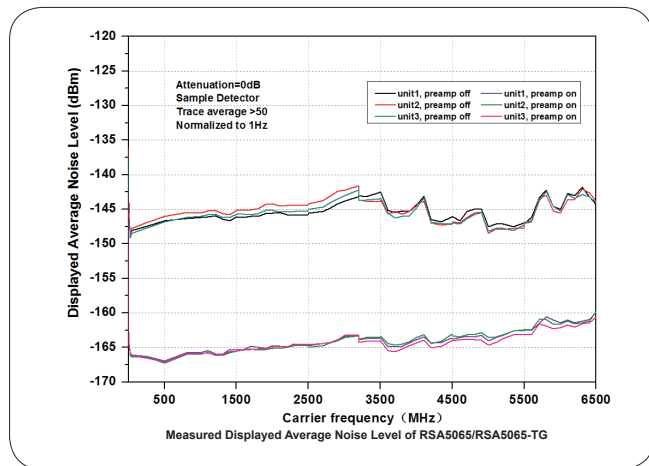
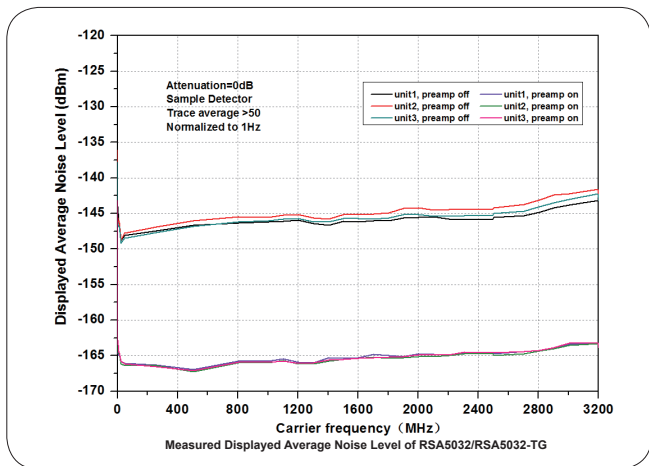
## Amplitude

Measurement Range	
Range	$f_c \geq 10$ MHz DANL to +30 dBm
Maximum Safe Input Level <sup>[1]</sup>	
DC Voltage	50 V
CW RF Power	+30 dBm, attenuation $\geq 40$ dB, preamp off. -10 dBm, attenuation = 20 dB, preamp on.
Maximum Damage Level	
CW RF Power	+33 dBm (2 W)

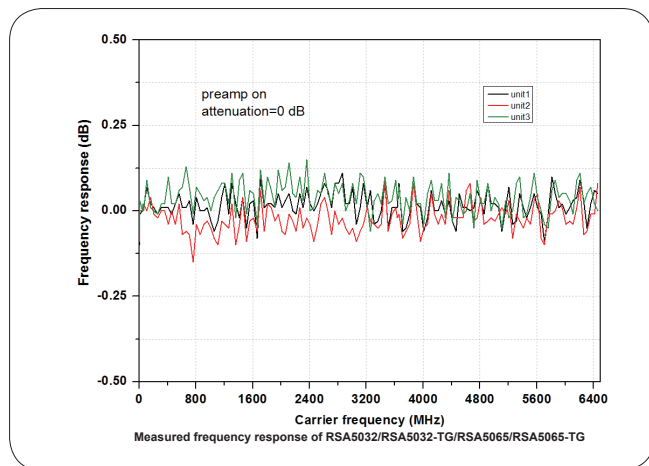
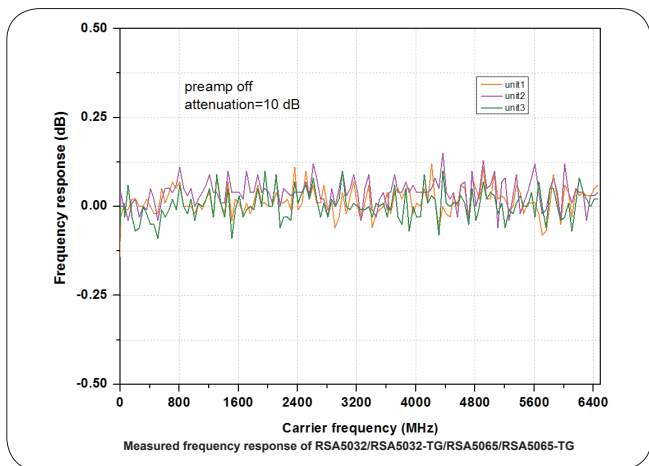


Displayed Average Noise Level (DANL)		RSA5032	RSA5032-TG	RSA5065	RSA5065-TG
		attenuation = 0 dB, sample detector, trace averages $\geq 50$ , tracking generator off, normalized to 1 Hz, 20°C to 30°C, input impedance = 50 $\Omega$ .			
Preamp off	9 kHz to 100 kHz		<-120 dBm (typical)	<-120 dBm (typical)	
	100 kHz to 20 MHz		<-135 dBm, <-140 dBm (typical)	<-135 dBm, <-140 dBm (typical)	
	20 MHz to 1.5 GHz		<-142 dBm, <-145 dBm (typical)	<-142 dBm, <-145 dBm (typical)	
	1.5 GHz to 2.7 GHz		<-140 dBm, <-143 dBm (typical)	<-140 dBm, <-143 dBm (typical)	
	2.7 GHz to 3.2 GHz		<-138 dBm, <-141 dBm (typical)	<-138 dBm, <-141 dBm (typical)	
	3.2 GHz to 5.5 GHz			<-138 dBm, <-143 dBm (typical)	
	5.5 GHz to 6.5 GHz			<-136 dBm, <-141 dBm (typical)	
Preamp on	100 kHz to 20 MHz		<-152 dBm, <-160 dBm (typical)	<-152 dBm, <-160 dBm (typical)	
	20 MHz to 1.5 GHz		<-162 dBm, <-165 dBm (typical)	<-162 dBm, <-165 dBm (typical)	
	1.5 GHz to 2.7 GHz		<-160 dBm, <-163 dBm (typical)	<-160 dBm, <-163 dBm (typical)	
	2.7 GHz to 3.2 GHz		<-158 dBm, <-161 dBm (typical)	<-158 dBm, <-161 dBm (typical)	
	3.2 GHz to 5.5 GHz			<-156 dBm, <-161 dBm (typical)	
	5.5 GHz to 6.5 GHz			<-154 dBm, <-159 dBm (typical)	

Note: [1] When  $f_c < 10$  MHz, the maximum safe input level is decreased.

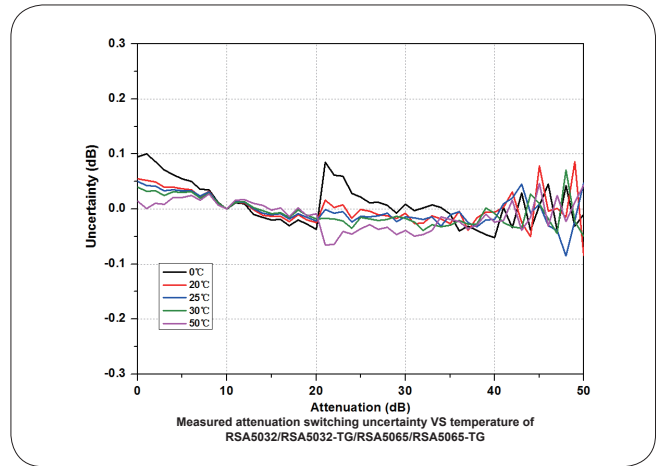
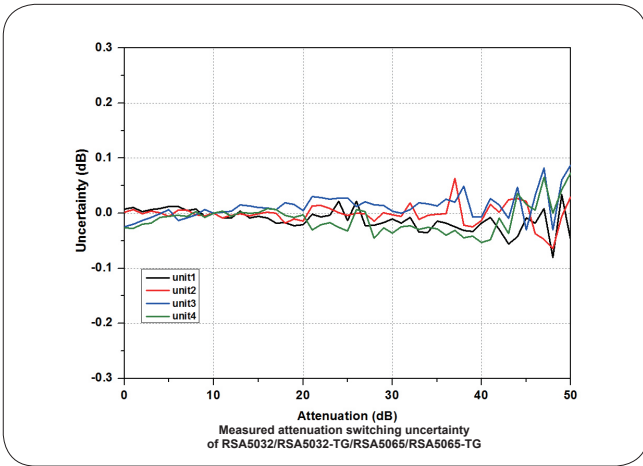


Level Display			
Logarithmic Scale	1 dB to 200 dB		
Linear Scale	0 to reference level		
Number of Display Points	801		
Number of Traces	6		
Trace Detector	normal, pos-peak, neg-peak, sample, RMS average, voltage average, and quasi-peak		
Trace Function	clear write, max hold, min hold, average, view, blank		
Scale Unit	dBm, dBmV, dBμV, nV, μV, mV, V, nW, μW, mW, W		
Frequency Response			
	RSA5032      RSA5032-TG      RSA5065      RSA5065-TG		
	attenuation = 10 dB, relative to 50 MHz, 20°C to 30°C		
Preamp off	100 kHz to 3.2 GHz	<0.5 dB, <0.3 dB (typical)	<0.5 dB, <0.3 dB (typical)
	3.2 GHz to 6.5 GHz		<0.7 dB, <0.5 dB (typical)
		attenuation = 0 dB, relative to 50 MHz, 20°C to 30°C	
Preamp on	100 kHz to 3.2 GHz	<0.7 dB, <0.3 dB (typical)	<0.7 dB, <0.3 dB (typical)
	3.2 GHz to 6.5 GHz		<0.9 dB, <0.5 dB (typical)



### Input Attenuation Switching Uncertainty

Setting Range	0 dB to 50 dB, in 1 dB step
Switching Uncertainty	$f_c = 50$ MHz, relative to 10 dB, preamp off, 20°C to 30°C <0.3 dB



### Absolute Amplitude Accuracy

Uncertainty	$f_c = 50$ MHz, peak detector, preamp off, attenuation = 10 dB, input signal level = -10 dBm, 20°C to 30°C <0.3 dB
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### Reference Level

Range	Logarithmic Scale	-170 dBm to +30 dBm, in 0.01 dB step
	Linear Scale	707 pV to 7.07 V, 0.11% (0.01 dB) resolution

### RBW Switching

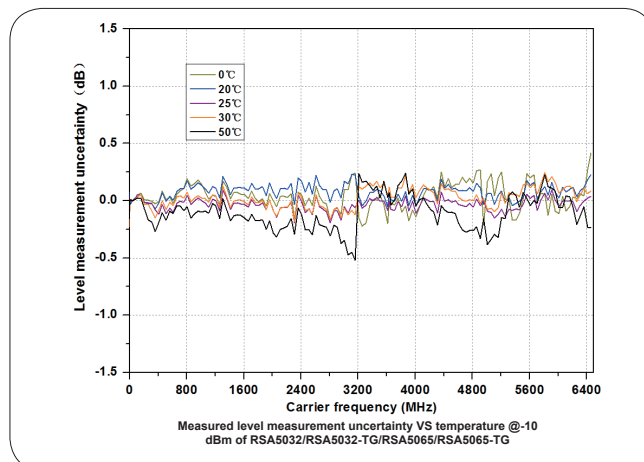
Uncertainty	Set "Sweep Time Rule" to "Accy", relative to 30 kHz RBW	
	1 Hz to 1 MHz	<0.1 dB
	3 MHz, 10 MHz	<0.3 dB

### Preamp (Option RSA5000-PA)

	RSA5032	RSA5032-TG	RSA5065	RSA5065-TG
Frequency Range	100 kHz to 3.2 GHz		100 kHz to 6.5 GHz	
Gain	20 dB (nominal)			

### Level Measurement Uncertainty

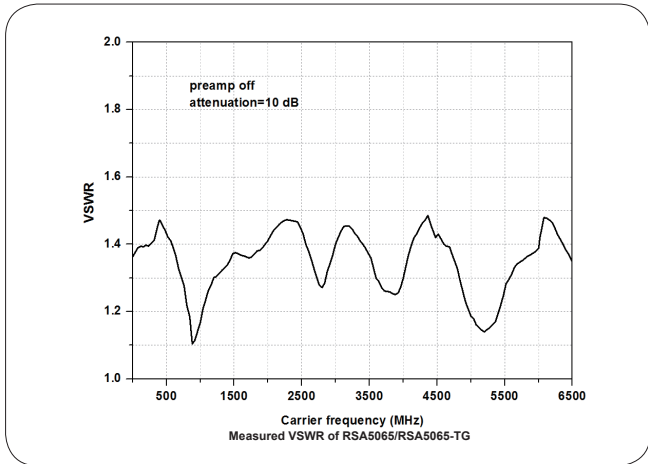
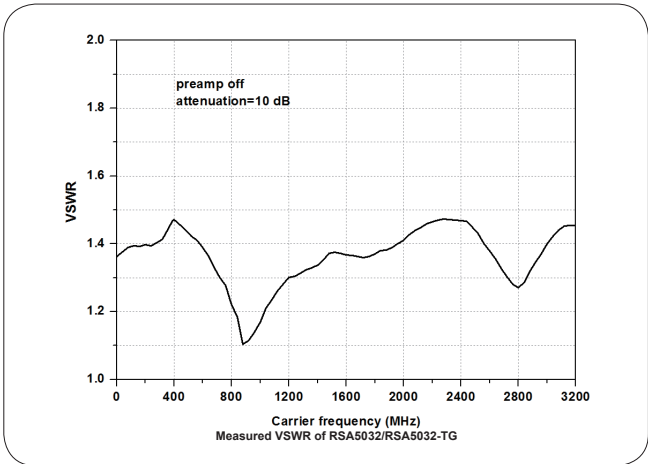
Level Measurement Uncertainty	95% confidence level, S/N > 20 dB, RBW = VBW = 1 kHz, preamp off, attenuation = 10 dB, -50 dBm < input level ≤ 0 dBm, $f_c > 10$ MHz, 20°C to 30°C
Level Measurement Uncertainty	<0.8 dB (nominal)





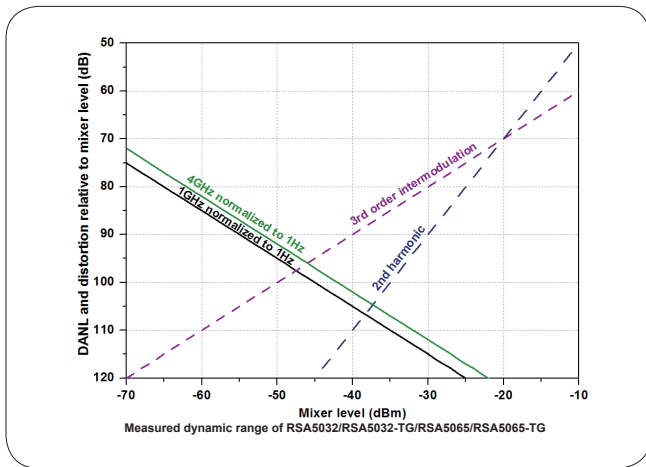
## RF Input VSWR

		RSA5032	RSA5032-TG	RSA5065	RSA5065-TG
		attenuation ≥ 10 dB, preamp off			
VSWR	300 kHz to 3.2 GHz	<1.6 (nominal)		<1.6 (nominal)	
	3.2 GHz to 6.5 GHz			<1.8 (nominal)	



## Distortion

Second Harmonic Intercept (SHI)	$f_c \geq 50$ MHz, input signal level = -20 dBm, attenuation = 0 dB, preamp off. +45 dBm
Third-order Intercept (TOI)	$f_c \geq 50$ MHz, two -20 dBm tones at input mixer spaced by 200 kHz, attenuation = 0 dB, preamp off. +11 dBm, +15 dBm (typical)
1 dB Gain Compression (P1dB) <sup>[1]</sup>	$f_c \geq 50$ MHz, attenuation = 0 dB, preamp off. 0 dBm (nominal)



## Spurious Response

Residual Response	input terminated with a 50 Ω load, attenuation = 0 dB, 20°C to 30°C <-90 dBm, <-100 dBm (typical)
Intermediate Frequency	<-60 dBc
System-related Sideband	referenced to local oscillators, referenced to A/D conversion, referenced to subharmonic of first LO, referenced to harmonic of first LO <-60 dBc
Input-related Spurious	mixer level = -30 dBm <-60 dBc

Note: [1] The frequency interval of the two-tone signals should be greater than 10 MHz.



## Sweep

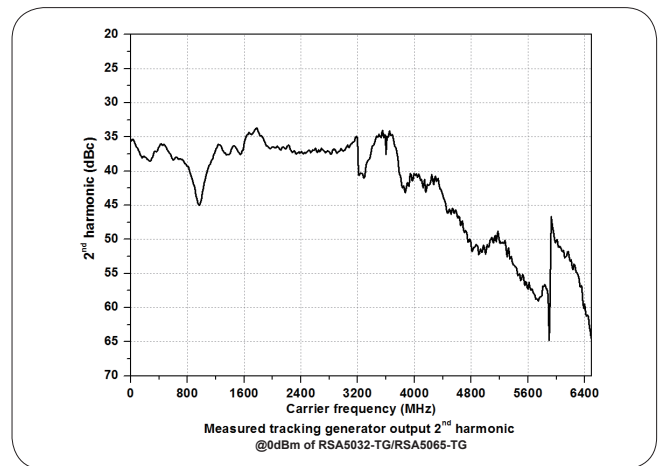
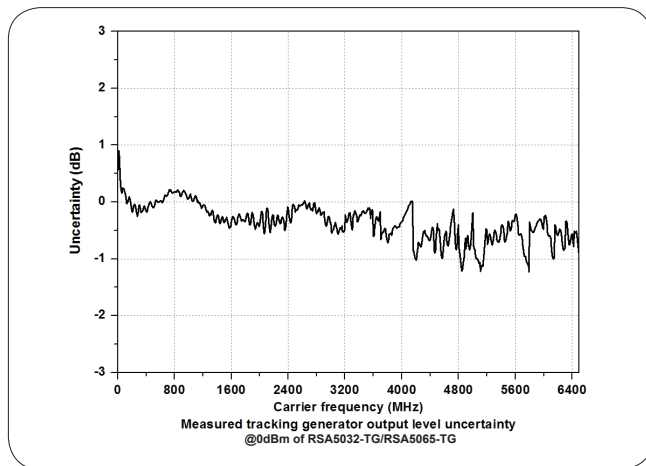
Sweep		
Sweep Time	span $\geq$ 10 Hz	1 ms to 4,000 s
	zero span	1 $\mu$ s to 6,000 s
Sweep Time Uncertainty	span $\geq$ 10 Hz, RBW $\geq$ 1 kHz	5% (nominal)
	zero span (sweep time > 1 ms)	5% (nominal)
Sweep Mode	continue, single	

## Trigger

Trigger		
Trigger Source	free run, external 1, external 2, video	
Trigger Delay	span $\geq$ 10 Hz	0 to 500 ms
	zero span	0 to 500 ms

## Tracking Generator

Tracking Generator Output				
	RSA5032	RSA5032-TG	RSA5065	RSA5065-TG
Frequency Range	-	100 kHz to 3.2 GHz	-	100 kHz to 6.5 GHz
Output Level Range	-	-40 dBm to 0 dBm	-	-40 dBm to 0 dBm
Output Level Resolution	-	1 dB	-	1 dB
Output Flatness	relative to 50 MHz			
	-	$\pm 3$ dB (nominal)	-	$\pm 3$ dB (nominal)



## RTSA Mode

Real-time Analysis Bandwidth	25 MHz					
	40 MHz (Option RSA5000-B40)					
Min. Signal Duration for 100% POI at the Full-Scale Accuracy	maximum span, default Kaiser window					
	7.45 $\mu$ s					
Trace Detector	pos-peak, neg-peak, sample, average					
Number of Traces	6					
Window Type	Hanning, Blackman-Harris, Rectangular, Flattop, Kaiser, and Gaussian					
Resolution Bandwidth	provides 6 RBWs for each window, except the Rectangular; for Kaiser window					
	Span	Min. bandwidth		Max. bandwidth		
	40 MHz	100 kHz		3.21 MHz		
	25 MHz	62.8 kHz		2.01 MHz		
	10 MHz	25.1 kHz		804 kHz		
	1 MHz	2.51 kHz		80.4 kHz		
	100 kHz	251 Hz		8.04 kHz		
Max. Sample Rate	51.2 MSa/s					
FFT Rate	146,484/s (nominal)					
Number of Markers	8					
Amplitude Resolution	0.01 dB					
Frequency Point	801					
Acquisition Time	Max. sample rate					
	>156.5 $\mu$ s					
Min. Signal Duration for 100% POI at Different RBWs						
	Duration Time ( $\mu$ s)					
Span	RBW1	RBW2	RBW3	RBW4	RBW5	RBW6
40 MHz	26.9	16.9	11.9	9.32	8.07	7.45
25 MHz	38.9	22.9	14.9	10.9	8.82	7.82
10 MHz	86.8	46.8	26.8	16.8	11.8	9.30
1 MHz	807	407	207	107	56.3	31.3
Amplitude						
Amplitude Flatness	<0.5 dB <sup>[1]</sup> (nominal)					
SFDR	<-60 dBc (typical)					
<i>UltraReal</i> Density						
Probability Range	0 to 100% (with a step of 0.1%)					
Min. Span	5 kHz					
Persistence Duration	32 ms to 10 s					
<i>UltraReal</i> Spectrogram						
History Depth	8,192					
Dynamic Range Covered by Bitmap Color	200 dB					
<i>UltraReal</i> PVT						
Min. Acquisition Time	187.9 $\mu$ s					
Max. Acquisition Time	40 s					
Trigger						
Trigger Source	free run, external 1, external 2, power, FMT					
<i>UltraReal</i> FMT						
Trigger Diagram	density, spectrogram, normal, PVT					
Trigger Resolution	0.5 dB (nominal)					
Trigger Criteria	enter, leave, inside, outside, enter-leave, leave-enter					

Note:[1] Only applicable to the Normal measurement.

## General Specifications

Display		
Type	capacitive multi-touch screen	
Resolution	1024 × 600 pixels	
Size	10.1"	
Color	24-bit color	
Printer Supported		
Protocol	network printer	
Mass Memory		
Mass Memory	Internal Storage	512 MB (nominal)
	External Storage	USB storage device (not supplied)
Power		
Input Voltage Range, AC	100 V to 240 V (nominal)	
AC Frequency	45 Hz to 440 Hz	
Power Consumption	55 W (typical), max. 90 W with all options	
Environment		
Temperature	Operating Temperature Range	0°C to 50°C
	Storage Temperature Range	-20°C to 70°C
Humidity	0°C to 30°C	≤95% RH
	30°C to 40°C	≤75% RH
Altitude	Operating Height	below 3,048 m (10,000 feet)
Electromagnetic Compatibility and Safety		
EMC	complies with EMC Directive 2014/30/EU, complies with or above the standard specified in IEC61326-1:2013/EN61326-1:2013 Group 1 Class A	
	CISPR 11/EN 55011	
	IEC 61000-4-2:2008/EN 61000-4-2	±4.0 kV (contact discharge), ±8.0 kV (air discharge)
	IEC 61000-4-3:2002/EN 61000-4-3	3V/m (80 MHz to 1 GHz); 3V/m (1.4 GHz to 2 GHz); 1V/m (2.0 GHz to 2.7 GHz)
	IEC 61000-4-4:2004/EN 61000-4-4	1 kV power
	IEC 61000-4-5:2001/EN 61000-4-5	0.5 kV (phase-to-neutral voltage); 1 kV (phase-to-earth voltage); 1 kV (neutral-to-earth voltage)
	IEC 61000-4-6:2003/EN 61000-4-6	3 V, 0.15 to 80 MHz
	IEC 61000-4-11:2004/EN 61000-4-11	voltage dip: 0% UT during half cycle; 0% UT during 1 cycle; 70% UT during 25 cycles short interruption: 0% UT during 250 cycles
Safety	complies with IEC 61010-1:2010 (Third Edition)/EN 61010-1:2010, UL 61010-1:2012 R4.16 and CAN/CSA-C22.2 No. 61010-1-12+ G11+ G12	
Environmental Stress	Samples of this product have been type tested in accordance with RIGOL's reliability test regulations and verified to be robust against the environmental stresses of storage, transportation, and end-use; those stresses include, but are not limited to, temperature, humidity, shock, and vibration. The test methods are compliant with standards specified in GB/T6587 Class 2 and MILPRF-28800F Class 3.	
Size		
(W x H x D)	410 mm × 224 mm × 135 mm (16.14" × 8.82" × 5.32")	
Weight		
Without Tracking Generator	4.65 kg (10.25 lb)	
With Tracking Generator	4.95 kg (10.91 lb)	
Calibration Interval		
Recommended Calibration Interval	18 months	

## Input/Output

Front Panel Connector			
RF Input	Impedance	50 $\Omega$ (nominal)	
	Connector	N-type female	
TG Output	Impedance	50 $\Omega$ (nominal)	
	Connector	N-type female	
Internal/External Reference			
Internal Reference	Frequency	10 MHz	
	Output Level	+3 dBm to +10 dBm, +7 dBm (typical)	
	Impedance	50 $\Omega$ (nominal)	
	Connector	BNC female	
External Reference	Frequency	10 MHz $\pm$ 5 ppm	
	Input Level	0 dBm to +10 dBm	
	Impedance	50 $\Omega$ (nominal)	
	Connector	BNC female	
External Trigger Input/Output			
External Trigger Input 1	Impedance	$\geq$ 1 k $\Omega$ (nominal)	
	Connector	BNC female	
	Level	5 V TTL level	
External Trigger Input 2/Trigger Output	Impedance	on trigger input	$\geq$ 1 k $\Omega$ (nominal)
		on trigger output	50 $\Omega$ (nominal)
	Connector	BNC female	
	Level	5 V TTL level	
IF Output			
IF Output	Frequency	430 MHz $\pm$ 20 MHz (nominal)	
	Amplitude	RF input power (PRFin) $\leq$ -10 dBm, attenuation = 0, preamp off.	
		50MHz, P <sub>RFIn</sub> $\pm$ 4 dB (nominal) other frequency, P <sub>RFIn</sub> $\pm$ 4 dB + RF frequency response (nominal)	
	Impedance	50 $\Omega$ (nominal)	
Connector	SMB male		
Communication Interface			
USB Host (4 ports)	Connector	A plug	
	Protocol	version 2.0	
USB Device	Connector	B plug	
	Protocol	version 2.0	
LAN	Connector	100/1000Base, RJ-45	
	Protocol	LXI Core 2011 Device	
HDMI	Connector	A plug	
	Protocol	HDMI 1.4b	

## ► Order Information

	Description	Order No .
Model	Real-time Spectrum Analyzer, 9 kHz to 3.2 GHz	RSA5032
	Real-time Spectrum Analyzer, 9 kHz to 6.5 GHz	RSA5065
	Real-time Spectrum Analyzer, 9 kHz to 3.2 GHz (with TG installed when leaving the factory)	RSA5032-TG
	Real-time Spectrum Analyzer, 9 kHz to 6.5 GHz (with TG installed when leaving the factory)	RSA5065-TG
Standard Accessories	Quick Guide (hard copy)	-
	Power Cable	-
Option	Preamplifier (PA)	RSA5000-PA
	High Stability Clock	OCXO-C08
	Real-time/Analysis Bandwidth 40 MHz	RSA5000-B40
	Advanced Measurement Kit	RSA5000-AMK
	Spectrum Analyzer PC Software	Ultra Spectrum
	EMI Pre-compliance Test Software	S1210 EMI Pre-compliance Software
Optional Accessories	Include: N-SMA cable, BNC-BNC cable, N-BNC adaptor, N-SMA adaptor, 75 Ω-50 Ω adaptor, 900 MHz/1.8 GHz antenna (2pcs), 2.4 GHz antenna (2pcs)	DSA Utility Kit
	Include: N(F)-N(F) adaptor (1pcs), N(M)-N(M) adaptor (1pcs), N(M)-SMA(F) adaptor (2pcs), N(M)-BNC(F) adaptor (2pcs), SMA(F)-SMA(F) adaptor (1pcs), SMA(M)-SMA(M) adaptor (1pcs), BNC T type adaptor (1pcs), 50 Ω SMA load (1pcs), 50 Ω BNC impedance adaptor (1pcs)	RF Adaptor Kit
	Include: 50 Ω to 75 Ω adaptor (2pcs)	RF CATV Kit
	Include: 6 dB attenuator (1pcs), 10 dB attenuator (2pcs)	RF Attenuator Kit
	30 dB high-power attenuator, with the max power of 100 W	ATT03301H
	N(M)-N(M) RF Cable	CB-NM-NM-75-L-12G
	N(M)-SMA(M) RF Cable	CB-NM-SMAM-75-L-12G
	VSWR Bridge, 1 MHz to 3.2 GHz	VB1032
	VSWR Bridge, 2 GHz to 8 GHz	VB1080
	Near-field Probe	NFP-3
	Rack Mount Kit	RM6041
	USB Cable	CB-USBA-USBB-FF-150

## Warranty

Three years for the mainframe



#### HEADQUARTER

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