RIGOL

RSA3000E Series

Real-time Spectrum Analyzer

- Ultra-Real technology
- Frequency: up to 3 GHz
- Displayed average noise level (DANL): <-161 dBm (typical)
- Phase noise: <-102 dBc/Hz (typical)
- Level measurement uncertainty: <1.0 dB
- 3 GHz tracking generator
- Min. RBW 1 Hz
- Up to 10 MHz real-time analysis bandwidth
- Multiple measurement modes
- Various advanced measurement functions
- EMI measurement application (option)
- 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

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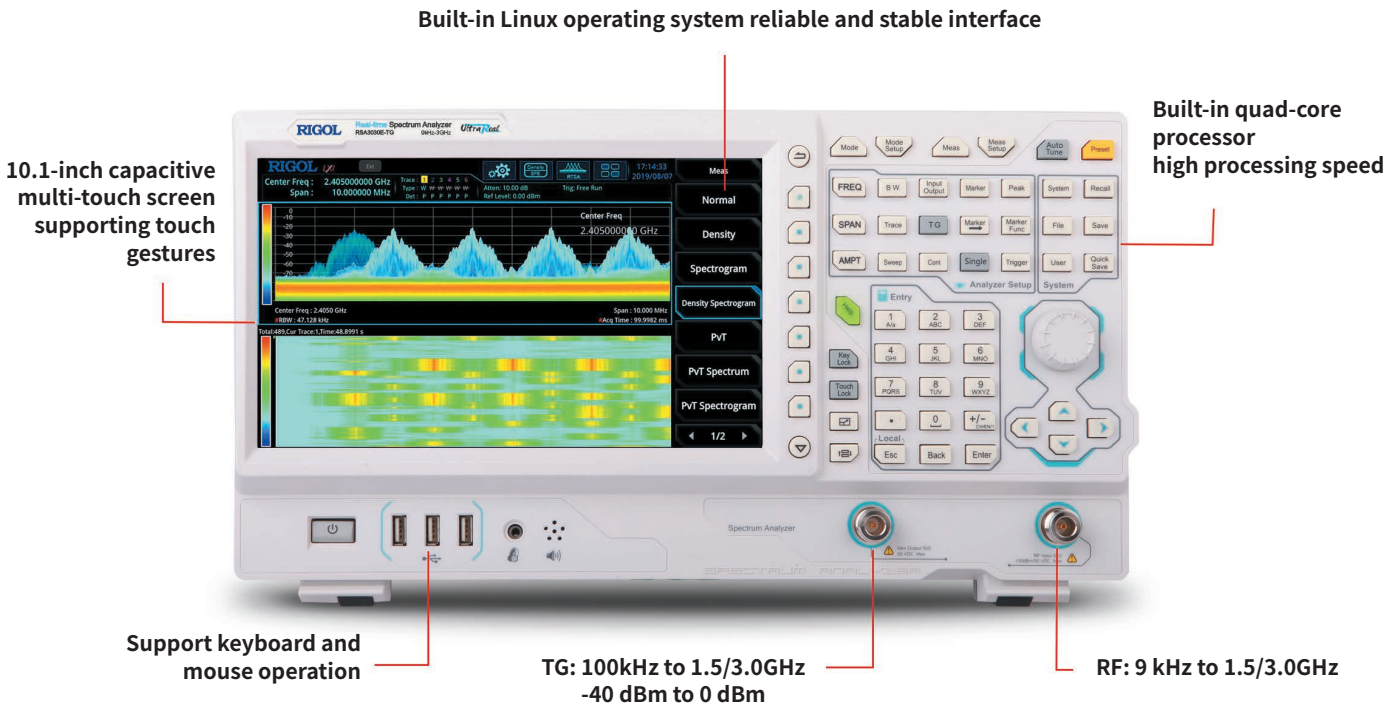
RSA3000E Series Real-time Spectrum Analyzer



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

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➤ Specifications

Specifications are valid under the following conditions: the instrument is within the calibration period, is stored for at least two hours at 0℃ to 50℃ 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℃). 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℃).

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℃).

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)
EMI Measurement Application (EMI) Option RSA3000E-EMI
ASK/FSK Demodulation Software Option RSA3000E-ASK/FSK

All Measurement Modes

Frequency Range		
Model RSA3015E/RSA3015E-TG		9 kHz to 1.5 GHz
Model RSA3030E/RSA3030E-TG		9 kHz to 3 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℃ to 50℃ , with the reference 25℃	
	Standard	<0.5 ppm
	Option OCXO-C08	<0.005 ppm
Aging Rate	Standard	<1 ppm/year
	Option OCXO-C08	<0.03 ppm/year

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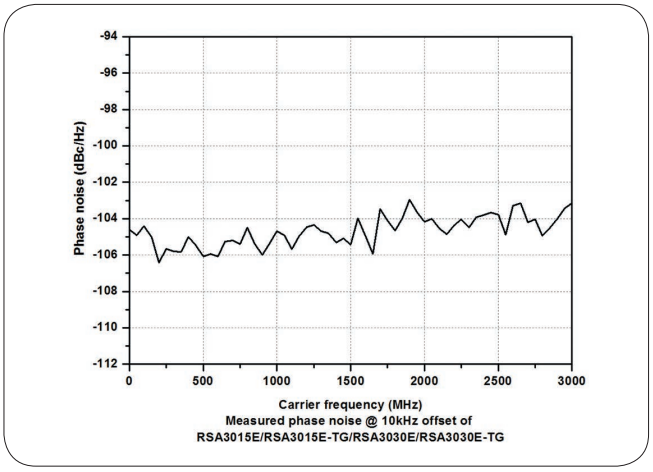
GPSA Mode

Frequency

Frequency Readout Accuracy		
Marker Frequency Resolution		span/(number of sweep points - 1)
Marker Frequency Uncertainty		±(marker frequency readout × reference frequency accuracy + 1% × span + 10% × resolution bandwidth + marker frequency resolution)
Frequency Counter		
Resolution		1 Hz
Uncertainty		±(marker frequency readout × reference frequency accuracy + counter resolution)
Frequency Span		
Range		0 Hz, 10 Hz to maximum frequency
Resolution		2 Hz
Uncertainty		±span/(number of sweep points - 1)
SSB Phase Noise		
		20℃ to 30℃， f_C = 500 MHz
Carrier Offset	1 kHz	<-90 dBc/Hz (typical)
	10 kHz	<-100 dBc/Hz, <-102 dBc/Hz (typical)
	100 kHz	<-100 dBc/Hz, <-102 dBc/Hz (typical)
	1 MHz	<-110 dBc/Hz, <-112 dBc/Hz (typical)



Residual FM	
	20℃ to 30℃ , RBW = VBW = 1 kHz
Residual FM	<10 Hz (nominal)
Bandwidth	
	Set "Sweep Time Rule" to "Accy"
Resolution Bandwidth (-3 dB)[1]	1 Hz to 3 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) (Option RSA3000E-EMC)	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 3 MHz.

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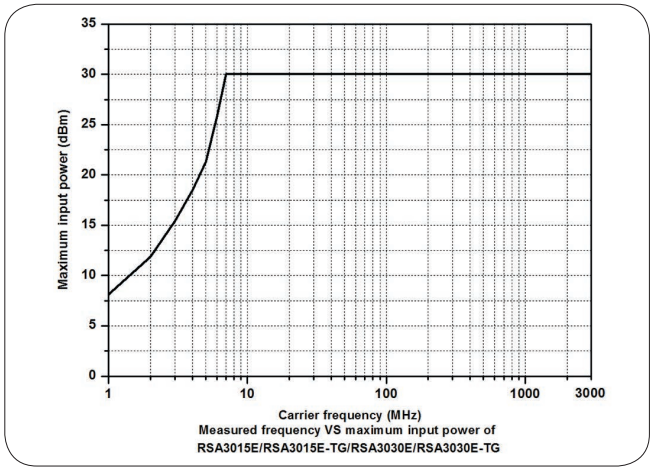
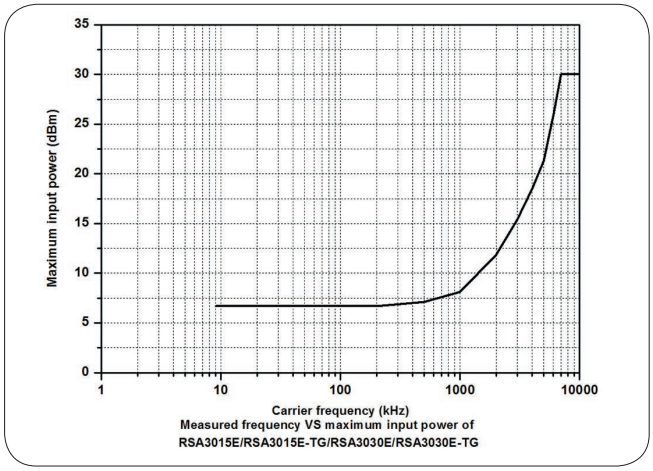
Amplitude

Measurement Range	
Range	f_C ≥ 10 MHz
	DANL to +30 dBm
Maximum Safe Input Level[1]	
DC Voltage	50 V
CW RF Power	+30 dBm, attenuation ≥ 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)		
	attenuation = 0 dB, sample detector, trace averages ≥ 50, tracking generator off, normalized to 1 Hz, 20℃ to 30℃, input impedance = 50 Ω.	
Preamp off	9 kHz to 100 kHz	<-120 dBm (typical)
	100 kHz to 20 MHz	<-135 dBm, <-140 dBm (typical)
	20 MHz to 1.5 GHz	<-138 dBm, <-141 dBm (typical)
	1.5 GHz to 3.0 GHz	<-136 dBm, <-141 dBm (typical)
Preamp on	100 kHz to 20 MHz	<-152 dBm, <-160 dBm (typical)
	20 MHz to 1.5 GHz	<-158 dBm, <-161 dBm (typical)
	1.5 GHz to 3.0 GHz	<-156 dBm, <-161 dBm (typical)

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

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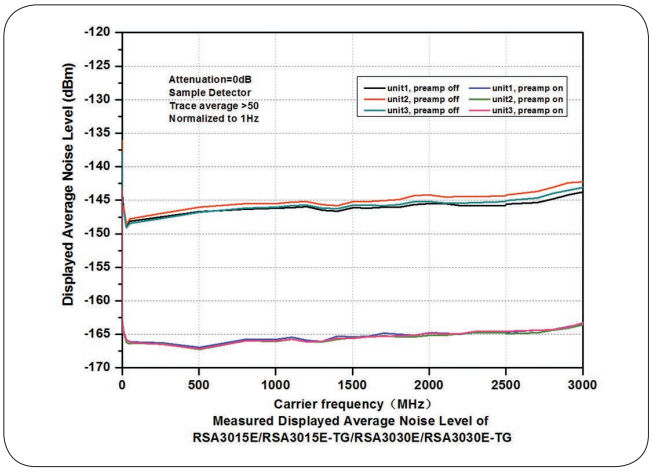
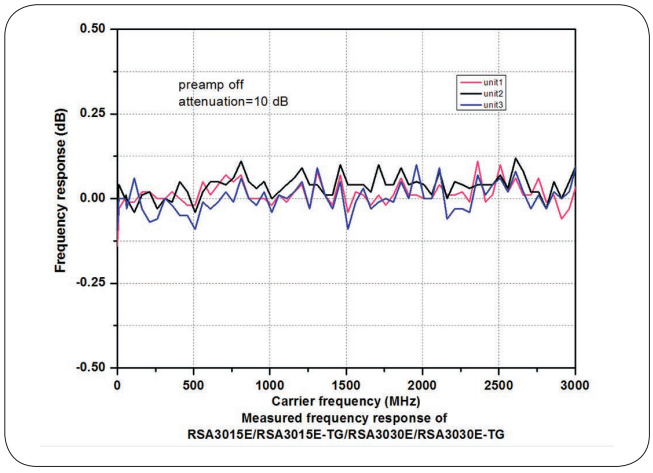
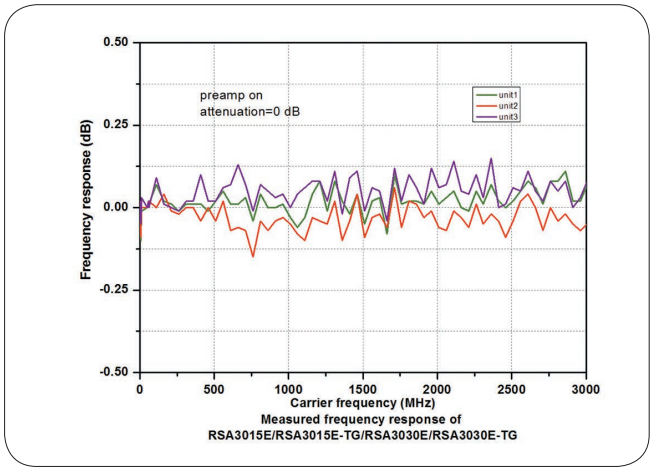


Level Display		
Logarithmic Scale		1 dB to 200 dB
Linear Scale		0 to reference level
Number of Display Points		801
Number of Traces		6
Trace Detector		normal, pos-peak, neg-peak, sample, RMS average, voltage average, and quasi-peak (Option RSA3000E-EMC)
Trace Function		clear write, max hold, min hold, average, view, blank
Scale Unit		dBm, dBmV, dBμV, nV, μV, mV, V, nW, μW, mW, W
Frequency Response		
		attenuation = 10 dB, relative to 50 MHz, 20℃ to 30℃
Preamp off	100 kHz to 3.0 GHz	<0.7 dB, <0.5 dB (typical)
		attenuation = 0 dB, relative to 50 MHz, 20℃ to 30℃
Preamp on	100 kHz to 3.0 GHz	<1.0 dB, <0.5 dB (typical)





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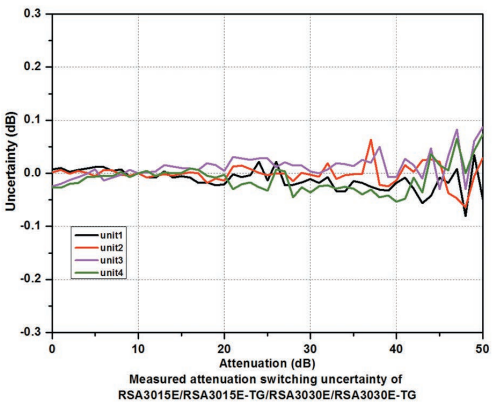
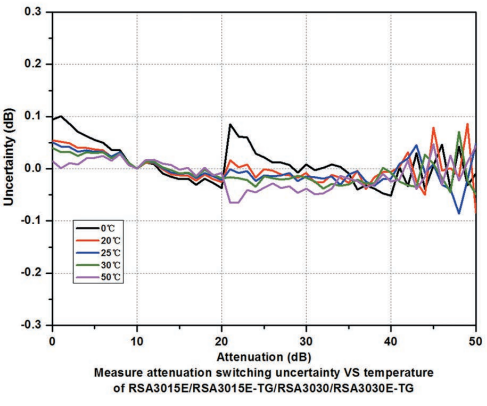
Input Attenuation Switching Uncertainty	
Setting Range	0 dB to 50 dB, in 1 dB step
Switching Uncertainty	f_C = 50 MHz, relative to 10 dB, preamp off, 20℃ to 30℃
	<0.3 dB

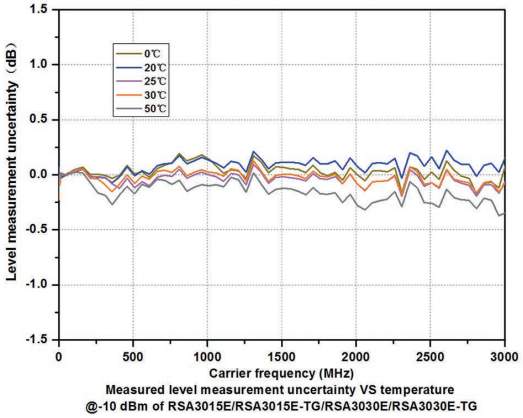


Measured attenuation switching uncertainty of RSA3015E/RSA3015E-TG/RSA3030E/RSA3030E-TG



Measure attenuation switching uncertainty VS temperature of RSA3015E/RSA3015E-TG/RSA3030/RSA3030E-TG

Absolute Amplitude Accuracy			
Uncertainty		f_C = 50 MHz, peak detector, preamp off, attenuation = 10 dB, input signal level = -10 dBm, 20℃ to 30℃	
		<0.3 dB	
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	<0.3 dB
Preamp (Option RSA3000E-PA)			
Frequency Range		RSA3015E/RSA3015E-TG	100 kHz to 1.5 GHz
		RSA3030E/RSA3030E-TG	100 kHz to 3 GHz
Gain		20 dB (nominal)	
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℃ to 30℃	
Level Measurement Uncertainty		<1.0 dB (nominal)	



Measured level measurement uncertainty VS temperature @-10 dBm of RSA3015E/RSA3015E-TG/RSA3030E/RSA3030E-TG

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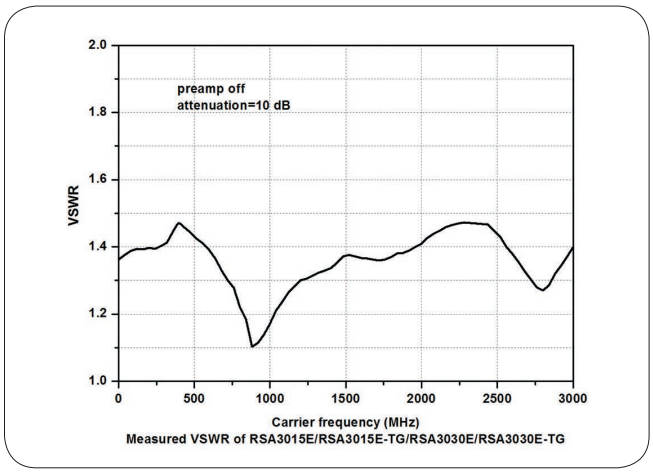
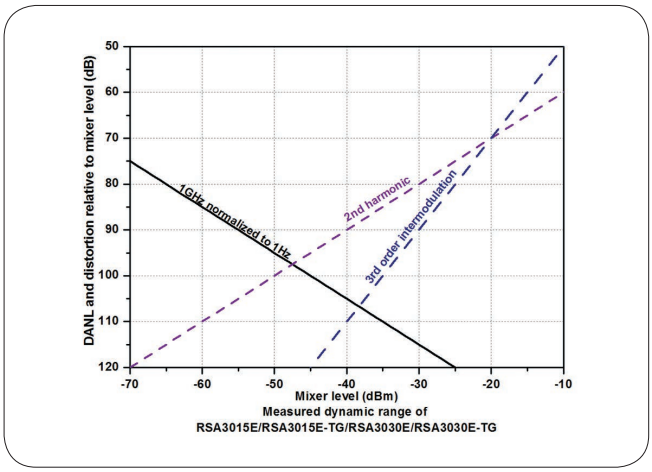
RF Input VSWR		
		attenuation ≥10 dB, preamp off
VSWR	300 kHz to 3.0 GHz	<1.6 (nominal)



Distortion	
Second Harmonic Intercept (SHI)	fc ≥ 50 MHz, input signal level = -20 dBm, attenuation = 0 dB, preamp off.
	+45 dBm
Third-order Intercept (TOI)	f_C ≥ 50 MHz, two -20 dBm tones at input mixer spaced by 200 kHz, attenuation = 0 dB, preamp off.
	+10 dBm, +15 dBm (typical)
1 dB Gain Compression (P_{1dB})[1]	fc ≥ 50 MHz, attenuation = 0 dB, preamp off
	0 dBm (norminal)



Spurious Response	
Residual Response	input terminated with a 50 Ω load, attenuation = 0 dB, 20℃ to 30℃
	<-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.

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Sweep

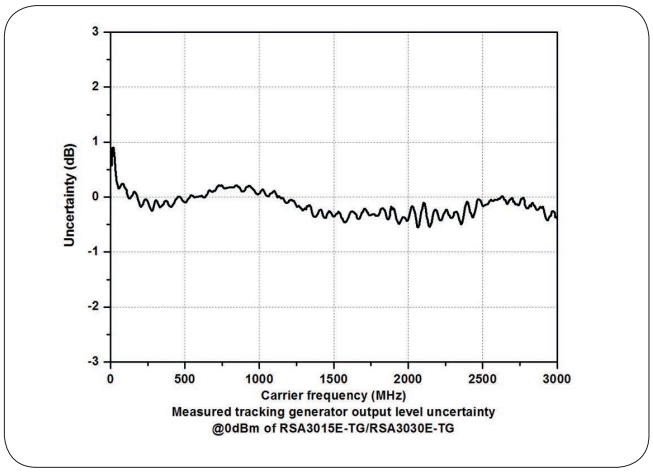
Sweep		
Sweep Time	span ≥ 10 Hz	1 ms to 4,000 s
	zero span	1 μs to 6,000 s
Sweep Time Uncertainty	span ≥ 10 Hz, RBW ≥ 1 kHz	5% (nominal)
	zero span (sweep time > 1 ms)	5% (nominal)
Sweep Mode		continue, single

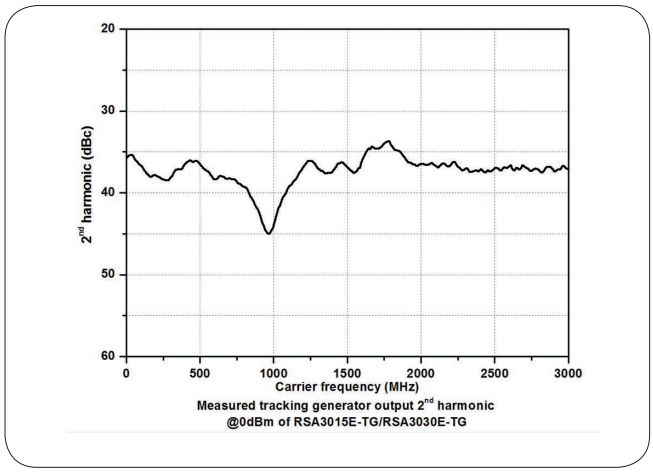
Trigger

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

Tracking Generator

Tracking Generator Output		
Frequency Range	RSA3015E-TG	100 kHz to 1.5 GHz
	RSA3030E-TG	100 kHz to 3.0 GHz
Output Level Range	-40 dBm to 0 dBm	
Output Level Resolution	1 dB	
Output Flatness	Relative to 50 MHz	
	±3 dB (nominal)	
Function Supported		
Function Supported	VSWR measurement	





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RTSA Mode

Real-time Analysis Bandwidth	10 MHz					
Min. Signal Duration for 100% POI at the Full-Scale Accuracy	maximum span, default Kaiser Window					
	9.3 μs					
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	
	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	12.8 Msa/s					
FFT Rate	146,484/s (norminal)					
Number of Markers	8					
Amplitude Resolution	0.01 dB					
Frequency Point	801					
Acquisition Time	Max. sample rate					
	>32 ms					
Min. Signal Duration for 100% POI at Different RBWs						
	Duration Time (μs)					
Span	RBW1	RBW2	RBW3	RBW4	RBW5	RBW6
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[1] (nominal)					
SFDR	<-50 dBc/Hz (typical)					
UltraReal Density						
Probability Range	0 to 100% (with a step of 0.1%)					
Min. Span	5 kHz					
Persistence Duration	32 ms to 10 s					
UltraReal Spectrogram						
History Depth	8,192					
Dynamic Range Covered by Bitmap Color	200 dB					
UltraReal PVT						
Min. Acquisition Time	187.917 μs					
Max. Acquisition Time	40 s					
Trigger						
Trigger Source	free run, external 1, external 2, power(time), FMT					
UltraReal 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.

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VSA Mode (Option RSA3000E-ASK/FSK)

Capture Oversampling		
Capture Oversampling		4, 8, 16
Capture Length		
Capture Oversampling = 4		Maximum 4096
Capture Oversampling = 8		Maximum 2048
Capture Oversampling = 16		Maximum 1024
Sample Rate		
Maximum Sample Rate		12.8 MHz
Symbol Rate		
Symbol Rate		depends on capture oversampling
		= sample rate/capture oversampling, ≥1 kHz
Usable I/Q Bandwidth		
Usable I/Q Bandwidth		symbol rate × capture oversampling/1.28
Trigger Mode		
Trigger Mode		free run, external1, external2, power (time), and FMT
Modulation Format		
FSK		2FSK, 4FSK, and 8FSK
ASK		2ASK and 4ASK
Filter Type		
Measurement Filter Type		No Filter, RRC, Gaussian, Rectangular, and User Defined
Reference Filter Type		Raised Cosine, RRC, Gaussian, Rectangular, and User Defined
Measurement Uncertainty		
		Specifications apply under the following conditions: temperature from +20 °C to +30 °C signal level ≥ –25 dBm properly adjusted reference level offset between device's center frequency and signal's center frequency smaller than 5 % of symbol rate Random data sequence Capture oversampling is set to 4.
Residual Error for FSK		
Test Signal		The reference filter is RRC with rolloff factor 0.22. The measurement filter is RRC with rolloff factor 0.22. The FSK reference deviation is a quarter of the symbol rate. The result length is 150 symbols. The center frequency is 1 GHz.
		Residual Frequency Error RMS
Symbol Rate	100 kHz	< 2.8% (nominal)
	500 kHz	< 2.8% (nominal)

EMI Mode (Option RSA3000E-EMI)

EMI Resolution Bandwidth		
Resolution Bandwidth (-3 dB)		100 Hz to 3 MHz, in 1-3-10 sequence
Resolution Bandwidth (-6 dB)		200 Hz, 9 kHz, 120 kHz and 1 MHz
EMI Detector		
Detector		pos-peak, neg-peak, average, quasi-peak, CISPR average, RMS average
EMI Key Feature		
Key Feature		CISPR 16-1-1 detectors
		CISPR 16-1-1 bandwidths
		log and linear display
		signal table
		scan table
		simultaneous detectors
		automatic limit testing
		measure at marker
		delta to limit
		step and swept scans
		report generation

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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℃ to 50℃
	Storage Temperature Range	-20℃ to 70℃
Humidity	0℃ to 30℃	≤95% RH
	30℃ to 40℃	≤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+ GI1+ GI2
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

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Input/Output

Front Panel Connector			
RF Input	Impedance		50 Ω (nominal)
	Connector		N-type female
TG Output	Impedance		50 Ω (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 Ω (nominal)
	Connector		BNC female
External Reference	Frequency		10 MHz ± 5 ppm
	Input Level		0 dBm to +10 dBm
	Impedance		50 Ω (nominal)
	Connector		BNC female
External Trigger Input/Output			
External Trigger Input 1	Impedance		≥1 kΩ (nominal)
	Connector		BNC female
	Level		5 V TTL level
External Trigger Input 2/Trigger Output	Impedance	on trigger input	≥1 kΩ (nominal)
		on trigger output	50 Ω (nominal)
	Connector		BNC female
	Level		5 V TTL level
IF Output			
IF Output	Frequency		430 MHz ± 20 MHz (nominal)
	Amplitude		RF input power (P_{RFin}) ≤ -10 dBm, attenuation = 0, preamp off.
			50MHz, P_{RFin} ± 4 dB (nominal) other frequency, P_{RFin} ± 4 dB + RF frequency response (nominal)
	Impedance		50 Ω (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

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▶ Order Information

	Description	Order No.
Model	Real-time Spectrum Analyzer, 9 kHz to 1.5 GHz	RSA3015E
	Real-time Spectrum Analyzer, 9 kHz to 3 GHz	RSA3030E
	Real-time Spectrum Analyzer, 9 kHz to 1.5 GHz (with TG installed when leaving the factory)	RSA3015E-TG
	Real-time Spectrum Analyzer, 9 kHz to 3 GHz (with TG installed when leaving the factory)	RSA3030E-TG
Standard Accessories	Quick Guide (hard copy)	-
	Power Cord	-
Option	EMI Measurement Application (includes RSA3000E-EMC)	RSA3000E-EMI
	Preamplifier (PA)	RSA3000E-PA
	High Stability Clock	OCXO-C08
	Advanced Measurement Kit	RSA3000E-AMK
	EMC Filter and Quasi-Peak Detector Kit	RSA3000E-EMC
	Spectrum Analyzer PC Software	Ultra Spectrum
	ASK/FSK Demodulation Software	RSA3000E-ASK/FSK
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

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HEADQUARTER

RIGOL TECHNOLOGIES, INC.
No.8 Keling Road, New District,Suzhou,
JiangSu,P.R.China
Tel:+86-400620002
Email:info@rigol.com

EUROPE

RIGOL TECHNOLOGIES EU GmbH
Lindbergh str. 4
82178 Puchheim
Germany
Tel: 0049-89/89418950
Email: info-europe@rigol.com

NORTH AMERICA

RIGOL TECHNOLOGIES, USA INC.
8140 SW Nimbus Ave.
Beaverton, OR 97008
Tel: 877-4-**RIGOL**-1
Fax: 877-4-**RIGOL**-1
Email: info@rigol.com

JAPAN

RIGOL TECHNOLOGIES JAPAN, LLC
MJ Bldg. 3F, 1-7-4 Minato, Chuou-ku,
Tokyo, Japan 104-0043
Tel: +81-3-6262-8932
Fax: +81-3-6262-8933
Email: info-japan@rigol.com

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