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

Distribution in the UK & Ireland

Lambda

Lambda Photometrics Limited
Lambda House Batford Mill
Harpenden Herts AL5 5BZ
United Kingdom
E: info@lambdaphoto.co.uk
W: www.lambdaphoto.co.uk
T: +44 (0)1582 764334
F: +44 (0)1582 712084

RSA3000E Series Real-time Spectrum Analyzer

Built-in Linux operating system reliable and stable interface

Built-in quad-core processor
high processing speed

10.1-inch capacitive multi-touch screen supporting touch gestures

Support keyboard and mouse operation

TG: 100kHz to 1.5/3.0GHz
-40 dBm to 0 dBm

RF: 9 kHz to 1.5/3.0GHz

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

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℃ 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

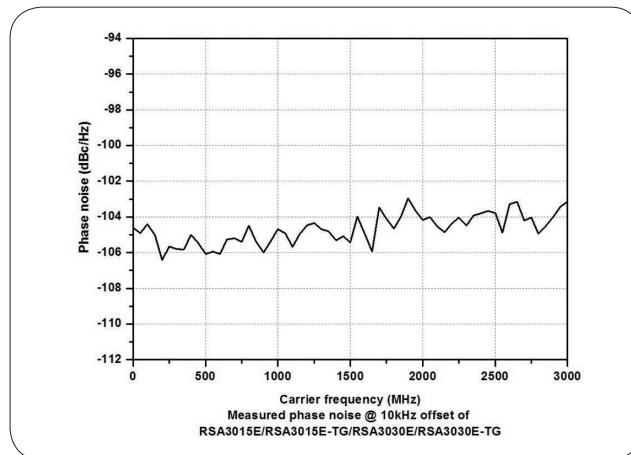| Measurement Mode |
| --- |
| General-Purpose Spectrum Analyzer (GPSA) |
| Real-time Spectrum Analyzer (RTSA) |
| EMI Measurement Application (EMI) Option RSA3000E-EMI |
| ASK/FSK Demodulation Software Option RSA3000E-ASK/FSK |

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

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	

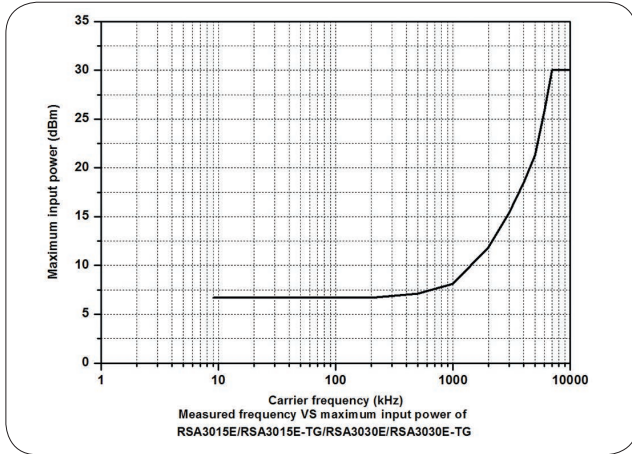|		20℃ to 30℃, f_C = 500 MHz
Carrier Offset	1 kHz	<-90 dBc/Hz (typical)
	10 kHz	<-100 dBc/Hz, <-102 dBc/Hz (typical)
	100 kHz	<-100 dBc/Hz, <-102 dBc/Hz (typical)
	1 MHz	<-110 dBc/Hz, <-112 dBc/Hz (typical)

Measured phase noise @ 10kHz offset of
RSA3015E/RSA3015E-TG/RSA3030E/RSA3030E-TG

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.
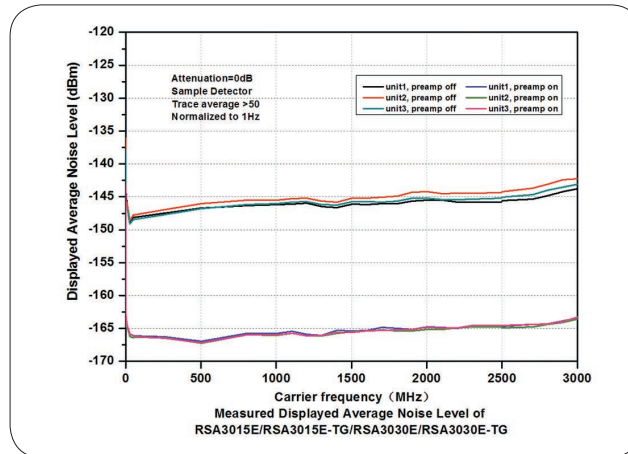
Amplitude

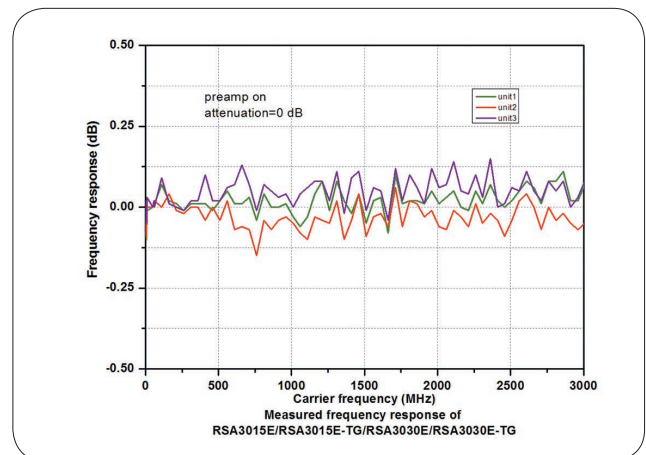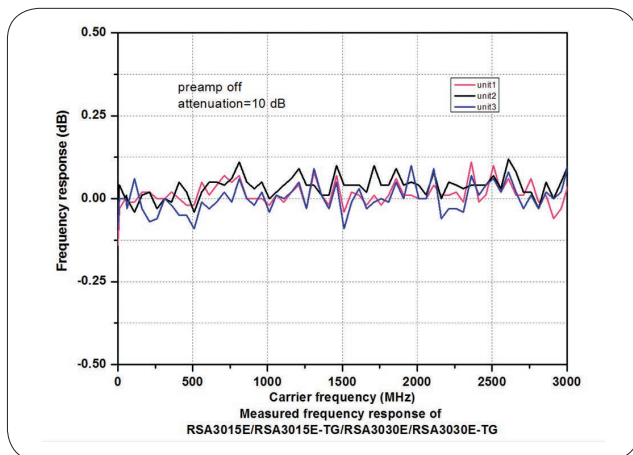| Measurement Range	
Range	$f_C \geq 10$ MHz
	DANL to +30 dBm
Maximum Safe Input Level[1]	
DC Voltage	50 V
CW RF Power	+30 dBm, attenuation ≥ 40 dB, preamp off.
	-10 dBm, attenuation = 20 dB, preamp on.
Maximum Damage Level	
CW RF Power	+33 dBm (2 W)

Measured frequency VS maximum input power of
RSA3015E/RSA3015E-TG/RSA3030E/RSA3030E-TG

Measured frequency VS maximum input power of
RSA3015E/RSA3015E-TG/RSA3030E/RSA3030E-TG
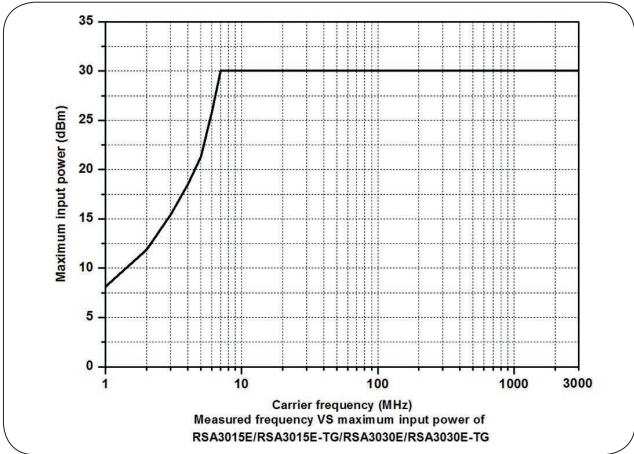
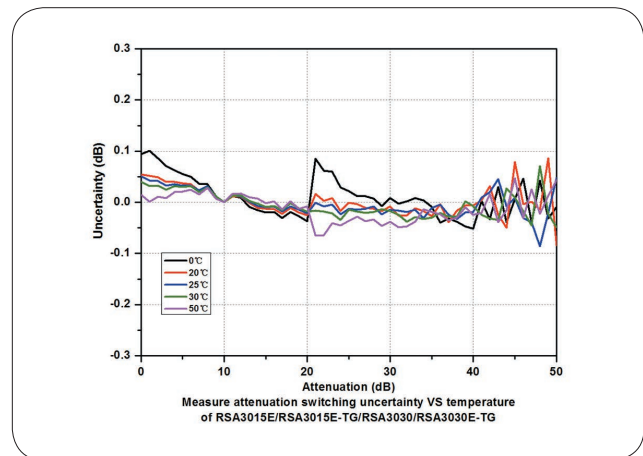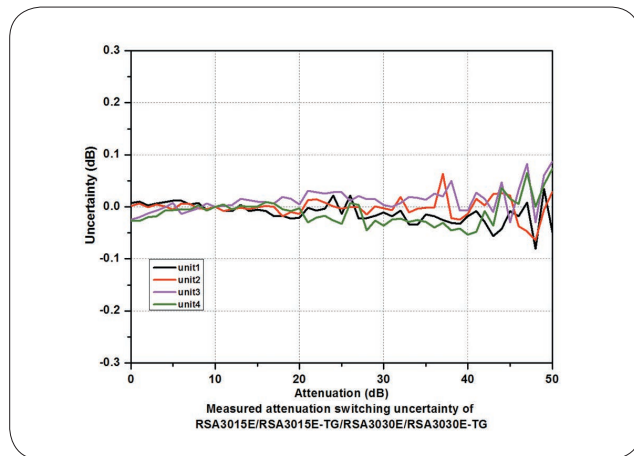| Displayed Average Noise Level (DANL)		
	attenuation = 0 dB, sample detector, trace averages ≥ 50, tracking generator off, normalized to 1 Hz, 20℃ to 30℃, input impedance = 50 Ω.	
Preamp off	9 kHz to 100 kHz	<-120 dBm (typical)
	100 kHz to 20 MHz	<-135 dBm, <-140 dBm (typical)
	20 MHz to 1.5 GHz	<-138 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.

Measured Displayed Average Noise Level of
RSA3015E/RSA3015E-TG/RSA3030E/RSA3030E-TG

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)

Measured frequency response of
RSA3015E/RSA3015E-TG/RSA3030E/RSA3030E-TG

Measured frequency response of
RSA3015E/RSA3015E-TG/RSA3030E/RSA3030E-TG

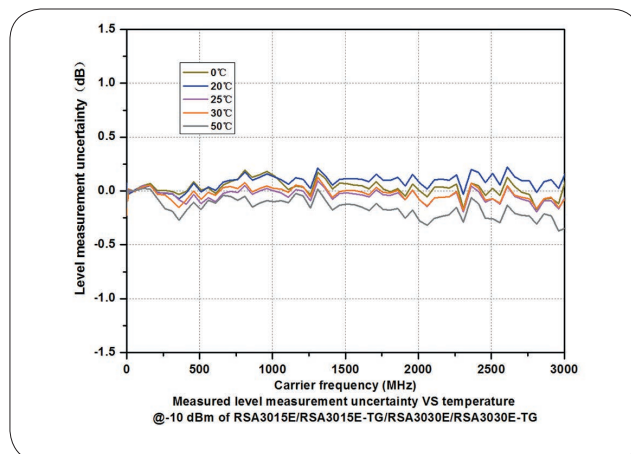| Input Attenuation Switching Uncertainty	
Setting Range	0 dB to 50 dB, in 1 dB step
Switching Uncertainty	f_c = 50 MHz, relative to 10 dB, preamp off, 20℃ to 30℃
	<0.3 dB

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

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

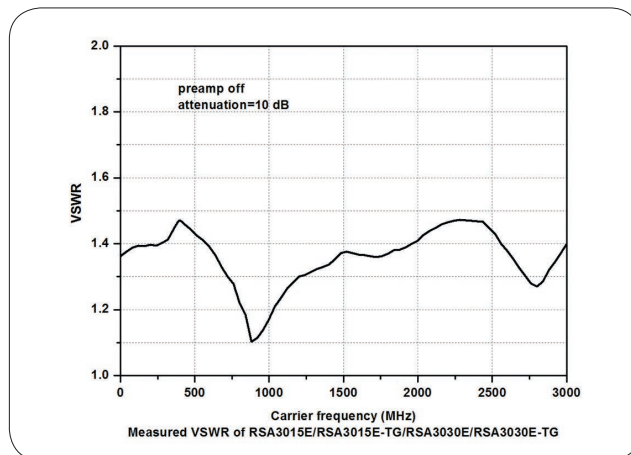| Absolute Amplitude Accuracy		
Uncertainty	f_c = 50 MHz, peak detector, preamp off, attenuation = 10 dB, input signal level = -10 dBm, 20℃ to 30℃	
	<0.3 dB	
Reference Level		
Range	Logarithmic Scale	-170 dBm to +30 dBm, in 0.01 dB step
	Linear Scale	707 pV to 7.07 V, 0.11% (0.01 dB) resolution
RBW Switching		
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

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

Measured VSWR of RSA3015E/RSA3015E-TG/RSA3030E/RSA3030E-TG

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)	

Measured dynamic range of
RSA3015E/RSA3015E-TG/RSA3030E/RSA3030E-TG
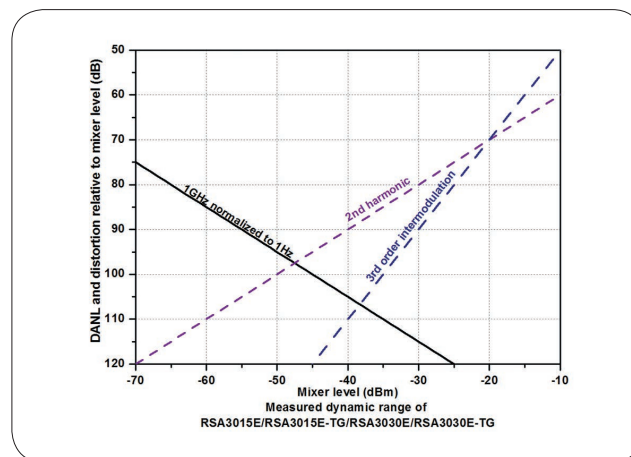
Spurious Response		
Residual Response	input terminated with a 50 Ω load, attenuation = 0 dB, 20℃ to 30℃	
	<-90 dBm, <-100 dBm (typical)	
Intermediate Frequency	<-60 dBc	
System-related Sideband	referenced to local oscillators, referenced to A/D conversion, referenced to subharmonic of first LO, referenced 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.
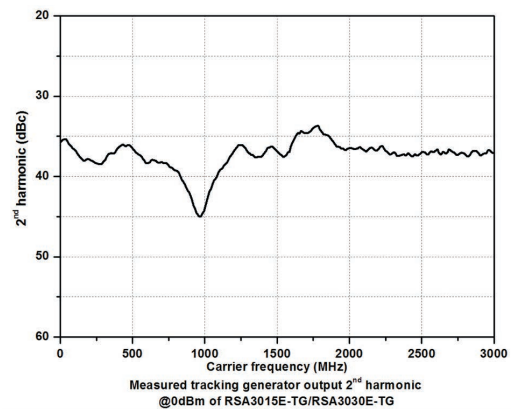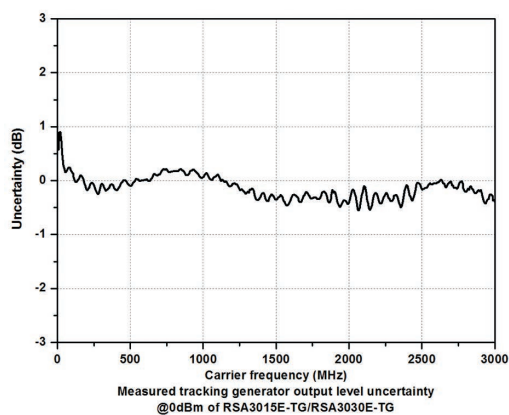
Sweep

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	

Measured tracking generator output level uncertainty
@0dBm of RSA3015E-TG/RSA3030E-TG

Measured tracking generator output 2nd harmonic
@0dBm of RSA3015E-TG/RSA3030E-TG

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.

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

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

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)
	Impedance — 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

▶ 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