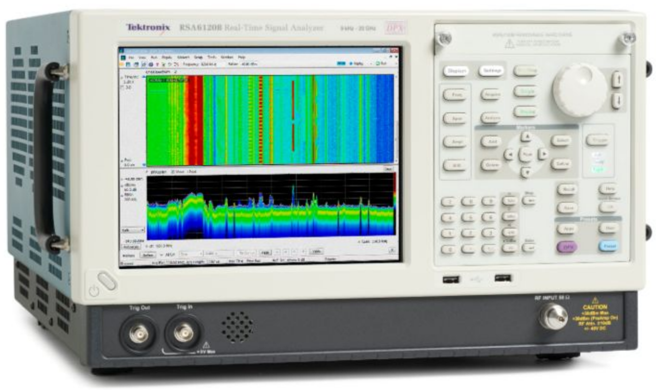
Spectrum Analyzers

RSA6000 Series Datasheet



The RSA6000 Series gives you the functionality of a high-performance spectrum analyzer, wideband vector signal analyzer, and the unique trigger-capture-analyze capability of a real-time spectrum analyzer - all in a single package. A typical 20 dBm TOI and -151 dBm/Hz DANL at 2 GHz gives you the dynamic range you expect for challenging spectrum analysis measurements.

Key Performance Specifications

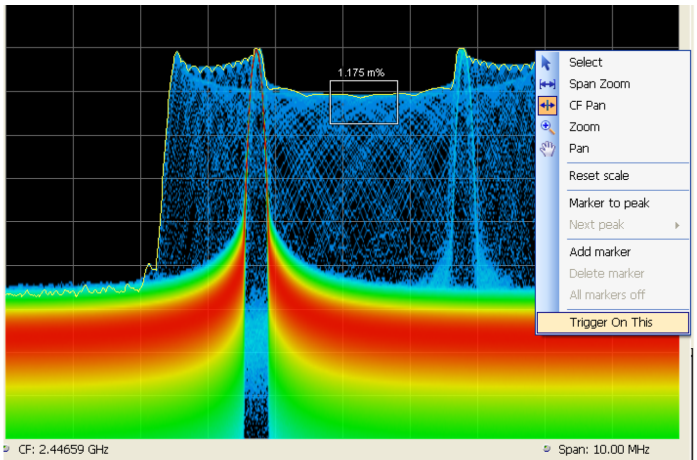
- 20 dBm 3rd order intercept at 2 GHz, typical
- Displayed average noise level –151 dBm/Hz at 2 GHz (–167 dBm/Hz, preamp on, typical) enables low-level signal search
- Revolutionary DPX displays transients with a minimum event duration of 3.7 μs
- Trigger on frequency edge or power level transients with a minimum event duration of 3.7 μs in the frequency domain, 9.1 ns in time domain
- Up to 7.15 s acquisitions at 110 MHz bandwidth can be directly stored as MATLAB™ compatible files

Key Features

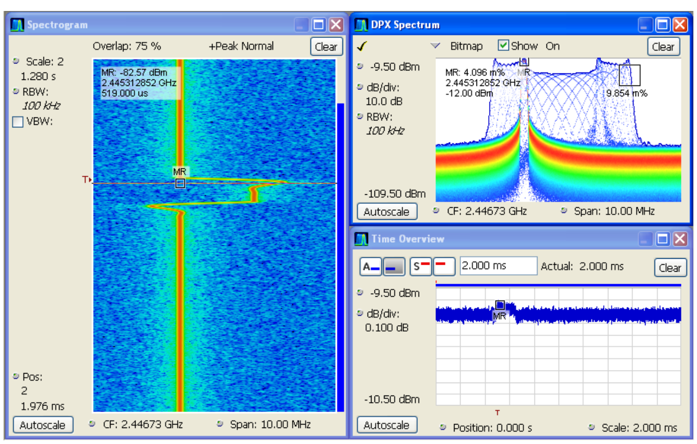
- High-performance spectrum analysis
  - Fully preselected and image free at all times for maximum dynamic range at any acquisition bandwidth
  - Fastest high-resolution sweep speed: 1 GHz sweep in 10 kHz RBW in less than 1 second
  - Internal preamp up to 20 GHz
- Discover
  - DPX® spectrum processing provides an intuitive understanding of time-varying RF signals with color-graded displays based on frequency of occurrence
  - Swept DPX spectrum enables unprecedented signal discovery over full instrument span
- Trigger
  - DPX density™ trigger activated directly from DPX display
  - Time-qualified and runt triggers trap elusive transients
  - Frequency mask trigger captures any change in frequency domain
- Capture
  - Gap-free DPX spectrogram records up to 4444 days of spectral information for analysis and replay
  - Interfaces with TekConnect® probes for RF probing
- Analyze
  - Time-correlated multidomain displays for quicker understanding of cause and effect when troubleshooting
  - Standard power, spectrum, and statistics measurements help you characterize components and systems: channel power, ACLR, power vs. time, CCDF, OBW/EBW, and spur search
  - AM/FM/PM modulation and audio measurements (Opt. 10)
  - Phase noise and jitter measurements (Opt. 11)
  - Settling time measurements, frequency, and phase (Opt. 12)
  - Pulse measurements (Opt. 20) – over 20 vector and scalar parameters including rise time, pulse width, Pulse-to-Pulse phase provide deep insight into pulse train behavior
  - General purpose digital modulation analysis (Opt. 21) provides vector signal analyzer functionality for over 20 modulation types
  - Simple and complete APCO Project 25 transmitter compliance testing and analysis for Phase 1 (C4FM) and Phase 2 (TDMA) (Opt. 26)
  - WLAN analysis for 802.11 a/b/g/j (Opt 23), 802.11n (Opt. 24), 802.11ac (Opt. 25)
  - Noise figure and gain measurements (Opt. 14)
  - Bluetooth® Analysis (Opt. 27)
  - Signal strength function provides audio tone and visual indication of received signal strength

Applications

- Spectrum management – find interference and unknown signals
- Radar/EW – full characterization of pulsed and hopping systems characterize radar and pulsed RF signals
- RF debug – components, modules, and systems
- Radio/Satellite communications – analyze time-variant behavior of cognitive radio and software-defined radio systems
- EMI diagnostics – increase confidence that designs will pass compliance testing



Revolutionary DPX® spectrum display reveals transient signal behavior that helps you discover instability, glitches, and interference. Here, an infrequently occurring transient is seen in detail. The frequency of occurrence is color-graded, indicating the infrequent transient event in blue and the noise background in red. The DPX Density™ Trigger is activated, seen in the measurement box at the center of the screen, and Trigger On This™ has been activated. Any signal density greater than the selected level causes a trigger event.



Trigger and Capture: The DPX Density™ Trigger monitors for changes in the frequency domain, and captures any violations into memory. The spectrogram display (left panel) shows frequency and amplitude changing over time. By selecting the point in time in the spectrogram where the spectrum violation triggered the DPX Density™ Trigger, the frequency domain view (right panel) automatically updates to show the detailed spectrum view at that precise moment in time.

High performance spectrum and vector signal analysis, and a lot more

The RSA6000 Series replaces conventional high-performance signal analyzers, offering the measurement confidence and functionality you demand for everyday tasks. A typical 20 dBm TOI and -151 dBm/Hz DANL at 2 GHz gives you the dynamic range you expect for challenging spectrum analysis measurements. All analysis is fully preselected and image free. The RSA6000 Series uses broadband preselection filters that are always in the signal path. You never have to compromise between dynamic range and analysis bandwidth by 'switching out the preselector'.

A complete toolset of power and signal statistics measurements is standard, including Channel Power, ACLR, CCDF, Occupied Bandwidth, AM/FM/PM, and Spurious measurements. Available Phase Noise and General Purpose Modulation Analysis measurements round out the expected set of high-performance analysis tools.

But, just being a high-performance signal analyzer is not sufficient to meet the demands of today's hopping, transient signals.

The RSA6000 Series will help you to easily discover design issues that other signal analyzers may miss. The revolutionary DPX® spectrum display offers an intuitive live color view of signal transients changing over time in the frequency domain, giving you immediate confidence in the stability of your design, or instantly displaying a fault when it occurs. Once a problem is discovered with DPX®, the RSA6000 Series spectrum analyzers can be set to trigger on the event, capture a contiguous time record of changing RF events, and perform time-correlated analysis in all domains. You get the functionality of a high-performance spectrum analyzer, wideband vector signal analyzer, and the unique trigger-capture-analyze capability of a real-time spectrum analyzer - all in a single package.

Discover

The patented DPX® spectrum processing engine brings live analysis of transient events to spectrum analyzers. Performing up to 292,968 frequency transforms per second, transients of a minimum event duration of 3.7 μs in length are displayed in the frequency domain. This is orders of magnitude faster than swept analysis techniques. Events can be color coded by rate of occurrence onto a bitmapped display, providing unparalleled insight into transient signal behavior. The DPX spectrum processor can be swept over the entire frequency range of the instrument, enabling broadband transient capture previously unavailable in any spectrum analyzer. In applications that require only spectral information, the RSA6000 Series provides gap-free spectral recording, replay, and analysis of up to 60,000 spectral traces. Spectrum recording resolution is variable from 110 μs to 6400 s per line, allowing multiple days of recording time.

Trigger

Tektronix has a long history of innovative triggering capability, and the RSA Series spectrum analyzers lead the industry in triggered signal analysis. The RSA6000 Series provides unique triggers essential for troubleshooting modern digitally implemented RF systems. Trigger types include time-qualified power, runt, density, and frequency mask.

Time qualification can be applied to any internal trigger source, enabling capture of'the short pulse' or 'the long pulse'in a pulse train, or only triggering when a frequency domain event lasts for a specified time. Runt triggers capture troublesome infrequent pulses that either turn on or turn off to an incorrect level, greatly reducing time to fault.

DPX Density™ Trigger works on the measured frequency of occurrence or density of the DPX display. The unique Trigger On This™ function allows the user to simply point at the signal of interest on the DPX display, and a trigger level is automatically set to trigger slightly below the measured density level. You can capture low-level signals in the presence of high-level signals at the click of a button.

The Frequency Mask Trigger (FMT) is easily configured to monitor all changes in frequency occupancy within the acquisition bandwidth.

A Power Trigger working in the time domain can be armed to monitor for a user-set power threshold. Resolution bandwidths may be used with the power trigger for band limiting and noise reduction. Two external triggers are available for synchronization to test system events.

Capture

Capture once - make multiple measurements without recapturing. All signals in an acquisition bandwidth are recorded into the RSA6000 Series deep memory. Record lengths vary depending upon the selected acquisition bandwidth - up to 7.15 seconds at 110 MHz, 343.5 seconds at 1 MHz, or 6.1 hours at 10 kHz bandwidth with Deep Memory (Opt. 53). Real-time capture of small signals in the presence of large signals is enabled with 73 dB SFDR in all acquisition bandwidths, even up to 110 MHz (Opt. 110). Acquisitions of any length can stored in MATLAB™ Level 5 format for offline analysis.

Most spectrum analyzers in the market use narrowband tunable band pass filters, often YIG tuned filters (YTF) to serve as a preselector. These filters provide image rejection and improve spurious performance in swept applications by limiting the number of signals present at the first mixing stage. YTF's are narrow band devices by nature and are usually limited to bandwidths less than 50 MHz. These analyzers bypass the input filter when performing wideband analysis, leaving them susceptible to image responses when operating in modes where wideband analysis is required such as for real time signal analysis.

Unlike spectrum analyzers with YTF's, Tektronix Real Time Signal Analyzers use a wideband image-free architecture guaranteeing that signals at frequencies outside the band to which the instrument is tuned do not create spurious or image responses. This image-free response is achieved with a series of input filters designed such that all image responses are suppressed. The input filters are overlapped by greater than the widest acquisition bandwidth, ensuring that full-bandwidth acquisitions are always available. This series of filters serves the purpose of the preselector used by other spectrum analyzers, but has the benefit of always being on while still providing the image-free response in all instrument bandwidth settings and at all frequencies.

Analyze

The RSA6000 Series offers analysis capabilities that advance productivity for engineers working on components or in RF system design, integration, and performance verification, or operations engineers working in networks, or spectrum management. In addition to spectrum analysis, spectrograms display both frequency and amplitude changes over time. Time-correlated measurements can be made across the frequency, phase, amplitude, and modulation domains. This is ideal for signal analysis that includes frequency hopping, pulse characteristics, modulation switching, settling time, bandwidth changes, and intermittent signals.

Performance you can count on

Depend on Tektronix to provide you with performance you can count on. In addition to industry-leading service and support, this product comes backed by a one-year warranty as standard.

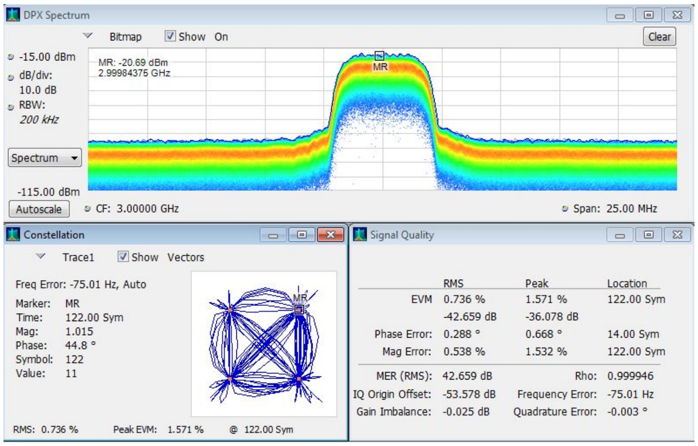
Measurement functions

The measurement capabilities of the RSA6000 series and available options and software packages are summarized below:

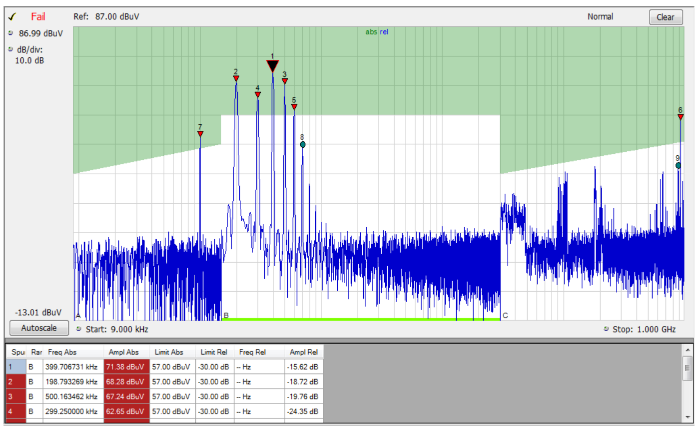
Measurements	Description
Spectrum analyzer measurements	Channel power, adjacent channel power, multicarrier adjacent channel Power/Leakage ratio, occupied bandwidth, xdB bandwidth, dBm/Hz marker, dBc/Hz marker, spectrum emissions mask
Time domain and statistical measurements	RF IQ vs. Time, Power vs. Time, Frequency vs. Time, Phase vs. Time, CCDF, Peak-to-Average Ratio
Spur search measurement	Up to 20 frequency ranges, user-selected detectors (Peak, Average, QP), filters (RBW, CISPR, MIL), and VBW in each range. Linear or Log frequency scale. Measurements and violations in absolute power or relative to a carrier. Up to 999 violations identified in tabular form for export in .CSV format

Measurements	Description
Analog modulation measurements	% amplitude modulation (+Peak, –Peak, RMS, mod. depth) Frequency modulation (±Peak, +Peak to –Peak, RMS, Peak-Peak/2, frequency error) Phase modulation (±Peak, RMS, +Peak to –Peak)
AM/FM/PM modulation and audio measurements (Opt. 10)	Carrier power, frequency error, modulation frequency, modulation parameters (±Peak, Peak-Peak/2, RMS), SINAD, modulation distortion, S/N, THD, TNHD
Phase noise and jitter measurements (Opt. 11)	Phase Noise vs. Frequency Offset Offset range 10 hz to 1 GHz. Measures carrier power, frequency error, RMS phase noise, integrated jitter, residual FM
Settling time (frequency and phase) (Opt. 12)	Measured frequency, settling time from last settled frequency, settling time from last settled phase, settling time from trigger. Automatic or manual reference frequency selection. User-adjustable measurement bandwidth, averaging, and smoothing. Pass/Fail mask testing with 3 user-settable zones
Noise Figure and Gain measurements (Opt. 14)	Measurement displays of noise figure, gain, Y-factor, noise temperature, and tabular results. Single-frequency metering and swept-trace results are available. Support for industry standard noise sources. Measures amplifiers and other non-frequency converting devices plus fixed local-oscillator up and down converters. Performs mask testing to user-defined limits. Built in uncertainty calculator.
Advanced pulse measurements suite (Opt. 20)	Average on power, peak power, average transmitted power, pulse width, rise time, fall time, repetition interval (seconds), repetition interval (Hz), duty factor (%), duty factor (ratio), ripple (dB), ripple (%), overshoot (dB), overshoot (%), droop (dB), droop (%), Pulse-Pulse frequency difference, Pulse-Pulse phase difference, RMS frequency error, max frequency error, RMS phase error, max phase error, frequency deviation, delta frequency, phase deviation, impulse response (dB), impulse response (time), time stamp
General purpose digital modulation analysis (Opt. 21)	Error vector magnitude (EVM) (RMS, peak, EVM vs. time), modulation error ratio (MER), magnitude error (RMS, peak, mag error vs. time), phase error (RMS, peak, phase error vs. time), origin offset, frequency error, gain imbalance, quadrature error, Rho, constellation, symbol table

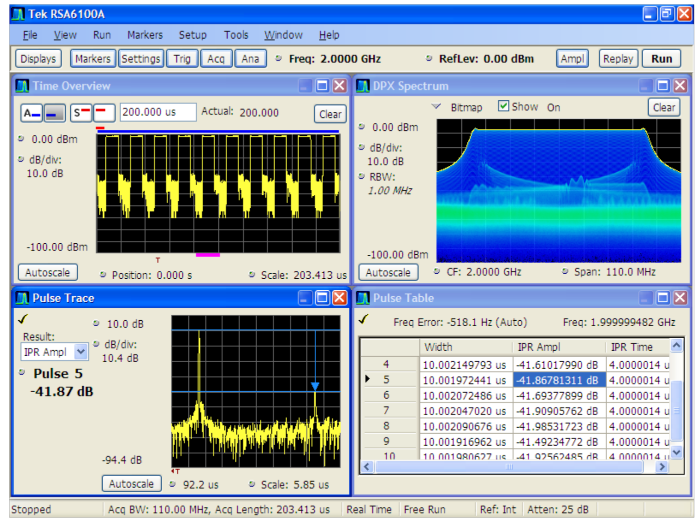
Measurements	Description
DPX Density Measurement	Measures % signal density at any location on the DPX spectrum display and triggers on specified signal density
RSAVu analysis software	W-CDMA, HSUPA. HSDPA, GSM/ EDGE, CDMA2000 1x, CDMA2000 1xEV-DO, RFID, Phase Noise, Jitter, IEEE 802.11 a/b/g/n WLAN, IEEE 802.15.4 OQPSK (Zigbee), audio analysis
Mapping and signal strength (Opt. MAP)	Both manual and automatic drive test are supported by built-in mapping software. Commercial off-the-shelf 3rd party GPS receiver supported via USB or Bluetooth connection. Supports MapInfo format and scanned version maps. Also supports exporting to popular Google Earth and MapInfo map format for post analysis. Signal strength measurement provides both a visual indicator and audible tone of signal strength.
Flexible OFDM Analysis (Opt. 22)	OFDM Analysis for WLAN 802.11a/g/j/p and WiMAX 802.16-2004
WLAN 802.11a/b/g/j/p measurement application (Opt. 23)	All of the RF transmitter measurements as defined in the IEEE standard, as well as a wide range of additional measurements including Carrier Frequency error, Symbol Timing error, Average/peak burst power, IQ Origin Offset, RMS/Peak EVM, and analysis displays, such as EVM and Phase/ Magnitude Error vs. time/frequency or vs. symbols/ subcarriers, as well as packet header decoded information and symbol table.
WLAN 802.11n measurement application (Opt. 24)	
WLAN 802.11ac measurement application (Opt. 25)	
APCO P25 compliance testing and analysis application (Opt. 26)	Complete set of push-button TIA-102 standard based transmitter measurements with pass/fail results including ACPR, transmitter power and encoder attack times, transmitter throughput delay, frequency deviation, modulation fidelity behavior, as well as HCPM transmitter logical channel peak ACPR, off slot power, power envelope and time alignment.
Bluetooth Basic LE TX SIG measurements (Opt. 27)	Presets for transmitter measurements defined by Bluetooth SIG for Basic Rate and Bluetooth Low Energy. Results also include Pass/Fail information. Application also provides packet header field decoding and can automatically detect the standard, including Enhanced Data Rate.



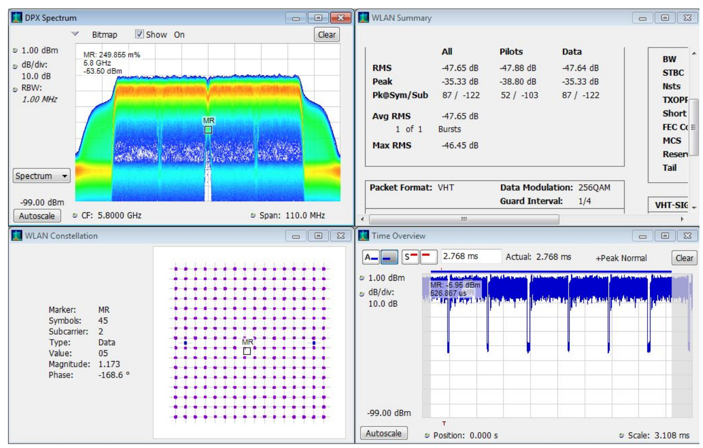
Multi-domain views provide a new level of insight into design or operational problems not possible with conventional analysis solutions. Here vector modulation quality and constellation (Opt. 21) are combined with the continuous monitoring of the DPX® spectrum display.



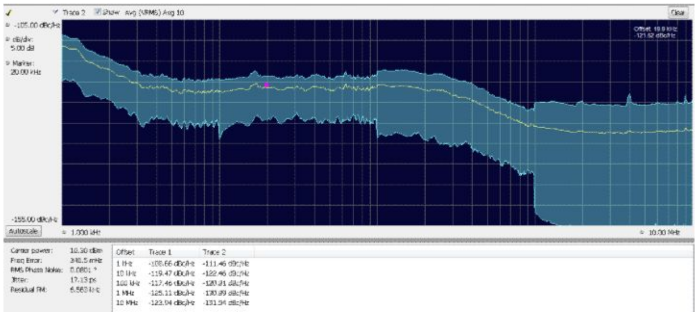
Spurious Search - Up to 20 noncontiguous frequency regions can be defined, each with their own resolution bandwidth, video bandwidth, detector (peak, average, quasi-peak), and limit ranges. Test results can be exported in .CSV format to external programs, with up to 999 violations reported. Spectrum results are available in linear or log scale.



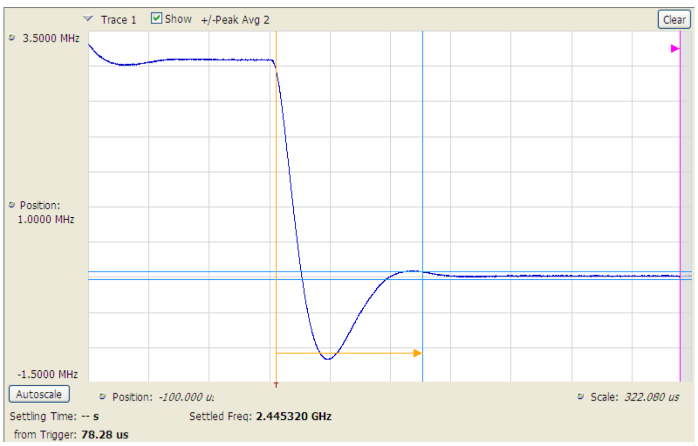
Advanced Signal Analysis package (Opt. 20) offers over 20 automated pulse parameter calculations on every pulse. Easily validate designs with measurements of peak power, pulse width rise time, ripple, droop, overshoot, and pulse-to-pulse phase. Gain insight into linear FM chirp quality with measurements such as Impulse Response and Phase Error. A pulse train (upper left) is seen with automatic calculation of pulse width and impulse response (lower right). A detailed view of the Impulse Response is seen in the lower left, and a DPX® display monitors the spectrum on the upper right.



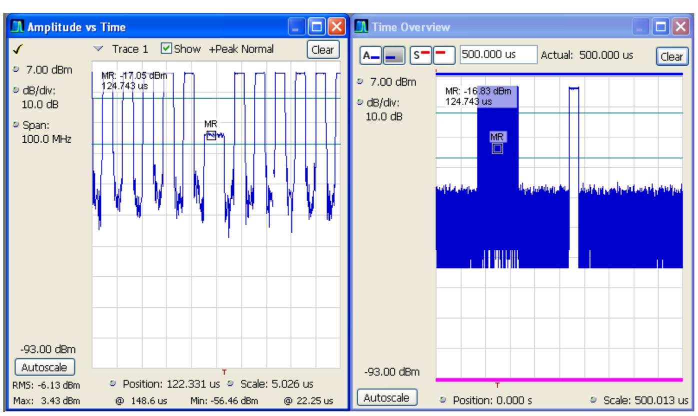
Analysis options for 802.11 standards are available. Here, an 802.11ac 80 MHz signal is analyzed, with displays of constellation, amplitude vs. time, summary of WLAN measurements, and the DPX spectrum of the analyzed signal. The density of the 'shoulders' of the WLAN signal are clearly seen in the DPX display, and a marker was placed on the suppressed center carrier of the signal. An EVM of -47.65 dB and other signal measurements are seen in the summary panel.



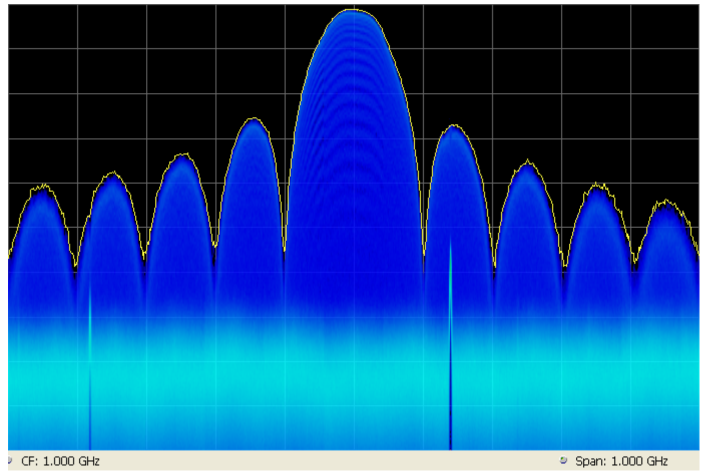
Phase noise and jitter measurements (Opt. 11) adds value to your RSA6000 Series by replacing a conventional phase noise tester for many applications. Phase noise can be measured at carrier offsets up to 1 GHz, and internal phase noise is automatically reduced by optimizing acquisition bandwidths and attenuator settings at each carrier offset for maximum dynamic range. For less critical measurements, speed optimization may be applied for faster results. Typical residual phase noise of -130 dBc/Hz at 1 MHz offset, 18 GHz carrier frequency gives sufficient measurement margin for many applications.



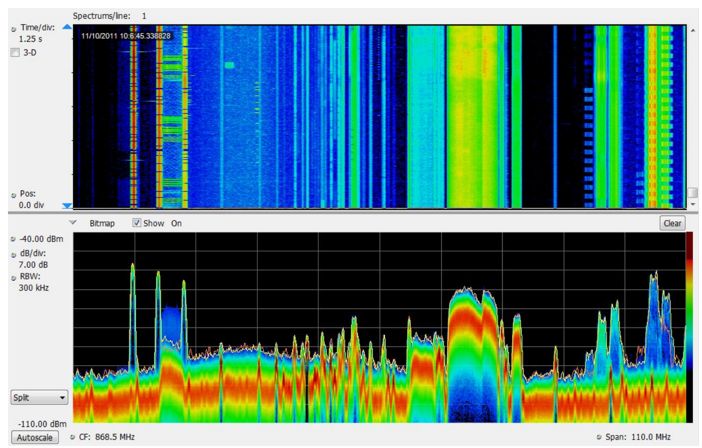
Settling time measurements (Opt. 12) are easy and automated. The user can select measurement bandwidth, tolerance bands, reference frequency (auto or manual), and establish up to 3 tolerance bands vs. time for Pass/Fail testing. Settling time may be referenced to external or internal trigger, and from the last settled frequency or phase. In the illustration, frequency settling time for a hopped oscillator is measured from an external trigger point from the device under test.



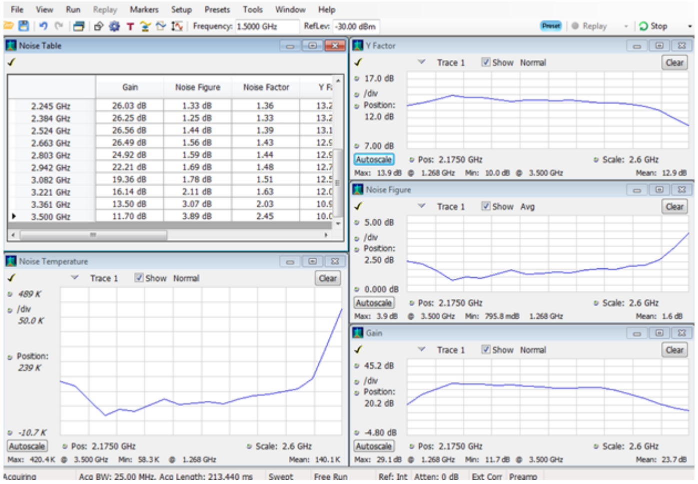
Swept DPX combines the revolutionary DPX Density™ Trigger with the ability to trigger on runt pulses and apply time qualification to any trigger. The runt trigger seen here can be used to track down nonconforming pulses in a pulse train, greatly reducing time to insight. Time qualification can be used to separate ranging pulses from higher resolution pulses in a radar signal, or trigger only on signals that remain on longer than a specified time.



Swept DPX re-invents the way swept spectrum analysis is done, and is included in the base instrument. The DPX engine collects hundreds of thousands of spectrums per second over a 110 MHz bandwidth. Users can now sweep the DPX across the full input range of the RSA6000 Series, up to 20 GHz. Here, we see a DPX sweep of 1 GHz span, revealing two narrow-band spurious under the level of the main pulse signal. In the time a traditional spectrum analyzer has captured one spectrum, the RSA6000 Series has captured orders of magnitude more spectrums. This new level of performance reduces the chance of missing time-interleaved and transient signals during broadband searches.



DPX Spectrograms provide gap-free spectral monitoring for up to days at a time. 60,000 traces can be recorded and reviewed, with resolution per line adjustable from 110 µs to 6400 s.



Noise Figure and Gain measurements (Option 14) help you to quickly and easily measure your device using the RTSA and a noise source. This image shows the measurement summary table with graphs of noise temperature, gain, noise figure and Y-factor.

Specifications

All specifications apply to all models unless noted otherwise.

Model overview

	RSA6106B	RSA6114B	RSA6120B
Frequency range	9 kHz to 6.2 GHz	9 kHz to 14 GHz	9 kHz to 20 GHz
Real-time acquisition bandwidth	40 MHz (110 MHz, Opt. 110)	40 MHz (110 MHz, opt. 110)	40 MHz (110 MHz, opt. 110)
Trigger modes	Free run, triggered, FastFrame	Free run, triggered, FastFrame	Free run, triggered, FastFrame
Trigger types	Power (Std.), Frequency mask (Opt. 52), Frequency edge, DPX density, Runt, Time qualified	Power (Std.), Frequency mask (Opt. 52), Frequency edge, DPX density, Runt, Time qualified	Power (Std.), Frequency mask (Opt. 52), Frequency edge, DPX density, Runt, Time qualified
Acquisition memory	1 GB (4 GB, Opt. 53)	1 GB (4 GB, opt. 53)	1 GB (4 GB, opt. 53)

Standard displays and measurements

For optional displays and measurements, see the individual options sections

DPX®-based measurements on real-time data	DPX Spectrum display (live RF color-graded spectrum)
	DPX Spectrogram (Live spectrograms)
	DPX amplitude vs. time
	DPX frequency vs. time
	DPX phase vs. time
Displays and Measurements from acquisition data	Spectrum (amplitude vs linear or log frequency)
	Spectrogram (amplitude vs. frequency over time of acquisition data)
	Spurious (amplitude vs linear or log frequency)
	Amplitude vs. time
	Frequency vs. time
	Phase vs. time
	Amplitude modulation vs. time
	Frequency modulation vs. time
	Phase modulation vs. time
	RF IQ vs. time
	Time overview
	CCDF
	Peak-to-Average ratio
Frequency offset measurement	Signal analysis can be performed either at center frequency or the assigned measurement frequency up to the limits of the instrument's acquisition and measurement bandwidths
Acquisition replay	Replay entire contents of acquisition memory or subset of acquisitions and frames. history can collect up to 64,000 acquisitions (each containing one or more frames) or 1 GB of sample data, including DPX spectrogram data, whichever limit is reached first

Frequency characteristics

Center frequency setting resolution	0.1 Hz
Frequency marker readout accuracy	±(RE × MF + 0.001 × Span + 2) Hz (RE = Reference frequency error) (MF = Marker frequency (Hz))
Span accuracy	±0.3% (auto mode)
Reference frequency	
Initial accuracy at cal	1×10^{-7} (after 10 minute warm-up)
Aging per day	1×10^{-9} (after 30 days of operation)
Aging per year	5×10^{-8} (first year of operation)
Aging per 10 years	3×10^{-7} (after 10 years of operation)
Temperature drift	2×10^{-8} (0 to 50 °C)
Cumulative error (temperature + aging)	4×10^{-7} (within 10 years after calibration, typical)
Reference output level	>0 dBm (internal reference selected)
Reference output level (loopthrough)	0 dB nominal gain from Ext Ref In to Ref Output, +15 dBm max output
External reference input frequencies	1 to 25 MHz (1 MHz steps) + 1.2288 MHz, 4.8 MHz, 19.6608 MHz, 31.07 MHz
External reference input requirements	
Frequency accuracy	Within $\pm 3 \times 10^{-7}$ of a valid listed input frequency
Spurious	< -80 dBc within 100 kHz offset to avoid on-screen spurious
Input level range	-10 dBm to +6 dBm

Trigger related characteristics

Trigger event source	RF input, Trigger 1 (front panel), Trigger 2 (rear panel), Gated, Line
Trigger setting	Trigger position settable from 1 to 99% of total acquisition length
Trigger combinatorial logic	Trigger 1 AND trigger 2 / gate may be defined as a trigger event
Trigger actions	Save acquisition and/or save picture on trigger

Power level trigger

Level range	0 dB to –100 dB from reference level
Accuracy	For trigger levels >30 dB above noise floor, 10% to 90% of signal level
Level ≥ –50 dB from reference level	±0.5 dB
From < –50 dB to –70 dB from reference level	±1.5 dB
Trigger bandwidth range	At maximum acquisition BW
Standard	4 kHz to 20 MHz + wide open
Opt. 110	11 kHz to 60 MHz + wide open
Trigger position timing uncertainty	
40 MHz acquisition BW, 20 MHz BW	Uncertainty = ±15 ns
110 MHz acquisition BW, 60 MHz BW (Opt 110)	Uncertainty = ±5 ns
Trigger re-arm time, minimum (fast frame on)	
10 MHz acquisition BW	≤25 µs
40 MHz acquisition BW	≤10 µs
110 MHz acquisition BW (Opt. 110)	≤5 µs

Frequency mask trigger (Opt. 52)

Mask shape User defined

Mask point horizontal resolution <0.12% of span

Level range 0 dB to –80 dB from reference level

Level accuracy [1]

0 to –50 dB from reference level ±(Channel response + 1.0 dB)

–50 dB to –70 dB from reference level ±(Channel response + 2.5 dB)

Span range

100 Hz to 40 MHz

100 Hz to 110 MHz (Opt. 110)

Minimum signal duration for 100% probability of trigger at 100% amplitude

Events lasting less than minimum event duration specification will result in degraded frequency mask trigger accuracy.

Opt. 110 SPAN = 110 MHz

FMT RBW	Minimum even duration (µs)	
	Std.	Opt. 09
10 MHz	17.3	3.7
1 MHz	19.5	5.8
100 KHz	37.6	37.6

Std. SPAN = 40 MHz

FMT RBW	Minimum even duration (µs)	
	Std.	Opt 09
5 MHz	17.5	3.9
1 MHz	19.5	5.8
300 KHz	25.1	11.4
100 KHz	37.7	30.9

Trigger position uncertainty

Acquisition bandwidth	Opt. 52 (RBW = Auto)	Opt. 52 plus Opt. 09 (RBW = Auto)
40 MHz	±12.6 µs	±5.8 µs
110 MHz	±9.8 µs	±3 µs

1 For masks >30 dB above noise floor.

Advanced triggers

DPX density trigger	
Density range	0 to 100% density
Horizontal range	0.25 hz to 40 MHz 0.25 Hz to 110 MHz (Opt. 110)
Runt trigger	
Runt definitions	Positive, Negative
Accuracy (for trigger levels >30 dB above noise floor, 10% to 90% of signal level)	±0.5 dB (level ≥ –50 dB from reference level) ±1.5 dB (from < –50 dB to –70 dB from reference level)
Time qualified triggering	
Trigger types and source	Time qualification may be applied to: Level, Frequency mask (Opt. 52), DPX density, Runt, Ext. 1, Ext. 2
Time qualification range	T1: 0 to 10 seconds T2: 0 to 10 seconds
Time qualification definitions	Shorter than T1 Longer than T1 Longer than t1 AND shorter than T2 Shorter than t1 OR longer than t2
Frequency edge trigger	
Range	±(1/2 × (Acq. BW or TDBW if active))
Minimum event duration	25 ns for 40 MHz acquisition BW using no trigger RBW 50 ns for 40 MHz acquisition BW using 20 MHz trigger RBW 9.1 ns for 110 MHz Acq. BW using no RBW 16.7 ns for 110 MHz Acq. BW using 60 MHz trigger RBW .
Timing uncertainty	Same as power trigger position timing uncertainty
Holdoff trigger	
Range	20 ns to 10 seconds

Minimum signal duration

For 100% probability of intercept, full amplitude

110 MHz span

RBW	FFT length	Spectrums /sec	Minimum event duration 100% POI (µs)	
			Base unit	Opt. 09
10000	1024	292,969	17.3	3.7
1000	1024	292,969	19.5	5.8
300	2048	146,484	28.5	14.8
100	4096	73,242	37.6	37.6
30	16384	18,311	134.6	134.6
20	32768	18,311	229.2	229.2

40 MHz span

RBW	FFT length	Spectrums /sec	Minimum event duration 100% POI (µs)	
			Base unit	Opt. 09
5000	1024	292,969	17.5	3.9
1000	1024	292,969	19.4	5.8
300	1024	146,484	25	11.4
100	2048	73,242	37.6	30.8
30	4096	36,621	93.6	93.6
20	8192	18,311	147.3	147.3
10	16384	18,311	194.5	194.5

External trigger 1

Level range -2.5 V to +2.5 V

Level setting resolution 0.01 V

Trigger position timing uncertainty (50 Ω input impedance)

- **MHz acquisition BW, 40 MHz span** Uncertainty = ±20 ns
- **110 MHz acquisition BW, 110 MHz span (Opt. 110)** Uncertainty = ±12 ns

Input impedance Selectable 50 Ω/5 kΩ impedance (nominal)

External trigger 2

Threshold voltage	Fixed, TTL
Input impedance	10 kΩ (nominal)
Trigger state select	High, Low

Acquisition related

A/D converter	100 MS/s 14 bit (optional 300 MS/s, 14 bit, Opt. 110)
Minimum acquisition length	64 samples
Acquisition length setting resolution	1 sample
Fast frame acquisition mode	>64,000 records can be stored in a single acquisition (for pulse measurements and spectrogram analysis)

Memory depth (time) and minimum time domain resolution

Acquisition BW	Sample rate (for I and Q)	Record length	Record length (Opt. 53)	Time resolution
110 MHz (Opt. 110)	150 MS/s	1.79 s	7.15 s	6.6667 ns
60 MHz (Opt. 110)	75 MS/s	3.58 s	14.31 s	13.33 ns
40 MHz	50 MS/s	4.77 s	19.08 s	20 ns
20 MHz	25 MS/s	9.54 s	38.17 s	40 ns
10 MHz	12.5 MS/s	19.08 s	76.35 s	80 ns
5 MHz	6.25 MS/s	38.17 s	152.7 s	160 ns
2 MHz [2]	3.125 MS/s	42.9 s	171.8 s	320 ns
1 MHz	1.56 MS/s	85.8 s	343.5 s	640 ns
500 kHz	781 kS/s	171.7 s	687.1 s	1.28 μs
200 kHz	390 kS/s	343.5 s	1374 s	2.56 μs
100 kHz	195 kS/s	687.1 s	2748 s	5.12 μs
50 kHz	97.6 kS/s	1374 s	5497 s	10.24 μs
20 kHz	48.8 kS/s	2748 s	10955 s	20.48 μs
10 kHz	24.4 kS/s	5497 s	21990 s	40.96 μs
5 kHz	12.2 kS/s	10955 s	43980 s	81.92 μs
2 kHz	3.05 kS/s	43980 s	175921 s	328 μs
1 kHz	1.52 kS/s	87960 s	351843 s	655 μs
500 Hz	762 S/s	175921 s	703687 s	1.31 ms
200 Hz	381 S/s	351843 s	1407374 s	2.62 ms
100 Hz	190 S/s	703686 s	2814749 s	5.24 ms

2 In spans ≤2 MHz, higher resolution data is stored, reducing maximum acquisition time.

Bandwidth related

Resolution bandwidth

Resolution bandwidth range (spectrum analysis)
0.1 Hz to 8 MHz

0.1 Hz to 10 MHz (Opt. 110)

Resolution bandwidth shape
Approximately Gaussian, Shape factor 4.1:1 (60:3 dB) ±10%, typical

Resolution bandwidth accuracy
±1% (auto-coupled RBW mode)

Alternative resolution bandwidth types
Kaiser window (RBW), –6 dB mil, CISPR, Blackman-Harris 4B window, Uniform (none) window, Flat-top (CW ampl.) window, Hanning window

Video bandwidth

Video bandwidth range
1 Hz to 10 MHz plus wide open

RBW/VBW maximum
10,000:1

RBW/VBW minimum
1:1 plus wide open

Resolution
5% of entered value

Accuracy (typical)
±10%

Time domain bandwidth (amplitude vs. time display)

Time domain bandwidth range
At least 1/10 to 1/10,000 of acquisition bandwidth, 1 Hz minimum

Time domain bandwidth shape
≤10 MHz, Approximately Gaussian, Shape factor 4.1:1 (60:3 dB), typical

20 MHz (60 MHz, Opt. 110), Shape factor< 2.5:1 (60:3 dB) typical

Time domain bandwidth accuracy
1 Hz to 10 MHz = 1% (auto-coupled)

20 MHz and 60 MHz = 10%

Minimum settable spectrum analysis RBW vs. span

Frequency span	RBW
>10 MHz	100 Hz
>1 MHz to 10 MHz	10 Hz
>5 kHz to 1 MHz	1 Hz
≤5 kHz	0.1 Hz

Spectrum display traces, detector, and functions

Characteristic	Description
Traces	Three traces + 1 math waveform + 1 trace from spectrogram for spectrum display
Detector	Peak, –Peak, Average, ±Peak, Sample, CISPR (Avg, Peak, Quasi-peak, Average of logs)
Trace functions	Normal, Average, Max hold, Min hold, Average of logs
Spectrum trace length	801, 2401, 4001, 8001, or 10401 points

Minimum FFT length vs. Trace length (independent of span and RBW)

Trace length (points)	Minimum FFT length
801	1024
2401	4096
4001	8192
10401	16384

Resolution BW range vs. span (DPX®)

Acquisition bandwidth	RBW (min)	RBW (max)
110 MHz	20 kHz	10 MHz
55 MHz	10 kHz	5 MHz
40 MHz	10 kHz	3 MHz
20 MHz	5 kHz	2 MHz
10 MHz	2 kHz	1 MHz
5 MHz	1 kHz	500 kHz
2 MHz	500 Hz	200 kHz
1 MHz	200 Hz	100 kHz
500 kHz	100 Hz	50 kHz
200 kHz	50 Hz	20 kHz
100 kHz	20 Hz	10 kHz
50 kHz	10 Hz	5 kHz
20 kHz	5 Hz	2 kHz
10 kHz	2 Hz	1 kHz
5 kHz	0.1 Hz	500 Hz
2 kHz	0.1 Hz	200 Hz
1 kHz	0.1 Hz	100 Hz
500 Hz	0.1 Hz	50 Hz
200 Hz	0.1 Hz	20 Hz
100 Hz	0.1 Hz	10 Hz

Minimum RBW, swept spans 10 kHz

DPX® related

DPX® digital phosphor spectrum processing

Spectrum processing rate (RBW = auto, trace length 801)	292,968/s
DPX bitmap resolution	201 × 801
DPX bitmap color dynamic range	8G (99 dB)
Marker information	Amplitude, frequency, and signal density on the DPX display
Minimum signal duration for 100% probability of detection (Max-hold on)	See table: Minimum signal duration for 100% probability of intercept, full amplitude
Span range (continuous processing)	100 Hz to 40 MHz (110 MHz with opt. 110)
Span range (swept)	Up to instrument frequency range
Dwell time per step	50 ms to 100 s
Trace processing	Color-graded bitmap, +Peak, –Peak, Average
Trace length	801, 2401, 4001, 10401
Resolution BW accuracy	7%

DPX® zero-span amplitude, frequency, phase performance (Nominal)	
Measurement bandwidth range	100 Hz to maximum acquisition bandwidth of instrument
Time domain bandwidth (TDBW) range	At least 1/10 to 1/10,000 of acquisition bandwidth, 1 Hz minimum
Time domain bandwidth (TDBW) accuracy	±1%
Sweep time range	100 ns (minimum)
	1 s (maximum, measurement BW >60 MHz)
	2000 s (maximum, measurement BW ≤60 MHz)
Time accuracy	±(0.5 % + reference frequency accuracy)
Zero-span trigger timing uncertainty (power trigger)	+/-(Zero-span sweep time / 400) at trigger point, for S/N ratio ≥40 dB
DPX frequency display range	±100 MHz maximum
DPX phase display range	±200 degrees maximum, phase-wrapped
	±500G degrees, phase-unwrapped

DPX® spectrogram performance	
Span range	100 Hz to maximum acquisition bandwidth
DPX spectrogram trace detection	+Peak, –Peak, avg (V_{RMS})
DPX spectrogram trace length	801 to 4001
DPX spectrogram memory depth	Trace length = 801: 60,000 traces
	Trace length = 2401: 20,000 traces
	Trace length = 4001: 12,000 traces
Time resolution per line	110 µs to 6400 s, user settable
Maximum recording time vs. line resolution	6.6 seconds (801 points/trace, 110 µs/line) to 4444 days (801 points/trace, 6400 s/line)

Stability

Residual FM	<2 Hz_{p-p} in 1 second (95% confidence, typical)

Phase noise sidebands

dBc/Hz at specified center frequency

CF = 1 GHz

Offset	Specification	Typical
100 Hz	–86	–86
1 kHz	–100	–106
10 kHz	–106	–110
100 kHz	–107	–113
1 MHz	–128	–134
6 MHz	–134	–142
10 MHz	–134	–142

CF = 2 GHz

Offset	Specification	Typical
100 Hz	---	– 80
1 kHz	---	–106
10 kHz	---	–110
100 kHz	---	–111
1 MHz	---	–133
6 MHz	---	–142
10 MHz	---	–142

CF = 6 GHz

Offset	Specification	Typical
100 Hz	---	– 70
1 kHz	---	–96
10 kHz	---	–107
100 kHz	---	–107
1 MHz	---	–132
6 MHz	---	–142
10 MHz	---	–142

CF = 10 GHz (RSA6114B)

Offset	Specification	Typical
100 Hz	---	– 64
1 kHz	---	–91
10 kHz	---	–106
100 kHz	---	–106
1 MHz	---	–132
6 MHz	---	–142
10 MHz	---	–142

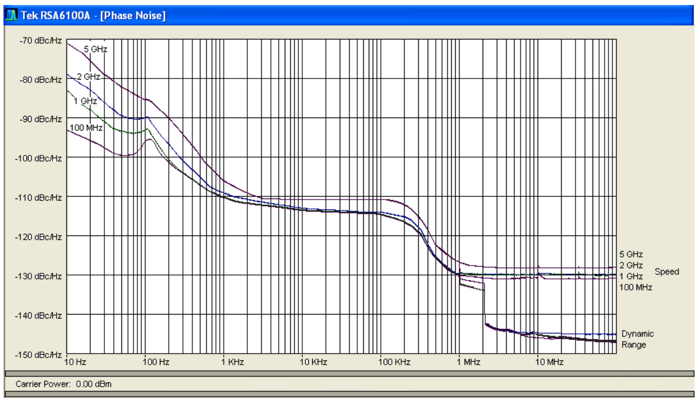
CF = 10 GHz (RSA6120B)

Offset	Specification	Typical
100 Hz	---	– 77
1 kHz	---	–95
10 kHz	---	–111
100 kHz	---	–112
1 MHz	---	–130
6 MHz	---	–142
10 MHz	---	–142

CF = 18 GHz (RSA6120B)

Offset	Specification	Typical
100 Hz	---	– 70
1 kHz	---	–93
10 kHz	---	–108
100 kHz	---	–111
1 MHz	---	–130
6 MHz	---	–142
10 MHz	---	–142

Typical phase noise performance as measured by Opt. 11.



Amplitude

Measurement range	Displayed average noise level to maximum measurable input
Input attenuator range	0 dB to 55 dB, 5 dB step
Maximum safe input level	
Average continuous (RF ATT ≥10 dB, preamp off)	+30 dBm
Average continuous (RF ATT ≥10 dB, preamp on)	Option 50 preamp on: +20 dBm Option 51 preamp on: +30 dBm
Maximum measurable input level	
Average continuous	+30 dBm (RF ATT: Auto)
Pulsed RF	10 W (RF Input, RF ATT: Auto, PW <10 μs, 1% duty cycle repetitive pulses)
Max DC voltage	±40 V
Log display range	0.01 dBm/div to 20 dB/div
Display divisions	10 divisions
Display units	dBm, dBmV, Watts, Volts, Amps, dBuW, dBuV, dBuA, dBW, dBV, dBV/m, and dBA/m
Marker readout resolution, dB units	0.01 dB
Marker readout resolution, Volts units	Reference-level dependent, as small as 0.001 μV
Reference level setting range	0.1 dB step, –170 dBm to +50 dBm (minimum ref. level –50 dBm at center frequency <80 MHz)
Level linearity	±0.1 dB (0 to –70 dB from reference level)

Frequency response

18 °C to 28 °C, atten. = 10 dB, preamp off

Range	Response
10 MHz - 3 GHz	±0.5 dB
>3 GHz - 6.2 GHz	±0.8 dB
>6.2 GHz - 14 GHz (RSA6114B)	±1.0 dB
>6.2 GHz - 20 GHz (RSA6120B)	±1.0 dB

5 °C to 50 °C, all attenuator settings (Typical)

Range	Response
9 kHz - 3 GHz	±0.7 dB
>3 GHz - 6.2 GHz	±0.8 dB
>6.2 GHz - 14 GHz (RSA6114B)	±2.0 dB
>6.2 GHz - 20 GHz (RSA6120B)	±2.0 dB

RSA6106B Preamp (Opt. 50) On (Atten. = 10 dB)

Range	Response
1 MHz - 6.2 GHz	±2.0 dB

RSA6114B and RSA6120B Preamp (Opt. 51) On (Atten. = 10 dB)

Range	Response
100 kHz - 8 GHz	±1.5 dB
8 GHz - 14 GHz	±3 dB
14 GHz - 20 GHz (RSA6120B only)	±3 dB

Amplitude accuracy

Specifications excluding mismatch error.

Absolute amplitude accuracy at calibration point	±0.31 dB (100 MHz, –10 dBm signal, 10 dB ATT, 18 °C to 28 °C)
Input attenuator switching uncertainty	±0.2 dB
Absolute amplitude accuracy at center frequency, 95% confidence [3]	
10 MHz to 3 GHz	±0.5 dB
3 GHz to 6.2 GHz	±0.8 dB
6.2 GHz to 20 GHz	±1.5 dB
VSWR	Atten. = 10 dB, preamp off, CF set within 200 MHz of VSWR test frequency
10 MHz to 4 GHz	<1.5:1
4 GHz to 6.2 GHz	<1.6:1
6.2 GHz to 14 GHz (RSA6114B only)	<1.9:1
6.2 GHz to 20 GHz (RSA6120B only)	<1.9:1

3 18 °C to 28 °C, Ref Level ≤ -15 dBm, Attenuator Auto-coupled, Signal Level -15 dBm to -50 dBm. 10 Hz ≤ RBW ≤ 1 MHz, after alignment performed.

VSWR with preamp	Atten. = 10 dB, preamp on, CF set within 200 MHz of VSWR test frequency
10 MHz to 6.2 GHz (RSA6106B only)	<1.5:1
10 MHz to 4 GHz	<1.5:1
4 GHz to 6.2 GHz	<1.6:1
6.2 GHz to 14 GHz (RSA6114B only)	<1.9:1
6.2 GHz to 20 GHz (RSA6120B only)	<1.9:1

Noise and distortion characteristics

3rd order intermodulation distortion, typical [4] [5]

RSA6106B, RSA6114B

Frequency	3rd order intermodulation distortion, dBc	3rd order intercept, dBm
9 kHz to 100 MHz	-77	13.5
100 MHz to 3 GHz	-80	15
3 GHz to 6.2 GHz	-84	17
6.2 GHz to 14 GHz	-84	17

RSA6120B

9 kHz to 100 MHz	-79	14.5
100 MHz to 3 GHz	-90	20
3 GHz to 6.2 GHz	-88	19
6.2 GHz to 20 GHz	-88	19

2nd harmonic distortion

Frequency	2nd Harmonic Distortion, Typical
10 MHz to 3.1 GHz [6]	< –80 dBc
>3.1 GHz to 7 GHz (RSA6114B) [6]	< –80 dBc
>3.1 GHz to 10 GHz [7] (RSA6120B)	< –80 dBc

4 Each Signal Level -25 dBm, Ref Level -20 dBm, Attenuator = 0 dB, 1 MHz tone separation.

5 3rd order intercept point is calculated from 3rd order intermodulation performance.

6 -40 dBm at RF input, Attenuator = 0, Preamp Off, typical.

7 < -80 dBc, -25 dBm at RF input, Atten = 0, Preamp OFF, Maximize Dynamic Range "RF & IF Optimization" mode.

Displayed average noise level, Preamp off [8]

General

Frequency	Specification	Typical
9 kHz to 10 MHz	-99 dBm/Hz	-102 dBm/Hz
>10 MHz to 100 MHz	-149 dBm/Hz	-151 dBm/Hz
>100 MHz to 2.3 GHz	-151 dBm/Hz	-153 dBm/Hz
>2.3 GHz to 4 GHz	-149 dBm/Hz	-151 dBm/Hz
>4 GHz to 6.2 GHz	-145 dBm/Hz	-147 dBm/Hz

RSA6114B only

Frequency	Specification	Typical
6.2 GHz to 7 GHz	-145 dBm/Hz	-147 dBm/Hz
7 GHz to 10 GHz	-137 dBm/Hz	-139 dBm/Hz
10 GHz to 14 GHz	-135 dBm/Hz	-139 dBm/Hz

RSA6120B Only

Frequency	Specification	Typical
>6.2 GHz to 8.2 GHz	-145 dBm/Hz	-147 dBm/Hz
>8.2 GHz to 15 GHz	-149 dBm/Hz	-152 dBm/Hz
>15 GHz to 17.5 GHz	-145 dBm/Hz	-147 dBm/Hz
>17.5 GHz to 20 GHz	-143 dBm/Hz	-145 dBm/Hz

Preamplifier performance RSA6106B (Opt. 50)

Frequency range 1 MHz to 6.2 GHz

Noise figure at 6.2 GHz <6 dB at 10 GHz

Gain 20 dB at 2 GHz

ESD protection level 1 kV (human body model)

Preamplifier performance RSA6114B and RSA6120B (Opt. 51)

Frequency range 100 kHz to 14 GHz (RSA6114B)

100 kHz to 20 GHz (RSA6120B)

Noise figure at 10 GHZ <6 dB at 10 GHz

Gain 30 dB at 10 GHz

ESD protection level 500 V (Human Body Model)

Displayed average noise level, [9] **preamp on (RSA6106B, Opt.50**

Frequency	Specification	Typical
1 MHz to 10 MHz	–159 dBm/Hz	–162 dBm/Hz
10 MHz to 1 GHz	–165 dBm/Hz	–168 dBm/Hz
1 GHz to 4 GHz	–164 dBm/Hz	–167 dBm/Hz
4 GHz to 6.2 GHz	–163 dBm/Hz	–166 dBm/Hz

8 Measured using 1 kHz RBW, 100 kHz span, 100 averages, Best Noise mode, input terminated, Average of Logs detection.

9 Measured using 1 kHz RBW, 100 kHz span, 100 averages, Best Noise mode, input terminated, Average of Log detection.

Displayed average noise level,[10] preamp on (RSA6114B and RSA6120B, Opt. 51)

Frequency	Specification	Typical
100 kHz to 2 MHz	–122 dBm/Hz	–133 dBm/Hz
2 MHz to 5 MHz	–140 dBm/Hz	–151 dBm/Hz
5 MHz to 15 MHz	–145 dBm/Hz	–155 dBm/Hz
15 MHz 50 MHz	–152 dBm/Hz	–160 dBm/Hz
50 MHz to 150 MHz	–160 dBm/Hz	–166 dBm/Hz
150 MHz to 4 GHz	–164 dBm/Hz	–168 dBm/Hz
4 GHz to 14 GHz	–162 dBm/Hz	–166 dBm/Hz
14 GHz to 17.5 GHz	–160 dBm/Hz	–165 dBm/Hz
17.5 GHz to 20 GHz	–159 dBm/Hz	–163 dBm/Hz

Residual response[11]

40 MHz to 200 MHz	-90 dBm
>200 MHz to 6.2 GHz (RSA6106B)	-95 dBm -110 dBm (typical)
>200 MHz to 14 GHz (RSA6114B)	-95 dBm (typical)
>200 MHz to 20 GHz (RSA6120B)	-95 dBm -110 dBm (typical)

Image response[12]

9 kHz to 6.2 GHz	< -80 dBc
6.2 GHz to 8 GHz (RSA6114B/ RSA6120B)	< -80 dBc
>8 GHz to 14 GHz (RSA6114B)	< -76 dBc
>6.2 GHz to 20 GHz (RSA6120B)	< -76 dBc

Spurious response with signal[13]

Frequency	Span ≤ 40 MHz		Opt. 110	
	Swept spans >40 MHz		40 MHz < span ≤ 110 MHz	
	Specification	Typical	Specification	Typical
30 MHz to 6.2 GHz	-73 dBc	-78 dBc	-73 dBc	-75 dBc
≥6.2 GHz to 14 GHz (RSA6114B)	-70 dBc	-75 dBc	-70 dBc	-75 dBc
>6.2 GHz to 20 GHz (RSA6120B)	-70 dBc	-75 dBc	-70 dBc	-75 dBc

Spurious response with signal at 4.75 GHz

< 62 dBc

(CF 9 kHz to 8 GHz, Ref = -30 dBm, Atten = 10 dB, RBW = 1 kHz)

Signal frequency range = 4.7225 to 4.7775 GHz, RF input level = -30 dBm

Local oscillator feed-through to input connector

< -65 dBm

(typical, attenuator = 10 dB)

10 Measured using 1 kHz RBW, 100 kHz span, 100 averages, Best Noise mode, input terminated, Average of Logs detection.

11 Input terminated, RBW = 1 kHz, Attenuator = 0 dB.

12 Ref = -30 dBm, Attenuator = 10 dB, RF Input Level = -30 dBm, RBW = 10 Hz.

13 RF Input Level = -15 dBm, Attenuator = 10 dB, Offset ≥400 kHz, Mode: Auto. Input signal at center frequency. Performance level for signals offset from center frequency typically the same.

Adjacent channel leakage ratio dynamic range [14]

3GPP downlink, 1 DPCH

Measurement mode	ACLR, typical	
	Adjacent	Alternate
Uncorrected	-70 dB	-70 dB
Noise corrected	-79 dB	-79 dB

3GPP TM1 64 channel

Measurement mode	ACLR, typical	
	Adjacent	Alternate
Uncorrected	-69 dB	-69 dB
Noise corrected	-78 dB	-78 dB

IF frequency response and phase linearity [15]

Frequency range (GHz)	Acq. bandwidth	Specification	Amplitude/phase (typical, RMS)
0.01 to 6.2 [16]	≤300 kHz	±0.10 dB	0.05 dB/0.1°
0.03 to 6.2	≤40 MHz	±0.30 dB	0.20 dB/0.5°
>6.2 to 14 (RSA6114B)	≤300 kHz	±0.10 dB	0.05 dB/0.1°
>6.2 to 14 (RSA6114B)	≤40 MHz	±0.50 dB	0.40 dB/1.0°
>6.2 to 20 (RSA6120B)	≤300 kHz	±0.10 dB	0.05 dB/0.1°
>6.2 to 20 (RSA6120B)	≤40 MHz	±0.50 dB	0.40 dB/1.0°

Opt. 110

Frequency range (GHz)	Acq. bandwidth	Specification	Amplitude/phase (typical, RMS)
0.07 to 3.0	≤110 MHz	±0.50 dB	0.30 dB/1.0°
>3 to 6.2	≤110 MHz	±0.50 dB	0.40 dB/1.0°
>6.2 to 14 (RSA6114B)	≤80 MHz	±0.75 dB	0.70 dB/1.5°
>6.2 to 14 (RSA6114B)	≤110 MHz	±1.0 dB	0.70 dB/1.5°
>6.2 to 20 (RSA6120B)	≤80 mHz	±0.75 dB	0.70 dB/1.5° 0.05 dB/0.1°
>6.2 to 20 (RSA6120B)	≤110 MHz	±1.0 dB	0.70 dB/1.5°

14 Measured with test signal amplitude adjusted for optimum performance. (CF = 2.13 GHz)

15 Amplitude flatness and phase deviation over the acquisition BW, includes RF frequency response. Attenuator Setting: 10 dB.

16 High Dynamic Range mode selected.

Analog IF and Digital IQ output (Opt. 05)

Analog IF

Frequency 500 MHz

Output frequency varies±1 MHz with changes in center frequency. Sidebands may be frequency inverted from input, depending on center frequency

Output level +3 to -10 dBm for peak signal level of -20 dBm at RF mixer (typical)

Characteristic	Description
Filter control	Wide open (square top) or 60 MHz Gaussian
Bandwidth (wide open)	>150 MHz (typical)
Bandwidth (Gaussian)	60 MHz, gaussian to –12 dB

Digital IQ output

Connector type MDR (3M) 50 pin × 2

Data output Data is corrected for amplitude and phase response in real time

Data format	Specification
I data	16 bit LVDS
Q data	16 bit LVDS

Control output Clock: LVDS, 150 MHz - Acquisition Bandwidth >40 MHz, 50 MHz - Acquisition Bandwidth ≤40 MHz, DV (Data Valid), MSW (Most Significant Word) indicators, LVDS

Control input IQ data output enabled, connecting GND enables output of IQ data

Clock rising edge to data transition time (hold time) 8.4 ns (typical, standard), 1.58 ns (typical, Opt. 110)

Data transition to clock rising edge (setup time) 8.2 ns (typical, standard), 1.54 ns (typical, Opt. 110)

AM/FM/PM and direct audio measurements (Opt. 10)

Available displays Audio spectrum, Audio measurements summary

Analog demodulation

Carrier frequency range (for modulation and audio measurements) 9 kHz or (1/2 × Audio Analysis Bandwidth) to maximum input frequency. Distortion and noise performance reduced below 30 MHz

Maximum audio frequency span 10 MHz

Audio filters

Low pass (kHz) 0.3, 3, 15, 30, 80, 300, and user-entered up to 0.9 × audio bandwidth

High pass (Hz) 20, 50, 300, 400, and user-entered up to 0.9 × audio bandwidth

Standard CCITT, C-Message

De-emphasis (μs) 25, 50, 75, 750, and user-entered

File User-supplied .TXT or .CSV file of amplitude/frequency pairs. Maximum 1000 pairs

FM Modulation Analysis (Modulation Index >0.1)	
FM measurements	Carrier Power, Carrier Frequency Error, Audio Frequency, Deviation (+Peak, -Peak, Peak-Peak/2, RMS), SINAD, Modulation Distortion, S/N, Total Harmonic Distortion, Total Non-harmonic Distortion, Hum and Noise
Carrier power accuracy (10 MHz to 2 GHz, -20 to 0 dBm input power)	±0.85 dB
Carrier frequency accuracy (deviation: 1 to 10 kHz)	±0.5 Hz + (transmitter frequency × reference frequency error)
FM deviation accuracy (rate: 1 kHz to 1 MHz)	±(1% of (rate + deviation) + 50 Hz)
FM rate accuracy (deviation: 1 to 100 kHz)	±0.2 Hz
Residuals (FM) (rate: 1 to 10 kHz, deviation: 5 kHz)	
THD	0.10%
Distortion	0.7%
SINAD	43 dB
AM modulation analysis	
AM measurements	Carrier Power, Audio Frequency, Modulation Depth (+Peak, –Peak, Peak-Peak/2, RMS), SINAD, Modulation Distortion, S/N, Total Harmonic Distortion, Total Non-harmonic Distortion, Hum and Noise
Carrier power accuracy (10 MHz to 2 GHz, –20 to 0 dBm input power)	±0.85 dB
AM depth accuracy (rate: 1 to 100 kHz, depth: 10% to 90%)	±0.2% + 0.01 × measured value
AM rate accuracy (rate: 1 kHz to 1 MHz, depth: 50%)	±0.2 Hz
Residuals (AM) (rate: 1 to 100 kHz, depth: 50%)	
THD	0.16%
Distortion	0.13%
SINAD	58 dB
PM modulation analysis	
PM measurements	Carrier Power, Carrier Frequency Error, Audio Frequency, Deviation (+Peak, -Peak, Peak-Peak/2, RMS), SINAD, Modulation Distortion, S/N, Total Harmonic Distortion, Total Non-harmonic Distortion, Hum and Noise
Carrier power accuracy (10 MHz to 2 GHz, -20 to 0 dBm input power)	±0.85 dB
Carrier frequency accuracy (deviation: 0.628 rad)	±0.02 Hz + (transmitter frequency × reference frequency error)
PM deviation accuracy (rate: 10 to 20 kHz, deviation: 0.628 to 6 rad)	±100% × (0.005 + (rate / 1 MHz))
PM rate accuracy (rate: 1 to 10 kHz, deviation: 0.628 rad)	±0.2 Hz

Residuals (PM) (rate: 1 to 10 kHz, deviation: 0.628 rad)	
THD	0.1%
Distortion	1%
SINAD	40 dB
Direct audio input	Direct input (unmodulated) audio measurements are limited by the low-frequency input range of 9 kHz in the RSA6000 Series.
Audio measurements	Signal Power, Audio Frequency (+Peak, -Peak, Peak-Peak/2, RMS), SINAD, Modulation Distortion, S/N, Total Harmonic Distortion, Total Non-harmonic Distortion, Hum and Noise
Direct input frequency range (for audio measurements only)	9 kHz to 10 MHz
Maximum audio frequency span	10 MHz
Audio frequency accuracy	±0.2 Hz
Signal power accuracy	±1.5 dB
Residuals (rate: 10 kHz, input level: 1.0 V)	
THD	0.1%
Distortion	0.8%
SINAD	42 dB

Phase noise and jitter measurements (Opt. 11)

Available displays	Phase noise vs. frequency, log-frequency scale
Carrier frequency range	30 MHz to maximum instrument frequency – less selected frequency offset range
Measurements	Carrier power, Frequency error, RMS phase noise, Jitter (time interval error), Residual FM
Residual Phase Noise	See Phase noise specifications
Phase noise and jitter integration bandwidth range	Minimum offset from carrier: 10 Hz Maximum offset from carrier: 1 GHz
Number of traces	2
Trace and measurement functions	Detection: average or ±Peak Smoothing Averaging Optimization: speed or dynamic range

Settling time, frequency, and phase (Opt. 12)[17]

Available displays Frequency settling vs. time, Phase settling vs. time

Settled frequency uncertainty, 95% confidence (typical), at stated measurement frequencies, bandwidths, and # of averages

Measurement frequency: 1 GHz

Averages	Frequency uncertainty at stated measurement bandwidth			
	110 MHz	**10 MHz**	**1 MHz**	**100 kHz**
Single measurement	2 kHz	100 Hz	10 Hz	1 Hz
100 averages	200 Hz	10 Hz	1 Hz	0.1 Hz
1000 averages	50 Hz	2 Hz	1 Hz	0.05 Hz

Measurement frequency: 10 GHz

Averages	Frequency uncertainty at stated measurement bandwidth			
	110 MHz	**10 MHz**	**1 MHz**	**100 kHz**
Single measurement	5 kHz	100 Hz	10 Hz	5 Hz
100 averages	300 Hz	10 Hz	1 Hz	0.5 Hz
1000 averages	100 Hz	5 Hz	0.5 Hz	0.1 Hz

Measurement frequency: 20 GHz

Averages	Frequency uncertainty at stated measurement bandwidth			
	110 MHz	**10 MHz**	**1 MHz**	**100 kHz**
Single measurement	2 kHz	100 Hz	10 Hz	5 Hz
100 averages	200 Hz	10 Hz	1 Hz	0.5 Hz
1000 averages	100 Hz	5 Hz	0.5 Hz	0.2 Hz

17 Measured input signal level > -20 dBm, Attenuator: Auto.

Settled phase uncertainty, 95% confidence (typical), at stated measurement frequencies, bandwidths, and # of averages

Measurement frequency: 1 GHz

Averages	Phase uncertainty at stated measurement bandwidth		
	110 MHz	10 MHz	1 MHz
Single measurement	1.00°	0.50°	0.50°
100 averages	0.10°	0.05°	0.05°
1000 averages	0.05°	0.01°	0.01°

Measurement frequency: 10 GHz

Averages	Phase uncertainty at stated measurement bandwidth		
	110 MHz	10 MHz	1 MHz
Single measurement	1.5°	1.00°	0.50°
100 averages	0.20°	0.10°	0.05°
1000 averages	0.10°	0.05°	0.02°

Measurement frequency: 20 GHz

Averages	Phase uncertainty at stated measurement bandwidth		
	110 MHz	10 MHz	1 MHz
Single measurement	1.00°	0.50°	0.50°
100 averages	0.10°	0.05°	0.05°
1000 averages	0.05°	0.02°	0.02°

Gain and Noise Figure (Option 14)

Measurements (tabular)	Noise Figure, Gain, Y-Factor, Noise Temperature, P-Hot, P-Cold
Measurements (displays)	Noise Figure, Gain, Y-Factor, Noise Temperature, Uncertainty Calculator
Single frequency measurements	When Single Frequency mode is selected, each display acts as a meter and single-value readout for each selected trace in the measurement
Measurement configurations	Direct, Up-Converter, Down-Converter
Frequency modes	Single Frequency, Swept (Center+Span or Start-Stop), Frequency Table; 1 to 999 measurement points
Noise source	Constant ENR or tabular entry; entry fields for noise source model and type
Noise sources supported	NoiseCom NC346 series and similar models from other manufacturers
Noise source control	+28 V switched output, rear panel
External gain/loss tables	3 tables or constants available for gain or loss
Measurement control settings	Source settling time, reference temperature, RBW(50 Hz to 10 MHz), Average count(1 to 100)
Instrument input control settings	Attenuator value, Preamp On/Off
Trace controls	3 traces per display: Ave(V_{RMS}), Max-hold, Min-hold trace functions
Display scaling	Auto or manual: Auto resets scale after each measurement
Markers	Up to 5 markers on any trace; Absolute and Delta marker functions

Limit mask testing	Positive and negative limits may be applied to noise figure, gain, Y-factor traces; limits and Pass/Fail indicated on screen
Uncertainty calculator	Provides noise figure and gain measurement uncertainty based on user-entered values for ENR, external preamp, external preamp, and spectrum analyzer parameters
Application preset for Noise Figure and Gain	Sets the analyzer to measure Gain, Noise Figure, and the Measurement Table. Sets attenuation to zero, preamplifier ON, and acquisition mode to best for minimum noise

Performance

Specification	Description
Frequency range	10 MHz to maximum frequency of instrument (nominal)
Noise figure measurement range	0 to 30 dB (nominal)
Gain measurement range	-10 to 30 dB (nominal)
Noise figure and gain measurement resolution	0.01 dB (nominal)
Noise figure measurement error	±0.1 dB (typical) [18]
Gain measurement error	±0.1 dB (typical) [18]

Note: These conditions for Noise Figure and Gain specifications apply: Operating temperature 18 to 28 deg. C, after 20 minute warmup with internal preamp ON, immediately after internal alignment. Specified error includes only the error of the spectrum analyzer. Uncertainty from errors in ENR source level, external amplifier gain, low SN ratio and measurement system mismatch are not included, and can all be estimated using the uncertainty calculator included in the software.

Advanced measurement suite (Opt. 20)

Available displays	Pulse results table, Pulse trace (selectable by pulse number), Pulse statistics (trend of pulse results, FFT of trend, and histogram)
Measurements	Average on power, Peak power, Average transmitted power, Pulse width, Rise time, Fall time, Repetition interval (seconds), Repetition rate (Hz), Duty factor (%), Duty factor (ratio), Ripple (dB), Ripple (%), Droop (dB), Droop (%), Overshoot (dB), Overshoot (%), Pulse-Pulse frequency difference, Pulse-Pulse phase difference, RMS frequency error, Max frequency error, RMS phase error, Max phase error, Frequency deviation, Phase deviation, Impulse response (dB), Impulse response (time), Time stamp
Minimum pulse width for detection	150 ns (standard), 50 ns (Opt. 110)
Number of pulses	1 to 10,000
System rise time (typical)	<25 ns (standard), <10 ns (Opt. 110)
Pulse measurement accuracy	Signal conditions: Unless otherwise stated, pulse width >450 ns (150 ns, Opt. 110), S/N ratio ≥30 dB, duty cycle 0.5 to 0.001, temperature 18 °C to 28 °C
Impulse response	Measurement range: 15 to 40 dB across the width of the chirp Measurement accuracy (typical): ±2 dB for a signal 40 dB in amplitude and delayed 1% to 40% of the pulse chirp width [19]
Impulse response weighting	Taylor window

18 For (ENR of noise source) > (measured noise figure + 4 dB)

19 Chirp width 100 MHz, pulse width 10 μs, minimum signal delay 1% of pulse width or 10/(chirp bandwidth), whichever is greater, and minimum 2000 sample points during pulse on-time.

Pulse measurement performance

Pulse amplitude and timing

Measurement	Accuracy (Typical)
Average On Power [20]	±0.3 dB + absolute amplitude accuracy
Average Transmitted Power [21]	±0.4 dB + absolute amplitude accuracy
Peak Power [22]	±0.4 dB + absolute amplitude accuracy
Pulse Width	±3% of reading
Duty Factor	±3% of reading

Frequency and phase error referenced to nonchirped signal

At stated frequencies and measurement bandwidths, [23] typical.

20 MHz bandwidth

Center frequency	Abs. freq err (RMS)	Pulse-pulse freq	Pulse-pulse phase
2 GHz	±5 kHz	±13 kHz	±0.3°
10 GHz	±5 kHz	±40 kHz	±0.6°
20 GHz	±8 kHz	±60 kHz	±1.3°

40 MHz bandwidth

Center frequency	Abs. freq err (RMS)	Pulse-pulse freq	Pulse-pulse phase
2 GHz	±10 kHz	±30 kHz	±.35°
10 GHz	±10 kHz	±50 kHz	±0.75°
20 GHz	±20 kHz	±60 kHz	±1.3°

60 MHz bandwidth (Opt. 110)

Center frequency	Abs. freq err (RMS)	Pulse-pulse freq	Pulse-pulse phase
2 GHz	±30 kHz	±70 kHz	±0.5°
10 GHz	±30 kHz	±150 kHz	±0.75°
20 GHz	±50 kHz	±275 kHz	±1.5°

110 MHz bandwidth (Opt. 110)

Center frequency	Abs. freq err (RMS)	Pulse-pulse freq	Pulse-pulse phase
2 GHz	±50 kHz	±170 kHz	±0.6°
10 GHz	±50 kHz	±150 kHz	±0.75°
20 GHz	±100 kHz	±300 kHz	±1.5°

20 Pulse Width >300 ns (100 ns, Opt. 110).

21 Pulse Width >300 ns (100 ns, Opt. 110).

22 Pulse Width >300 ns (100 ns, Opt. 110).

23 Pulse ON Power ≥ -20 dBm, signal peak at Reference Level, Attenuator = Auto, t_{meas} - $t_{reference}$ ≤ 10 ms, Frequency Estimation: Manual. Pulse-to-Pulse Measurement time position excludes the beginning and ending of the pulse extending for a time = (10 / Measurement BW) as measured from 50% of the $t_{(rise)}$ or $t_{(fall)}$. Absolute Frequency Error determined over center 50% of pulse.

Frequency and phase error referenced to a linear chirp

At stated frequencies and measurement bandwidths [24], typical. Signal type: Linear Chirp, Peak-to-Peak Chirp Deviation: ≤0.8 Measurement BW.

20 MHz bandwidth

Center frequency	Abs. freq err (RMS)	Pulse-pulse freq	Pulse-pulse phase
2 GHz	±10 kHz	±25 kHz	±0.4°
10 GHz	±15 kHz	±30 kHz	±0.9°
20 GHz	±25 kHz	±50 kHz	±1.8°

40 MHz bandwidth

Center frequency	Abs. freq err (RMS)	Pulse-pulse freq	Pulse-pulse phase
2 GHz	±12 kHz	±40 kHz	±0.4°
10 GHz	±15 kHz	±50 kHz	±1.0°
20 GHz	±30 kHz	±130 kHz	±2.0°

60 MHz bandwidth (Opt. 110)

Center frequency	Abs. freq err (RMS)	Pulse-pulse freq	Pulse-pulse phase
2 GHz	±60 kHz	±130 kHz	±0.5°
10 GHz	±60 kHz	±150 kHz	±1.0°
20 GHz	±75 kHz	±200 kHz	±2.0°

110 MHz bandwidth (Opt. 110)

Center frequency	Abs. freq err (RMS)	Pulse-pulse freq	Pulse-pulse phase
2 GHz	±75 kHz	±275 kHz	±0.6°
10 GHz	±75 kHz	±300 kHz	±1.0°
20 GHz	±125 kHz	±500 kHz	±2.0°

Digital modulation analysis (Opt. 21)

Available displays

Constellation diagram, EVM vs. time, Symbol table (binary or hexadecimal), Magnitude and phase error versus time, and signal quality, Demodulated IQ vs. time, Eye diagram, Trellis diagram, Frequency deviation vs. time

Modulation formats

π/2DBPSK, BPSK, SBPSK, QPSK, DQPSK, π/4DQPSK, D8PSK, D16PSK, 8PSK, OQPSK, SOQPSK, CPM, 16/32-APSK, 16/32/64/128/256QAM, MSK, GMSK, 2-FSK, 4-FSK, 8-FSK, 16-FSK, C4FM

Analysis period

Up to 81,000 samples

Filter types

Measurement filters

Square-root raised cosine, Raised cosine, Gaussian, Rectangular, IS-95, IS-95 EQ, C4FM-P25, Half-sine, None, User defined

Reference filters

Raised cosine, Gaussian, Rectangular, IS-95, SBPSK-MIL, SOQPSK-MIL, SOQPSK-ARTM, none, user defined

Alpha/B*T range

0.001 to 1, 0.001 step

Measurements

Constellation, Error vector magnitude (EVM) vs. Time, Modulation error ratio (MER), Magnitude error vs. Time, Phase error vs. Time, Signal quality, Symbol table, Rho

FSK only: Frequency deviation, Symbol timing error

Symbol rate range

1 kS/s to 100 MS/s (modulated signal must be contained entirely within acquisition BW of the instrument)

24 Pulse ON Power ≥ -20 dBm, signal peak at Reference Level, Attenuator = Auto, t_{meas} - $t_{reference}$ ≤ 10 ms, Frequency Estimation: Manual. Pulse-to-Pulse Measurement time position excludes the beginning and ending of the pulse extending for a time = (10 / Measurement BW) as measured from 50% of the $t_{(rise)}$ or $t_{(fall)}$. Absolute Frequency Error determined over center 50% of pulse.

Digital (Opt. 21)

QPSK residual EVM (typical) [25]

100 kS/s	<0.5%
1 MS/s	<0.5%
10 MS/s	<0.6%
30 MS/s	<1.5%
80 MS/s (Opt. 110)	<2.0%

256 QAM residual EVM (typical) [26]

10 MS/s	<0.5%
30 MS/s	<0.8%
80 MS/s (Opt. 110)	<0.8%

Offset QPSK residual EVM (typical) [27]

100 kS/s	<0.5%
1 MS/s	<0.5%
10 MS/s	<1.4%

S-OQPSK (MIL, ARTM) residual EVM (typical) [28]

4 kS/s, CF = 250 MHz	<0.5%
20 kS/s	<0.5%
100 kS/s	<0.5%
1 MS/s	<0.5%

S-BPSK (MIL) residual EVM (typical) [29]

4 kS/s, CF = 250 MHz	<0.4%
20 kS/s	<0.5%
100 kS/s	<0.5%
1 MS/s	<0.5%

CPM (MIL) residual EVM (typical) [30]

4 kS/s, CF = 250 MHz	<0.5%
20 kS/s	<0.5%

25 CF = 2 GHz, Measurement Filter = root raised cosine, Reference Filter = raised cosine,Analysis Length = 200 symbols.

26 CF = 2 GHz, Measurement Filter = root raised cosine, Reference Filter = raised cosine,Analysis Length = 400 symbols.

27 CF = 2 GHz, Measurement Filter = root raised cosine, Reference Filter = raised cosine, Analysis Length = 400 symbols.

28 CF = 2 GHz unless otherwise noted. Reference Filters: MIL STD, ARTM, Measurement Filter: none.

29 CF = 2 GHz unless otherwise noted. Reference Filter: MIL STD.

30 CF = 2 GHz unless otherwise noted. Reference Filter: MIL STD.

100 kS/s	<0.5%
1 MS/s	<0.5%
2/4/8/16 FSK residual RMS FSK error (typical) [31]	
10 kS/s, deviation 10 kHz	<0.6%

Adaptive equalizer characteristics

Type	Linear, decision-directed, feed-forward (FIR) equalizer with co-efficient adaptation and adjustable convergence rate
Modulation types supported	BPSK, QPSK, OQPSK, π/2DBPSK, π/4DQPSK, 8PSK, 8DPSK, 16DPSK, 16/32/64/128/256QAM
Reference filters for all modulation types except OQPSK	Raised cosine, rectangular, none
Reference filters for OQPSK	Raised cosine, half sine
Filter length	3 to 2001 taps
Taps/Symbol: raised cosine, half sine	1, 2, 4, 8
Taps/Symbol: rectangular filter, no filter	1
Equalizer controls	Off, train, hold, reset

Flexible OFDM characteristics (Opt. 22)

Available displays	Constellation, scalar measurement summary, EVM or power vs. carrier, symbol table (binary or hexadecimal)
Recallable standards	WiMAX 802.16-2004, WLAN 802.11a/g/j/p
Parameter settings	Guard interval, subcarrier spacing, channel bandwidth
Advanced parameter settings	Constellation detect: auto; manual select (BPSK, QPSK, 16QAM, 64QAM) Symbol analysis offset: (–100% to 0%) Pilot tracking: phase, amplitude, Timing Swap I and Q: Enable/Disable
Summary measurements	Symbol clock error, frequency error, average power, Peak-to-Average, CPE EVM (RMS and peak) for all carriers, plot carriers, data carriers OFDM parameters: number of symbols, frequency error, symbol clock error, IQ origin offset, CPE, average power, Peak-to-Average Power EVM (RMS and peak) for all subcarriers, pilot subcarriers, data subcarriers

31 CF = 2 GHz. Reference Filter: None, Measurement Filter: None.

Displays	EVM vs. Symbol, vs. Subcarrier Subcarrier Power vs. Symbol, vs. Subcarrier Subcarrier Constellation Symbol Data Table Mag Error vs. Symbol, vs. Subcarrier Phase Error vs. Symbol, vs. Subcarrier Channel Frequency Response
Residual EVM	-49 dB (WiMAX 802.16-2004, 5 MHz BW) -49 dB (WLAN 802.11g, 20 MHz BW) Signal input power optimized for best EVM

WLAN IEEE802.11a/b/g/j/p (Opt. 23)

General characteristics	
Modulation formats	DBPSK (DSSS-1M), DQPSK (DSSS-2M), CCK 5.5M, CCK 11M , OFDM (BPSK, QPSK, 16 or 64QAM)
Measurements and displays	Burst Index, Burst Power, Peak to Average Burst Power, IQ Origin Offset, Frequency Error, Common Pilot Error, Symbol Clock Error RMS and Peak EVM for Pilots/Data, Peak EVM located per Symbol and Subcarrier Packet Header Format Information Average Power and RMS EVM per section of the header WLAN Power vs. Time, WLAN Symbol Table, WLAN Constellation Spectrum Emission Mask, Spurious Error Vector Magnitude (EVM) vs. Symbol (or Time), vs. Subcarrier (or Frequency) Mag Error vs. Symbol (or Time), vs. Subcarrier (or Frequency) Phase Error vs. Symbol (or Time), vs. Subcarrier (or Frequency) WLAN Channel Frequency Response vs. Symbol (or Time), vs. Subcarrier (or Frequency) WLAN Spectral Flatness vs. Symbol (or Time), vs. Subcarrier (or Frequency)
Residual EVM - 802.11b (CCK-11Mbps)	RMS-EVM over 1000 chips, EQ On; 2.4 GHz: 1.1% (-39.3 dB), typical, 0.95% (-40.5 dB) typical-mean Signal input power optimized for best EVM
Residual EVM - 802.11a/g/j (OFDM, 20 MHz, 64-QAM)	2.4 GHz: –49 dB; 5.8 GHz: –48 dB typical, –49 dB typical-mean; (RMS-EVM averaged over 20 bursts, 16 symbols each) Signal input power optimized for best EVM

WLAN IEEE802.11n (Opt. 24)

General characteristics	
Modulation formats	SISO, OFDM (BPSK, QPSK, 16 or 64QAM)
Measurements and displays	Burst Index, Burst Power, Peak to Average Burst Power, IQ Origin Offset, Frequency Error, Common Pilot Error, Symbol Clock Error,
	RMS and Peak EVM for Pilots/Data, Peak EVM located per Symbol and Subcarrier
	Packet Header Format Information
	Average Power and RMS EVM per section of the header
	WLAN Power vs. Time, WLAN Symbol Table, WLAN Constellation
	Spectrum Emission Mask, Spurious
	Error Vector Magnitude (EVM) vs. Symbol (or Time), vs. Subcarrier (or Frequency)
	Mag Error vs. Symbol (or Time), vs. Subcarrier (or Frequency)
	Phase Error vs. Symbol (or Time), vs. Subcarrier (or Frequency)
	WLAN Channel Frequency Response vs. Symbol (or Time), vs. Subcarrier (or Frequency)
	WLAN Spectral Flatness vs. Symbol (or Time), vs. Subcarrier (or Frequency)
Residual EVM - 802.11n (40 MHz, 64-QAM)	–45 dB typical, –47 dB typical-mean (5.8 GHz, RMS-EVM averaged over 20 bursts, 16 symbols each)
	Signal input power optimized for best EVM

WLAN IEEE802.11ac (Opt. 25)

General characteristics	
Modulation formats	SISO, OFDM (BPSK, QPSK, 16, 64, 256QAM)
Measurements and displays	Burst Index, Burst Power, Peak to Average Burst Power, IQ Origin Offset, Frequency Error, Common Pilot Error, Symbol Clock Error,
	RMS and Peak EVM for Pilots/Data, Peak EVM located per Symbol and Subcarrier
	Packet Header Format Information
	Average Power and RMS EVM per section of the header
	WLAN Power vs. Time, WLAN Symbol Table, WLAN Constellation
	Spectrum Emission Mask, Spurious
	Error Vector Magnitude (EVM) vs. Symbol (or Time), vs. Subcarrier (or Frequency)
	Mag Error vs. Symbol (or Time), vs. Subcarrier (or Frequency)
	Phase Error vs. Symbol (or Time), vs. Subcarrier (or Frequency)
	WLAN Channel Frequency Response vs. Symbol (or Time), vs. Subcarrier (or Frequency)
	WLAN Spectral Flatness vs. Symbol (or Time), vs. Subcarrier (or Frequency)
Residual EVM - 802.11ac (256-QAM)	–42 dB typical, –44.6 dB typical-mean (5.8 GHz, 80 MHz RMS-EVM averaged over 20 bursts, 16 symbols each) Signal input power optimized for best EVM

Bluetooth (Option 27)

	Basic Rate, Bluetooth Low Energy, Enhanced Data Rate - Revision 4.1.1
Measurements and displays	Peak power, average power, adjacent channel power or inband emission mask, -20 dB bandwidth, frequency error, modulation characteristics including ΔF1avg (11110000), ΔF2avg (10101010), ΔF2 > 115 kHz, ΔF2/ΔF1 ratio, frequency deviation vs. time with packet and octet level measurement information, carrier frequency f0, frequency offset (Preamble and Payload), max frequency offset, frequency drift f_1-f_0, max drift rate f_n-f_0 and f_n-f_{n-5}, center frequency offset table and frequency drift table, color-coded symbol table, packet header decoding information, eye diagram, constellation diagram
Output power (average and peak)	
Level uncertainty	Refer to instrument amplitude and flatness specification
Measurement range	> -70 dBm
Modulation characteristics (ΔF_1avg, ΔF_2avg, ΔF_2avg/ ΔF_1avg, ΔF_2max ≥115 kHz)	
Deviation range	± 280 kHz
Deviation uncertainty (at 0 dBm)	< 2 kHz + instrument frequency uncertainty (Basic Rate) < 3 kHz + instrument frequency uncertainty (Low Energy)
Measurement resolution	10 Hz
Measurement range	Nominal channel frequency ±100 kHz
Initial Carrier Frequency Tolerance (ICFT)	
Measurement uncertainty (at 0 dBm)	<1 kHz + instrument frequency uncertainty
Measurement resolution	10 Hz
Measurement range	Nominal channel frequency ±100 kHz
Carrier frequency drift	
Supported measurements	Max freq. offset, drift f_1- f_0, max drift f_n-f_0, max drift f_n-f_{n-5} (50 μs)
Measurement uncertainty	< 1 kHz + instrument frequency uncertainty
Measurement resolution	10 Hz
Measurement range	Nominal channel frequency ±100 kHz
In-band emissions and ACP	
Level uncertainty	Refer to instrument amplitude and flatness specification

APCO P25 measurement (Option 26)

Modulation formats	Phase 1 (C4FM), Phase 2 (HCPM, HDQPSK)
Measurements and displays	RF output power, operating frequency accuracy, modulation emission spectrum, unwanted emissions spurious, adjacent channel power ratio, frequency deviation, modulation fidelity, frequency error, eye diagram, symbol table, symbol rate accuracy, transmitter power and encoder attack time, transmitter throughput delay, frequency deviation vs. time, power vs. time, transient frequency behavior, HCPM transmitter logical channel peak adjacent channel power ratio, HCPM transmitter logical channel off slot power, HCPM transmitter logical channel power envelope, HCPM transmitter logical channel time alignment
Residual modulation fidelity	
Phase 1 (C4FM)	≤1.0% typical
Phase 2 (HCPM)	≤0.5% typical
Phase 2 (HDQPSK)	≤0.4% typical
Adjacent channel power ratio [32]	
25 kHz offset from the center and bandwidth of 6 kHz	-71 dBc typical
62.5 kHz offset from the center and bandwidth of 6 kHz	-72 dBc typical

Mapping and field strength (Option MAP)

RF field strength	
Signal strength indicator	Located at right-side of display
Measurement bandwidth	Up to 165 MHz, dependent on span and RBW setting
Tone type	Variable frequency
Mapping	
Map types directly supported	Pitney Bowes MapInfo (*.mif), Bitmap (*.bmp)
Saved measurement results	Measurement data files (exported results) Map file used for the measurements Google earth KMZ file Recallable results files (trace and setup files) MapInfo-compatible MIF/MID files

32 Measured with test signal amplitude adjusted for optimum performance if necessary. Measured with Averaging, 10 waveforms.

Modulation analysis accuracy

AM demodulation accuracy	±2% 0 dBm input at center Carrier frequency 1 GHz, 10 to 60% modulation depth, 1 kHz/5 kHz Input/Modulated frequency
PM demodulation accuracy	±3° 0 dBm input at center Carrier frequency 1 GHz, 400 hz/1 kHz Input/Modulated frequency
FM demodulation accuracy	±1% of span 0 dBm input at center Carrier frequency 1 GHz, 1 kHz/5 kHz Input/Modulated frequency

Inputs and outputs

Front panel

Display	Touch panel, 10.4 in. (264 mm)
Planar crown™ RF input connector	Type-N Female (RSA6106B and RSA6114B) 3.5 mm Male (RSA6120B only) SMA (m) to SMA (f) adapter (RSA6120B only)
Trigger out	BNC, High: >2.0 V, Low: <0.4 V, output current 1 mA (LVTTL), 50 Ω
Trigger in	BNC, 50 Ω/5 kΩ impedance (nominal), ±5 V max input, -2.5 V to +2.5 V trigger level
USB ports	1 USB 2.0, 1 USB 1.1
Audio	Speaker

Rear panel

10 MHz REF OUT	50 Ω, BNC, >0 dBm
External REF IN	50 Ω, BNC, -10 dBm - +6 dBm, 1 to 25 MHz in 1 MHz steps, plus 1.2288, 4.8, 19.6608, and 31.07 MHz
External REF IN frequency accuracy required	≤ ±0.3 ppm
Trig 2 / gate IN	BNC, High: 1.6 to 5.0 V, Low: 0 to 0.5 V
GPIB interface	IEEE 488.2
LAN interface ethernet	Rj45, 10/100/1000base-t
USB ports	USB 2.0, two ports
VGA output	VGA compatible, 15 DSUB
Audio out	3.5 mm headphone jack
Noise source drive	BNC, +28 v, 140 mA (nominal)

General characteristics

Temperature range	
Operating	+5 °C to +50 °C. (+5 °C to +40 °C when accessing DVD)
Storage	–20 °C to +60 °C
Warm-up time	20 minutes
Altitude	
Operating	Up to 3000 m (approximately 10,000 ft.)
Nonoperating	Up to 12,190 m (40,000 ft.)
Relative humidity	
Operating and nonoperating	+40 °C at 95% relative humidity, meets intent of EN 60068-2-30. [33]
Vibration	
Operating (except when equipped with option 56 removable SSD)	$0.22G_{RMS}$. Profile = 0.00010 g^2 /Hz at 5-350 Hz, -3 dB/Octave slope from 350-500 Hz, 0.00007 g^2 /Hz at 500 Hz, 3 Axes at 10 min/axis
Nonoperating	$2.28G_{RMS}$. Profile = 0.0175 g^2 /Hz at 5-100 Hz, -3 dB/Octave slope from 100-200 Hz, 0.00875 g^2 /Hz at 200-350 Hz,-3 dB/Octave slope from 350-500 Hz, 0.006132 g^2 /Hz at 500 Hz, 3 Axes at 10 min/axis
Shock	
Operating	15 G, half-sine, 11 ms duration. (1 G max when accessing DVD and Opt. 56 Removable HDD)
Non-operating	30 g, half-sine, 11 ms duration
Safety	L 61010-1:2004 CSA C22.2 No.61010-1-04
Electromagnetic compatibility	Complies with EU council EMC directive 2004/108/EC Complies with EN61326, Class A
Power requirements	90 V AC to 240 V AC, 50 Hz to 60 Hz 90 V AC to 132 V AC, 400 Hz
Power consumption	450 W max
Data storage	Internal HDD, USB ports, DVD±RW (Opt. 59), Removable HDD (Opt. 56)
Calibration interval	One year
Warranty	One year
GPIB	SCPI-compatible, IEEE488.2 compliant

33 Frequency amplitude response may vary up to ±3 dB at +40 °C and greater than 45% relative humidity.

Physical characteristics

Dimensions (with feet)

Height	282 mm (11.1 in.)
Width	473 mm (18.6 in.)
Depth	531 mm (20.9 in.)

Weight

With all options

kg	lb
26.4	58

Ordering information

Models

RSA6106B	Spectrum analyzer, 9 kHz to 6.2 GHz, 40 MHz capture BW
RSA6114B	Spectrum analyzer, 9 kHz to 14 GHz, 40 MHz capture BW
RSA6120B	Spectrum analyzer, 9 kHz to 20 GHz, 40 MHz capture BW

Note: Please specify power plug and language options when ordering.

Standard accessories

Accessories

All instruments include	Product documentation CD (Quick-start user manual, Application examples manual, Printable online help, Programmer manual, Service manual, Specification and Performance Verification manual, Declassification and Security instructions), Front cover, USB keyboard, USB mouse, and Planar crown™ RF input connector – Type-N (RSA6106B and RSA6114B) / 3.5 mm (RSA6120B only) / SMA (m) to SMA (f) adapter (RSA6120B only)

Warranty

One-year warranty

Options [34] [35]

Option	Description
Opt. 05	Digital IQ Output and 500 MHz Analog IF Output
Opt. 09	Enhanced Real Time
Opt. 10	AM/FM/PM Modulation and Audio Measurements
Opt. 11	Phase Noise and Jitter Measurement
Opt. 12	Settling Time Measurements (Frequency and Phase)
Opt. 14	Noise Figure and Gain (Internal preamp recommended)
Opt. 20	Advanced Signal Analysis (including pulse measurements)
Opt. 21	General Purpose Digital Modulation Analysis
Opt. 22	Flexible OFDM
Opt. 23	WLAN 802.11a/b/g/j/p measurement application
Opt. 24	WLAN 802.11n measurement application (requires Opt. 23)
Opt. 25	WLAN 802.11ac measurement application (requires Opt. 24)
Opt. 26	APCO P25 measurement application
Opt. 27	Bluetooth Basic LE Tx Measurements
Opt. MAP	Mapping and signal strength
Opt. 50	Preamp, 1 MHz - 6.2 GHz, 20 dB Gain (RSA6106B only)
Opt. 51	Preamp, 100 kHz - 20 GHz, 30 dB Gain (RSA6114B and RSA6120B only)
Opt. 52	Frequency Mask Trigger
Opt. 53	Memory Extension, 4 GB Total Acquisition Memory

34 Options 56, 57, 59, and WinXP are mandatory/exclusive options - one of them must be ordered. There is no charge for Option 59, Internal HDD.

35 Options 10, 11, 12, 20, 21, 22, 52, and 110 are SW only. All other options are HW.

Option	Description
Opt. 56	Removable SSHD (160 GB SS), incompatible with Option 57, 59, WINXP
Opt. 57	CD/DVD-RW and Fixed Internal HDD (160 GB) incompatible with Option 56, 59, WINXP
Opt. 59	Internal HDD (160 GB), incompatible with Option 56, 57, WINXP
Opt. 110	110 MHz Capture BW
Opt. RSA56KR	Rackmount

Power plug options

Opt. A0	North America power plug (115 V, 60 Hz)
Opt. A1	Universal Euro power plug (220 V, 50 Hz)
Opt. A2	United Kingdom power plug (240 V, 50 Hz)
Opt. A3	Australia power plug (240 V, 50 Hz)
Opt. A4	North America power plug (240 V, 50 Hz)
Opt. A5	Switzerland power plug (220 V, 50 Hz)
Opt. A6	Japan power plug (100 V, 50/60 Hz)
Opt. A10	China power plug (50 Hz)
Opt. A11	India power plug (50 Hz)
Opt. A12	Brazil power plug (60 Hz)
Opt. A99	No power cord

Language options

Opt. L0	English manual
Opt. L5	Japanese manual
Opt. L7	Simplified Chinese manual
Opt. L10	Russian manual
Opt. L99	No manual

Language options include translated front-panel overlay for the selected language(s).

Service options

Opt. C3	Calibration Service 3 Years
Opt. C5	Calibration Service 5 Years
Opt. CA1	Single Calibration or Functional Verification
Opt. D1	Calibration Data Report
Opt. D3	Calibration Data Report 3 Years (with Opt. C3)
Opt. D5	Calibration Data Report 5 Years (with Opt. C5)
Opt. G3	Complete Care 3 Years (includes loaner, scheduled calibration, and more)
Opt. G5	Complete Care 5 Years (includes loaner, scheduled calibration, and more)
Opt. R3	Repair Service 3 Years (including warranty)
Opt. R5	Repair Service 5 Years (including warranty)

Recommended accessories

Accessory	Description
RTPA2A	Spectrum Analyzer Probe Adapter Compatibility: P7225 - 2.5 GHz Active Probe P7240 - 4 GHz Active Probe P7260 - 6 GHz Active Probe P7330 - 3.5 GHz Differential Probe P7350 - 5 GHz Differential Probe P7350SMA - 5 GHz Differential SMA Probe P7340A - 4 GHz Z-Active Differential Probe P7360A - 6 GHz Z-Active Differential Probe P7380A - 8 GHz Z-Active Differential Probe P7380SMA - 8 GHz Differential Signal Acquisition System P7313 - >12.5 GHz Z-Active Differential Probe P7313SMA - 13 GHz Differential SMA Probe P7500 Series - 4 GHz to 20 GHz TriMode Probes
Noise source	NoiseCom NC346C Series. Provides supported sources up to 55 GHz in a variety of connector types and ENR values. Contact NoiseCom for full information and to order: http://noisecom.com
K420	Stable/Mobile instrument cart
119-4146-xx	E and H near-field probes. For EMI troubleshooting
065-0906-xx	Additional removable hard drive (160 GB solid state). For use with option 56 (Windows 7 and instrument FW preinstalled)
016-2026-xx	Transit case
071-1909-xx	Additional quick-start manual (paper)
071-1914-xx	Service manual (paper)
119-7902-xx	DC Block, Type-N, 10 MHz to 18 GHz (blocks both center and shield)
131-4329-00	Planar crown RF input connector - 7005A-3 Type-N female
131-9062-00	Planar crown RF input connector - 7005A-6 3.5 mm female
131-8822-00	Planar crown RF input connector - 7005A-7 3.5 mm male
131-8689-00	Planar crown RF input connector - 7005A-1 SMA female
015-0369-00	RF adapter - n (male) to SMA (male)
119-6599-00	Power attenuator - 20 dB, 50 w, 5 GHz
119-6598-00	DC block, Type-N, 10 MHz to 12.4 GHz (blocks both center and shield)
101A EMC Probe Set 150A EMC Probe Amplifier 110A Probe Cable SMA Probe Adapter BNC Probe Adapter	RF probes. Contact Beehive Electronics to order: http://beehive-electronics.com/probes.html
174-5706-xx	SMA (m) to SMA (m) 36 in. cable
600 Ω BNC pass-through	Required for higher speed noise figure measurements when ordering RSA6BIP Opt 14 for RSA6000B. POMONA 4119-600 RF/COAXIAL ADAPTER, BNC PLUG-BNC JACK. Contact Pomona Electronics and distributors worldwide to order: http://pomonaelectronics.com

Upgrades

RSA6BUP

Option	Description	HW or SW	Factory calibration required?
Opt. 05	500 MHz IF, Digital IQ Output	HW	No
Opt. 09	Enhanced Real Time	SW	No
Opt. 10	AM/FM/PM Modulation and Audio Measurements	SW	No
Opt. 11	Phase Noise and Jitter Measurements	SW	No
Opt. 12	Frequency and Phase Settling Measurements	SW	No
Opt. 14	Noise Figure and Gain (Internal preamp recommended)	SW	No
Opt. 20	Advanced Signal Analysis (Pulse Measurement Suite)	SW	No
Opt. 21	GP Digital Modulation Analysis	SW	No
Opt. 22	Flexible OFDM Analysis	SW	No
Opt. 23	WLAN 802.11a/b/g/j/p measurement application	SW	No
Opt. 24	WLAN 802.11n measurement application (requires opt 23)	SW	No
Opt. 25	WLAN 802.11ac measurement application (requires opt 24)	SW	No
Opt. 26	APCO P25 measurement application	SW	No
Opt. 27	Bluetooth Basic LE Tx Measurements	SW	No
Opt. MAP	Mapping and signal strength	SW	No
Opt. 50	Preamp, 1 MHz - 6.2 GHz, 20 dB Gain (RSA6106B only)	HW	Yes
Opt. 51	Preamp, 100 kHz - 20 GHz, 30 dB Gain (RSA6114B and RSA6120B only)	HW	Yes
Opt. 52	Frequency Mask Trigger	SW	No
Opt. 53	Memory Extension, 4 GB Total Acquisition Memory	HW	No
Opt. 56	Removable SSHD (160 GB), incompatible with Option 57, 59, WINXP	HW	No
Opt. 57	CD/DVD-RW and Fixed Internal HDD (160 GB) incompatible with Option 56, 59, WINXP	HW	No
Opt. 59	Internal HDD (160 GB), incompatible with Option 56, 57, WINXP	HW	No
Opt. 110	110 MHz Real-time Acquisition BW	SW	No

Tektronix is registered to ISO 9001 and ISO 14001 by SRI Quality System Registrar.

Product(s) complies with IEEE Standard 488.1-1987, RS-232-C, and with Tektronix Standard Codes and Formats.

Product Area Assessed: The planning, design/development and manufacture of electronic Test and Measurement instruments.

ASEAN / Australasia (65) 6356 3900
Belgium 00800 2255 4835*
Central East Europe and the Baltics +41 52 675 3777
Finland +41 52 675 3777
Hong Kong 400 820 5835
Japan 81 (3) 6714 3010
Middle East, Asia, and North Africa +41 52 675 3777
People's Republic of China 400 820 5835
Republic of Korea 001 800 8255 2835
Spain 00800 2255 4835*
Taiwan 886 (2) 2656 6688
Austria 00800 2255 4835*
Brazil +55 (11) 3759 7627
Central Europe & Greece +41 52 675 3777
France 00800 2255 4835*
India 000 800 650 1835
Luxembourg +41 52 675 3777
The Netherlands 00800 2255 4835*
Poland +41 52 675 3777
Russia & CIS +7 (495) 6647564
Sweden 00800 2255 4835*
United Kingdom & Ireland 00800 2255 4835*
Balkans, Israel, South Africa and other ISE Countries +41 52 675 3777
Canada 1 800 833 9200
Denmark +45 80 88 1401
Germany 00800 2255 4835*
Italy 00800 2255 4835*
Mexico, Central/South America & Caribbean 52 (55) 56 04 50 90
Norway 800 16098
Portugal 80 08 12370
South Africa +41 52 675 3777
Switzerland 00800 2255 4835*
USA 1 800 833 9200

* European toll-free number. If not accessible, call: +41 52 675 3777

For Further Information. Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology. Please visit www.tektronix.com.

11 Feb 2015 37W-28055-6