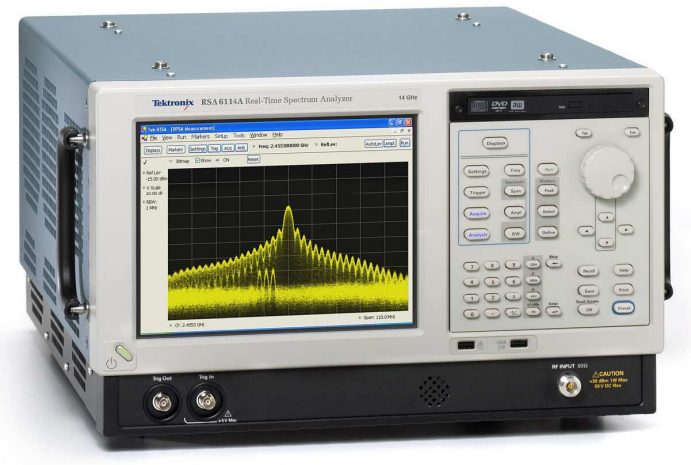
Spectrum Analyzers

RSA6000 Series Data Sheet



Features & Benefits

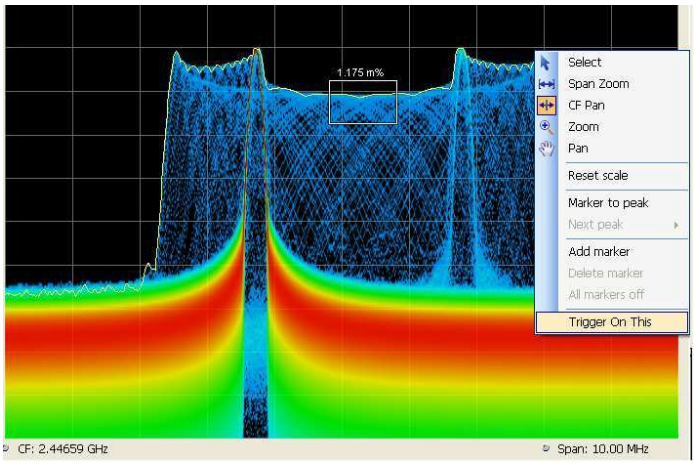
RSA6000 Series 6.2, 14, and 20 GHz Spectrum Analyzers

- High-performance Spectrum Analysis
  - 20 dBm 3rd Order Intercept at 2 GHz, Typical
  - Displayed Average Noise Level –151 dBm/Hz at 2 GHz (–170 dBm/Hz, Preamp On, typical) enables Low-level Signal Search
  - ±0.5 dB Absolute Amplitude Accuracy to 3 GHz for High Measurement Confidence
  - 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
- Discover
  - DPX® Spectrum Processing provides an Intuitive Understanding of Time-varying RF Signals with Color-graded Displays based on Frequency of Occurrence
  - Revolutionary DPX Displays Transients with a Minimum Event Duration of 3.7 µs
  - Swept DPX Spectrum enables Unprecedented Signal Discovery over Full Instrument Span
- Trigger
  - Trigger on Frequency Edge or Power Level Transients with a Minimum Event Duration of 3.8 µs in the Frequency Domain, 9.1 ns in Time Domain
  - 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
  - Up to 1.7 s Acquisitions at 110 MHz Bandwidth can be Directly Stored as MATLAB™ Compatible Files
  - Gap-free 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
  - 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
  - Flexible OFDM analysis of 802.11a/g/j and WiMAX 802.16-2004

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

Tektronix®



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.

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'.

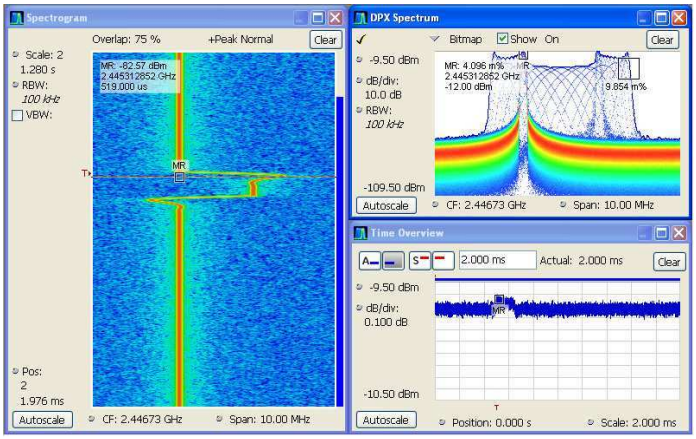
A complete toolset of power and signal statistics measurements is standard, including Channel Power, ACLR, CCDF, Occupied Bandwidth, AM/FM/PM, and Spurious measurements. Available Phase Noise and General Purpose Modulation Analysis measurements round out the expected set of high-performance analysis 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. This live display of transients is impossible with other signal analyzers. 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, Opt. 200 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.



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.

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 1.7 seconds at 110 MHz, 81.9 seconds at 1 MHz, or 1.46 hours at 10 kHz bandwidth with FMT / Deep Memory (Opt. 02). 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.

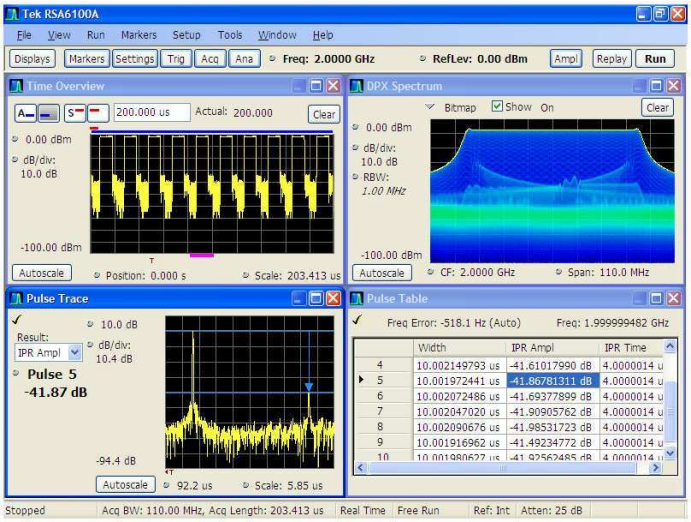
Analyze

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.

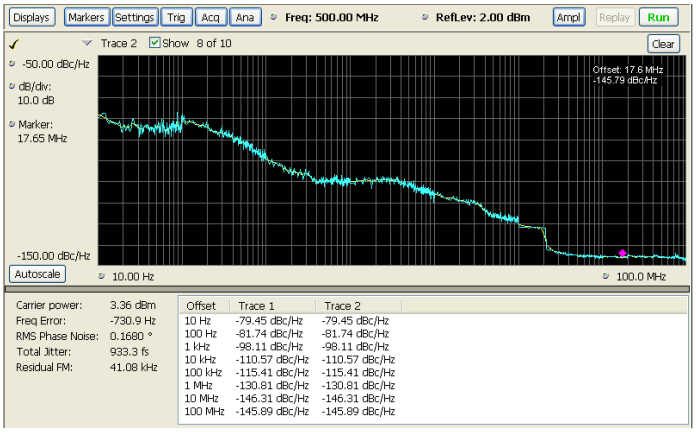
The measurement capabilities of the RSA6000 Series and available options and software packages are summarized below:

Measurement Functions

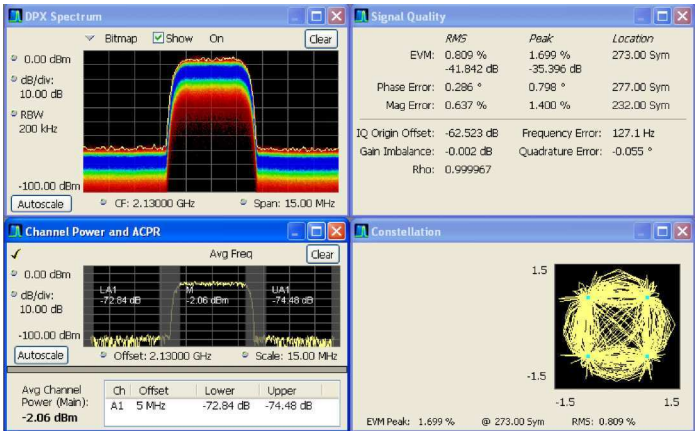
Measurements	Description
Spectrum Analyzer Measurements	Channel Power, Adjacent Channel Power, Multicarrier Adjacent Channel Power/Leakage Ratio, Occupied Bandwidth, xdB Bandwidth, dBm/Hz Marker, dBc/Hz Marker, Spectrum Emissions Mask
Time Domain and Statistical Measurements	RF IQ vs. Time, Power vs. 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
Analog Modulation Measurements (Standard)	% 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
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, 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
DPX Density Measurement (Opt. 200)	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
Flexible OFDM Analysis (Opt. 22)	OFDM Analysis for WLAN 802.11a/g/j and WiMAX 802.16-2004



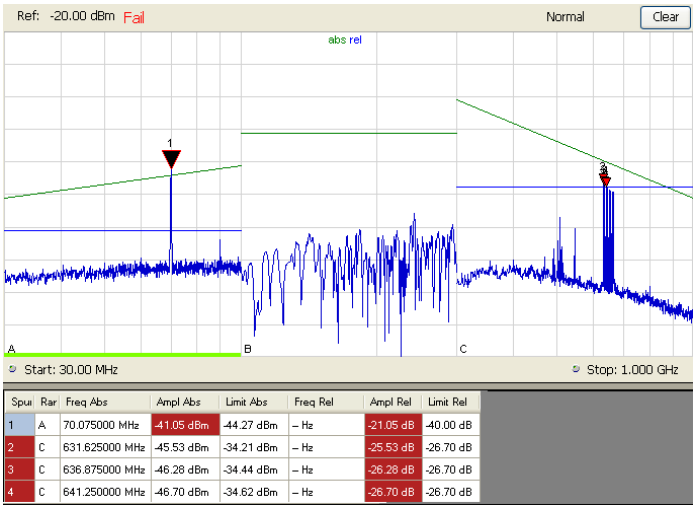
Advanced Signal Analysis package (Opt. 20) offers over 20 automated pulse parameter calculations on every pulse. Easily validate designs with measurements of peak power, pulse width rise time, ripple, droop, overshoot, and pulse-to-pulse phase. Gain insight into linear FM chirp quality with measurements 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.



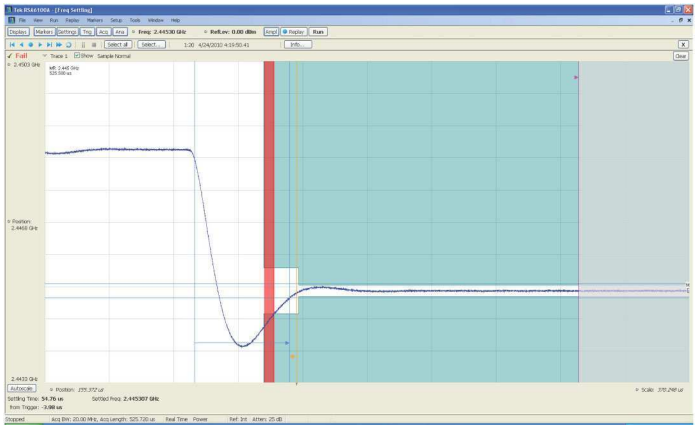
Phase noise and jitter measurements (Opt. 11) adds value to your RSA6000 Series by replacing a conventional phase noise tester for many applications. Phase noise can be measured at carrier offsets up to 1 GHz, and internal phase noise is automatically reduced by optimizing acquisition bandwidths and attenuator settings for each carrier offset for maximum dynamic range. For less critical measurements, speed optimization may be applied for faster results. Typical residual phase noise of –132 dBc/Hz at 1 MHz offset, 0 GHz carrier frequency gives sufficient measurement margin for many applications.



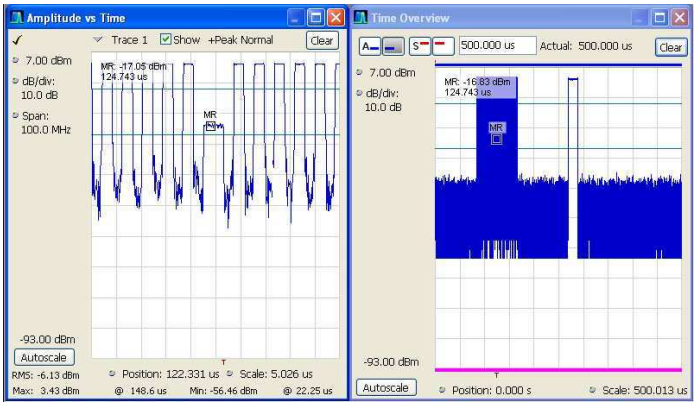
Time-correlated, multidomain views provide a new level of insight into design or operational problems not possible with conventional analysis solutions. Here, ACLR and Vector Modulation Quality (Opt. 21) are performed on a single acquisition, combined with the continuous monitoring of the DPX® spectrum display.



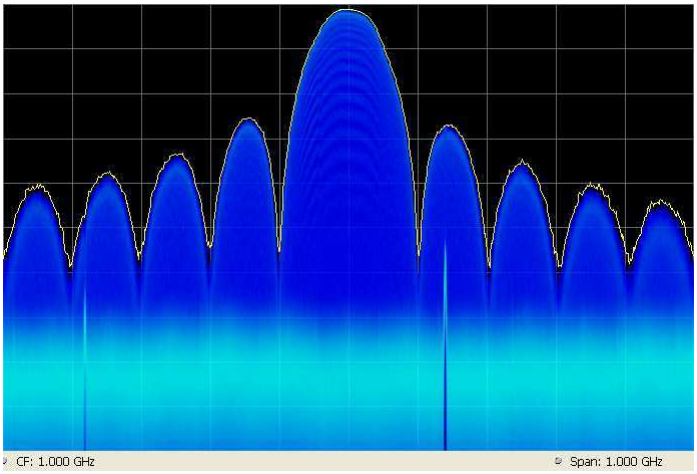
Spurious Search – Up to 20 noncontiguous frequency regions can be defined, each with their own resolution bandwidth, video bandwidth, detector (peak, average, quasi-peak), and limit ranges. Test results can be exported in .CSV format to external programs, with up to 999 violations reported. Spectrum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



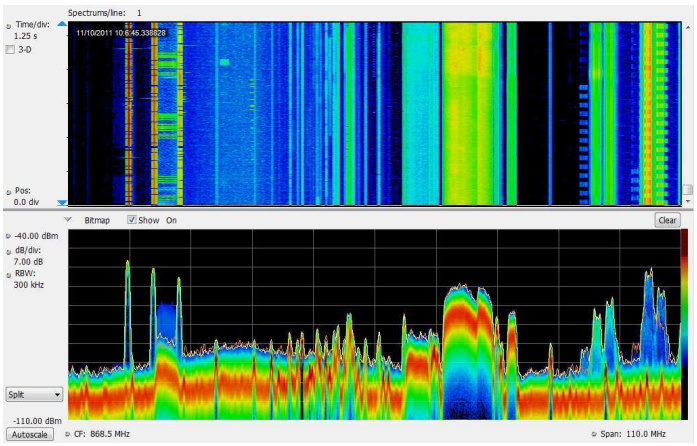
Settling time measurements (Opt. 12) are easy and automated. The user can select measurement bandwidth, tolerance bands, reference frequency (auto or manual), and establish up to 3 tolerance bands vs. time for Pass/Fail testing. Settling time may be referenced to external or internal trigger, and from 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.



Advanced Triggers and Swept DPX (Opt. 200) 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.



Advanced Triggers and Swept DPX (Opt. 200) re-invents the way swept spectrum analysis is done. 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. 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 (Opt. 200) 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.

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.

Characteristics

Frequency Related

Characteristic	Description
Frequency Range	9 kHz to 20 GHz (RSA6120A) 9 kHz to 14 GHz (RSA6114A) 9 kHz to 6.2 GHz (RSA6106A)
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 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 Frequency Accuracy	Must be 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

Characteristic	Description
Trigger Modes	Free Run, Triggered, FastFrame
Trigger Event Source	RF Input, Trigger 1 (Front Panel), Trigger 2 (Rear Panel), Gated, Line
Trigger Types	Power (Std.), Frequency Mask (Opt. 02), Frequency Edge, DPX Density, Runt, Time Qualified (Opt. 200)
Trigger Setting	Trigger position settable from 1 to 99% of total acquisition length
Trigger Combinational 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

Characteristic	Description
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)	±0.5 dB (level ≥ –50 dB from reference level)
	±1.5 dB (from < –50 dB to –70 dB from reference level)
Trigger Bandwidth Range	
(at maximum acquisition BW)	4 kHz to 20 MHz + wide open (standard)
	11 kHz to 60 MHz + wide open (Opt. 110)
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. 02)

Characteristic	Description
Mask Shape	User Defined
Mask Point Horizontal Resolution	<0.2% 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 Event Duration for 100% Probability of Trigger (at maximum acquisition bandwidth, RBW = Auto). Events lasting less than minimum event duration specification will result in degraded Frequency Mask Trigger accuracy.	
Acq. BW 40 MHz	
Opt. 02 (fixed FFT length)	30.7 µs
Opt. 02 plus Opt. 200 at specified resolution bandwidths	10 MHz: 3.9 µs 1 MHz: 5.8 µs 100 kHz: 30.9 µs
Acq. BW 110 MHz (Opt. 110)	
Opt. 02 (fixed FFT length)	10.3 µs
Opt. 02 plus Opt. 200 at specified resolution bandwidths	10 MHz: 3.7 µs 1 MHz: 5.8 µs 100 kHz: 37.6 µs
Trigger Position Uncertainty	Span = 40 MHz: ±12.8 µs ±2 µs (Opt. 200, RBW = Auto)
	Span = 110 MHz: ±5.12 µs (Opt. 110) ±2 µs (Opt. 200, RBW = Auto)

*[1] For masks >30 dB above noise floor.

Opt. 200 – Advanced Triggers

Characteristic	Description
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)
Minimum Signal Duration for 100% Probability of Trigger (at maximum acquisition bandwidth and RBW) Trace Length 801 Points	3.9 µs 3.7 µs (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. 02), 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 Acq. BW using no trigger RBW 50 ns for 40 MHz Acq. 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

External Trigger 1

Characteristic	Description
Level Range	–2.5 V to +2.5 V
Level Setting Resolution	0.01 V
Trigger Position Timing Uncertainty (50 Ω input impedance)	
40 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

Characteristic	Description
Threshold Voltage	Fixed, TTL
Input Impedance	10 kΩ (nominal)
Trigger State Select	High, Low

Trigger Output

Characteristic	Description
Voltage	Output Current <1 mA
High	>2.0 V
Low	<0.4 V (LVTTL)
Output impedance	50 Ω (nominal)

Acquisition Related

Characteristic	Description
Real-time Acquisition Bandwidth	40 MHz (110 MHz, Opt. 110)
A/D Converter	100 MS/s 14 bit (optional 300 MS/s, 14 bit, Opt. 110)
Acquisition Memory Size	256 MB (1 GB, Opt. 02)
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 IQ)	Max Acquisition Time	Max Acquisition Time (Opt. 02)	Time Resolution
110 MHz (Opt. 110)	150 MS/s	0.426 s	1.706 s	6.6667 ns
60 MHz (Opt. 110)	75 MS/s	0.852	3.413	13.33 ns
40 MHz	50 MS/s	1.28 s	5.12 s	20 ns
20 MHz	25 MS/s	2.56 s	10.2 s	40 ns
10 MHz	12.5 MS/s	5.12 s	20.5 s	80 ns
5 MHz	6.25 MS/s	10.2 s	41.0 s	160 ns
2 MHz*2	3.125 MS/s	10.2 s	41.0 s	320 ns
1 MHz	1.56 MS/s	20.5 s	81.9 s	640 ns
500 kHz	781 kS/s	41.0 s	164 s	1.28 µs
200 kHz	390 kS/s	81.9 s	328 s	2.56 µs
100 kHz	195 kS/s	164 s	655 s	5.12 µs
50 kHz	97.6 kS/s	328 s	1310 s	10.24 µs
20 kHz	48.8 kS/s	655 s	2620 s	20.48 µs
10 kHz	24.4 kS/s	1310 s	5240 s	40.96 µs
5 kHz	12.2 kS/s	2620 s	10500 s	81.92 µs
2 kHz	3.05 kS/s	10500 s	41900 s	328 µs
1 kHz	1.52 kS/s	21000 s	83900 s	655 µs
500 Hz	762 S/s	41900 s	168000 s	1.31 ms
200 Hz	381 S/s	83900 s	336000 s	2.62 ms
100 Hz	190 S/s	168300 s	671000 s	5.24 ms

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

Analysis Related

Displays by Domain	Views
Frequency	Spectrum (Amplitude vs Linear or Log Frequency) DPX® Spectrum Display (Live RF Color-graded Spectrum) Spectrogram (Amplitude vs. Frequency over Time) Spurious (Amplitude vs Linear or Log Frequency) Phase Noise (Phase Noise and Jitter Measurement) (Opt. 11)
Time and Statistics	Amplitude vs. Time Frequency vs. Time Phase vs. Time DPX Amplitude vs. Time (Opt. 200) DPX Frequency vs. Time (Opt. 200) DPX Phase vs. Time (Opt. 200) Amplitude Modulation vs. Time Frequency Modulation vs. Time Phase Modulation vs. Time RF IQ vs. Time Time Overview CCDF Peak-to-Average Ratio
Settling Time, Frequency, and Phase (Opt. 12)	Frequency Settling vs. Time, Phase Settling vs. Time
Advanced Measurements Suite (Opt. 20)	Pulse Results Table Pulse Trace (selectable by pulse number) Pulse Statistics (Trend of Pulse Results, FFT of Trend, and Histogram)
Digital Demod (Opt. 21)	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
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
Flexible OFDM Analysis (Opt. 22)	Constellation, Scalar Measurement Summary, EVM or Power vs. Carrier, Symbol Table (Binary or Hexadecimal)
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, whichever limit is reached first

RF Spectrum and Analysis Performance

Bandwidth Related

Characteristic	Description
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 BW 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

DPX® Digital Phosphor Spectrum Processing

Characteristic	DPX (Standard)	Advanced DPX (Opt. 200)
Spectrum Processing Rate (RBW = Auto, Trace Length 801)	48,828/s	292,968/s
DPX Bitmap Resolution	201 × 501	201 × 801
DPX Bitmap Color Dynamic Range	64k (48 dB)	8G (99 dB)
Marker Information	Amplitude, frequency, and hit count on the DPX display	Amplitude, frequency, and signal density on the DPX display
Minimum Signal Duration for 100% Probability of Detection (Max-hold On)	31 µs (24 µs, Opt. 110)	5.8 µs (3.7 µs, Opt. 110)
Span Range (Continuous processing)	100 Hz to 40 MHz (110 MHz with Opt. 110)	100 Hz to 40 MHz (110 MHz with Opt. 110)
Span Range (Swept)	Not Available	Up to instrument frequency range
Dwell Time per Step	Not Available	50 ms to 100 s
Trace Processing	Color-graded bitmap, +Peak, –Peak, Average	Color-graded bitmap, +Peak, –Peak, Average
Trace Length	501	801, 2401, 4001, 10401
Resolution BW Accuracy	7%	7%

DPX® Zero-span Amplitude, Frequency, Phase Performance, Opt. 200 (Nominal)

Characteristic	Description
Measurement BW Range	100 Hz to maximum acquisition bandwidth of instrument
Time Domain BW (TDBW) Range	At least 1/10 to 1/10,000 of acquisition bandwidth, 1 Hz minimum
Time Domain BW (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
DPX Frequency Display Range	±100 MHz maximum
DPX Phase Display Range	±200 degrees maximum, phase-wrapped ±500G degrees, phase-unwrapped

DPX® Spectrogram Performance

Characteristic	Description
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)

Minimum Signal Duration vs. RBW, Opt. 200 (Trace Length, 801 Points)

Span	RBW (kHz)	FFT Length	Spectrums/sec	Minimum Signal Duration for 100% POI, µs
110 MHz	10,000	1024	292,968	3.7
	1000	1024	292,968	5.8
	300	2048	146,484	14.8
	100	4096	73,242	37.7
	30	16384	18,311	134.7
	20	32768	9,155	229.3
40 MHz	10,000	1024	292,968	3.9
	1000	1024	292,968	5.8
	300	1024	292,968	11.4
	100	2048	146,484	30.9
	30	4096	73,242	93.8
	20	8192	36,621	147.5
	10	16384	18,311	295.0

Minimum FFT Length vs. Trace Length (Independent of Span and RBW), Opt. 200

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 (Min) (Opt. 200)	RBW (Max) (Opt. 200)
110 MHz	640 kHz	20 kHz	10 MHz
55 MHz	320 kHz	10 kHz	5 MHz
40 MHz	214 kHz	10 kHz	3 MHz
20 MHz	107 kHz	5 kHz	2 MHz
10 MHz	53.3 kHz	2 kHz	1 MHz
5 MHz	26.7 kHz	1 kHz	500 kHz
2 MHz	13.4 kHz	500 Hz	200 kHz
1 MHz	6.66 kHz	200 Hz	100 kHz
500 kHz	3.33 kHz	100 Hz	50 kHz
200 kHz	1.67 kHz	50 Hz	20 kHz
100 kHz	833 Hz	20 Hz	10 kHz
50 kHz	417 Hz	10 Hz	5 kHz
20 kHz	209 Hz	5 Hz	2 kHz
10 kHz	105 Hz	2 Hz	1 kHz
5 kHz	52 Hz	0.1 Hz	500 Hz
2 kHz	13.1 Hz	0.1 Hz	200 Hz
1 kHz	6.51 Hz	0.1 Hz	100 Hz
500 Hz	3.26 Hz	0.1 Hz	50 Hz
200 Hz	1.63 Hz	0.1 Hz	20 Hz
100 Hz	0.819 Hz	0.1 Hz	10 Hz

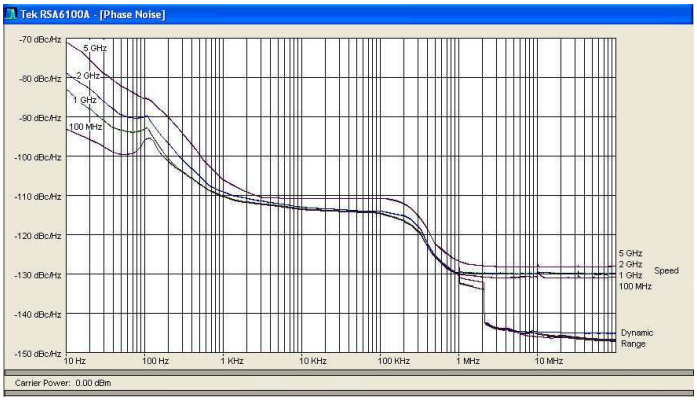
Minimum RBW, Swept Spans (Opt. 200) – 10 kHz.

Stability

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

Phase Noise Sidebands, dBc/Hz at Specified Center Frequency (CF)

Offset	CF = 1 GHz		CF = 2 GHz	CF = 6 GHz	CF = 10 GHz (RSA6114A)	CF = 10 GHz (RSA6120A)	CF = 18 GHz (RSA6120A)
	Spec	Typical	Typical	Typical	Typical	Typical	Typical
100 Hz	–80	–86	–80	–70	–64	–77	–70
1 kHz	–100	–106	–106	–96	–91	–95	–93
10 kHz	–106	–110	–110	–107	–106	–111	–108
100 kHz	–107	–113	–111	–107	–106	–112	–111
1 MHz	–128	–134	–133	–132	–132	–130	–130
6 MHz	–134	–142	–142	–142	–142	–142	–142
10 MHz	–134	–142	–142	–142	–142	–142	–142



Typical phase noise performance as measured by Opt. 11.

Amplitude

(Specifications excluding mismatch error)

Characteristic	Description
Measurement Range	Displayed average noise level to maximum measurable input
Input Attenuator Range	0 dB to 75 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)	+20 dBm
Pulsed RF (RF ATT ≥30 dB, PW <5 µs, 0.5% Duty Cycle)	75 W
Maximum Measurable Input Level	
Average Continuous (RF ATT: Auto)	+30 dBm
Pulsed RF (RF ATT: Auto, PW <5 µs, 0.5% Duty Cycle)	75 W
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

Range	Response
18 °C to 28 °C, Atten. = 10 dB, Preamp Off	
10 MHz - 3 GHz	±0.5 dB
>3 GHz - 6.2 GHz	±0.8 dB
>6.2 GHz - 14 GHz (RSA6114A)	±1.0 dB
>6.2 GHz - 20 GHz (RSA6120A)	±1.0 dB
5 °C to 50 °C, All Attenuator Settings (Typical)	
9 kHz - 3 GHz	±0.7 dB
>3 GHz - 6.2 GHz	±0.8 dB
>6.2 GHz - 14 GHz (RSA6114A)	±2.0 dB
>6.2 GHz - 20 GHz (RSA6120A)	±2.0 dB
Preamp (Opt. 01) On (Atten. = 10 dB)	
10 MHz - 3 GHz	±0.7 dB

Amplitude Accuracy

Characteristic	Description
Absolute Amplitude Accuracy at Calibration Point (100 MHz, –20 dBm signal, 10 dB ATT, 18 °C to 28 °C)	±0.31 dB
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 (Typical) (Atten. = 10 dB, Preamp Off, CF set within 200 MHz of VSWR Test Frequency)	
10 MHz to 4 GHz	<1.6:1
4 GHz to 6.2 GHz	<1.8:1
6.2 GHz to 20 GHz (RSA6114A only)	<1.9:1
VSWR with Preamp (Typical) (Atten. = 10 dB, Preamp On, CF set within 200 MHz of VSWR Test Frequency	
10 MHz to 3 GHz	<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.

Noise and Distortion

3rd Order Intermodulation Distortion*4 (Typical)

Frequency	3rd Order Intermodulation Distortion, dBc	3rd Order Intercept, dBm
RSA6106A, RSA6114A		
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
RSA6120A		
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

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

Note: 3rd order intercept point is calculated from 3rd order intermodulation performance.

2nd Harmonic Distortion*5

Frequency	2nd Harmonic Distortion, Typical
10 MHz to 3.1 GHz*5	< –80 dBc
>3.1 GHz to 7 GHz*5 (RSA6114)	< –80 dBc
>3.1 GHz to 10 GHz*6 (RSA6120A)	< –80 dBc

*5 –40 dBm at RF input, Attenuator = 0, Preamp Off, typical.

*6 < –80 dBc, –25 dBm at RF input, Atten = 0, Preamp OFF, Maximize Dynamic Range "RF & IF Optimization" mode.

Displayed Average Noise Level*7, Preamp Off

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
RSA6114A Only		
4 GHz to 7 GHz	–145 dBm/Hz	–147 dBm/Hz
>7 GHz to 14 GHz	–137 dBm/Hz	–139 dBm/Hz
RSA6120A Only		
>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

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

Preamplifier Performance (Opt. 01)

Characteristic	Description
Frequency Range	10 MHz to 3.0 GHz
Noise Figure at 2 GHz	4 dB
Gain	30 dB
ESD Protection Level	1 kV (Human Body Model) RSA6106A Serial Number ≥ B020241 RSA6114A Serial Number ≥ B020759 RSA6120A Serial Number ≥ B010173

Displayed Average Noise Level*7, Preamp On (Opt. 01)

Frequency	Specification	Typical
10 MHz to 50 MHz	–162 dBm/Hz	–170 dBm/Hz
>50 MHz to 1 GHz	–167 dBm/Hz	–170 dBm/Hz
1 GHz to 2 GHz	–168 dBm/Hz	–170 dBm/Hz
2 GHz to 3 GHz	–166 dBm/Hz	–170 dBm/Hz

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

Residual Response*8

Frequency	Spec
40 MHz to 200 MHz	–90 dBm
>200 MHz to 6.2 GHz	–95 dBm
6.2 GHz to 14 GHz (RSA6114A)	–95 dBm (typical)
6.2 GHz to 20 GHz (RSA6120A)	–95 dBm (typical)

*8 Input terminated, RBW = 1 kHz, Attenuator = 0 dB.

Image Response*9

Frequency	Spec
9 kHz to 6.2 GHz	< –80 dBc
6.2 GHz to 8 GHz (RSA6114A/RSA6120A)	< –80 dBc
>8 GHz to 14 GHz (RSA6114A)	< –76 dBc
>6.2 GHz to 20 GHz (RSA6120A)	< –76 dBc

*9 Ref = –30 dBm, Attenuator = 10 dB, RF Input Level = –30 dBm, RBW = 10 Hz.

Spurious Response with Signal*10

Frequency	Span ≤40 MHz, Swept Spans >40 MHz		Opt. 110 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 (RSA6114A)	–70 dBc	–75 dBc	–70 dBc	–75 dBc
>6.2 GHz to 20 GHz (RSA6120A)	–70 dBc	–75 dBc	–70 dBc	–75 dBc

*10 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.

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)

Adjacent Channel Leakage Ratio Dynamic Range*[11]

Signal Type, Measurement Mode	ACLR, Typical	
	Adjacent	Alternate
3GPP Downlink, 1 DPCH		
Uncorrected	–70 dB	–70 dB
Noise Corrected	–79 dB	–79 dB
3GPP TM1 64 Channel		
Uncorrected	–69 dB	–69 dB
Noise Corrected	–78 dB	–78 dB

*[11] Measured with test signal amplitude adjusted for optimum performance. (CF = 2.13 GHz)

IF Frequency Response and Phase Linearity*[12]

Frequency Range	Specification		Typical (RMS)
Freq (GHz)	Acq. Bandwidth	Specification	Amplitude/Phase
0.01 to 6.2*[13]	≤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 (RSA6114A)	≤300 kHz	±0.10 dB	0.05 dB/0.1°
>6.2 to 14 (RSA6114A)	≤40 MHz	±0.50 dB	0.40 dB/1.0°
>6.2 to 20 (RSA6120A)	≤300 kHz	±0.10 dB	0.05 dB/0.1°
>6.2 to 20 (RSA6120A)	≤40 MHz	±0.50 dB	0.40 dB/1.0°
Opt. 110			
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 (RSA6114A)	≤80 MHz	±0.75 dB	0.70 dB/1.5°
>6.2 to 14 (RSA6114A)	≤110 MHz	±1.0 dB	0.70 dB/1.5°
>6.2 to 20 (RSA6120A)	≤80 MHz	±0.75 dB	0.70 dB/1.5°
>6.2 to 20 (RSA6120A)	≤110 MHz	±1.0 dB	0.70 dB/1.5°

*[12] Amplitude flatness and phase deviation over the acquisition BW, includes RF frequency response. Attenuator Setting: 10 dB. For RSA6106A S/N ≥ B020214 and RSA6114A S/N ≥ B020630.

*[13] High Dynamic Range mode selected.

Analog IF and Digital IQ Output (Opt. 05)

Characteristic	Description
Analog IF Output	
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)
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	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 Measurement (Opt. 10)

Characteristics (typical) for input frequencies <2 GHz, RBW: Auto, Averaging: Off, Filters: Off

Characteristic	Description
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 **Note**: 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 Measurement (Opt. 11)

Characteristic	Description
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)*14

Settled Frequency Uncertainty, 95% Confidence (Typical), at Stated Measurement Frequencies, Bandwidths, and # of Averages

Measurement Frequency, Averages	Frequency Uncertainty at Stated Measurement Bandwidth			
	110 MHz	10 MHz	1 MHz	100 kHz
1 GHz				
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
10 GHz				
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
20 GHz				
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

Settled Phase Uncertainty, 95% Confidence (Typical), at Stated Measurement Frequencies, Bandwidths, and # of Averages

Measurement Frequency, Averages	Phase Uncertainty at Stated Measurement Bandwidth		
	110 MHz	10 MHz	1 MHz
1 GHz			
Single Measurement	1.00°	0.50°	0.50°
100 Averages	0.10°	0.05°	0.05°
1000 Averages	0.05°	0.01°	0.01°
10 GHz			
Single Measurement	1.50°	1.00°	0.50°
100 Averages	0.20°	0.10°	0.05°
1000 Averages	0.10°	0.05°	0.02°
20 GHz			
Single Measurement	1.00°	0.50°	0.50°
100 Averages	0.10°	0.05°	0.05°
1000 Averages	0.05°	0.02°	0.02°

*14 Measured input signal level > –20 dBm, Attenuator: Auto.

Advanced Measurement Suite (Opt. 20)

Characteristic	Description
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*15
Impulse Response Weighting	Taylor Window

*15 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*16	±0.3 dB + Absolute Amplitude Accuracy
Average Transmitted Power*16	±0.4 dB + Absolute Amplitude Accuracy
Peak Power*16	±0.4 dB + Absolute Amplitude Accuracy
Pulse Width	±3% of reading
Duty Factor	±3% of reading

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

Frequency and Phase Error Referenced to Nonchirped Signal

At stated frequencies and measurement bandwidths*17, 95% confidence.

Bandwidth	CF: 2 GHz			CF: 10 GHz			CF: 20 GHz		
	Abs. Freq Err (RMS)	Pulse-Pulse Freq	Pulse-Pulse Phase	Abs. Freq Err (RMS)	Pulse-Pulse Freq	Pulse-Pulse Phase	Abs. Freq Err (RMS)	Pulse-Pulse Freq	Pulse-Pulse Phase
20 MHz	±5 kHz	±13 kHz	±0.3°	±5 kHz	±40 kHz	±0.6°	±8 kHz	±60 kHz	±1.3°
40 MHz	±10 kHz	±30 kHz	±0.35°	±10 kHz	±50 kHz	±0.75°	±20 kHz	±60 kHz	±1.3°
60 MHz (Opt. 110)	±30 kHz	±70 kHz	±0.5°	±30 kHz	±150 kHz	±0.75°	±50 kHz	±275 kHz	±1.5°
110 MHz (Opt. 110)	±50 kHz	±170 kHz	±0.6°	±50 kHz	±150 kHz	±0.75°	±100 kHz	±300 kHz	±1.5°

*17 Pulse ON Power ≥ –20 dBm, signal peak at Reference Level, Attenuator = Auto, $t_{meas} - t_{reference} \leq 10$ 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. For RSA6106A S/N ≥ B020214 and RSA6114A S/N ≥ B020630.

Frequency and Phase Error Referenced to a Linear Chirp

At stated frequencies and measurement bandwidths*17, 95% confidence.

Bandwidth	CF 2 GHz			CF: 10 GHz			CF: 20 GHz		
	Abs. Freq Err (RMS)	Pulse-Pulse Freq	Pulse-Pulse Phase	Abs. Freq Err (RMS)	Pulse-Pulse Freq	Pulse-Pulse Phase	Abs. Freq Err (RMS)	Pulse-Pulse Freq	Pulse-Pulse Phase
20 MHz	±10 kHz	±25 kHz	±0.4°	±15 kHz	±30 kHz	±0.9°	±25 kHz	±50 kHz	±1.8°
40 MHz	±12 kHz	±40 kHz	±0.4°	±15 kHz	±50 kHz	±1.0°	±30 kHz	±130 kHz	±2.0°
60 MHz (Opt. 110)	±60 kHz	±130 kHz	±0.5°	±60 kHz	±150 kHz	±1.0°	±75 kHz	±200 kHz	±2.0°
110 MHz (Opt. 110)	±75 kHz	±275 kHz	±0.6°	±75 kHz	±300 kHz	±1.0°	±125 kHz	±500 kHz	±2.0°

*17 Pulse ON Power ≥ –20 dBm, signal peak at Reference Level, Attenuator = Auto, $t_{meas} - t_{reference} \leq 10$ 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. For RSA6106A S/N ≥ B020214 and RSA6114A S/N ≥ B020630.

Note: Signal type: Linear Chirp, Peak-to-Peak Chirp Deviation: ≤0.8 Measurement BW.

Digital Modulation Analysis (Opt. 21)

Characteristic	Description
Modulation Formats	π/2DBPSK, BPSK, SBPSK, QPSK, DQPSK, π/4DQPSK, D8PSK, D16PSK, 8PSK, OQPSK, SOQPSK, CPM, 16/32/64/128/256QAM, MSK, GMSK, 2-FSK, 4-FSK, 8-FSK, 16-FSK, C4FM
Analysis Period	Up to 80,000 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 RSA6000 Series)

Digital (Opt. 21)

Symbol Rate	Residual EVM (Typical)
QPSK Residual EVM*18	
100 kS/s	<0.35%
1 MS/s	<0.35%
10 MS/s	<0.6%
30 MS/s	<1.5%
80 MS/s (Opt. 110)	<2.0%
256 QAM Residual EVM*19	
10 MS/s	<0.4%
30 MS/s	<0.8%
80 MS/s (Opt. 110)	<0.8%
Offset QPSK Residual EVM*18	
100 kS/s	<0.5%
1 MS/s	<0.5%
10 MS/s	<1.4%
S-OQPSK (MIL, ARTM) Residual EVM*20	
4 kS/s, CF = 250 MHz	<0.3%
20 kS/s	<0.5%
100 kS/s	<0.5%
1 MS/s	<0.5%
S-BPSK (MIL) Residual EVM*21	
4 kS/s, CF = 250 MHz	<0.2%
20 kS/s	<0.5%
100 kS/s	<0.5%
1 MS/s	<0.5%
CPM (MIL) Residual EVM*21	
4 kS/s, CF = 250 MHz	<0.3%
20 kS/s	<0.5%
100 kS/s	<0.5%
1 MS/s	<0.5%
2/4/8/16 FSK Residual RMS FSK Error*22	
10 kS/s, deviation 10 kHz	<0.6%

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

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

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

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

*22 CF = 2 GHz. Reference Filter: None, Measurement Filter: None.

Adaptive Equalizer

Characteristic	Description
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	1 to 128 taps
Taps/Symbol: Raised Cosine, Half Sine, No Filter	1, 2, 4, 8
Taps/Symbol: Rectangular Filter	1
Equalizer Controls	Off, Train, Hold, Reset

Flexible OFDM Characteristics (Opt. 22)

Characteristic	Description
Recallable Standards	WiMAX 802.16-2004, WLAN 802.11a/g/j
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
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	–44 dB (WiMAX 802.16-2004, 5 MHz BW) –44 dB (WLAN 802.11g, 20 MHz BW) Signal input power optimized for best EVM

Modulation Analysis Accuracy

Analog (Typical)

Modulation	Description
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

Characteristic	Description
Front Panel	
Display	Touch panel, 10.4 in. (264 mm)
RF Input Connector	N-type female, 50 Ω (RSA6106A/RSA6114A) 3.5 mm male, ruggedized, 50 Ω (RSA6120A)
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

Characteristic	Description
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 min.
Altitude	
Operating	Up to 3000 m (approximately 10,000 ft.)
Nonoperating	Up to 12,190 m (40,000 ft.)
Relative Humidity	
Operating and nonoperating (80% RH max when accessing DVD)	90% RH at 30 °C (No condensation, max wet bulb, 29 °C)
Vibration	
Operating (except when equipped with Option 06 Removable HDD, or when accessing DVD/CD)	$0.22G_{RMS}$. 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. 06 Removable HDD)
Nonoperating	30 G, half-sine, 11 ms duration
Safety	UL 61010-1:2004
	CSA C22.2 No.61010-1-04
Electromagnetic Compatibility, Complies with:	EU Council EMC Directive 2004/108/EC
	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. 07), Removable HDD (Opt. 06)
Calibration Interval	One year
Warranty	One year
GPIB	SCPI-compatible, IEEE488.2 compliant

Physical Characteristics

Dimensions	mm	in.
Height	282	11.1
Width	473	18.6
Depth	531	20.9
Weight	**kg**	**lb.**
With All Options	26.4	58

Note: Physical characteristics, with feet, without accessory pouch.

Ordering Information

RSA6106A
Spectrum Analyzer, 9 kHz to 6.2 GHz

RSA6114A
Spectrum Analyzer, 9 kHz to 14 GHz

RSA6120A
Spectrum Analyzer, 9 kHz to 20 GHz

All Include: Quick-start Manual (Printed), Application Guide (Printed), Printable Online Help File, Programmer's manual (on CD), power cord, BNC-N adapter (RSA6106A/RSA6114), SMA Female barrel (RSA6120A), USB Keyboard, USB Mouse, Front Cover, One-year Warranty.

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

Options

Option	Description
Opt. 01	Internal Preamp, 10 MHz to 3 GHz, 30 dB gain, 4 dB Noise Figure at 2 GHz, typical
Opt. 02	1 GB Acquisition Memory Total, Frequency Mask Trigger
Opt. 05	Digital IQ Output and 500 MHz Analog IF Output
Opt. 06*[23]	≥80 GB Removable HDD. This removes the internal HDD
Opt. 07*[23]	CD R/W, DVD-R. Includes internal HDD
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. 20	Advanced Signal Analysis (including pulse measurements)
Opt. 21	General Purpose Digital Modulation Analysis
Opt. 22	Flexible OFDM
Opt. 110	110 MHz Real-time Acquisition BW
Opt. 200	Advanced Triggers and Swept DPX
Opt. 1R	Rackmount

*[23] One of the following mutually exclusive options must be ordered: 06 or 07.

Accessories

Accessory	Description
RTPA2A Spectrum Analyzer Probe Adapter compatibility	Supports TekConnect probe series P7200, P7300, P7300SMA, P7500
RSAVu	Software based on the RSA3000 Series platform for analysis supporting 3G wireless standards, WLAN (IEEE802.11a/b/g/n), RFID, Audio Demodulation, and more measurements
E and H Near-field Probes	For EMI troubleshooting. 119-4146-xx
Additional Removable Hard Drive	For use with Opt. 06 (Windows XP and instrument SW preinstalled). 065-0751-xx
Additional Removable Hard Drive (Solid State)	For use with Opt. 08 (Windows XP and instrument SW preinstalled). 065-0765-xx
Transit Case	016-2026-xx
Rackmount Retrofit	016-1962-xx
Additional Quick-start Manual (Paper)	071-1909-xx
Service Manual (Paper)	071-1914-xx
SMA (Male) to SMA (Male) 36 in. Cable	174-5706-xx
SMA Female to Female Barrel	131-8508-xx

International Power Plugs

Option	Description
Opt. A0	North America power
Opt. A1	Universal Euro power
Opt. A2	United Kingdom power
Opt. A3	Australia power
Opt. A4	240 V, North America power
Opt. A5	Switzerland power
Opt. A6	Japan power
Opt. A10	China power
Opt. A11	India power
Opt. A99	No power cord or AC adapter

Service

Option	Description
Opt. C3	Calibration Service 3 Years
Opt. C5	Calibration Service 5 Years
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
Opt. R5	Repair Service 5 Years
Opt. CA1	Single Calibration or Functional Verification

Upgrades – RSA6UP

Option	Description	For Serial Numbers	HW or SW	Factory Calibration Required?
Opt. 01	Internal Preamp, 10 MHz to 3 GHz	All	HW	Yes
Opt. 02	1 GB Memory, Frequency Mask Trigger for S/N	S/N ≥ B020212 (RSA6106A) S/N ≥ B020603 (RSA6114A) All RSA6120	SW	No
Opt. 2L	1 GB Memory, Frequency Mask Trigger for S/N	S/N < B020212 (RSA6106A) S/N < B020603 (RSA6114A)	HW	No
Opt. 05	Digital IQ Output and 500 MHz Analog IF Output	All	HW	No
Opt. 06	80 GB Removable HDD. This removes the internal HDD, and is not compatible with Opt. 07	All	HW	No
Opt. 07	CD R/W, DVD-R. Includes internal HDD, and is not compatible with Opt. 06	All	HW	No
Opt. 10	AM/FM/PM Modulation and Audio Measurements	All	SW	No
Opt. 11	Phase Noise and Jitter Measurements	All	SW	No
Opt. 12	Settling Time Measurements (Frequency and Phase)	All	SW	No
Opt. 20	Advanced Signal Analysis (including pulse measurements)	All	SW	No
Opt. 21	General Purpose Digital Modulation Analysis	All	SW	No
Opt. 22	Flexible OFDM	All	SW	No
Opt. 110	110 MHz Real-time Acquisition BW	All S/N ≥ B02xxxx	SW	No
Opt. 110L	110 MHz Real-time Acquisition BW	All S/N B01xxxx	HW	Yes
Opt. 200	Advanced Triggers and Swept DPX (Tektronix installation recommended, add Opt. IF)	All	HW	No
Opt. IF	Installation Labor for all purchased options	All	—	—
Opt. IFC	Installation Labor + Calibration	All	—	—

Languages

Option	Description
Opt. L0	English Manual
Opt. L5	Japanese Manual
Opt. L7	Simplified Chinese Manual
Opt. L10	Russian Manual

CE

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

GPIB IEEE-488

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

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