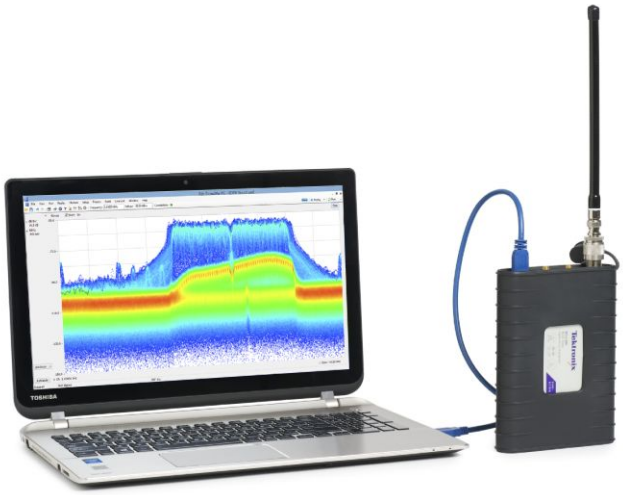
Spectrum Analyzer

RSA306 USB Real Time Spectrum Analyzer Datasheet



The RSA306 uses your PC and Tektronix SignalVu-PC™ RF Signal Analysis Software to provide real time spectrum analysis, streaming capture and deep signal analysis capabilities for signals from 9 kHz to 6.2 GHz, all in a low-cost, highly portable package that is ideal for field, factory, or academic use.

Key performance specifications

- 9 kHz to 6.2 GHz frequency range covers a broad range of analysis needs
- +20 dBm to -160 dBm measurement range
- Captures interference to ensure that you see problems first time, every time
- Mil-Std 28800 Class 2 environmental, shock and vibration specifications for use in harsh conditions

Key features

- Full-featured spectrum analysis capability with included Tektronix SignalVu-PC™ software
- 27 spectrum and signal analysis measurements standard
- Options for mapping, modulation analysis, WLAN and Bluetooth standards support, pulse measurements, playback of recorded files, and frequency settling
- Real time Spectrum/Spectrogram display to minimize time spent on transient and interference hunting
- Application programming interface (API) included for Microsoft Windows environments
- MATLAB instrument driver for use with Instrument Control Toolbox
- Streaming capture records long-term events

Applications

- Academic/education
- Maintenance, installation and repair in the factory or field
- Value-conscious design and manufacturing
- Interference hunting

The RSA306: a new class of instrument

The RSA306 offers full-featured spectrum analysis and deep signal analysis at a price unmatched by any previous offering. Using the latest in commercial interfaces and available computing power, the RSA306 separates signal acquisition from measurement, dramatically lowering the cost of instrument hardware. Data analysis, storage and replay is performed on your personal computer, tablet or laptop. Managing the PC separately from the acquisition hardware makes processing upgrades easy, and minimizes IT management issues.

SignalVu-PC™ software and an API for deep analysis and fast programmatic interaction

The RSA306 operates with SignalVu-PC, a powerful program that is the basis of Tektronix performance signal analyzers. SignalVu-PC offers a deep analysis capability previously unavailable in value-priced solutions. Real-time processing of the DPX spectrum/spectrogram is enabled in your PC, further reducing the cost of hardware. Customers who need programmatic access to the instrument can choose either the SignalVu-PC programmatic interface or use the included application programming interface (API) that provides a rich set of commands and measurements. A MATLAB driver for the API is available, enabling operation with MATLAB and the Instrument Control Toolbox.

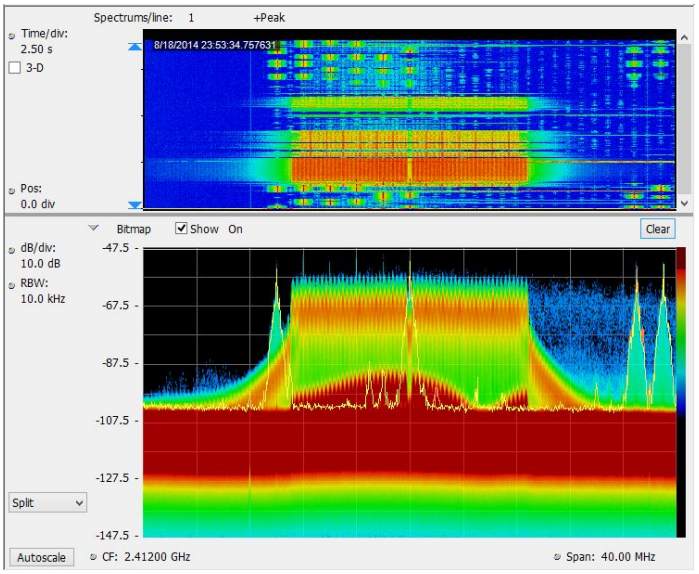
Measurements included in SignalVu-PC base version

Basic functionality of the free SignalVu-PC program is far from basic. The table below summarizes the measurements included in the free SignalVu-PC software.

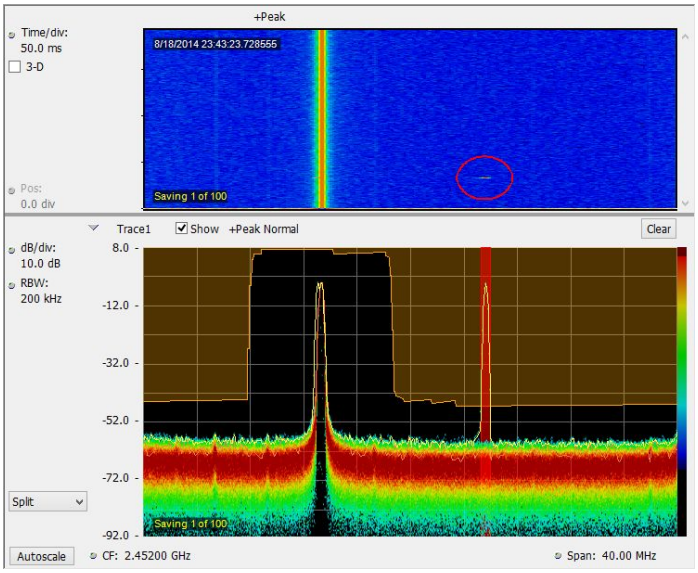
General signal analysis	
Spectrum analyzer	Spans from 1 kHz to 6.2 GHz Three traces plus math and spectrogram trace Five markers with power, relative power, integrated power, power density and dBc/Hz functions
DPX Spectrum/Spectrogram	Real time display of spectrum with 100% probability of intercept of 100 µsec signals in up to 40 MHz span
Amplitude, frequency, phase vs. time, RF I and Q vs. time	Basic vector analysis functions
Time Overview/Navigator	Enables easy setting of acquisition and analysis times for deep analysis in multiple domains
Spectrogram	Analyze and re-analyze your signal with a 2-D or 3-D waterfall display
AM/FM listening	Hear, and record to file, FM and AM signals
Analog modulation analysis	
AM, FM, PM analysis	Measures key AM, FM, PM parameters
RF measurements	
Spurious measurement	User-defined limit lines and regions provide automatic spectrum violation testing across the entire range of the instrument
Spectrum emission mask	User-defined or standards-specific masks
Occupied Bandwidth	Measures 99% power, -xdB down points
Channel Power and ACLR	Variable channel and adjacent/alternate channel parameters
MCPR	Sophisticated, flexible multi-channel power measurements
CCDF	Complementary Cumulative Distribution Function plots the statistical variations in signal level

The RSA306 with SignalVu-PC offers basic and advanced measurements for field and lab

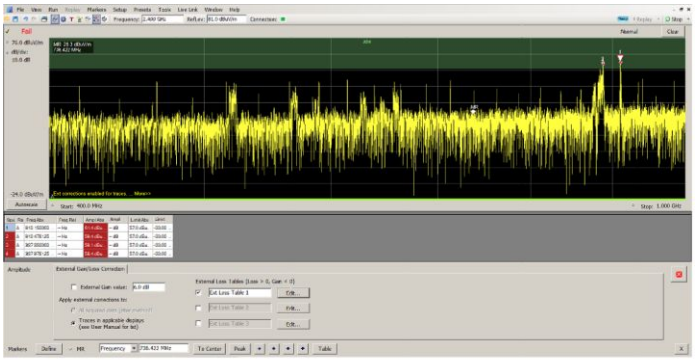
See what you've never seen before: The 40 MHz real time bandwidth of the RSA306 combined with the processing power of SignalVu-PC shows you every signal, even down to 100 µs in duration. The following image shows a WLAN transmission (green and orange), and the narrow signals that repeat across the screen are a Bluetooth access probe. The spectrogram (upper part of the screen) clearly separates these signals in time to show any signal collisions.



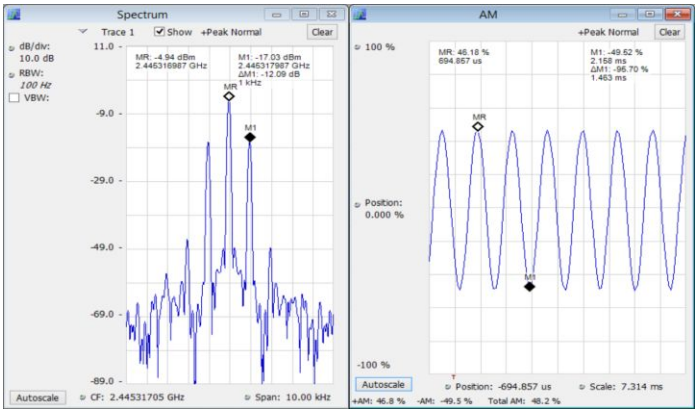
Monitoring has never been easier. Spectrum mask testing captures detail of transients found in the frequency domain, such as intermittent interference. Mask testing can be set to stop acquisition, save acquisition, save a picture, and send an audible alert. The following image shows a spectrum mask (in orange on the spectrum display) created to monitor a band of frequencies for violations. A single transient of 125 µs duration has occurred that violated the mask, with the violation shown in red. The transient is clearly seen on the spectrogram above the red violation area (circled).



EMI pre-compliance and diagnostic measurements are easy with the RSA306 and SignalVu-PC. Transducer, antenna, preamplifier, and cable gain/loss can be entered and stored in correction files, and the standard spurious measurement feature of SignalVu-PC can be used to establish limit lines for your test. The following illustration shows a test from 400 MHz to 1 GHz with the test limit shown in green. Violations are recorded in the results table of the test below the graph, and the control panel for external loss entry is shown. CISPR peak detection and -6 dB filter bandwidths are standard functions, giving you comparable results to other tools.



Analysis of AM and FM signals is standard in SignalVu-PC. The following screen shot shows a 1 kHz tone amplitude modulating a carrier to 48.9% total AM. Markers are used on the spectrum display to measure the modulation sideband at 1 kHz offset, 12.28 dB down from the carrier. The same signal is simultaneously viewed in the modulation display, showing AM versus time, with +Peak, -Peak and Total AM measurements. Advanced measurements for analog audio modulation including SINAD, THD and modulation rate are available in Option SVA.

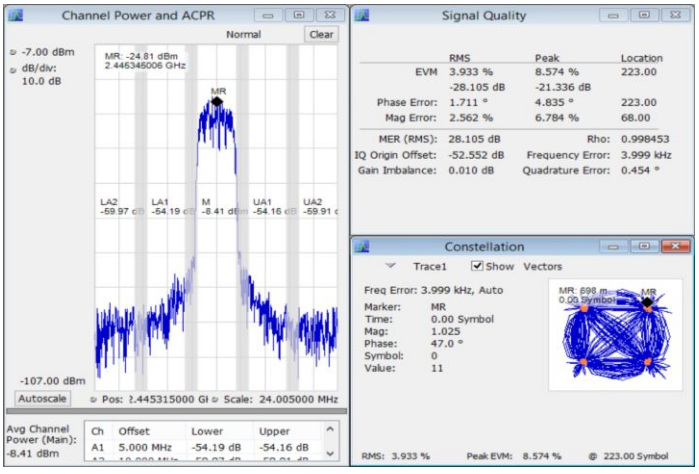


SignalVu-PC application-specific options

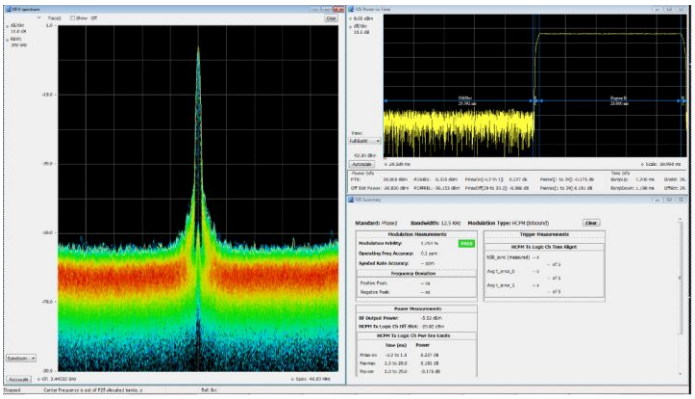
SignalVu-PC offers a wealth of application-oriented measurement and analysis options including:

- General-purpose modulation analysis (27 modulation types including 16/32/64/256 QAM, QPSK, O-QPSK, GMSK, FSK, APSK)
- P25 analysis of phase I and phase 2 signals
- WLAN analysis of 802.11a/b/g/j/p, 802.11n, 802.11ac
- LTE™ FDD and TDD Base Station (eNB) Cell ID & RF measurements (Option SV28)
- Buetooth® analysis of Low Energy, Basic Rate and Enhanced Data Rate
- Mapping and signal strength
- Pulse analysis
- AM/FM/PM/Direct Audio Measurement including SINAD, THD
- Playback of recorded files, including complete analysis in all domains

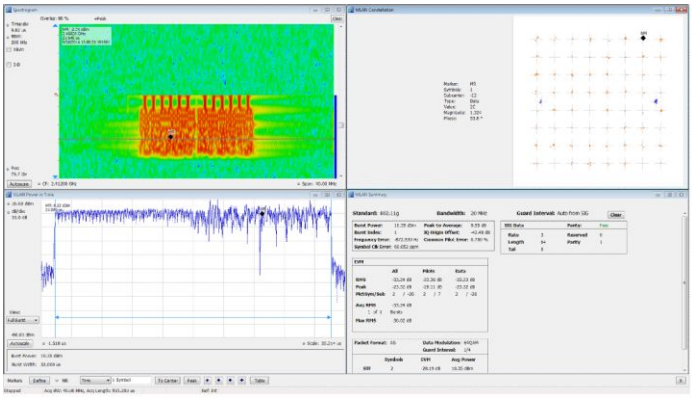
Modulation analysis option SVM enables multiple displays of modulation quality. The following screen shot shows the standard Channel Power/ ACLR measurement combined with a constellation display and vector signal quality measurements on a QPSK signal.



SignalVu-PC Option SV26 enables quick, standards-based transmitter health checks on APCO P25 signals. The following image shows a Phase II signal being monitored for anomalies with the spectrum analyzer while performing transmitter power, modulation and frequency measurements.

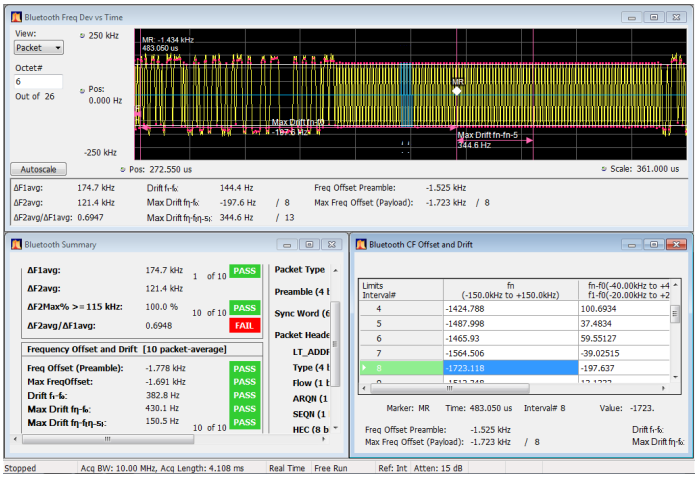


Sophisticated WLAN measurements are easy. On the following 802.11g signal display below, the spectrogram shows the initial pilot sequence followed by the main signal burst. The modulation is automatically detected as 64 QAM for the packet and displayed as a constellation. The data summary indicates an EVM of -33.24 dB RMS, and burst power is measured at 10.35 dBm. SignalVu-PC options are available for 802.11a/b/j/g/p, 802.11n and 802.11ac to 40 MHz bandwidth.

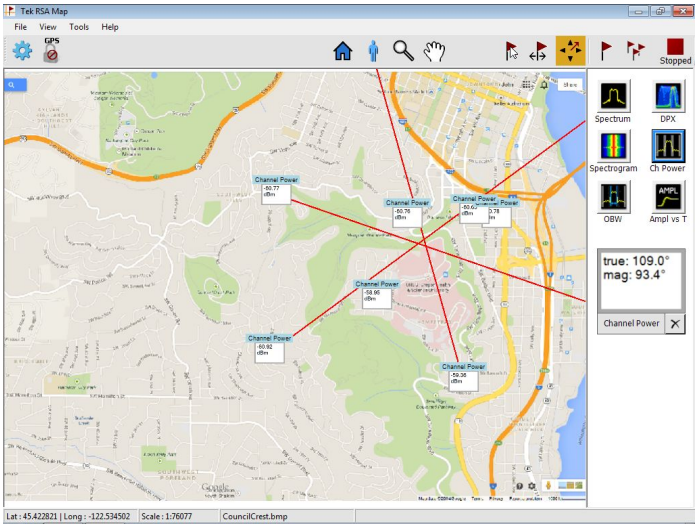


With Option SV27, you can perform Bluetooth SIG standard-based transmitter RF measurements in the time, frequency, and modulation domains. This option supports Basic Rate and Low Energy Transmitter measurements defined by Bluetooth SIG Test Specification RF.TS.4.1.1 for Basic Rate and RF-PHY.TS.4.1.1 for Bluetooth Low Energy. Option SV27 also automatically detects Enhanced Data Rate packets, demodulates them and provides symbol information. Data packet fields are color encoded in the Symbol table for clear identification.

Pass/Fail results are provided with customizable limits and the Bluetooth presets make the different test set-ups push-button. The measurement below shows deviation vs. time, frequency offset and drift, and a measurement summary with pass/fail results.



SignalVu-PC Option MAP enables interference hunting and signal strength analysis. Locate interference with azimuth direction function. It lets you draw a line or an arrow on a mapped measurement to indicate the direction your antenna was pointing when you take a measurement. You can also create and display measurement labels.



Option SV28 enables the following LTE base station transmitter measurements:

Cell ID

Channel Power

Occupied Bandwidth

Adjacent Channel Leakage Ratio (ACLR)

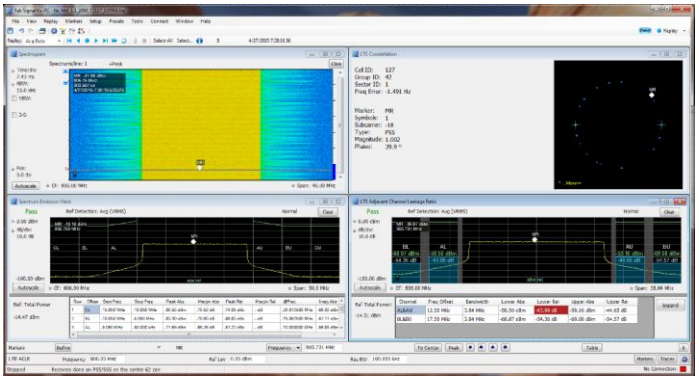
Spectrum Emission Mask (SEM)

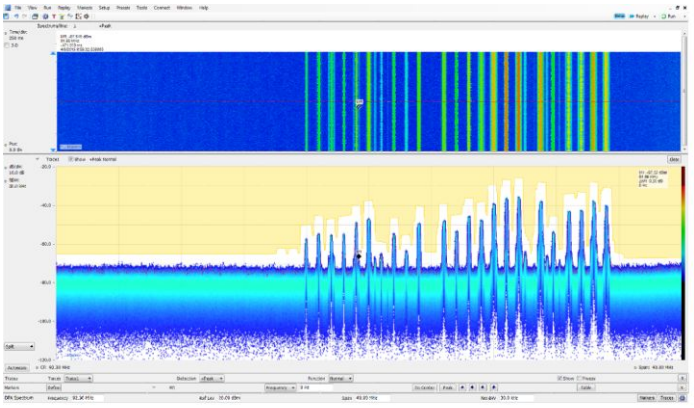
Transmitter Off Power for TDD

There are four presets to accelerate pre-compliance testing and determine the Cell ID. These presets are defined as Cell ID, ACLR, SEM, Channel Power and TDD Toff Power. The measurements follow the definition in 3GPP TS Version 12.5 and support all base station categories, including picocells and femtocells. Pass/Fail information is reported and all channel bandwidths are supported.

The Cell ID preset displays the Primary Synchronization Signal (PSS) and the Secondary Synchronization Signal (SSS) in a Constellation diagram. It also provides Frequency Error.

The ACLR preset measures the E-UTRA and the UTRA adjacent channels, with different chip rates for UTRA. ACLR also supports Noise Correction based on the noise measured when there is no input. Both ACLR and SEM will operate in swept mode (default) or in faster single acquisition (real-time) when the measurement bandwidth required is less than 40 MHz.





Playback of recorded signals can reduce hours of watching and waiting for a spectral violation to minutes at your desk reviewing recorded data. Recording length is limited only by storage media size. SignalVu-PC Option SV56 Playback allows for complete analysis by all SignalVu-PC measurements, including DPX Spectrogram. Minimum signal duration specifications are maintained during playback. AM/FM audio demodulation can be performed. Variable span, resolution bandwidth, analysis length, and bandwidth are all available. Frequency mask testing can be performed on recorded signals up to 40 MHz in span, with actions on mask violation including beep, stop, save trace, save picture, and save data. Portions of the playback can be selected and looped for repeat examination of signals of interest. Playback can be skip-free, or time gaps can be inserted to reduce review time. A Live Rate playback ensures fidelity of AM/FM demodulation and provides a 1:1 playback vs. actual time. Clock time of the recording is displayed in the spectrogram markers for correlation to real world events. In the illustration below, the FM band is being replayed, with a mask applied to detect spectral violations, simultaneous with listening to the FM signal at the center frequency of 92.3 MHz.

Specifications

Specifications are valid within the following conditions:

- Operate the instrument in an environment that meets the temperature, altitude, and humidity characteristics listed in these specifications.
- Warm up time is 30 minutes after connecting to the PC and starting the SignalVu application.

Frequency

RF input frequency range 9 kHz to 6.2 GHz

Frequency reference accuracy

- **Initial** ±3 ppm + aging (18 °C to 28 °C ambient, after 20 minute warm up)
  ±25 ppm + aging (-10 °C to 55 °C ambient, after 20 minute warm up), typical
- **Aging (typical)** ±3 ppm (1st year), ±1 ppm/year thereafter

External frequency reference input

- **Input frequency range** 10 MHz ±10 Hz
- **Input level range** -10 dBm to +10 dBm sinusoid
- **Impedance** 50 Ω

Center frequency resolution

- **Block IQ samples** 1 Hz
- **Streamed ADC samples** 500 kHz

Amplitude

RF input impedance 50 Ω

RF input VSWR (typical) ≤ 1.8:1 (10 MHz to 6200 MHz, reference level ≥ +10 dBm)

Maximum RF input level without damage

- **DC voltage** ±40 V_{DC}
- **Reference level ≥ –10 dBm** +23 dBm (continuous or peak)
- **Reference level < –10 dBm** +15 dBm (continuous or peak)

Maximum RF input operating level The maximum level at the RF input for which the instrument will meet its measurement specifications.

- **Center frequency < 22 MHz (low-frequency path)** +15 dBm
- **Center frequency ≥22 MHz (RF path)** +20 dBm

Amplitude accuracy at all center frequencies

Center frequency	Warranted (18 °C to 28 °C)	Typical (95% confidence) (18 °C to 28 °C)	Typical (-10 °C to 55 °C)
9 kHz - < 3 GHz	±2.0 dB	±1.25 dB	±3.0 dB
≥ 3 GHz - 6.2 GHz	±2.75 dB	±2.0 dB	±3.0 dB

Reference level +20 dBm to -30 dBm, alignment run prior to testing.

Applies to corrected IQ data, with signal to noise ratios > 40 dB.

Accuracy may degrade up to ±0.6 dB after storage at maximum storage temperature, recovers within 24 hours

Intermediate frequency and acquisition system

IF bandwidth	40 MHz
ADC sample rate and bit width	112 Ms/s, 14 bits
Real-time IF acquisition data (uncorrected)	112 Ms/s, 16-bit integer real samples 40 MHz BW, 28 ±0.25 MHz Digital IF, uncorrected. Corrected values are stored with saved files Block streaming data at an average rate of 224 MB/s
Block baseband acquisition data (corrected)	
Maximum acquisition time	1 second
Bandwidths	≤ 40 /(2^N) MHz, 0 Hz Digital IF, N ≥ 0
Sample rates	≤ 56 / (2^N) Msps, 32-bit float complex samples, N ≥ 0
Channel amplitude flatness	±1.0 dB, 18 °C to 28 °C ±2.0 dB, -10 °C to 55 °C, typical ±3.0 dB, 22 MHz - 24 MHz, -10 °C to 55 °C, typical Reference level +20 dBm to -30 dBm, alignment run before testing Applies to corrected IQ data, with signal to noise ratios > 40 dB

Trigger

Trigger/sync input	
Voltage range	TTL, 0.0 V – 5.0 V
Trigger level, positive-going threshold voltage	1.6 V minimum; 2.1 V maximum
Trigger level, negative-going threshold voltage	1.0 V minimum; 1.35 V maximum
Impedance	10 kΩ
IF power trigger	
Threshold range	0 dB to -50 dB from reference level, for trigger levels > 30 dB above the noise floor
Type	Rising or falling edge
Trigger re-arm time	≤100 µs

Noise and distortion

Displayed Average Noise Level (DANL)

Reference level = -50 dBm, input terminated with 50 Ω load, log-average detection (10 averages). SignalVu-PC Spectrum measurements with Span > 40 MHz may use LF or RF path in the first segment of the spectrum sweep.

Center frequency	Frequency range	DANL (dBm/Hz)	DANL (dBm/Hz), typical
< 22 MHz (LF path)	100 kHz - 42 MHz	-130	-133
≥ 22 MHz (RF path)	2 MHz - 5 MHz	-145	-148
	> 5 MHz - 1.0 GHz	-160	-163
	> 1.0 GHz - 2.0 GHz	-158	-161
	> 2.0 GHz - 4.0 GHz	-155	-158
	> 4.0 GHz - 6.2 GHz	-150	-153

Noise and distortion

Phase noise

Phase noise measured with 1 GHz CW signal at 0 dBm

The following table entries are in dBc/Hz units

	Center frequency				
Offset	**1 GHz**	**10 MHz (typical)**	**1 GHz (typical)**	**2.5 GHz (typical)**	**6 GHz (typical)**
1 kHz	-85	-115	-89	-78	-70
10 kHz	-84	-122	-87	-84	-83
100 kHz	-90	-126	-92	-92	-94
1 MHz	-118	-127	-120	-114	-108

Residual spurious response

< -78 dBm (Reference level ≤ -50 dBm, RF input terminated with 50 Ω)

Harmonics of 112 MHz in the range 1680-2688 MHz

LO related spurious in the ranges 3895-3945 MHz, 4780-4810 MHz, and 4920-4950 MHz

Input related spurious response (SFDR)

≤ -50 dBc, 18 ºC to 28 ºC, with auto settings on and signals 10 dB below reference level of -30 dBm, span ≤ 40 MHz

Input frequencies ≤ 8 GHz

≤ -50 dBc, -10 ºC to 55 ºC, typical

Exceptions, typical:

IF feedthrough: ≤ -45 dBc for 1850 MHz - 2700 MHz center frequency

Image: ≤ -35 dBc for 3700 MHz - 3882 MHz center frequency; ≤ -35 dBc for 5400 MHz - 5700 MHz center frequency

RFx3LO: ≤ -45 dBc for 4175 MHz - 4225 MHz center frequency

Input frequencies 6.2 GHz - 8.0 GHz, typical

Image: ≤ -40 dBc for 3882 MHz - 4760 MHz center frequency

RFx2LO: ≤ -25 dBc for 4800 MHz - 5150 MHz center frequency

RFx3LO: ≤ -45 dBc for 4175 MHz - 4225 MHz center frequency

Residual FM

< 10 Hz_{P-P} (95% confidence)

3RD order IM distortion

Two input CW signals, 1 MHz separation, each input signal level 5 dB below the reference level setting at the RF input

Reference level at-15 dBm disables Preamp; reference level at -30 dBm enables Preamp

Center frequency 2130 MHz

≤ -60 dBc at reference level -15 dBm, 18 ºC to 28 ºC

≤ -60 dBc, at reference level -15 dBm, -10 ºC to 55 ºC, typical

40 MHz to 6.2 GHz, typical

< -58 dBc at reference level = -10 dBm

< -50 dBc at reference level = -50 dBm

3RD order intercept (TOI)

Center frequency 2130 MHz

≥ +10 dBm at reference level -15 dBm, 18 ºC to 28 ºC

≥ +10 dBm, at reference level -15 dBm, -10 ºC to 55 ºC, typical

40 MHz to 6.2 GHz, typical

+14 dBm at reference level -10 dBm

-30 dBm at reference level -50 dBm

2ND harmonic distortion, typical

< -55 dBc, 10 MHz to 300 MHz, reference level = 0 dBm

< -60 dBc, 300 MHz to 3.1 GHz, reference level = 0 dBm

< -50 dBc, 10 MHz to 3.1 GHz, reference level = -40 dBm

Exception: < -45 dBc in the range 1850-2330 MHz

Noise and distortion

2ND harmonic intercept (SHI)	+55 dBm, 10 MHz to 300 MHz, reference level = 0 dBm +60 dBm, 300 MHz to 3.1 GHz, reference level = 0 dBm +10 dBm, 10 MHz to 3.1 GHz, reference level = -40 dBm Exception: < +5 dBm in the range 1850-2330 MHz
Local oscillator feedthrough to input connector	< -75 dBm at reference level = -30 dBm

Audio Output

Audio output (from SignalVu-PC or application programming interface)	
Types	AM, FM
IF bandwidth range	Five selections, 8 kHz – 200 kHz
Audio output frequency range	50 Hz – 10 kHz
PC audio output	16 bits at 32 ks/s
Audio file output format	.wav format, 16 bit, 32 ks/s

SignalVu-PC base performance summary

Selected SignalVu-PC features when used with the RSA306. See the SignalVu-PC datasheet for more information on the application features.

SignalVu-PC/RSA306 key characteristics	
Maximum span	40 MHz real-time 9 kHz - 6.2 GHz swept
Maximum acquisition time	1.0 s
Minimum IQ resolution	17.9 ns (acquisition BW = 40 MHz)
Spectrum display	
Traces	Three traces + 1 math trace + 1 trace from spectrogram for spectrum display
Trace functions	Normal, Average (VRMS), Max Hold, Min Hold, Average of Logs
Detector	Average (VRMS), Average, CISPR peak, +Peak, -Peak, Sample
Spectrum trace length	801, 2401, 4001, 8001,10401, 16001, 32001, and 64001 points
RBW range	10 Hz to 10 MHz
DPX spectrum display	
Spectrum processing rate (RBW = auto, trace length 801)	10,000/s
DPX bitmap resolution	201x801
Marker information	Amplitude, frequency, signal density
Minimum signal duration for 100% probability of detection	100 µs Span: 40 MHz, RBW = Auto, Max-hold on Due to the non-deterministic execution time of programs running under the Microsoft Windows OS, this specification may not be met when the host PC is heavily loaded with other processing tasks
Span range (continuous processing)	1 kHz to 40 MHz
Span range (swept)	Up to maximum frequency range of instrument
Dwell time per step	50 ms to 100 s

SignalVu-PC base performance summary

Trace processing	Color-graded bitmap, +Peak, -Peak, average
Trace length	801, 2401, 4001, 10401
RBW range	1 kHz to 10 MHz

DPX Spectrogram display

Trace detection	+Peak, -Peak, Average(V_{RMS})
Trace length, memory depth	801 (60,000 traces)
	2401 (20,000 traces)
	4001 (12,000 traces)
Time resolution per line	50 ms to 6400 s, user selectable

Analog modulation analysis (standard)

AM demodulation accuracy, typical	±2%
	0 dBm input at center, carrier frequency 1 GHz, 1kHz/5kHz input/modulated frequency, 10% to 60% modulation depth
	0 dBm input power level, reference level = 10 dBm
FM demodulation accuracy, typical	±3%
	0 dBm input at center, carrier frequency 1 GHz, 400Hz/1kHz input/modulated frequency
	0 dBm input power level, reference level = 10 dBm
PM demodulation accuracy, typical	±1% of measurement bandwidth
	0 dBm input at center, carrier frequency 1 GHz, 1kHz/5kHz input/modulated frequency
	0 dBm input power level, reference level = 10 dBm

SignalVu-PC options

AM/FM/PM and direct audio measurement (Option SVA)

Carrier frequency range (for modulation and audio measurements)	(1/2 × audio analysis bandwidth) to maximum input frequency
Maximum audio frequency span	10 MHz
FM measurements (Mod. index >0.1)	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
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
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

SignalVu-PC options

Direct 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

Audio filters

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

High pass: 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

Performance characteristics, typical	**Conditions: Unless otherwise stated, performance is given for: Modulation rate = 5 kHz AM depth: 50% PM deviation 0.628 Radians**			
	FM	**AM**	**PM**	**Conditions**
Carrier Power accuracy	Refer to instrument amplitude accuracy			
Carrier Frequency accuracy	± 7 Hz + (transmitter frequency × ref. freq. error)	Refer to instrument frequency accuracy	± 2 Hz + (transmitter frequency × ref. freq. error)	FM deviation: 5 kHz / 100 kHz
Depth of Modulation accuracy	NA	± 0.5%	NA	Rate: 5 kHz Depth: 50%
Deviation accuracy	± (2% × (rate + deviation))	NA	± 3%	FM deviation: 100 kHz
Rate accuracy	± 0.2 Hz	± 0.2 Hz	± 0.2 Hz	FM deviation: 5 kHz / 100 kHz
Residual THD	0.5%	0.5%	NA	FM Deviation: 5 kHz / 100 kHz Rate: 1 kHz
Residual SINAD	49 dB 40 dB	56 dB	42 dB	FM deviation 5 kHz FM deviation 100 kHz Rate: 1 kHz

Pulse measurements (Option SVP)

Measurements (nominal)

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, 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, Time Stamp, Delta Frequency, Impulse Response, Overshoot

Minimum pulse width for detection

150 ns

Average ON power at 18 °C to 28 °C, typical

±1.0 dB + absolute amplitude accuracy

For pulses of 300 ns width or greater, duty cycles of .5 to .001, and S/N ratio ≥ 30 dB

Duty factor, typical

±0.2% of reading

For pulses of 450 ns width or greater, duty cycles of .5 to .001, and S/N ratio ≥ 30 dB

Average transmitted power, typical

±1.0 dB + absolute amplitude accuracy

For pulses of 300 ns width or greater, duty cycles of .5 to .001, and S/N ratio ≥ 30 dB

Peak pulse power, typical

±1.5 dB + absolute amplitude accuracy

For pulses of 300 ns width or greater, duty cycles of .5 to .001, and S/N ratio ≥ 30 dB

Pulse width, typical

±0.25% of reading

For pulses of 450 ns width or greater, duty cycles of .5 to .001, and S/N ratio ≥ 30 dB

SignalVu-PC options

General purpose digital modulation analysis (Option SVM)

Modulation formats	BPSK, QPSK, 8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, PI/2DBPSK, DQPSK, PI/4DQPSK, D8PSK, D16PSK, SBPSK, OQPSK, SOQPSK, 16-APSK, 32-APSK, MSK, GFSK, CPM, 2FSK, 4FSK, 8FSK, 16FSK, C4FM
Analysis period	Up to 81,000 samples
Measurement filter	Root Raised Cosine, Raised Cosine, Gaussian, Rectangular, IS-95 TX_MEA, IS-95 Base TXEQ_MEA, None
Reference Filter	Gaussian, Raised Cosine, Rectangular, IS-95 REF, None
Filter rolloff factor	α : 0.001 to 1, in 0.001 steps
Measurements	Constellation, Demod I&Q vs. Time, Error Vector Magnitude (EVM) vs. Time, Eye Diagram, Frequency Deviation vs. Time, Magnitude Error vs. Time, Phase Error vs. Time, Signal Quality, Symbol Table, Trellis Diagram
Symbol rate range	1 k symbols/s to 40 M symbols/s
	Modulated signal must be contained entirely within the acquisition bandwidth
Adaptive equalizer	Linear, Decision-Directed, Feed-Forward (FIR) equalizer with coefficient adaptation and adjustable convergence rate. Supports modulation types BPSK, QPSK, OQPSK, π/2-DBPSK, π/4-DQPSK, 8-PSK, 8-DSPK, 16-DPSK, 16/32/64/128/256-QAM,16/32-APSK
QPSK Residual EVM (center frequency = 2 GHz), typical	1.1 % (100 kHz symbol rate)
	1.1 % (1 MHz symbol rate)
	1.2 % (10 MHz symbol rate)
	2.5 % (30 MHz symbol rate)
	400 symbols measurement length, 20 Averages, normalization reference = maximum symbol magnitude
256 QAM Residual EVM (center frequency = 2 GHz), typical	0.8 % (10 MHz symbol rate)
	1.5 % (30 MHz symbol rate)
	400 symbols measurement length, 20 Averages, normalization reference = maximum symbol magnitude

WLAN Measurements, 802.11a/b/g/j/p (Option SV23)

Measurements	WLAN power vs. time; WLAN symbol table; WLAN constellation; spectrum emission mask; 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); channel frequency response vs. symbol (or time), vs. subcarrier (or frequency); spectral flatness vs. symbol (or time), vs. subcarrier (or frequency)
Residual EVM - 802.11a/g/j /p (OFDM), 64-QAM, typical	2.4 GHz, 20 MHz BW: -38 dB
	5.8 GHz, 20 MHz BW: -38 dB
	Input signal level optimized for best EVM, average of 20 bursts, ≥16 symbols each
Residual EVM - 802.11b, CCK-11, typical	2.4 GHz, 11 Mbps: 2.0 %
	Input signal level optimized for best EVM, average of 1,000 chips, BT = .61

WLAN Measurements 802.11n (Option SV24)

Measurements	WLAN power vs. time; WLAN symbol table; WLAN constellation; spectrum emission mask; 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); channel frequency response vs. symbol (or time), vs. subcarrier (or frequency); spectral flatness vs. symbol (or time), vs. subcarrier (or frequency)
EVM performance - 802.11n, 64-QAM, typical	2.4 GHz, 40 MHz BW: -35 dB
	5.8 GHz, 40 MHz BW: -35 dB
	Input signal level optimized for best EVM, average of 20 bursts, ≥16 symbols each

SignalVu-PC options

WLAN Measurements 802.11ac (Option SV25)

Measurements	WLAN power vs. time; WLAN symbol table; WLAN constellation; spectrum emission mask; 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); channel frequency response vs. symbol (or time), vs. subcarrier (or frequency); spectral flatness vs. symbol (or time), vs. subcarrier (or frequency)
EVM performance - 802.11ac, 256-QAM, typical	5.8 GHz, 40 MHz BW : -35 dB Input signal level optimized for best EVM, average of 20 bursts, ≥16 symbols each

APCO P25 Measurements (Option SV26)

Measurements	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, cross-correlated markers
Modulation fidelity, typical	C4FM = 1.3% HCPM = 0.8% HDQPSK = 2.5% Input signal level is optimized for best modulation fidelity.

Bluetooth Measurements (Option SV27)

Modulation formats	Basic Rate, Bluetooth Low Energy, Enhanced Data Rate - Revision 4.1.1
Measurements	Peak Power, Average Power, Adjacent Channel Power or InBand Emission mask, -20dB 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, In-band emissions and ACP	Level uncertainty: refer to instrument amplitude and flatness specification Measurement range: signal level > –70 dBm
Modulation characteristics	Deviation range: ±280 kHz Deviation uncertainty (at 0 dBm) 2 kHz + instrument frequency uncertainty (basic rate) 3 kHz + instrument frequency uncertainty (low energy) Measurement range: Nominal channel frequency ±100 kHz
Initial Carrier Frequency Tolerance (ICFT)	Measurement uncertainty (at 0 dBm): <1 kHz + instrument frequency uncertainty Measurement range: Nominal channel frequency ±100 kHz
Carrier Frequency Drift	Measurement uncertainty: <2 kHz + instrument frequency uncertainty Measurement range: Nominal channel frequency ±100 kHz

SignalVu-PC options

LTE Downlink RF measurements (Opt. SV28)	
Standard Supported	3GPP TS 36.141 Version 12.5
Frame Format supported	FDD and TDD
Measurements and Displays Supported	Adjacent Channel Leakage Ratio (ACLR), Spectrum Emission Mask (SEM), Channel Power, Occupied Bandwidth, Power vs. Time showing Transmitter OFF power for TDD signals and LTE constellation diagram for Primary Synchronization Signal, Secondary Synchronization Signal with Cell ID, Group ID, Sector ID and Frequency Error.
ACLR with E-UTRA bands (Nominal, with Noise Correction)	1st Adjacent Channel 65 dB (RSA306) 2nd Adjacent Channel 66 dB (RSA306)
Mapping and Signal Strength (Option MAP)	
Supported map types	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
RF signal strength	
Signal strength indicator	Located at right side of display
Measurement bandwidth	Up to 40 MHz, dependent on span and RBW setting
Tone type	Variable frequency based on received signal strength
Playback of recorded signals (Option SV56)	
Playback file type	R3F recorded by RSA306
Recorded file bandwidth	40 MHz
File playback controls	General: Play, stop, exit playback Location: Begin/end points of playback settable from 0-100% Skip: Defined skip size from 73 µs up to 99% of file size Live rate: Plays back at 1:1 rate to recording time Loop control: Play once, or loop continuously
Memory requirement	Recording of signals requires storage with write rates of 300 MB/sec. Playback of recorded files at live rates requires storage with read rates of 300 MB/sec.

Inputs, outputs, interfaces, power consumption

RF input	Type N, female
External frequency reference input	SMA, female
Trigger/sync input	SMA, female
Status indicator	LED, dual color red/green
USB device port	USB 3.0 - Micro-B
Power consumption	Per USB 3.0 SuperSpeed requirements: 5.0 V, ≤ 900 mA (nominal)

Physical characteristics

Dimensions	
Height	30.5 mm (1.2 in)
Width	190.5 mm (7.5 in)
Depth	127 mm (5 in)
Weight	0.59 kg (1.3 lbs)

Regulatory

Safety	UL61010-1, CAN/CSA-22.2 No.61010-1, EN61010-1, IEC61010-1
Regional certifications	Europe: EN61326 Australia/New Zealand: AS/NZS 2064
EMC emissions	EN61000-3-2, EN61000-3-3, EN61326-2-1
EMC immunity	EN61326–1/2, IEC61000-4-2/3/4/5/6/8/11

Environmental performance

Temperature	
Operating	-10 °C to +55 °C (+14 °F to +131 °F)
Nonoperating	-51 °C to +71 °C (-60 °F to +160 °F)
Humidity (operating)	5% to 75% ±5% relative humidity (RH) from +30 °C to +40 °C (+86 °F to 104 °F) 5% to 45% RH above +40 °C to +55 °C (+86 °F to +131 °F)
Altitude	
Operating	Up to 9,144 meters (30,000 feet)
Nonoperating	15,240 meters (50,000 feet)
Dynamics	
Mechanical shock, operating	Half-sine mechanical shocks, 30 g peak amplitude, 11 µs duration, three drops in each direction of each axis (18 total)
Random vibration, nonoperating	0.030 g^2/Hz, 10-500 Hz, 30 minutes per axis, three axes (90 minutes total)
Handling and transit	
Bench handling, operating	Per MIL-PRF-28800F Class 2 operating: Rotational-edge-drops of appropriate edges on appropriate sides of the equipment
Transit drop, nonoperating	Per MIL-PRF-28800F Class 2 nonoperating: Transit drops onto six faces and four corners of the equipment, from a height of 30 cm (11.8 in.) for a total of 10 impacts

Ordering information

Models

RSA306	USB real time spectrum analyzer, 9 kHz - 6.2 GHz, 40 MHz acquisition bandwidth. The RSA306 requires a PC with Windows 7 or Windows 8/8.1, 64-bit operating system. A USB 3.0 connection is required for operation of the RSA306. 8 GB RAM and 20 GB free drive space is required for installation of SignalVu-PC. For full performance of the real time features of the RSA306, an Intel Core i7 4th generation processor is required. Processors of lower performance can be used, with reduced real-time performance. Storage of streaming data requires that the PC be equipped with a drive capable of streaming storage rates of 300 MB/sec.

Standard accessories

174-6796-xx	USB 3.0 locking cable (1 M)
063-4543-xx	SignalVu-PC software, documentation, USB key
071-3323-xx	Printed safety/installation manual (English)

Warranty

Warranty	1 year

SignalVu-PC application-specific options

SignalVu-PC-SVE requires the Microsoft Windows 7 or 8/8.1, 64-bit operating system. The base software is free, included with the instrument, and is also available to download from www.tek.com. Purchased option keys are emailed and then entered into the application. Fully functional trial options can be activated locally for 30 days.

The following SignalVu-PC-SVE options add functionality and value to your measurement solution:

Option SVA	AM/FM/PM/Direct audio analysis
Option SVT	Settling Time (frequency and phase) measurement
Option SVM	General purpose modulation analysis
Option SVP	Advanced Signal Analysis (including pulse measurements)
Option SVO	Flexible OFDM Analysis
Option SV23	WLAN 802.11a/b/g/j/p measurement application
Option SV24	WLAN 802.11n measurement application (requires option SV23)
Option SV25	WLAN 802.11ac measurement application (requires option SV24). Limited to 40 MHz bandwidth on RSA306
Option SV26	APCO P25 measurement application
Option SV27	Bluetooth Basic LE Tx measurement
Option SV28	LTE Downlink RF measurements
Option MAP	Mapping and signal strength
Option SV56	Playback of recorded files (requires 300 MB/sec read rate from storage for live rate playback)
Option CON	SignalVu-PC live link to the MDO4000B series mixed-domain oscilloscopes
Option SIGNALVU-PC-SVE SV2C	Live Link to MDO4000B and WLAN 802.11a/b/g/j/p/n/ac measurements (includes options CON, SV23, SV24 and SV25)

Service options

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. R3	Repair Service 3 Years (including warranty)
Opt. R5	Repair Service 5 Years (including warranty)

Recommended accessories

RSA300CASE	Soft case with shoulder-strap
RSA300TRANSIT	Hard-sided transit case for RSA300 with room for USB cable and small accessories. Pelican model Stormcase iM2100
RSA306RACK	Rackmount with slots for two RSA306. 19 inch rack with cover for unused slot
119-6609-xx	BNC whip antenna
103-0045-xx	N-BNC adapter
119-6594-xx	Beam antenna, 824 MHz to 896 MHz
119-6595-xx	Beam antenna, 896 MHz to 960 MHz
119-6596-xx	Beam antenna, 1710 MHz to 1880 MHz
119-6597-xx	Beam antenna, 1850 MHz to 1990 MHz
119-6970-xx	Magnetic mount antenna, 824 MHz to 2170 MHz (requires adapter 103-0449-00)
119-7246-xx	Pre-filter, general purpose, 824 MHz to 2500 MHz, Type-N (f) connector
119-7426-xx	Pre-filter, general purpose, 2400 MHz to 6200 MHz, Type-N (f) connector
012-0482-xx	Cable, 50 Ω, BNC (m) 3 foot (91 cm)
174-4977-xx	Cable, 50 Ω, straight Type-N (m) and angled Type-N (m) connector, 1.6 foot (50 cm)
174-5002-xx	Cable, 50 Ω, Type-N (m) to Type-N (m) connector, 3 foot (91 cm)
119-4146-xx	EMCO E/H-field probes
10 dB 2W pad, SMA M-F	Available from Pasternack http://www.pasternack.com/10db-fixed-sma-male-sma-female-2-watts-attenuator-pe7045-10-p.aspx
E/H field probes, lower cost alternative	Available from Beehive www. http://beehive-electronics.com/

CE

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.

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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.

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