

# RSA7100A

## RSA7100A Spectrum Analyzer Datasheet



\* Monitor not included.

The RSA7100A wideband signal analyzer offers real time spectrum analysis up to 800 MHz bandwidth, and streaming storage of up to 2 hours of seamless data at full bandwidth.

### KeyFeatures

- 16 kHz to 14/26.5 GHz frequency range covers a broad range of analysis needs
- High performance spectrum analysis for advanced design verification with -134 dBc/Hz phase noise at 1 GHz, 10 kHz offset and typical amplitude accuracy of 0.5 dB at 10 GHz
- Standard 320 MHz real time bandwidth
- Available 800 MHz acquisition bandwidth for advanced Radar, communications and spectrum management requirements
- Real time triggers on events of 4 ns in time domain, 700 ns in frequency domain ensures you catch the signals of interest first time, every time
- Streaming capture to internal RAID of over 2 hours (maximum of 2.75 hours) at full 800 MHz bandwidth enables environment recording and analysis of long event sequences
- DataVu-PC software for analysis of recorded events of any length includes ability to mark events of interest, export waveforms to other formats and perform pulse analysis with export of Pulse Descriptor Word (PDW) information
- Simultaneous streaming and real time analysis for live monitoring of recording events ensures you are getting the data you need
- Efficient fast-frame capture with dead-time eliminated optimizes memory and analysis so you can analyze longer test sequences
- Standard real time spectrum analysis with DPX spectrum/spectrogram minimizes time finding transients and interference

- Standard measurements including channel power, ACLR, CCDF, OBW/EBW, spurious search and amplitude/frequency/phase versus time provide a complete tool set for development work
- Application licenses for SignalVu-PC are available to provide a wide variety of analysis including modulation, pulse, WLAN and frequency/phase settling measurements
- Internal GPS receiver available for precise time stamping of events

### Applications

- Advanced radar/EW design evaluation
- Environment evaluation, monitoring, and recording
- Wideband communications design
- Spectrum management

### The RSA7100A gives you the power to imagine new solutions

The RSA7100A is a high performance spectrum analyzer focused on wideband analysis and signal recording. By separating the RF acquisitions from the compute engine, a graphics processor can be used in place of previously required FPGA designs for real time processing. As processor capabilities advance, new performance can be easily maintained for the system with PC upgrades instead of RF hardware replacement, making the RSA7100A a smart choice for minimizing long term costs. You can also harness the power of this CPU/GPU combination in your own simulations and designs, using the instrument as a powerful workstation.

The RSA7100A is designed for engineers working on the latest wideband designs in communications, radar and electronic warfare and for spectrum managers who need to see the effects of new wideband systems when fielded and operational.

Analysis of signals is enabled with two software packages. SignalVu-PC for real time, spectrum and vector signal analysis, and DataVu-PC for analysis of the very large file sets produced when recording wideband signals.

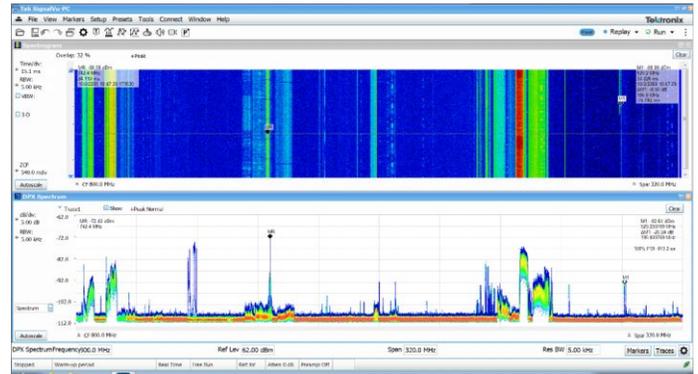
## SignalVu-PC software offers rich analysis capability

The RSA7100 operates with SignalVu-PC, a powerful program used as the basis of Tek's traditional spectrum analyzers. SignalVu-PC offers a deep analysis capability including real time spectrum analysis and a wide variety of application packages. A programmatic interface to SignalVu-PC is provided, offering all measurements and settings to external programs. Basic functionality of the free SignalVu-PC program is far from basic and includes the measurements shown below.

### Measurements and functions included in SignalVu-PC base version

General signal analysis	Description
Spectrum analyzer	Spans from 100 Hz to full range of the instrument, 3 traces + math and spectrogram trace, 5 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 700 nsec signals in up to 800 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 in 2-D or 3-D waterfall display
Analog modulation analysis	Description
AM, FM, PM analysis	Measures key AM, FM, PM parameters
RF measurements	Description
Spurious measurement	User-defined limit lines and regions provide automatic spectrum violation testing across the entire range of the instrument.
Spectrum emission mask	User-set 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.
Signal strength	Measures signal strength and displays a spectrum and signal strength bar for interference hunting and signal quality evaluations.

The illustration below demonstrates the power of wide-band continuous monitoring for determining spectrum occupancy and interference over time. The spectrogram and real-time spectrum displays off-air spectral activity over time from 640 MHz to 960 MHz, showing TV, narrow-band communications, cellular base stations and the unregulated 900 MHz ISM band, all time-correlated. The resolution bandwidth of the analysis is 5 kHz to assure a low noise floor, and the minimum signal duration for 100% probability of intercept is a remarkable 872 microseconds.



### The RSA7100A combined with SignalVu-PC application licenses offers advanced analysis, 800 MHz bandwidth, and streaming to internal RAID

SignalVu-PC offers a wealth of application-oriented options, including:

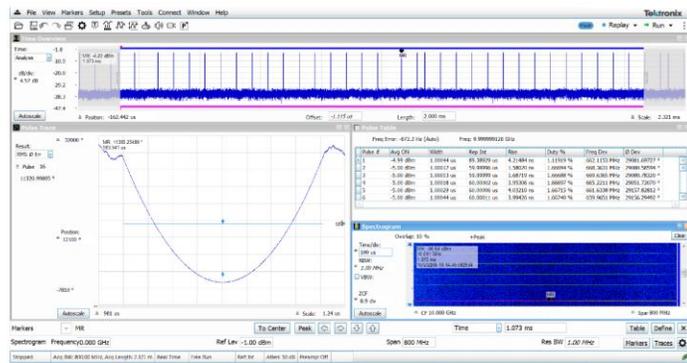
- Pulse analysis including exclusive Pulse-Ogram™ displays
- General-purpose modulation analysis (27 modulation types including 16/32/64/256 QAM, QPSK, O-QPSK, GMSK, FSK, APSK)
- Streaming data to internal RAID
- WLAN analysis of 802.11a/b/g/j/p, 802.11n, 802.11ac
- P25 analysis of phase 1 and phase 2 signals
- LTE™ FDD and TDD Base Station (eNB) Cell ID & RF measurements
- Bluetooth® analysis of Low Energy, Basic Rate and Enhanced Data Rate
- Mapping
- AM/FM/PM/Direct Audio Measurement including SINAD, THD
- Signal Classification and Survey

See the separate SignalVu-PC data sheet for complete details and ordering information. Selected applications are illustrated below.

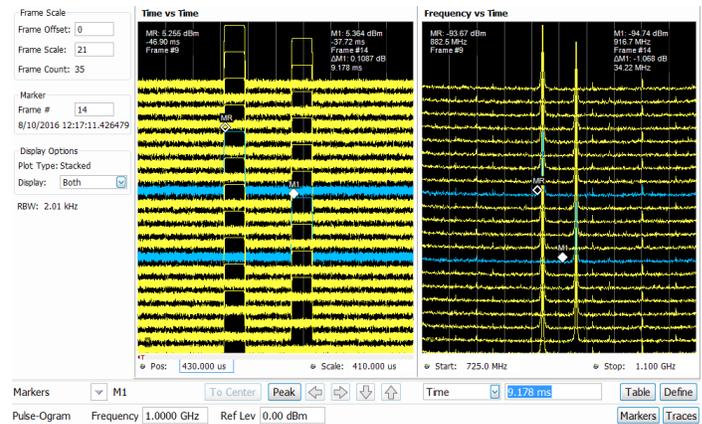
### Pulse analysis

The Pulse Analysis package (SVPH) provides 29 individual measurements plus cumulative statistics, opening a world of characterization for wideband pulsed system designers and evaluators. The fast-frame acquisition mode of SignalVu-PC with the RSA7100A allows you to acquire just the time of interest during your pulse, making the most efficient use of memory. Cumulative statistics displays analyze data over multiple acquisitions, further extending the analysis to millions of pulses. Displays and measurements include:

Displays	Available measurements
Cumulative histograms of any measurement	Pulse frequency
Cumulative measurements table with statistics (min, max, mean, standard deviation)	Power (Average on, Peak, Average transmitted)
Cumulative histograms of any measurement	Pulse width
Pulse-Ogram waterfall display of amplitude vs. time of multiple pulses	Rise time
Spectrum of any pulse from the Pulse-Ogram	Fall time
Measurement display of any selected pulse vs. time	Repetition interval (seconds and Hz)
Trend of selected measurement vs. pulse number	Duty factor (% and ratio)
FFT of selected measurement vs. pulse number	Ripple (dB and %)
	Droop (dB and %)
	Overshoot (dB and %)
	Pulse-to-Pulse and Pulse-to-Reference frequency difference
	Pulse-to-Pulse and Pulse-to-Reference phase difference
	Frequency error (RMS and Maximum)
	Phase error (RMS and Maximum)
	Deviation (Frequency and Phase)
	Impulse response (dB and time)
	Time stamp



Shown above is a 700 MHz wide chirped signal. A time overview is presented at the top of the display that shows the pulses in the current acquisition. Phase deviation is displayed on the left, showing the characteristic parabolic shape of a frequency chirp. The signal has variations in repetition interval, shown in both the pulse table and the spectrogram on the right.



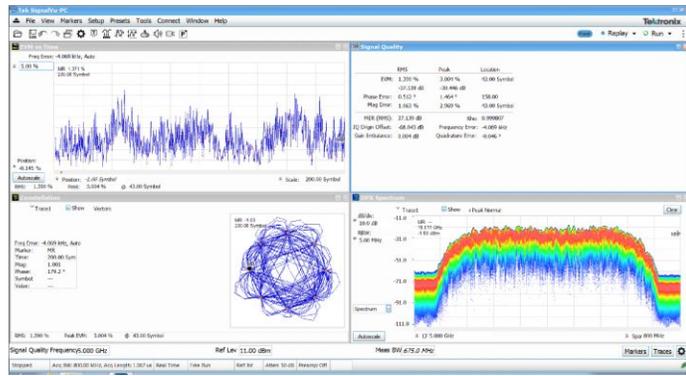
The illustration above is the unique Pulse-Ogram display in SignalVu-PC application license SVPH. This is a waterfall of triggered pulses showing their relationship to the trigger in time domain. Variations are immediately seen as changes in timing vs. trigger. Each time domain trace is represented as a spectrum on the right side of the display for immediate correlation of time and frequency domain effects.

### General purpose modulation analysis

SignalVu-PC application SV21 bundles 27 different modulation types into a single analysis package that includes:

Displays	Measurements
Constellation	Error vector magnitude (RMS, Peak, EVM vs Time)
I and Q vs. Time	Modulation error ratio (MER)
EVM vs. Time	Magnitude Error (RMS, peak, mag error vs time)
Frequency deviation vs. Time	Phase error (RMS, Peak, Phase error vs time)
Magnitude error vs. Time	Origin offset
Phase error vs. Time	Frequency error
Eye diagram	Gain imbalance
Trellis diagram	Quadrature error
Signal quality	Rho
Symbol table	FSK only: Frequency deviation, Symbol timing error

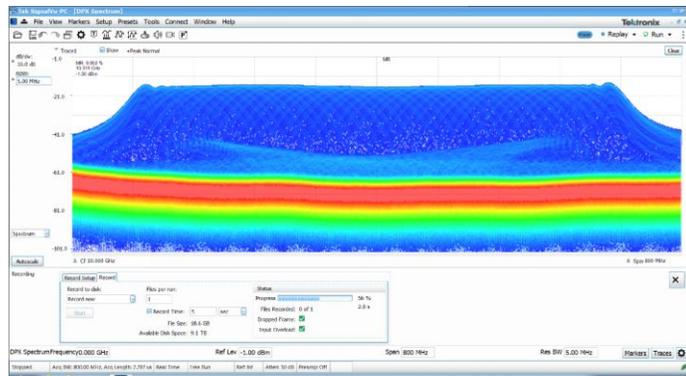
Modulation types
$\pi/2$ DQPSK, BPSK, SBPSK, QPSK, DQPSK, $\pi/4$ DQPSK, D8PSK, 8PSK, OQPSK, SOQPSK, CPM, 16/32/64/128/256QAM, MSK, GMSK, GFSK, 2-FSK, 4-FSK, 8-FSK, 16-FSK, C4FM, D16PSK, 16APSK, and 32APSK



In the illustration above, a 5 GHz carrier modulated with 500 MSymbols/sec pi/4-QPSK is analyzed with the RSA7100A Option B800 and SignalVu-PC application license SVMH. A measurement summary, EVM vs. Time, and constellation display are shown along with the continuous monitoring of the DPX spectrum.

### Streaming recording to RAID

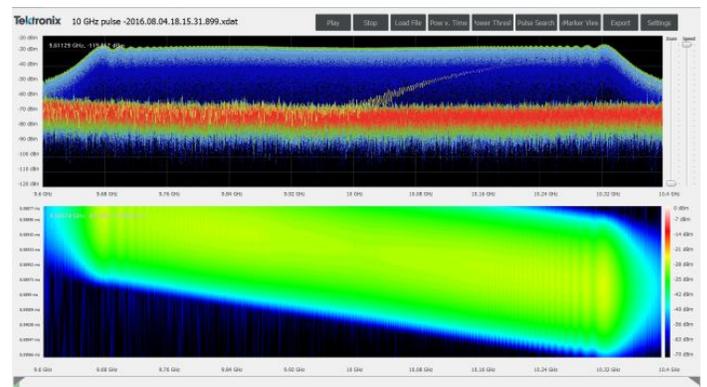
With option STREAMxx-SVPC, you can stream the full real time bandwidth of the RSA7100A to the available RAID system in the controller. All other analysis (real time spectrum analysis, modulation analysis, etc.) is available simultaneous with streaming. This ability to analyze while streaming ensures the quality of your data collection, avoiding re-runs and saving time. Two options for RAID are offered, with over 2 hours storage available at 800 MHz bandwidth. Longer recording times are available at reduced bandwidths.



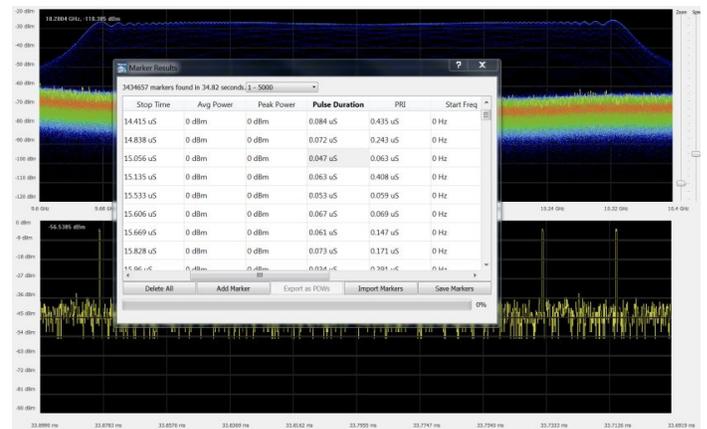
Easy recordings are available at the touch of a button or when a trigger is received. Anticipated file size is reported and indications of skipped frames or overload conditions are provided to ensure high quality recording. Above we see a 5 second recording being made. DPX spectrum is providing real time monitoring of the 800 MHz acquisition. The file size, available disk space, recording progress, number of files recorded are all reported. Indicators of dropped frames and input overload are presented all in the same control screen.

### DataVu-PC for analysis of long recordings

SignalVu-PC can open files up to 16 GB in size, and perform analysis on any 1 GB of the opened file. But 16 GB is just a few seconds of data in 800 MHz bandwidth, not enough for analysis of streamed recordings that can reach 30 TB in size. DataVu-PC is the solution for analysis of large files. With DataVu-PC you can view color-graded spectrums, spectrograms and amplitude vs. time of files of unlimited length. Search-and-mark testing is available to quickly identify signals of interest. Searches can be amplitude qualified, and a marker is placed on up to 2,000,000 events found. Replay of user-selected sections is offered for review of signals of interest, and selected areas can be exported to SignalVu-PC for further analysis. Pulse analysis is available within DataVu-PC, with results start/stop time, average/peak power, pulse duration, Pulse Repetition Interval (PRI) and start/stop frequencies on up to 2,000,000 pulses, all exportable in Pulse Descriptor Word (PDW) format. See the separate DataVu-PC data sheet for further details.



Above is a color-graded spectrum display combined with a 99% overlap spectrogram display as shown on DataVu-PC. You have full overlap/skip control to vary rate and detail of the streaming file for complete visualization of the data.



DataVu-PC pulse option provides fast marking of pulses and measurements on large data sets. Above, the results of a pulse search are presented with the pulse measurements of start/stop time, average/peak power, pulse duration, Pulse Repetition Interval (PRI) and start/stop frequencies on up to 2,000,000 pulses. Pulse results can be exported in PDW format for use by other tools.

## CTRL7100A controller included with the RSA7100A

Tektronix has designed the CTRL7100A controller to meet the specified performance of real time DPX operation with simultaneous streaming to RAID. You can also harness the power of this CPU/GPU combination in your own simulations and designs, using the instrument as a powerful workstation.

### Key specifications, instrument controller CTRL7100A

The CTRL7100A is offered in the following configuration.

- Dual Intel® Xeon® Processor E5-2623 v4 (10M Cache, 2.6 GHz)
- 64 GB DDR4 2133 MHz RAM
- 512 GB SSD (removable)
- Windows 7 (Win8 Pro COA) operating system
- AMD FirePro W9100 16GB 512-bit GDDR5 PCIe 3.0 Workstation Video Card
  - 16 GB GDDR5 memory
  - 6 Mini Display Port 1.2 outputs
  - 320 GB/s memory bandwidth
  - 4K display resolution (up to 4096 x 2160)
  - 5.24 TFLOPS single precision performance
- Streaming to RAID options (20 minutes, or 165 minutes at full 800 MHz bandwidth)
- CTRL-7100A temperature range:
  - Operating: +10 °C to +35 °C
  - Storage: -40 °C to +70 °C

## Specifications

All specifications are guaranteed unless noted otherwise. All specifications apply to all models unless noted otherwise.

### Frequency range

<b>Frequency range</b>	Preamp OFF: 16 kHz to 14 GHz (RSA7100A Option 14) 16 kHz to 26.5 GHz (RSA7100A Option 26) Preamp ON: 10 MHz to 3.6 GHz
------------------------	------------------------------------------------------------------------------------------------------------------------------------

### Tuning resolution

$1 \times 10^{-3}$  Hz

### Frequency marker readout accuracy

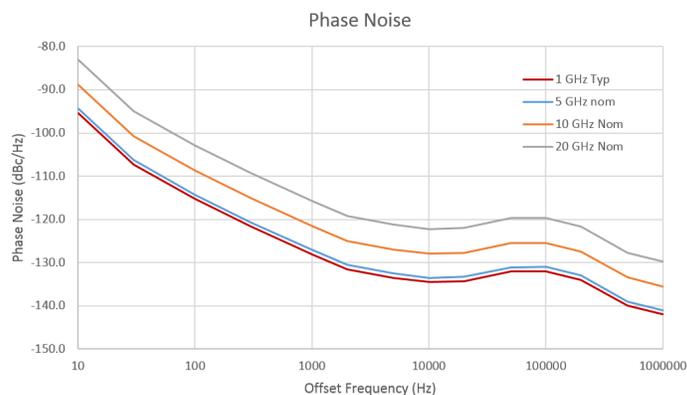
$\pm (RE \times MF + 0.001 \times \text{Span})$  Hz  
RE: Reference Frequency Error  
MF: Marker Frequency [Hz]

### Frequency reference

<b>Frequency</b>	10 MHz
<b>Initial accuracy at Cal (10 min warm-up)</b>	$\pm 50 \times 10^{-9}$ (23 °C to 28 °C)
<b>Aging after 30 days of continuous operation, typical</b>	$\pm 0.5 \times 10^{-9}$ per day $\pm 100 \times 10^{-9}$ first year
<b>Cumulative error (Initial + Temperature + Aging), typical</b>	$200 \times 10^{-9}$ (1 year)
<b>Temperature drift</b>	$10 \times 10^{-9}$ (23 °C to 28 °C) $50 \times 10^{-9}$ (0 °C to 55 °C)
<b>External reference output</b>	BNC connector, 50 $\Omega$ , nominal
<b>External reference output level</b>	0.71 V <sub>pp</sub> to 2 V <sub>pp</sub> into 50 $\Omega$
<b>External reference output level, typical</b>	1.2 V <sub>pp</sub> into 50 $\Omega$
<b>External reference input</b>	BNC connector, 50 $\Omega$ , nominal
<b>External reference input frequency</b>	10 MHz $\pm 0.2 \times 10^{-6}$
<b>External reference input level</b>	0.5 V <sub>pp</sub> to 2 V <sub>pp</sub> into 50 $\Omega$

## Phase noise

Frequency = 1 GHz, typical mean	-115 dBc/Hz at 100 Hz offset
	-128 dBc/Hz at 1 kHz offset
	-134 dBc/Hz at 10 kHz offset
	-132 dBc/Hz at 100 kHz offset
	-142 dBc/Hz at 1 MHz offset
Frequency = 5 GHz (typical mean, extrapolated from 1 GHz performance based on architecture)	-114 dBc/Hz at 100 Hz offset
	-127 dBc/Hz at 1 kHz offset
	-133 dBc/Hz at 10 kHz offset
	-131 dBc/Hz at 100 kHz offset
	-141 dBc/Hz at 1 MHz offset
Frequency = 10 GHz (typical mean, extrapolated from 1 GHz performance based on architecture)	-109 dBc/Hz at 100 Hz offset
	-122 dBc/Hz at 1 kHz offset
	-128 dBc/Hz at 10 kHz offset
	-125 dBc/Hz at 100 kHz offset
	-136 dBc/Hz at 1 MHz offset
Frequency = 20 GHz (typical mean, extrapolated from 1 GHz performance based on architecture)	-103 dBc/Hz at 100 Hz offset
	-116 dBc/Hz at 1 kHz offset
	-122 dBc/Hz at 10 kHz offset
	-120 dBc/Hz at 100 kHz offset
	-130 dBc/Hz at 1 MHz offset



## RF input

RF input impedance	50 $\Omega$
RF VSWR (RF attn $\geq 10$ dB), typical	< 1.5 (10 MHz to 14 GHz) < 1.7 (> 14 GHz to 26.5 GHz)

**Maximum RF input level**

- Maximum DC voltage**            ±40 V (RF Input)
- Maximum Safe input power**    + 30 dBm
- Maximum Measurable input power**    + 30 dBm

ADC and IF overload are detected and the user is informed and streaming data is flagged, but not stopped. Furthermore, an IF overload will initiate a protection event that will switch out the input signal. If SignalVu-PC is acquiring samples when this occurs, SignalVu-PC will automatically reset the switch periodically so that if the overload condition goes away, the input will continue to be sampled normally.

If the overload occurs while SignalVu-PC is not acquiring, then before SignalVu-PC starts acquiring it will automatically set an appropriate reference level then begin acquiring. When Center Frequency (CF) is < 80 MHz and reference level is < -40 dBm with pre-amp on, LO-to-IF leakage can cause ADC overload due to the 0 Hz spur. In this case, increasing reference level will correct the overload condition.

**Input attenuator**

- RF attenuator**                    0 dB to 100 dB in 1dB steps, 16kHz to 3.6 GHz
- 0 dB to 75 dB in 5dB steps, 3.6 GHz to 26.5 GHz

**Input preselector**

The preselector is input filters used for image suppression when the span of the instrument allows for its use. Two methods of preselection are used in the RSA7100A: a fixed low-pass filter (LPF) and a tunable bandpass filter (BPF).

Acquisition mode	Preselector Auto	Preselector On	Preselector Off
Swept, 50 MHz steps	On	On	Step CF ≤ 3.6 GHz: On Step CF > 3.6 GHz: Off
Swept, 320 MHz steps	NA	NA	Step CF ≤ 3.41 GHz: On Step CF > 3.41 GHz: Off
Real-time span ≤ 50 MHz	On	On	CF ≤ 3.6 GHz: On CF > 3.6 GHz: Off
Real-time span > 50 MHz	CF ≤ 3.41 GHz: On CF > 3.41 GHz: Off	NA	CF ≤ 3.41 GHz: On CF > 3.41 GHz: Off

**Sweep speed**

- Full-span sweep speed, typical mean**    (RBW: Auto, Span = 26.5 GHz)
- Preselector Auto: 13.5 sec
- Preselector Off: 1.9 sec

**Amplitude and RF flatness**

**Reference level setting range** -170 dBm to +40 dBm, 0.1 dB step

**Frequency response at 18°C to 28°C (At 10 dB RF attenuator setting)**

Span ≤ 100 MHz.

For CF < 100 MHz, specifications apply for Ref Level ≥ -40 dBm.

Verified with input level of -20 to -15 dBm, Ref level = -15 dBm, 10 dB RF attenuation, all settings auto-coupled.

Signal to noise ratios > 40 dB.

**Amplitude accuracy – preamp OFF**

Center frequency range	18 °C to 28 °C	18 °C to 28 °C, typical	0 °C to 55 °C, typical
10 MHz to < 100 MHz	---	±0.11 dB	---
100 MHz to < 2.8 GHz	±0.16 dB	±0.13 dB	±0.18 dB
2.8 GHz to 3.6 GHz	±0.16 dB	±0.13 dB	±0.38 dB

**Amplitude accuracy – preamp ON**

Center frequency range	18 °C to 28 °C	18 °C to 28 °C, typical	0 °C to 55 °C, typical
10 MHz to < 100 MHz	---	±0.2 dB	---
100 MHz to < 2.8 GHz	±0.20 dB	±0.14 dB	±0.10 dB
2.8 GHz to 3.6 GHz	±0.20 dB	±0.14 dB	±0.26 dB

**Absolute amplitude accuracy**

Span ≤ 100 MHz.

For CF < 100 MHz, specifications apply for Ref Level ≥ -40 dBm.

Verified with input level of 0 to 10 dB below Ref level, 10 dB RF attenuation, all settings auto-coupled.

Signal to noise ratios > 40 dB.

**Preamp OFF, Preselector Bypassed, 100 MHz Span, -10 dBm Ref Level**

Center frequency range	18 °C to 28 °C	18 °C to 28 °C, typical	0 °C to 55 °C, typical
10 MHz to < 100 MHz	---	±0.3 dB	---
100 MHz to 3.6GHz	±0.8 dB	±0.4 dB	±0.8 dB
> 3.6 GHz to < 8.5 GHz	±0.9 dB	±0.4 dB	±1.1 dB
8.5 GHz to < 14 GHz	±1.0 dB	±0.5 dB	±1.4 dB
14 GHz to < 20 GHz	±1.7 dB	±1.0 dB	±1.7 dB
20 GHz to 26.5 GHz	±2.0 dB	±1.2 dB	±2.2 dB

**Preamp ON, 100 MHz Span, -30 dBm Ref Level**

Center frequency range	18 °C to 28 °C	18 °C to 28 °C, typical	0 °C to 55 °C, typical
10 MHz to < 100 MHz	---	±0.4 dB	---
100 MHz to 3.6GHz	±1.2 dB	±0.6 dB	±1.2 dB

**Preselector Enabled, 50 MHz Span, -10 dBm Ref Level**

Center frequency range	18 °C to 28 °C	18 °C to 28 °C, typical	0 °C to 55 °C, typical
> 3.6 GHz to 8.5 GHz	±1.6 dB	±0.8 dB	±1.7 dB
8.5 GHz to 14 GHz	±1.5 dB	±0.7 dB	±1.5 dB
> 14 GHz to 20 GHz	±2.6 dB	±1.3 dB	±2.2 dB
20 GHz to 26.5 GHz	±2.8 dB	±1.5 dB	±2.2 dB

**Channel response (amplitude and phase deviation), typical**

For these specifications, set Preselector as Off, Attenuator to 10 dB, 18 °C to 28 °C.

**Channel response, typical**

Characteristic		Description			
Measurement center frequency	Span (MHz)	Amplitude flatness (dBrms)	Amplitude flatness (dB)	Phase linearity (degrees rms)	Phase linearity (degrees)
10 MHz to 3.6 GHz (CF ≥ Span)	10	0.06	±0.8	0.08	±0.1
	25	0.15	±0.2	0.4	±0.5
	50	0.2	±0.3	1.0	±1.3
	100	0.4	±0.6	2.5	±3.5
	320	1.0	±1.4	10	±13
3.6 GHz to 26.5 GHz	10	0.07	±0.1	0.08	±0.1
	25	0.1	±0.12	0.3	±0.5
	50	0.1	±0.15	0.8	±1.1
	100	0.17	±0.24	1.2	±1.8
	320	0.6	±0.86	5	±8
	800	0.9	±1.27	11	±16

**Noise and distortion**

**3rd Order IM intercept (TOI)**

+24 dBm at 3.3 GHz, Preamp OFF

(2-tone signal level -20 dBm per tone at the RF input. 1 MHz tone separation. Attenuator = 0 dB, Ref Level = -10 dBm. 5 MHz span, RBW set so noise is 10 dB below the IM3 tone level or lower. Production tested in a verification mode not part of normal operation.)

**3rd Order IM intercept (TOI), typical**

-12 dBm (10 MHz to 3.6 GHz, Preamp ON)

+19 dBm (10 MHz to 100 MHz, Preamp OFF)

+24 dBm (100 MHz to 3.6 GHz, Preamp OFF)

+20 dBm (3.6 GHz to 7 GHz)

+27 dBm (7.5 GHz to 14 GHz)

+21 dBm (14 GHz to 26.5 GHz)

(2-tone signal level -20 dBm per tone at the RF input. 1 MHz tone separation. Attenuator = 0 dB, Ref Level = -10 dBm. 5 MHz span, RBW set so noise is 10 dB below the IM3 tone level or lower.)

**3rd Order Intermod Distortion (Preamp OFF, Preselector Off, 320 MHz acquisition bandwidth), typical**

-85 dBc (100 MHz to 3.4 GHz)

-65 dBc (3.4 GHz to 6 GHz)

-80 dBc (6 GHz to 26.5 GHz)

(2-tone signal level -20 dBm per tone at the RF input. 50 MHz tone separation. Attenuator = 0 dB, Ref Level = -10 dBm)

**2nd Harmonic Intercept (Preselector Enabled, Preamp OFF), typical**

+40 dBm (50 MHz to 300 MHz input signal)

+74 dBm (300 MHz to 1.8 GHz input signal)

+68 dBm (1.8 GHz to 13.25 GHz input signal)

(0 dBm CW at the RF input. Attenuator = 10 dB, Ref Level = 0 dBm. Span 50 ≤ MHz.)

<b>Displayed Average Noise Level (DANL) (Preamp OFF, Preselector OFF, 18 °C to 28 °C)</b>	-153 dBm/Hz (>10 MHz to 1.7 GHz)
	-150 dBm/Hz (>1.7 GHz to 2.8 GHz)
	-148 dBm/Hz (>2.8 GHz to 3.6 GHz)
	-152 dBm/Hz (>3.6 GHz to 14 GHz)
	-145 dBm/Hz (>14 GHz to 17 GHz)
	-150 dBm/Hz (>17 GHz to 24 GHz)
	-146 dBm/Hz (>24 GHz to 26.5 GHz)
	(Normalized to 1 Hz RBW, with log-average detector, 0 dB attenuation, ref level -50 dBm.)
<b>Displayed Average Noise Level (DANL) (Preamp OFF, Preselector OFF), typical</b>	-153 dBm/Hz (200 kHz to 10 MHz)
	-155 dBm/Hz (10 MHz to 100 MHz)
	-156 dBm/Hz (100 MHz to 1.7 GHz)
	-154 dBm/Hz (1.7 GHz to 2.8 GHz)
	-151 dBm/Hz (2.8 GHz to 3.6 GHz)
	-156 dBm/Hz (3.6 GHz to 14 GHz)
	-152 dBm/Hz (14 GHz to 24 GHz)
	-150 dBm/Hz (24 GHz to 26.5 GHz)
	(Normalized to 1 Hz RBW, with log-average detector, 0 dB attenuation.)
<b>Displayed Average Noise Level (DANL) (Preamp ON, 18 °C to 28 °C)</b>	-163 dBm/Hz (10 MHz to 50 MHz)
	-164 dBm/Hz (50 MHz to 1.7 GHz)
	-162 dBm/Hz (>1.7 GHz to 3.6 GHz)
	(Normalized to 1 Hz RBW, with log-average detector, 0 dB attenuation, ref level -50 dBm.)
<b>Displayed Average Noise Level (DANL) (Preamp ON), typical</b>	-168 dBm/Hz (10 MHz to 100 MHz)
	-167 dBm/Hz (100 MHz to 1.7 GHz)
	-165 dBm/Hz (1.7 GHz to 3.6 GHz)
	(Normalized to 1 Hz RBW, with log-average detector, 0 dB attenuation.)
<b>Displayed Average Noise Level (DANL) (Preselector ON), typical</b>	-152 dBm/Hz (3.6 GHz to 14 GHz)
	-147 dBm/Hz (14 GHz to 26.5 GHz)
	(Normalized to 1 Hz RBW, with log-average detector, 0 dB attenuation, ref level -50 dBm.)

**Residual spurious response**

<b>Residual response, typical</b> (Ref = -60 dBm, Span = 5 MHz)	< -115 dBm (100 MHz to 3.6 GHz)
	< -115 dBm (3.6 GHz to 11 GHz)
	< -105 dBm (11 GHz to 14 GHz)
	< -105 dBm (14 GHz to 24 GHz)
	< -95 dBm (24 GHz to 26.5 GHz)
	(Measured with input terminated, 0 dB attenuation, preamp off.)
<b>Residual response, typical</b> (Ref = -60 dBm, Span = 100 MHz, 18 °C to 28 °C)	< -99dBm (100 MHz to 3.6 GHz)
	< -102 dBm (>3.6 GHz to 11 GHz)
	< -86 dBm (>11 GHz to 14 GHz)
	< -86 dBm (>14 GHz to 24 GHz, Option 26)
	< -84 dBm (>24 GHz to 26.5 GHz, Option 26)
	(Measured with input terminated, 0 dB attenuation, preamp off, preselector off.)
<b>Residual response, typical</b> (Ref = -60 dBm, Span = 320 MHz)	< -110 dBm (100 MHz to 3.6 GHz)
	< -105 dBm (3.6 GHz to 11 GHz)
	< -85 dBm (11 GHz to 14 GHz)
	< -85 dBm (14 GHz to 26.5 GHz)
	(Measured with input terminated, 0 dB attenuation, preamp off, preselector off.)
<b>Residual response, typical</b> (Ref = -60 dBm, Span = 800 MHz)	< -85 dBm (3.6 GHz to 14 GHz)
	< -85 dBm (14 GHz to 20 GHz)
	< -75 dBm (20 GHz to 26.5 GHz)
	(Measured with input terminated, 0 dB attenuation, preamp off, preselector off.)

**Spurious response with signal**

<b>Spurious response with image signal (18 °C to 28 °C)</b>	-98 dBc (CF = 100 MHz to 3.6 GHz, input at CF +9.225 GHz)
	-81 dBc (CF > 3.6 GHz to 14 GHz, input at CF + 1.225 GHz)
	-74 dBc (CF > 14 GHz to 26.5 GHz, input at CF + 1.225 GHz)
	(Input level = 0 dBm. Ref Level = 0 dBm. RF atten = 10 dB. 50 MHz span.)
<b>Spurious response with signal at CF, span = 320 MHz (Spur offset &gt; 2.5 MHz), typical</b>	<-80 dBc (CF = 100 MHz to 3.6 GHz, except 3.2 to 3.55 GHz)
	<-65 dBc (CF = 3.2 GHz to 3.55 GHz)
	<-85 dBc (CF = 3.6 to 14 GHz)
	<-80 dBc (CF = 14 GHz to 26.5 GHz)
	<-65 dBc (CF = 3.6 GHz to 14 GHz, span = 800 MHz)
	<-65 dBc (CF = 14 GHz to 26.5 GHz, span = 800 MHz)
	(Input level = -10 dBm. Ref Level = -10 dBm. RF atten = 10 dB. Preselector off.)
<b>Spurious response with signal at CF (50 kHz ≤ spur offset &lt; 2.5 MHz), typical</b>	-80 dBc (CF = 100 MHz to 3.6 GHz, except 3.38 to 3.39 GHz)
	-70 dBc (CF = 3.38 GHz to 3.39 GHz)
	-75 dBc (CF = 3.6 GHz to 14 GHz)
	-65 dBc (CF = 14 GHz to 26.5 GHz)
	(Input level = -10 dBm. Ref Level = -10 dBm. RF atten = 10 dB. Preselector on, span = 5 MHz.)

<b>Spurious response with signal within capture BW at other than CF, span = 320 MHz, typical</b>	<-80 dBc (CF = 100 MHz to 3.6 GHz, except Signal at 3.2 to 3.55 GHz) < -65dBc (Signal at 3.2 to 3.55 GHz, CF = 3.04 GHz to 3.6 GHz) -85 dBc (CF 3.6 GHz to 14 GHz ) -80 dBc (CF 14 GHz to 26.5 GHz) (Input level = -10 dBm. Ref Level = -10 dBm. RF atten = 10 dB.)
<b>Spurious response with signal within capture BW at other than CF, span = 800 MHz, typical mean</b>	-65 dBc (CF = 3.6 GHz to 26.5 GHz) (Ref Level = -10 dBm. RF atten = 10 dB, Input Level = -20 dBm.)  The mean is taken from the largest spur within the span at each CF step and each input frequency stepped across the span. The input signal is stepped at 80 MHz/step across the span and the CF is stepped at 800 MHz/step across the specified frequency range.  If a particular span and input combination has no spurs > -70 dBc it is not included in the mean so it does not contribute to reducing the mean.
<b>Spurious response with signal outside span, except for signal frequencies specified here, typical</b>	-80 dBc (Input level = -30 dBm. Ref Level = -30 dBm. RF atten = 10 dB. Span ≤ 50 MHz.)
<b>Spurious Response due to signal applied at CF+1225 MHz to CF+1250 MHz and 2290 MHz to 2320 MHz, typical</b>	-55 dBc (CF 100 MHz to 2.5 GHz) (Input level = -10 dBm. Ref Level = -10 dBm. RF atten = 10 dB, span ≤ 50 MHz.)
<b>Spurious Response due to signal applied at 160 MHz to 215 MHz and 3360 MHz to 3415 MHz, typical</b>	-65 dBc (CF 100 MHz to 3.6 GHz) (Input level = -10 dBm. Ref Level = -10 dBm. RF atten = 10 dB, span ≤ 50 MHz.)
<b>Spurious Response due to signal applied at 585 MHz to 640 MHz and 4585 MHz to 4640 MHz, typical</b>	-70 dBc (CF 100 MHz to 3.6 GHz) (Input level = -10 dBm. Ref Level = -10 dBm. RF atten = 10 dB, span ≤ 50 MHz.)
<b>Local oscillator feed-through to input connector (Attenuator = 10 dB), typical</b>	< - 110 dBm (CF ≤ 3.6 GHz, preamp off) < -60 dBm (CF >3.6 GHz, preselector on)

## Internal trigger

<b>Trigger mode, type, and source</b>	Modes: <b>Free run</b> (triggered by the end the preceding acquisition), <b>Triggered</b> (triggered by event) Types: <b>Single</b> (one acquisition from one trigger), <b>Continuous</b> (repeated acquisitions from repeating triggers) Sources: <b>RF Input</b> (downconverted to IF), <b>Trigger Input, Host</b> (trigger initiated by host)
<b>Trigger events</b>	Power Level within Span (RF Input) Frequency Mask, (Host) Host Request (Host) Trigger edge (Trigger Input)
<b>Trigger event delay range</b>	8 ns to 60 sec
<b>Trigger event delay resolution</b>	8 ns
<b>Trigger event delay uncertainty</b>	±4 ns
<b>Pre- and post-trigger setting</b>	Trigger position is settable within 1 % to 99 % of total data length

**Power trigger**

<b>Power trigger level range</b>	30 dBm to -170 dBm
<b>Power trigger level resolution</b>	0.1 dB
<b>Power trigger level accuracy</b> (This specification is in addition to the overall amplitude accuracy uncertainty for SA mode.)	±0.5 dB (level ≥ -50 dB from reference level) for trigger levels >30 dB above the noise floor at the center frequency. Instrument Center Frequency ≥ 100 MHz This applies when the Trigger Level is between 10% and 90% of the signal amplitude
<b>Power trigger position timing uncertainty, typical</b>	±8 ns
<b>Power trigger bandwidth setting</b>	This is not an independent setting. It is set by the "Time-Domain Bandwidth" control. Power Trigger Bandwidth is determined by Acquisition bandwidth.
<b>Power trigger minimum event duration</b>	4 ns

---

**External trigger**

<b>External trigger threshold voltage</b>	3.3V TTL, VIL 0.8V, VIH 2.0V
<b>External trigger input impedance</b>	10 kΩ
<b>External trigger minimum pulse width</b>	>10 ns
<b>External trigger timing uncertainty</b>	±8 ns

---

**Trigger timing**

<b>Trigger holdoff range</b>	8 ns to 10 s
<b>Trigger holdoff time resolution</b>	8 ns
<b>Trigger holdoff time accuracy</b>	(total holdoff time x reference oscillator accuracy) + holdoff time resolution

---

**Frequency edge and mask trigger**

<b>Frequency edge trigger range</b>	±(1/2 x (ACQ BW or TDBW if TDBW is active))
<b>Frequency edge trigger timing uncertainty</b>	±8 ns
<b>Frequency mask trigger mask point horizontal resolution</b>	< 0.13 % of span
<b>Frequency mask trigger level range</b>	0 to -80 dB from reference level
<b>Frequency mask trigger level resolution</b>	0.1 dB
<b>Frequency mask trigger level accuracy (with respect to reference level)</b>	±(Channel Response Flatness + 2.5 dB) for mask levels ≥ -50 dB and >30 dB above the noise floor

Frequency mask trigger timing  $\pm(0.5 \times \text{Spectrum time})$   
uncertainty

Frequency mask trigger real-time event minimum duration for 100% probability of trigger at 800 MHz span, DPX off

Span (MHz)	RBW (kHz)	FFT length (points)	Spectrums/sec	Min pulse width for 100% POI with full amplitude
800	50000	256	1.47 M	700 ns
	20000	256	1.46 M	780 ns
	10000	256	1.45 M	880 ns
	1000	2,048	763 K	3.2 $\mu$ s
	300	8,192	148 K	13 $\mu$ s
	100	32,768	31.8 K	50 $\mu$ s
	30	65,536	12.5 K	142 $\mu$ s
	25	131,072	6.4 K	231 $\mu$ s
	1	2,097,152	164	4.06 ms
	0.12	16,777,216	34	45.4 ms
320	32000	256	1.46 M	745 ns
	20000	256	1.46 M	780 ns
	10000	256	1.45 M	880 ns
	1000	1,024	1.12 M	2.79 $\mu$ s
	300	4,096	255 K	10.3 $\mu$ s
	100	16,384	56 K	36.9 $\mu$ s
	30	32,768	27.2 K	100.0 $\mu$ s
	25	65,536	12.8 K	154.3 $\mu$ s
	1	1,048,576	825	3.1 ms
	0.1	16,777,216	41	43.3 ms
100	8000	256	1.46 M	921 ns
	1000	256	1.42 M	2.6 $\mu$ s
	300	1,024	267 K	9.0 $\mu$ s
	100	4,096	92 K	30 $\mu$ s
	30	8,192	44.8 K	85.6 $\mu$ s
	25	16,384	24.7 K	116 $\mu$ s
	1	262,144	1.7 K	2.5 ms
	0.1	4,194,304	114	27.7 ms
50	4000	256	1.46 M	1.2 $\mu$ s
	1000	256	670 K	3.4 $\mu$ s
	300	512	412 K	8.8 $\mu$ s
	100	2,048	103 K	28.6 $\mu$ s
	30	4,096	49.1 K	83.6 $\mu$ s
	25	8,192	28.1 K	111 $\mu$ s
	1	131,072	1.9 K	2.4 ms
	0.1	2,097,152	156	25.4 ms

**Amplitude vs Time**

Time scale zero span	1 $\mu$ s min to 2000 s max
Time accuracy	$\pm$ 0.5% of total time
Time resolution	0.1% of total time
Time linearity	$\pm$ 0.5% of total time

**Recording to RAID**

**Sampling rate and maximum record length**

Acquisition bandwidth	Streaming sample rate (for I and Q)	Maximum record length (Option B)	Maximum record length (Option C)
>320 to 800 MHz	1000 MS/s	20 min	165 min
>320 to 800 MHz	1000 MS/s, unpacked	20 min	120 min
>160 to 320 MHz	500 MS/s	40 min	4 hr
> 50 to 160 MHz	250 MS/s	80 min	8 hr
> 40 to 50 MHz	125 MS/s	160 min	16 hr
> 20 to 40 MHz	65.2 MS/s	320 min	32 hr
> 10 to 20 MHz	31.25 MS/s	10 hr	64 hr
$\leq$ 10 MHz	15.625 MS/s	20 hr	128 hr

**Disk size and lifetime, 800 MHz bandwidth**

RAID option	Total time of all records	Expected lifetime of disk
Option B at 1000 MS/s	55 min	290 hr
Option B at 1000 MS/s, stored unpacked	40 min	226 hr
Option C at 1000 MS/s	165 min	900 hr
Option C at 1000 MS/s, stored unpacked	120 min	680 hr

**Unpacked data**

At >320 to 800 MHz acquisition bandwidth, data can be packed in 12-bit samples. This is done to reduce the data transfer rate requirement and to guarantee gap-free recordings. At 320 MHz acquisition bandwidth and below, packing is not necessary and data is always stored as 16-bit samples.

## SignalVu-PC standard measurements

## Measurements included

General signal analysis	
Spectrum analyzer	Spans from 100 Hz to full span of instrument 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 700 nsec signals in up to 800 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
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, - $\alpha$ dB 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

## Measurement functions

Measurement functions	Description
Frequency domain	Channel Power, Multi-Carrier Adjacent Channel Power / Leakage Ratio, Adjacent Channel Power, dBm/Hz Marker, dBc/Hz Marker
Time domain and statistical	RF I/Q vs. Time, Power vs. Time, Frequency vs. Time, Phase vs. Time, CCDF, Peak-to-Average Ratio
Advanced measurement suite (Option 20)	Rise Time, Fall Time, Pulse Width, Pulse Peak Power, Pulse Average Power, Pulse Ripple, Pulse Repetition Interval, Duty Cycle, Pulse-to-Pulse Phase, Frequency Error, Droop, Trend, FFT of Trend
General purpose digital modulation analysis (Option 21)	EVM (RMS, Peak, EVM vs. Time), Magnitude Error (RMS, Peak, Magnitude Error vs. Time), Phase Error (RMS, Peak, Phase Error vs. Time), Waveform Quality (RHO), Frequency Error, Origin Offset, Gain Imbalance, Quadrature Error, Constellation, Symbol Table

## Displays (views) by domain

Measurement domain	Display
Frequency	Spectrum (Amplitude vs. Frequency) DPX™ Spectrum Display (Color-Graded Frequency-of-Occurrence) Spectrogram (Spectrums over Time vs. Frequency)
Advanced measurement suite (Option 20)	Pulse Results Table Pulse Trace (selectable by pulse number) Pulse Statistics (Trend of Pulse Results and FFT of Trend)
General purpose digital modulation analysis (Option 21)	Constellation diagram I/Q vs. Time EVM vs. Time Symbol Table (Binary or Hexadecimal)

## SignalVu-PC standard measurements

DPX spectrum processing	
DPX Spectrogram trace detection	+Peak, -Peak, Avg (Vrms)
DPX Spectrogram trace length	800 to 10401 points

---

## SignalVu-PC applications performance summary

### AM/FM/PM and direct audio measurement (SVAx-SVPC)

<b>Carrier frequency range (for modulation and audio measurements)</b>	(1/2 × audio analysis bandwidth) to maximum input frequency
<b>Maximum audio frequency span</b>	10 MHz
<b>FM measurements (Mod. index &gt;0.1)</b>	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
<b>AM measurements</b>	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
<b>PM measurements</b>	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
<b>Audio filters</b>	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

---

### APCO P25 Measurements (SV26xx-SVPC)

<b>Measurements</b>	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
<b>Modulation fidelity, typical</b>	Input signal level is optimized for best modulation fidelity.

---

### Bluetooth Measurements (SV27xx-SVPC)

<b>Modulation formats</b>	Packet types: DH1, DH3, DH5 (BR), Reference (LE)
<b>Measurements</b>	Peak Power, Average Power, Adjacent Channel Power or InBand Emission mask, -20 dB Bandwidth, Frequency Error, Modulation Characteristics including $\Delta F1_{avg}$ (11110000), $\Delta F2_{avg}$ (10101010), $\Delta F2 > 115$ kHz, $\Delta F2/\Delta F1$ ratio, frequency deviation vs. time with packet and octet level measurement information, Carrier Frequency $f_0$ , 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
<b>Output power, In-band emissions and ACP</b>	Level uncertainty: refer to instrument amplitude and flatness specification  Measurement range: signal level > -70 dBm
<b>Modulation characteristics</b>	Deviation range: $\pm 280$ kHz  Deviation uncertainty (at 0 dBm)  Measurement range: Nominal channel frequency $\pm 100$ kHz

**SignalVu-PC applications performance summary**

**Initial Carrier Frequency Tolerance (ICFT)** Measurement uncertainty (at 0 dBm): <1 kHz + instrument frequency uncertainty  
Measurement range: Nominal channel frequency  $\pm 100$  kHz

**Carrier Frequency Drift** Measurement range: Nominal channel frequency  $\pm 100$  kHz

**General purpose digital modulation analysis (SVMxx-SVPC)**

**Carrier type** Continuous, Burst (5  $\mu$ s minimum on-time)

**Modulation formats** BPSK, QPSK, 8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM,  $\pi/2$ DBPSK, DQPSK,  $\pi/4$ DQPSK, D8PSK, D16PSK, SBPSK, OQPSK, SOQPSK, 16-APSK, 32-APSK, MSK, GFSK, CPM, 2FSK, 4FSK, 8FSK, 16FSK, C4FM

**Analysis period** Up to 163,000 samples

**Measurement filter** Root Raised Cosine, Raised Cosine, Gaussian, Rectangular, IS-95 Base EQ, None

**Reference Filter** Gaussian, Raised Cosine, Rectangular, IS-95 baseband, None

**Filter rolloff factor**  $\alpha$  : 0.001 to 1, in 0.001 steps

**Measurement functions** Constellation, Error Vector Magnitude (EVM) vs. Time, Symbol Table

**Vector diagram display format** Symbol/locus display, Frequency Error measurement, Origin Offset measurement

**Constellation diagram display format** Symbol display, Frequency Error measurement, Origin Offset measurement

**Error vector diagram display format** EVM, Magnitude Error, Phase Error, Waveform Quality ( $\rho$ ) measurement, Frequency Error measurement, Origin Offset measurement

**Symbol table display format** Binary, hexadecimal

**Maximum symbol rate** 40 M symbols/s

Modulated signal must be contained entirely within the acquisition bandwidth

**QPSK Residual EVM (center frequency = 2 GHz), typical mean**

- 0.35 % (100 kHz symbol rate)
- 0.35 % (1 MHz symbol rate)
- 0.35 % (10 MHz symbol rate)
- 0.75 % (30 MHz symbol rate)
- 0.75 % (60 MHz symbol rate)
- 1.5 % (120 MHz symbol rate)
- 2.0 % (240 MHz symbol rate)

400 symbols measurement length, 20 Averages, normalization reference = maximum symbol magnitude

**256 QAM Residual EVM (center frequency = 2 GHz), typical mean**

- 0.4 % (10 MHz symbol rate)
- 0.6 % (30 MHz symbol rate)
- 0.6 % (60 MHz symbol rate)
- 1.0 % (120 MHz symbol rate)
- 1.5 % (240 MHz symbol rate)

400 symbols measurement length, 20 Averages, normalization reference = maximum symbol magnitude

**OQPSK Residual EVM (center frequency = 2 GHz), typical mean**

- 0.6% (100 kHz symbol rate, 200 kHz measurement bandwidth)
- 0.6% (1 MHz symbol rate, 2 MHz measurement bandwidth)
- 1.0% (10 MHz symbol rate, 20 MHz measurement bandwidth)

Reference filter: raised-cosine, Measurement filter: root raised cosine, Filter parameter: Alpha = 0.3

**SOQPSK (MIL) Residual EVM (center frequency = 250 MHz), typical mean**

- 0.4% (4 kHz symbol rate, 64 kHz measurement bandwidth)

Reference filter: MIL STD, Measurement filter: none

**SignalVu-PC applications performance summary**

<b>SOQPSK (MIL) Residual EVM (center frequency = 2 GHz), typical mean</b>	0.5% (20 kHz symbol rate, 320 kHz measurement bandwidth)
	0.5% (100 kHz symbol rate, 1.6 MHz measurement bandwidth)
	0.5% (1 MHz symbol rate, 16 MHz measurement bandwidth)
	Reference filter: MIL STD, Measurement filter: none
<b>SOQPSK (ARTM) Residual EVM (center frequency = 250 MHz), typical mean</b>	0.3% (4 kHz symbol rate, 64 kHz measurement bandwidth)
	Reference filter: ARTM STD, Measurement filter: none
<b>SOQPSK (ARTM) Residual EVM (center frequency = 2 GHz), typical mean</b>	0.5% (20 kHz symbol rate, 320 kHz measurement bandwidth)
	0.5% (100 kHz symbol rate, 1.6 MHz measurement bandwidth)
	0.5% (1 MHz symbol rate, 16 MHz measurement bandwidth)
	Reference filter: ARTM STD, Measurement filter: none
<b>SBPSK (MIL) Residual EVM (center frequency = 250 MHz), typical mean</b>	0.3% (4 kHz symbol rate, 64 kHz measurement bandwidth)
	Reference filter: MIL STD, Measurement filter: none
<b>SBPSK (MIL) Residual EVM (center frequency = 2 GHz), typical mean</b>	0.5% (20 kHz symbol rate, 320 kHz measurement bandwidth)
	0.5% (100 kHz symbol rate, 1.6 MHz measurement bandwidth)
	0.5% (1 MHz symbol rate, 16 MHz measurement bandwidth)
	Reference filter: MIL STD, Measurement filter: none
<b>CPM (MIL) Residual EVM (center frequency = 250 MHz), typical mean</b>	0.3% (4 kHz symbol rate, 64 kHz measurement bandwidth)
	Reference filter: MIL STD, Measurement filter: none
<b>CPM (MIL) Residual EVM (center frequency = 2 GHz), typical mean</b>	0.5% (20 kHz symbol rate, 320 kHz measurement bandwidth)
	0.5% (100 kHz symbol rate, 1.6 MHz measurement bandwidth)
	0.5% (1 MHz symbol rate, 16 MHz measurement bandwidth)
	Reference filter: MIL STD, Measurement filter: none
<b>2/4/8/16FSK Residual RMS FSK Error (center frequency = 2 GHz), typical mean</b>	0.5% (2/4FSK, 10 kHz symbol rate, 10 kHz frequency deviation)
	0.4% (8/16FSK, 10 kHz symbol rate, 10 kHz frequency deviation)
	Reference filter: none, Measurement filter: none

**Adaptive equalizer**

<b>Type</b>	Linear, Decision-Directed, Feed-Forward (FIR) equalizer with coefficient adaptation and adjustable convergence rate.
<b>Supported modulation types</b>	BPSK, QPSK, OQPSK, DQPSK, $\pi/2$ DBPSK, $\pi/4$ DQPSK, 8PSK, D8SPK, D16PSK, 16/32/64/128/256-QAM, 16/32-APSK
<b>Reference filters</b>	Raised cosine, rectangular, none
<b>Reference filters (OQPSK)</b>	Raised cosine, half sine
<b>Adaptive filter length</b>	1 to 128 taps
<b>Adaptive filter taps/symbol</b>	1, 2, 4, or 8 (Raised cosine, half sine, or none)
<b>Adaptive filter taps/symbol (Rectangular filter)</b>	1
<b>Equalizer controls</b>	Off, Train, Hold, Reset

**Flexible OFDM Measurements application (SVOxx-SVPC)**

<b>OFDM maximum residual EVM (RMS), typical mean</b>	-52 dB at 2.4 GHz
	-50 dB at 5.8 GHz
	(802.11a/g/j OFDM and 802.16-2004)

## SignalVu-PC applications performance summary

### WLAN 802.11a/b/g/j/p

#### Measurement application

OFDM Maximum Residual EVM (RMS), typical mean  
-50 dB at 2.4 GHz  
-50 dB at 5.8 GHz  
(802.11a/g/j/p OFDM)

802.11b Maximum Residual EVM (RMS), typical mean  
1.0% at 2.4 GHz  
(802.11a/g/j/p OFDM)

### WLAN 802.11n Measurement application, typical mean

OFDM Maximum Residual EVM (RMS)  
-49 dB at 2.4 GHz  
-49 dB at 5.8 GHz  
(40 MHz bandwidth)

### WLAN 802.11ac measurement application, typical mean

(802.11ac OFDM)  
OFDM Maximum Residual EVM (RMS), CF = 5.8 GHz  
-50 dB at 40 MHz BW  
-48 dB at 80 MHz BW  
-43 dB at 160 MHz BW

### LTE Downlink RF measurements (SV28xx-SVPC)

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 (typical, with noise correction)

### Mapping (MAPxx-SVPC)

Supported map types Pitney Bowes MapInfo (\*.mif), Bitmap (\*.bmp), Open Street Maps (.osm)

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

### Pulse measurements (SVPxx-SVPC)

Measurements (nominal) Pulse-Ogram™ waterfall display of multiple segmented captures, with amplitude vs time and spectrum of each pulse. Pulse frequency, Delta Frequency, 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 (%), Droop (dB), Droop (%), Overshoot (dB), Overshoot (%), Pulse- Ref Pulse frequency difference, Pulse- Ref Pulse phase difference, 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, typical 150 ns

Minimum pulse width for detection, typical 150 ns (40 MHz bandwidth)  
50 ns (320/800 MHz bandwidth)

**SignalVu-PC applications performance summary**

<b>Average ON power at 18 °C to 28 °C, typical</b>	For pulses of 300 ns width or greater, duty cycles of .5 to .001, and S/N ratio ≥ 30 dB
<b>Duty factor, typical</b>	±0.2% of reading
	For pulses of 450 ns width or greater, duty cycles of .5 to .001, and S/N ratio ≥ 30 dB
<b>Average transmitted power, typical</b>	For pulses of 300 ns width or greater, duty cycles of .5 to .001, and S/N ratio ≥ 30 dB
<b>Peak pulse power, typical</b>	For pulses of 300 ns width or greater, duty cycles of .5 to .001, and S/N ratio ≥ 30 dB
<b>Pulse width, typical</b>	±0.25% of reading
	For pulses of 450 ns width or greater, duty cycles of .5 to .001, and S/N ratio ≥ 30 dB

<b>General Purpose Analog Modulation Analysis Accuracy, typical</b>	(0 dBm input at center; 0 dBm Input Power Level, Reference Level 10 dBm, Attenuation = Auto)
<b>AM demodulation accuracy</b>	±2% (Carrier Frequency 1 GHz, 10 to 60 % Modulation Depth) (1 kHz / 5 kHz Input/Modulated Frequency)
<b>PM demodulation accuracy</b>	±3° (Carrier Frequency 1 GHz, 400 Hz / 1 kHz Input/Modulated Frequency)
<b>FM demodulation accuracy</b>	±1% of span (Carrier Frequency 1 GHz, 1 kHz / 5 kHz Input/Modulated Frequency)

**Environmental specifications**

**Atmospherics**

<b>Temperature</b>	<b>RF Converter:</b> Operating: 0 ° C to + 40 ° C Non-operating: - 20 ° C to +60 ° C <b>Controller:</b> Operating: +10 ° C to + 35 ° C Non-operating: -20 ° C to +60 ° C
<b>Relative humidity non-condensing, typical</b>	<b>RF Converter</b> Operating: 10% to 90%, up to 40 ° C <b>Controller</b> Operating: 40 to 70 %
<b>Altitude</b>	<b>RF Converter:</b> Operating: Up to 2000 m Non-Operating: Up to 12000 m <b>Controller:</b> Operating: Up to 3000 m Non-operating: Up to 12000 m

## Installation requirements

### Heat dissipation

<b>RSA7100A Maximum Power Dissipation (fully loaded)</b>	400 W maximum. Maximum line current is 4.5 Amps at 90 V line. 300 W typical
<b>CTRL7100A maximum power dissipation (fully loaded)</b>	500 W maximum. Maximum line current is 5.5 Amps at 90 V line. 400 W typical

### Cooling (RSA7100A)

<b>Bottom/Top</b>	44.45 mm (1.75 in)
<b>Both sides</b>	44.45 mm (1.75 in)
<b>Rear</b>	76.2 mm (3.0 in)

### Cooling (CTRL7100A)

<b>Bottom/Top/Both sides</b>	6.4 mm (0.25 in)
<b>Front/Rear</b>	76.2 mm (3.00 in)

### Primary line voltage

<b>Voltage</b>	100 to 240 V at 50/60 Hz
<b>Voltage range limits</b>	90 to 264 V at 47 to 63 Hz

### Physical specifications RSA7100A

<b>Width</b>	445.5 mm (17.54 in)
<b>Height</b>	177.1 mm (6.99 in)
<b>Length</b>	577.9 mm (22.75 in)
<b>New weight</b>	24.2 kg (53.2 lbs)

### CTRL7100A characteristics

<b>I/O</b>	PCIe 2x USB 3.0 on front panel 2x USB 3.0 on rear panel 2x USB 2.0 on rear panel 17 removable drive bays (1 for OS, 16 for RAID) 6 Mini-Display ports 2x 10 Gbit Ethernet
------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

### RAID

RAID option	Total time of all records	Expected lifetime of disk
Option B at 1000 MS/s	55 min	290 hr
Option B at 1000 MS/s, stored unpacked	40 min	226 hr
Option C at 1000 MS/s	165 min	900 hr
Option C at 1000 MS/s, stored unpacked	120 min	680 hr

<b>Internal characteristics</b>	<p>GPU: AMD W9100</p> <p>Dual Intel® Xeon® Processor E5-2623 v4 (10M Cache, 2.6 GHz)</p> <p>Clock 2.6 GHZ</p> <p>Internal Cache 10MB</p> <p>64GB DDR4 2133 MHz RAM</p> <p>Optional RAID controller and front-panel removable drives supports 4 GB/s streaming and up to 32 TB memory</p> <p>OS: Windows 7</p>
<b>Physical characteristics</b>	<p>Height: 450.9 mm (17.75 in)</p> <p>Width: 177.8 mm (7.0 in)</p> <p>Depth: 660.4 mm (26 in)</p> <p>Weight: 23.8 kg (52.4 lb) with Option C7100-B</p>

---

## RSA7100A interfaces, inputs, and output ports

### Connectors

<b>RF input</b>	40 GHz Planar Crown bulkhead with 3.5mm female coax adapter
<b>External frequency reference input</b>	BNC, female
<b>External frequency reference output</b>	BNC, female
<b>Trigger/Sync input</b>	BNC, female
<b>Noise source control</b>	BNC, female
<b>GPS antenna</b>	SMA, female

---

### Status indicators

<b>Power LED</b>	LED, red
------------------	----------

---

### Dynamics

<b>Random vibration</b>	<p>RF Converter, Operating: 5-500 Hz, 0.3 G rms</p> <p>Controller, Operating: 5-500 Hz, 1.0 G rms</p>
<b>Shock operating</b>	<p>RF Converter, Operating: 30 G, half-sine, 11ms duration</p> <p>RF Converter, Non-operating: 5-500 Hz, 2.45 G rms</p> <p>Controller, Operating: 15 G, half-sine, 11ms duration</p> <p>Controller, Non-operating: 5-500 Hz, 2.28 G rms</p> <p>(Converter RF attenuator may change states during horizontal shock. To reset, change to any other state and back to desired state.)</p>
<b>Shock non-operating</b>	<p>RF Converter: 30 G, half-sine, 11ms duration</p> <p>Controller: 25 G, half-sine, 11ms duration</p>

---

## Ordering information

### RSA7100A

Real-Time Spectrum Analyzer, up to 800 MHz acquisition bandwidth

**Includes:** Installation and safety manual, 3.5mm Crown Connector-Female, PCIe cable, mouse, keyboard, adapter: Mini-Display Port to HDMI, Mini-Display Port to DVI. Power cables, rack mount kits for acquisition unit and controller. Controller rack-mount is a 'telecom-style'. A server-style rackmount can also be used with the controller, available from third parties.

**Note:** A PC monitor is not included with the RSA7100A. Tektronix recommends the Dell UltraSharp U2414H 23.8 inch Widescreen IPS LCD Monitor, or any monitor that supports Display port, DVI or HDMI input and has a minimum 1920 x 1080 display resolution.

### How to order

When ordering the RSA7100A, you select between two frequency ranges and whether you would like to have an internal GPS receiver and/or an ISO17025 calibration data report.

SignalVu-PC licenses can be ordered as options to the RSA7100A and are installed on the unit during manufacturing, minimizing order complexity and saving you time in configuration upon receiving your instrument. These licenses are node-locked to the RSA7100A controller and can be moved twice over the lifetime of the license. All licenses, including floating licenses, can be ordered separately if greater flexibility is needed.

### RSA7100A license options

RSA7100A and options	Description	Ordering instructions
RSA7100A	Real-time spectrum analyzer, 320 MHz bandwidth	
Opt. 14	Frequency range 16 kHz-14 GHz	Select one
Opt. 26	Frequency range 16 kHz-26.5 GHz	
Opt. GPS	GPS receiver	Select one
Opt. NO GPS	No GPS receiver	
Opt. CAL	Calibration report with data (ISO 17025)	
Opt. GPS CAL	GPS receiver and calibration report with data (ISO17025)	
Opt. C7100-A	Controller, no RAID storage	Select one
Opt. C7100-B	Controller, RAID storage, 20 minutes recording time at 800 MHz bandwidth (requires STREAMNL-SVPC)	
Opt. C7100-C	Controller, RAID storage, > 120 minutes recording time at 800 MHz bandwidth (requires STREAMNL-SVPC)	
Opt. SV09	High performance real time (export class 3A002), node-locked license	Mandatory option

SignalVu-PC licenses ordered as options to CTRL7100A (Factory installed on unit)	License type	Description
Opt. B800NL-SVPC	Node locked	800 MHz acquisition bandwidth
Opt. STREAMNL-SVPC	Node locked	Steaming data
Opt. SVMHNL-SVPC	Node locked	General Purpose Modulation Analysis to work with analyzer of any acquisition bandwidth and MDO
Opt. SVPHNL-SVPC	Node locked	Pulse Analysis to work with analyzer of any acquisition bandwidth and MDO
Opt. TRIGHNL-SVPC	Node locked	Advanced triggers (Frequency Mask, Density) to work with RSA7100A
Opt. MAPNL-SVPC	Node locked	Mapping and signal strength
Opt. SV54NL-SVPC	Node locked	Signal survey and classification
Opt. SVTNL-SVPC	Node locked	Settling Time (frequency and phase) measurements
Opt. SV23NL-SVPC	Node locked	WLAN 802.11a/b/g/j/p measurement

SignalVu-PC licenses ordered as options to CTRL7100A (Factory installed on unit)	License type	Description
Opt. SV24NL-SVPC	Node locked	WLAN 802.11n measurement (requires SV23)
Opt. SV25HNL-SVPC	Node locked	WLAN 802.11ac measurement to work with analyzer of acquisition bandwidth ≤40 MHz and MDO4000B/C (requires SV23 and SV24)
Opt. SV26NL-SVPC	Node locked	APCO P25 measurement
Opt. SV27NL-SVPC	Node locked	Bluetooth measurement to work with analyzer of acquisition bandwidth ≤40 MHz and MDO4000B/C
Opt. SV28NL-SVPC	Node locked	LTE Downlink RF measurement to work with analyzer of acquisition bandwidth ≤40 MHz and MDO4000B/C
Opt. SVANL-SVPC	Node locked	AM/FM/PM/Direct Audio Analysis
Opt. SVONL-SVPC	Node locked	Flexible OFDM Analysis
Opt. CONNL-SVPC	Node locked	SignalVu-PC live link to the MDO4000B/C series mixed-domain oscilloscopes

### Language options for the RSA7100A

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

### Power plug options

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

### Service options

Opt. G3	Complete Care 3 Years (includes loaner, scheduled calibration, and more)
Opt. G5	Complete Care 5 Years (includes loaner, scheduled calibration, and more)

## Complimentary products

DataVu-PC is recommended for users who record data using the RSA7100A streaming and RAID options. Ordering information for DataVu-PC is shown below. See the separate DataVu-PC datasheet for details on licensing, minimum PC requirements, features, and functions.

## DataVu-PC ordering information

DataVu-PC is distributed via [www.tek.com](http://www.tek.com). Hard copy versions of the software are not available. An operation manual is distributed in .pdf format with the software.

Nomenclature	License type	Description
DVPC-SPAN50NL	Node locked	Base version, DataVu-PC operation on acquisitions to 50 MHz bandwidth
DVPC-SPAN50FL	Floating	
DVPC-SPAN200NL <sup>1</sup>	Node locked	Base version, DataVu-PC operation on acquisitions to 200 MHz bandwidth
DVPC-SPAN200FL	Floating	
DVPC-SPAN1000NL	Node locked	Base version, DataVu-PC operation on acquisitions to 1000 MHz bandwidth
DVPC-SPAN1000FL	Floating	
DVPC-SMARKNL	Node locked	DataVu-PC smart markers and time overview (requires base version)
DVPC-SMARKFL	Floating	
DVPC-PULSEN	Node locked	DataVu-PC pulse analysis (requires DVPC-SMARKNL)
DVPC-PULSEFL	Floating	

## CTRL7100A: Additional controllers for the RSA7100A

Additional controllers are available for the RSA7100A should you need to have controllers in multiple locations. The CTRL7100A is identical to the unit included with the RSA7100A. For detailed ordering information, see the CTRL7100A datasheet on [www.Tek.com](http://www.Tek.com).



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.

<sup>1</sup> DataVu-PC can open files recorded in 16-bit .XDAT format from any source. If you have a data source that records at 50 MHz to 200 MHz bandwidth, such as a Tektronix RSA5000 or RSA6000 series spectrum analyzer with a third-party recording solution, choose DVPC-SPAN200.

**ASEAN / Australasia** (65) 6356 3900  
**Belgium** 00800 2255 4835\*  
**Central East Europe and the Baltics** +41 52 675 3777  
**Finland** +41 52 675 3777  
**Hong Kong** 400 820 5835  
**Japan** 81 (3) 6714 3086  
**Middle East, Asia, and North Africa** +41 52 675 3777  
**People's Republic of China** 400 820 5835  
**Republic of Korea** +822 6917 5084, 822 6917 5080  
**Spain** 00800 2255 4835\*  
**Taiwan** 886 (2) 2656 6688

**Austria** 00800 2255 4835\*  
**Brazil** +55 (11) 3759 7627  
**Central Europe & Greece** +41 52 675 3777  
**France** 00800 2255 4835\*  
**India** 000 800 650 1835  
**Luxembourg** +41 52 675 3777  
**The Netherlands** 00800 2255 4835\*  
**Poland** +41 52 675 3777  
**Russia & CIS** +7 (495) 6647564  
**Sweden** 00800 2255 4835\*  
**United Kingdom & Ireland** 00800 2255 4835\*

**Balkans, Israel, South Africa and other ISE Countries** +41 52 675 3777  
**Canada** 1 800 833 9200  
**Denmark** +45 80 88 1401  
**Germany** 00800 2255 4835\*  
**Italy** 00800 2255 4835\*  
**Mexico, Central/South America & Caribbean** 52 (55) 56 04 50 90  
**Norway** 800 16098  
**Portugal** 80 08 12370  
**South Africa** +41 52 675 3777  
**Switzerland** 00800 2255 4835\*  
**USA** 1 800 833 9200

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

**For Further Information.** Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology. Please visit [www.tek.com](http://www.tek.com).

Copyright © Tektronix, Inc. All rights reserved. Tektronix products are covered by U.S. and foreign patents, issued and pending. Information in this publication supersedes that in all previously published material. Specification and price change privileges reserved. TEKTRONIX and TEK are registered trademarks of Tektronix, Inc. All other trade names referenced are the service marks, trademarks, or registered trademarks of their respective companies.

