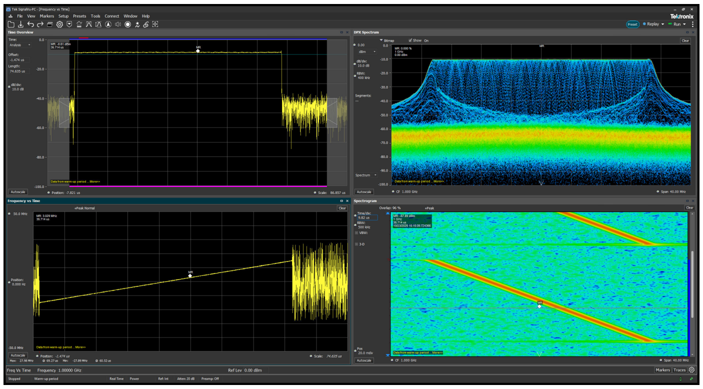
Vector and RF Suite of Signal Analysis Software for PC

SignalVu-PC Applications Datasheet



SignalVu-PC enables powerful RF and vector signal analysis using Tektronix real-time spectrum analyzers and MSO/DPO Series oscilloscopes.

Key features

- Multi-domain tool set for spectrum analysis, vector signal analysis, demodulation, and more including:
  - Offline analysis of waveforms captured by all Tektronix spectrum analyzers and oscilloscopes
  - Real-time recording and analysis with Tektronix RSA signal analyzers (RSA7100, RSA600, RSA500, and RSA306 Series)
  - Options for multi-channel acquisition and analysis with Tektronix MSO/DPO oscilloscopes (5/6 Series MSO, 7 Series DPO, LPD64, and MSO/DPO70000SX/DX models)[1]
- Analyze wideband designs
- Enhance data analysis with the ability to leverage the processing power of Windows PCs and tablets, including the Tektronix 5/6/7 Series oscilloscopes with an embedded Windows OS
- Node Locked and Floating License available for each SignalVu-PC optional application
- Analyze
  - Extensive time-correlated, multi-domain displays connect problems in time, frequency, phase, and amplitude for quicker understanding of cause and effect when troubleshooting
  - Advanced pulse radar analysis suite - automated pulse measurements provide deep insight into pulse train behavior. Measure pulse statistics over many acquisitions (millions of pulses). Multi-channel analysis is enabled with MSO/DPO oscilloscopes
  - Power measurements and signal statistics help you characterize components and systems: ACLR, Multicarrier ACLR, Power vs. Time, CCDF, and OBW/EBW
  - EMC/EMI pre-compliance and troubleshooting with RSA signal analyzers - CISPR detectors, predefined standards, limit lines, easy accessory setup, ambient capture, failure analysis, and report generation
  - WLAN spectrum and modulation transmitter measurements based on IEEE 802.11 a/b/g/j/p/n/ac/ad/ay standards
  - Bluetooth® Transmitter Measurements based on Bluetooth SIG RF specifications for Basic Rate, Low Energy, and Bluetooth 5. Few supports the Enhanced Data Rate measurement
  - Settling time measurements, frequency, and phase for characterization of wideband frequency-agile oscillators
  - General-purpose digital modulation analysis (SVM) provides modulation analysis of 26 modulation types from FSK to 1024QAM. Multi-channel analysis is enabled with MSO/DPO Oscilloscopes
  - Flexible OFDM analysis of custom OFDM signals
  - Frequency offset control for analyzing baseband signals with near-zero intermediate frequencies (IF)
  - AM/FM/PM modulation and audio measurements for characterization of analog transmitters and audio signals
  - Simple and complete APCO Project 25 transmitter compliance testing and analysis for Phase 1 (C4FM) and Phase 2 (TDMA)
  - Playback of recorded files from the USB spectrum analyzers (RSA306, RSA500, and RSA600)
  - LTE™ FDD and TDD Base Station (eNB) Transmitter RF measurements
  - Automated Phase Noise/Jitter measurements
  - Signal Classification and Survey
  - Mapping

Applications

- Wideband radar and pulsed RF signals
- Frequency agile communications
- Broadband satellite and microwave backhaul links
- Wireless LAN, Bluetooth, Commercial Wireless
- Land Mobile Radio (LMR), APCO P25
- Education
- Long Term Evolution (LTE), Cellular
- EMC/EMI pre-compliance and troubleshooting

Advanced triggers

Besides traditional external and RF power triggers, SignalVu-PC offers advanced triggering capabilities:

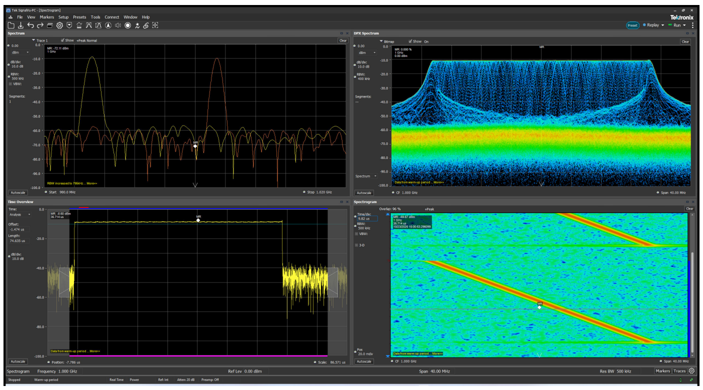
- Time-qualified triggers enable capture of events at desired pulse widths, ideal for capturing dynamic test environments

[1] MSO/DPO70000 instruments require SignalVu for performance oscilloscopes (not SignalVu-PC) to be installed.

- Frequency mask triggers facilitate definition of a spectrum mask to capture events or signal anomalies based on their frequency and amplitude
- DPX density trigger lets you analyze and measure infrequent or elusive RF events by defining a spectrum measurement box by frequency and amplitude, and using the percentage of time that the signal falls withing the box to trigger the capture

Capture with variety of tools

The software offers a comprehensive solution for analyzing RF (Radio Frequency) systems performance at every stage, from initial laboratory research through field testing to factory production. Designed for a seamless user experience across various windows devices, it enables you to gain valuable insights wherever you are.



Capture once - make multiple measurements without recapturing. Once stored in memory, SignalVu-PC provides detailed analysis in multiple domains, saving you time and enhancing your insight.

For example, the spectrogram display (bottom left panel of the image) shows how the frequency of an LFM (Linear Frequency Modulation) radar pulse changes over time. By selecting a specific moment during the pulse's active phase, you can observe the chirp's behavior as it transitions from low to high frequencies, as depicted in the upper right panel.

Setups, captures, and recordings are easily shareable among teams, for boosting collaboration and analysis.

Moreover, optional pulse radar analysis software enables you to analyze the pulse's modulation characteristics and measure other essential parameters like pulse width and repetition intervals from the same captured data.

This approach provides a deep dive into the system's performance without the need for additional data captures, streamlining your workflow and enriching your insights.

Connect with 5/6/7 Series oscilloscopes

SignalVu-PC now supports a wider range of Tektronix oscilloscopes, including 5 Series MSO, 6 Series MSO, 6 Series LPD, and 7 Series DPO, offering engineers exceptional flexibility in RF analysis across platforms. With these instruments, SignalVu-PC transforms the oscilloscope into a fully capable vector signal analyzer, tightly integrating signal acquisition, and measurement functions.

On the 6 Series MSO, SignalVu makes use of both DDC and Fast Frame acquisition modes. When used with the Pulse plug-in, this configuration with RFVT triggers allows you to isolate and capture only on-time signal data dramatically optimizing memory usage and acquisition efficiency, especially for burst and pulsed RF signals. The combination of hardware and software transforms the oscilloscope into a wideband vector signal analyzer (VSA) with up to 2 GHz capture bandwidth on up to eight channels.

The 7 Series DPO utilizes its High-Speed Interface (HSI) to transfer waveform samples rapidly into SignalVu-PC. This high-speed data path enables responsive analysis for advanced debug and validation workflows. SignalVu-PC can either run on the oscilloscope (with optional Windows 10 SSD) or on separate Windows PC connected via USB or LAN to the instrument.

SignalVu-PC is deeply integrated with these oscilloscopes, allowing you to manage critical acquisition parameters directly from the application. Reference level - vertical scale, sampling rate, and trigger settings are all controllable within the SignalVU, making the entire system feel like a unified solution, avoiding the need of scope software.

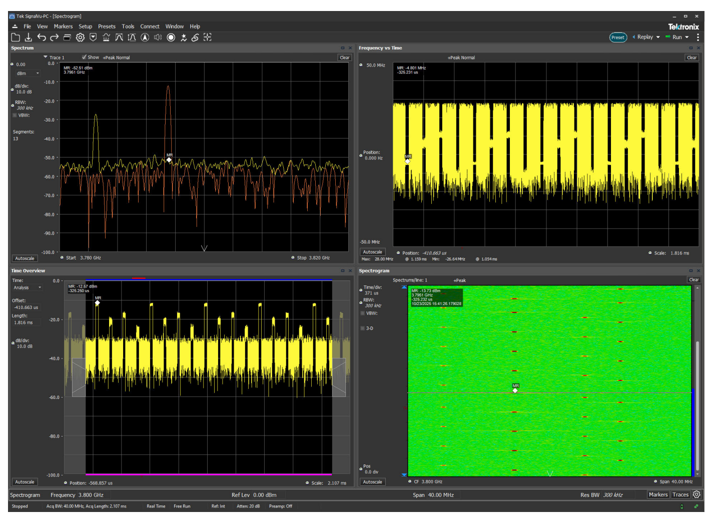
SignalVu-PC also delivers powerful multi channel capability. On the 5/6/7 Series oscilloscopes, you can access and analyse on all oscilloscope channels simultaneously. This enables engineers to perform time-correlated, Phase-coherent measurements across multiple signal paths ideal for MIMO systems, phased arrays, and complex RF subsystems.

Each channel in SignalVu-PC can be independently configured, including center frequency, span, resolution bandwidth (RBW), and time gating. This level of per channel control empowers you to tailor the analysis for diverse signals in parallel, providing deeper insight into system behavior and improving debug efficiency across the board.

Analyze

Time-correlated measurements can be made of frequency, phase, amplitude, and modulation versus time. This is ideal for signal analysis that includes frequency hopping, pulse characteristics, modulation switching, settling time, bandwidth changes, and intermittent signals.

Acquisitions from the USB Spectrum Analyzers and all Tektronix MSO/DPO Series oscilloscopes can be analyzed with SignalVu-PC, adding deep analysis capabilities to these broadband acquisition systems.



Time-correlated, multi-domain, multi-channel views provide a new level of insight into design or operational problems not possible with conventional analysis solutions. Here, the hop patterns of a narrowband signal can be observed using Spectrogram (bottom right) and its hop characteristics can be precisely measured with Frequency vs Time display (upper right). The time and frequency responses can be observed as the signal hops from one frequency to the next. All of the analysis shown above is available in the free base version of SignalVu-PC.

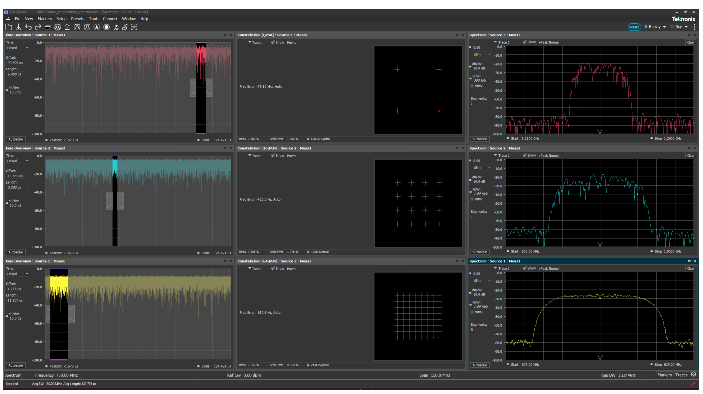
Multi-channel support

Simultaneously acquire, independently configure settings, and analyze data from up to eight channels of the 5/6/7 Series oscilloscopes using the general signal viewing (with option CON or SVE), advanced pulse radar analysis (SVP), and general-purpose digital modulation analysis (SVM) displays of SignalVu-PC.

This approach enables a comprehensive understanding of complex systems, such as RADAR, MIMO, uplink/downlink systems, and phased-array systems. It facilitates the examination of multiple signals across various parameters, including power, time, frequency, phase, and modulation by allowing you to independently configure channel settings such as center frequency, span, RBW, reference level, and analysis time. Available global settings control saves valuable time configuring multiple channels.

In addition to RF, you can analyze baseband signals by configuring channels as I/Q, or differential I/Q.

For multi-channel applications greater than 10 GHz in frequency, up to 70 GHz can be simultaneously analyzed on up to four channels using Tektronix DPO70000SX oscilloscopes. Refer to SignalVu for Performance Oscilloscopes for more details.

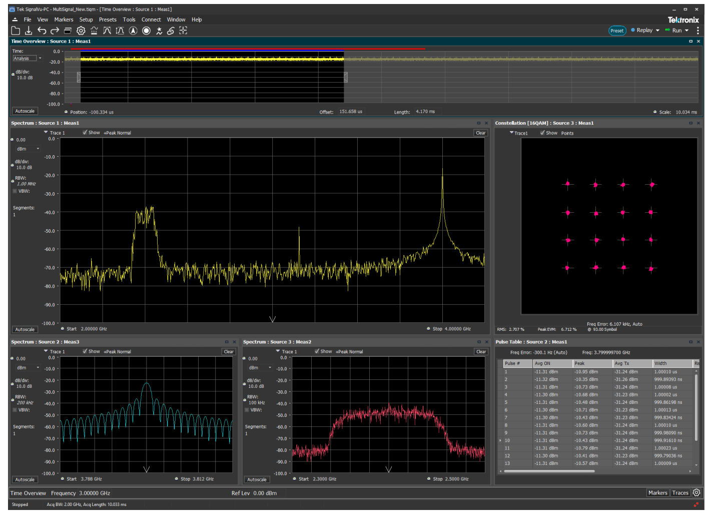


Three signals, each from a separate channel of the MSO64B, are acquired and analyzed with unique center frequencies, spans, and RBWs. These signals, featuring three different modulation schemes, are demodulated and analyzed within separate time slots, highlighting the independent control capabilities of each channel.

Shared acquisition multi-signal support

SignalVu-PC software expands your analysis capabilities even further on oscilloscope by enabling simultaneous analysis of multiple frequency dispersed signals within a single acquisition bandwidth. By configuring multiple sources to one physical oscilloscope channel, it supports independent analysis of signals at different frequency bands from I/Q data acquired by a single channel. This capability offers critical insights into advanced, multi-standard systems, streamlining development and validation.

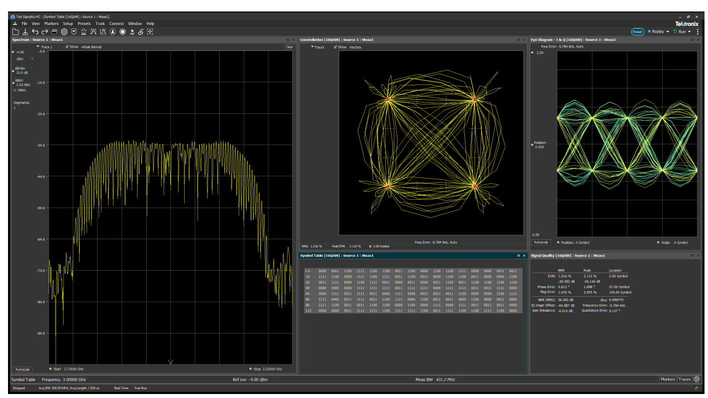
One example among many where such analysis is beneficial involves electronic warfare or military communications research, where analyzing pulse radar and 64QAM signals simultaneously on the same medium helps test and ensure system reliability under mixed signal conditions.



Analyze both wide and narrow bandwidths simultaneously. On the same oscilloscope channel of the 6 Series MSO, a 64QAM signal and a pulsed radar signal are captured using Source 1. For detailed analysis, Source 2 zooms in on the radar signal, while Source 3 focuses on the 64QAM signal.

Optional applications tailored for your RF applications

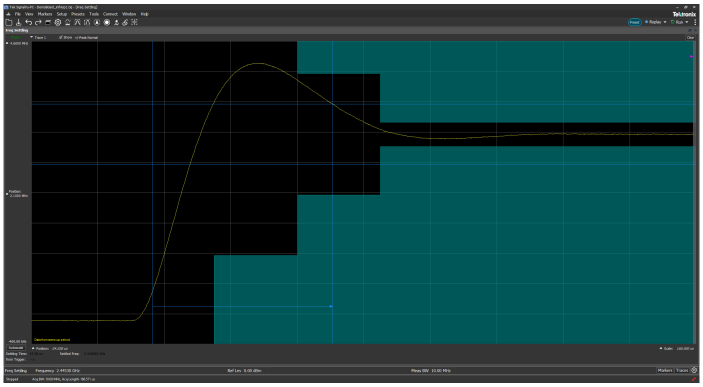
The base SignalVu-PC version ships free[2] and enables 16 or more general signal viewing and RF measurement displays including spectrum analysis, RF power and statistics, spectrograms, amplitude, frequency and phase versus time, and analog modulation measurements. Field-upgradeable software options may be added, including pulse radar analysis, general-purpose modulation analysis, settling time, automated phase noise measurements, EMI pre-compliance, commercial standard analysis (WLAN, Bluetooth, LTEs), playback of recorded files, and more.



Wideband satellite and point-to-point microwave links can be directly observed with SignalVu-PC analysis software. Here, general-purpose Digital Modulation Analysis (SVM) is demodulating a 16QAM backhaul link running at 312.5 MS/s.

2 Free for real time acquisition and control of RSA instruments or offline analysis of waveforms. Unlock 30-days support of 5/6 Series MSO or LPD64 and other application options with available trial licenses.

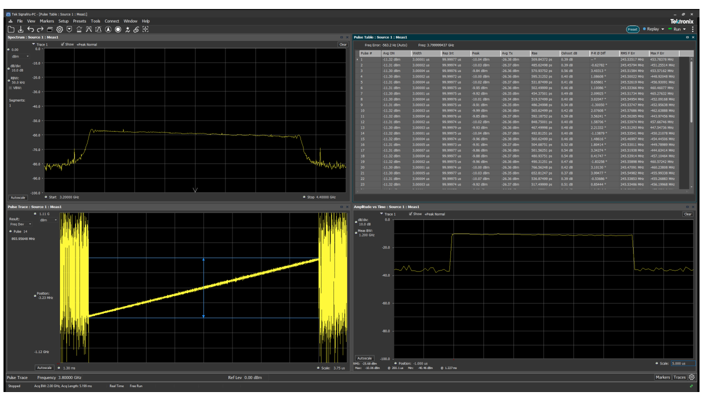
From FSK to 1024QAM, general-purpose digital modulation analysis (SVM) provides precise modulation accuracy and essential physical-layer measurements for 26 prevalent digital modulation types.

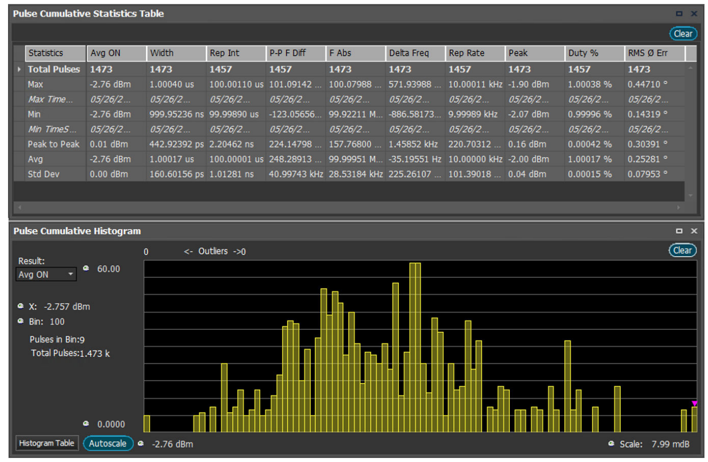


Settling time measurements (SVT) are easy and automated. The user can select measurement bandwidth, tolerance bands, reference frequency (auto or manual), and establish up to 3 tolerance bands vs. time for Pass/Fail testing. Settling time may be referenced to external or internal trigger, and from the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

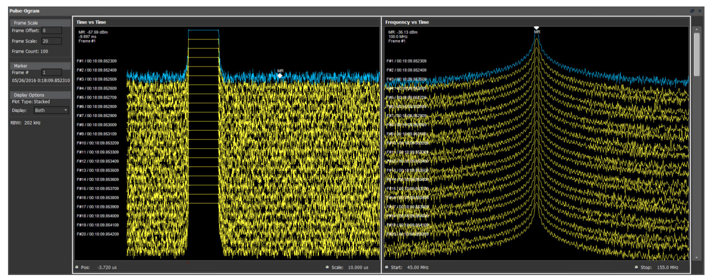
Advanced pulse analysis

The advanced pulse analysis package (SVP) provides 31 individual measurements to automatically characterize long pulse trains often associated with RADAR. An 850 MHz wide LFM chirp centered at 3.85 GHz is seen here with measurements for pulses 7 through 14 (top right). The shape of the pulse can be seen in the Amplitude vs. Time plot shown in the upper left. Detailed views of pulse #8's frequency deviation and parabolic phase trajectory are shown in the lower two views.





Cumulative statistics provides timestamps for Min, Max values as well as Peak to Peak, Average and Standard deviation over multiple acquisitions, further extending the analysis. Histogram shows you outliers on the right and left.



Pulse-Ogram displays a waterfall of multiple segmented captures, with correlated amplitude vs time and spectrum of each pulse. Can be used with an external trigger to show target range and speed.

Four pulse trains are captured and analyzed simultaneously with time-correlated markers, pulse table, and pulse trace displays used to gain insight into the signal behavior across channels over time.

Multi-channel support is enabled when the 5/6/7 Series oscilloscopes are used. This allows you to capture and analyze up to 8 phase-coherent RF pulse trains of up to 5 GHz in frequency and up to 2 GHz in bandwidth. Or up to 4 pulse trains of up to 10 GHz in frequency and up to 2 GHz in bandwidth.

WLAN sub 6 GHz Wi-Fi transmitter testing

With the WLAN measurement applications, you can perform standards-based transmitter measurements in the time, frequency, and modulation domains.

- SV23 supports IEEE 802.11a, b, g, j, and p signals
- SV24 supports 802.11n 20 MHz and 40 MHz SISO signals
- SV25 802.11ac 20/40/80/160 MHz SISO signals

All modulation formats, as shown in the following table can be measured.

Standard	Std PHY	Freq band(s)	Signal	Modulation formats	Bandwidth (max)	802.11-2012 section
802.11b	DSSS HR/ DSSS	2.4 GHz	DSSS/CCK 1 - 11 Mbps	DBSK, DQPSK CCK5.5M, CCK11M	20 MHz	16 & 17
802.11g	ERP	2.4 GHz	DSSS/CCK/ PBCC 1 - 33 Mbps	BPSK DQPSK	20 MHz	17
802.11a	OFDM	5 GHz	OFDM 64 <54 Mbps	BPSK QPSK 16QAM 64QAM	20 MHz	18
802.11g		2.4 GHz			20 MHz	19
802.11j/p		5 GHz			5, 10, 20 MHz	18
802.11n	HT	2.4 GHz & 5 GHz	OFDM 64, 128 ≤ 150 Mbps	BPSK QPSK 16QAM 64QAM	20 , 40 MHz	20
802.11ac	VHT	5 GHz	OFDM 64, 128, 256, 512 ≤ 867 Mbps	BPSK QPSK 16QAM 64QAM 256QAM	20, 40, 80, 160 MHz	22

The WLAN presets make the Error Vector Magnitude (EVM), Constellation, and Spectral Emission Mask (SEM) measurements push-button.

The WLAN RF transmitter measurements are defined by the IEEE 802.11-2012 revision of the standard. Analysis of 1024-QAM 802.11ac signals is also possible.

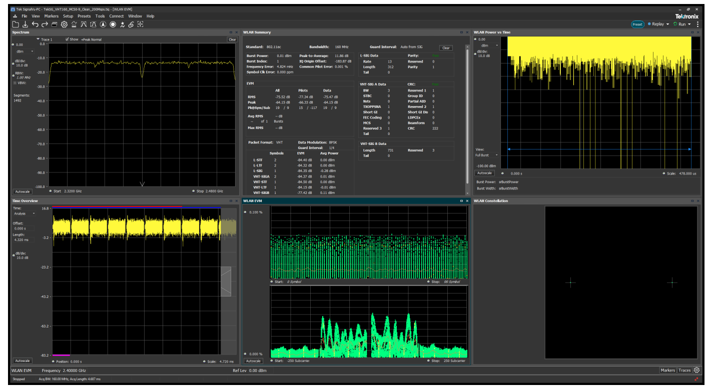
IEEE 802.11 RF layer test	IEEE reference 802.11-2012	Limit tested
Transmit Power ON/Off Ramp	16.4.7.8 (DSSS)	(10%-90%) 2 usec
	17.4.7.7 ("b")	(10%-90%) 2 usec
Transmit Spectrum mask	16.4.7.5 (DSSS)	std mask
	17.4.7.4 ("b")	std mask
	18.3.9.3 ("a")	std mask
	19.5.5 ("g")	std mask
	20.3.20.1 ("n")	std mask
	22.3.18.1 ("ac")	std mask
RF Carrier suppression	16.4.7.9 ("DSSS")	-15 dB
	17.4.7.8 ("b")	-15 dB
Centre frequency leakage	18.3.9.7.2 ("a")	-15 dBc or +2 dB with respect to average subcarrier power
	20.3.20.7.2 ("n")	20 MHz follow 18.3.9.7.2
		40 MHz -20dBc or 0 dB with respect to average subcarrier power
Transmit Spectral flatness	18.3.9.7.3 ("a")	+/-4dB (SC = -16... 16), +4/-6 dB (other)
	20.3.20.2 ("n")	+/-4dB, +4/-6 dB
	22.3.18.2 ("ac")	+/-4dB, +4/-6 dB (various BWs, 20-160 MHz)
Transmit Spectral flatness	18.3.9.7.3 ("a")	+/-4 dB (SC = -16... 16), +4/-6 dB (other)
	20.3.20.2 ("n")	+/-4 dB, +4/-6 dB
	22.3.18.2 ("ac")	+/-4 dB, +4/-6 dB (various BWs, 20-160 MHz)
Transmit Centre frequency tolerance	16.4.7.6 ("DSSS")	+/-25 ppm
	17.4.7.5 ("b")	+/-25 ppm
	18.3.9.5 ("a")	+/-20 ppm (20 MHz and 10 MHz), +/- 10 ppm (5 MHz)
	19.4.8.3 ("g")	+/-25 ppm
	20.3.20.4 ("n")	+/-20 ppm (5 GHz band), +/- 25 ppm (2.4 GHz band)
	22.3.18.3 ("ac")	+/-20 ppm
Symbol clock frequency tolerance	16.4.7.7 ("DSSS")	+/-25 ppm
	17.4.7.6 ("b")	+/-25 ppm
	18.3.9.6 ("a")	+/-20 ppm (20 MHz and 10 MHz), +/-10 ppm (5 MHz)
	19.4.8.4 ("g")	+/-25 ppm
	20.3.20.6 ("n")	+/-20 ppm (5 GHz band), +/-25 ppm (2.4 GHz band)
	22.3.18.3 ("ac")	+/-20 ppm

Table continued…

IEEE 802.11 RF layer test	IEEE reference 802.11-2012	Limit tested
Transmit Modulation accuracy	16.4.7.10 ("DSSS")	Peak EVM < 0.35
	17.4.7.9 ("b")	Peak EVM < 0.36

IEEE 802.11 WLAN transmitter test summary

IEEE 802.11 RF layer test	IEEE reference 802.11-2012	limit		
Transmitter Constellation Error	18.3.9.7.4 ("a")	Modulation	Coding rate (R)	Relative constellation error
		BPSK	1/2	-5
		BPSK	3/4	-8
		QPSK	1/2	-10
		QPSK	3/4	-13
		16-QAM	1/2	-16
		16-QAM	3/4	-19
		64-QAM	2/3	-22
		64-QAM	3/4	-25
	20.3.20.7.3 ("n")	BPSK	1/2	-5
		QPSK	1/2	-10
		QPSK	3/4	-13
		16-QAM	1/2	-16
		16-QAM	3/4	-19
		64-QAM	2/3	-22
		64-QAM	3/4	-25
		64-QAM	5/6	-27
	22.3.18.4.3 ("ac")	BPSK	1/2	-5
		QPSK	1/2	-10
		QPSK	3/4	-13
		16-QAM	1/2	-16
		16-QAM	3/4	-19
		64-QAM	2/3	-22
		64-QAM	3/4	-25
		64-QAM	5/6	-27
		256-QAM	3/4	-30
		256-QAM	5/6	-32



Easy analysis of WLAN 802.11ac transmitter with a WLAN preset that provides spectral emission mask, constellation diagram, and decoded burst information.

Bluetooth transmitter testing

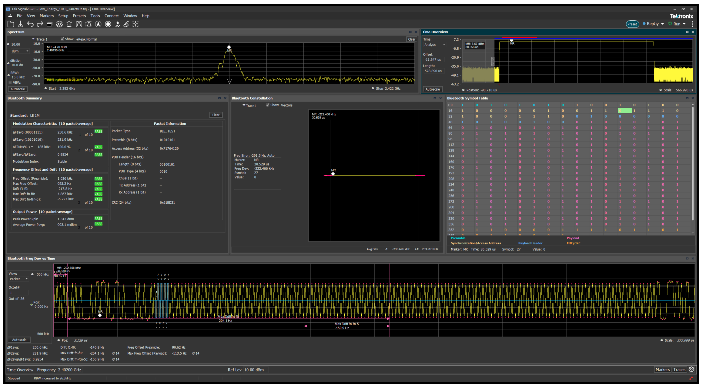
Two options have been added to help with Bluetooth SIG standard base transmitter RF measurements in the time, frequency and modulation domains. Option SV27 supports Basic Rate and Low Energy Transmitter measurements defined by RF.TS.4.2.0 and RF-PHY.TS. 4.2.0 Test Specification. It also demodulates and provides symbol information for Enhanced Data Rate (EDR) packets. Option SV31 supports Bluetooth 5 standards (LE 1M, LE 2M, LE Coded) and measurements defined in the Core Specification. Both options also decode the physical layer data that is transmitted and color-encode the fields of packet 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.

Below is a summary of the measurements that are automated with option SV27 and SV31 (unless noted):

- Bluetooth Low Energy (BLE) transmitter measurements
  - Output power at NOC TRM-LE/CA/01/C and at EOC TRM-LE/CA/02/C
  - In-band emission at NOC TRM-LE/CA/03/C and at EOC TRM-LE/CA/04/C
  - Modulation characteristics TRM-LE/CA/05/C
  - Carrier frequency offset and drift at NOC TRM-LE/CA/06/C and at EOC TRM-LE/CA/07/C
- Basic Rate transmitter measurements
  - Output power TRM/CA/01/C
  - Power Density TRM/CA/02/C (no preset)
  - Power Control TRM/CA/03/C (no preset)
  - Tx output Spectrum – Frequency Range TRM/CA/04/C (no preset)
  - Tx output spectrum - 20 dB Bandwidth TRM/CA/05/C
  - Tx output spectrum - Adjacent Channel Power TRM/CA/06/C
  - Modulation characteristics TRM/CA/07/C
  - Initial carrier frequency tolerance TRM/CA/08/C
  - Carrier frequency-drift TRM/CA/09/C

The following additional information is also available with SV27 and SV31: symbol table with color coded field information, constellation, eye diagram, frequency deviation vs time with highlighted packet and octet, frequency offset and drift detailed table, as well as packet header field decoding. Markers can be used to cross-correlate the time, vector, and frequency information.

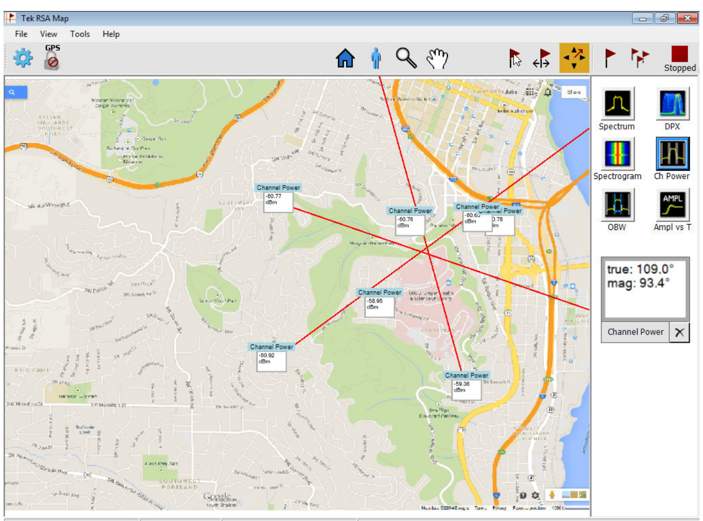


Easy validation of Bluetooth transmitter with push button preset, pass/fail information, and clear correlation between displays.

Mapping

When paired with the Alaris Smart Antenna with electronic compass, and battery-powered RSA500 Series (with built-in GPS transceiver) or RSA306B (with third party GPS dongle), the Mapping (MAP) application enables interference hunting, spectrum clearing, coverage mapping, surveying, and triangulation on signal sources.

Locate interference with an azimuth function that lets you draw a line or an arrow on a mapped measurement to indicate the direction your antenna was pointing when you took a measurement. You can also create and display measurement results and labels.



Mapped channel power readings using the azimuth function.

LTE FDD and TDD base station transmitter RF testing

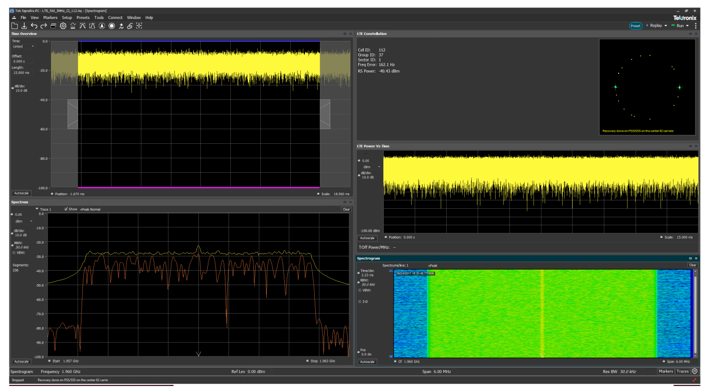
Option SV28 enables the following LTE measurements:

- Cell ID
- Channel Power
- Occupied Bandwidth (OBW)
- Adjacent Channel Leakage Ratio (ACLR)
- Spectrum Emission Mask (SEM)
- Transmitter Off Power for TDD
- Reference Signal Power

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 and Reference Signal (RS) Power.

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 if the instrument has enough acquisition bandwidth.



Fast validation of LTE base station transmitter with push button preset, and pass/fail information.

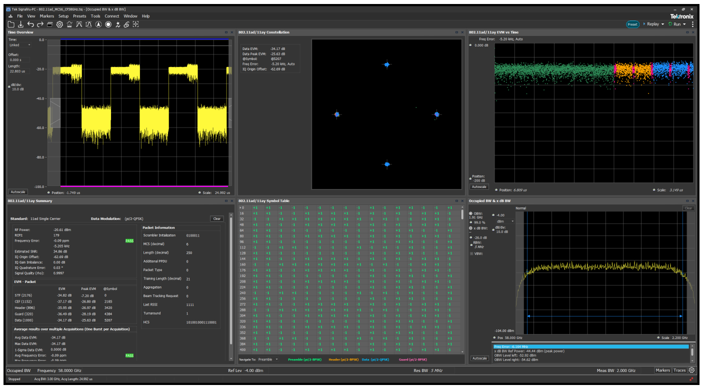
WiGig IEEE802.11ad/ay 60 GHz Wi-Fi transmitter testing (offline analysis)

Options SV30NL-SVPC and SV30FL-SVPC provide offline analysis for WiGig IEEE802.11ad/ay IC characterization. However, Tektronix DPO70000SX Series oscilloscope with option SV30 installed can be used for full online 60 GHz measurements and analysis using SignalVu. For more details, refer to *SignalVu-PC vs. SignalVu*.

SV30 installed on an oscilloscope provides significant margin in EVM performance compared to what is required by the standard. Both Control PHY (802.11ad) and Single Carrier PHY (802.11ad and 802.11ay) are supported and provides analysis of 802.11ay 2.16 GHz packets or 4.23 GHz adjacent two-channel bonded packets.

Testing and verification can be done on IF and RF setups. RF power, Received Power Indicator (RCPI), Frequency error (Max, Average, Std. Deviation), DC Offset, IQ DC origin offset, IQ Gain and Phase imbalance, Signal Quality, and estimated SNR measurements are reported in the Summary display. Pass/Fail results are reported using customizable limits and the presets make the test set-up push-button.

For further insight into the signal, color coding is available in the user interface, allowing you to visualize the EVM spread across the analyzed packet with color codes differentiating regions. You can also view the demodulated symbols in tabular form with different color codes and with an option to traverse to the start of each region for easier navigation.



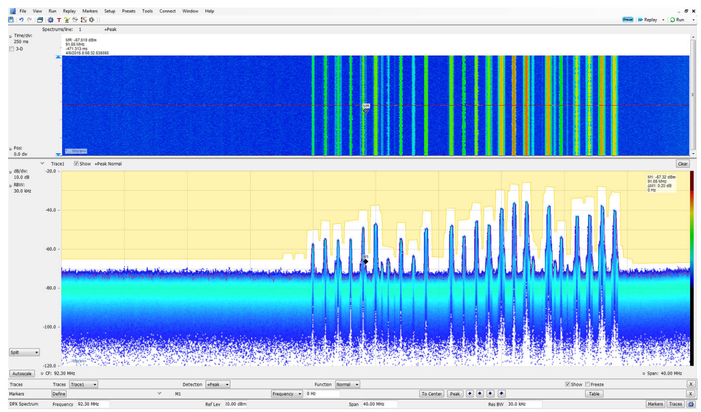
WiGig IEEE802.11ad/ay transmitter testing (offline analysis)

Modulation formats	**802.11ad**: MCS0-12.6 **802.11ay**: MCS1-21
	802.11ad/ay Single carrier: π/2 BPSK, π/2 QPSK, π/2 16QAM, π/2 64QAM **802.11ad Control PHY**: π/2 DBPSK
Measurements	RF output power, Received Channel Power Indicator (RCPI), Estimated SNR, Frequency Error, Symbol Rate Error, IQ Origin Offset, IQ Phase Imbalance, IQ Gain Imbalance, IQ Quadrature Error, EVM results for each packet region (STF, CEF, Header and Data). Packet information includes the Packet type, Preamble, Synchronization Word or Access Code, Packet Header, Payload length, and CRC details.
Displays	Constellation, EVM vs Time, Symbol Table, Summary

Playback of recorded files

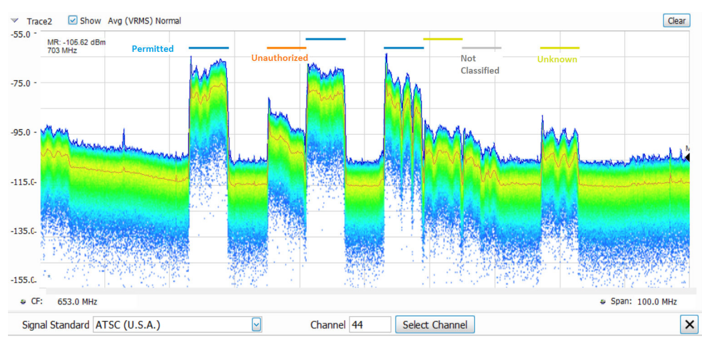
With SV56, playback of recorded files from one of the USB spectrum analyzers is possible. Playback of recorded signals can reduce hours of watching and waiting for a spectral violation to minutes at your desk reviewing recorded data. Recording length is limited only by storage media size and recording is a basic feature included in SignalVu-PC. SignalVu-PC 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 gap-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.



Signal survey

The signal classification application (SV54) enables expert systems guidance to aid the user in classifying signals. It provides graphical tools that allow you to quickly create a spectral region of interest, enabling you to classify and sort signals efficiently. The spectral profile mask, when overlaid on top of a trace, provides signal shape guidance, while frequency, bandwidth, channel number, and location are displayed allowing for quick checks. WLAN, GSM, W-CDMA, CDMA, Bluetooth standard and enhanced data rate, LTE FDD and TDD, and ATSC signals can be quickly and simply classified. Databases can be imported from your H500/RSA2500 signal database library for easy transition to the new software base.



Above is a typical signal survey. This survey is of a portion of the TV broadcast band, and 7 regions have been declared as either Permitted, Unknown, or Unauthorized, as indicated by the color bars for each region.

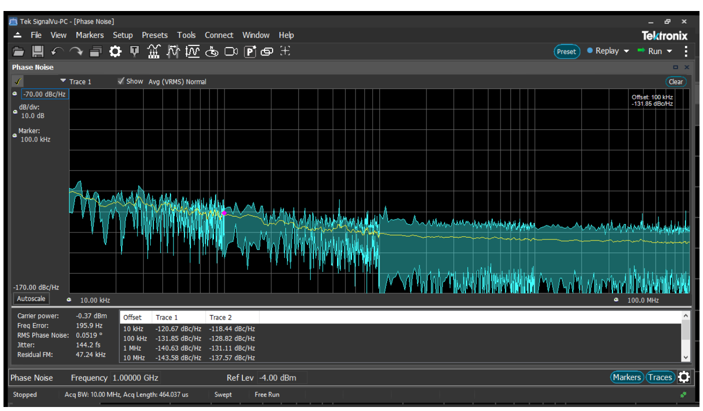
In this illustration, a single region has been selected. Since we have declared this to be an ATSC video signal, the spectrum mask for the ATSC signal is shown overlaid in the region. The signal is a close match to the spectrum mask, including the vestigial carrier at the lower side of the signal, characteristic of ATSC broadcasts.

Smart antenna for interference hunting

SignalVu-PC with mapping can be used to manually indicate the azimuth of a measurement made in the field, greatly aiding in triangulation efforts. The addition of a smart antenna able to report its direction to SignalVu-PC automates this process. Automatically plotting the azimuth/bearing of a measurement during interference hunting can greatly speed the time spent searching for the source of interference. Tektronix mapping capability provides support for the third-party *Alaris DF-A0047* handheld direction finding antenna with frequency coverage from 20 MHz -8.5 GHz (optional 9 kHz-20 MHz) as part of a complete interference hunting solution. All SignalVu-PC data streams include time-stamp information for effective data logging and coherent signal analysis applications. Full specifications for the DF-A0047 antenna are available at *www.alarisantennas.com/products/df-a0047-handheld-wideband-direction-finding-antenna/*.

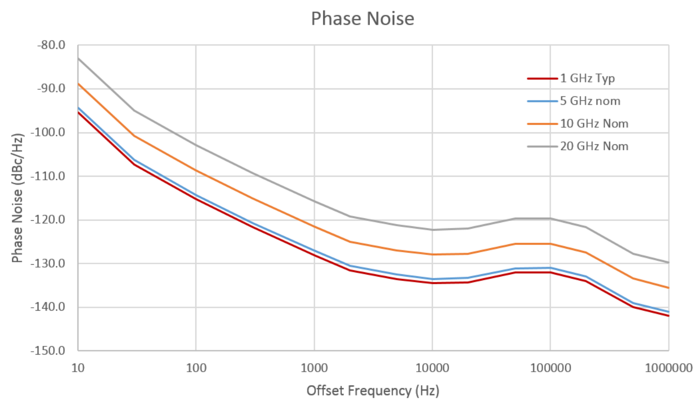
Automated phase noise and jitter measurements

Phase noise degrades the ability to process Doppler information in radar systems and degrades error vector magnitude in digitally modulation communication systems. Automated phase noise and jitter measurements with a spectrum analyzer (PHAS) may reduce the cost of your measurements by reducing the need for a dedicated phase noise analyzer.



Applications include testing VCO phase noise, oscillator phase noise, clock source jitter, signal generator phase noise, and more. The Tektronix phase noise / jitter application, when combined with DPX® signal processing, provides a powerful solution for designing and troubleshooting momentarily unstable signal sources.

The phase noise application performs automated carrier tracking, averaging, and dynamic measurement bandwidth adjustment, providing the accuracy and speed of measurement needed at all carrier offsets - ranging from 10 Hz to 1 GHz. Results are available in log-frequency trace or tabular form with pass/fail limits on-screen or via programmatic control. Integration limits are programmable for RMS phase noise, jitter, and residual FM. The low instrument phase noise of the RSA7100B together with this measurement application allows for high-performance phase noise measurements at frequencies up to 26.5 GHz.



The previous figure shows the RSA7100B typical and nominal phase noise performance.

Education license

Qualified educational facilities can cost-effectively use SignalVu-PC in teaching environments. The specially priced education version includes all available applications and provides results watermarked 'Education Version'.

Measurement functions

Spectrum analyzer measurements (base software)	Channel power, Adjacent channel power, Multicarrier adjacent channel Power/Leakage ratio, Occupied bandwidth, xdB down, Marker measurements of power, delta power, integrated power, power density, dBm/Hz, and dBc/Hz, Signal strength with audible feedback.
Time domain and statistical measurements (base software)	RF IQ vs time, Amplitude vs time, Power vs time, Frequency vs time, Phase vs time, CCDF, Peak-to-Average ratio, Amplitude, Frequency, and Phase modulation analysis.
Automated phase noise / jitter measurements (PHAS) (RSA7100 only)	Carrier power, Frequency error, RMS phase noise, Jitter, Residual FM.

Table continued…

WLAN 802.11a/b/g/j/p measurement application (SV23)	All of the RF transmitter measurements as defined in the IEEE standard, and a wide range of additional scalar measurements such as Carrier Frequency error, Symbol Timing error, Average/peak burst power, IQ Origin Offset, RMS/Peak EVM, and analysis displays, such as EVM and Phase/ Magnitude Error vs time/frequency or vs symbols/ subcarriers, as well as packet header decoded information and symbol table. SV24 requires SV23. SV25 requires SV24.
WLAN 802.11n measurement application (SV24)	
WLAN 802.11ac measurement application (SV25)	
APCO P25 compliance testing and analysis application (SV26)	Complete set of push-button TIA-102 standard-based transmitter measurements with pass/fail results including ACPR, transmitter power and encoder attack times, transmitter throughput delay, frequency deviation, modulation fidelity, symbol rate accuracy, and transient frequency behavior, as well as HCPM transmitter logical channel peak ACPR, off slot power, power envelope, and time alignment.
Bluetooth Basic LE TX SIG measurements (SV27)	Presets for transmitter measurements defined by Bluetooth SIG for Basic Rate and Bluetooth Low Energy. Results also include Pass/Fail information. Application also provides Packet Header Field Decoding and can automatically detect the standard including Enhanced Data Rate.
Bluetooth 5 measurements (SV31)	Bluetooth SIG measurements for Bluetooth Low Energy version 5. Results also include Pass/Fail information. Application also provides Packet Header Field Decoding of LE Data Packets. SV31 requires SV27.
AM/FM/PM modulation and audio measurements (SVA)	Carrier power, frequency error, modulation frequency, modulation parameters (±peak, peak-peak/2, RMS), SINAD, modulation distortion, S/N, THD, TNHD, hum and noise.
Settling time (frequency and phase) (SVT)	Measured frequency, settling time from last settled frequency, settling time from last settled phase, settling time from trigger. Automatic or manual reference frequency selection. User-adjustable measurement bandwidth, averaging, and smoothing. Pass/Fail mask testing with 3 user-settable zones.
Advanced Pulse analysis (SVP)	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. Oscilloscopes support multi-channel analysis when used.
Flexible OFDM analysis (SVO)	OFDM analysis with support for WLAN 802.11a/g/j and WiMAX 802.16-2004. Constellation, Scalar measurement summary, EVM or power vs carrier, Symbol table (Binary or Hexadecimal).
General-purpose digital modulation analysis (SVM)	Error vector magnitude (EVM) (RMS, Peak, EVM vs Time), Modulation error ratio (MER), Magnitude Error (RMS, peak, mag error vs time),Phase error (RMS, Peak, Phase error vs time), Origin offset, Frequency error, Gain imbalance, Quadrature error, Rho, Constellation, Symbol table. FSK only: Frequency deviation, Symbol timing error. Oscilloscopes support multi-channel analysis when used.
Playback of recorded files (SV56)	Playback of files recorded with one of the USB spectrum analyzers (RSA306, RSA500, or RSA600). Controls for file selection, begin/end points. Rate controls for gap-free or live-rate playback.
LTE Downlink RF measurements (SV28)	Presets for Cell ID, ACLR, SEM, Channel Power and TDD Toff Power. Supports TDD and FDD frame format and all base stations defined by 3GPP TS version 12.5. Results include Pass/Fail information. Real-Time settings make the ACLR and the SEM measurements fast, if the connected instrument has required bandwidth.
WiGig IEEE 802.11ad/ay (SV30) (For offline analysis only. Real-time 60 GHz measurements can be made with Opt. SV30 on DPO70000SX Series oscilloscopes.)	Presets for Control PHY (802.11ad) and Single Carrier PHY (802.11ad and 802.11ay). The 802.11ay analysis results are shown for the EDMG, PreEDMG1, and PreEDMG2 regions. The 802.11ad preset measures EVM in each of the packet fields per the standard, and decodes the header packet information. RF power, Received Channel Power Indicator, Frequency error, IQ DC origin offset, IQ Gain and Phase imbalance are reported in the Summary display. Pass/Fail results are reported using customizable limits.
CISPR Detectors (Quasi Peak and Average) (SVQP)	This option enables CISPR Quasi Peak and Average detectors (defined per CISPR16) in Spectrum and Spurious displays.
EMC/EMI pre-compliance and troubleshooting (EMCVU)	This option supports many predefined limit lines. It also adds a wizard for easy setup of recommended antennas, LISN, and other EMC accessories with a one-button push. When using the new EMC-EMI display, you can accelerate the test by applying the time consuming quasi peak only on failures. This display also provides a push-button ambient measurement. The Inspect tool lets you measure frequencies of interest locally, removing the need for scanning.

Table continued…

Specifications

Performance (typical)

The following is typical performance of SignalVu-PC analyzing acquisitions from 5/6/7 Series oscilloscopes. All other analysis specifications are available in the instrument's datasheet. Performance for SignalVu-PC when used with the RSA7100 real-time spectrum analyzer and the RSA306, RSA500, RSA600 USB real time spectrum analyzers are shown respectively in the RSA7100, RSA306, RSA500, and RSA600 datasheets.

Frequency-related

Frequency range	See appropriate instrument data sheet
Initial center frequency setting accuracy	Equal to time-base accuracy of instrument
Center frequency setting resolution	0.1 Hz
Frequency offset range	0 Hz to the maximum bandwidth of the oscilloscope
Frequency marker readout accuracy	±(Reference Frequency Error × Marker Frequency + 0.001 × Span + 2) Hz
Span accuracy	±0.3%
Reference frequency error	Equal to oscilloscope reference frequency accuracy, aging, and drift. Refer to appropriate DPO/MSO data sheet.
Tuning Tables	Tables that present frequency selection in the form of standards-based channels are available for the following. Cellular standards families: AMPS, NADC, NMT-450, PDC, GSM, CDMA, CDMA-2000, 1xEV-DO WCDMA, TD-SCDMA, LTE, WiMax Unlicensed short range: 802.11a/b/j/g/p/n/ac, Bluetooth Cordless phone: DECT, PHS Broadcast: AM, FM, ATSC, DVBT/H, NTSC Mobile radio, pagers, other: GMRS/FRS, iDEN, FLEX, P25, PWT, SMR, WiMax

Analysis-related

Frequency (base software)	Spectrum (amplitude vs linear or log frequency) Spectrogram (amplitude vs frequency over time)
Time and statistics (base software)	Amplitude vs time Frequency vs time Phase vs time Amplitude modulation vs time Frequency modulation vs time Phase modulation vs time RF IQ vs time Time overview CCDF Peak-to-Average ratio
Settling time, frequency, and phase (SVT)	Frequency settling vs time Phase settling vs time
Advanced Pulse measurements suite (SVP)	Pulse results table Pulse trace (selectable by pulse number) Pulse statistics (trend of pulse results, FFT of time trend, and histogram) Cumulative statistics Cumulative histogram Pulse-Ogram
Digital demod (SVM)	Constellation diagram

	EVM vs Time Symbol table (binary or hexadecimal) Magnitude and phase error vs time, and signal quality Demodulated IQ vs time Eye diagram Trellis diagram Frequency deviation vs time
Flexible OFDM (SVO)	EVM vs Symbol, vs Subcarrier Subcarrier power vs symbol, vs subcarrier Subcarrier constellation Symbol data table Mag error vs Symbol, vs Subcarrier Phase error vs Symbol, vs Subcarrier Channel frequency response
Automated phase noise and jitter measurements (PHAS)	Carrier power Frequency error RMS phase noise Jitter Residual FM
WLAN measurements (SV23, SV24, SV25 or SV2C)	Burst index Burst power Peak to average burst power IQ origin offset Frequency error Common pilot error Symbol clock error RMS and Peak EVM for Pilots/Data Peak EVM located per symbol and subcarrier Packet header format information Average power and RMS EVM per section of the header WLAN power vs Time or vs Symbol Burst Width WLAN symbol table WLAN Constellation Spectrum emission mask Spurious EVM vs symbol (or time), vs subcarrier (or frequency) Mag error vs symbol (or time), vs subcarrier (or frequency) Phase error vs symbol (or time), vs subcarrier (or frequency) WLAN channel frequency response vs symbol (or time), vs subcarrier (or frequency) WLAN spectral flatness vs symbol (or time), vs subcarrier (or frequency)
APCO P25 measurement application (SV26)	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
Bluetooth Basic LE Tx (SV27) and Bluetooth 5 (SV31) 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, editable limits
LTE Downlink RF measurements (SV28)	Adjacent Channel Leakage Ratio (ACLR), Spectrum Emission Mask (SEM), Channel Power, Occupied Bandwidth, Power vs. Time displaying Transmitter OFF power for TDD signals and LTE constellation diagram for PSS, SSS with Cell ID, Group ID, Sector ID, Reference Signal (RS) Power, and Frequency Error.
WiGig 802.11ad/ay Measurements (SV30) (Offline analysis)	RF output power, Received Channel Power Indicator (RCPI), Estimated SNR, Frequency Error, Symbol Rate Error, IQ Origin Offset, IQ Gain Imbalance, IQ Phase Imbalance, IQ Quadrature Error, EVM results for each packet region: Packet information, 802.11ad (STF, CEF, Header, Guard, and Data), 802.11ay (LSTF, LCEF, L Header, EDMG Header-A, EDMG STF, EDMG CEF Guard and Data) including the Packet type, Preamble, Synchronization Word or Access Code, Packet Header, Payload length, and CRC details.

Signal strength

Signal Strength display

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

AM/FM/PM modulation and audio measurements (SVA)

All published performance based on conditions of Input Signal: 0 dBm, Input Frequency: 100 MHz, RBW: Auto, Averaging: Off, Filters: Off. Sampling and input parameters optimized for best results.

Carrier frequency range[3]	1 kHz or (1/2 × audio analysis bandwidth) to maximum input frequency
Maximum audio frequency span	10 MHz

Audio filters

Low pass (kHz)	0.3, 3, 15, 30, 80, 300, and user-entered up to 0.9 × audio bandwidth
High pass (Hz)	20, 50, 300, 400, and user-entered up to 0.9 × audio bandwidth
Standard	CCITT, C-Message
De-emphasis (μs)	25, 50, 75, 750, and user-entered
File	User-supplied .TXT or .CSV file of amplitude/frequency pairs. Maximum 1000 pairs.

FM modulation analysis

FM measurements,	Carrier power, carrier frequency error, audio frequency, deviation (+peak, –peak, peak-peak/2, RMS), SINAD, modulation distortion, S/N, total harmonic distortion, total non-harmonic distortion, hum and noise
FM deviation accuracy	±1.5% of deviation
FM rate accuracy	±1.0 Hz
Carrier frequency accuracy	±1 Hz + (transmitter frequency × reference frequency error)

Residuals (FM) (rate: 1 kHz to 10 kHz, deviation: 5 kHz)

THD	0.2% (MSO/DPO70000)

3 Sampling rates of the oscilloscope are recommended to be adjusted to no more than 10X the audio carrier frequency for modulated signals, and 10X the audio analysis bandwidth for direct input audio. This reduces the length of acquisition required for narrow-band audio analysis.

SINAD	44 dB (MSO/DPO70000)

AM modulation analysis

AM measurements	Carrier power, audio frequency, modulation depth (+peak, –peak, peak-peak/2), RMS, SINAD, modulation distortion, S/N, total harmonic distortion, total non-harmonic distortion, hum and noise
AM depth accuracy (rate: 1 kHz, depth: 50%)	±1% + 0.01 × measured value
AM rate accuracy (rate: 1 kHz, depth: 50%)	±1.0 Hz

Residuals (AM)

THD	0.3% (MSO/DPO70000)
SINAD	48 dB (MSO/DPO70000)

PM modulation analysis

PM measurement	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
PM deviation accuracy (rate: 1 kHz, deviation: 0.628 rad)	±100% × (0.01 + (rate / 1 MHz))
PM rate accuracy (rate: 1 kHz, deviation: 0.628 rad)	±1 Hz

Residuals (PM)

THD	0.1% (MSO/DPO70000)
SINAD	48 dB (MSO/DPO70000)

Direct audio input

Audio measurements	Signal power, audio frequency (+peak, –peak, peak-peak/2, RMS), SINAD, modulation distortion, S/N, total harmonic distortion, total non-harmonic distortion, hum and noise
Direct input frequency range (for audio measurements only)	1 Hz to 10 MHz
Maximum audio frequency span	10 MHz
Audio frequency accuracy	±1 Hz

Residuals (PM)

THD	1.5%
SINAD	38 dB

Minimum audio analysis bandwidth and RBW vs. oscilloscope memory and sample rate (SVA)

Model	Sample rate: 1 GS/s				Sample rate: maximum			
	Standard memory		Maximum memory		Standard memory		Maximum memory	
	Min. Aud. BW	RBW (Auto)	Min. Aud. BW	RBW (Auto)	Min. Aud. BW	RBW (Auto)	Min. Aud. BW	RBW (Auto)
DPO/MSO 70000 ≥ 12.5 GHz BW	200 kHz	400 Hz	10 kHz	20 Hz	Not recom-mended	> 4 kHz	1 MHz	2 kHz
DPO/MSO 70000 < 12.5 GHz BW	200 kHz	400 Hz	20 kHz	40 Hz	Not recom-mended	> mee4 kHz	500 kHz	1 kHz

Settling time, frequency, and phase (SVT)

Settled frequency uncertainty[4]

Measurement frequency: 1 GHz

Averages	Frequency uncertainty at stated measurement bandwidth			
	1 GHz	100 MHz	10 MHz	1 MHz
Single measurement	20 kHz	2 kHz	500 Hz	100 Hz
100 averages	10 kHz	500 Hz	200 Hz	50 Hz
1000 averages	2 kHz	200 Hz	50 Hz	10 Hz

Measurement frequency: 9 GHz

Averages	Frequency uncertainty at stated measurement bandwidth			
	1 GHz	100 MHz	10 MHz	1 MHz
Single Measurement	20 kHz	5 kHz	2 kHz	200 Hz
100 Averages	10 kHz	2 kHz	500 Hz	50 Hz
1000 Averages	2 kHz	500 Hz	200 Hz	20 Hz

Settled phase uncertainty[4]

Measurement frequency: 1 GHz

Averages	Phase uncertainty at stated measurement bandwidth			
	1 GHz	100 MHz	10 MHz	1 MHz
Single measurement	2°	2°	2°	2°
100 averages	0.5°	0.5°	0.5°	0.5°
1000 averages	0.2°	0.2°	0.2°	0.2°

Measurement frequency: 9 GHz

Averages	Phase uncertainty at stated measurement bandwidth			
	1 GHz	100 MHz	10 MHz	1 MHz
Single measurement	5°	5°	5°	5°
100 averages	2°	2°	2°	2°

Table continued…

4 Settled Frequency or Phase at the measurement frequency. Measured signal level > -20 dBm, Attenuator: Auto.

Averages	Phase uncertainty at stated measurement bandwidth			
	1 GHz	100 MHz	10 MHz	1 MHz
1000 averages	0.5°	0.5°	0.5°	0.5°

Advanced Pulse measurement suite (SVP)

General characteristics

Measurements

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.

System rise time (typical)

Equal to oscilloscope rise time

Minimum pulse width for detection [5]

Model	Minimum PW
MSO54	300 ps
MSO56	300 ps
MSO58	300 ps
MSO64B	300 ps
MSO66B	300 ps
MSO68B	300 ps

Pulse measurement accuracy (typical) [6]

Average on power	±0.3 dB + Absolute Amplitude Accuracy of instrument
Average transmitted power	±0.4 dB + Absolute Amplitude Accuracy of instrument
Peak power	±0.4 dB + Absolute Amplitude Accuracy of instrument
Pulse width	±(3% of reading + 0.5 × sample period)
Pulse repetition rate	±(3% of reading + 0.5 × sample period)

Digital modulation analysis (SVM)

Modulation formats

π/2DBPSK, BPSK, SBPSK, QPSK, DQPSK, π/4DQPSK, D8PSK, 8PSK, OQPSK, SOQPSK, CPM, 16/32/64/128/256/1024QAM, MSK, 2-FSK, 4-FSK, 8-FSK, 16-FSK, C4FM, D16PSK, 16APSK, and 32APSK

Analysis period

Up to 80,000 samples

Measurement filters

Square-root raised cosine, raised cosine, Gaussian, rectangular, IS-95, IS-95 EQ, C4FM-P25, half-sine, None, User Defined

5 Conditions: Approximately equal to 10/(IQ sampling rate). IQ sampling rate is the final sample rate after frequency domain processing from the oscilloscope. Pulse measurement filter set to max bandwidth.

6 Conditions: Pulse Width > 450 ns, S/N Ratio ≥ 30 dB, Duty Cycle 0.5 to 0.001, Temperature 18 °C to 28 °C.

Reference filters	Raised cosine, Gaussian, rectangular, IS-95, SBPSK-MIL, SOQPSK-MIL, SOQPSK-ARTM, None, User Defined
Alpha/B x T range	0.001 to 1, 0.001 step
Measurements	Constellation, Error Vector Magnitude (EVM) vs time, Modulation error ratio (MER), Magnitude error vs time, Phase error vs time, Signal quality, Symbol table rhoFSK only: Frequency deviation, Symbol timing error
Symbol rate range	1 kS/s to (0.4 * Sample Rate) GS/s (modulated signal must be contained entirely within the acquisition bandwidth)

Adaptive equalizer

Type	Linear, decision-directed, feed-forward (FIR) equalizer with coefficient adaptation and adjustable convergence rate
Modulation types supported	π/2 DBPSK, BPSK, SBPSK, QPSK, DQPSK, π/4 DQPSK, D8PSK, 8PSK, D16PSK, OQPSK, SOQPSK, CPM, 16/32/64/128/256/1024QAM, MSK, 2-FSK, 4-FSK, 8-FSK, 16-FSK, C4FM
Reference filters for all modulation types except OQPSK	Raised Cosine, Rectangular, None
Reference filters for OQPSK	Raised Cosine, Half Sine
Filter length	1-128 taps
Taps/symbol: raised cosine, half sine, no filter	1, 2, 4, 8
Taps/symbol: rectangular filter	1
Equalizer controls	Off, Train, Hold, Reset

16QAM Residual EVM (typical) for DPO/MSO70000 series [7]

Symbol Rate	RF	IQ
100 MS/s	< 2.0%	< 2.0%
312.5 MS/s	< 3.0%	< 3.0%

OFDM residual EVM, 802.11g Signal at 2.4 GHz, input level optimized for best performance

DPO/MSO70000 Series	–38 dB

WLAN IEEE802.11a/b/g/j/p (SV23)

General characteristics

Modulation formats	DBPSK (DSSS1M), DQPSK (DSSS2M), CCK5.5M, CCK11M , OFDM (BPSK, QPSK, 16 or 64QAM)
Measurements and displays	Burst Index, Burst Power, Peak to Average Burst Power, IQ Origin Offset, Frequency Error, Common Pilot Error, Symbol Clock Error RMS and Peak EVM for Pilots/Data, Peak EVM located per Symbol and Subcarrier Packet Header Format Information Average Power and RMS EVM per section of the header

[7] CF = 1 GHz, Measurement Filter = root raised cosine, Reference Filter = raised cosine, Analysis Length = 200 symbols.

WLAN Power vs Time, WLAN Symbol Table, WLAN Constellation
Spectrum Emission Mask[8], Spurious
Error Vector Magnitude (EVM) vs Symbol (or Time), vs Subcarrier (or Frequency)
Mag Error vs Symbol (or Time), vs Subcarrier (or Frequency)
Phase Error vs Symbol (or Time), vs Subcarrier (or Frequency)
WLAN Channel Frequency Response vs Symbol (or Time), vs Subcarrier (or Frequency)
WLAN Spectral Flatness vs Symbol (or Time), vs Subcarrier (or Frequency)

WLAN IEEE802.11n (SV24)

General characteristics

Modulation formats	SISO, OFDM (BPSK, QPSK, 16 or 64QAM)
Measurements and displays	Burst Index, Burst Power, Peak to Average Burst Power, IQ Origin Offset, Frequency Error, Common Pilot Error, Symbol Clock Error RMS and Peak EVM for Pilots/Data, Peak EVM located per Symbol and Subcarrier Packet Header Format Information Average Power and RMS EVM per section of the header WLAN Power vs Time, WLAN Symbol Table, WLAN Constellation Spectrum Emission Mask[8] , Spurious Error Vector Magnitude (EVM) vs Symbol (or Time), vs Subcarrier (or Frequency) Mag Error vs Symbol (or Time), vs Subcarrier (or Frequency) Phase Error vs Symbol (or Time), vs Subcarrier (or Frequency) WLAN Channel Frequency Response vs Symbol (or Time), vs Subcarrier (or Frequency) WLAN Spectral Flatness vs Symbol (or Time), vs Subcarrier (or Frequency)

WLAN IEEE802.11ac (SV25)

General characteristics

Modulation formats	SISO, OFDM (BPSK, QPSK, 16/64/256/1024QAM)
Measurements and displays	Burst Index, Burst Power, Peak to Average Burst Power, IQ Origin Offset, Frequency Error, Common Pilot Error, Symbol Clock Error, RMS and Peak EVM for Pilots/Data, Peak EVM located per Symbol and Subcarrier Packet Header Format Information Average Power and RMS EVM per section of the header WLAN Power vs Time, WLAN Symbol Table, WLAN Constellation Spectrum Emission Mask[8], Spurious Error Vector Magnitude (EVM) vs Symbol (or Time), vs Subcarrier (or Frequency) Mag Error vs Symbol (or Time), vs Subcarrier (or Frequency) Phase Error vs Symbol (or Time), vs Subcarrier (or Frequency) WLAN Channel Frequency Response vs Symbol (or Time), vs Subcarrier (or Frequency) WLAN Spectral Flatness vs Symbol (or Time), vs Subcarrier (or Frequency). For reference *WLAN IEEE802.11a/b/g/j/p (SV23)*

[8] SEM is specified with noise reduction and at least 30 averages for 802.11a/n/ac signals in 5 GHz band. Residual noise performance of the instrument may exceed SEM mask at frequency above 5.85 GHz

APCO P25 (SV26)

Modulation formats	Phase 1 (C4FM), Phase 2 (HCPM, HDQPSK)
Measurements and displays	RF output power, operating frequency accuracy, modulation emission spectrum, unwanted emissions spurious, adjacent channel power ratio, frequency deviation, modulation fidelity, frequency error, eye diagram, symbol table, symbol rate accuracy, transmitter power and encoder attack time, transmitter throughput delay, frequency deviation vs. time, power vs. time, transient frequency behavior, HCPM transmitter logical channel peak adjacent channel power ratio, HCPM transmitter logical channel off slot power, HCPM transmitter logical channel power envelope, HCPM transmitter logical channel time alignment

Residual modulation fidelity (with 5/6 Series MSO, USB RF, RSA7100)

Phase 1 (C4FM)	≤ 1.0% typical
Phase 2 (HCPM)	≤ 0.5% typical
Phase 2 (HDQPSK)	≤ 0.5% typical

Adjacent channel power ratio

25 kHz offset from the center and bandwidth of 6 kHz [9]	Phase 1 (C4FM): -76 dBc typical Phase 2 (HCPM): -74 dBc typical Phase 2 (HDQPSK): -74 dBc typical
62.5 kHz offset from the center and bandwidth of 6 kHz	Phase 1 (C4FM): -77 dBc typical Phase 2 (HCPM): -78 dBc typical Phase 2 (HDQPSK): -76 dBc typical

LTE Downlink RF measurements (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 PSS, SSS with Cell ID, Group ID, Sector ID, Frequency Error, and Reference Signal (RS) Power.

ACLR with E-UTRA bands (Typical Mean, with Noise Correction)

1st Adjacent Channel	61 dB (RSA600/RSA500); 65 dB (RSA306/B)
2nd Adjacent Channel	63 dB (RSA600/RSA500); 66 dB (RSA306/B)

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

Bluetooth (SV27 and SV31)

Modulation formats	Bluetooth® 4.2 Basic Rate, Bluetooth® 4.2 Low Energy, Bluetooth® 4.2 Enhanced Data Rate. Bluetooth® 5 when SV31 is enabled.
Measurements and displays	Peak Power, Average Power, Adjacent Channel Power or InBand Emission mask, -20 dB Bandwidth, Frequency Error, Modulation Characteristics including ΔF1avg (11110000), ΔF2avg (10101010), ΔF2 > 115 kHz, ΔF2/ΔF1 ratio, frequency deviation vs. time with packet and octet level measurement information, Carrier Frequency f0, Frequency Offset (Preamble and Payload), Max Frequency Offset, Frequency Drift f_1-f_0, Max Drift Rate f_n-f_0 and f_n-f_{n-5}, Center Frequency Offset Table and Frequency Drift table, color-coded Symbol table, Packet header decoding information, eye diagram, constellation diagram.

Output power (Average and Peak Power)

Level uncertainty	Refer to instrument amplitude and flatness specification
Measurement range	Signal level > -70 dBm (for USB Spectrum Analyzers)

Modulation Characteristics (ΔF_1avg, ΔF_2avg, ΔF_2avg/ΔF_1avg, ΔF_2max ≥115 kHz)

Deviation range	± 280 kHz
Deviation uncertainty (at 0 dBm)	< 2 kHz + instrument frequency uncertainty (Basic Rate) < 3 kHz + instrument frequency uncertainty (for USB spectrum analyzers and Low Energy)
Measurement resolution	10 Hz
Measurement range	Nominal channel frequency ±100 kHz

Initial Carrier Frequency Tolerance (ICFT)

Measurement uncertainty (at 0 dBm)	< 1 kHz + instrument frequency uncertainty (for USB Spectrum Analyzers)
Measurement resolution	10 Hz
Measurement range	Nominal channel frequency ±100 kHz

Carrier Frequency Drift (Max freq. offset, drift f_1- f_0, max drift f_n-f_0, max drift f_n-f_{n-5} (50 μs))

Measurement uncertainty	< 2 kHz + instrument frequency uncertainty (for RSA306) < 1 kHz + instrument frequency uncertainty (for RSA600 and RSA500)
Measurement resolution	10 Hz
Measurement range	Nominal channel frequency ±100 kHz

In-band Emissions and ACP

Level uncertainty	Refer to instrument amplitude and flatness specification

Phase noise and jitter measurements (PHAS)

Supported instruments	RSA7100A/B and 6 Series B MSO models

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

Mapping (MAP)

Map types directly supported	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

WiGig 802.11ad/ay (SV30) measurements (Offline analysis only)

WiGig 802.11ad/ay (SV30) Measurements	(For offline analysis only. For online anlaysis, 60 GHz measurements can be made with Opt. SV30 on DPO70000SX Series oscilloscopes.) RF output power, Received Channel Power Indicator (RCPI), Estimated SNR, Frequency Error, Symbol Rate Error, IQ Origin Offset, IQ Gain Imbalance, IQ Phase Imbalance, IQ Quadrature Error, EVM results for each packet region: Packet information, 802.11ad (STF, CEF, Header, Guard, and Data), 802.11ay (LSTF, LCEF, L Header, EDMG Header-A, EDMG STF, EDMG CEF Guard and Data include the Packet type, Preamble, Synchronization Word or Access Code, Packet Header, Payload length, and CRC details.

Playback of recorded signals (SV56)

Playback file type	R3F recorded by RSA306, RSA500, or RSA600
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.

EMC pre-compliance and troubleshooting (EMCVU)

Standards	EN55011, EN55012, EN55013, EN55014, EN55015, EN55025, EN55032, EN60601, DEF STAN, FCC Part 15, FCC Part18, IEC 61000-6-3, and MIL-STD 461G
Features	EMC-EMI display, Wizard to setup accessories and limit lines, Inspect, Harmonic Markers, Level Target, Compare Traces, Measure Ambient, Report generation, Re-measure Spot
Detectors	+Peak, Avg, Avg (of logs), Avg (VRMS), CISPR QuasiPeak, CISPR Peak, CISPR Average, CISPR Average of Logs, MIL +Peak, DEF STAN Avg, DEF STAN Peak
Limit lines	Up to 3 Limit Lines with corresponding margins
Resolution BW	Set per standard or user definable
Dwell time	Set per standard or user definable
Report format	PDF, HTML, MHT,RTF, XLSX, Image File format
Accessory type	Antenna, Near Field Probe, Cable, Amplifier, Limiter, Attenuator, Filter, Other
Correction format	Gain/Loss Constant, Gain/loss table, Antenna Factor
Traces	Save/recall up to 5 traces, Math trace (trace1 minus trace2), Ambient trace

General characteristics

CON	Provides connection to Connect with 5/6/6B MSO or 6 Series LPD Series oscilloscopes
CON7	Provides connection to connect with 7 Series DPO oscilloscopes.
Update rate	< 0.2 /sec (802.11ac EVM, acq BW: 200 MHz, record length: 400 µs)

Programmatic interface	SCPI-compliant command set. Requires installation of Tektronix Virtual Instrument Software Architecture (VISA) drivers

System requirements

Requirements

Operating systems	Windows 10 x64 or Windows 11 x64 [10] Windows 8 x64
Disk space	20 GB free on C: drive
RAM	1 GB (4 GB recommended) Operation with one of the USB real-time spectrum analyzers has additional requirements. See the related instrument data sheet for details.

Instruments and file types supported

Instrument family	Save different types of data for later recall and analysis including setups, screen captures, settings, results, traces, acquisition data, and gap-free recordings.

10 For use with Tektronix USB RSA306B, RSA500, and RSA600 instruments

Oscilloscopes

	File type		
	.WFM	.TIQ	.TIQM
DPO DPO70000SX and 7 Series DPO	X	X	X
Touchscreen Mixed-Domain: 5 Series/6 Series/6 Series B MSO	X	X	X

Real-time signal analyzers

	File type					
	.TIQ	.IQT	.CSV	.R3F	.CDIF	.MAT
RSA5000	X		X			X
RSA306B	X	X	X	X	X	X
RSA500/ 600	X	X	X	X	X	X
RSA7100	X	X	X		X	X

Other

	File type				
	.WFM	.ISF	.TIQ	.IQT	.MAT
3rd party waveforms in MATLAB Level 5 and Level 7.3 formats					X

SignalVu-PC vs. SignalVu

SignalVu for oscilloscopes is a separate downloadable software application made to run directly on Tektronix performance oscilloscopes. With the base version (opt. SVE) SignalVu directly controls the acquisition settings of the MSO/DPO70000 SX/DX Series Oscilloscope and automatically transfers data from its acquisition system to the SignalVu software.

SignalVu-PC is designed to run on a Windows 10, Windows 11 PC or tablet (64 bit) and the base version is free to download and use for controlling and analyzing acquisitions from Tektronix RSA306, RSA300/500/600 or RSA7100 Series Real-Time Spectrum (signal) Analyzers or for analyzing signals offline, without an instrument present.

With 5/6/7 Series oscilloscopes you may choose to install SignalVu-PC directly on the Windows 10 SSD of the oscilloscope (opt. 5/6-WIN required). With the base version (opt. RFVT and CONx license) SignalVu-PC directly controls the acquisition settings of the 5/6 Series MSO or LPD64 oscilloscopes and automatically transfers data from the oscilloscope acquisition system to the SignalVu-PC software. To support acquisition length of more than 10 ms for a span of 2 GHz or more, RL-1 (125 Mpoints record length) license needs to be installed.

Ordering information

Purchasing, licensing, and activation

SignalVu-PC and its applications are available for download at *www.tektronix.com/downloads*. EDUFL-SVPC is a bundle version of SignalVu-PC that includes all analysis applications for educational institutions.

A variety of optional, licensed applications are available for purchase for SignalVu-PC. These licenses can be associated with and stored on either your PC or any RSA300 series, RSA500 series, RSA600 series, and RSA7100A spectrum analyzers. Licenses can be purchased as an option to your hardware or separately as a Node-locked or a Floating license.

Contact your local Tektronix Account Manager to purchase a license. If your purchased license is not ordered as an option to your instrument, you will receive an email with a list of the applications purchased and the URL to the Tektronix Product License Web page, where you will create an account and can then manage your licenses using the Tektronix Asset Management System (AMS): *www.tek.com/products/product-license*.

AMS provides an inventory of the license(s) in your account. It enables you to check out or check in a license and view the history of licenses.

Optional applications are enabled by one of the following license types.

License type	Description
Node locked license (NL) purchased as an option to your instrument	When associated with an instrument, this license is factory-installed on that instrument at the time of manufacture. It will be recognized by any PC operating with SignalVu-PC when the instrument is connected. However, the licensed application is deactivated from the PC if the licensed instrument is disconnected. This is the most common form of licensing, as it simplifies management of your applications.
Node locked license (NL) purchased separately	This license is initially assigned to a specific host id, which can be either a PC or an instrument. It can be reassociated to either a PC or instrument two times using Tek AMS. This license is delivered via email and is associated with either your PC or with an instrument when you install the license. This license should be purchased when you want your license to stay on your PC, or if you have an existing USB instrument on which you would like to install a license.
Floating license(FL) purchased separately	This license can be moved between different host ids, which can be either PCs or instruments. It can be reassociated to different PCs or instruments an unlimited number of times using Tek AMS. This license is delivered via email and is associated with either your PC or with an instrument when you install the license. This is the most flexible license and is recommended in applications where the license needs to be moved frequently.

In December 2015, the license policy and nomenclature was changed for SignalVu-PC and its options.

The legacy system is no longer supported and all customers are asked to transition to the new Tektronix license management system (TekAMS) going forward. Contact Tektronix sales or technical support for transferring previously purchased legacy license(s) to the new license file system.

The new license structure and the old options are shown below.

Legacy SignalVu-PC option	New application license	License type	Description
SVA	SVANL-SVPC	NL	AM/FM/PM/Direct Audio analysis
	SVAFL-SVPC	FL	
SVT	SVTNL-SVPC	NL	Settling Time (frequency and phase) measurements
	SVTFL-SVPC	FL	
SVM	SVMNL-SVPC	NL	General-purpose digital modulation analysis
	SVMFL-SVPC	FL	
SVP	SVPNL-SVPC	NL	Advanced pulse radar analysis
	SVPFL-SVPC	FL	

Table continued…

Legacy SignalVu-PC option	New application license	License type	Description
SVO	SVONL-SVPC	NL	Flexible OFDM analysis
	SVOFL-SVPC	FL	
Not available in legacy license	PHASNL-SVPC	NL	Automated phase noise/jitter measurements (RSA7100A and 6 Series B MSO only)
	PHASFL-SVPC	FL	
SV23	SV23NL-SVPC	NL	WLAN 802.11a/b/g/j/p measurements
	SV23FL-SVPC	FL	
SV24	SV24NL-SVPC	NL	WLAN 802.11n measurements (requires SV23)
	SV24FL-SVPC	FL	
SV25	SV25NL-SVPC	NL	WLAN 802.11ac measurements (requires SV23 and SV24)
	SV25FL-SVPC	FL	
SV26	SV26NL-SVPC	NL	APCO P25 measurements
	SV26FL-SVPC	FL	
SV27	SV27NL-SVPC	NL	Bluetooth 4.2 measurements
	SV27FL-SVPC	FL	
Not available in legacy license	SV31NL-SVPC	NL	Bluetooth 5 measurements (requires SV27)
	SV31FL-SVPC	FL	
MAP	MAPNL-SVPC	NL	Mapping
	MAPFL-SVPC	FL	
SV56	SV56NL-SVPC	NL	Playback of recorded files
	SV56FL-SVPC	FL	
SV60	SV60NL-SVPC	NL	Return loss, VSWR, cable loss, and distance to fault (requires option 04 on RSA500A/600A)
	SV60FL-SVPC	FL	
CON	CONNL-SVPC	NL	Live connection and base SignalVu-PC VSA measurements using the 5 or 6 Series MSO or LPD64 (requires Opt. SV-RFVT).
	CONFL-SVPC	FL	
CON7	CON7NL-SVPC	NL	Live connection and base signalVU-Pc vsa measurements using 7 series oscilloscopes.
	CON7FL-SVPC	FL	
SV2C	SV2CNL-SVPC	NL	Bundle of WLAN 802.11a/b/g/j/p/n/ac (SV23, SV24, and SV25) and live Connect (CON) to 5/6 Series MSO or LPD64 (requires Opt. SV-RFVT)
	SV2CFL-SVPC	FL	
SV28	SV28NL-SVPC	NL	LTE Downlink RF measurements
	SV28FL-SVPC	FL	
PHAS	PHASNL-SVPC	NL	Automated phase/jitter measurements (Available on the RSA7100A/B and 6 Series B MSO only)
	PHASFL-SVPC	FL	
Not available in legacy license	SV54NL-SVPC	NL	Signal survey and classification
	SV54FL-SVPC	FL	
Not available in legacy license	SVQPNL-SVPC	NL	EMI CISPR detectors
	SVQPFL-SVPC	FL	
Not available in legacy license	EMCVUNL-SVPC	NL	EMC pre-compliance and troubleshooting (includes EMI CISPR detectors)
	EMCVUFL-SVPC	FL	
SignalVu-PCEDU	EDUFL-SVPC	FL	Education-only version with all SignalVu-PC modules

Table continued…

Legacy SignalVu-PC option	New application license	License type	Description
Not available in legacy license	SV30NL-SVPC	NL	WiGig 802.11ad/ay measurements (only for offline analysis) [11]
	SV30FL-SVPC	FL	
Not available in legacy license	TRIGHNL-SVPC	NL	Advanced triggers (Frequency Mask, Density, Time Qualified) (RSA7100A/B only)
	TRIGHNL-SVPC	FL	
Not available in legacy license	STREAMNL-SVPC	NL	Streaming IQ data to RAID and 40 GbE (RSA7100A/B only)
	STREAMNL-SVPC	FL	

Any of these licenses above enable SignalVu's advanced triggering capabilities: Time qualified, DPX density, and Frequency mask triggers.

SignalVu-PC application upgrades

Owners of SignalVu-PC applications can download any bug fixes or enhancements to existing products free of charge. New applications with new measurements may become available and upgrades can be purchased to add the new functionality using the ordering information described above.

Tektronix is registered to ISO 9001:2015 and ISO 14001:2015.

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

Bluetooth is a registered trademark of Bluetooth SIG, Inc.

LTE is a trademark of ETSI.

11 Refer to hardware opt. SV30 on DPO700000SX/DX oscilloscopes for full 60 GHz online analysis

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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.tek.com*.

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