

Spectrum Analyzer

RSA500A Series Portable Spectrum Analyzer Datasheet



The RSA500A Series USB spectrum analyzers offer high performance portable spectrum analysis in a rugged battery-powered package.

Features and benefits

- 9 kHz to 3.0/7.5 GHz frequency range covers a broad range of analysis needs
- 40 MHz acquisition bandwidth enables real time analysis for transient capture and vector analysis
- Standard GPS/GLONASS/Beidou receiver for mapping and reference oscillator accuracy enhancement
- Optional tracking generator for gain/loss, antenna and cable measurements
- Streaming capture can be used to record and play back long term events
- Mil-Std 28800 Class 2 environmental, shock and vibration specifications for use in harsh conditions
- Internal battery for extended field operations
- SignalVu-PC software offers real time signal processing with DPX Spectrum/Spectrogram to minimize time spent on transient and interference hunting
- 100 μ sec minimum signal duration with 100% probability of intercept ensure you see problems first time, every time
- Application programming interface included for development of custom programs
- Accessories including tablet PC, calibration kits, adapters and phase-stable cables offer a complete field solution for interference hunting and transmitter maintenance

Applications

- Spectrum management
- Interference hunting
- Maintenance, installation and repair of radio networks

The RSA500 Series saves you time and helps you succeed

The RSA500 series was built to bring real-time spectrum analysis to solving the problems of spectrum managers, interference hunters and network maintenance personnel who need to track down hard to find interferers, maintain RF networks and keep records of their efforts. The heart of the system is the USB-based RF spectrum analyzer that captures 40 MHz bandwidths with great fidelity in harsh environments. With 70 dB dynamic range and frequency coverage to 7.5 GHz, all signals of interest can be examined with high confidence in your measurement results. The USB form factor moves the weight of the instrument off of your hands, and replaces it with a lightweight Windows tablet or laptop. Holding a light PC instead of a heavy spectrum analyzer means you can move faster, for longer, and get your work done faster.

The optional tracking generator enables gain/loss measurements for quick tests of filters, duplexers and other network elements, and you can add cable and antenna measurements of VSWR, return loss, distance to fault and cable loss as needed.

SignalVu-PC software offers rich analysis capability in the field

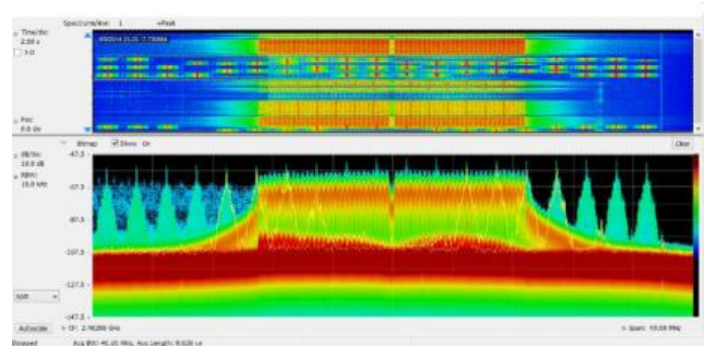
The RSA500 series operates with SignalVu-PC, a powerful program used as the basis of Tek's traditional spectrum analyzers, offering a deep analysis capability previously unavailable in high performance battery-operated solutions. Real-time processing of the DPX spectrum/spectrogram is enabled in your PC, further reducing the cost of hardware. Customers who need programmatic access to the instrument can choose either the SignalVu-PC programmatic interface or use the included application programming interface (API) that provides a rich set of commands and measurements directly. Basic functionality of the free SignalVu-PC program is far from basic. Base version measurements are shown below.

Measurements and functions included in SignalVu-PC base version

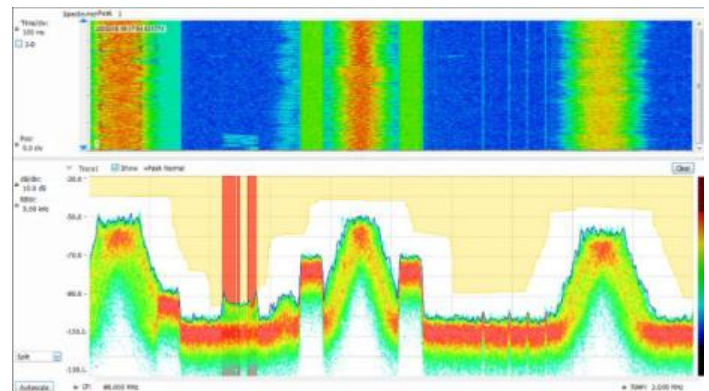
General signal analysis	Description
Spectrum analyzer	Spans from 100 Hz to 7.5 GHz, 3 traces + math and spectrogram trace, 5 markers with power, relative power, integrated power, power density and dBc/Hz functions
DPX spectrum/spectrogram	Real time display of spectrum with 100% probability of intercept of 100 usec signals in up to 40 MHz span
Amplitude, frequency, phase vs. time, RF I and Q vs. time	Basic vector analysis functions
Time overview/navigator	Enables easy setting of acquisition and analysis times for deep analysis in multiple domains
Spectrogram	Analyze and re-analyze your signal in 2-D or 3-D waterfall display
AM/FM listening	Hear and record to file FM and AM signals
Signal recording	Record 40 MHz bandwidth for re-analysis in all domains including real time spectrum analysis (requires application SV56 for Playback)
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 with audio tone	Measures signal strength and displays a spectrum and signal strength bar for interference hunting and signal quality evaluations.

The RSA500A combined with SignalVu-PC offers advanced field measurements

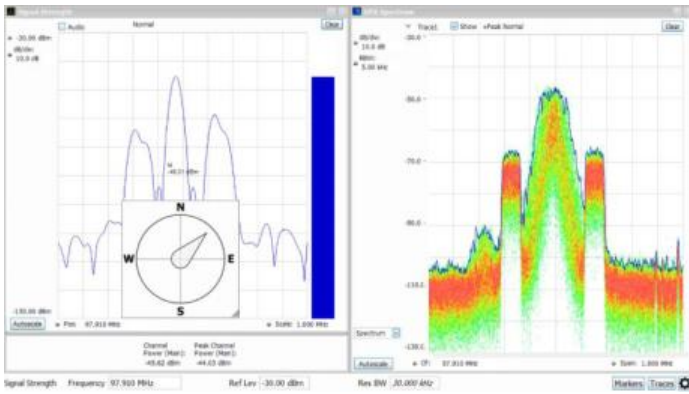
With 40 MHz of real-time bandwidth, the unique DPX spectrum/spectrogram shows you every instance of an interfering or unknown signal, even down to 100 μ s in duration. The following image shows a WLAN transmission (green and orange), and the narrow signals that repeat across the screen are a Bluetooth access probe. The spectrogram (upper part of the screen) clearly separates these signals in time to show any signal collisions.



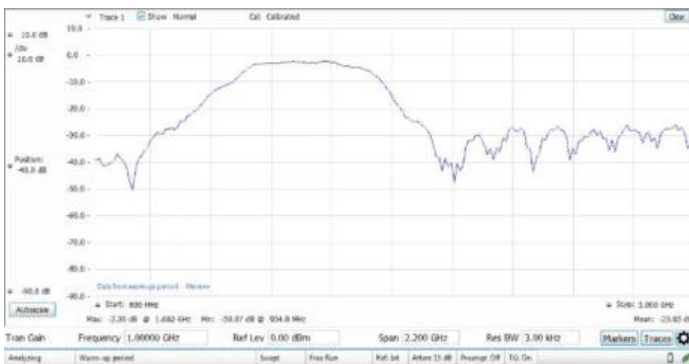
Finding unexpected signals is easy with unattended mask monitoring. A mask can be created on the DPX spectrum display, and actions taken upon every violation, including stop, save a picture, save acquisition, or send an audible alert. In the illustration below, a mask violation has occurred in red on the mask, and a picture of the screen was saved as a result. Mask testing can be used for unattended monitoring and when playing back recorded signals, enabling testing for different violations on the same signals.



Direction finding and signal strength measurements are quick and easy with the standard SignalVu-PC software. In the illustration below, using the available Alaris smart antenna, a compass continuously monitors antenna direction while the signal strength monitor performs measurements and provide audio indication of signal strength. When combined with the MAP option for SignalVu-PC, signal strength and azimuth are automatically placed on the map of your choice.



The tracking generator (Option 04 on the RSA500) is controlled via SignalVu-PC. Here you can enter start-stop frequencies, set number of steps in the span, adjust reference level, and normalize the tracking generator with a calibrate function. A bandpass filter response from 800 MHz to 3 GHz is shown below.



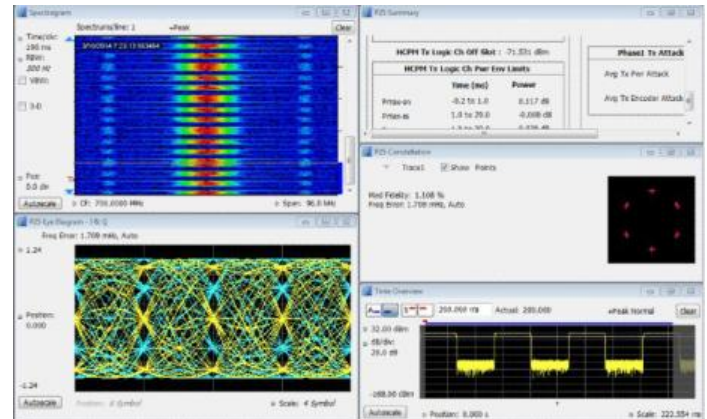
SignalVu-PC application-specific licenses

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

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

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

APCO 25 – SignalVu-PC application SV26 enables quick, standards-based transmitter health checks on APCO P25 signals. The following image shows a Phase II HCPM signal being monitored for anomalies with the spectrogram while performing transmitter power, modulation and frequency measurements to the TIA-102 standards specification.



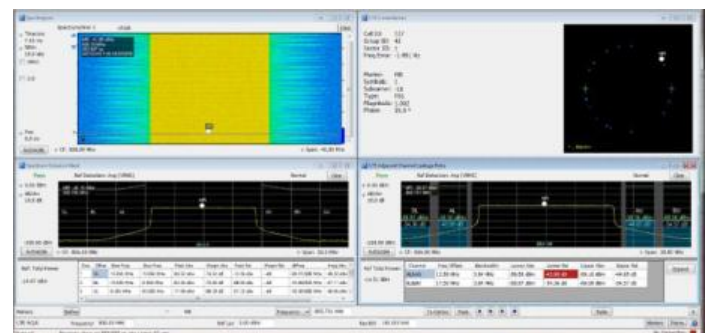
LTE – Application SV28 enables the following LTE base station transmitter measurements:

- Cell ID
- Channel power
- Occupied bandwidth
- Adjacent channel leakage ratio (ACLR)
- Spectrum emission mask (SEM)
- Transmitter off power for TDD

The measurements follow the definition in 3GPP TS Version 12.5 and support all base station categories, including picocells and femtocells. Pass/Fail information is reported and all channel bandwidths are supported.

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

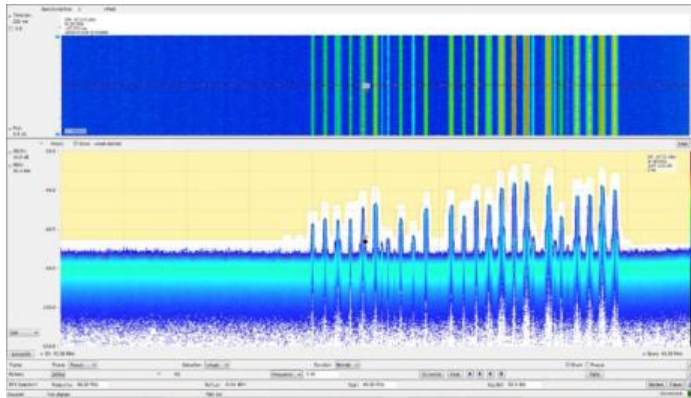
The illustration below shows spectral monitoring with the spectrogram display combined with a Cell ID/Constellation, Spectrum Emission Mask and ACLR measurements.



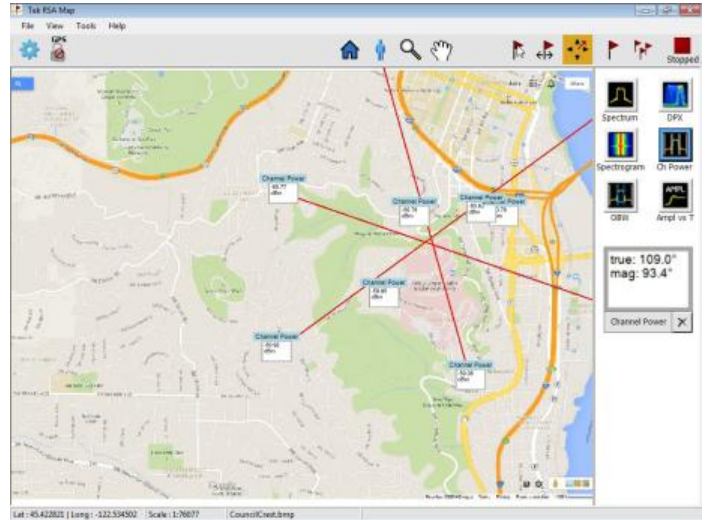
Playback – Application SV56, Playback of recorded signals, can reduce hours of watching and waiting for a spectral violation to minutes at your desk reviewing recorded data.

Recording length is limited only by storage media size, and recording is a basic feature included in SignalVu-PC. SignalVu-PC application 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, with actions on mask violation including beep, stop, save trace, save picture, and save data. Portions of the playback can be selected and looped for repeat examination of signals of interest. Playback can be skip-free, or time gaps can be inserted to reduce review time.

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.

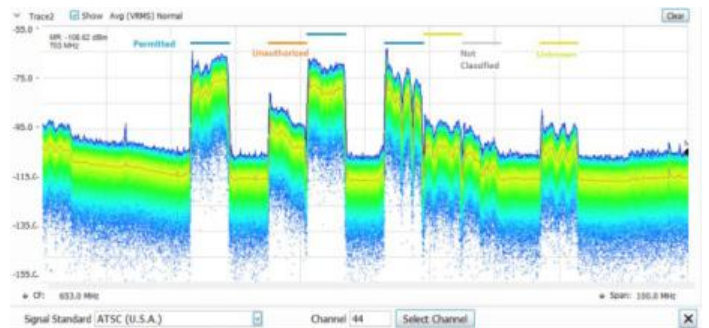


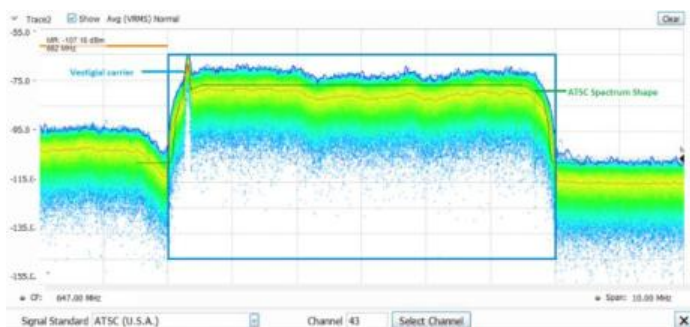
Mapping – The SignalVu-PC MAP application enables interference hunting and location analysis. Locate interference with an azimuth function that lets you draw a line or an arrow on a mapped measurement to indicate direction, or use the available Alaris smart antenna with automated azimuth placement.



Signal survey/classification – Application SV54 enables expert systems guidance to aid the user in classifying signals. You can quickly create a spectral region of interest, enabling users to identify and sort signals efficiently. The spectral profile mask, when overlaid on top of a trace, provides signal shape guidance while frequency, bandwidth, and channel number are displayed allowing for fast classification. WLAN, GSM, W-CDMA, CDMA, Bluetooth standard and enhanced data rate, LTE FDD and TDD, ATSC and other signals can be quickly and simply identified. Databases can be imported from your H500/RSA2500 signal database library for easy transition to the new software base.

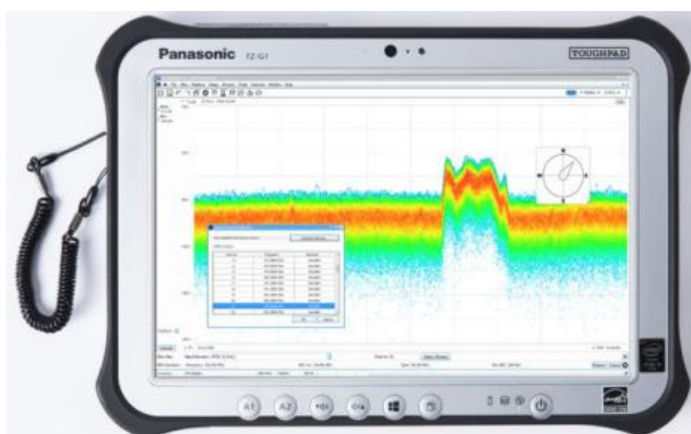
A typical signal survey is show below. The survey is of a portion of the TV broadcast band, and 7 regions have been declared as either Permitted, Unknown, or Unauthorized, as indicated by the color bars for each region. In the detail illustration, a single region has been selected, and since we've declared 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.





Instrument controller for USB spectrum analyzers

For field operations, a complete solution requires a Windows Tablet or laptop for instrument operation, record keeping and communication. Tektronix offers the Panasonic FZ-G1 tablet computer as an option to the RSA500 series and as a standalone unit.



When purchased from Tektronix, the FZ-G1 includes pre-loaded SignalVu-PC software, with custom-programmed display settings and front-panel buttons to optimize the SignalVu-PC experience. In addition, Tektronix has tested the FZ-G1 to ensure that the specified real time performance of all USB spectrum analyzers is met with this configuration. Accessories including battery packs, cases and automotive power adapters are also available from Tektronix.

Key specifications, instrument controller

- Windows 7 operating system (Win8 Pro COA)
- Intel® Core i5-5300U 2.30GHz Processor (i5-4310U 2.00GHz in China)
- 8GB RAM
- 256 GB Solid State Drive
- 10.1" (25.6 cm) Daylight-readable screen
- 10-point Multi Touch+ Digitizer screen plus included pen interface
- USB 3.0 + HDMI Ports, 2nd USB Port
- Wi-Fi, Bluetooth® and 4G LTE Multi Carrier Mobile Broadband with Satellite GPS
- MIL-STD-810G certified (4' drop, shock, vibration, rain, dust, sand, altitude, freeze/thaw, high/low temperature, temperature shock, humidity, explosive atmosphere)
- IP65 certified sealed all-weather design
- Integrated microphone
- Integrated speaker
- On-screen and button volume and mute controls •
- Integrated battery backup for hot-swap of battery packs
- 3-year Warranty with Business Class Support (provided by Panasonic in your region)

Smart antenna for interference hunting

Tektronix offers the Alaris DFA-0047¹ smart antenna with built-in USB compass for direction finding and interference hunting applications. Full details on the antenna are available in the Alaris data sheet available on Tek.com by searching on Alaris. A summary of features and specifications is shown below.

- Frequency Range: 20 MHz – 8.5 GHz
 - 9 kHz-20 MHz extension available(0.3m loop antenna), order DF-A0047-01¹
- Trigger control for one-hand operation with functions for:
 - Preamp on/off
 - Band switch
 - Push to measure with SignalVu-PC with MAP option
- Standard armrest extension for ease in long interference hunting sessions
- Transit case available

¹ Alaris antenna and Panasonic tablet are available in limited geographies. See ordering information for details.



Calibration kits, phase-stabilized cables, adapters, antennas and other accessories

Tektronix offers a variety of accessories to simplify your shopping for the complete solution for field test. See the ordering information section for further details.

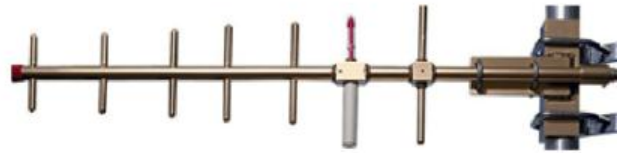
Alaris direction-finding smart antenna.



Calibration Kits for one-port measurements



Phase-stabilized cables from Tektronix for cable and antenna measurements



Antennas for interference hunting

Specifications

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

Frequency

Frequency range	
RSA503A	9 kHz to 3 GHz
RSA507A	9 kHz to 7.5 GHz
<hr/>	
Frequency marker readout accuracy	$\pm(\text{RE} \times \text{MF} + 0.001 \times \text{Span}) \text{ Hz}$ RE: Reference Frequency Error MF: Marker Frequency [Hz]
<hr/>	
Reference frequency accuracy	
Initial accuracy at Cal (30 min warm-up)	$\pm 1 \times 10^{-6}$
First year aging, typical	$\pm 1 \times 10^{-6}$ (1 year)
Cumulative error (Initial accuracy + temperature + aging), typical	3×10^{-6} (1 year)
Temperature drift	$\pm 0.9 \times 10^{-6}$ (-10 to 60 °C)
External reference input	BNC connector, 50 Ω nominal
External reference input frequency	Every 1 MHz from 1 to 20 MHz plus the following: 1.2288 MHz, 2.048 MHz, 2.4576 MHz, 4.8 MHz, 4.9152 MHz, 9.8304 MHz, 13 MHz, and 19.6608 MHz. The spurious level on the input signal must be less than -80 dBc within 100 kHz offset to avoid on-screen spurious.
External reference input range	$\pm 5 \text{ ppm}$
External reference input level	-10 to +10 dBm

RF input

RF input	
RF Input Impedance	50 Ω
RF VSWR (RF Attn = 20 dB), typical	< 1.2 (10 MHz to 3 GHz) < 1.5 (>3 GHz to 7.5 GHz)
RF VSWR preamp ON, typical	< 1.5 (10 MHz to 6 GHz, RF ATT=10 dB, preamp on) < 1.7 (> 6 GHz to 7.5 GHz, RF ATT=10 dB, preamp on)
<hr/>	
Maximum RF input level	
Maximum DC voltage	$\pm 40 \text{ V}$ (RF input)
Maximum safe input power	+33 dBm (RF input, 10 MHz to 7.5 GHz, RF Attn \geq 20 dB) +13 dBm (RF input, 9 kHz to 10 MHz) +20 dBm (RF input, RF Attn < 20 dB)

RF input

Maximum safe input power (Preamp On)	+33 dBm (RF input, 10 MHz to 7.5 GHz, RF Attn ≥ 20 dB) +13 dBm (RF input, 9 kHz to 10 MHz) +20 dBm (RF input, RF Attn < 20 dB)
Maximum measurable input power	+30 dBm (RF input, ≥10 MHz to Fmax, RF ATT Auto) +20 dBm (RF input, <10 MHz, RF ATT Auto)

Input RF attenuator 0 dB to 51 dB (1 dB step)

Amplitude and RF

Amplitude and RF flatness

Reference level setting range -170 dBm to +40 dBm, 0.1 dB step, (Standard RF input)

Frequency response at 18 °C to 28 °C (At 10 dB RF Attenuator Setting)

Amplitude accuracy at all center frequencies

	18 °C to 28 °C	18 °C to 28 °C, typical-S95	-10 °C to 55 °C, typical
9 kHz ≤ 3.0 GHz	±0.8 dB	±0.2 dB	±1.0 dB
> 3 to 7.5 GHz	±1.5 dB	±0.6 dB	±2.0 dB

Amplitude Accuracy at All Center Frequencies - Preamp ON (18 °C to 28 °C , 10 dB RF Attenuator)

Center frequency range	18 °C to 28 °C	18 °C to 28 °C, typical-S95	18 °C to 28 °C, typical
100 kHz to ≤3.0 GHz	±1.0 dB	±0.5 dB	±1.0 dB
> 3 to 7.5 GHz	±1.75 dB	±0.75 dB	±3.0 dB

Preamp gain

30 dB at 2 GHz
24 dB at 6 GHz (RSA507A)

Channel response (amplitude and phase deviation), typical

For these specifications, use a flat top window for maximum CW amplitude verification accuracy with the RF attenuator setting at 10 dB.

Characteristic		Description		
Measurement center frequency	Span	Amplitude flatness, typical	Amplitude flatness, RMS, typical	Phase linearity, RMS, typical
9 kHz to 40 MHz	≤40 MHz ²	±1.0 dB	0.60 dB	
>40 MHz to 4.0 GHz	≤20 MHz	±0.10 dB	0.08 dB	0.3°
>4 GHz to 7.5 GHz	≤20 MHz	±0.35 dB	0.20 dB	0.7°
>40 MHz to 4 GHz	≤40 MHz	±0.15 dB	0.08 dB	0.6°
>4 GHz to 7.5 GHz	≤40 MHz	±0.40 dB	0.20 dB	1.0°

² Span extents cannot exceed lower frequency limit of the instrument

Trigger

Trigger/Sync input, typical	<p>Voltage range: TTL, 0.0 V to 5.0 V</p> <p>Trigger level (Schmitt trigger):</p> <p>Positive-going threshold voltage: 1.6 V min, 2.1 V max</p> <p>Negative-going threshold voltage: 1.0 V min., 1.35 V max</p> <p>Impedance: 10 k ohms with schottky clamps to 0 V, +3.4 V</p>
External trigger timing uncertainty	<p>>20 MHz to 40 MHz acquisition bandwidth: ± 250 ns</p> <p>Uncertainty increases as acquisition bandwidth is decreased.</p>
Power trigger	
Power trigger, typical	<p>Range: 0 dB to -50 dB from reference level, for trigger levels > 30 dB above the noise floor.</p> <p>Type: Rising or falling edge</p> <p>Trigger re-arm time: ≤ 100 usec</p>
Power trigger position timing uncertainty	<p>>20 MHz to 40 MHz acquisition bandwidth: ± 250 ns</p> <p>Uncertainty increases as acquisition bandwidth is decreased.</p>
Power trigger level accuracy	<p>± 1.5 dB for CW signal at tuned center frequency for trigger levels > 30 dB above the noise floor.</p> <p>This specification is in addition to the overall amplitude accuracy uncertainty for SA mode.</p>

Noise and distortion

3rd Order IM intercept (TOI)	+12 dBm at 2.130 GHz
3rd Order IM intercept (TOI), Preamp off, typical	<p>+10 dBm (9 kHz to 25 MHz)</p> <p>+15 dBm (25 MHz to 3 GHz)</p> <p>+15 dBm (3 GHz to 4 GHz, RSA507A)</p> <p>+8 dBm (4 GHz to 6 GHz, RSA507A)</p> <p>+10 dBm (6 GHz to 7.5 GHz, RSA507A)</p>
Preamp on, typical	<p>-20 dBm (9 kHz to 25 MHz)</p> <p>-15 dBm (25 MHz to 3 GHz)</p> <p>-15 dBm (3 GHz to 4 GHz, RSA507A)</p> <p>-20 dBm (4 GHz to 6 GHz, RSA507A)</p> <p>-20 dBm (6 GHz to 7.5 GHz, RSA507A)</p>
3rd Order Inter-modulation distortion	<p>-74 dBc at 2.130 GHz</p> <p>Each signal level -25 dBm at the RF input. 2 MHz tone separation. Attenuator = 0, Reference level = -20 dBm.</p>

Noise and distortion

3rd Order inter-modulation distortion

Preamp off, typical	<p>< -70 dBc (10 kHz to 25 MHz)</p> <p>< -80 dBc (25 MHz to 3 GHz)</p> <p>< -80 dBc (3 GHz to 4 GHz)</p> <p>< -70 dBc (4 GHz to 6 GHz, RSA507A)</p> <p>< -70 dBc (6 GHz to 7.5 GHz, RSA507A)</p> <p>Each signal level -25 dBm at the RF input. 2 MHz tone separation. Attenuator = 0, Reference level = -20 dBm.</p>
Preamp on, typical	<p>< -70 dBc (9 kHz to 25 MHz)</p> <p>< -80 dBc (25 MHz to 3 GHz)</p> <p>< -80 dBc (3 GHz to 4 GHz)</p> <p>< -70 dBc (4 GHz to 6 GHz, RSA507A)</p> <p>< -70 dBc (6 GHz to 7.5 GHz, RSA507A)</p> <p>Each signal level -55 dBm at the RF input. 2 MHz tone separation. Attenuator = 0, Reference level = -50 dBm.</p>

2nd Harmonic distortion, typical

2nd Harmonic distortion	<p>< -75 dBc (40 MHz to 1.5 GHz)</p> <p>< -75 dBc (1.5 GHz to 3.75 GHz, RSA507A)</p>
2nd Harmonic distortion, Preamp on	<p>< -60 dBc, 40 MHz to 13.5 GHz, input frequency</p>

2nd Harmonic distortion intercept (SHI)	<p>+35 dBm, 40 MHz to 1.5 GHz, input frequency</p> <p>+35 dBm, 1.5 GHz to 3.75 GHz, input frequency</p>
--	---

2nd Harmonic distortion intercept (SHI), Preamp on	<p>+15 dBm, 40 MHz to 3.75 GHz, input frequency</p>
---	---

Displayed average noise level (DANL) (Normalized to 1 Hz RBW, with log-average detector)

Frequency range	Preamp on	Preamp on, typical	Preamp off, typical
500 kHz to 1 MHz	-138 dBm/Hz	-145 dBm/Hz	-130 dBm/Hz
1 MHz to 25 MHz	-153 dBm/Hz	-158 dBm/Hz	-130 dBm/Hz
>25 MHz to 2 GHz	-161 dBm/Hz	-164 dBm/Hz	-141 dBm/Hz
>2 GHz to 3 GHz	-158 dBm/Hz	-162 dBm/Hz	-138 dBm/Hz
>3 GHz to 4.2 GHz, RSA507A	-155 dBm/Hz	-159 dBm/Hz	-138 dBm/Hz
>4.2 GHz to 6 GHz, RSA507A	-160 dBm/Hz	-163 dBm/Hz	-147 dBm/Hz
>6 GHz to 7.5 GHz, RSA507A	-157 dBm/Hz	-160 dBm/Hz	-145 dBm/Hz

Phase noise

Phase noise	Offset	1 GHz CF	1 GHz CF (typical)	2 GHz CF (typical)	6 GHz CF, (RSA507A) (typical)	10 MHz (typical)
	10 kHz	-94 dBc/Hz	-97 dBc/Hz	-96 dBc/Hz	-94 dBc/Hz	-120 dBc/Hz
	100 kHz	-94 dBc/Hz	-98 dBc/Hz	-97 dBc/Hz	-96 dBc/Hz	-124 dBc/Hz
	1 MHz	-116 dBc/Hz	-121 dBc/Hz	-120 dBc/Hz	-120 dBc/Hz	-124 dBc/Hz

Spurious response

Residual spurious response
(Reference = 30 dBm, RBW = 1 kHz)

< -75 dBm (500 kHz to 60 MHz), typical
< -85 dBm (>60 MHz to 80 MHz), typical
< -100 dBm (>80 MHz to 7.5 GHz)

Spurious response with Signal (Image suppression)

< -65 dBc (10 kHz to < 3 GHz, Ref= -30 dBm, Atten = 10 dB, RF input Level = -30 dBm, RBW = 10 Hz)
< -65 dBc (3 GHz to 7.5 GHz, Ref= -30dBm, Atten = 10 dB, RF input Level = -30 dBm, RBW = 10 Hz)

Spurious response with signal at CF

Offset \geq 1 MHz

Frequency	Span \leq 40 MHz, swept spans >40 MHz	
		Typical
1 MHz - 100 MHz		-75 dBc
100 MHz - 3 GHz	-72 dBc	-75 dBc
3 GHz - 7.5 GHz (RSA507A)	-72 dBc	-75 dBc

Spurious response with signal at CF

150 kHz \leq offset < 1 MHz, Span=1 MHz

Frequency	Typical
1 MHz - 100 MHz	-70 dBc
100 MHz - 3 GHz	-70 dBc
3 GHz - 7.5 GHz (RSA507A)	-70 dBc ³

Spurious response with signal at other than CF, typical

Frequency	Span \leq 40 MHz, swept spans >40 MHz
1 MHz – 25 MHz (LF Band)	-73 dBc
25 MHz – 3 GHz	-73 dBc
3 GHz – 7.5 GHz (RSA507A)	-73 dBc

³ Power supply sidebands, 620-660 kHz: -67 dBc, typical

Spurious response

Spurious response with signal at half-IF⁴

RSA503A, RSA507A	< -60 dBc, (CF: 30 MHz to 3 GHz, Ref = -30 dBm, Atten = 10 dB, RBW = 10 Hz, Span = 10 kHz) Signal frequency = 2310 MHz, RF input level = -30 dBm
RSA507A	<-60 dBc, (CF 3 G Hz to 7.5 GHz, Ref= -30 dBm, Atten = 10 dB, RBW=10 Hz, Span=10 kHz) RF input Level = -30 dBm

Local oscillator feed-through to input connector, typical	< -70 dBm, preamp off. < -90 dBm, preamp on. Attenuator = 10 dB.
--	--

Acquisition

IF bandwidth	40 MHz.
A/D converter	14 bits, 112 Ms/s.
Real-Time IF Acquisition Data	112 Ms/s, 16-bit integer samples.

GPS location

Format	GPS/GLONASS/BeiDou
GPS antenna power	3 V, 100 mA maximum
Time to first fix, maximum	Lock time ranges from 2 sec (hot) to 40 sec (cold start). -130 dBm input signal power.
Horizontal position accuracy	GPS: 2.6 m Glonass: 2.6 m BeiDou: 10.2 m GPS + Glonass: 2.6 m GPS + BeiDou: 2.6 m Test conditions: 24 hr. static, -130 dBm, full power

Tracking generator (Option 04)

Tracking Generator (Option 04)

Frequency range	10 MHz to 3 GHz 10 MHz to 7.5 GHz
Sweep speed	6700 MHz/second, 101 points, 50 kHz RBW (11 mS per point) Measured using a Panasonic Toughpad FZ-G1, Intel® Core™ i5-5300U 2.3 GHz Processor, 8 GB RAM, 256 GB SSD, Windows®7 Pro.
Frequency resolution	100 Hz
TG output connector	N type
VSWR	< 1.8:1, 10 MHz to 7.5 GHz, -20 dBm output level
Maximum output power	-3 dBm

⁴ This is an input signal at half of the IF frequency.

Tracking generator (Option 04)

Output power level setting range	40 dB
Output power level step size	1 dB
Output power level step size accuracy	± 0.5 dB
Output level accuracy	± 1.5 dB, 10 MHz to 7.5 GHz, -20 dBm output level
Harmonics	< -22 dBc
Non-harmonic spurious	< -30 dBc; spurious < 2 GHz from TG output frequency < -25 dBc; spurious ≥ 2 GHz from TG output frequency
Reverse power without damage	40 Vdc, +20 dBm RF
Transmission gain measurement error	Gain of +20 to -40 dB: ± 1 dB
Transmission gain measurement dynamic range	70 dB

SignalVu-PC standard measurements and performance

Measurements included	General signal analysis	
	Spectrum analyzer	Spans from 1 kHz to 7.5 GHz Three traces plus math and spectrogram trace Five markers with power, relative power, integrated power, power density and dBc/Hz functions
	DPX Spectrum/Spectrogram	Real time display of spectrum with 100% probability of intercept of 100 μ sec signals in up to 40 MHz span
	Amplitude, frequency, phase vs. time, RF I and Q vs. time	Basic vector analysis functions
	Time Overview/Navigator	Enables easy setting of acquisition and analysis times for deep analysis in multiple domains
	Spectrogram	Analyze and re-analyze your signal with a 2-D or 3-D waterfall display
	AM/FM listening	Hear, and record to file, FM and AM signals
	Analog modulation analysis	
	AM, FM, PM analysis	Measures key AM, FM, PM parameters
	RF measurements	
	Spurious measurement	User-defined limit lines and regions provide automatic spectrum violation testing across the entire range of the instrument
	Spectrum emission mask	User-defined or standards-specific masks
	Occupied Bandwidth	Measures 99% power, - x 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

SignalVu-PC/RSA507A key characteristics

Maximum span	40 MHz real-time
	9 kHz - 3 GHz swept
	9 kHz - 7.5 GHz swept
Maximum acquisition time	1.0 s

SignalVu-PC standard measurements and performance

Minimum IQ resolution	17.9 ns (acquisition BW = 40 MHz)
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

DPX spectrum display

Spectrum processing rate (RBW = auto, trace length 801)	≤10,000/s
DPX bitmap resolution	201x801
Marker information	Amplitude, frequency, signal density
Minimum signal duration for 100% probability of detection	100 μs Span: 40 MHz, RBW = Auto, Max-hold on Due to the non-deterministic execution time of programs running under the Microsoft Windows OS, this specification may not be met when the host PC is heavily loaded with other processing tasks
Span range (continuous processing)	1 kHz to 40 MHz
Span range (swept)	Up to maximum frequency range of instrument
Dwell time per step	50 ms to 100 s
Trace processing	Color-graded bitmap, +Peak, -Peak, average
Trace length	801, 2401, 4001, 10401
RBW range	1 kHz to 10 MHz

DPX spectrogram display

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

Spectrum display

Traces	Three traces + 1 math trace + 1 trace from spectrogram for spectrum display
Trace functions	Normal, Average (VRMS), Max Hold, Min Hold, Average of Logs
Detector	Average (VRMS), Average, CISPR peak, +Peak, -Peak, Sample
Spectrum trace length	801, 2401, 4001, 8001, 10401, 16001, 32001, and 64001 points
RBW range	10 Hz to 10 MHz

SignalVu-PC standard measurements and performance

Analog modulation analysis (standard)

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

Spectrum sweep rates vs. resolution bandwidth

Full-Span sweep speed	5500 MHz/sec (RBW = 1 MHz)
	5300 MHz/sec (RBW = 100 kHz)
	3700 MHz/sec (RBW = 10 kHz)
	950 MHz/sec (RBW = 1 kHz)
	Measured using a Panasonic Toughpad FZ-G1, Intel® Core™ i5-5300U 2.3 GHz Processor, 8 GB RAM, 256 GB SSD, Windows®7 Pro.
	Spectrum display is only measurement on screen.

SignalVu-PC applications performance summary

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

Carrier frequency range (for modulation and audio measurements)	(1/2 × audio analysis bandwidth) to maximum input frequency
Maximum audio frequency span	10 MHz
FM measurements (Mod. index >0.1)	Carrier Power, Carrier Frequency Error, Audio Frequency, Deviation (+Peak, -Peak, Peak-Peak/2, RMS), SINAD, Modulation Distortion, S/N, Total Harmonic Distortion, Total Non-harmonic Distortion, Hum and Noise
AM measurements	Carrier Power, Audio Frequency, Modulation Depth (+Peak, -Peak, Peak-Peak/2, RMS), SINAD, Modulation Distortion, S/N, Total Harmonic Distortion, Total Non-harmonic Distortion, Hum and Noise

SignalVu-PC applications performance summary

PM measurements Carrier Power, Carrier Frequency Error, Audio Frequency, Deviation (+Peak, -Peak, Peak-Peak/2, RMS), SINAD, Modulation Distortion, S/N, Total Harmonic Distortion, Total Non-harmonic Distortion, Hum and Noise

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 (us): 25, 50, 75, 750, and user-entered

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

Performance characteristics, typical	Conditions: Unless otherwise stated, performance is given for: Modulation rate = 5 kHz AM depth: 50% PM deviation 0.628 Radians			
	FM	AM	PM	Conditions
Carrier Power accuracy	Refer to instrument amplitude accuracy			
Carrier Frequency accuracy	± 0.5 Hz + (transmitter frequency × ref. freq. error)	Refer to instrument frequency accuracy	± 0.2 Hz + (transmitter frequency × ref. freq. error)	FM deviation: 5 kHz / 100 kHz
Depth of Modulation accuracy	NA	± 0.2%+(0.01 * measured value)	NA	Rate: 5 kHz Depth: 50%
Deviation accuracy	± (1% × (rate + deviation)+50 Hz)	NA	± 100% * (0.01 + (measured rate/1 MHz))	FM deviation: 100 kHz
Rate accuracy	± 0.2 Hz	± 0.2 Hz	± 0.2 Hz	FM deviation: 5 kHz / 100 kHz
Residual THD	0.10%	0.16%	0.1%	FM Deviation: 5 kHz / 100 kHz Rate: 1 kHz
Residual SINAD	43 dB	56 dB	40 dB	FM deviation 5 kHz FM deviation 100 kHz Rate: 1 kHz

APCO P25 Measurements (SV26xx-SVPC)

Measurements RF output power, operating frequency accuracy, modulation emission spectrum, unwanted emissions spurious, adjacent channel power ratio, frequency deviation, modulation fidelity, frequency error, eye diagram, symbol table, symbol rate accuracy, transmitter power and encoder attack time, transmitter throughput delay, frequency deviation vs. time, power vs. time, transient frequency behavior, HCPM transmitter logical channel peak adjacent channel power ratio, HCPM transmitter logical channel off slot power, HCPM transmitter logical channel power envelope, HCPM transmitter logical channel time alignment, cross-correlated markers

Modulation fidelity, typical
 C4FM ≤ 1.0%
 HCPM ≤ 0.5%
 HDQPSK ≤ 0.25%
 Input signal level is optimized for best modulation fidelity.

SignalVu-PC applications performance summary

Bluetooth Measurements (SV27xx-SVPC)

Modulation formats	Basic Rate, Bluetooth Low Energy, Enhanced Data Rate - Revision 4.1.1 Packet types: DH1, DH3, DH5 (BR), Reference (LE)
Measurements	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
Output power, In-band emissions and ACP	Level uncertainty: refer to instrument amplitude and flatness specification Measurement range: signal level > -70 dBm
Modulation characteristics	Deviation range: ± 280 kHz Deviation uncertainty (at 0 dBm) < 2 kHz ⁵ + instrument frequency uncertainty (basic rate) < 3 kHz ⁵ + instrument frequency uncertainty (low energy) Measurement range: Nominal channel frequency ± 100 kHz
Initial Carrier Frequency Tolerance (ICFT)	Measurement uncertainty (at 0 dBm): < 1 kHz + instrument frequency uncertainty Measurement range: Nominal channel frequency ± 100 kHz
Carrier Frequency Drift	Measurement uncertainty: < 1 kHz + instrument frequency uncertainty Measurement range: Nominal channel frequency ± 100 kHz

General purpose digital modulation analysis (SVMxx-SVPC)

Modulation formats	BPSK, QPSK, 8PSK, 16QAM, 32QAM, 64QAM, 256QAM, PI/2DBPSK, DQPSK, PI/4DQPSK, D8PSK, D16PSK, SBPSK, OQPSK, SOQPSK, MSK, GFSK, CPM, 2FSK, 4FSK, 8FSK, 16FSK, C4FM
Analysis period	Up to 81,000 samples
Measurement filter	Root Raised Cosine, Raised Cosine, Gaussian, Rectangular, IS-95 TX_MEA, IS-95 Base TXEQ_MEA, None
Reference Filter	Gaussian, Raised Cosine, Rectangular, IS-95 REF, None
Filter rolloff factor	α : 0.001 to 1, in 0.001 steps
Measurements	Constellation, Demod I&Q vs. Time, Error Vector Magnitude (EVM) vs. Time, Eye Diagram, Frequency Deviation vs. Time, Magnitude Error vs. Time, Phase Error vs. Time, Signal Quality, Symbol Table, Trellis Diagram
Symbol rate range	1 k symbols/s to 40 M symbols/s Modulated signal must be contained entirely within the acquisition bandwidth
Adaptive equalizer	Linear, Decision-Directed, Feed-Forward (FIR) equalizer with coefficient adaptation and adjustable convergence rate. Supports modulation types BPSK, QPSK, OQPSK, $\pi/2$ -DBPSK, $\pi/4$ -DQPSK, 8-PSK, 8-DSPK, 16-DPSK, 16/32/64/128/256-QAM

⁵ At nominal power level of 0 dBm

SignalVu-PC applications performance summary

QPSK Residual EVM (center frequency = 2 GHz), typical	0.6 % (100 kHz symbol rate)
	0.8 % (1 MHz symbol rate)
	0.8 % (10 MHz symbol rate)
	0.8 % (30 MHz symbol rate)
	400 symbols measurement length, 20 Averages, normalization reference = maximum symbol magnitude
256 QAM Residual EVM (center frequency = 2 GHz), typical	0.6 % (10 MHz symbol rate)
	0.7 % (30 MHz symbol rate)
	400 symbols measurement length, 20 Averages, normalization reference = maximum symbol magnitude

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)	1st Adjacent Channel 60 dB (RSA507A)
	2nd Adjacent Channel 62 dB (RSA507A)

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)	Average On Power, Peak Power, Average Transmitted Power, Pulse Width, Rise Time, Fall Time, Repetition Interval(seconds), Repetition Interval (Hz), Duty Factor (%), Duty Factor (ratio), Ripple, Droop, Pulse-Pulse Frequency Difference, Pulse-Pulse Phase Difference, RMS Frequency Error, Max Frequency Error, RMS Phase Error, Max Phase Error, Frequency Deviation, Phase Deviation, Time Stamp, Delta Frequency, Impulse Response, Overshoot
Minimum pulse width for detection	150 ns
Average ON power at 18 °C to 28 °C, typical	±0.3 dB + absolute amplitude accuracy For pulses of 300 ns width or greater, duty cycles of .5 to .001, and S/N ratio ≥ 30 dB
Duty factor, typical	±0.2% of reading For pulses of 450 ns width or greater, duty cycles of .5 to .001, and S/N ratio ≥ 30 dB
Average transmitted power, typical	±0.5 dB + absolute amplitude accuracy For pulses of 300 ns width or greater, duty cycles of .5 to .001, and S/N ratio ≥ 30 dB
Peak pulse power, typical	±1.2 dB + absolute amplitude accuracy For pulses of 300 ns width or greater, duty cycles of .5 to .001, and S/N ratio ≥ 30 dB
Pulse width, typical	±0.25% of reading For pulses of 450 ns width or greater, duty cycles of .5 to .001, and S/N ratio ≥ 30 dB

SignalVu-PC applications performance summary

WLAN Measurements, 802.11a/b/g/j/p (SV23xx-SVPC)

Measurements	WLAN power vs. time; WLAN symbol table; WLAN constellation; spectrum emission mask; error vector magnitude (EVM) vs. symbol (or time), vs subcarrier (or frequency); mag error vs symbol (or time), vs. subcarrier (or frequency); phase error vs symbol (or time), vs. subcarrier (or frequency); channel frequency response vs. symbol (or time), vs. subcarrier (or frequency); spectral flatness vs. symbol (or time), vs. subcarrier (or frequency)
Residual EVM - 802.11a/g/j /p (OFDM), 64-QAM, typical	2.4 GHz, 20 MHz BW: -39 dB 5.8 GHz, 20 MHz BW: -38 dB Input signal level optimized for best EVM, average of 20 bursts, ≥ 16 symbols each
Residual EVM - 802.11b, CCK-11, typical	2.4 GHz, 11 Mbps: 1.3 % Input signal level optimized for best EVM, average of 1,000 chips, BT = .61

WLAN Measurements 802.11n (SV24xx-SVPC)

Measurements	WLAN power vs. time; WLAN symbol table; WLAN constellation; spectrum emission mask; error vector magnitude (EVM) vs. symbol (or time), vs subcarrier (or frequency); mag error vs symbol (or time), vs. subcarrier (or frequency); phase error vs symbol (or time), vs. subcarrier (or frequency); channel frequency response vs. symbol (or time), vs. subcarrier (or frequency); spectral flatness vs. symbol (or time), vs. subcarrier (or frequency)
EVM performance - 802.11n, 64-QAM, typical	2.4 GHz, 40 MHz BW: -38 dB 5.8 GHz, 40 MHz BW: -38 dB Input signal level optimized for best EVM, average of 20 bursts, ≥ 16 symbols each

WLAN Measurements 802.11ac (SV25xx-SVPC)

Measurements	WLAN power vs. time; WLAN symbol table; WLAN constellation; spectrum emission mask; error vector magnitude (EVM) vs. symbol (or time), vs subcarrier (or frequency); mag error vs symbol (or time), vs. subcarrier (or frequency); phase error vs symbol (or time), vs. subcarrier (or frequency); channel frequency response vs. symbol (or time), vs. subcarrier (or frequency); spectral flatness vs. symbol (or time), vs. subcarrier (or frequency)
EVM performance - 802.11ac, 256-QAM, typical	5.8 GHz, 40 MHz BW : -38 dB Input signal level optimized for best EVM, average of 20 bursts, ≥ 16 symbols each

Input and output ports

Inputs, outputs, and interfaces

RF input	N type, female
External frequency reference input	BNC, female
Trigger/Sync input	BNC, female
Tracking Generator Source Output	N type, female
GPS Antenna	SMA, female
USB Device Port	USB 3.0 – Type A

Input and output ports

USB Status LED	LED, dual color red/green LED states: Steady Red: USB power applied, or resetting Steady Green: Initialized, ready for use Blinking Green: Transferring data to host
Battery Status LED	LED, green LED states: Blinking Green: External power connected, charging battery Off – no external power connected

Installation requirements

Maximum power dissipation (fully loaded)	15 W maximum. Maximum line current is 0.2 A at 90 V line.
Surge current	2 A peak maximum, at 25 °C (77 °F) for ≤ 5 line cycles, after the product has been turned off for at least 30 seconds.
Cooling clearance	Bottom, top RSA500A: 25.4 mm (1.0 in.) Sides RSA500A: 25.4 mm (1.0 in.) Rear: 25.4 mm (1.0 in.)
External DC input	
Voltage	18 V
Voltage range limits	Operation: +12.0 V to +19.95 V Battery Charging: +17.5 V to +19.95 V
Connector type	2.5mm male Center conductor: positive Outer conductor: negative
AC Adapter Output	18 V ± 5%, 5 A (90 W max) Center conductor: positive Outer conductor: negative
Battery	
Nominal voltage	14.4 V
Nominal capacity	6140 mAh
Battery technology	Li-Ion, Smart Battery compatible with SMBus interface.
Battery operational life	4 hours of continuous operation per battery
Battery operating temperature	Operating (discharge) ⁶ : -10 °C to +45 °C (14 °F to 113 °F) ⁷ Charging: 0 °C to 45 °C (32 °F to 113 °F)
Battery storage life	2 years at +20 °C (68 °F) nominal Max storage duration between recharge: 10 months @ +20 °C (68 °F)

⁶ Operation at -10 °C may require turning on the unit at room temperature first.

⁷ Varies per discharge current and heat dissipation characteristics; actual limit may be lower.

Physical characteristics

Physical characteristics

Width	299.1 mm (11.78 in)
Height	67.3 mm (2.65 in)
Length	271.3 mm (10.68 in)
Net weight	2.54 kg (5.6 pounds) without battery 2.99 kg (6.6 pounds) with battery

Environmental and safety

Temperature

Without battery installed	Operating: -10 °C to +55 °C (+14 °F to +131 °F) Non-operating: -51 °C to +71 °C (-60 °F to +160 °F)
With battery installed	Operating (discharge) ⁶ : -10 °C to +45 °C (+14 °F to +113 °F) ⁷ Charging: 0 °C to 45 °C (32 °F to +113 °F)

Humidity

Without battery Installed	MIL-PRF-28800F Class 2 Operating: 5% to 95±5%RH (relative humidity) in the temperature range of +10 °C to 30 °C (+50 °F to 86 °F) 5% to 75±5% RH above +30 °C to 40 °C (+86 °F to 104 °F) 5% to 45±5% RH above +40 °C up to +55 °C (+86 °F to +131 °F) <10 °C (+50 °F) humidity is uncontrolled; non-condensing
With battery Installed	Operating: 5% to 95% RH (relative humidity) in the temperature range of +10 °C to 30 °C (+14 °F to +86 °F) 5% to 45% RH above +30 °C to 50 °C (+86 °F to 122 °F) <10 °C (+50 °F) humidity is uncontrolled; non-condensing

Altitude

Operating	Up to 5000 m (16,404 ft.)
Non-operating	Up to 15240 m (50,000 ft.)

Exposure

Splash-Proof test, operating and non-operating	No potential of shock hazard after exposure to non-operating Splash Proof Test per IEC529, level IP52
Dust resistance test, operating and non-operating	Test method per IEC529, level IP52, test conditions 13.4 and 13.5.
Salt exposure test, structural parts	Standard MIL-STD-810, Method 509.1, Procedure 1

Dynamics

Vibration

Operating Tektronix Class 2 Random Vibration Test at 2.66 GRMS: 5-500 Hz, 3 Axes at 10 min/axis

Non-Operating MIL-PRF-28800F Class 2
0.030 g²/Hz., 10 500 Hz, 30 minutes per axis, 3 axes (90 minutes total)

Shock

Operating Test method per Military Standard MIL-PRF-28800F 1-4

Non-Operating Exceeds the requirements of Military Standard MIL-PRF-28800F

Handling and transit

Bench handling, operating MIL-PRF-28800F Class 2

Transit drop, non-operating MIL-PRF-28800F Class 2

Free-Fall drop, non-operating 32 inches

Ordering information

Models

RSA500A Series

RSA500A Series

USB Real-Time Spectrum Analyzer, 40 MHz acquisition bandwidth

The RSA500 requires a PC with Windows 7, Windows 8/8.1, or Windows 10, 64-bit operating system. A USB 3.0 connection is required for operation of the RSA500. 8 GB RAM and 20 GB free drive space is required for installation of SignalVu-PC. For full performance of the real time features of the RSA500, an Intel Core i7 4th generation processor is required. Processors of lower performance can be used, with reduced real-time performance. Storage of streaming data requires that the PC be equipped with a drive capable of streaming storage rates of 300 MB/sec..

Includes: USB 3.0 cable (2 M), A-A connection, screw lock, shoulder strap, carrying case with room for unit, tablet, accessories, quick-start manual (printed), connector covers, WFM200BA Li-Ion rechargeable battery pack, WFM200BA Li-Ion battery pack instructions (printed), AC power adapter, power cord (see power plug options), USB memory device with SignalVu-PC, API and documentation files.

Item	Description
RSA503A	USB real time spectrum analyzer, 9 kHz – 3.0 GHz, 40 MHz acquisition bandwidth
Option 04	Tracking generator, 10 MHz – 3.0 GHz
Option CTRL-G1-B	Portable controller, Brazil power, see country list for availability
Option CTRL-G1-C	Portable controller, China power, see country list for availability
Option CTRL-G1-E	Portable controller, Europe power, see country list for availability
Option CTRL-G1-I	Portable controller, India power, see country list for availability
Option CTRL-G1-N	Portable controller, North America power, see country list for availability
Option CTRL-G1-U	Portable controller, UK power, see country list for availability
RSA507A	USB real time spectrum analyzer, 9 kHz – 7.5 GHz, 40 MHz acquisition bandwidth
Option 04	Tracking generator, 10 MHz – 7.5 GHz
Option CTRL-G1-B	Portable controller, Brazil power, see country list for availability
Option CTRL-G1-C	Portable controller, China power, see country list for availability
Option CTRL-G1-E	Portable controller, Europe power, see country list for availability
Option CTRL-G1-I	Portable controller, India power, see country list for availability
Option CTRL-G1-N	Portable controller, North America power, see country list for availability
Option CTRL-G1-U	Portable controller, UK power, see country list for availability
RSA500TRANSIT	Hard-sided transit case, RSA500 series real time spectrum analyzer with room for tablet and accessories

Options

RSA500A power plug options

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

Language options for the RSA500

Opt. L0	English manual
Opt. L1	French manual
Opt. L2	Italian manual
Opt. L3	German manual
Opt. L4	Spanish manual
Opt. L5	Japanese manual
Opt. L6	Portuguese manual
Opt. L7	Simplified Chinese manual
Opt. L8	Traditional Chinese manual
Opt. L9	Korean manual
Opt. L10	Russian manual

RSA500A service options ⁸

Opt. C3	Calibration Service 3 Years
Opt. C5	Calibration Service 5 Years
Opt. D1	Calibration Data Report
Opt. D3	Calibration Data Report 3 Years (with Opt. C3)
Opt. D5	Calibration Data Report 5 Years (with Opt. C5)
Opt. R5	Repair Service 5 Years (including warranty)

⁸ Not available on tablet options.

Warranty

- RSA500 series warranty: 3 years.
- FZ-G1 tablet: 3-year warranty with Business Class Support (provided by Panasonic in region of purchase).
- Alaris DF-A0047 antenna: 1-year warranty, provided by Alaris in South Africa. Service and calibration provided by Alaris.

Tablet

Tablets ordered as standalone

When ordered standalone, the Panasonic FZ-G1 has the nomenclature below. See the RSA500 option list if you'd like to order the controller as an option to the RSA500. The FZ-G1 is available in limited geographies from Tektronix as shown in the ordering information below.

Item	Description	Regional availability
FZ-G1-N	Controller for USB Spectrum Analyzers, Panasonic ToughPad FZ-G1. Includes tablet, battery, digitizer pen and tether, battery charger with power cord.	Canada, Columbia, Ecuador, Mexico, Philippines, Singapore, United States
FZ-G1-C	Controller for USB Spectrum Analyzers, Panasonic ToughPad FZ-G1. Includes tablet, digitizer pen and tether, battery charger with power cord	China
FZ-G1-I	Controller for USB Spectrum Analyzers, Panasonic ToughPad FZ-G1. Includes tablet, battery, digitizer pen and tether, battery charger with power cord	India
FZ-G1-E	Controller for USB Spectrum Analyzers, Panasonic ToughPad FZ-G1. Includes tablet, battery, digitizer pen and tether, battery charger with power cord.	Austria, Baltic States, Belgium, Bosnia, Bulgaria, Chile, Croatia, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Indonesia, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, South Africa, Spain, Sweden, Thailand, Turkey
FZ-G1-U	Controller for USB Spectrum Analyzers, Panasonic ToughPad FZ-G1. Includes tablet, battery, digitizer pen and tether, battery charger with power cord.	Egypt, Kenya, Malaysia, United Kingdom
FZ-G1-B	Controller for USB Spectrum Analyzers, Panasonic ToughPad FZ-G1. Includes tablet, battery, digitizer pen and tether, battery charger with power cord	Brazil
FZ-G1-J	Controller for USB Spectrum Analyzers, Panasonic ToughPad FZ-G1. Includes tablet, battery, digitizer pen and tether, battery charger with power cord	Japan

Panasonic FZ-G1 accessories

Item	Description
FZ-VZSU84U ⁹	Li-ion battery, standard capacity
FZ-VZSU88U ⁹	Long-life battery pack for Panasonic ToughPad FZ-G1
FZ-BNDLG1BATCHR	Single battery charger bundle for FZ-G1. 1 charger and 1 adapter
CF-LNDDC120	Lind 120 W 12-32 Volt input vehicle adapter for Toughbook and ToughPad
TBCG1AONL-P	Panasonic Toughmate always on case for FZ-G1
TBCG1XSTP-P	Infocase Toughmate X-strap for Panasonic FZ-G1

⁹ Not available in China, Hong Kong, Macau or Mongolia

Licenses

SignalVu-PC application-specific modules

Application license	Description
SVANL-SVPC	AM/FM/PM/Direct Audio Analysis - Node Locked License
SVAFL-SVPC	AM/FM/PM/Direct Audio Analysis - Floating License
SVTNL-SVPC	Settling Time (frequency and phase) measurements - Node Locked License
SVTFL-SVPC	Settling Time (frequency and phase) measurements - Floating License
SVMNL-SVPC	General Purpose Modulation Analysis to work with analyzer of acquisition bandwidth <= 40 MHz or MDO - Node Locked License
SVMFL-SVPC	General Purpose Modulation Analysis to work with analyzer of acquisition bandwidth <= 40 MHz or MDO- Floating License
SVPNL-SVPC	Pulse Analysis to work with analyzer of acquisition bandwidth <= 40 MHz or MDO - Node Locked License
SVPFL-SVPC	Pulse Analysis to work with analyzer of acquisition bandwidth <= 40 MHz or MDO- Floating License
SVONL-SVPC	Flexible OFDM Analysis - Node Locked License
SVOFL-SVPC	Flexible OFDM Analysis - Floating License
SV23NL-SVPC	WLAN 802.11a/b/g/j/p measurement - Node Locked License
SV23FL-SVPC	WLAN 802.11a/b/g/j/p measurement - Floating License
SV24NL-SVPC	WLAN 802.11n measurement (requires SV23) - Node Locked License
SV24FL-SVPC	WLAN 802.11n measurement (requires SV23) - Floating License
SV25NL-SVPC	WLAN 802.11ac measurement to work with analyzer of acquisition bandwidth <= 40 MHz (requires SV23 and SV24) or MDO - Node Locked License
SV25FL-SVPC	WLAN 802.11ac measurement to work with analyzer of acquisition bandwidth <= 40 MHz (requires SV23 and SV24) or MDO - Floating License
SV26NL-SVPC	APCO P25 measurement - Node Locked License
SV26FL-SVPC	APCO P25 measurement - Floating License
SV27NL-SVPC	Bluetooth measurement to work with analyzer of acquisition bandwidth <= 40 MHz or MDO - Node Locked License
SV27FL-SVPC	Bluetooth measurement to work with analyzer of acquisition bandwidth <= 40 MHz or MDO- Floating License
MAPNL-SVPC	Mapping - Node Locked License
MAPFL-SVPC	Mapping - Floating License
SV56NL-SVPC	Playback of recorded files - Node Locked License
SV56FL-SVPC	Playback of recorded files - Floating License
CONNL-SVPC	SignalVu-PC live link to the MDO4000B series mixed-domain oscilloscopes - Node Locked License
CONFL-SVPC	SignalVu-PC live link to the MDO4000B series mixed-domain oscilloscopes - Floating License
SV2CNL-SVPC	WLAN 802.11a/b/g/j/p/n/ac and live link to MDO4000B to work with analyzer of acquisition bandwidth <= 40 MHz - Node Locked License
SV2CFL-SVPC	WLAN 802.11a/b/g/j/p/n/ac and live link to MDO4000B to work with analyzer of acquisition bandwidth <= 40 MHz - Floating License
SV28NL-SVPC	LTE Downlink RF measurement to work with analyzer of acquisition bandwidth <= 40 MHz or MDO - Node Locked License
SV28FL-SVPC	LTE Downlink RF measurement to work with analyzer of acquisition bandwidth <= 40 MHz or MDO - Floating License
SV54NL-SVPC	Signal survey and classification - Node Locked License
SV54FL-SVPC	Signal survey and classification - Floating License
EDUFL-SVPC	Education-only version of all modules for SignalVu-PC - Floating License

Recommended accessories

Tektronix offers a wide variety of adapters, attenuators, cables, impedance converters, antennas and other accessories for the RSA500 series.

General purpose RF cables

012-1738-00	Cable, 50 Ω , 40 inch, type-N(m) to type-N(M)
012-0482-00	Cable, 50 Ω , BNC (m) 3 foot (91 cm)
174-4977-00	Cable, 50 Ω , straight type-N (m) and angled type-N (m) connector, 1.6 foot (50 cm)
174-5002-00	Cable, 50 Ω , type-N (m) to type-N (m) connector, 3 foot (91 cm)

Adapters

103-0045-00	Adapter, coaxial, 50 Ω type-N(m) to type-BNC(f)
013-0410-00	Adapter, coaxial, 50 Ω type-N (f) to type-N (f)
013-0411-00	Adapter, coaxial, 50 Ω type-N (m) to type-N (f)
013-0412-00	Adapter, coaxial, 50 Ω , type-N(m) to type-N(m)
013-0402-00	Adapter, coaxial, 50 Ω type-N (m) to type-N 7/16(m)
013-0404-00	Adapter, coaxial, 50 Ω type-N(m) to type-7/16 (f)
013-0403-00	Adapter, coaxial, 50 Ω type-N(m) to type DIN 9.5(m)
013-0405-00	Adapter, coaxial, 50 Ω type-N(m) to type-DIN 9.5(f)
013-0406-00	Adapter, coaxial, 50 Ω type-N(m) to type-SMA(f)
013-0407-00	Adapter, coaxial, 50 Ω type-N(m) to type-SMA(m)
013-0408-00	Adapter, coaxial, 50 Ω type-N(m) to type-TNC(f)
013-0409-00	Adapter, coaxial, 50 Ω type-N(m) to type-TNC(m)

Attenuators and 50/75 Ω pads

013-0422-00	Pad, 50/75 Ω , minimum loss, type-N(m) 50 Ω to type-BNC(f) 75 Ω
013-0413-00	Pad, 50/75 Ω , minimum loss, type-N(m) 50 Ω to type-BNC(m) 75 Ω
013-0415-00	Pad, 50/75 Ω , minimum loss, type-N(m) 50 Ω to type-F(m) 75 Ω
015-0787-00	Pad, 50/75 Ω , minimum loss, type-N(m) 50 Ω to type-F(f) 75 Ω
015-0788-00	Pad, 50/75 Ω , minimum loss, type-N(m) 50 Ω to type-N(f) 75 Ω
011-0222-00	Attenuator, fixed, 10 dB, 2 W, DC-8 GHz, type-N(f) to type-N(f)
011-0223-00	Attenuator, fixed, 10 dB, 2 W, DC-8 GHz, type-N(m) to type-N(f)
011-0224-00	Attenuator, fixed, 10 dB, 2 W, DC-8 GHz, type-N(m) to type-N(m)
011-0228-00	Attenuator, fixed, 3 dB, 2 W, DC-18 GHz, type-N(m) to type-N(f)
011-0225-00	Attenuator, fixed, 40 dB, 100 W, DC-3 GHz, type-N(m) to type-N(f)
011-0226-00	Attenuator, fixed, 40 dB, 50 W, DC-8.5 GHz, type-N(m) to type-N(f)

Antennas

119-6609-00	Whip antenna, BNC, wideband untuned, with center of sensitivity approximately 136 MHz, passband 5-1080 MHz. 9 inches length.
DF-A0047	Directional antenna, 20-8500 MHz, with electronic compass and preamp ¹⁰
DF-A0047-01	Frequency range extension for DF-A0047 directional antenna, 9 kHz-20 MHz ¹⁰

DF-A0047-C1	DF-A0047 antenna and DF-A0047-01 extension ¹⁰
016-2107-00	Transit case for DF-A0047 and DF-A0047-01 ¹⁰
119-6594-00	Yagi antenna, 825-896 MHz forward gain (over half-wave dipole): 10 dB
119-6595-00	Yagi antenna, 895-960 MHz forward gain (over half-wave dipole): 10 dB
119-6596-00	Yagi antenna, 1850-1990 MHz forward gain (over half-wave dipole): 9.3 dB
119-6597-00	Beam antenna, 1850 to 1990 MHz
119-6970-00	Magnetic mount antenna, 824 MHz to 2170 MHz (requires adapter 103-0449-00)
Filters, probes, demonstration board	
119-7246-00	Pre-filter, general purpose, 824 MHz to 2500 MHz, type-N (f) connector
119-7426	Pre-filter, general purpose, 2400 MHz to 6200 MHz, type-N (f) connector
119-4146-00	EMCO E/H-field probes
E/H field probes, lower cost alternative	Available from Beehive www. http://beehive-electronics.com/
RSA-DKIT	RSA Version 3 demo board with N-BNC adapter, case, antenna, instructions
011-0227-00	Bias-T, type N(m) RF, type N(f) RF+DC, BNC(f) Bias, 1 W, 0.5 A, 2.5 MHz-6 GHz

Tracking generator accessories

A variety of calibration kits and phase-stabilized cables are available for the RSA500 tracking generator when used with the optional cable and antenna measurements software.

CALOSLNM	Calibration kit, 3-in-1, open, short, load, DC to 6 GHz, Type-N(m), 50 ohm
CALOSLNF	Calibration kit, 3-in-1, open, short, load, DC to 6 GHz, Type-N(f), 50 ohm
CALOSLNF	Calibration kit, 3-in-1, open, short, load, DC to 6 GHz, 7/16 DIN(m)
CALOSL716F	Calibration kit, 3-in-1, open, short, load, DC to 6 GHz, 7/16 DIN(f)
CALSOLT35F	Calibration kit, 4-in-1 3.5 mm (f) short, open, load, through, 13 GHz
CALSOLT35M	Calibration kit, 4-in-1 3.5 mm (m) short, open, load, through, 13 GHz
CALSOLTNF	Calibration kit, 4-in-1 type-N (f) short, open, load, through, 9 GHz
CALSOLTNM	Calibration kit, 4-in-1 type-N (m) short, open, load, through, 9 GHz
CALSOLT716F	Calibration kit, 4-in-1 7/16 (f) short, open, load, through, 6 GHz
CALSOLT716M	Calibration kit, 4-in-1 7/16 (m) short, open, load, through, 6 GHz
CALSOLTNF-75	Calibration kit, 4-in-1 type-N (f) short, open, load, through, 75 Ohm, 3 GHz
CALSOLTNM-75	Calibration kit, 4-in-1 type-N (m) short, open, load, through, 75 Ohm, 3 GHz
012-1745-00	Cable, rugged, phase-stable, type-N (m) to type-N (f), 5 ft or 1.5 m
012-1746-00	Cable, rugged, phase-stable, type-N(m) to type-N(f), 3.28 ft or 1 m
012-1747-00	Cable, rugged, phase-stable, type-N(m) to 7/16(f), 60 cm (23.6 in.)
012-1748-00	Cable, rugged, phase-stable, type-N(m) to 7/16(f), 3.28 ft or 1 m
012-1749-00	Cable, rugged, phase-stable, type-N(m) to 7/16(f), 5 ft or 1.5 m

¹⁰ Not available in China, Japan, New Zealand, Australia, Korea, Russia, Belarus, Kazakhstan

012-1750-00	Cable, rugged, phase-stable, type-N(m) to 7/16(m), 3.28 ft or 1 m
012-1751-00	Cable, rugged, phase-stable, type-N(m) to 7/16(m), 5 ft or 1.5 m
012-1752-00	Cable, rugged, phase-stable, type-N(m) to 7/16(m), 60 cm (23.6 in.)
012-1753-00	Cable, rugged, phase-stable, type-N(m) to DIN 9.5(f), 60 cm (23.6 in.)
012-1754-00	Cable, rugged, Phase-stable, type-N(m) to DIN 9.5(f), 3.28 ft or 1 m
012-1755-00	Cable, rugged, phase-stable, type-N(m) to DIN 9.5(f), 5 ft or 1.5 m
012-1756-00	Cable, rugged, phase-stable, type-N(m) to DIN 9.5(m), 3.28 ft or 1 m
012-1757-00	Cable, rugged, phase-stable, type-N(m) to DIN 9.5(m), 5 ft or 1.5 m
012-1758-00	Cable, rugged, phase-stable, type-N(m) to DIN 9.5(m), 60 cm (23.6 in.)
012-1759-00	Cable, rugged, phase-stable, type-N(m) to TNC(f), 3.28 ft or 1 m
012-1760-00	Cable, rugged, phase-stable, type-N(m) to TNC(f), 5 ft or 1.5 m
012-1761-00	Cable, rugged, phase-stable, type-N(m) to TNC(f), 60 cm (23.6 in.)
012-1762-00	Cable, rugged, phase-stable, type-N(m) to TNC(m), 60 cm (23.6 in.)
012-1763-00	Cable, rugged, phase-stable, type-N(m) to TNC(m), 3.28 ft or 1 m
012-1764-00	Cable, rugged, phase-stable, type-N(m) to TNC(m), 5 ft or 1.5 m
012-1765-00	Cable, rugged, phase-stable, type-N(m) to type-N(f), 60 cm (23.6 in.)
012-1766-00	Cable, rugged, phase-stable, type-N(m) to type-N(f), 3.28 ft or 1 m
012-1767-00	Cable, rugged, phase-stable, type-N(m) to type-N(m), 3.28 ft or 1 m
012-1768-00	Cable, rugged, phase-stable, type-N(m) to type-N(m), 60 cm (23.6 in.)
012-1769-00	Cable, rugged, phase-stable, type-N(m) to type-SMA(f), 60 cm (23.6 in.)
012-1770-00	Cable, rugged, phase-stable, type-N(m) to type-SMA(f), 3.28 ft or 1 m
012-1771-00	Cable, rugged, phase-stable, type-N(m) to type-SMA(f), 5 ft or 1.5 m
012-1772-00	Cable, rugged, phase-stable, type-N(m) to type-SMA(m) 60 cm (23.6 in.)
012-1773-00	Cable, rugged, phase-stable, type-N(m) to type-SMA(m), 3.28 ft or 1 m
012-1774-00	Cable, rugged, phase-stable, type-N(m) to type-SMA(m), 5 ft or 1.5 m



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



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



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

ASEAN / Australasia (65) 6356 3900
Belgium 00800 2255 4835*
Central East Europe and the Baltics +41 52 675 3777
Finland +41 52 675 3777
Hong Kong 400 820 5835
Japan 81 (3) 6714 3010
Middle East, Asia, and North Africa +41 52 675 3777
People's Republic of China 400 820 5835
Republic of Korea +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.

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.



Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «JONHON», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «FORSTAR».



JONHON

«JONHON» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«FORSTAR» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели,
кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



Телефон: 8 (812) 309-75-97 (многоканальный)

Факс: 8 (812) 320-03-32

Электронная почта: ocean@oceanchips.ru

Web: <http://oceanchips.ru/>

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А