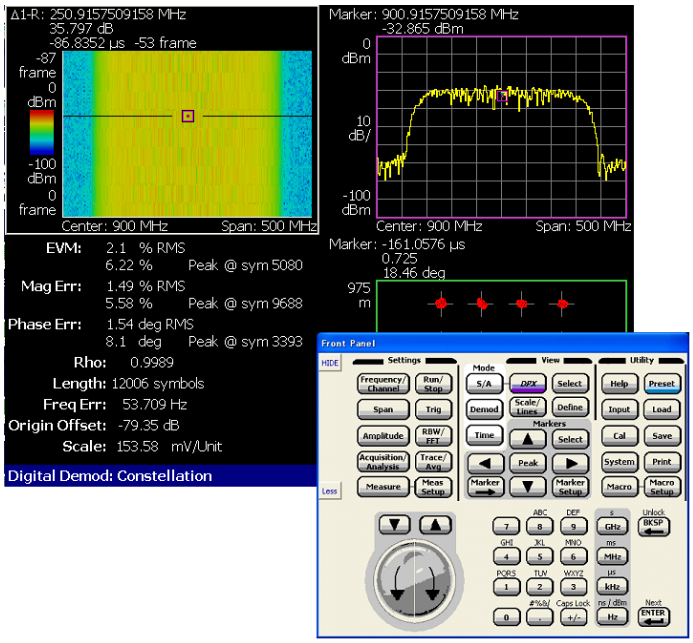
Real-Time Spectrum Analyzer Software

RSAVu Data Sheet



Features & Benefits

Real-Time Spectrum Analyzer Software for RTSAs, Oscilloscopes, and Logic Analyzers

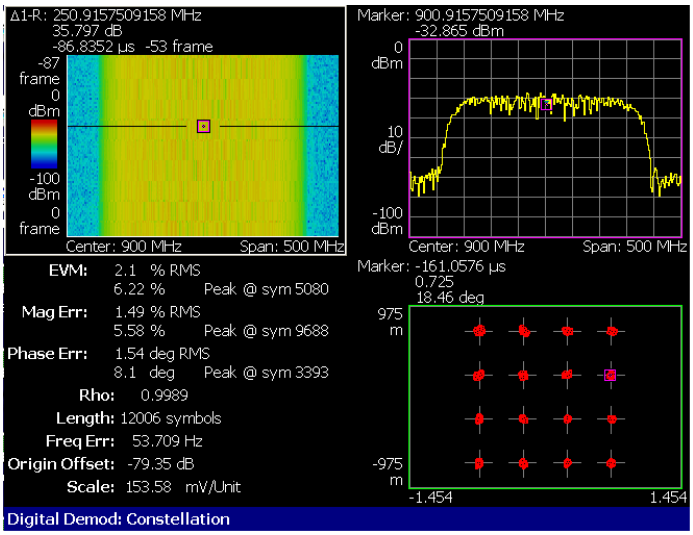
- Offline Signal Analysis
  - Multidomain Analysis Enables Fast, Complete Signal Analysis in Frequency, Time, Code, and Modulation Domains
  - Complete Analysis for Acquisition Rates as Fast as 50 GS/s with Oscilloscopes
  - Pulse Measurements including Pulse Width, PRI, Pulse-to-Pulse Phase, Pulse power
  - General Purpose Digital Modulation Analysis for a Wide Variety of Modulation Types
  - RFID Interrogator and Response Analysis
  - Signal Source Analysis Simplifies Phase Noise, Jitter, and Frequency Settling Measurements
  - Easy Analysis of IEEE 802.15.4 (ZigBee) Measurements
  - C4FM modulation analysis for Project 25 Compliance Measurements*[1]
  - 3G Measurement Versatility with W-CDMA, cdma2000, 1x EVDO, HSUPA, HSDPA, RF and Modulation Analysis
  - 802.11a/b/g/n Measurement Suite
  - Analog Demodulation Analysis including Baseband, AM, FM, PM measurements
  - Audio Distortion Analysis of Baseband, AM and FM with Real-time Spectrogram and Graphical Display of Harmonics and Spurious. Wide Choices of Low-pass Filters, High-pass Filters, Band-pass Filters, and De-emphasis Settings.
  - Import User-defined and Reference Filters for Customer Modulation Types
  - Save Captured Waveforms in .mat or .csv Formats for Post-processing Analysis
- Programmatic Interface (With RSAVu on an External PC)
  - Integrate with Test Executive for Automated Compliance and Stress Testing
  - Access Measurement Results through GPIB/LAN
  - Batch Process Data Files Without Being Connected to Acquisition Hardware

Applications

- Very Wideband Signal Analysis Using Oscilloscope Acquisitions
- Field Tactical Radio
- P25 (C4FM signal analysis)
- Radar
- Digital Modulation Analysis
- RFID
- Phase Noise
- Jitter
- GSM/EDGE
- W-CDMA
- HSUPA
- HSDPA
- CDMA2000 1x
- CDMA2000 1xEV-DO
- IEEE 802.11 a/b/g/n WLAN with MIMO
- IEEE 802.15.4 OQPSK (ZigBee)
- Audio Distortion Analysis

*[1] Typical or representative performance. See individual data sheets for more complete specifications. Memory depth refers to available acquisition-instrument memory. RSAVu can accept waveforms as large as the available instrument memory. RSAVu analysis length maximum is 64 M Samples.

Tektronix®



Oscilloscope capture of 312.5 MSymbols/sec 16 QAM signal, analyzed with RSAVu

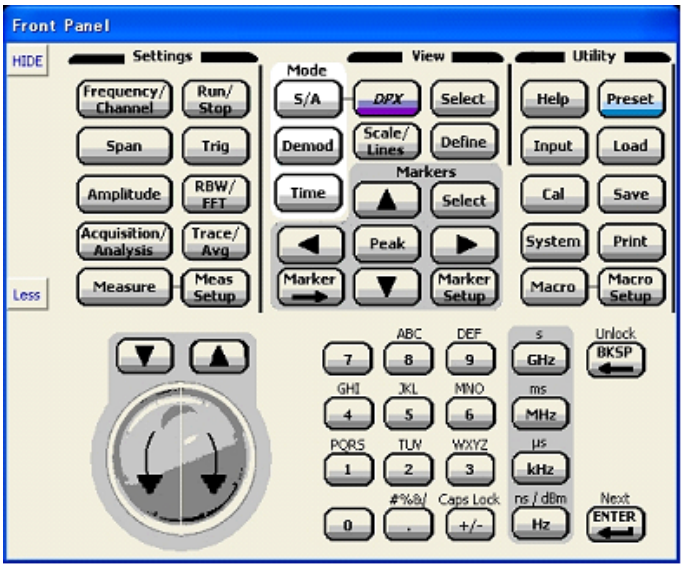
Real-Time Spectrum Analyzer Software for RTSAs, Oscilloscopes, and Logic Analyzers

RSAVu (RSA6000A, RSA3000 Series RTSAs, DSA/DSO70000 Series, and TLA5000/7000 Series)

Offline Analysis Software for RSA6000, RSA3000 Series RTSAs, DSA/DSO70000 Series Oscilloscopes, and TLA5000/7000 Logic Analyzers

RSAVu software enables offline analysis of data captured from Tektronix Real-Time Spectrum Analyzers (RTSAs) and oscilloscopes. The software offers users the same demodulation and analysis capabilities included in the RSA3408B software option suite. From 3G wireless standards to the latest RFID formats and pulsed-signal analysis, RSAVu is a tool designers can use to analyze signals without having acquisition hardware connected. The software supports data files saved on the RSA6106A, RSA6114A, RSA3408A/B, RSA3308A/B and RSA3303A/B Real-Time Spectrum Analyzers and DSA/DSO70000 Series oscilloscopes with option UWB.

When used with the RSA6000 Series RTSA and oscilloscopes, RSAVu can be installed and manually operated directly on the instrument. When used on an external PC, RSAVu supports a remote interface for performing data analysis in automated test environment. Users can programmatically load RSA data files and extract demodulated parameters using their test software to minimize time required for conformance and stress testing.



The RSAVu soft front panel allows easy offline access to settings and controls

Characteristics

Sampling rates, dynamic range, accuracy and memory depth of the analysis is instrument-dependent as shown in the table below.

Supported Instrument / Characteristics*1	RSA3303 RSA3308	RSA3408	RSA6106A RSA61114A	DSA/DSO70000
Frequency Range	DC - 3/8 GHz	DC - 8 GHz	9 kHz - 6.2/14 GHz	DC - Up to 20 GHz
Analysis Bandwidth	15 MHz	36 MHz	Up to 110 MHz	Up to 20 GHz
Sampling Rate, Maximum	51.2 MS/sec	102.4 MS/sec	Up to 300 MS/sec	Up to 50 GS/sec
Memory Depth (max) Memory Depth, seconds (at maximum sampling rate)	256 MB 2.56 sec	256 MB 1.28 sec	1000 MB 1.28 sec	200 MB X 4 channels 4 ms at 50 GS/s
Spectrum Analysis Spurious Free Dynamic Range	-70 dBc	-73 dBc	-73 dBc	~-40 dBc
Residual EVM, typical (1.6 GSymbol/sec QPSK, 2 - 16 GHz Carrier Frequency)	NA	NA	NA	< 1.5%
Residual EVM, typical (4 Msymbol/sec QPSK, 2 GHz Carrier Frequency)	< 2%	<0.6%	<0.6%	< 1%

*1 Typical or representative performance. See individual data sheets for more complete specifications. Memory depth refers to available acquisition-instrument memory. RSAVu can accept waveforms as large as the available instrument memory. RSAVu analysis length maximum is 64 MSamples.

Measurement Functions in the Base RSAVu Software

Note: available as a free download.

Measurement Mode	Measurements and Displays
Spectrum	Operates on recalled spectrum traces. Channel Power, Adjacent Channel Power, Occupied Bandwidth, Emission Bandwidth, Carrier-to-Noise Ratio, Carrier Frequency, Spurious Search, dBm/Hz Marker, dBc/Hz Marker, Spectrum Emission Mask
DPX	Spectrum Trace and DPX Bitmap recall
RTSA Mode	Channel Power, Adjacent Channel Power, Occupied Bandwidth, Emission Bandwidth, Carrier-to-Noise Ratio, Carrier Frequency, Spurious Search, dBm/Hz Marker, dBc/Hz Marker, Real-Time Spectrum Emission Mask
RTSA with Zoom	dBm/Hz Marker, dBc/Hz Marker
Analog Mod. Analysis	IQ vs. Time, AM Depth, FM Deviation, PM, Pulse Spectrum
Time	IQ vs. Time, Power vs. Time, Frequency vs. Time, CCDF, Crest Factor
Pulse	Pulse Width, Peak Power, Ripple, Pulse Repetition Interval, Duty Cycle, Pulse-to-Pulse Phase, Frequency Deviation, Channel Power, OBW, EBW

Measurement Functions and Specifications Available with RSAVu Options

Options allow you to extend the analysis capabilities of RSAVu to include general purpose and applications-specific modulation analysis. The following measurement characteristics apply to both the RSA3000A and RSA6000A Series Real-Time Spectrum Analyzers.

Opt. 10 - Audio Distortion Analysis

Characteristic	Description
Demodulation Types	Baseband, AM and FM
Measurement Range	20 Hz to 100 kHz
Displays	Spectrum and Spectrogram
Measurements	S/N, SINAD, THD, TNHD, Hum and Noise Ratio, Audio Frequency
Audio Filters	
De-emphasis	25 us, 50 us, 75 us, 750 us
LPF	3 kHz, 15 kHz, 30 kHz, 80 kHz
HPF	50 Hz, 300 Hz, 400 Hz
CCITT	
C-message	

Opt. 21 – Advanced Measurement Suite Software

Characteristic	Description
Modulation Formats	BPSK, QPSK, OQPSK, SOQPSK, π/4 – DQPSK, 8PSK, D8PSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, GMSK, GFSK, ASK, FSK, 4FSK, 8FSK, 16FSK, CPM (per MIL STD 188-181C), DSB-ASK, OOK, PR-ASK, SSB-ASK, Subcarrier OOK, Subcarrier BPSK, C4FM (Fixed symbol rate and span). Coding format varies with modulation type. User defined filters are also available.
Parameter Presets	PDC, PHS, NADC, TETRA, GSM, CDPD, Bluetooth, IEEE 802.15.4 OQPSK (ZigBee), C4FM (Project 25)
Vector Diagram Display Format	Symbol/Locus Display, Frequency Error and Origin Offset Measurement
Constellation Diagram Display Format	Symbol Display, Frequency Error and Origin Offset Measurement
Eye Diagram Display Format	I/Q/Trellis Display (1 to 16 symbols)
Error Vector Diagram Display Format	EVM, Magnitude Error, Phase Error, Waveform Quality (ρ), Frequency Error and Origin Offset Measurement ~
Coding Format	Miller, Modified Miller, Miller (M_2), Miller (M_4), Miller (M_8), Manchester, NRZ, direct-phase, grey and RFID-specific coding. Coding format availability varies with modulation format.
Symbol Table Display Format	Binary, Octal, Hexadecimal
Signal Source Analysis	Phase Noise, Jitter, and Frequency Settling Measurement

RFID Standards

- ISO/IEC 18000-7
- ISO/IEC 18000 Part 6 Type A, B, C
- ISO/IEC 18000 Part 4 Mode 1
- ISO/IEC 18092 (424k)
- ISO/IEC 15693
- ISO/IEC 14443 Part 2 Type A, B
- EPC Global Generation 1 Class 0, Class 1

Digital Demodulation

Characteristic	Description
GMSK (1 MHz Span)	EVM ≤1.8%, Magnitude Error ≤1.2%, Phase Error ≤1.0º
64QAM, 5.3 MS/s 1 GHz Carrier (15 MHz Span)	EVM ≤2.5% (typical)
QPSK, 3.84 MS/s 2 GHz Carrier (15 MHz Span)	EVM ≤2.5% (typical)

QPSK EVM (%), Typical

Characteristic	RSA6000A	RSA3408A/B	RSA3300A/B
QPSK EVM CF = 2 GHz (typical value)	0.5% (at 100 kS/s) 0.5% (at 1 MS/s) 0.6% (at 4 MS/s) 0.9% (at 10 MS/s)	0.5% (at 100 kS/s) 0.5% (at 1 MS/s) 0.6% (at 4 MS/s) 0.9% (at 10 MS/s)	0.5% (at 100 kS/s) 0.5% (at 1 MS/s) 1.2% (at 4 MS/s) 2.7% (at 10 MS/s)

Opt. 24 – GSM/EDGE Analysis Software

Burst Type: Normal

Characteristic	Description
Modulation Measurement Accuracy	
Carrier Power Range	-30 to +30 dBm
Phase Error Measurement Accuracy for GMSK Modulation (typical)	≤0.8º (RMS) 1.8º (Peak)
Phase Error Resolution	0.01º
EVM Measurement Accuracy for 8-PSK Modulation (typical)	≤0.9% (RMS)
EVM Resolution	0.01%
Time Resolution	0.15625 µs at 5 MHz span
Burst Count	1000 maximum
Mean Power Measurement	
RF Input Range	-50 dBm to +30 dBm
Absolute Power Measurement Accuracy for GSM900 at 20 ºC to 30 ºC, Excluding Mismatch Error (typical)	±0.5 dB, Signal frequency: 880 MHz to 960 MHz, Signal power: +10 dBm to -30 dBm, RF attenuator: 0 dB to 20 dB, after auto level is performed at 5 MHz span
Absolute Power Measurement Accuracy for DCS1800/PCS1900 at 20 ºC to 30 ºC, Excluding Mismatch Error (typical)	±0.6 dB, Signal frequency: 1710 MHz to 1990 MHz, Signal power: +10 dBm to -30 dBm, RF attenuator: 0 dB to 20 dB, after auto level is performed at 5 MHz span
Resolution	0.01 dB
Burst Count	1000 maximum
Power Versus Time Measurement	
RF Input Range	-50 dBm to +30 dBm
Power Ramp Relative Accuracy (typical)	±0.2 dB at 0 dBfs to -40 dBfs
Time Resolution (typical)	0.15625 µs at 5 MHz span
Marker Amplitude Resolution	0.001 dB
Burst Count	1000 maximum
Modulation Spectrum Measurement	
Carrier Power Range	-5 dBm to +30 dBm
Dynamic Range for GMSK Modulation (typical)	82 dB at 600 kHz offset (30 kHz RBW) 86 dB at 1.2 MHz offset (30 kHz RBW) 83 dB at 1.8 MHz offset (100 kHz RBW), 85 dB at 6 MHz offset (100 kHz RBW)
Dynamic Range for 8-PSK Modulation (typical)	82 dB at 600 kHz offset (30 kHz RBW), 85 dB at 1.2 MHz offset (30 kHz RBW), 83 dB at 1.8 MHz offset (100 kHz RBW), 83 dB at 6 MHz offset (100 kHz RBW)
Burst Count	1000 maximum
Switching Spectrum Measurement	
Carrier Power Range	-5 dBm to +30 dBm
Dynamic Range for GMSK Modulation (typical)	75 dB at 400 kHz offset (30 kHz RBW), 80 dB at 600 kHz offset (30 kHz RBW), 84 dB at 1.2 MHz offset (30 kHz RBW), 88 dB at 1.8 MHz offset (30 kHz RBW)
Dynamic Range for 8-PSK Modulation (typical)	75 dB at 400 kHz offset (30 kHz RBW), 80 dB at 600 kHz offset (30 kHz RBW) 84 dB at 1.2 MHz offset (30 kHz RBW) 88 dB at 1.8 MHz offset (30 kHz RBW)
Burst Count	1000 maximum

Opt. 25 – cdma2000 1x Analysis Software

Perform key measurement for cdma2000 forward link (3GPP2 C.S0010) and reverse link (3GPP2 C.S0011)

Opt. 26 – 1xEVDO Analysis Software

Perform key measurement for cdma2000 forward link (3GPP2 C.S0010) and reverse link (3GPP2 C.S0011)

cdma2000 1x and 1xEVDO Forward and Reverse Link

Characteristic	Forward and Reverse Link
Code Domain Power	
Relative Code Domain Power Accuracy, Typical	±0.075 dB
QPSK EVM	
Minimum Carrier Power at RF Input	-40 dBm
EVM Floor, Typical	2.0%
Modulation Accuracy (composite)	
Minimum Carrier Power at RF input	-40 dBm
Composite EVM Floor, Typical	2.0%
Rho (ρ)	0.999
Frequency Error Accuracy	±10 Hz + center frequency accuracy
Forward Link Timing Accuracy (τ)	±250 ns
CCDF	
Histogram Resolution	0.01 dB
Minimum Carrier Power at RF Input -50 dBm	-50 dBm

IEEE 802.11 Measurements

Measurement	Measurement Contents	802.11a	802.11b	802.11g	802.11n
Modulation Analysis					
EVM vs. Time	EVM	X	X	X	X
	Magnitude Error	X	X	X	X
	Phase Error	X	X	X	X
Power vs. Time	—	X	X	X	X
Constellation	—	X	X	X	X
EVM vs. SC	EVM	X	X	X	X
	Magnitude Error	X	X	X	X
	Phase Error	X	X	X	X
Power vs. SC	—	X	X	X	X
SC Constellation	—	X	X	X	X
Frequency Error	—	X	X	X	X
OFDM Flatness	—	X	—	X	X (SISO only)
OFDM Linearity	—	X	—	X	X (SISO only)
Symbol Table	—	X	X	X	X
2 x 2 MIMO Signal Analysis	—	—	—	—	X
Power Analysis					
Transmit Power	—	—	X	X	—
Transmission Analysis					
Transfer Function vs. Time	—	—	—	—	X
Delay Profile vs. Time	—	—	—	—	X

Opt. 30 – 3GPP Release 99 (WCDMA) and Release 5 Downlink (HSDPA) Analysis Software

3GPP Release 99 W-CDMA Uplink Analysis

Perform key measurements for 3GPP TS34.121 including PRACH analysis capability.

Supports the following measurements — Constellation, EVM, Eye Diagram, Symbol Table, CDP Spectrogram, CDP vs. Short Code, CDP vs. Symbol, CDP vs. Time Slot, Symbol Constellation, Symbol EVM, Symbol Eye Diagram.

Supports W-CDMA uplink signals — DPDCH 9 Dedicated Physical Data Channel/DPCCH (Dedicated Physical Control Channel), PRACH (Physical Random Access Data Channel), PCPCH (Physical Common Packet Channel).

3GPP Release 5 Downlink (HSDPA) Analysis

Perform key measurements for 3GPP TS25.141 v5.7.0

3GPP-R5 Downlink

Characteristic	Description
Modulation Format	QPSK, 16QAM auto detection
Channel Power Measurement	
Minimum power at RF input	-50 dBm
Absolute Power Measurement Accuracy (typical)	±0.6 dB at 20 °C to 30 °C, excluding mismatch error Signal frequency: 1900 - 2200 MHz Signal power: +10 dBm to -30 dBm after auto level is performed at 10 MHz span.
Relative Power Measurement Accuracy (typical)	±0.2 dB at 20 °C to 30 °C, excluding mismatch error Signal frequency: 1900 - 2200 MHz Signal power: 0 dBm to -30 dBm after auto level is performed at 10 MHz span.
Resolution	0.01 dB
ACLR Measurement	
Minimum Carrier Power at RF Input	-40 dBm
Signal Type, Measurement Mode	**ACLR**
3GPP Downlink, 1 DPCH	Adjacent Alternate
Real-time (spec.)	-66 dB -68 dB
Stepped (typical)	-70 dB -72 dB
CCDF Measurement	
Histogram Resolution	0.01 dB
OBW (Occupied Bandwidth) Measurement	
Minimum Carrier Power at RF Input	-50 dBm
Measurement Accuracy	0.2% (5 MHz Span, 1000 times averaging)
Spectrum Emission Mask	
Dynamic Range	82 dB (30 kHz BW, Input Power > -5 dBm, 5 MHz offset)
Code Domain Power	
Relative Accuracy of Code Domain Power Accuracy	±0.15 dB, typically ±0.075 dB Using Test Model 5, Total Power = 0 dBm, Code Level > -15 dB
QPSK EVM (Pilot Channel Only)	
Minimum Carrier Power at RF Input	-60 dBm (EVM <9 %)
EVM Floor (typical)	2.0% (Input Power > -40 dBm, 10 times averaged)
Modulation Accuracy (Composite, Test Model 5)	
Minimum Carrier Power at RF Input	-60 dBm (EVM < 9%)
Composite EVM Floor (typical)	2.5% (Input Power > -40 dBm, 10 times averaged)
Frequency Error Accuracy	±10 Hz + (center frequency accuracy)
Modulation Accuracy (Composite, Alternate Scrambling Code)	
Minimum Carrier Power at RF Input	-60 dBm (EVM <9%)
Composite EVM Floor (typical)	2.5% (Input Power > -40 dBm, 10 times averaged)
Frequency Error Accuracy	±10 Hz + (center frequency accuracy)

3GPP-R5 Uplink

Characteristic	Description
ACK/NACK Analysis	
ACK/NACK Analysis Function	ACK/NACK/DTX detection, CQI decode
Code Domain Power	
Relative Accuracy of Code Domain Power Accuracy	±0.15 dB, typically ±0.075 dB (Total Power = 0 dBm, Code Level > -15 dB)

Opt. 40 – 3GPP Release 6 Uplink (HSUPA) Analysis Software

Perform key measurement for 3GPP TS25.141 141 V6.11.0 and TS25.101 V6.9.0 (Uplink)

3GPP - R6 Uplink

Characteristic	Description
Modulation Format	Channel detection, IQ split analysis
Code Domain Power	
Relative Accuracy of Code Domain Power Accuracy	±0.15 dB, typically ±0.075 dB Using Test Model 5, Total Power = 0 dBm, Code Level > -15 dB
QPSK EVM (Pilot Channel Only)	
Minimum Carrier Power at RF Input	-60 dBm (EVM <9%)
EVM Floor (typical)	2.0% (Input Power > -40 dBm, 10 times averaged)
Modulation Accuracy (Composite, Test Model 5)	
Minimum Carrier Power at RF Input	-60 dBm (EVM < 9%)
Composite EVM Floor (typical)	2.5% (Input Power > -40 dBm, 10 times averaged)
Frequency Error Accuracy	±10 Hz + (center frequency accuracy)
Modulation Accuracy (Composite, Alternate Scrambling Code)	
Minimum Carrier Power at RF Input	-60 dBm (EVM <9%)
Composite EVM Floor (typical)	2.5% (Input Power > -40 dBm, 10 times averaged)
Frequency Error Accuracy	±10 Hz + (center frequency accuracy)

3GPP-R6 Uplink and Downlink Analysis

Characteristic	Description
Uplink	
Phase Discontinuity	Result of Phase Discontinuity in accordance with 3GPP standard TS25.101(V6.9.0) 6.8.4
Gain Ratio over Time	Power ratio % over time
Modulation Accuracy over Time	EVM, Mag error, Phase error, PCDE, Frequency error, Origin offset, Phase discontinuity over time
Uplink Signaling Analysis	
HS-DPCCH Analysis	ACK/NACK/PRE/POST/DTX detection, CQI decode
E-DPCCH Analysis	RSN/E-TFCI/HAPPY decode
DPCCH	TPC, TFCI decode
Downlink	
Modulation Accuracy over Time	EVM, Mag error, Phase error, PCDE, Frequency error, Origin offset over time
Downlink Signaling Analysis	
E-RGCH (E - Relative Grant Channel) Analysis	UP/HOLD/DOWN detection
E-HICH (E-Hybrid ARQ Indicator Channel) Analysis	ACK/NACK decode
E-AGCH Analysis	AGV/AGS decode

Recommended PC Configuration

Characteristic	Description
Processor	Pentium-compatible: >2.4 GHz, and >500 MB RAM
Platform	Microsoft Windows XP
Space Required	100 MB free hard-disk space
Port	Available USB port used for hardware license key

Ordering Information

RSAVu

Offline analysis software for RSA Series spectrum analyzers and DSA/DSO70000 oscilloscopes. Basic RSAVu is free of charge on the Tektronix web site (www.tektronix.com) and is capable of performing :

- Amplitude, frequency, and phase vs. time analysis.
- Analog modulation analysis for AM, FM and PM signals
- I and Q versus time measurements
- Pulsed signal analysis

Options may be ordered which provide digital modulation analysis, for a variety of modulation types and standards. Options are delivered in the form of a USB key that is used with your PC when RSAVu is operating.

Options

Option	Description
Offline Modulation Analysis	
Opt. 10	Audio Distortion Analysis Software
Opt. 21	Advanced Measurement Suite Software
Opt. 24	GSM/EDGE
Opt. 25	CDMA2000/1X
Opt. 26	1x EVDO
Opt. 29	IEEE 802.11a/b/g/n
Opt. 30	3GPP Release 99 and Release 5 UL/DL Analysis
Opt. 40	HSUPA 3GPP Release 6*2

*2 Requires Option 30.

RSAVuUP

Upgrades for offline analysis software. Upgrades are installed using a USB key that ships with the purchased option. If you already own an RSAVu USB key, the new key will reprogram your key to activate all purchased options.

Upgrade Options

Option	Description
Reprograms USB HW Key to add option:	
Opt. 10	Option 10 – Audio Distortion Analysis Software
Opt. 21	Option 21 – Advanced Measurement Suite Software
Opt. 24	Option 24 – GSM/EDGE
Opt. 25	Option 25 – CDMA2000/1X
Opt. 26	Option 26 – 1x EVDO
Opt. 29	Option 29 – IEEE 802.11a/b/g/n
Opt. 30	Option 30 – 3GPP Release 99 and Release 5 UL/DL Analysis
Opt. 40	Option 40 – HSUPA 3GPP Release 6*2

*2 Requires Option 30.

CE

ISO 9001 Product(s) are manufactured in ISO registered facilities.

GPIB IEEE-488 Product(s) complies with IEEE Standard 488.1-1987, RS-232-C, and with Tektronix Standard Codes and Formats.

Contact Tektronix:

ASEAN / Australasia (65) 6356 3900

Austria +41 52 675 3777

Balkans, Israel, South Africa and other ISE Countries +41 52 675 3777

Belgium 07 81 60166

Brazil +55 (11) 40669400

Canada 1 (800) 661-5625

Central East Europe, Ukraine, and the Baltics +41 52 675 3777

Central Europe & Greece +41 52 675 3777

Denmark +45 80 88 1401

Finland +41 52 675 3777

France +33 (0) 1 69 86 81 81

Germany +49 (221) 94 77 400

Hong Kong (852) 2585-6688

India (91) 80-42922600

Italy +39 (02) 25086 1

Japan 81 (3) 6714-3010

Luxembourg +44 (0) 1344 392400

Mexico, Central/South America & Caribbean 52 (55) 54247900

Middle East, Asia, and North Africa +41 52 675 3777

The Netherlands 090 02 021797

Norway 800 16098

People's Republic of China 86 (10) 6235 1230

Poland +41 52 675 3777

Portugal 80 08 12370

Republic of Korea 82 (2) 6917-5000

Russia & CIS +7 (495) 7484900

South Africa +27 11 206 8360

Spain (+34) 901 988 054

Sweden 020 08 80371

Switzerland +41 52 675 3777

Taiwan 886 (2) 2722-9622

United Kingdom & Ireland +44 (0) 1344 392400

USA 1 (800) 426-2200

For other areas contact Tektronix, Inc at: 1 (503) 627-7111

Updated 30 October 2008

For Further Information. Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology. Please visit **www.tektronix.com**

28 May 2009 37W-20383-2

Tektronix®