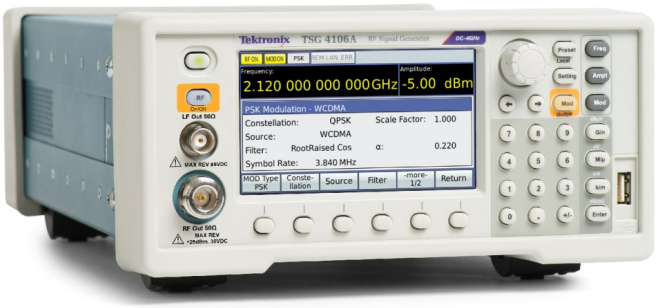
Tektronix®

RF Vector Signal Generators

TSG4100A Series



The TSG4100A Series RF Vector Signal Generator offers mid-range performance and up to 200 MHz modulation bandwidth at an entry-level RF signal generator price. They use a new technique to provide spurious free outputs with low phase noise (-113 dBc/Hz at 20 kHz offset from 1 GHz carrier) and extraordinary frequency resolution (1 µHz at any frequency). The TSG4100A Series comes standard with analog modulation. Convenient, in-field software upgrades allow for easy transition from analog to more advanced vector and digital modulation capabilities, providing the most flexible configuration and best CAPEX protection. These instruments complement other leading mid-range RF test solutions from Tektronix, such as the USB-based RSA306 Spectrum Analyzer and MDO4000B and MDO3000 Mixed Domain Oscilloscopes.

The TSG4100A Series instruments use an ovenized SC-cut oscillator (TSG410xA-M00 or E1 models) time-base, providing a 100 X improvement in stability (and a 100 X reduction in the in-close phase noise) compared to instruments that use a TCXO time-base.

Key features

- Analog and vector/digital signal generation capabilities
- Dual baseband ARB generators
- Analog modulation standard
- Soft key upgrade to vector/digital modulation at very low cost
- Digital modulation applications for GSM, EDGE, W-CDMA, APCO-25, DECT, NADC, PDC, and TETRA
- USB, GPIB, RS-232, and LAN interfaces
- 12 pounds (5.6 kg)
- 2U high and half standard rack width

Key performance specifications

- True DC to 2 GHz, 4 GHz or 6 GHz to support both analog and vector/digital signal generation
- Typical ≤±0.30 dB amplitude accuracy (0 dBm CW signal at 22 ºC) from 10 MHz to 6 GHz
- I/Q modulation inputs (400 MHz RF bandwidth)
- ASK, FSK, MSK, PSK, QAM, VSB, and custom I/Q

Analog modulation

The Tektronix TSG4100A Series RF Vector Signal Generators offer a wide variety of modulation capabilities. Modes include amplitude modulation (AM), frequency modulation (FM), phase modulation (ΦM), and pulse modulation. There is an internal modulation source as well as an external modulation input. The internal modulation source produces sine, ramp, saw, square, and noise waveforms. An external modulation signal may be applied to the rear panel modulation input. The internal modulation generator is available as an output on the rear panel.

Vector modulation

The TSG4100A Series builds on this performance by adding full support for vector signal modulation on RF carriers between 400 MHz and 6.0 GHz. It features a dual arbitrary waveform generator operating at 125 MHz for baseband signal generation. The generator has built-in support for the most common vector modulation schemes: ASK, QPSK, DQPSK, π/4 DQPSK, 8PSK, FSK, CPM, QAM (4 to 256), 8VSB, and 16VSB. It also includes built-in support for all the standard pulse shaping filters used in digital communications: raised cosine, root-raised cosine, Gaussian, rectangular, triangular, and more. Lastly, it provides direct support for the controlled injection of additive white Gaussian noise (AWGN) into the signal path.

Internal baseband generators

Using a novel architecture for I/Q modulation, the TSG4100A Series provides quick, user-friendly waveform generation. The baseband generator supports the playback of pure digital data. It automatically maps digital symbols into a selected I/Q constellation at symbol rates of up to 6 MHz and passes the result through the selected pulse shaping filter to generate a final waveform updated in real time at 125 MHz. This baseband signal is then modulated onto an RF carrier using standard IQ modulation techniques.

Digital communications protocols (GSM, GSM EDGE, W-CDMA, APCO-25, DECT, NADC, PDC, and TETRA) quickly configure the signal generator to the correct modulation type, symbol data rates, TDMA duty cycles, and digital waveform filters. The preset protocols also configure the rear-panel TDMA, START of FRAME, and SYMBOL CLOCK digital outputs. The baseband generators can be configured for these protocols without the use of external computers or third party software.

The I/Q waveforms are computed in real time. Symbols are mapped to constellations, digitally filtered, and up-sampled to 125 Msps to drive the I/Q modulator via dual 14-bit DACs. The symbols can be a fixed pattern, PRBS data from an internal source, or come from a downloaded user list of up to 16 Mbits.

The constellation mapping can be modified by the user. Digital filters include raised cosine, root raised cosine, Gaussian, rectangular, linear, sinc, and user-defined FIR.

External IQ modulation

The rear-panel BNC I/Q modulation inputs and outputs enable arbitrary vector modulation via an external source. The external signal path supports maximally 400 MHz of RF bandwidth with a full scale range of ±0.5 V and a 50 Ω input impedance.

Power vs. frequency

All TSG4100A Series models have cascaded stages of amplifiers and digital attenuators to drive the RF output. Five stages can provide up to +25 dB of gain to -130 dB of attenuation in 156 digitally controlled steps. During factory calibration, the output power is measured at 32 frequencies per octave for each of the 156 attenuator steps to populate a memory matrix with about 40,000 elements. When set to a particular frequency and power, the instrument interpolates between these matrix elements to determine the best attenuator setting. An analog attenuator is used to provide 0.01 dB resolution between matrix elements and to compensate for residual thermal effects.

OCXO time-base

These instruments offer an oven-controlled crystal oscillator (OCXO) time-base. The time-base uses a third-overtone stress-compensated 10 MHz resonator in a thermostatically controlled oven. The time-base provides very low phase noise and very low aging.

Easy remote communications

Remote operation is supported with RS-232, LAN, and GPIB interfaces. All instrument functions can be controlled and read over any of the interfaces. Up to nine instrument configurations can be saved in non-volatile memory.

Specifications

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

Frequency

BNC output, all models	DC to 62.5 MHz
N-type outputs	
TSG4102A	950 kHz to 2.0 GHz
TSG4104A	950 kHz to 4.0 GHz
TSG4106A	950 kHz to 6.0 GHz
Frequency resolution	1 µHz at any frequency
Switching speed	<8 ms (to within 1 ppm)
Frequency error	$<(10^{-18}$ + time-base error) × fc
Frequency stability	1×10^{-11} (1 s Allan variance)

Front panel BNC output

Frequency range	DC to 62.5 MHz
Amplitude	1.00 V_{RMS} to 0.001 V_{RMS} (-47 dBm to +14.96 dBm)
Offset	±1.5 VDC
Offset resolution	5 mV
Maximum excursion	1.817 V (amplitude + offset)
Amplitude resolution	<1 %
Amplitude accuracy	±0.7 dB
Harmonics, typical	<–40 dBc
Spurious, typical	<–65 dBc
Output coupling	DC, 50 Ω ±2%
Impedance	50 Ω
Reverse protection	±5 VDC
VSWR, typical	< 1.6 :1

Front panel N-type output

Power output

TSG4102A	+16.5 dBm to –110 dBm
TSG4104A	+16.5 dBm to –110 dBm (<3 GHz)
TSG4106A	+16.5 dBm to –110 dBm (<4 GHz) +10 dBm to –110 dBm (4-6 GHz)

Voltage output

TSG4102A	1.5 V_{RMS} to 0.7V_{RMS}
TSG4104A	1.5 V_{RMS} to 0.7 μV_{RMS} (<3 GHz)
TSG4106A	1.5 V_{RMS} to 0.7 μV_{RMS} (<4 GHz)

Amplitude resolution 0.01 dBm

Amplitude accuracy

CW, 50 Ω load (dB, typical)

CW, 18 °C to 28 °C	>10 dBm	10 to -30 dBm	-30 to -60 dBm	-60 to -100 dBm	<-100 dBm
10 MHz to 0.1 GHz	±0.2	±0.25	±0.35	±0.45	±0.6
0.1 GHz to 2 GHz	±0.15	±0.15	±0.25	±0.35	±0.6
2 GHz to 4 GHz	±0.3	±0.2	±0.35	±0.6	±0.8
4 GHz to 6 GHz	NA	±0.3	±0.4	±0.75	±1.25

CW, 50 Ω load (dB, max)

Level range:	+5 to -30 dBm (max)		+5 to -30 dBm (typical)
Temperature:	**18 °C to 28 °C**	**5 °C to 40 °C**	**5 °C to 40 °C**
10 MHz to 0.1 GHz	±0.6	±1.0	±0.7
0.1 GHz to 2 GHz	±0.6	±1.0	±0.6
2 GHz to 4 GHz	±0.6	±1.0	±0.7
4 GHz to 6 GHz	±1	±1.5	±0.9

Impedance 50 Ω

Output coupling AC, 50 Ω

VSWR, typical

<1.5 (2 MHz to 2 GHz)

<1.8 (2 GHz to 6 GHz)

Reverse protection 30 VDC, +25 dBm

IQ modulation output level accuracy

Output amplitude is -5 dBm.

Temperature:	18 °C to 28 °C		5 °C to 40 °C
Fc:	**Typical (dB)**	**Max (dB)**	**Typical (dB)**
<2 GHz	±0.1	±0.4	±0.4
2 GHz to 4 GHz	±0.2	±0.6	±0.4
4 GHz to 6 GHz	±0.4	±0.8	±0.7

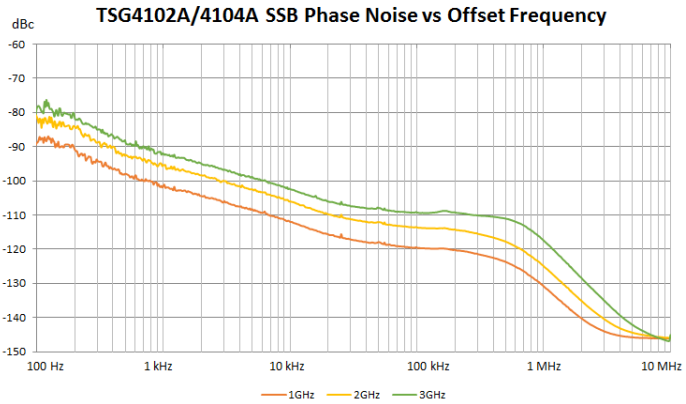
Spectral purity of the RF output

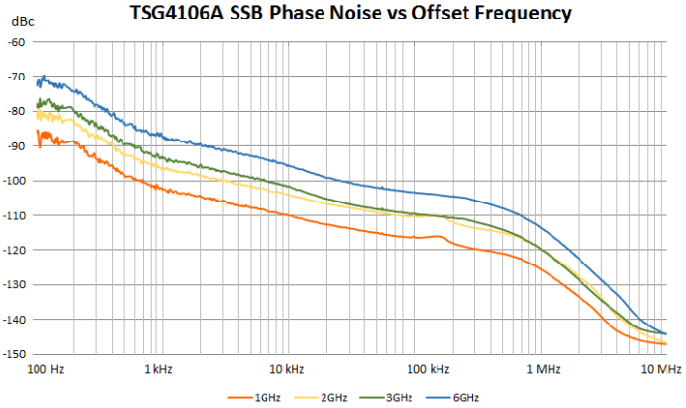
Subharmonics	None
Harmonics, maximum	Output level <0 dBm, 1 GHz CW signal
TSG4102A and TSG4104A	< -38 dBc
TSG4106A	< -30 dBc
Harmonics, typical (output level < 0 dBm)	< -35 dBc, CW , Fc < 2 GHz
Spurious (typical)	Output level -10 dBm, CW
< -68 dBc	>10 kHz from carrier in 950 kHz to 1 GHz
< -60 dBc	>10 kHz from carrier in 1 GHz to 2 GHz
< -55 dBc	>10 kHz from carrier in 2 GHz to 4 GHz
< -55 dBc	>10 kHz from carrier in 4 GHz to 6 GHz
Residual FM, typical	1 Hz rms (300 Hz to 3 kHz bandwidth)
Residual AM, typical	0.006 % rms (300 Hz to 3 kHz bandwidth)
SSB phase noise	Output level is +5 dBm at 18 °C to 28 °C.

Carrier	Offset from carrier, typical (dBc/Hz)			
	1 kHz	10 kHz	20 kHz	1 MHz
1 GHz	-102	-110	-113	-124
2 GHz	-96	-104	-107	-118
3 GHz	-93	-102	-105	-120
6 GHz	-87	-96	-99	-114

SSB phase noise at 1 GHz carrier, maximum (output level +5 dBm, 5 ℃ to 40 ℃)	
1 kHz offset	–95 dBc/Hz
10 kHz offset	–106 dBc/Hz
20 kHz offset	–107 dBc/Hz
1 MHz offset	–120 dBc/Hz
2 GHz offset	–118 dBc/Hz
>3 GHz offset	–120 dBc/Hz

Spectral purity of the RF output





Phase setting (front panel outputs)

Maximum phase step	±360°
Phase resolution	0.01° (DC to 100 MHz) 0.1° (100 MHz to 1 GHz) 1.0° (1 GHz to 6 GHz)

OCXO time-base (Option M00 or Option E1)

Oscillator type	Oven-controlled, 3rd OT, SC-cut crystal
Initial accuracy at calibration (20 minute warm-up, at 18 °C to 28 °C)	<±0.02 ppm
Temperature drift (0 °C to 40 °C)	<±0.003 ppm
Aging	<±0.05 ppm/year

VCXO time base (Option M01)

Initial accuracy at calibration (20 minute warm-up, at 18 ºC to 28 ºC)	<±0.5 ppm
Temperature drift (0 ºC to 40 ºC)	<±5.0 ppm
Aging	<±3.0 ppm/year

Time-base input

Frequency	10 MHz, ±2 ppm
Amplitude	0.5 V_{P-P} to 4 V_{P-P} (–2 dBm to +16 dBm)
Input impedance	50 Ω, AC coupled

Time-base output

Frequency	10 MHz, sine
Source	50 Ω, DC transformer coupled
Amplitude	>7.5 dBm

Internal modulation source

Waveforms	Sine, ramp, saw, square, pulse, noise
Sine THD	–74 dBc (typical at 20 kHz)
Ramp linearity	<0.05 % (1 kHz)
Rate	
TSG4102A and TSG4104A	1 µHz to 500 kHz: < 62.5 MHz CF
	1 µHz to 50 kHz: ≥62.5 MHz
TSG4106A	1 µHz to 500 kHz: < 93.75 MHz CF
	1 µHz to 50 kHz: ≥93.75 MHz
Rate resolution	1 µHz
Rate error	$1:2^{31}$ + time-base error
Noise function	White Gaussian noise (rms = dev / 5)
Noise bandwidth	1 µHz < ENBW < 50 kHz
Pulse generator period	1 µs to 10 s
Pulse generator width	100 ns to 9999.9999 ms
Pulse timing resolution	5 ns
Pulse noise function	Length 2^N-1 PRBS 5 ≤ N ≤ 32, bit period 100 nS to 10 S

Analog modulation output

Connector type	BNC (rear panel)
Impedance	50 Ω
Function	AM, FM, ΦM, Pulse
Scale factor	±1 V for ± full deviation
Pulse/Blank	Low = 0 V Hi = 3.3 V

External analog modulation input

Connector type	BNC (rear panel)
Impedance	100 kΩ
Function	AM, FM, ΦM, Pulse
Scale factor	±1 V for ± full deviation
Pulse/Blank	Low = 0 V Hi = 3.3 V
Input coupling	DC or 4 Hz High-pass
Pulse Threshold	+1 VDC
Input Offset	< 500 µV

Amplitude modulation

Range	0 to 100% (decreases above +7 dBm)
Resolution	0.1%
Modulation source	Internal or external
Modulation distortion, typical	
BNC output	<1 % (fc < 62.5 MHz, fm = 1 kHz)
N-type output	<3 % (fc > 62.5 MHz, fm = 1 kHz)
Modulation bandwidth (external)	>100 kHz

Frequency modulation

Minimum frequency deviation 0.01 Hz

Maximum frequency deviation

TSG4102A and TSG4104A Smaller of fc and 64 MHz – fc. In 0 to 62.5 MHz

Frequency range	Maximum deviation
62.5 MHz < fc ≤ 126.5625 MHz	1 MHz
126.5625 MHz < fc ≤253.1250 MHz	2 MHz
253.1250 MHz < fc ≤ 506.25 MHz	4 MHz
506.25 MHz < fc ≤ 1.0125 GHz	8 MHz
1.0125 GHz < fc ≤ 2.0 GHz	16 MHz
2.025 GHz < fc ≤ 4.0 GHz (TSG4104A)	32 MHz

TSG4106A Smaller of fc and 96 MHz – fc. In 0 to 93.75 MHz

Frequency range	Maximum deviation
93.75 MHz < fc ≤ 189.84375 MHz	1 MHz
189.84375 MHz < fc ≤ 379.6875 MHz	2 MHz
379.6875 MHz< fc ≤ 759.375 MHz	4 MHz
759.375 MHz < fc ≤ 1.51875 GHz	8 MHz
1.51875 GHz < fc ≤ 3.0375 GHz	16 MHz
3.0375 GHz < fc ≤ 6.0 GHz	32 MHz

Deviation resolution 0.1 Hz

Deviation accuracy, typical

TSG4102A and TSG4104A < 0.1% of selected deviation + 5 Hz (fc < 62.5 MHz)

< 2% of selected deviation + 20 Hz (fc > 62.5 MHz)

TSG4106A < 0.1% of selected deviation + 5 Hz (fc < 93.75 MHz)

< 2% of selected deviation + 20 Hz (fc > 93.75 MHz)

Modulation source Internal or external

Modulation distortion, typical < -60 dB (fc=100 MHz, fm=1 KHz, fd= 3 KHz)

External FM carrier offset, typical < ±0.001 X FM deviation

Modulation bandwidth, typical

TSG4102A and TSG4104A 500 kHz (fc < 62.5 MHz)

100 kHz (fc > 62.5 MHz)

TSG4106A 500 kHz (fc < 93.75 MHz)

100 kHz (fc > 93.75 MHz)

Phase modulation

Deviation	0º to 360º
Deviation resolution, typical	0.01º (DC to 100 MHz) 0.1º (100 MHz to 1 GHz) 1º (1 GHz and above)
Deviation accuracy, typical	
TSG4102A and TSG4104A	2% (fc < 62.5 MHz) 3% (fc > 62.5 MHz)
TSG4106A	2% (fc < 93.75 MHz) 3% (fc > 93.75 MHz)
Modulation source	Internal or external
Modulation distortion, typical	< -60 dB (fc = 100 MHz, fm =1 kHz, ΦD = 50º)
Modulation bandwidth, typical	
TSG4102A and TSG4104A	500 kHz (fc < 62.5 MHz) 100 kHz (fc > 62.5 MHz)
TSG4106A	500 kHz (fc < 93.75 MHz) 100 kHz (fc > 93.75 MHz)

Pulse modulation

Pulse mode	Logic High turns RF output ON
On-Off ratio, typical	
BNC output	> 70 dB
Type-N output	> 57 dB (fc < 1.0 GHz) > 40 dB (1.0 GHz ≤ fc < 4.0 GHz) > 35 dB (4.0 GHz ≤ fc < 6.0 GHz)
Pulse feed-through, typical	10% of carrier for 20 ns at turn on
Turn On-Off delay	60 ns
RF Rise-Fall time, typical	20 ns
Modulation source	Internal or external pulse

Interface connectors

USB	USB 2.0, host
Ethernet (LAN)	10/100 Base-T.TCP/IP and DHCP default
GPIB	IEEE488.2
RS-232	4800 to 115,200 baud, RTS/CTS flow

External I/Q modulation (Option EIQ)

Carrier frequency range	400 MHz to 2.0 GHz (TSG4102A) 400 MHz to 4.0 GHz (TSG4104A) 400 MHz to 6.0 GHz (TSG4106A)
I/Q inputs (rear panel)	50 Ω, ±0.5 V
I/Q full scale input	$(I^2 + Q^2)^{1/2} = 0.5$ V
Modulation bandwidth	max 400 MHz RF bandwidth
I or Q input offset	<500 µV
Carrier suppression	> -45 dBc for fc ≤ 3 GHz > -40 dBc for 3 GHz < fc ≤ 5 GHz > -35 dBc for fc > 5 GHz
I and Q baseband modulation bandwidth (3 dB from fc)	> 200 MHz (fc < 2.5 GHz, RF BW >400 MHz) > 150 MHz (fc > 2.5 GHz, RF BW >300 MHz)

Dual baseband generator (Option VM00)

Channels	2 (I and Q)
DAC data format	Dual 14-bit at 125 MS/s
Reconstruction filter	10 MHz, 3rd order Bessel LPF
Arbitrary symbol memory	Up to 16 Mbits
Symbol rate	1 Hz to 6 MHz (1 µHz resolution)
Symbol length	1 to 9 bits (maps to constellation)
Symbol mapping	Default or user-defined constellation
Symbol source (User-defined symbols, built-in PRBS generator, or settable pattern generator)	
PRBS length	2n – 1 (5 < n < 32; 31 to about 4.3×10^9 symbols)
Pattern generator	16 bits

Dual baseband generator (Option VM00)

Digital filtering

Filter type	Raised Cosine, Root Raised Cosine, Gaussian, Rectangular, Linear, Sinc, linearized Gaussian, C4FM, customized FIR
Filter length	24 symbols

Noise impairments

Additive noise	White, Gaussian
Level	–70 dBc to –10 dBc

Basic vector modulation formats (Option VM00)

Formats by bit

Constellation	1-bit	2-bit	3-bit	4-bit	5-bit	6-bit	8-bit
ASK	2ASK	4ASK	8ASK	16ASK			
FSK	BFSK	4FSK	8FSK	16FSK			
PSK	BPSK	QPSK	8PSK	16PSK			
QAM	n/a	4QAM	n/a	16QAM	32QAM	64QAM	256QAM
CPM	BCPM	4CPM	8CPM	16CPM			
VSB	n/a	n/a	8VSB	16VSB			

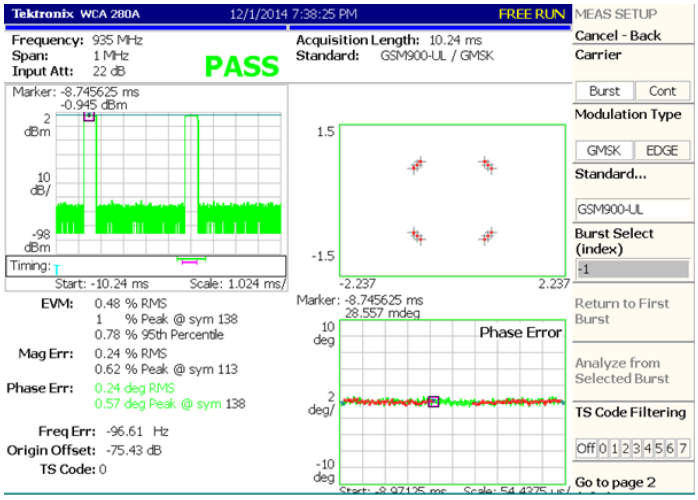
Others OQPSK, DQPSK, π/4DQPSK, 3π/8 8 PSK

Digital modulation applications (typical)

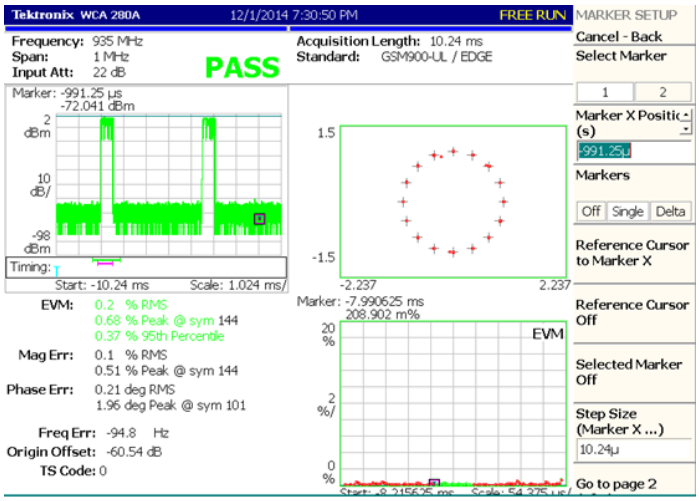
Digital modulation applications options

Option	Application
VM01	GSM
VM02	GSM-EDGE
VM03	W-CDMA
VM04	APCO-25 Phase 1
VM05	DECT
VM06	NADC
VM07	PDC
VM08	TETRA
VM10	Audio clip (analog AM and FM)

Option VM01 GSM, (GMSK, 270.833 kS/s, 935 MHz, 0 dBm), RMS EVM: 0.6%

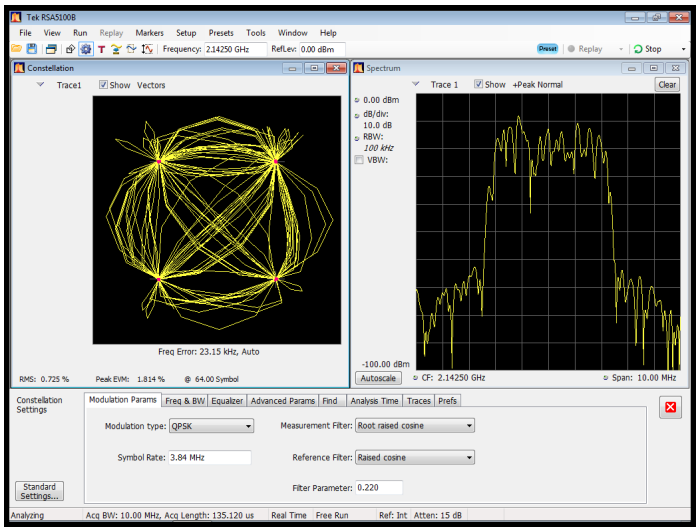


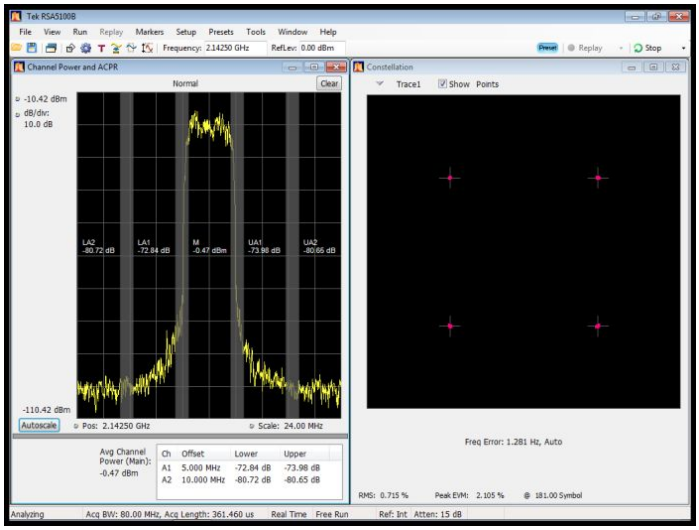
Option VM02 GSM-EDGE, (3π/8 8PSK, 270.833 kS/s, 935 MHz, 0 dBm), RMS EVM: 0.30%



Digital modulation applications (typical)

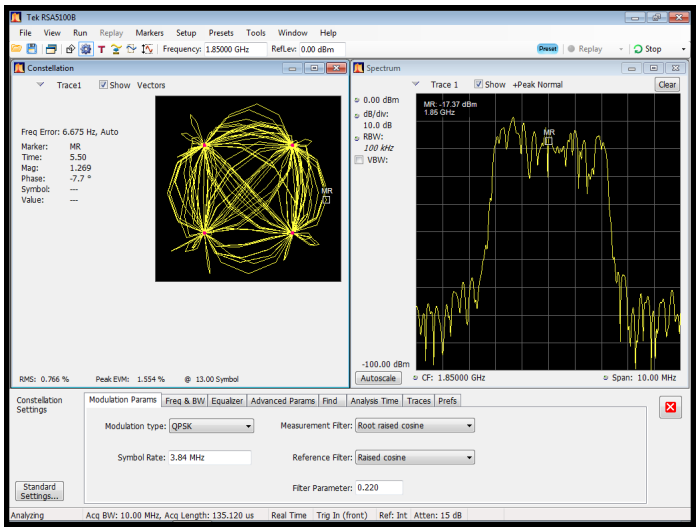
Option VM03 W-CDMA, (QPSK,3.840Mcps, 2.1425GHz, 0dBm), RMS EVM: 1.7%

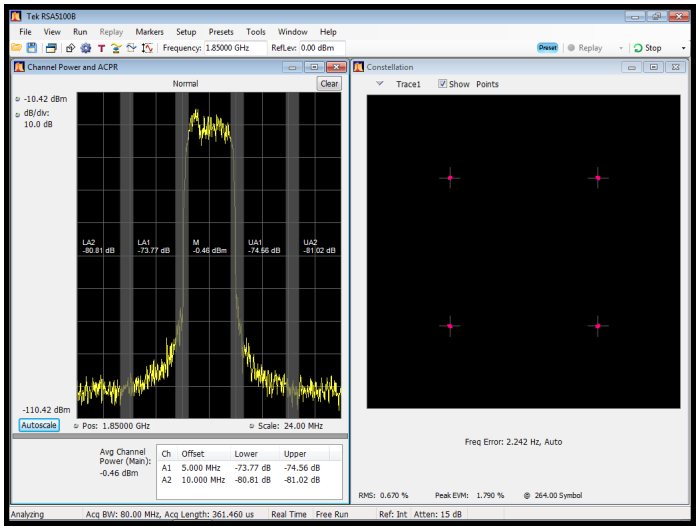




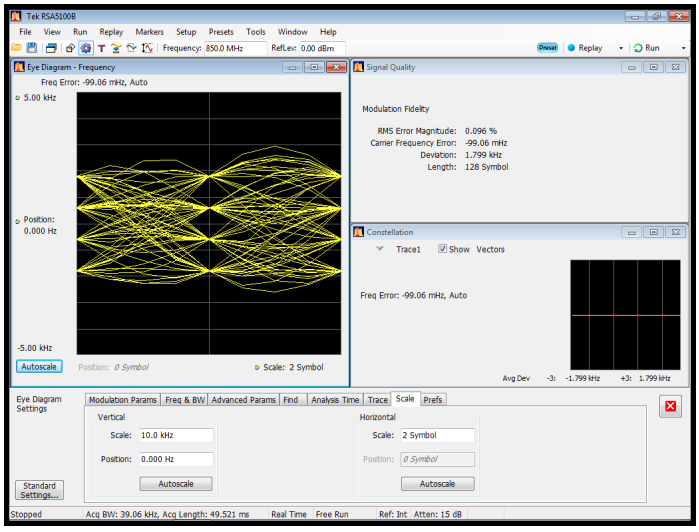
Digital modulation applications (typical)

Option VM03 W-CDMA (QPSK,3.840Mcps, 1.85 GHz, 0dBm), RMS EVM: 1.7%



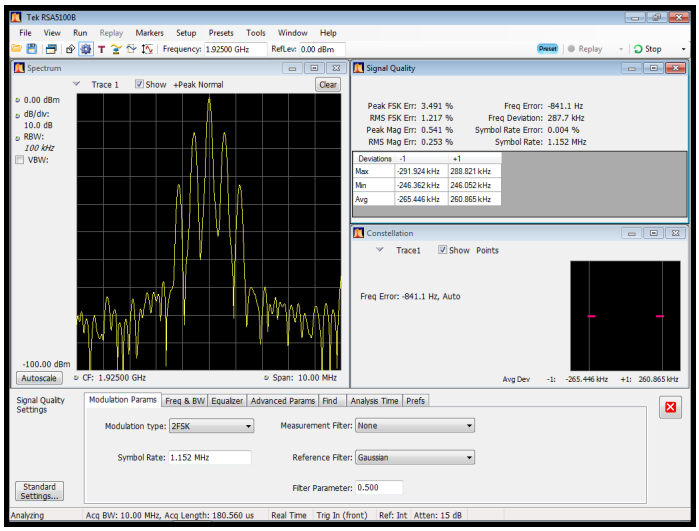


Option VM04 APCO-25, (4FSK-C4FM, 4.8 kS/s,850 MHz, 0 dBm), Freq Err: 0.5%

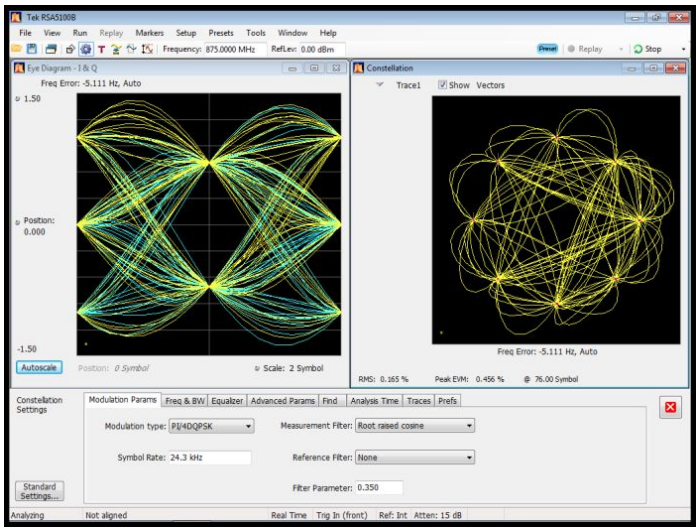


Digital modulation applications (typical)

Option VM05 DECT, (2FSK 1.152 Mbps,1.925 GHz, 0 dBm), RMS FSK Err: 1.5%

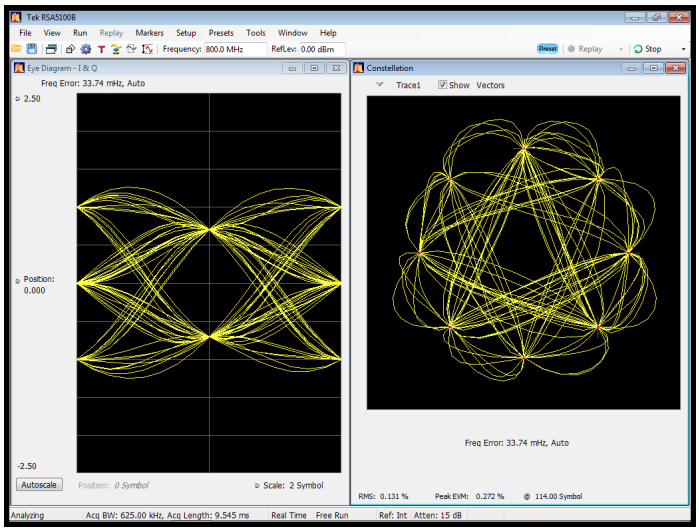


Option VM06 NADC, (π/4 DQPSK, 24.3 kS/s, 875 MHz, 0 dBm), RMS EVM: 0.3%

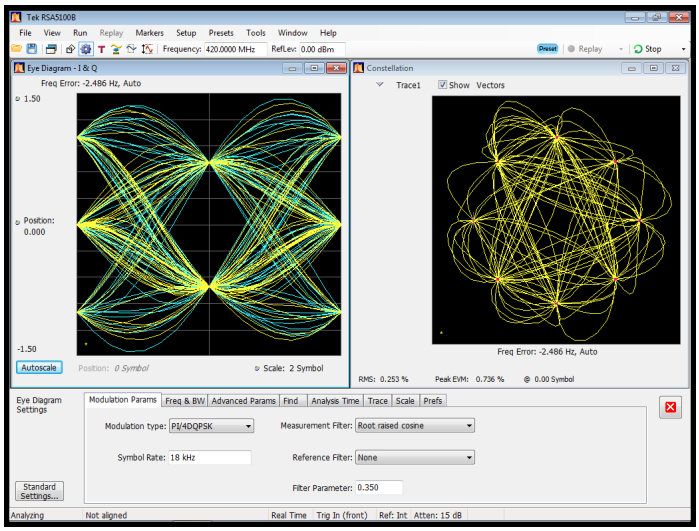


Digital modulation applications (typical)

Option VM07 PDC, (π/4 DQPSK, 21 kS/s, 800 MHz, 0 dBm), RMS EVM: 0.6%

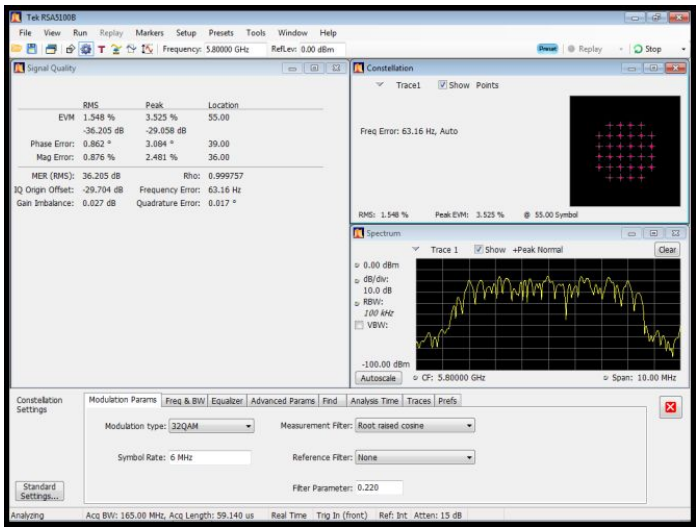


Option VM08 TETRA, (π/4 DQPSK,18 kS/s, 420 MHz, 0 dBm), RMS EVM: 0.7%

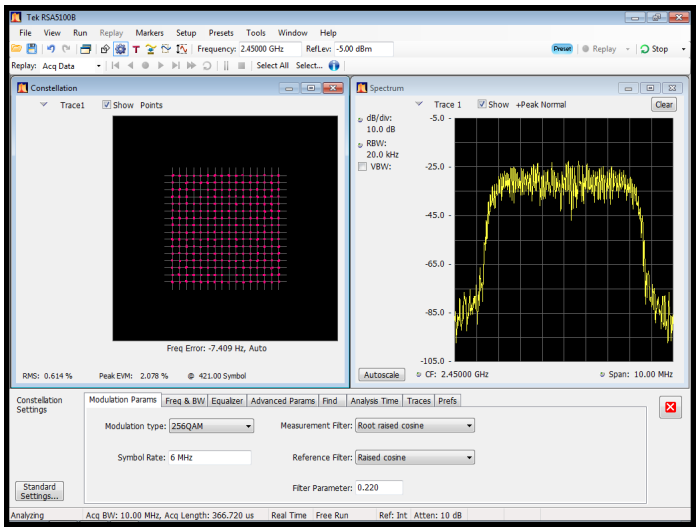


Digital modulation applications (typical)

32QAM, (6 MS/s, 5.8 GHz, Root raised cosine filter, 0 dBm), RMS EVM: 1.6%



256QAM, (6 MS/s, 2.45 GHz, Root raised cosine filter, 0 dBm), RMS EVM: 1.1%



TSG4100A-ATT Option

Nominal impedance	50 Ω
Nominal attenuation	30 dB
Frequency range	DC to 6 GHz
Attenuation deviation	±0.75 dB (DC to 6 GHz)
Maximum VSWR	1.15 (DC to 4 GHz) 1.2 (4 GHz to 6 GHz)
Power rating	5 Watt average power up to 25 ˚C ambient temperature, linearly derated to 1 Watt at 125 ˚C ambient temperature.
Weight	0.052 kg

TSG4100A-ATT Option

Operating temperature	-65 °C to 125 °C
Compliance	2011/65/EU (RoHS) compliant

Rear-panel markers

Type	Symbol Clock, Data Frame, TDMA, and user-defined
Amplitude	0.5 to 4 V_{pp} (–2 dBm to +16 dBm)
Output impedance	50 Ω, AC coupled

Physical characteristics

Dimensions

Height	114 mm (4.5 in)
Width	216 mm (8.5 in)
Depth	347 mm (13.7 in)
Weight	5.4 kg (12 lbs)

Operating characteristics

Temperature

Operating	+5 °C to +40 °C
Non-operating	-20 °C to +60 °C

Humidity

Operating	Non-operating
5% to 95% relative humidity (%RH) at up to +30 °C	5% to 95% RH (Relative Humidity) at up to +30 °C
5% to 45% RH above +30 °C up to +40 °C, non-condensing	5% to 45% RH above +30 °C up to +40 °C, non-condensing

Altitude

Operating	Up to 3,000 m
Non-operating	Up to 12,000 m

Line power <90 W, 90 to 264 VAC, 47 to 63 Hz with PFC

Vibration and shock

Random vibration

Operating	Non-operating
0.27 GRMS, 5 500 Hz, 10 minutes per axis, 3 axes (30 minutes total for Option M01)	2.28 GRMS, 5 500 Hz, 10 minutes per axis, 3 axes (30 minutes total for Option M01)
0.22 GRMS, 5 500 Hz, 10 minutes per axis, 3 axes (30 minutes total for Options M00 or E1)	2.13 GRMS, 5 500 Hz, 10 minutes per axis, 3 axes (30 minutes total for Options M00 or E1)

Mechanical shock

Non-operating
Half-sine mechanical shocks, 50 g peak amplitude, 11 msec duration, 3 drops in each direction of each axis (18 total for Option M01)
Half-sine mechanical shocks, 30 g peak amplitude, 11 msec duration, 3 drops in each direction of each axis (18 total for Options M00 or E1)

Regulatory information

EC Declaration of Conformity - EMC

EMC Directive 2004/108/EC	EN 61326-1
Radiated and Conducted emissions	Class A
Australia/New Zealand	Australia Radio Communications Act 1992
Korea	KCC

Safety

Third Party Certification Standards	UL 61010; CSA C22.2 No. 61010-1
EC Declaration of Conformity - Low Voltage	Low Voltage Directive 2006/95/EC; EN61010-1

Safety Certification Compliance

Equipment type:	Test and measuring
Safety class:	Class 1 - grounded product
Pollution degree:	2 (as defined in IEC61010-1)
Rated for indoor use only.	

Ordering information

Models

For each of the basic models, there are three required but exclusive model options that need to be specified at the time of order: M00, M01, and E1. Pricing varies based on chosen option. See the Instrument Options section for details.

TSG4102A	Analog signal generator with 2 GHz frequency coverage, basic model
TSG4104A	Analog signal generator with 4 GHz frequency coverage, basic model
TSG4106A	Analog signal generator with 6 GHz frequency coverage, basic model

Standard accessories

Accessory	Description
RF cable	1 meter, N-type to N-type RF cable
Documentation CD	All instrument models ship with a CD containing PDF files of user manuals in all available languages.
Installation and Safety Instructions	All instrument models ship with a printed Installation and Safety Instructions manual (multi-language: English and Russian).
Calibration	Statement of Calibration
Power cord	Country specific (see Power cord options)

Warranty

Three years

Instrument options

Hardware options (All regions except North America)

Options M00 or M01 must be specified at the time of instrument order.

M00	Instrument with oven-controlled crystal oscillator (OCXO)
M01	Instrument with voltage-controlled crystal oscillator (VCXO)
GPIB	Adds GPIB interface

Hardware options (North America only)

Option E1 must be specified at the time of instrument order.

E1	Instrument with oven-controlled crystal oscillator (OCXO) time-base and GPIB interface

Hardware options (All regions)

TSG4100A-RM1	Single rack mount kit (can be ordered separately)
TSG4100A-RM2	Dual rack mount kit (can be ordered separately)
TSG4100A-ATT	30 dB, 5 W RF attenuator up to 6 GHz
D1	A list of performance verification test results

Software options

To upgrade to vector/digital modulation capability and/or add more modulation options after initial purchase, order "TSG4100A-UP + VM xx" instead of "TSG410xA VMxx".

VM00	Basic vector modulation package with internal 6 MHz modulation bandwidth
VM01	GSM modulation (requires Option VM00)
VM02	GSM EDGE modulation (requires Option VM00)
VM03	W-CDMA modulation (requires Option VM00)
VM04	APCO-25 modulation (requires Option VM00)
VM05	DECT modulation (requires Option VM00)
VM06	NADC modulation (requires Option VM00)
VM07	PDC modulation (requires Option VM00)
VM08	TETRA modulation (requires Option VM00)
VM10	Audio Clip (analog AM and FM)
EIQ	External 200 MHz modulation bandwidth (requires Option VM00)

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. 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

Request the option below if you would like to order a printed verison of the English User Manual. (An electronic version of this manual is provided as a PDF on the CD that shipped with your instrument and is also available for download from the Tektronix Web site.)

Opt. L0	English manual

Service options

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

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

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

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

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

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