Giga-tronics

Technical Datasheet

2500 Series RF/Microwave Signal Generator

100 kHz to 40 GHz

Low Offset Phase Noise and Fast Switching Speed in a Single Unit

GT-1001-Rev. E / US080616

2500A/2500AS Series
Performance Line RF & Microwave Synthesizer/Signal Generator

Signal Generator Frequency Range

The 2500 Series signal generators are offered in two different configurations designed for bench top and ATE applications covering 100 kHz to 8 GHz, 20 GHz, 26.5 GHz, and 40 GHz with frequency resolution of 0.001 Hz. The four models covering the frequency range from 100 kHz to 40 GHz are:

Model Number	Frequency Range
2508A/2508AS	100 kHz - 8 GHz
2520A/2520AS	100 kHz - 20 GHz
2526A/2526AS	100 kHz - 26.5 GHz
2540A/2540AS	100 kHz - 40 GHz

Available Options and Accessories

Option	Description
17A	Delete Modulation Suite
17B	Delete Internal Modulation
18	Delete 100 kHz to 2 GHz
23	Type N Connector (2520 Series only)
26	Delete Step Attenuator
31	2 msec. Switching Speed Limit/Pulse Width
44	Delete Front Panel, 2500AS series only
46	Rack Slide Kit
55A	Hewlett Packard 8370 Command Set
55B	Hewlett Packard 8340 Command Set
55C	Hewlett Packard 8673C/D Command Set
55D	Hewlett Packard 8663A Command Set
55E	Systron Donner Command Set
55F	Wavetek 90X Command Set
55G	Hewlett Packard 8350 Command Set
55H	Hewlett Packard 8360 Command Set

Advanced Synthesizer Technology

The 2500 Series signal generator utilizes Giga-tronics' new Accumulator High Frequency Feedback (AHFF™) patented technology that delivers an excellent close in phase noise performance of -81 dBc @ 100 Hz and -104 dBc @ 1kHz offset and an ultra low phase noise performance of -110 dBc @ 10 kHz and 100 kHz offset on a 10 GHz carrier frequency.

High Precision Power Output

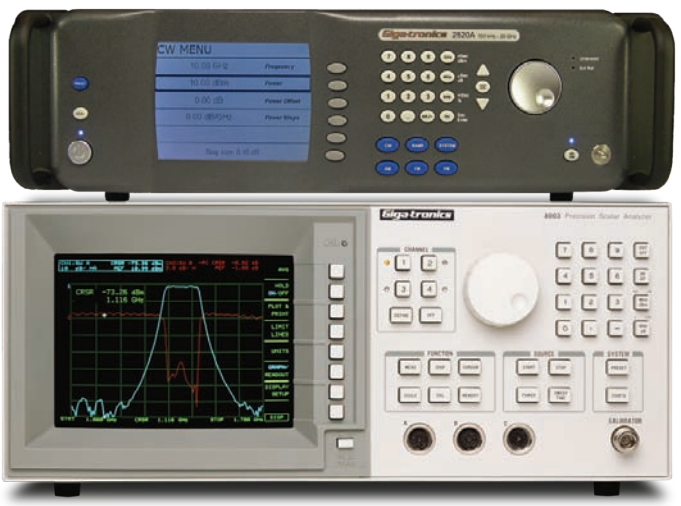
The 2500 Series signal generator, with standard high output power exceeding +20 dBm to 20 GHz, eliminates the need to use an external power amplifier and makes it ideal for measurements where low harmonics and high drive conditions are required. In addition, the unit comes loaded with a programmable step attenuator that, along with high precision frequency compensated automatic level control (ALC), gives a dynamic range from +20 dBm to -110 dBm.

High Stability Time Base and Low Residual Phase Noise

A standard ovenized OCXO oscillator in the 2500 Series signal generator offers a high stability time base to satisfy most stringent requirements in terms of time base aging and accuracy. Furthermore, the 2500 accepts both a 10 MHz and 100 MHz external reference that automatically disconnects the internal 10 MHz OCXO reference and phase locks it with the internal 100 MHz OCXO reference. In addition, the ability to share a reference frequency between two sources at 100 MHz rather than 10 MHz leads to much greater stability (time and temperature) and lower residual phase noise performance.

Digital High Rate Sweep Modes

The 2500 Series is loaded with digital high rate sweep modes that allow the output frequency to sweep linearly between a pre-determined start and stop frequency. In addition, the 2500 Series signal generator interfaces seamlessly with the Giga-tronics 8003 Precision Scalar Analyzer for swept stimulus/response measurements such as gain, isolation, and return loss of components such as amplifiers, isolators/circulators, filters, converters etc.



Faster to Program

Every 2500 Series microwave synthesizer/signal generator comes with Giga-tronics Automation Xpress, a PC based software package designed for enhanced user interface and automatic test systems. Automation Xpress leverages industry leading software applications, familiar Windows drop-down menus, and other functions to perform tasks. Using Windows-based applications, such as Microsoft™ Excel or Notepad, engineers can create, manage, and download complex lists in seconds.

Fast Frequency Switching

The fast frequency switching of the Giga-tronics 2500 Series microwave synthesizer pays dividends in any test environment where large amounts of data are collected. Regardless of the complexity of your application, such as antenna characterization or RFIC testing, the 2500 Series will quickly prove itself as your best test investment by providing settling time for amplitude and frequency of < 500 µsec at ΔF_0 = 500 MHz.[1]

Compatibility

The 2500 Series unit has full command compatibility with the 2400 Series and previous generation signal generators from Giga-tronics. In addition, Giga-tronics offers optional command sets for the legacy signal generators offered by other manufacturers allowing customers to replace all the legacy signal generators with a single unit from Giga-tronics.

Automation Xpress Interface

The 2500 Series microwave synthesizer offers unmatched frequency and power switching in list mode. However, this approach may not be suitable in many remote programming situations. For these cases, Automation Xpress offers fast remote operation that goes beyond just fast frequency switching. Automation Xpress, combined with the Automation Xpress interface option, ensures unmatched **2.0 msec CW frequency and power switching performance**, providing fast and flexible data exchange rates for faster testing and more device throughput.

All Performance Features are Standard

The 2500 Series comes loaded with standard performance features such as high time base stability, full analog modulation suite (AM, FM, and Pulse Modulation), step attenuator, extended frequency range down to 100 kHz and high leveled output power.

Simpler to Operate

The 2500 Series is designed to streamline user navigation by moving complex testing functions from the front panel to the desktop PC. The result is a ground breaking system that reduces training time, speeds workflow, and dramatically boosts end-user productivity. To enhance user navigation, we minimized the number of soft screens and menu layers, simplifying content and improving operational performance. That means you will spend less time scrolling through data menus and more time getting your work done.

Two Year Calibration Cycle

A two-year calibration cycle significantly reduces your calibration downtime.

Optimized for ATE

With the 2500AS Series, ATE integrators now have a system source specifically designed to match their unique performance needs. The 2500AS Series works seamlessly with other instruments. It includes hardware triggering and synchronization signals with programmable delays to allow coordination with other test products in your system. Replacing other industry-standard microwave synthesizers can also be accommodated, making the 2500AS Series an ideal choice for upgrading older systems.

[1] $\Delta F_0 = | (F_{stop} \times N_{stop}) - (F_{start} \times N_{start}) |$ - See Frequency Bands Table for N values.

2500A/2500AS Series
Technical Specifications

Frequency

Range	**2508A/AS**	100 kHz to 8 GHz
	2520A/AS	100 kHz to 20 GHz
	2526A/AS	100 kHz to 26.5 GHz
	2540A/AS	100 kHz to 40 GHz
Frequency Resolution	0.001 Hz	
Power Slope	0 to 0.5 dB/GHz	

Frequency Stability

Internal Reference Output	**10 MHz**	A 2 Vp-p square wave reference output signal into 50Ω
	100 MHz	typ. +5 dBm AC coupled reference output signal into 50Ω
Aging Rate (After 30 days warm period)	$< 5 \times 10^{-10}$/day (10 MHz)	
Temperature Stability (Over operating temperature range of 0°C to +55°C after 30 days warm period)	$< 2.5 \times 10^{-8}$/ °C (10 MHz)	
External Reference Frequency Input	**Frequency**	10 MHz or 100 MHz
	Frequency Deviation	± 1 ppm
	Recommended Input Level	> -5 dBm into 50Ω for 10 MHz
		> +5 dBm to < +8 dBm into 50Ω for 100 MHz
Reference Tuning	**Voltage Range**	0 to 10V
	Sensitivity	0.25 V/GHz, 20-40 GHz
		0.50 V/GHz, 0.01 - 20 GHz
Lock/Level Indicator (CW Mode Only)	Sync Out = +5 V (TTL High)	

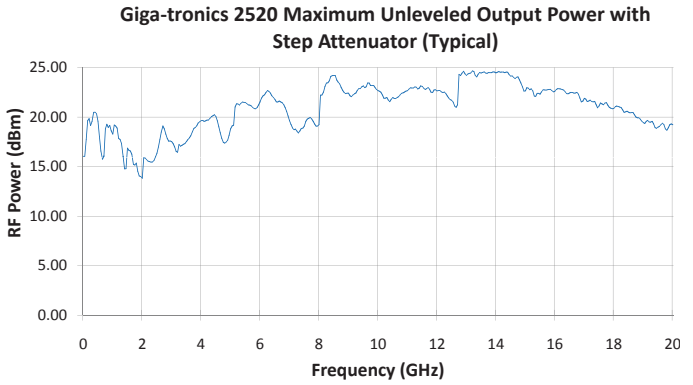
Frequency Bands

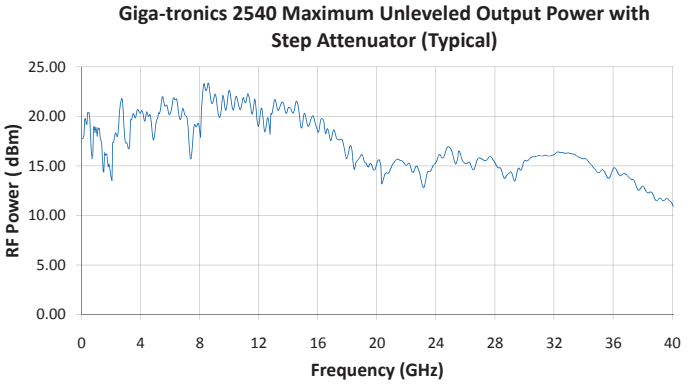
Band	Frequency	N
0	0.1-9.99 MHz	N/A
1	10.00-16.00 MHz	512
2	16.01-31.00 MHz	256
3	31.01-63.00 MHz	128
4	63.01-125.00 MHz	64
5	125.01-250.00 MHz	32
6	250.01-500.00 MHz	16
7	500.01-1000.00 MHz	8
8	1.01-2.00 GHz	4
9	2.01-4.00 GHz	2
10	4.01-10.1 GHz	1
11	10.11-20.20 GHz	1/2
12	20.21-40.00 GHz	1/4

Maximum Leveled Output Power

(Specification applies over 0 to 35°C range and degrades <2.0 dB from 35°C to 55°C)

Model	0.1-10 MHz (w/ Step Attenuator)	0.01-2 GHz (w/ Step Attenuator)	2-8 GHz (w/ Step Attenuator)	8-20 GHz (w/ Step Attenuator)	20-26.5 GHz (w/ Step Attenuator)	26.5-40 GHz (w/ Step Attenuator)
2508	10 dBm (9.5 dBm)	14 dBm (13.2 dBm)	17 dBm (15.8 dBm)	N/A	N/A	N/A
2520	10 dBm (9.5 dBm)	14 dBm (13.2 dBm)	17 dBm (15.8 dBm)	20 dBm (17.5 dBm)	N/A	N/A
2526	10 dBm (9 dBm)	14 dBm (13 dBm)	12 dBm (10.8 dBm)	15 dBm (13.4 dBm)	10 dBm (8.2 dBm)	N/A
2540	10 dBm (9 dBm)	14 dBm (13 dBm)	12 dBm (10.8 dBm)	15 dBm (13.4 dBm)	10 dBm (8.2 dBm)	9 dBm (6.5 dBm)



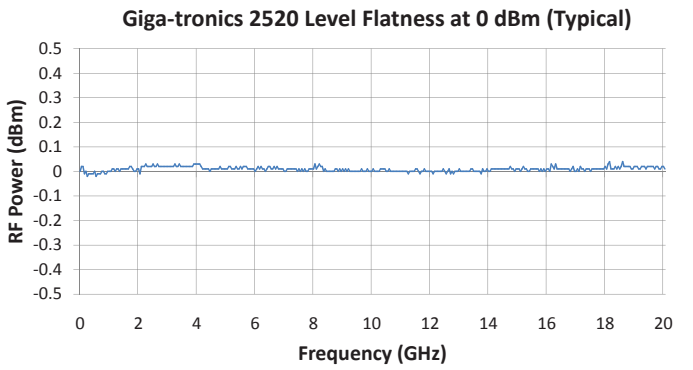


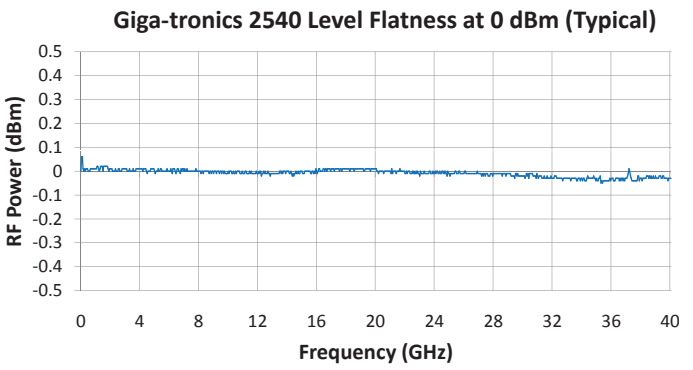
Minimum Settable Level	Standard Model	-110 dBm for < 20 GHz
		-100 dBm for > 20 GHz
	Option 26	-20 dBm for < 20 GHz
		-10 dBm for > 20 GHz
Power Offset (CW Mode)	0 to 10 dB	
Power Resolution	0.05 dB	
Temperature Stability	0.025 dB/°C	
Output Source Match (ALC on)	< 2.0:1 to 40 GHz	

Accuracy (dB)

(Specifications apply over 15 to 35°C range and degrades < 0.10 dB/°C outside the range)

Frequency Range	> 5 dBm	> -10 dBm	> -100 dBm[2]
100 kHz - 20 GHz	± 0.85	± 0.7	± 1.2
20 - 40 GHz	± 1.05	± 0.9	± 1.4





[2] Does not apply with option 26. Level accuracy at –17 dBm is typically less than ± 1.5 dB without step altenuator.

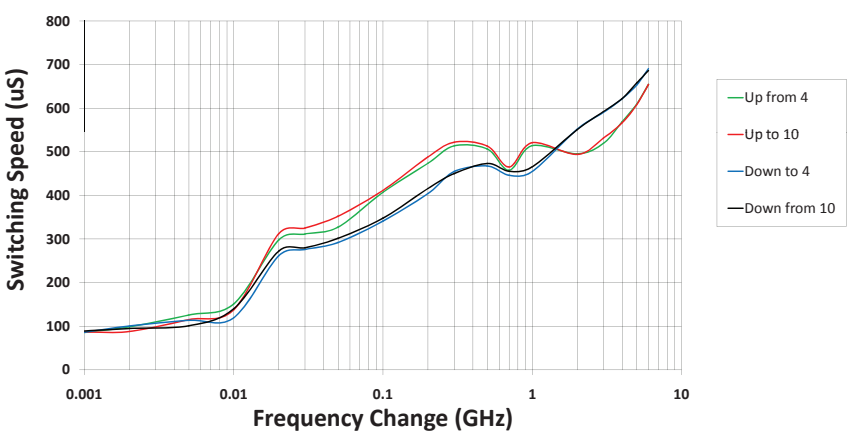
Frequency and Power Sweep

Ramp Frequency Sweep	Full Frequency Coverage
Ramp Power Sweep	0 to 25 dB
Power Slope (CW Mode, List Mode)	0 to 0.5 dB/GHz
Ramp Output	0 to 10V
Z-Axis Blanking	+5V (Positive Only)
Sweep Time[3]	10 msec - 200 msec

List Mode

Number of Points	4000	
Frequency Settling[4] (Inside band Frequency Range)	< 550 µsec for $\Delta F_0 \leq 500$ MHz [5]	
Amplitude Settling[6] (Within step attenuator hold range)	< 500 µsec	
Digital Sweep	**Trigger Modes**	External, GPIB GET, Software
	Sweep Modes	Continuous, Single Step, Single Sweep
Step Time	**Standard**	150 µsec - 1 sec
	Option 31	2 msec - 1 sec
Sync Out Delay[7]	50 µsec - 10 msec	

Giga-tronics 2500 Series Switching Speed vs. Frequency Change (Typical)



Spectral Purity

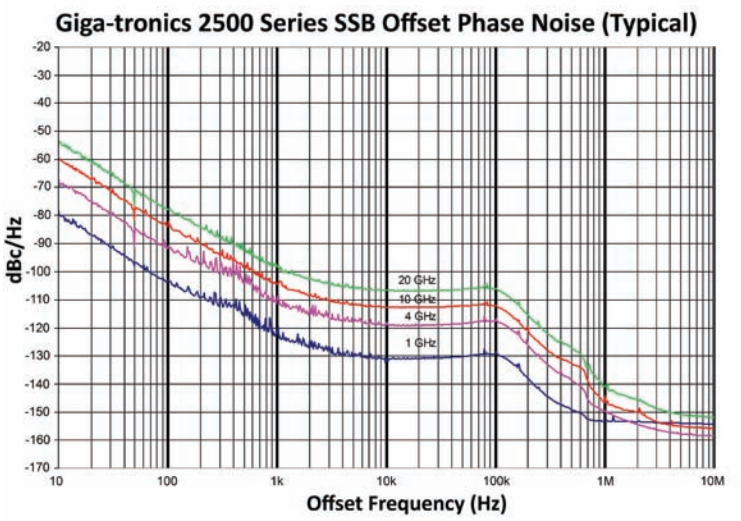
Harmonics	**Max level or +10 dBm, whichever is lower (specification for harmonics above instrument frequency range are typical)**	
	0.1 - 10 MHz	-30 dBc
	10 - 100 MHz	-40 dBc
	0.1 - 20.2 GHz	-55 dBc
	20.21 - 40.0 GHz	-50 dBc
Sub-Harmonics	**Max level or +10 dBm, whichever is lower**	
	100 kHz - 2.0 GHz	-80 dBc
	2.01 - 20.2 GHz	-60 dBc
	20.21 - 40.0 GHz	-50 dBc
Spurious	**Specification is -45 dBc typical for offsets < 300 Hz**	
	100 kHz - 10.10 GHz	-65 dBc
	10.11 - 20.20 GHz	-58 dBc
	20.21 - 40.00 GHz	-50 dBc

[3] Sweep Rate must be < 500 MHz/msec.
[4] Time for frequency to settle within 50 kHz of final value after a frequency switch.
[5] $\Delta F_0 = | (F_{stop} \times N_{stop}) - (F_{start} \times N_{start}) |$ - See Frequency Bands Table for N values.
[6] Time for amplitude to settle within 0.1 dB of final value after an amplitude switch.
[7] Delay is specified from edge of trigger pulse.

Residual FM (typical)	**50 Hz - 15 kHz Bandwidth**	
	100 kHz - 20.20 GHz	< 6 Hz
	20.21 - 40.00 GHz	< 12 Hz
AM Noise (typical)	**Offset > 5 MHz**	
	100 kHz - 2 GHz	-130 dBm/Hz
	2.01 - 20.20 GHz	-145 dBm/Hz
	20.21 - 40.00 GHz	-140 dBm/Hz

SSB Phase Noise

Carrier Frequency	Offset from Carrier (dBc/Hz)					
CW (GHz)	**10 Hz**	**100 Hz**	**1 kHz**	**10 kHz**	**100 kHz**	**1 MHz**
1.0	-61	-96	-109	-124	-124	-150
4.0	-52	-84	-94	-114	-112	-142
10.0	-47	-77	-96	-109	-108	-138
15.0	-44	-73	-85	-105	-105	-133
20.0	-40	-71	-88	-102	-102	-126
30.0	-38	-67	-79	-99	-99	-127



Amplitude Modulation[8]

(Specification applies for frequencies above 10 MHz)

Depth	0 - 90% (Level = 0 dBm)	
Rate (3 dB Bandwidth at carrier level of 0 dBm)	m=30%	DC - 10 kHz
Sensitivity	0 - 95% /V Selectable	
Accuracy	± 10% of setting at 1 kHz rate	
Input	**Range**	± 1V
	Impedance	600 Ω

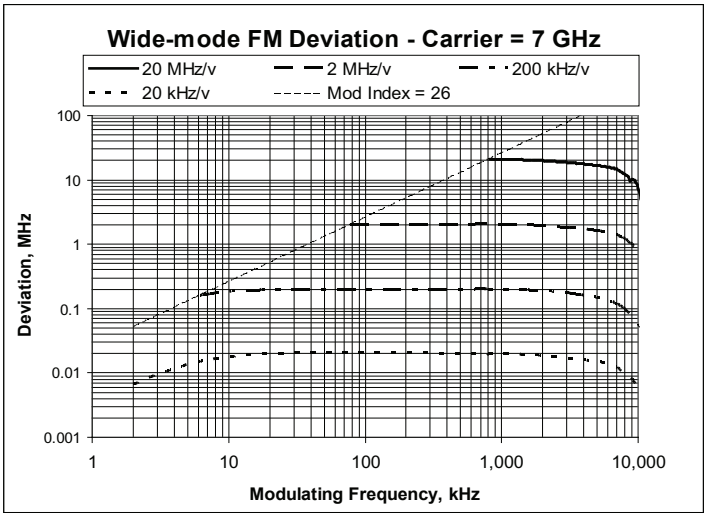
[8] Modulation peaks must be less than maximum available power.

Frequency Modulation

(Specification applies for frequencies above 10 MHz)

Narrow Mode	**Modulation Index**	Deviation Limited	
	Rate (3 dB bandwidth)	DC - 50 kHz	
	Peak Deviation	**1 MHz/N**	DC - 3 kHz
		0.4 MHz/N	3 kHz to 50 kHz
	Accuracy	± 5% at 5 kHz rate with .6013 V peak input, 20 kHz/V sensitivity	
	Input Range	± 1V	
	Input Impedance	50 Ω	
Wide Mode	**Modulation Index**	< 15/N	
	Rate (3 dB bandwidth)	10 kHz - 5 MHz	
	Peak Deviation	20 MHz/N or modulation index of 3.7 x F_{GHz} , whichever is less.	
	Accuracy	± 5% at 100 kHz rate with 0.2405 V peak input , 1 MHz/V sensitivity	
	Input Range	± 1V	
	Input Impedance	50 Ω	

Wide-mode deviation as a function of modulating frequency at 1 V Peak Input (Supplemental)



Pulse Modulation

(Specification applies for frequencies above 500 MHz)

Standard Operating Modes	Internal, External	
On/Off Ratio	> 80 dB	
Rise/Fall Times	**0.5 - 20 GHz**	< 10 nsec
	20 - 40 GHz	< 25 nsec
Minimum Leveled Pulse Width	**External**	100 nsec
	Internal	100 nsec
Minimum Unleveled Pulse Width	**External**	10 nsec
	Internal	50 nsec
Level Accuracy[9]	**Pulse Width > 250 nsec**	± 0.5 dB
	Pulse Width > 150 - 250 nsec	+ 1.5 / - 0.5 dB
	Pulse Width > 100 - 150 nsec	+ 2.5 / -0.5 dB
PRF (50% Duty Cycle)	**Leveled**	DC - 5 MHz
	Unleveled	DC - 10 MHz
Pulse Fidelity	**Video Feed Through**	0.5 - 2 GHz (< 5%)
		2 - 40 GHz (< 1%)
	Compression	< ± 5 nsec
	RF Delay	< 75 nsec
Input	**Sensitivity**	TTL levels (polarity selectable)

[9] Duty Cycle must be > 0.01%

Internal Function Generator

AM Modulation Source	**Waveforms**	Sine, Square, Triangle, Ramp, Gaussian Noise
	Rate	0.01 Hz to 10 kHz, all waveforms
	Resolution	0.01 Hz
	Accuracy	Same as time base
	AM Out	2V, peak to peak into 10 kΩ load
FM Modulation Source	**Waveforms**	Sine, Square, Triangle, Ramp, Gaussian Noise
	Rate	0.01 Hz to 1 MHz, all waveforms
	Resolution	0.01 Hz
	Accuracy	Same as time base
	FM Out	2V, peak to peak into 10 kΩ load
PM Modulation Source	**Width**	0.05 µsec to 0.01 sec
	Pulse Repetition Interval	0.2 µsec to 1 sec
	Sync. Out Delay	0 to 10 msec
	Resolution	10 nsec
	Accuracy	+/- 0.1% typical Worst case: ± 2% of setting or ± 20 nsec, whichever is greater
	PM Out	2 V into 50 Ω

Remote Programming

Hardware Interface	IEEE 488.2, RS-232, & USB (w/ supplied adapter)		
Software Interface	SCPI, GT12000, GT9000, GT900, Automation Xpress Interface (Standard)		
Execution Speed (IEEE 488.2)		**AXI**	**SCPI**
	CW Switching	2.0 msec	28 msec
	4000 Point List Download	13 sec	28 sec
Automation Xpress Interface (AXI)	For use with Giga-tronics Automation Xpress software. The AXI provides Xpress 2.0 ms CW Frequency/Power switching, faster data exchange and functional downloads/executions, and a stable API programming interface for ATE programming environment.		
Automation Xpress Requirements (All 2500 Series models)	20 MB Disk Space Windows 2000, Windows XP 128 MB RAM or greater		
Remote Interface	GPIB (IEEE 488.2, 1987) with listen and talk RS-232		

Physical

Environmental	MIL-PRF-28800F. Class 3
Safety	EN61010
Weight	< 35 lbs (15.9 kg)
Emissions	EN61326
Rack Height	3U (5.25 inches (133.4 mm))
Connector Types (All Series)	2508 (N(f)) 2520/2526 (SMA(f)) 2540 (2.92 mm(f))

2500AS Series Only

2500AS Series Inclusions	Rear RF Output Delete Front Panel Option Includes Front Panel LED Indicators for Line Power, EXT REF, and Unleveled

2500 Series Rear Panel I/O Connector Descriptions

Connector Label	Specifications	Connector Type
EXT ALC	External ALC Input	BNC
RF OUT	Rear Panel Output, 2500AS Series models only	SMA, N, 2.92 mm
FM OUT[10]	Internal modulation generator output; 2 Vp-p into 10 kΩ	BNC
PULSE OUT[10]	A +4 V video representation of the pulsed RF output signal	BNC
AM OUT[10]	Internal modulation generator output; 2 Vp-p into 10 kΩ	BNC
PM SYNC OUT[10]	Synchronization output pulse width > 75 nsec width	BNC
FM IN[11]	50 Ω	BNC
AM IN[11]	600 Ω	BNC
PULSE IN/PM TRIG IN[11]	+5 V, 50 Ω	BNC
LOCK/LEVEL	+5 V indicator for phase/level lock for CW mode and in list mode	BNC
REF TUNE	0 to +10 V	BNC
SYNC OUT	+5 V output pulse	BNC
TRIGGER IN	Used to trigger a list. Accepts a TTL level signal of > 50 nsec width.	BNC
BLANKING	+5 V output indicator for band crossing, filter switching, and retraces	BNC
RAMP OUT	0 to 10 V	BNC
STOP SWP IN/OUT	5 V, 2 kΩ, active low	BNC
V/GHz	0.5 V (2508, 2520) 0.25 V (2526, 2540)	BNC
100 MHz OUT	+5 dBm typical, 50 Ω	BNC
10 MHz OUT	2 Vp-p, 50 Ω	BNC
EXT REF IN	10 MHz ± 50 Hz (> -5.0 dBm)/100 MHz ± 500 Hz (> +5 dBm to +8 dBm), 50 Ω	BNC
GPIB	A 24-pin IEEE STD 488.2 connector for control of the instrument during remote operation using GPIB	Type 57
RS-232	A DB-9 connector for control of the instrument during remote operation using RS-232 serial communications	DB-9
AC POWER INPUT	90-253 VAC, auto-sensing, 47 Hz to 440 Hz	IEC Power Line

[10] Not Available with Option 17A or 17B.
[11] Not Available with Option 17A.

Ordering Information

Giga-tronics has a network of RF and Microwave instrumentation sales engineers and a staff of factory support personnel to help you find the best, most economical instrument for your specific applications. In addition to helping you select the best instrument for your needs, our staff can provide quotations, assist you in placing orders, and do everything necessary to ensure that your business transactions with Giga-tronics are handled efficiently.

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2508A/2508AS	100 kHz - 8 GHz
2520A/2520AS	100 kHz - 20 GHz
2526A/2526AS	100 kHz - 26.5 GHz
2540A/2540AS	100 kHz - 40 GHz

Available Options and Accessories

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31	2 msec Switching Speed Limit
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Giga-tronics Support Services

At Giga-tronics, we understand the challenges you face. Our support services begin from the moment you call us. We help you achieve both top-line growth and bottom-line efficiencies by working to identify your precise needs and implement smart and result orientated solutions. We believe and commit ourselves in providing you with more than our superior test solutions. For technical support, contact:

Tel: 1-800-726-GIGA (4442) or (925) 328-4669
Email: support@gigatronics.com

Updates

All data is subject to change without notice. For the latest information on Giga-tronics products and applications, please visit:

http://www.gigatronics.com

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