Product Catalog

Microwave Synthesizers- Bench/VXI

Power Meters- Bench/VXI

Scalar Network Analyzers

Power Sensors

Automation Test Software

Microwave Synthesizers

FASTER SWITCHING SPEEDS, HIGH POWER, AND LOW PHASE NOISE.

2400B SERIES MICROWAVE SYNTHESIZER

The 2400 Series Microwave Synthesizers are the industry's first general purpose microwave synthesizers providing highly stable, fast frequency switching signals while maintaining low phase noise performance that you expect in a microwave synthesizer. In addition to these features, the 2400B series delivers high output power making it an excellent test solution for a wide range of CW, LO substitution, modulated, sweep, and step frequency applications for R&D, and manufacturing environments.

The 2400B series are fully equipped with the typical features needed to perform everything from simple test to complex design and verification. It offers excellent repeatability, ensuring minimal uncertainty contribution to your test system measurements.

Excellent reliability and trouble-free operation are features that you demand in a microwave synthesizer. At Giga-tronics, we're so confident of the 2400B Series reliability, all 2400B models come with a standard 4 year warranty!

Microwave Synthesizers

FINALLY A SYNTHESIZER OPTIMIZED FOR YOUR APPLICATION

> 4 frequency ranges. 8, 20, 26.5 and 40 GHz
> Phase noise at 10 GHz is -92 dBc/Hz at 10 kHz offset
> 4 year warranty is standard, no hidden charges
> Typical output power is +15 dBm to 20 GHz
> 500 usec. frequency and power switching in List Mode
> 2.5 msec. frequency and power switching using AX interface
> Rear RF Output for 2400S Models
> High Stability Timebase is standard on all models
> Automation Xpress Interface is standard
> Ramp Sweep is standard on all 2400B models and 2400S models without Option 44
> Standard 3U rack-mountable Microwave Synthesizer with rack ears

2400B SERIES MICROWAVE SYNTHESIZER

With frequency ranges to 40 GHz, the 2400B delivers industry-leading performance combining state of the art low phase noise, high output power, and fast frequency switching simultaneously. In addition, the 2400B Series incorporate all the performance features you expect in a microwave synthesizer including frequency modulation, high-speed pulse modulation, amplitude modulation and scan modulation.The 2400B Series is capable of switching speeds of 160 microseconds for small frequency steps, making the 2400B series ideal for test applications demanding high throughput such as antenna pattern characterization, T/R module evaluation, or RFIC manufacturing. Whether the application is high volume manufacturing requiring only a few data points or low volume test requiring large amounts of data, the 2400B pays dividends from your investment in the form of reduced costs to manufacture, ease of use,

2400S SERIES MICROWAVE SYNTHESIZER

Optimized for ATE

The 2400S Series Microwave Synthesizer is designed to deliver all the outstanding features and performance of the 2400B and is optimized for ATE integration. Rear panel output and an option to delete the front panel provides an ATE-based microwave source at a price. designed not to break your budget. Automation Xpress is provided to significantly reduce integration time and effort when developing an ATE system. This ATE development tool virtually eliminates the need to learn a new command set. Given the complexities of modern ATE systems, microwave sources should not contribute to the development effort. The 2400S coupled with Automation Xpress and its interface ensures fast, easy integraton.

Connectivity

TAKE YOUR PROGRAMMING TO THE NEXT LEVEL.

AUTOMATION XPRESS SOFTWARE

The advanced Automation Xpress software, an easy to use, application development tool for use with Giga-tronics 2400 Series Microwave Synthesizers and Automation Xpress Interface offers fast remote operation that goes beyond just fast frequency switching. Automation Xpress can be linked to a variety of common application development environments such as Microsoft® Visual Basic, Visual C++, and NI LabWindows.®

> Provides access to fast 2.6 ms CW Frequency/Power switching; enabling faster testing, list download speeds, and more device throughput

> Xpress Auto-programmer Visual Basic & Visual C++

> Immediate access to full-featured command windows for modulation, CW, list creation, and Auto-programming

> Xpress Auto-Programming eliminates the complexity of having to write specific code sequences needed to control the operation of the instrument

> Ensure consistent future programming

UNPARALLED EASE OF USE

Automation Xpress software is a PC based software package designed for enhanced user interface and automatic test systems. It gives you unparalleled ease of use with a feature set and intutive interface to perform quick instrument settings and simple operation for advanced capabilities such as List mode.

> Auto-programmer for SCPI & Native Command

> A comprehensive LIST mode, Command-Line interpreter with script and loop capability, and GPIB traffic monitoring

SYSTEM REQUIREMENTS FOR AUTOMATION XPRESS

> Pentium 233 MHz or higher Pentium III recommended

> Microsoft® Windows® 2000, Windows XP

> 128 MB of RAM recommended

> 20 MB of hard disk space recommended

> GPIB or RS-232 Interface

2400B SERIES SPECIFICATIONS

All specifications apply over a 0°C to +55°C range after 30 minutes of warm-up time unless otherwise stated.

FREQUENCY

Accuracy: Same as time-base
Resolution: 0.1 Hz
Power Slope: 0 to 0.5 dB/GHz
Internal Reference: 10 MHz, 100 MHz
Aging Rate: (after 30 day warm up)
2400B/2400S < 5 X 10^{-10}/day (10 MHz)
< 1 X 10^{-8}/day (100 MHz)
Temperature Stability: (after 30 day warm up)
2400B/2400S < 2.5 X 10^{-8}/°C (10 MHz)
< 2.5 X 10^{-8}/°C (100 MHz)
10 MHz Reference Output: TTL level into 50Ω
External Reference Input: 10 MHz or 100 MHz
± 1ppm
> - 5 dBm into 50Ω

Volts/GHz: 0 to 10 V range:
0.50 V/GHz, 0.01to 20 GHz
0.25 V/GHz, 20 to 40 GHz
Lock/Level Indicator: Sync Out = TTL High

FREQUENCY BANDS

Band	Frequency	N
0	10 - 15.99 MHz	512
1	16 - 30.99 MHz	256
2	31 - 62.99 MHz	128
3	63- 124.99 MHz	64
4	125 - 249.99 MHz	32
5	250 - 499.99 MHz	16
6	500 - 999.99 MHz	8
7	1.0 - 1.99 GHz	4
8	2.0 - 3.99 GHz	2
9	4.0 - 7.99 GHz	1
10	8.0 - 15.99 GHz	1/2
11	16.0 - 31.99 GHz	1/4
12	32.0 - 40 GHz	1/8

OUTPUT POWER

Maximum Leveled (dBm)[1]
(Specification applies over 0 to 35°C range and degrades <2.0 dB from 35°C to 55°C)

Models	.01 - >2 GHz	2 - 20 GHz	20-40 GHz[2]
2408	+14	+15 (8 GHz)	–
2420	+14	+15	–
2426	+13	+9	+10
2440	+10	+9	+9

Minimum Leveled:
-110 dBm to 20 GHz; -100 dBm > 20 GHz
Option 26: -20 dBm to 20 GHz; -10 dBm >20 GHz
Power Offset: 0 to 10 dB
Resolution 0.05 dB

2400B SERIES SPECIFICATIONS CONTINUED

Temperature Stability: 0.025 dB/°C
Output Source Match (typical): < 2.0:1 into 50 Ω

ACCURACY (dB)

(Specifications apply over 15 to 35°C range and degrades <0.5 dB outside the range)

Model	>5 dBm	> -20 dBm	>-110 dBm
0.01 - 20 GHz	±1.0	±0.8	±1.3
20 - 40 GHz	±1.2	±1.0	±1.5

SPECTRAL PURITY

Harmonics

(Specifications for harmonics above instrument frequency range are typical.)

Frequency (GHz)	Standard (at 6 dBm)
0.01 - 20 GHz[3]	-55 dBc
20 - 40 GHz	-30 dBc

Sub-Harmoncs

Frequency (GHz)	Standard (at 6 dBm)
0.01 - 2 GHz	-80 dBc
2 - 20 GHz	-60 dBc
20 - 40 GHz	-50 dBc

Spurious

(Specification is -45 dBc typical for offsets < 300 Hz)

Frequency (GHz)	Standard (at 6 dBm)
0.01 - 16 GHz	-60 dBc
16 - 32 GHz	-54 dBc
32 - 40 GHz	-48 dBc

Residual FM (typical)

Frequency (GHz) (bandwidth)	50 Hz - 15 kHz
0.01 - 16 GHz	<40 Hz
16 - 32 GHz	<80 Hz
32 - 40 GHz	<120 Hz

AM Noise (typical)

Frequency (GHz)	Offsets (> 5 MHz)
0.01 - 2 GHz	-130 dBm/Hz
2 - 20 GHz	-145 dBm/Hz
20 - 40 GHz	-140 dBm/Hz

SSB PHASE NOISE:

Frequency	Offset from Carrier (dBc/Hz)				
GHz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz
0.85	-92	-111	-112	-123	-130
1.85	-86	-105	-106	-117	-135
5.6	-75	-97	-98	-105	-130
10	-74	-92	-92	-101	-128
18	-68	-89	-90	-99	-123
23	-63	-85	-86	-93	-118
30	-61	-83	-84	-91	-115

FREQUENCY & POWER SWEEP (not available on 2400S models with option 44)

Ramp Frequency Sweep: Full Frequency Coverage
Ramp Power Sweep: 0 to 25 dB
Power Slope: 0 to 0.5 dB/GHz
Power Flatness: See Accuracy table
Ramp Output: 0 to 10V
Z-Axis Blanking: ± 5V
Sweep Time[4]: 10 msec — 200 secs

LIST MODE

Number of List Points: 4000
Frequency Settling Time[5]: < 550 µsec for ΔF_0[6] ≤ 500 MHz
Amplitude Settling Time[7]: < 500 µsec
Step Time: 150 µsec - 1 sec
2 ms - 1 sec (option 31)
Sync Out Delay[8]: 50 µsec - 10 msec
Trigger Modes: EXT, GPIB GET, Software
Sweep Modes: Continuous, Single Step,& Single Sweep
ΔF_0 in GHz[6]

REMOTE PROGRAMMING

Hardware Interface: IEEE 488.2 RS-232 & USB (w/supplied adapter)
Software Interface: SCPI & GT-12000A Automation Xpress Interface) Option 55

Command Sets
Command sets available:
HP8370, HP8340, HP8673, HP8663, HP 8350, HP 8360, Systron-Donner, Wavetek 904/907. Gt12000, GT9000, GT900 are standard

Execution Speed (IEEE 488.2):

	AXI	SCPI	GT-12000A
CW Switching	2.6ms	28ms	22ms
4000 pt. download	13 sec	28 sec	288 sec

Automation Xpress Interface (AXI)

For use with Giga-tronics Automation Xpress software. The AXI provides Xpress 2.6 ms CW Frequency/Power switching, faster data exchange and functional downloads/executions, and a stable API programming interface for the ATE programming environment.

MODULATION SPECIFICATIONS:

Amplitude Modulation[9]:
Depth[10]: -20 dBm to maximum available power.
Rate[11] (3 dB Bandwidth): DC — 5 kHz (depth = 30%)
Sensitivity: 10 — 95% /V select-able
Accuracy: ± 10% of setting at 1 kHz rate, 30% depth
Input:
Range: ± 1 V
Impedance: 600Ω

Scan Modulation

(Specification applies for frequencies below 20 GHz)
Depth: > 60 dB
Scan Time: 200 ms - 10 sec
Maximum Number of Points: 4000
Minimum Time per Point: 1 ms
Scan Pattern: Sin (x) / X
Minimum # of Lobes: 1

FREQUENCY MODULATION
Narrow Mode:
(Deviation Limited Modulation Index)
Rate (3 dB bandwidth): DC - 50 kHz
Peak Deviation[11]: 1 MHz / N
Accuracy[12]: (Narrow) ± 5% @ 5 kHz rate

Input:
Range: ± 1V
Impedance: 50 Ω

Wide Mode:
(Modulation Index < 15/N)
Rate (3 dB bandwidth): 1 kHz - 3 MHz
Peak Deviation[11]: 20 MHz / N
Accuracy: ± 5% at 200 kHz rate with 1V peak input

Input:
Range: ± 1V
Impedance: 50Ω

2400B SERIES SPECIFICATIONS CONTINUED

PULSE MODULATION

(Specification applies for frequencies above 500 MHz)

On/Off Ratio: 80 dB

Rise/Fall Times:

Frequency (GHz)	Rise Time
0.5 - 20 GHz	<10 ns
20 - 40 GHz	<25ns

Minimum Width: 100 ns

Level Accuracy[13]: ± 0.5 dB Pulse Width >250 ns
(relative to CW) +1.0 / -0.5 dB Pulse Width >150 - 250 ns
+2.5 / -0.5 dB Pulse Width 125 - 150 ns

PRF (50% duty cycle): DC - 3.33 MHz

Pulse Fidelity (typical):

Overshoot & Ringing: 0.5 - 2 GHz: < 15%
2 - 40 GHz: < 10%

Video feed through: 0.5 - 2 GHz: < 5%
2 - 40 GHz: < 1%

Compression: < ± 5ns

Delay: < 75 ns

Input;

Sensitivity: TTL levels (polarity selectable)

Impedance: 50Ω

Internal Function Generator:

AM/FM Modulation Source

Waveforms: Sine, Square, Triangle, Ramp, Gaussian Noise

Rate: AM: 0.01 Hz to 10kHz
FM: 0.01 Hz to 1 MHz

Resolution: 0.01 Hz

Accuracy: Same as time base

AM Out: 2V, peak to peak into 10 kΩ Load

FM Out: 2V, peak to peak into 10 kΩ Load

PM Modulation Source

Width: 0.05 uSec. to 0.01 Sec.

Pulse Repetition Interval: 0.2 uS 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

AUTOMATION XPRESS REQUIREMENTS

20 MB Disk Space
Windows 2000, Windows XP
128 MB RAM or greater

2400S Series Models Only

2400S Series include:

Rear RF Output
Delete Front Panel Option
Front Panel LED Indicators:
Power, EXT REF, Unleveled
AXI Interface

INPUTS & OUTPUTS

All 2400B and 2400S Models

Inputs

EXT REF Input
AM IN
FM IN
PM/PM Trigger IN
External ALC
Trigger In
Stop Sweep

Outputs

RF Output
10 MHz REF Output
100 MHz REF Output
V/GHz Output
Sync Output
Blanking Output

PHYSICAL

Environmental: MILPRF-28800F. Class 3
Safety: EN61010
Weight: < 35 lbs
Emissions: EN61326
Rack Height: 3U (5.25 inches)
Dimensions: 16.75 X 21 X 5.25 inches
Connector Types (All Series):
2408 - N(f)
2420/2426 - SMA(f)
2440 - K(f)

ORDERING INFORMATION

Front Panel Out Frequency	Rear Panel Out	
2408B	2408S	10 MHz-8 GHz
2420B	2420S	10 MHz-20 GHz
2426B	2426S	10 MHz-26 GHz
2440B	2440S	10 MHz-40 GHz

OPTIONS

17 Delete Modulation and Internal Function Generator
18 Delete 0.01 to 2 GHz Frequency Extension
23 Type N connector, 2420 Series only
26 Delete Step Attenuator
44 Delete Front Panel, Ramp Sweep. 2400S series only
46 Rack Slide Kit
55 Command Set
55A - HP 8370
55B - HP 8340
55C - HP 8663
55D - HP 8673
55E - Systron-Donner
55F - Wavetek 904/907
55G - HP 8350
55H - HP 8360

Automation Xpress Interface and Ramp Sweep is standard on all 2400B and 2400S models.

[1] Option 26, Delete Step Attenuator increases maximum leveled power by 1.5 dB to 18 GHz, 2.0 dB, 18- 26.5 GHz, and 2.5 dB above 26.5 GHz. [2] 20 - 26.5 GHz for model 2426. [3] Freuquencies of 500 MHz and higher. Below 500 MHz: -55 dBc typical, -45 dBc worst case.[4] Sweep rate must be < 500 MHz/msec. [5] Time for frequency to settle within 50 kHz of final value after a frequency switch. [6] $\Delta F_0 = | (F_{stop} \times N_{stop}) . (F_{start} \times N_{start}) |$ - See Frequency Bands Table for N values. [7] Time for amplitude to settle within 0.1 dB of final value after an amplitude switch. [8] Delay is specified from edge of trigger pulse. [9] Modulation peaks must be less than maximum available power. [10] Levels noted can be offset using step attenuator (option 26). [11] Refer Frequency Table for band index factor. [12] 1 volt peak input [13] Duty Cycle must be > 0.01%).

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)	

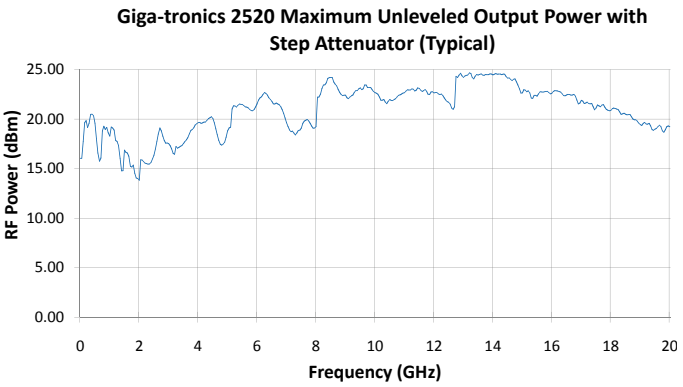
Frequency Bands

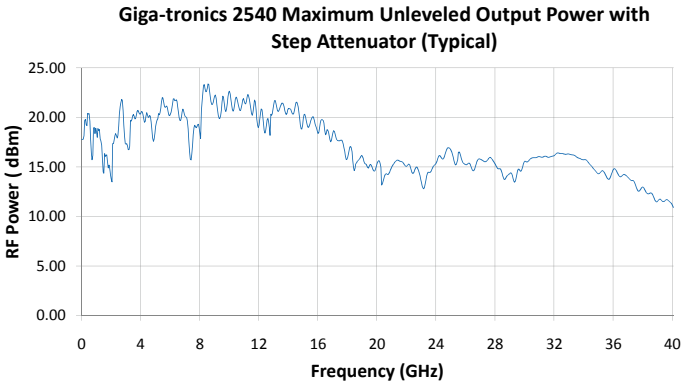
Band	Frequency	N
0	0.1-9.99 MHz	N/A
1	10.00-16.00 MHz	512
2	16.01-31.00 MHz	256
3	31.01-63.00 MHz	128
4	63.01-125.00 MHz	64
5	125.01-250.00 MHz	32
6	250.01-500.00 MHz	16
7	500.01-1000.00 MHz	8
8	1.01-2.00 GHz	4
9	2.01-4.00 GHz	2
10	4.01-10.1 GHz	1
11	10.11-20.20 GHz	1/2
12	20.21-40.00 GHz	1/4

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)



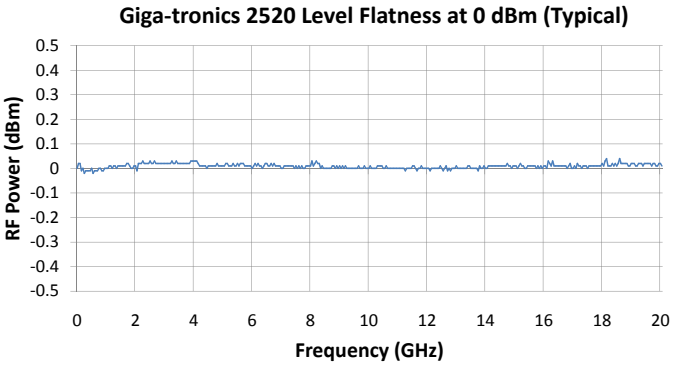


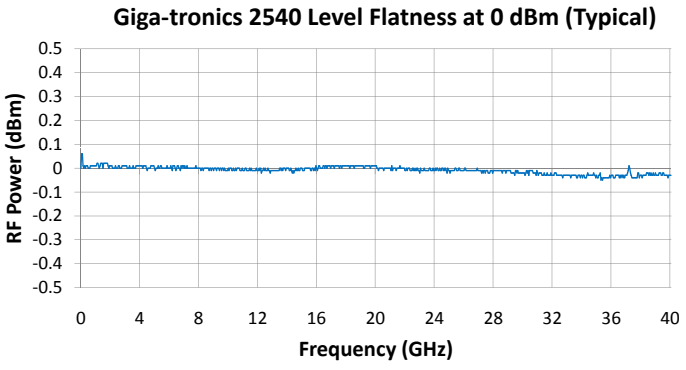
Minimum Settable Level	Standard Model	-107 dBm for < 20 GHz
		-100 dBm for > 20 GHz
	Option 26	-17 dBm for < 20 GHz
		-10 dBm for > 20 GHz
Power Offset (CW Mode)	0 to 10 dB	
Power Resolution	0.05 dB	
Temperature Stability	0.025 dB/°C	
Output Source Match (ALC on)	< 2.0:1 to 40 GHz	

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





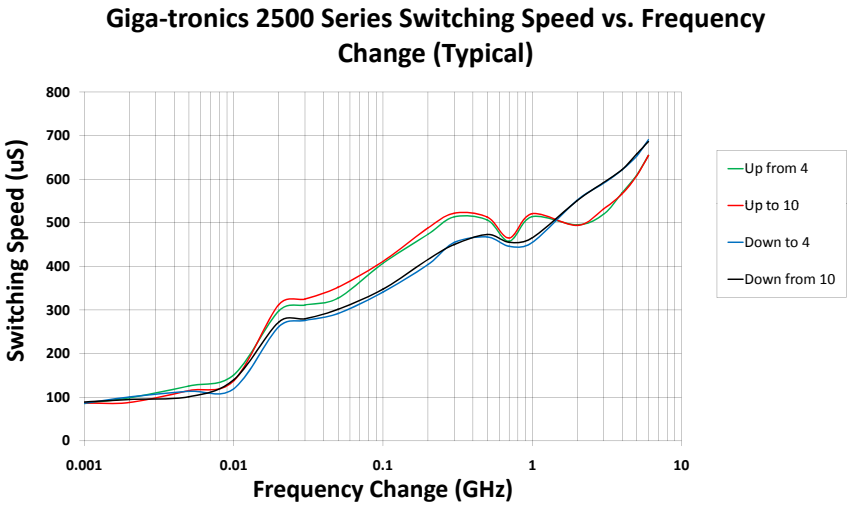
[2] Does not apply with option 26. Level accuracy at –17 dBm is typically less than ± 1.5 dB without step altenuator.

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	



Spectral Purity

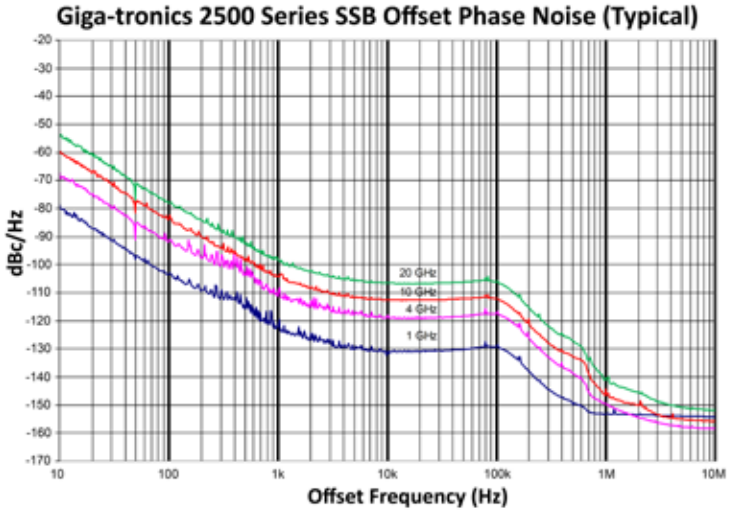
Harmonics	**Max level or +10 dBm, whichever is lower (specification for harmonics above instrument frequency range are typical)**	
	0.1 - 10 MHz	-30 dBc
	10 - 100 MHz	-40 dBc
	0.1 - 20.2 GHz	-55 dBc
	20.21 - 40.0 GHz	-50 dBc
Sub-Harmonics	**Max level or +10 dBm, whichever is lower**	
	100 kHz - 2.0 GHz	-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

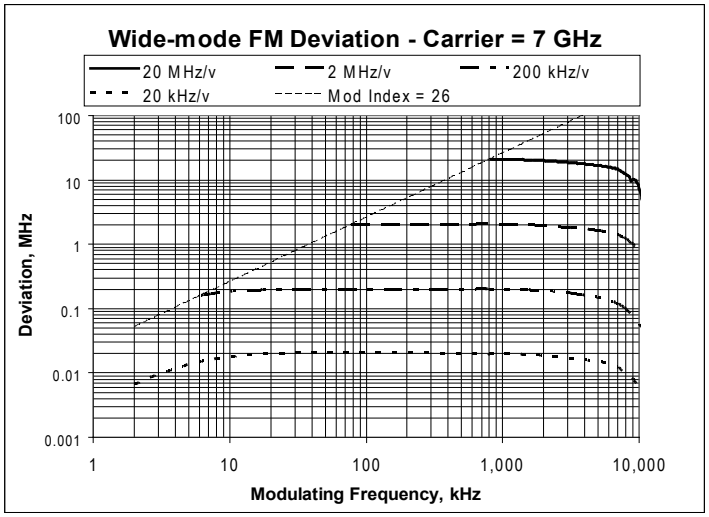
[8] Modulation peaks must be less than maximum available power.

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.

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
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

VXI Synthesizers

SERIES 50000B VXIBUS MICROWAVE SYNTHESIZERS

Full-function synthesizer performance in a three-slot VXIbus module. Generate, modulate, level and attenuate RF output signals from 10 MHz to 20 GHz. Get unprecedented performance by incorporating the unique Model 52000B single-slot synthesizer control module that provides the digital programming and analog time-based signals required to operate up to eight, two-slot 50000B synthesizer modules.

Series 50000B Microwave Synthesizers are available in eleven models with a frequency range as narrow as 2 to 8 GHz or as broad as 10 MHz to 20 GHz. Choose the frequency range that meets your specific need. If you need a wide range, it's available. But if you don't, you won't have to pay for unnecessary range.

THE EFFICIENT AND ECONOMICAL APPROACH

> Frequency ranges from a narrow 2 to 8 GHz or as wide as 10 MHz to 20 GHz.

> 2 models in narrow/wide frequency ranges from 0.01 to 20 GHz

> Control power level from -100 to +10 dBm with 0.1 dB resolution

> Frequency stability is better than 3 Hz per GHz per day

> Frequency resolution is 1 Hz

> Harmonics is -50 dBc from 2 to 20 GHz

> Phase noise from 2 to 20 GHz is -97 dBc or less at 100 kHz offset

52000B/50000B VXIBUS MICROWAVE SYNTHESIZER MODULE/CONTROL SPECIFICATIONS

GENERAL SPECIFICATIONS

VXIbus Characteristics

Device Type: Message based Instrument.

Compatibility: Fully compatible with VXIbus system specification, rev 1.4.

Protocol: Word serial.

Languages (52000B): Giga-tronics syntax subset, CIIL syntax subset, SCPI syntax subset, HP compatible syntax subset.

Programming (50000B): Local bus from the associated Giga-tronics VXIbus control module.

Temperature Range:

Operating: 0 to +50 °C (+32 to +122 °F).

Storage: -40 to +70 °C (-40 to +158 °F).

Cooling Requirements:

52000B: For 10° C temperature rise, air flow must be 2 L/s at 0.1 mm H_2O.

50000B: For 10° C temperature rise, air flow must be 5 L/s at 0.2 mm H_2O.

Relative Humidity: 0 to 95%, non-condensing

EMI: Below 1 GHz, complies with VXIbus specification Rev 1.4; above 1 GHz, complies with MIL-STD-461C REO2 (part 2).

Power Requirement:

Voltage (Vdc)	Max Current(52000A) (mA)	Max Current(50000A) (mA)
+24	175	2500
+12	100	1200
+5	2500	Not Used
+5 standby	Not Used	Not Used
- 2	Not Used	Not Used
- 5.2	Not Used	Not Used
-12	700	1600
-24	30	200

Power Rating:

52000B: 30 W maximum.

50000B: 100 W maximum.

Physical Characteristics:

52000B:

Dimensions: C-size, one-slot, VXI standard,
30 mm (1.2 in) wide,
234 mm (9.2 in) high,
340 mm (13.4 in) deep.

Weight: 2.27 kg (5.0 lbs).

50000B:

Dimensions: C-size, two-slot, VXI standard,
60 mm (2.4 in) wide,
234 mm (9.2 in) high,
340 mm (13.4 in) deep.

Weight: 5.45 kg (12.0 lbs).

OPTIONS

Option 26: Provides a built-in 90 dB step attenuator in 10 dB steps (reduces maximum leveled power by 1 dB from 8 to 16 GHz and 2 dB above 16 GHz).

52000B VXIBUS MICROWAVE SYNTHESIZER CONTROL MODEL & 50000B MICROWAVE SYNTHESIZER MODULE SPECIFICATIONS

LOCAL BUS CHARACTERISTICS (52000B)

Capability: Controls from 1 to 8 Series 50000B synthesizer modules.

Digital Output Signals (to synthesizer modules): Output is to the right (as viewed from the front) on the 12 'local bus' lines on connector P2.

TIME BASE CHARACTERISTICS (52000B)

Internal: 10 MHz temperature compensated crystal oscillator; aging rate ± 1 x 10^{-6}/year after 20 minutes of continuous operation.

External (automatically overrides internal time base):

10 MHz ± 1 x 10^{-6} or better; >1.5 Vpp.

Time Base Related Analog Output Signals (derived from internal or external time base): 10 MHz,

ECL levels; 330 MHz, .15 dBm, typical, into 50Ω;

10 MHz 'Time Base Out', ≥ 2 Vpp into 50Ω.

FRONT PANEL CONNECTORS (52000B)

10 MHz Output: Type SMB male.

330 MHz Output: Type SMB male.

Time Base Input: Type BNC female.

Time Base Output: Type BNC female.

INPUTS REQUIRED (50000B)

Local Bus Input Signals (from a compatible Giga-tronics VXIbus module): Inputs from the left (as viewed from the front), on the 12 'local' bus lines on connector

Time Base Related Analog Input Signals (from a compatible Giga-tronics VXIbus module): 10 MHz, ECL levels; 330 MHz, -15 dBm, typical.

OUTPUTS SUPPLIED (50000B)

RF Output: RF signal produced by the module; available at the RF OUT connector.

Digital Output Signals (replicates corresponding input signals to control other Giga-tronics VXIbus modules): Output to the right (as viewed from the front), on the 12 'local' bus lines on connector P2.

Time Base Related Analog Output Signals (buffered from corresponding inputs; used to drive other Giga-tronics VXIbus modules): 10 MHz, ECL levels; 330 MHz, .15 dBm, typical (at REFERENCE OUT connectors).

FRONT PANEL CONNECTORS (50000B)

10 MHz Input and Output: Type SMB male.

330 MHz Input and Output: Type SMB male.

AM In: Type SMB male.

FM In: Type SMB male.

PM In: Type SMB male.

RF Out: Type SMA female.

FRONT PANEL INDICATORS (50000B)

Lock: Green LED.

Level: Green LED.

RF On: Green LED.

FREQUENCY CHARACTERISTICS (50000B)

Range	Model Number	Frequency Range
	50208B	2 to 8 GHz
	50212B	2 to 12 GHz
	50218B	2 to 18 GHz
	50220B	2 to 20 GHz
	50612B	5.4 to 12.5 GHz
	50618B	6 to 18 GHz
	51218B	12 to 18 GHz
	50008B	0.01 to 8 GHz
	50012B	0.01 to 12 GHz
	50018B	0.01 to 18 GHz
	50020B	0.01 to 20 GHz

Resolution: 1 Hz throughout the frequency range.

Accuracy and Stability: Identical to, and determined by, the time base oscillator selected in the 52000B Control Module.

RF OUTPUT POWER PARAMETERS (50000B)

Maximum Leveled Output: ≥+8 dBm, 0.01 to 2 GHz; ≥+12 dBm, 2 to 12 GHz; ≥+9 dBm, 12 to 20 GHz.

Resolution: 0.1 dB

Minimum Leveled Output: .10 dBm (-15 dBm typical); -90 dBm with option 26.

RF Off: Typically attenuates a 0 dBm signal to -140 dBm at the output connector.

Output Accuracy (internally leveled): ±2 dB

Flatness: Included in accuracy.

Output Impedance: 50Ω, nominal.

Output SWR: <2:1

SPECTRAL PURITY (50000B)

Harmonics: (up to maximum frequency of synthesizer):

≤50 dBc (measured at +5 dBm, 2 to 20 GHz);

≤40 dBc (measured at +5 dBm, .01 to 2 GHz).

Subharmonics: None.

Nonharmonics (tested at 0 dBm):

Offset Frequency	Level	Typical
<100 kHz	<-40 dBc	<-50 dBc
100 kHz to < 1MHz	<-50 dBc	<-60 dBc
>1MHz	<-60 dBc	<-70 dBc

SSB PHASE NOISE (dBc):

Frequency GHz	Offset from Carrier (dBc/Hz) 1 kHz	10 kHz	100 kHz
<2	≤-70	≤-75	≤-97
2 to 8	≤-75	≤-77	≤-97
8 to 12	≤-70	≤-75	≤-97
12 to 16	≤-65	≤-73	≤-97
16 to 18	≤-60	≤-72	≤-97
18 to 20	≤-60	≤-70	≤-97

Residual FM (50 Hz to 15 kHz bandwidth): <200 Hz rms, below 8 GHz; <300 Hz rms, from 8 GHz to 16 GHz; <400 Hz rms, above 16 GHz.

AMPLITUDE MODULATION (AM) (50000B)

AM specifications apply for waveforms where envelope peak is at least 1 dB below maximum specified output power, with FM off and PM off. However, AM may be operated simultaneously with FM and/or PM.

AM Envelope Parameters (measured at 7 dB below max rated power).

Depth: 0 to ≥82%, 90% typical.

Bandwidth (50% depth; 3 dB points referenced to 1 kHz): 10 Hz to 10 kHz, (50 kHz typical).

Harmonic Distortion (relative to externally supplied AM envelope): <10% at 1 kHz rate and 50% depth, 5% typical.

Externally Supplied AM Envelope

Waveform: Any waveform compatible with band width considerations.

Rate: See Bandwidth, above.

Sensitivity: 1 Vpp=50% modulation ±10% (i.e., 40 to 60%) at a 1 kHz rate, measured at 7 dB below max rated power.

Input Impedance: 600 Ω, nominal, ac coupled.

FREQUENCY MODULATION (FM) (50000B)

FM specifications apply with AM and PM off. However, FM may be operated simultaneously with AM and/or PM.

FM Envelope Parameters

Deviation: 10 kHz to 5 MHz, peak.

Bandwidth: ±3 dB, 10 Hz to 1 MHz.

Residual FM: ≤1.5 kHz rms, typical.

Distortion (relative to externally supplied FM envelope): <5% at 500 kHz rate and 5 MHz, peak, deviation.

Externally Supplied FM Envelope

Waveform: Any waveform compatible with bandwidth considerations.

Rate: See Bandwidth, above.

Sensitivity: 2 Vpp is maximum (nominal) deviation.

Input Impedance: 50 Ω, nominal.

PULSE/SQUARE WAVE MODULATION (PM) (50000B)

PM specifications apply with AM and FM off. However, PM may be operated simultaneously with AM and/or FM.

PM Envelope Parameters

On/Off Ratio: >80 dB.

Rise/Fall Time: <25 ns.

Overshoot, Undershoot and Ringing: ±2 dB, typical.

Pulse Amplitude Accuracy: Same as RF output level accuracy.

Externally Supplied PM Envelope

Repetition Rate: dc to 1 MHz.

Pulse Delay (output envelope leading edge reference to input pulse leading edge): 100 ns, typical.

Input Pulse Required: TTL level pulse, >50 ns wide

(leveled output), positive level=RF 'on'.

UNIVERSAL POWER METERS

FASTER, EASIER, AND MORE ACCURATE.

8650 POWER METER

Get the extensive measurement capabilities and features you need to test today's sophisticated communications systems faster, easier and more accurately. The 8650A measures the CW power, peak power and average power of TDMA, GSM and CDMA (both IS-95 and third-generation 10 MHz wideband) signals. CW measurement readings per second over GPIB exceed 1,750 and modulated measurement speeds exceed 800. Plus, the 8650A also has time-saving features such as automatic time gate setting, direct crest factor measurement and statistical power measurement analysis.

- 100 kHz to 40 GHz Frequency Range, depending on sensor
- -70 to +47 dBm Power Range, depending on sensor
- Linearity ± 0.02 dB over any 20 dB range from -70 to +16 dBm
- GPIB CW Measurement Speed (rdgs/s)

  Normal Mode > 300 • Swift Mode >1,750 • Fast Modulated Mode > 26,000
- GPIB Modulated Measurement Speed (rdgs/s)

  Normal Mode > 150 • Swift Mode >800 • Fast Modulated Mode > 800

8540 SERIES POWER METER

Built-in features such as power sweep calibration and frequency calibration factors provide an unsurpassed degree of measurement accuracy. The 8540C Series Power Meters have the speed and range to meet the throughput demands of high-volume manufacturing. And the meters can measure the CW, peak and true average power of the complex modulated signals used in EW, radar and communication systems.

- Frequency Range 100 kHz to 40 GHz, depending on sensor used
- Power Range: -70 to +47 dBm, depending on sensor used
- Linearity ± 0.02 dB over any 20 dB range from -70 to +16 dBm
- 100 ns Maximum Peak Power Sensor Rise Time
- Automatically measures peak and average power of TDMA, GSM and CDMA signals

BENCH-TOP METERS

MEET DEMANDS OF HIGH-VOLUME THROUGHPUT

- Random Sample Rate from 2.5 to 5 MHz
- 20 MHz Maximum Diode Sensor Video Bandwidth
- 10 MHz Instrument Video Bandwidth Maximum
- CW Single Sensor Dynamic Range: 90 dB
- Maximum Peak Single Sensor Dynamic Range: TDMA/GSM 60 dB CDMA 80 dB
- 100 ns Maximum Peak Power Sensor Rise Time
- Automatic (Burst Average Power Mode) and manual Time Gate Setting
- Statistical Power Measurement Analysis (Histogram, CCDF/CDF, Crest Factor, Standard Deviation)
- True RMS, low VSWR sensors and precision CW return loss bridges

- Achieve 500 readings per second over GPIB
- Use the Fast Buffered Mode to capture up to 4000 readings per second
- Measure the instantaneous peak power level of a pulse modulated signal
- True RMS, low VSWR sensors and precision CW return loss bridges.
- Statistical Power Measurement Analysis (Histogram, CCDF/CDF, Crest Factor, Standard

8650 POWER METER SPECIFICATIONS

Specifications describe the instrument's warranted performance, and apply when using the 80300A, 80400A, 80600A, and 80700A Series Sensors.

METER

Frequency Range: 10 MHz to 40 GHz [10]

Power Range: -70 dBm to +47 dBm (100 pW to 50 Watt) [10]

Single Sensor Dynamic Range: [10]

CW Power Sensors:	90 dB
Peak (Pulse) Power Sensors:	40 dB, Peak
	50 dB, CW
Modulation Power Sensors:	87 dB, CW
	80 dB, MAP/PAP [11]
	60 dB, BAP [11]

Display Resolution: User selectable from 1 dB to 0.001 dB in Log mode, and from 1 to 4 digits of display resolution in Linear mode.

METER FUNCTIONS

Measurement Modes (Sensors):

CW (80300A, 80350A, 80400A, 80600A, and 80700A Series)

Peak (80350A Series)

MAP/PAP/BAP [11] (80400A, 80600A, and 80700A Series)

Averaging: User selectable, auto-averaging or manual from 1-1024 readings. Timed averaging from 20 ms to 20 seconds.

dB Rel and Offset: Power display can be offset by -99.999 to +99.999 dB to account for external loss/gain.

Configuration Storage Registers: Allows up to 20 front panel setups.

Power Measurements and Display Configurations: Any two of the following channel configurations, simultaneously:
A, B, A/B, B/A, A-B, B-A, DLYA, DLYB

Number of Display Lines: 4

Sampling:
CW and Modulation Mode: 2.5 to 5 MHz asynchronous

Analog Bandwidth:

CW Mode: 3 kHz

Modulation Mode: >10 MHz

Time Gating:

Trigger Delay: 0 to 327 ms
Gate Time: 5 µs to 327 ms
Holdoff Time: 0 to 327 ms

ACCURACY

50 MHz Calibrator: (Standard)

Calibrator: +20 dBm to -30 dBm power sweep calibration signal to dynamically linearize the power sensors.

Connector: Type N, 50

Frequency: 50 MHz, nominal 0.0 dBm Accuracy: ±1.2% worst case for one year, over temperature range of 5° to 35°C.

VSWR: <1.05 (Return Loss >33 dB) @ 0 dBm.

1 GHz Calibrator: (Option 12)
Required for 80700A Series Sensors.

Calibrator: +20 dBm to -30 dBm power sweep calibration signal to dynamically linearize power sensors.

Connector: Type N, 50

Frequency: (Switchable): 1 GHz, nominal; 50 MHz, nominal

0.0 dBm Accuracy: ±1.2% worst case for one year, over temperature range of 5° to 35°C.

VSWR: <1.07 (Return Loss >30 dB) @ 0 dBm.

800 MHz - 1 GHz Synthesizer Specifications: (Option 12)

Power Range: +15 dBm to -30 dBm, settable in 1 dB steps.

Frequency: 800 MHz to 1 GHz, settable in 1 MHz steps.

Power Stability: <0.1 dB/Hour

Frequency Accuracy: ± 0.05%

Instrumentation Linearity:

±0.02 dB over any 20 dB range from -70 to +16 dBm. 10
±0.02 dB + (±0.05 dB/dB) from +16 to +20 dBm.
±0.04 dB from -70 to +16 dBm.

Graph show linearity plus worst case zero set, and noise versus input power

Temperature Coefficient of Linearity: <0.3%/°C temperature change following Power Sweep calibration. 24 hour warm-up required.

Zeroing Accuracy: (CW)

Zero Set[12]: <±50 pW, <±100 pW with 80400A and 80600A Series Modulation Power Sensors.
<±200 pW with 80700A Series Sensors.

Zero Drift[12]: <±100 pW during 1 hour,
<±200 pW with 80400A and 80600A Series Sensors,
<±400 pW with 80700A Series Sensors.

Noise: <±50 pW, <±100 pW with 80400A and 80600A Series Modulation Power Sensors.
<±200 pW with 80700A Series Sensors. Measurable over any 1 minute interval after zeroing, 3 standard deviations.

REMOTE INPUTS/OUTPUTS

V Prop F Input (BNC)[13]: Sets calibration factors using source VpropF output.

Analog Output (2) (BNC): Provides an output voltage of 0 to 10V in either Lin or Log units.[13]

Trigger Input (BNC): TTL trigger input signal for Swift and Fast Buffered modes.

GPIB Interface: IEEE-488 and IEC-625 remote programming.

RS232 Interface: Programmable serial interface, DB-9 connector.

GENERAL SPECIFICATIONS

Temperature Range:

Operating: 0° to 55°C (+32° to +131°F)[14]

Storage: -40°C to 70°C (-40° to +158°F)

Power Requirements:
100/120/220/240V ±10%,
48 to 440 Hz, 25VA typical

Physical Characteristics:

Dimensions: 215 mm (8.4 in) wide,
89 mm (3.5 in) high, 368 mm (14.5 in) deep

Weight: 4.55 kg (10lbs)

ORDERING INFORMATION

POWER METERS

8651A	Single Input Universal Power Meter (includes 1 sensor cable)
8652A	Dual Input Universal Power Meter includes 2 sensor cables)

ACCESSORIES

One manual, one power cord.

POWER METER OPTIONS

01	Rack mount kit
03	8651A Rear Panel Sensor and Calibrator Connections
04	8652A Rear Panel Sensor and Calibrator Connections
05	Soft Carry Case
07	Side Mounted Carrying Handle
08	Transit Case, (Includes Soft Carry Case)
09	Dual Rack Mount Kit (with assembly instructions)
10	Dual Rack Mount Kit (factory assembled)
12	1 GHz, 50 MHz Switchable Calibrator
13	8651A Rear Panel Input Connector
14	8652A Rear Panel Input Connectors

[10] Depending on sensor used. [11] MAP (Modulated Average Power), PAP (Pulse Average Power), BAP (Burst Average Power). [12] Specified performance applies with maximum averaging and 24 hour warm-up at constant temperature. [13] Operates in Normal Mode only. [14] Display contrast reduces above 50° C. [15] Does not apply to 80701A Sensor below 500 MHz.

8540C UNIVERSAL POWER METER SPECIFICATIONS

Specifications describe the instrument's warranted performance, and apply when using 80300A, 80400A, and 80600A Series sensors. Typical performance, (shown in italics), is non-warranted.

METER

Frequency Range: 10 MHz to 40 GHz [10]

Power Range: -70 dBm to +47 dBm (100 pW to 50 Watt) [10]

Single Sensor Dynamic Range:[10]

CW Power Sensors: 90 dB

Peak Power Sensors: 40 dB, Peak 50 dB, CW

Modulation Power Sensors: 87 dB, CW 80 dB, MAP/PAP [11] 60 dB, BAP [11]

Display Resolution: User selectable from 1 dB to 0.001 dB in Log mode, and from 1 to 4 digits of display resolution in Linear mode.

Meter Functions

Measurement Modes (Sensors):

CW (80300A, 80350A, 80400A, 80600A, and Series)

Peak (80350A Series)

MAP/PAP/BAP [11] (80400A and 80600A Series)

Averaging: User selectable, auto-averaging or manual from 1-512 readings.

dB Rel and Offset: Power display can be offset by -99.999 to +99.999 dB to account for external loss/gain.

Configuration Storage Registers:

Allows up to 20 front panel setups.

Power Measurements and Display Configurations: Any two of the following channel configurations, simultaneously:

A, B, A/B, B/A, A-B, B-A, DLYA, DLYB

ACCURACY

Calibrator: Power Sweep calibration signal to dynamically linearize the sensors (Type N connector).

Frequency: 50 MHz, nominal

Graph shows linearity plus worst case zero set and noise versus input power.

0.0 dBm Accuracy: ±1.2% worst case for one year, over temperature range of 5° to 35°C.

VSWR: <1.05 (Return Loss >33 dB)

Instrumentation, Relative to 0 dBm:

±0.02 dB over any 20 dB range from -70 to +16 dBm.

±0.02 dB + (±0.05 dB/dB) from +16 to +20 dBm.

±0.04 dB from -70 to +16 dBm.

Temperature Coefficient of Linearity: <0.3%/°C temperature change following Power Sweep calibration. 24 hour warm-up required.

Zeroing Accuracy: (CW)

Zero Set: 12 <±50 pW, <±100 pW with 80400A and 80600A Series Modulation Power Sensors.

Zero Drift: 12 <±100 pW during 1 hour

Noise: <±50 pW, <±100 pW with 80400A and 80600A Series Modulation Power Sensors. <±200 pW with 80700A Series Sensors, measureable over any 1 minute interval 3 standard deviations.

REMOTE INPUTS/OUTPUTS

V Prop F Input (BNC): Used to correct power readings for sensor frequency response using source VpropF output. [13]

Analog Output (BNC): Provides an output voltage of 0 to 10V for Channels 1 and 2 in either Lin or Log units. [13] Does not operate in Swift or Buffered modes.

Blanking Output (BNC): TTL High during power meter zero. Can be used to shut off signal generator RF output during sensor zero.

Trigger Input (BNC): TTL trigger input signal for Swift and Fast Buffered modes.

GPIB Interface: IEEE-488 and IEC-625 remote programming.

GENERAL SPECIFICATIONS

Temperature Range:

Operating: 0° to 50°C (+32° to +122°F)

Storage: -40°C to 70°C (-40° to +158°F)

Power Requirements:

100/120/220/240V ±10%,

48 to 440 Hz, 25VA typical

Physical Characteristics:

Dimensions: 215 mm (8.4 in) wide,

89 mm (3.5 in) high, 368 mm (14.5 in) deep

Weight: 4.55 kg (10lbs)

ORDERING INFORMATION

POWER METERS

8541C	Single Input Universal Power Meter (includes 1 sensor cable)
8542C	Dual Input Universal Power Meter (includes 2 sensor cables)

ACCESSORIES

One manual, one power cord, detachable sensor cables.

POWER METER OPTIONS

01	Rack mount kit
02	Add 256K buffer for Fast Buffered Mode Power Readings Stores up to 128,000 readings
03	8541C Rear Panel Sensor and Calibrator Connections
04	8542C Rear Panel Sensor and Calibrator Connections
05	Soft Carry Case
06	Second Analog Output, -10V to +10 V
07	Side Mounted Carrying Handle
08	Transit Case, (Includes Soft Carry Case)
09	Dual Rack Mount Kit (with assembly instructions)
10	Dual Rack Mount Kit (factory assembled)
11	Time Gating

[10] Depending on sensor used. [11] MAP (Modulated Average Power), PAP (Pulse Average Power), BAP (Burst Average Power). [12] Specified performance applies with maximum averaging and 24 hour warm-up at constant temperature. [13] Operates in Normal Mode only.

PEAK POWER METERS

ANALYZES PULSED WAVEFORMS AND CW SIGNALS

8500A SERIES PEAK POWER METER

The Giga-tronics 8500A Series Peak Power Meters combine CW power measurement with the ability to make precise peak power measurements at any point on a pulsed waveform. This dual, built-in capability lets you measure and analyze pulsed waveforms with a single instrument. The 8500A Series meters lets you view a pulsed waveform, along with critical parameters, on a built-in display.

Analyze pulse profiles and read peak power at any point on the pulse using the reference level cursor. And make precise timing measurements, such as rise time and pulse width, using up to four measurement points per channel.

- Rise time <15ns
- Sensor frequency range from 0.03 or 0.75 to 18.5, 26.5 or 40 GHz
- Power Range: -20 to +20 dBm Pulse; -40 to +20 dBm CW
- Measurement resolution is 100 ps
- Measure the same point on repetitive pulses at over 70 m measurements/second
- Built-in power sweep calibrator with NIST traceable accuracy

8500 PEAK POWER METER SPECIFICATIONS

METER

Frequency Range: 30 MHz to 40 GHz depending on sensors (see sensors specifications)

Power Range:

Pulse: -20 to +20 dBm

CW: -40 to +20 dBm (see sensor specifications)

ACCURACY

The uncertainty of microwave power measurements depends on several factors, the most imporant being the effective mismatch of both the power sensor and the RF source. Excluding mismatch effects, the measurement uncertainties of the instrument are:

Calibration Power Uncertainty (at 0 dBm): ± 1.5%

Linearity after Automatic Calibration:
± 3% (at stable temperature)

Temperature Coefficient of Linearity at Ambient
± 5° C, CW and Peak; typical:
>-10 dBm: negligible, 0 to 50° C
<-10 dBm; ± 0.5%/° C, 15 to 50° C;
± 1.0%/° C, 0 to 15° C (Instrument indicates if ± 5° C calibration range is exceeded.)

Uncertainty due to Zeroing and Noise:
CW (Avg.=500): <± 10 nW, 15 to 50° C;
<± 20 nW, 0 to 15° C
Peak (Avg.=100): <± 3.5 µW, 15 to 50° C;
<± 5.0 µW, 0 to 15° C
Single Pulse (typ.): <± 15 µW, 15 to 50° C;
<± 30 µW, 0 to 15° C

Time Base Range: 1.2 ns/div to 20 ms/div (12 ns to 200 ms time window, using either the Data Entry Keyboard or the Control Knob.)

Maximum Resolution: 0.1 ns

Accuracy: 0.01% of time window, ± 1 ns

Triggering Modes:
Internal: -20 to + 16 dBm
External (BNC): TTL Levels, Maximum PRF 1 MHz

Trigger Delay Range: 0 to 200 ms, using either the Data Entry Keyboard or the Control Knob.

Resolution: 0.1 ns

Accuracy: 0.01% of delay, ± 1 ns

Minimum Pulse Width: 20 ns, 15 ns rise time sensors.

Markers: Up to 4 markers per channel plus a Reference Power Level cursor. Markers can be positioned at any point on the pulse waveform. Typcially they would be positioned to make rise time and pulse width measurements. The markers and cursor can be positioned either at user selected delays or automatically atspecified percentage of amplitude for pulse parameter measurements.

Graph Display Mode: Plots the outline of the detected pulse on the front panel display, and provides read out of amplitude and timing information.

Fast Measurement Mode: Available under GPIB control to provide fast data acquisition and output. For an average number = 1, typically between 70 and 120 measurements per second are made. Via the rear panel analog output, swept frequency response tests can be made using a network analyzer.

GENERAL

Stored Setups: Saves settings at power down and ten additional stored setups in non-volatile memory.

Self-Test: Performed automatically at turn-on and optionally at anytime. A diagnostic code indicites the cause and location of any errors.

Reset Control (Rear Panel): Returns instrument to present default condition.

Design and Construction: To the intent of MIL-T-28800C, Type III, Class 5, Style E or F, Color R.

Power Requirements: 100, 120, 220 or 240 VAC ± 10%, 48 to 480 Hz.

Power Consumption: Approximately 100 VA

Temperature:
Operating: 0 to 50° C (32 to 122° F)
Non-operating: -40 to +65° C (-40 to 149° F)

Humidity (Operating w/o precipitation):
95% ±5% to 30° C; 75% ±5% to 40° C; 45% ±5% to 50° C

PHYSICAL CHARATERISTICS:

Size: 13.3 cm H x 42.6 cm W x 35.6 cm D (5.25 in x 16.75 in x 14 in)

Weight: Model 8501A, 12 kg (26 lbs);
Model 8502A, 13 kg (28 lbs)

AUXILIARY OUTPUTS/INPUTS (BNC)

Monitor: Provides a real time profile of the detected RF envelope. Rise time is typically 20 ns, output impedance is nominally 50. Voltage output is typically 4 mV to +2 V depending on power level.

8500 PEAK POWER METER SPECIFICATIONS CONTINUED

Trigger Input: TTL
RF Blanking: TTL open collector low during zeroing. Used to control power source.
Analog Output: Provides a voltage proportional to detected power. Scale factor is 100 mV/dB, ±0.5%, offset is <±10 mV.
Voltage Proportional to Frequency (V/GHz): Allows direct entry of frequency from RF power sources equipped with V prop F output.

GPIB INTERFACE

In accordance with IEEE STD 488-1978
GPIB Indicators: REM, TLK, LSN, SRQ, LLO
Remote Operation: Complete setup and measurement capabilities accessible via GPIB. Reporting of errors, malfunctions, operational status and self-test diagnostics available through serial poll capability.
Direct Plot Output: Outputs hardcopy pulse profile, including time, date and part identification, to a GPIB plotter.
GPIB Address: Selectable from front panel.
GPIB Interface Functions: SHI, AHI, T6, L4, SRI, RLI, PPO, DCI, DTI, TEO, LEO
ORDERING INFORMATION

Peak Power Meters

8501A	Single Channel Peak Power Meter
8502A	Dual Channel Peak Power Meter

POWER SENSORS

16934A	30 MHz to 18.5 GHz, Type N
16935A	30 MHz to 18.5 GHz, APC-7
16936A	750 MHz to 18.5 GHz, High Speed, Type N
16937A	750 MHz to 18.5 GHz, High Speed, APC-7
17266A	750 MHz to 26.5 GHz, High Speed Sensor, Type K
17267A	30 MHz to 26.5 GHz, Type K
17071A	750 MHz to 40.0 GHz, High Speed Sensor, Type K
17071/S5428	500 MHz to 40.0 GHz, High Speed, Type K

OPTIONS

01	Rack Mount
03	Rear Panel Sensor and Calibrator Connectors (Replaces Front Panel Connectors)

ACCESSORIES & MAINTENANCE TOOLS

16956-001	Extra Sensor Cable Assembly, 5 ft.
16956-002	Extra Sensor Cable Assembly, 10 ft.
14052	IEEE-488 (GPIB) Cable, 2 Meter
16976	Sensor PROM Programmer
17075	Extender Board, Single Connector
17076	Extender Board, Dual Connector
20790	Extra 8500A Series Manual
19206	8500A Series Calibration Kit: Consists of 17075, 17076, 16976 & 20790

VXI Universal Power Meters

THE FASTEST VXIBUS POWER METER

58542 VXIBUS UNIVERSAL POWER METER

Get NIST traceable, lab-grade CW power measurements from a single VXI bus module. You can also measure pulsed RF signals simply by using a Giga-tronics peak pulse power sensor, additionally enabling exact power measurements at any point on the waveform. The Giga-tronics 58542 is the fastest VXI power meter available. Measurement speeds exceed 150 readings per second, and our exclusive Burst Mode captures more than 5,000 readings in the same tick of a clock. In fact, the 58542 is so fast you can measure the power level of many swept signals, giving you the capability of a scalar analyzer without the additional cost.

Because the 58542 supports the SCPI command language —the standard for VXI computer controlled testing. Think about what all this will do for your ATE productivity as well as for your company's bottom line.

- True 2-channel operation displays reading from both channels
- Computer control over GPIB using the SCPI command language
- Accurate CW measurements from -70 to +20 dBm with a single sensor
- Measures instantaneous peak power of pulsed RF signals
- True RMS, low VSMR sensors and precision CW return loss bridges

VXIBUS UNIVERSAL POWER METER SPECIFICATIONS

Specifications describe the instrument's warranted performance, and apply when using 80300A Series Power Sensors. Typical performance, (shown in italics), is non-warranted.

METER

Frequency Range: 10 MHz to 40 GHz [10]

Power Range: -70 dBm to +47 dBm (100 pW to 50 Watt) [10]

Single Sensor Dynamic Range:

CW Power Sensors: 90 dB [10]

Peak Power Sensors: 40 dB, Peak 50 dB, CW

ACCURACY

Calibrator: Power Sweep calibration signal to dynamically linearize the sensors.

Frequency: 50 MHz, nominal.

Settability: The 1 mW (0.0 dBm) level in the Power Sweep Calibrator is factory set to ±0.7% traceable to the NIST.

0.0 dBm Accuracy: ±1.2% worst case for one year, over temperature range of 5 to 35°C.

Connector: Type N(f) connector, 50 ½.

VSWR: <1.05 (Return Loss >33 dB).

System Linearity (at 50 MHz for Standard CW Sensors)

±0.02 dB over any 20 dB range from -70 to +16 dBm.

±0.02 dB + (+0, -0.05 dB/dB) from +16 to +20 dBm.

±0.04 dB from -70 to +16 dBm.

Graph shows linearity plus zero set and noise vs. input power.

Zeroing Accuracy: (Standard CW Sensors)

Zero Set: <±50 pW [11]

Zero Drift: <±100 pW during 1 hour [11]

Noise Uncertainty: <±50 pW measured over a 1 minute interval. [11]

MEASUREMENT SPEED

Measurement speed increases significantly using data storage capabilities. Storing data in the power meter's memory for later down loading to your controller reduces word serial protocol and protocol conversion overhead. Up to 128,000 readings can be buffered. The table below illustrates typical maximum measurement rates for 80300 Series Peak Power Sensors. Measurement rate depends on several factors including controller speed and number of averages. Burst Mode speed shown does not include bus communication time.

Normal Mode	Swift Mode	Burst Mode
Non-Buffered	Buffered Data	Buffered Data
55 rdgs/s	150 rdgs/s	5100 rdgs/s

Data is read immediately after measurement in Normal Mode. Swift Mode allows triggering of individual data points, and stores the data in the 58542's memory. Burst Mode also buffers measurement data. Triggering is controlled by setting the time interval between measurements.

FRONT PANEL CONNECTIONS

Analog Output: Provides an output voltage con figurable in either Lin or Log units.

Normal Mode.

Trigger Input: Used to connect EXT trigger.

Swift and Burst Modes

Voltage proportional to Frequency:

Allows automated Cal Factor correction. Input the analog VpropF signal level from the microwave source. Normal Mode.

RETURN LOSS BRIDGES

Return Loss Bridge Frequency Response:

Use the standard "Open/Short" supplied with the bridge to frequency compensate 58542 return loss and VSWR measurements.

Bridge Insertion Loss: 6.5 dB, nominal, from input port to test port.

GENERAL SPECIFICATIONS

Temperature Range:

Operating: 0 to 50°C (+32 to +122°F)

Storage: -40 to 70°C (-40 to +158°F)

Power Requirements:

+5 VDC @ 800 mA

+24 VDC @ 250 mA

-24 VDC @ 250 mA

Physical Characteristics:

Dimensions:

C-size, single slot VXI standard

30 mm (1.2 in) wide, 234 mm (9.2 in) high, 340 mm (13.4 in) deep.

Weight: 2.5 kg (5.5 lbs)

[10] Depending on sensor used. [11] Specified performance applies with maximum averaging and 24 hour warm-up at constant temperature.

SCALAR ANALYZER

IDEAL FOR HIGH-VOLUME MANUFACTURING.

8003 NIST TRACEABLE PRECISION SCALAR ANALYZER

The Giga-tronics Model 8003 Precision Scalar Analyzer combines a 90 dB wide dynamic range with the accuracy and linearity of a power meter in a single instrument. The Model 8003 also incorporates a unique, built-in power sweep calibrator that linearizes the sensor's diode response in the nonsquare-law region, from –30 to +20 dBm. The calibration system uses the inherent linearity and stability of an ovenized thermistor to accurately calibrate the high-speed diode sensors from 0 to 50°C, ambient. The result is a linearity specification of ± 0.02 dB (0.5 %) over any 20 dB span and ± 0.04 dB (1%) over the entire 90 dB. The same built-in calibrator that linearizes the sensor provides a 1 mW signal accurate to within ±0.7%, stable over temperature and time, and traceable to NIST.

Giga-tronics offers an extensive line of power sensors for the Model 8003 to address a variety of power measurement applications. This includes standard CW power sensors, low VSWR CW power sensors, true RMS sensors, and our unique triggerable pulse sensors.

- Linearity of ± 0.02 dB (0.5%) over any 20 dB span
- Linearity of ± 0.04 dB (1%) over the entire dB
- Sensor frequency range from 0.01 to 18,20, 26.5 or 40 GHz
- Power Range: -20 to +20 dBm Pulse; -70 to +20 dBm CW

8003 SCALAR ANALYZER SPECIFICATIONS

SYSTEM SPECIFICATIONS

Specifications describe the instrument's warranted performance, and apply when using 80300A Series Power Sensors and 80500A Series Bridges.

Frequency Range: 10 MHz to 40 GHz in coax using the Giga-tronics 80300 Series power sensors and 80500 Series bridges.

Power Range: +30 to -70 dBm, see power sensor specifications.

System Dynamic Range:

CW Measurements: 90 dB

Peak Measurements: 40 dB

Swept Measurements: AC Mode 90 dB
DC Mode 80 dB

Inputs: Three identical inputs, A, B and C, accept detected outputs from the Giga-tronics power sensors and bridges.

Channels: Four channels can be used to select and simultaneously display inputs from A, B and C sensors in single channel or ratio mode.

DISPLAY MODES

Graph/Readout: Graph mode displays swept frequency response on CRT. Readout mode displays power level at cursor frequency or CW power levels in digital format on CRT.

Graph Mode:

dBm: single channel power measurement.

dB: relative power measurement (ratio or relative to trace memory).

Readout Mode:

dBm: single channel power measurement

dB: relative power measurement

Lin: nW, µW, mW and Watts: signal channel measurement. %: dual channel measurement. % Rel: dual channel measurement relative to a reference.

Channel Offset: -90 dB to +90 dB in .01 dB increments.

Autoscale: Automatically sets the scale factor, reference level and reference position to provide optimum display of active channel.

Averaging: 2, 4, 8, 16, 32, 64, 128, or 256 successive traces (swept) or readings (CW) can be averaged to reduce effects of noise on measurement.

Smoothing: Provides a linear moving average of adjacent data points. The smoothing aperture defines the trace width (number of data points) to be averaged. The smoothing aperture can be set from 0.1% to 20% of the trace width.

Trace Memory: Ten traces can be individually labeled and stored in non-volatile memory and recalled. Stored traces can be displayed, and trace differences from any measurement can be displayed.

Adaptive Path Calibration (Normalization): Traces are stored in non-volatile memory and normalized with the highest resolution, independent of display scale/division or offset. Up to 4,096 points for each trace are stored over the full frequency range the sweeper or any user selected frequency range. Normalization data is automatically interpolated for ranges within the original normalized range.

ACCURACY

Transmission Loss or Gain Measurement: Transmission loss or gain measurements are made relative to a 0 dB reference point established during calibration. Therefore, frequency response errors of the source, sensors, and signal splitting device are removed. The remaining elements of uncertainty are mismatch error, instrument linearity (Fig. 1) and noise uncertainty given in the absolute power accuracy section.

Reflection Measurements: When measuring devices with high return loss (>10 dB), reflection accuracy is typically dominated by the effective system directivity (Fig. 2), instrument linearity errors, and noise uncertainty. With low return loss devices (<10 dB), reflection accuracy is typically dominated by source match
(Fig. 3). Calibration with an open and short effectively removes uncertainties due to frequency response of the source, sensors, and signal splitting device.

8003 SCALAR ANALYZER SPECIFICATIONS CONTINUED

Calibrator: Provides a 50 MHz calibration signal at 51 very accurately controlled levels from +20 to -30 dBmto dynamically linearize the sensors.
Connector: Type N(f) precision connector, 50 ½.
Settability: The 1.00 mW level in the power sweep is factory set to ±0.7% traceable to the National Institute of Standards and Technology.
Accuracy: ±1.2% worst case for one year, over temperature range 15 to 35° C.
VSWR: <1.05 (Return Loss >33 dB)
Instrument plus Power Sensor Linearity:
Standard Sensors:
CW Mode:
±0.02 dB (±0.5%) over any 20 dB range from +16 to -70 dBm
±0.02 dB + (+0 dB, -0.05 dB/dB) from +16 to +20 dBm
±0.04 dB (±1.0%) from +16 to -70 dBm
Swept Mode:
±0.03 dB (±0.7%) over any 20 dB range from +16 to -70 dBm
±0.03 dB + (+0 dB, -0.05 dB/dB) from +16 to +20 dBm
±0.06 dB (±1.4%) from +16 to -70 dBm
Temperature Coefficient of Linearity: <0.3% /°C temperature change after calibration
Zeroing Accuracy:
(CW Mode, Averaging Factor = 32):
Zero set: ±50 pW
Zero drift: <±200 pW in 1 hour at constant temperature after at 24 hour warmup.
(Swept Mode,Averaging Factor = 32):
Zero set: ±50 pW (AC Detection)
±800 pW (DC Detection)
Zero drift: 2 nW (DC detection), typical, in 1 hour at constant temperature after 24 hour warmup. Zero drift not applicable in AC detection.
Noise Uncertainty: <50 pW, typical, at constant temperature, measured over a 1 minute interval, two standard deviations.
Cal Factor Correction: Manual or automatic correction to power readings to compensate for frequency response variations of the power sensors and bridges.
Manual: Cal Factor, Cal Frequency, Off
Auto: Sweeper

GPIB

Interface: Operates according to IEEE-488.2 and IEC-625 interface standards, A private line GPIB is used to connect the analyzer to firmware supported sweepers.

REAR PANEL INPUTS/OUTPUTS

Sweep In (Sweep Voltage Requirements):
(BNC connector). 0 to +10 V nominal.
Blanking Input: (BNC connector) Used to blank the sweep oscillator band switching points on the 8003 display.
Voltage level: Blanked >2 V; Unblanked <0.8 V
Input 1: (BNC connector) TTL levels, used with some sweepers to provide synchronization.
AC Modulation Output: (BNC connector) Provides drive to modulation input on sweeper or external modulator for use in AC detection mode.
Bias Output: (BNC connector). Programmable output voltage used to display family of curves.
Voltage range: +/-10 V
Current compliance: Source or sink 150 mA max
System GPIB: (GPIB connector) Used to connect 8003 to GPIB system controller.
Private GPIB: (GPIB connector) Used to connect 8003 to dedicated signal source, plotter or printer.
RS232 Port: Serial Communications Interface for driving an HP Laserjet printer.

SIGNAL SOURCES

System Integrated: The 8003 can be system integrated (sweeper control using the 8003) with all Giga-tronics sweepers and the following sweepers:
Marconi 6310 Series Programmable Sweep Generators
HP8350A and B Sweep Oscillator with RF plug-in (HP83500 Series or HP 86200 Series with HP11869A adapter)
HP8340A/B or HP8341B Synthesized Sweeper
HP8360 Series Synthesized Sweepers
Wiltron 6600B Sweep Generators
Wiltron 6700A Swept Frequency Synthesizers

Operator Integrated: The 8003 is compatible with any signal source meeting the following requirements:
Horizontal Ramp: Provides 0 to +10 V nominal ramp signal.
Blanking Signal: Provides a TTL level during retrace and bandswitching.
Modulation:
AC Detection Mode: A square wave is provided by the analyzer to modulate the signal source.
Frequency: 1 KHz nominal
On/Off ratio: >30 dB

GENERAL SPECIFICATIONS

Temperature Range: Operating: 0 to 50° C,
Storage: -40 to 70° C
Power Requirements:
100/120/220/240 V ±10%, 48 to 440 Hz, 200 VA
Physical Characteristics:
Dimensions: 45.1 cm (17.76 in) wide, 17.8 cm (7.00 in) high, 48.3 cm (19.00 in) deep
Weight: 16.6 Kg (36.5 lbs)

ORDERING INFORMATION

8003 Precision Scalar Analyzer
Options for 8003:

01	Rack Mount
02	RGB Interface

Power Sensor Options

20954-001	1.5 meter cable (5 feet)
20954-002	3.0 meter cable (10 feet)
20954-003	7.6 meter cable (25 feet)
20954-004	15.2 meter cable (50 feet)

8003 Accessories
PC Board Extender Kit P/N 20641
Bridge Adapter for use with Wiltron 560 Series Bridges P/N 20779

POWER SENSORS

THE SECRET IS THE SENSORS

Giga-tronics power meter architecture provides for a broad choice of functional sensors. Just by changing a sensor, you can measure CW power, pulse power, and the peak and average power of modulated wireless and cellular signals, faster and more accurately over a wider range.

THE FASTEST CW MEASUREMENTS

Giga-tronics 80300A Series CW Power Sensors let you measure CW power from 10 MHz to 40 GHz at more than 1,750 readings per second over GPIB. Measure up to 90 dB with a single sensor, and select from a variety of high power sensors, up to 50 W.

The Giga-tronics 80600A Series Modulated Power Sensors provide bandwidth up to 1.5 MHz to measure the peak and average power of CDMA signals.

PULSE POWER MEASUREMENTS

Attach a Giga-tronics 80350A Series Peak Power Sensor to an 8650A meter and directly measure the instantaneous peak power level of a pulse modulated signal.Use the 'sample delay' function to set the desired measurement point on the waveform. An oscilloscope can be used to view the profile and see the exact measurement point on the pulse.

MODULATED POWER MEASUREMENTS

The Giga-tronics 80400A Series Modulated Power Sensors let you measure the average power of amplitude modulated, burst modulated and other complex modulated signals — such as TDMA signals — at bandwidths up to 40 kHz.

The Giga-tronics 80701A Modulated Power Sensor operating with the 8650A power meter, provides system bandwidth up to 10 MHz to measure the peak and average power of wide band, third-generation CDMA signals over an 80 dB range.

POWER SENSOR SELECTION CHART

SENSOR SERIES	8540C	8650A	58542	8003	8500A
80300A	•	•	•	•	
80340A				•	
80350A	•	•	•		
80400A	•	•			
80500	•		•	•	
80600A	•	•			
80700A		•			
16900					•
17000					•

SENSOR MEASUREMENT CAPABILITIES

Signal Type	Sensor Model 80301A	80350A	80401A	80601A	80701A
CW Power Level	–70 to +20 dBm	–30 to +20 dBm	–67 to +20 dBm	–67 to +20 dBm	–64 to +20 dBm
Amplitude Modulation Rate, Power Range	N/A	N/A	$f_m \leq$ 40 kHz, –60 to +20 dBm $f_m >$ 40 kHz, –60 to –20 dBm	$f_m \leq$ 1.5 MHz, –60 to +20 dBm $f_m >$ 1.5 MHz, –60 to –20 dBm	$f_m \leq$10 MHz, –60 to +20dBm
Two-Tone Maximum Separation Between Carriers	N/A	N/A	≤ 40 kHz, –60 to +20 dBm > 40 kHz, –60 to –20 dBm	≤ 1.5 MHz, –60 to +20 dBm > 1.5 MHz, –60 to –20 dBm	10 MHz, –60 to +20 dBm > 10 MHz, –60 to –20 dBm
Pulse Modulation	N/A	> 350 ns Pulse Width	> 200 µs Pulse Width	> 300 µs Pulse Width	> 100 µs Pulse Width
Burst with Modulation $f_{m\ =\ modulation\ rate}$	N/A	N/A	$f_m \leq$ 40 kHz, > 200 µs Pulse Width; –40 to +20 dBm $f_m >$ 40 kHz, > 200 µs Pulse Width; –40 to –20 dBm	$f_m \leq$ 1.5 MHz, > 300 µs Pulse Width; –40 to +20 dBm $f_m >$ 1.5 MHz, > 300 µs Pulse Width; –40 to –20 dBm	$f_m \leq$ 10 MHz, > 100 µs Pulse Width;–30 to +20 dBm $f_m >$ 10 MHz, > 100 µs Pulse Width;–30 to –20 dBm

CW POWER SENSOR SELECTION GUIDE

	Frequency Range/ Power Range	Maximum Power	Power Linearity [1] (Frequency > 8 GHz)	RF Connector	Length	Diameter	Weight	VSWR
200 mW CW Power Sensors								
80301A	10 MHz to 18 GHz –70 to +20 dBm	+23 dBm (200 mW)	–70 to –20 dBm: ±0.00 dB –20 to +20 dBm: ±0.05 dB/10 dB	Type N(m) 50Ω	114.5 mm (4.5 in)	32 mm (1.25 in)	0.18 kg (0.4 lb)	1.12: 0.01 - 2 GHz 1.22: 2 - 12.4 GHz
80302A	10 MHz to 18 GHz –70 to +20 dBm	+23 dBm (200 mW)	–70 to –20 dBm: ±0.00 dB –20 to +20 dBm: ±0.05 dB/10 dB	APC-7 50Ω	114.5 mm (4.5 in)	32 mm (1.25 in)	0.18 kg (0.4 lb)	1.29: 12.4 - 18 GHz
80303A	10 MHz to 26.5 GHz –70 to +20 dBm	+23 dBm (200 mW)	–70 to –20 dBm: ±0.00 dB –20 to +20 dBm: ±0.1 dB/10 dB	Type K(m) [2] 50 Ω	114.5 mm (4.5 in)	32 mm (1.25 in)	0.18 kg (0.4 lb)	1.12: 0.01 - 2 GHz 1.22: 2 - 12.4 GHz
80304A	10 MHz to 40 GHz –70 to 0 dBm	+23 dBm (200 mW)	–70 to –20 dBm: ±0.00 dB –20 to 0 dBm: ±0.2 dB/10 dB	Type K(m) [2] 50Ω	114.5 mm (4.5 in)	32 mm (1.25 in)	0.18 kg (0.4 lb)	1.38: 12.4 - 18 GHz 1.43: 18 - 26.5 GHz 1.92: 26.5 - 40 GHz
Low VSWR CW Power Sensors								
80310A	10 MHz to 18 GHz –64 to +26 dBm	+29 dBm (800 mW)	–64 to –14 dBm: ±0.00 dB –14 to +26 dBm: ±0.05 dB/10 dB	Type K(m) [2] 50Ω	127 mm (5.0 in)	32 mm (1.25 in)	0.23 kg (0.5 lb)	1.13: 0.01 - 2 GHz 1.16: 2 - 12 GHz
80313A	10 MHz to 26.5 GHz –64 to +26 dBm	+29 dBm (800 mW)	–64 to –14 dBm: ±0.00 dB –14 to +26 dBm: ±0.1 dB/10 dB					1.23: 12 - 18 GHz 1.29: 18 - 26.5 GHz
80314A	10 MHz to 40 GHz –64 to +6 dBm	+29 dBm (800 mW)	–64 to –14 dBm: ±0.00 dB –14 to +6dBm: ±0.2 dB/10 dB					1.50: 26.5 - 40 GHz
1 W CW Power Sensors								
80320A	10 MHz to 18 GHz –60 to +30 dBm	+30 dBm (1 W)	–60 to –10 dBm:±0.00 dB –10 to +30 dBm: ±0.05 dB/10 dB	Type K(m) [2] 50Ω	127 mm (5.0 in)	32 mm (1.25 in)	0.23 kg (0.5 lb)	1.11: 0.01 - 2 GHz 1.12: 2 - 12 GHz
80323A	10 MHz to 26.5 GHz –60 to +30 dBm	+30 dBm (1 W)	–60 to –10 dBm: ±0.00 dB –10 to +30 dBm: ±0.1 dB/10 dB					1.18: 12 - 18 GHz 1.22: 18 - 26.5 GHz
80324A	10 MHz to 40 GHz –60 to +10 dBm	+30 dBm (1 W)	–60 to –10 dBm: ±0.00 dB –10 to +10 dBm: ±0.2 dB/10 dB					1.36: 26.5 - 40 GHz
5 W CW Power Sensor [3]								
80321A	10 MHz to 18 GHz –50 to +37 dBm	+37 dBm (5 W)	–50 to 0 dBm: ±0.00 dB 0 to +37 dBm: ±0.05 dB/10 dB	Type N(m) 50Ω	150 mm (5.9 in)	32 mm (1.25 in)	0.23 kg (0.5 lb)	1.20: 0.01 - 6 GHz 1.25: 6 - 12.4 GHz 1.35: 12.4 - 18 GHz
25 W CW Power Sensor [4]								
80322A	10 MHz to 18 GHz –40 to +44 dBm	+44 dBm (25 W)	–40 to +10 dBm: ±0.00 dB +10 to +44 dBm: ±0.05 dB/10 dB	Type N(m) 50Ω	230 mm (9.0 in)	104 mm (4.1 in)	0.3 kg (0.6 lb)	1.20: 0.01 - 6 GHz 1.30: 6 - 12.4 GHz 1.40: 12.4 - 18 GHz
50 W CW Power Sensor [4]								
80325A	10 MHz to 18 GHz –40 to +47 dBm	+47 dBm (50 W)	–40 to +10 dBm: ±0.00 dB +10 to +47 dBm: ±0.05 dB/10 dB	Type N(m) 50Ω	230 mm (9.0 in)	104 mm (4.1 in)	0.3 kg (0.6 lb)	1.25: 0.01 - 6 GHz 1.35: 6 - 12.4 GHz 1.45: 12.4 - 18 GHz

MODULATION POWER SENSOR SELECTION GUIDE ($f_M \leq$1.5 MHZ)

	Frequency Range/ Power Range	Maximum Power	Power Linearity [1] (Frequency > 8 GHz)	RF Connector	Length	Diameter	Weight	VSWR
200 mW Modulation Power Sensors								
80601A	10 MHz to 18 GHz –67 to +20 dBm, CW	+23 dBm (200 mW)	–67 to –20 dBm: ±0.00 dB –20 to +20 dBm: ±0.05 dB/10 dB	Type N(m) 50Ω	137 mm (5.39 in)	41 mm (1.62 in)	0.23 kg (0.5 lb)	1.12: 0.01 - 2 GHz 1.22: 2 - 12.4 GHz 1.29: 12.4 - 18 GHz
5 W Modulation Power Sensor [5, 6]								
80621A	10 MHz to 18 GHz –47 to +37 dBm	+37 dBm (5 W)	–47 to 0 dBm: ±0.00 dB 0 to +37 dBm: ±0.05 dB/10 dB	Type N(m) 50Ω	175 mm (6.90 in)	41 mm (1.62 in)	0.28 kg (0.6 lb)	1.20: 0.01 - 6 GHz 1.25: 6 - 12.4 GHz 1.35: 12.4 - 18 GHz

PEAK POWER SENSOR SELECTION GUIDE

	Frequency Range/ Power Range	Maximum Power	Power Linearity [1] (Frequency > 8 GHz)	RF Connector	Length	Diameter	Weight	VSWR
200 mW Peak Power Sensors								
80350A	45 MHz to 18 GHz –20 to +20 dBm, Peak –30 to +20 dBm, CW	+23 dBm (200 mW) CW or Peak	–30 to –20 dBm: ±0.00 dB –20 to +20 dBm: ±0.05 dB/10 dB	Type N(m) 50Ω	165 mm (6.5 in)	37 mm (1.25 in)	0.3 kg (0.7 lb)	1.12: 0.045 - 2 GHz 1.22: 2 - 12.4 GHz 1.37: 12.4 - 18 GHz
80353A	45 MHz to 26.5 GHz –20 to +20 dBm, Peak –30 to +20 dBm, CW	+23 dBm (200 mW) CW or Peak	–30 to –20 dBm: ±0.00 dB –20 to +20 dBm: ±0.1 dB/10 dB	Type K(m) [2] 50Ω	165 mm (6.5 in)	37 mm (1.25 in)	0.3 kg (0.7 lb)	1.50: 18 - 26.5 GHz 1.92: 26.5 - 40 GHz
80354A	45 MHz to 40 GHz –20 to +0.0 dBm, Peak –30 to +0.0 dBm, CW	+23 dBm (200 mW) CW or Peak	–30 to –20 dBm: ±0.00 dB –20 to 0.0 dBm: ±0.2 dB/10 dB	Type K(m) [2] 50Ω	165 mm (6.5 in)	37 mm (1.25 in)	0.3 kg (0.7 lb)	
5 W Peak Power Sensor [5, 6]								
80351A	45 MHz to 18 GHz 0 to +40 dBm, Peak –10 to +37 dBm, CW	CW: +37 dBm (5 W Average) Peak: +43 dBm	–10 to +0 dBm: ±0.00 dB 0.0 to +40 dBm: ±0.05 dB/10 dB	Type N(m) 50Ω	200 mm (7.9 in)	37 mm (1.25 in)	0.3 kg (0.7 lb)	1.15: 0.045 - 4 GHz 1.25: 4 - 12.4 GHz 1.35: 12.4 - 18 GHz
25 W Peak Power Sensor [4, 6]								
80352A	45 MHz to 18 GHz +10 to +50 dBm, Peak 0.0 to +44 dBm, CW	CW: +44 dBm (25 W Average) Peak: +53 dBm	0.0 to +10 dBm: ±0.00 dB +10 to +50 dBm: ±0.05 dB/10 dB	Type N(m) 50Ω	280 mm (11.0 in)	104 mm (4.1 in)	0.3 kg (0.7 lb)	1.20: 0.045 - 6 GHz 1.30: 6 - 12.4 GHz 1.40: 12.4 - 18 GHz
50 W Peak Power Sensor [4, 6]								
80355A	45 MHz to 18 GHz +10 to +50 dBm, Peak 0.0 to +47 dBm, CW	CW: +47 dBm (50 W Average) Peak: +53 dBm	0.0 to +10 dBm: ±0.00 dB +10 to +50 dBm: ±0.05 dB/10 dB	Type N(m) 50Ω	280 mm (11.0 in)	104 mm (4.1 in)	0.3 kg (0.7 lb)	1.25: 0.045 - 6 GHz 1.35: 6 - 12.4 GHz 1.45: 12.4 - 18 GHz

BRIDGE SELECTION GUIDE

	Frequency Range/ Power Range	Maximum Power	Power Linearity [1] (Frequency > 8 GHz)	Input	Test Port	Directivity	Weight	VSWR
Precision CW Return Loss Bridges								
80501	10 MHz to 18 GHz –35 to +20 dBm	+27 dBm (0.5 W)	–35 to +10 dBm: ±0.1 dB +10 to +20 dBm: ±0.1 dB ±0.005 dB/dB	Type N(f) 50Ω	Type N(f) 50Ω	38 dB	0.340 kg	< 1.17: 0.01 - 8 GHz < 1.27: 8 - 18 GHz
80502	10 MHz to 18 GHz –35 to +20 dBm	+27 dBm (0.5 W)	–35 to +10 dBm: ±0.1 dB +10 to +20 dBm: ±0.1 dB ±0.005 dB/dB	Type N(f) 50Ω	APC-7(f) 50Ω	40 dB	0.340 kg	< 1.13: 0.01 - 8 GHz < 1.22: 8 - 18 GHz
80503	10 MHz to 26.5 GHz –35 to +20 dBm	+27 dBm (0.5 W)	–35 to +10 dBm: ±0.1 dB +10 to +20 dBm: ±0.1 dB ±0.005 dB/dB	SMA(f) 50Ω	SMA(f) 50Ω	35 dB	0.340 kg	< 1.22: 0.01 - 18 GHz < 1.27: 18 - 26.5 GHz
80504	10 MHz to 40 GHz –35 to +20 dBm	+27 dBm (0.5 W) ±0.005 dB/dB	–35 to +10 dBm: ±0.1 dB +10 to +20 dBm: ±0.1 dB	Type K(f) 50Ω	Type K(f) 50Ω	30 dB	0.198 kg	< 1.35: 0.01 - 26.5 GHz < 1.44: 26.5 - 40 GHz

MODULATION POWER SENSOR SELECTION GUIDE (F_M < 40 KHZ)

	Frequency Range/ Power Range	Maximum Power	Power Linearity [1] (Frequency > 8 GHz)	RF Connector	Length	Diameter	Weight	VSWR
200 mW Modulation Power Sensors								
80401A	10 MHz to 18 GHz –67 to +20 dBm	+23 dBm (200 mW)	–67 to –20 dBm: ±0.00 dB –20 to +20 dBm: ±0.05 dB/10 dB	Type N(m) 50Ω	114.5 mm (4.5 in)	32 mm (1.25 in)	0.18 kg (0.4 lb)	1.12: 0.01 - 2 GHz 1.22: 2 - 12.4 GHz
80402A	10 MHz to 18 GHz –67 to +20 dBm	+23 dBm (200 mW)	–67 to –20 dBm: ±0.00 dB –20 to +20 dBm: ±0.05 dB/10 dB	APC-7 50Ω				1.29: 12.4 - 18 GHz
Low VSWR Modulation Power Sensor								
80410A	10 MHz to 18 GHz –64 to +26 dBm	+29 dBm (800 mW)	–64 to –14 dBm: ±0.00 dB –14 to +26 dBm: ±0.05 dB/10 dB	Type K [2](m) 50Ω	127 mm (5.0 in)	32 mm (1.25 in)	0.23 kg (0.5 lb)	1.13: 0.01 - 2 GHz 1.16: 2 - 12 GHz 1.23: 12 - 18 GHz
1 W Modulation Power Sensor								
80420A	10 MHz to 18 GHz –57 to +30 dBm	+30 dBm (1 W)	–57 to–10 dBm: ±0.00 dB –10 to +30 dBm: ±0.05 dB/10 dB	Type K [2](m) 50Ω	127 mm (5.0 in)	32 mm (1.25 in)	0.23 kg (0.5 lb)	1.11: 0.01 - 2 GHz 1.12: 2 - 12 GHz 1.18: 12 - 18 GHz
5 W Modulation Power Sensor [3]								
80421A	10 MHz to 18 GHz –47 to +37 dBm	+37 dBm (5 W)	–47 to 0 dBm: ±0.00 dB 0 to +37 dBm: ±0.05 dB/10 dB	Type N(m) 50Ω	150 mm (5.9 in)	32 mm (1.25 in)	0.23 kg (0.5 lb)	1.20: 0.01 - 6 GHz 1.25: 6 - 12.4 GHz 1.35: 12.4 - 18 GHz
25 W Modulation Power Sensor [4]								
80422A	10 MHz to 18 GHz –37 to +44 dBm	+44 dBm (25 W)	–37 to +10 dBm: ±0.00 dB +10 to +44 dBm: ±0.05 dB/10 dB	Type N(m) 50Ω	230 mm (9.0 in)	104 mm (4.1 in)	0.3 kg (0.6 lb)	1.20: 0.01 - 6 GHz 1.30: 6 - 12.4 GHz 1.40: 12.4 - 18 GHz
50 W Modulation Power Sensor [4]								
80425A	10 MHz to 18 GHz –34 to +47 dBm	+47 dBm (50 W)	–34 to +10 dBm: ±0.00 dB +10 to +47 dBm: ±0.05 dB/10 dB	Type N(m) 50Ω	230 mm (9.0 in)	104 mm (4.1 in)	0.3 kg (0.6 lb)	1.25: 0.01 - 6 GHz 1.35: 6 - 12.4 GHz 1.45: 12.4 - 18 GHz

MODULATION POWER SENSOR SELECTION GUIDE ($F_M \leq 10$ MHZ)

	Frequency Range/ Power Range	Maximum Power	Power Linearity [1]	RF Connector	Length	Diameter	Weight	VSWR
200 mW Modulation Power Sensor								
80701A (Requires option 12)			Frequency >8 GHz					
	50 MHz to 18 GHz	+23 dBm (200 mW)	–60 to –20 dBm: ±0.00 dB	Type N(m)	120 mm	27 mm	0.10 kg	1.12: 0.01 - 2 GHz
	–64 to +20 dBm, CW 250 MHz to 18 GHz –60 to +20 dBm, Modulation		–20 to +20 dBm: ±0.05 dB/10 dB Frequency <500 MHz –60 to –20 dBm: ±0.00 dB –20 to +20 dBm: ±0.05 dB/10 dB	50Ω	(4.72 in)	(1.06 in)	(0.2 lb)	1.22: 2 - 12.4 GHz 1.29: 12.4 - 18 GHz

TRUE RMS SENSORS SELECTION GUIDE ($F_M > 10$ MHZ)

	Frequency Range/ Power Range	Maximum Power	Power Linearity [1] (Frequency > 8 GHz)	RF Connector	Length	Diameter	Weight	VSWR
True RMS Sensors (-30 dBm to +20 dBm)								
80330A	10 MHz to 18 GHz	+33 dBm (2 W)	–30 to +20 dBm: ±0.00 dB	Type K(m) [2]	152 mm	32 mm	0.27 kg	1.12: 0.01 - 12 GHz
80333A	10 MHz to 26.5 GHz			50Ω	(6.0 in)	(1.25 in)	(0.6 lb)	1.15: 12 - 18 GHz
80334A	10 MHz to 40 GHz							1.18: 18 - 26.5 GHz 1.29: 26.5 - 40 GHz

8500 SERIES PEAK POWER SENSOR SELECTION GUIDE

Model	Frequency Range	Power Range Peak	Power Range CW	Maximum Power	Maximum VSMR		RF Connector
High Speed Sensors (<15 ns Rise Time, Typically 10 ns)							
16936A	750 MHz to 18.5 GHz	–20 to +20 dBm	–40 to +20 dBm	+23 dBM 200 mW	Below 2.0 GHz 2.0 to 12.4 GHz 12.4 to 18.0 GHz	1.12 1.22 1.37	Type N(m) 50 Ω
16937A	750 MHz to 18.5 GHz	–20 to +20 dBm	–40 to +20 dBm	+23 dBM 200 mW	Below 2.0 GHz 2.0 to 12.4 GHz 12.4 to 18.0 GHz	1.12 1.22 1.37	APC-7 50 Ω
17266A	750 MHz to 26.5 GHz	–20 to +20 dBm	–40 to +20 dBm	+23 dBM 200 mW	Below 2.0 GHz 2.0 to 12.4 GHz 12.4 to 18.0 GHz 18.0 to 26.5 GHz	1.12 1.22 1.37 1.50	Type K(m) 50 Ω
17071A	750 MHz to 40.0 GHz	–20 to +20 dBm	–40 to +20 dBm	+23 dBM 200 mW	Below 2.0 GHz 2.0 to 12.4 GHz 12.4 to 18.0 GHz 18.0 to 26.5 GHz 26.5 to 40.0 GHz	1.12 1.22 1.37 1.50 1.92	Type K(m) 50 Ω
Low Frequency Sensors (<750 ns Rise Time, Typically 500 ns)							
16934A	30 MHz to 18.5 GHz	–20 to +20 dBm	–40 to +20 dBm	+23 dBM 200 mW	Below 2.0 GHz 2.0 to 12.4 GHz 12.4 to 18.0 GHz	1.12 1.22 1.37	Type N(m) 50 Ω
16935A	30 MHz to 18.5 GHz	–20 to +20 dBm	–40 to +20 dBm	+23 dBM 200 mW	Below 2.0 GHz 2.0 to 12.4 GHz 12.4 to 18.0 GHz	1.12 1.22 1.37	APC-7 50 Ω
17267A	30 MHz to 26.5 GHz	–20 to +20 dBm	–40 to +20 dBm	+23 dBM 200 mW	Below 2.0 GHz 2.0 to 12.4 GHz 12.4 to 18.0 GHz 18.0 to 26.5 GHz	1.12 1.22 1.37 1.50	Type K(m) 50 Ω

SENSOR CALIBRATION FACTOR UNCERTAINTIES

Root Sum of Squares (RSS) Uncertainties(%)[7]

Frequency (GHz) Lower	Upper	80301A 80302A 80350A 80401A 80402A 80601A 80701A	80303A 80304A 80353A 80354A	80310A 80313A 80314A 80410A	80320A 80323A 80324A 80420A	80321A[8] 80322A[8] 80325A[8] 80421A[8] 80422A[8] 80425A[8] 80621A[8]	80330A 80333A 80334A	80351A[8] 80352A[8] 80355A[8]
Min	1	1.04	1.64	1.58	1.58	4.54	1.58	4.92
1	2	1.20	1.73	1.73	1.73	4.67	1.73	5.04
2	4	1.33	1.93	1.91	1.91	4.89	1.90	7.09
4	6	1.41	2.03	2.02	2.01	5.01	2.01	7.17
6	8	1.52	2.08	2.07	2.06	5.12	2.06	7.25
8	12.4	1.92	2.55	2.54	2.53	5.56	2.53	7.56
12.4	18	2.11	2.83	2.80	2.79	5.89	2.78	12.37
18	26.5	—	3.63	3.68	3.62	—	3.59	—
26.5	40	—	6.05	5.54	5.39	—	5.30	—

[1] For frequencies above 8 GHz, add power linearity to system linearity.

[2] The K connector is electrically and mechanically compatible with the APC-3.5 and SMA connectors. Note: Use a Type N(m) to SMA(f) adapter (part no. 29835) for calibration of power sensors with Type K(m) connectors.

[3] Power coefficient equals <0.01 dB/Watt. [4] Power coefficient equals <0.015 dB/Watt. [5] Power coefficient equals <0.01 dB/Watt (Average). [6] Peak operating range above CW maximum range is limited to <10% duty cycle.

[7] Square root of the sum of the individual uncertainties squared (RSS). [9] Cal factor numbers allow for 3% repeatability when reconnectring attenuator to sensor and 3% for attenuator measurement uncertainty and mismatch of sensor/pad combination.

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8650A Power Meter Application Notes

Standard Deviation Function of 8650A Universal Power Meter

Discover the value of the 8650A standard deviation function when analyzing the performance of a wireless communication system. Standard deviation provides information on the range of power distribution around the mean over a period of time, giving further evidence of probability of occurence of maximum peak signals.

Histogram Function of the 8650A Universal Power Meter

A description of the histogram plot, discussing the theory of power distribution and the relationship to real world signals. The histogram plot is important in communication systems where digital modulation of wireless systems results in a random amplitude variation.

Power Meter Emulation of the 8540C

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