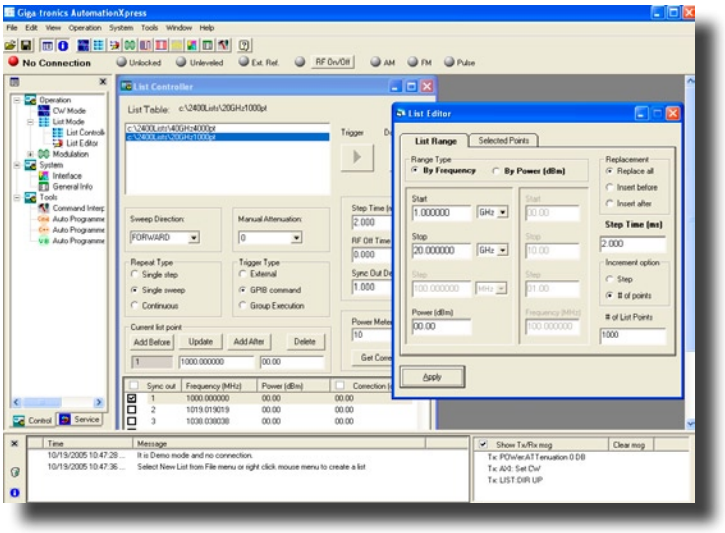
2400B Series

Microwave Synthesizer

Signal Generator	Frequency Range
2408B/2408S	10 MHz - 8 GHz
2420B/2420S	10 MHz - 20 GHz
2426B/2426S	10 MHz - 26.5 GHz
2440B/2440S	10 MHz - 40 GHz

Available Options and Accessories

17	Delete Modulation Suite
18	Delete 0.01 to 2 GHz
23	Type N Connector (2420 Series only)
26	Delete Step Attenuator
31	2 msec. Switching Speed Limit
44	Delete Front Panel, 2400S series only
46	Rack Slide Kit
55	Command Sets



Fast Frequency Switching

The fast frequency switching of the Giga-tronics 2400 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 2400 Series will quickly prove itself as your best test investment by providing quick settling of amplitude and frequency for minimum waiting between measurement points. In addition, the 2400 Series Automation Xpress software and interface option ensures unmatched 2.5 ms CW frequency and power switching performance, providing fast and flexible data exchange rates for faster testing and more device throughput.

Low Phase Noise

The Giga-tronics 2400 Series Microwave Synthesizers deliver state of the art phase noise and fast switching simultaneously. The 2400 Series low noise, high power and excellent phase stability are ideal for your measurement system's local oscillator or low jitter clock.

Faster to Program

Every 2400 Series Microwave Synthesizer 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.

Simpler to Operate

At first glance, it's clear the Giga-tronics 2400 Series is different. Its innovative design and intuitive interface will make you productive right out of the box. The 2400 was designed to streamline user navigation by moving complex testing functions from the front panel to the desktop PC. The result is a groundbreaking 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'll spend less time scrolling through data menus and more time getting your work done.

2400 Series Optimized for ATE

With the 2400 Series, ATE integrators now have a system source specifically designed to match their unique performance needs. The 2400 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 2400 Series the ideal choice for upgrading older systems.

2400 Series
Technical Specifications

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

Frequency (after 30 day warm-up)

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

Volts/GHz: 0 to 10 V range: 0.50 V/GHz, 0.01 – 20 GHz
0.25 V/GHz, 20 – 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 – 40.00 GHz	1/8

Output Power

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

Model	.01 - <2 GHz (w/ Step Attenuator)	2 - <8 GHz (w/ Step Attenuator)	8 - 20 GHz (w/ Step Attenuator)	20-40 GHz[1] (w/ Step Attenuator)
8 GHz	+14 (13.0)	+15 (13.8)	—	—
20 GHz	+ 14 (13.0)	+15 (13.8)	+15 (12.8)	—
26.5 GHz	+ 13 (12)	+ 10 (8.8)	+10 (8.4)	+10 (8.0)
40 GHz	+ 10 (9)	+ 10 (8.8)	+ 9 (7.4)	+9 (6.5)

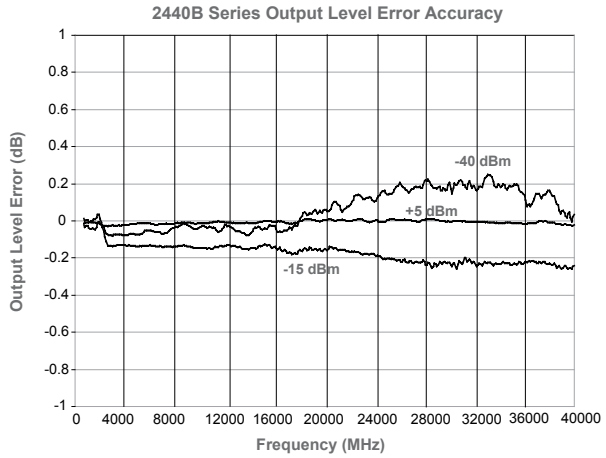
Minimum Settable: -107 dBm, <20 GHz; -100 dBm, >20 GHz
(Option 26) -17 dBm<20 GHz; -10 dBm, >20 GHz

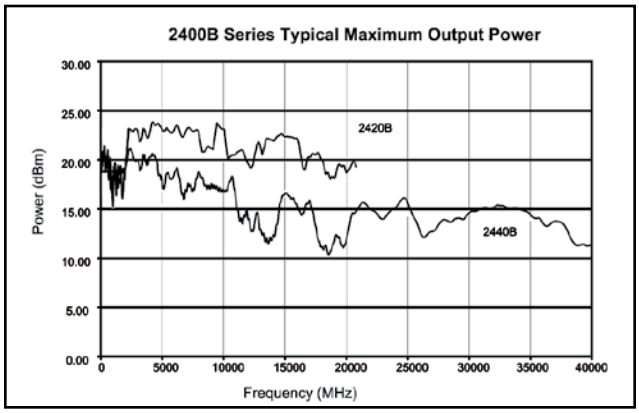
Power Offset: 0 to 10 dB
Resolution 0.05 dB
Temperature Stability: 0.025 dB/°C
Output Source Match (typical): < 2.0:1

Accuracy (dB)
(Specifications apply over 15 to 35°C range and degrades <0.1 dB/°C outside the range)

Model	> 5 dBm	> -10 dBm	> -100 dBm
.01 - 20 GHz	± 1.0	± 0.8	± 1.3
20 - 40 GHz	± 1.2	± 1.0	± 1.5

Output Power and Level Accuracy for the 2400 Series





Spectral Purity

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

Frequency (GHz)	Standard (at +6 dBm)
0.01 – 20 GHz	– 55 dBc[2,3]
20 – 40 GHz	– 50 dBc

Frequency (GHz)	Standard (at +6 dBm)
.01 – 2 GHz	– 80 dBc
2 – 20 GHz	– 60 dBc
20 – 40 GHz	– 50 dBc

Frequency (GHz)	Offsets > 300 Hz
.01 – 16 GHz	– 60 dBc
16 – 32 GHz	– 54 dBc
32 – 40 GHz	– 48 dBc

[1] 20 - 26.5 GHz for model 2426 series
[2] Frequencies > 100 MHz; for frequencies < 100 MHz, -45 dBc typical, worst case -40 dBc
[3] Specification is -50 dBc for 2426B, 2426S, 2440B, and 2440S models

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2400 Series
Technical Specifications

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

Spectral Purity Continued:

Residual FM (typical)

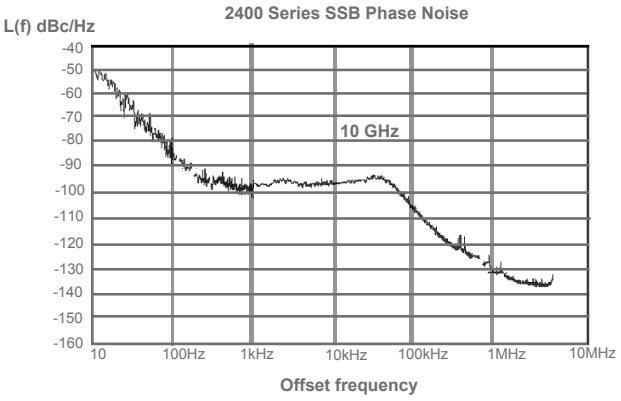
Frequency (GHz)	50 Hz - 15 kHz Bandwidth
.01 – 16 GHz	< 40 Hz
16 – 32 GHz	< 80 Hz
32 – 40 GHz	< 120 Hz

AM Noise (typical)

Frequency (GHz)	Offsets > 5 MHz
.01 – 2 GHz	– 130 dBm/Hz
2 – 20 GHz	– 145 dBm/Hz
20 – 40 GHz	– 140 dBm/Hz

SSB Phase Noise

Frequency (GHz)	Offset from Carrier (dBc/Hz) 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 - B Series and S Series

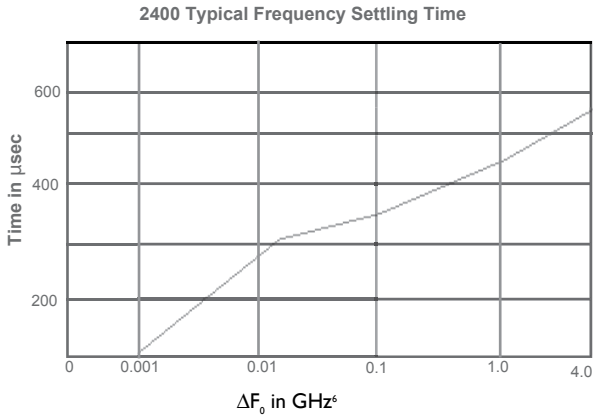
Ramp Frequency Sweep:	Full Frequency Coverage
Ramp Power Sweep:	0 to 25 dB
Power Slope:	0 to 0.5 dB/GHz
Power Flatness:	See Accuracy table
Ramp Output:	0 to 10V
Z-Axis Blanking:	+ 5V (Positive Only)
Sweep Time[4]:	100 msec — 200 secs

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

List Mode Continued:

Sweep Modes: Continuous, Single Step, & Single Sweep



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	2.5 ms	28 ms
4000 pt. List Download	13 sec	28 sec

Automation Xpress Interface (AXI)

For use with Giga-tronics Automation Xpress software. The AXI provides Xpress 2.5 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:	0 — 75% (Level = 0 dBm)
Rate (3 dB Bandwidth):	DC — 5 kHz (depth = 30%)
Sensitivity:	0 — 95% /V selectable
Accuracy:	± 10% of setting at 1 kHz rate
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

[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

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Modulation Specifications:

Frequency Modulation

Narrow Mode: (Deviation Limited Modulation Index)

Rate (3 dB bandwidth):	DC - 50 kHz	
Peak Deviation:	1 MHz/N	DE-3kHz
	0.4 MHz/N	3kHz to 50 kHz
Accuracy:	± 5% at 5 kHz rate with 0.6013 V peak input, 20 kHz/V sensitivity	
Input Range:	±1V	
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 xF_{GHz}, whichever is less
Accuracy:	± 5% at 100 kHz rate with 0.2405 V peak input, 1 MHz/V sensitivity
Input Range:	± 1V
Impedance:	50 Ω

Pulse Modulation (Specification applies for frequencies above 500 MHz)

On/Off Ratio: 80 dB

Rise/Fall Times:

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

Minimum Width: 100 ns

Level Accuracy[10]: (relative to CW)	± 0.5 dB	Pulse Width > 250 ns
	+1.5 / -0.5 dB	Pulse Width >150 -250 ns
	+2.5 / -0.5 dB	Pulse Width 125 - 150 ns

PRF (50% duty cycle): DC - 5 MHz

Pulse Fidelity (typical):

Overshoot & Ringing:	< 15%
Video feed through:	0.5 - 2 GHz (< 5%)
	2 - 40 GHz (< 1%)
Compression:	< ± 5ns
Delay:	< 75 ns

Input

Sensitivity:	TTL levels (polarity selectable)
Impedance:	50 Ω

Automation Xpress Requirements- All 2400 Series models

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

Internal Function Generator:

AM Modulation Source

Waveforms:	Sine, Square, Triangle, Ramp, Gaussian Noise
Rate:	0.01 Hz to 10kHz, 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 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:	Accuracy: +/-0.1% typical, worst case: ±2% of setting or ±20nS whichever is greater
PM Out:	2 Volts into 50 Ω

Physical

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

Remote Interface

GPIB (IEEE 488.2, 1987) with listen and talk
RS - 232

2400S Series Only

2400S Series include:
Rear RF Output
Delete Front Panel Option
includes front panel LED Indicators: Power, EXT REF, Unleveled

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.

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[10] Duty Cycle must be > 0.01%) Data subject to change without notice.

Inputs & Outputs:

Connector		
EXT REF Input	RF Output	AM Output
AM IN	10 MHz REF Output	FM Output
FM IN	100 MHz REF Output	Pulse Output
PM/PM Trigger IN	V/GHz Output	Pulse Sync Output
External ALC	Sync Output	
Trigger In	Blanking Output	
Stop Sweep I/O	Ramp Output	
	Lock/Level Output	

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