USB/Ethernet Very Wideband

Synthesized Signal Generator SSG-6400HS

50Ω -75 dBm to +14 dBm, 250 kHz - 6400 MHz

Case Style: LV1804

Installation CD with Software included

The Big Deal

- Cost effective production test solution
- Power level resolution of 0.01 dB
- Frequency resolution under 0.01 Hz
- Fast tuning: under 100µs
- Low phase noise: -133 dBc/Hz @1GHz (offset 10 kHz)
- **USB** *or* Ethernet-TCP/IP (**HTTP** and **Telnet** protocols) control
- AM/PM/FM/Pulse Modulation Capability

Product Overview

Mini-Circuits SSG-6400HS is a very wideband synthesized signal generator operating over a frequency range of 0.25 to 6400 MHz. The signal generator is cased in a rugged metal shielded package (11" x 8.5" x 2.15") and equipped with an N-type 50Ω connector at the RF output port.

The signal generator is supplied with a CD containing user friendly GUI control software and programming APIs for 32 and 64 bit environments. Using the supplied software, the user can easily select one of several different output modes including AM, FM and pulse modulation options, frequency and power sweeps and more.

The SSG-6400HS can be controlled from almost any Windows or Linux[1] PC, via USB 2.0 interface, or any computer with a network interface via HTTP or Telnet. Included with the generator are a 2.7 ft. USB cable, a 5 ft. Ethernet cable and a 12V power adapter. Longer USB cables and a mounting bracket are available as additional options.

Key Features

Feature	Advantages
Wide output power range 89 dB (-75 dBm to +14 dBm)	Ideal for high dynamic range measurements from compression to noise floor
Variety of modulation options	Opportunity to modulate your signal, as with higher end, higher priced devices
Multiple sweep options, including frequency, power and list sweep	Automatically run test over range of frequency at constant power, range of levels at constant frequency or preset a list of signals (frequency and power) for fast specific measurements.
Fine Frequency Resolution 0.01 Hz	Simulate Doppler shift measurements
GUI and DLL for Windows® and programming instructions for Windows®, Mac® and Linux®[1]	Easy to integrate in an automated test setup
USB HID (Human Interface Device)	Plug-and-Play (no need to install a driver for the device).
Ethernet-TCP/IP (Supports DHCP and Static IP)- HTTP and Telnet Protocols	The SSG-6400HS can be controlled from any Windows®, Mac®, or Linux® computer with a network port and Ethernet-TCP/IP (HTTP or Telnet protocols) support or using a VPN controlled remotely from anywhere in the world.

1. Windows is a registered trademark of Microsoft Corporation. Linux is a registered trademark of Linus Torvalds. Mac is a registered trademark of Apple Inc. Neither Mini-Circuits nor the Mini-Circuits SSG-6400HS Signal Generator are affiliated with or endorsed by the owners of the above referenced trademarks.

Very Wideband, USB/Ethernet

Synthesized Signal Generator

50Ω -75 dBm to +14 dBm, 250 kHz - 6400 MHz

Features

- Adjustable output power, 89 dB range and 0.01 dB steps
- Fine Frequency resolution (0.01 Hz)
- Can sweep frequency and power together power up, down or bidirectionally
- Multiple modulation options (AM, FM, Phase and Pulse)
- User friendly Windows® Graphical User Interface
- Supports a wide range of programming environments (See application note **AN-49-001** for details)
- USB HID and Ethernet control interfaces (Plug and Play)
- Mounting bracket (Optional)
- CE marked

Applications

- Lab Test equipment
- Automated Test capability
- Production Line testing
- Field Testing Line

Case Style: LV1804

Installation CD with Software included

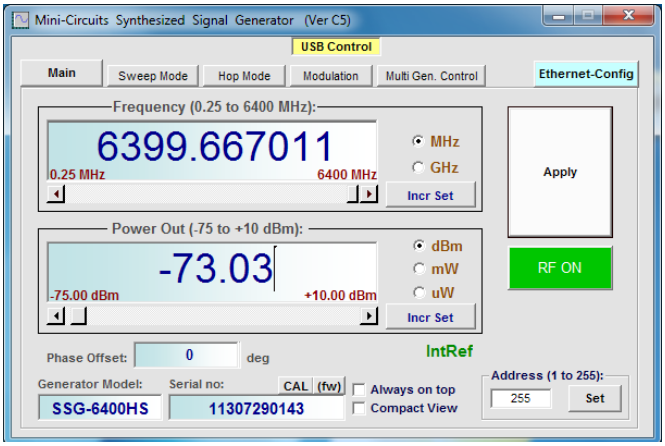
SSG-6400HS

Model P/N	Description
SSG-6400HS	**Synth. Signal Generator**
Included Accessories	
AC/DC-12-3W1	AC/DC 12V Adapter *(see Ordering Information)*
CBL-3W1-XX	AC Power cord *(see Ordering Information)*
CBL-RJ45-MM-5+	Ethernet cable RJ45 plug to RJ45 plug (5ft.)
USB-CBL-AB-3+	USB cable (2.7ft.)
SSG-CD	Software CD

RoHS Compliant

See our web site for RoHS Compliance methodologies and qualifications

Mini-Circuits GUI Control Program for Synthesized Signal Generators



Electrical Specifications at +25°C

Parameter	Test Conditions		Min.	Typ.	Max.	Units
Output Frequency			0.25	—	6400	MHz
Frequency resolution [2]	0.25 - 6400 MHz, using external reference		—	0.01	—	Hz
Frequency Accuracy	With internal reference [2]		—	—	±1.6	ppm
VSWR	0.25 - 32 MHz		—	1.3	—	:1
	32 - 1024 MHz		—	1.2	—	
	1024 - 6400 MHz		—	1.2	—	
Output Power Min [3]	0.25 - 4096 MHz		—	-75	-70	dBm
	4096 - 6400 MHz		—	-75	-60	
Output Power Max [3]	0.25 - 32 MHz		0	6	—	dBm
	32 - 6400 MHz		10	14	—	
Output power accuracy [4]	0.25 - 10 MHz	@ -70 to 0 dBm	—	+0.25/-2	—	dB
	10 - 32 MHz	@ -70 to 0 dBm	—	+0.1/-1.25	+0.8/-2.0	
	32 - 4096 MHz	@ -70 to -30 dBm	—	±0.25	±1.0	
	32 - 4096 MHz	@ -30 to +10 dBm	—	±0.1	±1.0	
	4096 - 6400 MHz	@ -60 to -30 dBm	—	±0.25	±1.0/-1.0	
	4096 - 6400 MHz	@ -30 to +10 dBm	—	±0.15	±1.0	
Power Resolution	0.25 - 32 MHz	@ -70 to 0 dBm	—	0.01	—	dB
	32 - 4096 MHz	@ -70 to +10 dBm				
	4096 - 6400 MHz	@ -60 to +10 dBm				
Phase Control						
Max Phase Offset From Reference			—	359	—	Deg.
Phase Offset Accuracy	0.25 - 1024 MHz		—	±0.3	—	Deg.
	1024-2048 MHz		—	±0.6	—	
	2048-4096 MHz		—	±1.5	—	
	4096-6400 MHz		—	±2.7	—	
Phase Offset Step Size	0.25 -1024 MHz		—	0.2	—	Deg.
	1024-2048 MHz		—	0.4	—	
	2048-4096 MHz		—	0.8	—	
	4096-6400 MHz		—	1.6	—	
Output Spectrum						
Non Harmonic Spurious	0.25 - 5 MHz	@ 0 dBm	—	-50	-30	dBc
	5 - 3000 MHz		—	-70	-60	
	3000 - 6400 MHz		—	-60	-40	
2nd Harmonic	0.25 - 6400 MHz	@ 0 dBm	—	-40	-30	dBc
	0.25 - 3000 MHz	@ +10 dBm	—	-35	—	
	3000 - 6400 MHz		—	-30	—	
3rd Harmonic	0.25 - 6400 MHz	@ 0 dBm	—	-60	-30	dBc
		@ +10 dBm	—	-40	—	
Sub-Harmonic	0.25 - 3000 MHz	@ 0 dBm	—	-90	-60	dBc
	3000 - 6400 MHz		—	-65	-40	

[2] When using external reference input, generator's output frequency accuracy equals that of the external reference. Frequency accuracy achieved within 2 minutes from power up.
[3] Generator units are calibrated within typical power range, however performance is guaranteed only within power max/min limits.
[4] Output power level for frequencies below 32 MHz is affected by temperature.

Typical Phase Noise, SSB at +25°C

Carrier Frequency (MHz)	Offset From Carrier					Units
	100Hz	1kHz	10kHz	100kHz	1MHz	
100	-122	-137	-149	-152	-153	dBc/Hz
500	-109	-128	-139	-146	-150	dBc/Hz
1000	-103	-122	-133	-140	-145	dBc/Hz
2000	-97	-117	-127	-134	-139	dBc/Hz
3000	-93	-113	-122	-130	-135	dBc/Hz
4000	-91	-110	-121	-128	-133	dBc/Hz
6000	-87	-107	-117	-124	-129	dBc/Hz

Electrical Specifications at 25°C (Reference, Trigger & DC Power)

Parameter		Test Conditions	Min.	Typ.	Max.	Units
Reference In [5]	Power	10 MHz	0	—	+10	dBm
		100 MHz	+2	—	+6	
	Impedance		—	50	—	Ω
Reference Out [6]	Frequency			10		MHz
	Power		+4	+6	+7	dBm
	Phase Noise	SSB @ 10 kHz offset	—	-145	—	dBc/Hz
	Impedance		—	50	—	Ω
Internal reference drift			—	±1	—	ppm/year
Int. ref. temp. effects		0-35°C	—	± 1	—	ppm
Int. ref. line voltage effects		11.4V-12.6V, ripple: 150 mV peak-to-peak, max	—	± 0.1	—	ppm
Trigger Out, Low [7,8]				—	0.4	V
Trigger Out, High [7,8]			2.4	—	3.3	V
Trigger In, Low [7,8]			0	—	0.4	V
Trigger In, High [7,8]			2.4	—	3.3	V
Trigger in, response time		Time between Trigger rising slope and next signal in Sweep/Hop modes	—	2.5	—	msec
Trigger out, response time			—	0.1	—	msec
Trigger out pulse width			—	5	—	msec
Supply Voltage [9]			11.4	12	12.6	V
Supply Current [9]			—	2.4	3.5	A
USB Current [9]			—	10	30	mA

[5] When a signal is applied to the Reference Input, the SSG-6400HS automatically detects the signal and will prompt the user to select INTERNAL or EXTERNAL REFERENCE. The SSG-6400HS will synchronize with either a 10 MHz or a 100MHz reference signal(specified by user).
[6] The Reference Output provides a non-sinusoidal 10MHz signal. Reference Output is always available.
[7] The SSG-6400HS triggers are active on rising edge.
[8] Trigger In and Trigger Out can be specified by the user (in Frequency sweep, Power Sweep, and Hop modes) to ignore/disabled, at every point in the sweep, or at the start of each sweep cycle.
[9] Power On Sequence: Connect the 12V power, followed by the USB or Ethernet control before turning on the generator

Electrical Specifications at 25°C [10] (Switching Speeds)

Parameter	Test Conditions	Min.	Typ.	Max.	Units
Minimum dwell time [11]	—	—	100	—	µsec
Frequency Settling Time[12]	To within 1/1000 of final frequency	—	36	—	µsec
Power Settling Time[13]	To within 1dB of final power	—	18	—	µsec

[10] Switching speed without communications delay. Communication delays will vary by computer
[11] Dwell time - duration of each signal point in a Sweep or Hop sequence set by user.
[12] Time from the beginning of a frequency change until the frequency is settled to within 0.1% of the final frequency.
[13] Time from the beginning of a change in the power output until the power is settled to within 1dB of the final power

Modulation Parameters[14]

Parameter	Test Conditions	Min.	Typ.	Max.	Units
Modulation input					
Max Voltage	FM, PM, AM	—	2	—	V p-p
	Pulse Modulation [15]	—	5	—	V_{MAX}
Impedance		—	50	—	Ω
Max Modulating frequency (3dB point)	Frequency & Phase Modulation [16]	—	20	—	kHz
	Amplitude Modulation [16]	—	10	—	kHz
	Pulse Modulation	—	Note 17	—	MHz
Frequency Modulation					
Max. Deviation	When modulation input is at ±1V	—	100	—	kHz
Phase Modulation					
Minimum. Deviation	When modulation input is at ±1V	—	1.6	—	Deg.
Maximum Deviation		—	180	—	
Amplitude Modulation					
Minimum Depth	When modulation input is at ±1V	—	5	—	% of carrier amplitude
Maximum Depth		—	60	—	
Pulse Modulation					
Input Threshold		—	1.2	—	V
Rise time	From 10% to 90% of specified power	—	0.1	—	µsec
Fall time	From 90% to 10% of specified power	—	0.1	—	µsec
Pulse power ratio	At output power 0 dBm	—	70	—	dB
Minimum Pulse Width	External modulation	—	0.2	—	µsec
	Internal modulation	—	1	—	µsec
Minimal Pulse Period	External modulation	—	0.4	—	µsec
	Internal modulation	2	—	—	µsec

[14] Frequency, phase and amplitude modulation require an external modulating signal at the Mod IN port. Pulse modulation may be done with either an external modulating signal, or the internal pulse generator.
[15] Minimum voltage is input threshold voltage.
[16] Modulating frequency is limited by the 3dB modulation frequency point.
[17] Pulse modulation modulating frequency is limited by pulse period limits - 2.5 MHz for external modulation or 500 kHz for internal.

Minimum System Requirements

Interface	USB HID or HTTP Get/Post or Telnet protocols
Host operating system - USB Control	**Windows 32/64 Bit operating system:** Windows 98®, Windows XP®, Windows Vista®, Windows 7®, Windows 8.® **Linux® support:** 32/64 Bit operating system
Host operating system - Ethernet Control	Any Windows®, Mac®, or Linux® computer with a network port and Ethernet-TCP/IP (HTTP or Telnet protocols) support
Hardware	Pentium® II or better [18]

[18] Pentium® is a registered trademark of Intel Corporation

Absolute Maximum Ratings

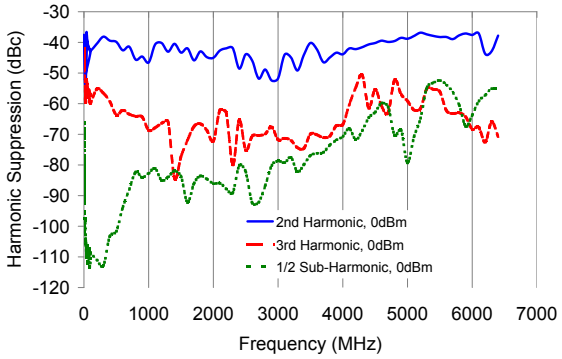
Operating Temperature	0°C to +50°C
Storage Temperature	-20°C to +60°C
Power in @ Reference In	+15 dBm
Reverse DC Power @ RF Out	25V
Reverse RF Power @ RF Out	+10 dBm
Reverse Power @ Reference Out	+15 dBm
Voltage input to Trigger ports	$-0.3V_{DC}$ to $+3.5V_{DC}$
Voltage input to Mod. In port	$\pm 5V_{DC}$

Connections

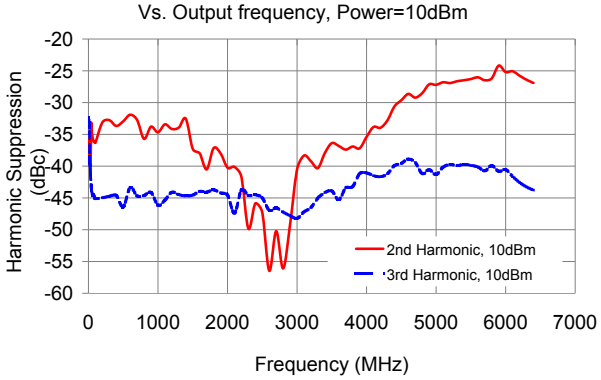
RF Output	(N Type-Female)
Mod In	(BNC-Female)
Ref. In	(BNC-Female)
Ref. Out	(BNC-Female)
Trig In	(BNC-Female)
Trig Out	(BNC-Female)
Power In	(2.1 mm DC socket)
USB Port	(USB B female)
Network (Ethernet/LAN)	(RJ45 socket)

Typical Performance Curves at 25°C

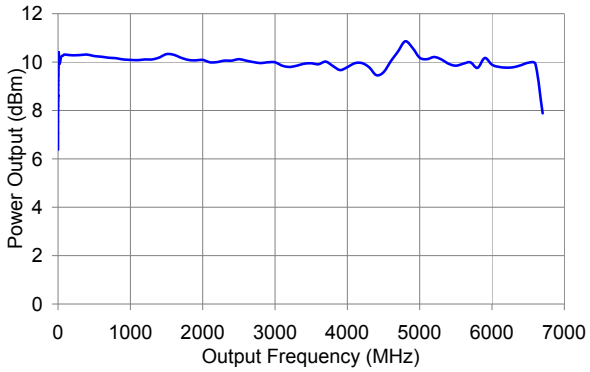
Harmonic and Sub-Harmonic Levels
Vs. Output Frequency. Power=0dBm



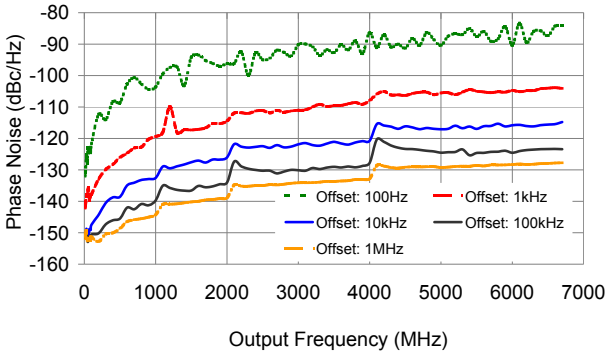
Harmonics Levels
Vs. Output frequency, Power=10dBm



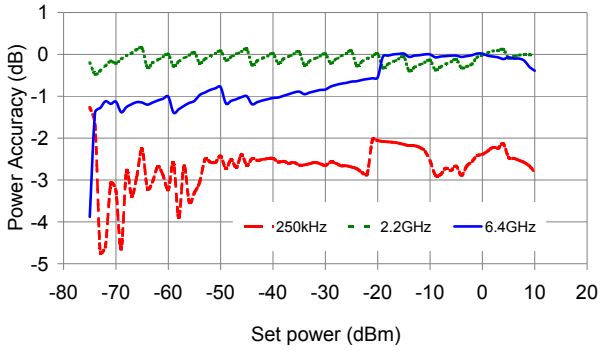
Max Power Output Vs. Output Frequency



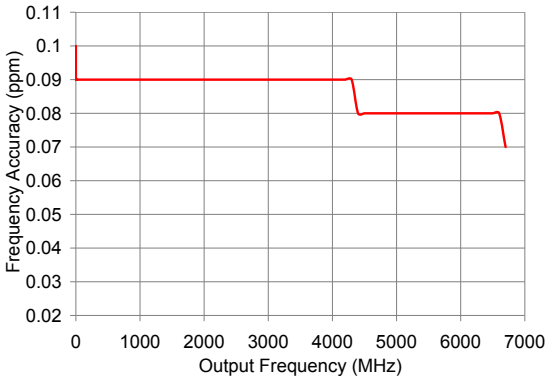
Phase Noise Vs. Frequency
at fixed offset frequencies



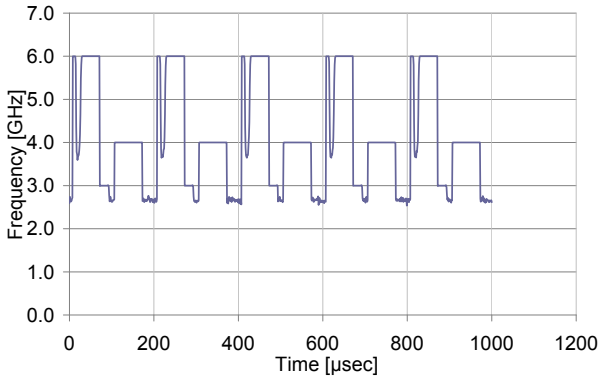
Power Accuracy
Vs. Output Power



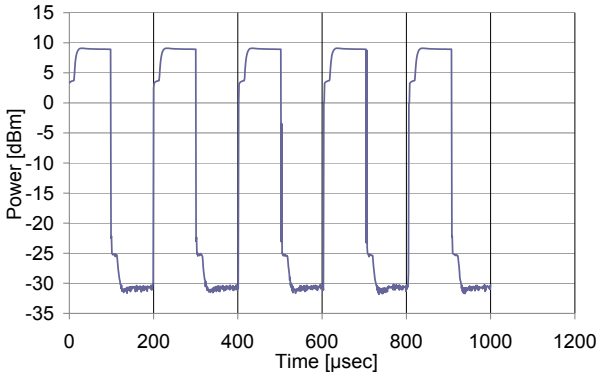
Frequency Accuracy Vs. Set Frequency



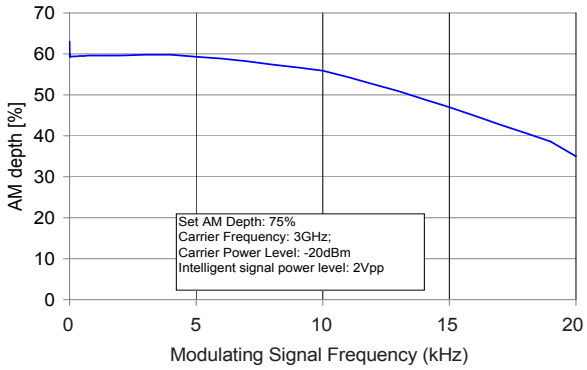
Max Continuous Frequency Switching Speed



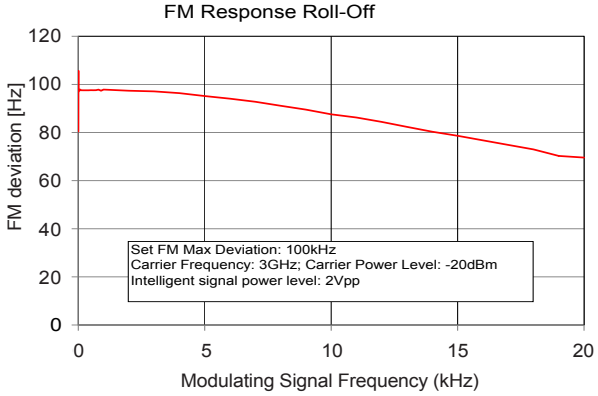
Max Continuous Power Switching Speed



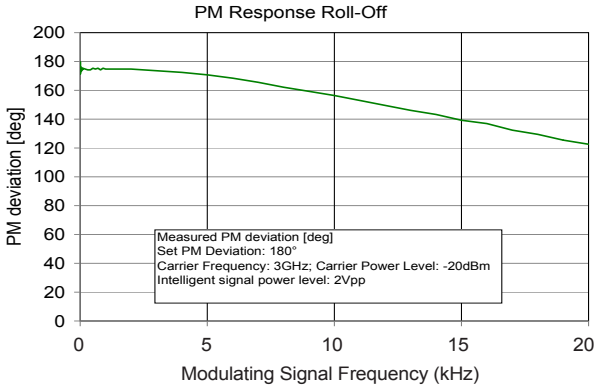
AM Response Roll-Off



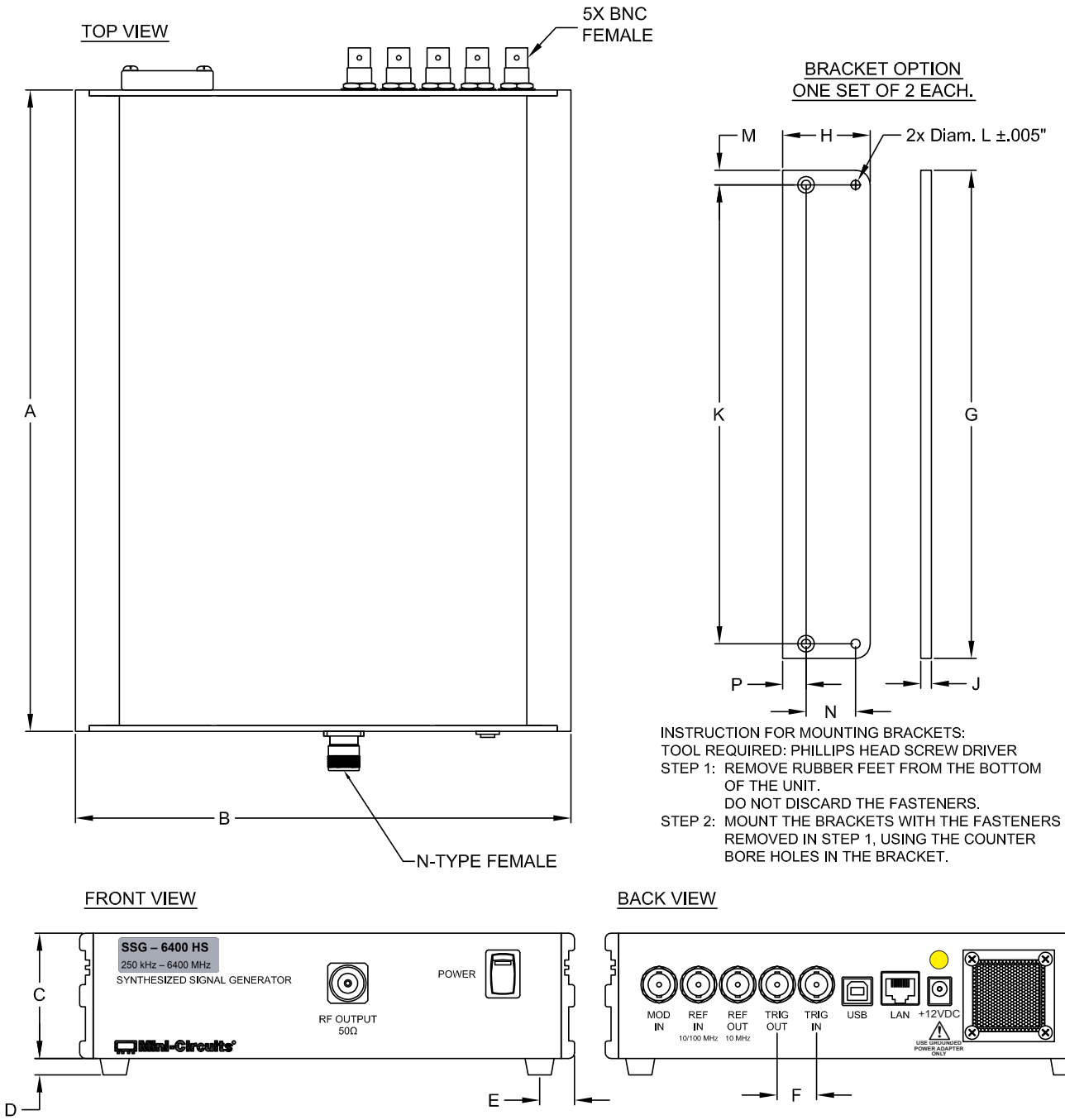
FM Response Roll-Off



PM Response Roll-Off



Outline Drawing LV1804



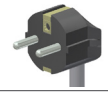
Outline Dimensions (inch / mm)

A	B	C	D	E	F	G	H	J	K	L	M	N	P	WT. GRAMS
11.00	**8.50**	**2.15**	**0.28**	**0.60**	**0.68**	**8.37**	**1.50**	**0.18**	**7.870**	**0.158**	**0.25**	**0.850**	**0.40**	2720
279.4	215.9	54.6	7.1	15.2	17.27	212.6	38.1	4.6	199.9	4.0	6.35	21.6	10.2	

Ordering Information

Model	Description
SSG-6400HS	USB/Ethernet Synthesized Signal Generator

Included Accessories	Description
AC/DC-12-3W1	AC/DC 12V Power Adapter with 3-wire Power Cord (grounded)
CBL-3W1-XX	AC Power cord *(Select one power cord from below with each Signal Generator)*
SSG-CD	Installation CD
USB-CBL-AB-3+	2.7 ft USB Cable
CBL-RJ45-MM-5+	5 ft. Ethernet cable RJ45 plug to RJ45 plug

AC Power Cords[19]	Part No.	Description
	CBL-3W1-US	Power Cord for United States
	CBL-3W1-EU	Power Cord for Europe
	CBL-3W1-UK	Power Cord for United Kingdom
	CBL-3W1-AU	Power Cord for Australia and China
	CBL-3W1-IL	Power Cord for Israel

[19] Power cords for other countries are also available, if you need a power cord for a country not listed in the table please contact apps@minicircuits.com or check http://www.minicircuits.com/contact/offices.html for regional offices e-mail and phone numbers.

Optional Accessories	Description
USB-CBL-AB-3+ (Spare)	2.7 ft USB Cable (USB-A to USB-B)
USB-CBL-AB-7+	6.8 ft. USB Cable (USB-A to USB-B)
USB-CBL-AB-11+	11 ft. USB Cable (USB-A to USB-B)
BKT-280-06+	Bracket (set of two each)

Calibration	Description	
CALSSG-6400HS	Calibration Service	*Click Here*

Additional Notes

A. Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.

B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.

C. The parts covered by this specification document are subject to Mini-Circuits standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the Standard Terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits' website at www.minicircuits.com/MCLStore/terms.jsp