USB / ETHERNET

Synthesized Signal Generator SSG-15G-RC

50Ω 0.01 to 15 GHz -50 dBm to +16 dBm

THE BIG DEAL

- Wideband Generator with 0.1 Hz Frequency Resolution
- Internal & External Pulse Modulation
- 0.5 µs Pulse Signals
- USB and Ethernet Control

APPLICATIONS

- C, X & Ku Band Radar Simulation
- LTE / 5G / WiFi 6E Testing
- Dynamic Frequency Selection (DFS) Simulation
- High Speed RF, Microwave ATE

Model No.	SSG-15G-RC
Case Style	SL2686
RF Connectors	SMA

DOWNLOAD

SOFTWARE PACKAGE

Refer to user guide for compliance information

PRODUCT OVERVIEW

Mini-Circuits SSG-15G-RC is a wideband synthesized signal generator operating over a frequency range of 10 MHz to 15 GHz. The signal generator is cased in a compact, rugged metal shielded package (5.1 × 3.6 × 1.0") and equipped with an SMA(F) 50Ω connector at the RF output port and starts immediately when power is applied.

Using the supplied software, the user can easily select one of several different output modes including multiple pulse modulation options, frequency sweep, and power sweep (up, down, or bidirectional).

Full software support is provided, including our user-friendly GUI application for Windows and a full API with programming instructions for Windows and Linux environments (both 32-bit and 64-bit systems). The SSG-15G-RC can be controlled from almost any Windows or Linux PC, via USB interface, or any computer with a network interface via HTTP, Telnet or SSH.

Included with the generator are a 6.6 ft. USB cable, two SMB-BNC cables for trigger and reference, and a 6V power adapter. See "Ordering Information" on the last page for more details.

KEY FEATURES

Feature	Advantages
Pulse Modulation Options	The SSG-15G-RC can produce pulse modulated RF signals using an internal or external modulating pulse.
Multiple Sweep Options	The SSG-15G-RC can be set to sweep either power or frequency up, down, or bidirectionally.
USB & Ethernet Control	USB HID and Ethernet (HTTP / Telnet / SSH) interfaces provide easy compatibility with a wide range of software setups and programming environments.
Full Software Support	User friendly Windows GUI (graphical user interface) allows manual control straight out of the box, while the comprehensive API (application programming interface) with examples and instructions allows easy automation in most programming environments

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ELECTRICAL SPECIFICATIONS AT +25°C

Parameter	Condition (GHz)		Min.	Typ.	Max.	Unit
Output Frequency	-		0.01		15	GHz
Frequency Resolution [1]	0.01 - 15 GHz		-	0.1	-	Hz
Frequency Accuracy	Using Internal Reference		-	±1	-	ppm
Settling Time [2, 4]	Hop Mode [3]		-	0.2	0.3	ms
	Freq. Sweep [3]		-	0.6	0.8	
	PC (External) Control		-	1.2	5	
Dwell Time (nominal) [4, 5]	-		0.1	-	10,000	ms
VSWR	0.01 - 4.9 GHz		-	1.40	-	:1
	4.9 - 10 GHz		-	1.50	-	
	10 - 15 GHz		-	2.10	-	
Output Power Max [6]	0.01 - 0.05 GHz		+3	+8	-	dBm
	0.05 - 15 GHz		+10	+16	-	
Output Power Min [6]	0.01 - 4.8 GHz		-	-50	-45	dBm
	4.8 - 15 GHz		-	-48	-43	
Power Resolution (nominal) [7]	0.01 - 15 GHz		-	0.1	-	dB
Output Power Accuracy [6]	0.01 - 0.05 GHz	-45 dBm to +3 dBm	-	±0.50	-	dB
	0.05 - 5 GHz	-45 dBm to -35 dBm	-	±0.60	-	
		-35 dBm to -14 dBm	-	±0.75	-	
		-14 dBm to +5 dBm	-	±0.55	-	
		+5 dBm to +10 dBm	-	±0.90	-	
	5 - 12 GHz	-45 dBm to -21 dBm	-	±0.70	-	
		-21 dBm to +10 dBm	-	±0.80	-	
	12 - 15 GHz	-45 dBm to -21 dBm	-	±0.70	-	
		-21 dBm to +10 dBm	-	±0.95	-	
RF Output Level	0.01 - 7 GHz	RF off	-	-95	-	dBm
	7 - 15 GHz		-	-75	-	
Harmonics [6]	0.01 - 2 GHz	-45 dBm to +10 dBm	-	-9	-	dBc
	2 - 4.9 GHz		-	-25	-	
	4.9 - 10 GHz		-	-20	-	
	10 - 15 GHz		-	-30	-	
Non-Harmonic Spurious	-		-	-70	-	dBc
Ethernet Communication	Protocol		TCP / IP, HTTP, Telnet, SSH, DHCP, UDP (limited)			
	Max Data Rate		100 Mbps (100 Base-T Full Duplex)			
USB Communication	Protocol		HID (Human Interface Device) - High Speed			
	Min Communication Time [8]		400 µs typ (full transmit/recieve cycle)			

1. Frequency resolution is tested with 10 MHz external reference.
2. Settling time - transition time between 2 output states. During the transition, RF output is turned off to avoid transient outputs.
3. For sweep / hop sequences pre-loaded into internal memory (high-speed mode).
4. Generator response time is Dwell time + Settling time.
5. Dwell time - duration of each signal point in a Sweep or Hop sequence set by user. Default is minimum dwell time.
6. The generator is calibrated within typical power range, however performance is guaranteed only within power max/min limits.
7. At power steps below 0.5 dB increased non-monotonic behavior may be observed.
8. USB min communication time is based on the polling interval of the USB HID protocol (125 µs polling interval, 64 bytes per packet), medium CPU load and no other high-speed USB devices using the USB bus.

REGULAR PULSE MODULATION SPECIFICATIONS AT +25°C

Repetitive RF pulse sequences with fixed freq. and power, supporting internal or external modulation and input / output trigger options.

Parameter	Condition		Min.	Typ.	Max.	Unit
Pulse Width Resolution	Nominal value		0.05	-	-	µs
Pulse Width [9, 12]	Measured at the 50% of pulse level		0.5	-	10e6	µs
Pulse Period [9]	Measured at the 50% of pulse level		2	-	10e6	µs
Duty Cycle (in Free Run)	Pulse Width divided by Pulse Period		0.1	-	99.9	%
Rise / Fall Time [11]	Measured between 10% and 90% of pulse level		-	100 / 20	-	ns
Pulse Width Accuracy [12]	Measured at 50% of pulse level	Internal pulse modulation	-	±3	-	%
		External pulse modulation	-	±3	-	
External Pulse Modulation Input Threshold	External pulse modulation		-	-	3	V
Trigger Response Delay	Trigger edge to 50% of pulse level		-	1	-	µs
Pulse Power Ratio	PWR_{OUT} = 0 dBm, $FREQ_{OUT}$ = 10 MHz		-	58	-	dB
	PWR_{OUT} = +10 dBm, $FREQ_{OUT}$ = 15 GHz		-	50	-	

DYNAMIC PULSE MODULATION SPECIFICATIONS AT +25°C

Flexible RF pulse sequences with varying frequency, power, pulse width and pulse repetition interval (PRI).

Parameter		Condition	Min.	Typ.	Max.	Unit
Pulse Width Resolution		Nominal value	0.05	-	-	µs
Pulse Width [12]		Measured at the 50% of pulse level	0.5	-	4e6	µs
Pulse Interval	Fixed Freq. & Power	Measured at the 50% of pulse level	4.5	-	4e6	µs
	Fixed Frequency	Measured at the 50% of pulse level	7	-	4e6	
	Varying Frequency	Measured at the 50% of pulse level	150	-	4e6	
Duty Cycle (in Free Run)		Pulse Width divided by Pulse Period	0.1	-	99.9	%
Rise / Fall Time [11]		Measured between 10% and 90% of pulse level	-	100 / 20	-	ns
Pulse Width Accuracy [12]		Measured at 50% of pulse level	-	±3	-	%
Pulse Power Ratio		PWR_{OUT} = 0 dBm, $FREQ_{OUT}$ = 10 MHz	-	58	-	dB
		PWR_{OUT} = +10 dBm, $FREQ_{OUT}$ = 15 GHz	-	50	-	

9. Pulse width must be less than pulse period by at least 0.5 µs.
10. Pulse widths below 0.5 µs can be set, however performance is only guranteed for 0.5 µs and up.
11. Pulse rise time will increase with pulse interval under 3 µs.
12. Pulse width accuracy is 3% of pulse width, or ±100 ns, whichever is greater.

TYPICAL PHASE NOISE (SSB) AT +25°C

Carrier Frequency (GHz)	Frequency Offset (dBc / Hz)				
	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz
0.01	-130	-135	-140	-146	-147
0.05	-116	-130	-140	-143	-157
0.10	-108	-127	-137	-137	-159
0.20	-106	-122	-131	-131	-155
0.40	-97	-116	-124	-125	-150
0.80	-91	-109	-118	-118	-144
1.60	-83	-103	-112	-112	-138
3.20	-81	-97	-106	-106	-129
4.00	-78	-95	-105	-105	-132
5.00	-75	-94	-103	-102	-129
6.40	-73	-92	-100	-100	-123
8.00	-70	-90	-98	-98	-123
10.00	-69	-90	-96	-96	-123
12.80	-67	-90	-95	-94	-118
15.00	-66	-89	-92	-92	-116

REFERENCE, TRIGGER & DC POWER AT +25°C

Parameter	Condition		Min.	Typ.	Max.	Unit
Aging	Using Internal Reference		-	2	-	ppm/yr
Reference In	Frequency	-	-	10	-	MHz
	Power	-	-3.5	-	+7.5	dBm
	Phase Noise	10kHz Offset	-	-145	-	dBc/Hz
Reference Out	Frequency	-	-	10	-	MHz
	Frequency Accuracy	Using Internal Reference	-	±1	-	ppm
	Power	-	-	±5.5	-	dBm
Trigger Out [13]	Low		0	-	0.4	V
	High		3	-	5	
Trigger In	Low		0	-	0.4	
	High		3	-	5	
Supply Voltage	-		5.6	6	6.4	V_{DC}
Supply Current [14]	-		-	1250	1850	mA
USB Current [14]	-		-	0	-	

13. Trigger out voltage specified with impedance load of 10 kΩ minimum.
14. All power is drawn from power adaptor, USB is used for control only.

ABSOLUTE MAXIMUM RATINGS

Operating Temperature		0°C to 50°C
Storage Temperature		-20°C to 60°C
Power in @ Reference In		+10 dBm
Reverse Power (DC) @ Reference Out		8 V_{DC}
Reverse Power (DC) @ RF Out		16 V_{DC}
Reverse Power (RF) @ RF Out	0.01 - 0.1 GHz	Derates linearly from +22 dBm at 100 MHz to +13 dBm at 10 MHz
	0.1 - 15 GHz	+22 dBm
Voltage input to Trigger ports		-0.3V_{DC} to +5.5V_{DC}

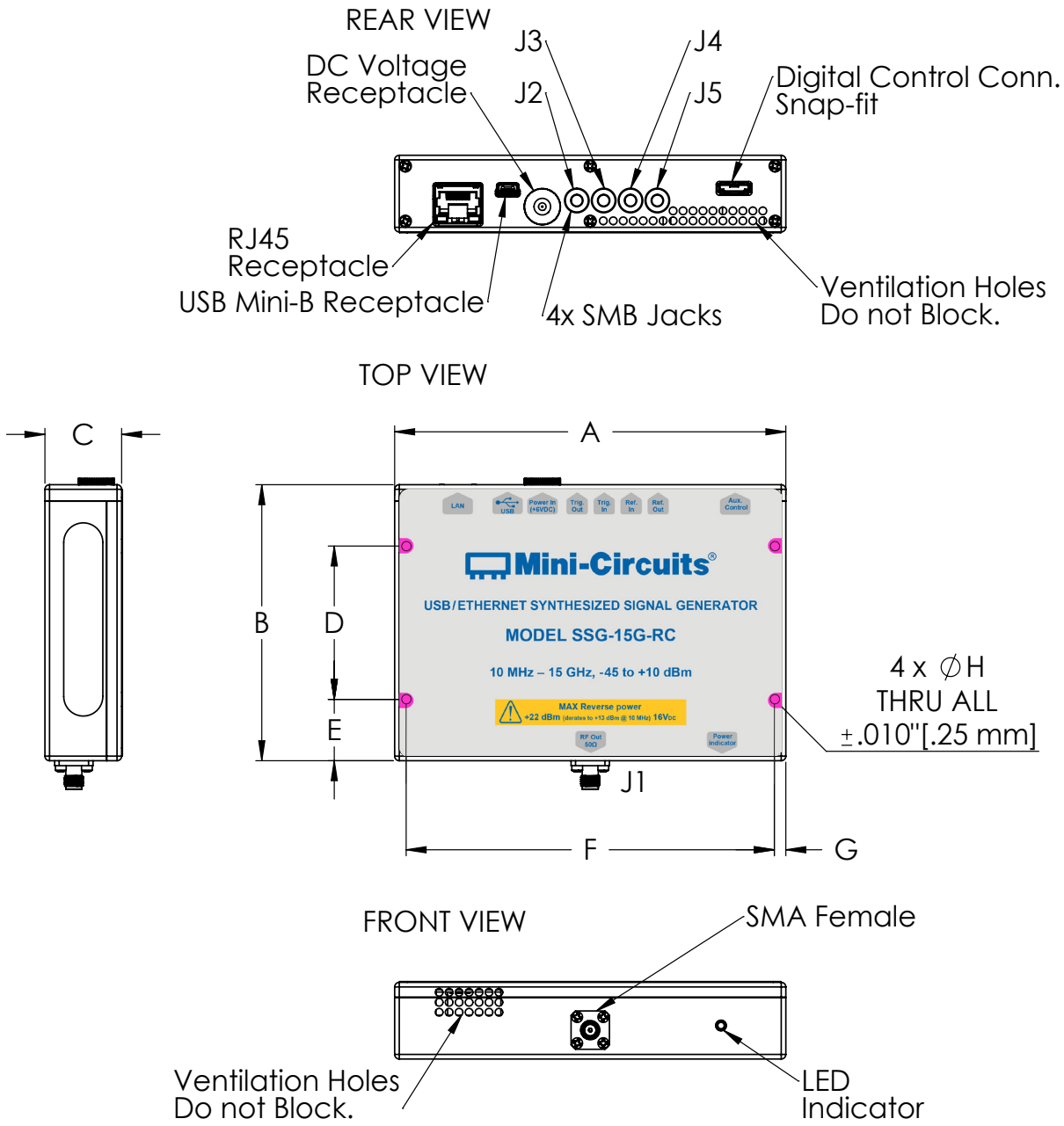
Permanent damage may occur if any of these limits are exceeded. Operating in the range between operating power limits and absolute maximum ratings for extended periods of time may result in reduced life and reliability.

CONNECTIONS

Port Name	Connector Type
RF Output	J1 SMA-Female
Reference In	J4 SMB-Male
Reference Out	J5 SMB-Male
Trigger In	J3 SMB-Male
Trigger Out	J2 SMB-Male
Power In [15]	2.1 mm DC socket
USB Port	USB type Mini-B female
Network (Ethernet/LAN)	RJ45 socket
Auxiliary Control	Snap Fit

15. No power On/Off switch - SSG will power on as soon as power is connected, starting at the specified startup condition (factory default set to 15 GHz, -45 dBm, RF Off).

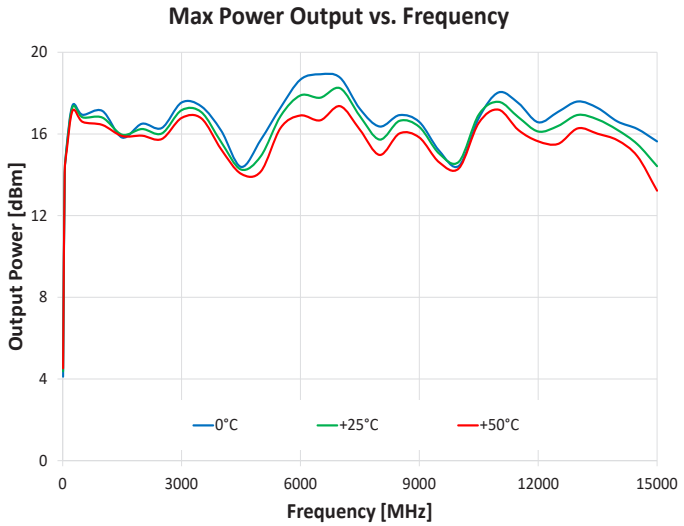
OUTLINE DRAWING (SL2686)

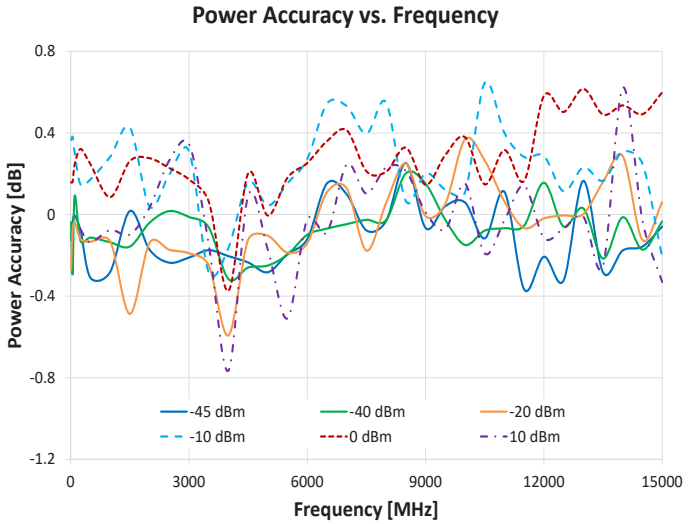


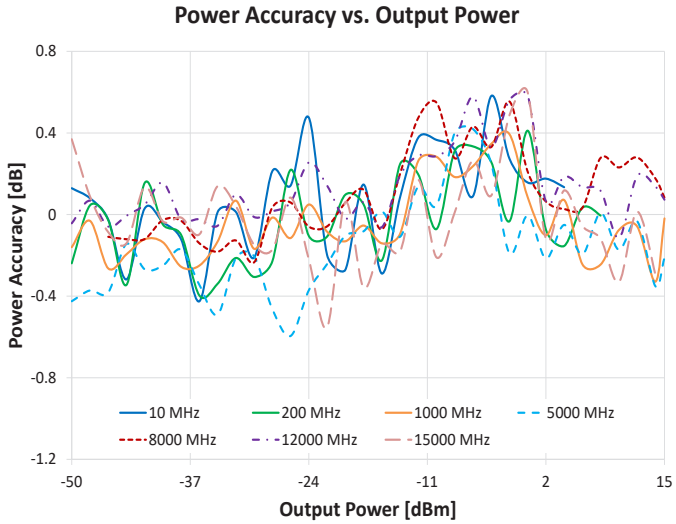
OUTLINE DIMENSIONS (INCH / MM)

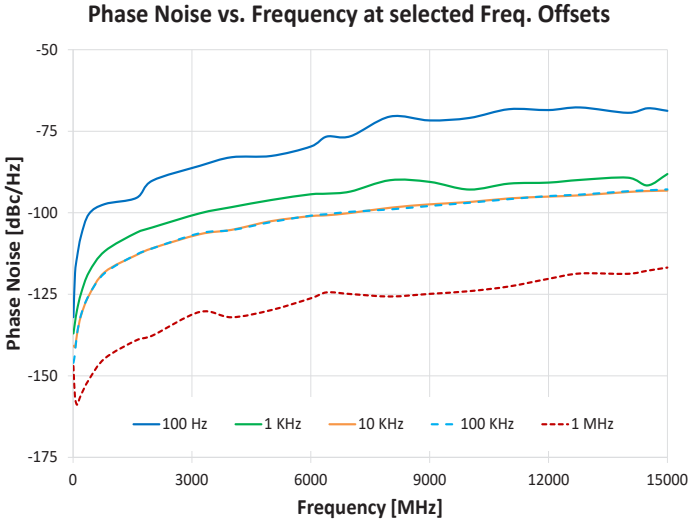
A	B	C	D	E	F	G	H	weight
5.10	**3.60**	**1.00**	**2.00**	**0.80**	**4.80**	**0.15**	**0.125**	(grams)
129.50	91.40	25.40	50.80	20.32	121.92	3.81	3.180	600

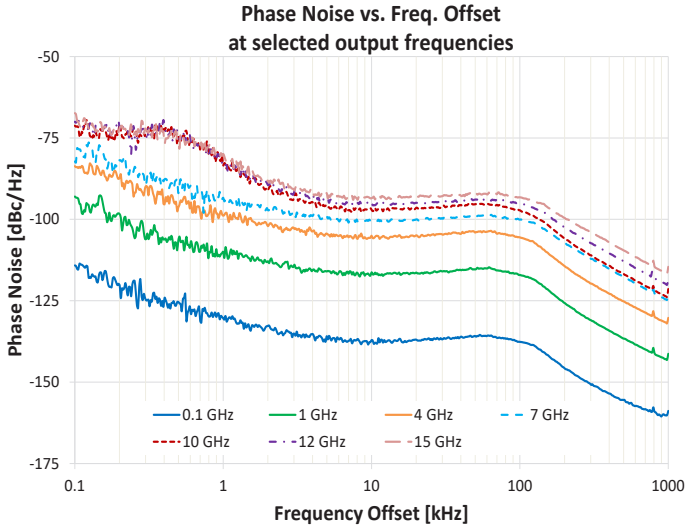
TYPICAL PERFORMANCE CURVES





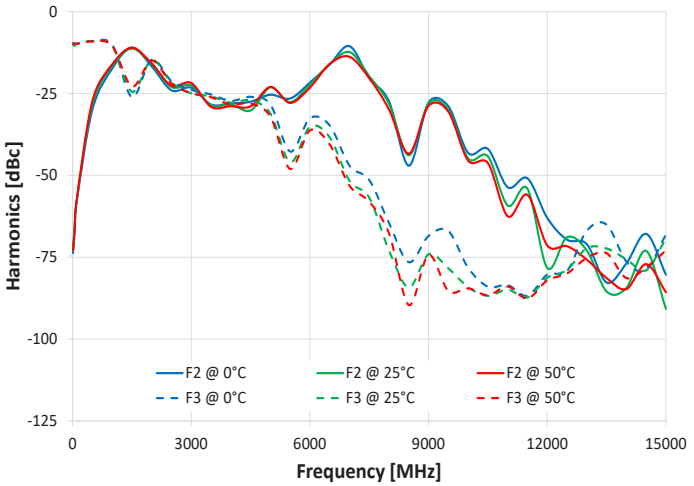




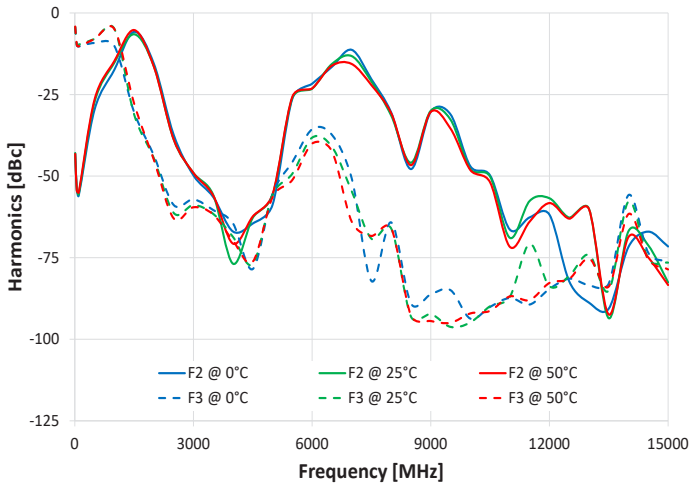


TYPICAL PERFORMANCE CURVES (CONTINUED)

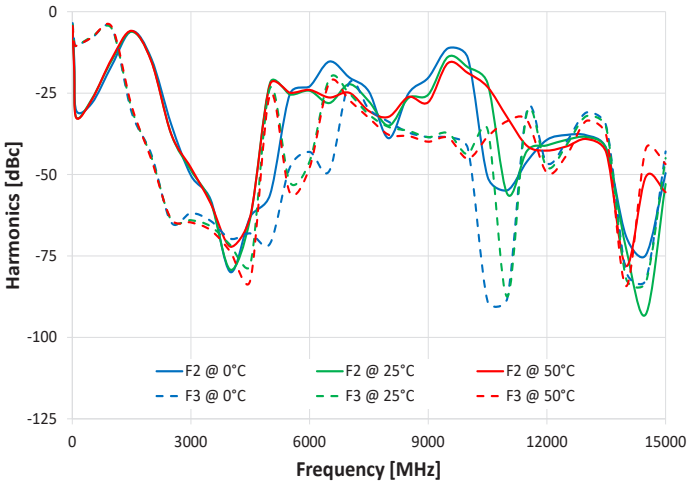
Harmonics vs. Frequency @ PWR = -40 dBm



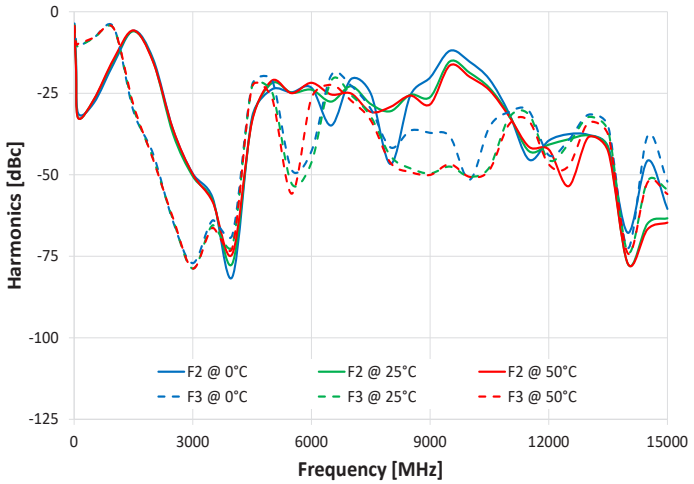
Harmonics vs. Frequency @ PWR = -20 dBm



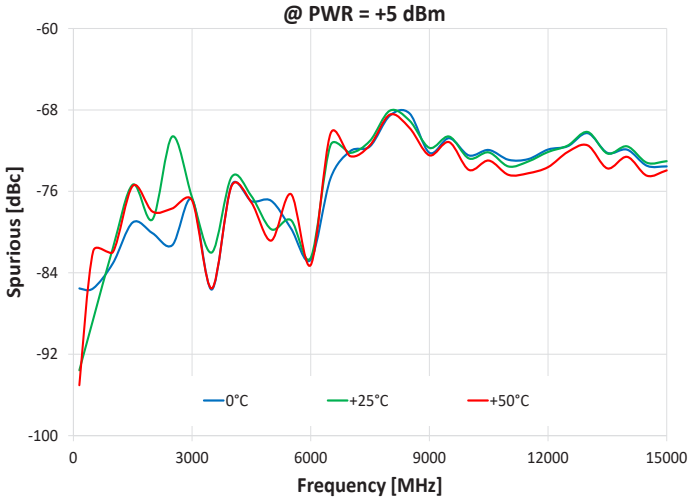
Harmonics vs. Frequency @ PWR = 0 dBm



Harmonics vs. Frequency @ PWR = +10 dBm



Spurious @ ±100 kHz to 50 MHz offset vs. Frequency @ PWR = +5 dBm



SOFTWARE SPECIFICATIONS

SOFTWARE & DOCUMENTATION DOWNLOAD:

- Mini-Circuits' full software and support package including user guide, Windows GUI, DLL files, programming manual and examples can be downloaded free of charge from: https://www.minicircuits.com/softwaredownload/sg.html
- Please contact testsolutions@minicircuits.com for support

MINIMUM SYSTEM REQUIREMENTS:

Parameter	Requirements	
Interface	USB HID or HTTP Get/Post or Telnet protocols or SSH protocols	
System Requirements	GUI	Windows 7 or later
	USB API DLL	Windows 7 or later and programming environment with ActiveX or .NET support
	USB Direct Programming	Linux, Windows 7 or later
	HTTP, Telnet or SSH	Any computer with a network port and Ethernet-TCP/IP (HTTP, Telnet or SSH protocols) support
Hardware	Intel i3 (or equivalent) or later	

APPLICATION PROGRAMMING INTERFACE (API)

ETHERNET SUPPORT:

- Simple ASCII / SCPI command set for unit control
- Communication via HTTP or Telnet
- Supported by most common programming environments

USB SUPPORT (WINDOWS):

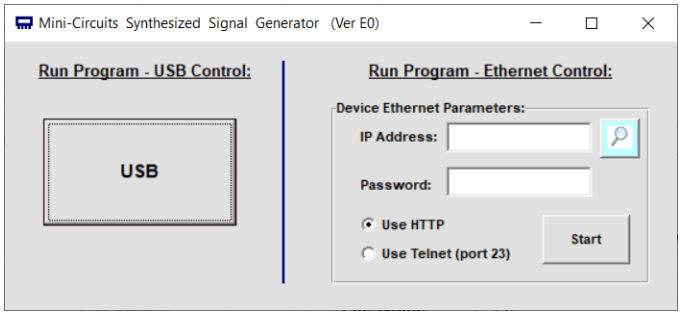
- ActiveX COM DLL file for creation of 32-bit programs
- .NET library DLL file for creation of 32 / 64-bit programs
- Supported by most common programming environments (refer to application note AN-49-001 for summary of suported environments)

USB SUPPORT (LINUX):

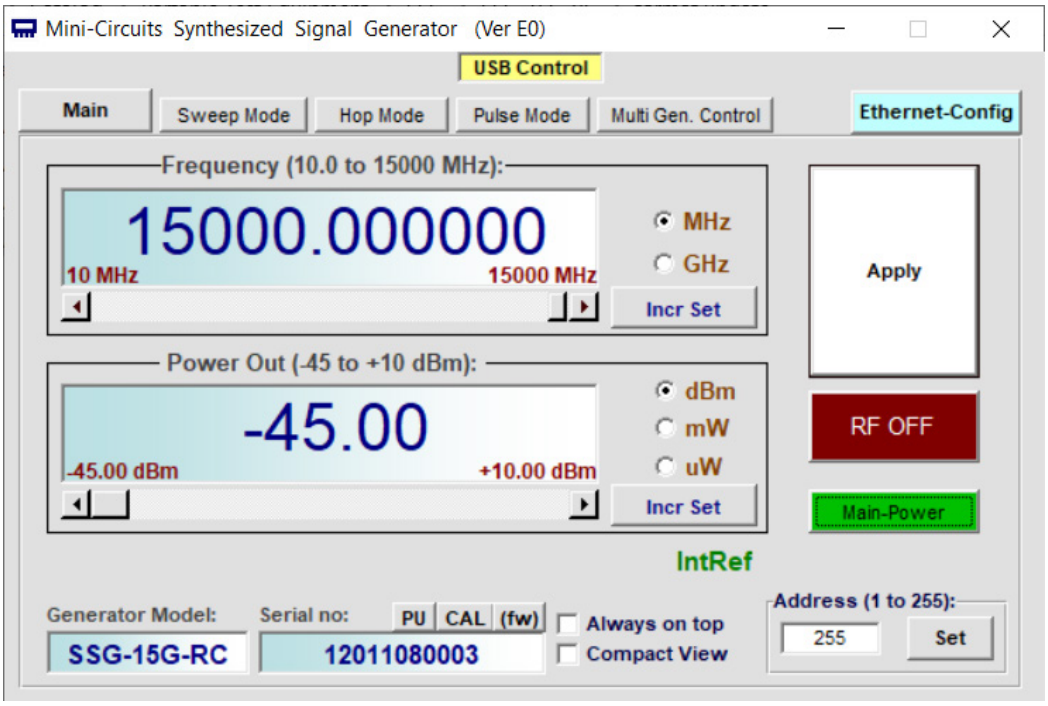
- Direct USB programming using a series of USB interrupt codes

GRAPHICAL USER INTERFACE (GUI) FOR WINDOWS - KEY FEATURES

- Connect via USB or Ethernet
- Password protected access for safe remote usage over Ethernet



- Configure output power, frequency, pulse modulation
- Program timed signal output sequences (linear sweep and frequency hop)
- Control timed sequences in multiple generators simultaneously
- Track unit operation time since last calibration and setup calibration reminders



ORDERING INFORMATION

Please contact Mini-Circuits' Test Solutions department for price and availability: testsolutions@minicircuits.com

Model	Description
SSG-15G-RC	USB/Ethernet Synthesized Signal Generator

Included Accessories	Part No.	Description
	AC/DC-6-3W	AC/DC Grounded Power adapter, 0°C to +40°C AC Input: 100-240 V, 50/60 Hz, I_{Max}= 1.2A DC Output 6±0.3 V, I_{Max}= 3A
	CBL-3W-xx	AC Power Cord (Select one power cord from below with each unit)
	MUSB-CBL-7FR+	6.6 ft (2.0 m) USB Cable: USB type A (Male) to USB type Mini-B (Male) with ferrite
	CBL-5FT-BMSMB+	2 x 5 ft (1.5 m) Trigger cable: BNC (male) to SMB (Female)

AC Power Cords [16]	Part No.	Description
	CBL-3W-US	Power Cord for United States
	CBL-3W-EU	Power Cord for Europe
	CBL-3W-UK	Power Cord for United Kingdom
	CBL-3W-AU	Power Cord for Australia and China
	CBL-3W-IL	Power Cord for Israel

16. Power cords for other countries are also available, if you need a power cord for a country not listed in the table please contact testsolutions@minicircuits.com

OPTIONAL ACCESSORIES

MUSB-CBL-7FR+ (spare)	6.6 ft (2.0 m) USB Cable: USB type A (Male) to USB type Mini-B (Male) with ferrite
CBL-RJ45-MM-5+	5 ft. network cable: RJ45 (Male) to RJ45 (Male) Cat 5E cable
CBL-5FT-BMSMB+ (spare)	5 ft (1.5 m) Trigger & Reference cable: BNC (male) to SMB (Female)

CALIBRATION

CALSSG-15G-RC	Calibration Service	Click Here

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-Circuits' 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/terms/viewterm.html