

Very Wideband, USB/Ethernet

Synthesized Signal Generator

SSG-15G-RC

50Ω -50 dBm to +16 dBm, 10-15000 MHz

The Big Deal

- Wideband generator with 0.1 Hz frequency resolution
- **USB and Ethernet** control
- Internal & external pulse modulation
- 0.5 μs pulse signals

Typical Applications

- LTE / 5G / Wi-Fi (2.4-7.2 GHz) testing
- Dynamic Frequency Selection(DFS) simulation
- Lab and field test equipment
- High volume production testing / ATE



Case Style: SL2686



Software Package

Included Accessories

Model No.	Description	Qty.
AC/DC-6-3W	AC/DC 6V adapter (<i>see Ordering Information</i>)	1
CBL-3W-XX	AC power cord (<i>see Ordering Information</i>)	1
MUSB-CBL-7FR+	6.6 ft. USB cable with ferrite	1
CBL-5FT-BMSMB+	BNC(M) to SMB(F) Trigger cable	2

RoHS Compliant

See our web site for RoHS Compliance methodologies and qualifications

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" x 3.6" x 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).

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 page 9 for all accessories and order options available.

Key Features

Feature	Advantages
USB & Ethernet control	USB HID and Ethernet (HTTP / Telnet / SSH) interfaces provide easy compatibility with a wide range of software setups and programming environments. The device draws all power requirements through the USB port.
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.
Full software support included	Mini-Circuits' full software package, programming and user manual are available for download from https://www.minicircuits.com/softwaredownload/sg.html at no extra cost.

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Electrical Specifications at +25°C

Parameter	Test Conditions	Min.	Typ.	Max.	Units	
Output Frequency	-	10	-	15,000	MHz	
Frequency Resolution ¹	10 - 15,000 MHz	-	0.1	-	Hz	
Frequency accuracy	Using Internal Reference	-	±1	-	ppm	
Settling time ^{2,4}	-	-	3.5	8	ms	
Dwell time (nominal) ^{3,4}	-	20	-	10,000	ms	
VSWR	10 - 4,900 MHz	-	1.40	-	:1	
	4,900 - 10,000 MHz	-	1.50	-		
	10,000 - 15,000 MHz	-	2.10	-		
Output power Max ⁵	10 - 50 MHz	+3	+8	-	dBm	
	50 - 15,000 MHz	+10	+16	-		
Output power Min ^{5,6}	10 - 5,000 MHz	-	-50	-45	dBm	
	5,000 - 15,000 MHz	-	-48	-45		
Power resolution (nominal) ⁷	10 - 15,000 MHz	-	0.1	-	dB	
Dynamic range	-	-	60	-	dB	
Output power accuracy ^{5,7}	10 - 50 MHz	PWR _{out} : -45 to +3 dBm	-	±0.50	-	dB
		50 - 5000 MHz	PWR _{out} : -45 to -35 dBm	-	±0.60	
	PWR _{out} : -35 to -14 dBm		-	±0.75	-	
	PWR _{out} : -14 to +5 dBm		-	±0.55	-	
	PWR _{out} : +5 to +10 dBm		-	±0.90	-	
	5000 - 12000 MHz	PWR _{out} : -45 to -21 dBm	-	±0.70	-	
		PWR _{out} : -21 to +10 dBm	-	±0.80	-	
	12000 - 15000 MHz	PWR _{out} : -45 to -21 dBm	-	±0.70	-	
PWR _{out} : -21 to +10 dBm		-	±0.95	-		
RF output level	@RF OFF	10 - 7,000 MHz	-	-95	-	dBm
		7,000 - 15000 MHz	-	-75	-	
Harmonics ⁵	10 - 2000 MHz	-45 to +10 dBm	-	-9	-	dBc
	2000 - 4900 MHz		-	-25	-	
	4900 - 10000 MHz		-	-20	-	
	10000 - 15000 MHz		-	-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 Dwell time - duration of each signal point in a Sweep or Hop sequence set by user. Default is minimum dwell time.

⁴ Generator response time is Dwell time + Settling Time.

⁵ The generator is calibrated within typical power range, however performance is guaranteed only within power max/min limits.

⁶ Minimum power in the 4800-8200 MHz may degrade to -43 dBm.

⁷ At power steps below 0.5 dB increased non-monotonic behavior and power accuracy values may be observed.

⁸ USB min communication time is based on the polling interval of the USB HID protocol(125 µs polling interval, 1024 bytes per packet), medium CPU load and no other high speed USB devices using the USB bus.

Typical Phase Noise, SSB (dBc/Hz) at +25°C

Carrier Frequency (MHz)	Frequency Offset				
	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz
10	-130	-135	-140	-146	-147
50	-116	-130	-140	-143	-157
100	-108	-127	-137	-137	-159
200	-106	-122	-131	-131	-155
400	-97	-116	-124	-125	-150
800	-91	-109	-118	-118	-144
1600	-83	-103	-112	-112	-138
3200	-81	-97	-106	-106	-129
4000	-78	-95	-105	-105	-132
5000	-75	-94	-103	-102	-129
6400	-73	-92	-100	-100	-123
8000	-70	-90	-98	-98	-123
10000	-69	-90	-96	-96	-123
12800	-67	-90	-95	-94	-118
15000	-66	-89	-92	-92	-116

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	Test Conditions	Min.	Typ.	Max.	Units
Pulse Width resolution	Nominal value	1	-	-	µs
Pulse width ⁹	Measured at the 50% of pulse level	1	-	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	0.0001	-	99.9999	%
Rise / Fall time	Measured between 10% and 90% of pulse level	-	0.1 / 0.02	-	µs
Pulse Width Accuracy ¹⁰	Measured at 50% of pulse level	-	±1	-	µs
	Internal pulse modulation	-	±1	-	
External pulse mod. input threshold	External pulse modulation	-	-	3.0	V
Trigger response delay	Trigger edge to 50% of pulse level	-	1	-	µs
Pulse Power ratio	@PWR _{OUT} =0dBm, FREQ _{OUT} =10 MHz	-	58	-	dB
Pulse Power ratio	@PWR _{OUT} =+10dBm, FREQ _{OUT} =15,000 MHz	-	50	-	

Dynamic Pulse Modulation Specifications at +25°C

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

Parameter	Test Conditions	Min.	Typ.	Max.	Units
Pulse Width resolution	Nominal value	0.05	-	-	µs
Pulse width ^{9, 11}	Measured at the 50% of pulse level	0.5	-	4e6	µs
Pulse period ⁹	Measured at the 50% of pulse level	100	-	4e6	µs
Duty cycle	Pulse Width divided by Pulse Period	0.0001	-	99.9999	%
Rise / Fall time	Measured between 10% and 90% of pulse level	-	0.1 / 0.02	-	µs
Pulse Width Accuracy ¹⁰	Measured at 50% of pulse level	-	±0.2	-	µs
Pulse Power ratio	@PWR _{OUT} =0dBm, FREQ _{OUT} =10 MHz	-	58	-	dB
Pulse Power ratio	@PWR _{OUT} =+10dBm, FREQ _{OUT} =15,000 MHz	-	50	-	

⁹ Pulse width must be less than pulse period by at least minimum pulse resolution.

¹⁰ Pulse width accuracy may increase at long pulse widths, up to 3% of pulse width.

¹¹ Pulse widths below 0.5µs can be set, however performance is only guaranteed for 0.5µs and up.

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

Parameter	Test Conditions	Min.	Typ.	Max.	Units	
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	
	Freq. Accuracy	Using Internal Reference	-	±1	-	ppm
	Power	-	+5.5	-	dBm	
Trigger Out, Low	-	0	-	0.4	V	
Trigger Out, High	-	3.0	-	5		
Trigger In, Low ¹²	-	0	-	0.4		
Trigger In, High ¹²	-	3.0	-	5		
Supply Voltage	-	5.6	6	6.4		V _{DC}
Supply Current ¹³	-	-	1250	1850	mA	
USB current ¹³	-	-	0	-		

¹² Trigger out voltage specified with impedance load of 10kΩ minimum.

¹³ All power is drawn from power adaptor, USB is used for control only.

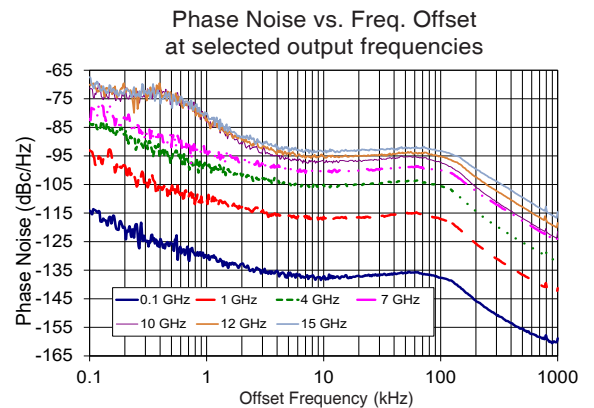
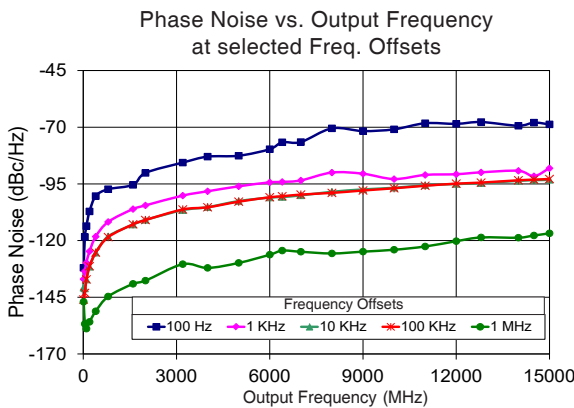
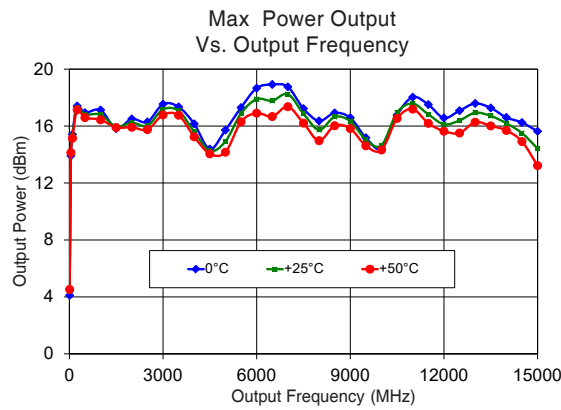
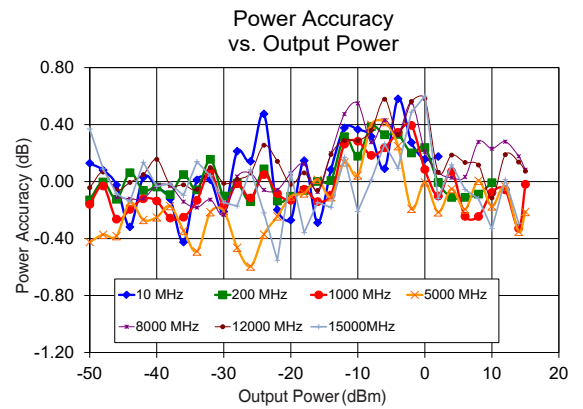
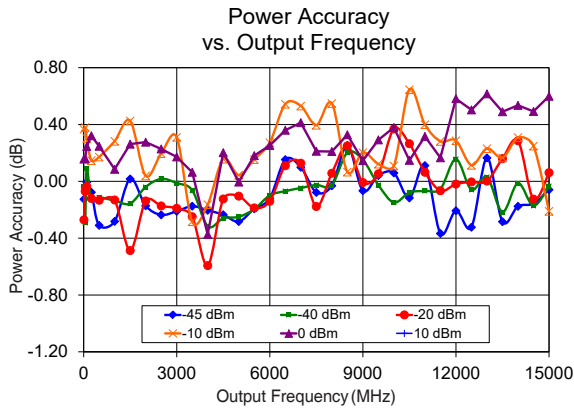
Absolute Maximum Ratings (Exceeding these limits will cause permanent damage)

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	@ 10 - 100 MHz	Derates linearly from +22 dBm at 100 MHz to +13 dBm at 10 MHz
	@ 100 - 15,000 MHz	+22 dBm
Voltage input to Trigger ports	-0.3V _{DC} to +5.5V _{DC}	

Operating in the range between operating power limits and absolute maximum ratings for extended periods of time may result in reduced life and reliability.

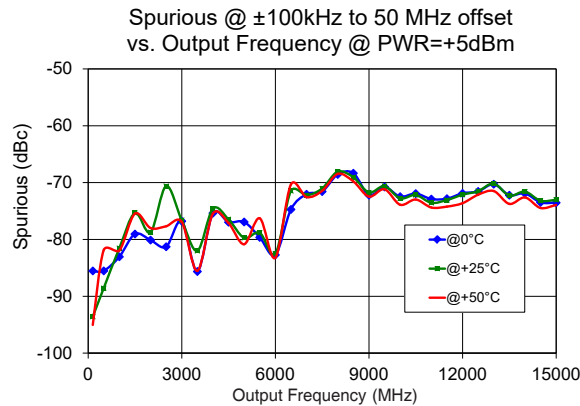
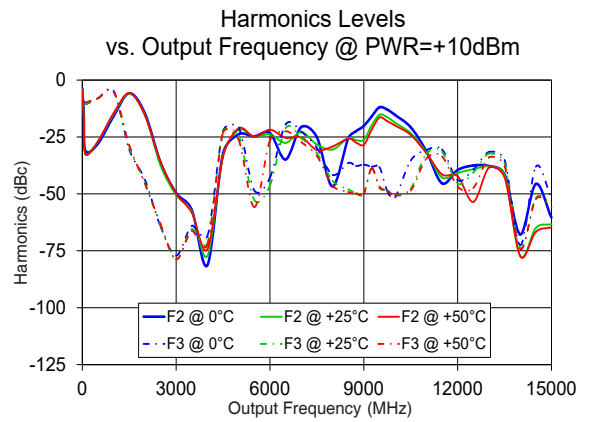
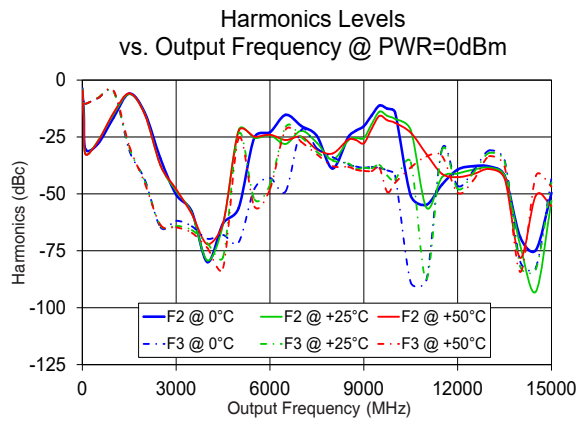
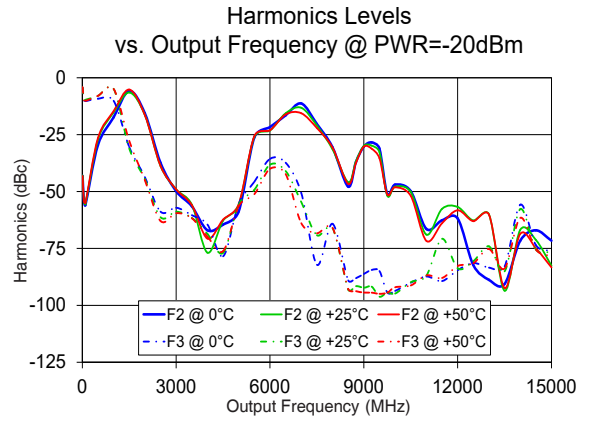
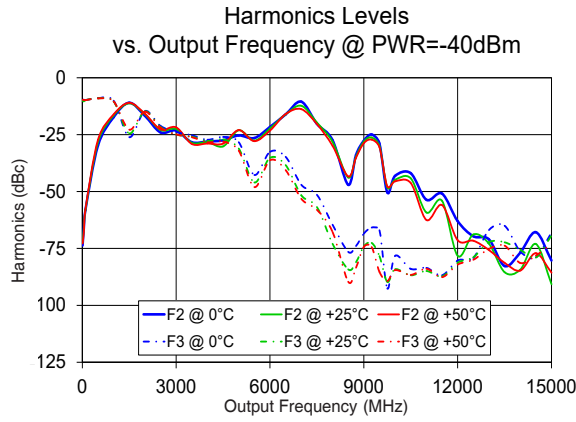
Typical Performance Curves*

*at +25°C unless noted otherwise

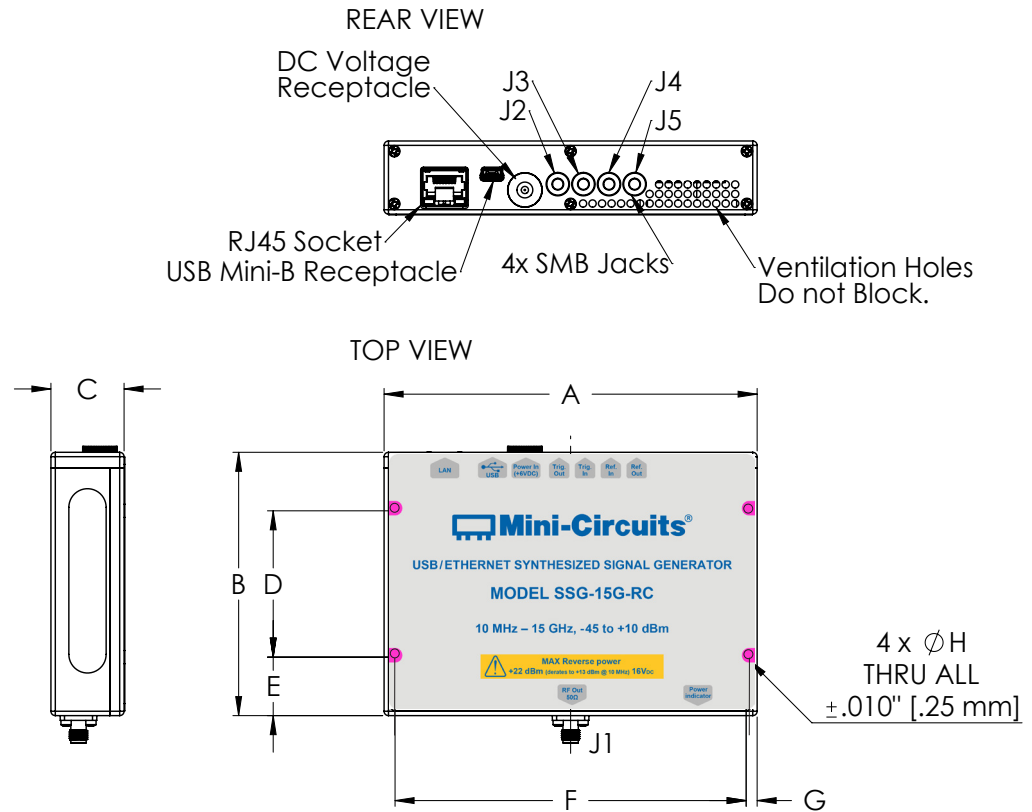


Typical Performance Curves* (continued)

*at +25°C unless noted otherwise



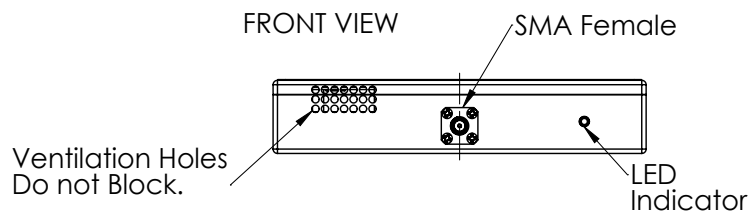
Outline Drawing SL2686



Connections

RF Output	J1 (SMA-Female)
Ref. In	J4 (SMB-Male)
Ref. Out	J5 (SMB-Male)
Trigger In	J3 (SMB-Male)
Trigger Out	J2 (SMB-Male)
Power In ¹⁴	(2.1 mm DC socket)
USB Port	(USB type Min-B female)
Network (Ethernet/LAN)	(RJ45 socket)

¹⁴ No power On/Off switch. SSG will power on as soon as power is connected, starting in -45 dBm, 15 GHz setting with RF OFF.



Outline Dimensions (inch/mm)

A	B	C	D	E	F	G	H	WT. GRAMS
5.10	3.60	1.00	2.000	0.800	4.800	0.150	0.125	600
129.5	91.4	25.4	50.80	20.32	121.92	3.81	3.18	

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

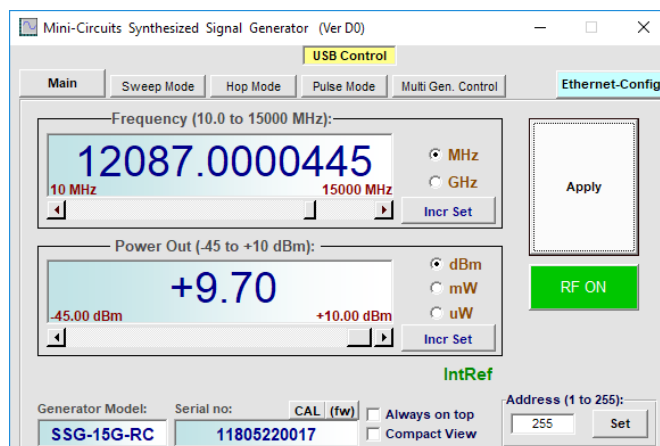
Parameter	Requirements	
Interface	USB HID or HTTP Get/Post or Telnet protocols or SSH protocols	
System requirements	GUI	Windows 32 & 64 bit systems from Windows 98 up to Windows 10
	USB API (ActiveX & .Net)	Windows 32 & 64 bit systems with ActiveX or .Net support from Windows 98 up to Windows 10
	USB direct programming support	Linux, Windows systems from Windows 98 up to Windows 10
	HTTP, Telnet or SSH	Any computer with a network port and Ethernet-TCP/IP (HTTP, Telnet or SSH protocols) support
Hardware	Pentium® II or higher, RAM 256 MB	

Graphical User Interface (GUI) for Windows

Key Features:

- Set signal power and Frequency
- Set timed sequence of signals (Sweep & random sequence)
- Set timed sequences in multiple generators simultaneously
- Set trigger mode.
- Report if using internal or external reference
- Configure pulse modulation
- USB and Ethernet control
- Track unit operation time since calibration
- Set and receive calibration reminders
- Configure Ethernet settings
- Update firmware

Note: Generator state at power on will be RF OFF with power set to -45 dBm and frequency to 15 GHz. The SSG-15G-RC does not save last state.



Application Programming Interface (API)

Windows Support:




- API DLL files exposing the full switch functionality See programming manual for details
 - 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 tested environments)






Linux Support:

- Full switch control in a Linux environment is achieved by way of USB interrupt commands.

Ordering, Pricing & Availability Information see our web site

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

Included Accessories	Part No.	Description	Qty.
	AC/DC-6-3W	AC/DC Grounded Power adapter. 0°C to +40°C AC Input: 100-240V, 50/60 Hz, $I_{Max}=1.2A$ DC Output $6\pm0.3 V$, $I_{Max}=3A$	1
	CBL-3W-XX	AC Power Cord (<i>Select one power cord from below with each Signal Generator</i>)	1
	MUSB-CBL-7FR+	6.6 ft (2.0 m) USB Cable: USB type A(Male) to USB type Mini-B(Male) with ferrite	1
	CBL-5FT-BMSMB+	5 ft (1.5 m) Trigger cable: BNC(male) to SMB(Female)	2

AC Power Cords ¹⁵	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

¹⁵ 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	Description
MUSB-CBL-3FR+	2.6 ft (0.8 m) USB Cable: USB type A(Male) to USB type Mini-B(Male) with ferrite
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	Description
CALSSG-15G-RC	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