DS Instruments

SG6000

PORTABLE WIDEBAND SIGNAL GENERATORS

SG6000 - A wideband RF Signal Generator

The SG6000 family of signal generators enables users to generate a high quality RF/Microwave signal in a compact package. An OLED display and interface buttons allow frequency selection, attenuator control, and RF output ON/Off without need for a host PC. The RF output covers 7 octaves from 25 to 6000MHz or to 12000MHz with the optional doubled output, or to 22GHz with option 'Q'. The produced waveform is fully synthesized using modern fractional N synthesis. The final step size of the RF output varies from a maximum of ~3KHz to less than 20Hz depending on band of operation. This synthesized source has its own internal precision 10MHz TCXO oscillator and can accept an external reference signal if needed.

Power output level can be controlled via internal step attenuator over a range of 31dB in 0.5dB steps, and also has a separate 20dB power vernier setting. RF output power is calibrated to a maximum output level of +10dBm. Higher output is possible when in un-calibrated mode.

Ease of Use

SG6000 signal generators can be controlled from the front panel interface or by the USB port and a host PC. The user simply connects a PC to the SG6000, and with provided software all settings and functions can be remotely operated in real time.

Signal Generator USB Operation

With the SG6000 connected to the PC via micro USB port, industry standard SCPI commands are used to fully control the instrument. The USB port is configured on the host PC as a virtual COM port. This feature allows users to control the signal generator for automated test applications from many different operating systems and scripting languages and environments.

SG6000 Signal Generator Family

	SG4400L	SG6000L	SG6000E	SG6000X	SG6000F	SG6000LD	SG6000PRO	SG6000LDQ	SG6000B	SG6000LDQE
Max Frequency (GHz)	4.4	6.0	6.0	6.0x2	6.0	**12.0**	6.8	**22.0**	6.0	22.5
Display & Buttons	X	X	X	X	X	X	X	X	X	X
10MHz Reference Input	X	X	X	X	X	X	X	X	X	X
Sweep Trigger					X	X	X	X		
Power Source	USB	USB	USB	USB	USB	USB	USB	USB	USB + BAT	USB
Harmonic Filtering					X		X			
Ethernet			X			X				X
Step Attenuator Max Frequency (GHz)	4.4	6.0	6.0	6.0	6.0	12.0	6.8	6.0	6.0	12.0
Vernier Control Max Frequency (GHz)	4.4	6.0	6.0	6.0	6.0	12.0	6.8	12.0	6.0	12.0
Ultra-Low Phase Noise							X			

Note: Some devices (LD, LDQ, PRO) have a separate extended datasheets.

SG6000

Product Photos

SG6000L
(Ultra-Compact)

SG6000F
(Harmonic filtered -
PureSine)

SG6000PRO
(Harmonic Filter &
Low Phase Noise)

SG6000E
(Ethernet)

SG6000LDQ
(22GHz)

SG6000LX
(Dual Channel)

SG6000L

SPECIFICATIONS

Conditions: 25° C, Internal 10MHz Oscillator, USB supplied power

Parameter	Min	Max	Typ	Units
Output Frequency Range	25	6000		MHz
Output Power Range (**calibrated**)	-21.5	+10		dBm
Output Power Range (Uncalibrated mode)	-30	+15		dBm
Calibration Accuracy (output flatness)		± 2.5	±1.0	dB
Phase Noise @ 6000MHz, 10KHz Offset			**-74**	dBc
@ 2400MHz, 10KHz Offset			**-85**	dBc
@ 900MHz, 10KHz Offset			**-92**	dBc
@ 433MHz, 10KHz Offset			**-101**	dBc
@ 315MHz, 10KHz Offset			**-103**	dBc
Output VSWR	1.2:1	1.6:1	**1.3:1**	----
Step Size (decreases by 2 as RF band reduces)		2.44		KHz
Internal RF Attenuator Step Size	0.3	0.8	**0.5**	dB
Step Attenuator Range	0	31.5		dB
Power Vernier Range	0	20		dB
Typical Vernier Minimum Increment			**0.05**	dB
Device Temperature Rating	-40	50	**25**	Deg. C
Harmonic Levels – 2nd, 3rd (Standard SG6000)		-10	**-12**	dBc
Harmonic Levels (Filtered – SG6000F & PRO)		-25	**-30**	dBc
External MCX Sweep Trigger ("LF" version)	0	5		V
Reference 10MHz Input Level	-10	+15	**0**	dBm
Frequency Lock and Settle Time		4	**2**	mS
Internal Reference TCXO Stability (6GHz Models)			**± 2.50**	PPM
USB port Input Voltage	4.7	5.4	**5.0**	VDC
USB Current Requirement (L, F, PRO)		0.6	**0.4**	A
USB Current Requirement (LD, LDQ, LX, B, E)		0.8	**0.6**	A

SG6000
(6GHz) Typical Phase Noise

Phase Noise in dBc/Hz

Trace	Carrier Hz	Carrier dBm	dBc/Hz at 10000 Hz	RF Atten dB	VBW/RBW	Sweep
SG6000R7-INT	6 000 000 000	8.00	-72.5	10	1.00	70s

Phase Noise in dBc/Hz
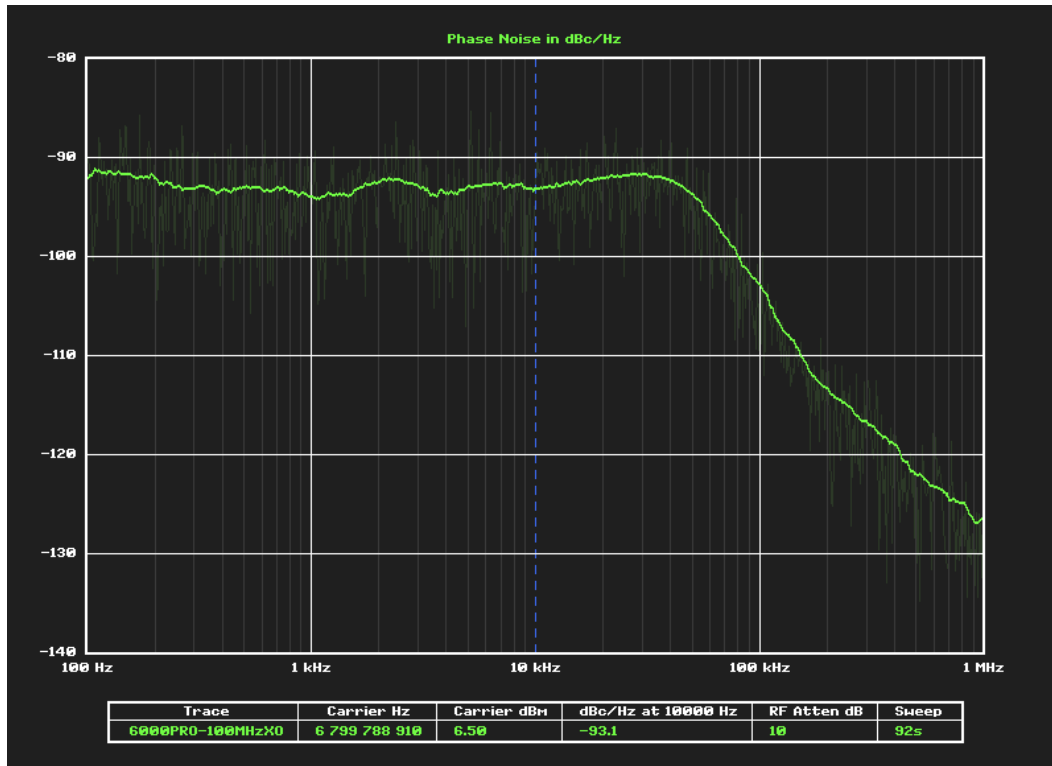
Trace	Carrier Hz	Carrier dBm	dBc/Hz at 10000 Hz	RF Atten dB	Sweep
6000PRO-100MHzXO	6 799 788 910	6.50	-93.1	10	92s

SG6000PRO – Phase noise measured at 6.8GHz

SG6000

Typical MAX Power Output (Calibration OFF)

Typical Max Power Output

(Chart: Power in dBm vs. Output Frequency in MHz, 0 to 6000 MHz)
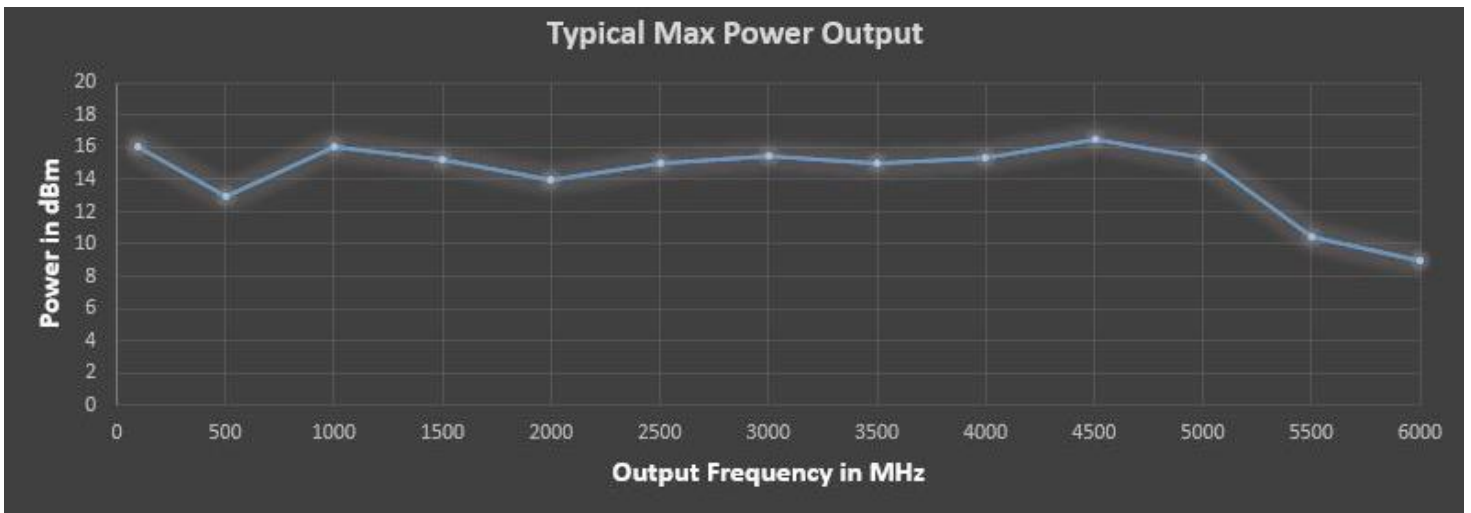
Case Dimensions & Front / Rear Panel Features

Ultra-Micro Case

2.75in
2.0in
1.15in

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3.0 Inch
2.75 Inch
1.15 Inch

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Models: F, E, LD, LDQ

STATUS   Mode ● ● ▼ ● ▲
● RFO
5889.7355 MHz
SG6000L

RF OUT   10 MHz
Micro USB
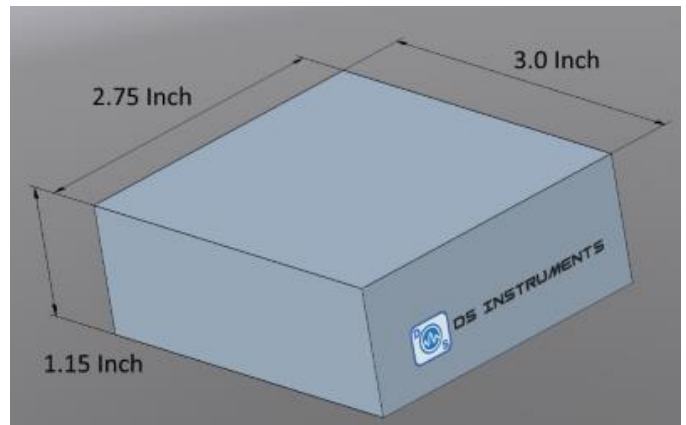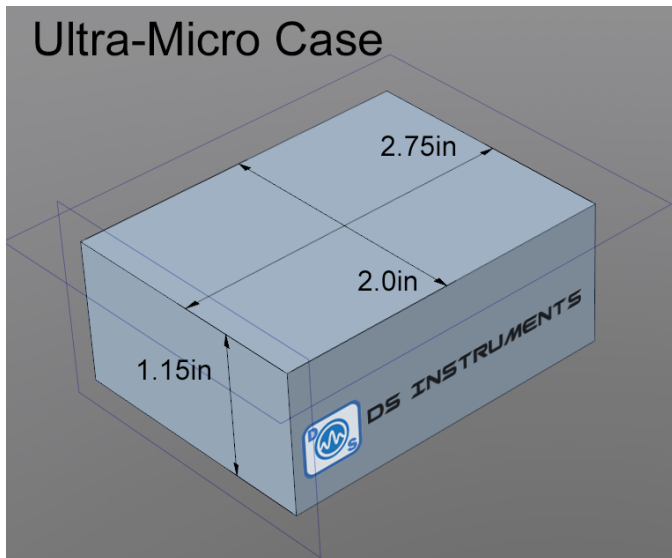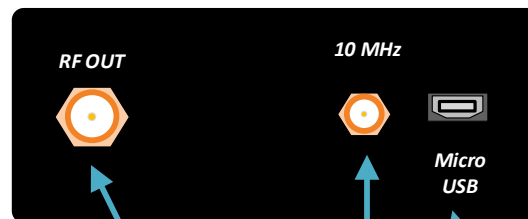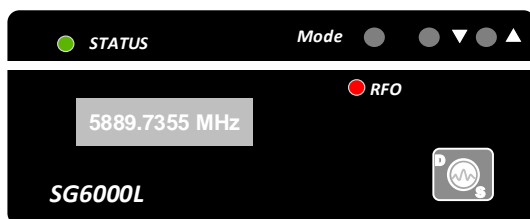
SG output Signal (SMA)

Reference In/Out

USB Interface to PC and DC Power Input

SG6000F
Harmonics

The **SG6000F and SG6000PRO** focus on filtering the harmonics inherent to PLL based synthesizers as best as possible. The SG6000F utilizes a filter matrix made up of 3 multi-octave tunable low frequency filters and two fixed high-frequency low-pass filters. The SG6000 PRO has an additional fixed filter to cover its extra bandwidth.


DS Instruments Internal Low-Pass Filter Matrix – SG6000F
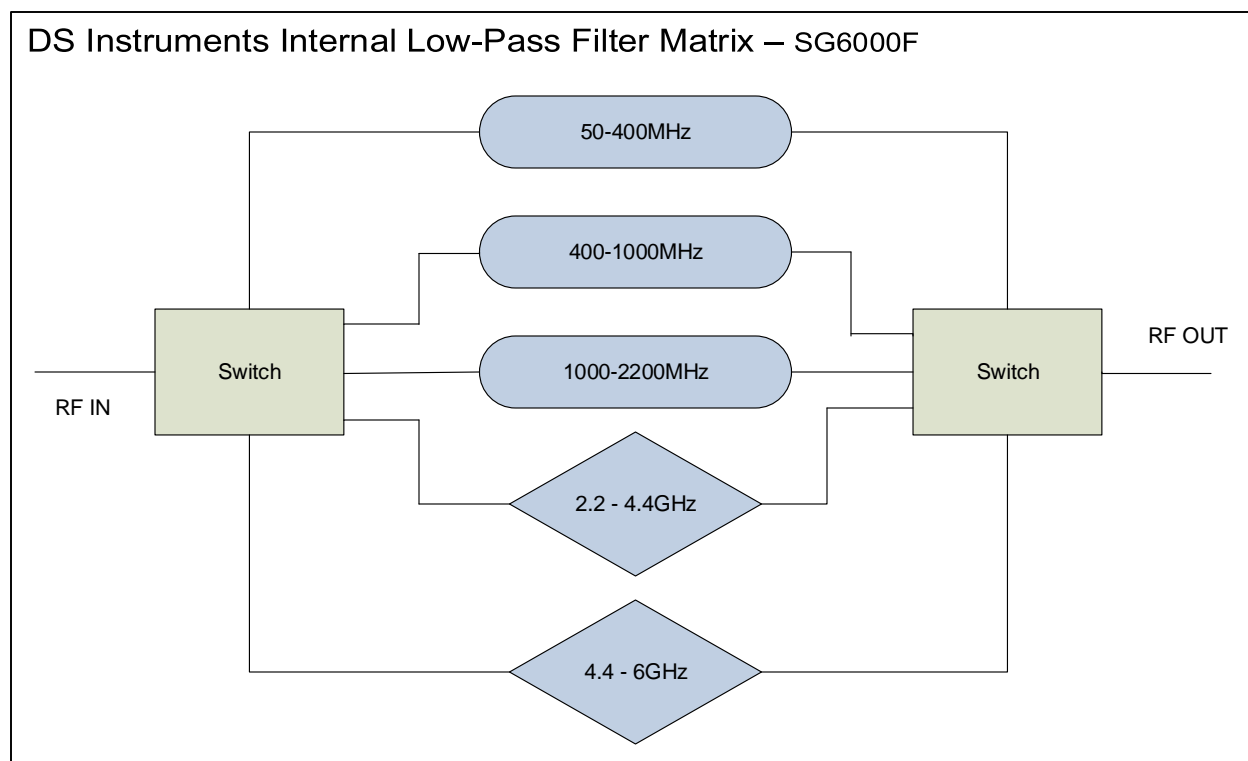
Harmonics are more plentiful at low frequencies (<500MHz) in wideband systems, causing more pronounced distortion. The SG6000 filtering is typically able to reduce the second harmonic to -30dBc, and the third harmonic to under -40dBc. Unfiltered synthesizers can have harmonics as high as -10dBc extending well beyond the 9th.
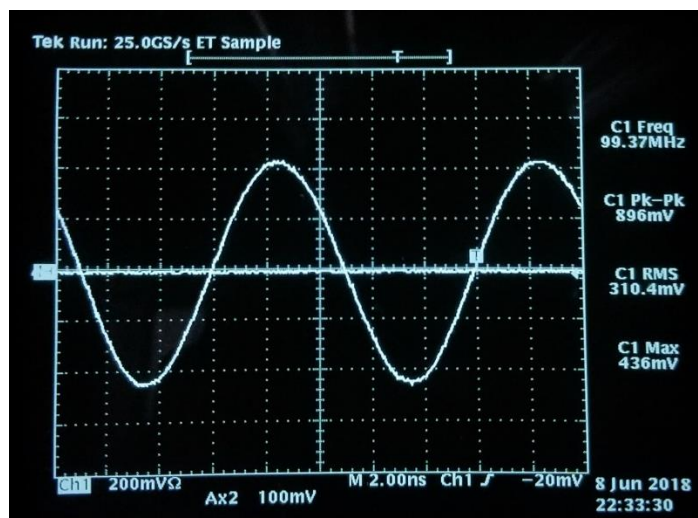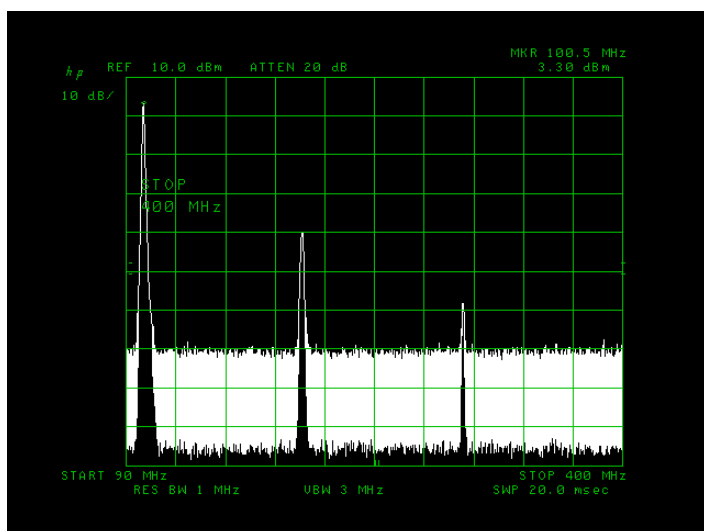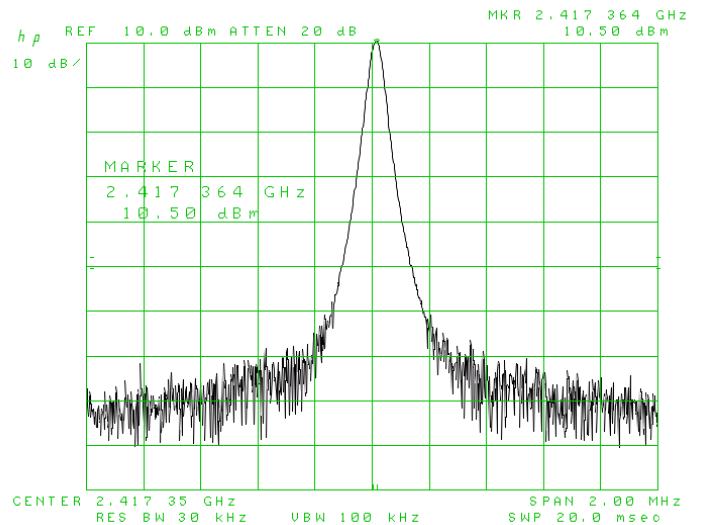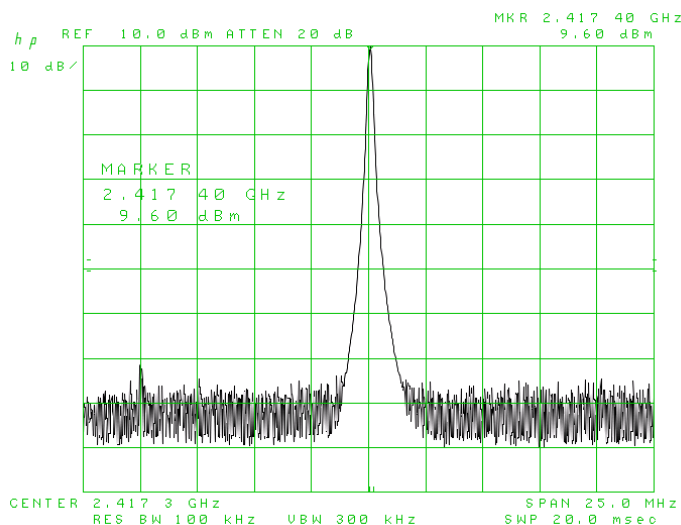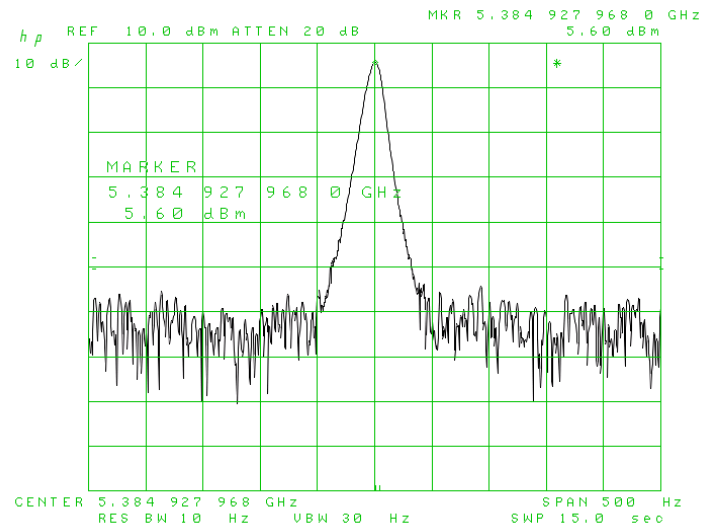
SG6000

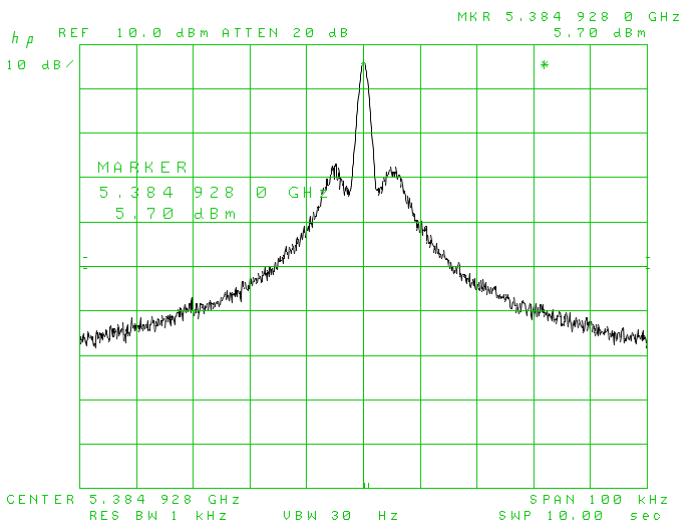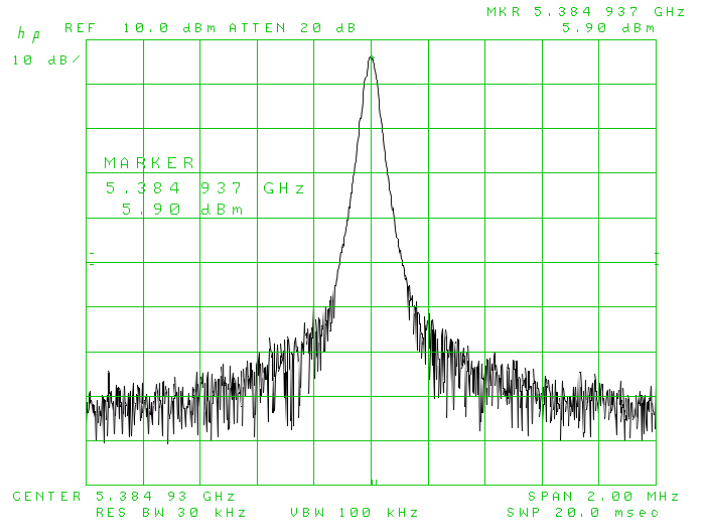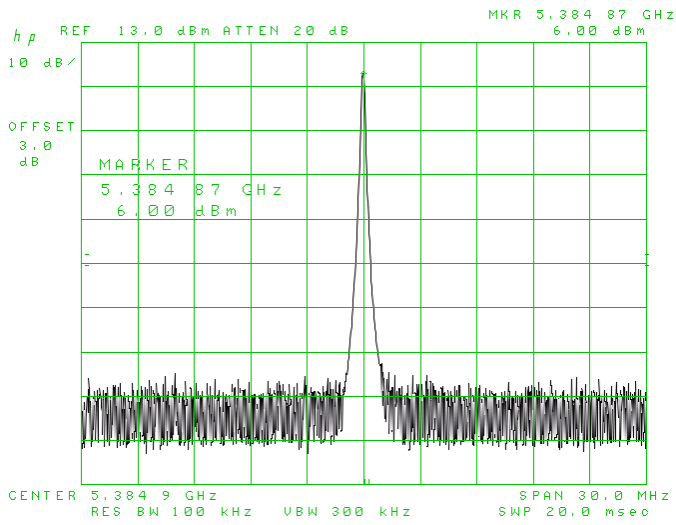## Typical Output Power Spectrums
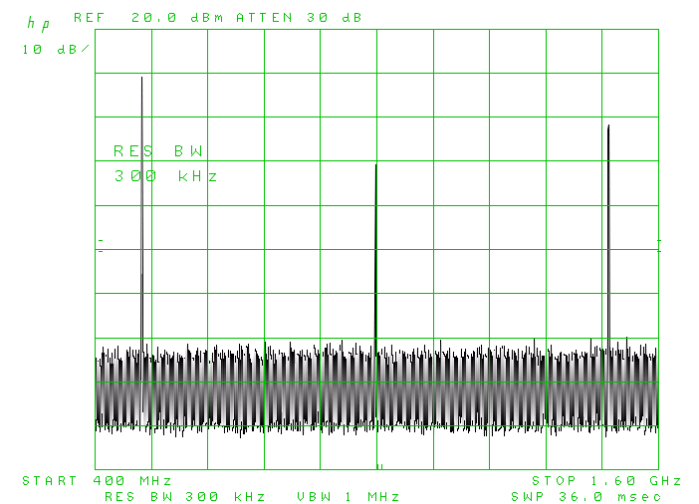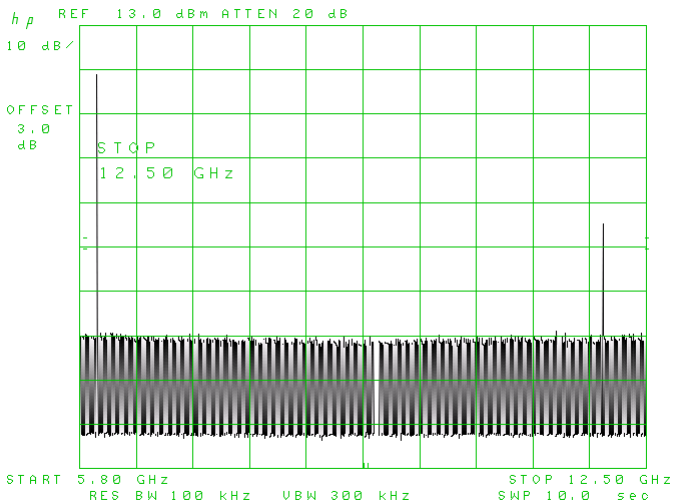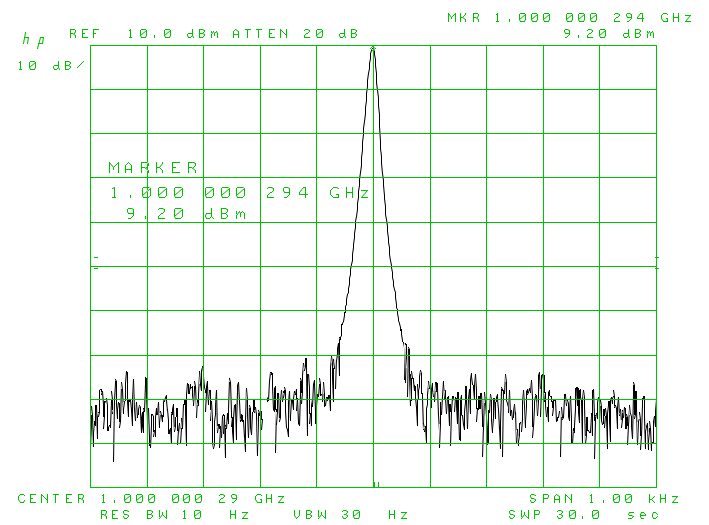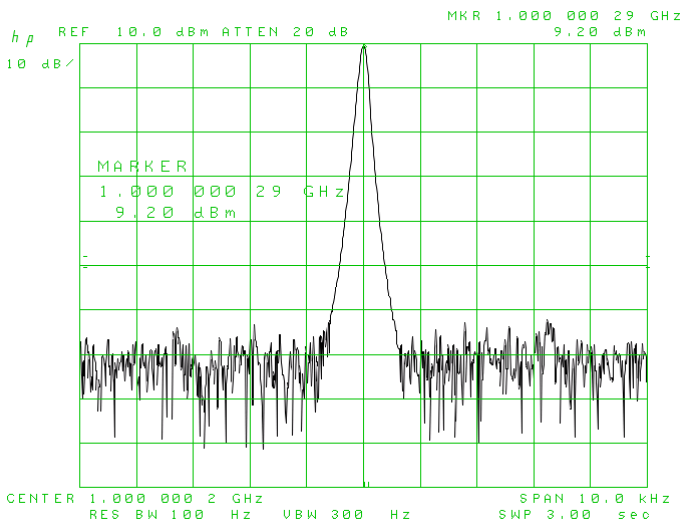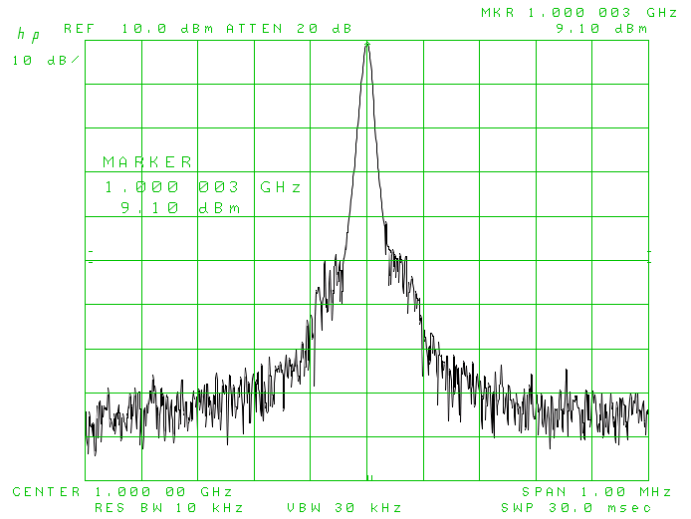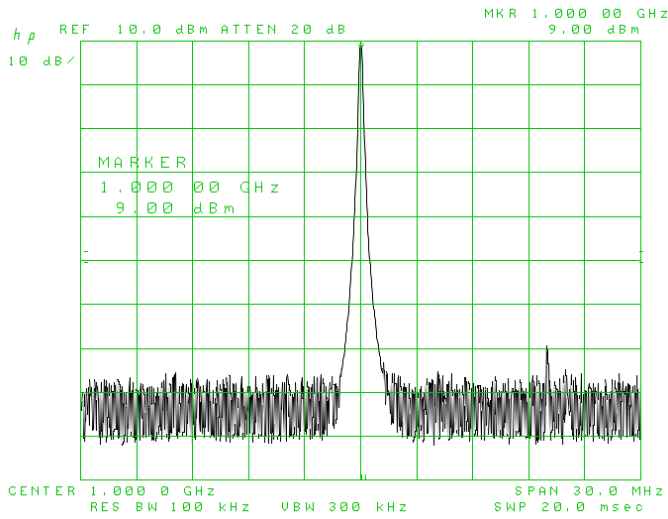
[25 Deg. C, USB Power , internal 10MHz]

SG6000

Typical Output Power Spectrums, Cont.

[25 Deg. C, USB Power , internal 10MHz]

hp   REF 13.0 dBm ATTEN 20 dB   MKR 5.384 87 GHz
                                              6.00 dBm
10 dB/

OFFSET
3.0
dB   MARKER
          5.384 87 GHz
          6.00 dBm

CENTER 5.384 9 GHz   SPAN 30.0 MHz
    RES BW 100 kHz   VBW 300 kHz   SWP 20.0 msec

hp   REF 10.0 dBm ATTEN 20 dB   MKR 5.384 937 GHz
                                              5.90 dBm
10 dB/

          MARKER
          5.384 937 GHz
          5.90 dBm

CENTER 5.384 93 GHz   SPAN 2.00 MHz
    RES BW 30 kHz   VBW 100 kHz   SWP 20.0 msec

hp   REF 10.0 dBm ATTEN 20 dB   MKR 5.384 928 0 GHz
                                              5.70 dBm
10 dB/   *

          MARKER
          5.384 928 0 GHz
          5.70 dBm

CENTER 5.384 928 GHz   SPAN 100 kHz
    RES BW 1 kHz   VBW 30 Hz   SWP 10.00 sec

hp   REF 10.0 dBm ATTEN 20 dB   MKR 5.384 927 968 0 GHz
                                              5.60 dBm
10 dB/   *

          MARKER
          5.384 927 968 0 GHz
          5.60 dBm

CENTER 5.384 927 968 GHz   SPAN 500 Hz
    RES BW 10 Hz   VBW 30 Hz   SWP 15.0 sec

hp   REF 10.0 dBm ATTEN 20 dB   MKR 2.417 40 GHz
                                              9.60 dBm
10 dB/

          MARKER
          2.417 40 GHz
          9.60 dBm

CENTER 2.417 3 GHz   SPAN 25.0 MHz
    RES BW 100 kHz   VBW 300 kHz   SWP 20.0 msec

hp   REF 10.0 dBm ATTEN 20 dB   MKR 2.417 364 GHz
                                              10.50 dBm
10 dB/

          MARKER
          2.417 364 GHz
          10.50 dBm

CENTER 2.417 35 GHz   SPAN 2.00 MHz
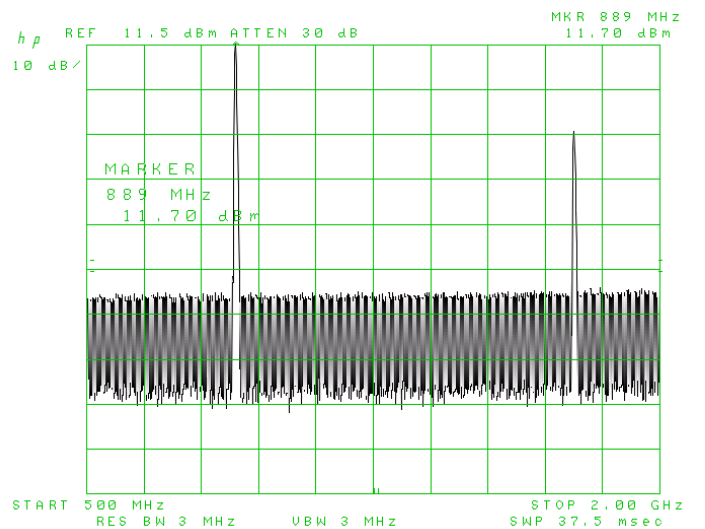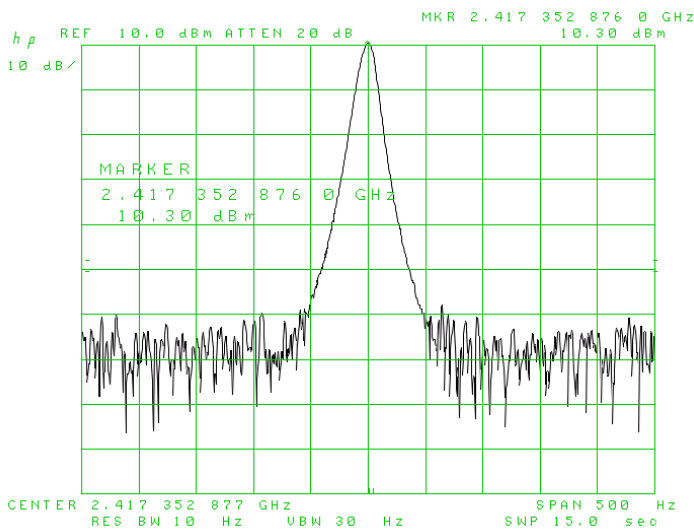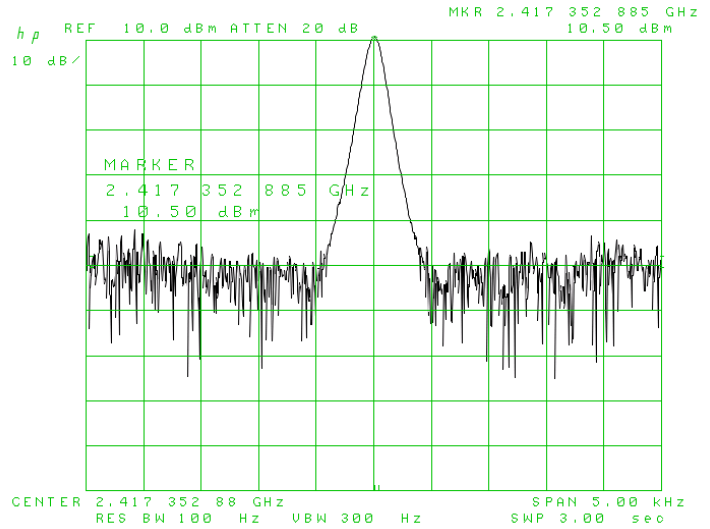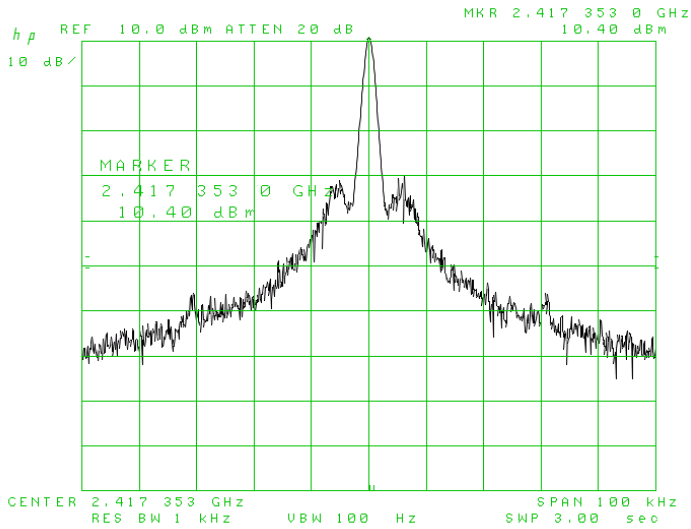   RES BW 30 kHz   VBW 100 kHz   SWP 20.0 msec

SG6000

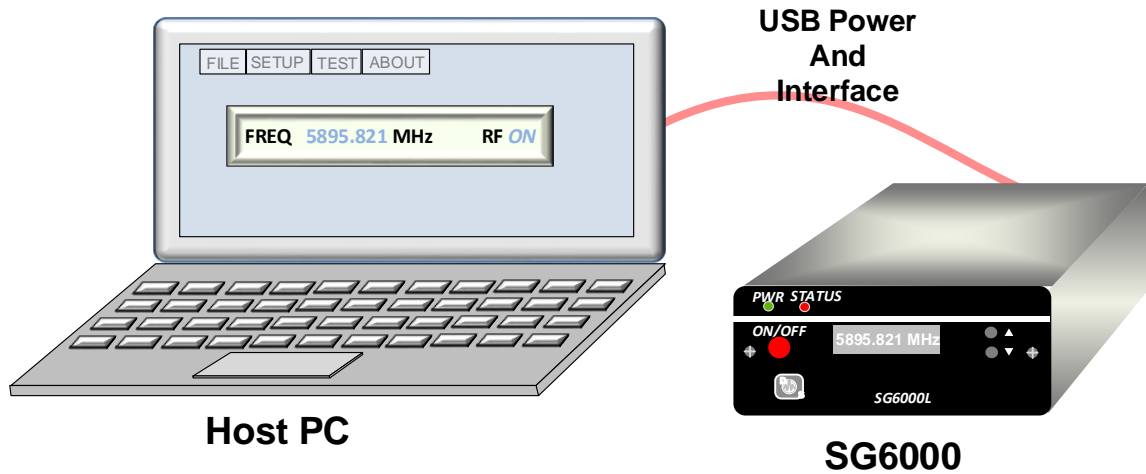## Typical Output Power Spectrums, Cont.

[25 Deg. C, USB Power, internal 10MHz]

SG6000

Windows GUI for remote Operation

USB Power
And
Interface

Host PC

SG6000

SG6000

SCPI Serial Command List

Command	Example 1	Example 2	Description
FREQ:CW	FREQ:CW 400MHZ	FREQ:CW 3.33GHZ	Set output Frequency
FREQ:CW?			Return current Frequency
OUTP:STAT	OUTP:STAT ON	OUTP:STAT OFF	Turn on or off the RF output
OUTP:STAT?			Return if output is enabled
POWER	9	-12.5	Set output power in **dBm**
POWER?			Return current output power
VERNIER	VERNIER 3	VERNIER -22	Fine tune the output power (no units)
VERNIER?			Return vernier setting
*IDN?			Return the SCPI identification string
*PING?			returns "PONG!" if device is responding
SYST:ERR?			Returns any pending error codes
*CLS			Clears any error codes
SYST:DBG?			Returns last debug status message
*RST			Reset unit now
*INTREF?			Is the internal reference enabled?
*EXTREF?			Is an external reference signal detected?
*INTERNALREF 1			Set reference to internal
*INTERNALREF 0			Set reference to external
*INTERNALREF A			Autodetect 10MHz reference at power up
*DISPLAY	*DISPLAY OFF	*DISPLAY ON	Power on of off the display
*BUZZER	*BUZZER ON	*BUZZER OFF	Mute the buzzer
*SAVESTATE			Save frequency & attenuation as boot defaults
*SYSVOLTS?			Return internal USB voltage
*UNITNAME	*UNITNAME Bob	*UNITNAME DEV-34	Set a unique name in flash memory
*UNITNAME?			Return this device's name
SWE:MODE	SWE:MODE SCAN		Enters sweep mode & arms external sweep trigger
FREQ:START	FREQ:START 1GHZ	FREQ:START 99MHZ	Sweep start frequency
FREQ:STOP	FREQ:STOP 2GHZ	FREQ:STOP 999MHZ	Sweep stop frequency
LIST:DIR	LIST:DIR UP	LIST:DIR DOWN	Sweep direction
SWE:POINTS	SWE:POINTS 10	SWE:POINTS 900	Sweep point count
SWE:DWELL	SWE:DWELL 25	SWE:DWELL 1000	Sweep dwell time in milliseconds
INIT:CONT	INIT:CONT 0	INIT:CONT 1	Sweep continuous mode or single
INIT:IMM			Trigger the sweep now
ABORT			Stop the sweep now
SWE:ACTIVE?			Is the device sweeping now
TRIG:STEP			Mode where trigger command only advances 1 step
TRIG:SWEEP			Trigger command will execute entire sweep (default)
LPMODE	LPMODE ON	LPMODE OFF	Low power mode reduces RF output by ~4-7dB

SG6000

Remote Control Example Code

All of our products can be controlled from any serial-capable programming language or environment. MATLAB, .NET, Linux, python are all popular. We use Visual Studio 2015 and C# for our standard GUI. First determine the port number that your device has installed itself as:
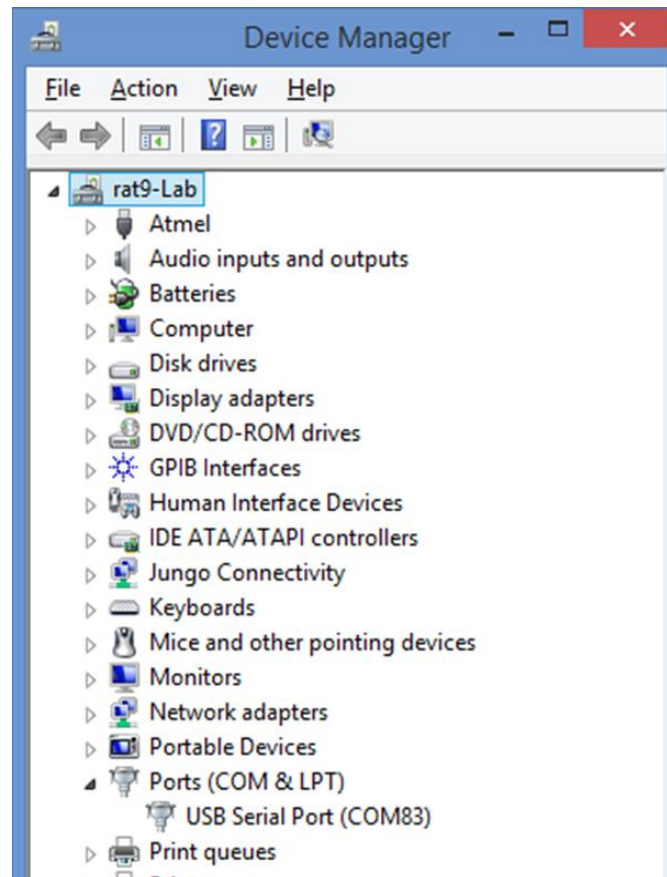
Example Code (C# .NET Framework):

```
using System;
using System.IO.Ports;     // include serial port library

SerialPort myPort = new SerialPort("COM83", 115200, System.IO.Ports.Parity.None, 8, System.IO.Ports.StopBits.One);

myPort.Open();         // open the port we just made

myPort.WriteLine("*IDN?");       // send any command here

myPort.ReadTimeout = 250;

string myResponse = myPort.ReadLine();      // read back the response

System.Threading.Thread.Sleep(30);           // delay before sending the next command
```

SG6000 Family Pricing

Ordering Information

SG4400L – No Display or Buttons – 35 to 4400MHz *($439.00)*

SG4400L – Standard Compact – 35 to 4400MHz *($499.00)*

SG6000 – No Display or Buttons – 25 to 6000MHz *($549.00)*

SG6000L – Standard Compact – 6000MHz *($649.00)*

SG6000B – Battery Powered – 6000MHz *($769.00)*

SG6000E – Ethernet Port – 6000MHz *($849.00)*

SG6000F – Harmonic Filtered – 6000MHz *(779.00)*

SG6000LX – Dual Channel – 60000MHz *($1099.00)*

SG6000PRO – Low Phase Noise – 6800MHz *($1199.00)*

SG6000LD – 24MHz to 12GHz *($899.00)*

SG6000LDQ – 24MHz to 22GHz *($1449.00)*

SG6000LDQE – Ethernet, Band 2 Attenuator – 24MHz - 22.5GHz *($1699.00)*

Contact Information

www.dsinstruments.com

support@dsinstruments.com

call us: (805) 242-6685

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NEVADA