

- Key Features -

- Wide Frequency Coverage
- Calibrated RF Power Output
- USB COM Interface
- Industry Standard SCPI Commands
- OLED Display and Control Buttons
- Very Cost Effective
- Incredibly Compact
- Conveniently USB Powered
- Models up to 40GHz
- Harmonic Filtering
- Optional Ethernet

DS Instruments

SG Series

PORTABLE WIDEBAND SIGNAL GENERATORS



SG6000 - A wideband RF Signal Generator

The SG Series of signal generators from DS Instruments enables users to generate high quality RF/Microwave signals quickly and easily. 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 12GHz, or to 22GHz depending on model. 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 (fine-tune) setting. RF output power is calibrated to a maximum output level of +10dBm or +15dBm. 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.



SG Series Models Compared

	SG4400L	SG6000L	SG6000B (Battery)	SG6000X (Dual Channel)	SG6000F	SG12000L	SG22000L	SG30000L	SG40000L
Min Frequency (MHz)	35	25	25	25	25	25	60	14000	25000
Max Frequency (GHz)	4.4	6.0	6.0	6.0	6.0	12.0	22.5	30	40
10MHz Reference Input	X	X	X	X	X	X	X	X	X
Sweep Trigger					X	X			
RFO Dynamic Range (dB) Step + Variable	70	40	40	40	40	40	40	35	35
Harmonic Filtering					X			X	X
Ethernet (Optional)	X	X		X	X	X	X	X	X
Step Attenuator Max Frequency (GHz)	4.4	6.0	6.0	6.0	6.0	12	12	30	40
Max Calibrated Output (dBm)	15	15	10	10	10	10	15	15	13
Low Phase Noise								X	X

Note: SG6000PRO has a separate extended datasheet for the SG PRO series models

SG6000

Product Photos



SG6000L / 4400
(Ultra-Compact)



SG6000F
(Harmonic filtered -
PureSine)



SG12000L
(12GHz)



SG22000L
(22GHz)

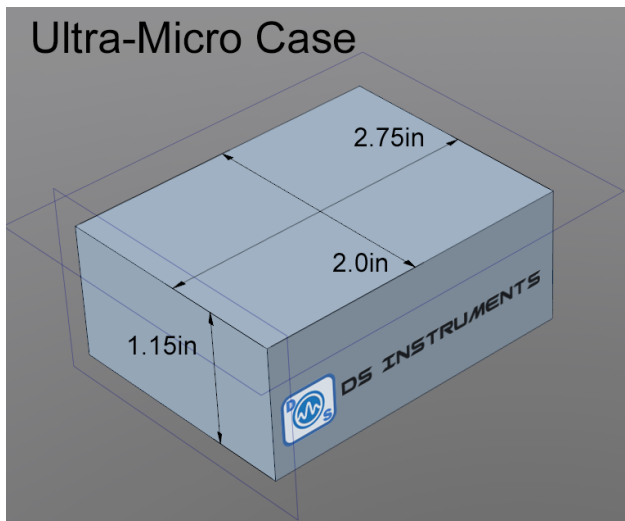


SG6000X
(Dual Channel)

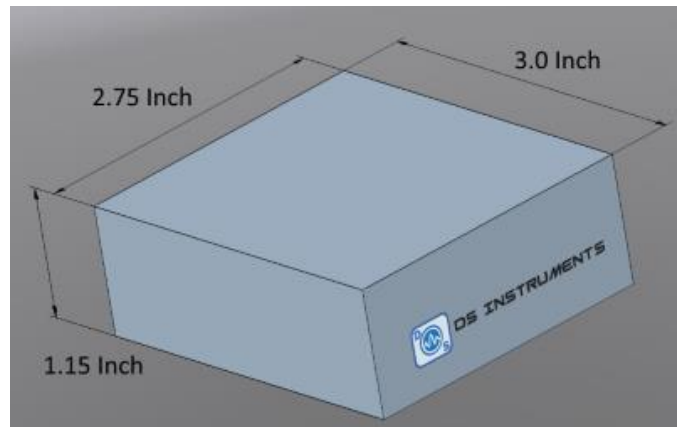


SG6000

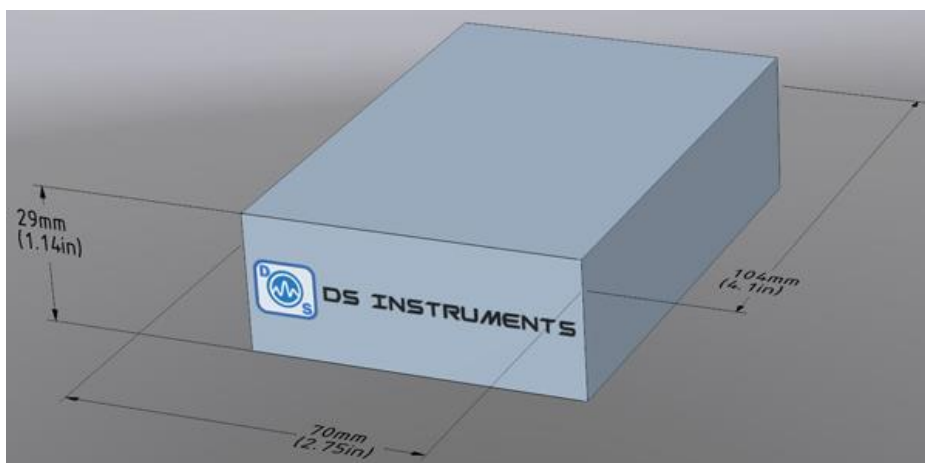
Case Dimensions & Front / Rear Panel Features



SG4400L, SG6000L, SG6000E

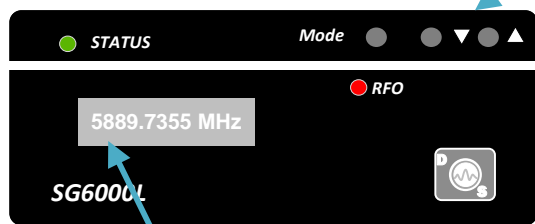


SG6000F, SG6000B, SG6000X, SG12000L

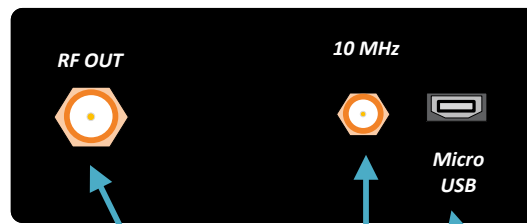


SG22000L

Control Buttons



OLED Display



SG output Signal (SMA)

Reference In/Out (MCX)

USB Interface to PC and DC Power Input

SG6000

RF Power Output

Power Calibration Explanation

DS Instruments signal generators are each calibrated at the factory to have accurate power output levels across the device bandwidth. When the VERNIER setting is at the default of ZERO, the device is operating in calibrated mode with no adjustment to the power setting shown.

If the fine power tune slider is moved in the control software, or the Vernier setting is changed from the front panel, the output is more (positive), or less (negative), than the dBm value shown. We now consider the device to be operating in uncalibrated mode. This mode will be indicated by the power level box changing colors in the control software.

Say you are at +10dBm, and need more power, slide the Vernier bar to the right. This is called uncalibrated mode because there is no feedback from the amplifiers to let the device know the exact power level at the current frequency. You would need a power meter to know the actual output in uncalibrated mode.

Typically this is used to get more than the max calibrated level, or to fine tune between digital attenuator steps. It can also be used to get a lower power than the minimum calibrated level by about 10dB.

Uncalibrated mode can usually achieve 3-5dB more power than the max level stated, depending on frequency.

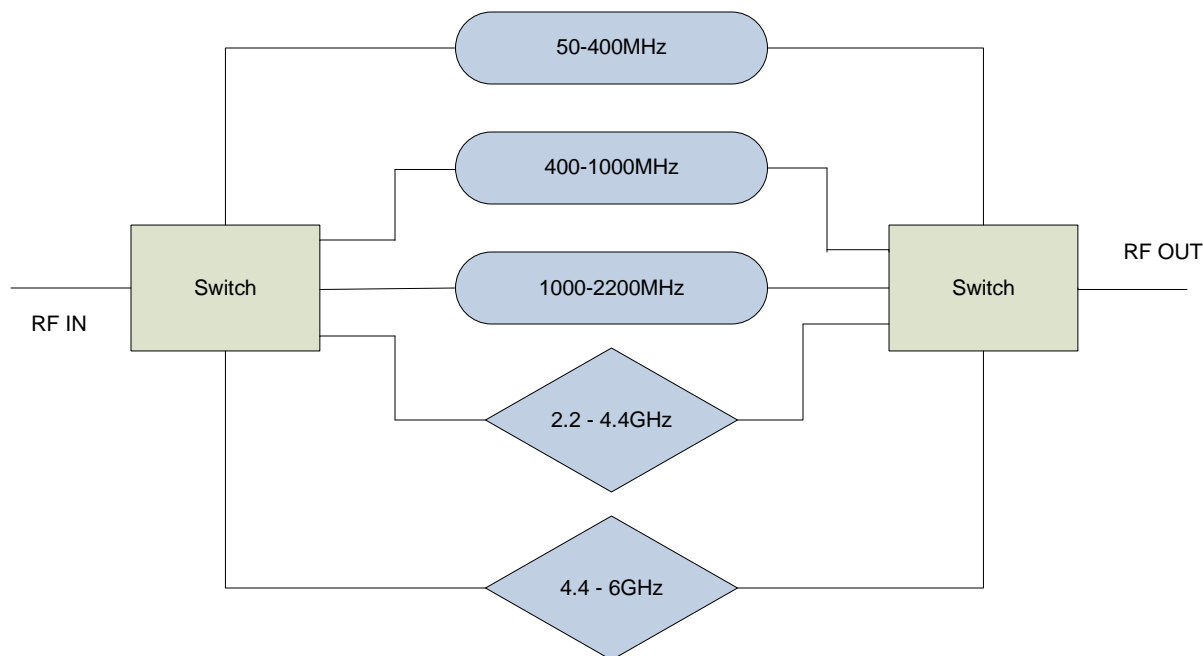
The Vernier power resolution is typically around 0.05dB.

SG6000F

Harmonics

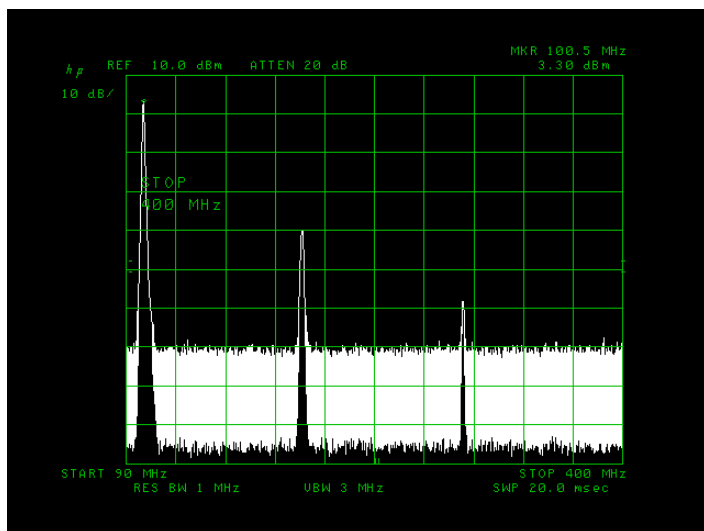
The **SG6000F** focuses on filtering the harmonics inherent to PLL based synthesizers as best as possible. The SG6000F utilizes a filter matrix made up of 3 multi-octave tunable low frequency filters and two fixed high-frequency low-pass filters.

DS Instruments Internal Low-Pass Filter Matrix – SG6000F

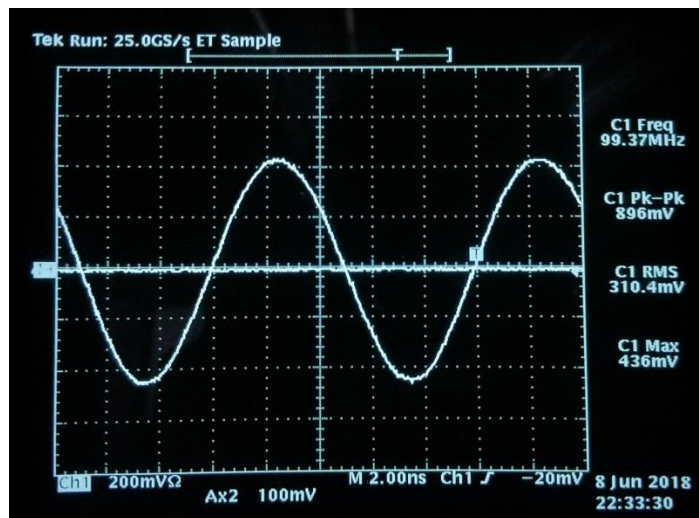


Harmonics are more plentiful at low frequencies (<500MHz) in wideband systems, causing more pronounced distortion. The SG6000 filtering is typically able to reduce the second harmonic to -30dBc, and the third harmonic to under -40dBc. Unfiltered synthesizers can have harmonics as high as -10dBc extending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

Low Harmonic Content

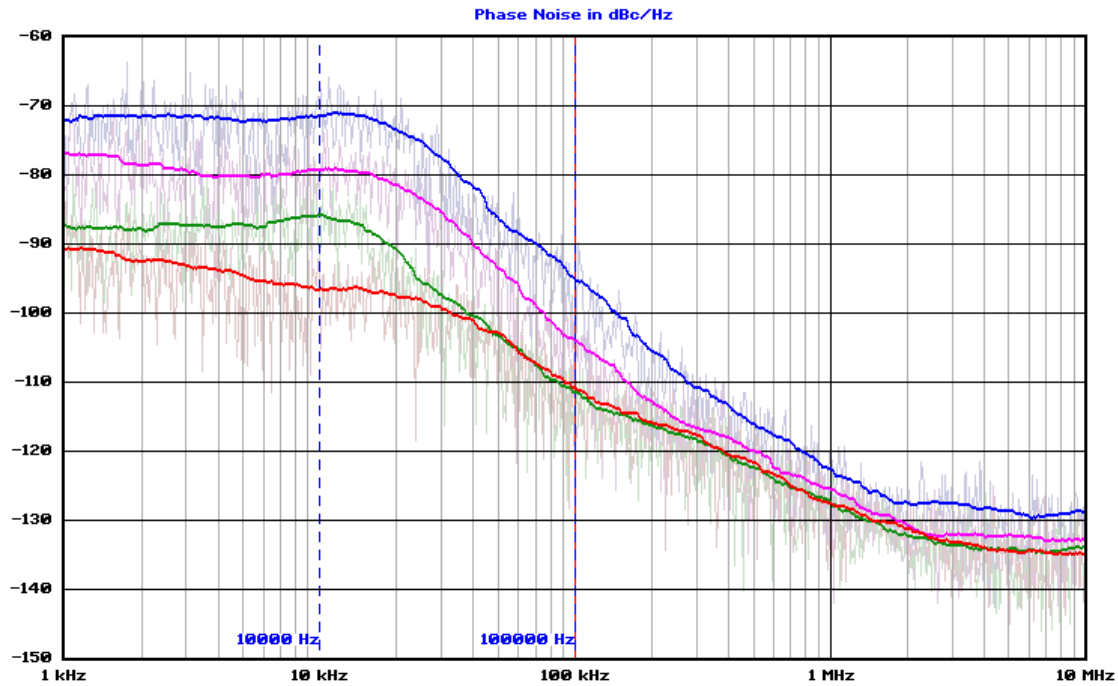


Low Distortion!

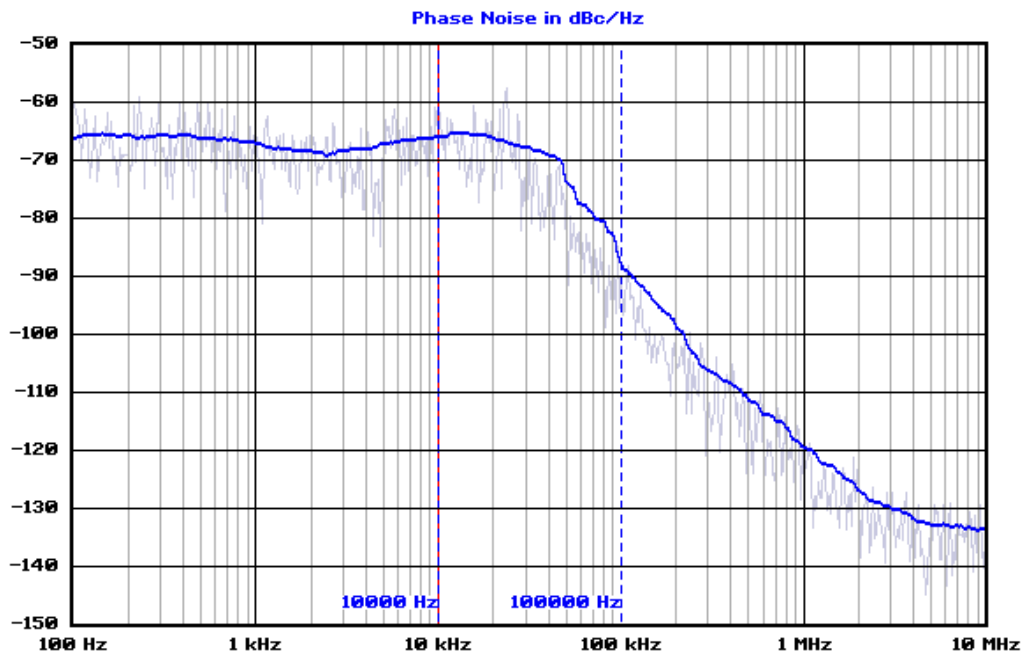


SG6000

(6GHz) Typical Phase Noise



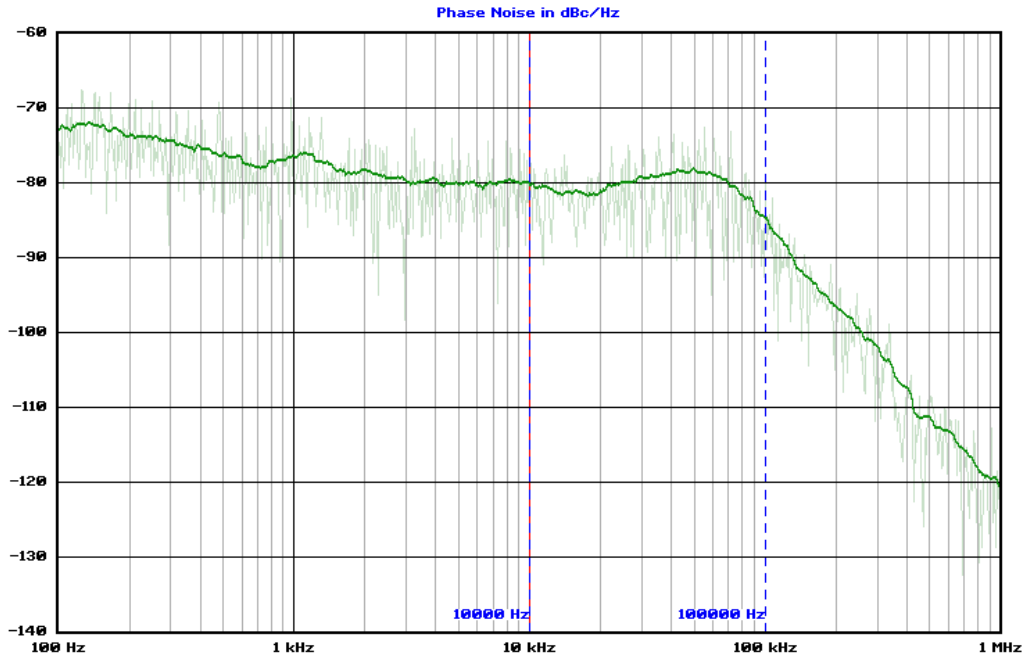
Trace	Carrier Hz	Carrier dBm	dBc/Hz at 100000 Hz	RMS Jitter
SG6000L	6 000 000 000	0.00	-95.2	1.3E-012 s
SG6000L	2 400 000 000	0.00	-104.0	1.3E-012 s
SG6000L	900 000 000	0.00	-111.3	1.2E-012 s
SG6000L	433 000 000	0.00	-110.8	1.3E-012 s



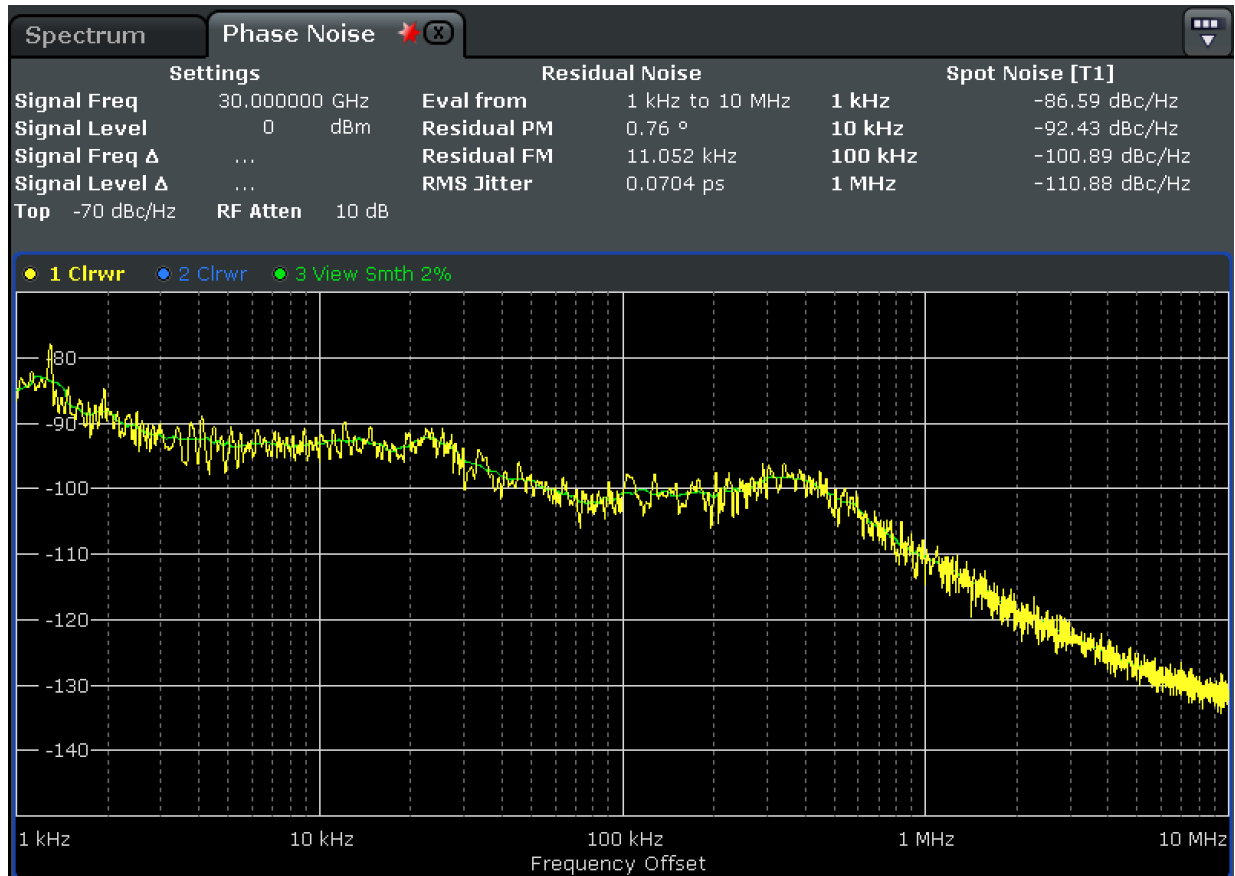
Trace	Carrier Hz	Carrier dBm	dBc/Hz at 10000 Hz	RMS Jitter
SG12000	12 000 000 000	13.00	-65.9	1.7E-012 s

SG6000

Phase Noise Plots Continued

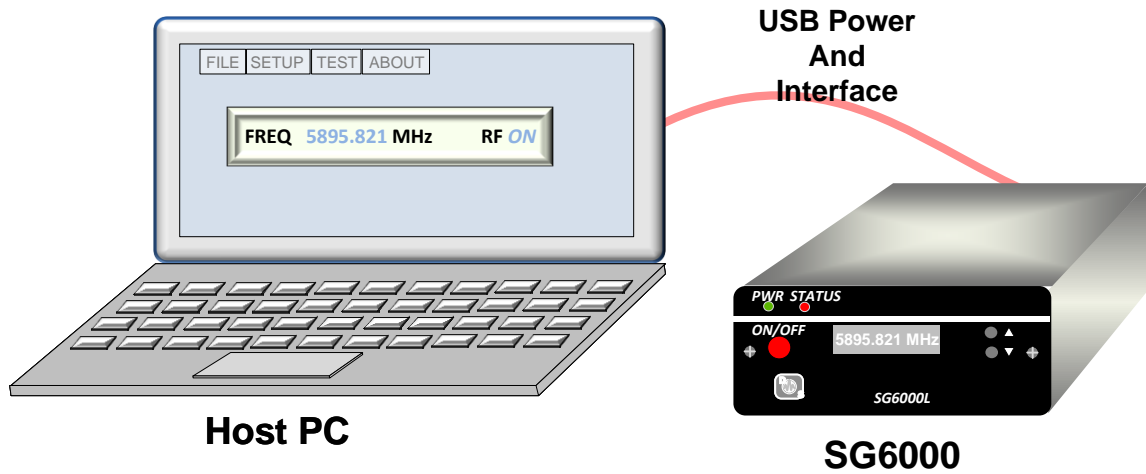


Trace	Carrier Hz	Carrier dBm	dBc/Hz at 10000 Hz	RMS Jitter
SC22000L-R18	18 000 000 000	15.00	-80.3	3.7E-013 s



SG6000

Windows GUI for remote Operation



The screenshot shows the "DS Instruments RF Control" software window. The title bar reads "DS Instruments RF Control". The main interface is titled "Signal Generator Control Rev 10+" and includes a logo, version information, and links for "DS Instruments" and "Help!".

On the left side, there are several configuration fields:

- COM41 (dropdown)
- SG6000L - SER:1011 - FW:10.02 (text field)
- Cal-101 (text field)
- Internal 10MHz (dropdown)
- 5500.0000 (frequency display)
- 9.0 (power dBm display)
- RF ON and RF OFF buttons
- Power Vernier slider set to 0

On the right side, there is a "Sweep Controls" panel with the following settings:

- Mode: Single
- Direction: UP
- Points: 100
- Dwell (mS): 5
- Start (MHz): 1000
- Stop (MHz): 2000
- Step Size: 10.1010 MHz
- Run Time: ~.500 Sec
- Sweep! button

A small inset image of the SG6000L device is shown in the top right corner of the software window, displaying "4307.0000" on its screen. A "USBVolts: 5.03" indicator is also present.

At the bottom of the window, a status bar displays: "0 [BADCOMMAND] 5.03 OFF ON +9.0DBM ON 2000.00000MHZ".

SG6000

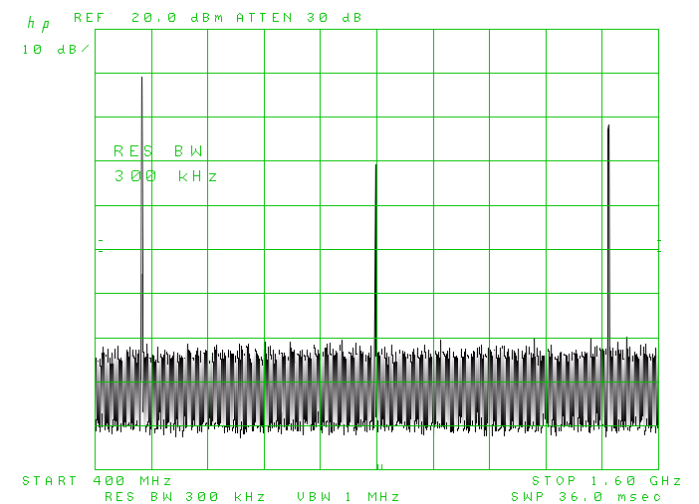
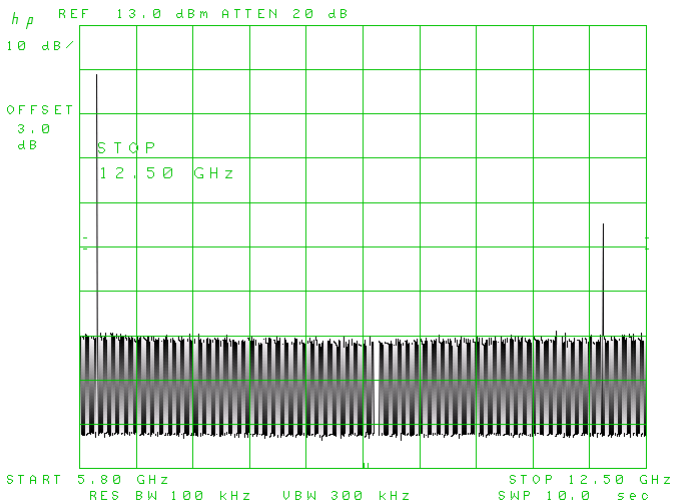
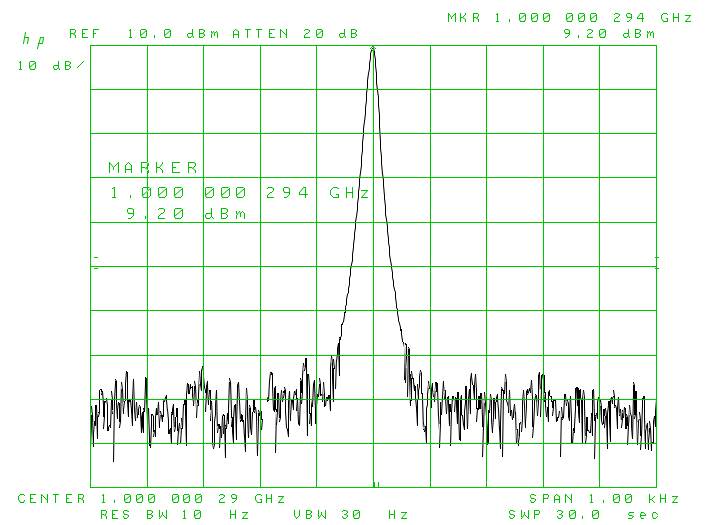
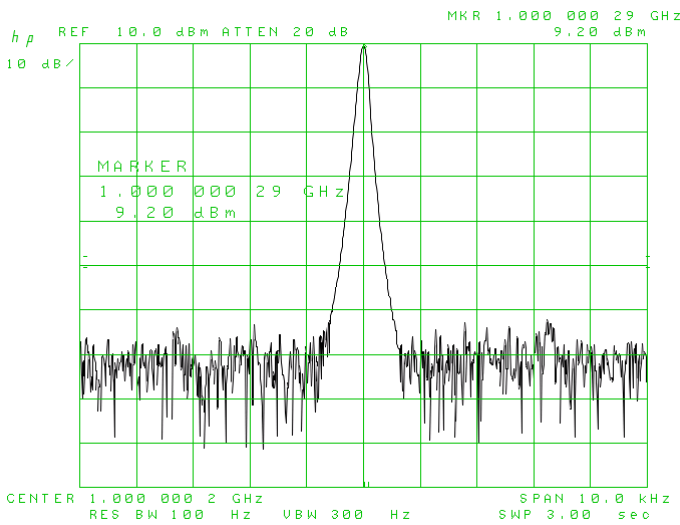
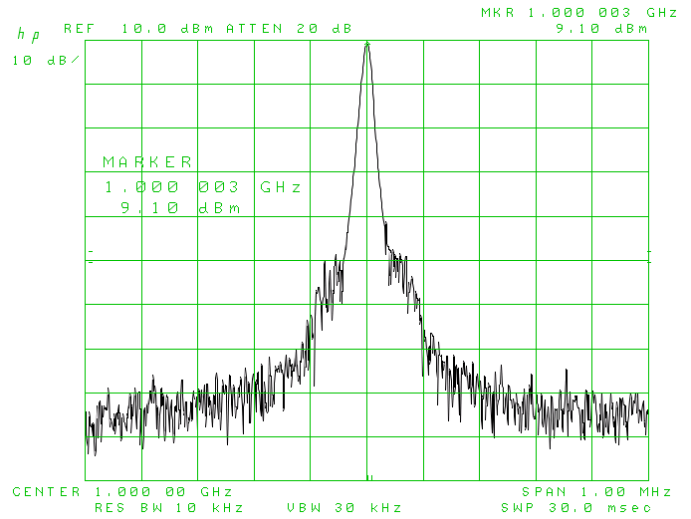
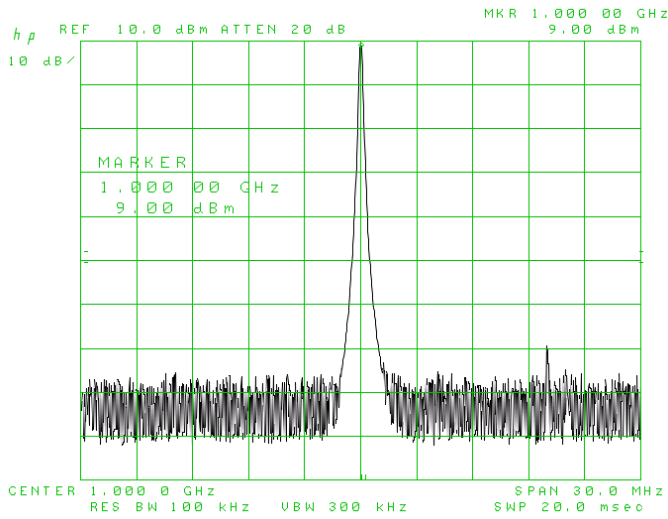
SCPI Serial Command List

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 or 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

Typical Output Power Spectrums

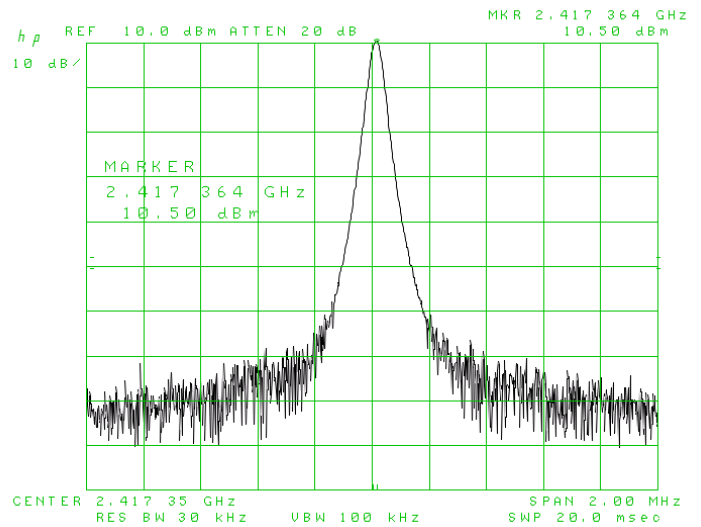
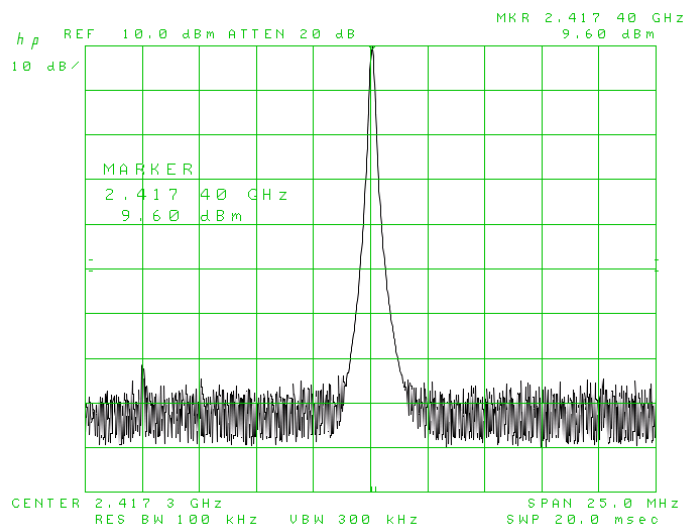
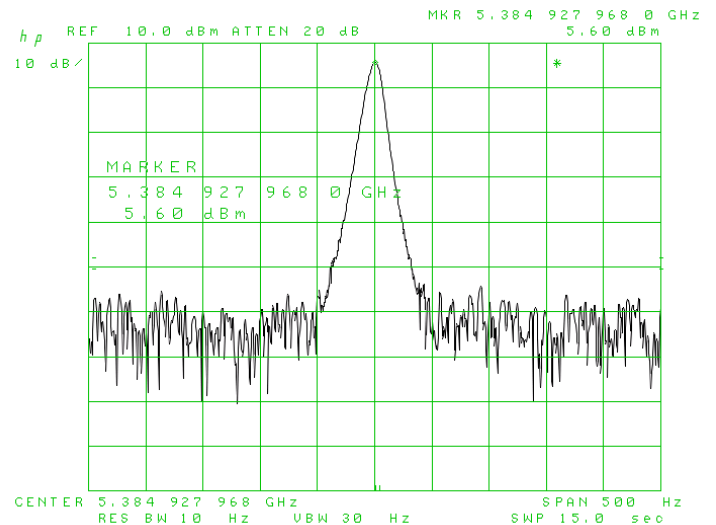
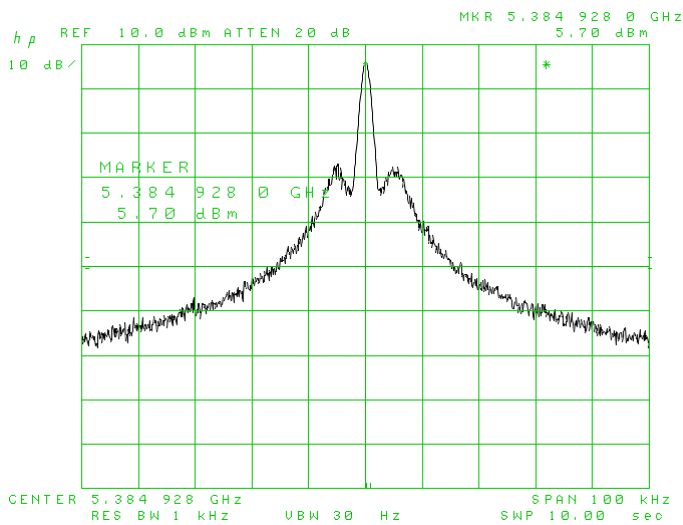
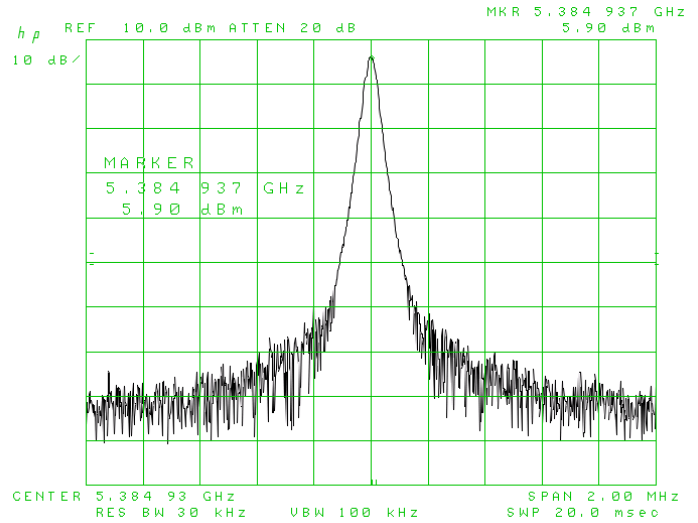
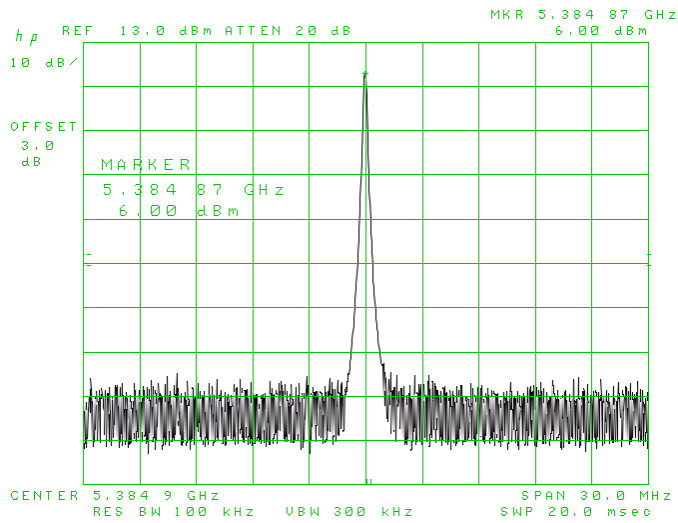
[25 Deg. C, USB Power, internal 10MHz]



SG6000

Typical Output Power Spectrums, Cont.

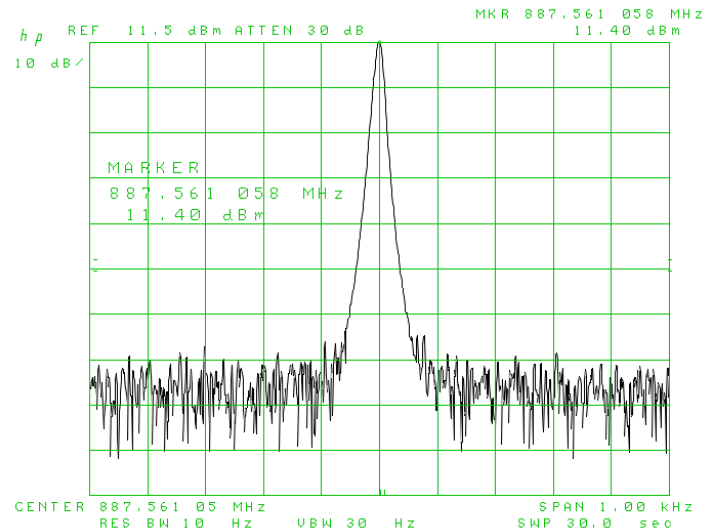
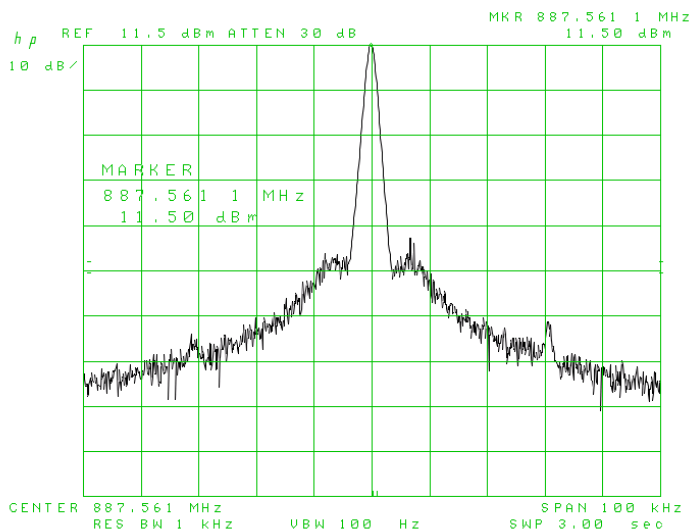
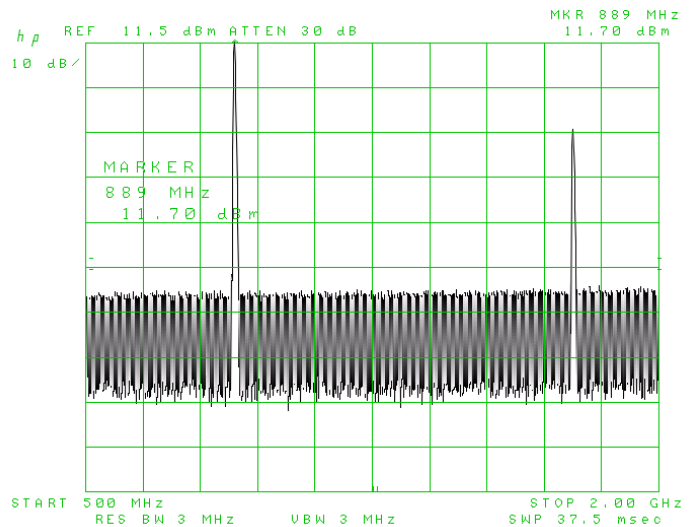
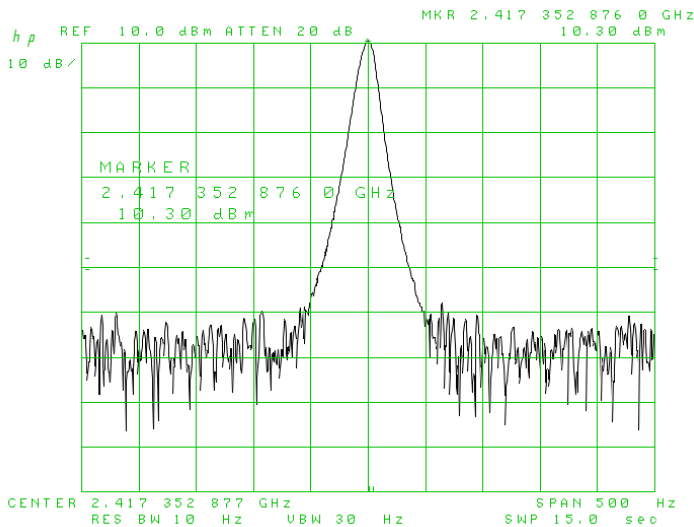
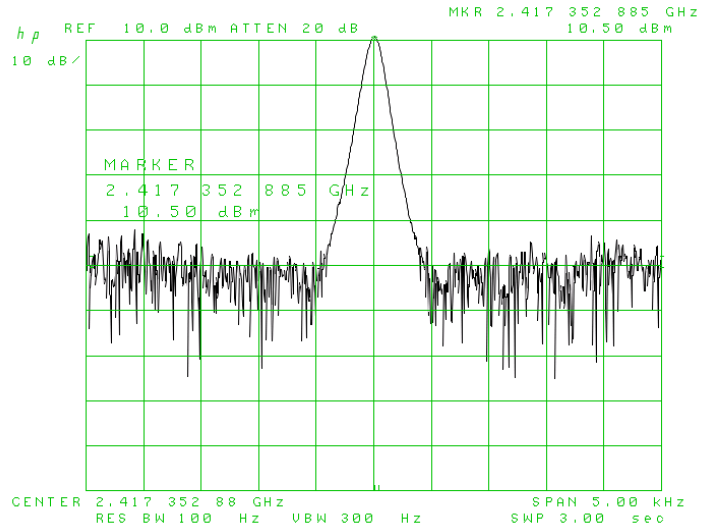
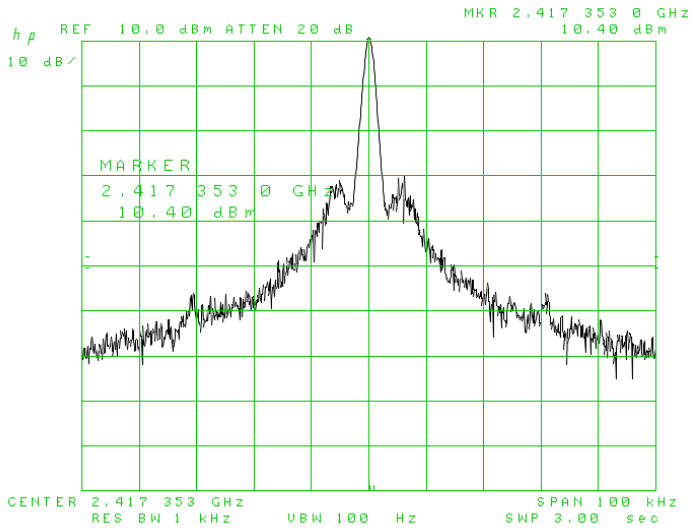
[25 Deg. C, USB Power, internal 10MHz]



SG6000

Typical Output Power Spectrums, Cont.

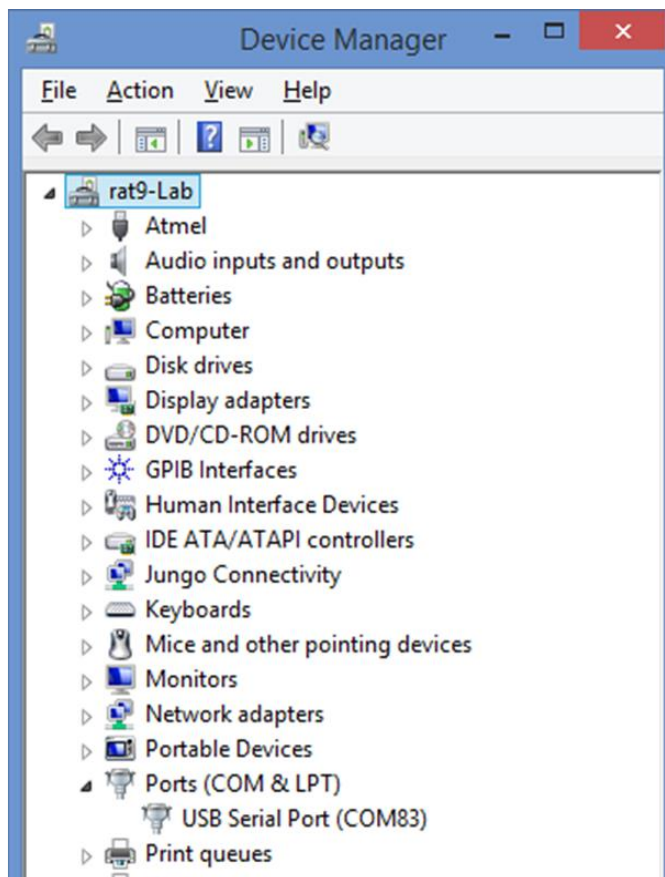
[25 Deg. C, USB Power, internal 10MHz]



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 Series Pricing

Ordering Information

SG4400 – No Display or Buttons – 35 to 4400MHz (\$499.00)

SG4400L – Standard Compact – 35 to 4400MHz (\$599.00)

SG6000 – No Display or Buttons – 25 to 6000MHz (\$599.00)

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

SG6000B – Battery Powered – 6000MHz (\$799.00)

SG6000F – Harmonic Filtered – 6000MHz (899.00)

SG6000X – Dual Channel – 6000MHz (\$1299.00)

SG12000L – 25MHz to 12GHz Output (\$1099.00)

SG22000L – 55MHz to 22GHz (\$1649.00)

Contact Information

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