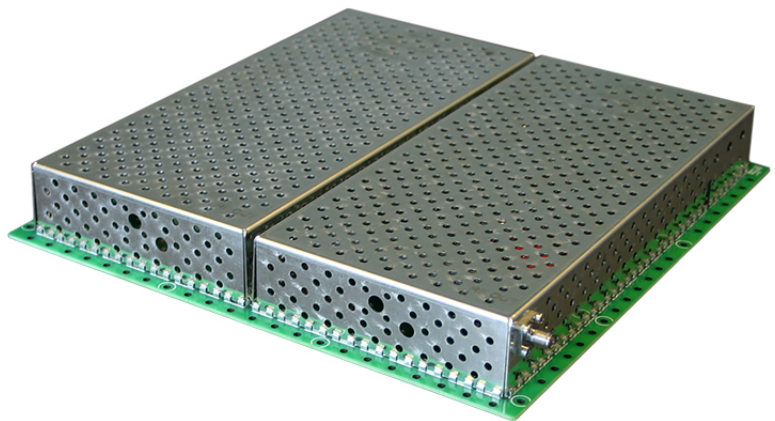
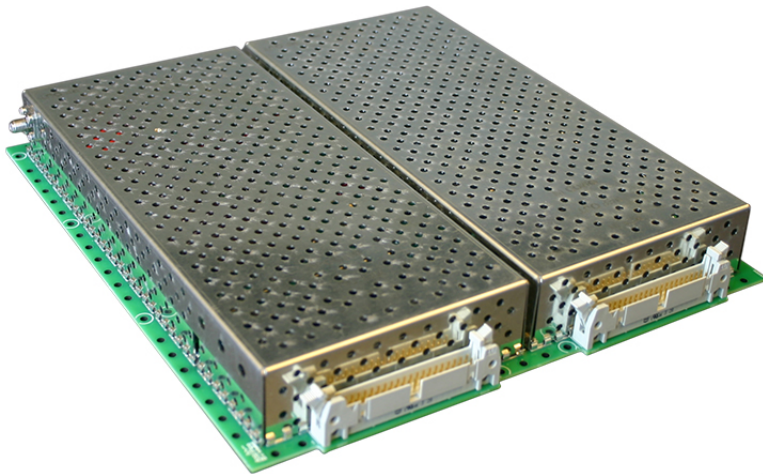


# OEM Custom Solutions

20, & 26.5 GHz RF / Microwave Signal Generator



**Berkeley Nucleonics**  
Test, Measurement and Nuclear Instrumentation since 1963

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## Synthesized Signal Generator - 100 kHz to 26.5 GHz

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### **Wide Frequency Range, 100 kHz to 26.5 GHz Signal Generator On a Board or 1U Rack!**

The Model 845-OEM series is an easy to implement test equipment solution designed to fulfill your signal generation needs. Built on a foundation of high quality and market leading Berkeley Nucleonics Signal Sources, the 845-OEM series provides the highest output power, lowest harmonic levels and broadest frequency range amongst signal generators of its size and cost.

This compact signal generator board level assembly features USB, GPIB and Ethernet interfaces ensuring carefree integration within various test environments while improving overall productivity and equipment utilization.

The 845-OEM incorporates several product upgrades: reduced spurious, wider dynamic range, higher frequency resolution, higher RF output power, reduced RF off leakage, and an added TRIGGER OUT function. This assembly can be readily integrated into a test equipment rack. Just supply power and cooling.

### **Applications**

- ◆ **ATE**
- ◆ **Test & Measurement**
- ◆ **R&D Laboratories**

### **Advantages**

- ◆ **Versatile: Higher Drive Simplifies Test Set-Ups**
- ◆ **Efficient: As fast as 40  $\mu$ s Frequency Switching**
- ◆ **Reliable: Incorporates BNC GUI's**
- ◆ **Flexible: Software Control (Via USB, GPIB or Ethernet)**

### **Performance**

- ◆ **High Output Power: +27 dBm @ 1 GHz with HP option**
- ◆ **Wide Frequency Range: 100 kHz to 26.5 GHz**
- ◆ **Excellent Phase Noise Performance: -100 dBc/Hz @ 1 kHz Offset @ 10 GHz**
- ◆ **Power Resolution: 0.01 dB**
- ◆ **Frequency Resolution: 0.001 Hz**
- ◆ **Phase Lock**

## Signal Specifications

The specifications in the following pages describe the warranted performance of the signal generator for  $23 \pm 10^\circ\text{C}$  after a 30 minute warm-up period and for all configurations (options PE3 if not explicitly stated). Typical specifications describe expected, but not warranted performance. Min and Max specifications are warranted.

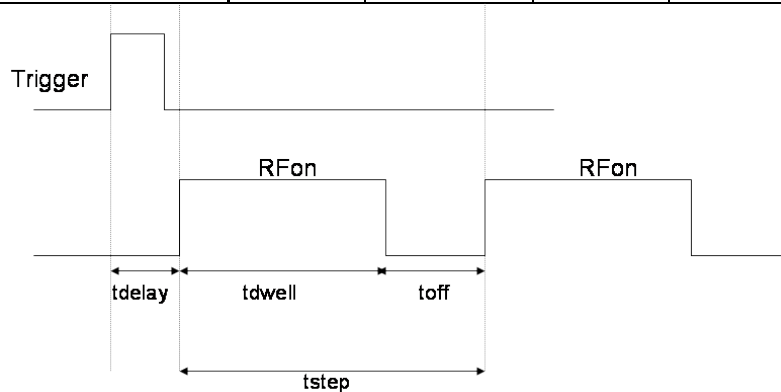
Parameter	Min.	Typ.	Max.	Note
<b>CW mode</b>				
Frequency range	100 kHz 100 kHz		20.0 GHz 26.5 GHz	<b>-OEM</b> <b>845-20 , settable to 20.5 GHz</b> <b>845-26, settable to 30 GHz</b>
resolution		0.001 Hz		
Phase resolution		0.1 deg		
Frequency / Amplitude settling time		200 $\mu\text{s}$	300 $\mu\text{s}$ 30 $\mu\text{s}$	time from receipt of SCPI command option FS
<b>SSB Phase noise (standard)</b>				
<b>500 MHz</b>				
10 Hz offset		-74 dBc/Hz		
1kHz offset		-126 dBc/Hz		
100 kHz offset		-137 dBc/Hz		
<b>4 GHz</b>				
10 Hz offset		-68 dBc/Hz		
1kHz offset		-108 dBc/Hz		
100 kHz offset		-119 dBc/Hz		
<b>20 GHz</b>				
10 Hz offset		-51 dBc/Hz		
1kHz offset		- 91 dBc/Hz		
100 kHz offset		- 104 dBc/Hz		
Wideband noise		-150 dBc/ Hz		
<b>SSB Phase noise (option LN)</b>				
<b>500 MHz</b>				
10 Hz offset		-106 dBc/Hz		
1kHz offset		-131 dBc/Hz		
100 kHz offset		-128 dBc/Hz		
<b>4 GHz</b>				
10 Hz offset		-88 dBc/Hz		
1kHz offset		-115 dBc/Hz		
100 kHz offset		-128 dBc/Hz		
<b>20 GHz</b>				
10 Hz offset		-74 dBc/Hz		
1kHz offset		- 100 dBc/Hz		
100 kHz offset		- 113 dBc/Hz		
<b>Amplitude Noise at 10 GHz</b>		-130 dBc/Hz -140 dBm		Pout=+10 dBm, 100 kHz offset noise floor
<b>Output power</b>				Check maximum output power plots on page 10
<b>Standard</b>				
100 kHz to fmax	-20 dBm		+15 dBm	
<b>Option PE3 only</b>				
100 kHz to fmax	-90 dBm		+13 dBm	

Parameter	Min.	Typ.	Max.	Note
<b>Option HP only</b>	-20 dBm -20 dBm -20 dBm		+25 dBm +23 dBm +18 dBm	0.2 to 9 GHz 9 to 18 GHz, see plot >18 GHz, see plot
<b>Options HP and PE3</b>	-90 dBm -90 dBm		+20 dBm	< 18 GHz >18 GHz, see plot
Level resolution	0.01 dB			
Level uncertainty, ALC on		0.3 dB	< 1 dB	> -15 dBm & < 15 dBm > -65 dBm, option PE3 <= -65 dBm, option PE3 0 to 45 °C
Temperature effects		1.5 dB	< 1.5 dB	
<b>User flatness correction</b>		0.015 dB/ °C up to 2000 points		
Output impedance	50 Ω			
VSWR	2.0			
Reverse Power Protection				
DC Voltage			±15 V	
RF power			30 dBm	
<b>Spectral purity at +5 dBm</b>				
Output harmonics		-40 dBc	-30 dBc	See plot
Sub-harmonics		-75 dBc -50 dBc	-65 dBc -40 dBc	< 20 GHz > 20 GHz
Non-harmonic spurious				CW +10 dBm, > 3 kHz offset
< 312 MHz		-80 dBc	-66 dBc	
> 312 to 625 MHz		-75 dBc	-70 dBc	
> 625 MHz to 1.5 GHz		-75 dBc	-65 dBc	
> 1.5 GHz to 2.5 GHz		-70 dBc	-65 dBc	
> 2.5 GHz to 5 GHz		-65 dBc	-60 dBc	
> 5 GHz to 10 GHz		-60 dBc	-55 dBc	
> 10 GHz to 20 GHz		-55 dBc	-50 dBc	
> 20 GHz		-50 dBc	-45 dBc	
Residual FM @ 10 GHz		15 Hz		0.3 kHz to 3 kHz, weighted (ITU-T), RMS
Residual AM @ 10 GHz		0.02 %		RMS value (0.01 kHz to 15 kHz)

## Sweeping Capability

Sweeps can be performed with combined internal or external AM/FM/PM/pulse modulation running. With modulation enabled, the minimum step time increases to 2 ms.

Parameter	Min.	Typ.	Max.	Note
<b>Digital frequency sweep</b>				
Sweep type: linear, logarithmic, random				
Step time ( $t_{step}$ )	400 $\mu$ s 40 $\mu$ s		19998 s	Option FS
Dwell time ( $t_{dwell}$ )	10 $\mu$ s		9999 s	
Off-time (incl. transient time) ( $t_{off}$ )	0		9999 s	
Timing accuracy per point		1 $\mu$ s 50 ns		Option FS



## Generalized list sweep

allows individual setting of frequency, power, dwell-time, and off-time for each point

List size	2		65'000	
Step time ( $t_{step}$ )	300 $\mu$ s 40 $\mu$ s		19998 s	mechanical attenuator not used option FS
Dwell time ( $t_{dwell}$ )	10 $\mu$ s		9999 s	
Off-time (incl. transient time) ( $t_{off}$ )	0		9999 s	
Time resolution		0.1 $\mu$ s		
Timing accuracy per point		1 $\mu$ s		

## Frequency Chirps

(linear ramp, up/down)

Bandwidth	10 %			of carrier frequency
Dwell time ( $t_{dwell}$ )	10 ns		10000 $\mu$ s	
Slope			100 MHz / $\mu$ s	
Number of frequencies			65'000	

## Reference Frequency

REF IN input and REF OUT output are at rear panel

Parameter	Min.	Typ.	Max.	Note
Internal reference frequency		100 MHz 10 / 100 MHz		Option LN
Initial accuracy			±40 ppb	calibrated at 23 ± 3 °C at time of calibration, user adjustable
Temperature stability (0 to 50 degC)			±100 ppb ±20 ppb	Option LN
Aging 1 <sup>st</sup> year		0.5 ppm 0.1 ppm		Option LN
Aging per day (after 30 days operations)			5 ppb tbm	Option LN
Warm-Up time		5 min		
Output of internal reference		10 MHz 10/100 MHz		
Output power		0 dBm		
Output impedance		50 Ohms		
Bypass Internal reference Input		100 MHz, -5 to +10 dBm 100 MHz, 1 GHz		High phase synchronous mode Option LN
Phase Lock to External Reference				
External Input Range	1 MHz		250 MHz	User programmable
Reference input level	-5 dBm	0 dBm	+13 dBm	
Lock Range			±1.5 ppm	
Reference input impedance		50 Ohms		

## Multi Purpose Output (FUNC OUT)

Output is FUNC OUT at rear panel

Parameter	Min.	Typ.	Max.	Note
<b>MULTIFUNCTION GENERATOR</b>	sine, triangle, square wave			
Frequency range	1 Hz 1 Hz		3 MHz 1 MHz 50 kHz	sine triangle square
Frequency resolution		0.1 Hz		
Output voltage amplitude peak-peak	10 mV	5V	2 V	Sine, triangle Square (CMOS output)
Harmonic Distortion		1 %		< 100 kHz, 1 Vpp
Output impedance		50 Ohms CMOS		Sine, triangle square wave
<b>VIDEO OUTPUT (of internal pulse modulator)</b>				
Output		CMOS		
Period	30 ns		50 s	
Pulse Width	15 ns		50 s	

Parameter	Min.	Typ.	Max.	Note
RF delay		10 ns		
<b>TRIGGER OUT                      Synchronization mode for multiple sources</b>				
Modes	Trigger on sweep start Trigger on each point			
Trigger waveform pulse width		100 ns		

## Trigger (TRIG IN)

Input is TRIG IN at rear panel

Parameter	Min.	Typ.	Max.	Note
Trigger Types	Continuous, single, gated, gated direction			
Trigger Source	RF key, external, bus (GPIB, LAN, USB)			
Trigger Modes	Continuous free run, trigger and run, reset and run			
Trigger latency		2 $\mu$ s tbd		Option FS
Trigger uncertainty		5 $\mu$ s 10 ns		Option FS
External Trigger delay	50 $\mu$ s 50 ns		40 s 10 s	programmable Option FS
External Delay Resolution		15 ns 10 ns		Option FS
Trigger Modulo	1		255	Execute only on Nth trigger event
Trigger Polarity	Rising, falling			

## Modulation Capabilities (not with option LO)

Combined AM/PM/FM/PULSE possible (see user manual)

Parameter	Min.	Typ.	Max.	Note
<b>Multifunction Generator</b> sine, triangle, square wave				
Output is FUNC OUT at rear panel				
Frequency range	1 Hz 1 Hz		3 MHz 1 MHz 50 kHz	sine triangle square
Frequency resolution		0.1 Hz		
Output voltage amplitude peak-peak	10 mV	5V	2 V	Sine, triangle Square (CMOS output)
Harmonic Distortion		1 %		< 100 kHz, 1 Vpp
Output impedance		50 Ohms CMOS		Sine, triangle square wave
<b>Pulse Modulation</b>				
On/off ratio		70 dB		<b>at +10 dBm</b>
Repetition frequency	DC		10 MHz	
Pulse width	30 ns 500 ns			ALC hold ALC on
Pulserise/fall time		7 ns		
Pulse width	30 ns		100 μs	
Pulse resolution		15 ns		
Polarity		selectable		
External input amplitude		1 V TTL		AC DC
<b>Pulse Pattern Modulation</b>				
On/off ratio		70 dB		Using internal pattern generator <b>at +10 dBm</b>
Pulse bit width	30 ns 500 ns			ALC hold ALC on
Pulserise/fall time		7 ns		
Programmable pattern length	2		4192	
Pulse width	30 ns		100 μs	
Pulse bit resolution		15 ns		
Polarity		selectable		
<b>Frequency Modulation</b>				
Maximum Frequency deviation (peak)		> 0.05·f N · 200 MHz		< 1.25 GHz 1.25 GHz to 2.5 GHz (N=0.125) 2.5 GHz to 5 GHz (N=0.25) 5 GHz to 10 GHz (N=0.5) > 10 GHz to 20 GHz (N=1)
Deviation accuracy (1kHz rate, 50 kHz deviation)		< 2%		
Modulation rate	DC		800 kHz	> -3dB frequency response
Modulation waveforms	Sine, triangle, FSK			
External input sensitivity				
AC	0 to N · 200 MHz / V			adjustable for ±1 V range
DC	0 to N · 100 MHz / V			discr. values ; ±5 V range
Total harmonic distortion	< 1%			1 kHz rate & N · 1 MHz deviation

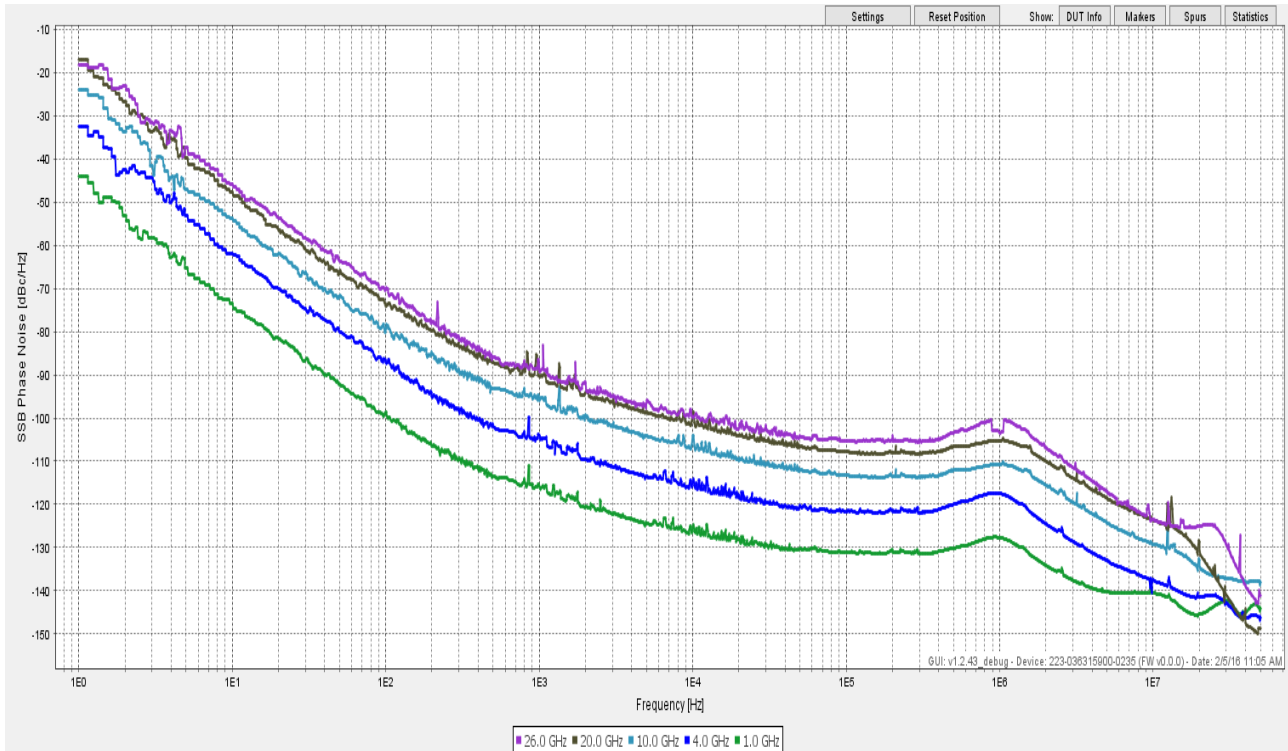


Parameter	Min.	Typ.	Max.	Note
<b>Phase Modulation</b>				
Phase deviation (peak)	0		N-300 rad	
Modulation rate	DC		800 kHz	> -3dB frequency response Max. phase deviation degrades above 20 kHz modulation rate
Modulation waveforms	Sine, triangle, FSK			
External Input sensitivity	Settable 0.1 rad/V to 360 rad/V			
Total harmonic distortion	< 1%			1 kHz rate & N x 100 rad deviation
<b>Amplitude Modulation</b>				
Modulation rate	0.1 Hz		50 kHz	
Modulation waveforms	Sine, triangle, square			
Modulation depth	0 %		90 %	
Distortion (sine wave)		2 %		at 60% modulation depth
Accuracy (1kHz, 80%)	- 4%		4 %	for 10 to 80%, 0 dBm

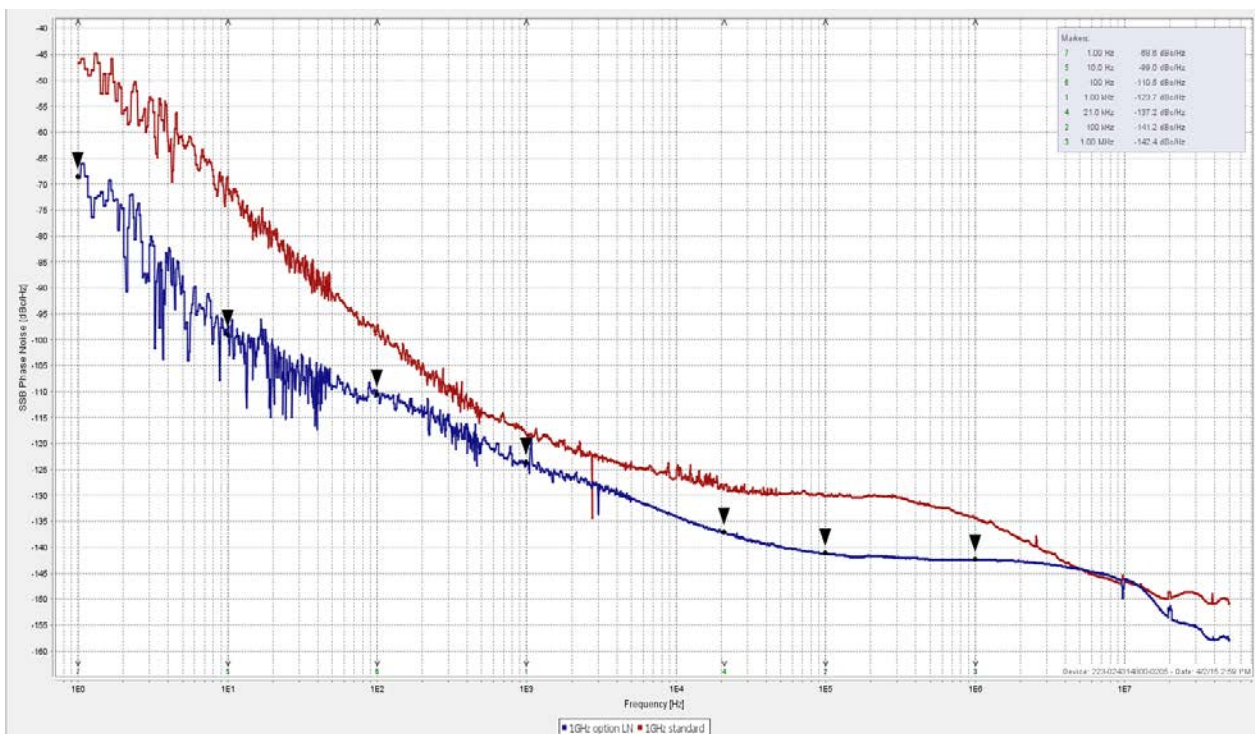
Notes:

## Typical performance curves

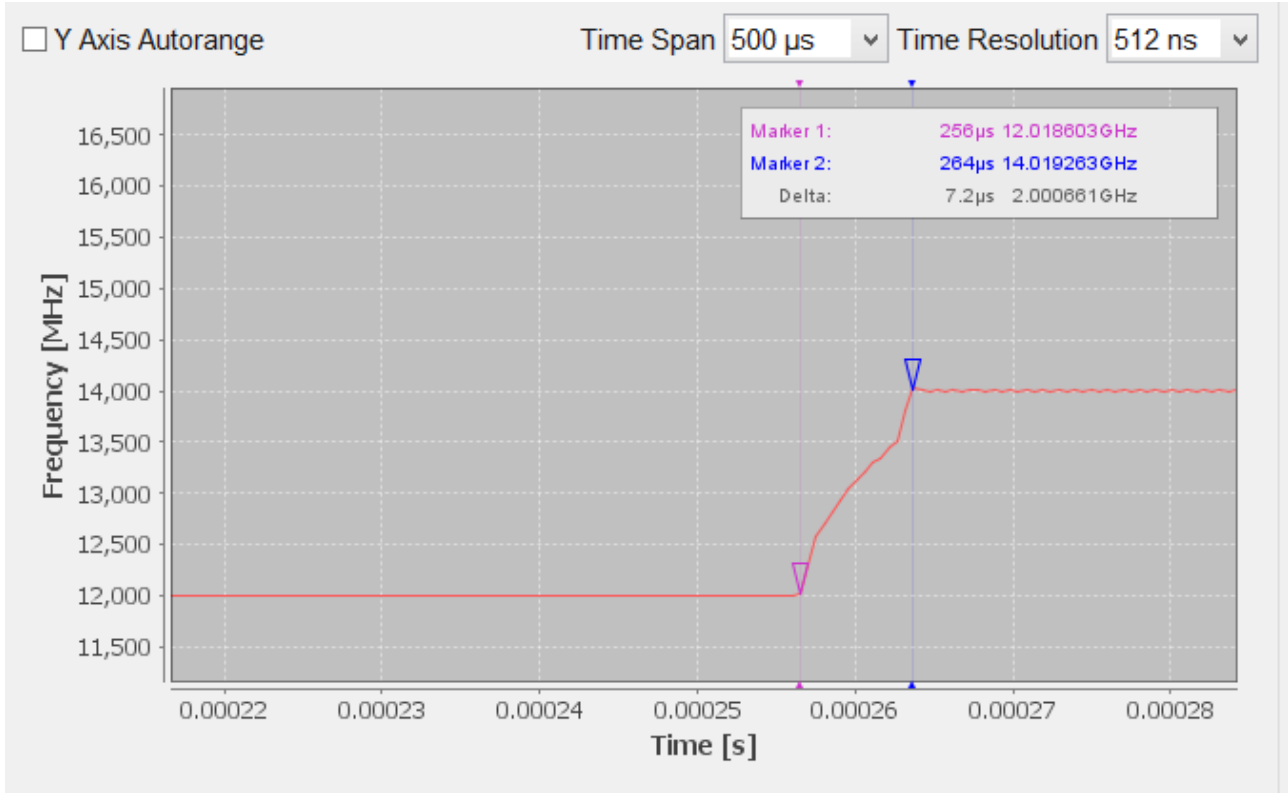
Phase Noise Performance (10 Hz to 50 MHz offset) at 1,4,13 and 26 GHz



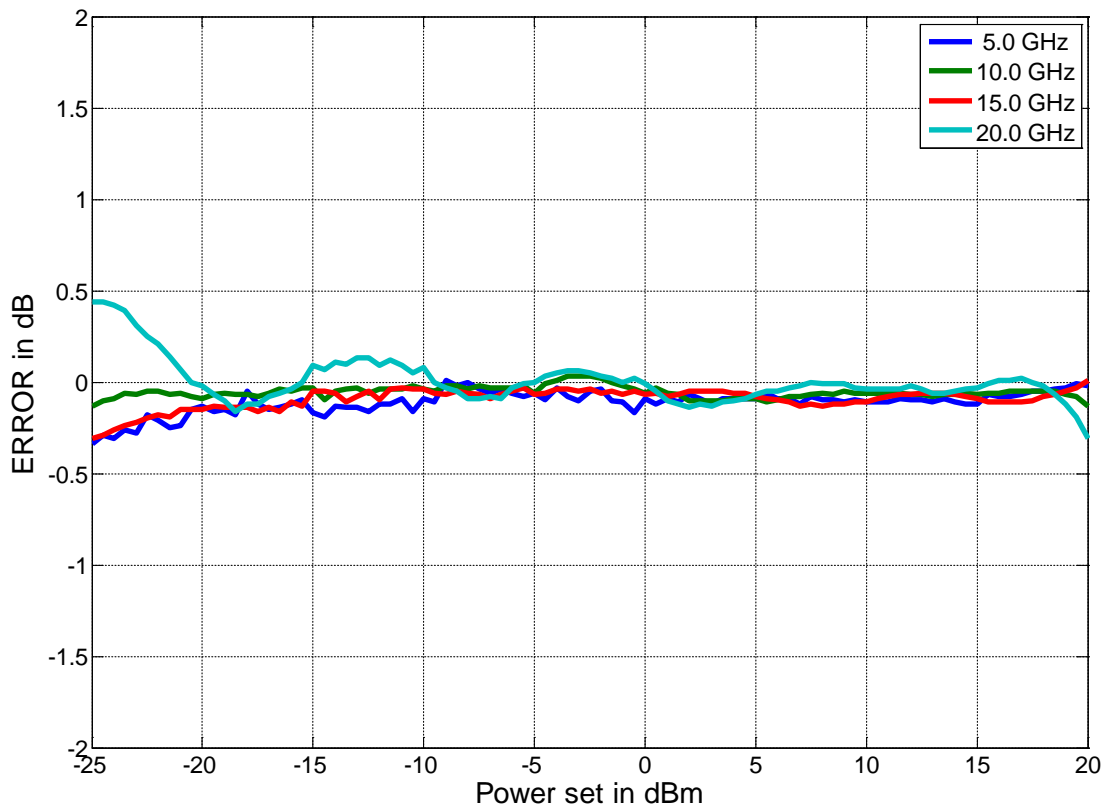
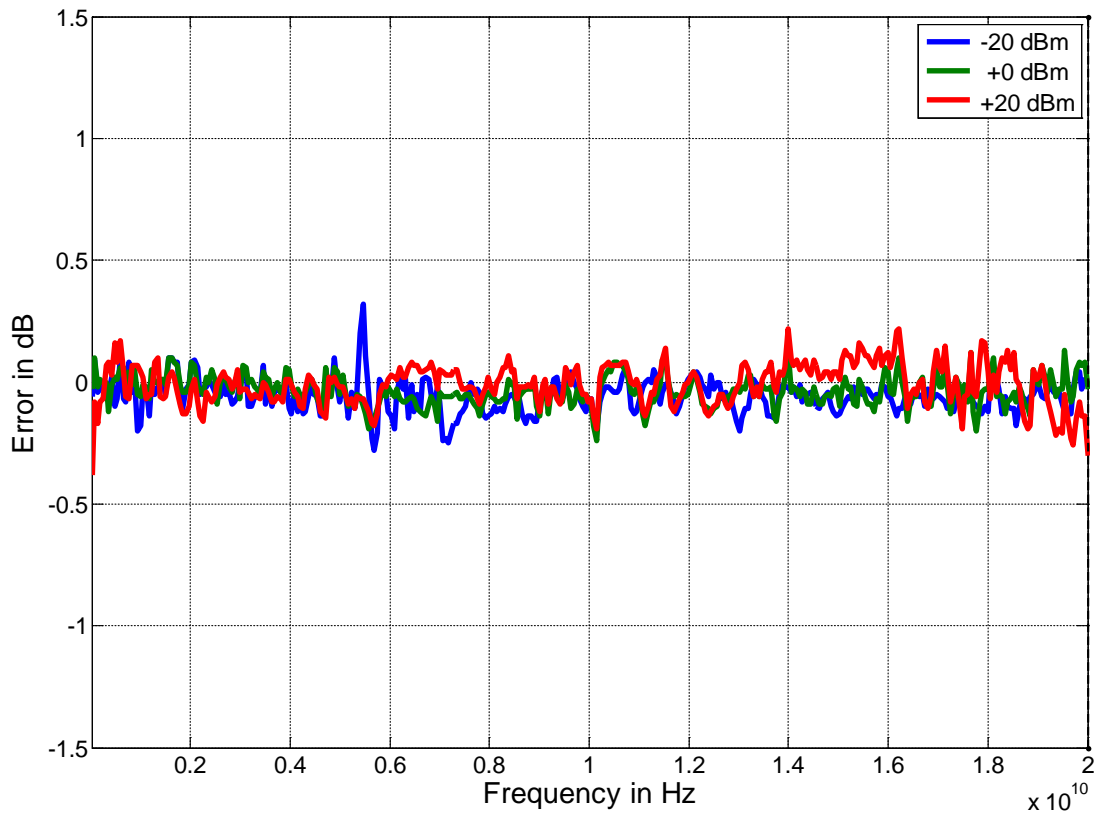
## Phase Noise with Option LN



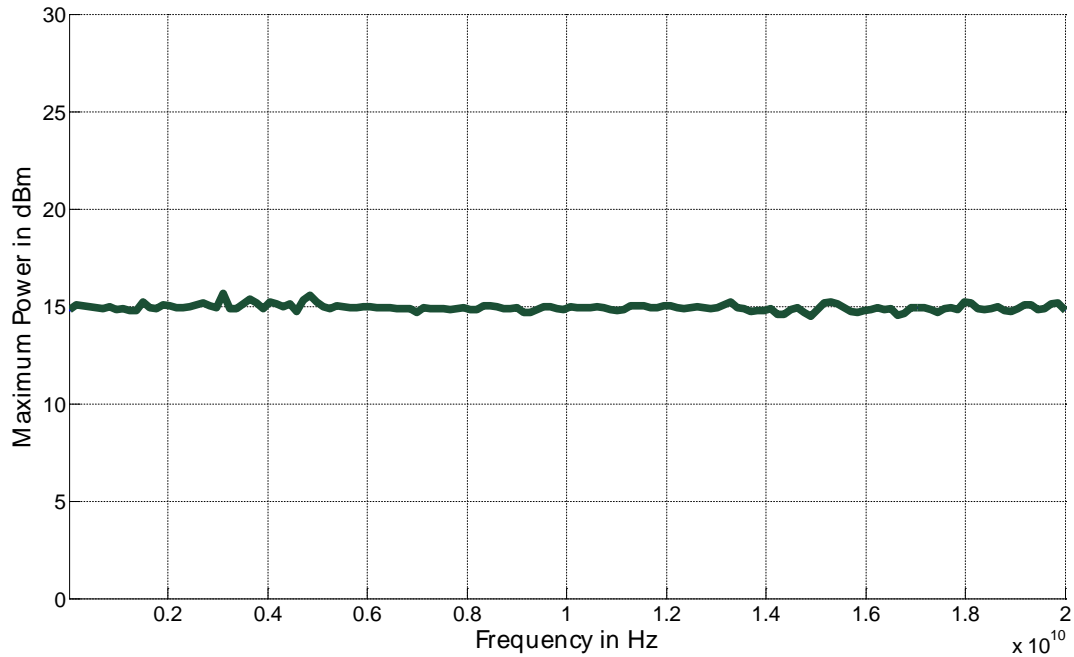
Typical Switching transient from 12 GHz to 14 GHz step



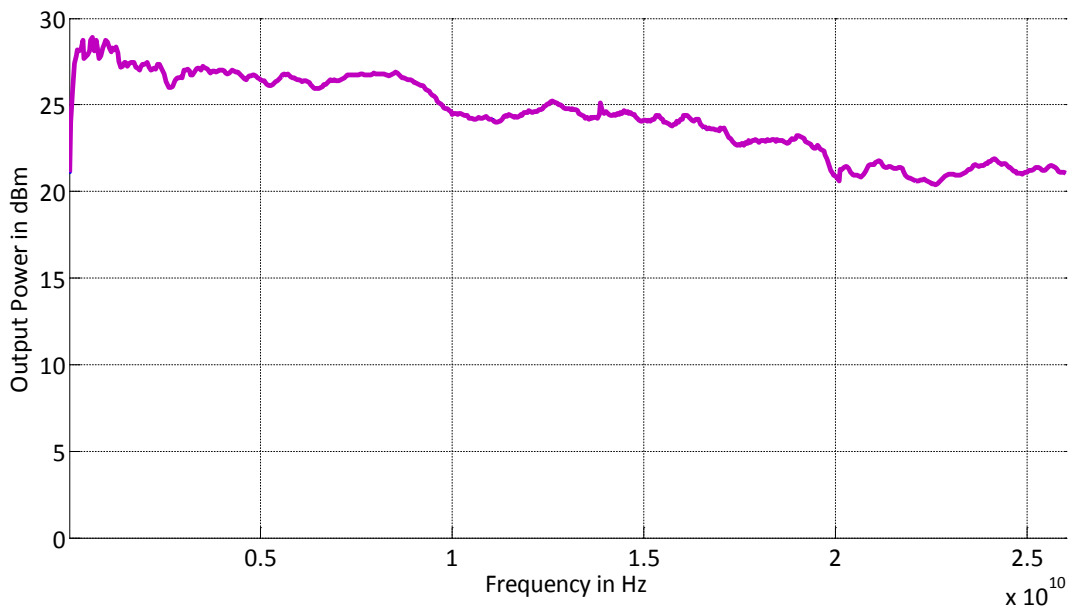
Typical Frequency Response 0 to 20 GHz at -20, 0, and +20 dBm



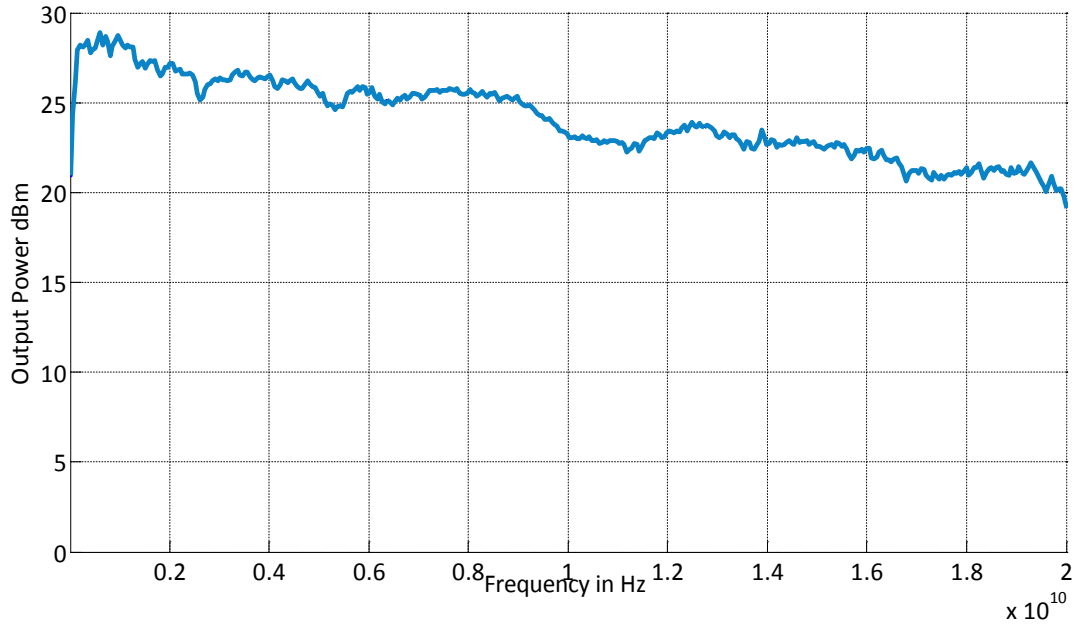
## Typical Maximum Output Power (standard)



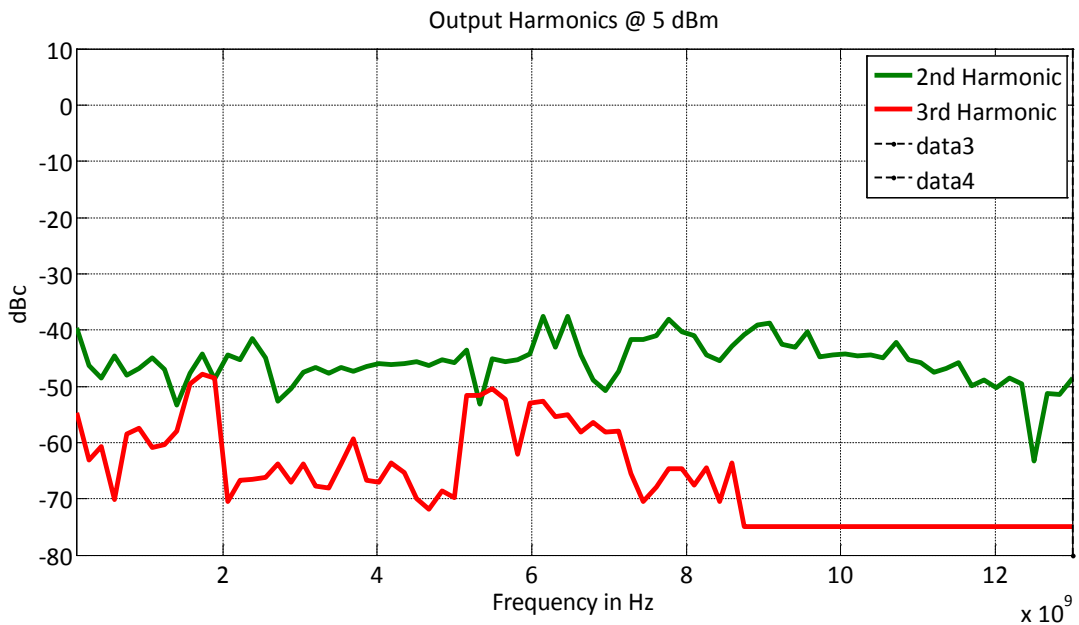
## Typical Maximum Output Power (option HP)



## Typical Maximum Output Power (options PE and HP)



## Harmonics (with option PE)



## General Characteristics

### Remote programming interfaces

Ethernet 100BaseT LAN interface,  
USB 2.0 host & device  
GPIB (IEEE-488.2,1987) with listen and talk (optional)  
Control language SCPI Version 1999.0

**Power requirements** 6.25 ± 0.2 VDC ; 20 W maximum

**Mains adapter supplied:** 100-240 VAC in/ 6 V 6.0 A DC out

**Operating temperature range** 0 to 40 °C

**Storage temperature range** -40 to 70 °C

**Operating and storage altitude** up to 15,000 feet



Safety/EMC complies with applicable Safety and EMC regulations and directives.

**Weight** ≤ 2.6 lbs net, ≤ 6 lbs shipping

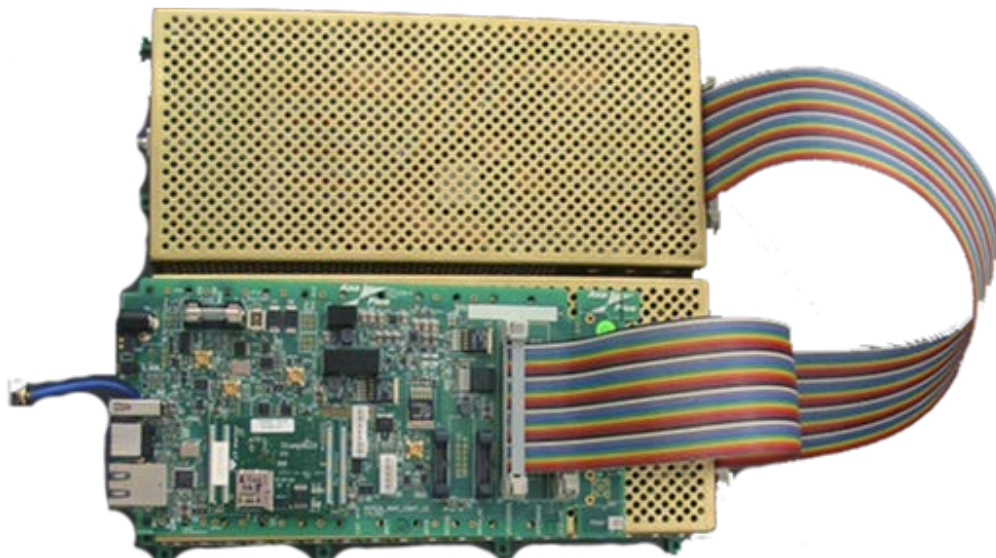
**Dimensions** 1.4" x 9.65" x 9.06" (incl. connectors)

**Recommended calibration cycle** 24 months

## Options

- **HP:** High output power
- **PE:** Extended power range down to <-90 dBm) step attenuator module
- **LO:** remove modulation
- **LN:** ultra low phase noise, improved frequency stability
- **FS:** enhanced switching speed
- **RB:** battery module
- **TP:** 3HE enclosure with touch display
- **R:** 19" 1HE enclosure with rack-mount capability. **Dimensions** 42 mm H x 426 mm W x 360 mm L [1.7 in H x 16.8 in W x 14.2 in L]

## Model 845-OEM Rear Panel I/O Connections

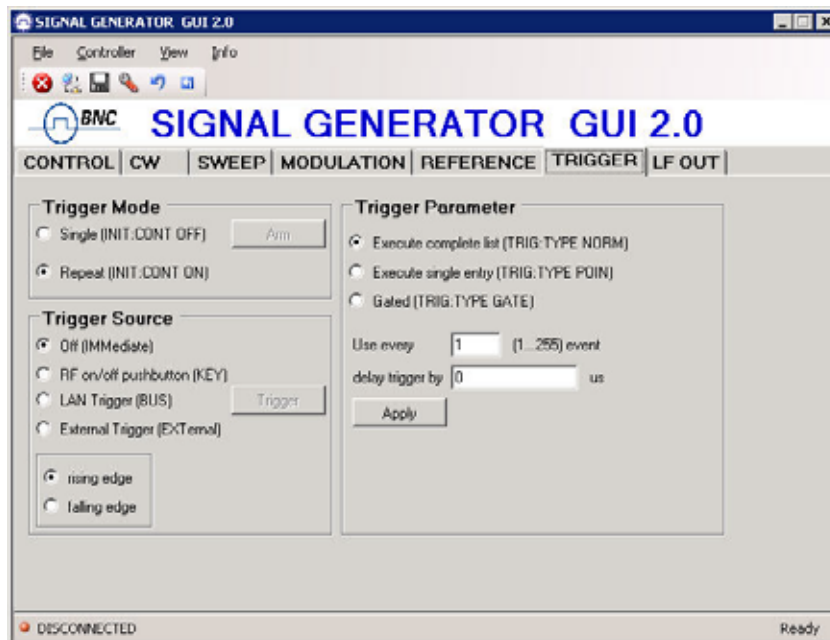


### Connectivity & Control

Its compact size, light weight, fast switching speed and USB, GBIP and Ethernet control interfaces support the standard SCPI command set ensuring smooth integration within all test environments, particularly those associated with automated test. An installation disk that accompanies each unit includes all the drivers required to remotely control the device as well as a user friendly GUI interface (right) compatible with a Windows XP®, Windows Vista® or Windows 7® operating system. User control is facilitated via pull down menus that allow programming of single or swept modes in frequency or power. Integration of multiple units within a production test environment is easy, and affordable.

#### Remote Interface

**Hardware:** USB (Windows XP®, Windows 7®, Windows Vista® Drivers Supplied), GPIB or Ethernet  
**Software:** LabVIEW 2009 Driver



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 with applicable Safety and EMC  
 regulations and directives.

REF-10312016