

# Model 855 Specification

A compact, 1 MHz to 6.2, 12.5, or 20 GHz ultra low phase noise, phase coherent signal generator with up to 8 independent outputs



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

## Introduction

The 855 is a phase-coherent, multi-output, fast-switching generator with low phase noise and a frequency range from 100 kHz to 6.2, 12.5, or 20.0 GHz. It's ideally suited for a wide range of applications where good signal quality, accurate and wide output power range are required. Excellent phase noise is combined with spurious and harmonic rejection. A high-stability OCXO reference provides excellent frequency accuracy and stability. The generator accepts external 10, 100 and 1000 MHz references.

The 855 comes in a standard 19 inch 1U (up to 4 channels) or 3U (4 or 8 channels) enclosure and offers various control interfaces like USB, LAN or GPIB. Each interface allows easy and fast communication using a SCPI 1999 command set. Remote control of the instrument can be quickly attained from any host system. A customer-supplied application programming interface (API) or programming examples for Matlab, Labview, C++ and other commercially available tools make implementation very straightforward.



Model 855 1U Rackmount

## CW Specifications

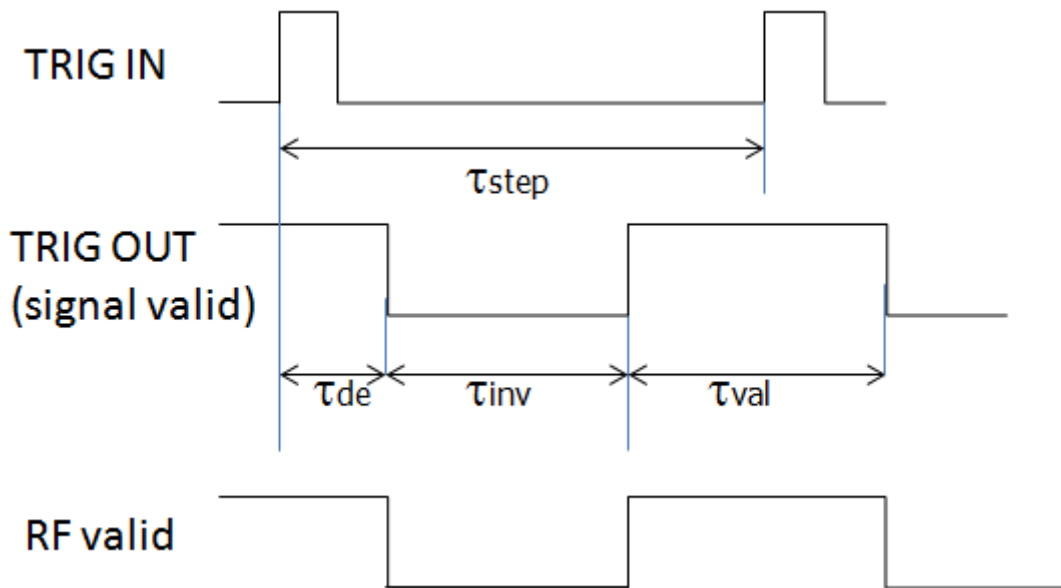
The specifications in the following pages describe the warranted performance of the signal generator for  $25 \pm 8^\circ\text{C}$  after a 30 minute warm-up period. Typical specifications describe expected, but not warranted performance. Min and Max specifications are warranted.

Parameter	Min.	Typ.	Max.	Note
<b>Frequency range</b>	100 kHz 100 kHz 100 kHz		6.0 GHz 12.5 GHz 20.0 GHz	855-6 855-12 855-20
Resolution		1 Hz		
Switching speed			0.02 ms	
Frequency / Amplitude settling time		0.01 ms	0.015 ms	
<b>Phase Range</b>	0 deg		360 deg	Individually adjustable per channel
Phase Resolution		0.1 deg		
<b>SSB Phase noise at 1 GHz</b>				
At 10 Hz from carrier		-105 dBc/Hz		scales with frequency at 20 dB/dec
20 kHz		-137 dBc/Hz		
100 kHz		-140 dBc/Hz		
<b>Power level</b>				
Range	-20 dBm -20 dBm -20 dBm -20 dBm		+20 dBm +25 dBm +23 dBm +22 dBm	1 to 10 MHz 10 Mhz to 6 GHz 6 to 15 GHz 15 to 20 GHz
Range with option PE4	-80 dBm -80 dBm -80 dBm		+20 dBm +18 dBm +15 dBm	Settable to -90 dBm 0.1 to 12 GHz 12 to 15 GHz 15 to 20 GHz
Resolution		0.01 dB		
Thermal drift		0.015 dB / deg C		
Level uncertainty		0.25 dB  $\pm 3.5$ dB	$\pm 1.0$ dB $\pm 2.0$ dB	-20 dBm to Pmax Option PE4, -60 to - 20 dBm Option PE4, <-60 dBm
Output impedance		50 Ohms		
VSWR		1.8		
<b>Reverse Power Protection</b>				
DC Voltage		15 V		
RF power			+26 dBm	
<b>Spectral purity</b>				at + 10 dBm output power
Output harmonics		-30 dBc -40 dBc -50 dBc	-25 dBc -30 dBc -35 dBc	<100 MHz 0.1 to 7 GHz >7 GHz
Non-harmonic spurious		-75 dBc		offsets > 1 kHz

Parameter	Min.	Typ.	Max.	Note
<b>Channel to channel</b>				
Isolation		> 90 dB		< 3 GHz 3 to 6 GHz 6 to 12 GHz
Phase stability		10 mrad		over 6 hours, at 1 GHz 100MHz phase locked
Phase coherent switching		maintains phase coherence during switching frequency		Option PHC
Temperature stability (10 to 45 degC)			0.02 ppm	
Aging (1st year)			0.05 ppm	
Reference IN		10 MHz. 100 MHz or 1000 MHz		
Reference OUT		10 MHz or 100 MHz		
<b>Power consumption</b>	10 W + 12 W per Channel			

## Sweeping Capability

Parameter	Min.	Typ.	Max.	Note
<b>Digital power / frequency / list sweeps</b>				
Sweep type: linear, logarithmic, random				
All channels can be programmed and run independently or fully synchronized.				
Step time ( $\tau_{step}$ )	20 $\mu$ s		200 s	For 1 channel, if N channels are swept synchronously, minimum step time is N times 20 $\mu$ s
Dwell time ( $\tau_{val}$ )	10 $\mu$ s		100 s	
Off-time (incl. transient time) ( $t_{off}$ )	0		100 s	
Transient time ( $\tau_{inv}$ )			15 $\mu$ s	
Timing delay ( $\tau_{de}$ )		50 ns		
Time resolution		5 ns		
Timing accuracy per point		5 ns		



## Modulation Capabilities

Parameter	Min.	Typ.	Max.	Note
<b>Pulse Modulation</b>				
Modulation source		Internal / External		Selectable for each channel
		Internal		Individual modulation for each channel
		External		Independent external modulation input for each channel
External input amplitude	TTL			
Pulse rise/fall time		10 ns		
On/off ratio		90 dB 80 dB		
Pulse overshoot			10 %	
Pulse Delay		20 ns		
External input amplitude				

Parameter	Min.	Typ.	Max.	Note
Pulse polarity		Normal, inverse		selectable
<b>Internal pulse generator</b>				
Repetition frequency (PRF)	0.1 Hz		20 MHz	
Duty cycle	1 % to 99 % in 1% steps			within specified minimum pulse width
Minimum pulse width	30 ns			
Pulse Pattern Modulation & Staggered PRF				Using internal pattern generator
Pulse width	30 ns 300 ns		1 $\mu$ s 5 s	ALC hold ALC on
Programmable pattern length	2		65536	
Duty cycle	0.05 %		99.95 %	
Pulse width resolution		5 ns		
Polarity		selectable		
<b>Intra-Pulse Modulation (</b>	Polyphase, BPSK, QPSK, linear & non-linear FM chirps			<b>option IPM</b>
Chirp to pulse timing alignment		5 ns		
Chirp to pulse delay (adjustable)	0		2 $\mu$ s	
Timing steps		4 ns		
Chirp bandwidth	0		8 %	Of carrier frequency
Dwell time ( $t_{dwell}$ )	10 ns		10000 $\mu$ s	
Chirp Rate	1 kHz/ $\mu$ s		1 GHz / $\mu$ s	
Rate resolution		1 kHz		
Polyphase				Up to 64 phases, Barker, QPSK, BPSK
<b>Pulse to pulse frequency hopping</b>				Up to 1024 frequencies within 10% bandwidth
Repetition frequency (PRF)	0.1 Hz		1 MHz	
Bandwidth			10%	Of carrier frequency

## Trigger Output (TRIG OUT)

Output is TRIG OUT at rear panel has multiple operating modes.

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	
RF delay		10 ns		
<b>TRIGGER OUT</b> Synchronization mode for multiple sources				
Modes	Trigger on sweep start Trigger on each point Signal valid			
Trigger waveform pulse width	100 ns			

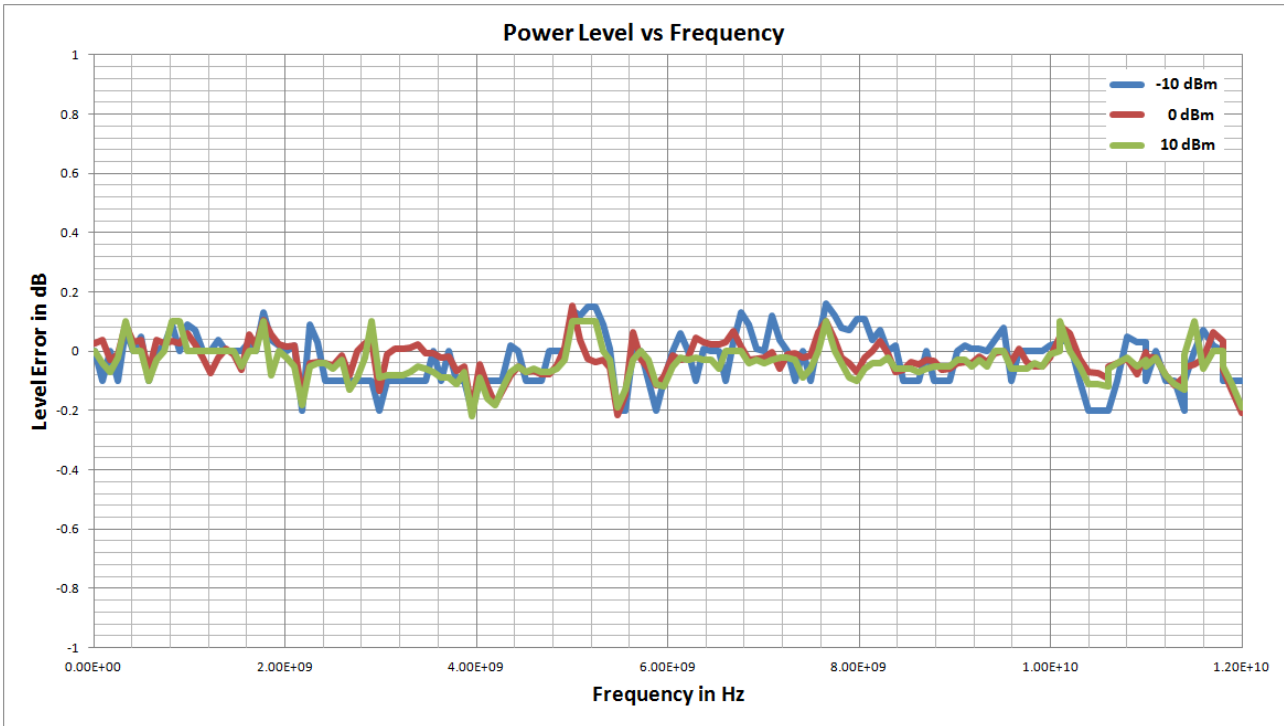
## Trigger (TRIG IN)

Input is TRIG IN at rear panel

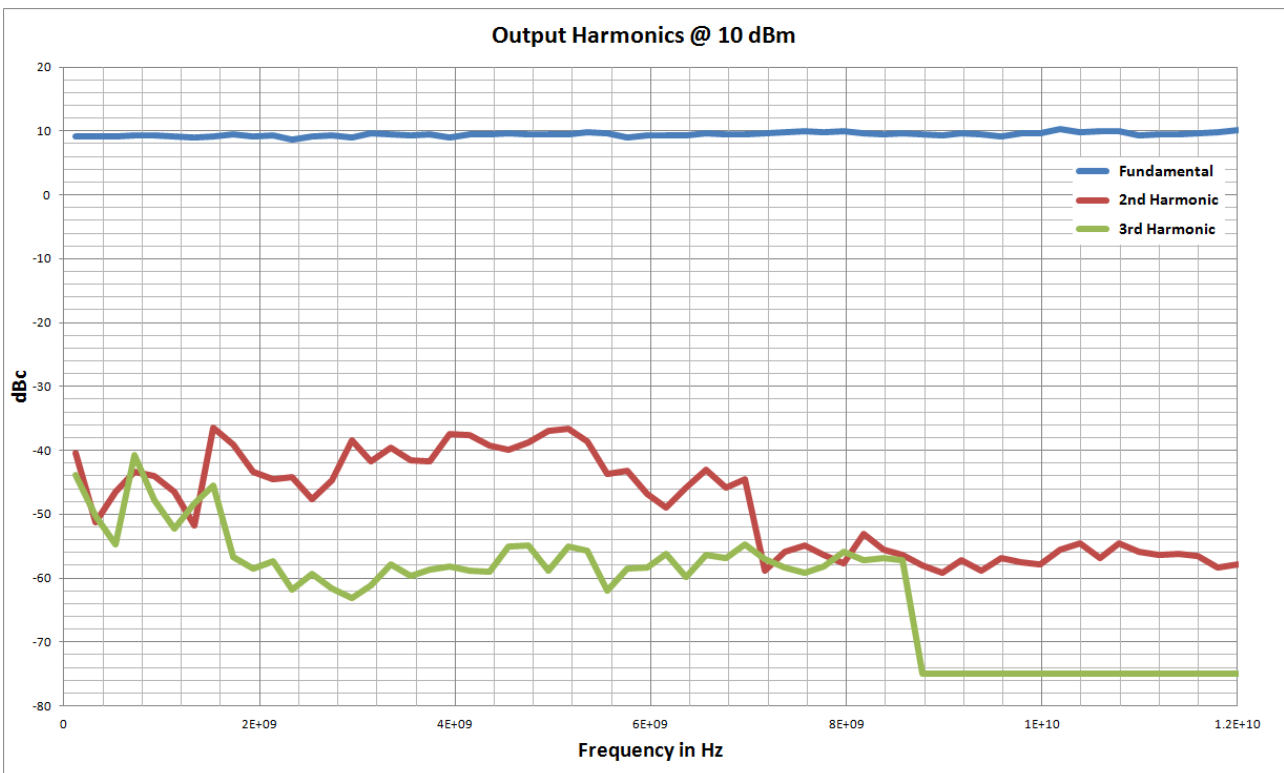
Parameter	Min.	Typ.	Max.	Note
Trigger Types	Continuous, single, gated, gated direction			
Trigger Source	external, bus (GPIB, LAN, USB)			
Trigger Modes	continuous free run, trigger and run, reset and run			
Trigger latency		5 ns		
Trigger uncertainty		10 ns		
External trigger delay	50 ns		10 s	programmable
External delay Resolution		10 ns		
Trigger Modulo	1		255	Execute only on Nth trigger event
Trigger Polarity	Rising, falling			

## Typical Performance

### Output Power Accuracy

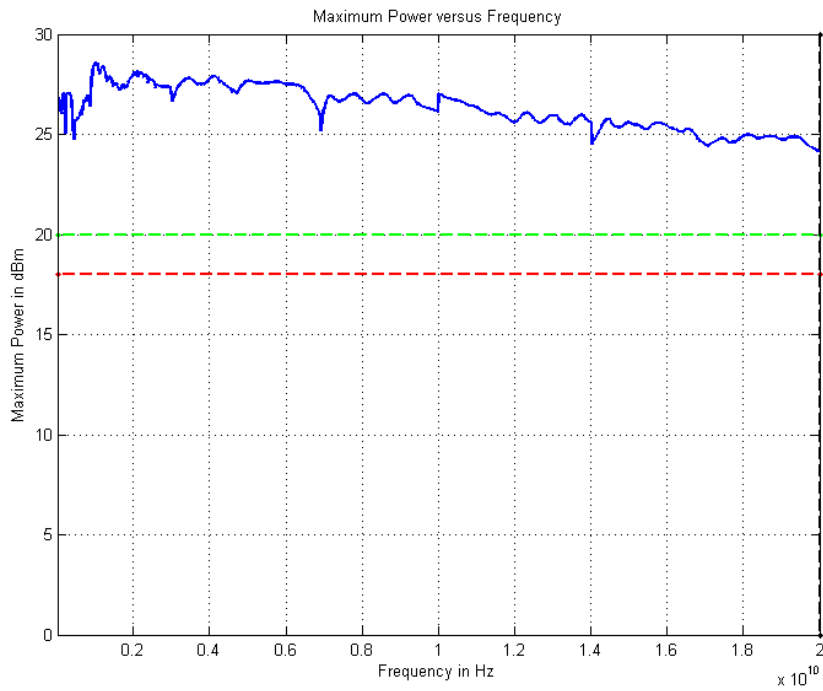


### Harmonic distortion

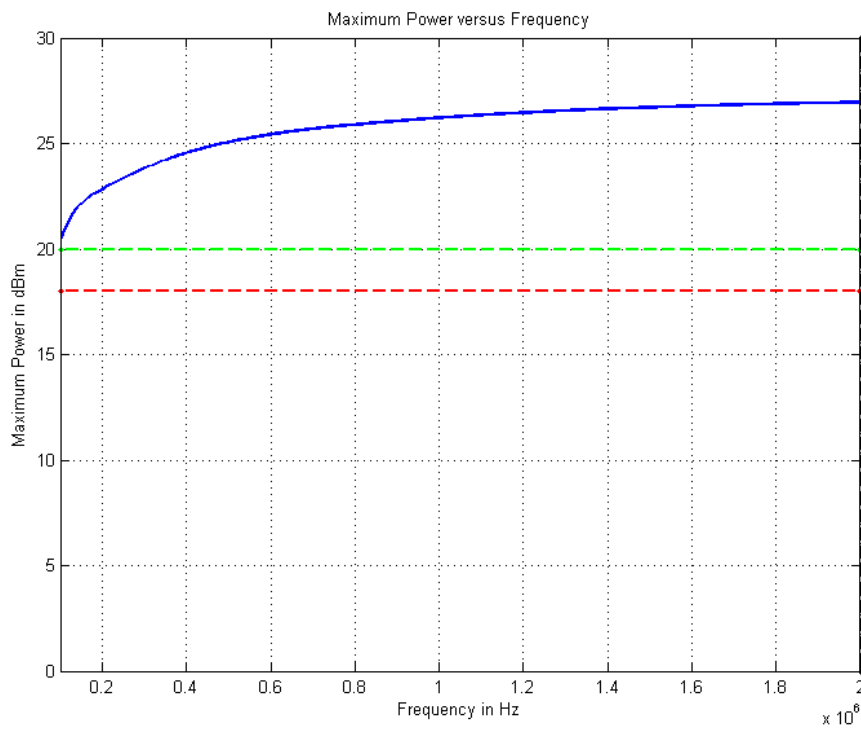




## Maximum Output Power



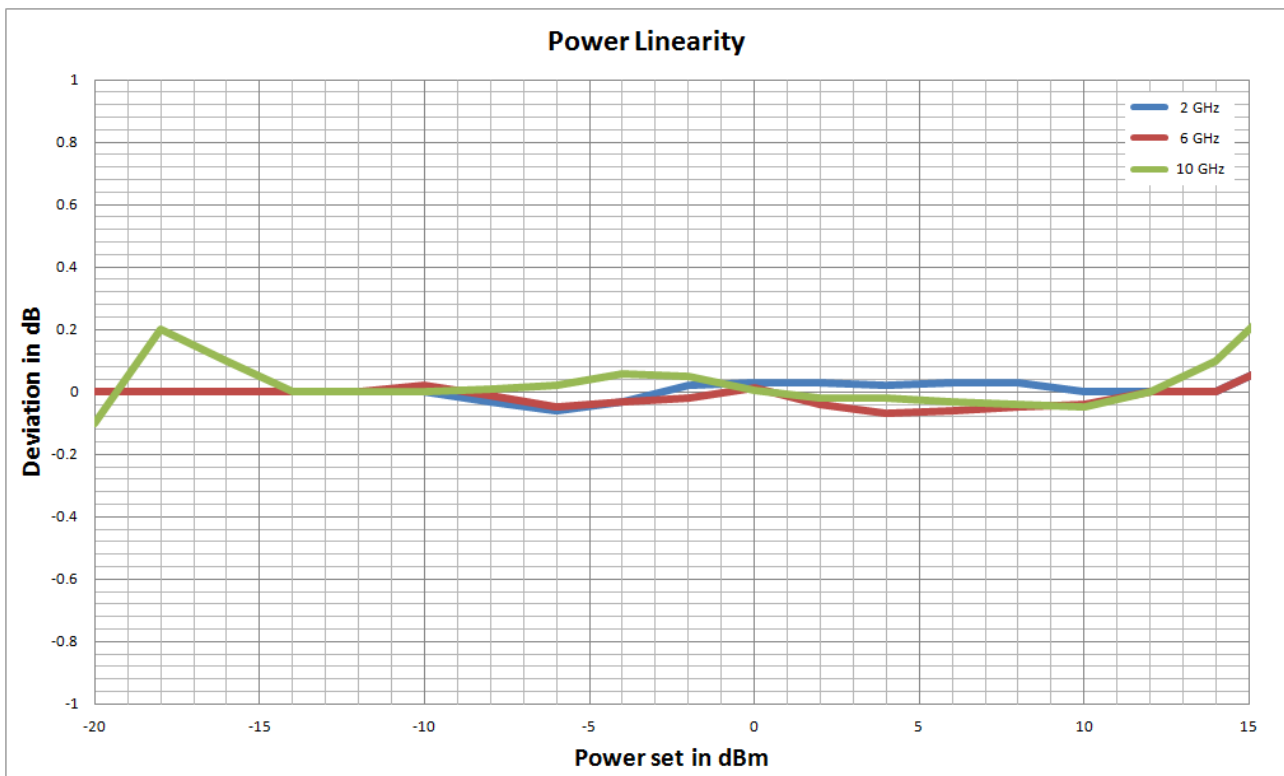
## Low frequency response



## SSB Phase Noise at 1 , 4, and 10 GHz



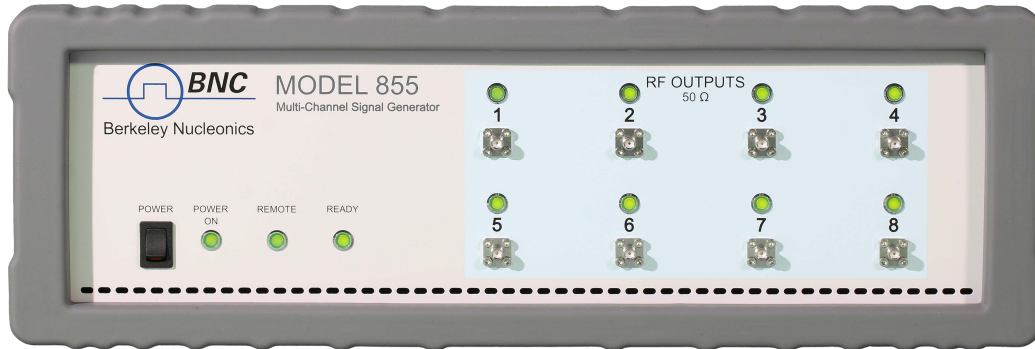
## Output Power Linearity



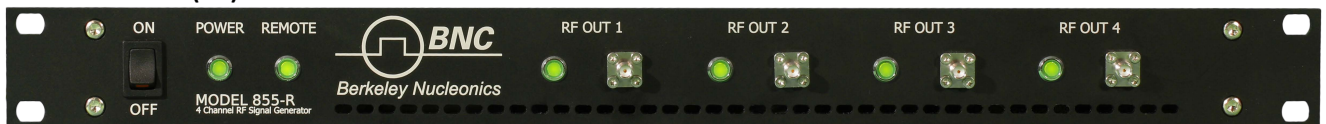
## Connectors

Front panel:

8 channel (3U)

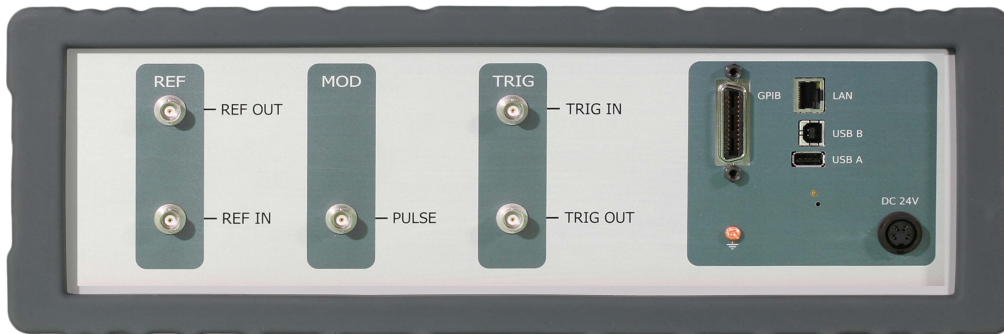


4 channel (1U)



1. RF outputs 1 to N: SMA female
2. DC power switch

Rear panel:



1. Trigger input: BNC female
2. Trigger output: BNC female
3. External reference input: BNC female
4. Internal reference output: BNC female
5. Pulse modulation: BNC female
6. LAN connection: RJ-45
7. USB 2.0 host and device
8. GPIB: IEEE-488.2, 1987 with listen and talk (optional)
9. DC Power plug (24V, 6A)

## Options

- **PE4**: electrical step attenuator
- **GPIB**: IEEE-488.2,1987 programming interface
- **PHC**: phase coherent switching

## General Characteristics

### Remote programming interfaces

Ethernet 100BaseT LAN interface,  
USB 2.0 , USBTMC  
GPIB (IEEE-488.2, 1987) with listen and talk (optional)

Control language SCPI Version 1999.0

**Power requirements** 100 or 240 VAC, 50 or 60 Hz

**Operating temperature range** 0 to 45 °C

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

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

### Dimensions:

19" 1HE enclosure : 43 mm H x 426 mm W x 460 mm L [1.7 in H x 16.8 in W x 18.1 in L]

19" 3HE enclosure incl. rubber: 154 mm H x 467.5 mm W x 342 mm L [6.1 in H x 18.4 in W x 13.5 in L]



notice

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

**Recommended calibration cycle** 24 months

**ISO compliant** Instrument is manufactured in an ISO-9001 registered facility under high quality standards.

### Document History