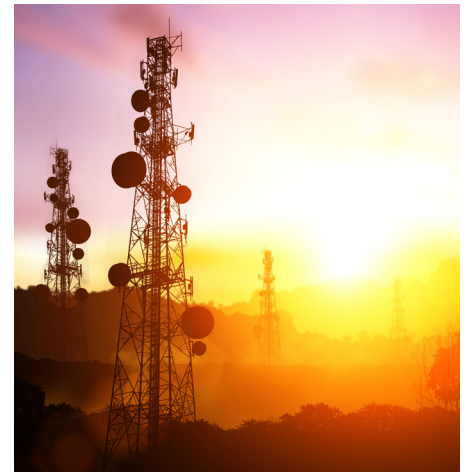


Model 865-M Wideband Synthesizer



Features

- Wideband Low phase noise
- Fast switching down to 20 μ s
- FM, Chirps, Pulse
- Internal OCXO, external variable reference
- Single DC supply

Applications

- ATE
- LO for frequency converters
- Telecom / SatCom



Model 865-M v.1.04

100 kHz to 40 GHz Wideband Synthesizer

Model 865-M RF / Microwave Synthesizer

Introduction

The Model 865-M is a wideband low phase-noise synthesizer operating from 100 kHz to 40 GHz. The settable output power range is from -5 to +20 dBm. The module has a milli-Hz frequency resolution that uses a high-stability internal reference. The internal reference can be phase-locked to a user-settable external reference. For highest phase coherence, multiple 865-M's can be cascaded with just one master reference clock.

The 865-M offers dedicated sweeping capabilities with switching speeds of only 500 μ s (20 μ s with option FS) and internal phase and narrow pulse modulation.

The module has a USB and LAN interface and can be controlled using SCPI 1999 command set. Operated with an external 24V DC supply, it consumes less than 25 watts.

Options

- **FS:** Ultra fast switching speed
- **LN:** Enhanced close in phase noise & stability
- **865-M-40-2:** 2 outputs (Rackmount Chassis)
- **865-M-40-4:** 4 outputs (Rackmount Chassis)



Signal Specifications

The specifications in the following pages describe the performance of the signal generator for 23 ± 5 °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
Frequency Range	100 kHz		40 GHz	Settable from 9 kHz to 43.5 GHz
Resolution		0.001 Hz		
Phase resolution		0.01 deg		
Switching Speed		1.5 ms		After SCPI command received Option FS
CW Mode		500 μ s		
Sweep / List Mode		500 μ s		
		20 μ s		
SSB Phase Noise at 1 GHz				(Also see plot)
at 1 kHz from carrier		-140 dBc/Hz		
at 100 kHz from carrier		-150 dBc/Hz		
Wideband noise		-160 dBc/Hz		
SSB Phase Noise at 10 GHz				
at 1 kHz from carrier		-120 dBc/Hz		
at 100 kHz from carrier		-130 dBc/Hz		
Wideband Noise		-160 dBc/Hz		
Output power Level				(Also see plot)
10 Mhz to 1.2 Ghz	0 dBm		+20 dBm	
1.2 Ghz to 20 Ghz	-5 dBm		+20 dBm	
20 to 30 Ghz	10 dBm		+18 dBm	
30 to 40 Ghz	0 dBm		+15 dBm	
Resolution		0.5 dB		
Reverse Power Protection				
DC Voltage		7 V		
RF power			20 dBm	
Output impedance		50 Ω		
VSWR		1.8		
Spectral purity				
Output harmonics		-15 dBc		
Sub-harmonics		-75 dBc	-45 dBc	< 20 GHz
		-50 dBc	-30 dBc	> 20 GHz
Non-harmonic spurious		-75 dBc	-60 dBc	

Parameter	Min.	Typ.	Max.	Note
Pulse Modulation				
Modulation source		Internal/ External		
Pulse rise/fall time		10 ns		
On/off ratio		40 dB		Pout > +10 dBm, see plot
Pulse overshoot			10 %	
Pulse delay		20 ns		
Pulse polarity		Normal, inverse		Selectable
External input amplitude	1V	2V TTL		AC coupled DC coupled
Internal Pulse Generator				
Repetition frequency (PRF)	0.1 Hz		100 MHz	= 1/T
Duty cycle	1 % to 99 % in 1 % steps			Within specified minimum pulse width
Pulse width settling range	30 ns		5 s	
Pulse Pattern Modulation & Staggered PRF				Using internal pattern generator
Programmable pattern length	2		65536	
Duty cycle	0.05 %		99.95 %	
Pulse period (T) accuracy		0.00005xT+3ns		
Pulse width accuracy		0.00005xT+ 5ns		
Pulse width resolution		5 ns		
Pulse jitter		2 ns	5 ns	
Polarity		selectable		
Frequency Modulation				
Modulation source		Internal		
Maximum Frequency deviation (peak)		N · 400 MHz		< 1.25 GHz (N=1) 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) 20 GHz to 40 GHz (N=2)
Deviation accuracy		0.50 %	2 %	
Distortion (THD)		< 1 %		1 kHz rate, 10 kHz deviation
Modulation rate	0.1 Hz		80 kHz	
Modulation waveforms	Sine			
Phase Modulation				
Modulation source		Internal		
Phase deviation (peak)	0		300 · N· rad	
Deviation accuracy		0.50 %	2 %	
Modulation rate	0.1 Hz		80 kHz	

Parameter	Min.	Typ.	Max.	Note
Modulation waveforms		Sine		
Distortion (THD)		<1%		1 kHz rate & N x rad deviation

Sweeping Capability

Parameter	Min.	Typ.	Max.	Note
Frequency Sweep				
Sweep type: linear, logarithmic, random				
Step time (t_{step})	500 μ s 20 μ s			Option FS
Dwell time (t_{dwell})	15 μ s			

Frequency Reference

Parameter	Min.	Typ.	Max.	Note
Internal Reference Frequency		100 MHz 10 MHz		Option LN
Internal reference output frequency				
Temperature stability			\pm 100 ppb	0 to 50 °C
Aging 1st year			1 ppm 0.3 ppm	Option LN
Aging per day			5 ppb 0.5 ppb	After 30 days of operation Option LN
Warm-up time		5 min		
Output internal reference		10 MHz 10/100 MHz		Option LN
Output power	0 dBm	5 dBm		
Output impedance		50 Ω		
Bypass internal reference input		100 MHz		High phase synchronous mode
Phase lock to external reference	1 MHz	10 MHz integer MHz	250 MHz	Option VREF
Reference Bypass mode		100 MHz		
Reference input level				
10 MHz or 1-250 MHz	-5 dBm	0 dBm	+13 dBm	
Bypass 100 MHz	5 dBm		+15 dBm	
Reference input impedance		50 Ω		
Lock Range				
10 MHz or 1-250 MHz			\pm 1.5 ppm	
Bypass 100 MHz			> 100 ppm	

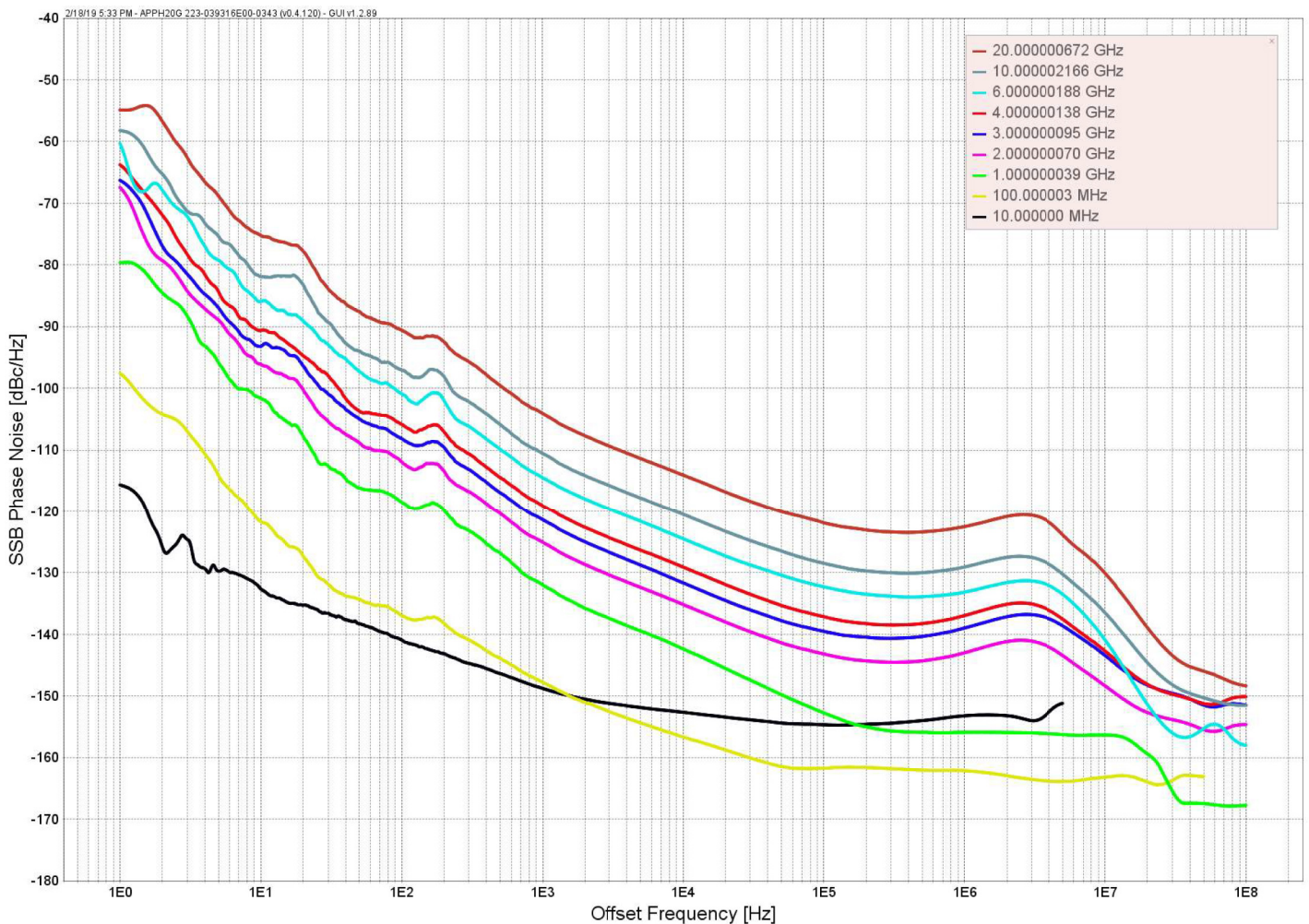
Trigger (TRIG IN)

Input is TRIG IN at front panel

Parameter	Min.	Typ.	Max.	Note
Trigger Types	continuous, single (point), gated, gated direction			
Trigger Source	external, bus (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		40 s	
External Delay Resolution		5 ns		
Trigger Modulo	1		255	Execute only on Nth trigger event
Trigger Polarity	Rising, falling			

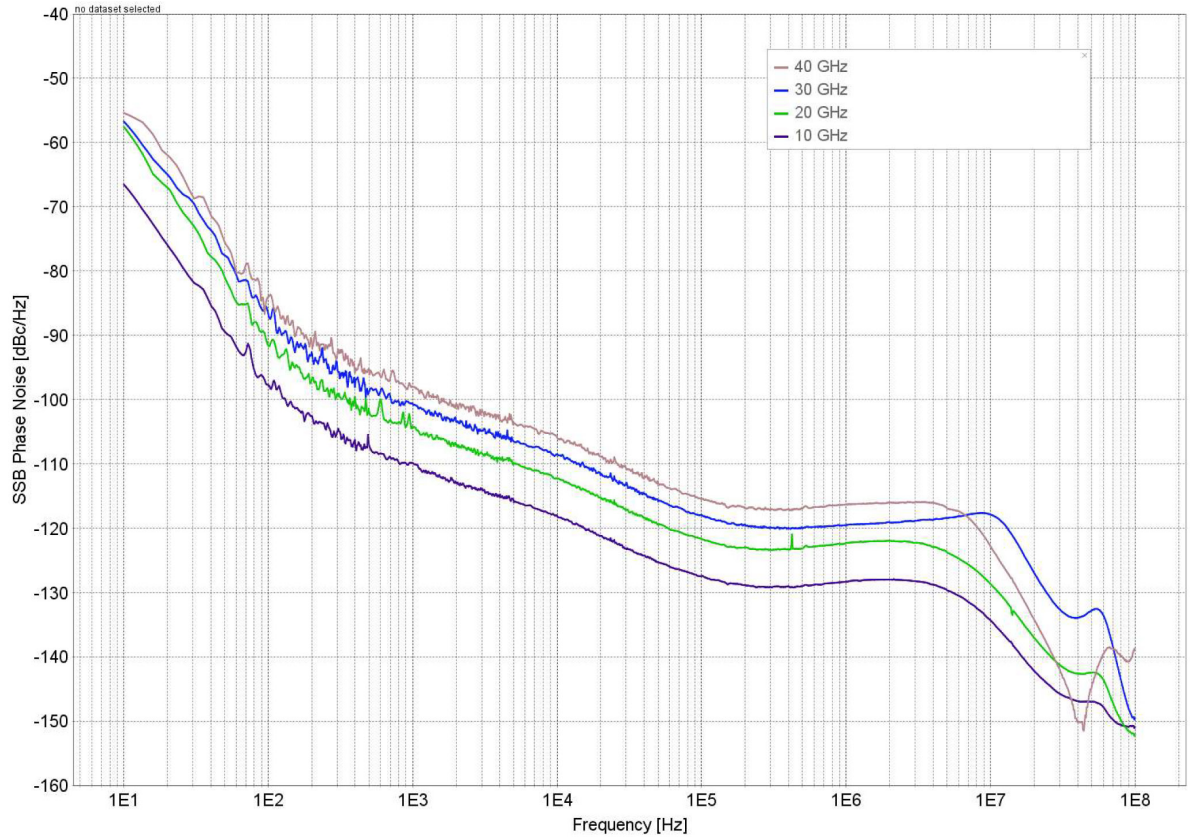
Typical Performance Curves

Phase Noise Performance with option LN



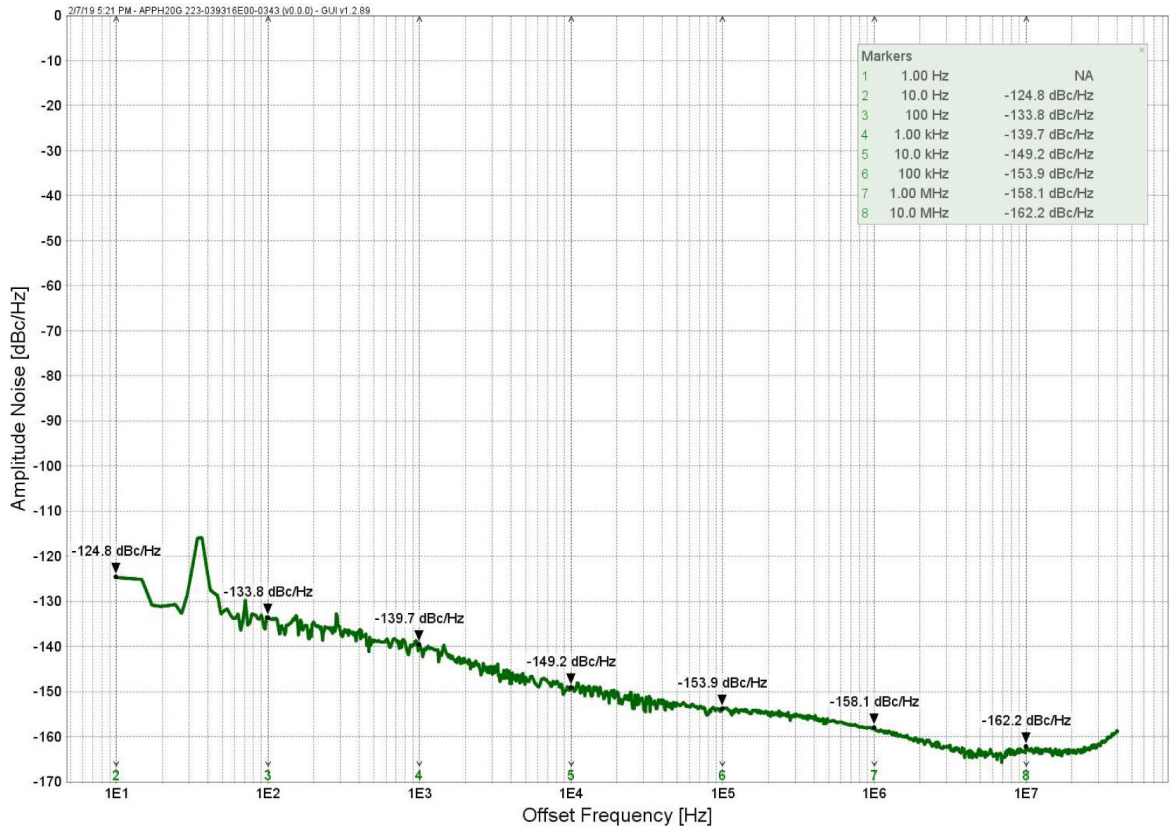
Model 865-M RF / Microwave Synthesizer

Noise Performance without option LN (10, 20, 30, 40 GHz)

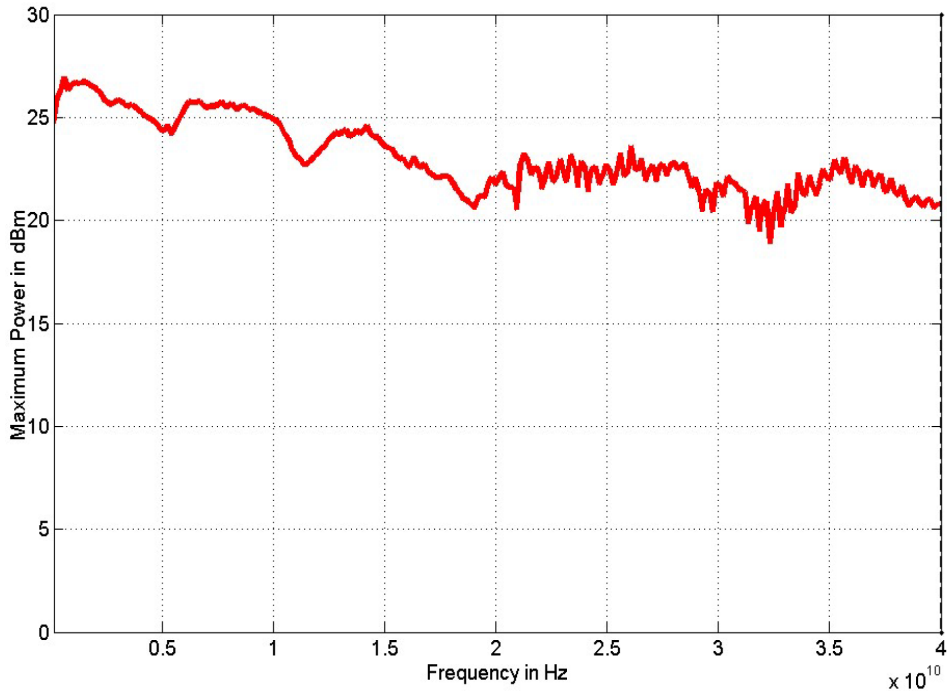


Model 865-M RF / Microwave Synthesizer

Amplitude Noise at 10 GHz

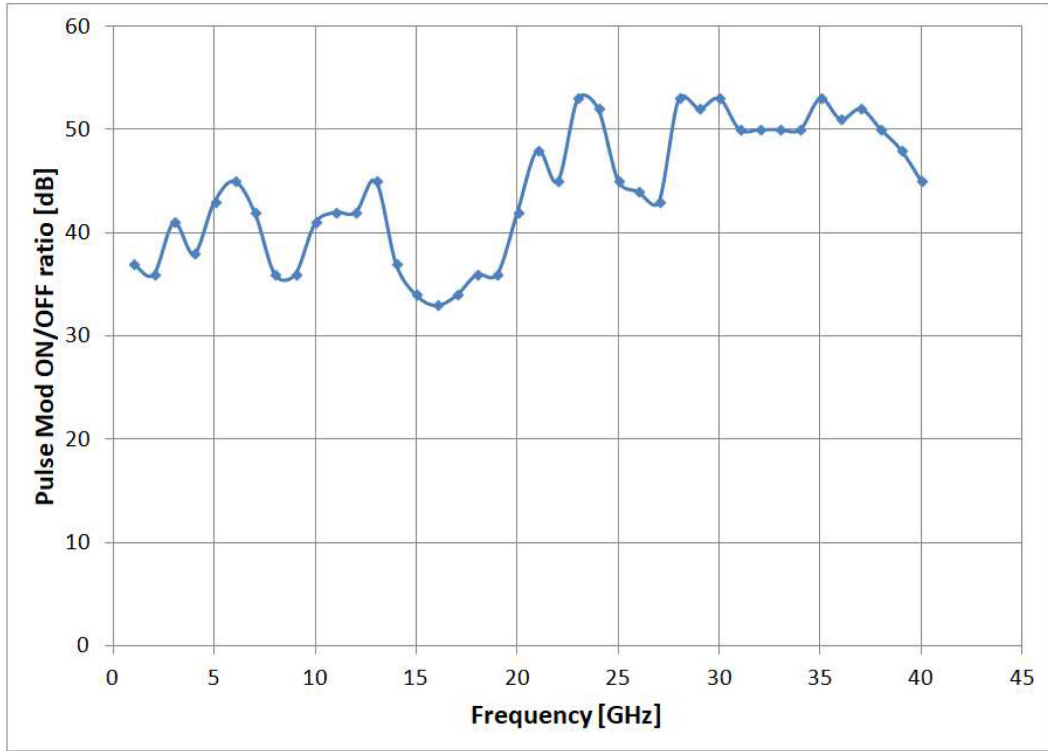


Maximum Output Power



Model 865-M RF / Microwave Synthesizer

Pulse modulation on-off ratio



Front Panel



Back Panel



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: 24 V \pm 3.0 VDC; 25 W maximum

Mains adapter supplied: 100-240 VAC in/ 24 V 4.0 A DC out

Environmental (Levels similar to MIL-PRF-28800F Class 3/4)

Environmental stress samples of this product have been type tested to be robust against the environmental stresses of storage, transportation, and end-use; those stresses to temperature, humidity, shock, vibration, altitude, and power line conditions.

Operating temperature range: 0 to 45 °C

Storage temperature range: -40 to 70 °C

Operating and storage altitude: up to 15,000 feet



notice

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

Weight: \leq 1.0 kg (2.2 lbs) net

Dimensions: 27 x 10.5 x 6 cm [10.63 x 4.13 x 2.366 in]

Options

- **FS:** Ultra fast switching speed
- **LN:** Enhanced close in phase noise
- **865-M-40-2:** 2 outputs (Rackmount Chassis)
- **865-M-40-4:** 4 outputs (Rackmount Chassis)

*Specifications subject to change