

# Model 845-M-X Dual Output Low Noise Synthesizer



## Features

- Low Phase Noise
- Fast switching down to 20  $\mu$ s
- FM, Chirps, Pulse
- Internal OCXO, 1 MHz to 250MHz variable External Reference

## Applications

- Automated Test Environments
- LO for frequency converters
- Telecom / SatCom



**Model 845-M-X v1.50**  
0.01 to 20 GHz Dual Output Low Noise Synthesizer

## DEFINITIONS

- The specifications in the following pages describe the warranted performance of the instrument for  $23 \pm 5 \text{ }^\circ\text{C}$  after a 30-minute warm-up period (unless otherwise stated).

**Min/Max:** Parameter range that is guaranteed by product design, and/or production tested. Warranted performance specifications include guard-bands to account for the expected statistical performance distribution, measurement uncertainties, and changes in performance due to environmental conditions.

**Typical:** Expected mean values, not warranted performance.

## INTRODUCTION

### • 0.01 to 20 GHz Dual-Output Phase-Synchronous Low Phase Noise Synthesizer

The MODEL 845-M-X is a dual-output wideband low phase-noise synthesizer operating from 0.01 to 20 GHz. The nominal output power is +23 dBm per output.

The RF outputs can be independently programmed with a mHz frequency resolution. The two independent synthesizers are operated from a single internal reference to maximize the phase coherence between the two outputs.

The internal reference can be phase-locked to a user-settable external reference in the range from 1 to 250 MHz.

The offers dedicated sweeping capability and wideband frequency and phase modulation as well as narrow pulse modulation.

The module has a USB and LAN interface and can be controlled using SCPI 1999 command set. Operated with an AC supply, it consumes less than 20 W.

## FACTS & FIGURES & SPECIFICATIONS

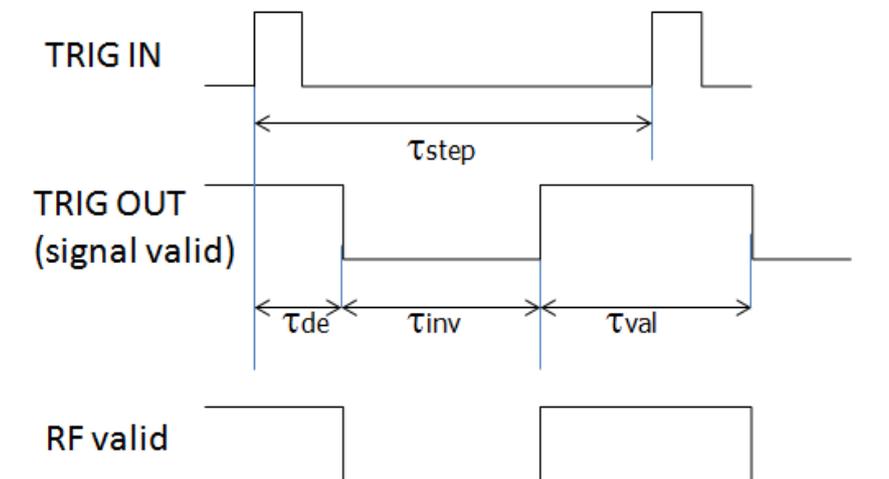
PARAMETER	MIN	TYPICAL	MAX	NOTE
<b>Frequency range</b>	0.01 GHz		20 GHz	
<b>Frequency resolution</b>		0.001 Hz		
<b>Phase resolution</b>		0.1 deg		
<b>Settling time</b>		20 $\mu$ s	100 $\mu$ s	
Frequency update rate		200 $\mu$ s		time from receipt of SCPI command
List / Sweep mode		130 $\mu$ s		
<b>SSB Phase noise at 10 GHz</b>				
at 1 kHz from carrier		-98 dBc/Hz		
at 20 kHz from carrier		-108 dBc/Hz		
Wideband noise		-150 dBc/ Hz		
<b>Output power level</b>		+23 dBm		(see also plot)
<b>Reverse power protection</b>				
DC voltage		7 V		
RF power			20 dBm	
<b>Output impedance</b>		50 $\Omega$		
VSWR		1.8		
<b>Spectral purity</b>				
Harmonics		-15 dBc		
Sub-harmonics		-75 dBc	-60 dBc	
<b>Non-harmonic spurious</b>		-50 dBc		



## Sweeping Capability

Sweep type: Power / frequency / list; linear / logarithmic / random

PARAMETER	MIN	TYPICAL	MAX	NOTE
Step time ( $\tau_{step}$ )	150 $\mu$ s 25 $\mu$ s			only one channel  Option FS: per channel, if 2 channels are swept synchronously, minimum step time is N times 25 $\mu$ s
Dwell time ( $\tau_{val}$ )	25 $\mu$ s		9999 s	
Off-time (incl. transient time) ( $t_{off}$ )	0		9999 s	
Transient time ( $\tau_{inv}$ )			15 $\mu$ s	
Timing delay ( $\tau_{de}$ )		50 ns		
Time resolution		5 ns		
Timing accuracy per point		5 ns		



## Frequency Reference

PARAMETER	MIN	TYPICAL	MAX	NOTE
Reference frequency input Phase coherent mode	1 MHz	100 MHz	250 MHz	
Reference input level	-5 dBm	0 dBm	+13 dBm	
Lock range			±1.0 ppm	
Reference input impedance		50 Ohms		
Internal reference output frequency		10/100 MHz		
Output power		>0 dBm 50 Ohms		
Temperature stability (0 to 50 °C)			±100 ppb	
Aging 1st year		0.5 ppm		
Aging per day (after 30 days operation)			5 ppb	
Warm-up time		5 min		

## Modulation Capability

PARAMETER	MIN	TYPICAL	MAX	NOTE
Frequency modulation (internal) Maximum frequency deviation (peak)		N · 500 MHz		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)
Modulation rate	DC		800 kHz	> -3dB frequency response
Total harmonic distortion		< 1%		1 kHz rate & 2 N · 1 MHz deviation
Phase modulation (internal) Phase deviation (peak)	0		N · 100 rad	
Modulation rate	DC		800 kHz	> -3dB frequency response
Total harmonic distortion		< 1%		1 kHz rate & 2 N x 100 rad deviation
Pulse modulation (int & ext) On/off ratio		Frequency dependant		
Repetition frequency	DC		10 MHz	
Pulse width	30 ns			ALC hold
Pulse rise/fall time		7 ns		
Pulse trains length (pulses)	2		4192	
Pulse width	30 ns		100 ms	(internal generator)
Pulse resolution		15 ns		(internal generator)
Polarity		selectable		

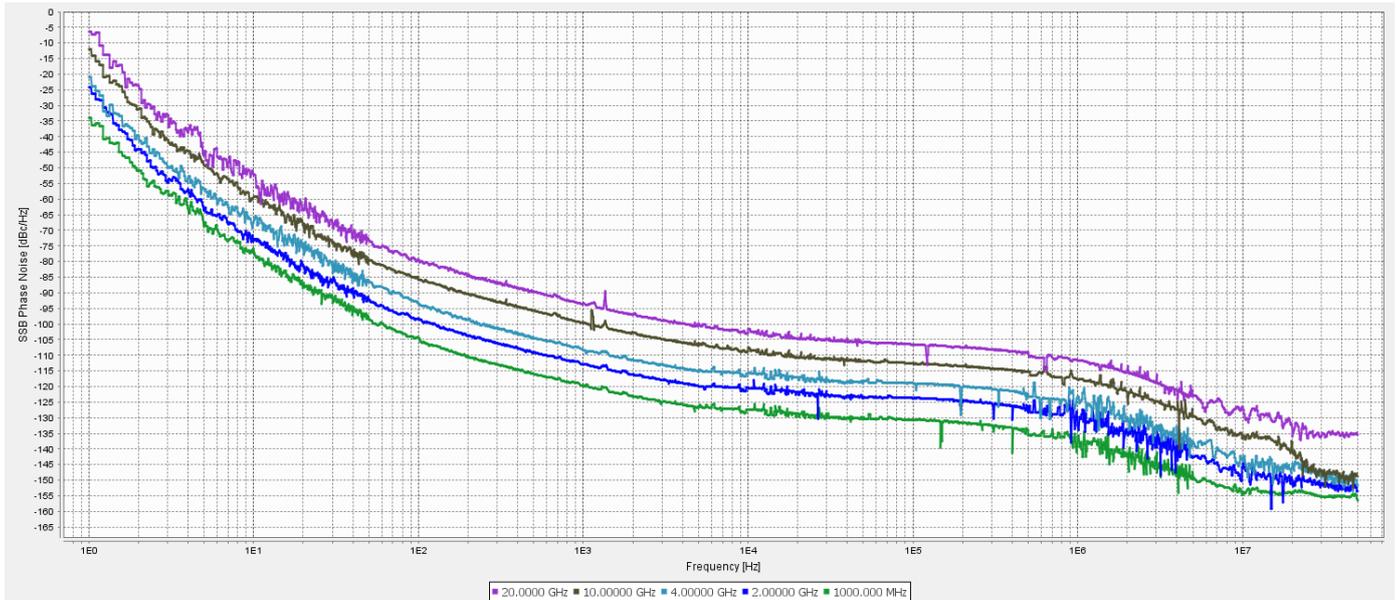
<b>External input threshold</b>	0.85 V	0.9 V	0.95 V	TTL compatible
<b>External input voltage range</b>	-0.5 V		+5.5 V	TTL compatible
<b>External input hysteresis</b>		60 mV		

## Trigger

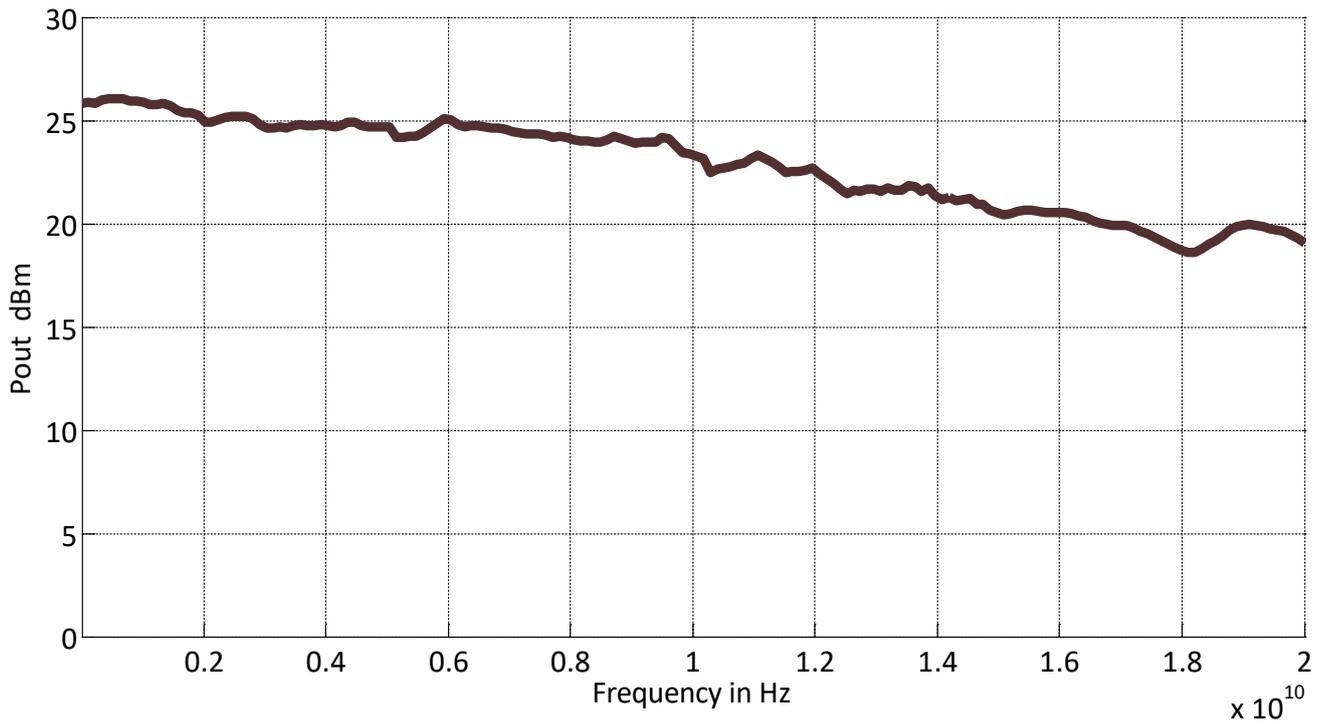
PARAMETER	MIN	TYPICAL	MAX	NOTE
<b>Trigger types</b>	Continuous, single (point), gated, gated direction			
<b>Trigger source</b>	external, bus (LAN, USB)			
<b>Trigger modes</b>	Continuous free run, trigger and run, reset and run			
<b>Trigger latency</b>		tbd		
<b>Trigger uncertainty</b>		5 $\mu$ s		
<b>External trigger delay</b>	50 $\mu$ s		40 s	
<b>External delay resolution</b>		15 ns		
<b>Trigger modulo</b>	1		255	Execute only on $n^{\text{th}}$ trigger event
<b>Trigger polarity</b>	Rising or Falling Edge			
<b>External trigger input threshold</b>	0.85 V	0.9 V	0.95 V	TTL compatible
<b>External trigger input range</b>	-0.5 V		+5.5 V	TTL compatible
<b>External trigger input hysteresis</b>		60 mV		

# TYPICAL PERFORMANCE CURVES

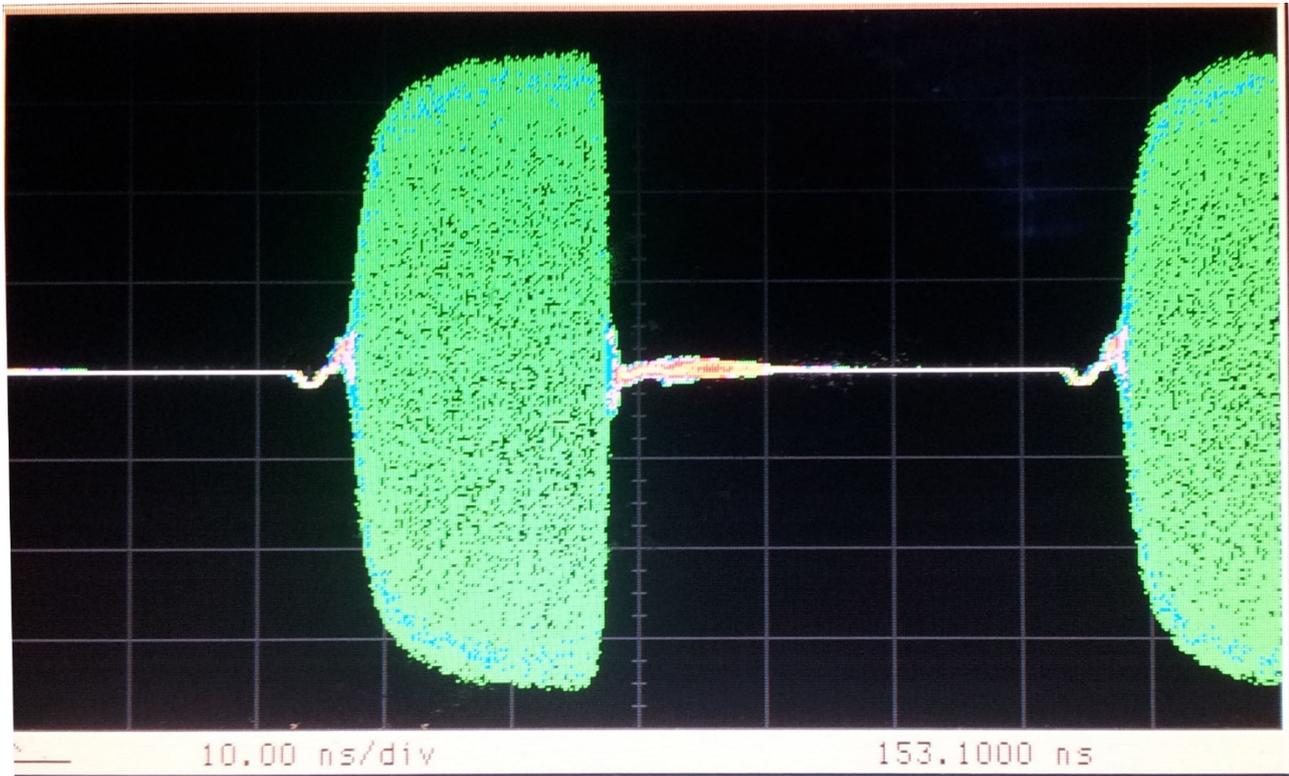
## Phase Noise Performance



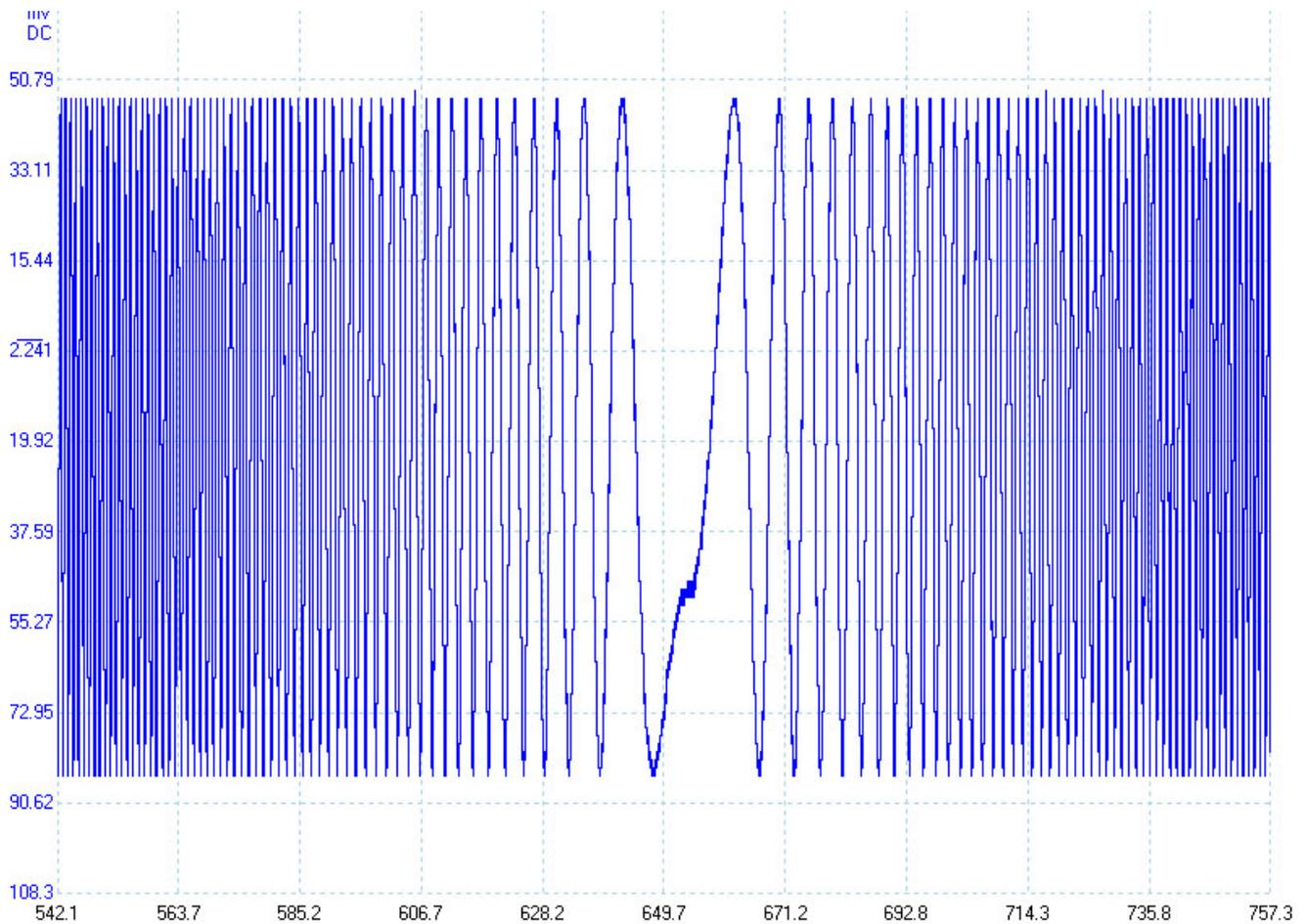
## Output Power 0.01 to 20 GHz



## Pulse Modulation (20 ns width, 100 ns period)



## Chirp (phase continuous, 1 GHz bandwidth)



# CONNECTORS

## Front panel:



## Rear panel:



# ORDERING INFORMATION



PRODUCT	DESCRIPTION
<b>MODEL 845-M-X</b>	2 channel 20 GHz Synthesizer, 19" 1U Rackmount Chassis
<b>Option FS</b>	Ultra-fast Switching Speed
<b>Option GPIB</b>	GPIB Interface

# GENERAL CHARACTERISTICS

**Remote programming interfaces:**

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

**Power requirements:** 100-240 V<sub>AC</sub> / 50 – 60 Hz

**Operating Temperature Range:** 32 to 104 F (0 to 40 °C)

**Storage Temperature Range:** -40 to 158 F (-40 to 70 °C)

**Operating and Storage Altitude:** up to 15,000 feet

**Weight (Net):** 17 lbs [8 kg]

**Dimensions (H x W x L):** 1.69 in H x 16.93 in W x 18.11 in L [43 x 430 x 460 mm]



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