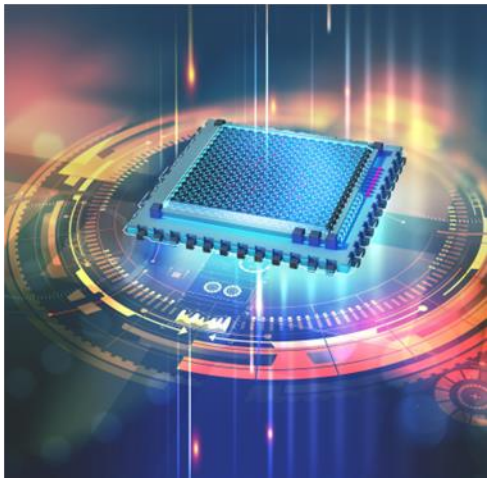
Model 805-M Ultra-Agile Frequency Synthesizer



Features

- Small size flange-mount module
- CW and pulse modulation
- Low phase noise
- Multi-channel configurable / cascadable: Master-slave connection through 1 GHz reference loop-through
- Phase coherent

Applications

- System clock source
- Beamforming, MIMO receiver R&D
- Electronic Warfare
- Multi-channel phase-coherent configurations for radar signal generation and testing
- Spectroscopy

Model 805-M 100

100 kHz to 22 GHz Ultra-Agile Frequency Synthesizer

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DEFINITIONS

The specifications in the following pages describe the warranted performance of the instrument for 23 ±5 °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

The Model 805-M is a compact-size frequency synthesizer for the generation of accurate and stable frequency signal in both CW and pulse form, covering a frequency range of 100 kHz to 22 GHz, with a fast-switching time of 5 us, the output power of -40 to 25 dBm depending on the frequency. The phase noise at 1 GHz and 20 kHz offset is -132 dBc/Hz, and the subharmonics and spurious lower than -55 dBc. The frequency setting resolution is 10 mHz and for the power 0.5 dB.

The synthesizer is excellently shielded and in a very compact flange-mountable form of 134 x 95 x 25 mm, weighs lighter than 0.5 kg, and consumes barely 17 W and therefore passively cooled. It features ETHERNET communication port for local and remote connection to a PC for control over GUI software or SCPI commands.

The module features external reference support of 100 MHz and 1 GHz. Multiple units can be connected, with one unit acting as the master and the others as slaves, to implement multi-channel PHASE-COHERENT sources. The Master reference frequency of 1 GHz is generated once in the master unit and looped through all the slave units. The phase coherence reached is about +/- 0.5 degree over 10 hours when all the channels are set to 5 GHz.

The product is suitable for many applications: as system clock source, in the multi-channel phase-coherent configurations for radar, beamforming, quantum computing, etc. The feature combination of phase coherence and fast switching allows also for applications in Electronic Warfare field.

SPECIFICATIONS

Signal Specifications

PARAMETER	MIN	TYPICAL	MAX	NOTE
Frequency Range	100 kHz		22 GHz	
Resolution		0.01 Hz		GUI SW setting resolution
Phase resolution		0.1 deg		0 to 360 deg
Switching speed in sweep mode		500 µs 5 µs	 10 µs	 Option FS

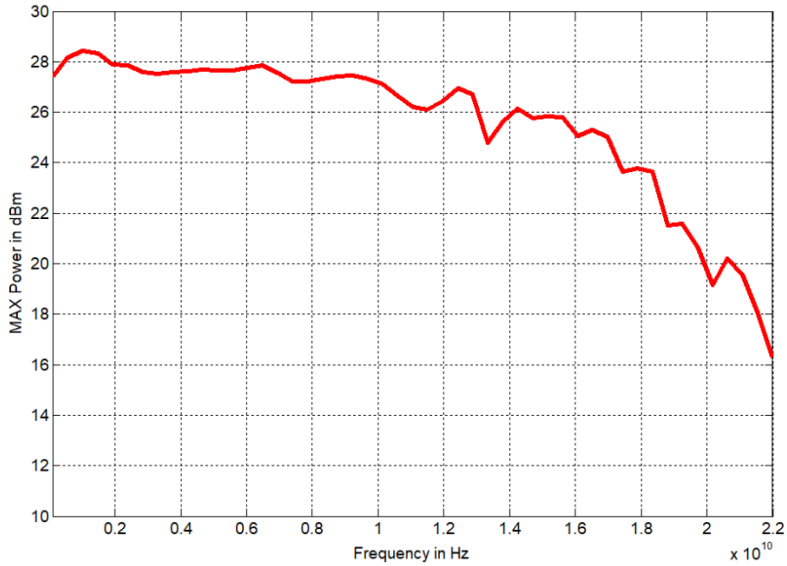
Frequency Reference

PARAMETER	MIN	TYPICAL	MAX	NOTE
Reference frequency input	100 MHz, 1 GHz			
Reference input level 100 MHz 1 GHz	 -3 dBm -5 dBm		 +10 dBm +10 dBm	
Reference input impedance		50 Ω		
Reference frequency output				
Power	2 dBm		8 dBm	1 GHz
Calibrated accuracy of int. reference		±30 ppb		calibrated at 23 ± 3 °C
Temperature stability (0 to 50 °C)			±100 ppb	
Aging 1st year		0.5 ppm		
Aging per day			5 ppb	After 30 days operation
Warm-up time		5 min		
Reference output impedance		50 Ω		

Level Performance

PARAMETER	MIN	TYPICAL	MAX	NOTE
Output Power Level				See plot below
Range 0.1 – 1 GHz 1 – 10 GHz 10 – 18 GHz 18 – 20 GHz > 20 GHz	 -20 dBm -30 dBm -20 dBm -30 dBm -30 dBm		 +25 dBm +26 dBm +23 dBm +21 dBm +16 dBm	
Resolution		0.5 dB		

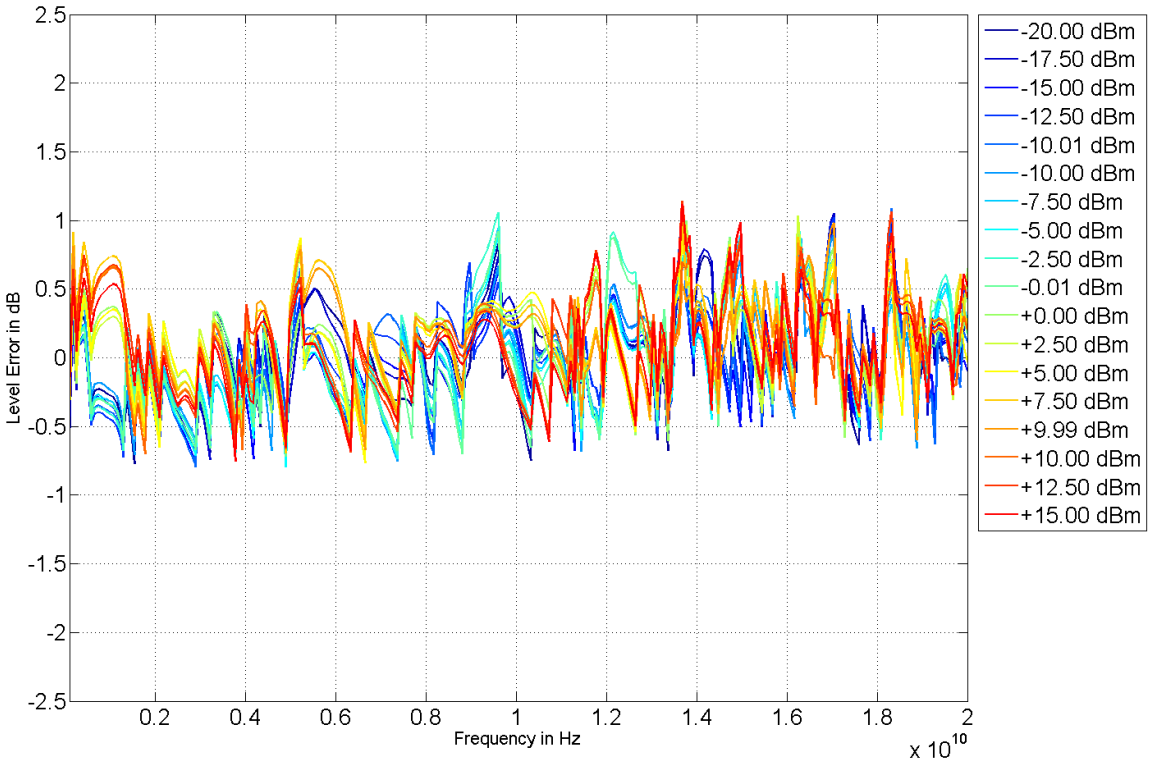
Figure 1: Typical Maximum Output Power



Level Uncertainty

PARAMETER	MIN	TYPICAL	MAX	NOTE
Power Level uncertainty				
0.1 GHz to 20 GHz		±1.5 dB	±2 dB	-20 dBm to +20 dBm
< 0.1 GHz or > 20 GHz		±1.5 dB		

Figure 2: Frequency Response



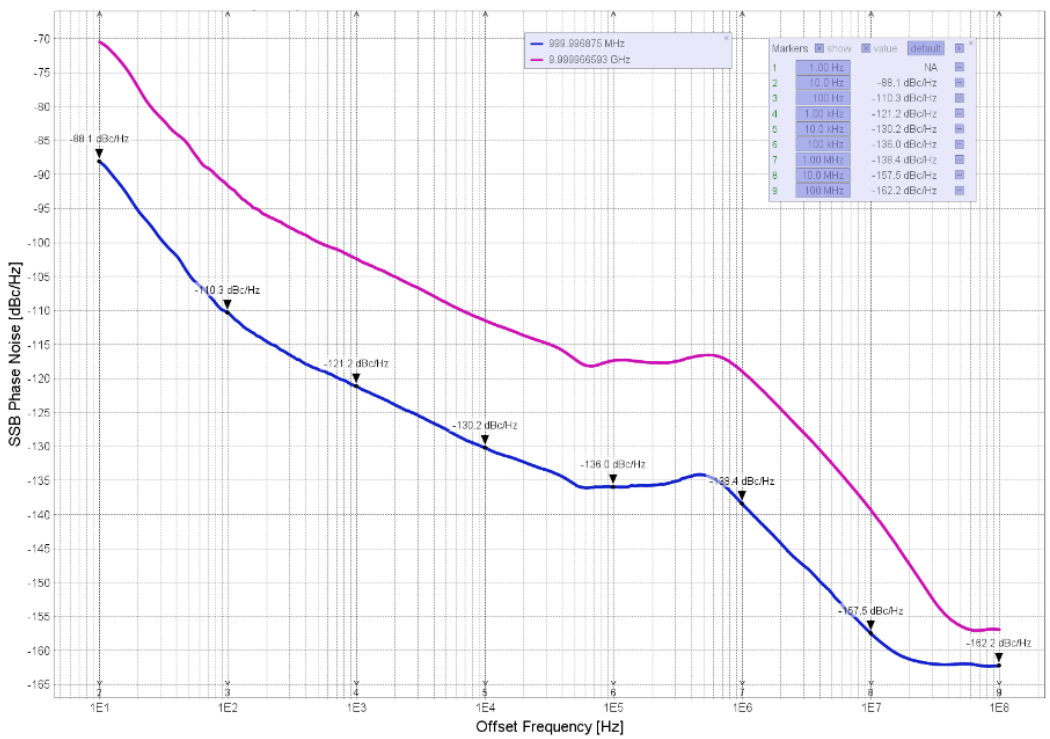
Reverse Power Protection and VSWR

PARAMETER	MIN	TYPICAL	MAX	NOTE
Output impedance VSWR		50 Ω 1.7		
Reverse power protection				
DC voltage			7 V	
RF power			23 dBm	

Phase Noise

PARAMETER	MIN	TYPICAL	MAX	NOTE
SSB Phase noise at 1 GHz				See also plots
at 10 Hz from carrier		-83 dBc/Hz	-78 dBc/Hz	
at 1 kHz from carrier		-120 dBc/Hz	-115 dBc/Hz	
at 20 kHz from carrier		-131 dBc/Hz	-126 dBc/Hz	
at 10 MHz from carrier		-154 dBc/Hz	-149 dBc/Hz	
SSB Phase noise at 10 GHz				
at 10 Hz from carrier		-70 dBc/Hz	-65 dBc/Hz	
at 1 kHz from carrier		-102 dBc/Hz	-98 dBc/Hz	
at 20 kHz from carrier		-112 dBc/Hz	-107 dBc/Hz	
at 10 MHz from carrier		-140 dBc/Hz	-135 dBc/Hz	

Figure 3: SSB Phase Noise Performance



Spectral Purity

PARAMETER	MIN	TYPICAL	MAX	NOTE
Output harmonics < 4.0 GHz		 -15 dBc	 -5 dBc	P_{out} = 10 dBm

4.0 – 14 GHz > 14.0 GHz		-27 dBc -60 dBc	-20 dBc -40 dBc	
Sub-harmonics < 11.0 GHz 11.0 – 20.0 GHz > 20.0 GHz		 -80 dBc -70 dBc -65 dBc	 -70 dBc -60 dBc	P_{out} = 10 dBm
Non-harmonic spurious		-65 dBc	-55 dBc	> 10 kHz offset

Figure 4: Harmonics at 10 dBm Output

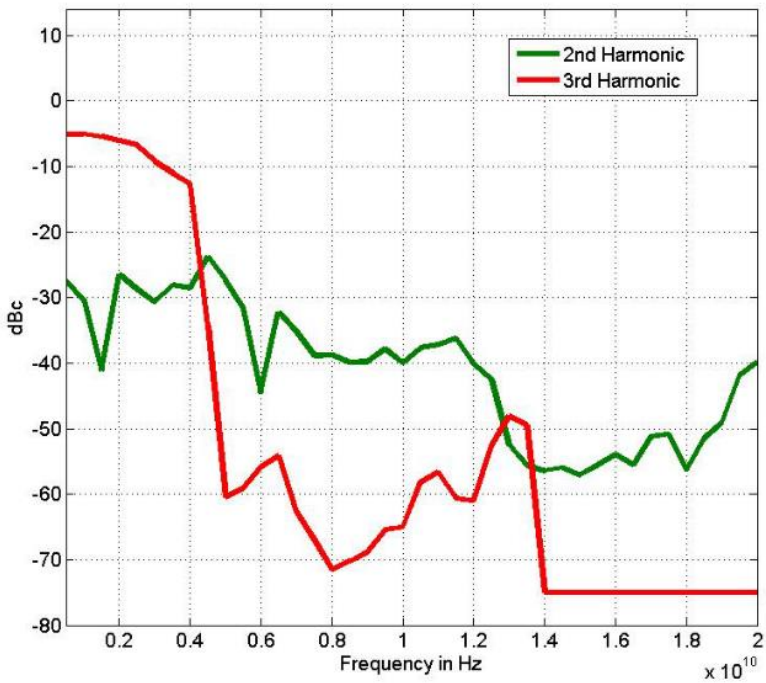
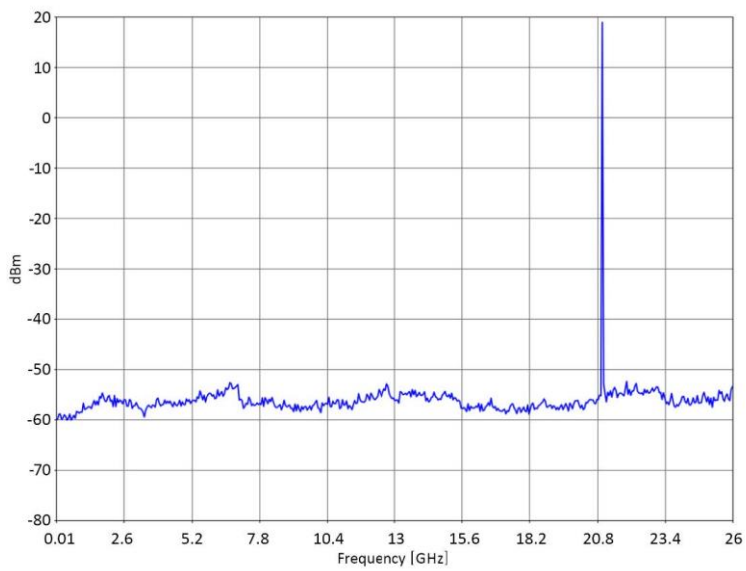


Figure 5: Wideband Spectrum at 21 GHz output



Modulation Capability

PARAMETER	MIN	TYPICAL	MAX	NOTE
Pulse modulation				

Modulation source	Internal External			Trigger port can be reconfigured as external modulation port
On/off ratio < 1 GHz 1 GHz to 10 GHz 10 GHz to 19 GHz > 19 GHz	 75 dB 60 dB 55 dB 50 dB	 85 dB 70 dB 65 dB 60 dB		At 10 dBm
Repetition frequency	DC		10 MHz	
Pulse width	30 ns		20 s	
Pulse rise/fall time		9 ns		
Pulse train length (pulses)	1		4096	
External input voltage range	-0.5 V		+5.5 V	TTL compatible
External input hysteresis		60 mV		
Delay (to RF)		20 ns	40 ns	

Sweeping Capability

PARAMETER	MIN	TYPICAL	MAX	NOTE
Sweep parameters	Frequency, power, list			
Sweep type	Linear, logarithmic, random			
Step time	500 µs 5 µs		20 s 20 s	 Option FS
Timing resolution		10 ns		
Timing accuracy per point		20 ns		
Generalized list sweep Allows for individual setting of frequency, power, step-time, for each point				

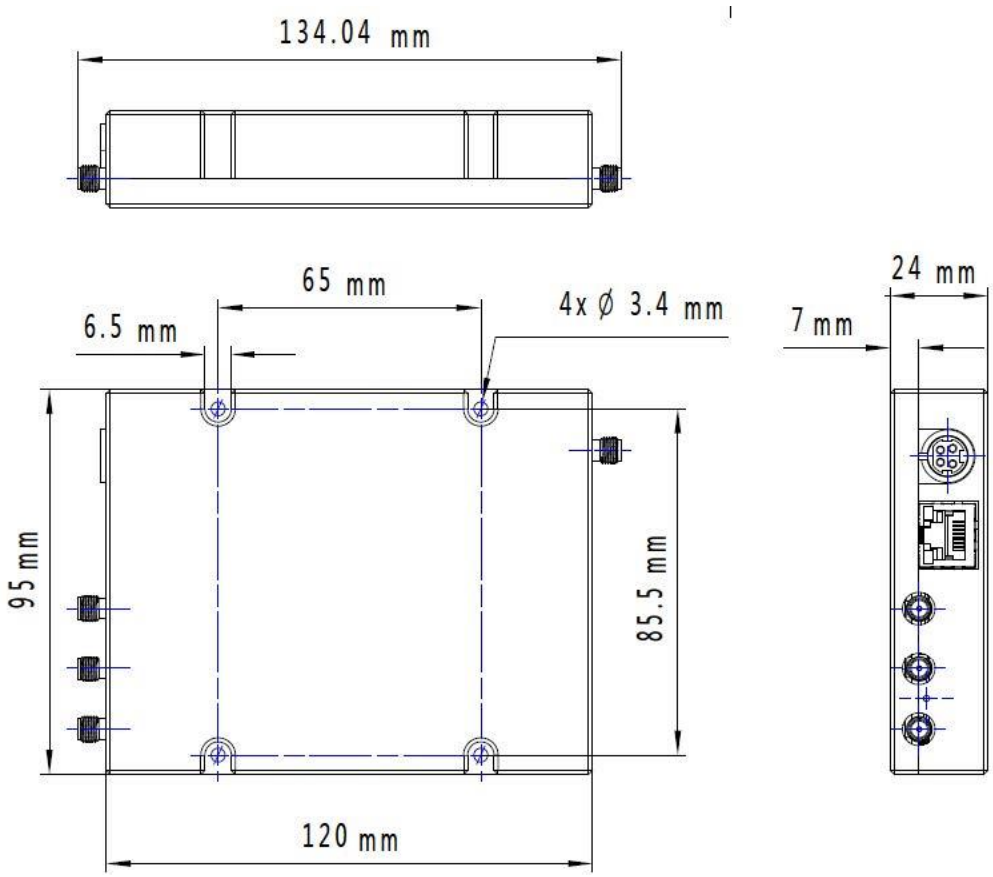
Trigger (TRIG)

PARAMETER	MIN	TYPICAL	MAX	NOTE
Trigger types	Continuous Single (point) Gated Gated direction			
Trigger source	External			
Trigger modes	Continuous free run Trigger and run Reset and run			
External trigger latency		140 ns		
External trigger uncertainty		20 ns		
External trigger delay	0 s		20 s	Settable
External delay resolution		10 ns		
Trigger modulo	1		255	Execute only on Nth trigger event
Trigger polarity		Rising Falling		
External trigger input threshold	0.85 V	0.9 V	0.95 V	TTL compatible
External trigger input voltage range	-0.5 V		+5.5 V	TTL compatible
External trigger input hysteresis		60 mV		

MECHANICAL SPECIFICATIONS

Dimensions & Weight

Dimensions / Weight	
Including Connectors	5.28 x 3.74 x 1.00 in [134 x 95 x 24 mm] / 1.0 lbs [0.45 kg]



Installation Instructions

The module relies on passive cooling. It is mandatory to mount the device on a heatsinking surface. Make sure the synthesizer operates under the conditions specified in this datasheet. Otherwise, the thermal protection will turn off the RF output.

CONNECTORS

Front Panel

LABEL	TYPE	DESCRIPTION
1. PWR	LED	Power ON/OFF indicator
2. REM	LED	Remote connection status indicator
3. RF	LED	RF output ON/OFF indicator
4. RF OUT	SMA	RF output

Rear Panel

LABEL	TYPE	DESCRIPTION
1. DC IN	KPJX-4S (Kycon)	DC input (see also chapter “Power Connector Assembly”)
2. ETH	RJ-45	Ethernet port
3. REF IN	SMA	Reference Signal Input
4. TRIG	SMA	Trigger Signal Input
5. RST	Button	Reset Button
6. REF OUT	SMA	Reference Signal output

Power Connector Assembly

The **PIN**	**ASSIGNMENT**
1	GND
2	DC Supply (see also “Power requirements”)
3	GND
4	DC Supply (see also “Power requirements”)

The power connector is a 4 pin, snap and look receptacle. BNC recommends Kycon manufactured plugs KPPX-4P from its KPPX series.

Reset Functionality

The reset functionality of the device can be used if the device has a wrong configured IP address and cannot be found in the local area network anymore. While pressing the reset button (>2 s), the device will be reconfigured to auto IP addressing mode (DHCP/Zero-conf) and restarts itself. After the device is up and running again, it gets a new IP address and can be discovered by the BNC Signal Generator UI.

ORDERING INFORMATION

HOST MODEL	PRODUCT	DESCRIPTION
805-M	**805-M**	22 GHz wideband frequency synthesizer module
805-M	**Option FS**	Fast switching option
805-M	**Option NOXO**	No internal reference
805-M	**Option DATA**	Commercial Calibration Certificate with test data

GENERAL CHARACTERISTICS

Remote Programming Interfaces:

Ethernet

Control language: SCPI Version 1999.0

Power requirements: 24±6 VDC; 17 W maximum

Mains adapter supplied: 100-240 VAC in / 24 V, 2.7 A DC out

Storage temperature range: – 40 to 70 °C

Operating temperature range: 0 to 45 °C; non-condensing

Operating and storage altitude: up to 15,000 feet

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

Recommended calibration cycle: 24 months

Document History

Version	Date	Author	Notes
V1.10	2021-11-10	Jk	First release
V1.11	2022-04-25	Ah	Parameter added
V1.12	2022-05-23	Yg	Added intro, multi-channel configurability and phase coherence specs
V1.13	2023-10-11	MH/ee	Refined power uncertainty, added phase stability in ps / updated layout structure

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NOTES