



DATASHEET APMQS20 Specification v1.03

Ultra-Agile Frequency Synthesizer
8 kHz to 20 GHz



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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 **APMQS20** microwave signal source modules deliver instrument-grade performance, increased functionality, and efficient power consumption at a reduced size and affordable cost. The design combines low phase noise with fast switching capability, covering a wide frequency range from 8 kHz up to 20 GHz. The low spurious and harmonic content of the signal makes it ideally suitable for many demanding applications. The unit contains a high stability OCXO, providing accurate, power-calibrated, phase-lockable output signals.

The frequency resolution is 1 MHz and the power resolution is 0.01 dB power.
The unit is remotely controlled with USB; LAN or SPI control.

Due to the form-factor, the unit can also be used as a drop-in replacement of the obsolete “QuickSyn Synthesizers” from NI.

FACTS & FIGURES & SPECIFICATIONS

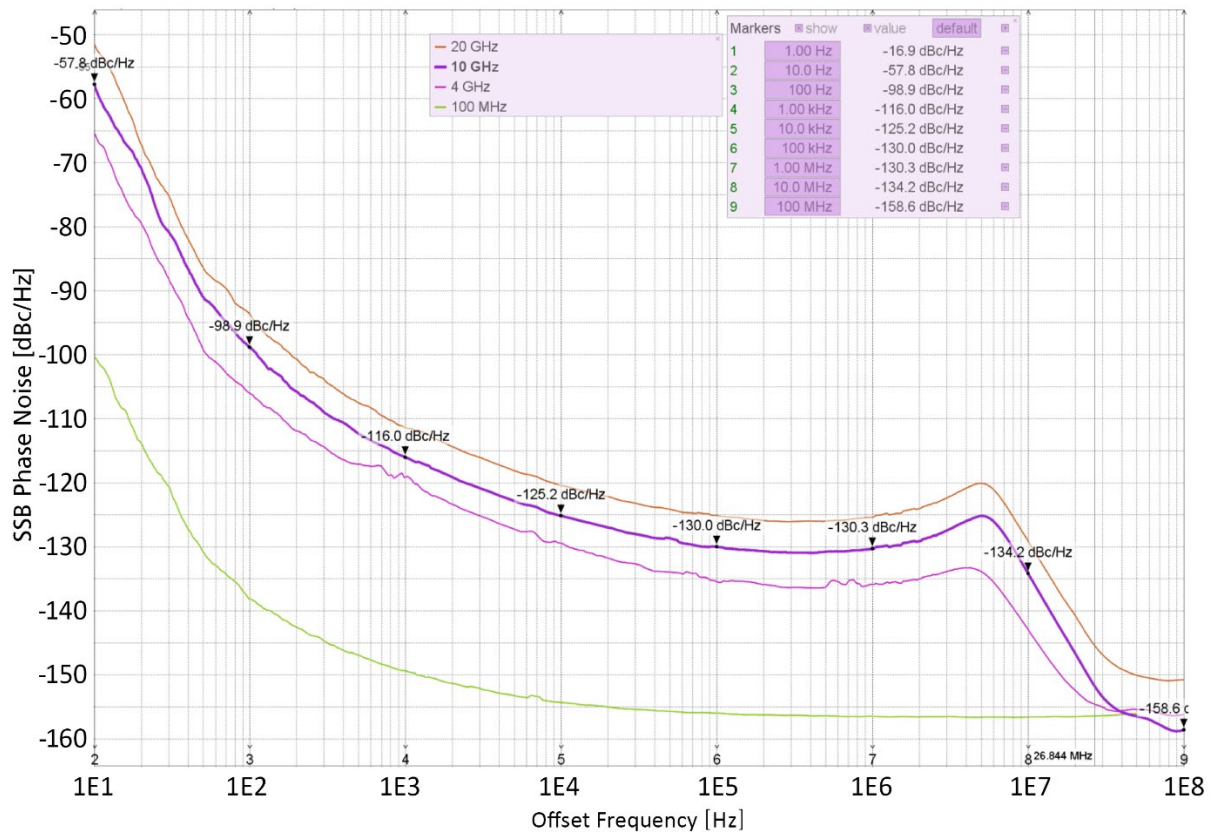
Signal Specifications

PARAMETER	MIN	TYPICAL	MAX	NOTE
Frequency range	10 MHz 8 kHz		20 GHz 20 GHz	settable to 22 GHz Option 8K
Frequency resolution		0.001 Hz		GUI SW setting resolution
Phase adjustment range	0 deg		360 deg	
Phase resolution		0.1 deg		
Switching speed		500 μ s	20 μ s	Option FS

Phase Noise

PARAMETER	MIN	TYPICAL	MAX	NOTE
SSB Phase noise at 1 GHz				See plot below
at 10 Hz from carrier		-85 dBc/Hz		
at 1 kHz from carrier		-133 dBc/Hz		
at 20 kHz from carrier		-145 dBc/Hz		
at 10 MHz from carrier		-155 dBc/Hz		
SSB Phase noise at 10 GHz				See plot below
at 10 Hz from carrier		-65 dBc/Hz		
at 1 kHz from carrier		-113 dBc/Hz		
at 20 kHz from carrier		-129 dBc/Hz		
floor		-156 dBc/Hz		

Figure 1: SSB Phase Noise Performance





Spectral Purity

PARAMETER	MIN	TYPICAL	MAX	NOTE
Harmonics				At 10 dBm; See plot below
< 100 MHz		-35 dBc		
100 MHz to 20 GHz		-50 dBc	-40 dBc	
Sub-harmonics				At 10 dBm
< 11 GHz		-80 dBc	-75 dBc	
11 GHz to 20 GHz		-70 dBc	-60 dBc	
Non-harmonic spurious				> 10 kHz offset
< 1 GHz		-70 dBc	-55 dBc	
1 GHz to 20 GHz		-70 dBc	-60 dBc	

Figure 2: Harmonics (at 10 dBm Output Power)

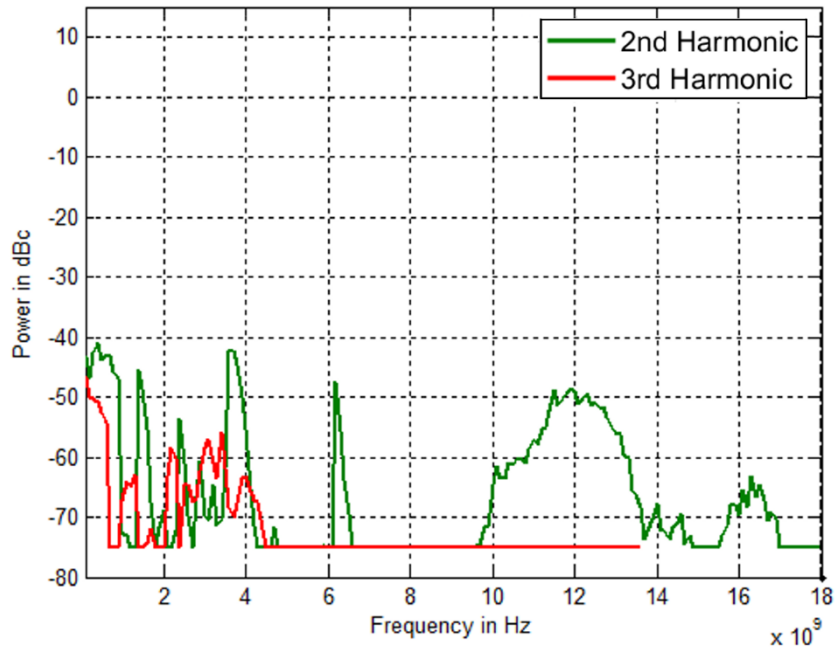


Figure 3: Wideband Spectrum for 5 GHz

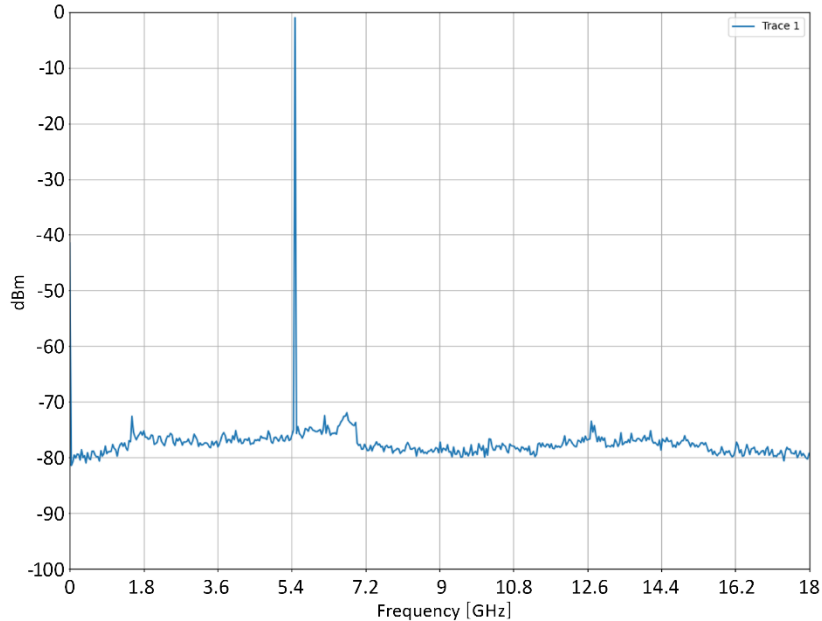
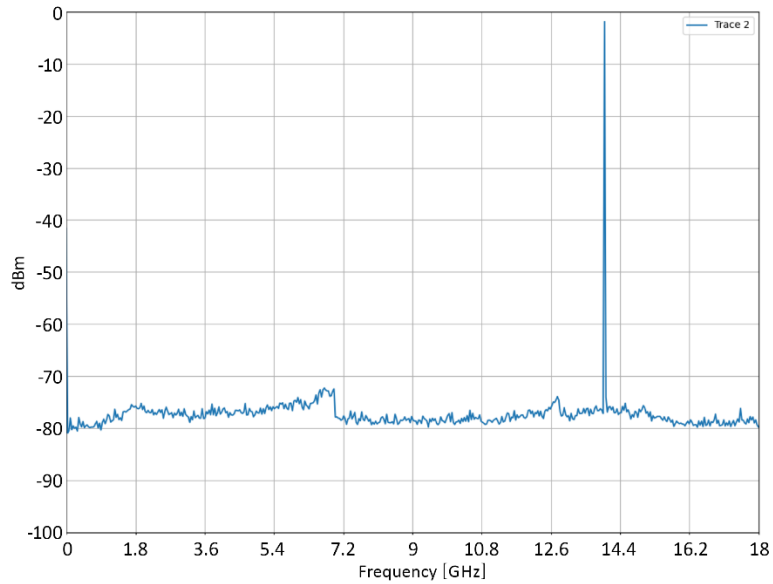


Figure 4: Wideband Spectrum for 14 GHz



Level Performance

PARAMETER	MIN	TYPICAL	MAX	NOTE
Output power level				See plot below
10 MHz to 1 GHz	-20 dBm		15 dBm	
1 GHz to 18 GHz	-20 dBm		15 dBm	
18 GHz to 20 GHz	-20 dBm		14 dBm	
Power level uncertainty				See plots below
		0.25 dB	1.0 dB	-20 to 14 dBm
Power resolution		0.01 dB		
Output impedance		50 Ω		
VSWR		1.7		
Reverse power protection				
DC voltage			7 V	
RF power			23 dBm	

Figure 5: Power Level Linearity

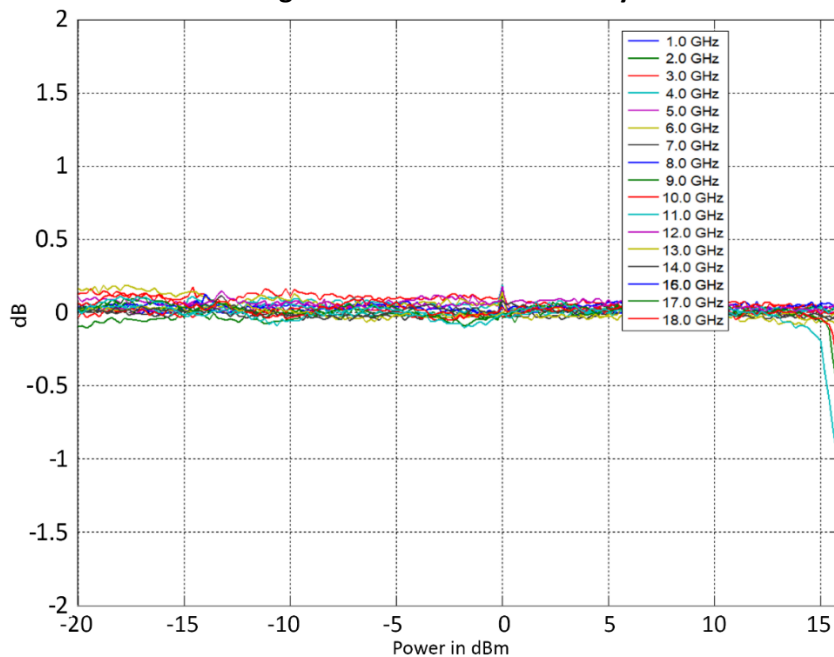
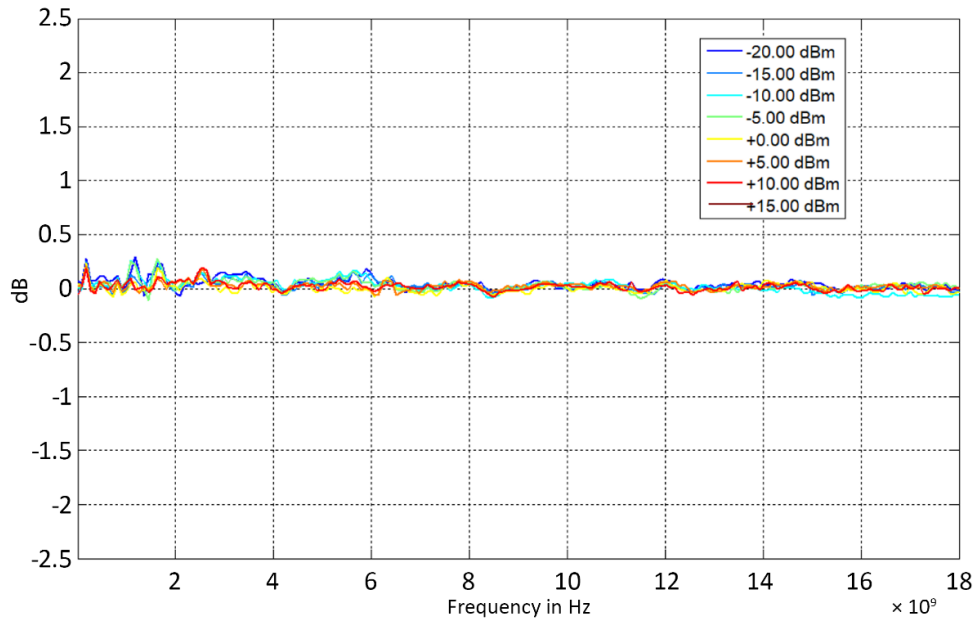


Figure 6: Frequency Response



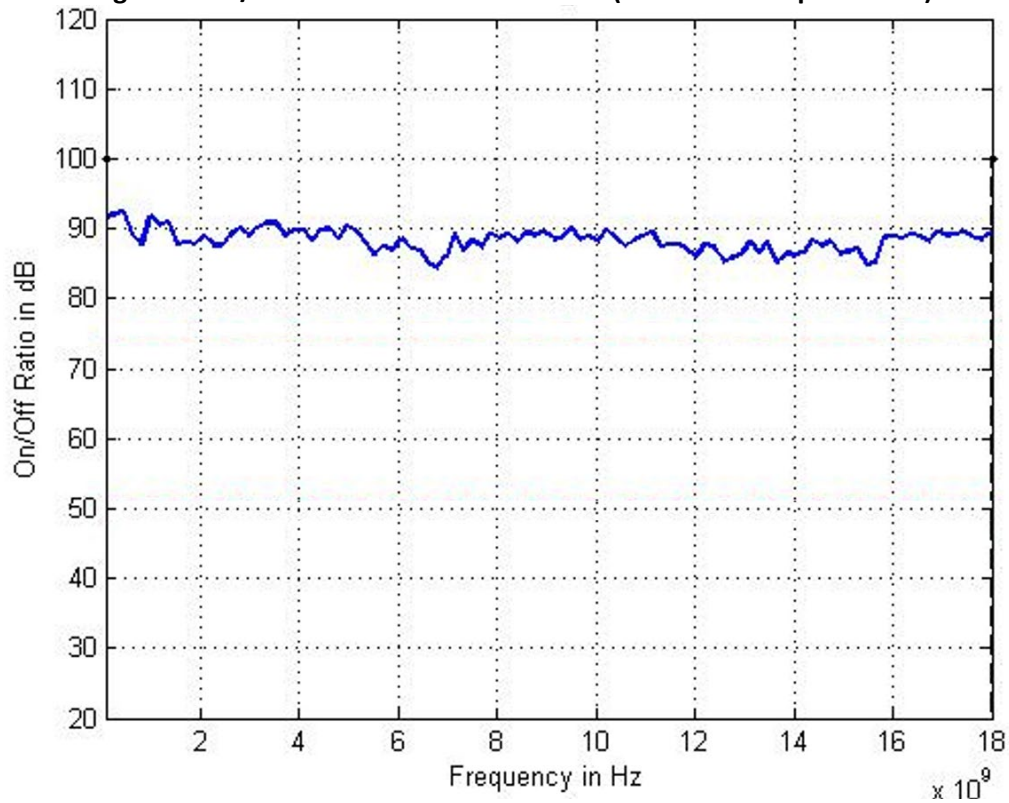
Reference Frequency

PARAMETER	MIN	TYPICAL	MAX	NOTE
Internal reference frequency		100 MHz		
Calibrated accuracy of int. reference		±30 ppb		Calibrated at 23 ± 3 °C
Temperature stability (0 to 50 °C)			±100 ppb	
Aging 1 st year			500 ppb	
Aging per day			5 ppb	After 30 days operation
Warm-Up time		5 min		
Reference frequency input	10 MHz, 100 MHz, 1 GHz			
Reference input level				
10 MHz	-3 dBm		+12 dBm	
100 MHz	-3 dBm		+12 dBm	
1 GHz	-3 dBm		+12 dBm	
Reference input impedance		50 Ω		
Reference frequency output	10 MHz, 100 MHz, 1 GHz			
Output power				
10 MHz	3 dBm	5 dBm	7 dBm	
100 MHz	3 dBm	5 dBm	7 dBm	
1 GHz	3 dBm	5 dBm	7 dBm	
Reference output impedance		50 Ω		

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 20 GHz	75 dB 70 dB	90 dB 85 dB		At 10 dBm; See plot below.
Repetition frequency	DC		10 MHz	
Pulse width	30 ns		20 s	
Pulse resolution		10 ns		
Pulse rise/fall time		9 ns	12 ns	
Pulse train length	1		4096	

Figure 7: On/Off Ratio – Pulse Modulation (at 10 dBm Output Power)



Sweeping Capability

PARAMETER	MIN	TYPICAL	MAX	NOTE
Sweep parameters	Frequency, power, list			
Sweep type	Linear, logarithmic, random			
Step time	500 μ s 20 μ s		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, step-time, and off-time for each point.

Trigger (PULSE)

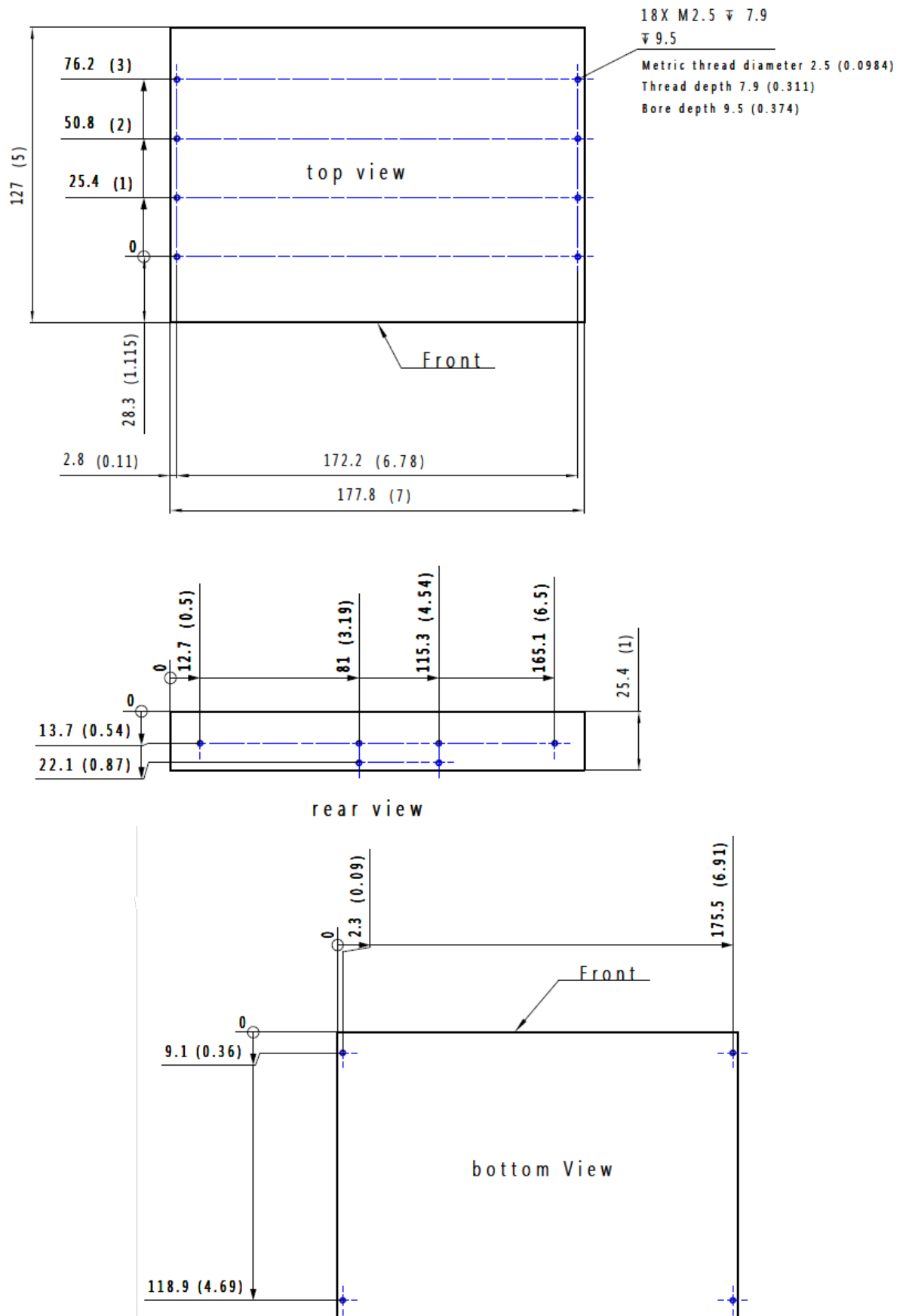
PARAMETER	MIN	TYPICAL	MAX	NOTE
Trigger types	Continuous Single (point) Gated Gated direction			
Trigger source	External (PULSE, SPI Trigger) Bus (Ethernet, USB, SPI)			
Trigger modes	Continuous free run Trigger and run Reset and run			
External trigger latency		140 ns		
External trigger uncertainty		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 PULSE input threshold	0.85 V	0.9 V	0.95 V	TTL compatible
External PULSE input voltage range	-0.5 V		+5.5 V	TTL compatible 100 k Ω pull-up to +5.0 V
External PULSE input hysteresis		30 mV		

MECHANICAL SPECIFICATIONS

Dimensions & Weight

Including connectors

W x L x H = 177.8 x 127.0 x 25.4 mm / 1.0 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.

INTERFACES

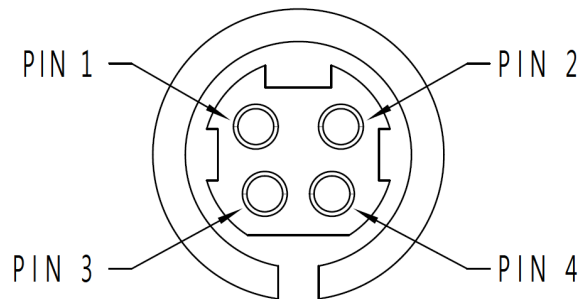
Front Panel

LABEL	TYPE	DESCRIPTION
1. DC IN	KPJX-4S	DC input (see also chapter “Power Connector Assembly”). Redundant power supply input to the SPI Interface DC input (supply with higher voltage will be chosen).
2. SPI	DF1BZ-20DP-2.5DS	SPI Interface, including DC input (see also chapter “SPI Interface”)
3. ETH	RJ-45	Ethernet port
4. USB	Micro B	USB port
5. PULSE	SMA	Trigger / Pulse interface, 100 kΩ pull-up to +5.0 V
6. PWR	LED	Power ON/OFF indicator
7. REM	LED	Remote connection status indicator
8. RF	LED	RF output ON/OFF indicator
9. REF OUT	SMA	Reference Signal output
10. REF IN	SMA	Reference Signal input
11. RF OUT	SMA	RF output

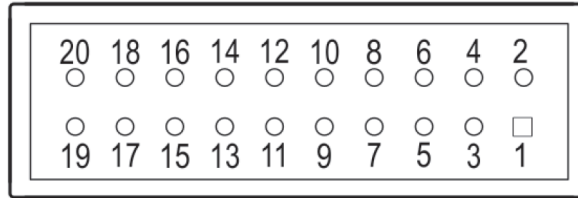


Power Connector Assembly

PIN	ASSIGNMENT
1	GND
2	+V_IN Supply (see also “Power requirements”)
3	GND
4	+V_IN Supply (see also “Power requirements”)

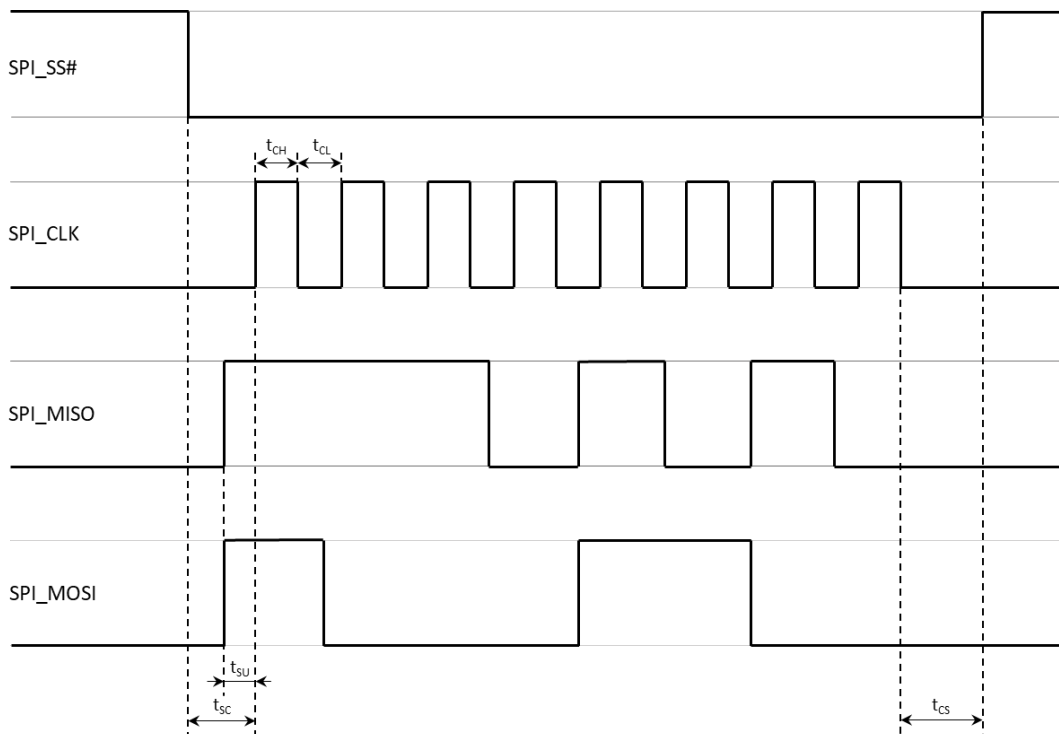


The power connector is a 4 pin, snap and lock receptacle. AnaPico recommends Kycon manufactured plugs KPPX-4P from its KPPX series.



SIGNAL	PIN	TYPE	DESCRIPTION
SPI_CLK	11	Input	SPI clock. Supplied by the controlling host. The controlling host is the SPI master, the synthesizer is the SPI slave.
SPI_SS#	13	Input	SPI Slave Select. This signal is an active low input from the host to the synthesizer. It frames command communications. For each command, SPI_SS# goes low before the first bit is sent and goes high after the last bit is sent
SPI_MISO	7	Output	Master In/Slave Out. Data line from the synthesizer to the host.
SPI_MOSI	9	Input	Master Out/Slave In. Command/Data line from the host to the synthesizer.
TRIGGER	17	Input	Edge sensitive input. The trigger signal of +3.3 V can be configured for multiple trigger modes (see also chapter “Trigger (PULSE)”).
LOCK	15	Output	Output indicates the RF output of the synthesizer is locked on its current setting (+3.3 V locked, 0 V unlocked).
REF_LOCK	16	Output	Output indicates the synthesizer has detected an external reference signal and locked on that signal (+3.3 V locked, 0 V unlocked).
RESET#	18	Input	Internally pulled up to +3.3 V with 100 kΩ resistor. Active low signal, which has a minimum width of 1 ms, will reset the synthesizer to a default state.
DC IN	3, 4		External power supply (see also “Power requirements”). Redundant power supply input to the DC IN interface (supply with higher voltage will be chosen).
GND	8, 10, 19, 20		Ground.
DNC	1, 2, 5, 6, 12, 14		Do not connect. Reserved for factory / future use.

The SPI interface connector is a 20 pin, 2.50 mm spaced double-row header. AnaPico recommends HIROSE manufactured socket DF1B-20DS-2.5RC and corresponding contacts from its DF1B series.



t_{sc}	> 25 ns	SPI_SS# to be low before first clock edge
t_{cs}	> 25 ns	SPI_CLK to be low before releasing SPI_SS#
t_{su}	> 15 ns	SPI_MISO/MOSI to be stable before rising edge of clock
t_{CH}	> 25 ns	Minimum high time of a clock pulse
t_{CL}	> 25 ns	Minimum low time of a clock pulse
f_{CLK}	≤ 12 MHz	Maximum clock frequency

ORDERING INFORMATION

HOST MODEL	PRODUCT	DESCRIPTION
APMQS20	APMQS20	20 GHz wideband frequency synthesizer module (with AC adapter)
APMQS20	Option FS	Fast switching
APMQS20	Option 8K	Frequency range extension to 8 kHz
APMQS20	Option PULSE	Internal / external pulse modulation
APMQS20	Option DATA	Factory Calibration Certificate with test data
APMQS20	Option WE	One year warranty extension (standard: 2 years)
APMQS20	Option ReCal	Recalibration (recommended: 2 years interval)

GENERAL CHARACTERISTICS

Remote programming interfaces:

Ethernet
USB 2.0
SPI
Control languages: SCPI Version 1999.0, native command set

Power requirements: 12.0 – 30.0 VDC; 24 W typical

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 60 °C, non-condensing, temperature of passive heatsink

Operating and storage altitude: up to 15,000 feet



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

Recommended calibration cycle: 24 months

