

DATASHEET APSYN140-X Specification V1.3

(Serial Number ***-**[6-9A-Z]*****-**** or higher)

Multi-Channel 8 kHz to 40 GHz Wideband Synthesizer System



Document size:

1 title page
15 content pages

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.

Typical: Expected mean values, not warranted performance

Min and 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.

INTRODUCTION

Multi-Output ultra-low Phase Noise Wideband Frequency Synthesizer with USB & LAN Interface

The APSYN140-X is a multi-channel wideband low phase-noise synthesizer settable from 100 kHz (8 kHz with option 8K) to 40 GHz.

The product is available with 1, 2, 3 or 4 fully independently configurable outputs. For each output channel, frequency, output power, phase and modulation can be set.

The settable output power range is from -5 to +25 dBm.

The APSYN140-X has a nHz-Hz frequency resolution and uses a high-stability OCXO internal reference. The reference can be phase-locked to an external reference. With option VREF, a user-settable range from 1 to 250 MHz is available.

For highest phase coherence, multiple APSYN140-X can be cascaded with just one master high-frequency (100 MHz, 1 GHz, 3 GHz) reference clock.

When ordered with option FILT, the APSYN140-X provides excellent harmonic rejection even a full output power.

With option ALC, a power resolution of 0.01 dB is available and power uncertainty can be further reduced.

The APSYN140-X 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 USB and LAN interfaces (optionally also GPIB) and can be controlled using the SCPI 1999 command set.

This datasheet is valid for APSYN140-X with serial number ***-**[6-9A-Z]*****-****** or higher. For all other serial numbers, please see datasheet V1.21.**

FACTS, FIGURES & SPECIFICATIONS

Signal Specifications

PARAMETER	MIN	TYPICAL	MAX	NOTE
Frequency Range	100 kHz 8 kHz		40 GHz	Settable to 43.5 GHz Option 8K
Resolution		0.00001 Hz		
Phase Resolution		0.01 deg		
Switching Speed		1.5 ms		after SCPI command received
CW Mode		500 μs		
Sweep / List Mode		20 μs		Option FS
SSB Phase noise at 1 GHz				(see also plots)
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 range				(see also plots)
8 kHz to 10 MHz	-20 dBm		+16 dBm	Option 8K
10 MHz to 5 GHz	-25 dBm		+20 dBm	
5 to 20 GHz	-25 dBm		+20 dBm	
20 to 27 GHz	-25 dBm		+19 dBm	
27 to 40 GHz	-25 dBm		+18 dBm	
10 MHz to 5 GHz	-10 dBm		+15 dBm	Option FILT
5 to 20 GHz	-10 dBm		+12 dBm	Option FILT
20 to 27 GHz	-5 dBm		+12 dBm	Option FILT
27 to 40 GHz	-10 dBm		+10 dBm	Option FILT
Power Resolution		0.5 dB 0.01 dB		Option ALC
Power Accuracy		±0.6 dB 0.25 dB	± 2 dB ± 1 dB	Option ALC
Reverse Power Protection				
DC Voltage		7 V		
RF Power			20 dBm	
Output impedance		50 Ohms		
VSWR		1.8		
Spectral purity				
Output harmonics		-15 dBc -55 dBc		(see also plots) >1 GHz, Option FILT
Sub-harmonics		-75 dBc -50 dBc	-50 dBc -30 dBc	< 20 GHz >20 GHz
Non-harmonic spurious		-75 dBc	-60 dBc	



Modulation Capabilities

PARAMETER	MIN	TYPICAL	MAX	NOTE
Pulse Modulation				
Modulation source		Internal/ External		
Pulse rise/fall time		10 ns		
On/off ratio		60 dB		Pout > +10 dBm, see plot
Pulse overshoot			10%	
Pulse delay		20 ns		
Pulse polarity		Normal, inverse		selectable
External input threshold	0.85 V	0.9 V	0.95 V	TTL compatible
External input voltage range	-0.5 V		+5.5 V	TTL compatible
External input hysteresis		60 mV		
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
Minimum pulse settling range	30 ns		20 s	
Pulse Pattern Modulation & Staggered PRF				Using internal pattern generator
Pulse width	30 ns		5 s	
Programmable pattern length	2		65536	
Duty cycle	0.05%		99.95%	
Pulse width resolution		5 ns		
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		(Option FM)
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		(Option FM)
Phase deviation (peak)	0		300 · N · rad	
Deviation accuracy		0.50%	2%	
Modulation rate	0.1 Hz		80 kHz	
Modulation waveforms		Sine		
Distortion (THD)		< 1%		1 kHz rate & N x rad deviation

Sweeping Capability, Sweep type: linear, logarithmic, random

PARAMETER	MIN	TYPICAL	MAX	NOTE
Frequency Sweep				
Step time (t_{step})	500 μ s 20 μ s			Option FS
Dwell time (t_{dwell})	15 μ s			

Frequency Reference

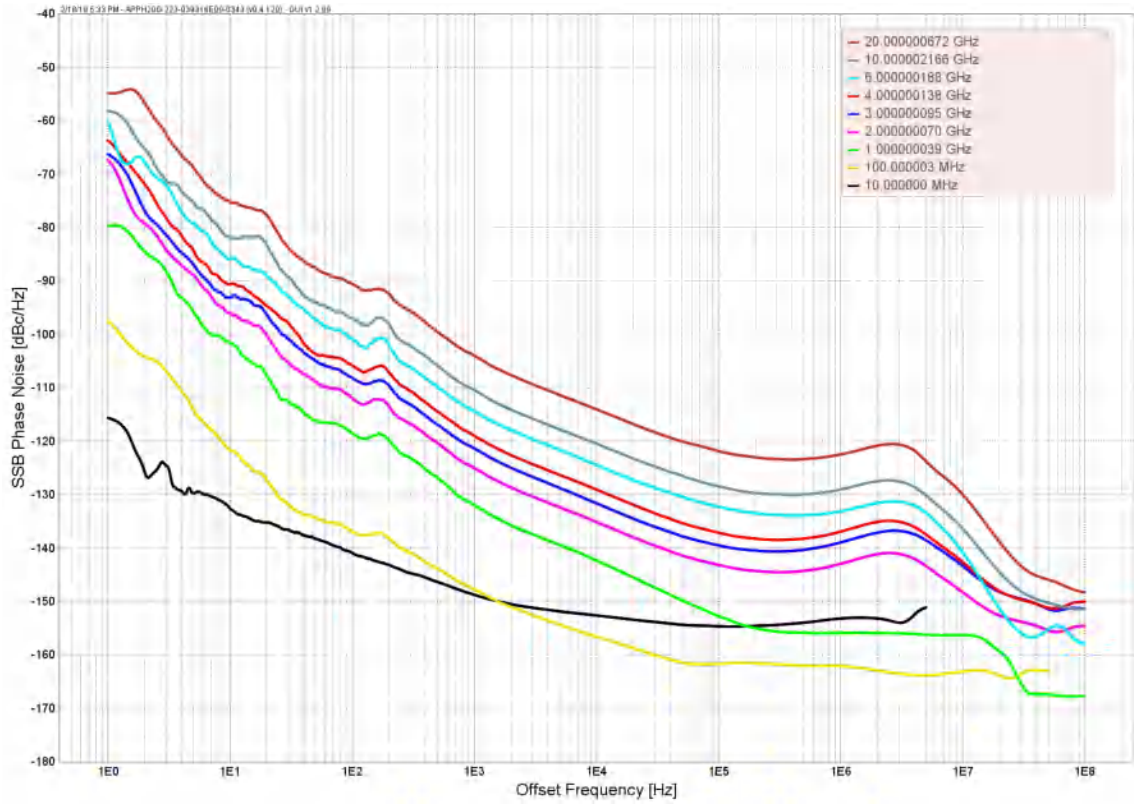
PARAMETER	MIN	TYPICAL	MAX	NOTE
Internal Reference Frequency		100 MHz 10 MHz		Option LN
Temperature stability (0 to 50 degC)			\pm 100 ppb \pm 20 ppb	Option LN
Aging 1st year			1 ppm 0.03 ppm 0.02 ppm	Option LN Option LN+
Aging per day (after 30days)			5 ppb 0.5 ppb	Option LN
Warm-up time		5 min		
Output of internal reference		100 MHz		
Output power		10/100 MHz 0 dBm 8 dBm		Option LN 10 MHz 100 MHz
Output impedance		50 Ohms		
Bypass Internal Reference Input		100, 1000 MHz		High phase synchronous mode
Phase Lock to External Reference	1 MHz	10 MHz integer MHz	250 MHz	Option VREF
Reference input level				
10 MHz or 1-250 MHz	-5 dBm	0 dBm	+10 dBm	
Bypass 100, 1000 MHz	+5 dBm		+15 dBm	
Reference input impedance		50 Ohms		
Reference Lock Range				
10 MHz or 1-250 MHz			\pm 1.5 ppm	
Bypass 100, 1000 MHz			>100 ppm	

Trigger (TRIG IN): Input is TRIG IN at front panel

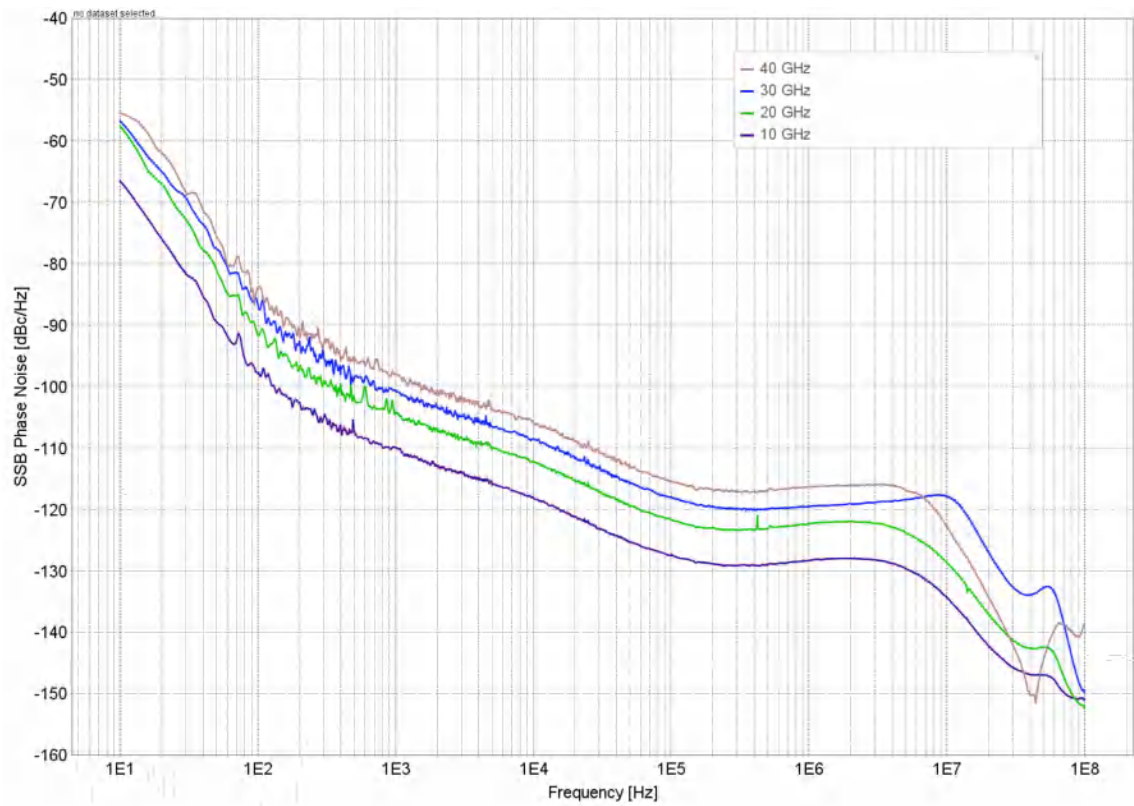
PARAMETER	MIN	TYPICAL	MAX	NOTE
Trigger Types	Continuous, single (point), gated, gated direction			
Trigger Source	external, bus (LAN, USB)			
Trigger Modes	Continuous free run, trigger and run, reset and run			
Trigger latency		5 ns		
Trigger uncertainty		10 ns		
External Trigger delay	50 ns		40 s	
External Delay Resolution		5 ns		
Trigger Modulo	1		255	Execute only on Nth trigger event
Trigger Polarity	Rising, falling			
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		

TYPICAL PERFORMANCE CURVES

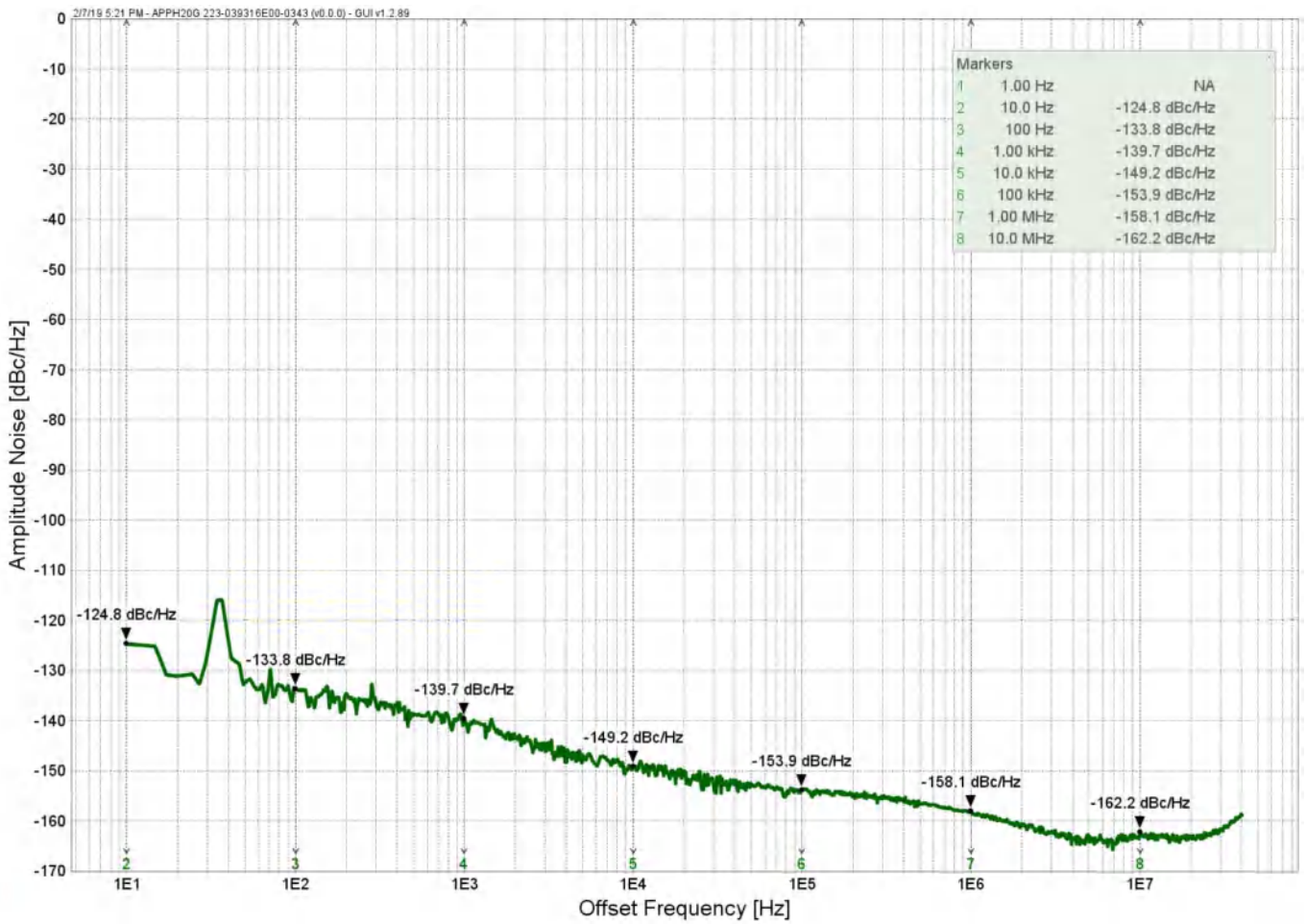
Phase Noise Performance with option LN



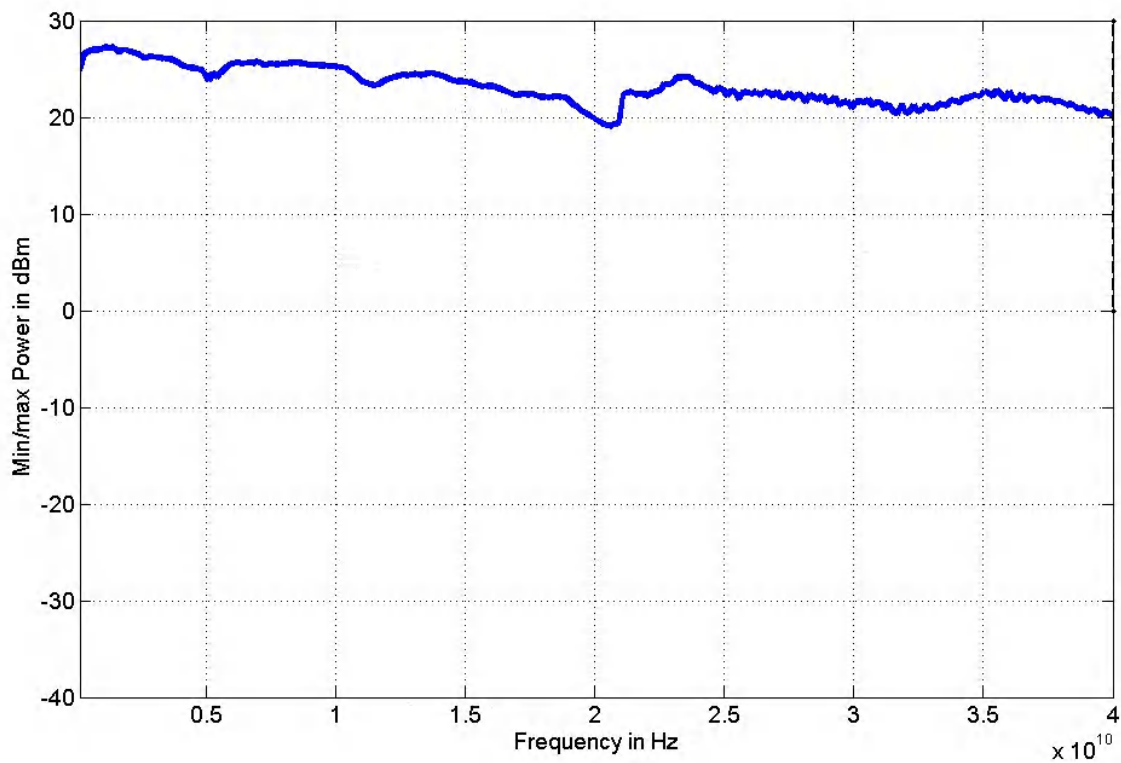
Phase Noise Performance without option LN



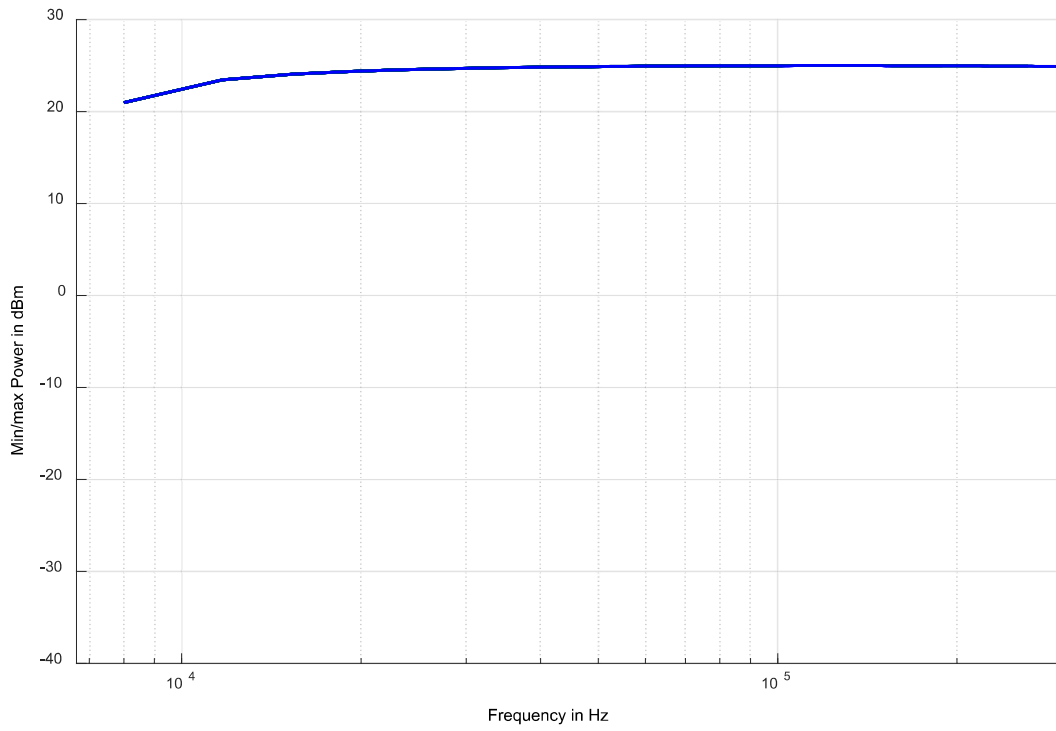
Amplitude Noise at 10 GHz



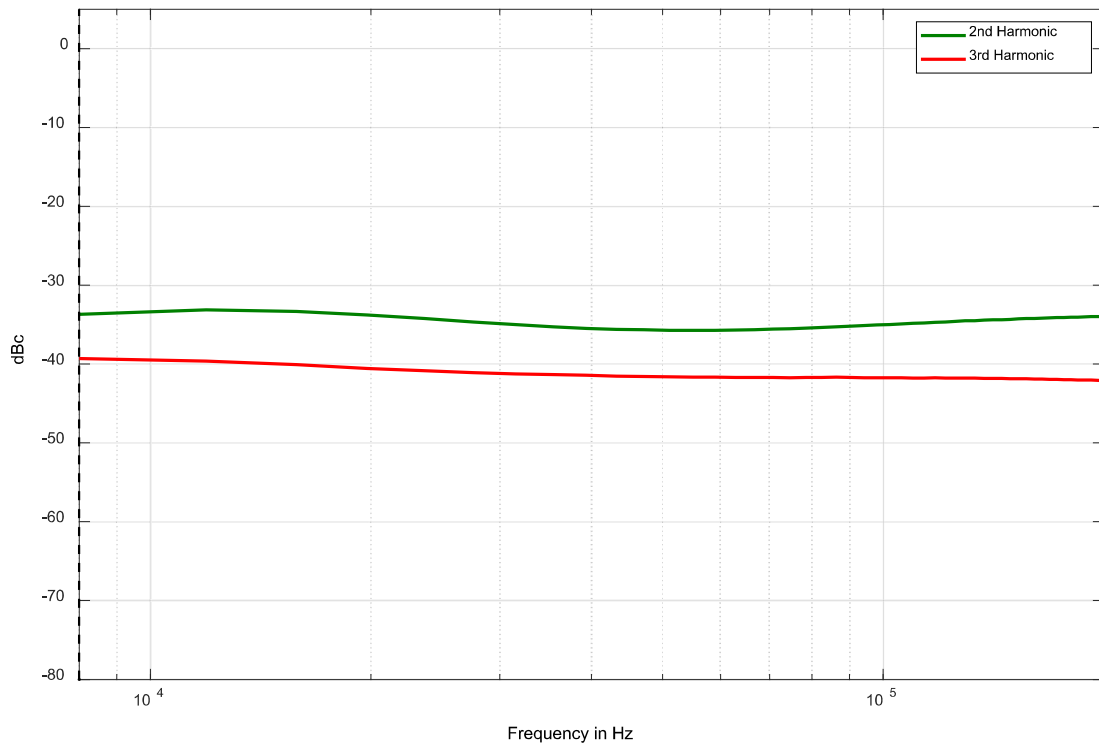
Maximum Output Power (without option FILT)



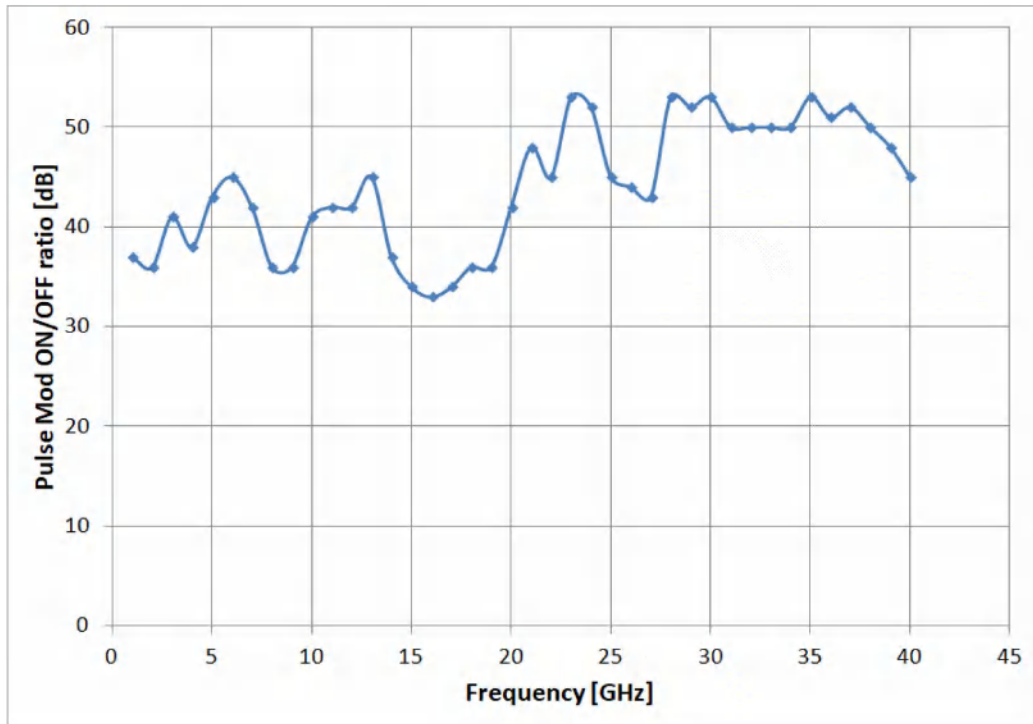
Maximum Output Power at 8 to 250 kHz (option 9K)



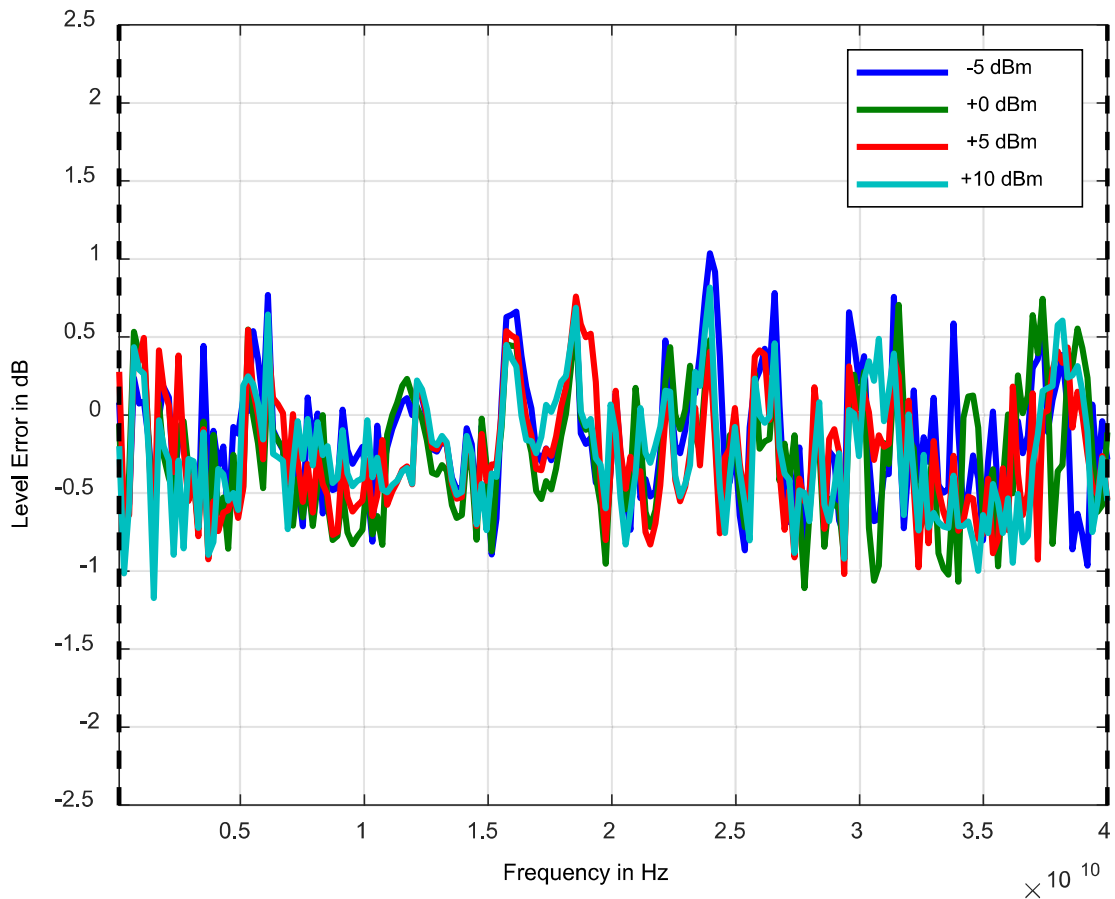
Harmonics at lower frequencies and 0 dBm (with option 9K)



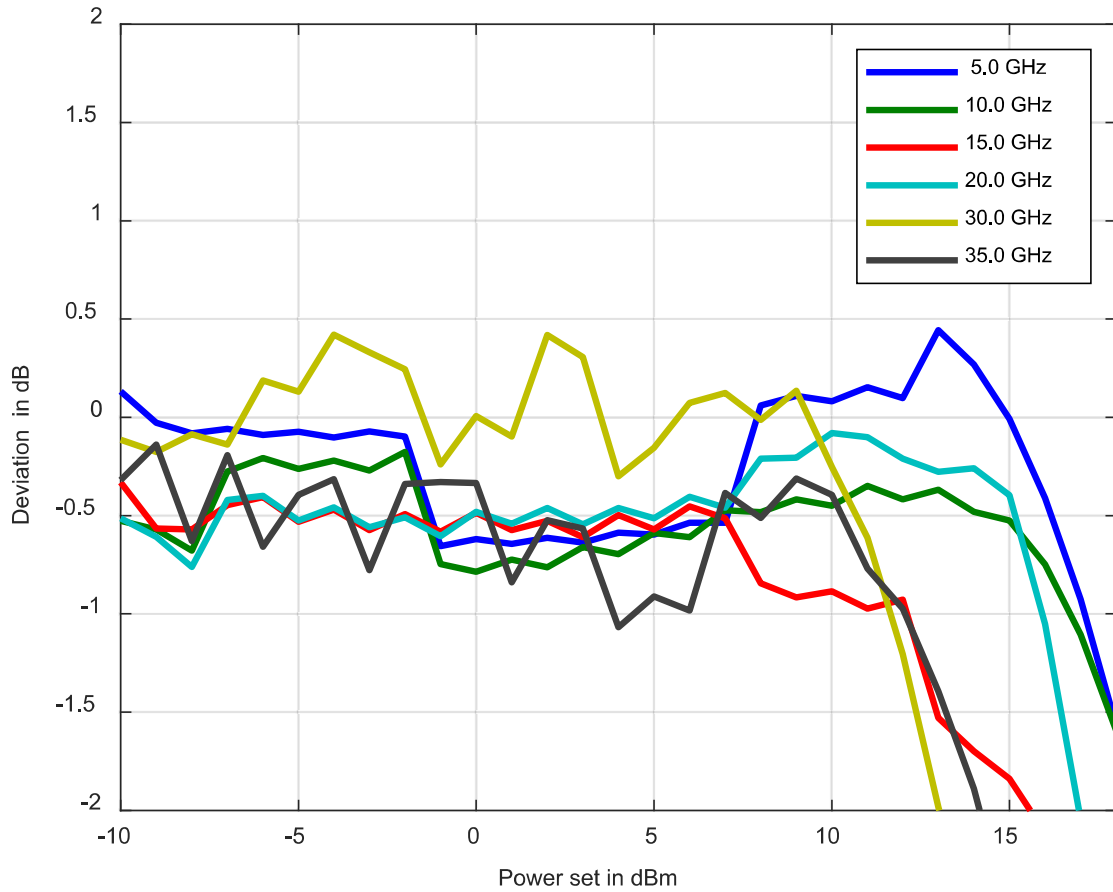
Pulse Modulation on-off ratio



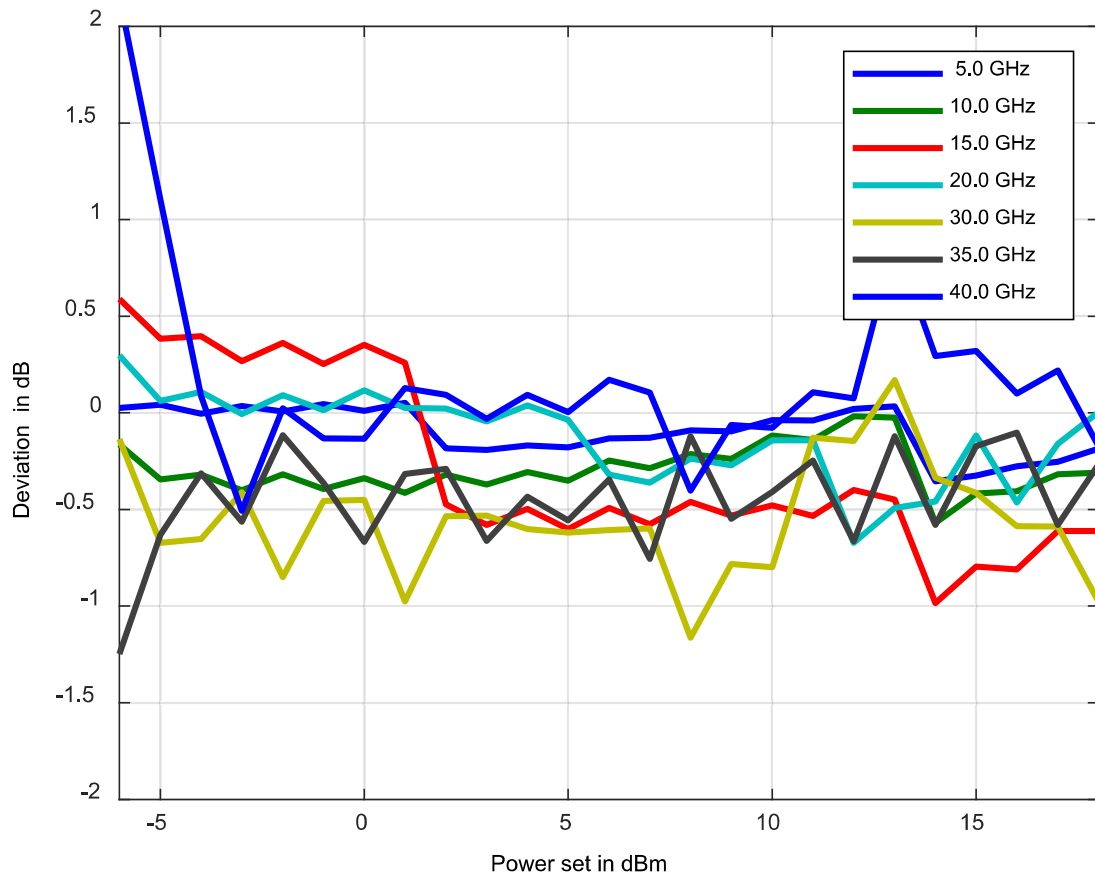
Power level accuracy (with option FILT)



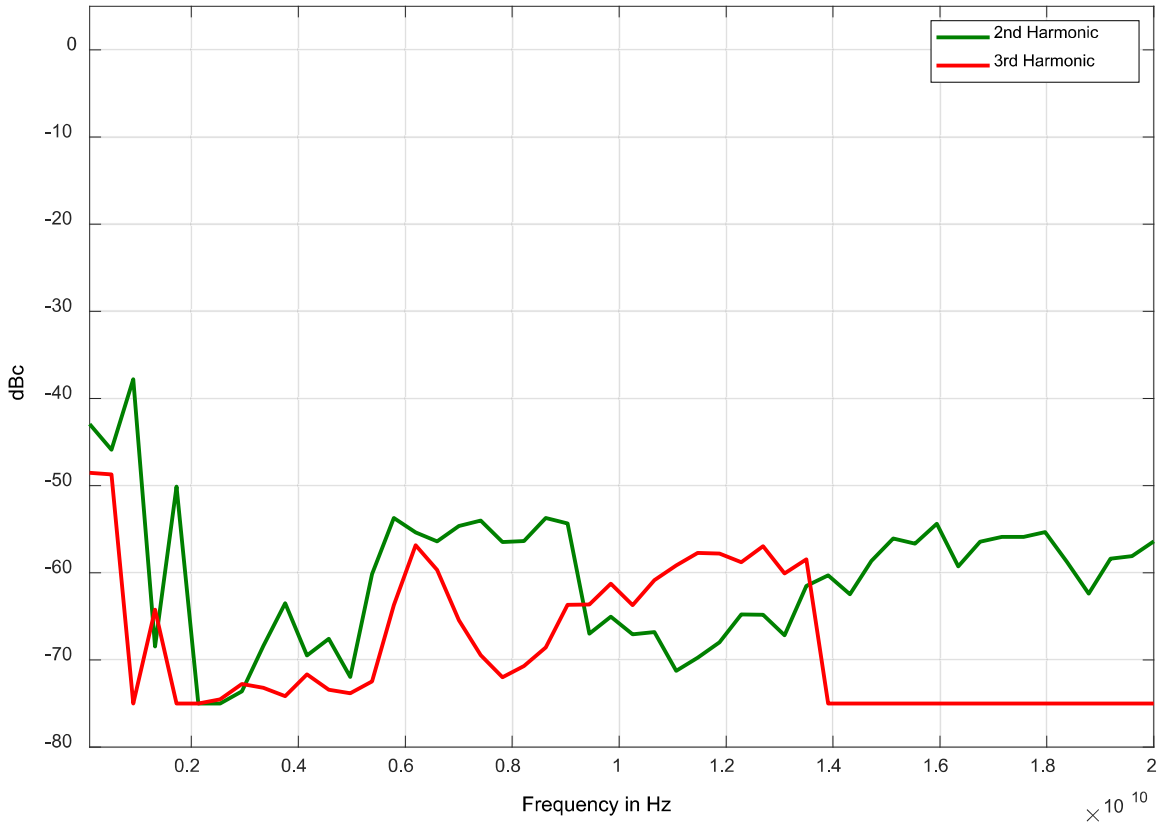
Power level linearity (with option FILT, without option ALC)



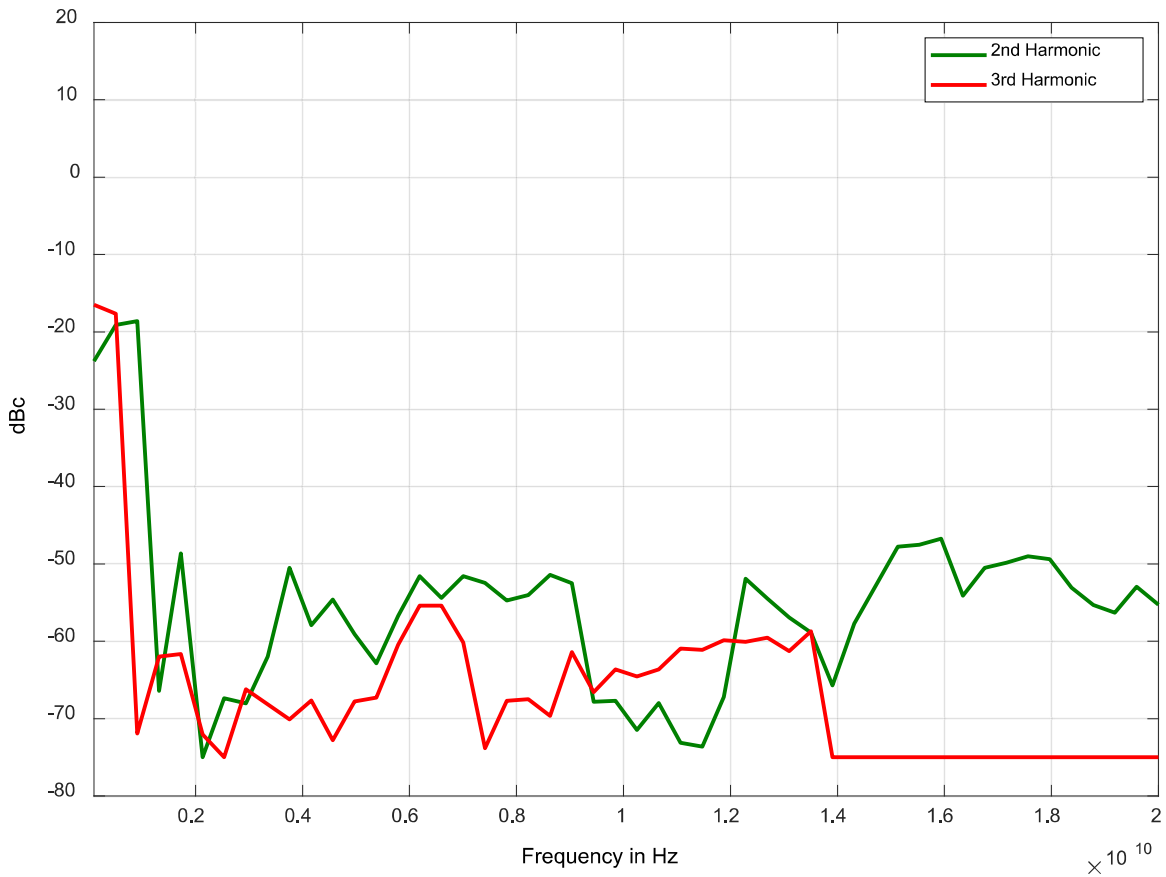
Power level linearity (without option ALC)



Harmonics @ 0 dBm (with option FILT)



Harmonics +15 dBm (with option FILT)



ORDERING INFORMATION



HOST MODEL	PRODUCT	DESCRIPTION
APSYN140-X	APSYN140-1	Single output, 19" 1HU rack-mount module
APSYN140-X	APSYN140-2	Dual-Output, 19" 1HU rack-mount module
APSYN140-X	APSYN140-3	Triple-Output, 19" 1HU rack-mount module
APSYN140-X	APSYN140-4	Quad-Output, 19" 1HU rack-mount module
APSYN140-X	Option LN	Enhanced close in phase noise & frequency stability
APSYN140-X	Option FS	Ultra-fast switching speed
APSYN140-X	Option ALC	Automated level control
APSYN140-X	Option PHS	Phase coherent switching
APSYN140-X	Option FM	Frequency/Phase Modulation
APSYN140-X	Option VREF	Variable external reference
APSYN140-X	Option GPIB	GPIB interface
APSYN140-X	Option FILT	Enhanced harmonic rejection
APSYN140-X	Option 8K	Frequency range extension to 8 kHz
APSYN140-X	Option HI	Special high isolation enclosure

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 24V ± 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)

Operating temperature range 0 to 45 °C

Storage temperature range –40 to 70 °C

Operating and storage altitude up to 15,000 feet (4600 m)



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

Weight ≤ 10.0 kg (22 lbs) net

Dimensions: 19" 1HU 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]



Front view

1. RF outputs: K (2.92 mm) female (1 to 4)
2. External pulse modulation inputs: BNC female (1 to 4)
3. DC power switch



Rear view

1. Internal reference output (SYSREF OUT): BNC female
2. External reference input (SYSREF IN): BNC female
3. Trigger output: BNC female
4. Trigger input: BNC female
5. Internal reference output (REF OUT): BNC female
6. External reference input (REF IN): BNC female
7. GPIB: IEEE-488.2, 1987 with listen and talk (optional)
8. USB 2.0 host and device
9. LAN connection: RJ-45
10. FUSE (3.15 A)
11. AC Power plug



High Isolation Casing 19" 1HU (Option HI, rack mount kit included)



Document History

Version/Status	Date	Author	Notes
V10	2019-02-20	jk	first release
V110	2020-01-26	jk	Added option FILT & option 8K
V120	2020-04-30	jk	Added plots for 8K and FILT
V121	2021-02-25	db	Pulse and trigger input electrical specifications
V130	2021-5-15	jk	Updated specs for product upgrade

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