

# DUAL -APSYN420D Specification 1.21

(April 2016)

0.01 - 20.0 GHz Dual Output Phase Synchronous Low Phase Noise Synthesizer



## **Introduction**

**The DUAL-APSYN420D 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 milli-Hz frequency resolution. The two independent synthesizer 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 DUAL-APSYN420 offers dedicated sweeping capabilities and wideband frequency 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 watts.**

## Signal Specifications

The specifications in the following pages describe the warranted performance of the signal generator for  $23 \pm 10$  °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	0.01 GHz		20 GHz	
resolution		0.001 Hz		
Phase resolution		0.1 deg		
Settling time		20 $\mu$ s	100 $\mu$ s	
Frequency update rate List/Sweep mode		200 $\mu$ s 130 $\mu$ s		time from receipt of SCPI command
SSB Phase noise at 10 GHz				
at 1 kHz from carrier		-98 dBc/Hz		
at 20 kHz from carrier		-108 dBc/Hz		
Wideband noise		-150 dBc/ Hz		
Output power level		+23 dBm		(see also plot)
Reverse Power Protection				
DC Voltage		7 V		
RF power			20 dBm	
Output impedance VSWR		50 $\Omega$ 1.8		
Spectral purity Output harmonics Sub-harmonics		-15 dBc -75 dBc	-60 dBc	
Non-harmonic spurious		-50 dBc		

# Sweeping Capability

Digital power / frequency / list sweeps				
Sweep type: linear, logarithmic, random				
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		

The diagram illustrates the timing relationships between three signals: TRIG IN, TRIG OUT (signal valid), and RF valid. TRIG IN is a square wave pulse. TRIG OUT is a square wave pulse that starts after a delay  $\tau_{de}$  from the rising edge of TRIG IN, has a duration  $\tau_{val}$ , and a transient time  $\tau_{inv}$  before returning to zero. RF valid is a square wave pulse that starts at the same time as TRIG IN and ends at the same time as TRIG OUT. The step time  $\tau_{step}$  is the interval between two TRIG IN pulses.

# Frequency Reference

Reference frequency input	1 MHz	250 MHz	
Max. phase coherent mode	100 MHz		
Reference input level	-5 dBm	0 dBm	+13 dBm
Lock Range			$\pm 1.0$ ppm
Reference input impedance		50 Ohms	
Internal Reference Output Frequency		10/100 MHz	
Output Power		>0 dBm 50 Ohms	
Temperature stability (0 to 50 degC)			$\pm 100$ ppb
Aging 1 <sup>st</sup> year		0.5 ppm	

<b>Aging per day (after 30days operations)</b>			<b>5 ppb</b>	
<b>Warm-Up time</b>		<b>5 min</b>		

Notes:

# Modulation Capabilities

Parameter	Min.	Typ.	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 µs	(internal generator)
Pulse resolution		15 ns		(internal generator)
Polarity		selectable		
External input amplitude		1 V TTL		AC DC

Notes:

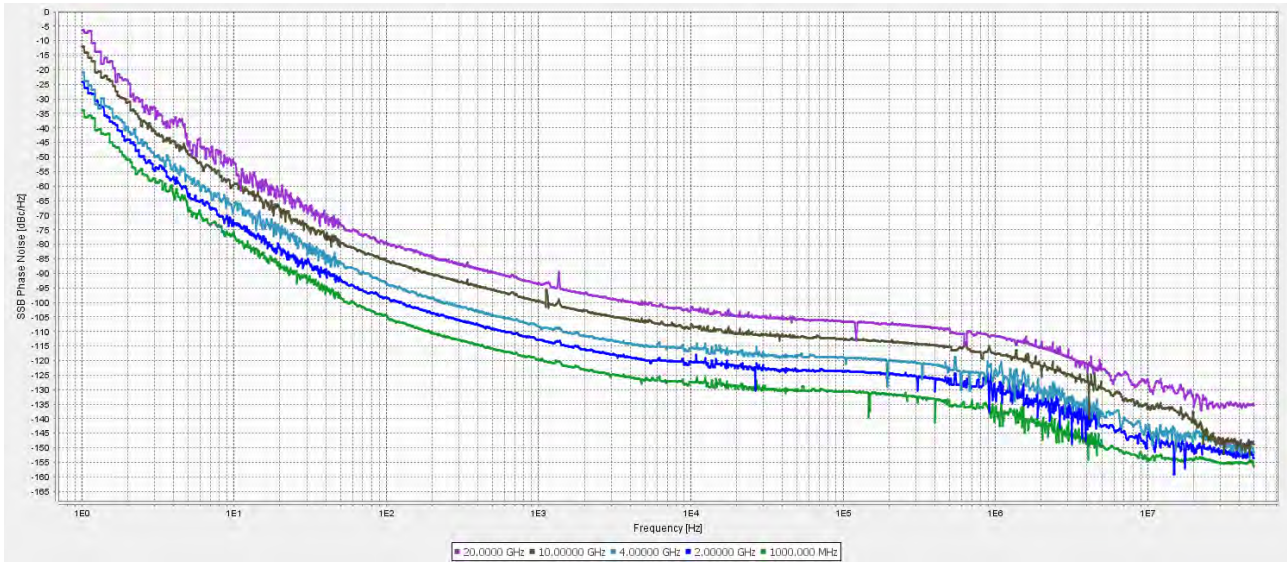
## Trigger (TRIG IN)

Input is TRIG IN at front panel

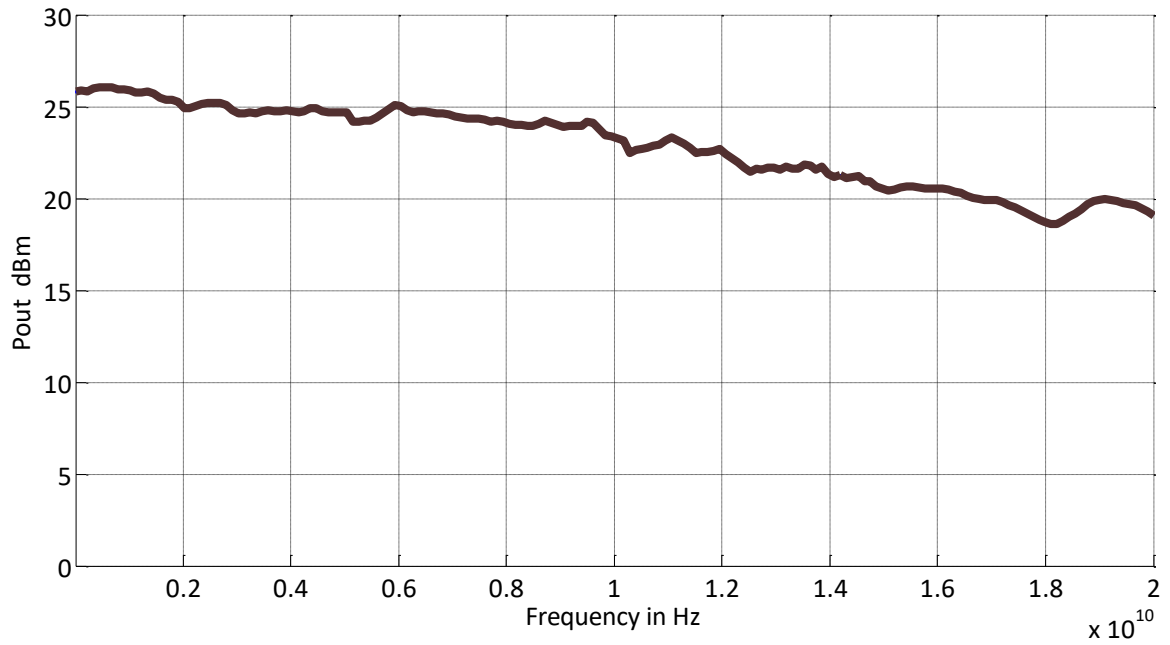
Parameter	Min.	Typ.	Max.	Note
Trigger Types	Continuous, single (point), gated, gated direction			
Trigger Source	external, bus (LAN, USB)			
Trigger Modes	Continuous free run, trigger and run, reset and run			
Trigger latency		tbd		
Trigger uncertainty		5 µs		
External Trigger delay	50 µs		40 s	
External Delay Resolution		15 ns		
Trigger Modulo	1		255	Execute only on Nth trigger event
Trigger Polarity	Rising, falling			

# Typical performance curves

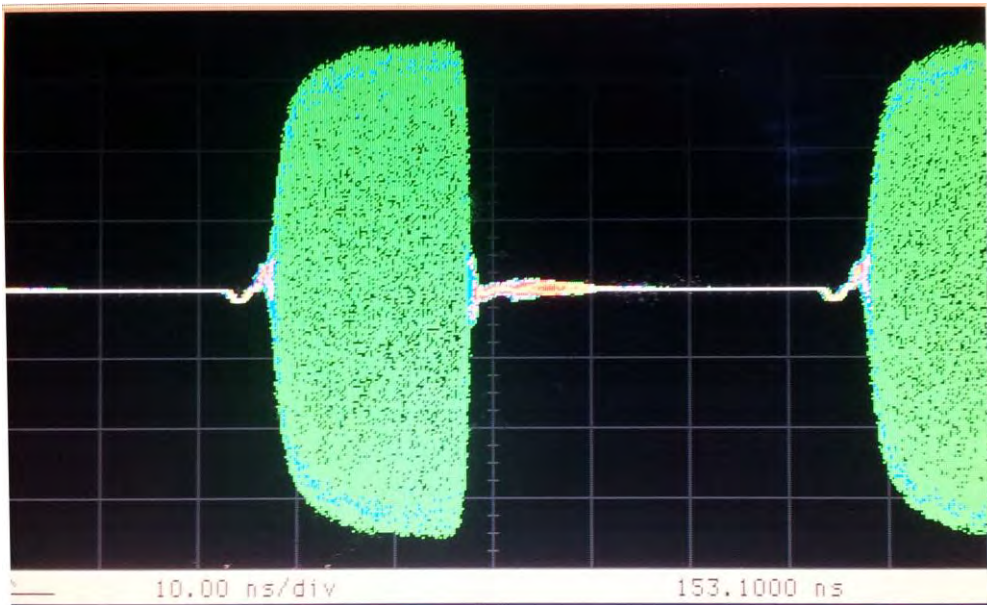
## Phase Noise Performance



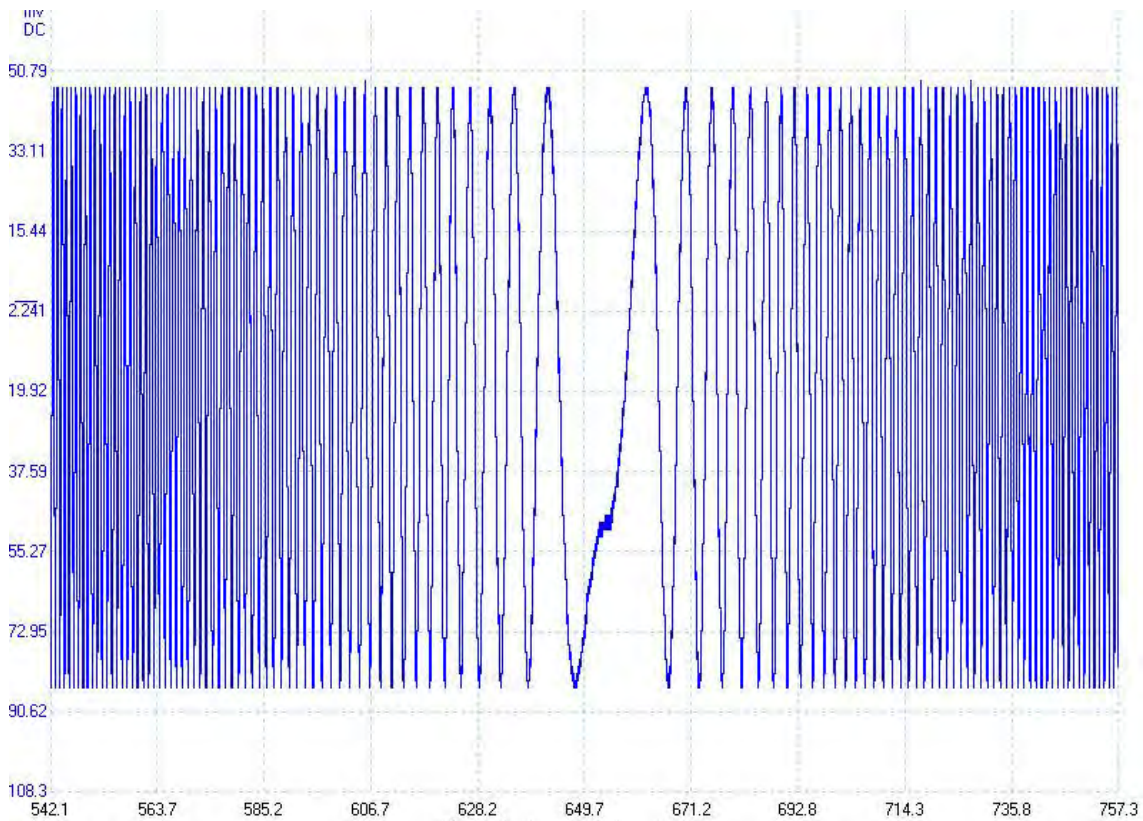
## Output Power 0.01 to 20 GHz



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



### Chirp (phase continuous, 1 GHz bandwidth)





# Connectors

Front panel:



Rear panel:



# 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 6 VDC; 20 W maximum

Mains adapter supplied: 100-240 VAC in/ 6V 2.5A DC out

Operating temperature range 0 to 40 °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  $\leq$  2.5 kg (6 lbs) net

Dimensions 43 x 48 x 4 cm (W x L x H)

## Document History

Version/Status	Date	Author		Notes
V10	2011-08-01	jk		first release
V11	2014-10-01	jk		Harmonics adjusted
V12	2015-8-31	jk		Product pictures, output power levels
V13	2016-4-22	jk		Option FS