

# DATASHEET RFSYN20-X Specification v1.26

Ultra-Agile Signal Sources from 8 kHz to 20 GHz  
(Single and Multi-Channel Versions)



Document size:

1 title page  
13 content pages

## DEFINITIONS

- The specifications in the following pages describe the warranted performance of the instrument for  $23 \pm 5$  °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 RFSYN20 is a very compact, very agile signal source series with frequency range of up to 20 GHz. It combines fast switching speed with low phase noise and good signal purity.

The single-channel unit is available as flange- and rack-mountable module or in a compact desktop enclosure with color touch display and front panel control.

The multi-channel version RFSYN20-X is available in 1, 2, 3 or 4 channel configurations in a standard 1U 19" rack-mountable enclosure. For high phase coherence, RF channels are locked to a common frequency reference.

The RFSYN20 has standard communication ports USB and ETHERNET, and optionally GPIB. All communication ports support the SCPI 1999 command set. The RFSYN20 also features an FCP (Fast Control Port) allowing for ultra-fast user-controlled list sweeping and frequency hopping.

## SPECIFICATIONS



PARAMETER	MIN	TYPICAL	MAX	NOTE
<b>Frequency range</b>	100 kHz 8 kHz		20 GHz 20 GHz	Option 8K
Resolution		0.01 Hz		
Phase resolution		0.1 deg		
Switching speed		200 $\mu$ s 5 $\mu$ s	500 $\mu$ s 10 $\mu$ s	In sweep mode Option FS
<b>SSB Phase noise at 1 GHz</b>				See also plots
at 1 kHz from carrier		-115 dBc/Hz		
at 20 kHz from carrier		-125 dBc/Hz		
<b>Spectral purity</b>				$P_{out} = 0$ dBm
Output harmonics				
<3.0 GHz		-20 dBc		
3.0 - 7.5 GHz		-30 dBc	-25 dBc	
7.5 – 12.0 GHz		-35 dBc	-35 dBc	
>12.0 GHz		-50 dBc	-45 dBc	
Sub-harmonics				$P_{out} = 0$ dBm
< 10.0 GHz		-80 dBc	-70 dBc	
10.0 – 19.0 GHz		-60 dBc	-50 dBc	
>19.0 GHz		-50 dBc		
Non-harmonic spurious (>10 kHz offset)		-65dBc	-55dBc	
<b>Channel to channel performance</b>				
Isolation				
< 3.0 GHz	90 dB			
3.0 – 8.0 GHz	70 dB			
>8.0 GHz		60 dB		
Relative phase stability		15 mrad		@5 GHz over 5 hours
<b>Power level</b>				
Range	0 dBm		+18 dBm	Settable to -10 to +23 dBm
Resolution		0.5 dB		
Level uncertainty		$\pm 1.5$ dB		
Output impedance		50 $\Omega$		
VSWR		1.7	2.0	
<b>Reference frequency input</b>	1 MHz		200 MHz	Integer MHz
Reference input level	-5 dBm	0 dBm	+13 dBm	
Lock Range			+/- 1.0 ppm	
Reference input impedance		50 $\Omega$		

PARAMETER	MIN	TYPICAL	MAX	NOTE
<b>Internal reference frequency output</b>		100 MHz		
Initial accuracy of internal reference		±40 ppb		calibrated at 23 ± 3 °C
Temperature stability (0 to 50 degC)			±100 ppb	
Aging 1 <sup>st</sup> year		0.5 ppm		
Aging per day			5 ppb	After 30 days operation
Warm-Up time		5 min		
Output of internal reference		+0 dBm 50 Ω		
<b>Reverse power protection</b>				
DC voltage		7 V		
RF power			23 dBm	

<b>Dimensions / Weight</b>	<b>Standard Flange-Mount</b>
Including connectors	W x L x H = 270 x 105 x 60 mm / ≤1.0 kg
<b>Dimensions / Weight</b>	<b>Option TOUCH</b>
Including connectors	W x L x H = 172 x 273 x 106 mm / ≤2.5 kg
<b>Dimensions / Weight</b>	<b>RFSYN20-X</b>
Including connectors	1 HU: W x L x H = 43 x 426 x 480 mm / ≤10.0 kg

## Sweeping Capability

PARAMETER	MIN	TYPICAL	MAX	NOTE
<b>Frequency / List sweep</b>				
Sweep type: linear, logarithmic, random				
Step time	500 μs 5 μs		200 s	Option FS
Timing resolution		5 ns		
Timing accuracy per point		20 ns		

### Generalized list sweep

Allows for individual setting of frequency, step-time, and off-time for each point

## Modulation Capabilities

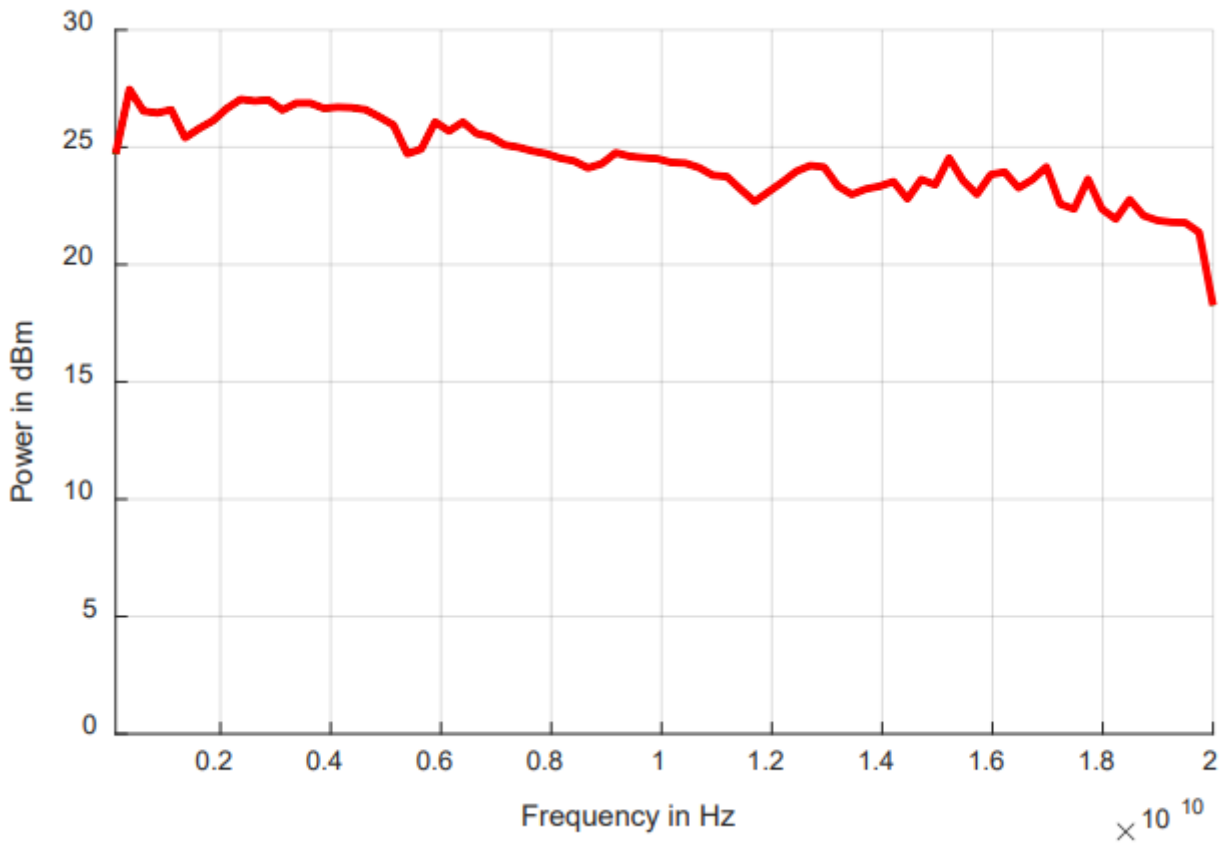
PARAMETER	MIN	TYPICAL	MAX	NOTE
<b>Pulse modulation</b>				
On/off ratio		60 dB		
Repetition frequency	DC		10 MHz	
Pulse width	30 ns		20 s	
Pulse rise/fall time		9 ns		
Pulse trainslength (pulses)	2		4192	
Video crosstalk		-40 dB		
Modulation source		Int. / Ext.		
External input threshold	0.85 V	0.9 V	0.95 V	TTL compatible
External input voltage range	-0.5 V		+5.5 V	TTL compatible
External input hysteresis		60 mV		
Delay (to RF)		20 ns	40 ns	

## Trigger (TRIG IN/OUT)

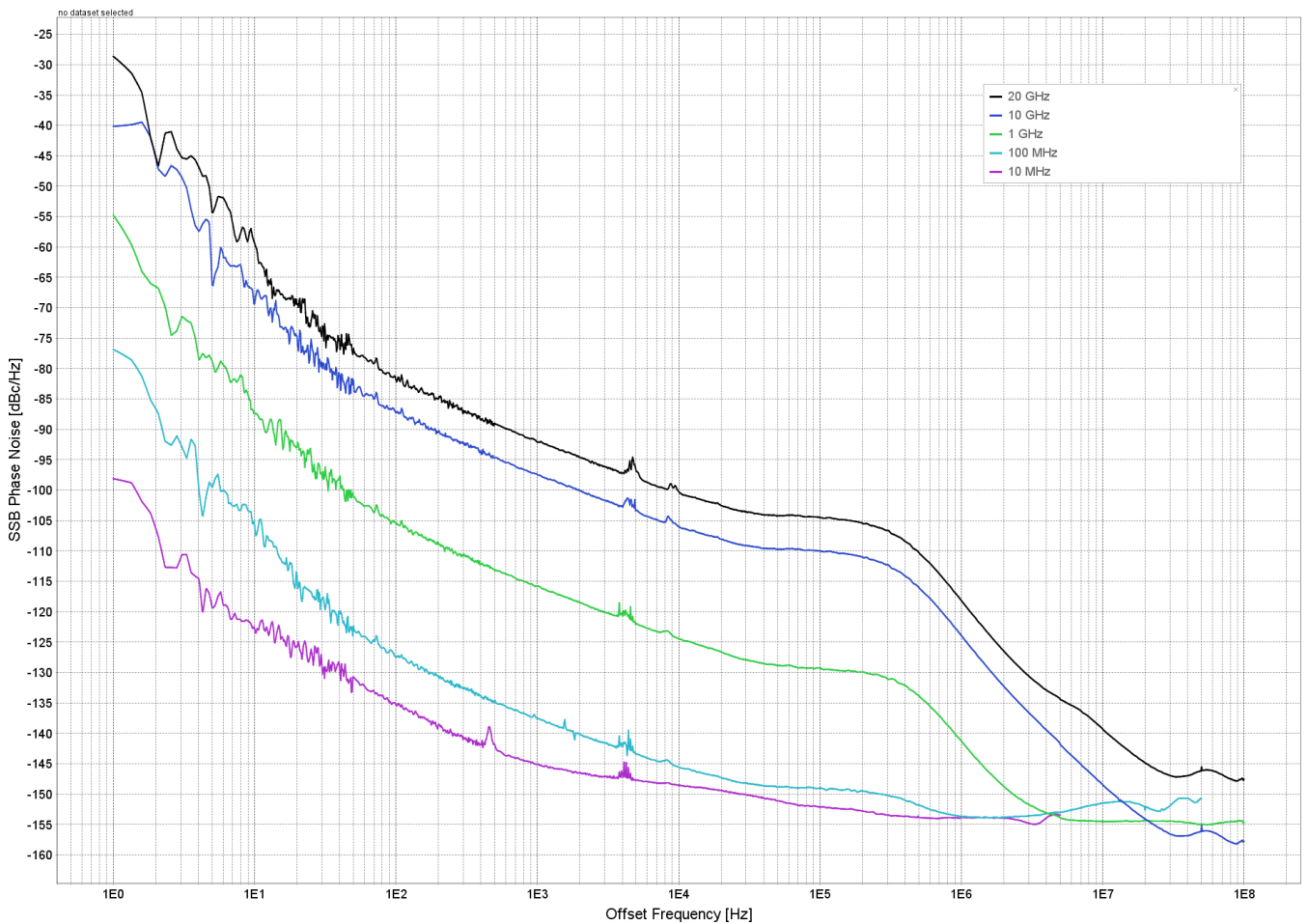
PARAMETER	MIN	TYPICAL	MAX	NOTE
<b>Trigger Types</b>				Continuous, single (point), gated, gated direction
<b>Trigger Source</b>				external, bus (LAN, USB)
<b>Trigger Modes</b>				Continuous free run, trigger and run, reset and run
Trigger uncertainty		5 $\mu$ s		
External Trigger delay	50 $\mu$ s		40 s	
External Delay Resolution		15 ns		
<b>Trigger Modulo</b>	1		255	Execute only on Nth trigger event
<b>Trigger Polarity</b>		Rising, falling		
<b>External trigger input threshold</b>	0.85 V	0.9 V	0.95 V	TTL compatible
<b>External trigger input voltage range</b>	-0.5 V		+5.5 V	TTL compatible
<b>External trigger input hysteresis</b>		60 mV		

# PERFORMANCE CURVES

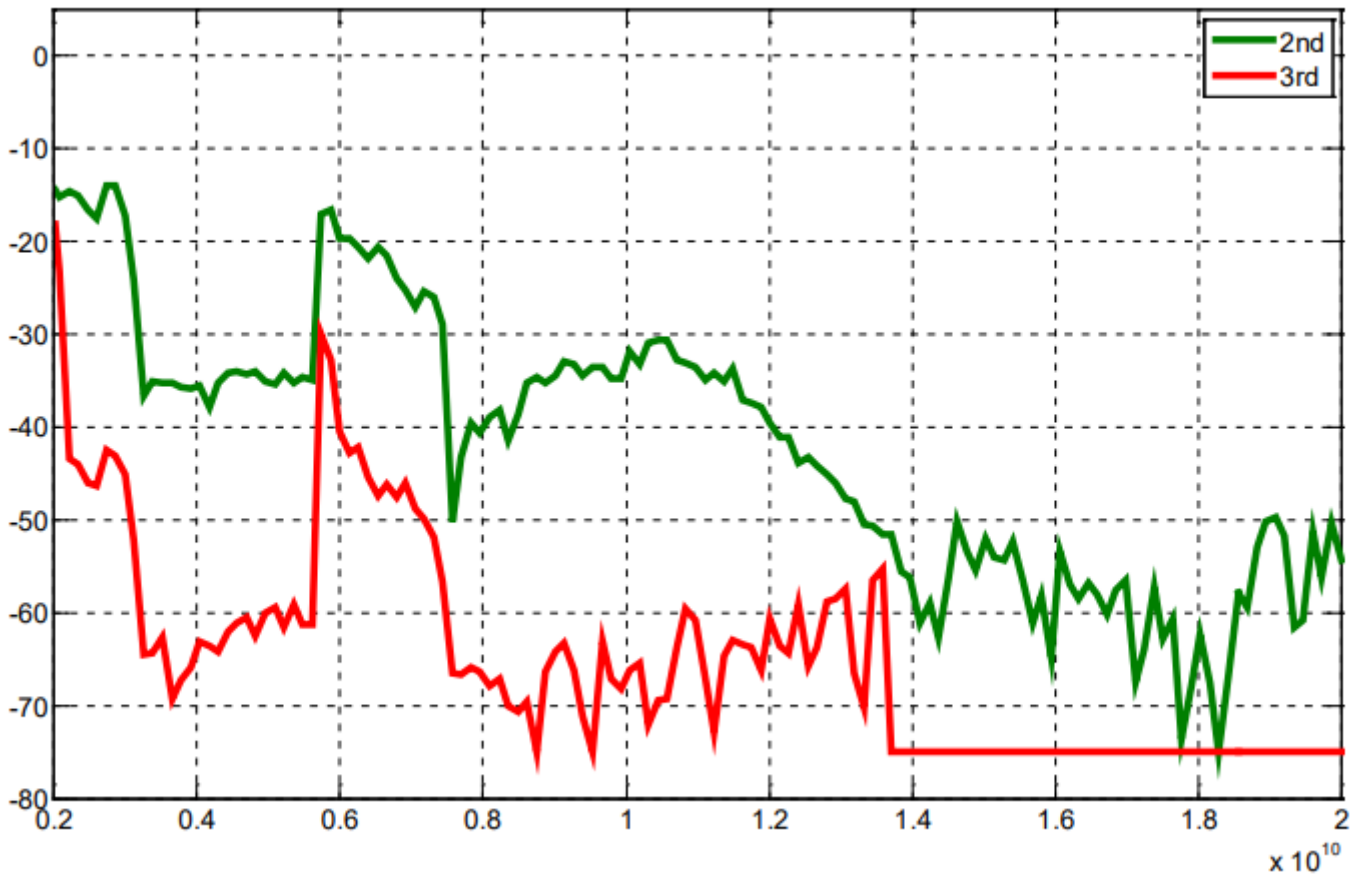
## Typical Maximum Output Power



## Phase Noise Performance

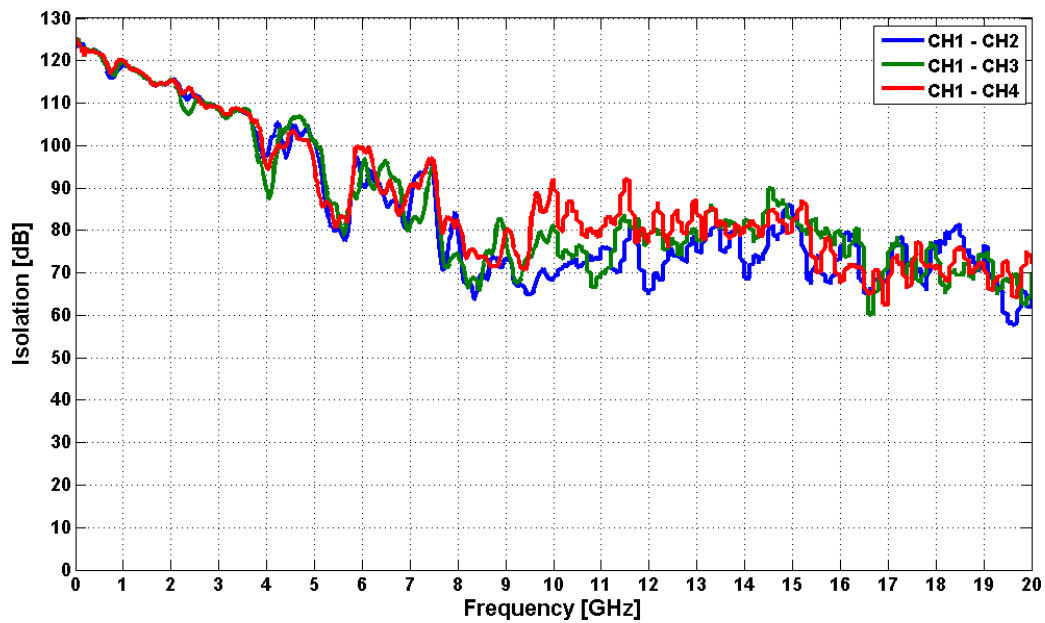


## Harmonic performance at 0 dBm



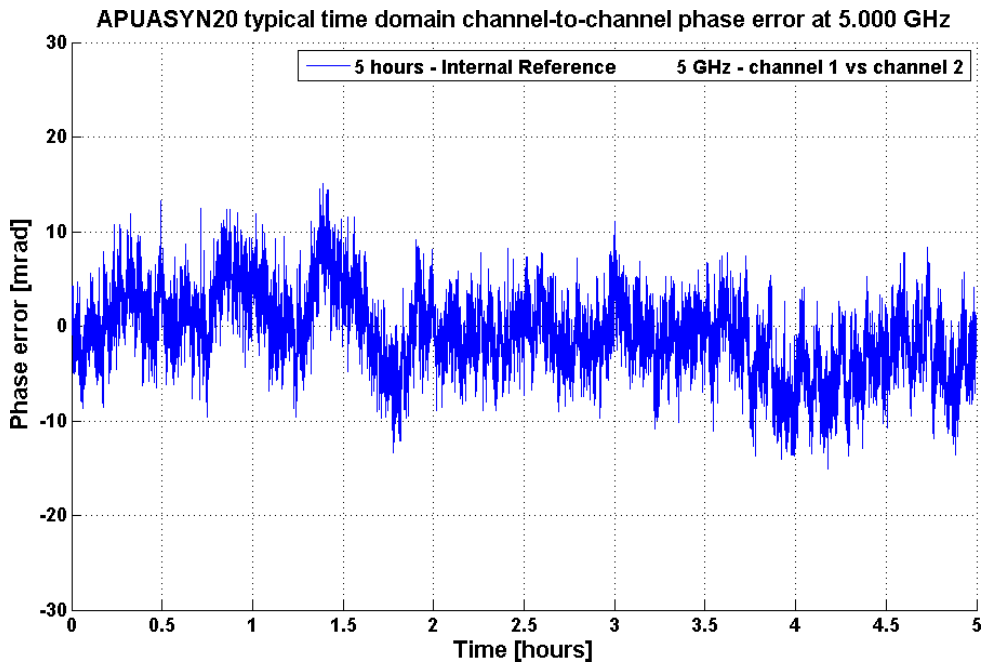
## Channel to channel isolation

The measurement shows the impact of channel #2, #3 and #4 at  $f_0+9$  MHz on the channel #1 (channel under test) operating at  $f_0$ . All channels have 10 dBm output power.

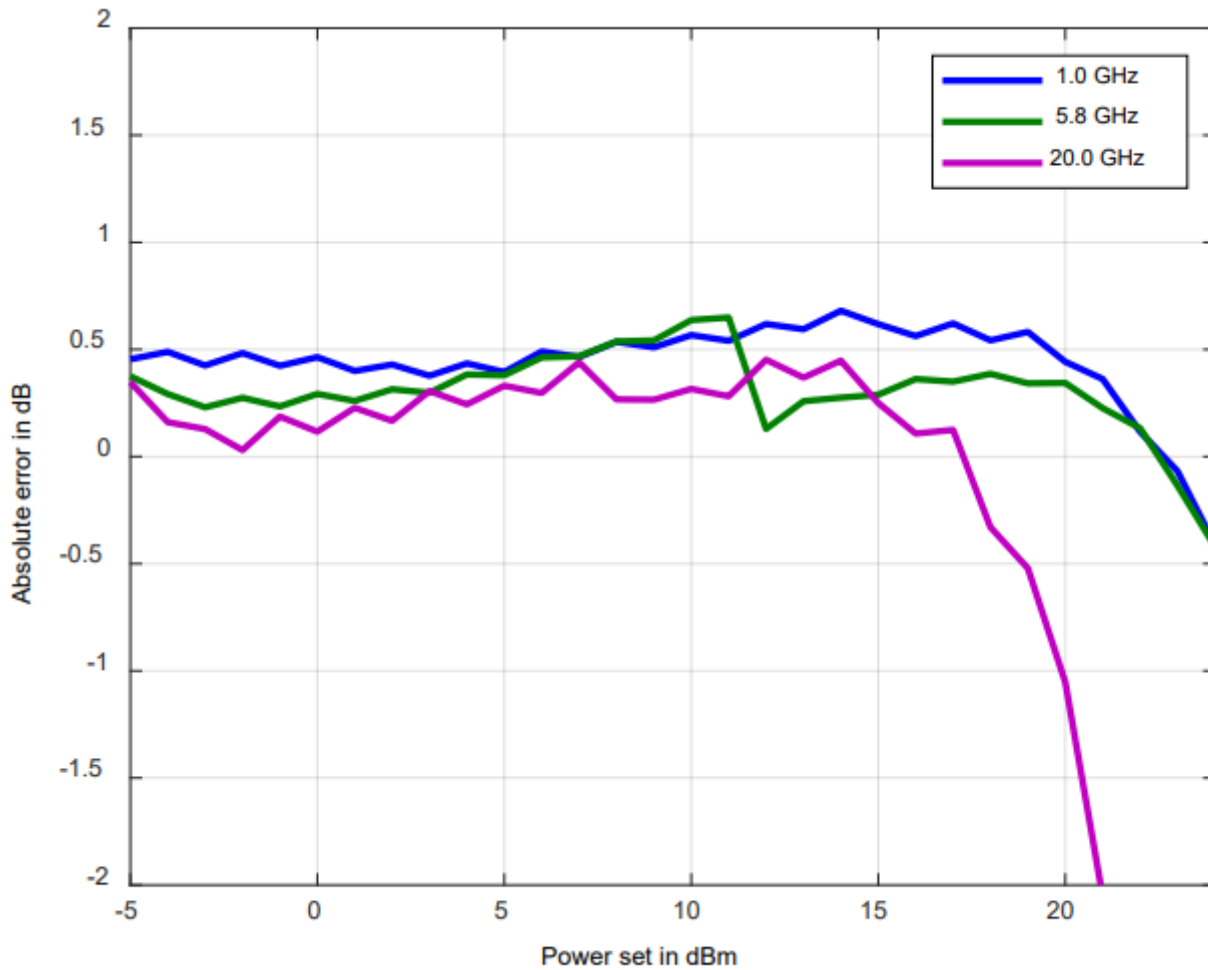


## Channel to channel phase stability

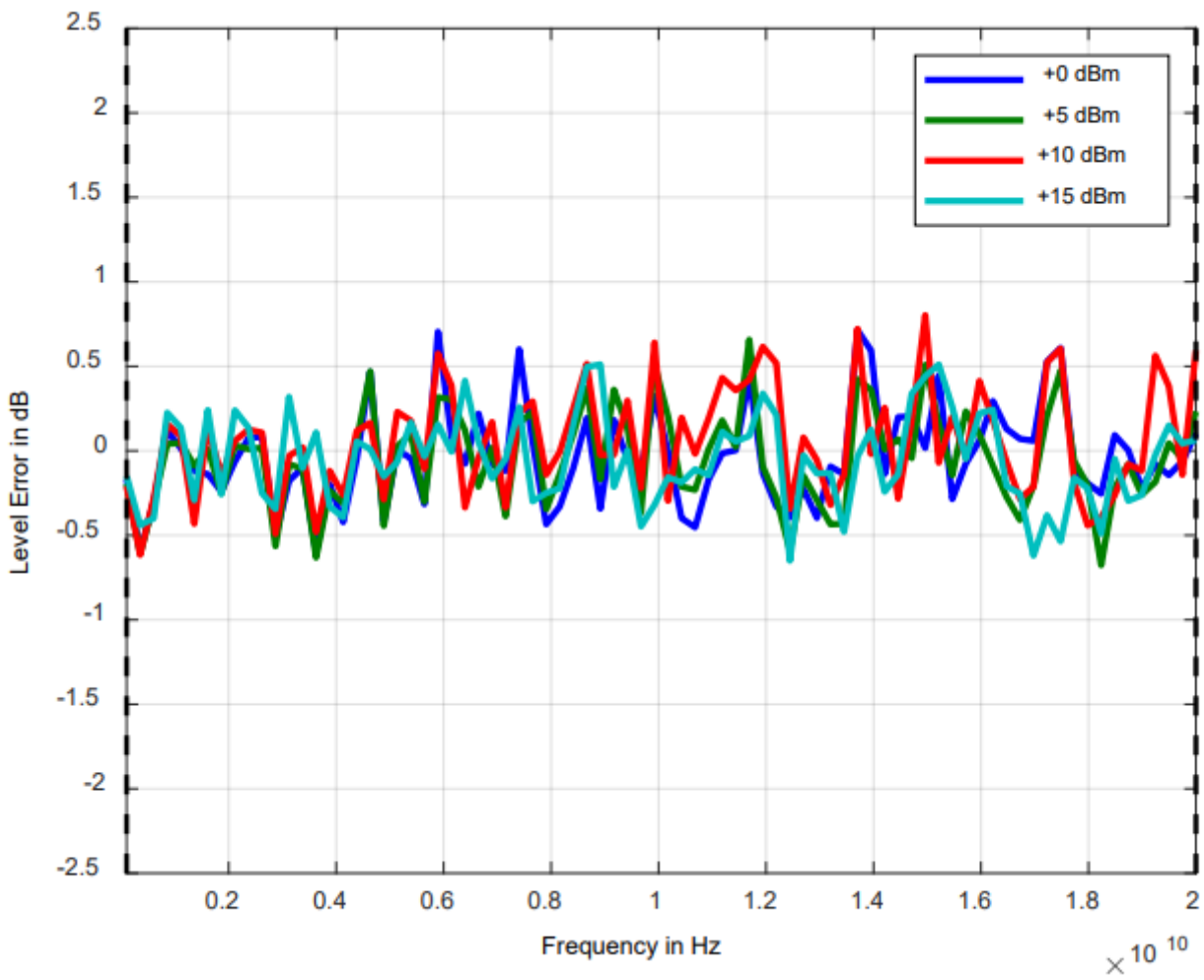
The measurement shows the phase fluctuation between two RF channels in the same device, measured over 5 hours with a 5 GHz CW signal.



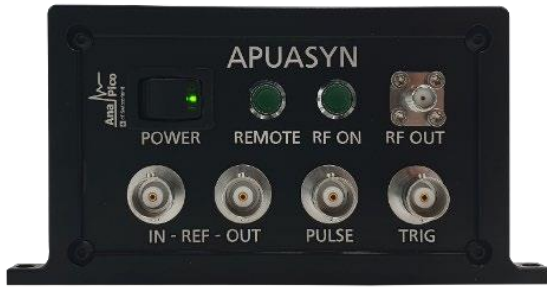
## Power linearity







**Connectors (Front)**



**Connectors (Rear)**



**RFSYN20 with Option TOUCH**



**RFSYN20-X Front view**



**RFSYN20-X Rear view**





## Fast Control Port (FCP)

- 8-bit or 16-bit parallel port for fast, time critical settings like frequency
- Sequential submission of 48-bit frequency word or access to pre-defined frequency table
- Optional amplitude control and support for multi-channel models (only with 16-bit bus)
- Signal Source confirms the received data with ACK (only in 8-bit mode) and informs the controller by the BUSY signal while processing the information.

**Connector:** 26 pin 3M Mini-D Ribbon Receptacle

**8-bit Mode:** Address A<3..0>, Data D<3..0>, STROBE, ACK, BUSY

**16-bit Mode:** Address A<7..0>, Data D<7..0>, STROBE, BUSY

**Input signal:** 0 to 5 V

**Input impedance:** 4,7 k $\Omega$

**Maximum toggle rate:** 10 MHz, frequency switching starts after transfer of last byte

## ORDERING INFORMATION

HOST MODEL	PRODUCT	DESCRIPTION
RFSYN20	RFSYN20	20 GHz wideband frequency synthesizer, flange-mount
RFSYN20-X	RFSYN20-X	Multi-channel 20 GHz frequency synthesizer, 19" 1U rack-mount
RFSYN20	Option TOUCH	Desktop enclosure with touch display control
RFSYN20	Option 8K	Frequency range extension to 8 kHz
RFSYN20	Option FS	Fast switching option (with FCP port)
RFSYN20	Option GPIB	GPIB interface (only with option TOUCH or 1U rack-mount)

## GENERAL CHARACTERISTICS RFSYN20

### Remote programming interfaces

Ethernet interface  
USB2.0 device interface  
GPIB (optional)  
Control language: SCPI Version 1999.0

**Power requirements:** 24 VDC; 20 W maximum

**Mains adapter supplied:** 100-240 VAC in / 24 V, 2 A DC out

**Storage temperature range:** -50 to 85 °C

**Operating temperature range:** -20 to 75 °C

**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



# Document History

Version	Date	Author	Notes
V10	2019-05-20	jk	first release
V11	2019-09-20	jk	added options
V12	2020-02-27	jk	Single and multi-channel version
V121	2020-03-25	jk	Plots added
V122	2020-05-08	jk	FCP specification added
V123	2020-06-01	db	FCP details added
V124	2020-10-20	jk	Refined harmonic specs
V125	2020-12-07	yg	Added multi-channel specs and pictures
V126	2021-02-25	db	Pulse and trigger input electrical specifications

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## NOTES