DATASHEET APSIN6G Specification v1.07

RF Signal Generator from 9 kHz to 6 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

Very compact, portable, high dynamic range analogue signal generator model from 9 kHz to 6 GHz.

The APSIN6G is a RF signal generator covering a continuous frequency range from 9 kHz to 6 GHz with a 0.001 Hz resolution. The APSIN6G provides an accurately levelled output power range and high spurious suppression. Advanced frequency synthesis with fractional-N divider makes for low SSB phase noise and µHz resolution.

Available Options (see Ordering Information for more options):

- **Option PE3** is an optional power level extension to accurately level below -120 dBm.
- **Option FS** substantially enhances the switching speed.
- **Option 1URM** modifies form-factor to a 19'' rack-mountable 1HU enclosure.
- **Option FILT** for harmonic filtering

FACTS & FIGURES & SPECIFICATIONS

Frequency Parameters / Range

PARAMETER	MIN	TYPICAL	MAX	NOTE
Frequency range	9 kHz		6.0 GHz	
Resolution		0.001 Hz		
Phase resolution		0.1 deg		
Frequency / Amplitude settling time		200 µs	300 µs 30 µs	 option FS

Level Performance

PARAMETER	MIN	TYPICAL	MAX	NOTE
Output power				
Standard 9 kHz to 100 kHz 100 kHz to 10 MHz > 10 MHz	 -20 dBm		 +12 dBm +20 dBm +25 dBm +24 dBm	 option FILT
Option PE3 9 kHz to 100 kHz 100 kHz to 10 MHz >= 10 MHz	 -120 dBm		 +12 dBm +20 dBm +24 dBm +23 dBm	 option FILT
Level resolution		0.01 dB		
User flatness correction		up to 2000 points		

Figure 1: Typical Maximum Output Power

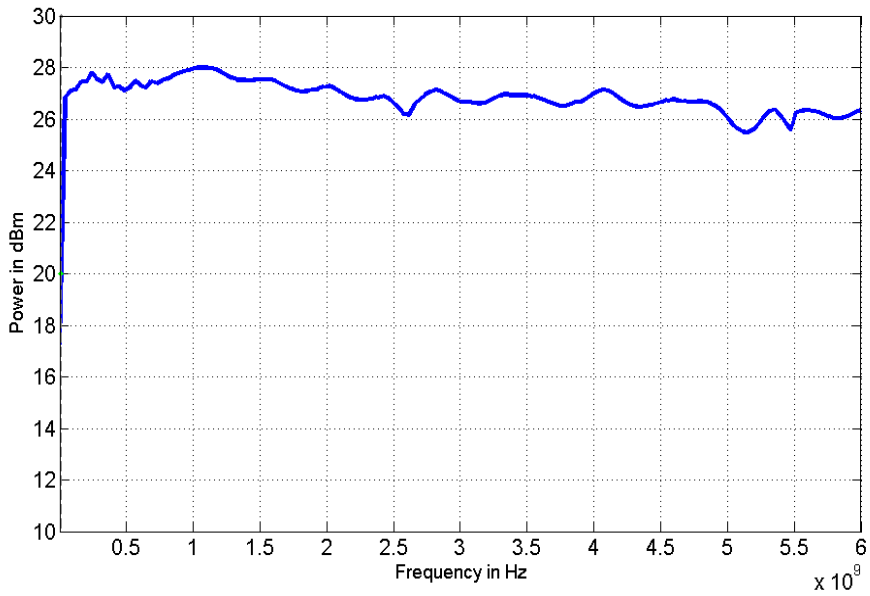


Figure 2: Typical Maximum Output Power (with option PE3)

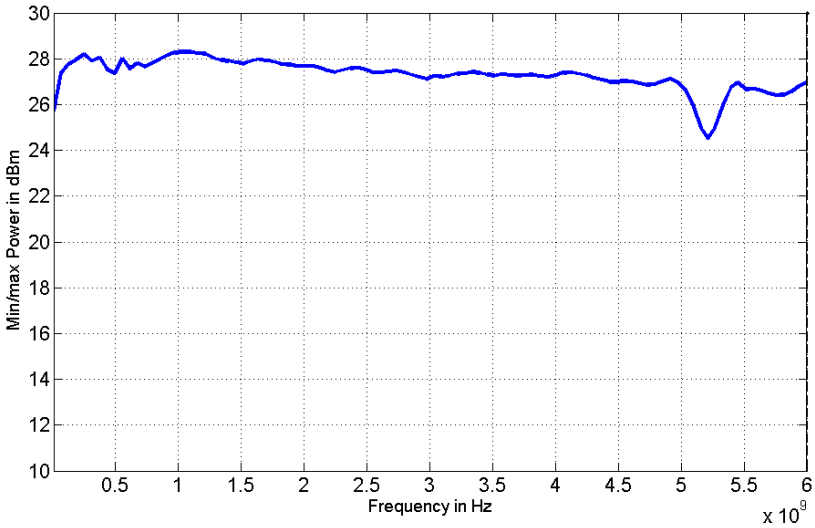
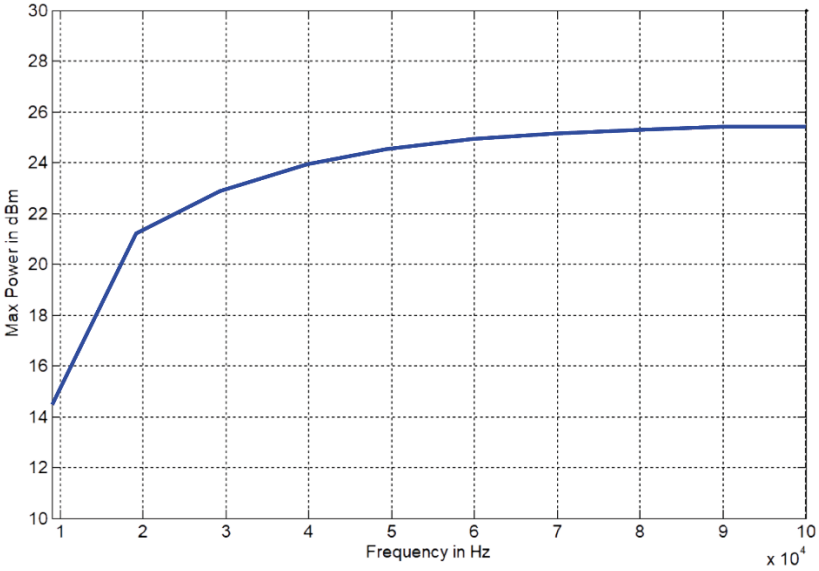


Figure 3: Typical Maximum Output Power from 9 kHz to 100 kHz



Reverse Power Protection and VSWR and Level Uncertainty

PARAMETER	MIN	TYPICAL	MAX	NOTE
Level uncertainty, ALC on		0.3 dB 0.6 dB 1.5 dB 2.0 dB	1.0 dB 1.5 dB	-20 to +15 dBm -65 to -20 dBm -100 to -65 dBm < -100 dB
Temperature effects		0.015 dB/°C		< -0 to 45°C
Reverse Power Protection				
DC Voltage			±15 V	
RF power			30 dBm	
Output impedance VSWR		50 Ω 1.5		

Figure 4: VSWR

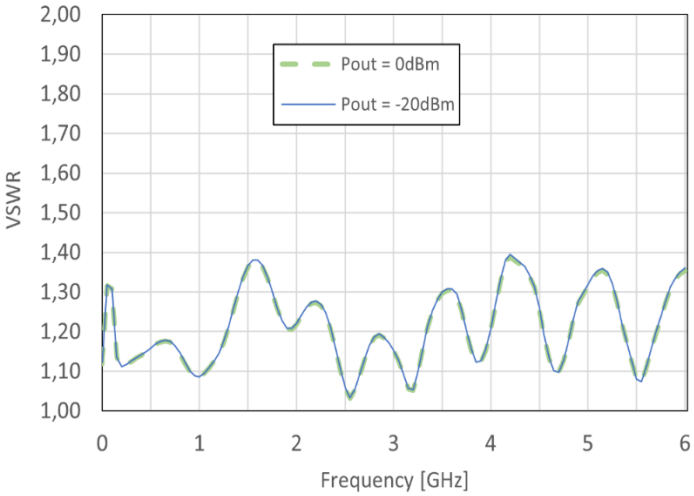
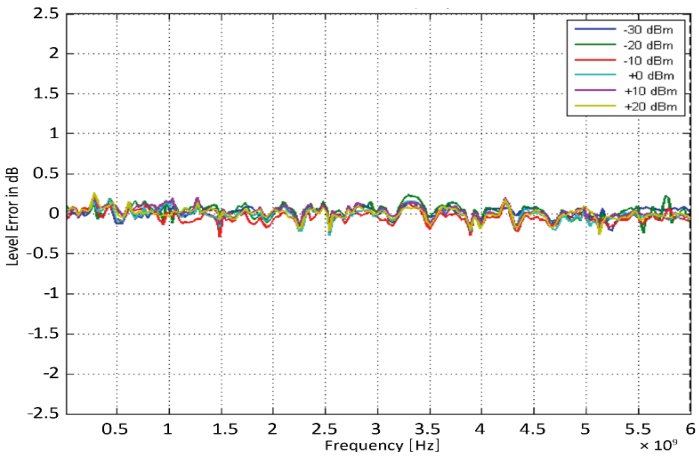


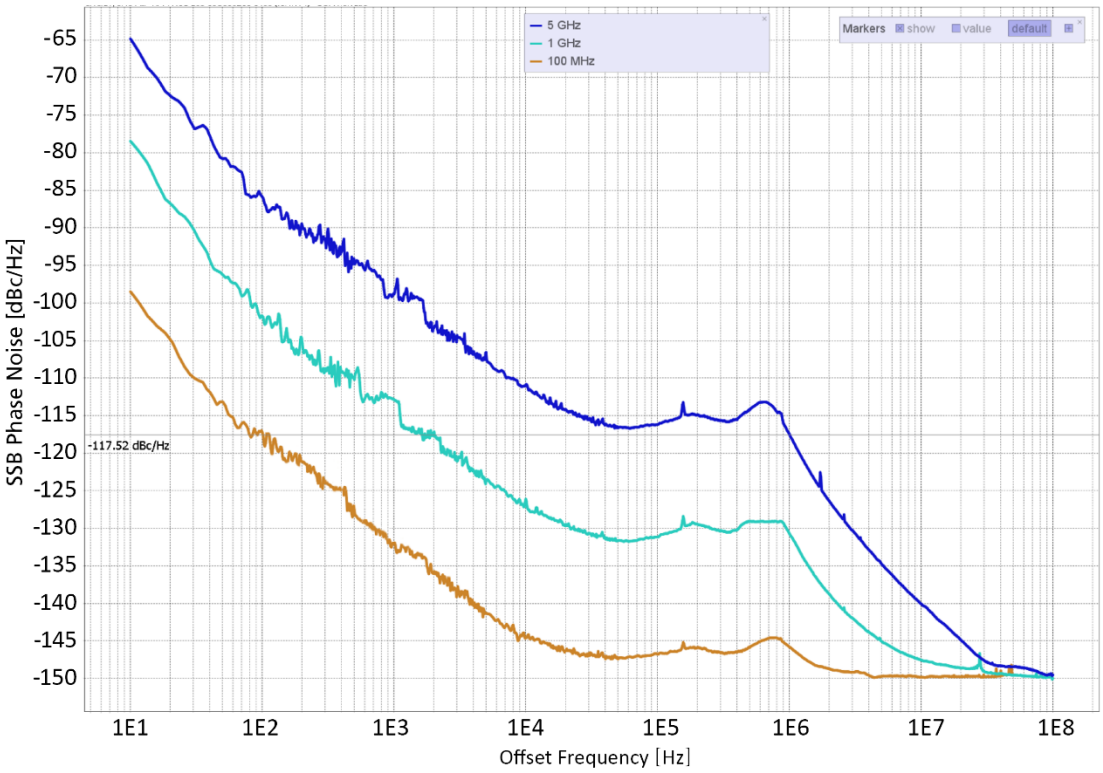
Figure 5: Typical Frequency Response 0.01 to 6 GHz



Phase Noise

PARAMETER	MIN	TYPICAL	MAX	NOTE
SSB Phase noise standard				
1 GHz				
10 Hz offset		-80 dBc/Hz	-76 dBc/Hz	
20 kHz offset		-130 dBc/Hz	-128 dBc/Hz	
100 kHz offset		-134 dBc/Hz	-130 dBc/Hz	
4 GHz				
10 Hz offset		-68 dBc/Hz	-64 dBc/Hz	
20 kHz offset		-119 dBc/Hz	-116 dBc/Hz	
100 kHz offset		-119 dBc/Hz	-115 dBc/Hz	
Wideband noise		-150 dBc/ Hz		

Figure 6: Phase Noise Performance (10 Hz to 100 MHz offset) at different frequencies



Spectral Purity

PARAMETER	MIN	TYPICAL	MAX	NOTE
Spectral purity at + 5 dBm Output harmonics 3.7 GHz		-40 dBc	-30 dBc -50 dBc	See plot Option FILT
Sub-harmonics		-75 dBc	-65 dBc	
Non-harmonic spurious < 312 MHz > 312 to 625 MHz > 625 MHz to 1.5 GHz > 1.5 GHz to 2.5 GHz > 2.5 GHz to 6 GHz		 -80 dBc -75 dBc -75 dBc -70 dBc -65 dBc	 -66 dBc -70 dBc -65 dBc -65 dBc -60 dBc	CW +10 dBm, > 3 kHz offset

Figure 7: Harmonics (5 dBm)

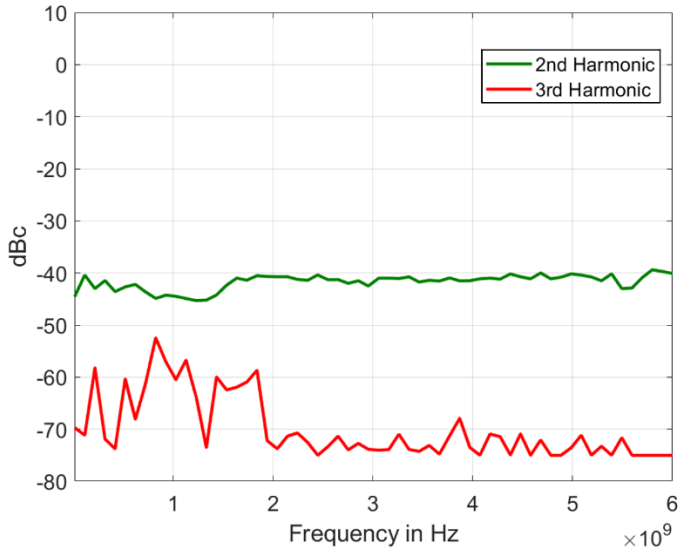
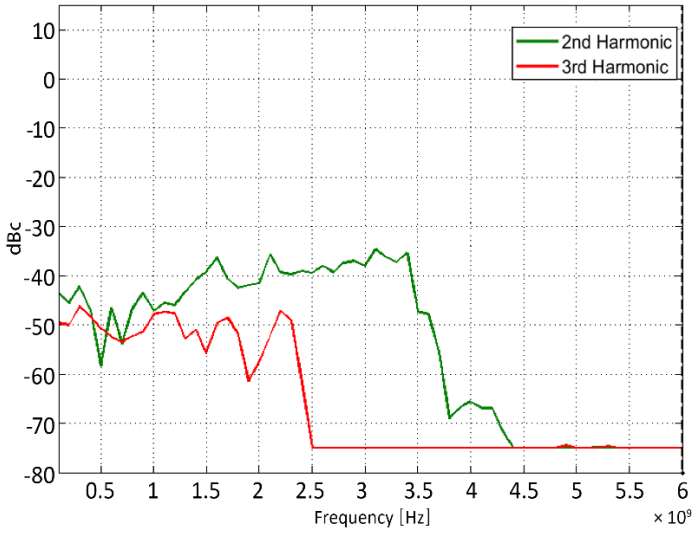


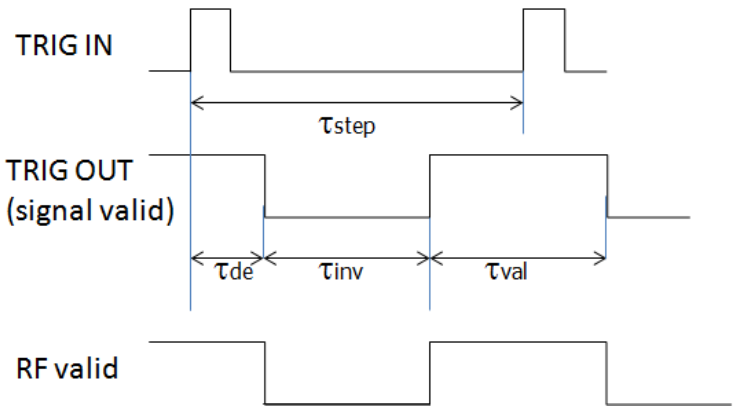
Figure 8: Harmonic performance APSIN6G with option FILT



Sweeping Capability

Sweeps can be performed with combined internal or external AM/FM/PM/pulse modulation running. With modulation enabled, the minimum step time increases to 2 ms.

PARAMETER	MIN	TYPICAL	MAX	NOTE
Digital power / frequency / list sweeps Sweep type: linear, logarithmic, random				
Step time (τ_{step})	400 µs 40 µs		19998 s	 Option FS
Dwell time (τ_{val})	10 µs		9999 s	
Off-time (incl. transient time) (t_{off})	0		9999 s	
Transient time (τ_{inv})			270 µs 30 µs	 Option FS
Timing delay (τ_{de})		2 to 10 µs 50 ns		 Option FS
Time resolution		0.1 µs 5 ns		 Option FS
Timing accuracy per point		3 µs 5 ns		 Option FS



Modulation Capabilities

Combination of AM/PM/FM/PULSE are possible. See user manual for more

Multifunction Generator

PARAMETER	MIN	TYPICAL	MAX	NOTE
Multifunction Generator sine, triangle, square wave Output is FUNC OUT at rear panel				
Frequency range	10 Hz 10 Hz		3 MHz 1 MHz 50 kHz	sine triangle square
Frequency resolution		0.1 Hz		
Output voltage amplitude peak-peak	10 mV	 5V	2 V	Sine, triangle Square (CMOS output)
Harmonic Distortion		1%		< 100 kHz, 1 Vpp
Output impedance		50 Ω CMOS		Sine, triangle square wave

Pulse Modulation

PARAMETER	MIN	TYPICAL	MAX	NOTE
Pulse Modulation On/off ratio		75 dB (typical)		at +10 dBm
Repetition frequency	DC		10 MHz	
Pulse width	100 ns 500 ns		5 s 5 s	ALC hold ALC on
Pulse rise/fall time		7 ns		
Duty cycle	0.05%		99.95%	
Pulse resolution		15 ns		
Polarity		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		
Delay (to RF)		20 ns	40 ns	

Pulse Pattern Modulation

PARAMETER	MIN	TYPICAL	MAX	NOTE
Pulse Pattern Modulation On/off ratio		75 dB		Using internal pattern generator at +10 dBm
Pulse bit width	30 ns 500 ns			ALC hold ALC on
Pulse rise/fall time		30 ns 7 ns		<5 GHz >5 GHz
Programmable pattern length	2		4192	
Duty cycle	0.05%		99.95%	
Pulse bit resolution		30 ns 10 ns		Option FS
Polarity		selectable		

Frequency Modulation

PARAMETER	MIN	TYPICAL	MAX	NOTE
Frequency Modulation Maximum Frequency deviation (peak)		> 0.05·f N · 200 MHz		< 1.25 GHz 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)
Deviation accuracy < 100 kHz rate > 100 kHz rate		0.5% 2%	2% 5%	
Distortion		< 1%		1 kHz rate, 50 kHz deviation
Modulation rate	DC		800 kHz	> -3dB frequency response
Modulation waveforms		Sine, triangle, FSK		
External input sensitivity AC coupled DC coupled		0 to N · 200 MHz / V 0 to N · 100 MHz / V		adjustable for ±1 V range discr. values; ±5 V range
Total harmonic distortion		< 1%		1 kHz rate & N · 1 MHz deviation

Frequency Chirps

(Linear ramp, up/down)

PARAMETER	MIN	TYPICAL	MAX	NOTE
Span			10%	of carrier frequency
Chirp time (t_{chirp})	10 ns		60 s	
Slope			100 MHz/ µs	
Total duration of finite repeated chirps (t_{chirp} * repetitions)			64.1 s 21.1 s	with option FS
Number of frequencies			65’000	

Phase Modulation

PARAMETER	MIN	TYPICAL	MAX	NOTE
Phase Modulation Phase deviation (peak)	0		N·300 rad	
Modulation rate	DC		800 kHz	> -3dB frequency response Max. phase deviation degrades above 20 kHz modulation rate
Modulation waveforms	Sine, triangle, FSK			
External Input sensitivity	Settable 0.1 rad/V to 360 rad/V			
Total harmonic distortion	< 1%			1 kHz rate & N x 100 rad deviation

Amplitude Modulation

PARAMETER	MIN	TYPICAL	MAX	NOTE
Amplitude Modulation				
Modulation rate	0.1 Hz		50 kHz	
Modulation waveforms	Sine, triangle, square			
Modulation depth	0%		90%	settable
Distortion (sine wave)		2%	7%	at 60% modulation depth

Reference Frequency

REF IN input and REF OUT output are at rear panel

PARAMETER	MIN	TYPICAL	MAX	NOTE
Internal reference frequency		100 MHz		
Initial accuracy			±40 ppb	calibrated at 23 ± 3 °C at time of calibration, user adjustable
Temperature stability (0 to 50 °C)			±100 ppb	
Aging 1st year			0.5 ppm	
Aging per year after 1st year			0.1 ppm	
Aging per day (after 30 days operation)			5 ppb	
Warm-up time		5 min		
Output of internal reference		10/100 MHz		Selectable
Output power		0 dBm		
Output impedance		50 Ω		
Bypass Internal reference Input	100 MHz, -5 to +10 dBm			High phase synchronous mode
Phase Lock to External Reference External Input Range	1 MHz		250 MHz	User programmable
Reference input level	-5 dBm	0 dBm	+13 dBm	
Lock Range			±1.5 ppm	
Reference input impedance		50 Ω		

Multi-Purpose Output (FUNC OUT)

Output is FUNC OUT at rear panel

PARAMETER	MIN	TYPICAL	MAX	NOTE
MULTIFUNCTION GENERATOR sine, triangle, square wave				
Frequency range	1 Hz 1 Hz		3 MHz 1 MHz	sine triangle

			50 kHz	square
Frequency resolution		0.1 Hz		
Output voltage amplitude peak-peak	10 mV	5V	2 V	Sine, triangle Square (CMOS output)
Harmonic Distortion		1%		< 100 kHz, 1 Vpp
Output impedance		50 Ω CMOS		Sine, triangle square wave
VIDEO OUTPUT (of internal pulse modulator)				
Output		CMOS		
Period	30 ns		50 s	
Pulse Width	15 ns		50 s	
RF delay		10 ns		
TRIGGER OUT Synchronization mode for multiple sources				
Modes	Trigger on sweep start Trigger on each point Signal Valid			Option FS

Trigger (TRIG IN)

Input is TRIG IN at rear panel

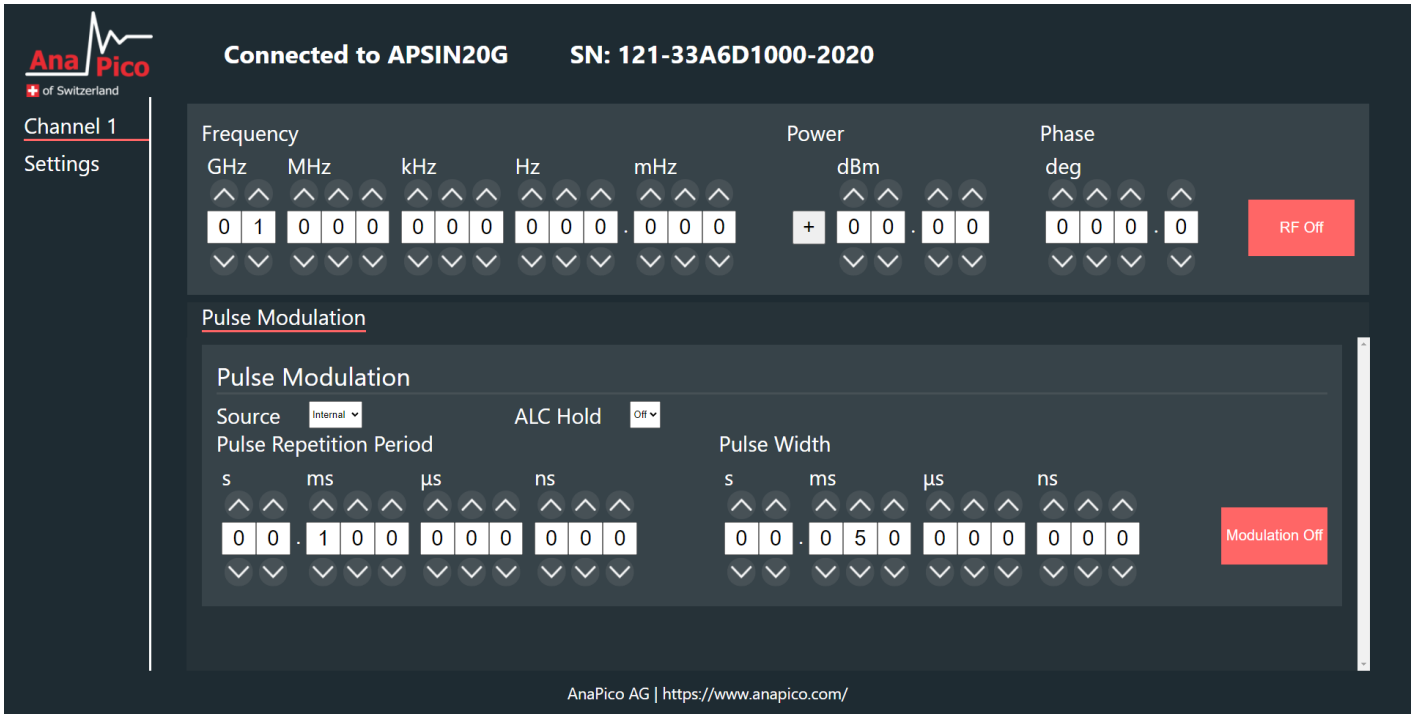
PARAMETER	MIN	TYPICAL	MAX	NOTE
Trigger Types	Continuous, single, gated, gated direction			
Trigger Source	RF key, external, bus (GPIB, LAN, USB)			
Trigger Modes	Continuous free run, trigger and run, reset, and run			
Trigger latency		2 µs 5 ns		Option FS
Trigger uncertainty		5 µs 10 ns		Option FS
External Trigger delay	50 µs 50 ns		40 s 10 s	programmable Option FS
External Delay Resolution		15 ns 10 ns		Option FS
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		

Trigger Output (TRIG OUT)

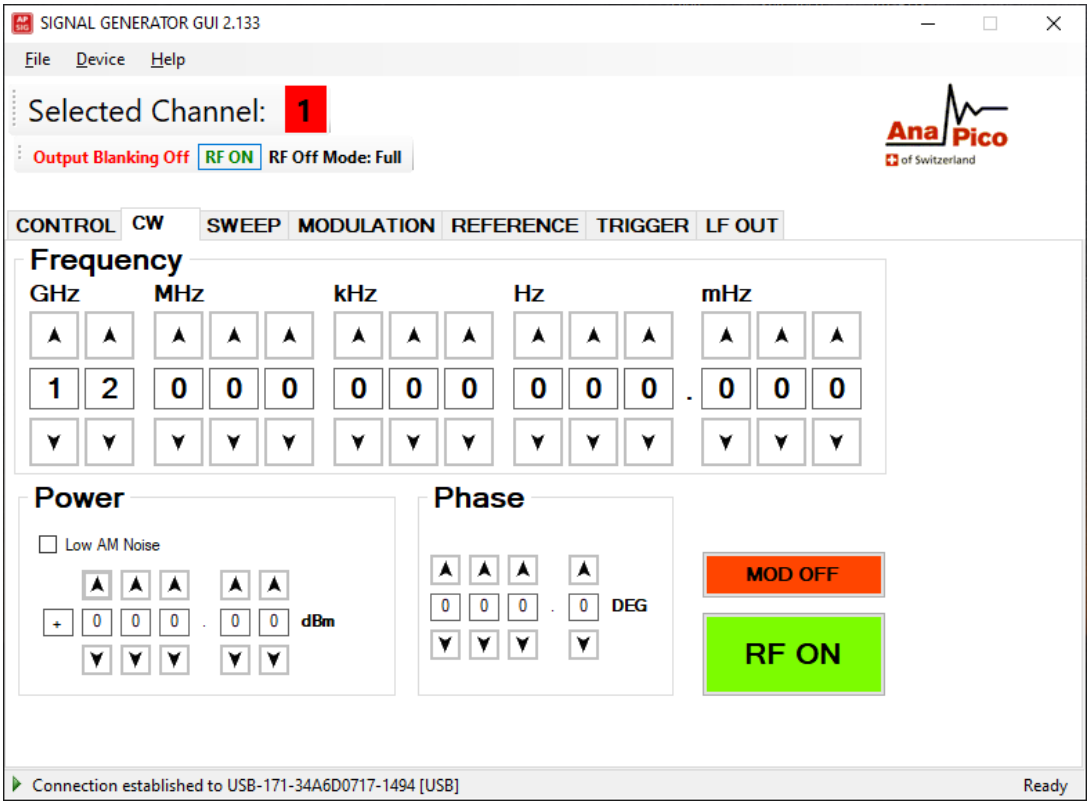
see Multi-Purpose Output (FUNC OUT)

GUI

Web Browser

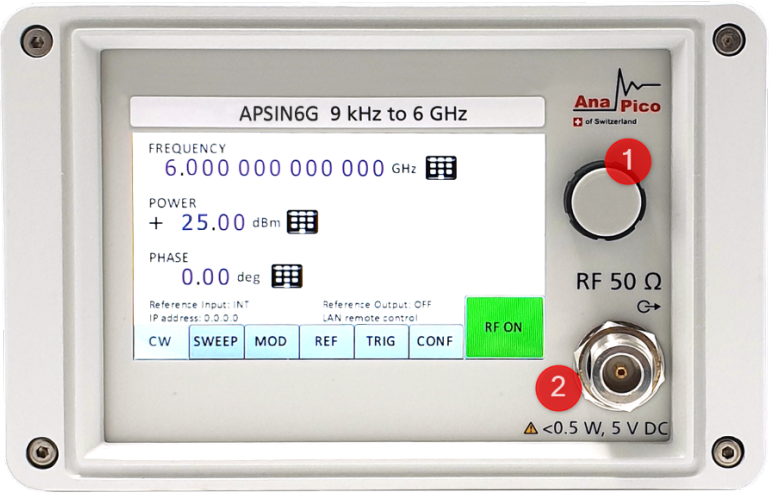


AnaPico Signal Generator GUI



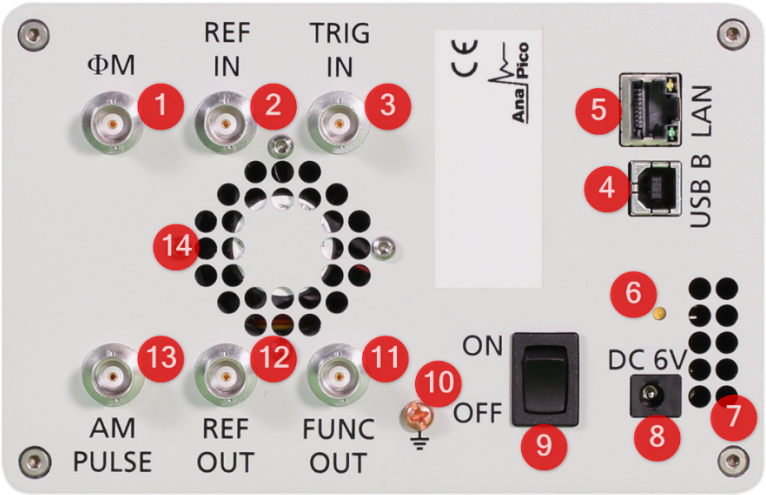
Connectors

Front



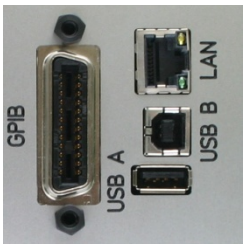
1. **Rotary Button** The rotary button is used to change the value selected on the screen.
2. **RF 50 Ω connector** This female N- type respectively SMA connector provides the output for generator signals. The impedance is 50 Ω. The reverse power damage level is +30 dBm maximum. The maximum allowed DC level is +/- 10 V. Please check the data sheets for more details.

Rear



1. **ΦM** This BNC female Connector is the input for FM and PM.
2. **REF IN** This BNC female Connector is the input for the reference signal.
3. **TRIG IN** This BNC female Connector is the trigger input.
4. **USB B** The USB B connector is used to connect the device to a computer.
5. **LAN** The LAN connector is used to connect the device to a network.
6. **Battery LED** In case the device has a rechargeable battery, this LED indicates whether the battery is charged or not.
7. **Fan Holes** The air intake of the fan.
8. **Power Supply** Connect the Anapico power adaptor to this connector to supply the device with energy.
9. **ON/OFF Switch** Turns the device on or off.
10. **Ground Screw**
11. **FUNC OUT** This BNC female Connector is the output for the function signal.
12. **REF OUT** This BNC female Connector is the output for the reference signal.
13. **AM PULSE** This BNC female Connector is the input for the AM and the PULSE Modulation signal.
14. **Fan Holes** The holes by which the air is extruded.

ORDERING INFORMATION

HOST MODEL	PRODUCT	DESCRIPTION
APSIN6G	**APSIN6G**	6 GHz RF Signal Generator
APSIN6G	**Option PE3**	Mechanical step attenuator
APSIN6G	**Option FS**	Ultra-fast switching speed
APSIN6G	**Option FILT**	Harmonic filtering
APSIN6G	**Option FLASH**	MicroSD card slot for removable SD memory
APSIN6G	**Option DATA**	Commercial Calibration Certificate with test data
APSIN6G	**Option Bag**	Portable Bag
APSIN6G	**Option GPIB***	GPIB interface 
APSIN6G	**Option EB6**	External power bank adapter cable with voltage converter for 12 to 25 V supply Required input connector: Inner / outer diameter 2.1 / 5.5 mm
APSIN6G	**Option 1URM**	19" 1HU rack-mount module Dimensions 42 mm H x 426 mm W x 460 mm L [1.7 in H x 16.8 in W x 18.1 in L]
APSIN6G	**Option RM**	19'' 3HU rack-mount kit
APSIN6G	**Option REAR**	Move output to rear panel
APSIN6G	**Option OEM**	OEM package
APSIN6G	**Option WE**	One year warranty extension (standard: 2 years)
APSIN6G	**Option ReCal**	Recalibration with test data (recommended: 2 years interval)
APSIN6G	**Option Retrofit**	Applies when options are backordered

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 requirement: 6.25 ± 0.2 VDC; 20 W max.
Main adapter supplied: 100-240 VAC in/ 6 V 6.0 A DC out
Environmental: (Levels similar to MIL-PRF-28800F Class 3/4)
Environmental stress Samples of this product have been type tested to be robust against the environmental stresses of storage, transportation, and end-use, those stresses to temperature, humidity, shock, vibration, altitude, and power line conditions.

Operating temperature range: 0 to 45 °C
Storage temperature range: –40 to 70 °C
Relative humidity range: max. 85% (non-condensing)
Operating and storage altitude: up to 15,000 feet (4600 m)

CE **notice**

EMC complies and EMC regulations and directives for emission and immunity to interference (EN 61326-1 Industrial, EN/IEC 61326-2-1)
Safety complies with applicable Safety regulation in line with IEC/EN 61010-1

Weight: ≤ 2.75 kg net, ≤ 4 kg shipping

Dimensions: 117 mm H x 178 mm W x 261 mm L (incl. connectors)

Recommended calibration cycle: 24 months

Document History

Version	Date	Author	Notes
V1.00	2021-09-01	jk	first release
V1.01	2021-11-15	yg	Refining specs with freq. stability, humidity, etc.
V1.02	2023-09-25	ap	Added option FILT; refining specs phase noise
V1.03	2023-10-23	ap	Added VSWR plot
V1.04	2024-06-05	ap,ph	Refined Chirp modulation
V1.06	2024-08-19	sh	Refined humidity specification
V1.07	2024-08-30	ap/ys	Removed option IEC

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