

APSIN6010 Specification 1.45

Portable Analog Signal Generator



Introduction

The APSIN 6010 is a low-noise and fast-switching analogue signal generator covering a frequency range from 9 kHz up to 6.1 GHz.

The APSIN 6010 provides full RF signal generator capabilities including OCXO-stabilized low phase-noise signal with micro-Hz frequency resolution, wide and accurately levelled output power range, extensive modulation capabilities, and fast switching.

It is targeted for a wide range of applications where a high-quality analogue signal is mandatory, offering an alternative to expensive high-end RF signal generators, where small size and excellent RF performance at an attractive cost is required.

The very compact and rugged design of the APSIN 6010 operates at very low DC power consumption (only 12 watts), with minor heat dissipation and not requiring noisy fan. This gives the APSIN 6010 a great advantage in laboratories or production test facilities.

The low power design allows the use of optional internal battery modules which make it a truly portable instrument, ideally suited for field testing, installation, and maintenance.

19 inch rack-mount solutions (APSIN6010RM) are also available.

The APSIN 6010 support various standard interfaces such as USB (USBTMC), LAN (VXI-11), or GPIB and extensive API with programming examples are available.

Signal Specifications

The specifications in the following pages describe the warranted performance of the signal generator for 25 ± 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	9 kHz		6.1 GHz	overrange to 6.2++ GHz
resolution		0.001 Hz		
Phase resolution		0.1 deg		
Settling time		20 μ s	100 μ s	transient to reach frequency accuracy to 1 ppm
Frequency update rate		300 μ s		time from receipt of SCPI command
List/Sweep mode		300 μ s		firmware
SSB Phase noise at 1 GHz at 20 kHz from carrier		-130 dBc/Hz		See measured phase noise plots
Wideband noise		-150 dBc/Hz		
Total jitter		68 fs RMS		10 Hz to 1 MHz BW
Spectral purity Output harmonics Sub-harmonics		-40 dBc	-30 dBc -70 dBc	$P_{out} = +10$ dBm; $f > 10$ MHz
Non-harmonic spurious < 1 MHz > 1 MHz		-70 dBc -75 dBc	-60 dBc -65 dBc	$P_{out} = +10$ dBm
Residual FM @ 1 GHz			3 Hz 12 Hz	0.3 kHz to 3 kHz, weighted (ITU-T) 0.03 kHz to 23 kHz
Residual AM @ 1 GHz		tbd		RMS value (0.01 kHz to 15 kHz)
Power level (see plot on p. 6)				
Range 9 kHz to 10 MHz 10 MHz to 5.0 GHz >5.0 GHz 9 kHz to 6.2 MHz	-30 dBm -30 dBm -30 dBm -100 dBm -120 dBm		+13 dBm +16 dBm +13 dBm +13 dBm +13 dBm	ALC ON with Option PE with option PE3
Resolution		0.05 dB		
Level uncertainty			< 0.8 dB < 1.2 dB	ALC ON, > -30 dBm ALC ON, > -110 dBm
Output impedance		50 Ω		
Reference frequency input	1 MHz		250 MHz	User programmable
Reference input level	-5 dBm	0 dBm	+13 dBm	
Lock Range			+/- 1.0 ppm	
Reference input impedance		50 Ω s		
Internal reference frequency output		10 MHz		
Temperature stability (0 to 50 degC)			± 100 ppb	

Parameter	Min.	Typ.	Max.	Note
Aging 1 st year		0.5 ppm		
Aging per day (after 30days operations)			5 ppb	
Warm-Up time		5 min		
Output of internal reference		+5 dBm 50 Ωs		
Reverse Power Protection				
DC Voltage		30 V		
RF power			36 dBm	
Dimensions				
Excluding connectors	W x L x H = 172 x 220 x 106 mm			
Including connectors	W x L x H = 172 x 243 x 106 mm			

Notes:

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.	Typ.	Max.	Note
Frequency sweep				
Sweep type: linear, logarithmic, random				
Step time (t_{step})	200 μs			
Dwell time (t_{dwell})	50 μs			
Off-time (incl. transient time) (t_{off})	50 μs		t_{step}	
Timing accuracy per point		1 μs		
Generalized list sweep				
allows individual setting of frequency, power, dwell-time, and off-time for each point				
List size	2		65'000	
Step time (t_{step})	300 μs			
Dwell time ($t_{dwell}(t)$)	50 μs			
Off-time (incl. transient time) (t_{off})	50 μs		t_{step}	
Time resolution		0.1 μs		
Timing accuracy per point		1 μs		
Trigger				
auto, bus (SCPI), trigger key, external				
Trigger delay	50 μs		10'000 μs	
Trigger modulo (use every Nth trigger)	1		255	
Trigger edge: positive or negative				

Modulation Capabilities

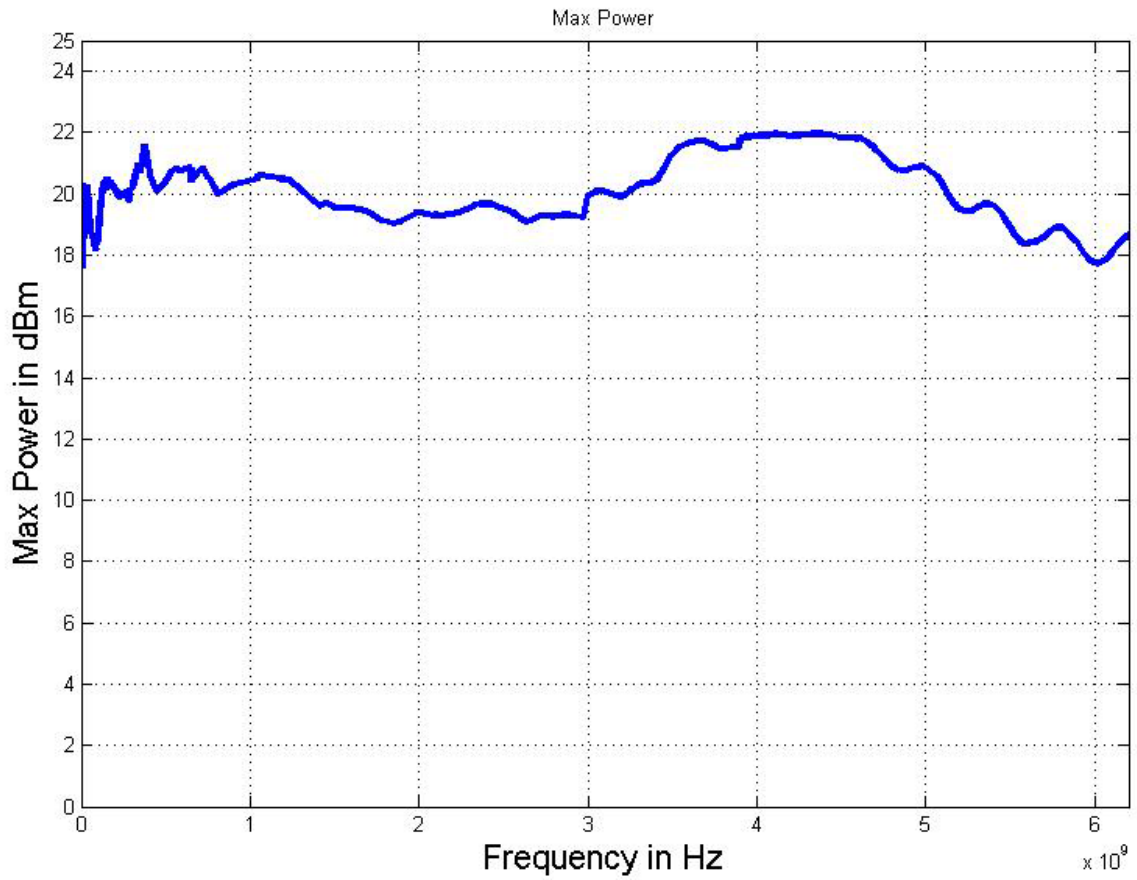
All modulation types (FM, PM, AM, and pulse modulation) may be simultaneously enabled except: FM and phase modulation can not be combined. For example, AM and FM can run concurrently and will modulate the output RF.

Parameter	Min.	Typ.	Max.	Note
Multifunction Generator	sine, triangle, square wave			
Output is Sync Out at rear panel				
Frequency range	1 Hz 1 Hz		3 MHz 1 MHz 50 kHz	sine triangle square
Frequency resolution		0.1 Hz		
Output voltage amplitude peak-peak	10 mV	5 V	2 V	Sine, triangle Square (CMOS output)
Sine Harmonic Distortion		1 %		< 100 kHz, 1 Vpp
Output impedance		50 Ohms CMOS		Sine, triangle square wave
Pulse modulation				
On/off ratio		70 dB		
Repetition frequency	DC		5 MHz	
Pulse width	40 ns 50 μs			ALC hold ALC on
Pulse rise/fall time		5 ns		
Video crosstalk		-40 dB		
External input amplitude		1 V TTL		AC DC
Frequency modulation				
Maximum Frequency deviation (peak)	> 2 MHz N x 100 MHz		< 0.37 GHz 0.37 GHz to 0.75 GHz (N=0.125) 0.75 GHz to 1.5 GHz (N=0.25) 1.5 GHz to 3 GHz (N=0.5) > 3 GHz to 6.1 GHz (N=1)	
Modulation rate	1 Hz/DC		800 kHz	-3dB frequency response
External input sensitivity	< N · 100 MHz for 1 Vpp			settable in AC mode discrete values in DC mode
Total harmonic distortion	< 1%			1 kHz rate & N · 100 kHz deviation
Phase modulation				
Phase deviation (peak)	0		N·80 rad	
Modulation rate	1 Hz		800 kHz	> -3dB frequency response
External Input sensitivity	N · 40 rad for 1 Vpp			
Total harmonic distortion	< 1%			1 kHz rate & N · 20 rad deviation
AM Modulation				
Modulation rate	0.1 Hz		20 kHz	
Modulation depth	0 %		90 %	
Distortion		2 %		
Accuracy		3 %		

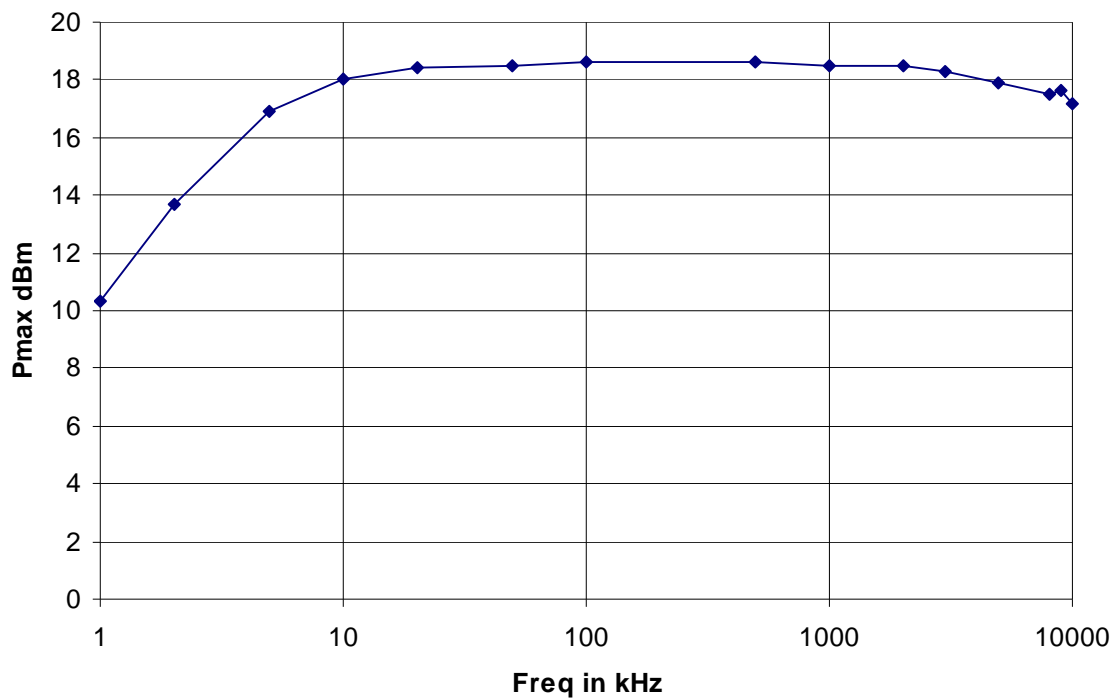
Notes:

Typical performance curves

Maximum Output Power



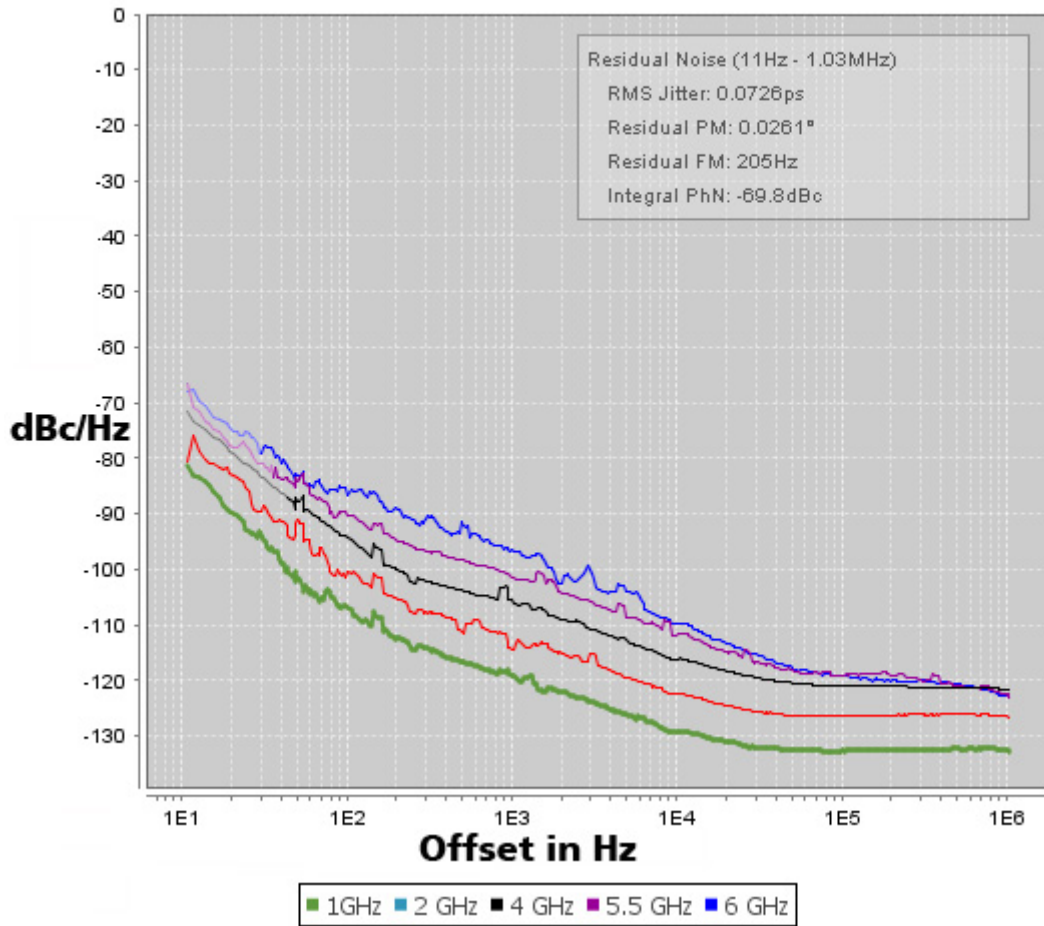
Maximum Output Power (1 kHz to 10 MHz)



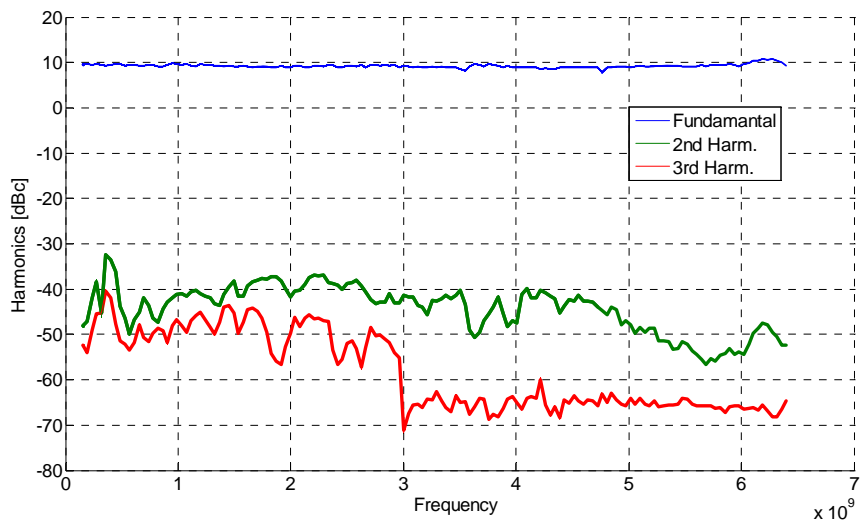
Phase Noise Performance



AnaPico Signal Source Analyzer APPH6000



Harmonic performance at + 10 dBm



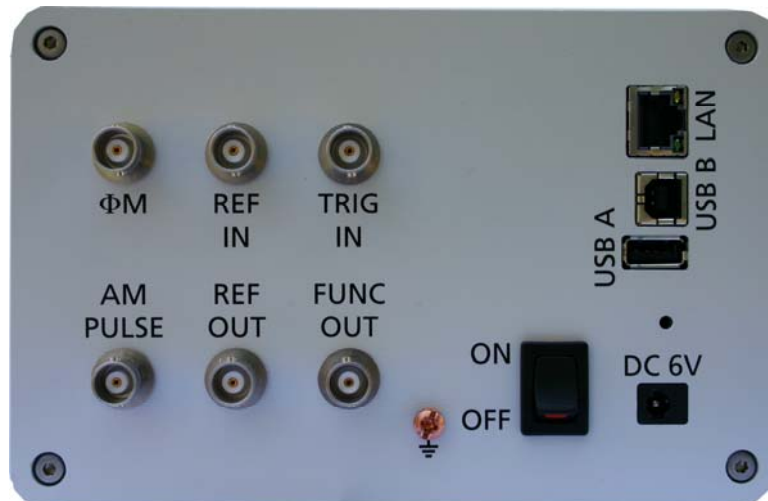
Connectors

Front panel:



1. RF output: N female
2. RF on/off button
3. Rotary knob
4. Menu and \downarrow \uparrow \leftarrow \rightarrow arrow keys

Rear panel:



1. Trigger input: BNC female
2. Function output: BNC female
3. External reference input: BNC female
4. Internal reference output: BNC female
5. FM/PM modulation input: BNC female
6. AM and Pulse modulation: BNC female
7. LAN connection: RJ-45
8. USB 2.0 host and device
9. GPIB: IEEE-488.2, 1987 with listen and talk (optional)
10. DC Power plug (6V, 2.5A)
11. DC power switch

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 55 °C
 Storage temperature range -40 to 70 °C
 Operating and storage altitude up to 15,000 feet



notice

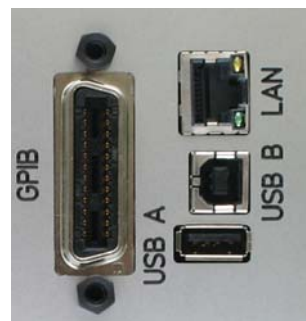
Safety/EMC complies with applicable Safety and EMC regulations and directives.

Weight ≤ 2.5 kg (6 lbs) net, ≤ 4 kg (8 lb.) shipping
 Dimensions 106 mm H x 172 mm W x 270 mm L
 [4.21 in H x 6.77 in W x 8.66 in L]

Recommended calibration cycle 24 months

Compatibility languages supporting commonly used commands
 Agilent Technologies N5181A MXG,
 Aeroflex
 Rohde & Schwarz SMA and SML models

- **B3:** Rechargeable battery pack (internal, up to 2.5 hours operation)
- **PE:** Extended power range (leveled down to -100 dBm)
- **PE3:** Extended power range (leveled down to -120 dBm)
- **AVIO:** VOR/ILS test signals
- **GPIB:** IEEE-488.2,1987 programming interface



- **TB:** improved internal reference stability
- **RM:** 19" rackmount enclosure

Document History

Version/Status	Date	Author	Notes
V10	2010-06-01	jk	first release
V11	2010-08-01	jk	mechanical information added
V12	2010-11-01	jk	Options,
V13	2010-12-30	jk	Measurements added
V131	2011-3-10	jk	Concurrent sweeps / modulation
V140	2011-4-28	jk	Frontpanel, measurement plots
V142	2011-5-20	jk	Reference output 10 MHz, Pmax adjusted
V143	2011-9-1	jk	Phase Noise plot
V144	2011-9-30	jk	Level ranges
V145	2012-5-15	jk	Option PE2 removed