APSIN 6000 Product Specification

Fast-Switching Low-Noise Signal Generator

Introduction

The APSIN6000 is a low-noise and fast-switching CW signal source covering a frequency range from 9 kHz up to 6.4 GHz.

The APSIN6000 provides broadest frequency range, highest output power, and lowest harmonic levels amongst signal generators of its size and cost. It is targeted for applications where a high-quality CW source is required. It offers 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 allows multiple units to be stacked in crowded environments like laboratories or production test facilities. A 19 inch rack-mount solution is also available. Light weight (less than three kilograms fully equipped) and optionally internal rechargeable batteries make the APSIN an easy-to-use truly portable instrument.

The APSIN operates with an ultra-stable temperature compensated 100 MHz reference (OCXO) and can be phase-locked to a selectable external reference. Multiple units can be synchronized daisy-chaining the units' reference inputs and outputs. Integration of multiple signal sources within a production test environment is now easy, affordable and repeatable.

The APSIN uses a standard Ethernet LAN interface (RJ-45) with a TCP/IP protocol and uses SCPI 1999 command language, enabling remote control over the LAN or from any PC or Laptop computer. The instrument is supplied with a quickly installed graphical user interface (GUI). Additional supplied software (API, DLLs) enable straightforward integration of the signal generator into larger automated test systems or measurement equipment. An intuitive front panel with rotary knob allow easy direct access to all the functionality of the APSIN.

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		6400 MHz	settable up to 6500 MHz
resolution		0.001 Hz		1
Phase resolution		0.2 deg		
Settling time		20 µs	200 µs	
Frequency update rate List/Sweep mode		2 ms	 1 ms	2
SSB Phase noise				
at 1 kHz from carrier		-120 dBc/ Hz		3
at 20 kHz from carrier		-130 dBc/ Hz		3
at 1 MHz from carrier		-135 dBc/ Hz		3
Wideband noise		-146 dBc/ Hz -155 dBc/ Hz		*carrier* <1.5 GHz *carrier* >1.5 GHz
Total jitter		120 fs RMS		BW over 10 Hz to 20 MHz
Power level				
Range 300 kHz to 6.0 GHz	 -60 dBm -100 dBm		 +13 dBm	 4 4 → Option PE
Resolution		0.1 dB		0.02 dB (firmware 2.2 and higher)
Level uncertainty		±0.2 dB	±1 dB	5
Output impedance		50 Ohms		
Spectral purity Output harmonics Sub-harmonics		 -45 dBc -70 dBc	 -30 dBc	 6
Non-harmonic spurious close to carrier (< 1 MHz offset) wideband		 -75 dBc -65 dBc	 -55 dBc -55 dBc	 6
Residual FM @ 1GHz		1.5 Hz RMS		0.3 kHz to 3 kHz, weighted (ITU-T)
		18 Hz RMS		0.01 kHz to 15 kHz
Residual AM @ 1GHz		0.01 %		RMS value (0.01 kHz to 15 kHz)
Frequency sweep Sweep type: linear, logarithmic, random				
Step time (t_{step})	1.0 ms			7
Dwell time ($t_{dwell()}$)	50 µs		10 s	
Off-time (incl. transient time) (t_{off})	0 or 50 µs		*Step time*	8
Timing accuracy per point		0.2 µs	0.6 µs	
Power sweep Sweep type: linear, list				
Step time (t_{step})	400 µs			7
Dwell time ($t_{dwell()}$)	50 µs		10 s	
Off-time (incl. transient time) (t_{off})	0 or 50 µs		*Step time*	8
Time resolution		0.2 µs		
Timing accuracy per point		0.2 µs	0.6 µs	
Generalized list sweep allows individual setting of frequency, power, dwell-time, and off-time for each point				
List size	2		3'501	
Step time (t_{step})	1.0 ms			7
Dwell time ($t_{dwell()}$)	50 µs		10 s	
Off-time (incl. transient time) (t_{off})	0 or 50 µs		*Step time*	8
Time resolution		0.2 µs		
Timing accuracy per point		0.2 µs	0.6 µs	

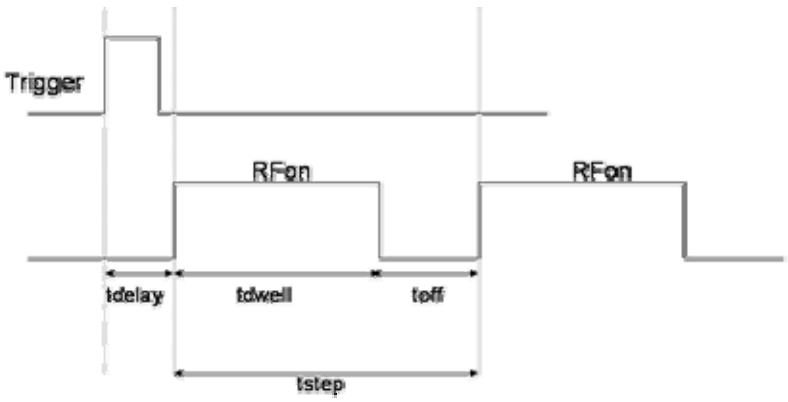
Parameter	Min.	Typ.	Max.	Note
Trigger auto, bus (SCPI), trigger key, external				
Trigger delay	50 µs		10'000 µs	
Trigger modulo (use every Nth trigger)	1		255	
Trigger edge: positive or negative				
Reference frequency input	1 MHz		100 Mhz	9
Reference input level	-5 dBm	0 dBm	+13 dBm	10
Accuracy/ Locking Range			+/- 1.0 ppm	
Reference input impedance		50 Ohms		
Internal reference frequency		100 Mhz		
Temperature stability (0 to 50 degC)			±100 ppb	
Aging 1st year		0.5 ppm		
Aging per day (after 30days operations)			5 ppb	
Warm-Up time		5 min		
Output of internal reference		5 dBm 50 Ohms		
Reverse Power Protection				
DC Voltage		10 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:

1. internal resolution is much smaller
2. time from receipt of SCPI command
3. at 1 GHz output carrier frequency
4. guaranteed level is -30 to + 13dBm in 0.1 dB resolution; below -30 dBm the resolution is 0.5 dB. Settable level is -60 to +25 dBm; for typical maximum power see plot on page 6.

   option PE: guaranteed level is -100 to + 13 dBm with 0.1 dB resolution. Below -100 dBm the resolution is 0.5 dB. Settable level is -120 to +25 dBm
5. ALC on, -30 dBm < Pout < +13 dBm
6. at output connector, -10 dBm < P_{out} < +10 dBm; f >143 MHz
7. $t_{step} = t_{dwell} + t_{off} > 900$ µs
8. t_{off} may be lower or zero, if no off time is required. But off times > 0 and < 200us may be inaccurate
9. must be integer N • 1 MHz;
10. slew rate must be > 10V/µs

Timing of Trigger + List sweep



Modulation Capabilities

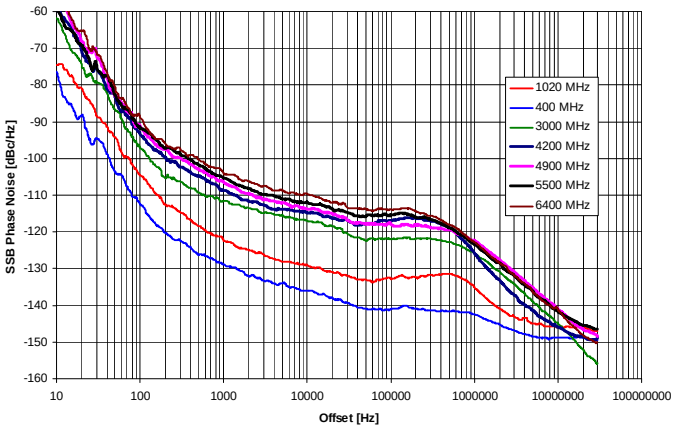
Parameter	Min.	Typ.	Max.	Note
Multifunction Generator sine, triangle, square wave Output is Sync Out at rear panel				
Frequency range	1 Hz 1 Hz		3 MHz 1 MHz 50 kHz	sine triangle square
Frequency resolution		0.1 Hz		
Output voltage amplitude peak-peak	10 mV	 5V	2 V	Sine, triangle Square (CMOS output)
Harmonic Distortion		1 %		< 100 kHz, 1 Vpp
Output impedance		50 Ohms CMOS		Sine, triangle square wave
Pulse Modulation (internal & external) On/off ratio		80 dB		
Repetition frequency	DC 0.1 Hz		4 MHz 100 kHz	External internal
Pulse width	40 ns 180 ns		 9 s	External internal
Pulse rise/fall time		10 ns		
Video crosstalk		-40 dB		
External input amplitude		1 V TTL		AC DC
External input amplitude		1 V TTL		AC DC
Frequency modulation (internal & external) (see note 1) Maximum Frequency deviation (peak)	200 kHz AND modulation index < 10 50 kHz AND modulation index < 3 100 kHz AND modulation index < 5 200 kHz AND modulation index < 10 400 kHz AND modulation index < 20			*< 143 MHz* *>143 MHz to 490 MHz (N=0.125)* *>490 MHz to 830 MHz (N=0.25)* *> 830 MHz to 1.65 GHz (N=0.5)* *> 1.65 GHz to 3.3 GHz (N=1)*
Modulation rate	100 Hz		300 kHz	> -3dB frequency response
External input sensitivity	Settable 1 kHz/V to 200 kHz/V			1V amplitude corresponds to N· kHz deviation
Total harmonic distortion	< 4%			1 kHz rate & 2.4 kHz deviation
Phase modulation (internal & external) (see note 1) Phase deviation (peak)	 0		 N·5 rad	
Modulation rate	100 Hz		300 kHz	> -3dB frequency response
External Input sensitivity	Settable 0.1 rad/V to 2 rad/V			1V amplitude corresponds to N· rad deviation
Total harmonic distortion				
AM Modulation (internal only) Modulation rate	 1 Hz		 20 kHz	
Modulation depth	1 %		90 %	
Distortion		3 %		

Notes:

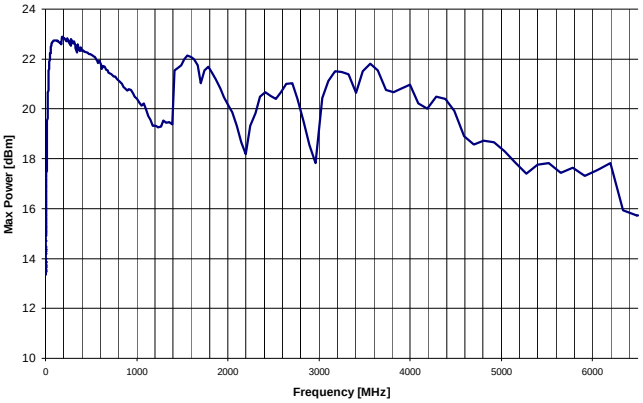
1. FM/PM modulator is supported for instruments with serial number **62233xxxxxxxx** or higher.

Typical performance curves

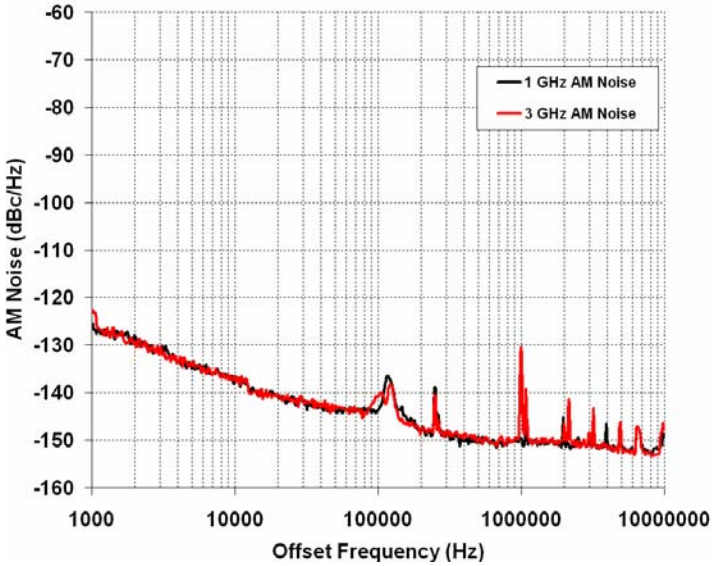
Phase Noise



Maximum output power



AM noise performance

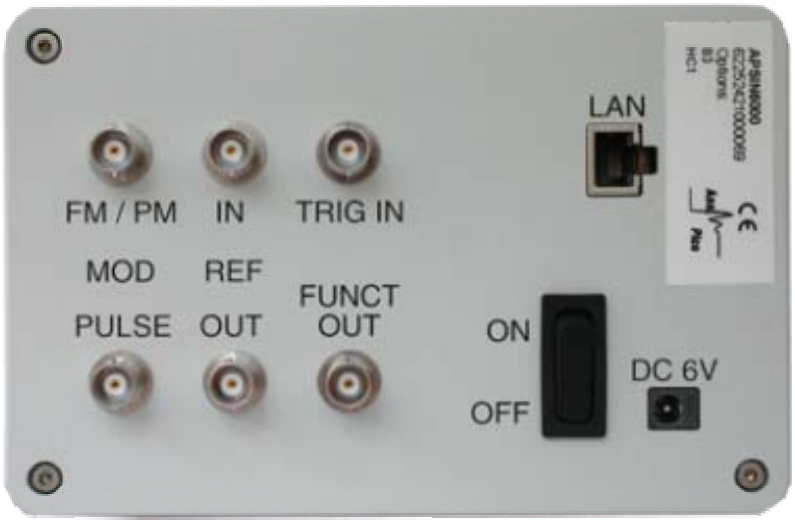


Connectors

Front panel (HC option):

1. RF output: N female
2. RF on/off button
3. Rotary knob
4. Menu and ↓ ↑ ← → 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 modulation input: BNC female
6. Pulse modulation and Trigger input: BNC female
7. LAN connection: RJ-45
8. DC Power plug (6V, 2.5A)

General Characteristics

Remote programming interfaces

LAN 10BaseT LAN interface,

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

CE **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 220 mm L
[4.21 in H x 6.77 in W x 8.66 in L]

Options

- ***B3***: Rechargeable battery pack (internal, 3 hours operation)
- ***PE***: Extended power range (-100 to +13 dBm)
- ***PE2***: Extended power range to -140 to +13 dBm
- **-**: Display-only frontpanel (for ATE)
- ***RM***: 19'' Rack mount (1 or 2 devices)

Document History

Version / Status	Date	Author		Notes
V10	2008-2-20	jk		first release
V11	2008-5-20	jk		Minor revision
V12	2008-7-2	jk		Minor revision
V13	2008-7-10	jk		Resized document
V14	2008-7-25	jk		Added list & trigger
V15	2009-1-20	jk		Added specs for option PE; AM modulation
V151	2009-2-23	jk		FM deviations changed
V16	2009-3-15	jk		Power level specifications clarified
V161	2009-4-2	jk		Modulation specs revised
V162	2009-8-22	jk		Added sweep timing accuracy
V17	2009-9-29	jk		FM specification adjusted