APSIN20HP Specification 1.0

High-Power Microwave Signal Generator

Introduction

The APSIN20HP is a high output power, low-noise and fast-switching microwave signal generator covering a frequency range from 100 kHz up to 20 GHz.

The APSIN20HP offers more than +25 dBm levelled output power range and various power level extensions are available to accurately level down to -120 dBm.

The APSIN20HP includes AM, DC-coupled, low distortion wideband-FM, PM, FSK and PSK, frequency chirp, and fast pulse modulation with internal pulse train generator as standard. Three internal modulations sources are available. All modulation modes of the APSIN20G can be combined. This allows the generation of complex modulation signals for modern communication and location systems. The combination of pulse modulation and FM simulates Doppler effects or chirp signals. Simultaneous AM and pulse modulation provides the types of signal occurring in pulse radar applications with rotating antenna. The combination of FM and AM can be used to check fading effects of FM receivers.

The APSIN20HP allows fast analog and digital sweeps including flexible list sweeps, where frequency, power and dwell times can be set individually. A flexible triggering capability simplifies synchronization within test environments.

The APSIN20HP operates with an ultra-stable temperature compensated 100 MHz reference (OCXO) to ensure minimal drift, and can be phase-locked to almost any stable external reference in a range from 1 to 200 MHz.

The APSIN20HP support various standard interfaces such as USB-TMC, LAN, and GPIB.

It is targeted for applications where a high-quality CW microwave source with versatile modulation is required. It offers an alternative to expensive high-end microwave signal generators, where small size and excellent microwave performance at an attractive cost is required.

Applications for the APSIN20G include

- **R&D high-power microwave source**
- **Production testing (industry-leading switching times; high dynamic range)**
- **Signal simulation (Radar, WiMax, UWB)**
- **Aerospace & Defence (Pulse modulator, Chirps)**

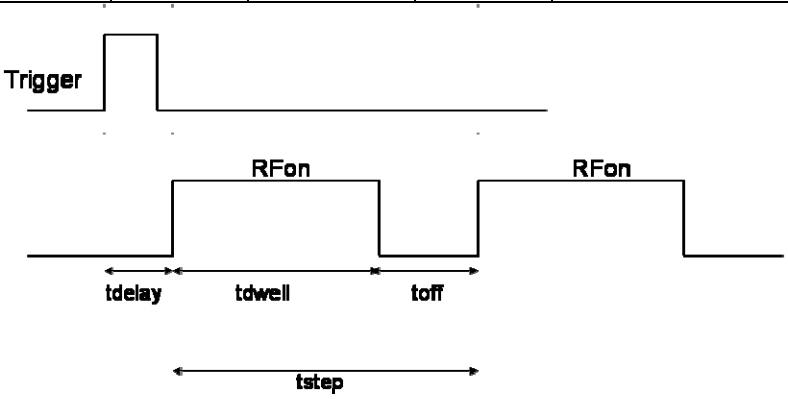
Signal Specifications

The specifications in the following pages describe the warranted performance of the signal generator for 23 ± 10 °C after a 30 minute warm-up period and for all configurations (options PE2/PE3 if not explicitly stated). Typical specifications describe expected, but not warranted performance. Min and Max specifications are warranted.

Parameter	Min.	Typ.	Max.	Note
Frequency range	100 kHz		20 GHz	
resolution		0.001 Hz		
Phase resolution		0.1 deg		
Settling time		20 µs	100 µs	
Frequency update rate List/Sweep mode		200 µs 100 µs		time from receipt of SCPI command
SSB Phase noise at 10 GHz				
at 1 kHz from carrier		-100 dBc/Hz		
at 20 kHz from carrier		-108 dBc/Hz		
Wideband noise		-150 dBc/ Hz		
Total jitter		100 fs RMS		BW over 10 Hz to 20 MHz
Amplitude Noise at 10 GHz		-130 dBc/Hz -140 dBm		Pout=+10 dBm, 100 kHz offset noise floor
Output power level				
Range 100 kHz to 10 MHz 10 MHz to 100 MHz 100 MHz to 18 GHz 18 GHz to 20 GHz 10 MHz to 20 GHz 10 MHz to 20 GHz	 -15 dBm -15 dBm -15 dBm -15 dBm -90 dBm -120 dBm		 +10 dBm +18 dBm +27 dBm +25 dBm +24 dBm +24 dBm	 with Option PE3 with option PE2
Resolution		0.01 dB		
Level uncertainty, ALC on User flatness correction		 up to 2000 points	< 1 dB < 1.5 dB	> -15 dBm > -90 dBm
Output impedance VSWR		50 Ω 2.0		
Spectral purity at + 10 dBm Output harmonics Sub-harmonics		 -45 dBc -40 dBc -45 dBc -75 dBc	 -35 dBc -30 dBc -30 dBc -60 dBc	 0.1 to 5.1 GHz 5.1 to 11 GHz 11 GHz to 20 GHz 0.01 to 20 GHz
Non-harmonic spurious		-75 dBc	-60 dBc	at +10 dBm output power
Residual FM @ 10 GHz		15 Hz		0.3 kHz to 3 kHz, weighted (ITU-T), RMS
Residual AM @ 10 GHz		0.02 %		RMS value (0.01 kHz to 15 kHz)

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})	400 µs			
Dwell time (t_{dwell})	10 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})	400 µs			mechanical attenuator not used
Dwell time ($t_{dwell()}$)	10 µs		1000 s	
Off-time (incl. transient time) (t_{off})	50 µs		t_{step}	
Time resolution		0.1 µs		
Timing accuracy per point		1 µs		
Fast sweep				
Sweep span		10 %		varies with carrier frequency
Sweep rate	tbd		N · 5 GHz / ms	
Sweep time	0.1 ms		100 ms	
Reference frequency input	1 MHz		200 MHz	User programmable
Reference input level	-5 dBm	0 dBm	+13 dBm	
Lock Range			±1.0 ppm	
Reference input impedance		50 Ohms		
Internal reference frequency output		100 MHz 10 MHz		Opt. improved stability >0 dBm
Temperature stability (0 to 50 degC)			±100 ppb	
Aging 1st year		0.5 ppm		
Aging per day (after 30days operations)			5 ppb	

Parameter	Min.	Typ.	Max.	Note
Warm-Up time		5 min		
Output of internal reference		5 dBm 50 Ohms		
Reverse Power Protection				
DC Voltage		15 V		
RF power			30 dBm	
Dimensions				
Excluding connectors		W x L x H =		
Including connectors		W x L x H =		

Notes:

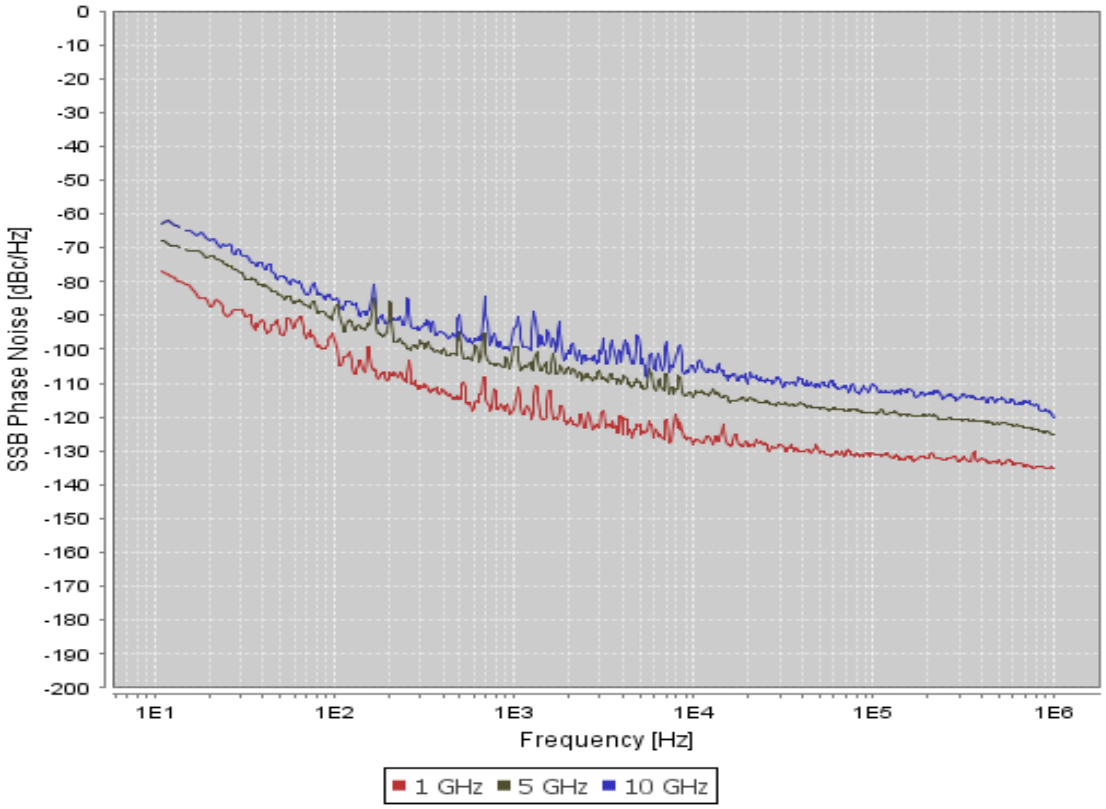
Modulation Capabilities

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 On/off ratio		 70 dB		
Repetition frequency	DC		10 MHz	
Pulse width	40 ns 50 µs			ALC hold ALC on
Pulse rise/fall time		7 ns		
Pulse train (optional)	2		1024	with settable pulse duration
Polarity		selectable		
External input amplitude		1 V TTL		AC DC
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)*
Modulation rate	DC		800 kHz	> -3dB frequency response
External input sensitivity AC DC		 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
Phase modulation Phase deviation (peak)	 0		 N·300 rad	
Modulation rate	DC		800 kHz	> -3dB frequency response
External Input sensitivity	Settable 0.1 rad/V to 360 rad/V			
Total harmonic distortion		< 1%		1 kHz rate & N x 100 rad deviation
AM Modulation Modulation rate	 0.1 Hz		 20 kHz	
Modulation depth	0 %		90 %	
Distortion		2 %		at 60% modulation depth
Accuracy		5 %		

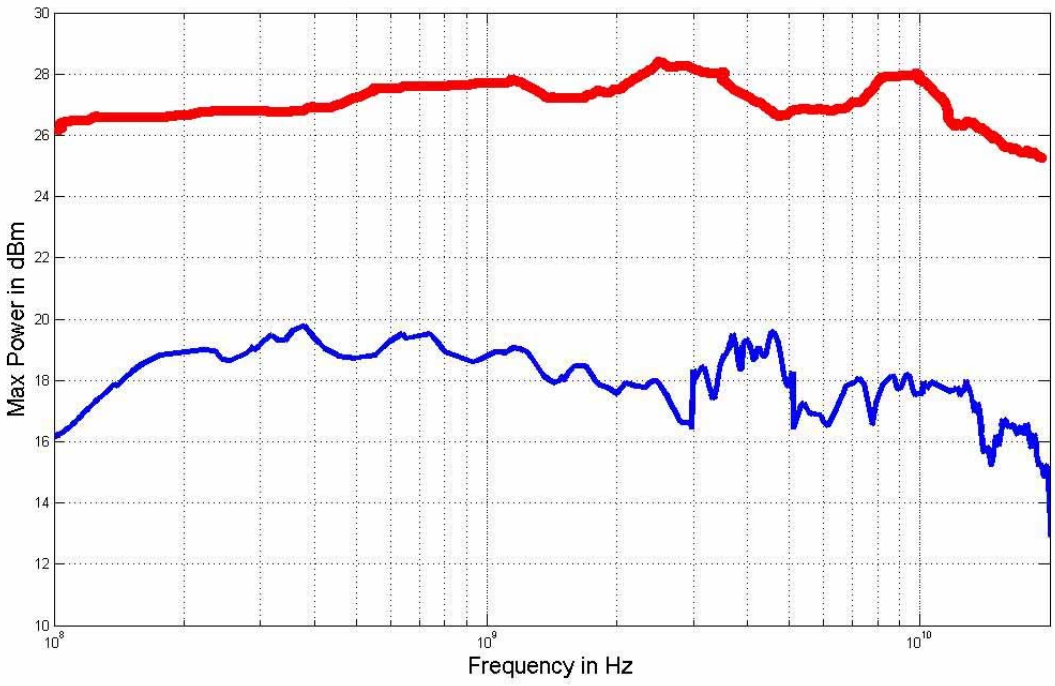
Notes:

Typical performance curves

Phase Noise Performance



Maximum Output Power APSIN20G (blue) and APSIN20HP (red)

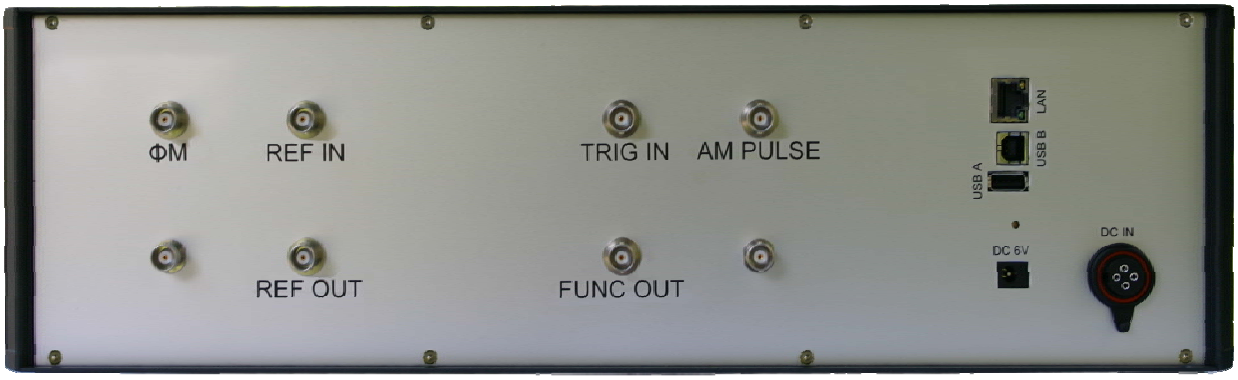


Connectors

Front panel:

1. **RF output: SMA female**
2. **Power on/off switch**

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 plug (15-30 V, optional)**
12. **AC Power plug (optional)**

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; 28 W maximum
Mains adapter supplied: 100-240 VAC in/ 15V 2.5A DC out
Operating temperature range 0 to 45 °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 ≤ 4.0 kg (9 lbs) net, ≤ 5.5 kg (12 lb.) shipping
Dimensions mm H x mm W x mm L
Recommended calibration cycle 24 months

Options

- ***PE3*: Extended power range down to <-90 dBm)**
- ***PE2*: Extended power range (down to <-120 dBm)**
- ***GPIB*: IEEE-488.2,1987 programming interface**
- ***TB*: improved internal reference stability**

Document History

Version/Status	Date	Author		Notes
V10	2012-5-15	jk		first release