APSIN26TP Target Specification 1.12

26.5 GHz Microwave Signal Generator

Introduction

The APSIN26TP is a very low phase noise and fast-switching microwave signal generator covering a frequency range from 100 kHz up to 26.5 GHz.

The APSIN26TP has a wide and accurately levelled output power range and high spurious suppression. Advanced frequency synthesis with fractional-N divider makes for low SSB phase noise and micro-Hz frequency resolution.

The modulation capabilities if the APSIN26TP includes frequency chirps, and fast pulse modulation with internal pulse train generator as standard.

The APSIN26TP allows fast quasi-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 APSIN26TP operates with an ultra-stable temperature compensated 100 MHz reference (OCXO) with minimal thermal drift and aging, and can be phase-locked to almost any stable external reference in a range from 1 to 250 MHz.
Additionally, optimum phase synchronous signals can be achieved by bypassing internal reference with an external 100 MHz.

The APSIN26TP supports SCPI command set through 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 APSIN26TP include

- R&D low noise microwave source
- Production testing (industry-leading switching times; high dynamic range)
- Service and maintenance (battery operation)
- Signal simulation (Radar)
- Aerospace & Defence (Pulse modulator, Chirps)

Preliminary 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 PE3 if not explicitly stated). Typical specifications describe expected, but not warranted performance. Min and Max specifications are warranted.

Parameter	Min.	Typ.	Max.	Note
CW Mode				
Frequency range	100 kHz		26.5 GHz	
resolution		0.001 Hz		
Phase resolution		0.1 deg		
Settling time		20 µs	50 µs	
Frequency update rate List/Sweep mode		300 µs 300 µs		time from receipt of SCPI command
SSB Phase noise at 10 GHz				(option LN)
at 1 Hz from carrier		-45 dBc/Hz		
at 10 Hz from carrier		-70 dBc/Hz		
at 1 kHz from carrier		-100 dBc/Hz		
at 20 kHz from carrier		-115 dBc/Hz		
at 100 kHz from carrier		-118 dBc/Hz		
at 1 MHz from carrier		-120 dBc/Hz		
at 1 Hz from carrier		-25 dBc/Hz		(standard)
at 10 Hz from carrier		-55 dBc/Hz		
at 1 kHz from carrier		-100 dBc/Hz		
at 20 kHz from carrier		-108 dBc/Hz		
at 100 kHz from carrier		-110 dBc/Hz		
at 1 MHz from carrier		-120 dBc/Hz		
Output power level				Check Maximum Output Power Plot
Range 100 kHz to 10 MHz 10 MHz to 20 GHz >20 GHz	 -20 dBm -20 dBm -20 dBm		 +22 dBm +25 dBm +23 dBm	
Range WITH option PE3 100 kHz to 10 MHz 10 MHz to 20 GHz >20 GHz	 -90 dBm -90 dBm -90 dBm		 +21 dBm +23 dBm +20 dBm	
Level resolution		0.01 dB		
Level uncertainty, ALC on		< 1 dB < 1.5 dB		> -15 dBm > -90 dBm
User flatness correction		up to 2000 points		
Output impedance VSWR		50 Ω 2.0		
Reverse Power Protection				
DC Voltage			10 V	
RF power			30 dBm	

Parameter	Min.	Typ.	Max.	Note
Spectral purity				**at + 10 dBm**
Harmonics		-40 dBc -50 dBc -60 dBc	-30 dBc -40 dBc -55 dBc	0.1 to 10.0 GHz 10.0 to 20 GHz 20 to 26.5 GHz
Sub-harmonics		-60 dBc		>20 GHz
Non-harmonic spurious		-75 dBc	-60 dBc	

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
Digital 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 digital 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			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		
Ramp (analog) sweep				
Sweep span		20 %		of carrier frequency
Sweep rate	tbd		N · 5 GHz / ms	
Sweep time	0.1 ms		100 ms	
Frequency chirps (linear ramp, up/down)				
Bandwidth	10%			
Dwell time (t_{dwell})	10 ns		100 µs	
Number of frequencies			65'000	

Reference Frequency

Parameter	Min.	Typ.	Max.	Note
Input frequency range	1 MHz		250 MHz	User programmable
Reference input level	-5 dBm	0 dBm	+13 dBm	
Lock Range			±1.5 ppm	
External Reference (internal ref bypassed)		100 MHz		
Reference input impedance		50 Ohms		
Internal reference frequency		100 MHz 10 MHz		 Option LN
Initial accuracy (standard option LN			 ±40 ppb ±10 ppb	calibrated at 23 ± 3 °C at time of calibration
Temperature stability (0 to 50 degC) standard option LN			 ±100 ppb ±10 ppb	
Aging 1st year standard option LN		 0.5 ppm 0.1 ppm		
Aging per day (after 30days operations) standard option LN			 5 ppb	
Warm-Up time		5 min		
Output of internal reference		10 /100 MHz 5 dBm 50 Ohms		User selectable

Notes:

Multi Purpose Output (FUNC OUT)

Output is FUNC OUT at rear panel

Parameter	Min.	Typ.	Max.	Note
MULTIFUNCTION GENERATOR	sine, triangle, square wave			
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
VIDEO OUTPUT (of internal pulse modulator)				
Output		CMOS		
Period	30 ns		50 s	
Pulse Width	15 ns		50 s	
RF delay		10 ns		

Parameter	Min.	Typ.	Max.	Note
TRIGGER OUT	**Synchronization mode for multiple sources**			
Modes	Trigger on sweep start Trigger on each point			
Trigger waveform pulse width		100 ns		

Trigger (TRIG IN)

Input is TRIG IN at rear panel

Parameter	Min.	Typ.	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		tbd		
Trigger uncertainty		5 µs		
External Trigger delay	50 µs		40 s	
External Delay Resolution		15 ns		
Trigger Modulo	1		255	Execute only on Nth trigger event
Trigger Polarity	Rising, falling			

External ALC (ALC IN)

Modulation Capabilities

Parameter	Min.	Typ.	Max.	Note
Multifunction Generator sine, triangle, square wave Output is FUNC 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		80 dB		
Repetition frequency	DC		10 MHz	
Pulse width	30 ns 500 ns			ALC hold/off ALC on
Pulse rise/fall time		10 ns		
Pulse trains length (pulses)	2		4192	
Pulse width	30 ns		100 µs	
Pulse resolution		15 ns		
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)*		**(not with option LN)**
Modulation rate	DC		800 kHz	> -3dB frequency response
Modulation waveforms	Sine, triangle, FSK			
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		

Parameter	Min.	Typ.	Max.	Note
Phase Modulation				**(not with option LN)**
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				
Modulation rate	0.1 Hz		20 kHz	
Modulation waveforms	Sine, triangle, square			
Modulation depth	0 %		90 %	
Distortion (sine wave)		2 %		at 60% modulation depth
Accuracy		4 %		

Notes:

Typical performance curves

Phase Noise Performance

Maximum Output Power

Connectors

Front panel:

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 (24V, 2 A)
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
Control language SCPI Version 1999.0

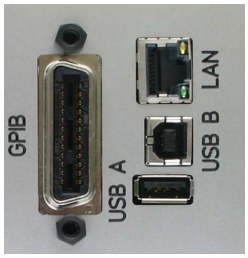
Power requirements 24 VDC; 30 W maximum
Mains adapter supplied: 100-240 VAC in/ 24V 2 A DC out
Operating temperature range 0 to 45 °C
Storage temperature range –40 to 70 °C
Operating and storage altitude up to 15,000 feet

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

Weight ≤ 5 kg (11 lbs) net
Dimensions
Recommended calibration cycle 24 months

Options

- ***PE3***: Extended power range down to -90 dBm)
- ***GPIB***: IEEE-488.2,1987 programming interface (contact AnaPico about availability)



- **RM: 19'' rackmount** kit

Document History

Version/Status	Date	Author		Notes
V10	2013-01-30	jk		first release
V101	2013-08-30	jk		Power ranges
V102	2013-09-30	jk		
V110	2014-2-27	jk		Redefined IOs
V111	2014-4-2	jk		Added phase noise data., incl. option LN
V112	2014-11-15	jk		Modulations, new product photo