

DATASHEET APSINXX10G Specification v2.19

Signal Generators from 9 kHz to 2000 MHz, 4000 MHz and
6100 MHz



Document size:

1 (one) title page
13 (treize) content pages

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

- **APSIN HC models comprises a set of very compact, portable analog signal generator models from 9 kHz up to 6100 MHz. A combination of good signal purity, fast switching speed and wide dynamic range makes these units useful for a variety of applications.**

The APSINX010 is a series of a low-noise and fast-switching analogue signal generator covering a frequency range from 9 kHz up to 2.0, 4.0, and 6.1 GHz, respectively.

The APSINX010 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 APSINX010 operates at very low DC power consumption (only 12 watts), with minor heat dissipation and not requiring noisy fan. This gives the APSINX010 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.

Available Options:

Option PE3 is an optional power level extension to accurately level below -120 dBm.

Option B3 adds an internal rechargeable battery module

Option AVIO adds dedicated avionics modulation like VOR/ILS

19 inch rack-mount solutions are also available.

The APSINX010 support various standard interfaces such as USB (USBTMC), LAN (VXI-11), or GPIB and extensive API with programming examples are available.

SPECIFICATIONS

| PARAMETER | MIN | TYPICAL | MAX | NOTE |
|--|----------|----------------------------|-------------------------------|--|
| Frequencyrange | 9 kHz | | 2.0 GHz 4.0 GHz 6.1 GHz | APSIN2010HC APSIN4010HC APSIN6010HC |
| resolution | | 0.001 Hz | | |
| Phase resolution | | 0.1 deg | | |
| Settling time | | 20 μs 20 μs | 100 μs 200 μs | <= SN xx-xxx2xxxxx-xxxx >= SN xx-xxx3xxxxx-xxxx |
| Frequency update rate | | 400 μs | | time from receipt of SCPI command firmware |
| List/Sweep mode | | 400 μs | | |
| SSB Phase noise at 1 GHz | | | | |
| at 20 kHz fromcarrier | | -130 dBc/Hz | | See measured phase noise plots |
| Total jitter | | 68 fs RMS | | 10 Hz to 1 MHz BW |
| Spectral purity | | | | |
| Output harmonics | | -40 dBc | -30 dBc | $P_{out} = +10$ dBm |
| Sub-harmonics | | -80 dBc | -70 dBc | |
| Non-harmonic spurious | | | | |
| < 1 MHz | | -70 dBc | -60 dBc | $P_{out} = +10$ dBm |
| > 1 MHz | | -75 dBc | -65 dBc | |
| Residual FM @ 1 GHz | | | 3 Hz | 0.3 kHz to 3 kHz, weighted (ITU-T) |
| | | | 12 Hz | 0.03 kHz to 23 kHz |
| Power level | | | | |
| Range | | | | |
| Without Option PE3 | -30 dBm | | 18 dBm typically | > 10 MHz See plots on page 8 |
| With Option PE3 | -120 dBm | | 17 dBm typically | |
| Resolution | | 0.01 dB | | |
| Level uncertainty | | 0.3 dB 0.5 dB 1.5 dB | < 0.8 dB < 1.3 dB | -20 to + 10 dBm -80 to -20 or >10 dBm <-80 dBm |
| Output impedance | | 50 Ω | | |
| VSWR | | 1.5 1.7 | 1.8 2.0 | < 3 GHz > 3 GHz |
| Reference frequency input | 8 MHz | | 200 MHz | User programmable |
| Reference inputlevel | -5 dBm | 0 dBm | +13 dBm | |
| Lock Range | | | +/- 1.0 ppm | |
| Reference inputimpedance | | 50 Ω | | |
| | | | | |
| Internal referencefrequencyoutput | | 10 MHz | | |

| | | | | |
|--|--------------------------------|----------------|----------|--|
| Initial accuracy of internal reference | | ±40 ppb | | calibrated at 23 ± 3 °C at time of calibration |
| Temperature stability (0 to 50 degC) | | | ±100 ppb | |
| Aging 1 st year | | 0.5 ppm | | |
| Aging per day (after 30 days operations) | | | 5 ppb | |
| Warm-Up time | | 5 min | | |
| Output of internal reference | | +0 dBm 50 Ω | | |
| Reverse Power Protection | | | | |
| DC Voltage | | 30 V | | |
| RF power | | | 36 dBm | |
| Dimensions | | | | |
| Excluding connectors | W x L x H = 172 x 250 x 106 mm | | | |
| Including connectors | W x L x H = 172 x 273 x 106 mm | | | |



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 |
|--|-----------|---------|---------|------|
| Frequency sweep | | | | |
| Sweep type: linear, logarithmic, random | | | | |
| Step time (t_{step}) | 400 μs | | 19998 s | |
| Dwell time (t_{dwell}) | 50 μs | | 9999 s | |
| Off-time (incl. transient time) (t_{off}) | 0 / 50 μs | | 9999 s | |
| 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 | | 20.000 | |
| Step time (t_{step}) | 200 μs | | 19998 s | |
| Dwell time (t_{dwell}) | 50 μs | | 9999 s | |
| Off-time (incl. transient time) (t_{off}) | 0 / 50 μs | | 9999 s | |
| Time resolution | | 0.1 μs | | |
| Timing accuracy per point | | 1 μs | | |
| Frequency Chirps (linear ramp, up/down) | | | | |
| Bandwidth | | | 10% | |
| Dwell time (t_{dwell}) | 10 ns | | 100 μs | |
| Number of frequencies | | | 20'000 | |



Modulation Capabilities

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

| PARAMETER | MIN | TYPICAL | MAX | NOTE |
|------------------------------------|-------------------------|------------------------|------------------|--|
| Pulse modulation | | | | |
| On/off ratio | | 70 dB | | |
| Repetition frequency | DC | | 33 MHz | |
| Pulse width | 30 ns 50 μ s | | 20 s 20 s | ALC hold ALC on |
| Pulse rise/fall time | | 5 ns | | |
| Pulse trainslength (pulses) | 2 | | 4192 | |
| Video crosstalk | | -40 dB | | |
| External input amplitude | | 1 V TTL | | AC DC |
| Delay (to RF) | | 20 ns | 40 ns | |
| 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 waveforms | Sine, triangle, FSK | | | |
| Modulation rate | 1 Hz/DC | | 800 kHz | -3dB frequency response Max. phase deviation degrades above 20 kHz modulation rate |
| External inputsensitivity | < N · 100 MHz for 1 Vpp | | | settable in AC mode discrete values in DC mode |
| Total harmonicdistortion | < 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 |
| Modulation waveforms | Sine, triangle, FSK | | | |
| External Input sensitivity | N · 40 radfor 1 Vpp | | | |
| Total harmonicdistortion | < 1% | | | 1 kHz rate & N · 20 rad deviation |
| Amplitude modulation | | | | |
| Modulation rate | 10 Hz 10 Hz | | 20 kHz 50 kHz | applies for internal and external >= SN xx-xxx5xxxxx-xxxx |
| Modulation depth | 0 % | | 95 % | |
| Modulation waveforms | Sine, triangle, square | | | |
| Distortion | | 2 % | | |
| Accuracy | | 3 % | | |
| External inputsensitivity | X % per 1 Vpp | | | settable |

Avionics Modulation (option AVIO)

| | | |
|--------------------------|---|--|
| ILS | | |
| Localizer RF frequency | 108 to 112 MHz | |
| Nominal tone frequencies | 90 & 150 Hz | |
| Frequency accuracy | < 0.02 Hz | |
| Centerline (in %) | DDM: 0 ± 0.1 ; SDM: 40 ± 2.0 | |
| Fly left (in %) | DDM: 15.5 ± 0.5 ; SDM: 40 ± 2.0 | |
| Fly right (in %) | DDM: -15.5 ± 0.5 ; SDM: 40 ± 2.0 | |
| Flag (in %) | DDM: 0 ± 0.1 ; SDM: 30 ± 2.0 | |
| Glide Path RF frequency | 328.6-335.4 MHz | |
| Angle of Descent (in %) | DDM: 0 ± 0.1 ; SDM: 80 ± 3.0 | |
| Fly up (in %) | DDM: 17.5 ± 0.5 ; SDM: 80 ± 3.0 | |
| Fly down (in %) | DDM: -17.5 ± 0.5 ; SDM: 80 ± 3.0 | |
| Flag (in %) | DDM: 0 ± 0.1 ; SDM: 70 ± 2.5 | |
| VOR RF frequency | 108 - 118 MHz | |
| Subcarrier Frequency | 9960 ± 2.0 Hz | |
| FM deviation | 480 Hz | |
| AM tone | 30 ± 0.02 Hz | |
| Bearing north | TDM: 30 ± 2.0 % Phase: 180 ± 0.5 deg | |
| Bearing south | TDM: 30 ± 2.0 % Phase: 90 ± 0.5 deg | |
| Bearing east | TDM: 30 ± 2.0 % Phase: 0 ± 0.5 deg | |
| Bearing west | TDM: 30 ± 2.0 % Phase: 270 ± 0.5 deg | |
| Test 1 | TDM: 20 ± 1.5 % Phase: 0 ± 0.5 deg | |
| Test 2 | TDM: 40 ± 2.0 % Phase: 0 ± 0.5 deg | |



Multi Purpose Output (FUNC OUT)

Output is FUNC OUT at rear panel

| PARAMETER | MIN | TYPICAL | MAX | NOTE |
|------------------------------------|--------------|--------------|--------------------------|--|
| MULTIFUNCTION GENERATOR | | | | |
| sine, triangle, square wave | | | | |
| Frequencyrange | 1 Hz 1 Hz | | 3 MHz 1 MHz 50 kHz | sine triangle square |
| Frequencyresolution | | 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 squarewave |

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 | | | |
| Trigger waveform pulse width | | 100 ns | | |



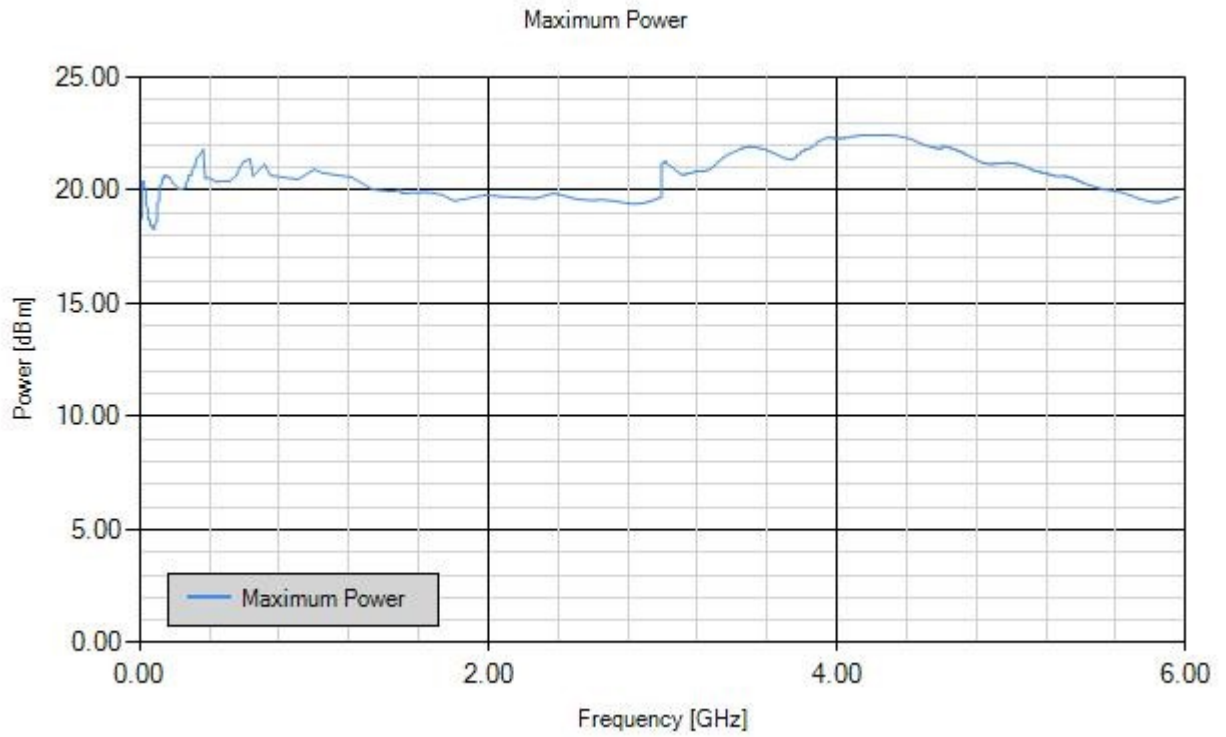
Trigger (TRIG IN)

Input is TRIG IN at rear panel

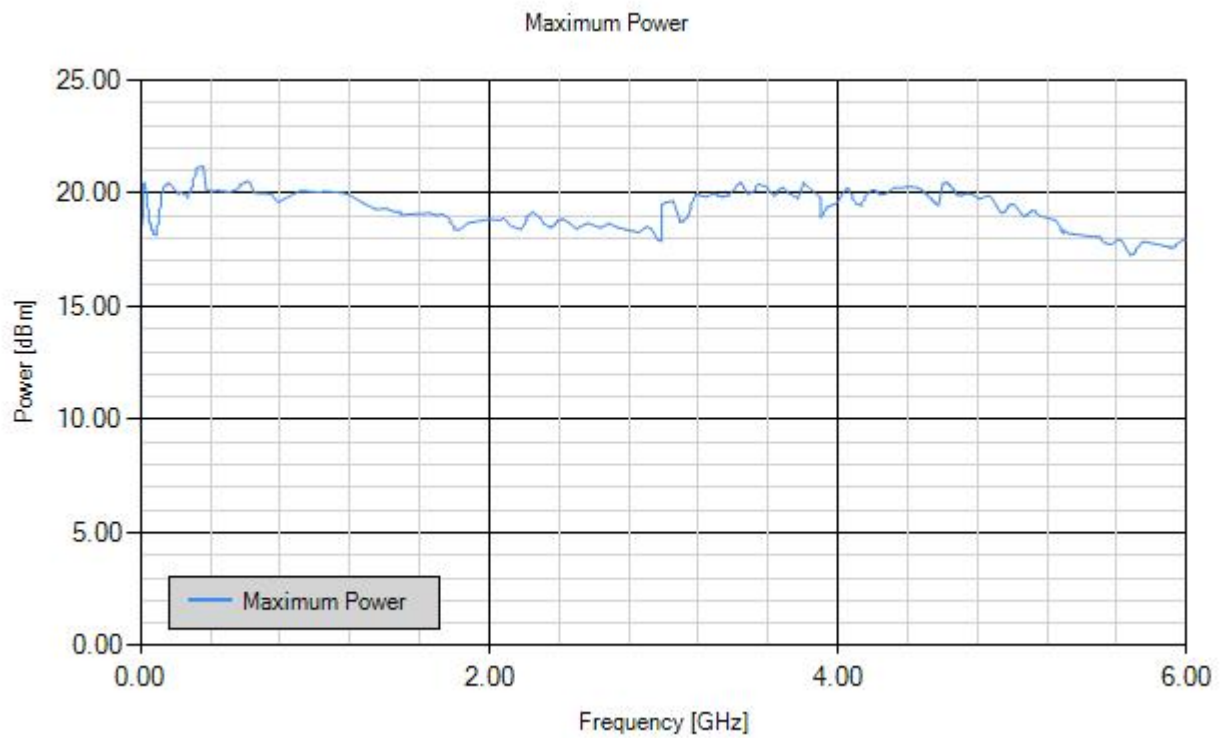
| PARAMETER | MIN | TYPICAL | MAX | NOTE |
|---------------------------|---|-----------|------|-----------------------------------|
| Trigger Types | Continuous, single, gated, gated direction | | | |
| Trigger Source | RF key, external, bus (GPIB, LAN, USB) | | | |
| Trigger Modes | Continuous free run, trigger and run, reset and run | | | |
| Trigger latency | | tbd | | |
| Trigger uncertainty | | 5 μ s | | |
| External Trigger delay | 50 μ s | | 40 s | |
| External Delay Resolution | | 15 ns | | |
| Trigger Modulo | 1 | | 255 | Execute only on Nth trigger event |
| Trigger Polarity | Rising, falling | | | |

PERFORMANCE CURVES

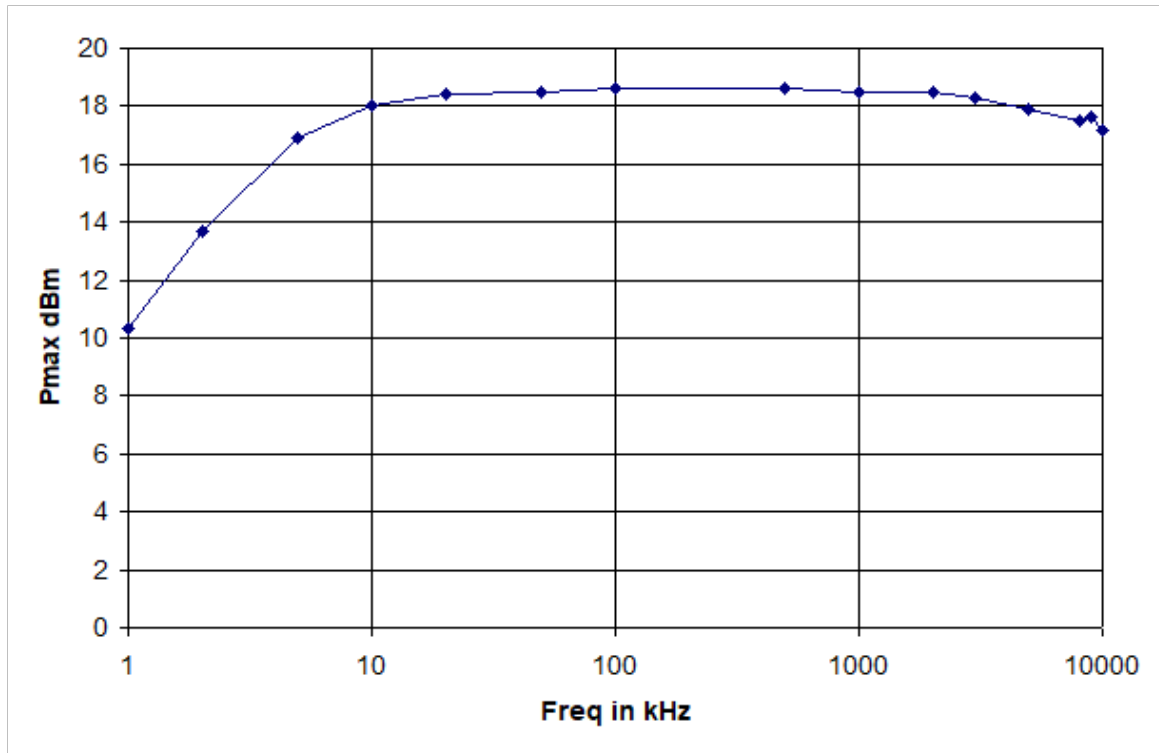
Typical Maximum Output Power (without option PE3)



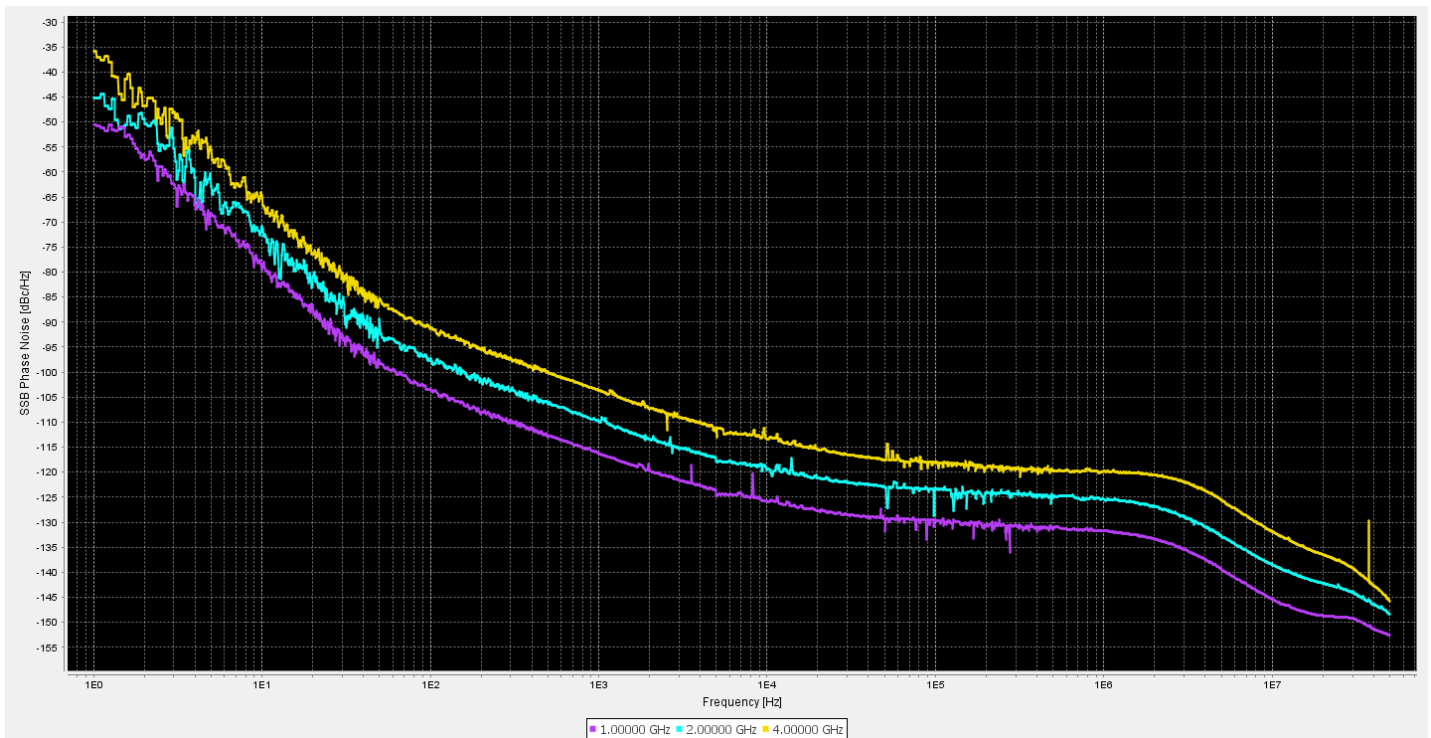
Typical Maximum Output Power (WITH option PE3)



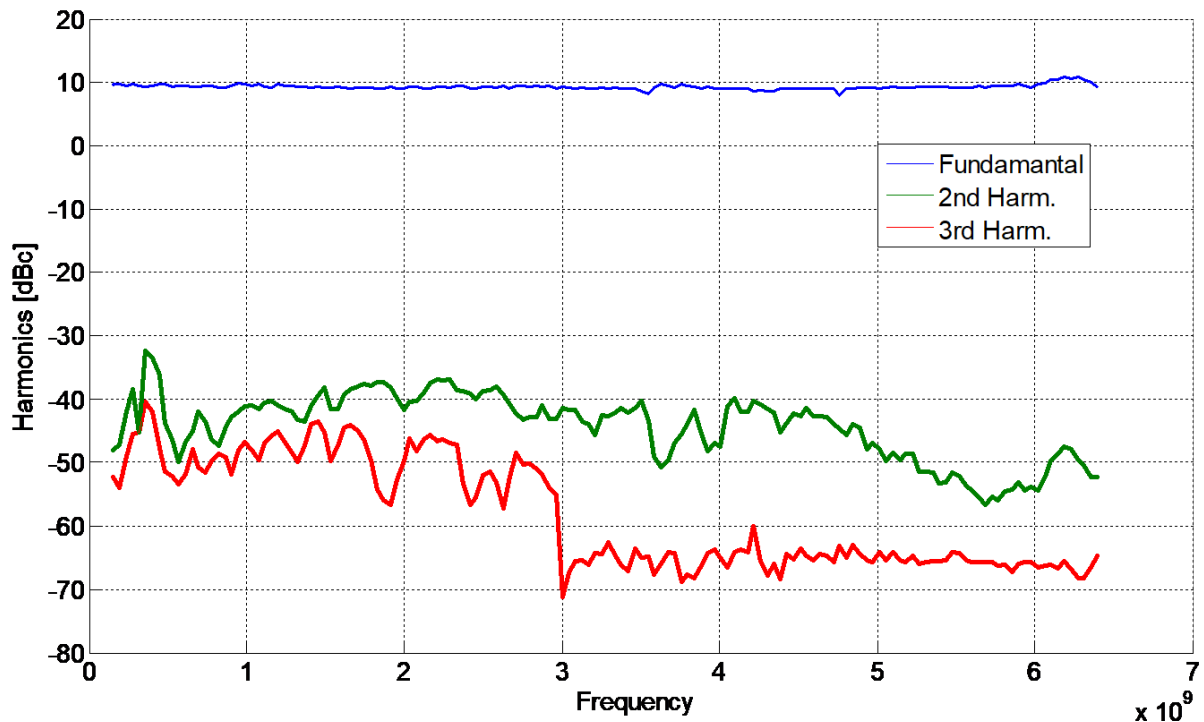
Maximum Output Power (1 kHz to 10 MHz)



Phase Noise Performance (1, 2 and 4 GHz)



Harmonic performance at + 10 dBm

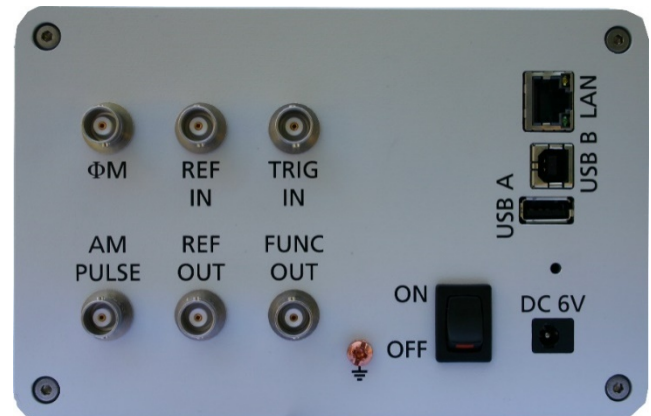


Connectors (Front)



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

Connectors (Rear)



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, 6 A)
11. DC power switch

ORDERING INFORMATION



| HOST MODEL | PRODUCT | DESCRIPTION |
|-------------|-------------|--|
| APSINX010HC | APSIN2010HC | 9 kHz – 2000 MHz Signal Generators |
| APSINX010HC | APSIN4010HC | 9 kHz – 4000 MHz Signal Generators |
| APSINX010HC | APSIN6010HC | 9 kHz – 6100 MHz Signal Generators |
| APSINX010HC | B3 | Internal rechargeable battery module |
| APSINX010HC | GPIO | GPIO interface |
| APSINX010HC | AVIO | Avionics modulation capability (VOR/ILS) |
| APSINX010HC | 1URM | 1U rack-mount module |
| APSINX010HC | REAR | Move output to the rear panel |
| APSINX010HC | OEM | OEM package |
| APSINX010HC | WE | One-year warranty extension (standard: 2 years) |
| APSINX010HC | ReCal | Recalibration with test data (recommended: two years interval) |

GENERAL CHARACTERISTICS

Remote programming interfaces

- Ethernet 100BaseT LAN interface
- USB 2.0 host & device
- GPIO (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/ 6 V 6.0 A DC out

Storage temperature range –40 to 70 °C

Operating temperature range 0 to 45 °C

Operating and storage altitude up to 15,000 feet



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

Weight ≤ 2.5 kg (6 lbs) net, ≤ 4 kg (8 lb.) shipping

Dimensions:

116.9 mm H x 173.6 mm W x 270.7 mm L (incl. connectors)
[4.60 in H x 6.83 in W x 10.66 in L]

Recommended calibration cycle 24 months

Compatibility languages supporting commonly used commands

Agilent Technologies N5181A MXG, Aeroflex, Rohde & Schwarz SMA and SML models


DocumentHistory

| Version | 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 | Front panel, measurement plots |
| V142 | 2011-5-20 | jk | Reference output 10 MHz, Pmax adjusted |
| V143 | 2011-9-1 | jk | Phase Noise plot |
| V144 | 2012-09-15 | jk | Reference input range adjusted |
| V145 | 2012-09-15 | jk | Added trigger, chirps, pulse trains |
| V146 | 2013-08-26 | db | Modified sweep timing specs |
| V147 | 2013-10-04 | db | Added frequency settling time specs |
| V148 | 2014-01-21 | jk | corrected dimensions |
| V149 | 2014-02-06 | jk | Maximum power plots added |
| V150 | 2014-06-30 | jk | New phase noise plot |
| V200 | 2014-12-10 | jk | Unified data sheet for APSINX010HC series |
| V210 | 2015-05-10 | jk | Updated sweeping timing parameters |
| V211 | 2015-06-23 | db | Added >= SN xx-xxx5xxxx-xxxx AM bandwidth data |
| V212 | 2016-07-05 | Db | Added option PE data |
| V214 | 2016-12-15 | jk | Refine power level accuracy |
| V215 | 2017-5-15 | jk | Option AVIO |
| V216 | 2017-8-15 | jk | VSWR Spec refined |
| V217 | 2019-01-30 | mm | Dimension up-date |
| V218 | 2019-03-25 | mm | New layout |
| V219 | 2019-07-10 | ee | Minor corrections |
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