APPH6040 Specification V1.23 (Feb 2014)

A fully integrated high-performance cross-correlation signal source analyzer for 5 MHz to 7 GHz

Introduction

The APPH6040 an integrated solution that offers an indispensable set of measurement functions for evaluating signal sources ranging from VHF to microwave frequencies such as crystal oscillators, PLL synthesizers, clocks, phase-locked VCOs, DROs, and others.
The flexible instrument comprises a two-channel cross-correlation system with two internal tunable references sources and allows also measurements with external references.

The APPH6040 provides a complete set of measurement such as absolute and additive phase noise measurements, direct access to the two channel 50 MHz FFT analyzer, or frequency counter function, time-domain transient and power measurements.

Using proven cross-correlation measurement procedures and self-calibration routines, reproducible, and accurate measurements are obtained even under changing environmental conditions. Fully automated frequency acquisition and self-calibration greatly simplify use and applicability of the instrument, resulting in much faster measurement throughput and greater ease-of-use in actual operation.

It is a compact and powerful instrument available with LAN (VXI-11), USBTMC, or with GPIB (optionally) interfaces. Platform independent intuitive graphical user interface (GUI), API library, and powerful SCPI command language set is available.

Measurement supported:

- Additive or absolute phase noise measurement
- Transient measurements
- 50 MHz bandwidth FFT analyzer mode
- Frequency counter
- Power level detector

Specifications

The specifications in the following pages describe the warranted performance of the instrument 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
Phase Noise Measurement (absolute)				
Measurement parameters	SSB phase noise [dBc/Hz], Spurious noise [dBc], Integrated rms phase deviation [deg, rad] or time jitter [s], Residual FM/PM [Hz rms]			
RF Frequency Range	5 MHz		7 GHz	Internal or external references
Input Power Range -15 dBm -5 dBm -10 dBm			 +20 dBm +20 dBm +23 dBm	+26 dBm is damage level < 400 MHz 400 < f < 1500 MHz > 1500 MHz
Input impedance VSWR		50 Ω 2		AC coupled, 10V DC max
Offset Analysis Range	0.1 Hz		50 MHz 20 MHz 5 MHz	for RF > 70 MHz for RF < 70 MHz RF < 25 MHz
Measurement Accuracy		±4 dB ±3 dB ±2 dB		< 10 Hz offset < 1 kHz offset > 1 kHz
System Phase Noise Floor 1 Hz 10 Hz 100 Hz 1 kHz 10 kHz 10 MHz		 -140 dBc/Hz -150 dBc/Hz -160 dBc/Hz -175 dBc/Hz -180 dBc/Hz -180 dBc/Hz		(cross-correlation, external references) See plot for sensitivity of internal sources
Measurement time				See Table "Measurement Time"
Internal References				
Frequency Range	5 MHz		7 GHz	
Phase Noise Sensitivity				See Plots "Sensitivity"
Tracking Range		±20 ppm / s		
External References				One or two channel
Frequency Range	5 MHz		7 GHz	
Reference Level Range	+0 dBm	+13 dBm	+ 20 dBm	< 10 dBm requires internal amp
Tuning Voltage Range	0 V		+20 V	settable
Output current			10 mA	

Parameter	Min.	Typ.	Max.	Note
Additive Phase Noise Measurement 5 MHz to 7 GHz				
Measurement parameters	SSB phase noise [dBc/Hz], Spurious noise [dBc], Integrated rms phase deviation [deg, rad] or time jitter [s], Residual FM/PM [Hz rms]			
RF Frequency Range	5 MHz		7 GHz	using external references
Input Power Range (RF port) **(REF ports)**	0 dBm 10 dBm		+20 dBm +16 dBm	
Offset Analysis Range	0.1 Hz 0.1 Hz 0.1 Hz		50 MHz 20 MHz 5 MHz	0.01 Hz via SCPI control for RF < 70 MHz RF < 25 MHz
Measurement Accuracy		±3 dB ±3 dB ±2 dB		< 10 Hz offset < 1 kHz offset > 1 kHz
Residual Phase Noise Floor 1 Hz 10 Hz 100 Hz 1 kHz 10 kHz 10 MHz		 -140 dBc/Hz -150 dBc/Hz -160 dBc/Hz -175 dBc/Hz -185 dBc/Hz -185 dBc/Hz		(cross-correlation engine)
Input impedance VSWR		50 Ω	 2	
Offset Analysis Range	0.1 Hz 0.1 Hz 0.1 Hz		50 MHz 20 MHz 5 MHz	for RF > 70 MHz for RF < 70 MHz RF < 25 MHz
Measurement Accuracy		±4 dB ±3 dB ±2 dB		< 10 Hz offset < 1 kHz offset > 1 kHz
System Phase Noise Floor 1 Hz 10 Hz 100 Hz 1 kHz 10 kHz 10 MHz		 -140 dBc/Hz -150 dBc/Hz -160 dBc/Hz -175 dBc/Hz -180 dBc/Hz -180 dBc/Hz		(cross-correlation, external references) See plot for sensitivity of internal sources
Transient Measurements				
Measurement parameters	Frequency, Phase (narrowband)			
Frequency range	5 MHz		7 GHz	
Measurement bandwidth		tbd		See table
Frequency resolution		tbd		See table
Phase resolution		tbd		See table
Measurement time	50 us		10 s	
Time resolution	20 ns			

FFT Analyzer

Input Connectors	2 BNC female (rear panel), AC coupled			
Measurement parameters	dBV/Hz, dBm/Hz, nV/√Hz			
DC Voltage Range Input Impedance	-12 V	1 kΩ	+ 12 V	DC
AC Voltage Range			+ 10 dBm	
Frequency Range	1 Hz		50 MHz	
Input Noise Density		< 1 nV/√Hz		f > 1kHz

Frequency Counter

Measurement parameters	Frequency [Hz]			
Frequency Range	5 MHz		7 GHz	
Absolute Accuracy		300 ppb		
Sensitivity		-10 dBm		

Power Detector

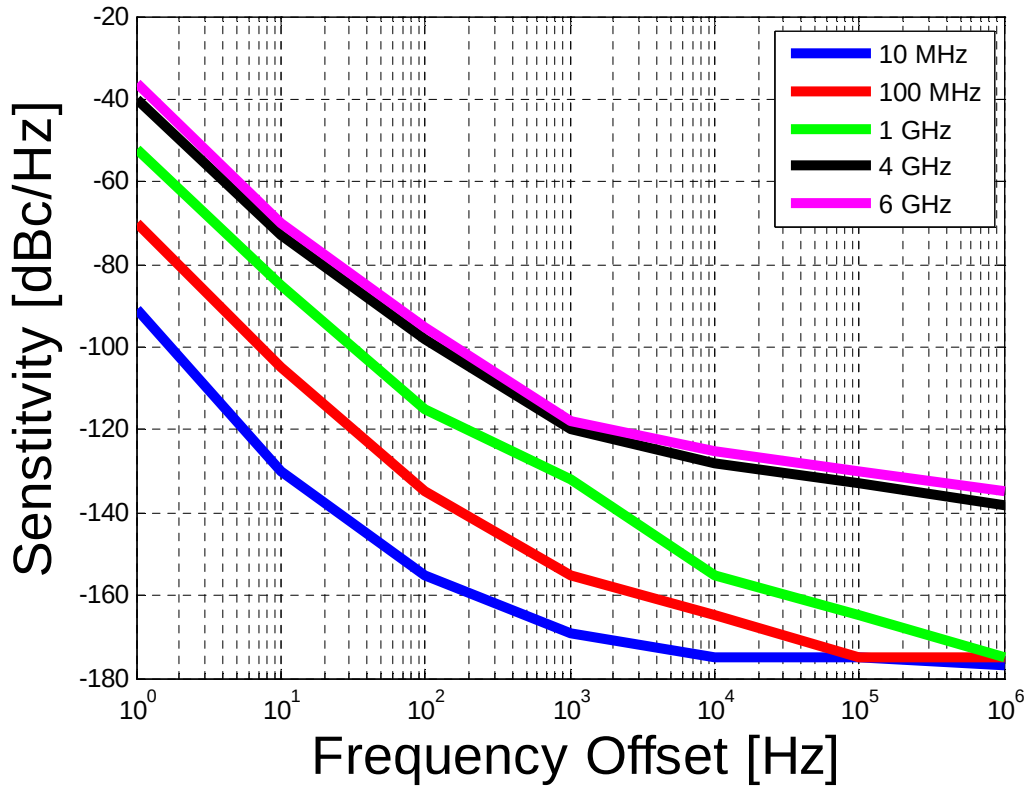
Measurement parameters	Power mW ,dBm			
Frequency Range	5 MHz		7 GHz	
Accuracy		1.5 dB		
Power Range	-10 dBm		+15 dBm	

Dual Power Supply (option SUPPLY)

DC Voltage Range	0		14 V	
Setting Resolution		1 mV		
Setting Uncertainty		±10 mV		
Noise Level		< 10 nVrms/√Hz		> 20 kHz
Output Resistance		< 0.5 Ohm		
DC current meas. range	0		400 mA	Per channel
Uncertainty		< 100 uA		

Phase Noise Sensitivity (dBc /Hz)

Measurement time ~10 seconds, after first cross-correlation; further correlations will improve sensitivity by 5 dB by for 10, 10 dB for 100, and 15 dB for 1000 respective correlations performed.



Measurement Time

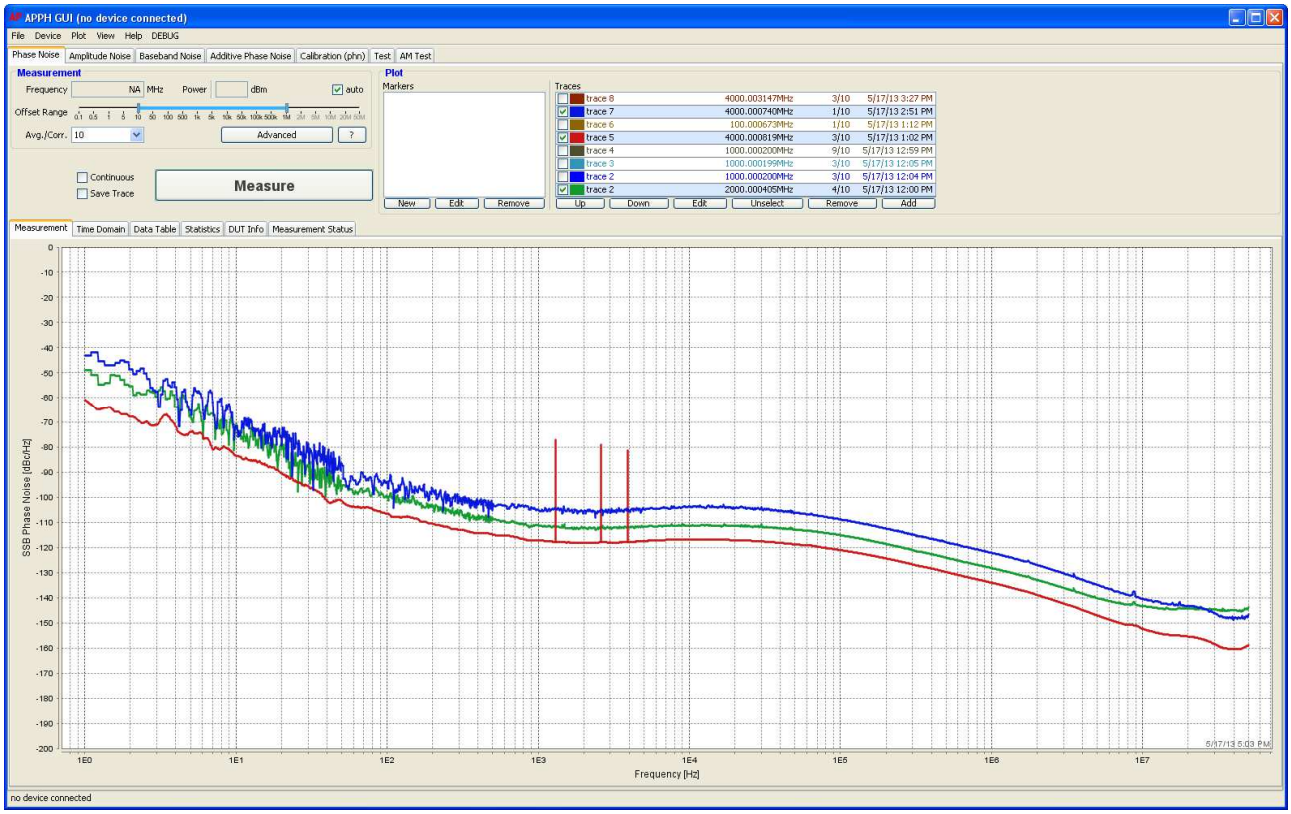
Total measurement time consists of setup time, transfer time plus the number of performed correlations times the time per correlation

	Typical setup time (sec)	Time per average (sec)	Nr. of points
0.1 Hz to 50 MHz	3	80	~ 1800
1 Hz to 50 MHz	3	10	~ 1700
10 Hz to 50 MHz	3	1.5	~ 1500
100 Hz to 50 MHz	3	0.5	~ 1300
1 kHz to 50 MHz	<2	0.2	~ 1050
10 kHz to 50 MHz	<2	<0.1	~ 800

Data Processing Capabilities

The analyzer employs a graphical user interface based on Windows OS.

GUI Interface



Display Functions	Phase Noise, Time Domain, Data Table, Residual, Statistics
Trace Functions **Data Traces**	Display current measurement and/or multiple memory data (up to 16 traces)
Math	Addition, subtraction, multiplication, or division of trace data, offset corrections
Title	Add customized title to each measurement window, legends
Auto-Scale	Automatically selects scale resolution and reference value to vertically center the trace.
Statistics	Calculates and displays mean, standard deviation, and peak-to-peak deviation of the trace.
Marker Functions	16 independent markers

Connectors

1. RF inputs: , RF IN, REFIN1, REFIN2, REFOUT1, REFOUT2 : SMA female
2. Tuning outputs: Tune1, Tune2 : BNC female
3. DC power switch

Connectors (Rear)

1. Supply outputs: Supply1, Supply2 : BNC female
2. Baseband inputs: BBIN1, BBIN2) BNC female
3. LAN connection: RJ-45
4. USB 2.0 host and device
5. DC Power plug (6V, 6A)

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; 24 W maximum
Mains adapter supplied: 100-240 VAC in/ 6V, 6A DC out
Operating temperature range 0 to 35 °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 kg (9 lbs) net
Dimensions

Options

- ***GPIB****: IEEE-488.2,1987 programming interface*
- ***SUPPLY:*** *dual programmable low noise supply*

Document History

Version/Status	Date	Author	Notes
V10	2012-10-30	jk	first release
V11	2013-3-4	jk	FFT data completed
V12	2013-5-4	jk	GUI
V121	2013-7-4	jk	Frequency counter and Power detector
V123	2014-2-2	jk	Option SUPPLY