

Signal Source Analysis Up to 21 GHz

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Anapico has developed the APPH series of fully automated signal source analyzers offering a measurement capability up to 21 GHz, with a fully integrated, cross correlation system that responds to the most common issues of phase, amplitude and base-band noise measurements. Key features of the APPH series of analyzers are: simplicity of use, high accuracy and reproducibility, measurement speed, high dynamic range with low system noise floors, while at the same time, offering attractive cost of ownership for labs and production environments. Application dependant, various models are offered with measurement capability from 2 to 400 MHz (APPH6000-IS400), 2 MHz to 6 GHz (APPH6000-IS and APPH6040) and 10 MHz to 21 GHz (APPH20G).



System Architecture

The APPH design focuses on delivering high performance with a simple, yet high-performing architecture, as shown in **Figure 1**. The core engine of the APPH combines low noise analog receiver channels with the latest digital signal processing technology to provide fast and repeatable noise measurements. The proprietary FPGA-based FFT cross-analyzer handles 125 MS/s samples in real-time, thus allowing thousands of correlations and sub -170 dBc/Hz measurements within seconds.

The APPH series uses PC, laptop or tablets as the control unit, so it does not incorporate displays, which minimizes product costs while increasing reliability. The LAN or USB controlled instrument is 'plug-and-play' with any standard computer.

Accurate Calibration

The entire test system is enclosed in a compact, fanless chassis. Developing the product on a fully integrated, low power platform has avoided fan cooling, further eliminating spurious signals and ground and power line loops. Two chassis are available, a 2.5 kg portable version, and a 4.5 kg, 19 inch rack mountable version.

A very important consideration is precise calibration. Before shipment, each instrument is carefully calibrated against a traceable noise standard to guarantee high precision, consistent and repeatable results. Optionally, a calibration standard can be supplied with the instrument to enable a user's on-site performance verification at any time.

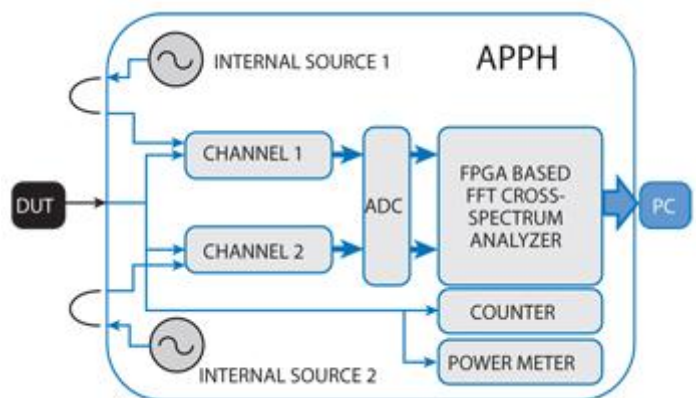


Figure 1 APPH system block diagram.

Measurement Capability

The APPH instruments are phase noise measurement systems that are designed to consistently provide clean, accurate absolute and additive phase noise data. The standard RF unit has an operating range of 2 to 400 MHz or 6.2 GHz. The microwave model extends the frequency range up to 21 GHz. The user may want to bypass the internal sources and work with their own reference sources to achieve improved phase noise floors with even shorter measurement times.

The phase noise data shown in **Figure 2** is data gathered from a low noise 100 MHz OCXO reference. The three traces shown are after first correlation (green, after 12 s measurement time), 10 correlations (blue, after 120 s) and 100 correlations (red, after 20 min), respectively. The noise floor of the DUT at -180 dBc/Hz is reached just after 10 correlations or two minutes. For this ultra-low noise measurement, even faster results can be obtained with external reference sources.

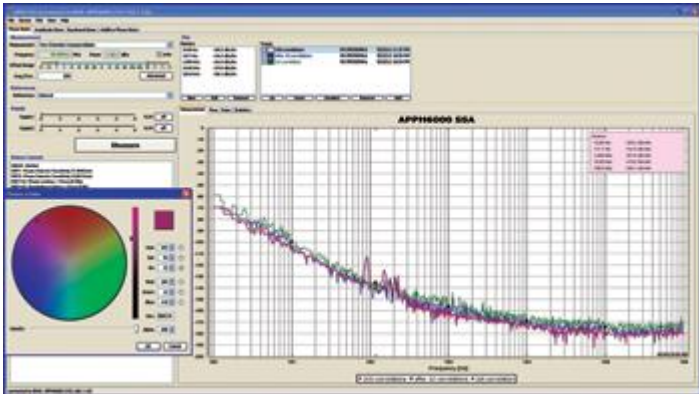


Figure 2 APPH Graphical User Interface (GUI).

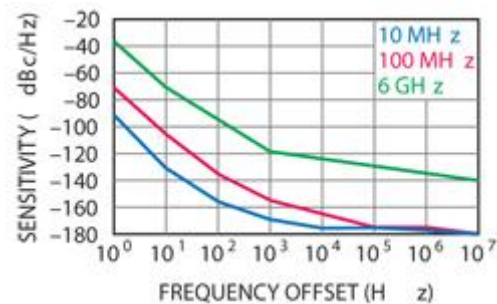


Figure 3 Sensitivity of APPH with internal reference sources (after 24 s measurement time).

The sensitivity of the system operated with the internal references is dependent on both the carrier frequency of the DUT and the frequency offset range. **Figure 3** shows the typical sensitivity when using the internal sources to make a measurement, assuming an approximate 24 second measurement with an offset from 1 Hz to 10 MHz.

However, the APPH signal source analyzers can do more than just absolute phase noise tests of oscillators and synthesizers. They can also measure additive phase noise of amplifiers under different drive conditions, and of frequency translating devices like prescalers or mixers. Additionally, amplitude noise measurements are also supported. **Figure 4** shows the amplitude noise obtained from one of Anapico's signal generators at 1 GHz, showing a trace with user defined markers and spurious list.

The APPH also offers direct access to the FFT analyzer, which enables noise analysis of supply and control voltages. The APPH6040 with extended offset range as well as the APPH20G provide bandwidth beyond 40 MHz and transient measurement capability.

Remote Control

It is known that efficient conduction of noise measurements requires high quality user interfacing. All Anapico instruments are supplied with a dedicated interface GUI that is easy to navigate and operate (see Figure 2) and allows simple 'one-click' measurements. There are simple indicators for DUT power, frequency and frequency stability, as well as lock status and indicators relating to the validity of the results. Embedded diagnostic hardware provides the information the software needs to auto-detect, lock, calibrate, acquire data and post-process data.

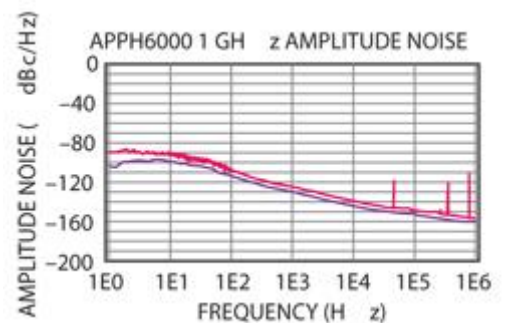


Figure 4 Amplitude noise measurement with noise and spurious marker lists.

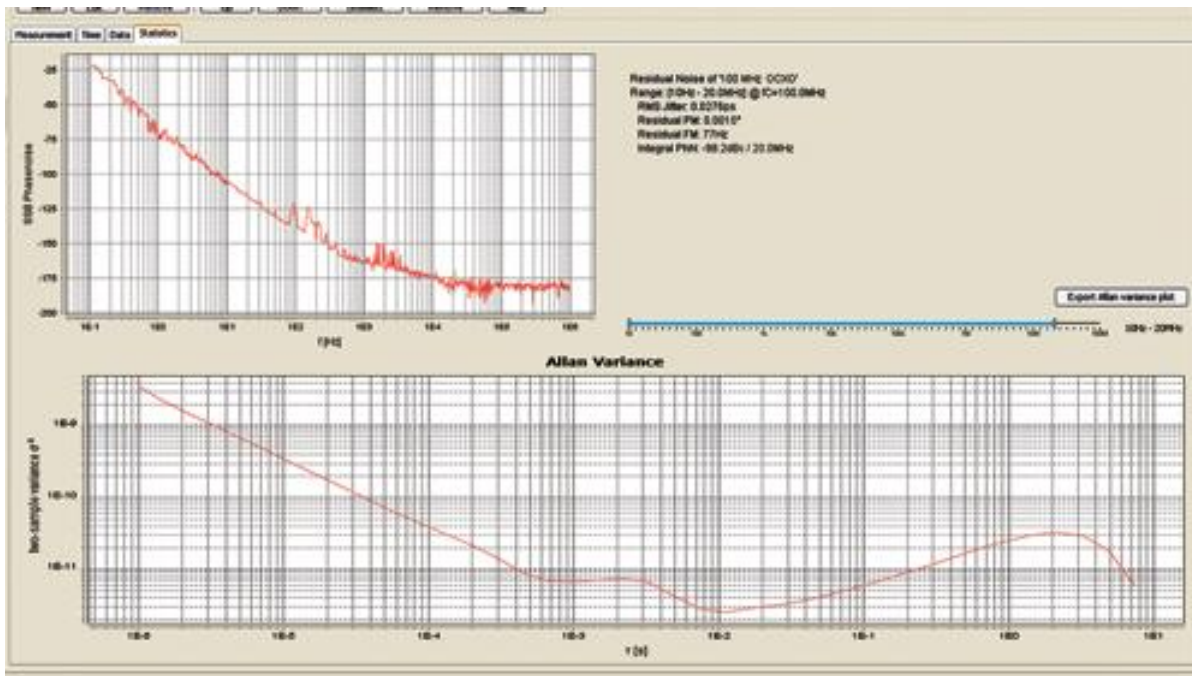


Figure 5 Statistic tab provides jitter, residual FM; integral phase noise, or Allan Variance.

- Important features include:
- DUT power level and frequency and drift indicator
- Dedicated plot window with auto-scale and versatile zoom functions, scaling and smoothing
- Drag and drop multiple markers
- Spurious detection, list and suppression
- Data export to CSV, Excel and ASCII data formats
- Single or multi plot traces export to bitmap or re-loadable APPH format
- Multiple post-processing data such as random jitter over defined bandwidth, Allan Variance, integral phase noise (see **Figure 5**).

While this GUI provides powerful features to the user, the APPH instruments are also optimized for direct control via user software. Programming libraries as well as standard SCPI command language allows direct access and control to the instrument and allows maximum measurement speed and test throughput. Single spot noise measurements can be performed at maximum speed per tested DUT.

The APPH series of signal source analyzers provides fast, accurate and easy to operate measurements beyond 20 GHz and with offset from 0.1 Hz to 40+ MHz at extremely attractive costs. Customers are supported with user and programmer manuals and direct support is provided through an instant email support hotline.

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