Transient Analysis and VCO Testing

Anapico Ltd.
Glattbrugg, Switzerland

Anapico has enhanced the APPH series of fully automated signal source analyzers offering a measurement capability up to 26 GHz. Besides the additive and absolute phase noise measurements from 0.1 Hz to 50 MHz offsets, additional measurement capability has been added such as transient analysis, RF spectrum monitoring and VCO characterization, making the APPH a very versatile signal source analyzer.

The instrument is simple to use and offers high accuracy and reproducibility, allied to good measurement speed. It provides high dynamic range with low system noise floors, while at the same time offering attractive cost of ownership for labs and production environments.

Two models are available, which are application dependant – the APPH6040 covers the 5 MHz to 7 GHz range while the APPH20G goes from 5 MHz to 26 GHz. The instruments are Ethernet, USB or GPIB controlled and 'plug-and-play' with any standard computer. The entire instrument is enclosed in a compact, fanless 3U 19 inch chassis and weighs 4.5 kg.

Developing the product on a fully integrated, low power platform has avoided fan cooling, further eliminating spurious signals and ground and power line loops. In fact, using an external battery this unit can be operated anywhere without need for AC power.

Available options include dual programmable low noise power supplies up to 15 V and 500 mA current, an ultra low close to carrier phase noise option of the internal reference synthesizer and a GPIB communication interface. Since the APPH series uses PC, laptop or tablets as the control unit, it does not incorporate displays, which minimizes costs while increasing reliability.

FREQUENCY AND PHASE TRANSIENT MEASUREMENTS

With the enhanced firmware, the APPH works like a high performance modulation domain analyzer – providing a view of frequency or time interval measurements over time. This way of seeing data is intuitive, enabling frequency switching, jitter or modulation to be viewed directly. The APPH also adds the time dimension to frequency counter results. Therefore, frequency variations can be seen directly without the dead-time between measurements traditionally found in frequency counters.

In effect, the APPH becomes a 'frequency oscilloscope' – measuring carrier frequencies

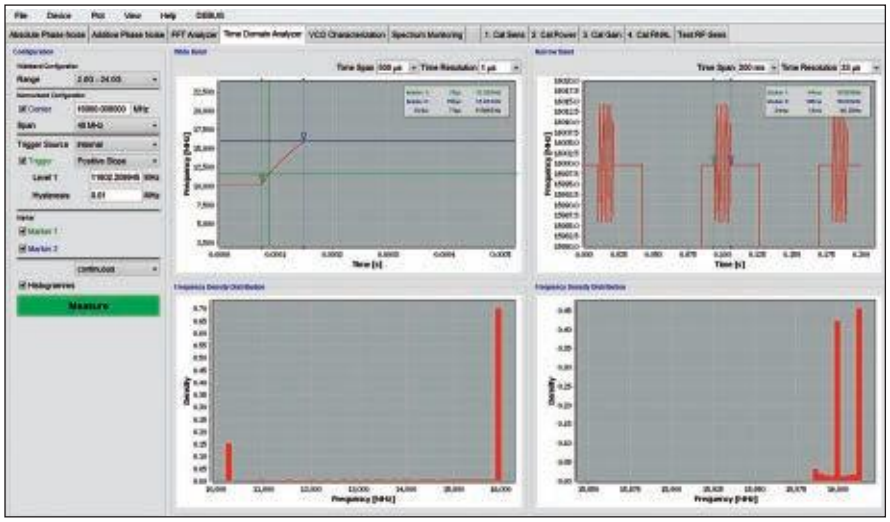

Fig. 1 APPH time domain measurement.

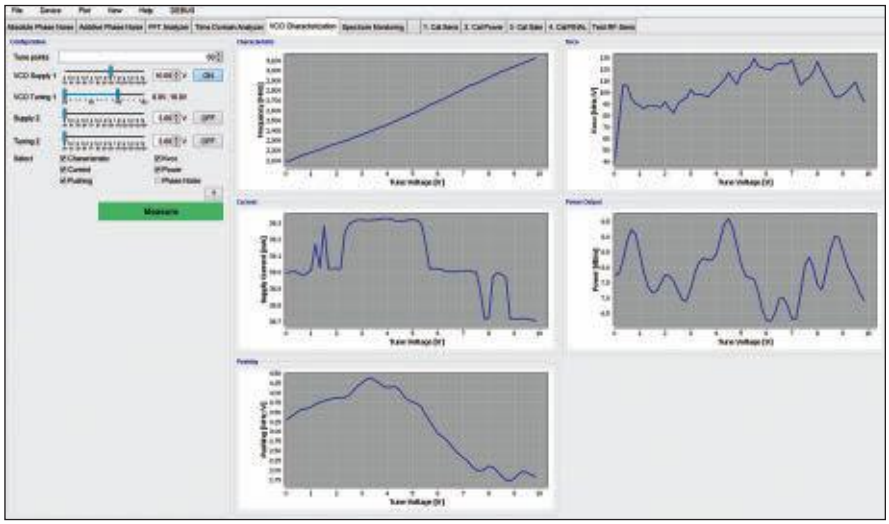

Fig. 2 APPH VCO characterization example.

versus time up to 26 GHz as fast as every 16 ns. Through continuous sampling of the carrier frequency, modulation can be recovered and carrier dynamics analyzed.

The APPH's transient measurement supports two modes, a narrowband and a wideband mode, both running synchronously. The wideband mode can be used to observe wide frequency span transients up to 20 GHz bandwidth. The narrowband mode is used to determine frequency transients with fine frequency resolution. With a time resolution down to 16 ns and a continuous time span up to several hours, a large number of applications can be covered. These include: measuring the frequency droop on individual channels in frequency hopping systems; analyzing chirp radar performance; measuring pulse jitter and viewing the distribution histogram; calibrating frequency sweep signals; and calibrating intentional modulation (FM or FSK).

Further applications consist of: analyzing PLLs and frequency locked-loops; discovering phase jumps in synchronization clocks; detecting missing periods from rotational encoders; measuring frequency settling times of VCOs; and characterizing start-up/warm-up of oscillators. A very powerful trigger system enables the selection of the trigger mode, source, polarity and hysteresis, and pre-trigger delay, the same as established digital sampling oscilloscopes provide.

MEASUREMENT EXAMPLE

A screenshot of a time domain measurement is shown in ***Figure 1***. Via the GUI interface, switching between the various measurements such as phase or amplitude noise, FFT analyzer, transient measurement, etc., can be done by just changing the respective tab at the top.

The GUI is configured to trigger on a frequency transient of a fast wideband synthesizer (APSYN420D) switching from approximately 10 to 16 GHz. In the upper left window, the wideband transient can be observed, showing a switching transient of approximately 20 microseconds. In the upper right window the 'zoomed-in' narrowband measurement, taken over a much longer time span, reveals details of the frequency modulation on top of the 16 GHz carrier. The lower windows have been configured to provide the frequency distribution over the measurement time span.

VCO CHARACTERIZATION

In order to characterize a VCO, at least two (low noise) DC sources and one signal analyzer are needed, which can measure power, frequency and phase noise. With its four independent programmable DC voltages to supply and control the device under test (DUT), the APPH can automatically characterize the VCO versus tuning voltage for the following parameters: frequency, tuning sensitivity, output power, current consumption, supply pushing and SSB phase noise. ***Figure 2*** shows a typical measurement of a wideband VCO taken with the APPH SSA. The desired VCO parameters are captured in a single sweep.

In summary, the Anapico APPH signal source analyzer has been extended with new measurement capabilities. Besides the powerful phase noise measurements (additive and absolute), other measurements are supported such as a transient time domain measurement mode, an FFT analyzer, a real time spectrum monitor and a VCO characterization tab. These independent measurement capabilities are easily used by a single intuitive graphical user interface. For production testing (ATE), a remote SCPI based programming language is supported with throughput optimized measurement times.

Anapico Ltd.
Glattbrugg, Switzerland
+41 44 515 55 01
sales@anapico.com
www.anapico.com