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### Synthesizers Shave Phase Noise to 24 GHz

**These stable broadband signal sources are available in three different packages, designed to minimize noise levels across wide bandwidths to 24 GHz and beyond.**

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Frequency stability is essential for most RF/microwave applications and it is usually synonymous with a signal source capable of low noise levels. The PHS 8400 family of frequency synthesizers from Pronghorn Solutions (Denver, CO) is an example of a stable line of signal sources with a unique twist: the synthesizers are available in three different form factors: benchtop, modular, and handheld configurations that will literally fit any application. Even better, they achieve low levels of harmonics, spurious, and phase noise across a standard frequency range of 0.7 to 24.0 GHz with options that extend that frequency range.

The modular versions of the frequency synthesizers, such as a model PHS-8400M (Fig. 1), show how the small size does not force users to sacrifice flexibility. In addition to the expected interconnections for DC power and RF output signals, the frequency synthesizers include a modulation/trigger input, an input/output port to use an external frequency reference or access signals from the PHS-8400M's internal frequency reference, and even a Universal Serial Bus for controlling the synthesizer with the appropriate software on a personal computer (PC). The model numbers for the rack-mountable benchtop and miniature handheld versions reflect their different form factors, PHS-8400B and PHS-8400H, albeit with the same performance levels provided in all three forms.

That performance includes a frequency range that can be customized according to specific requirements. The basic or "starting" frequency range is 0.7 to 24 GHz, but the frequency range can also start at 10 MHz, 0.5 GHz, or 1 GHz and stop at 12, 18, 24 GHz or higher, depending upon a customer's needs. The standard tuning resolution is 1 kHz, although this, too, can be changed, with options for frequency tuning resolution of 1 or 0.01 Hz.

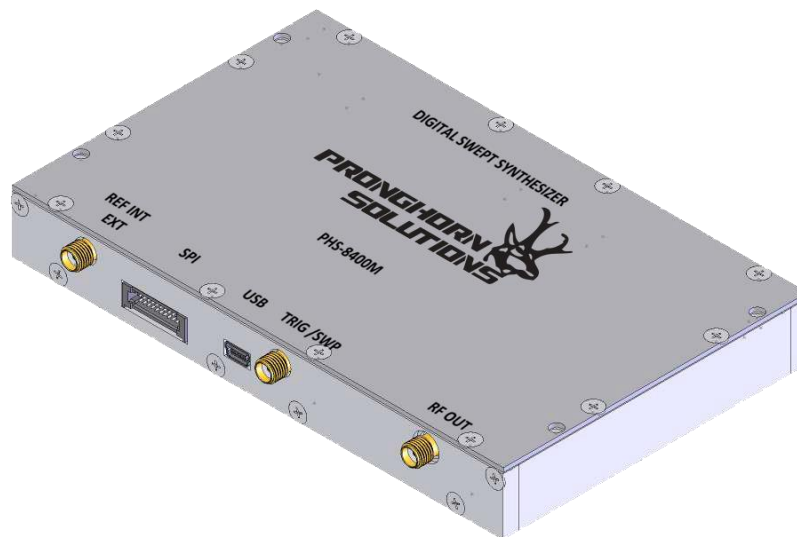
As noted, these are stable signal sources, with standard frequency stability of {PLUS/MINUS}10 ppm. They can be supplied with a 10- or 100-MHz internal crystal oscillator frequency reference and can work with an external frequency reference. As expected for a stable source, the noise levels are low, with single-sideband (SSB) phase noise of less than -120 dBc/Hz offset 100 kHz from a 10-GHz carrier and better than -111 dBc/Hz offset 100 kHz from a 24-GHz carrier. Measurements with a commercial phase-noise analyzer from Keysight Technologies ([www.keysight.com](http://www.keysight.com)) reveal that the phase noise at 10 GHz remains low for offsets closer to the carrier (Fig. 2). Spurious noise is less than -60 dBc. Harmonics and subharmonics held to less than -15 dBc with options for harmonics of -40 dBc or less and subharmonics of -50 dBc or less.

The PHS-8400 frequency synthesizers deliver at least +5 dBm output power across the full frequency range, with +7 dBm or more output power through 18 GHz. The power level can be controlled over a 10-dB range, in 0.5-dB increments. For applications requiring fast frequency switching speeds, the synthesizers can switch between two frequencies in list model in less than 100 {LC MU}s.

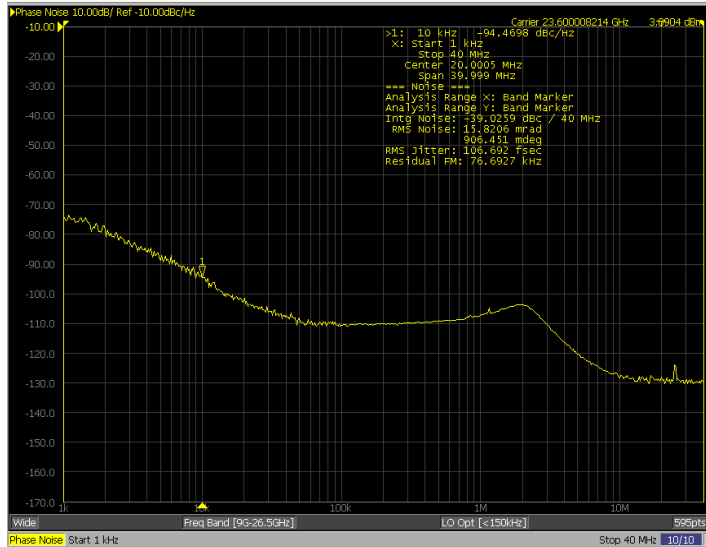
All three versions of the synthesizer include USB ports, and the synthesizers are also shipped with software drivers for control with a PC, including popular LabView{R} instrument drivers from MathWorks ([www.mathworks.com](http://www.mathworks.com)). The benchtop and handheld models include displays and keypads while benchtop and modular versions offer SCPI/IVI-compatible SPI and LAN interfaces as options. The synthesizers require a supply of +7.5 to +8.4 V dc and less than 1 A typical current. Power consumption for the modular synthesizer is typically less than 8 W, with a power-saver/standby mode available as an option to further conserve power. The modular synthesizer version (PHS-8400M) measures just 6.00 {MULT} 3.54 {MULT} 0.70 in. and weighs less than 1 lb.

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Figures



1. The modular version of the model PHS-8400 line of frequency synthesizers (model PHS-8400M) measures just 6.00 {MULT} 3.54 {MULT} 0.70 in. and weighs less than 1 lb. even with its many input, output, and control interfaces.



2. This plot shows phase-noise measurements on a 23.6-GHz carrier for a model PHS-8400M frequency synthesizer, with testing performed with a commercial frequency-downconverter and phase-noise test set from Keysight Technologies ([www.keysight.com](http://www.keysight.com)).