5125A

High-Performance, Extended-Range Phase Noise and Allan Deviation Test Set

Key Features

- Simultaneous phase noise and Allan Deviation measurements
- 1 MHz–400 MHz input frequency range
- No external data processing required
- Industry leading accuracy
- Allan Deviation measurements to over 300 days
- Phase noise measurements as close as 0.1 mHz from the carrier
- Displays internal noise estimate
- Excellent phase noise measurements down to –170 dBc/Hz (typical) and 10 kHz from the carrier (10 MHz input)

Key Benefits

- Measurement results displayed within seconds
- Makes measurements with input and reference at different frequencies
- No required measurement calibration saves time
- Easy-to-use graphical user interface

Quick, Accurate, Cost-Effective Measurements Now Possible over 400 MHz Input Frequency Range

The Microsemi® 5125A makes accurate phase noise measurements on signals from 1 MHz to 400 MHz, covering the full range of the most commonly used frequency references. The 5125A, which requires absolutely no configuration, displays measurement results seconds after the Start button is pressed.

Microsemi has designed the all-digital 5125A to meet the most demanding requirements. The 5125A's industry-leading close-in phase noise performance, –140 dBc/Hz at a 1 Hz offset (10 MHz fundamental), makes it the perfect solution to characterize the lowest noise frequency references available, such as those used in RADAR and satellite communications.

The all-digital architecture employed in the 5125A uses advanced, high-speed, low-noise analog-to-digital converters in a patented architecture that does not require a phase-lock loop to make measurements. This provides multiple benefits for 5125A users. First, the input carrier signals can be characterized much more accurately than before, to within 0.1 mHz of the carrier. Second, the measurements can be used to simultaneously evaluate the short-term stability. Last but not least, the user does not need to calibrate each individual measurement setup.

In addition to phase noise measurements, the 5125A simultaneously performs a variety of other measurements, which enables users to more fully characterize their Devices Under Test (DUT). The industry-standard stability metric for short-term stability, the Allan Deviation (ADEV), can be measured out to more than 300 days; the frequency and phase vs. time are plotted in real time; and the frequency counter displays 13 digits of precision in 1 second.

Established Leader in Time and Frequency Measurements

Years of research at the National Institute of Standards and Technology (NIST) and in private industry have come to fruition in Microsemi's phase noise test sets, which employ both direct sampling of the RF waveforms as well as cross correlation, making it possible to easily characterize the highest performance time and frequency references. The 5125A builds on the experience gained with Microsemi's ground breaking 5120A by extending the direct sampling approach throughout the frequency range up to 400 MHz.

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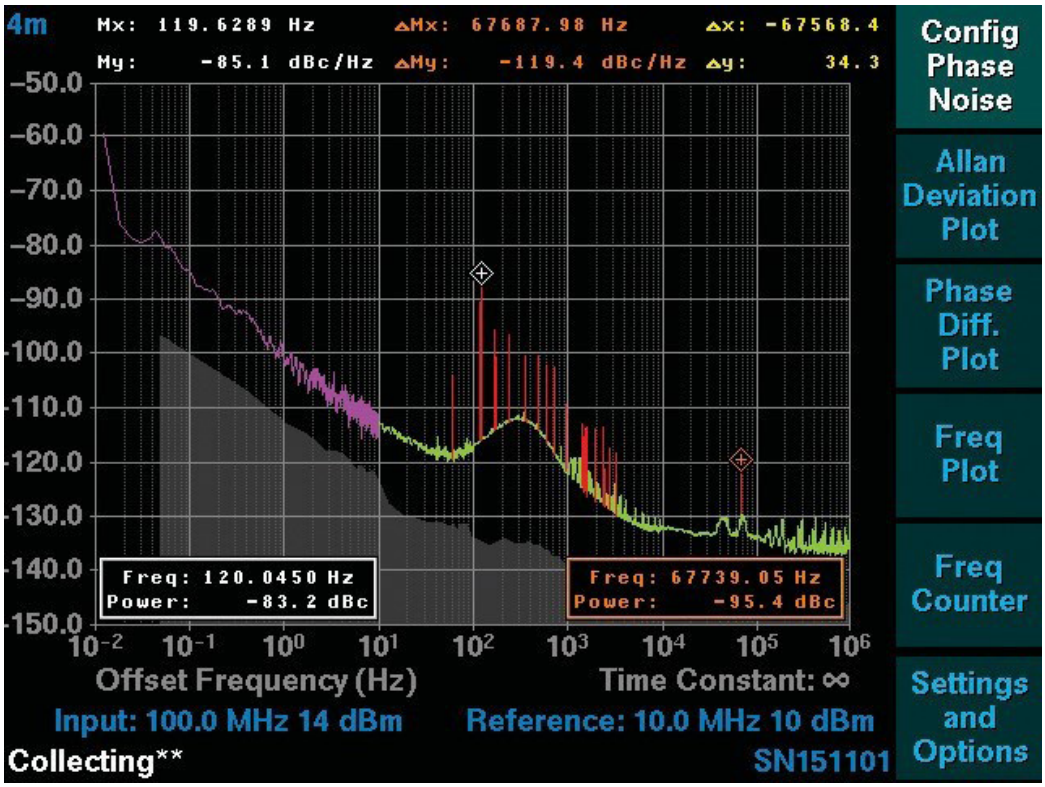
Quickest Start-to-Finish Measurements

Thanks to the 5125A's innovative internal architecture, it requires no user configuration or calibration and thus makes phase noise measurements in a matter of seconds.

Extremely Wide Range Measurement Capability

The 5125A supports a wide range of phase noise and ADEV measurements. By converting the DUT and reference signals to their digital representation at the first stage, the all-digital design in the 5125A has eliminated the need for carrier suppression when making measurements, enabling phase noise measurements at smaller frequency offsets than previously possible (to below 0.1 mHz). This same technology enables simultaneous long-term ADEV measurements. Technical advances like these provide the ability to characterize high-performance sources better than ever before.



5125A Sample Display Capture—Phase Noise
Spurs are highlighted in red. The instrument's real-time noise floor, shown in gray, provides the user with a way to estimate the 5125A's internal noise bias on the current measurement.

Excellent Close-In Phase Noise Floor

The 5125A's built-in cross correlation capability results in an extremely low close-in phase noise floor. At 100 MHz, measurements can be made down to –130 dBc/Hz (typical) at an offset of 1 Hz from the carrier, making the 5125A an excellent solution for the most demanding phase noise measurement requirements.

Advanced Spur Detection

The 5125A is equipped with sophisticated algorithms that analyze spurious signals in the spectrum simultaneous with the phase noise measurement. Internally generated spurs are detected and suppressed. External spurs are highlighted in red on the unit's display, as shown in the 5125A Sample Display Capture—Phase Noise diagram. The power of each spur is calculated without the need for a separate measurement. The results are shown on the phase noise plot as well as in a separate table.

Easy-toUse

Microsemi has combined its extensive knowledge in phase noise and ADEV measurement techniques into a one-box solution with an intuitive, easy-to-learn GUI. Since all configuration and calibration are done by the 5125A, extremely accurate measurements can be made without a highly trained engineer having to supervise the measurements.

Making measurements is as simple as connecting the DUT and a reference and pressing the Start button.

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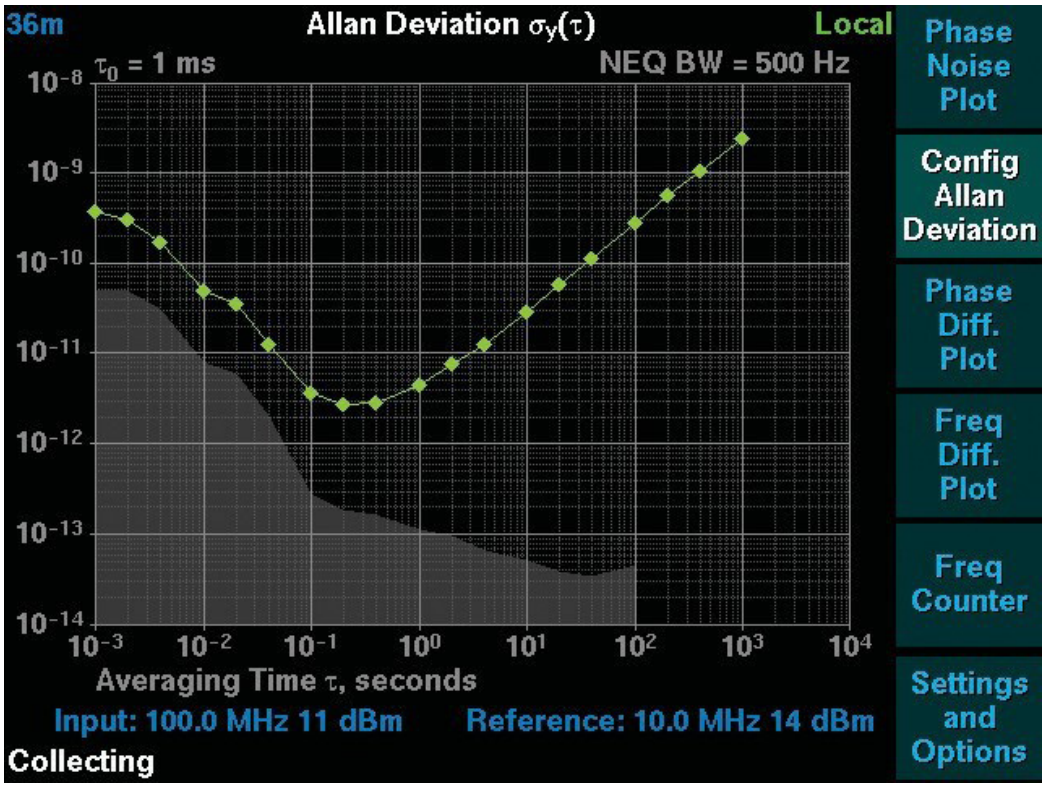
No Longer Must the Reference and DUT be at the Same Frequency

Unlike traditional measurement systems, the 5125A does not require that the frequency of the reference be the same as the DUT. Two enablers for this advance are that the 5125A synthesizes the two input frequencies for conversion to baseband, and the 5125A's phase detector has infinite range that doesn't require the two inputs to be phase locked. These advances allow accurate measurements to be made on a DUT at any frequency between 1 MHz–400 MHz, with a single low-noise reference.

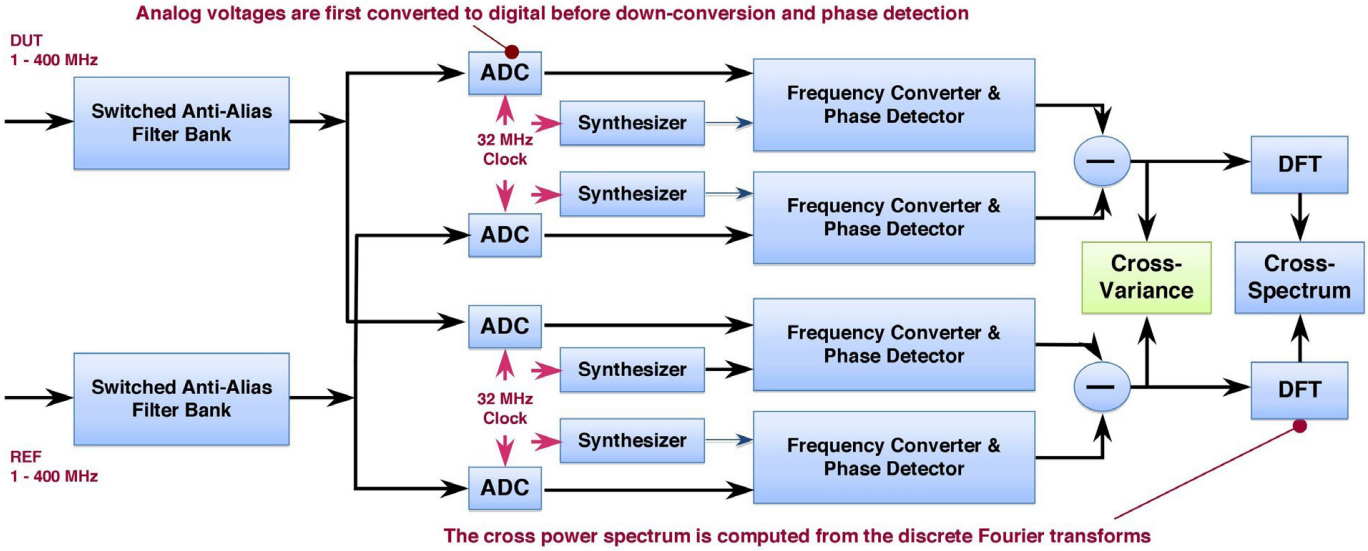
Multiple Connectivity Options

Connecting a mouse and/or keyboard directly to the 5125A's USB ports makes operating this instrument even easier. When remote operation is required, the user can connect to the 5125A's Ethernet port (over a standard 10/100BASE-T network) to start/stop measurements, gather raw phase data or measurement results, and print.



5125A Sample Display Capture – Allan Deviation

The instrument's real-time self-calculated noise floor, which can be used to estimate the 5125A's internal noise bias, is shown in gray. Allan Deviation measurements to over 300 days are supported.



5125A Block Diagram

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Benefits Of An All-Digital Test Set

The 5125A combines sophisticated timing technologies into a single, advanced measurement instrument. As is shown in the 5125A Block Diagram, after bandpass filtering to prevent undesired aliasing, the DUT and reference signals are converted to digital. This allows the 5125A to make accurate measurements without the need for an external phaselock loop and to measure both phase noise and Allan Deviation simultaneously. The use of a ratiometric phase measurement that depends on a trigonometric phase detector eliminates the need for user calibration.

Benefits of Cross-Correlation

The parallel measurement channels in the 5125A Block Diagram illustrate the unit's use of cross correlation. After making independent phase-difference measurements, the 5125A computes the cross spectrum using the discrete Fourier transforms from the two channels to estimate the noise of the input devices while rejecting the noises of the measurement sub-systems. This enables the instrument noise to be well below the noise floor of a single channel.

Specifications

Performance

- Frequency range: 1 MHz–400 MHz (sinewave)
- Allan Deviation: $<3 \times 10^{-15}$ at 1 sec (10 MHz–400 MHz, 0.5 Hz BW)

Phase Noise

- Measurement accuracy: ±1.0 dB
- Offset frequency range: 0.1 mHz to 1 MHz
- System noise floor (specifications): L(f) dBc/Hz

Offset Frequency	10 MHz	Input Frequency	
		100 MHz	400 MHz
1 Hz	–140	–120	–110
10 Hz	–150	–130	–120
100 Hz	–157	–140	–130
1 kHz	–162	–150	–140
10 kHz	–165	–160	–150
>100 kHz	–165	–162	–155

- System noise floor (typical): L(f) dBc/Hz

Offset Frequency	10 MHz	Input Frequency	
		100 MHz	400 MHz
1 Hz	–145	–130	–116
10 Hz	–155	–140	–126
100 Hz	–160	–150	–136
1 kHz	–165	–160	–146
10 kHz	–170	–170	–156
>100 kHz	–170	–170	–162

Electrical

- Input signal level: 3 dBm–17 dBm
- Input impedance: 50 Ω
- Input connectors: TNC (supplied with two BNC adapters)

Mechanical and Environmental

- Size: 34 cm x 17 cm x 44 cm (13" x 7" x17")
- Power: 100 VAC–240 VAC, 47 Hz–63 Hz IEC 320 connector, power switch.
- Operating temperature: 15 °C to 45 °C
- Storage temperature: –25 °C to 55 °C

Options

- Rack Mount Tray Kit (Option 001)
- Unlike the 5120A, there is no internal reference option

Product Includes

- 5125A Test Set, 2 TNC-BNC adapters, manual (on CD) and power cord
- One-year warranty

Front Panel

- Display: High-resolution 640 x 480 RGB LCD
- Buttons: 6 SoftKeys, Start, Stop, Print, Power
- TNC (2x): Input, Reference (3 dBm–17 dBm)
- LED: Power

Rear Panel

- USB: 2 each
- Network: RJ-45 10/100BASE-T Ethernet
- Printers: Printers with internal PostScript interpreters only.

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Power Matters.

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