

# 3120A

## High-Performance Phase Noise Test Probe

### Features

- Independent input and reference frequencies from 0.5 MHz to 30 MHz
- Cross-correlated measurements of PM noise at offsets from 1 Hz to 100 kHz
- Allan deviation (ADEV) typically less than  $1 \times 10^{-13}$  at  $t=1$  s
- SFDR specified at  $-100$  dBc, typically below  $-120$  dBc
- Frequency and phase difference graphs depict oscillator drift with more than 1 million point records
- Includes digital I/O expansion port and independent access to input ADCs
- Easy-to-use measurement software, fully multi-threaded for high performance
- Straight forward ASCII file format with flexible data import or export options

### Optional Features (Available as a Software Upgrade)

- AM noise license
- Signal statistics license for MDEV, HDEV, TDEV, and jitter measurements
- Frequency counter license
- Mask test license
- User-definable limit lines for all supported measurements take the guesswork out of pass or fail testing

### Benefits

- Measurement results displayed within seconds
- Supports measurements with input and reference at different frequencies
- No measurement calibration required: saves time
- Easy to use software with an intuitive graphical user interface
- Small form factor



### Accurate and Convenient Measurements in Seconds

The Microsemi-developed direct digital phase noise measurement technique has been extended to a test probe. Making accurate phase noise and Allan deviation measurements has never been more convenient. The programmable high-performance Microsemi 3120A phase noise test probe measures the amplitude, phase, and frequency stability of RF sources and two-port devices at frequencies from 0.5 MHz to 30 MHz.

Measurements made by the 3120A include the following:

- Real-time 'strip charts' of phase and frequency differences with sub-picosecond (ps) precision.
- Absolute frequency counts at more than 13 digits per second, 17 digits maximum (upgrade option)
- Allan deviation (ADEV) typically less than  $1 \times 10^{-13}$  at  $t=1$  s
- Modified Allan deviation (MDEV), Hadamard deviation (HDEV), and time deviation (TDEV) (upgrade option)
- RMS-integrated phase noise and phase noise at offsets from 1 Hz to 100 kHz and levels below  $-170$  dBc/Hz (upgrade option)

- AM noise at offsets from 1 Hz to 100 kHz and levels below  $-170$  dBc/Hz (upgrade option)
- RMS-integrated time jitter with less than 100 fs residual jitter from 1 Hz to 100 kHz (upgrade option)

All measurements made with the 3120A require a host PC and an external reference oscillator to be supplied by the user.

Virtually all aspects of measurement performance—accuracy, repeatability, noise floor, and spurious responses—depend on the ability to provide the best reference signal possible, such as a standalone low-noise OCXO for phase noise and AM noise measurements.

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**Figure 1: Screen View of the 3120A Test Probe Software**

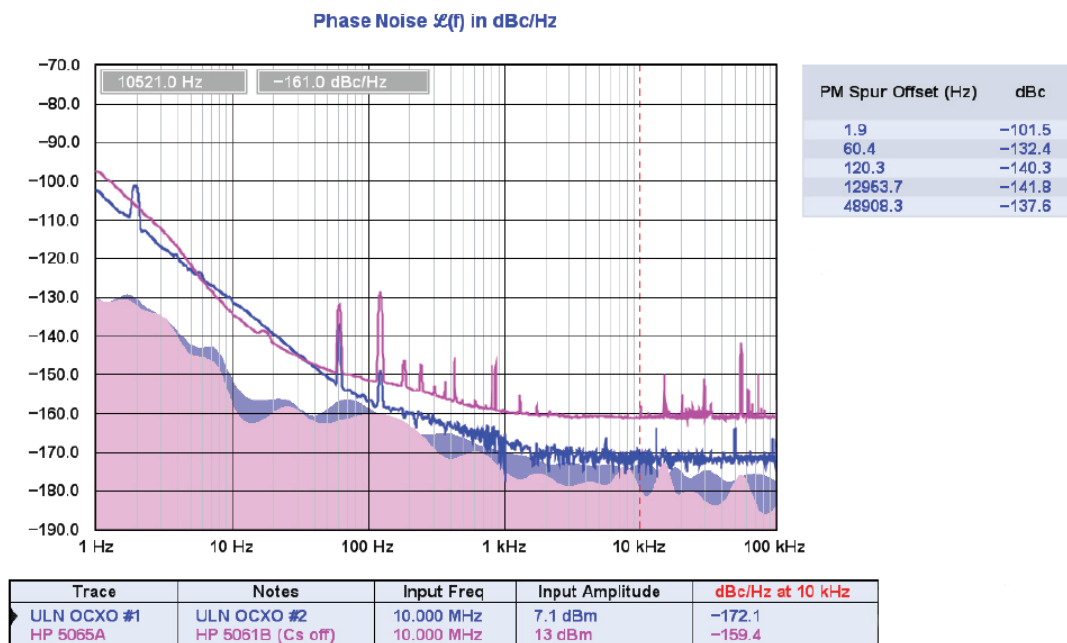


Figure 1 shows a screen capture view of the 3120A phase noise test software that is shipped along with the product. 3120A phase noise test software runs on Intel® or AMD® x86-based PCs equipped with Microsoft Windows® XP SP2, Windows 7, or Windows 8. Minimum system requirements are 100 MB of disk space, 1 GB RAM and a CPU with SSE2 support. A dual- or quad-core processor is strongly recommended.

Traditional analog measurement instruments require an external phase-lock loop, turning these types of measurements into a complicated and costly endeavor. Compare this to the 3120A, which makes fast yet accurate single sideband (SSB) carrier/noise ratio and ADEV measurements at the click of the button.

3120A continues the easy to use paradigm that Microsemi established with its earlier test sets. By simply connecting the device under test (DUT) and an external reference signal to the probe, which is connected to a Windows PC via a USB interface, the user can start taking measurements.

The 3120A leverages the extensive knowledge and experience obtained by Microsemi during the development of the industry standard for phase noise and ADEV measurements.

Recent advances in high speed, low noise analog to digital converters, have allowed the combination of multiple measurement tools to be integrated into a one probe chassis that connects to a PC. This enables the 3120A to make accurate measurements while remaining low profile.

The 3120A follows the paradigm shift begun by the Microsemi 5120A to the way phase noise and ADEV measurements are made. With the 3120A, these measurements are now easier in both R&D and production environments.

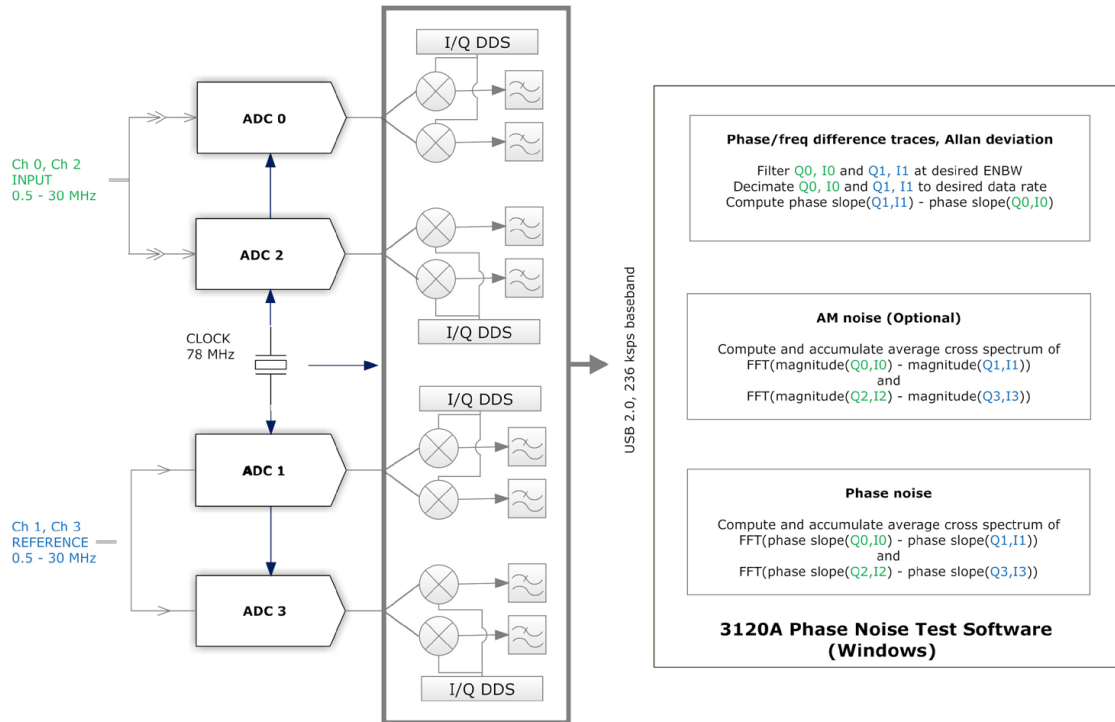
### Accurate Measurements in Seconds

The 3120A combines sophisticated timing technologies into a single, advanced measurements instrument. As shown in figure 2, upon entry to the unit, the DUT and reference signals are immediately converted to their digital representations. This allows the 3120A to make accurate measurements without the need for an external phaselock loop, enabling calibration-free measurements.

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Figure 2: 3120A Block Diagram



### 3120A Software Licensing Options

The base model of the 3120A allows customers to measure phase noise and ADEV. Upgradeable software options for customers to measure AM noise, HDEV, MDEV, TDEV, and jitter, along with the ability to set test mask limits or to use the probe as a frequency counter are available.

Upon purchase, customers will be provided a software license key based on their specific option choices. Once a license key has been used with the test probe for the first time, it is not necessary to re-enter the license key information, even if the probe is used with a different computer.

### AM Noise Measurement Floor

This option allows the 3120A to measure the AM noise spectrum of the input signal. Results are displayed in dBc/Hz at offsets from 1 Hz to 100 kHz, with typical instrument noise below -165 dBc/Hz at 10 kHz (-160 dBc/Hz specified performance). Applications include evaluation of high-performance HF oscillators, signal generators, and frequency standards, as well as residual AM measurement of distribution amplifiers and other two-port devices.

### Signal Statistics – HDEV, TDEV, MDEV Measurement and Jitter

The signal statistics option provides additional statistics for advanced stability monitoring and characterization. These

include modified Allan deviation (MDEV), Hadamard deviation (HDEV), and time deviation (TDEV) for frequency stability measurements, as well as jitter, residual FM, and SSB carrier/noise levels between user-specified integration limits in phase noise measurements. As with all of the 3120A's standard measurement views, results are displayed and updated in real-time.

### Frequency Counter

This option adds a real-time chart of absolute frequency measurements to the frequency difference graph. The chart is continuously updated at averaging times from less than one second to over 1000 seconds. Accuracy is determined solely by the external reference, with usable precision typically greater than 13 digits per second. The frequency counter option turns the 3120A into a dramatically superior alternative to traditional counters in high-performance HF measurements, including calibration of atomic frequency standards and ultra-high performance HF oscillators.

### Mask Test

The mask test option takes the visual guesswork out of performance optimization and production testing. With this option, measurements made by the 3120A are automatically evaluated against user-definable limit lines for phase noise, AM noise, Allan deviation, and other graph types. Pass or fail results and margins are continuously updated in the graph legend table as the measurement progresses.

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### Specifications

Performance	
Input and reference frequency range	0.5 MHz - 30 MHz, (sine wave)
Input and reference level	-5 dBm to 20 dBm, 50 Ω TNC-F (5 dBm to 15 dBm recommended)
Input/reference VSWR (0.5-25 MHz)	1.5:1 or better
Input/reference port isolation (10 MHz)	130 dB or better
Maximum allowed DC at any RF input	+/- 5 V
Allan deviation (5 MHz-25 MHz, t=1 s)	1×10 <sup>-13</sup> minimum, 5×10 <sup>-14</sup> typical (50 Hz ENBW)
Allan deviation (5 MHz-25 MHz, t=1000 s)	5×10 <sup>-15</sup> minimum, 1×10 <sup>-15</sup> typical
Phase stability (5 MHz signal)	Less than 10 ps/hour after 2 hour warmup. Typically below 3 ps/hour
Residual phase noise floor at 1 Hz (5 MHz signal)	-140 dBc/Hz minimum, <-145 dBc/Hz typical
Residual phase noise floor at 1 Hz (25 MHz signal)	-130 dBc/Hz minimum, <-135 dBc/Hz typical
Residual phase noise floor at 10 kHz (5 MHz signal)	-170 dBc/Hz minimum, <-175 dBc/Hz typical
Residual phase noise floor at 10 kHz (25 MHz signal)	-165 dBc/Hz minimum, <-170 dBc/Hz typical
Residual AM noise floor at 10 kHz (5 MHz signal)	-160 dBc/Hz minimum, <-165 dBc/Hz typical
Spurious responses (SFDR)	Less than -100 dBc (5 MHz, at 1 Hz - 100 kHz) (phase noise) or -90 dBc (AM noise) typically below -120 dBc
Mechanical and Environmental	
Size	28 cm x 12 cm x 7.5 cm (11" x 5" x 3")
Power	90-264 VAC 47-63 Hz, <25 W, 3-pole AC inlet IEC 320-C14
Operating temperature	15 °C to 35 °C (60 °F to 95 °F)
Storage temperature	-20 °C to 50 °C (0 °F to 125 °F)
Unit weight alone	1 kg (2 lbs)

### Upgrade Options

The following options are available for purchase individually:

- AM noise measurement
- Frequency counter
- Signal statistics - HDEV, TDEV, MDEV and jitter measurements
- Mask tests for automatic pass or fail evaluation

### Product Includes

3120A Test probe, (2) TNC-M/BNC-F coaxial adapters, (1) USB 2.0 cable A male/B Male, (1) Power supply, (2) 1" (2.54 mm) SMA-M/SMA-M coaxial jumpers (pre-installed)

### Product Service

One year warranty (HW only)  
 Platform maintenance (needs to be ordered separately)  
 Extended hardware warranty (needs to be ordered separately)

### Front Panel

(4) SMA (Ch 0 OUT, Ch2 OUT, Ch 0 IN, Ch2 IN),  
 (1) TNC (INPUT)

### Rear Panel

TNC-F input for external reference signal (REF IN)  
 USB (1x): Series B for PC connectivity (USB)  
 5-pin DIN jack for power supply (POWER)  
 8-pin mini DIN jack for future accessory expansion (ACC)  
 STATUS indicator

### Certifications

3120A phase noise test probe has passed EMC testing for FCC, CE, KCC, and VCCI certification

### RoHS Compliance

3120A phase noise test probe is RoHS compliant

### Ordering Information

Part Number	Description
990-05330-01	Test Probe Kit N.A.
990-05330-02	Test Probe Kit E.U.
990-05330-03	Test Probe Kit U.K.

Contact factory for complete list of p/n's and software options