NOISE XT

# PN9000

## Phase Noise Test Set System

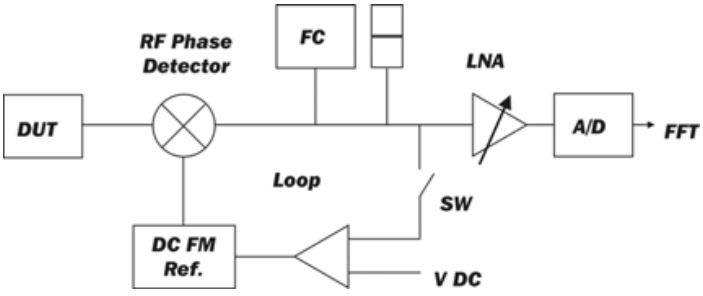
**The Modular design of the PN9000 provides versatility and flexibility to setup the appropriate configuration to measure any kind of phase noise from 2 MHz to 140 GHz.**

Using the built-in frequency counter, in open loop, the DC/FM reference source is manually or automatically tuned on the DUT frequency. The beat signal between DUT and reference is used to measure the demodulation factor of the phase detector using multiples techniques allowing non-linear operation of the detector.

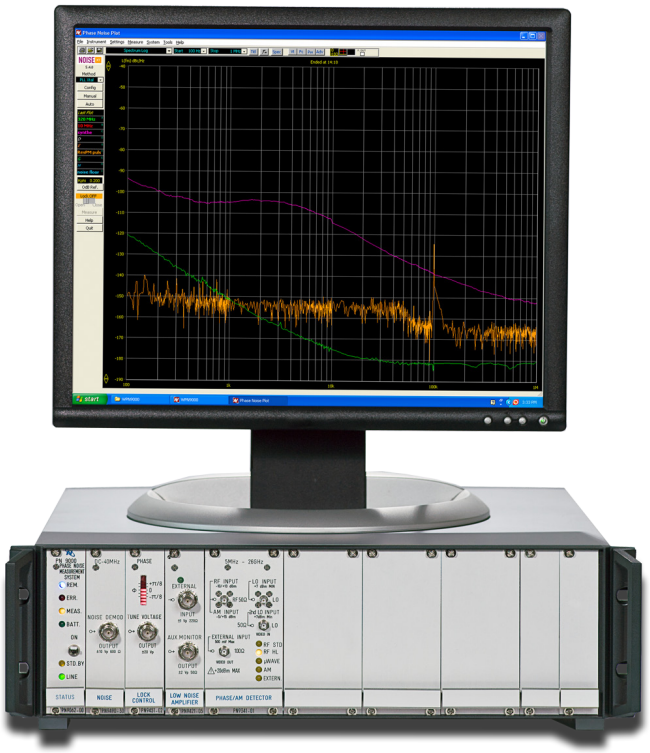
Loop bandwidth and reference FM deviation (or tune slope) will be adjusted depending on the expected noise and stability of the DUT. For most of PLL and synthesizers a few hundred Hz is an average convenient value. Then, closing the loop, the reference source will be phase locked on the DUT signal and RF/LO phase detector inputs will be set automatically in phase quadrature, providing at the output of the detector the combined phase noise of the DUT and the reference. The bar graph located on the lock control module will allow a quick visual check of the loop status (the bar graph should be centered and steady). When the reference's phase noise is 6 dB better than the DUT's one, its contribution to the detected noise is 1 dB only.

The LNA, with auto-gain feature, will adjust the noise level to the optimum dynamic range of the digitizing board housed into the computer. FFT calculation process is done in the computer and displayed on the monitor (not represented on the diagram). Loop bandwidth is fully compensated to display phase noise down to 0.01 Hz from the carrier.

In PLL measurements, the system residual noise, or noise floor, will be the reference oscillator's phase noise.



# PN9000 Phase Noise Analyzer



*PN9000 with option PN9341-01*

## TECHNIQUES:

Phase Lock Loop, Delay line (option), Residual phase noise, Amplitude Noise (option),
Frequency Stability (option); Pulsed (option).

## PLUG-IN OPTIONAL MODULES:

Internal phase detectors up to 50 GHz.
Low Noise built-in DC FM Reference Synthesizer MW down-converters for stable and free-running Sources.
mmW external harmonic mixers/diplexers to extend the frequency coverage up to 140 GHz.
Pulse generator and modulator.

## SOFTWARE:

**WPN9000**: Windows based graphical user interface with file management.
Remote control option through Ethernet or GPIB.

The base system is the core of any measurement configuration. It includes hardware and software, except the reference source, to measure stable sources from 2 MHz to 1.8 GHz.

| PARAMETERS | STANDARD RF | HI-LEVEL STD |
|---|---|---|
| Frequency Range, Ghz | 0.002 to 1.8 | 0.002 to 1.6 |
| RF Input min. dBm | -20 | +10 |
| RF Input max. dBm | +10 | +20 |
| LO Input min. dBm | 0 | +10 |
| RF Input Gain, dB | -10, 0, 10, 20 | None |
| LO Input Gain, dB | 0, 10 | None |
| **Noise Floor, in dBc/Hz** | | |
| 1 Hz Offset | -130 | -140 |
| 10 Hz | -140 | -150 |
| 100 Hz | -150 | -160 |
| 1 kHz | -168 | -170 |
| 10 kHz | -168 | -178 |
| 100 kHz & Beyond | -168 | -178 |
| Nominal RF Input Level, dBm | +6 | +16 |
| Nominal LO Input Level, dBm | +7 | +17 |

*For specified values add + 3 dB.*
*For RF levels < nominal value, the noise floor will increase by the number of dB below the nominal value. For example, for 0 dBm RF input, instead of +6, the typical system residual noise is, at 10 kHz offset : -168 dBc/Hz - 6 dB = - 162 dBc/Hz.*

# PN9000 Base System Specification

**Frequency Input Range:** 2 MHz to 1.8 GHz
**Offset Analysis:** 0.01 Hz to 1MHz (40 MHz, 500 MHz Optional)
**Measurement Accuracy:** ± 2 dB up to 1 MHz offset, ± 3 dB above 1 MHz offset
**Reference Tuning Voltage:** ± 20 Volt with 5 mV resolution
**Phase Lock Loop Gain:** Proportional and integral (DUT drift compensation)
**Spurious Level:** -110 dBc
**Built-in Counter, RF ans LO:** 2MHz to 2GHz
**IF/Beat:** 03.3 Hz to 400 kHz
**Mechanical Dim. (HxWxD):** 13.3 x 38.5 x 57.5 cm or 5.25" x 17.72" x 22.63"
**Temp. & Humidity Operating:** -10 to + 40°C. Up to 95% non condensing
**Loop Compensation:** Automatic (can be disabled)

# PN9000 Base System Includes

**PN9000 Mainframe:**
Status Module
Noise Module
Phase Lock Control Module
LNA Module
Standard & High Level RF Phase Detectors
Power Supply

**PN9000 Controller:**
Desktop PC
Digitizing Board
Set of Cables
OS, Software & Manual
TFT Flat Screen monitor

# PN9000 Typical Phase & Amplitude Detectors Options Specification

| PARAMETERS | MW (Option) STD Level | MW (Option) High Level | MW (Option) PN9361-02 | AM* (Option) |
|---|---|---|---|---|
| Frequency Range, GHz | 1.6 to 26.5 | 1.6 to 26.5 | 5 to 40 | 0.01 to 26.5 |
| RF Input min. dBm | -10 | +10 | -10 | -5 |
| RF Input max. dBm | +15 | +20 | +15 | +15 |
| LO Input min. dBm | +7 | +10 | +7 | None |
| LO Input max. dBm | +15 | +23 | +15 | None |
| RF Input Gain dB | None | None | None | None |
| LO Input Gain dB | None | None | None | None |
| **Noise Floor, in dBc/Hz** | | | | |
| 1 Hz offset | -120 | -128 | -125 | None |
| 10 Hz | -130 | -138 | -135 | None |
| 100 Hz | -140 | -148 | -145 | -142 |
| 1 kHz | -150 | -158 | -155 | -150 |
| 10 kHz | -160 | -168 | -168 | -160 |
| 100 kHz & beyond | -168 | -174 | -168 | -160 |
| Nominal RF input level dBm | +6 | +13 | +6 | +13 |
| Nominal LO input level dBm | +10 | +17 | +10 | None |

*(*) AM offset range 100 Hz to 10 MHz*

# PN9000 Main Options

| Part Number | Description |
|---|---|
| PN9100 | Internal low noise reference signal generator, 2 MHz to 4.5 GHz, options to 18 GHz,usable to 40 GHz. |
| PN9718 | Internal 20 and 100 ns Delay Line, 250 MHz to 2 GHz. Used to measure unstable sources. Other frequencies can be measured using down-converters. |
| PN9341 | 2MHz to 26GHz AM/PM detectors, pulse compatible. |
| PN9841 | Internal Added Noise Phase Shifter and Splitter, 2 to 18 GHz. Used to measure phase noise on Amplifiers and/or Radar systems. |
| PN9692-HR | HR ATE and high speed option. |
| PN9500 | Extended Span analysis up to 500MHz |

# PN9000 Reasons

The PN9000 overcomes all of the problems associated with trying to measure phase noise with any Spectrum Analyzer:

1. Can measure very close to Carrier (0.01 Hz away).
2. Can distinguish between PM and AM noise, and measure both separately.
3. Ensures you are not measuring the Spectrum Analyzer's LO phase noise
4. Has an extremely low residual noise floor (-178 dBc/Hz).
5. Can use any low noise signal generator as the reference LO (as long as it has GPIB control and an external FM input).
6. Can measure unstable devices.
7. Can measure multiport devices.

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