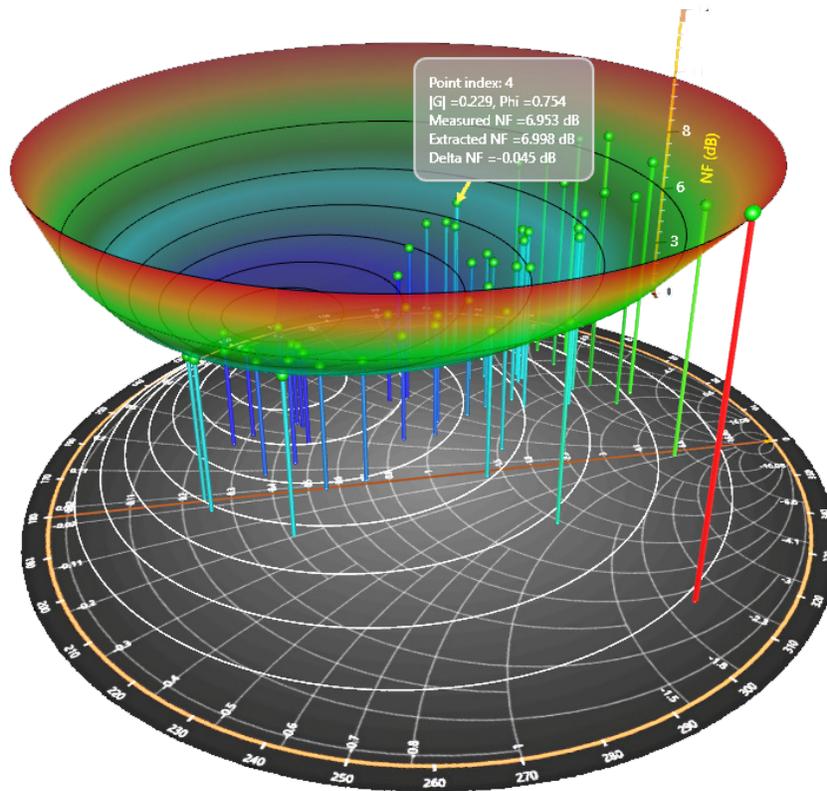


Noise Measurements

Wideband Noise Parameter Extraction 220GHz



Introduction | Noise Parameter Measurement System

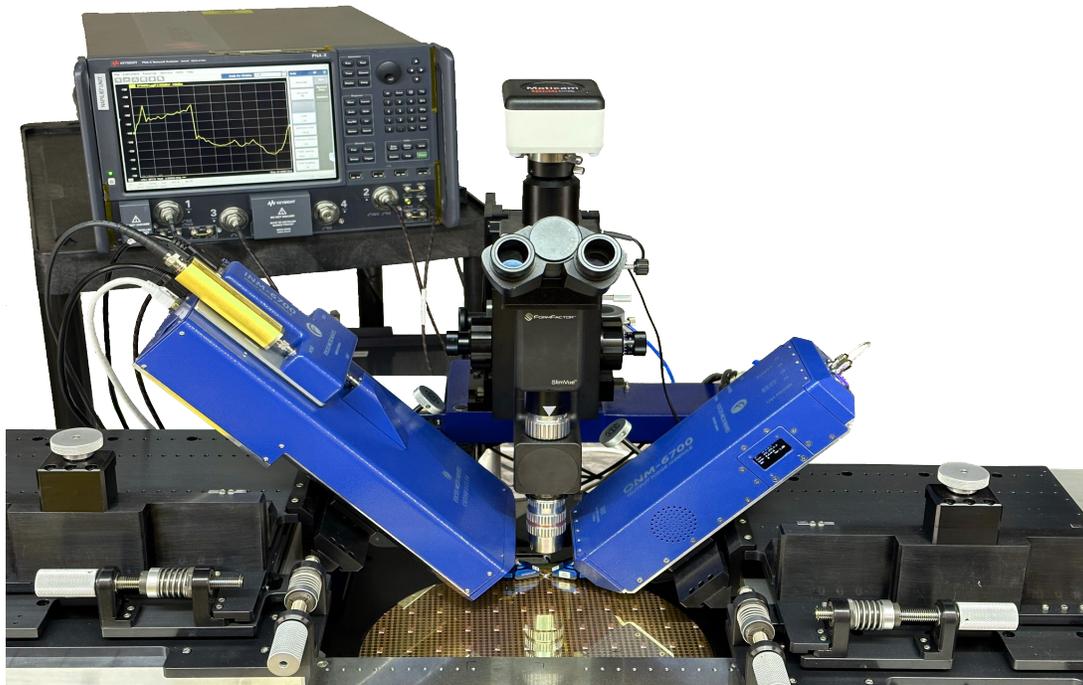
Focus Microwaves' noise parameter measurement system provides a solution to extract accurate noise parameters of a device under test (DUT): minimum noise figure, equivalent noise resistance and optimum noise reflection factor (Gamma and phase). The measurement system is designed to accommodate both connectorized and bare die devices,

while offering fast, precise and stable measurements. The noise measurement system, along with its dedicated software (Requires option NPEx), is specifically optimized for the system calibration, DUT measurement, and DUT noise parameters extraction.

The System Setup

The noise measurement system comprises three main components: the input noise module (INM), the output noise module (ONM), and the noise module controller (NMC). The modules are designed to enhance the precision and sensitivity of the noise receiver while also simplifying the system calibration and DUT measurement process. The innovative approach of direct probe mounting of

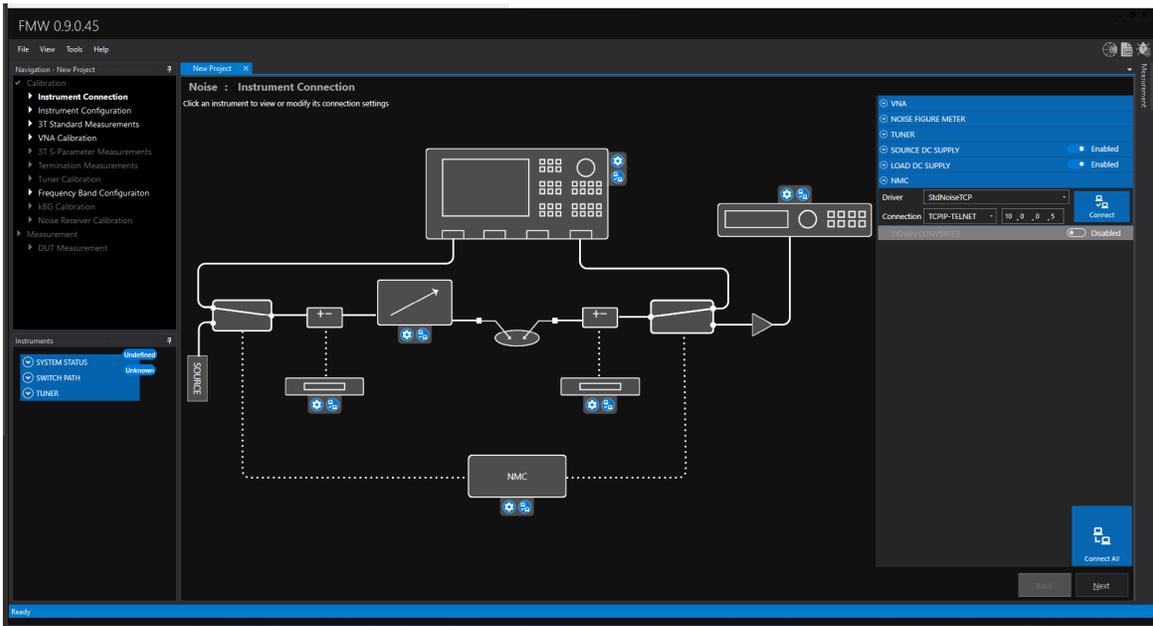
source tuner and the noise modules sets a new industry standard, offering enhanced sensitivity, improved dynamic range, and comprehensive coverage across a wide frequency band. The positive gain slope design incorporated into the solution enables an improved practical dynamic range for wideband noise measurements.



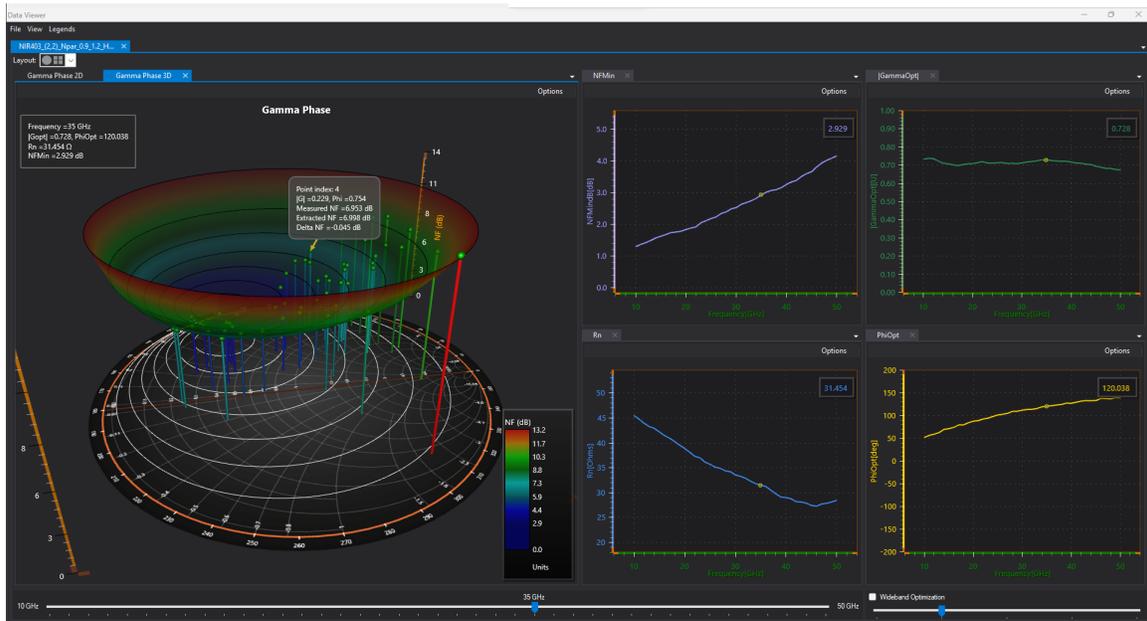
Software Features

The Focus Device Characterization Suite (FDCS) supports three types of noise measurement setups: Hot-Cold Noise, Cold-In Noise and Cold-Out Noise setups. A specialized calibration wizard is implemented in FDCS. It guides the user to set up and calibrate the system efficiently and en-

sure that accurate measurements can be obtained. Additionally, to enhance the productivity of wafer measurement, the automation feature is available for the user to create and execute a personalized sequence of measurement operations.

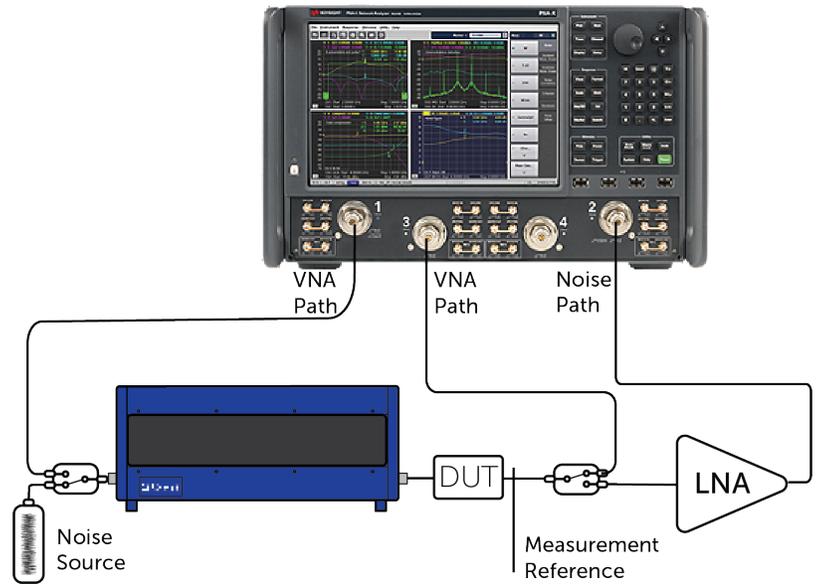


Noise Measurement Data



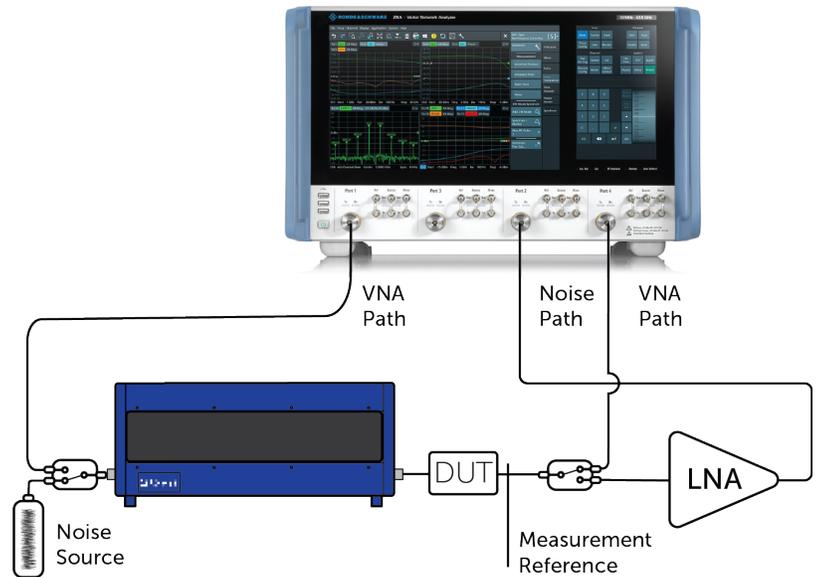
Noise Measurements Using PNA-X™

Focus microwaves' unique noise parameter measurement method leverages the Keysight PNA-X's dedicated noise receiver options 029 and latest E29. This specific technique requires a noise source to determine the Gain-Bandwidth constant (K_{BG}) of the system and a passive mechanical tuner is used to characterize the noise receiver across both the impedance and frequency space. This step is imperative to obtain fully vector-source-corrected measurements. Combined with broadband delta tuners (2-67GHz & 2-50GHz) the Focus Noise parameter extraction solution now stands as the industry's most broadband on-wafer solution. To cater frequencies beyond 67GHz an RF down conversion stage is required where the measurement frequency range exceeds the receiver's bandwidth. Focus microwaves offers noise modules that include down conversion for optimal speed and performance.



Noise Measurements Using ZNA™

The Focus noise parameter measurement system is also compatible with Rohde & Schwarz ZNA (Requires options K30 and B16). The system calibration and measurement procedures are similar to the setup with the PNA-X.



Noise Measurements Using Other Noise Receivers

The architecture of Focus microwaves' noise measurement system is designed to be compatible with a broad range of spectrum analyzers, including the most popular modern models on the market, such as the Keysight X-series signal analyzer, Rohde & Schwarz FSV/FSW, and National Instrument PXI Vector Signal Analyzer*. Furthermore, it is also engineered to provide compatibility with discontinued models, such as the N897XA family of noise figure analyzers and FSU.

*For certain noise receiver modules, the internal pre-amp option may be required.

Focus | Noise Measurement System (DNMS) | Models & Specifications

Model	Frequency (GHz)	Output Noise Module			Connector type
		Module VSWR	NF (dB)	Gain (dB)	
DNMS-2600	Up to 26	2:1	9	25	3.5 mm
DNMS-4000	Up to 40	2:1	9	23	2.95 mm
DNMS-5000	Up to 50	2:1	9	23	2.4 mm
DNMS-6700	Up to 67	2:1	10	23	1.85 mm
DNMS-6700-DC*	Up to 67	2:1	10	23	1.85 mm
NMS-75500-DC*	50 - 75	14:1	7	25	WR-15
NMS-90600-DC*	60 - 90	1.6:1	7	25	WR-12
NMS-110750-DC*	75 - 110	1.8:1	7	25	WR-10
NMS-1701100-DC*	110 - 170	1.8:1	8	25	WR-6.5
NMS-2201400-DC*	140 - 220	1.8:1	9	25	WR-05

* with Downconverter

** +/-10%

Focus | Popular Tuners for Noise Measurements | Models & Specifications

Model	f0, 2f0, 3f0	Frequency	VSWR	Connector type
C1808	f0	0.8 - 18 GHz	≥ 10:1 (typ. 15:1)	N, APC-7
C2607	f0	0.7 - 26 GHz	≥ 10:1 (typ. 15:1)	3.5 mm
C5020B	f0	2 - 50 GHz	≥ 10:1	2.4 mm
C6720B	f0	2 - 67 GHz	≥ 10:1	1.85 mm
W75500B	f0	50 - 75 GHz	≥ 20:1	WR-15
W90600B	f0	60 - 90 GHz	≥ 20:1	WR-12
W110750B	f0	75 - 110 GHz	≥ 20:1	WR-10
W1701100B	f0	110 - 170 GHz	≥ 10:1	WR-6.5
W2201400B	f0	140 - 220 GHz	≥ 10:1	WR-05