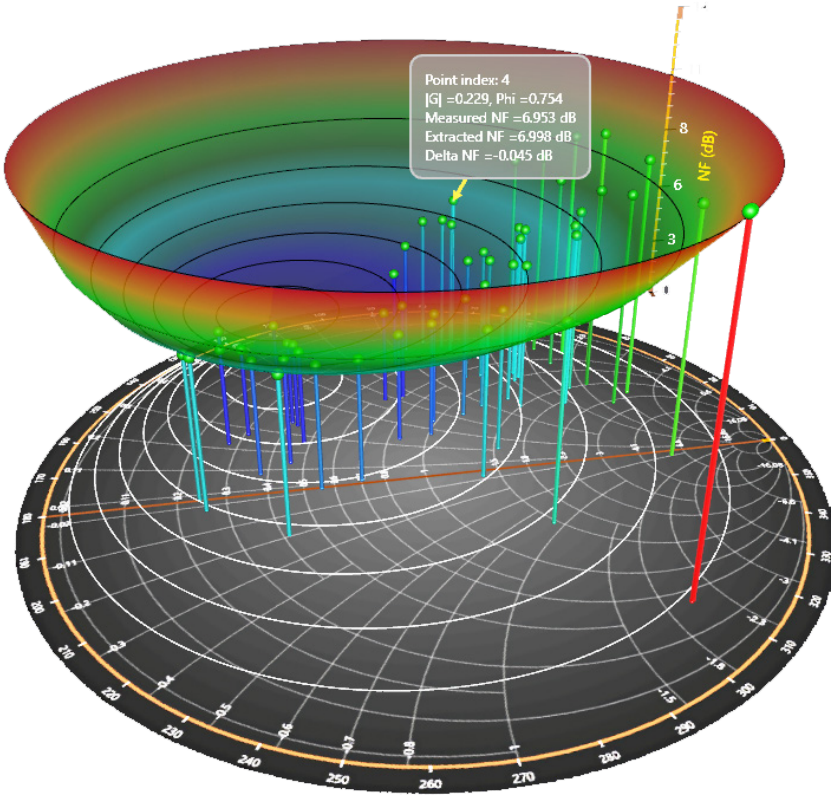
FOCUS MICROWAVES

Noise Measurements

Wideband Noise Parameter Extraction 1-170GHz

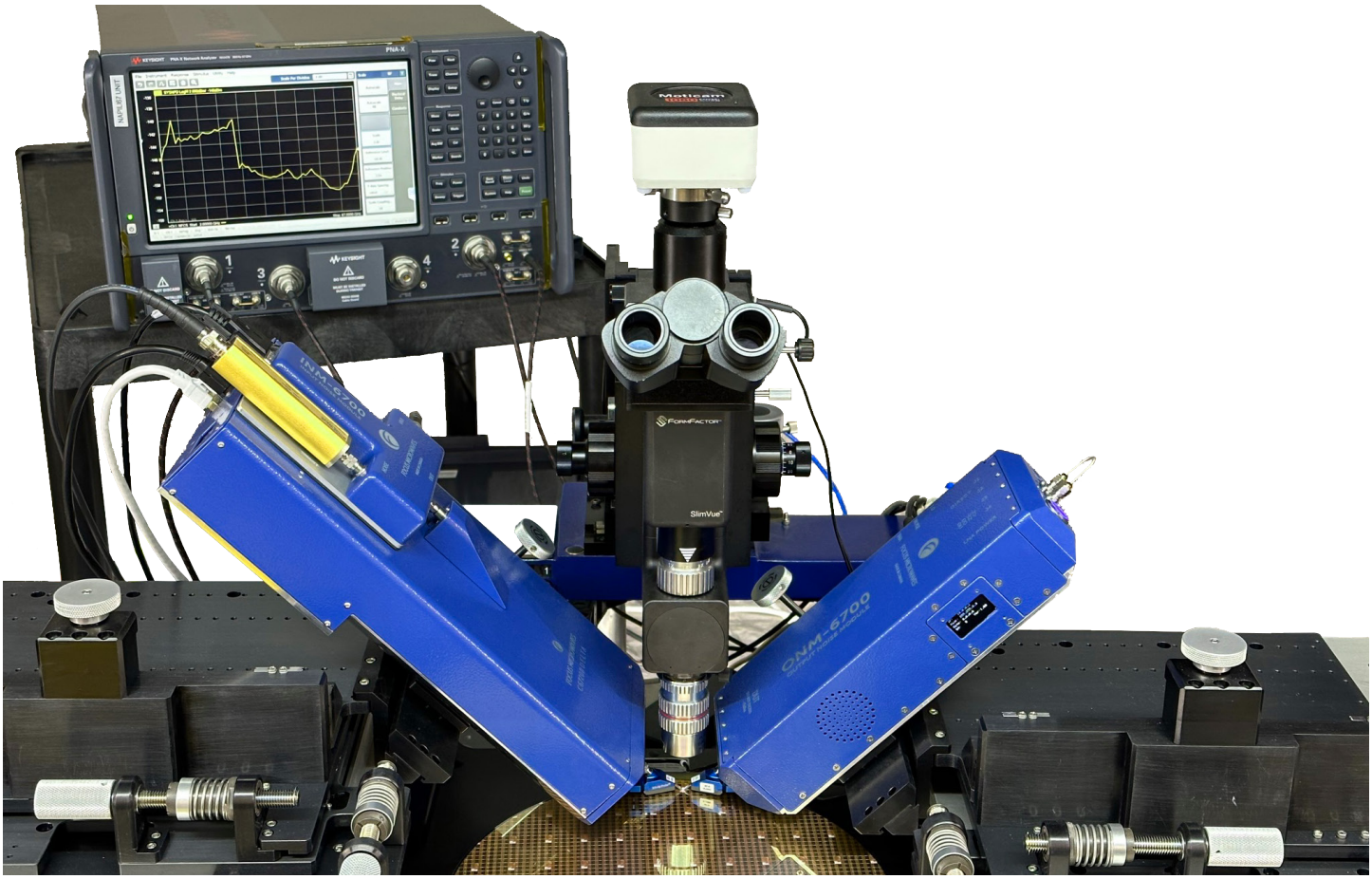


Introduction | Noise Parameter Measurement System

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.

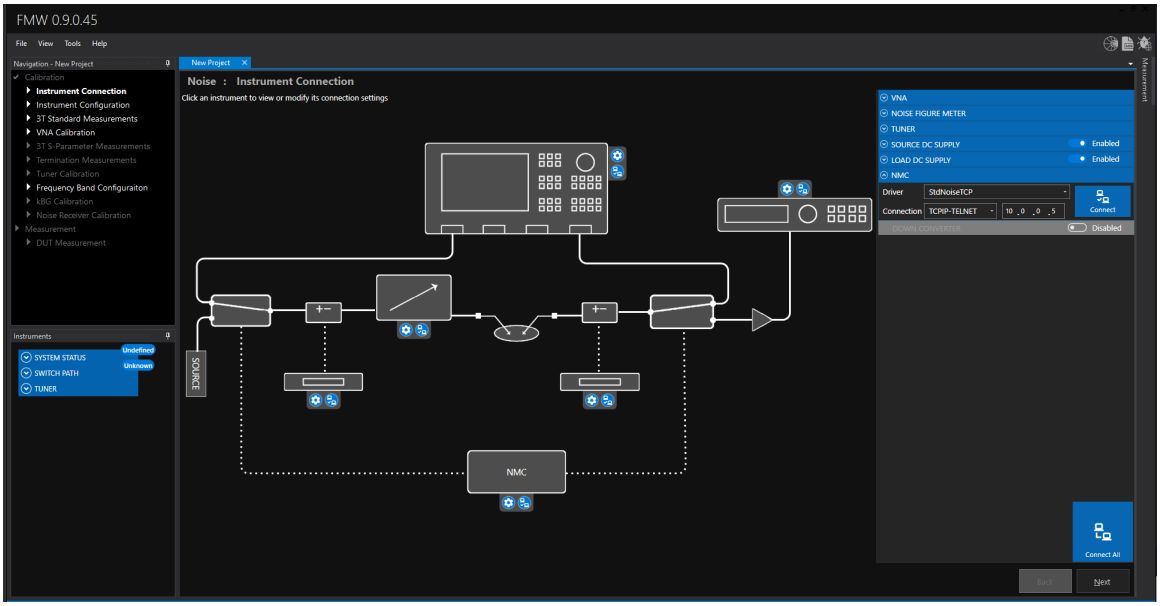
The System Setup

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 preci¬sion and sensitivity of the noise receiver while also simplify¬ing 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.

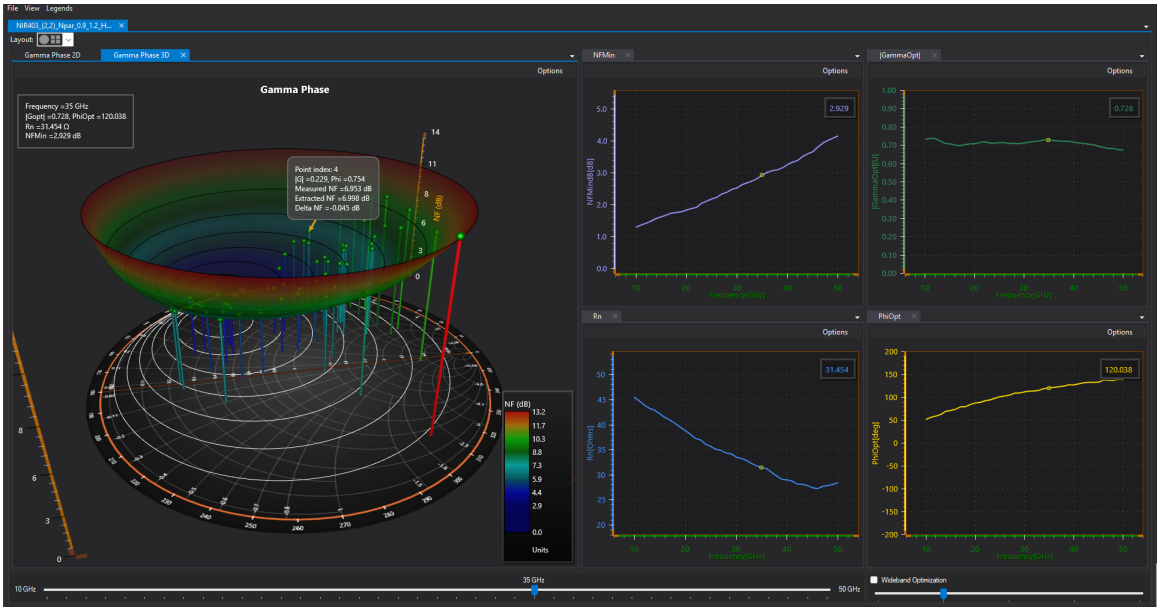


Software Features

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 ensure 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.

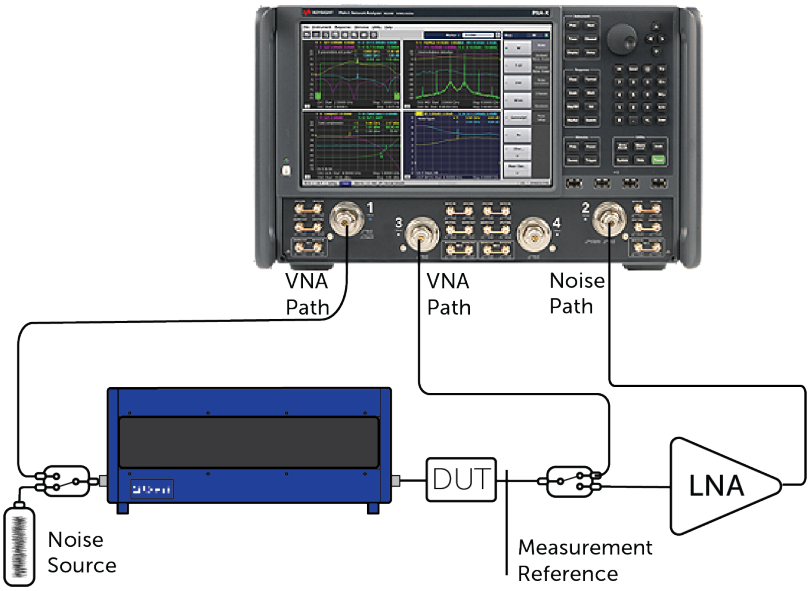


Noise Measurement Data



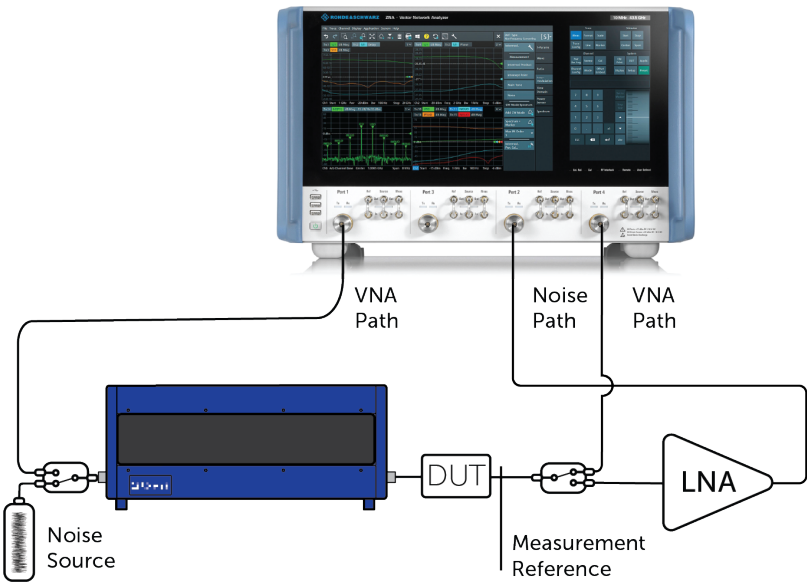
Noise Measurements Using PNA-X™

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 (KBG) of the system and a passive mechanical tuner is used to characterize the noise receiv¬er 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. Currently, the noise measurement system with ZNA can be operated up to 40 GHz.



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.

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

Model	Frequency	Input Noise Module		Output Noise Module		Connector
		Insertion Loss	VSWR	Min. Gain	Max. VSWR	
DNMS-2600	Up to 26.5 GHz	0.80 dB	1.6:1	29 for 0.8-26.5GHz	1.8:1	3.5 mm
DNMS-4000	Up to 40 GHz	0.91 dB	1.8:1	30 for ≤26.5GHz, 29 for 26-40GHz	2.1:1	2.95 mm
DNMS-5000	Up to 50 GHz	0.99 dB	1.8:1	27 for ≤26.5GHz, 27 for 26-40GHz, 28 for 40-50GHz	2:1	2.4 mm
DNMS-6700	Up to 67 GHz	1.12 dB	1.9:1	29 for ≤26.5GHz, 28.5 for 26-40GHz, 28 for 40-50GHz, 21 for 50-65GHz	3:1	1.85 mm
DNMS-6700-DC*	Up to 67 GHz	1.12 dB	1.9:1	29 for ≤26.5GHz, 28.5 for 26-40GHz, 28 for 40-50GHz, 37 for 50-65GHz	3:1	1.85 mm
NMS-75500-DC*	50 to 75 GHz	0.4dB	1.2:1**	40 for 50-75GHz	1.6:1**	WR-15
NMS-90600-DC*	60 to 90 GHz	0.9dB	1.3:1**	35 for 60-90GHz	1.8:1**	WR-12
NMS-110750-DC*	75 to 110 GHz	1.1dB	1.3:1**	36 for 75-110GHz	1.9:1**	WR-10
NMS-1701100-DC*	110 to 170 GHz	1.3dB	1.4:1**	36 for 110-170GHz	2:1**	WR-6.5

* with Downconverter
** +/-10%

Focus | Popular Tuners for Noise Measurements | Models & Specifications

Model	f0, 2f0, 3f0	Frequency	VSWR	Connector type
C1808	*f*0	0.8 - 18 GHz	≥ 10:1 (typ. 15:1)	N, APC-7
C2607	*f*0	0.7 - 26 GHz	≥ 10:1 (typ. 15:1)	3.5 mm
C5020B	*f*0	2 - 50 GHz	≥ 10:1	2.4 mm
C6720B	*f*0	2 - 67 GHz	≥ 10:1	1.85 mm
W75500B	*f*0	50 - 75 GHz	≥ 20:1	WR-15
W90600B	*f*0	60 - 90 GHz	≥ 20:1	WR-12
W110750B	*f*0	75 - 110 GHz	≥ 20:1	WR-10
W1701100B	*f*0	110 - 170 GHz	≥ 10:1	WR-6.5