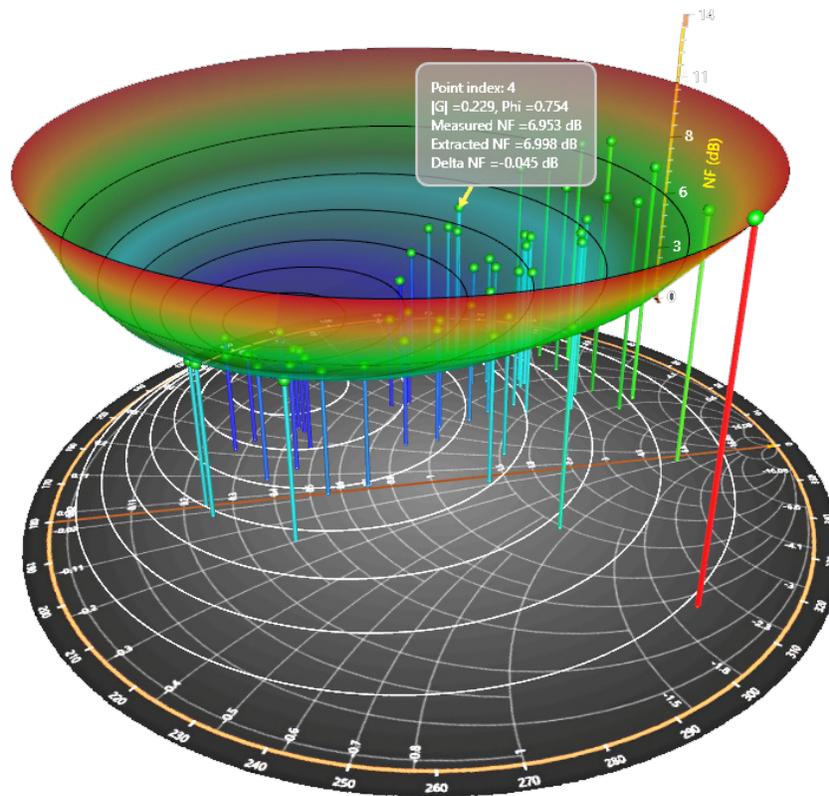


Noise Measurements

Wideband Noise Parameter Extraction 1-170GHz



Introduction | Noise Parameter Measurement System

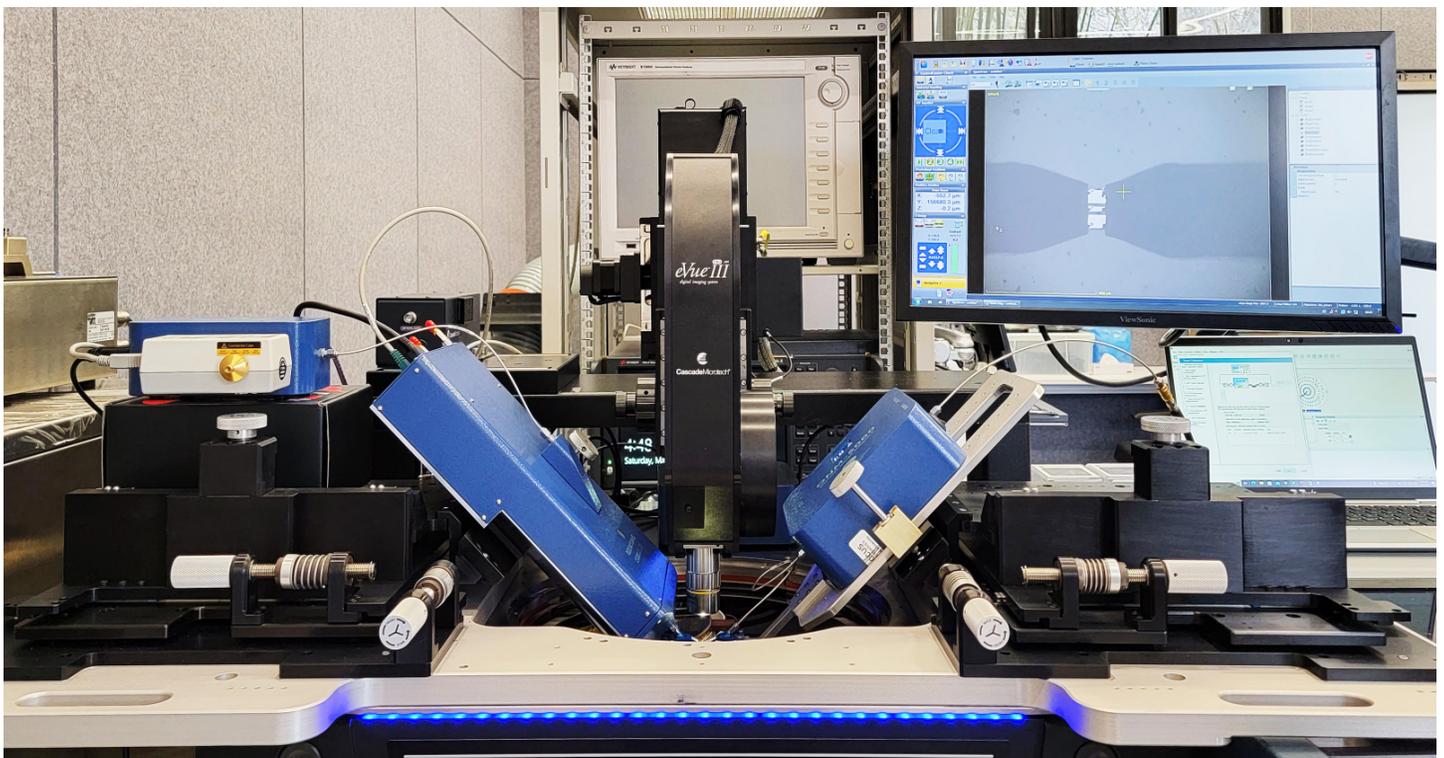
Focus Microwaves' noise parameter measurement system provides a solution to extract accurate noise parameters of a device under test (DUT): minimum noise figure, equivalent noise resistance and optimum noise reflection factor (Gamma and phase). The measurement system is designed to accommodate both connectorized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

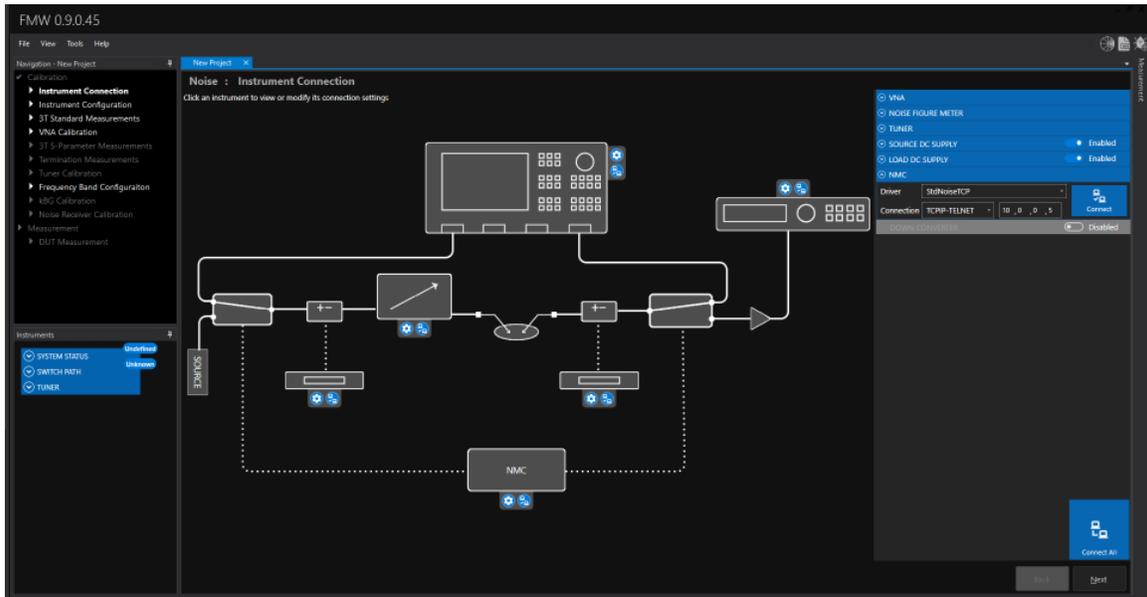
sion and sensitivity of the noise receiver while also simplifying the system calibration and DUT measurement process.



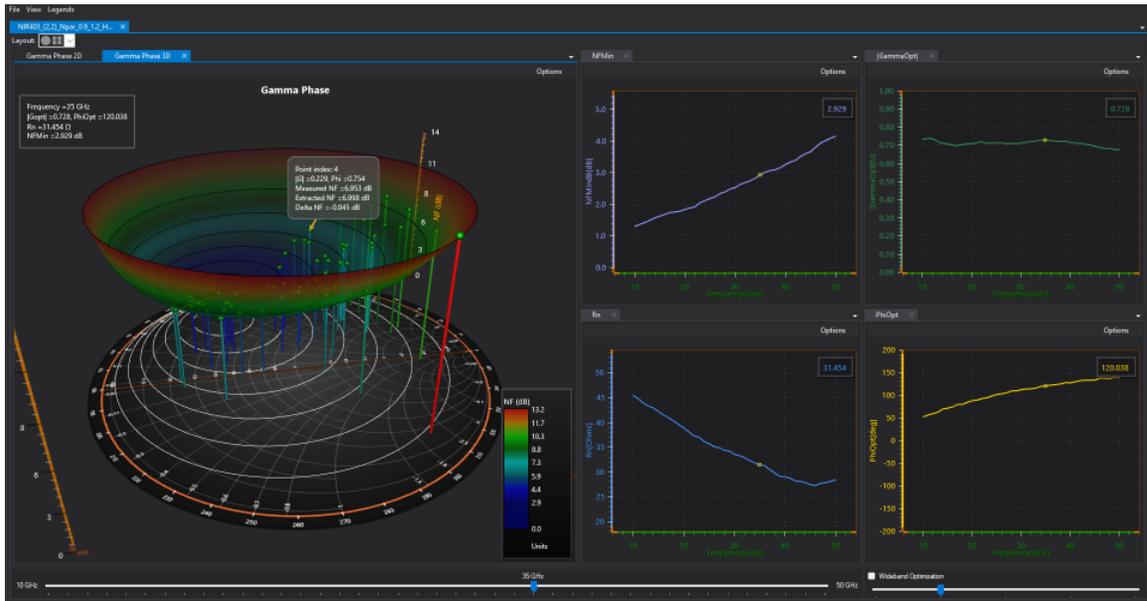
Software Features

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.

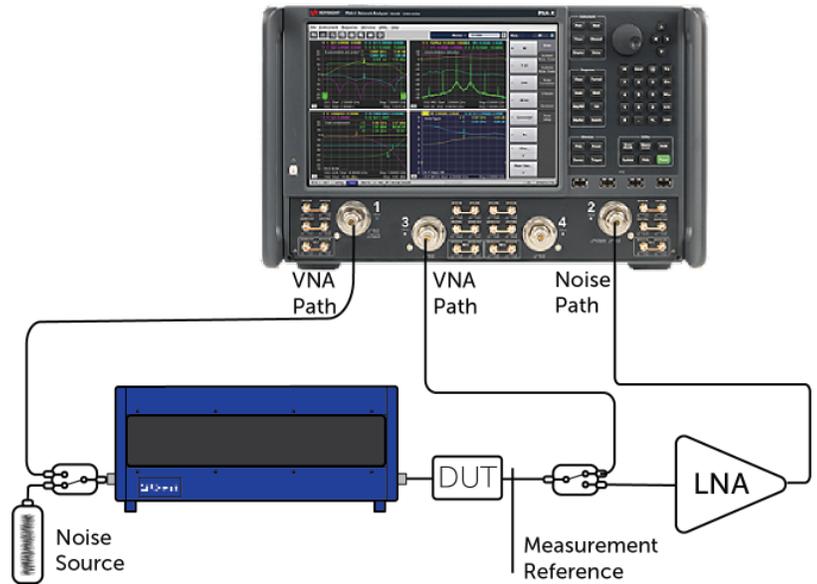


Noise Measurement Data



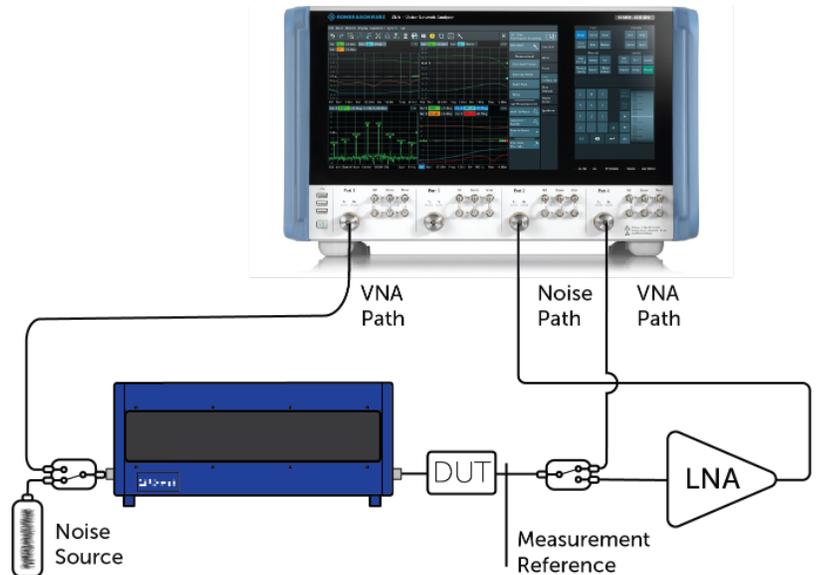
Noise Measurements Using PNA-X™

Focus microwaves' unique noise parameter measurement method leverages the Keysight PNA-X's dedicated noise receiver (option 029). 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 receiver across both the impedance and frequency space. This step is imperative to obtain fully vector-source-corrected measurements. An RF down conversion stage is required when 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 type
		Insertion Loss	VSWR	Min. Gain	Max. VSWR	
NMS-2600	up to 26.5 GHz	0.80 dB	1.6:1	29 for 0.8-26.5GHz	1.8:1	3.5 mm
NMS-4000	up to 40 GHz	0.91 dB	1.8:1	30 for ≤ 26.5 GHz, 29 for 26-40GHz	2.1:1	2.95 mm
NMS-5000	up to 50 GHz	0.99 dB	1.8:1	27 for ≤ 26.5 GHz, 27 for 26-40GHz, 28 for 40-50GHz	2:1	2.4 mm
NMS-6700	up to 67 GHz	1.12 dB	1.9:1	29 for ≤ 26.5 GHz, 28.5 for 26-40GHz, 28 for 40-50GHz, 21 for 50-65GHz	3:1	1.85 mm
NMS-6700-DC*	up to 67 GHz	1.12 dB	1.9:1	29 for ≤ 26.5 GHz, 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	f_0 , $2f_0$, $3f_0$	Frequency	VSWR	Connector type
C1808	f_0	0.8 - 18 GHz	$\geq 10:1$ (typ. 15:1)	N, APC-7
C2607	f_0	0.7 - 26 GHz	$\geq 10:1$ (typ. 15:1)	3.5 mm
C4060B	f_0	6 - 40 GHz	$\geq 10:1$	2.92 mm
C5020B	f_0	2 - 50 GHz	$\geq 10:1$	2.4 mm
W75500B	f_0	50 - 75 GHz	$\geq 20:1$	WR-15
W90600B	f_0	60 - 90 GHz	$\geq 20:1$	WR-12
W110750B	f_0	75 - 110 GHz	$\geq 20:1$	WR-10
W1701100B	f_0	110 - 170 GHz	$\geq 10:1$	WR-6.5