

## Tender Notification for the procurement of Low Noise Electrical Characterization Equipment setup

### To Whom It May Concern

This is an RFP (Request for Proposal) document for procurement of set of low noise electrical characterization equipment for setup of Fluctuation-Dissipation lab in Centre for Nano Science and Engineering (CeNSE) at IISc, Bangalore.

#### Procedure:

1. Vendors are required to submit a technical proposal and a commercial proposal **in two separate sealed envelopes**. Only vendors who meet the technical requirement will be considered for the commercial negotiation.
2. The decision of purchase committee will be final.
3. The technical proposal should contain a compliance table with 5 columns. The first column must list the technical requirements, in the order that they are given in the technical configuration below. The second column should describe your compliance in a "Yes" or "No" response. If "No" the third column should provide the extent of the deviation (please provide quantitative responses). The fourth column should state the reasons for the deviation, if any. The fourth column can be used to compare your tool with that of your competitors or provide details as requested in the technical requirements table below.
4. Any additional capabilities or technical details, that you would like to bring to the attention of the purchase committee, can be listed at the end of the technical table.
5. The **deadline for submission of proposals is the 5<sup>th</sup> of April 2019, 5:30 pm Indian Standard Time**. Proposals should arrive at the office of Dr. Saurabh Chandorkar, FF-08, Centre for Nano Science and Engineering, Indian Institute of Science, Bangalore 560012, India, by the above deadline.
6. The **quotes should be CIF Bangalore, India**. Please include cost of shipping.
7. Please provide itemized quotes for the instruments and any extra options/attachments/packages.
8. **To make a valid bid for instruments for i) Phase noise measurement, ii) Vector Network Analyzer for mixer measurements and iii) RF reference source, vendor must be able to supply all 3 of the instruments and should make a bid for all 3 of them together.**
9. Please indicate the warranty provided with the tool. Longer (1 year or more) warranty periods are preferable. Please provide options for extended warranty and calibration for instruments.
10. Vendors are encouraged to highlight the advantages of their tools over comparable tools from the competitors.
11. Any questions or clarifications can be directed to: Dr. Saurabh Chandorkar  
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Indian Institute of Science, Bangalore 560012  
[saurabhc@iisc.ac.in](mailto:saurabhc@iisc.ac.in)  
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## Technical Requirements:

The technical requirement is for a suite of instruments needed to setup MEMS Flucutation Dissipation lab. The instruments are meant to be used for measuring phase noise and carry out 2 port measurements. The specific instruments and their specifications are as follows:

### Phase Noise Measurement System

This requirement is for a system capable of measuring ultra low absolute and residual phase noise of continuous wave, amplitude and baseband noise and phase noise of pulsed signals. The tool is intended for measurement of phase noise and amplitude noise close to carrier as well as far from carrier. In addition to phase noise measurement, an integrated Vector Network Analyzer for 2 port measurement is required. The required specifications are listed below.

S. No.	Parameter	Specifications
1	Measurement capabilities	Absolute Phase noise of CW signals
		Residual Phase noise of CW signals
		Phase noise of Pulsed Signals
		AM noise
		Baseband Noise
2	Frequency range	Lowest frequency of operation $\leq 50\text{kHz}$ , Highest frequency of operation $\geq 2.5\text{GHz}$
3	Amplitude input range	Up to +23 dBm
4	Frequency offset range	0.01Hz to >2.5% of the carrier frequency
5	Absolute System Phase Noise floor (dBc/Hz) @ 1GHz	$\leq -170\text{dBc/Hz}$ at 10kHz
6	System AM noise floor (dBc/Hz) at 600MHz @ given Offset	$\leq -140\text{dBc/Hz}$ at 10kHz
7	Phase detector accuracy	.01 Hz to 1 MHz offset
		$\leq \pm 2\text{ dB}$
8	Options	Delay line based measurement, Upgradable to cross correlation measurement using additional port, External RF source should be integratable, Support for adding 2 port VNA and a spectrum analyzer
9	PC with GUI and software	SSD sized >200GB, Data bandwidth of 16B/s
10	I/O ports	USB ports, LAN ports, Display ports, GPIB
11	AC power supply	220V +/- 5%, 50Hz

12	Warranty	1 year or more with option for extending warranty period
13	Calibration	Provide options
14	Integrated VNA for 2 port network measurement is desirable	from <10kHz to >4GHz
15	VNA Test port power range	10 KHz < f ≤ 4 GHz: -60 dBm to >+0 dBm
16	VNA dynamic range	9 KHz < f ≤ 1 MHz: >90dB
		1 MHz < f ≤ 4.5GHz: >130dB

### Low Noise Power Supply

To carry out low noise measurements, a very low noise power supply is required. The supply needs to abide by following requirements:

S. No	Parameter	Specifications
1	Form Factor	Benchtop instrument with single box
2	No. of Channels	2
3	Maximum voltage	≥40V
4	Maximum current	≥100mA
5	Maximum power	≥4 W
6	Output polarity	Bipolar (4-quadrant operation)
7	Source resolution	>6 digit
8	Voltage resolution	100nV or better
9	Current resolution	10pA or better
10	Output Voltage Capability	DC, Pulsed, Arbitrary waveform
11	Noise (0.1 to 20MHz)	≤10 μVpp
12	Measurement capability	>4 digit built-in
13	Interface	GPIB, USB 2.0, LAN
14	Display	>4" TFT Display
15	AC Power Supply	230 VAC ±10%, 50Hz
16	Warranty	1 Year or more

### Low noise 3 Triple Output Power Supply

A low noise triple power supply is needed for powering amplifiers. The supply needs to abide by following requirements:

S. No.	Parameter	Specifications
1	Form Factor	Benchtop instrument with single box

2	No. of Channels	3
3	Maximum voltage	CH1: 0 to 5V(or higher)
4		CH2: 0 to 25V
5		CH3: 0 to -25V
6	Maximum current	CH1: 0 to 5A
7		CH2: 0 to 1A
8		CH3: 0 to 1A
9	Maximum power	80W
10	Load and Line regulation (Voltage)	< 0.01% +2 mV
11	Load and Line regulation (Current)	< 0.01% +250 uA
12	Output ripple and noise (20 Hz to 20 MHz)	< 350 uVrms/2 mVpp
13	Interface	USB & LAN
14	Display	>4-inch LCD color
15	AC Power Supply	230 VAC ±10%, 50Hz
16	Warranty	1 Year or more

### Vector Network Analyzer for mixer measurement

A Vector Network Analyzer is required for two port s parameter measurement. One of the key requirements for this VNA is the ability to measure at transfer characteristics of a mixer. The specific requirements are listed below:

S. No	Parameter	Specifications
1	Form Factor	Benchtop instrument with single box
2	Frequency range	Minimum frequency < 10KHz and Maximum frequency > 4 GHz
3	No. of test ports	2
4	Frequency resolution	1 Hz
5	Frequency stability	±7 ppm
6	System dynamic range	90dB or higher
7	Test port power range	£-50 to 10 dBm
8	Power level resolution	0.05 dB
9	Maximum test port input level	+10 dBm
10	Test port noise floor	-95 dBm/Hz or better
11	IF bandwidth	10 Hz to 1.5 MHz
12	Sweep Types	Linear Frequency, Log Frequency, Segment Sweep, Power Sweep, Frequency-Offset Sweep
13	Sweep points	2 to 20,001

14	Formats	LogMag, Phase, Group Delay, Smith, Polar, LinMag, SWR, Real, Imaginary, Expand Phase, Positive Phase
15	Measurements capability	s-parameters, Scalar and Vector mixer measurements
16	Upgradability	a. Should be upgradable to 4-port VNA b. Should be upgradable to 20GHz
17	Connector impedance termination	50 $\Omega$
18	Damage Level	> +25 dBm or $\pm$ 35 VDC
19	Display	>10 in TFT color LCD (touch screen preferred)
20	Operating system	Windows 10
21	External Source control	Must
22	In-built VBA support	Must
23	Interface	GPIB and LAN, USB is optional
24	Accessories required	a. 3.5mm Mechanical calibration kit b. Type-N Male to 3.5mm Male adapters - 2nos c. 3.5mm Male to 3.5mm Female cables - 2nos
25	AC Power Supply	230 VAC $\pm$ 10%, 50Hz
26	Warranty	1 Year or more

A precision RF source is needed for both phase noise measurements and mixer measurements. The requirements for the RF source are listed below:

#### Precision external RF Source

S. No.	Parameter	Specifications
1	Form Factor	Benchtop instrument with single box
2	Frequency Range	Lowest frequency of operation $\geq$ 300kHz, Highest frequency of operation $\geq$ 3GHz
3	Frequency Resolution	0.01 Hz
4	Reference Aging Rate	$\leq \pm 5 \times 10^{-8}$ /year
5	Reference input	10MHz
6	Reference output	10MHz
7	Frequency sweep modes:	a. Operating modes: Step & List Modes b. Sweep points: 2 to 65535 (Step) & 2 to 1601 (List) c. Sweep range: Within instrument frequency range
8	Output Power	$\leq$ -130 dBm to > +10 dBm across the entire frequency range
9	Amplitude Resolution	$\leq$ 0.01 dB
10	Harmonics	$\leq$ -45 dBc (with filters ON) across all frequency ranges

11	Phase Noise @ 10KHz offset	300 KHz < f ≤ 1 GHz: £-140dBc/Hz (typ.)
		1 GHz < f ≤ 3 GHz: -130dBc/Hz (typ.)
12	RF Output Connector impedance	50 ohms
13	Interface	GPIB & LAN
		Must be controllable by the VNA listed above to carry out mixer measurement
14	AC Power Supply	230 VAC ±10%, 50Hz
15	Warranty	1 Year or more

**Terms and conditions:**

1. The vendor should have a track record of having previously supplied at least three similar equipment in India in the last 5 years (please furnish the contact details of the customers).
2. The lead time for the delivery of the equipment should not be more than three months from the date of receipt of our purchase order.
3. The bid will be considered valid for 90 days after the last date of bid acceptance (i.e. 5<sup>th</sup> April 2019).
4. The payment terms are negotiable.