

Use this document to detail specifications/requirements for an item and/or ancillary services. ⓘ

## TITLE: Vector Signal Generators / Low-Noise Source/Measure Electronics Units ⓘ

Requesting Lab/Division/Group: PML Quantum Electromagnetics Division, Quantum Sensors Group - NB687080-23-02202

### General Statement of Need ⓘ

The Quantum Electromagnetics Division is developing the world's most sensitive absolute power meter of microwave signals. We require two (2) low-noise source/measure electronics units, which are capable of determining the extremely low power dissipated in a cryogenic resistor, as part of this power meter system. These units are critical in determining the absolute power.

### Items and/or Ancillary Services ⓘ

Item 1: Vector Network Analyzers 100 kHz – 9GHz

Quantity: 2

Specifications:

#### 1) Minimum Specifications:

##### a. Electrical Specifications

- i. Unit capable of simultaneous measurement of at least three channels. Synchronized, simultaneous measurement of the three channels is critical to ensure unwanted sources of noise, which commonly results from the interaction of multiple asynchronous clocks.
- ii. Configurable for:
  1. source voltage, measurement voltage
  2. source voltage, measure current
  3. source current, measure voltage
  4. source current, measure current
- iii. Inputs and outputs selectable as single-ended or differential
- iv. Powered by linear power supplies to ensure lowest possible noise
- v. Capable of sourcing and measuring signals from DC to at least 50 kHz
- vi. Source/measure modules are remote, that is separate from the main instrument to minimize cable length between the units and the device under test
- vii. Powered from 120V, 60Hz
- viii. Voltage measurement specifications:
  1. Less than 100 nVrms input voltage noise
  2. Input impedance greater than 10 MOhm
  3. Variable low pass input filter from 10 Hz to 10 kHz
  4. Variable high pass input filter from 10 Hz to 1 kHz
- ix. Voltage source specifications:
  1. Selectable shapes include DC and sine wave
  2. 1uV resolution
- x. Current measure specifications:
  1. Variable low pass input filter from 10 Hz to 10 kHz
  2. Variable high pass input filter from 10 Hz to 1 kHz
  3. 100 fA sensitivity when measuring 10nA
- xi. Current source specifications:
  1. Programmable current that can source as low as 10 pA
  2. Current noise at 1 Hz when sourcing 1nA < 1pA RMS

##### b. Software / Remote Control

- i. Capability to remote control device from a host computer via USB or ethernet

- connection.
- ii. Shall be controllable with Python software.
- c. Environmental specification: operational over the range 5 C to 40 C at ambient pressure
- d. Condition: The VNAs shall be new, not used or refurbished.

Separately Priced Options and Services:  
Item 2: [List minimum specifications.  
Quantity: [Enter quantity here.]  
Specifications: [Enter quantity here.]

[List any other item(s) or service requirements here using the same format above.]

## Service Requirements / Item Specifications

Section ⓘ	Requirements/Specifications ⓘ
<b>Planning Considerations</b> <input checked="" type="checkbox"/> N/A	<input type="checkbox"/> List any visits required to allow potential vendors to see site specific constraints. [Explain requirement here] <input type="checkbox"/> US citizen required on-site (foreign nationals require preregistration 30 days prior) <input type="checkbox"/> Vendor rep on-site more than three days <input type="checkbox"/> Other considerations: [List other considerations to ensure an accurate quote]
<b>Shipping &amp; Delivery</b> <input type="checkbox"/> N/A	a. The vendor shall deliver electronic equipment that meets the technical specifications above and is fully functional out of the box. b. The equipment shall be shipped to NIST Location: 325 Broadway, MS 687.08, Boulder, CO 80305 <b>Shipping criteria:</b> <input type="checkbox"/> Partial delivery acceptable <input type="checkbox"/> Direct delivery to building required [Explain need for requirement here] Building has: <input type="checkbox"/> Loading dock <input type="checkbox"/> Containerization preference: [Choose container] Other requirements: [List any other requirements here] <b>Delivery date criteria:</b> <input checked="" type="checkbox"/> Delivery of goods, installation, and training shall be completed no later than: 6 weeks ARO <input type="checkbox"/> Deliver no earlier than: [Insert date here] <input type="checkbox"/> Other: [List other shipping, delivery, or specil requirements]
<b>Electronic Media</b> <input type="checkbox"/> N/A	Software for remote operation and online manuals shall be made available. <input checked="" type="checkbox"/> Software <input checked="" type="checkbox"/> Electronic manuals <input type="checkbox"/> License Key <input type="checkbox"/> Other: [List any other Electronic Media requirements here] [Enter email address for software delivery here]
<b>Installation</b> <input checked="" type="checkbox"/> N/A	[Enter installation requirements by item here.] <input type="checkbox"/> Vendor technician on site

## Facility / Utility Considerations

☒ N/A

- ☐ Rigging
- ☐ Uncrating / Unpackaging
- ☐ Removal of packaging material
- ☐ Equipment set up
- ☐ Start-up services
- ☐ Turn key installation
- ☐ Other [Enter details here.]

Note: When installation is required, TPOC or COR shall be the coordination point.

[List site specific utility considerations by item here.]

- ☐ OFPM Work Order Number(s)

[List any Work Order Number(s) here]

- ☐ Power available

Voltage: [Enter voltage here] (V)

Max Current: [Enter max current draw here] (A)

Phase: [Choose phase]

Frequency: [Typically 60Hz] (Hz)

NEMA Plug Type: [Enter plug type here] (i.e.: NEMA L5-20P)

Environment: [Choose environment]

Other power consideration: [List any other power considerations here]

- ☐ Utility connections: [List relevant available utilities, pressure(s), and flowrate(s)]

- ☐ Other considerations: [List other considerations to ensure an accurate quote]

## Warranty ⓘ

☐ N/A

Base Manufacturer Warranty is acceptable

[If you require an Extended Manufacturer Warranty, describe the warranty requirements per item here.]

What is included?

- ☐ Labor
- ☐ Parts
- ☐ Travel
- ☐ Cost and liability for returns

- ☐ Other: [Enter other requirements here]

- ☐ Warranty length: Click or tap here to enter text.

Period Length:[Ex. month, 6 month, year etc.]

## Training

☒ N/A

[Training requirements (who, when, what, where) here. If on-site, is travel necessary?]

- ☐ On-site

- ☐ Off-site location: [Enter location(s) here]

- ☐ Number of trainees: [Enter number of trainees here]

Scope of training:

- ☐ Operations
- ☐ Maintenance
- ☐ Troubleshooting
- ☐ Safety

- ☐ Other: [Enter other scope requirements here]

<input type="checkbox"/> Training materials to be provided: [Describe requirement here] <input type="checkbox"/> Other: [Enter other training requirements here] Note: When training is required, TPOC or COR shall be the coordination point.	
<b>Inspection and Acceptance</b> <input type="checkbox"/> N/A	NIST will inspect and test the parts <input type="checkbox"/> Planned government acceptance testing (7 business days) <input checked="" type="checkbox"/> Gov't acceptance expected to take longer than 7 business days: 14 days <input checked="" type="checkbox"/> Inspection and acceptance plan: NIST will inspect and test the parts. Final inspection and performance evaluation will take place in our laboratory within 14 days of delivery. The following measurements will be made on appropriate test circuits/systems: a. ability to control the units through USB communication. B. signal to noise in the source current measure voltage configuration. <input type="checkbox"/> Other: [Enter other requirements here]
<b>Maintenance</b> ⓘ <input checked="" type="checkbox"/> N/A	[Describe your maintenance requirements per item here] Period Length: [Ex. month, 6 month, year etc.] What is included? <div style="display: flex; flex-wrap: wrap;"> <div style="width: 25%;"><input type="checkbox"/> Labor</div> <div style="width: 25%;"><input type="checkbox"/> Spare parts</div> <div style="width: 25%;"><input type="checkbox"/> Consumables</div> <div style="width: 25%;"><input type="checkbox"/> Travel</div> <div style="width: 25%;"><input type="checkbox"/> Cost and liability for returns</div> <div style="width: 25%;"><input type="checkbox"/> Software updates</div> <div style="width: 25%;"><input type="checkbox"/> Manuals</div> <div style="width: 25%;"><input type="checkbox"/> Service plan length: [Enter service plan length here]</div> </div> <input type="checkbox"/> Other: [Enter other requirements here] <input type="checkbox"/> Requirements: [Enter requirements here] (i.e.: onsite within 72 hours, etc.) <input type="checkbox"/> Option Period 1 <input type="checkbox"/> Option Period 2 <input type="checkbox"/> Option Period 3 <input type="checkbox"/> Option Period 4
<b>Government Furnished Material / Equipment</b> <input checked="" type="checkbox"/> N/A	[List any government furnished material/equipment per item here] <input type="checkbox"/> Samples for testing <input type="checkbox"/> Government equipment which will leave gov't site (TPOC must coordinate with division property custodian) Serial Number: [Enter Serial Number here] Description: [Enter description here] NIST property number: [Enter NIST property number here] <input type="checkbox"/> Other: [Enter other details here]
<b>Travel</b> <input checked="" type="checkbox"/> N/A	[Describe any travel requirements per item here] <input type="checkbox"/> Explain: [Explain here] <input type="checkbox"/> Other: [Enter other requirements here] <i>Vendor: To the maximum extent possible, include as part of appropriate sections above (maintenance, repair, etc.). Otherwise, it will be a separate line item, reimbursable per the Federal Travel Regulation.</i>

Provide suggestions to improve this form by clicking [here](#).