Request for Quote and Specifications of 67GHz 4-Port PNAX with Noise Modules for Loadpull & Semiconductor Wafer Characterization

- The GEECI (Gallium Nitride Ecosystem Enabling Centre and Incubator) at SID-Indian Institute of Science is seeking bids from qualified industries for this tool as per the specifications below.
- Companies need to submit two bids, a technical bid and a commercial bid, in **two separate** sealed envelopes. The bids should be submitted no later than 30 days from the date of posting of this tender, as listed on the website date/time stamp, and by 5 pm on the 30th day or next weekday in case the 30th day falls on a weekend or a national holiday.
- Both technical and commercial bids should be addressed to "The Chief Executive, SID, IISc, Bangalore 560012, GST # 29AAATS5333E1ZJ."
- All quotations should be CIF Bangalore.
- Cost of last mile transportation, including any insurance, from port of shipment to IISc has to be quoted as an option.
- In case of courier shipments maximum permissible weight would be 70kgs.
- The envelopes should be addressed to "Prof. Srinivasan Raghavan, CeNSE, IISc, Bangalore, 560012" and submitted to the office at CeNSE, IISc in Room No. GF 15 between 9 am and 5 pm.
- All questions regarding this tender should be addressed to Prof. Srinivasan Raghavan at the email address sraghavan@iisc.ac.in
- Post such submission all vendors should send an email to sraghavan@iisc.ac.in with the subject line: "GEECI_Bidder's name_Tool Name" to intimate him of the submission within one day.
- Deviations from the technical specifications requested are allowed. Such deviations must be highlighted and justified. Their acceptance or rejection will be left to the discretion of the technical committee.
- The equipment sought will be placed at the Centre for Nano Science and Engineering (CeNSE), Indian Institute of Science (IISc). IISc is India's No. 1 institution on higher learning and the Center for Nano Science and Engineering is home to one of the best academic fabs in the world.
- The technical and commercial response, corresponding to the tool being offered, should be in the form of a compliance table with at least 5 columns. Serial number in column 1. Each of the items below, **technical and non-technical**, should be addressed in a separate row of the table in column 2. Compliance to this requirement, in Yes/No, deviation from it and justification should be provided in the neighbouring columns 3-5. Post the opening of a hard copy of the technical bid the committee will request for a soft copy of the files for further processing. Companies should **NOT** mail soft copies of the files unless specifically requested for.
- A compliance table for the terms and conditions mentioned at the end of the RFQ should also be included in all bids.
- Detailed technical specifications of the tool being offered should be included.
- 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.
- If multiple systems can fulfill the requirements, vendors can submit multiple bids.
- Vendors are encouraged to highlight the advantages of their tools over comparable tools from the competitors.
- The commercial bid should be broken up to the maximum extent possible into separate items with a cost against each to enable better comparison of price for various

configurations across the bidders. As an option, please provide itemized cost for any *suggested* accessories/add-ons that may enhance the usability, capability, accuracy or reliability of the tool. Vendors are encouraged to quote for as many add-ons as their tool portfolio permits.

I. Technical Specifications of <u>67GHz VNA</u>

1. Single box Vector Network Analyzer with Frequency range of 10MHz to 67GHz
2. Should have demonstrated capability to work with Focus and Maury Load pull Setups (Provide a list of such integrations/installations, as an annexure).
3. System should have 4 number of ports
4. System should have direct generator & receiver access and source & receiver attenuators on all ports.
5. Number of inbuilt sources required: 2
6. System should be two sources with inbuilt combiner and mechanical switch.
7. System should have internal bias tees over full frequency range.
8. System should have a dedicated low noise receiver up to 50GHz
9. System should support Noise figure measurement with vector corrections
10. System should have inbuilt feature for S-par extraction of 2 ports networks by connecting only 1 port of DUT upto 40 GHz.
11. Output power @ 10GHz: ≥ 9 dBm
12. Output power @ 67GHz: ≥-5 dBm
13. Minimum settable power: -80dBm
14. System dynamic range with and without combined mode @ 67GHz with 10Hz IFBW at the test ports > 102dB
15. Source Harmonics at max power @ 20GHz: -60dBc
16. Source Harmonics at max power @ 32.5 GHz: -60dBc
17. Source Phase noise @ 67GHz and 10 kHz offset: -98dBc/Hz
18. Inbuilt display should be available with size greater than 12 inch
19. Minimum measurement capability required:

a. All eight S-parameters with single connection / frequency sweep.
b. System should support frequency and power, both log and linear sweeps, in automated way using VNA firmware.
c. Quoted system should allow all device/wafer level RF measurements and basic power amplifier measurements. Should have ability to measure the noise figure, of RF components up to 67 GHz.
d. System should support following formats Magnitude, wrapped and unwrapped phase, smith chart, group delay, etc

20. System should allow external bias Tee

a. Application software to measure noise figure and noise-power measurements of amplifiers with vector-source-correction technique up to 50GHz.
b. Feature for de-embedding all tester and probing parasitic. This should automatically remove the fixture/parasitic effects and save the snp (or relevant) file of the fixture required for the highest accuracy (ex: open, thru, short and 2× thru) System should have inbuilt features for S-Par extraction of 2 ports networks by connecting only 1 port of DUT upto 40 GHz

21. Should be able to Correct system performance data with electronic calibration kit upto 67GHz with following specifications:

a. Directivity: >32dB
b. Source match:> 25dB

c. Load match: >23dB
d. Reflection tracking magnitude: <±0.15dB
e. Transmission tracking magnitude: <±0.23dB

22. Should have LAN, GPIB and USB interface and should be programmable with standard programming languages
23. System should come with software (#1 Nos.) with permanent license to do measurements in an automated way. Provided software should have feature to control all hardware. It should be enable auto calibration.
24. System Must be compatible with Formfactor/Cascade make automatic/semiautomatic probers and it's automation software.
25. All necessary power cables must be provided.
26. System should have auto calibration feature.
27. System Upgrades Possible (Quote Optionally):
    a. Should be upgradable to 900Hz start frequency
    b. Should be upgradable to with internal source phase noise at 67GHz and 10KHz offset as -110dBc/Hz
    c. Should be upgradable with inbuilt spectrum analyzer application
    d. Should be upgradable to 120 GHz with single sweep and up to 1.5THz in waveguide bands.
    e. Should be upgradable to do pulsed measurements with in-built pulse generators and modulators.
    f. The VNA should be upgradable to characterize devices in Nonlinear operating regions
28. Accessories required: USB power sensor (1 No's) and Electronic calibration kit (1 No's) covering full frequency range in single unit without band splitting.

All of the above mentioned technical specifications are highly desired. However, lower technical specifications may be considered if the above mentioned specifications are found to be unsuitable in financial terms. The Institute reserves the right to go for lower specifications taking into consideration its technical preferences and financial constraints. Vendors are encouraged to highlight the advantages of their tools over comparable tools from the competitors.

Terms and conditions:

1. SEMI Standards (if applicable): The technical bid should include details of the SEMI standards the tool confirms to.
2. Shipping: On all systems the cost of shipping up to IISc should be included. IISc will take care of the customs clearance at Bangalore Airport. Please include your payment option. IISc would prefer to retain at least 40% of payment till instruments have been commissioned and successfully demonstrated.
3. Tool Training: Necessary training to operate the procured setup and required literature support should be provided without additional cost. In principle onsite installation should be free of cost. The amount of time / day committed by the engineer during installation must be clearly stated. The engineers must spent enough time at the installation site (at least 4 days to train all engineers/staff and students).
4. **Tool Qualification and Acceptance:** Commissioning shall involve demonstration of tool performance as per terms and conditions mutually agreed upon between the client and vendor and characterized by the client within time frames agreed upon. Given the requirements in the RFQ, details of the stage wise certification protocols to be pursued for

tool acceptance should be included in the technical bid. The PO will include a mutually agreed upon set of tool qualification criteria. Please list a set of acceptance tests for on-site (vendor) inspection and after installation at IISc.

5. **Tool footprint and utilities:** A floor plan should be part of the technical bid. A list of utility requirements should be part of the technical bid. The system should be compatible with 240±10V, 50 Hz single phase or 415±20V, 50 Hz 3 phase supplies. The MINIMUM set of utility requirements needed are provided in Table 1. If there are additional utility requirements please include them in the technical bid. Please list connector types for all utilities.
6. Software upgrade, if any, must be free of cost for next 5 years.
7. The vendor must assure that there are no bugs and glitches with the integration. In case of glitches or bugs at the time of installation, vendor must fix the issues in less than three days from the start date.
8. Maintenance: The cost of an annual maintenance contract and cost of emergency technical support that may involve an engineer being on site should be quoted for in the commercial bid and addressed in the technical bid. The availability of trained engineers in India for servicing the system will be preferred and should be described in the technical bid.
9. Maintenance: On all systems a set of basic tools required (like non-standard screw or spanner head that is required for routine tool maintenance) should be provided for performing routine maintenance.
10. Maintenance: System operation, process and troubleshooting manuals and detailed drawings are a must. Their inclusion must be indicated in the technical bid.
11. **Cost of Ownership and supply of spares:** The quote should include a listing of spares that need to be replaced periodically to ensure that the system is in operation in a stable fashion – the stability parameters being defined by the vendor and agreed to by the client – the cost of such items, the ability to guarantee their availability at this cost for a period of 5 years from the time of procurement. The aim of this exercise is to compare cost of ownerships between reactors.
12. Online support: System should have the capability for online diagnostics from a remote location in case of tool problems.
13. Post sales service and Indian Presence: Bidders should provide details of after sales service and support and in particular that available in India. If not India, the nearest geographical location should be specified. Please provide details of the number of trained personnel in India who can service the machine, the number of tools sold in India and the corresponding number in the southern region or in Bangalore.
14. Payment Terms and Conditions: On all systems the payment terms should be specified in the technical and commercial proposal and is subject to negotiation. Please include your payment option. IISc would prefer to retain at least 40% of payment till instruments have been commissioned and successfully demonstrated.
15. References: Bidders should provide details of other locations in India with similar tool installations. Vendor should have installed the same or similar tool at minimum 3 other locations in India.
16. References: Bidders should provide details of at least 10 other locations globally where similar tool installations have been deployed.
17. Company financials: Bidder shall have to submit audited accounts of financial year 2017-18, 2018-19 and 2019-20. Audited statement must be signed and stamped by qualified chartered accounted. Income Tax return for assessment year – 2017-18, 2018-19 and 2019-20.
18. The following documentation should be provided. ISO9001 quality certification. CE marking confirmation.

19. Guarantee: As high as possible (at least 3 years)
20. In case of software issues, vendor should be able to provide required solution within five days.
21. The lead time for the delivery of the equipment should preferably be less than 6 weeks from the date of receipt of our purchase order. The smallest lead time will be appreciated.
22. The validity period of the quotation should be 90 days at least.
23. System/computer required to operate the tool must come with the system with all software pre-loaded.
24. Free copies of analysis software must be provided with the tool (list out numbers)

Details to be provided in addition to other utility requirements the tool may require. If not applicable mark as NA: Not applicable.

				Electric		**Chilled Water**		**Gases**														**Exhaust**	**Thermic load**
Tool Foot Print, (LXBXH)			Area	Power consumption average	Peak power	Cooling capacity	Cooling Water Process	UHP Nitrogen	UHP Hydrogen	Dopant Silane	Pure Silane	Ammonia	Chlorine	He	Oxygen	Regular Nitrogen	CF4	CHF3	SF6	NO2	BCl3	Argon	Forming Gas		Thermic load to clean room
L (mm)	B (mm)	H (mm)	Sq.	kW	kVA	kW	l/h	slpm	slpm	slpm	slpm	slpm	slpm	slpm	slpm	slpm	slpm	slpm	slpm	slpm	slpm	slpm	slpm	m^3/h	kW