PART 1

1. Preamble:

Brief Introduction of Lab/Est.: DRDO Young Scientist Laboratory – Cognitive Technologies is a Lab of DRDO, under MOD and is situated in IITM Research Park, Taramani, Chennai – 600113.

Brief Introduction of EOI:

Director, DYSL-CT, is issuing this invitation for **Expression of Interest (EOI)** to invite proposals from capable vendors for the **design, simulation, prototyping, and testing** of a **wideband X-band Vivaldi antenna**, targeting a **gain of ~12 dB,** for each element, using **advanced additive manufacturing techniques (3D printing)**. The intended development is currently aimed at **Technology Readiness Levels (TRL) 2 & 3**, focusing on concept formulation, analytical and experimental proof-of-concept, and early functional validation in laboratory settings.

The objective of this EOI is to:

- Identify and engage firms or institutions with core competencies in **antenna design, RF simulation, electromagnetic analysis, and advanced manufacturing techniques**, particularly **metallic and dielectric 3D printing** suitable for high-frequency applications.
- To freeze the technical specification and development timelines for subsequent RFP stage.
- Evaluate the technical and operational readiness of interested vendors through a **Technical Evaluation Committee (TEC)**.
- Pre-qualify capable vendors for participation in the subsequent **Request for Proposal (RFP)** stage.

The development requires **multi-disciplinary expertise**, combining knowledge in:

- Electromagnetic theory and antenna design
- CAD and full-wave EM simulation tools (e.g., HFSS, CST)
- Materials and methods for RF-grade 3D printing
- Basic RF testing and measurement (e.g., return loss, bandwidth, gain, radiation pattern)

The outcome of this EOI will assist the Lab in firming up an RFP for the actual prototyping and lab-testing of the antenna. Successful execution of the RFP contract may further lead to **TRL progression and production contracts**, subject to performance and requirement evolution.

Applicants meeting the qualification criteria may be invited for presentation and discussions. Further based on the evaluation, finalised RFP bid documents will be issued to the shortlisted applicants only.

Director, DYSL-CT or his representatives reserve the right to cancel this request for EOI and/ or to invite EOI afresh with or without amendments, without liability or any obligation for such request for EOI and without assigning any reasons therefor. Director, DYSL-CT reserves the right to amend / add further details in the EOI.

The response must reach DYSL-CT on or before 17th August 2025 by 18:00 PM. Any late submission after the specified time won't be strictly entertained.

2. Scope of Work:

Design, Simulation, and Fabrication of the Wideband X-band Vivaldi Antenna:

- Propose an innovative design methodology for the **development of a 4×4 planar wideband Vivaldi antenna array** operating at **X-band frequency range**, with a **targeted single element gain of ~12 dB**.
- **Perform full-wave electromagnetic simulations** (using tools such as HFSS, CST, or equivalent) to analyze and optimize:
    - Bandwidth
    - Gain and efficiency
    - Radiation pattern
    - Return loss and impedance matching
    - Mutual coupling in array configuration
- The antenna structure must be designed to leverage **advanced 3D printing technologies**, with a focus on:
    - **Lightweight dielectric and/or metallic materials**
    - **Complex geometries** enabled by additive manufacturing
    - **Integration-readiness for conformal** and ready to operate under constraints such space, cooling, and processing resources for embedded system-level deployment
- **Demonstrate a reduction of at least 50% in weight** compared to equivalent conventionally manufactured X-band antenna arrays, without significant compromise in performance.
- The solution should include:
    - A modular approach for **planar array scalability**
    - Fabrication of a **functional prototype** (at least a 4×4 element array) using 3D printing
    - Lab-level **antenna characterization** (e.g., using VNA and anechoic chamber setups)
- Prepare a **detailed technical report** covering:
    - Design rationale and optimization process
    - Simulation results with parametric analyses
    - Fabrication methodology and material specifications
    - Test and validation results (including gain, S-parameters, and radiation pattern)

3. Draft Specification for the X-Band 4×4 UWB Vivaldi Antenna (3D-Printed):

a) Antenna Technology:

- **Tapered Slot Vivaldi Antenna**, arranged in a **4×4 planar array**
- Fabricated using **3D printing** with metallization (e.g., copper spray, sputtering, or plating on PLA/ABS/Nylon)
- Designed for **lightweight, rugged, and customizable deployment** on curved or flat surfaces

b) Frequency & Bandwidth:

- Operating band: **X-band ultra-wideband**
- Nominal centre frequency: **10 GHz**

- Bandwidth (S11 < –10 dB): **≥ 1 GHz**

c) Gain & Radiation Characteristics:

- **Individual element gain**: **≥ 12 dBi** (simulated and validated)
- **Total array gain**: **≥ 24 ± 2 dBi** with optimized feeding
- Half-power beam width (HPBW):
  - E-plane: ~**30°–40°**
  - H-plane: ~**60°** (depending on array spacing)
- Sidelobe level: **< –13 dB**
- Front-to-back ratio: **>15 dB**

d) Polarization:

- **Linear polarization** (typically vertical, but orientation customizable)
- Cross-polarization discrimination: **>20 dB**

e) Feeding Architecture:

- **Coaxial-fed** or **microstrip-fed** Vivaldi elements
- Integrated **corporate feed network** for in-phase power distribution
- Input impedance: **50 Ω**
- Return loss: **better than –10 dB** across band
- Supports connection to **SMA/MMCX connectors** or embedded feedlines for direct PCB integration

f) Mechanical Design:

- Substrate/body: **3D-printed dielectric** (e.g., PLA, PETG, or industrial resin)
- Metallization: **Conductive copper/nickel plating or paint**

g) Environmental:

- Designed for **rugged environments**, suitable for outdoor and mobile platforms
- Conformal or panel-mounted with optional **RF-transparent radome**
- Operating temperature: **–20°C to +65°C**
- Shock, vibration, and ingress protection (IP54/IP65)

i) Fabrication and Tooling:

- Fully **3D-printable mechanical and EM design**
- Design files to be compatible with standard **FDM/SLA printers**
- Post-processing for **surface smoothness and metallization**
- Mounting interface designed for **tool-less integration with embedded platforms**

4. Eligibility Criteria:

I. The applicant firm should have at least **5 years of experience** in the design and development of **RF antennas**, with demonstrated expertise in **ultra-wideband (UWB) antenna systems**, including **array design, EM simulation, and field validation**.

II. The applicant firm should have at least **2 years of experience** in the **fabrication of conformal or 3D-printed RF antennas**, including metallization processes.

III. The applicant firm should have on its permanent roll at least **5 Antenna/RF engineers**, continuously for the **last 3 years**, with proven experience in **antenna prototyping, measurements, and system-level integration**.

IV. The applicant firm should clearly bring out its **in-house EM simulation tools (e.g., CST, HFSS)**, **RF measurement facilities (e.g., anechoic chamber, VNA)**, and **QA practices** related to **antenna design, fabrication accuracy, repeatability, and performance validation**.

V. The applicant firm should have completed **at least**

- **One similar project** with cost greater than ₹ **80 Lakhs**

  (or)

- **Two similar projects** with average cost greater than ₹ **50 Lakhs (or)**
- **Three similar projects** with average cost greater than ₹ **40 Lakhs**

  in last three financial years involving **custom antenna array development** for any **government agency, defence lab, R&D organization, or industrial platform**, where the deliverables include **combined antenna design, fabrication, and field validation**.

VI. The applicant firm should not be under liquidation, court receivership or similar proceeding.

VII. The applicant firm should have an annual turnover of more than **₹ 2 Crores**, for the past 3 financial years.

VIII. The applicant firm should be positive net worth firm for the past 3 financial years.

5. Procedure for response:

The response can be either through official mail id / through post.

The response should be addressed to:

The Director,

DRDO Young Scientist Laboratory – Cognitive Technologies

IITM Research Park, 5th Floor, E-Block

Chennai – 600113

Phone No. 044-22548800

Contact Person: Shri R Avinash, Scientist 'F'

Email ID: avinash.r.dysl-ct@gov.in

5.1 Instruction / Notes:

5.1.1 General:

(a) All documents submitted along with EOI should be clear, legible and self-certified by the authorized representative of the applicant

(b) The applicant may kindly note that shortlisted firm may be required to sign a Non - Disclosure Agreement (NDA) at a later date as required by Lab/Est.

(c) Lab/Est. will not be responsible/ liable to any party in any way for costs associated in preparation & submission of EOI.

(d) Lab/Est. is also not obliged to share clarification related questions with other respondents than the one who seeks clarification.

(e) Lab/Est. reserves the right to accept or reject any EOI proposal without signing any reasons whatsoever.

(f) This Labs/Est. reserves the right to withdraw the EOI and change or vary any part thereof or foreclose the EOI at any stage.

5.1.2 Important

(a) Unit cost of the system without Non-Recurring Expenditure would become the basis for calculating the unit cost during the production phase.

(b) INTELLECTUAL PROPERTY RIGHTS (IPR) developed under the developmental contract, funded by DYSL-CT, DRDO, will be the property of DYSL-CT, DRDO, Govt. of India. The firm should provide technical know-how/ design data for production of the item to the DYSL-CT or any other designated production agency nominated by the DYSL-CT, DRDO. The firm will, however, be permitted to receive, upon demand, a royalty free license to use these intellectual properties for its own purposes, which specifically excludes sale or licensing to any third party other than the ones provided in separate agreement between DYSL-CT and the firm, if any.

(c) Manufacturing drawings prepared during the development phase shall be the property of the DRDO/ Ministry of Defence and will be handed over to DRDO whenever required. Further, these will also not be used by the development partner for any purpose other than stated in the contract, without the written consent of DRDO.

5.1.3 Submission of Information/Documents

Information should be submitted in the formats specified in this document. The Pre-qualification documents shall be submitted as follows: -

(a) Two (hard) copies with all supporting documents (if sent through post) (or) One digital copy of entire documentation (if sent through mail).

(b) With covering letter duly signed by Authorized Representative of the company with company's seal. Document in support of authorization granted to authorize representative to be submitted.

S NO	DOCUMENTS TO BE SUBMITTED BY THE APPLICANT FIRM
1	Undertaking of willingness, as per Form A
2	Certificate of incorporation of the applicant firm
3	Signed and sealed compliance of this EOI document including scope of work, specifications and other terms & conditions.
4	Milestone wise timeline for the design and development X-Band 4×4 UWB Vivaldi Antenna (3D-Printed).

5	Estimate of percentage of local content in the cost of the prototype and in the total cost of development.
6	Summary sheet, as per Form B
7	Litigation / Arbitration history, as per Form C
8	Duly audited annual financial year statements for past 3 financial years including balance sheets, profit & loss account statement.
9	A self-certification that applicant company / organisation is not under liquidation, court receivership or similar proceeding
10	Documents supporting 5 years of experience in the design and development of RF antennas, with demonstrated expertise in ultra-wideband (UWB) antenna systems, including array design, EM simulation, and field validation.
11	Documents supporting 2 years of experience in the fabrication of conformal or 3D-printed RF antennas, including metallization processes.
12	Supply order and completion certificate supporting execution of at least, i) One similar project with cost greater than ₹ 80 Lakhs (or) ii) Two similar projects with average cost greater than ₹ 50 Lakhs (or) iii) Three similar projects with average cost greater than ₹ 40 Lakhs, in last three financial years involving custom antenna array development for any government agency, defence lab, R&D organization, or industrial platform, where the deliverables include combined antenna design, fabrication, and field validation.
13	Documents supporting manpower availability of at least 5 Antenna/RF engineers, continuously for the last 3 years, with proven experience in antenna prototyping, measurements, and system-level integration.
14	Documents supporting in-house EM simulation tools (e.g., CST, HFSS), RF measurement facilities (e.g., anechoic chamber, VNA), and QA practices related to antenna design, fabrication accuracy, repeatability, and performance validation.
15	A self-declaration certificate, along with write-up on technical capabilities the firm possesses, for matching the eligibility criteria.

Failure by the applicant to provide information/documents, which is essential to evaluate the applicant's qualifications, or to provide timely clarification or substantiation of the information supplied may result in disqualification of the applicant.

5.1.4 Information

Any information/clarification regarding this subject matter can be obtained from: -

(Contact details id of contact person of Lab/Estt (Address, phone, email-id))

Contact Person: Shri. R Avinash, Scientist 'F'

Email ID: avinash.r.dysl-ct@gov.in
DRDO Young Scientist Laboratory Cognitive Technologies
IITM Research Park, E Block, 5th Floor

Phone No. 044-22548800

6 Part 2: Forms

6.1 Form A

Willingness/ Undertaking Format

(To be enclosed as part of Expression of Interest proposal on the letterhead of the company)

Date:

To

The Director DRDO Young Scientists Laboratory – Cognitive Technologies

IITM Research Park

E Block, 5th Floor

TARAMANI, CHENNAI - 600119

Reference: Expression of Interest No. ---------- dated---------- 2025

Dear Sir,

We hereby confirm that we have examined the lab/Est. EOI document dated ----------

We hereby confirm that we agree to all terms and conditions of the EOI document.

Yours faithfully,

(Applicant Head Signature)

6.2 Form B - Summary Sheet: Organization Structure / Legal Status/ Current Contract Commitments / Works in Progress

The Applicant firm shall submit with EOI, the organization structure , legal status of the applicant, place of Registration, principal place of business and brief on business activities undertaken by the applicant, the ownership details, shareholder pattern, details of manpower viz. discipline and geographical location wise permanent manpower strength for execution of proposed project, names and addresses of the present Directors and the Senior management and such other relevant details as the Applicant may like to share in the following format.

a) Corporate …….

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b) Corporate Structure ……...

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c) Applicant's Technical Capacity (State total number of professional staffs indicating each Individual's experience/ qualification):

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…….

d) Applicant's Facilities and Experience

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Name & Signature of authorized representative of the Applicant:

Name and Stamp of Company:

Date:

e) Applicant should provide information on their work performed in the last 2 years and also the current commitments on all contracts that have been awarded, or for which a letter of intent or acceptance has been received, or for contracts approaching completion, but for which an unqualified, full completion certificate has yet to be issued in the following format.

Year	Project Name/Client	Contract No. & Date	Value of Contract	Stipulated period of completion	Actual Date of Completion

6.3 Form C - Litigation /Arbitration History

Applicant should provide information on history of Court litigation or arbitration proceedings resulting from contracts executed in the last 2 years or currently under execution. The information should also be provided for any significant subcontractors.

Year	Decree/ Award for or against Applicant	Name of client, cause of litigation, and matter in dispute	Disputed Amount