भारत सरकार/GOVERNMENT OF INDIA
अंतरिक्ष विभाग/DEPARTMENT OF SPACE
क्रय यूनिट-II/PURCHASE UNIT-II
विक्रम साराभाई अंतरिक्ष केंद्र/VIKRAM SARABHAI SPACE CENTRE
तिरुवनंतपुरम/THIRUVANANTHAPURAM – 695 022
Tel: (0471) 2562425/2062
email: spo_avn_pur@vssc.gov.in, pso2_avn_pur@vssc.gov.in

EXPRESSION OF INTEREST / अभिरुचि की अभिव्यक्ति

No. VSSC/EOI/EMAD/01/2022/V1 **Date: 01.11.2022**

अभिरुचि की अभिव्यक्ति- विद्युत यांत्रिक प्रवर्तकों (ईएमए) एवं दर्पण प्रतिबिंब संवेदकों(एमआइएस) का उत्पादन

EXPRESSION-OF-INTEREST FOR "PRODUCTION OF ELECTRO-MECHANICAL ACTUATORS (EMA) & MIRROR IMAGE SENSORS(MIS)"

इच्छुक प्रत्याशित निर्माता हमारे संदर्भ सं. VSSC/EOI/EMAD/01/2022/V1 का उद्धरण करते हुए 30/11/2022 [16:00 Hrs.] को या उससे पहले निम्नलिखत पते पर अपनी अभिरुचि की अभिव्यक्ति दे सकते हैं।

VSSC invites, EOI from prospective bidders for PRODUCTION OF ELECTRO-MECHANICAL ACTUATORS (EMA) & MIRROR IMAGE SENSORS(MIS)". Interested parties may furnish their **Expression of Interest in Sealed Envelope** quoting our **Reference No. VSSC/EOI/EMAD/01/2022/V1 on or before 30/11/2022 [16:00 Hrs]** to the following address:

वरि. क्रय एवं भंड़ार अधिकारी / Sr. Purchase & Stores Officer,
क्रय यूनिट II /Purchase Unit- II,
आरएफएफ क्षेत्र, इसरो पीओ/ RFF Area, ISRO. PO,
तिरुवनंतपुरम/Thiruvananthapuram- 695022.
फोन/Ph: 0471-256 2425/2062

नोट/Note :- **मेक इन इंडिया नीति के अनुसार केवल श्रेणी-I तथा श्रेणी-II के स्थानीय आपूर्तिकार इस बोली में भाग लेने हेतु पात्र हैं। / Only Class-I and Class-II Local suppliers as per Make in India policy are eligible to participate in the bid.**

EOI documents are available at our website www.isro.gov.in and www.vssc.gov.in.

हस्ताक्षरित/Sd/-
वरि.प्रधान, क्रय एवं भंड़ार/ Sr.Head, Purchase & Stores

Government of India
Department of Space
Vikram Sarabhai Space Centre
Indian Space Research Organization
Thiruvananthapuram-695022
Kerala

No. VSSC/EOI/EMAD/01/2022/V1 **Date: 01.11.2022**

INVITATION FOR EXPRESSION-OF-INTEREST

Vikram Sarabhai Space Centre (VSSC), Thiruvananthapuram invites Expression-Of- Interest (EOI) from vendors for production of Electro-Mechanical Actuators (EMA) & Mirror Image Sensors (MIS) for a period of 3 years. Scope of work includes (1) fabrication of mechanical hardware, (2) procurement and acceptance testing of bought out items, (3) dimensional inspection, (4) hardware clearance and preassembly operations, (5) assembly of EMA & MIS, (6) realization of control electronics and checkout for testing, (7) testing and clearance of EMA & MIS and (8) Quality Control/Quality Assurance activities. Vendor should carry out production activities at vendor's facilities after the initial training at VSSC facility. The projected annual requirement of EMA & MIS is 60 numbers each (approx.). The realization and testing should be carried out as per VSSC approved documents and drawings. Interested Vendors having adequate know-how, adequate facilities for fabrication, inspection and testing, having qualified and skilled technical personnel, experience in realization and testing of Electromechanical Actuators production or similar items and having sound financial background, commitment and desirous of long-term partnership with ISRO are invited to participate in the Expression-Of-Interest. On receipt of EOI, VSSC shall evaluate and assess the suitability prior to short-listing of Vendors. This call for EOI does not carry with it any guarantee for allotment of contract.

EOI document can be downloaded from website **www.isro.gov.in** and the same shall be submitted within the due date and time. **"Expression of Interest"** with all essential information shall reach the **Senior Purchase and Stores Officer, Purchase Unit II, Vikram Sarabhai Space Centre, ISRO Post, Thiruvananthapuram 695022, Kerala,** on or **before 30.11.2022, 16.00hrs.** This EOI is issued as a "Pre-Bid Qualification". Inadequate or incomplete information will result in rejection of the offer. VSSC reserves the right to accept or reject all or any of the EOI. Mere compliance to the EOI terms does not guarantee further consideration for vendor qualification.

Senior Purchase and Stores Officer,
Purchase Unit II,
Vikram Sarabhai Space Centre,
ISRO P.O,
Thiruvananthapuram - 695022
Kerala State

Government of India
Department of Space
Vikram Sarabhai Space Centre
Indian Space Research Organisation
Thiruvananthapuram-695022
Kerala

No. VSSC/EOI/EMAD/01/2022/V1 Date: 14-10-22

INVITATION FOR EXPRESSION-OF-INTEREST

"Realisation and testing of three types of electromechanical actuators at vendor's facility".

1. Preamble

Vikram Sarabhai Space Centre (VSSC) is the lead centre of the Indian Space Research Organization (ISRO) that specialises in the design and realisation of satellite launch vehicles. To meet the increasing demand for launches, ISRO has decided to look forward to the participation of private industries in the production and supply of launch vehicle systems and sub-systems. Among various technologies being considered for production through Indian Industry, control systems is one of the crucial areas. VSSC proposes to effectively utilise the expertise, experience and capabilities of an industry that possesses prior experience in the production of similar aerospace products. The aim of the EOI (Expression of Interest) is to identify a vendor capable of carrying out the production and delivery of

1. **S200 FNC** (Flex Nozzle Control) EMA (Electromechanical Actuator) & S200 MIS (Mirror Image Sensor) for LVM3
   Quantity: 27 Nos of S200 EMA and 27 Nos of S200 MIS
   Production rate (Phase 3): 7 Nos of S200 EMA & 7 Nos of S200 MIS every four months.
   Production rate (Phase 4): 5 Nos of S200 EMA & 5 Nos of S200 MIS every nine months.
2. **Fault-tolerant PS4 Actuators** for PSLV (Polar Satellite Launch Vehicle)
   Quantity: 102 Nos
   Production rate (Phase 3): 9 Nos every four months
   Production rate (Phase 4): 20 Nos every four and half months.

3. **Fault-tolerant PS3 FNC** (Flex Nozzle Control) EMA (Electromechanical Actuator & PS3 MIS (Mirror Image Sensor) for PSLV

   Quantity: 52 Nos of PS3 EMA and 52 Nos of PS3 MIS

   Production rate (Phase 3): 5 Nos of PS3 EMA & 5 Nos of PS3 MIS in every four months.

   Production rate (Phase 4): 10 Nos of PS3 EMA & 10 Nos of PS3 MIS in every four and half months.

   VSSC reserves the right to entrust the activity to a single vendor or more than one vendor.

2. Objective

(a) **Fabrication** of electromechanical actuators and MIS components using Free Issue Material (FIM- steel and aluminium alloy and Teflon) supplied by VSSC at the vendors facility.

(b) **Procurement** of bought-out items including motor, position sensors, ballscrew, bearing, grease, connectors etc., based on the bill of materials provided by VSSC. Acceptance testing of this hardware is to be carried out by the vendor.

(c) **Assembly** of the actuator and MIS at the vendor's facility using these fabricated parts and bought-out items.

(d) **Testing** of the actuators as per the approved acceptance test plan at the vendor's facility and delivering successfully tested hardware to VSSC

3. Scope of work

Sl.no.	Operation	Activities involved
1.	Fabrication of mechanical hardware	• Should be carried out using FIM supplied by VSSC • Should be carried out using VSSC supplied CCB approved drawings • Should be carried out using Process control and QC Plan documents prepared by the vendor and approved by VSSC • The scope of work includes surface treatment, passivation and heat treatment operations at facilities approved by VSSC. • Inspection of dimensions as per drawing. • Preparation of report and acceptance of hardware as per acceptance plan of VSSC

Sl.no.	Operation	Activities involved
		• The fabrication facility required are listed in Annexure II.
2.	FCD/ACD inspection	• Functionally critical dimensions of fabricated items have to be inspected at the vendors facility, • Party has to carry out 100% inspection at their facility. • Hardware without deviations only will be acceptable for assembly • The inspection facilities required are listed in Annexure II.
3.	Kit of parts	• Preparation of kit of part list for assembly
4.	Pre-assembly. operations	• Deburring, cleaning of fabricated components and pre-assembly activities. Trial suiting of hardware
5.	Bought-out item procurement and acceptance testing	• The vendor should procure all bought-out items required for actuator realisation like motor, position sensor, ballscrew, bearing, grease, wave spring etc based on the bill of materials provided by VSSC. • Acceptance testing should be carried out for all the hardware as per the VSSC process plan. • A list of major acceptance tests and facilities required are listed in Annexure II
6.	Assembly. of Actuator	• Physical verification of hardware including visual examination. • Carry out mechanical integration as per the assembly document • Carrying out electrical wiring of the actuator as per the assembly document. • The realisation of all assembly fixtures and assembly facilities.
7.	Testing	• Carry out tests on the actuator and MI sensor as per the approved test document. • Analysis of data and report preparation • The realisation of all fixtures and assembly facilities, including drive electronics and checkout.
8.	Control Electronics and Checkout	• Party has to realise control electronics for testing the actuators. • VSSC can provide any details required by the vendor for the realisation of Control Electronics. • The requirements and specifications document generated by the vendor for the realisation of the Control Electronics shall be approved by VSSC. • The checkout should be developed following the general checkout guidelines provided by VSSC.

Sl.no.	Operation	Activities involved
		• The control electronics and checkout shall be developed by the vendor or through external parties. Industrial-grade components are also acceptable. • Three types of control electronics and checkout are required considering the various operating power levels of (1) S200 actuator (2) Fault-tolerant PS3 FNC Actuators (3) Fault-tolerant PS4 EGC Actuators • 2 Nos of each type of control electronics and the associated checkout has to be realised. Out of which, one electronics and checkout of each type should be delivered to VSSC for retesting of the actuators after its receipt at VSSC.
9.	QC/QA Activities	• Scrutinise the inspection report of fabricated hardware against drawings, ensure no dimensions are left out, and scrutinise functionally critical dimension inspection and reject hardware with deviations. • Preparation of Quality Conformance Report for assembly and testing • Preparation of non-conformance report during assembly and testing for discussion and disposition by VSSC • Contamination monitoring of clean tents and record-keeping • Ensure wrenches, instruments, and measuring instruments with valid calibration only are used in assembly and testing. • Surveillance of all the assembly and test operations • Assessment of in-process checks parameters. • Logging all the quality control parameters in separate log books. • Generation of production document based on log sheet/logbook and test data • Providing stage clearance, wherever required • Generation of Quality Assessment Plan (QAP) • Final product assessment based on visual, dimensional, assembly and test data • Real-time alerting of quality lapses and corrective action.
10.	Nonconformance management	• Any deviations observed during assembly process or testing or variation from specification should be presented in the Non-Conformance Review Board

Sl.no.	Operation	Activities involved
		(NCRB) of AVN. The deviations are to be proposed to NCRB in the prescribed format by the vendor before further operations
11.	Safety	• Conducting all the assembly and test operations including handling of electrical devices and instruments as per standard safety procedure. • Deploying qualified engineers/supervisors for surveillance of all activities. • Real-time alerting of safety lapses and corrective actions. • Generation of safety non-conformance report, follow-up for corrective action and reporting to VSSC.
12.	Maintenance of facilities	• Conducting facility fitness checks like contamination monitoring of clean tent, calibration validity of instruments used and recording the same before starting any process operation. • Conducting periodic and preventive maintenance including break-down maintenance
13.	Storage facility	• Storage facility required for fabricated items should be available • Humidity controlled chamber should be available for storing bought-out items and assembled actuators. • Storage facility for documentation
14.	Documentation	• Generate the specified reports and deliver the accepted and cleared actuators along with the required documents to the department.

4. Realization Plan & Timeline

S. N.	Phase	Item	Qty (sets)	Fabricated hardware	Bought-out components	period (months)
1	**Phase -1 Development (at VSSC)**	S200 Actuator & MIS	2	Supplied by VSSC	Supplied by VSSC	2
		Fault Tolerant PS4	2			
		PS3 Actuator & MIS	2			
2	**Phase -2 Qualification (at Vendor site)**	S200 Actuator & MIS	2	Supplied by VSSC	Supplied by VSSC	8
		Fault Tolerant PS4	2			
		PS3 Actuator & MIS	2			
3	**Phase -3 Production (at Vendor site)**	S200 Actuator & MIS	13	Realised by vendor based on VSSC FIM	Supplied by VSSC	8
		Fault Tolerant PS4	18			
		PS3 Actuator & MIS	10			
4	**Phase - 4 Production (at Vendor site)**	S200 Actuator & MIS	10	Realised by vendor based on VSSC FIM	Procured by Vendor	18
		Fault Tolerant PS4	80			
		PS3 Actuator & MIS	38			

Phase-1 (Development)

- Actuators and MIS as listed in table above will be assembled by the vendor's team in presence of VSSC team.
- This will be acceptance tested at VSSC facility in presence of the vendor's team with VSSC CE and checkout

Phase-2 (Qualification)

- Actuators and MIS as listed in table will be assembled by vendor in their site
- 1 set should be acceptance tested by the vendor using the vendor's test facility using vendor CE and checkout and delivered to VSSC.
- Another set should be supplied to VSSC after acceptance testing. This unit will be qualification tested at VSSC.

Phase-3 (Production -1)

- Actuators and MIS as listed in the table above to be assembled using FIM supplied by VSSC
- Acceptance testing including functional and environmental testing to be carried out on all packages at the vendor facility
- Actuators are to be delivered to VSSC after successful acceptance testing.

Phase-4 (Production -2)

- Actuators and MIS as listed in table above to be assembled using bought-out items procured by vendor.
- Acceptance testing including functional and environmental testing to be carried out on all packages at Vendor facility
- Actuators to be delivered to VSSC after successful acceptance testing.

The dimension, working voltage, current and mass of actuators are listed in Annexure III.

5. Training of Vendor personnel

VSSC will impart necessary training for the production team deployed by the vendor during the initial two months after signing the contract. Training is free but daily expenses of production team has to be borne by the vendor.

6. Other requirements

Security : Team shall comply with the security regulation stipulated by VSSC.

Safety : Production Team shall follow all safety stipulations.

Secrecy : The Vendor and their team shall abide by the Indian Official Secrets Act in vogue and shall provide information of awareness of the above in writing.

7. Criteria for shortlisting of EOI proposals

1. Vendors having facilities for fabrication in India will only be considered
2. Vendors should have experience in the area of fabrication, assembly and testing of electromechanical actuators or similar devices.
3. Availability of fabrication and inspection facility listed in Annexure II is mandatory.
4. The party has to ideally have all the four environmental facilities mentioned in Annexure II. Since the investment for EMI and vibration shaker is huge, the party can outsource these tests to a well-established third party. Remaining facilities namely vacuum and thermal chambers should be available with the party. If these chambers are not meeting VSSC specification, party should agree to upgrade these facilities to meet VSSC requirements after order placement. The test levels are detailed in Annexure IV. The assembly and testing facility should be well equipped to meet all the requirements.
5. The vendor should have an established management structure and shall possess human resources with adequate knowledge, skill and experience in the areas of fabrication, assembly and testing.
6. The vendor should be a profit-making Company during the last 3 financial years. Certified copies from chartered accountant for the annual financial turnover and balance sheet showing profit/loss to be furnished.

Note:

1. For Clause No. 7, all information provided by the vendor shall be supported with documentary evidence. Brochure/documents detailing the vendor profile may be submitted. Copy of the previous similar purchase/work orders executed by the vendor also may be appended.
2. The final evaluation of the responses will be based on (1) inputs furnished against our criteria (2) assessment based on vendor's facility evaluation by the department if required (3) feedback from customers and (4) overall assessment.

Vendors who are meeting the requirements as specified in clause 7 of the EOI and are interested in associating with ISRO for fabrication, assembly and testing of electromechanical actuators may submit their interest in writing along with copies of supporting documents for verification/evaluation at VSSC. **Qualified Vendors will be shortlisted and detailed proposals from such vendors only will be solicited through a Request for Proposal (RFP).** This qualification process shall be valid for one year.

A checklist (Annexure -1) for the supporting documents to be submitted by the vendor along with the EOI is enclosed.

Annexure - I

Checklist for the supporting documents

(Filled checklist to be submitted by the vendor along with the Expression of Interest)

Sl.	**Document/ Proof**	**Attached or Not-attached with EOI**	**Remarks**
1.	Company registration details		
2.	Proof for experience in the area of fabrication, assembly and testing of Electromechanical actuators or similar devices.		
3.	Certified copies from chartered accountant for balance sheet showing profit/loss for the last 3 years.		
5.	Copy of previous purchase orders executed with ISRO/Defense/Aerospace sectors		
6.	Company profile, management structure and human resources and their experience		
7.	Company brochure		
8.	Copies of similar purchase/work orders executed by the company		

Annexure II – Facility requirements and test plan

Sl. No.	Activity	Equipment/ Facility required
1.	Fabrication	• 3 axis vertical milling machine • CNC lathe capable of handling upto 400mm dia. • CNC EDM wire cutting machine with finish module • Cylindrical grinding machine • Surface grinding machines • De-burring and fitting tools • Heat treatment and surface treatment facilities (should be VSSC approved, if not can be outsourced to VSSC approved third party)
2.	Inspection	• Machineries like including CMM with accuracy 2µ, profile projector, Electronic height gauge with accuracy 2µ, surface table, Surface roughness measuring machine etc. • Gauges: Ring gauge, plug gauge, pin gauge, radius gauge, thread gauge etc. • Mechanical measuring Instruments
3. f	Bough out components acceptance testing • Motor: Electrical health check, no-load speed, peak torque test etc. • Ballscrew: Friction measurement, Run-out measurement etc. • Potentiometer/ LVDT: Electrical health check, linearity test, thermal soak test etc.	• Equipment like magnifier, Digital multimeter, High resistance meter, LCR meter, Oscilloscope, DC power supplies, Recorder, • Fixtures for friction measurement • Dynamometer for motor testing • Drive & checkout system for motor testing • Mechanical measuring Instruments like vernier calliper, depth gauge, micrometer etc.
4.	Assembly & pre-assembly facility	• Clean room of class 10,000 or better • Ultrasonic cleaning facility • Assembly tools like Torque wrenches, Spanners, Allen keys, Allen adaptors etc. • Equipped electrical wiring station meeting aerospace standards. • Mechanical measuring Instruments like vernier calliper, depth gauge, micrometer etc. • Lapping machine • Mechanical fixtures for assembly.

5.	<u>SRC testing</u> • Electrical health checks • Scale factor & linearity tests • Stall force test • Functional tests like step response, frequency response etc.	• Electrical equipment like Digital multimeter, high resistance meter, LCR meter, Oscilloscope, DC power supplies, Recorder etc. • Stall force test fixture with load cells. • Mechanical measuring Instruments like vernier calliper, depth gauge, micrometer etc. • No-load test rig. • Mechanical fixtures for testing • Actuator drive electronics and check out system
6.	<u>Environmental tests</u> • Thermal tests (Hot and cold soak) • Vibration and shock • Vacuum test • EMI test	• Thermal chamber • Vibration and shock test bed • Vacuum chamber • EMI test facility
7.	Storage (Bonded stores)	• Humidity controlled chambers for storing bought-out components and actuators. • Storage chambers for storing fabricated hardware • Documents and drawings storage facility • Raw material receipt and storage facility
8.	Handling	• Handling equipment like Jib cranes, Trolleys, pallet trucks etc. • Actuator transportation container

Note: Actuator dimensions, test levels for S200 FNC actuator, PS3 FNC and PS4 EGC actuators provided in annexure III

Annexure III – Actuator & MIS details

Sl. No.	Parameter	Actuator type				
		S200 EMA	**S200 MIS**	**PS3 EMA**	**PS3 MIS**	**Redundant PS4 EMA**
1.	Dimensions (mm)	1503x458x319	1500x75x110	410x205x135	300x100x85	268x121x106
2.	Working voltage (V)	270		60		28
3.	Maximum DC current (A)	424		50		8
4.	Mass (Kg)	154	10	9	0.5	1.3

Annexure IV – Environmental levels

S200 EMA & MIS

<table>
<tr><th>Sl. No.</th><th>Test</th><th>Qualification</th></tr>
<tr><td>1.</td><td>Hot soak</td><td>Maintain 60°C for 2½ hrs
Last ½ hr operational</td></tr>
<tr><td>2.</td><td>Cold soak</td><td>Maintain +13°C for 2½ hrs
Last ½ hr operational</td></tr>
<tr><td>3.</td><td>Vibration</td><td>
1. S200 Mirror Image Sensor

Random Vibration
<table>
<tr><th>Axis</th><th>Frequency (Hz)</th><th>FAT (g^2/Hz)</th><th>g (RMS)</th><th>Duration (s/axis)</th></tr>
<tr><td rowspan="11">Axial at Fork end</td><td>20</td><td>0.01</td><td rowspan="11">11.7</td><td rowspan="11">60</td></tr>
<tr><td>60</td><td>0.1</td></tr>
<tr><td>130</td><td>0.1</td></tr>
<tr><td>140</td><td>0.5</td></tr>
<tr><td>200</td><td>0.5</td></tr>
<tr><td>225</td><td>0.1</td></tr>
<tr><td>475</td><td>0.1</td></tr>
<tr><td>500</td><td>0.062</td></tr>
<tr><td>1000</td><td>0.062</td></tr>
<tr><td>2000</td><td>0.015</td></tr>
</table>
Sine Vibration
<table>
<tr><th>Axis</th><th>Frequency</th><th>Test level</th><th>Sweep rate</th></tr>
<tr><td rowspan="2">Longitudinal</td><td>10-16</td><td>12mm DA</td><td rowspan="2">4 oct./min</td></tr>
<tr><td>16-100</td><td>7g</td></tr>
</table>
2. S200 Actuator

Random Vibration
<table>
<tr><th>Axis</th><th>Frequency (Hz)</th><th>FAT (g^2/Hz)</th><th>g (RMS)</th><th>Duration (s/axis)</th></tr>
<tr><td rowspan="12">Axial</td><td>20</td><td>0.01</td><td rowspan="12">7.2</td><td rowspan="12">60</td></tr>
<tr><td>60</td><td>0.01</td></tr>
<tr><td>90</td><td>0.05</td></tr>
<tr><td>200</td><td>0.05</td></tr>
<tr><td>210</td><td>0.2</td></tr>
<tr><td>275</td><td>0.2</td></tr>
<tr><td>300</td><td>0.1</td></tr>
<tr><td>350</td><td>0.1</td></tr>
<tr><td>400</td><td>0.03</td></tr>
<tr><td>800</td><td>0.03</td></tr>
<tr><td>900</td><td>0.005</td></tr>
<tr><td>2000</td><td>0.005</td></tr>
</table>
<table>
<tr><th>Axis</th><th>Frequency (Hz)</th><th>FAT (g^2/Hz)</th><th>g (RMS)</th><th>Duration (seconds)</th></tr>
<tr><td rowspan="10">Lateral</td><td>20</td><td>0.05</td><td rowspan="10">3.7</td><td rowspan="10">60</td></tr>
<tr><td>70</td><td>0.05</td></tr>
<tr><td>100</td><td>0.004</td></tr>
<tr><td>370</td><td>0.004</td></tr>
<tr><td>400</td><td>0.02</td></tr>
<tr><td>630</td><td>0.02</td></tr>
<tr><td>700</td><td>0.003</td></tr>
<tr><td>2000</td><td>0.003</td></tr>
</table>
Sine Vibration
<table>
<tr><th>Axis</th><th>Frequency</th><th>Test level</th><th>Sweep rate</th></tr>
<tr><td rowspan="2">Longitudinal</td><td>10-16</td><td>12mm DA</td><td rowspan="2">4 oct./min</td></tr>
<tr><td>16-100</td><td>7g</td></tr>
</table>
</td></tr>
<tr><td>4.</td><td>Vacuum</td><td>Vacuum : 1 bar to10^{-5} mbar
Duration at : 1 hr
lower pressure ½ hr passive, last ½ hr operational</td></tr>
<tr><td>5.</td><td>EMI</td><td>RE02,RS02,RS03</td></tr>
</table>

PS3 EMA, PS4 EMA & PS3 MIS

Sl. No.	Test	Qualification
1.	Hot soak	Maintain 60°C for 2½ hrs Last ½ hr operational
2.	Cold soak	Maintain +13°C for 2½ hrs Last ½ hr operational
3.	Vibration	Random Vibration Frequency (Hz) PSD (g^2/HZ) 20 0.001 60 0.001 250 0.062 1000 0.062 2000 0.015 RMS level: 9grms, Axes: Thrust and lateral Duration: 60s
4.	Vacuum	Vacuum : 1 bar to10^{-5} mbar Duration at : 1 hr lower pressure ½ hr passive, last ½ hr operational
5.	EMI	RE02,RS02,RS03