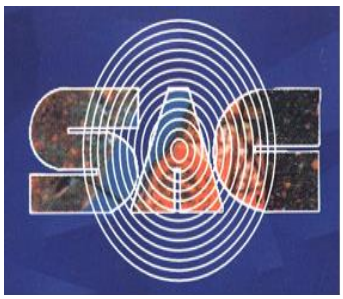

Request for Proposal (RFP) of
Delivery of FM & QM
Chirp Generation and Data Acquisition and Compression Subsystem (CGDACS)

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1. Scope of Work and General Guidelines

1.1. Introduction

Space Applications Centre (SAC) a unit of Indian Space Research Organization (ISRO) is currently engaged in the development of a number of remote sensing satellites for various land and ocean applications. A number of digital electronic sub-systems are under various stages of development for the payloads of these satellites. It has been ISRO's policy to involve Indian industries for the production of existing proven designs and fabrication technology as per project requirements and realize the space qualified systems, components and hardware, indigenously.

SAC proposes to realize CGDACS (Chirp Generation and Data Acquisition and Compression subsystem through the qualified vendors from the industry for fabrication and testing of Flight Model sub-systems. The selected vendor will have to assume full responsibility for the delivery of flight worthy units after qualification, ready for integration with the other units of the payload. In this context, the SAC, ISRO requests the Indian industries having the capability and experience in the above field with past heritage, to submit a detailed proposal for the Hi-Rel Space grade component procurement, Fabrication, Assembly, Testing and Qualification of Hi-Rel Space Qualified Sub-systems. **Only SAC or any ISRO qualified (hereafter refereed in document as SAC/ISRO) vendors are allowed to participate in this tender. During the bidding and execution of this tender vendor must have a valid Qualification certificate from SAC/ISRO. Vendors, who do not have valid SAC/ISRO qualification, will be rejected.**

This Request For Proposal (RFP) document provides the details of the work involved, delivery schedule and the relevant product assurance details. The details identified in this RFP may undergo some changes due to the on-going refinement of the requirements of hardware. The process and flow given in this document are also indicative in nature and may undergo revision after the preliminary review with the vendor.
It is very important for our evaluation of your offer that your proposal should include sufficient technical details of the proposed realization approach. It should be clearly understood that these are on-board systems for space usage, where highest quality and reliability are expected to be built in to the system. For this purpose, the vendor shall follow all necessary guidelines for on-board fabrication practice and recommended by SAC/ISRO. The quality assurance requirements are provided in the annexure to this RFP and further details will be provided at appropriate time during the execution of the contract. It shall be the objective of the vendor to ensure the fabrication and delivery of reliable sub-systems / modules for Space Application.

The terms supplier, vendor and contractor have been used interchangeably throughout this document and they all mean one and the same.

1.1.1. Introduction of Chirp Generation and Data Acquisition and Compression Subsystem (CGDACS)

X-band SAR payload necessitates ultra-high speed data acquisition to meet high resolution requirements. Moreover, data de-multiplexing into multiple channels and suitable data compression approach is also necessary to limit the resultant data rates and overall SAR data volume within the capabilities of spacecraft Data Handling unit (BDH). Considering the multi-mode nature of X-Band SAR operation, incorporating different swath coverage and resolution modes, resulting very high data rates and in order to optimally utilize the on-board storage and data transmission links, combined I & Q data acquisition channels have been implemented for both the polarization receiver chains. The Wide-Band I & Q Digital Chirp Generator (WBDCG) has been configured to synthesize required wideband chirp digitally so that it minimizes the number of stages of multiplication in RF hardware resulting in better signal quality. WBDCG and Dual Channel DACS have been implemented in a single hardware board.

The major elements of Baseband Digital Electronics subsystems for X-Band SAR are:

- Wideband I & Q Digital Chirp Generator (WBDCG)
- Dual Channel, Data Acquisition and Compression System (CG-DACS)

Wideband I & Q Digital Chirp Generator (WBDCG):

The main objective of the WBDCG is to digitally synthesize the requisite maximum bandwidth up to (150MHz) baseband I /Q chirp signal for various slant range resolution modes of X-band SAR and further multiplication by 2 is done at the Frequency Generator. The digitally synthesized I/Q chirp is low pass filtered, multiplied, vector modulated and subsequently up-converted in Frequency Generator (FG) to the RF transmit carrier frequency and fed to the active antenna array.

Data Acquisition and Compression Sub-System (DACS):

The main objective of the multichannel DACS subsystem is to provide the requisite data acquisition and digitization for I and Q channels receiver of the X-band SAR payload. Additionally, the DACS performs Block Adaptive Quantization of the digitized data, requisite formatting of the data along with payload and spacecraft aux and transfer the data to the Baseband Data Handling unit (BDH) via high speed serial interface.

The following figures shows the block diagram of the CGDACS and the photograph of the Flight Model (FM) CGDACS hardware stack at box level, Deliverable hardware is single tray configuration as shown in fig.

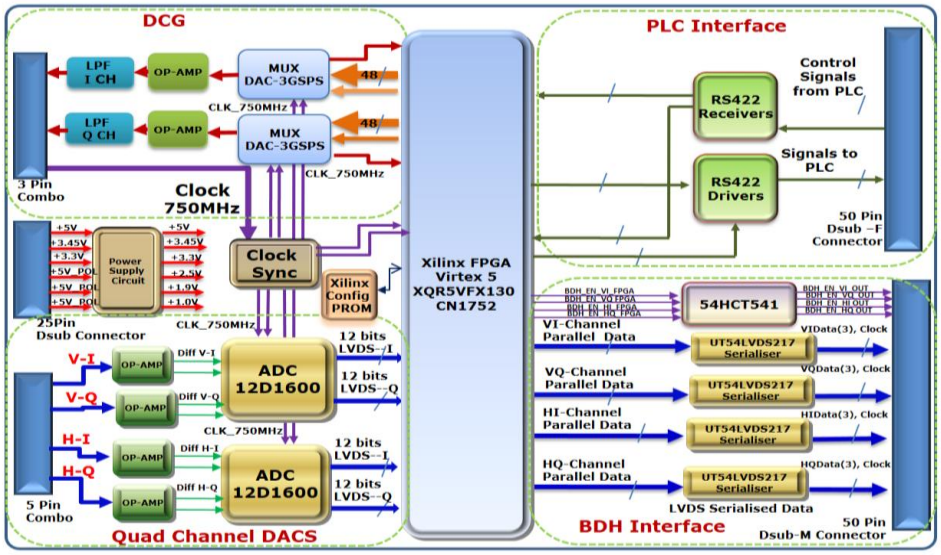


Figure 1: Block Diagram of CGDACS

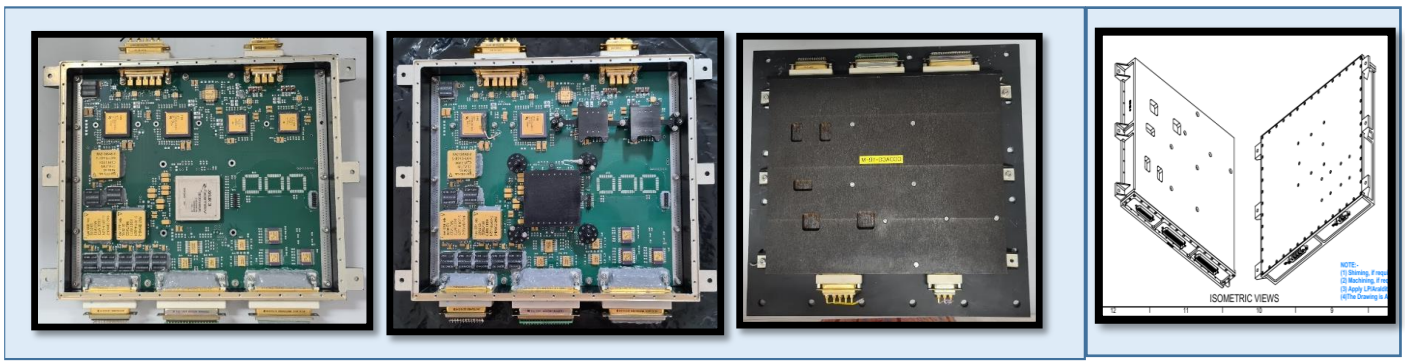


Figure 2: Photo of the wired CGDACS card, CGDACS single tray and assembled FM Package

1.2. Scope of Work

The scope of this RFP includes Component procurement, Electronic and Mechanical Fabrication, Assembly of populated digital PCB's with mechanical housing, testing at various stages of fabrication and environmental testing as per T &E plan defined in RFP. The scope also includes the procurement of Ground checkout units used for testing the CGDACS packages.

This RFP is intended for carrying out the following activities

- Collection of FIM from SAC
- Passive Components procurements as per Table 22
- Wiring of Electronic components as per Table 20 and Table 22
- Bench Testing at various stages of fabrication
- Mechanical housing Fabrication
- Assembly of populated digital PCB's with mechanical housing
- Stacking with other companion cards and/or their dummy packages
- Qualification including environmental testing of the sub-system
- Delivery of qualified Flight model subsystem
- Procurement of GCUs with accessories as specified in Table 23

The quantum of work can be typically divided in to following stages,

Table 1 : List of major Activities and responsibility

S.No.	Activity	SAC's Responsibility	Vendor's Responsibility
1.	Procurement of Passive Components as per Table 22		✓
2.	Issue of FIM as per BoM against Vendor Bank Guarantee	✓	
3.	Issue of Printed Circuit Boards (PCB) with special devices pre-mounted if any	✓	
4.	Collection of FIM from SAC in ESD safe boxes		✓
5.	All design documents like part-list, placement diagram, fabrication sequence, mechanical drawings of wiring Jigs, Trays and packages, test procedures etc.	✓	
6.	Procurement of materials like solder wire, flux, , thermal interface material (Chotherm, Silver Epoxy, H74), epoxy etc., (as per SAC R & QA guidelines) required for PCB wiring. Hardware required for mechanical assembly like fasteners, washers, PCB handing studs etc. Rugged ESD safe weather proof transportation boxes etc.		✓
7.	Fabrication of Mechanical Jigs, Trays and packages as per SAC approved drawings		✓
8.	Electronic Wiring (Component mounting & Testing) as per SAC approved fabrication sequence		✓
9.	PCB and mechanical package assembly		✓
10.	Procurement of Ground Checkout Unit (GCU) (As per SAC specifications)		✓
11.	Firmware for GCU	✓	

S.No.	Activity	SAC's Responsibility	Vendor's Responsibility
12.	Preparation of harness as per SAC requirements, for functional testing of sub-system and Burn-In test of GCU.		✓
13.	Functional Testing using the GCU		✓
14.	Functional Test results review by SAC	✓	
15.	Acceptance/Qualification level Environmental testing using the GCU		✓
16.	Environmental Test results review by SAC and Acceptance by SAC	✓	
17.	Packing the sub-system in rugged ESD safe boxes and Delivering the sub-system to SAC.		✓
18.	Delivery of GCUs and its accessories at the end of the Contract.		✓

These fabrication activities are to be carried out by vendor as per SAC/ISRO qualified processes and by SAC/ISRO approved fabricators, with quality control at each step, as per the SAC/ISRO approved fabrication sequence and test documents.
Vendor should have in-house capability in terms of fabrication facility, storage facility and test facility as well as necessary technical expertise to build, optimize, test and deliver the high reliability product.

1.2.1. Procurement of Passive Components

Vendor has to procure Space Qualified Passive components as per SAC R&QA (Reliability & Quality Assurance) Annexure. The list of such Passive components is provided in Table 22. Vendor should have controlled environment facility (refer ANA1.7) to store the procured Space Qualified Passive components.

1.2.2. Free Issue Materials list

Components as per Free Issue Materials list will be provided by SAC against Vendor submitted bank guarantee. FIM (active components) may be issued in multiple batches at discretion of SAC. A tentative list of all components required for wiring of the PCB is provided in Table 20.

1.2.3. Printed Circuit Boards (PCB)

SAC will be providing Printed Circuit Board (PCB) with special devices (if any) pre-mounted. This forms FIM as mentioned in 1.2.2 which is to be collected from SAC store. Vendor should have facility to store the wired PCBs in a controlled environment (refer ANA1.7).

1.2.4. Drawings of Mechanical Jigs, Trays and packages

SAC will be providing the approved Mechanical drawings of all types of housings and their assembly sequences. Drawing will mention surface treatment requirements with masking areas wherever needed. SAC will also provide the drawings of the jigs, which are required for handing the PCBs during its wiring testing and transportation.

1.2.5. Procurement of materials

Vendor has to procure all the material required for PCB wiring as prescribed by SAC QA (Ref ANA1.6). Vendor also needs to procure all the mechanical hardware used for assembling the trays and packages as per the mechanical drawings. Vendor needs to procure the ESD safe ruggedized weatherproof boxes, which are required for the transportation of packages to SAC as well as across various test facilities during T & E stage.

1.2.5.1. Material

Vendor shall ensure to use only ISRO approved / qualified materials. Procurement of all the mechanical and electronic fabrication consumables and materials shall be done as per SAC Approved Materials List (DML) and specifications. Vendor shall accept the procured materials from the OEMs after review of Material Test Report (MTR) & CoC. Non-metallic materials shall have a Total Mass Loss (TML) of less than 1% and Collectable Volatile Condensable Materials (CVCM) of less than 0.1% when subjected to a test condition of +125ºC and 1x10-06 torr pressure for 24 hours. If CoC contains outgassing parameters, then separate test not required. The vendor shall maintain all inspection and clearance records for the materials. Ferrous and non-ferrous material used shall be of corrosion resistance type or suitably treated to resist corrosion caused by atmospheric conditions existent in storage or normal operational conditions. Only non-magnetic materials shall be used; except where use of magnetic materials are essential. Materials, which are nutrients for fungus, shall not be used. Any other materials, which are not available in SAC DML, shall first be qualified as per SAC test plan & cleared by SAC prior to their use. Materials list consisting of the name of vendor, shelf life, qualifying agency, location of application in the sub-systems shall be submitted to SAC for approval. All the materials shall be used within their shelf life. Vendor also need to procure all the mechanical hardware used for assembling the trays and packages as per the mechanical drawings. Vendor needs to procure the ESD safe ruggedized weatherproof boxes, which are required for the transportation of packages to SAC as well as all intermediate transportation stages of realization.

1.2.6. Mechanical Fabrication

Mechanical fabrication includes the following (Ref: ANA1.5.2.2**)**

i) Fabrication of aluminum trays and cover plates for both Main and Redundant units.
ii) Black-anodization and Chromatization (Surface Treatment) of aluminum packages as per ISRO requirements.
iii) Jigs and mounting accessories required for fabrication and testing
iv) Fabrication of one additional companion trays for QM CGDACS package.

Compatibility check shall be performed by the vendor to ensure the mechanical compatibility of package with the bare PCB and temporarily mounted connectors. It is to be noted that this is the first activity to be carried out (may be at SAC or as mutually agreed place) before wiring of specially mounted components at SAC. This activity needs availability of mechanical package before start of PCB wiring.

1.2.7. Electronic Fabrication

SAC will provide full set of fabrication documents like part-list, placement diagrams, special instructions, fabrication sequence and any other relevant documents. Mounting and assembly of all components, as per the approved fabrication sequence and as per the guidelines and documents provided in ANA1.9, by the SAC/ISRO certified in-house manpower and in SAC/ISRO certified fabrication facility in accordance with ISRO-PAX-300. Minor modification in the fabrication sequence, if required, may be incorporated in the fabrication sequence after vetting by SAC. Mounting of all components will begin only after approval of fabrication sequence by SAC. A history sheet shall be maintained for each of the unit and all activities carried out on the PCB as well as final assembly, have to be recorded in the history sheet and reviewed by Vendor's internal QC. Unique ID shall be used for traceability of history sheets and log of all fabrication activities.

Functional testing has to be carried out by the vendor at various phases of component mounting as per the test plan and fabrication sequence or separate plan provided by SAC.

1.2.8. PCB and mechanical package assembly

Mounting of PCB in its mechanical tray along with mounting of Heat Sink assemblies, has to carried out by Vendor. CCGA Heat sink assembly shall be done by the vendor as per the SAC approved mounting procedure. Further, wherever required, these assembled trays need to be stacked as per the stacking diagram and as per procedure provided by SAC.

1.2.9. Procurement of Ground Checkout Unit (GCU)

Vendor has to procure Ground Checkout Unit (GCU) with relevant data acquisition/interface cards as per the specifications provided by SAC (Ref Table 23) along with the required connectors and cables/test harness. These GCUs are required for carrying out automated testing of wired PCBs at various phases.
Apart from GCU, the vendor should already possess the standard DC Power Supply, various test instruments like Multimeter, Oscilloscope, RF Clock Source etc.

1.2.10. Firmware for GCU

SAC will provide firmware and GUI for installing it in the Ground Checkout Units (GCU). This firmware will acquire the signals generated by the subsystem through the data acquisition cards installed in the GCU. The firmware will analyze the signals and generates a report. This report along with other reports needs to be submitted to SAC for review and approval of subsequent stages. GCU is to be kept powered-on for 168 Hour in normal Lab environment by Vendor after the firmware is installed as part of burn-in activity.

1.2.11. Preparation of harness for functional testing of sub-system

SAC will provide the details of connectors and pin details, wire type, length and other details of the test harness for connecting the signals from the subsystem to GCU. Vendor needs to procure the required connectors and cables/wires as per information given in Table: 23. Vendor has to prepare the test Harness as per the pin details provided by SAC at the time of PO and check the harness continuity.

1.2.12. Functional Testing using the GCU

The subsystem will be tested for its functional requirements using the GCU as per the test plan document provided by SAC. SAC will demonstrate testing procedure using the GCU at SAC premises or vendor's premises as per mutual agreement. Same procedure is to be followed by vendor in various phases of testing.

1.2.13. Functional Test results review by SAC

The GCU will capture data from DUT. Vendor has to send all test data collected by GCU during all phases of testing with proper labeling. The data pack is to be submitted to SAC. SAC will review the test data and provide clearance for further process.

1.2.14. Acceptance/Qualification level Environmental testing using the GCU

1.2.14.1. Qualification Testing

The first unit manufactured by the Vendor, needs to undergo Qualification level (QM) Environmental testing as per the Environmental specifications provided by SAC. This also demonstrates the electrical performance against spec., margins of the unit under given operating conditions. It includes various tests such as Burn-in, EMI/EMC/ESD tests, vibration/Shock test, thermal vacuum test, Life test etc as per list and details included in annexure – ANA1, Tests section of this RFP.

1.2.14.2. Acceptance Testing

All other units are subjected to Acceptance level (FM) Environmental testing only as per the Environmental specifications provided by SAC. Acceptance testing is a set of tests carried out on each unit to verify the workmanship and performance of the unit under given operating conditions. It includes various tests such as Burn-in, EMI/EMC tests, vibration test and thermal vacuum test etc. as per list and details included in annexure – ANA1.4, Tests section of this RFP.

1.2.15. Environmental Test results review by SAC and Acceptance by SAC

The reports generated during intermediate stages and during Environmental testing, are also to be submitted to SAC before delivering the subsystem. SAC will review the results and give approval for shipping the units. SAC may suggest some re-test if required. After the units are delivered, SAC will perform

functional testing in lab environment. Final acceptance of the unit will be based on test result compliance of the functional testing performed at SAC.

1.2.16. Packing and delivering the sub-system to SAC

For ease of handling during storing and transportation, each unit has to be packed separately in an ESD safe ruggedized weatherproof boxes. All boxes are to be labeled legibly with all the relevant details. Along with each box the relevant documents like history sheets, test reports etc. used in wiring of that unit is to be provided to SAC.

1.2.17. Delivery of GCU and Test Harness to SAC

GCU sets have to be delivered to SAC as per the delivery schedule mentioned in Table 6. Vendor shall also deliver the test harness along with the GCU sets at the end of contract.

1.3. Responsibilities of Vendor and SAC

Following sections describe the responsibilities of SAC and Vendor.

1.3.1. SAC Responsibilities

SAC will provide the following inputs to the Vendor, during different stages of the work execution:

a) SAC will issue flight model PCBs and the required components, as "**Free Issue Material**" to the vendor **against the Bank Guarantee**.
b) Mounting of special devices (CCGA etc.) is SAC responsibility. The PCB will be issued to vendor after mounting the special devices on to the PCB and properly securing it.
c) Approved Component Placement diagram and relevant fabrication documents
d) Firmware Program of the GCU hardware and FPGA code for CGDACS hardware.
e) Graphical User Interface (GUI) for *Ground Check-out Units (GCUs)*. Test procedure for card and package level testing. EID (Electrical Interface Details) for test harness between GCU and UUT (Unit Under Test).
f) SAC QA approved Mechanical package fabrication drawings and list of accessories.

1.3.2. Vendor's Responsibilities

The Vendor will be responsible for carrying out the following activities and for actions arising out of non-conformances at various stages.
The major activities include:

a) Procurement of GCUs and all the accessories (as per Table 23) required for carrying out the testing activities.
b) Procurement of all electronic (passive as per Table 22), mechanical fabrication materials including all the required consumables (which are used for electronics & mechanical hardware realization and environmental testing) as per SAC DML.
c) Incoming inspection and acceptance of all FIM components including electronic components, PCBs and fabrication materials like solder, flux, epoxy etc.
d) Apart from environmental controls of temperature and humidity, the electronic storage area shall meet class 100,000 cleanliness requirements as a minimum and shall have all the ESD safety precautions implemented. The work area shall meet the requirements of latest version of ISRO-PAX-300.
e) Vendor shall identify a controlled environment storage area for storing the space grade components and T&E completed packages to avoid deterioration during shelf life of the components.
f) Vendor shall entrust fabrication of the mechanical housing only after obtaining prior approval from SAC. The material to be used for enclosure / housing is Aluminum Alloy 6061 and SS-304 for the fasteners (material details and fabrication tolerances as provided in SAC supplied approved drawings).

g) Surface treatment of the enclosure needs to be implemented which includes Black-anodization and Chromatization as per ISRO requirements. Incoming inspection and quality control of these packages are also to be performed by qualified and experienced inspectors.
h) Lead forming of components should be done wherever necessary (e.g. for the fine pitch Flat Pack devices) as per the land patterns on the PCB. The vendor should be in possession of the necessary equipment, tools, jigs etc. The process of forming, soldering and local potting / damming of high-pin count CQFPs also must have to be as per SAC/ISRO approved.
i) Vendor to perform compatibility checks between the mechanical package, PCB and connectors before start of soldering. Compatibility of a CGDACS PCB to be carried out with respective package only. Prior to the compatibility , ensure that packages and jigs are available.
j) Populating the PCBs with all the components as per the approved layout and placement diagrams provided. The devices comprise fine pitch Flat Pack devices and through-hole devices. This activity has to be carried out at a fabrication facility qualified / approved by ISRO for Flight Model fabrication work.
k) The power supplies to be used for testing during initial bench as well as environmental testing have to be procured by the vendor. The details of the power supply requirements are given in annexure ANA2.4. These supplies have to be very reliable with all in-built protections and procured from only reputed manufacturers. Set of general purpose test equipment required for testing of these digital sub-systems e.g. Multimeter, Oscilloscope, RF Sources, etc. are expected to be available with the vendor.
l) Assembly of PCBs in its housing (“tray”)
m) Testing of the populated boards for compliance with the specifications as per details given.
n) Fabrication of the required handling fixtures, jigs etc. in adequate numbers necessary for performing all the internal fabrication and environmental testing (e.g. vibration testing).
o) Performing environmental testing including vibration, thermovac, EMI/EMC etc. tests for CGDACS. The sequence and the levels for each of these tests for all the phases are provided in annexure – ANA1.
p) Sending of test data to SAC.
q) Generation of all the other deliverables identified in this RFP. All FM and QM CGDACS units are to be hand delivered to SAC.

1.3.3. Process Flow Details and responsibility bifurcation

Table 2 : Detailed process flow with responsibility

Sr. No.	Activity	Responsibility
1.	Award of Contract and Initial Technical Inputs	SAC
2.	Mechanical Package drawings and Fabrication, testing related Information	SAC
3.	Mechanical Housing Fabrication	VENDOR
4.	Procurement of Bill of Material for Ground Check-out Unit (GCU) as per Table 23	VENDOR
5.	Clearance of BOM for GCU	SAC
6.	GCU cards/component/wires procurement	VENDOR
7.	Procurement of non-FIM components as per Table 22	VENDOR
8.	Issue of FIMs components and PCB with special devices mounted	SAC
9.	Incoming Inspection of FIM and non-FIM components	VENDOR
10.	Supply of Software/configuration files for GCU	SAC
11.	GCU test harness fabrication	VENDOR
12.	GCU 168 hour Burn-In test	VENDOR
13.	Compatibility Check of PCB, Connectors & mechanical tray	VENDOR
14.	Lead cutting and Forming of Components	VENDOR
15.	PCB wiring as per approved fabrication sequence in compliance to ISRO-PAX-300 requirements.	VENDOR
16.	CGDACS FPGA Code file	SAC
17.	Functional Testing at various stages	VENDOR
18.	Functional Test Result Review and clearance for further activity	SAC
19.	Local Potting and Conformal Coating	VENDOR
20.	Tray Assembly and cover closing	VENDOR
21.	Stacking multiple trays (if required)	VENDOR
22.	T&E approval by vendor QA	VENDOR
23.	T&E start approval by SAC.	SAC
24.	T&E of QM/FM CGDACS unit.	VENDOR
25.	Test Results submission to SAC	VENDOR
26.	Review of the Results	SAC
27.	clearance for shipment	SAC

1.4. Deliverables by the vendor

Test Reports are to be supplied by vendor for review and acceptance by SAC. Upon acceptance of reports by SAC, the tested CGDACS Packages are to be delivered to SAC. Following items are to be delivered against each work order:

1. Assembled, packaged and T&E completed CGDACS as per the order. All FM and QM CGDACS units are to be hand delivered to SAC.
2. Documents / Reports as per ANA1.18.2 to ANA1.18.4 along with card fabrication history
3. At end of the contract, all spare unconsumed components (if any)
4. One GCU unit has to be delivered to SAC at the beginning of the contract and remaining GCUs at the end of the contract. Vendor has to install GCU at SAC and demonstrate that it is in working condition.

1.5. Bid submission details and Bid format

Vendor should submit their offers in two parts

- **Part1: "Detailed Technical Proposal"** giving all details as per RFP.

- **Part2: "Financial bid"** giving financial details **separately.**

The Part1 (Technical proposal) should also include all the details given in Part2 (Financial bid) without the prices (Prices should be masked in the Part-1 offer).

The prospective vendors should provide the pricing information with the following break-up in Part2 (Financial bid). The offered prices should be inclusive of charges towards packaging and handling.

Table 3 : Part2 (Financial bid) Template

S. No	Items	Qty	Unit Rate (Rs)	Remarks
1	Delivery of FM CGDACS (Component procurement, Fabrication and Test & Evaluation)	Slab-1 : 1 to 4		• Mounting of Components mentioned in Table 20 and as per SAC fabrication Guidelines. • Mechanical fabrication as per Mechanical drawings supplied by SAC
		Slab-2 : 5 to 9		
		Slab-3 : 10 to 14		
		Slab-3 : 15 to 20		
2	Delivery of QM CGDACS (Component procurement, Fabrication and Test & Evaluation)	Slab-1 : 1 to 2		
		Slab-2 : 3 to 4		
3	GCU set	Slab-1 : 1 to 2		As per SAC requirements in Table 23
		Slab-2 : 3 to 4		

1.6. Vendor Evaluation and Selection Criteria

Only ISRO space qualified vendors are allowed to participate in this tender. At the time of bidding and during execution of this PO, the vendor must have a valid Qualification Certificate from ISRO. The offers from vendors who do not have a valid ISRO space related Qualification Certificate would be rejected. Vendor has to submit Project Execution Plan along with the Technical bid, detailing vendor's in-house activities and the outsourced activities (if any) along with relevant details. All out-sourced activities should be in SAC/ISRO qualified facilities and with prior approval of SAC only. Out-sourced activities must be mentioned at time of quote with relevant supporting document for use of third party facilities.
Commercial Offer will be evaluated for cumulative price of all items and not for individual item wise price. The order cannot be split.

1.7. Delivery Schedule

A tentative schedule of milestones and delivery period is provided in the tables below.

Table 4 : QM Work Order Schedule

Sl. No	Milestone	Completion Time
1.	Issue of FIM for QM package, against Bank Guarantee	TQ1
2.	Fabrication, Testing (Including Life Test) and Delivery of QM Package	TQ2 = TQ1 + 36 weeks

Table 5 : FM Work Order Schedule

Sl. No	Milestone	Completion Time
1.	Issue of FIM for each FM package, against Bank Guarantee	TF1
2.	Fabrication, Testing and Delivery of each FM Package	TF2 = TF1 + 20 weeks

Table 6 : GCU Schedule

Sl. No	Milestone	Completion Time
1.	GCU BOM clearance from SAC	TG1
2.	GCU set Delivery to SAC (One Qty) along with test harness	TG1 + 24 weeks
3.	GCU set Delivery to SAC (Remaining Qty) along with test harness	End of Contract

SAC activities related to issue of documents, Interim and Final Test reports reviews, clearance for shipment, etc. are not accounted in the above-mentioned timelines. The above-mentioned timelines are exclusive of SAC responsibilities.

SAC may issue FIM in two or three or more phases. The time TQ1 (For QM Unit), TF1 (For FM Unit), TG1(For GCU unit) will start only after issue of last batch of FIM components and acceptance by Vendor for start of the activity.

1.8. Payment terms

Payment will be made against delivery, on pro-rata basis. SAC reserves right to short close this Purchase Order or any running Work Order at any stage of fabrication/testing. In case of short closing, the vendor has to deliver all the materials, components (FIM + Non-FIM) in his procession as per the terms of this Purchase Order.

1.9. Warranty terms

Vendor has to provide warranty of 12 (twelve) months for CGDACS package from the date of delivery to SAC.

1.10. Parallel Contract[s]

SAC, Ahmedabad reserves the right to enter into parallel Contract[s] and ad-hoc Contract[s] simultaneously or at any time during the period of the Purchase Order with one or more Agencies.

1.11. Force Majeure

If at any time, during the currency of this Purchase Order, the performance in whole or In part by either party or any obligation under this Contract shall be prevented or delayed by reason of any war, hostility, Acts of Public Enemy, Civil Commotions, Sabotage, Fire, Flood, Explosions, Epidemics, Quarantine restrictions, Strikes, Lockouts or Acts of God (hereinafter referred to as events) then provided notice of happenings of any such event is given by either party to the other within 48 hours from the date of occurrence thereof, either party shall be reasons of such event, be entitled to terminate this Purchase Order nor shall either party have a claim for damages against the other in respect of such non-performance or delay in performance.

1.12. Risk Purchase

In the event of failure on the part of the Vendor to deliver the package/s in accordance with the delivery schedule, extra cost, if any, involved in procurement of the same by the Purchaser, from any other sources, will be borne by the Vendor not withstanding any other penalty.

1.13. Subletting Of the Contract

The Supplier may sub-let the Contract or any work covered against this requirement to third party after obtaining written permission from SAC. Such sub-contracting shall in no way reduce or affect neither the rights of Purchaser nor the responsibility of the Vendor. SAC shall issue permission to Vendor to sub-let only to SAC/ISRO qualified third-parties.

1.14. Intellectual Property Rights/ Confidentiality / Non-Disclosure Clause

The intellectual property rights relating to the design, development, processes, models and other fabrication details given to and received from the supplier shall remain the exclusive property of SAC. Supplier shall not attempt to unlawfully reveal, misuse or encroach upon the intellectual or private data, information to which they may have access to, as part of the work carried out.

All documents prepared for fabrication, test procedures, log books, drawings, schematics and any other communications, codes revealed during the process of testing will be exclusive property of SAC .The supplier is prohibited from further utilizing or passing on any exploitation, commercial purpose or otherwise without written prior permission from SAC.

These documents are to be strictly confidential and should not be reproduced, copied / transmitted to any media explicit permission of SAC. Further, the supplier must not quote any of these works in any publications or to any of their customers without explicit permission from SAC and adhere to strict confidentially.

1.15. Details to be provided with the proposal

The vendor shall provide a detailed Development Plan along with the Technical proposal. This plan should give the detailed schedule, implementation plan, expected manpower deployment, major milestones etc.

The prospective vendors should bring out full details of their technical competence for undertaking project of this nature, in the technical part of their proposal document. A preferable format is provided in the following table. The vendor is encouraged to provide any relevant additional information.

Table 7 : Vendor's Technical Competence Details

Sr. No.	DESCRIPTION	DETAILS
1.	SAC/ISRO qualification. Please attach certificate.	
2.	Year Of Establishment	
3.	Vendor’s Area Of Core Competence / Activities	
4.	Infrastructure Details (Area, Facilities Etc.)	
5.	Annual Turnover in the last two financial years	
6.	PO Details of such major orders executed / currently in progress especially for organizations like ISRO, DRDO, DAE etc. Sample reports with customer’s / project details may be attached.	
7.	No. of Skilled and ISRO certified technicians for fabrication and inspection of Hi-Rel assembly work and testing	
8.	Capability of Hi-Rel fabrication and testing in terms of no. of products completed, etc.	
9.	List of in house facilities with qualification Status (Clean room facilities with area, relevant test equipment and environment test facilities etc.	

1.16. Inspection of Vendor’s Facilities by SAC Team

The vendor should allow inspection of their facilities by a SAC team, if found necessary, for an on the spot assessment of their capabilities, prior to placement of order or at any later date during execution of the contract. The vendor should be in a position to present and explain in detail sample products manufactured earlier at his site to ascertain their capabilities.

1.17. Other Terms and Conditions / Important Guidelines

1. The Vendor is required to examine the RFP thoroughly and offer point by point compliance for complete RFP supported by technical documents. The quotation should be given in Indian rupees only

2. All vendors may be called for a pre-bid meeting / technical discussions and should be prepared to attend the same at short notice. Vendors should make sure that competent technical personnel attend the same.
3. The vendor is required to clearly state in his proposal, all the assumptions made while finalizing the proposal.
4. If the vendor proposes to subcontract any part of the work to other Companies, then the relevant details must be mentioned in the bid. Only environmental test facilities can be used from third party. DABF wiring, assembly and testing cannot be subcontracted.
5. It is mandatory that the vendor should have their facility certified by ISRO and should have prior experience of assembly, testing and qualification of Hi-Rel subsytems hardware. Accordingly, vendor is required to submit the relevant documents along with their offer, without which their offer shall not be considered. The criteria for the selection of vendor in terms of their financial and technical capabilities are as below.
    a) Should be an Indian company with their design, fabrication and test facilities in India.
    b) It is mandatory that the vendor's facility as well as manpower should have ISRO's certification, valid at time of bidding. Vendor is required to submit details of the available ISRO certified manpower with their total work experience for ISRO on-board projects.
    c) Vendor should have sufficient technical capabilities in terms of fabrication and handling test equipment. Vendor is required to provide the details of the available test equipment like, make, brief specifications, year of procurement, number of equipment etc.
    d) Vendor should have a controlled environment storage area for components, materials and fabricated hardware, class 100,000 clean room (24X7) with ESD safe storage as a minimum.
    e) Vendor should be able to arrange and access the test facilities required for the environmental testing of mentioned subsystems. It is to be noted that SAC will not provide any of the test facilities for environmental testing.
    f) Vendor is required to provide the details of the available test facilities (either available with vendor or through external agency)
    g) The responsibility of design and fabrication of required fixtures for mechanical shock test lies with Vendor.
    h) Based on the details provided by the vendor, SAC will assess the capability of the vendor to take up this work. Decision of SAC will be final in this regard.
    i) Vendor should not have been banned or black-listed by ISRO or any Government Department /Public Sector Unit and submit a declaration in this regard.
    j) If required, SAC Officers may visit the Vendor's premises for verification of information related to work orders/space/manpower etc. and other infrastructure facilities and equipment claimed. The technical bid of Vendor, who is not able to substantiate/satisfy the technical requirements laid down in this RFP, is liable to be rejected.

6. After PO, the vendor is required to submit undertaking regarding Confidentiality / Non-Disclosure Agreement (NDA) and Intellectual Property Rights (IPR).
7. SAC reserves the right to review the progress of work at any time in addition to milestones specified by the vendor.
8. The electrical and mechanical details mentioned in RFP are tentative and there may be minor variations. Final electrical and mechanical design details shall be provided at the time of every work order. In case of any modification to be incorporated during development, it should be mutually discussed and agreed upon before implementation.

ANA1 Product Assurance Requirements

ANA1.1 Introduction

This document describes the Reliability and Quality Assurance requirements to be followed by Vendor during fabrication, assembly and testing of ordered subsystems.

ANA1.2 Applicable Documents

Following reference documents are applicable during realization of the hardware.

Table 8 : Applicable documents

ISRO-PAS-206 Issue-4, Nov 2012	Qualification requirements for Thick Film Hybrid Micro Circuits
ISRO-PAS-207	Storage, Handling and Transportation requirements for Electronic Hardware
ISRO-PAX-300	Workmanship Standards for the Fabrication of Electronic Packages
ISRO-PAX-304	Test Specification & Requirements for Multilayer Printed Circuit Boards
ISRO-PAS-502	Procurement Specifications for Austenitic stainless steel Bolts and Screws
MIL-STD-202G	Test Method Standard Electronic and Electrical Component Parts
MIL-STD-461E	Requirements for the control of Electromagnet Interference Characteristics of Subsystems and Equipment
MIL-STD – 883	Test Method Standard for Microcircuits

ANA1.3 Reliability

The unit is designed by SAC, for space use.

ANA1.3.1 Life:

The unit shall meet all the fabrication requirements for use onboard spacecraft.

ANA1.3.2 Operating condition for Active Components:

The electrical designs are made compliant to the SAC derating requirements for space payloads.

ANA1.4 Environmental Specifications

ANA1.4.1 Non-Operating Environment:

The units shall be capable of withstanding following environmental conditions:

a) Temp. Range : -30°C to +60°C
b) Pressure : Ambient and Hard Vacuum better than 10^{-5} torr.
c) Relative Humidity : Max. 95% non-condensing at +40°C

(Applicable for storage on ground only)

ANA1.4.2 Operating Environment:

The units shall meet all the performance requirements as given in electrical specifications under the following environmental conditions:

a) Temp. Range:
   i) FM : -10°C to +50°C
   ii) QM : -15°C to +55°C

b) Pressure:

The unit shall be capable of operating and compliant to the specifications at ambient pressure as well as vacuum level of 10^{-5}torr and hard vacuum of the order of 10^{-13}torr.

Note: All temperatures are referred to the base plate. Temperature up to +75°C of base plate should not affect the life, operation and performance of the unit.

ANA1.4.3 EMI / EMC:

Fabricated unit shall meet EMI / EMC requirements as per Table 11 and ANA3.

ANA1.4.4 VIBRATION / SHOCK / ACCELERATION:

The units shall be designed and fabricated to meet the vibration (Sine and Random) and mechanical shock requirements as per the test plan given in this exhibit.

ANA1.5 Parts

The parts and materials list consisting of following details (as a minimum) shall be submitted to SAC along with deliverables

Part / material name	Quality level
Part / material number	Name of manufacturer
Package style (applicable for parts)	Qualification / approval status

ANA1.5.1 Qualification (QM) / Flight Model (FM) Parts Quality

Not applicable

ANA1.5.2 Inspection of parts:

ANA1.5.2.1 Electronic parts:

All the active and passive electronic parts (packaged) shall be subjected to incoming inspection. Traceability shall be maintained for parts, from incoming inspection to the final units (Lot No, Batch No, Date code etc).

ANA1.5.2.2 Mechanical parts:

All the mechanical parts & materials procured by the vendor shall undergo Incoming inspection / testing including measurement of critical physical, chemical & mechanical properties including Outgassing properties of specified materials. Wherever the Outgassing test results with the compliance certificate are supplied by the manufacturer along with material batch test results, out gassing test is not required. The vendor shall carry out the fabrication of mechanical parts as per SAC approved drawings. Dimensional measurements and visual inspection of packages, boxes, covers, clamps etc. shall be carried out by the vendor on 100% basis.

The mechanical parts shall also be inspected on 100% basis from plating / thermal painting workmanship point of view. All the bought out mechanical components including fasteners, spring, plain washers, nuts etc. shall be procured by the vendor in accordance with procurement specifications approved by SAC. Incoming screening of fasteners shall include review of Manufacturer's Test Report (MTR) & Certificate of Compliance (CoC), as well as inspection on 100% basis GO/NO-GO gauge inspection, and dimension inspection on sampling basis by the vendor.

Declared Material List (DML) & Declared mechanical parts List (DMPL) used shall be prepared and sent to SAC for review and acceptance. List shall contain following minimum details.

a) Material designation
b) Material details (i.e Heat Treatment, Finish, Mix ratio, Cure Time etc.)
c) Applied specification, conditions
d) Manufacturer and/or Vendor name,
e) Application area in UNITs
f) Heritage

Following traceability information shall be maintained by the vendor for records & SAC audit purpose.

a) Raw material identification details, relevant in-house incoming inspection & test reports.
b) Materials batch/lot Nos. information
c) Parts identification records
d) QC inspection and clearance reports of the vendor for both bought out & in-house fabricated hardware.
e) Process documentation like process log, applicable process documents etc.

f) Certificate Of Compliance (CoC) supplied by sub-vendor/manufacturer for bought out items.

ANA1.6 Materials

Vendor shall ensure to use of SAC/ISRO approved / qualified materials. Procurement of all the mechanical and electronic fabrication materials shall be in accordance with Approved Materials List (AML) given in document No. SAC/QACMG/MQAD/GEN/05/ APRIL-2012 followed by incoming acceptance. Any other materials, which are not available in AML shall first be qualified as per SAC test plan & clearance from SAC to be obtained by the vendor. All inspection and clearance records for the materials shall be maintained by the vendor. Only approved and cleared materials shall be used.

Technical specification of other materials to be used in the hardware which are not included in the above documents shall be submitted to SAC for review and clearance before procurement. Non-compliance of specifications for any bought out or in-house fabricated materials shall be intimated to SAC for necessary review and clearance.

Materials list consisting of the name of vendor, shelf life, qualifying agency, location of application in the sub-systems shall be submitted to SAC for approval. All the materials shall be used within their shelf life. Life limited materials may be considered for use only after appropriate re-testing and approval as defined by SAC.

Ferrous and non-ferrous material used shall be of corrosion resistance type or suitably treated to resist corrosion caused by atmospheric conditions existent in storage or normal operational conditions. Only non-magnetic materials shall be used; except where use of magnetic materials are essential. Materials, which are nutrients for fungus, shall not be used.

Organic and inorganic materials shall be stable under atmospheric and high vacuum conditions. These materials shall have a Total Mass Loss (TML) of less than 1% and Collectable Volatile Condensable Materials (CVCM) of less than 0.1% when subjected to a test condition of +125ºC and $1x10^{-06}$torr pressure for 24 hours. Only space qualified epoxies, potting materials, etc. shall be used, within their shelf life and with cure schedule as specified in the material datasheet. However, their use shall be restricted and failure due to these shall be recorded and analysed as and when detected. Wherever the Outgassing test results with the compliance certificate are supplied by the manufacturer along with material batch test results, out gassing test is not required.

The selection and use of dissimilar materials shall be avoided, wherever it is impractical to avoid dissimilar materials in direct contact with each other, suitable protection shall be provided by space proven coatings / plating etc.

ANA1.7 Storage of Hardware, Parts, & Materials

Vendor shall ensure that all the parts and fabricated hardware are stored under controlled environment in a Bonded-Store till their actual use. Storage of fabricated hardware, parts & materials shall be done as per ISRO-PAS-207. Manufacturer instruction for storage & handling of parts shall strictly be followed during the storage. Preferably dry Nitrogen purged packaging and storage cabinets shall be used for storage of oxygen sensitive items like PCBs / mechanical hardware.

ANA1.8 Processes

ISRO-PAX-300 workmanship standards shall be followed for the fabrication work. All electronic fabrication processes like bare PCB fabrication and parts mounting/assembly, etc. shall be SAC/ISRO qualified. Similarly, the processes used for surface treatment of the box like plating and coating in realizing the hardware shall also be SAC/ISRO qualified. All the processes shall be carried out in accordance with PIDs reviewed by QA-SAC.

Vendor is required to provide a list of processes to be used to realize the hardware along with their qualification status, at the time of bid.

In case of processes qualified by other agencies, process qualification reports shall be submitted to QA, SAC for review. After review of previous qualification plan, SAC will decide for requirement of full qualification / delta qualification of such processes, if any. However, right for decision on feasibility of such a qualification activity will be retained by QA SAC.

Fabrication work shall be carried out on SAC/ISRO qualified fabrication line by SAC/ISRO certified operators.

ANA1.8.1 Verification of Process Quality (VOPQ)

Witness samples shall be prepared & processed along with each batch of plated, painted / coated mechanical parts& components as per the requirements defined as part of process qualification certification. This witness surface treatment samples shall be subjected to Batch acceptance testing, as per the SAC defined acceptance test plan.

Any non-conformance observed on these samples shall be a cause for rejection of fabricated batch / lot and a final disposition shall be taken after discussion with SAC regarding their impact on unit functioning and reliability. Corrective action shall be taken to ensure quality.

Only items from accepted batches / lots shall be cleared for use in FM fabrication.

ANA1.9 Fabrication Documentation

ANA1.9.1 Product Realization Document (PRD)

All the activities involved for realization of QM and FM units shall be addressed in this document. Vendor and SAC shall prepare PRD, identifying all the activities with sequence, methods / procedures & inspection check points that will be followed for realization of the units.

For traceability of fabrication/assembly/testing activities, Vendor shall maintain, a fabrication history sheets for each unit, where-in all the fabrication activities and QC inspection comments are logged. This shall include any non-conformance reported by QC and its close out, if any.

ANA1.9.2 Process Identification Document (PID)

The PID shall include detailed manufacturing process flow chart indicating critical process parameters, inspection checks points, instruments used in manufacturing these components including parameter setting etc. for all stages of fabrication, assembly and testing. Vendor and SAC shall generate PID documents. Only approved PIDs shall be followed.

ANA1.9.3 Fabrication Sequence

Before start of fabrication, a generalized fabrication sequence / flowchart detailing each step of fabrication and QC inspection shall be prepared by the vendor in consultation with SAC and to be submitted SAC for approval. SAC approved fabrication sequence shall only be implemented. This is to ensure smooth flow of the assembly activity and avoiding rework / rejection. This shall be clearly understood and agreed upon. The fabrication / assembly flowchart shall include the following:

a) Flow of fabrication activities
b) Approved drawing nos.
c) Name of processes and PID numbers, as applicable..
d) Intermediate functional verification/electrical testing
e) Specific instructions for Storage & Handling, if any.
f) Permanent/Temporary torque values. On-line Electronics, Mehanical QC requirements.

g) Fabrication alerts/Specific Instructions, caution notes etc, if any.
h) Potting/Dam-fill requirement for components , if any.
i) Any environmental test which is a part of fabrication process or for electrical performance check and selection of TBD component values
j) Marking & Identification of unit.
k) QA-SAC audit stages

ANA1.10 Quality Control (QC)

Vendor's in-house Quality Control (QC) shall carry out 100% inspection of all the fabricated / processed units as well as on-line inspection during the electronic & mechanical fabrication activity as per SAC approved fabrication sequence / PIDs. QC inspection work shall be carried out by SAC/ISRO certified inspectors.

All fabrication and inspection work shall be carried out by ISRO certified fabricators / inspectors of vendor. All fabrication and inspection records/history sheets, as per approved fabrication sequence/ PIDs/ guidelines etc., shall be generated and maintained by the vendor QC.

Any non-conformance observed at any stage of fabrication shall be recorded and disposed-off through the vendor's NCR board with SAC consultation.

ANA1.11 QA Audit

The QA audit shall be carried out by QA/SAC from both electronic & mechanical point of view along with qualified subordinates also. Following may be noted.

- The frequency for QA audit shall be decided by SAC and intimated to the Vendor.
- All the fabricated PCBs / Packages shall be first inspected and accepted by QC/QA of the vendor and proper records shall be generated. Audit by QA/SAC shall be carried out on QC accepted hardware.
- Audit by SAC shall cover Electronic & Mechanical aspects for the following,
  i. Bare PCB, if applicable
  ii. Machined package/ cover etc.
  iii. Surface finishing (plating / painting)
  iv. Wired Substrate / PCB
  v. Packaging & fixing of cards/ substrates/ connectors & internal harness
  vi. Audit for integrated package level.
  vii. Test setup and unit level testing.
- SAC shall audit/ inspect all related facilities, activities which the vendor will carryout to realise the hardware. Fabrication processes, cleanliness records, QC inspected hardware, process log books/history records, overall documentation, parts & material evaluation/test reports, facilities, procedures followed etc. shall be followed as per ISRO guidelines.
- The audit report will be generated by QA/SAC. The Vendor shall generate close outs on the discrepancies observed during audit by taking appropriate corrective actions and submit the same to SAC for review and acceptance.
- The disposition on the non-conformances on actual hardware, if any, which cannot be closed by the auditee, shall be closed through vendor's NCRB, with approval from SAC, after reviewing the impact of the non-conformance on reliability of the non-conformed hardware for intended use.
- The corrective actions implemented by the vendor shall be documented after necessary review and approval by QA/SAC.
- Based on the compliance to ISRO guidelines and closeouts for audit observations by the vendor, stage wise clearance shall be given by QA/SAC.
- **Real-time On-line Audit / Virtual Audit :** Based on confidence level build-up on fabricated hardware, SAC may opt for virtual audit of hardware, provided vendor facility, process line, their quality system,

etc found satisfactory. Vendor shall have the required resources / infrastructure for Real-time On-line Audit, as per SAC-QA requirements.

ANA1.12 Marking and Identification

The units shall be identified as shown in the below table, by assigning a unique serial number on the exterior surface of the package by a suitable process applicable for space use. In addition, the connector numbers are to be marked at the relevant places as per the mechanical drawing.

Marking shall not degrade the performance and quality of the unit. The permanency of the marking shall be sufficient to withstand the specified environmental conditions and normal cleaning operations using Isopropyl Alcohol and other cleaning solvents.

Table 9 : Units' Identification marking

Sl. No.	CGDACS-T-MM-WWYY-ZZ	Unit Name	CGDACS
WO. No.	<Numeric PO No>\<Work Order Serial No>	PCB QCR No.	
Manufacturer			

Serial Number Decoding : CGDACS-T-MM-WWYY-ZZ

Where

T : Type (M/R)
MM : Model (QM/FM)
YYWW : Year (24 to 29) and Week no of the year (01 to 52) (e.g. YYWW : 2408)
ZZ : Sr. No. (01 to 99)

ANA1.13 Transportation

Suitable packing shall be provided for the transportation of the unit by air or road without any degradation / damage. Each unit shall be packaged in individual ESD protective packaging. This package shall protect the unit from environmental conditions encountered during transportation, like heat, humidity & dust. This individual container shall then be placed in a transportation container. More than one individual unit may be placed in the transportation container. The transportation container shall protect the units from heat, humidity, dust, mechanical shock & vibrations during transportation.

The individual unit packages and transportation containers shall be clearly marked with following instructions along with other mandatory markings.

"ESD sensitive units"
"To be opened only under clean environment with ESD precautions"
"High reliability space usage systems"

ANA1.14 Test Program

Final production tests shall be carried out just prior to submitting the units for the formal test phase, to ensure that units meeting the functional requirements. As a part of final production test, it is recommended that Temperature cycling over the acceptance temperature limits should be carried out.

ANA1.14.1 Model Philosophy

Following Models shall be fabricated and tested as per the requirements of this RFP:

- Qualification Model (QM)
- Flight Model (FM)

a) Qualification Model (QM) :

The design of the QM units shall be same as that for the FM units. Materials, parts, and component to be used shall be as that for FM. Similarly same processes as FM shall be used to realize QM. QM shall be subjected to the Qualification level tests as per Table 11. After completion of QM unit testing, the test

report shall be submitted to SAC for review. Fabrication of FM units shall commence only after clearance from SAC of the QM test results.

b) Flight Models (FM) :

The FM units represent the final electrical & mechanical design and configuration using screened Hi-Rel parts, material and processes of qualified standard and workmanship. All the flight model CGDACSs shall be subjected to Flight Acceptance Level Tests.

ANA1.14.2 Test Plan

The vendor shall submit to SAC the detailed test plan document for the functional & environmental tests to be conducted on QM and FM units, whenever applicable, for approval by SAC. This includes the detailed test procedure for conducting each test consisting of test method, test conditions, test equipment etc. Only approved test plan shall be implemented. The environmental level severity for the test to be performed on different units should be as listed in the following Table.

Table 10 : Test Severity Levels

Model Type	Levels	Remarks
QM	Qualification	Only for the specified unit
FM	Acceptance	For all other Units

CGDACSs shall be tested in accordance with Table given below. The tests shall be performed in the listed sequence.

Table 11 : Tests applicability

Sr. No.	Test	QM	FM
1.	Physical Measurements	✓	✓
2.	Visual Inspection	✓	✓
3.	Passive cycle (Five cycles)	✓	✓
4.	Visual Inspection	✓	✓
5.	Cover closing	✓	✓
6.	Initial Bench Test (IBT)	✓	✓
7.	Burn-in Test (168 Hrs.)	✓	✓
8.	Post Burn-in Bench Test	✓	✓
9.	Storage tests		
	a) Cold Storage test	✓	-
	b) Hot Storage test	✓	-
	c) Humidity Storage test	✓	-
10.	Temp. operational test	✓	-
11.	EMI / EMC ---Refer ANA3		
12.	Sine Vibration	✓	✓
13.	Random Vibration	✓	✓
14.	Thermo-Vacuum test	✓	✓
15.	Mechanical Shock	✓	-
16.	ESD test – Refer ANA3	✓	
17.	Life Test	✓	-
18.	Final Bench Tests (FBT)	✓	✓
19.	Final Visual inspection	✓	✓

Notes:

1. Final Levels of FM/QM units will be communicated at the time of each work order. Maximum Allowable Tolerance in Environmental test Conditions levels are given in Table: 12
2. At the end of each test, visual inspection wherever possible and electrical performance check check shall be carried out.
3. Suitable buffer connectors shall be used to protect input / output connectors of the device from wear and tear due to mating / de-mating with other connectors during testing. Record of number of time mating / de-mating of connectors shall be maintained.

ANA1.14.3 Failure

Deviation from the agreed electrical specifications shall be treated as non-compliance, and may be as cause to reject the units. Any failure observed at any stage shall be reported to SAC immediately. This shall be followed by detailed failure analysis by Vendor, clearly identifying the cause of failure as random or process/procedure related. Any modifications required in electrical, mechanical or process related aspects shall be approved by SAC. In case of mechanical or electrical design related failures; a retest plan or modification in the test plan may be necessary. Based on the failure analysis, such retest plan / modified test plan shall be decided and implemented after approval by SAC. This may include requalification of process or the unit / Proto flight level testing.

ANA1.15 Tests

All the specification requirements shall be verified by testing. Testing shall be done as per SAC approved test procedure using calibrated test & measuring instruments as well as GCU. Vendor is required to generate test procedure, in consultation with SAC, clearly showing test set-up and connection details including groundings. This test procedure shall be sent to SAC for review & clearance. It is preferred that cable types and length used by the vendor for harnessing during testing shall be similar or very close to cable type and length to be used in harnessing of FM unit in the Space craft.

Acceptance of the test set-up shall be done jointly by SAC and vendor before the testing of the QM and FM units. This shall also be audited, during the testing activity. Vendor shall inform the readiness of the test set-up as well as the schedule well in advance. Representatives from SAC may participate in the testing.

(a) Test setup calibration and accuracy:

The test instruments used during testing shall have valid calibration status. Test instruments shall have adequate measurement accuracy. These shall be verified and shall be stated in the test plan and procedures document submitted by the vendor.

(b) Maximum Allowable Tolerance In Environmental Test Conditions :

Table 12 : Test Condition Tolerances

Parameter		Tolerance
Temperature		±1°C Amb. Pressure ±3°C under vacuum
Atmospheric Pressure		
	Greater than 0.1 Torr	±5%
	Below 0.1 Torr	±50%
Relative Humidity		±5%
Acceleration		±10%
Vibration Frequency		±2% above 25 Hz 0.5 Hz below 25 Hz
Sine Vibration	Amplitude	±10%
	Amplitude Frequency	± 2% above 25 Hz & 0.5 Hz below 25 Hz
	Sweep rate	5%
	Time	± 1%

Random Vibration	
Power Spectral Density	± 1.5 dB for 20-300 Hz & ±3 dB for 300-2000 Hz
Overall (g-rms)	±10%
Duration	+ 10% / - 0%
Shock Response Spectrum Test	
Amplitude	-3dB / +6dB

ANA1.15.1 Test condition & details

Following paragraphs give details of various tests to be performed on units. Electrical test shall be carried out within 96 hours after completion of each environmental test.

The test parameters to be measured during / after each of following test shall be defined in Test plan document for QM and FM units.

ANA1.15.1.1 Physical Measurement:

All the units shall be examined and documented for - Mass, Dimensions & Flatness. All the Test parameters to be measured and reported.

ANA1.15.1.2 Visual Inspection :

ANA1.15.1.2.1 Internal Visual Inspection:

After completion of all fabrication activities, internal visual inspection at suitable magnification of the units shall be carried out to detect any workmanship related deviation and non-conformance w.r.t respective ISRO standards. SAC may participate / audit visual inspection. Vendor shall inform the schedule of sealing / cover closing of QM / FM units.

ANA1.15.1.2.2 External Visual Inspection :

All the units shall be examined visually at 10 X magnification before and after each environmental test. The units shall be inspected for surface finish, plating, mechanical and workmanship related defects.

ANA1.15.1.3 Pre Burn-in Electrical Test (IBT) :

This test shall be performed in ambient conditions to verify compliance to all the electrical parameters and will be taken as reference for all subsequent tests. Electrical parameters to be as per approved test plan.

ANA1.15.1.4 Burn-In Test :

Units shall undergo burn-in at maximum Operating Temperature in power 'ON' condition. The duration of Burn-in shall be 168 hrs for all units. Data log for Time-Temperature shall be kept for verification.

ANA1.15.1.5 Post Burn-in Electrical Test:

This test shall be conducted at ambient temperature. Electrical parameters shall be measured during Post burn-in functional tests as per approved test plan.

ANA1.15.1.6 Temperature storage test :

Temperature storage test is applicable to QM units only. The units shall be subjected to minimum storage temperature for 24 hours. After this storage, electrical and visual inspection shall be performed. The test shall be repeated for maximum storage temperature for 24 hours. Units shall be in non-operating conditions for the storage duration.

Visual inspection shall be performed after the test. Pre and post electrical measurements shall also be carried out outside the chamber on the unit.

ANA1.15.1.7 Humidity Test :

This test shall be conducted on QM units as per the following conditions :

Humidity : 95 % RH

Temperature : 40 ^{0}C
Duration : 24 Hrs.
After the humidity test, units shall be visually inspected. There shall be no visual defect like, degradation of plating/coating, discoloration, patches, etc. Parameters shall be measured after the test.

ANA1.15.1.8 Operational temperature test :
This test shall be performed to check the performance specifications of the units at the specified Lowest and Highest operating temperatures. The units shall be placed in a suitable thermal chamber, and connected with the external test set-up. Dwell time at temperature extreme shall be at least 6 hours. Parameters to be measured during this test shall be as per approved test plan.

ANA1.15.1.9 EMI / EMC Test :
The units shall be subjected to EMI / EMC tests as per ANA3. Any additional tests, if required by SAC, shall also be carried out by the vendor. Plots taken during all the tests shall be kept for verification.

ANA1.15.1.10 Vibration Test :
Sine / Random vibration tests shall be carried out on applicable QM / FM units. Visual & electrical measurement shall also be performed after each Sine & Random vibration test. Vibration levels given below are tentative. Levels may change latter, depending upon mechanical configuration.

ANA1.15.1.10.1 Resonance Search :
Pre & Post Vibration, resonance search shall be carried out in all the three axes as per following levels. Natural resonance frequency (Fn) shall be greater than 100 Hz and drift in pre & post vibration 'Fn' shall be within 10%.

Table 13 : Resonance search

Frequency (Hz)	Amplitude
10 - 2000	0.5 g
Sweep rate	2 Oct / Minute

ANA1.15.1.10.2 Sine Vibration :
Sine vibration test shall be conducted only on QM units. The unit shall be in non-operating condition for the duration of vibration test. One Sweep in each axis shall be performed.

Table 14 : Sine vibration values

Normal to mounting plane (z-axis)		Parallel to mounting plane (x & y axes)	
Frequency (Hz)	**Amplitude**	**Frequency (Hz)**	**Amplitude**
5-20	12.4 mm (0 to peak)	5-20	9.3 mm (0 to peak)
20-50	20g		
50-70	15g	20-70	15g
70-100	8g	70-100	8g
Sweep rate QM	2 Oct./minute	**Sweep rate** QM	2 Oct./minute

ANA1.15.1.10.3 Random Vibration:
Units shall be subjected to random vibration tests with levels as given below in passive mode. Frequency verses PSD plots shall be obtained and shall be kept along with the test results for verification.
For QM units :

Table 15 : Random Vibration values for QM

Frequency (Hz)	Power spectral density	
	Normal to mounting plane (z-axis)	**Parallel to mounting plane (X & Y axes)**
20-100	+ 3 dB/octave	+ 3 dB/octave
100-700	0.30 g^2/Hz	0.10 g^2/Hz
700-2000	-6 dB/octave	-3 dB/octave
Overall RMS	18.1 g	11.8 g
Duration QM	120 sec.	120 sec.

For FM units:

Table 16 : Random Vibration values for FM

Frequency (Hz)	Power spectral density	
	Normal to mounting plane (z-axis)	**Parallel to mounting plane (X & Y axes)**
20-100	+ 3 dB/octave	+ 3 dB/octave
100-700	0.13 g^2/Hz	0.044 g^2/Hz
700-2000	-6 dB/octave	-3 dB/octave
Overall RMS	12.1 g	7.9 g
Duration	60 sec.	60 sec.

WORKMANSHIP VIBRATION TEST LEVEL :

Table 17 : Workmanship Vibration test values

Frequency (Hz)	PSD
	(X, Y & Z axes)
20-100	+ 3 dB/octave
100-700	0.04 g^2/Hz
700-2000	-6 dB/octave
Overall RMS	6.81 g
Duration	60 sec.

ANA1.15.1.11 Thermo vacuum Test:

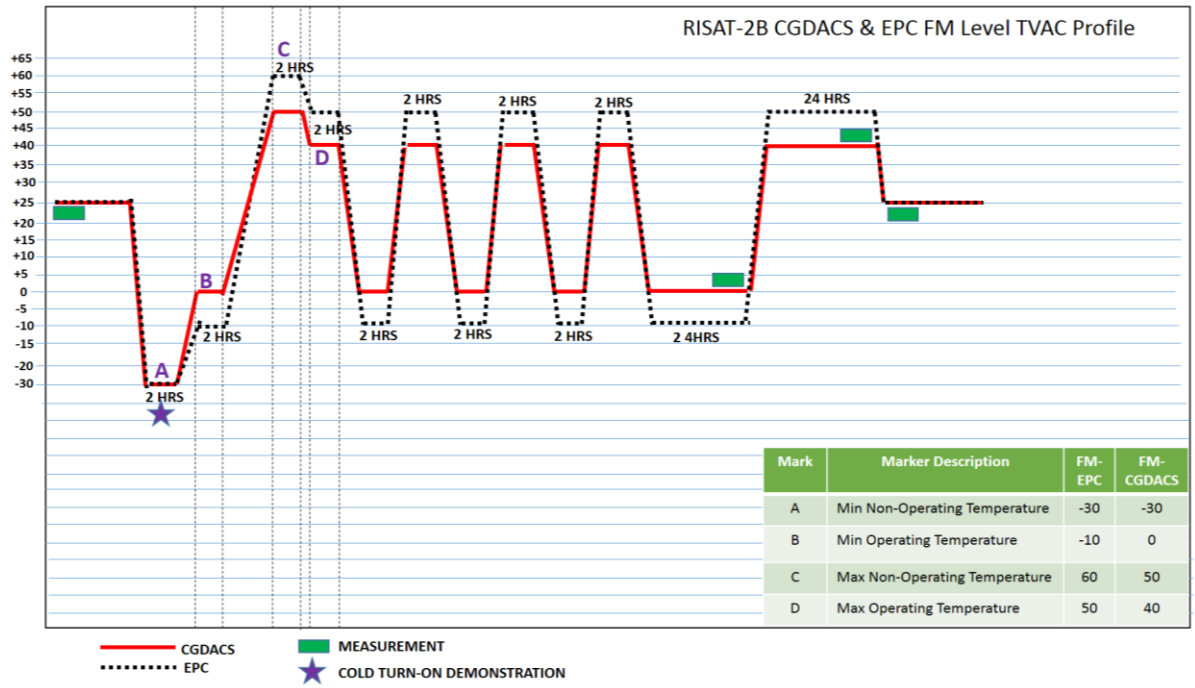
QM / FM units shall be subjected to thermo-vacuum test as per the test profiles shown in following figure. Following points shall be considered before starting thermo-vacuum test :

- It shall be ensured that the parameters of the thermo vacuum chamber i.e. temperature, air pressure measuring device, etc are properly calibrated prior to the start of the test.
- It should be ensured that the temperature sensors are mounted at pre-determined locations for monitoring base plate and package temperatures as defined in test plan.

Electrical measurements shall be carried out at the points mentioned in test profiles. Time-Temperature and Pressure data shall be logged along with electrical results for verification. Critical parameters (mutually agreed) shall be logged/monitored continuously during operating temperature cycles.

ANA1.15.1.11.1 Thermo Vacuum Test Profile:

Following figure shows the tentative test cycle.



ANA1.15.1.12 Mechanical Shock Test for QM only:

Only QM unit shall be subjected to mechanical shock test as per the following test levels in all the 3 axes. Number of shocks in each axis shall be 2 and Shock levels specified with Q = 10.

Table 18 : Shock test values

Frequency (Hz)	SRS
100-1000	+12 dB / Oct.
1000-5000	1000g

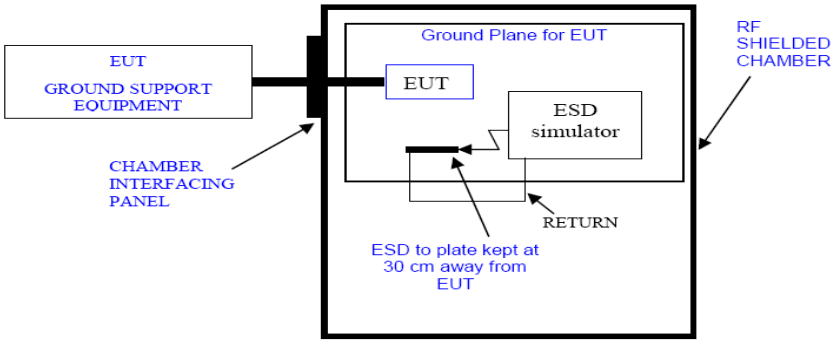
(levels are tentative)

ANA1.15.1.13 ESD Test for QM only :

ESD tests shall be conducted on QM unit only. Electrical measurements shall be carried out after ESD tests as per test plan

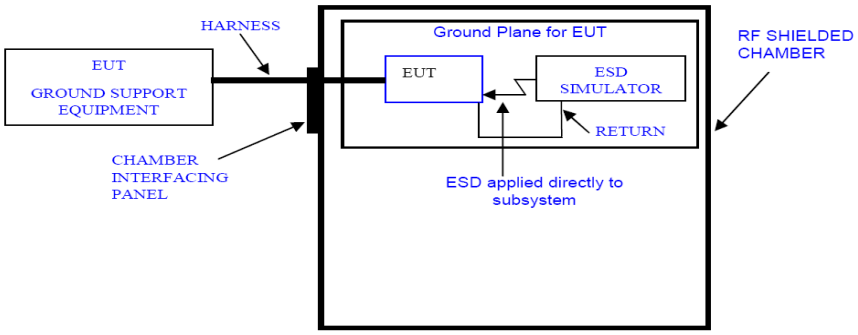
ANA1.15.1.13.1 Radiated field Test

The unit (EUT) shall not exhibit any degradation of performance when subjected to the radiated fields of less than or equal to 7 kV ESD, simulated at 30 cm from all critical points identified by SAC. Discharge rate shall be 1 discharge per second for a period of 30 seconds at each point. The test set up is as shown in figure below.



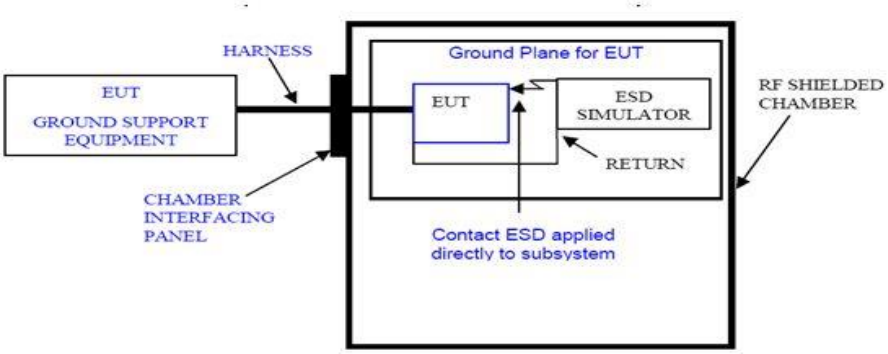
ANA1.15.1.13.2 Single point Discharge Test

The Unit (EUT) shall not exhibit any degradation of performance when subjected to discharges equal to or less than 5 kV with discharge current return wire in close proximity, applied to subsystem surface directly at critical points to simulate the discharge and local flowing of arc currents. Discharge rate shall be 1 discharge per second for a period of 30 seconds at each point. The test set up is as shown in Figure below.



ANA1.15.1.13.3 Structural current test

The Unit (EUT) shall not exhibit any malfunction, degradation of performance or deviation from the specifications when subjected to contact discharges of less than or equal 5 kV, simulating structural current transients, with discharge current return wire at diagonally opposite corners, to simulate blow-off discharge currents. Discharge rate shall be 1 discharge per second for a period of 30 seconds at each point.



ANA1.15.1.14 Life test:

Life test shall be carried out during qualification testing. The unit shall be subjected at maximum operating temperature for 2000 hours, with DC biasing applied at maximum power dissipation condition. During this test, electrical measurement of critical parameters shall be carried out periodically after 240 hours, 500 hours, 1000 hours, 1500 hours and 2000 hours. The critical parameters of the unit under test shall be monitored continuously during testing. However, the parameters to be monitored, duration and interval for monitoring of parameters (typically 24 hours) shall be mutually agreed between SAC and vendor. Acceptance criteria and parametric drift shall be decided later.

ANA1.15.1.15 Final Bench Test (FBT) :

The final bench test shall be conducted for measurement of electrical parameters as given in test matrix. The test shall be conducted at ambient temperature. All the test results shall be recorded and any performance deviation with respect to Initial Bench Test shall be evaluated and shall be within specified limits.

ANA1.15.1.16 Final Visual Inspection :

The unit shall be inspected for plating, surface, finish, mechanical deviations, corrosion and workmanship related defects. No visual degradation shall be allowed after completion of tests.

ANA1.16 Non-Conformance Management

Effective non-conformance management mechanism shall be established. e.g. a Non-Conformance Review Board / Material Review Board may be set-up constituting representatives from design, fabrication, quality, procurement and testing departments. Major non-conformance at any stage, which affects the quality & reliability or the fabrication process of entire lot, shall be reported to SAC immediately with photographs, nature of non-conformance observed, etc. However, for all the minor non-conformances, approval from SAC is not mandatory, and shall be reviewed and discussed by the vendor's NCR board. Major and Minor Non-conformances are broadly defined as follows.

ANA1.16.1 Major or Critical NC

Major non-conformances are those which have an impact on the contract requirements. These non-conformances, of the contractual end item which cannot be completely eliminated by rework or repair using standard repair procedures so that it could be categorised as a major NC. Major non-conformance at any stage, which affects the quality & reliability or the fabrication process of entire lot, shall be reported to SAC immediately and further action shall be taken only after clearance from SAC. In general Major NC is considered when the following properties are adversely affected:

- Functional performance
- Interchangeability
- Interface requirements
- Reliability / Maintainability / Availability
- Predicted life time
- Qualification status of parts, materials and processes
- Safety of personnel or equipment
- EEE parts failure, in case of :
- Lot/batch rejection during manufacturing, screening or testing at the manufacturer's facilities.
- Failures detected during any inspection or test which affect form, fit or function and cannot be considered as random failures, where no risk for lot-related reliability or quality problem exists.

ANA1.16.2 Minor NC

Any non-conformance other than major, are categorized as Minor NCs. Minor NCs shall be compiled and reported to SAC at agreed intervals.

All minor non-conformances, shall be reviewed and discussed by the NCR board. Non-conformance report shall be generated by the concerned agency and shall be reviewed and discussed by the NCR board.

Any non-conformance affecting the fabrication and/or inspection procedure shall be reported to SAC. Changes in related documents shall be implemented and revision number of the document shall be updated. This shall be followed by updating all the documentation (fabrication, inspection, and test).

All the non-conformances with the disposition given by the NCR board shall be compiled and reported to SAC periodically. This shall be followed by report of close out action completion, if any. For all the non-conformance report, SAC representative shall be the focal person.

ANA1.17 Configuration Change Control

The manufacturer shall follow an effective configuration change control procedure during the fabrication stages. Plans for both non-conformance and configuration change control shall be made for submission to SAC for review and approval before initiation of manufacturing activities.

ANA1.18 Documents to Be Supplied

ANA1.18.1 Document supplied along with quote

Following document shall be supplied along with quote

a) Point by point compliance to all the requirements of this document.
b) Details to be provided as per QA check list given in Annexure- ANA1.18.5.

ANA1.18.2 Documents to be supplied during the contract

The following documents shall be supplied during the contract

a) Parts & Materials List to be used for the fabrication of units, detailing their quality level, procurement specifications, traceability information, out gassing specifications etc.
b) CoC, screening (at Vendors / sub-vendors) reports, incoming inspection report, batch acceptance test reports of Parts & Materials.
c) Record of Bias conditions of identifying the channel / junction temperatures of all the active devices if applicable.
d) Interface control drawing (AutoCAD soft copy)
e) Details of design modifications (wherever applicable) with respect to the given details.
f) Process Identification Documents along with standard process average for rejection rate for major fabrication activities.
g) Test procedure/plan documents for QM & FM tests with test conditions, procedures, list of equipment's and their calibration status, for review & approval by SAC.
h) All documents, including various Analyses as per the requirements of this document.
i) Non-conformance management plan.
j) Configuration change control plan.
k) Program management plan

ANA1.18.3 Documents to be supplied during the program

Following documents shall be supplied during the program with respect to relevant activity

a) Status report for the fabrication activity and test schedule.
b) Schedule for Cover closing of the units
c) Details of test set-up and readiness
d) Non-conformance report at agreed intervals
e) Failure Report; as and when failure occurs

ANA1.18.4 Documents to be supplied for each unit

Following detailed documents shall be supplied for each unit along with deliverables, in Hard copy as well as in soft copy.

a) T & E report of each unit containing detailed test results, test history, conformance matrix, TBD values etc.
b) CoC of the deliverable units
c) CoC of parts & materials Including screening report
d) All fabrication details supplied by SAC for fabrication
e) Non- Conformance reports with close-outs

ANA1.18.5 Certificates

Vendor to provide complete details of following with relevant certificates for following QA check list.

QA Check List

Table 19 : QA Checklist

Sr. No	Details of information required	Vendor response
1	Point by Point compliance provided ? (Yes / No)	
2	List each applicable process (ISRO space qualified) at your / sub-vendor's facility, their qualification status & attach qualification certificate.	

	Process Name	Facility Name & Location	Certificate No.
	a) Component mounting & Assembly process on PCB		
	b) Plating / Surface treatment (type wise)		
	c) Paralyne CC process qualification		
	d) Details of other ISRO space qualified processes available (if any)		
3	Details of ISRO certified fabricator and Inspector for PCB and assembly as per ISRO-PAX-300		
4	Location of test facilities likely to be used for following tests shall be provided (whichever applicable). SAC facilities will not be offered.		
	a) Physical Measurements		
	b) Visual Inspection (internal & external)		
	c) Electrical measurements		
	d) Burn-in		
	e) Temperature tests : Storage temperature test, Humidity Storage and Temp. operational test		
	f) EMI / EMC & ESD		
	g) Vibration test (sine & Random)		
	h) Thermo-Vacuum		
	i) Mechanical Shock		
	j) Life Test		

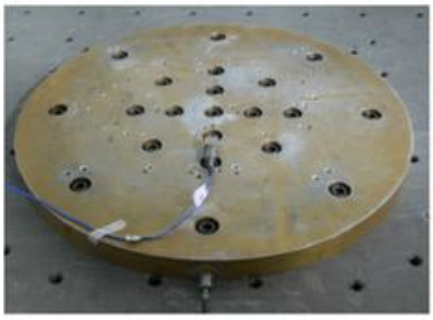
Company Logo	Name & Address of Company/Industry
REPORT No.	DATE

STANDARD FORMAT OF VIBRATION & SRS TEST REPORT FOR ISRO-SAC UNIT

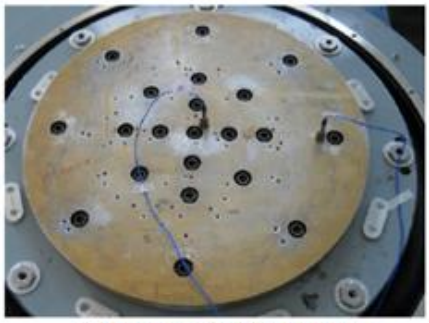
ISRO Specification Number
Subsystem
Sub Assembly details
Customer Part No
Model No
Serial No
Model
Weight
Test start date &Test End date
Drawing No. and T & E clearance certificate no with date :
Vibration Test Equipment & calibration details:

Sample of Photo graphs showing test set-up of Subsystem with control & measurement accelerometer location with Axis definition.

Fixture Characterization in LLS

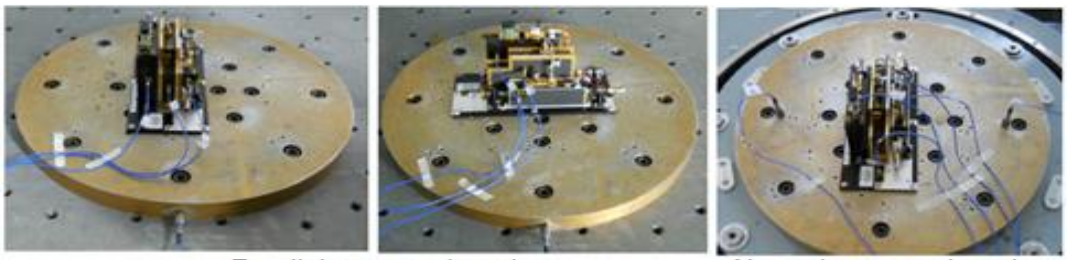


Parallel to mounting plane



Normal to mounting plane

Subsystem during Vibration test in each Axis



Parallel to mounting plane | Normal to mounting plane

Test Description:

1. Vibration Test Set-up:

1.1 Fixture details [size, Material, No of mounting fasteners & torque details to shaker]

1.2 Mounting Torque: Fixture to subsystem: Size & -No. of Fastener

1.3 Torque Wrench Calibration details

1.4 Accelerometer details with calibration

1.4. Axis Definition with photo graph/sketch [Parallel to Mounting Plane, Perpendicular to Mounting Plane]

2. TEST SPECIFICATIONS:

2.1 Resonance Test [LLS]

Axis	(Frequency-Hz)	Amplitude	Sweep Rate Oct/Min.
X, Y & Z	10 to 2000 Hz	0.5 g	2

2.2 Sample of Sine & Random Test Levels:

Axis	SINE TEST (Frequency-Hz)	Amplitude	Sweep Rate Oct/Min.
X,Y			
Z			
Axis	**RANDOM TEST (Frequency-Hz)**	**PSD (g^2/Hz)**	**OVERALL g.r.m.s.**
X & Y			
Z			

Above images with DUT are only for representation, actual packages size should be considered.

2.3 Sample of SRS Test Levels:

Axis	SRS TEST (Frequency-Hz)	Amplitude	No. of Pulses
X,Y,Z			

3. Response of Random/SRS & Resonance search tests: Frequency (Hz) / Amplitude (g):

Axis	Measurement Accelerometer Ch. No	Measurement Accelerometer location	Pre-Sine/SRS Resonance Hz/g	Post-Sine Resonance Hz/g	Random response grms	Post Random/SRS Resonance Hz/g
X						
Y						
Z						

4. TEST SEQUENCE: For Vibration testing of QM

QM 1.[LLS-SINE-LLS-FUNCTION-TEST-LLS-RANDOM-LLS] in X, Y, Z Axis
PFM 2.[LLS-SINE-LLS-RANDOM-LLS] in X, Y, Z Axis
FM 3.[LLS-RANDOM-LLS] in X, Y, Z Axis
For SRS testing of QM[LLS-SRS-LLS] in X, Y, Z Axis

5. PASS/FAILURE CRITERIA:

Pass Criteria:

- Full functionality and structural integrity of subsystem following vibration testing as verified by visual inspection during and after test.
- Structural integrity is defined as no loose components (bolts backing out), cracking of structure, excessive buckling, or excessive displacements. Functionality is defined as full electrical and mechanical characteristics.
- First natural frequency greater than 100 Hz.
- "Before" and "After" Sine Survey Sweeps match each other within 10% of frequency & 20 % of Amplitude.

6. OBSERVATION/ ANALYSIS:

- Natural frequency of the package in each Axis above 120Hz.
- No apparent structural damage observed after & during vibration test. Pre & Post resonance signatures are matching within acceptable criteria.
- No loosening or damage found during or after Vibration test.
- Annexure should be attached for vibration test plots.

7. CONCLUSION

Sub-system withstood the specified level as per Para: 2.2/2.3 vibration/SRS tests successfully and hence, cleared for further activities.

Test carried out by

Test surveillance by

Note: Temperature limits and vibration/mechanical shock levels mentioned are tentative and final values would be communicated to vendor during PID finalization.

ANA2 Technical Details of CGDACS Card

ANA2.1 FIM Bill of Materials (BoM) for CGDACS Card

Following is the list of tentative components used in the CGDACS card. The final component list may vary slightly with respect to type and quantities. The final component list will be issued at the time of every work order being issued.

All these components will be issued as Free Issue Material (FIM) against Bank Guarantee (BG) equivalent to the value of FIM. **The total cost of one set of FIM (components) required for wiring one CGDACS card, is max. Rs.1,90,00,000/- (Rupees One Crore Ninety Lacs only).** However, the total cost of FIM will vary based on the final components issued and it will be indicated in each of the work orders.

SAC is likely to issue FIM for upto 4 CGDACS units only at any given point of time. So vendor will be required to give BG for FIM of upto 4 CGDACS units.

Additionally, one EPC hardware (subject to availability) will be issued, as FIM against BG, which is to be used during the environmental testing of CGDACS Package, in place of external power supplies. **The cost of one EPC hardware is Rs.40,00,000/- (Rupees Forty Lacs only).**

Vendor has to collect all FIMs from SAC stores.

Note :

1. Loss and Damage of partial/complete hardware due to handling, testing, fabrication or any reason at vendor's place shall be borne by the vendor.
2. All FIM components will be issued by SAC in ESD packets. Vendor need to carry out necessary actions in case it is required for the automated pick & place soldering process (if any).

Table 20 : CGDACS BoM (FIM)

S. No.	Component Type	Package	Qty per Card
1.	RS 422 Receiver	CFP16	4
2.	RS 422 Transmitter	CFP16	2
3.	LVDS Serialiser	CFP-48	4
4.	Memory Device	CFP112	1
5.	Clock Manager	CQFP52	1
6.	Buffer	CFP20	1
7.	POL -HMC	DIP-20	3
8.	3W3 D Type Combo Female Connector	9 Pin Through Hole	1
9.	5W5 D Type Combo Female Connector	15 Pin Through Hole	1
10.	50 Pin D Type Male Connector	50 Pin Through Hole	1
11.	50 Pin D Type Female Connector	50 Pin Through Hole	1
12.	25 Pin D Type Male Connector	25Pin Through Hole	1

Following items are included in FIM for ascertaining Bank Guarantee Value. These items are required for handling the board. These following components are not required to be soldered.

Table 21 : FIM but not to be soldered

S. No.	Component Type	Qty per Card
13.	50 Pin High Density D Type Saver Connector	2
14.	3W3 D Type Combo Saver Connector	1
15.	5W5 D Type Combo Saver Connector	1
16.	25 Pin D Type Saver Connector	1
17.	Female Screw locks Type-I (7.9 mm)	16
18.	Female Screw locks Type-II (14.5 mm)	16
19.	Bare PCB of CGDACS card with special devices CCGA and QFNs (like FPGA, 2 nos ADC, 2 nos DAC and 6 nos OP-AMP) mounted on it	1

ANA2.2 Non-FIM BoM

Following is the tentative list of passive components used in the CGDACS card. These components are to be procured by vendor as per SAC R&QA requirements. This is exact requirement per PCB. Vendor may suitably add margin in procurement quantity as per his experience.

These components are to be procured by vendor as per SAC provided QA Annexure ANA 4. Prior to placing Purchase order, vendor should submit the list of ordering part numbers to SAC and obtain clearance.

Table 22 : Passive Components to be procured by Vendor (Non-FIM)

S. No.	Item Name	Make	Value	Package	Qty per CGDACS
1.	CWR29MC106JCHC	Kemet, Vishay, AVX	10uF/35V	CWR29 E	33
2.	CDR12BG150AFUS	Kemet, Vishay, AVX	15pF/150V	CDR12	1
3.	11.000 PF 1.00 % 150.000 V MIL S CDR12BG	Kemet, Vishay, AVX	11pF/150V	CDR12	2
4.	5K1.000 PF 1.00 % 150.000 V MIL S CDR12BG	Kemet, Vishay, AVX	5.1pF/50V	CDR12	1
5.	100.000KPF 10% 25V-ESA B(300904102104KA)	Kemet, Vishay, AVX	0.1uF/25V	C0603	44
6.	10nf/50V, 10% 100V ESA B (300903807B103KE)	Kemet, Vishay, AVX	0.01uf/50V	C0603	129
7.	100PF 10% 100V-GSFC (G311P829ADX101K3N3)	Kemet, Vishay, AVX	0.1nf/100V (100pF)	C0603	122
8.	220PF 10% 50V (M123A10BPB220KS)	Kemet, Vishay, AVX	220pF/50V	CKS51	18
9.	1000PF 10% 100V-GSFC (G311P829ADX102K3N3)	Kemet, Vishay, AVX	1nf/100V (1000pF)	C0603	7
10.	TES 330µF 10% 10V ESA B (301200405B337KA0035)	AVX	330uF/10V	SMD	6

S. No.	Item Name	Make	Value	Package	Qty per CGDACS
11.	TES 33µF 10% 35V ESA B (301200405B336KV0065)	AVX	33uF/35V	SMD	4
12.	CWR29FC227JCHC	Kemet, Vishay, AVX	220uF/10V	CWR29 H	8
13.	M55342K06B100DS	Vishay, SOTA, TT	100E, 150 mW	RM0705	47
14.	M55342K06B330DS	Vishay, SOTA, TT	330E, 150 mW	RM0705	1
15.	M55342K06B47D5S	Vishay, SOTA, TT	47E5, 150 mW	RM0705	12
16.	M55342K06B10E0S	Vishay, SOTA, TT	10K, 150 mW	RM0705	39
17.	M55342K06B1E00S	Vishay, SOTA, TT	1K, 150 mW	RM0705	21
18.	M55342K06B100ES	Vishay, SOTA, TT	100K, 150 mW	RM0705	36
19.	M55342K06B22D1S	Vishay, SOTA, TT	22E1, 150 mW	RM0705	24
20.	M55342K06B2E21S	Vishay, SOTA, TT	2K21, 150 mW	RM0705	8
21.	M55342K06B150DS	Vishay, SOTA, TT	150E, 150 mW	RM0705	11
22.	M55342K06B130DS	Vishay, SOTA, TT	130E, 150 mW	RM0705	6
23.	M55342K06B4E75S	Vishay, SOTA, TT	4K75, 150 mW	RM0705	32
24.	M55342K06B49D9S	Vishay, SOTA, TT	49E9, 150 mW	RM0705	3
25.	M55342K06B121DS	Vishay, SOTA, TT	121E, 150 mW	RM0705	1
26.	M55342K06B100DS	Vishay, SOTA, TT	100E, 150 mW	RM0705	47
27.	M55342K06B3E30S	Vishay, SOTA, TT	3.3K, 150 mW	RM0705	16
28.	M55342K09B5E11S	Vishay, SOTA, TT	5.11K, 150 mW	RM0705	1
29.	M55342K06B51E1SWL	Vishay, SOTA, TT	1.1K, 150 mW	RM0705	2
30.	M55342K06B8E25SWL	Vishay, SOTA, TT	8.25K, 150 mW	RM0705	3
31.	M55342K06B82D5S	Vishay, SOTA, TT	82.5E, 150 mW	RM0705	2
32.	M55342H06B10D0S	Vishay, SOTA, TT	10E, 150 mW	RM0705	1
33.	M55342K06B39E2S	Vishay, SOTA, TT	39.2K, 150 mW	RM0705	1
34.	M55342K06B470DS	Vishay, SOTA, TT	470E, 150 mW	RM0705	4
35.	WAMT-1-A-N-150R0-F-NU 150 OHM 1% 250mW RFP	Vishay, SOTA, TT	150E, 250 mW	RM0402(WAMT-1)	8
36.	WAMT-1-A-N-100R0-F-NU 100 OHM 1% 250mW RFP	Vishay, SOTA, TT	100E, 250 mW	RM0402(WAMT-1)	4
37.	WAMT-1-A-N-121R0-F-NU 121 OHM 1% 250mW RFP	Vishay, SOTA, TT	121E, 250 mW	RM0402(WAMT-1)	8
38.	WAMT-1-A-N-178R0-F-NU 178 OHM 1% 250mW RFP	Vishay, SOTA, TT	178E, 250 mW	RM0402(WAMT-1)	8
39.	WAMT-1-A-N-39R20-F-NU 39.2 OHM 1% 250mW RFP	Vishay, SOTA, TT	39.2E, 250 mW	RM0402(WAMT-1)	8
40.	21K 1SR(320100902B210M) 21µH, 2.9A ESA B	Microspire	SESI 14/15 Inductor - 21uH	SESI15	4
41.	4K9 1SR(320100902B4L9M) 4.9µH, 6A ESA B	Microspire	SESI 14/15 Inductor - 4.9uH	SESI15	3
42.	2K7 1SR(320100902B2L7M) 2.7 µH, 8.2 A ESA B	Microspire	SESI 14/15 Inductor 2.7uH	SESI15	1
43.	MPCI10K 47.000nH 10.0 % 750.000 mA ESA B	Microspire	MPCI Inductors 47nH	MPCI10K	2

S. No.	Item Name	Make	Value	Package	Qty per CGDACS
44.	MPCI10K 12.000 nH 10.0 % 750.000 mA ESA B	Microspire	MPCI Inductors 12nH	MPCI10K	2
45.	MPCI10K 39.000 nH 10.00 % 0.600 A ESA B3	Microspire	MPCI Inductors 39nH	MPCI10K	2

ANA2.3 Specifications and BoM of GCU set

Following is the tentative list of BOM for Ground Checkout Unit (GCU) set. Vendor needs to procure following items mentioned in this BOM. Vendor has to submit their final BoM of GCU and get clearance from SAC before proceeding with GCU procurement.

Table 23 : BoM for One GCU

Sr. No.	Item Name	Make	Qty per GCU set
1.	cPCI 3U Chassis with min 4 slots of 6U backplane	ELMA or Equivalent	1
2.	Core-i7 processor, min. 2.4GHz, 16GB RAM, min. 512GB SSD, 3xUSB, 2xEthernet, VGA/DVI or better	Advantech or Equivalent	1
3.	Microsoft Windows10 licence	Microsoft	1
4.	27in LED Monitor, Keyboard, Mouse	Dell/LG/Samsung	1
5.	BGCUMB-CPCI-001-109 (FPGA Board) or Equivalent	BitMapper/Phoenix	1
6.	B-GCU-DB1-1113-00-CS01 (RS-422 Board) or Equivalent	BitMapper/Phoenix	1
7.	National Instruments Chassis, Controller and FPGA Module • PXIe Chassis – PXIe-1092,10-Slot (7 Hybrid Slots, 1 PXI Express System Timing Slot, 1 Peripheral Expansion Slot), Up to 24 GB/s PXI Chassis, • PXIe-8881, 3.9 GHz 8-Core PXI Controller, Windows 10, 32 GB RAM, 512 GB SSD, 4xUSB, 2xEthernet • PXIe-7976R FlexRIO FPGA Module (Kintex-7 K410T, 2GB RAM,3.2 GB/s) • PXIe 8267, PXI Data storage module	National Instruments	1
8.	4-channel LVDS218-OST-1003A (NI chassis compatible Serializer card)	Optimized Solutions	1
9.	SCSI 68-Pin 1.27 mm Pitch Micro-D Connector, for Discrete Wire Cable, With Back shell, Male	Pickering or Equivalent	2
10.	Vacuum compatible Teflon PTFE wire (26AWG), (24AWG) and (22AWG)	Any make	1500m
11.	Gore Cable (GSC-05-81973-00)	IT Globe	1000m
12.	RF Cable, M17/113-RG316 Part No F316	FLU-TEF	1000m
13.	DBMA25SNMB-FR022-FO (25 Pin D Type Female Connector for Harness)	C&K	6
14.	DBMA25PNMB-FR022-FO (25 Pin D Type Male Connector for Harness)	C&K	4
15.	DDMA50SNMB-FR022-FO (50 Pin D Type Female Connector for Harness)	C&K	10

Sr. No.	Item Name	Make	Qty per GCU set
16.	DDMA50PNMB-FR022-FO (50 Pin D Type Male Connector for Harness)	C&K	10
17.	26-pin high density D type Female Connector for Harness	C&K	2
18.	340100101B DAM 3W3P NMB C & K Part No: C115371-5008 (3W3 Combo Plug type Connector Shell -FR022 Quality)	C&K	2
19.	340100101B DBM 5W5P NMB C & K Part No: C115371-5016 (5W5 Combo Plug type Connector Shell -FR022 Quality)	C&K	2
20.	Male SMA Harness Connectors	Radiall	10
21.	DEMA9PNMB-FR022-FO (9 Pin D Type Male Harness Connector)	C&K	2
22.	DEMA9SNMB-FR022-FO (9 Pin D Type Female Harness Connector)	C&K	2
23.	330-8997-101-FR022 (Std Density Male Contacts)	C&K	1500
24.	031-8997-101-FR022 (Std Density Female Contacts)	C&K	1500
25.	High Density Female Contacts	C&K	100
26.	DM115740-0013-FR022 (Combo Male Contacts)	C&K	20
27.	2 way 1MHz-500 MHz SMA power dividers	PULSAR	2
28.	4 way 1MHz-500 MHz SMA power dividers	PULSAR	1
29.	Male Screw locks for connector mounting	C&K	12
30.	JTAG Programmer Hardware for Xilinx Virtex devices	Xilinx or Equivalent	1
31.	SMA to SMA Buffer Cables 2m length, up-to 6GHz operating frequency range	Any make	10

ANA2.4 Power Supply Requirement of CGDACS card

Vendor has to make minimum three (3) sets of following power supplies.

Table 24 : Power Supply Requirements

Power Supply Requirements	Power Supply - 1	Power Supply - 2	Power Supply - 3	Power Supply - 4	Power Supply - 5
Power per Unit	7.5W	10W	5W	2.25W	4.125W
Supply source Voltage	+5V	+5V	+5V	+5.0VD (450 mA)	+3.3VD (1250 mA)
Supply Voltage on board through POL	2.5V/(1500 mA) with 80% POL efficiency	1.9V/(2000 mA) with 80% POL efficiency	1.0V/(1000 mA) with 75% POL efficiency	+5.0VD	+3.3VD
Line regulation	±1%	±1%	±1%	±1%	±1%
Load Regulation	±1%	±1%	±1%	±1%	±1%
Ripple	40 mV(P-P)	40 mV(P-P)	40 mV(P-P)	40 mV(P-P)	40 mV(P-P)
Overshoot at Turn ON	3% max	3% max	3% max	3% max	3% max

ANA2.5 CGDACS Interface Signals at connectors

The CGDACS subsystem has various interface as listed in the below table.

Table 25 : CGDACS Signals' list

Type	Direction wrt CGDACS	Signals
RS422 (3.3V) (Diff) (50 pin-D type)	Out	08
	In	12
LVDS (3.3V) (Diff) (50 pin-D type)	Out	16
CMOS (5V)	Out	4
CMOS (3.3V)	Out	06
Temp Thermistor (Diff)	Out	03
Analog (SMA)	In	05
	Out	02
	Total	56

ANA2.6 Typical test setup for CGDACS

cPCI based Ground Checkout Unit (GCU) to be procured by the vendor and SAC will be provide the firmware of GCU for testing CGDACS. Ground Checkout Unit (GCU) has capability of testing one CGDACS. Either main or redundant CGDACS has to be powered ON and tested, one at a time. A separate Daily Operations Record (DOR) logbook to be maintained for each hardware. Record all testing activities in the DOR. All supplies' voltage and currents are to be recorded in DOR, at regular intervals during all testing phases. The input signals required for CGDACS, are provide by either the GCU or the external sources. The CGDACS's response is to be captured in the GCU. Serial Data interface are to be tested using the GCU. All output signals of CGDACS package mentioned in Table 25, are to be captured manually on an Oscilloscope and the screenshots are to be included in the test report. The +ve and –ve line of differential signals are to be captured together. These tests are to be repeated at all applicable testing phases as mentioned in Table 26. The screenshot of the signals should include the measurement information like Amplitude, positive width, negative width, frequency, duty cycle, etc. The test reports are to be generated as per the template provided by SAC. A detailed test plan document will be provide later, if required.

Following table shows the tentative list of tests to be performed. Also refer Table 11 for tests applicable based on the type of CGDACS being tested.

Table 26 : CGDACS Test Matrix for QM package

Sr. No.	Parameter	IBT	Burn-in	Post Burn-in electrical	Post cold storage	Post hot storage	Post Humidity storage	Temp. operational test	EMI/ EMC	sine vibration	Random vibration	Thermovac	Post mechanical shock	ESD	Life test	FBT
1	Verification of I&Q Chirp signal duration w.r.t DCG Tx pulse at different Pulse Width & for all SAR Modes .	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

2	Measurement of spurious as well as chirp signal delay w.r.t rising edge of DCG Tx pulse for all SAR modes Digital, CMO	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	Capturing of I&Q chirp signal at different pulse width & for all SAR modes	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
4	Processing of chirp data to evaluate following parameters	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
5	DCG I&Q output line monitoring before MAP ON & after MAP OFF .	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table 27 : CGDACS Test Matrix for FM package

Sr. No.	Parameter	IBT	Burn-in	Post Burn-in electrical	Post cold storage	Post hot storage	Post Humidity storage	Temp. operational test	EMI/ EMC	sine vibration	Random vibration	Thermovac	FBT
1	Verification of I&Q Chirp signal duration w.r.t DCG Tx pulse at different Pulse Width & for all SAR Modes .	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	Measurement of spurious as well as chirp signal delay w.r.t rising edge of DCG Tx pulse for all SAR modes Digital, CMO	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	Capturing of I&Q chirp signal at different pulse width & for all SAR modes	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4	Processing of chirp data to evaluate following parameters	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
5	DCG I&Q output line monitoring before MAP ON & after MAP OFF .	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table 28 : List of Equipments

S. No.	Item Name	Specifications	Make	Qty per Test setup
1	Signal Generator	Output:(9 KHz-3GHz), Model No: EXG analog signal generator N5171B or equivalent	Keysight	2

2	Oscilloscope:	Model No: DPO70404C-BW-4GHz, sampling-25GSPS or equivalent	Tektronix	1
3	Power Supplies	ZUP20-10U (alternatively Z20-10-U) or ZUP10-20/LU (alternatively Z10-20-L-U) or equivalent	TDK-Lambda	5
4	Raw Bus power supply	ZUP-80-5U/10U –or equivalent	TDK-Lambda	1

ANA3 EMI/EMC tests for CGDACS with Electronic Power Conditioners (EPCs)

Sr. No.	Test Description	Test Specifications	Applicability	
			QM with EPC	FM with EPC
1.	Radiated Emissions-Electric Field - (RE) 10kHz to 18GHz	• 10KHz - 400MHz: 50dBµV/m • 400MHz–18GHz: 50dBµV/m - 83dBµV/m	A	A
2.	Radiated Emissions-Electric Field - (RE)-Notches	Notches : as per document and information provided by SAC at the time of Test	A	A
3.	Conducted Emission-Differential Mode (CE-DM) – Power lines (Live and Return) (50Hz to 50 MHz)	• 50Hz -1KHz: 100dBµA • 1KHz – 1MHz: 100-40dBµA • 1MHz - 50MHz: 40dBµA	A	A
4.	Conducted Emission-Common Mode (CE-CM) – Power lines (Live and Return) (10KHz to 200MHz)	10KHz -200MHz: 60dBµA	A	NA
5.	Conducted Emission – Time domain, Turn ON /OFF Transient (CE-Transient) CE07	• Amplitude:50%-150% Raw bus Voltage • Time: T1(50uS), T2(1mS)	A	NA
6.	Conducted Susceptibility - Sinusoidal, Power Leads (CS-DM-CS01) (50Hz to 150 KHz)	CS-DM-CS01 (50Hz to 150kHz): 1Vrms	A	NA
7.	Conducted Susceptibility Sinusoidal, Power Leads (CS-DM-CS02) (150kHz to 50 MHz)	CS-DM-CS02 (150KHz to 50MHz): 1Vrms	A	NA
8.	Conducted Susceptibility Transient, Power leads (CS-DM-Transient, Time domain) CS06 (10uS & 10 PPS) Note-2	• **For QM:** ➢ Epeak= Bus voltage +100% of bus voltage i.e. 70V +70V=140V ➢ Pulse width:10uS ± 20% ➢ Repetition rate: 10PPS ➢ Duration: 5- 15 minutes	A	NA
9.	Conducted Susceptibility-Bulk Cable Injection, only on Power leads (CS-BCI-CW) CS114 (10KHz to 200MHz) (Note-1)	10KHz - 200MHz: 84dBµA	A	NA

<table>
<tr><th rowspan="2">Sr. No.</th><th rowspan="2">Test Description</th><th rowspan="2">Test Specifications</th><th colspan="2">Applicability</th></tr>
<tr><th>QM with EPC</th><th>FM with EPC</th></tr>
<tr><td>10.</td><td>Conducted Susceptibility Test (CS115-Bulk Cable Injection, Impulse Excitation) (Note-1)</td><td>1A, 30nS transient pulse with 2nS rise and fall time, at the rate of 30Hz for one minute.</td><td>A</td><td>NA</td></tr>
<tr><td>11.</td><td>Conducted Susceptibility Test (CS116-Damped Sinusoidal Transients (Note-1)</td><td>10kHz-1MHz: 0.01A- 10A
1MHz-30 MHz: 10A
30MHz-100MHz:10A-2A</td><td>A</td><td>NA</td></tr>
<tr><td>12.</td><td>Radiated Susceptibility-Electric Field (RS)
Sweep frequency mode (CW)</td><td>Sweep frequency mode (CW):
<table>
<tr><th>S. No.</th><th>Frequency (MHz)</th><th>Source</th><th>E-field (V/m) QM</th></tr>
<tr><td>1.</td><td>50MHz - 18GHz</td><td>General</td><td>5</td></tr>
<tr><td>2.</td><td>Banded Sweeps (on-board frequencies)</td><td>Details will be provided</td><td>QM: 20
FM: 5</td></tr>
</table></td><td>A</td><td>NA</td></tr>
<tr><td>13.</td><td>Radiated Susceptibility-Electric Field (RS)
Spot frequency mode</td><td>• Spot frequency mode (discrete): Details will be provided
• On-board spot frequencies and applicable electric field levels
E-field (V/m) QM= 20V/m
E-field (V/m) FM= 5V/m</td><td>A</td><td>A</td></tr>
<tr><td>14.</td><td>ESD- Radiated Field Test</td><td>discharge voltage of 7 kV
(1 discharge/sec, 30 discharges)</td><td>A</td><td>NA</td></tr>
<tr><td>15.</td><td>ESD-
Single Point Discharge Test</td><td>discharge voltage of 5 kV
(1 discharge/sec, 30 discharges)</td><td>A</td><td>NA</td></tr>
<tr><td>16.</td><td>ESD- Structural Current Test</td><td>discharge voltage of 5 kV
(1 discharge/sec, 30 discharges)</td><td>A</td><td>NA</td></tr>
</table>

Legend :
A -> Applicable
NA -> Not Applicable
Note-1: CS-114/CS-115/CS-116 test to be conducted on power line only. In case of any special requirement, only injection shall be applied on signal lines.
Note-2: Maximum rating of input components of DC-DC converter/EPC shall be verified before applying the CS06 spike.
Parameters to be monitored during each of the above tests shall be defined as per subsystem specifications in Exhibit-I below.

ANA 1 R&QA requirements for Procurement of Resistors and Capacitors

QA REQUIREMENTS FOR RM0705 STYLE RESISTORS		
Sr. No.	**Quality Requirement description**	**Compliance Remark(s)**
1	The Chip Resistors should be qualified to and as per the latest-PRF-55342/06 specification, Established Reliability, Failure rate "S" level.	
2	The offered part(s) and the Part-manufacturer should be listed on the latest QML-55342.	
3	The deliverable resistors shall have a Single Lot Date Code (SLDC) (preferred) not older than two years from the date of shipment (mandatory).	
4	The PIN (Part Identification Number) / Marking on the parts as well as marking on the part label/package/container shall be as per the MIL-PRF-55342 specification.	
5	**The resistors shall be supplied in standard size antistatic waffle packages 50 pieces per package preferable.**	
6	**The following details shall be supplied along with proposal.**	
6a	Name of the Original Part Manufacturer.	
6b	Details of marking on components and marking on the component bag/package/label.	
6c	A copy of the authorization letter issued by the original part manufacturer.	
6d	The status of qualification (to MIL-PRF-55342), of offered part and part-manufacturer. *A copy of Qualification Certificate and relevant pages of the QML-55342 be attached in the quote.*	
6e	The latest data sheet(s) of the offered part(s) indicating electrical, mechanical, environmental specifications and engineering drawing.	
7	**The following shall be supplied along with the deliverable components.**	
7a	The Certificate of Compliance (CoC) from the Original Part Manufacturer.	
7b	The Certificate of Compliance (CoC) from the supplier/vendor.	
7c	The data sheet of the delivered part(s) indicating complete electrical, mechanical, environmental specifications and engineering drawing.	
8	**Important notes**	
8a	The vendors, authorized by the Original Part Manufacturer, to source/sell the space grade parts in India, shall only be considered. Hence, the **relevant certificate and document, point by point QA compliance shall be endorsed by the original part Manufacturer, must be enclosed with the quote. Failing so the offer shall be rejected.**	
8b	Vendor shall clearly indicate the Compliance (or non-compliance or partial-compliance or non-compliance), in the "Compliance Remark(s)" column for each requirement. The relevant detail/information, substantiating the compliance, shall also be provided along-with. QA compliance shall be endorsed by OEM. **Failing so the offer shall be rejected. Simple tick mark or blank will be considered as non-compliance.**	

QA REQUIREMENTS FOR CWR29 STYLE CAPACITORS		
Sr. No	**Quality Requirement description**	**Compliance Remark(s)**
1	The capacitors shall be qualified to and as per the MIL-PRF-55365/11 specification, Established Reliability with; **a)** Weibull Failure rate level `C' or better. **b)** Termination finish: Hot solder dipped **c)** Surge current test option Code 'C'	
2	The offered part and the Part-manufacturer should be listed on the latest QML-55365.	
3	The PIN (Part Identification Number) / Marking on the parts as well as marking on the part label/container shall be as per the MIL-PRF-553651 specification	
4	The parts, to be delivered, shall preferably have a Single Lot Date Code (SLDC) not older than two years from the date of shipment.	
5	The capacitors shall be supplied in the standard size waffle packages.	
6	**The following details shall be supplied along with proposal.**	
6a	Name of the Original Part Manufacturer.	
6b	A copy of the authorization letter endorsed by the Original Part Manufacturer.	
6c	Ordering information, Details of marking on components and marking on the component bag/package/label.	
6d	The latest data sheet of the offered part(s) indicating electrical, mechanical, environmental specifications and engineering drawing. *The provided datasheet must be endorsed by the vendor.*	
7	**The following details shall be supplied along with the deliverable components.**	
7a	The Certificate of Conformance (CoC) from the Original Part Manufacturer.	
7b	The Certificate of Conformance (CoC) from the vendor.	
7c	Copy of PO placed by Supplier/Vendor to OCM to be supplied to SAC.	
7d	The test data package stated mandatory to supplied with the deliverables as per the MIL-PRF-55365 specification requirements.	
7e	The data sheet of the delivered part(s) indicating electrical, mechanical, environmental specifications and engineering drawing.	
8	**Important notes**	
8a	The vendors, authorized by the Original Part Manufacturer, to source/sell the space grade parts in India, shall only be considered. Hence, the relevant certificate and document, endorsed by the original part Manufacturer, must be enclosed with the quote. ***Failing so the offer shall be rejected***.	
8b	Vendor shall clearly indicate the Compliance (or non-compliance or partial-compliance or non-compliance), in the "Compliance Remark(s)" column for each requirement. ***The relevant detail/information, substantiating the compliance endorsed by OEM, shall also be provided along with***. ***Failing so***	

	***the offer shall be rejected*. Simple tick mark or blank will be considered as non-compliance.**	

QA REQUIREMENTS FOR CKS STYLE CAPACITORS		
Sr. No.	**Quality requirement description**	**Compliance Remark(s)**
1	The capacitors, shall be qualified to and as per the latest MIL-PRF-123 applicable specifications.	
2	The offered part(s) and the Part-manufacturer should be listed on the latest QML-123.	
3	The capacitors, to be delivered, shall have a Single Lot Date Code (preferable) not older than two years from the date of shipment (mandatory).	
4	The PIN (Part Identification Number) / Marking on the parts and the marking on the part package/container shall be as per the MIL-PRF-123 specification.	
5	The capacitors shall be supplied in the standard waffle packages. Tape & reel packaging shall not be acceptable.	
6	**The following details shall be supplied along with proposal.**	
6a	Name of the original part manufacturer.	
6b	The vendor(s) authorized by original part manufacturer to source and sell parts in INDIA shall only be considered. Latest copy of authorization letter and point by point compliance endorsed by the Original Part Manufacturer in case quote is not from OEM. OR ***If quote is from Authorized Representative of HI-REL Parts Procurement Agency (HRPPA); Copy of latest authorization letter and point by point compliance endorsed by the HRPPA.***	
6c	***If supplier is HI-REL Parts Procurement Agency (HRPPA) OR Representative of HRPPA; in addition to all the quality requirement of this Indent compliance with the supporting documents/certificates for the following shall be provided along with the quote-***	
	The vendor should have more than 5 years of experience as HRPPA. Details regarding the same shall be supplied.	
	Details of EEE parts supplied to other customers with name of space programs supported and Space agencies / Satellite payload manufacturers.	
	Supplied parts shall meet Manufacturer recommended storage & cleanliness condition	
	Outline of the Vendor's operating procedure, for compliance to quality requirements of this document; including details of mechanism for traceability up to Original Parts Manufacturer.	
	Details of Quality documents that will be supplied along with deliverables	
	For off-the-shelf parts following shall be provided along with quote- • Date-code of supplied parts • Storage and inspection criteria to be supplied whenever applicable • Technical and Quality Procurement specifications	

	Acceptability of such off-the-shelf parts will be at SAC's discretion	
6d	The latest data sheet of the offered part(s) indicating electrical, mechanical, environmental specifications and engineering drawing.	
6e	Ordering information, Details of marking on components and marking on the component bag/package/label.	
7	**The following details shall be supplied along with the deliverable components.**	
7a	The Certificate of Compliance (CoC) stating that delivered capacitors meet all the requirements of applicable MIL-PRF-123/11 specifications and all the associated documents. The CoC should be from the original part manufacturer.	
7b	The complete data package, as per the mandatory requirements of the MIL-PRF-123. It shall minimally consists of;	
	I. Summary of Group `A' testing.	
	II. Summary of Group `B' testing.	
	III. Group `B' Variables Test Data.	
	IV. Final Destructive Physical Analysis Report.	
7c	The Certificate of Compliance (CoC) from the supplier/vendor.	
7d	The data sheet of the delivered part(s) indicating electrical, mechanical, environmental specifications and engineering drawing.	
8	**Important notes**	
8a	Point by point compliance with supporting documents as described above in para 1 to 7 shall be submitted along with the technical quote. Additionally, if supplier is HRPPA/authorized representative of HRPPA, all the details as per para 6c shall be submitted along with quote with the supporting technical documents/certificates. **Failing so the offer is liable to be rejected.**	

QA REQUIREMENTS FOR CAPACITORS, TANTALUM LOW ESR TES STYLE		
Sr. No.	**Quality requirement description**	**Compliance Remark(s)**
1	Parts supplied shall be qualified to and as per the latest ESCC 3012/004 specifications level B chart F2 & F3 testing. *The offered part(s) and the part manufacturer should be listed on the latest ESCC QPL.*	
2	The capacitors, to be delivered, shall preferably have a Single Lot Date Code (SLDC) not older than two years from the date of shipment.	
3	PIN/marking on the parts as well as marking on its label/container/package shall be as per the ESCC specification bearing the ESCC logo.	
4	The parts shall be properly packed in standard anti-corrosive waffle packaging.	
5	***Tape & reel packaging shall not be acceptable.***	
6	**The following details shall be supplied along with proposal.**	
6a	Name of the Original Part Manufacturer.	
6b	The vendor(s) authorized by original part manufacturer to source and sell parts in INDIA shall only be considered. ***Latest copy of authorization letter and point by point compliance endorsed by the Original Part Manufacturer in case quote is not from OEM***. OR	

	<u>If quote is from Authorized Representative of HI-REL Parts Procurement Agency (HRPPA); Copy of latest authorization letter and point by point compliance endorsed by the HRPPA.</u>	
6c	***<u>If supplier is HI-REL Parts Procurement Agency (HRPPA) OR Representative of HRPPA; in addition to all the quality requirement of this Indent compliance with the supporting documents/certificates for the following shall be provided along with the quote-</u>***	
	The vendor should have more than 5 years of experience as HRPPA. Details regarding the same shall be supplied.	
	Details of EEE parts supplied to other customers with name of space programs supported and Space agencies / Satellite payload manufacturers.	
	Supplied parts shall meet Manufacturer recommended storage & cleanliness condition	
	Outline of the Vendor's operating procedure, for compliance to quality requirements of this document; including details of mechanism for traceability up to Original Parts Manufacturer.	
	Details of Quality documents that will be supplied along with deliverables	
	For off-the-shelf parts following details shall be provided along with quote- Date-code of supplied parts Storage and inspection criteria to be supplied whenever applicable Technical and Quality Procurement specifications	
	Acceptability of such off-the-shelf parts will be at SAC's discretion	
6d	Ordering information, Details of marking on components and marking on the component bag/package/label.	
6e	The exact ESCC part no. of the offered part(s) and its cross reference with the generic/manufacturer' part no.	
6f	The latest data sheet(s) of the offered part(s) indicating electrical, mechanical, environmental specifications and engineering drawing. *The attached data-sheet shall be endorsed by the vendor/supplier.*	
7	**The followings shall be supplied along with the deliverable components.**	
7a	Certificate of Compliance (CoC) from the original part manufacturer.	
7b	Certificate of Compliance (CoC) from the vendor/supplier if quote is not from OEM.	
7c	Complete soft copy of data package as per the ESCC 3012/004 specifications.	
7d	A copy of guideline/application note pertaining to the handling, storage, mounting, soldering/fabrication of the offered capacitors.	
7e	The data sheet of the delivered part(s) indicating electrical, mechanical, environmental specifications and engineering drawing.	
8	**Important notes:**	
8a	Point by point compliance with supporting documents as described above in para 1 to 7 shall be submitted along with the technical quote. Additionally, if supplier is HRPPA/authorized representative of HRPPA, all the details as per para 6c shall be submitted along with quote with the supporting technical documents/certificates. **<u>Failing so the offer is liable to be rejected.</u>**	

QA requirements for Inductors, Fixed SMD	
Sr. No.	**SAC Requirement description**
1	The parts to be supplied, shall be either; Qualified to & as per the latest MIL-PRF-83446/05 specification with Group `A' inspection. The manufacturer shall be qualified to and listed on the latest QML-83446 for the offered parts. OR The chip inductors shall be qualified to and as per the latest ESCC 3201/008 specifications with Level `B'. The offered part and part manufacturer shall be qualified to and listed on the latest ESCC QPL.
2	The following details shall be supplied along with proposal.
2a	Name of the original part manufacturer.
2b	Ordering information, Details of marking on components and marking on the component bag/package/label.
2c	A copy of the latest authorization letter issued by the original part manufacturer.
2d	The latest data sheet(s) of the offered part(s) indicating electrical, mechanical, environmental specifications and engineering drawing.
2e	Qualification status on ESCC QPL/QML and EPPL/ MIL-PRF-83446 with a copy of certificates.
3	The following shall be supplied along with the deliverable components.
3a	The Certificate of Compliance (CoC) from the Original Part Manufacturer.
3b	The Certificate of Compliance (CoC) from the supplier/vendor.
3c	Soft copy of Test reports of Group 'A' inspection, for parts as per the MIL-PRF-83446/05. OR Complete Data Package (mandatory to be supplied with deliverables) as per the ESCC 3201 specification.
3d	The data sheet of the delivered part(s) indicating complete electrical, mechanical, environmental specifications and engineering drawing.
4	General requirements
4a	The deliverable inductors shall have preferably a Single Lot Date Code (SLDC) not older than two years (mandatory) from the date of shipment to SAC .
4b	The PIN (Part Identification Number), Part marking, Label/Marking on the parts/ package/container bag shall be as per the applicable MIL-PRF-83446 or ESCC 3201 specification.
4c	The parts shall be supplied in standard size waffle packages not more than 50 in single package having the label/marking as per the MIL-PRF-83446 or ESCC 3201 specifications.
5	Other Important requirements
5a	The vendors/suppliers who are authorized by the Original Part Manufacturer, to source/sell the space grade parts in INDIA, shall only be considered. Hence, the relevant certificate and document, issued by and duly authorized & endorsed by the original part Manufacturer, must be enclosed with the quote.
5b	The vendors/suppliers must give the Compliance (or non-compliance), to each requirement of this annexure, The necessary details/information substantiating the compliance shall also be provided in the quotation itself.

	IMPORTANT NOTE : THE COMPLIANCE/NON-COMPLIANCE TO EACH POINT OF THIS ANNEXURE IS ESSENTIAL AND SHALL CLEARLY BE MENTIONED IN "COMPLIANCE BY THE VENDOR" COLUMN.

	QA REQUIREMENTS FOR CDR12 CAPACITORS	
Sr. No.	**Quality requirement description**	**Compliance Remark(s)**
1	The capacitors shall be qualified to and as per the latest applicable specification MIL-PRF-55681 Established Reliability `S' level Failure rate (0.001%/1000 hrs.) with Group A testing. OR Capacitors supplied shall be from ISRO qualified vendor as per Annexure ANA 2	
2	The offered part(s) and the Part-manufacturer should be listed on the latest QML-55681 or shall be ISRO qualified vendor.	
3	The deliverable capacitors shall preferably have a Single Lot Date Code (SLDC), not older than two years from the date of shipment.	
4	The PIN (Part Identification Number) / Marking on the parts as well as marking on the part label/package/container shall be as per the MIL-PRF-55681 specifications.	
5	The capacitors shall be supplied in standard waffle packages.	
6	**The following details shall be supplied along with proposal.**	
6a	Name of the original part manufacturer.	
6b	Ordering information, Details of marking on components and marking on the component bag/package/label.	
6c	**The latest endorsed copy of the authorization letter issued by the original part manufacture in case quote is not from OEM.**	
6d	For ISRO qualified part- Qualification data shall be supplied along with quote.	
7	**The following details shall be supplied along with the deliverable components.**	
7a	The Certificate of Compliance (CoC) from the Original Part Manufacturer.	
7b	The Certificate of Compliance (CoC) from the supplier/vendor (NA- if quote is not from OEM).	
7c	Group-A/Screening test report for MIL Qualified parts. ISRO qualified vendor shall supply test data as per Annexure ANA 2	
7d	The data sheet of the delivered part(s) indicating complete electrical, mechanical, environmental specifications and engineering drawing.	
8	**Important notes**	
8a	The vendors, authorized by the Original Part Manufacturer, to source/sell the space grade parts in India, shall only be considered. Hence, **the relevant technical certificate and supporting documents, endorsed by**	

	<u>the original part Manufacturer, must be enclosed with the quote</u>. ***Failing so the offer shall be rejected.***	
8b	Vendor shall clearly indicate the Compliance (or non-compliance or partial-compliance or non-compliance), in the "Compliance Remark(s)" column for each requirement. The relevant detail/information, substantiating the compliance, shall also be provided along with. ***Failing so the offer shall be rejected*. Simple tick mark or blank will be considered as non-compliance.**	

QA REQUIREMENTS FOR POWER INDUCTORS, MOULDED, SMD (SESI Series)		
Sr. No.	**SAC requirement description**	**Compliance Remark(s)**
1	The inductors shall be qualified to and as per ESCC 3201/009 with Level `B'.	
2	The offered part(s) and the Part-manufacturer should be listed on the latest ESCC QPL.	
3	The deliverable inductors shall have a Single Lot Date Code (SLDC) not older than two years from the date of shipment to SAC.	
4	The PIN (Part Identification Number) / Marking on the parts as well as marking on the part label/package/container shall be as per the ESCC 3201/009 specification.	
5	The inductors shall be supplied in standard packages.	
6	**The following details shall be supplied along with proposal.**	
6a	Name of the original part manufacturer.	
6b	Ordering information, Details of marking on components and marking on the component bag/package/label.	
6c	A copy of the authorization letter issued by the original part manufacturer.	
6d	Charges for LAT-3 testing and no. of destruct sample pieces for the LAT. Requirement of LAT-3 testing (with sample distribution as per ESCC 3201) shall be decided at the time of ordering.	
6e	The details of previous LAT testing (carried out as a mandatory requirement to retain the qualification status on ESCC QPL). *A copy of test report/detail of the same shall be provided with quote.*	
6f	The status of qualification (to ESCC 3201/009), of offered part and part-manufacturer. *A copy of Qualification Certificate and relevant pages shall be attached in the quote.*	
6g	The latest data sheet of the offered part(s) indicating electrical, mechanical, environmental specifications and engineering drawing.	
7	**The following details shall be supplied along with the deliverable components.**	
7a	The Certificate of Compliance (CoC) from the Original Part Manufacturer.	
7b	The Certificate of Compliance (CoC) from the supplier/vendor.	
7c	The data sheet of the delivered part(s) indicating complete electrical, mechanical, environmental specifications and engineering drawing.	
8	**Important notes**	

8a	The vendors, authorized by the Original Part Manufacturer, to source/sell the space grade parts in India, shall only be considered. Hence, the relevant certificate and document, endorsed by the original part Manufacturer, must be enclosed with the quote. ***Failing so the offer shall be rejected***.
8b	Vendor shall clearly indicate the Compliance (or non-compliance or partial-compliance or non-compliance), in the "Compliance Remark(s)" column for each requirement. The relevant detail/information, substantiating the compliance, shall also be provided alongwith. ***Failing so the offer shall be rejected*. Simple tick mark or blank will be considered as non-compliance.**

Ceramic Chip Capacitor (CDR) from ISRO qualified Vendors

A. QUALITY REQUIREMENTS

1. Governing Specification : MIL- PRF- 55681 & ISRO-ISAC-ST-0157

B. COMPONENT SPECIFICATION

1. Style
2. Value
3. Dielectric material
4. Tolerance
5. Rated voltage

} As per Indent Technical Specifications

6. Termination finish: Solder Finish

C. TEST REQUIREMENTS

7. The chip capacitors offered shall meet the requirements of MIL-PRF-55681 & ISRO-ISAC-ST-0157.
8. The chip capacitors shall be manufactured as per PID: Dalmia-PID-ISAC Revision #2, dated 24-Nov-2010 of Dalmia. Changes, if any, in above referenced PID shall be implemented with approval of SAC.
9. 100% of the Chip Capacitors supplied shall be subjected to Screening as per Chart 1.
10. If the manufacturer does not have qualification validity, each type of the chip capacitors shall be subjected to qualification Table of ISRO-ISAC-ST-0157.
11. Any non-conformance during manufacturing or testing of chip capacitors shall be immediately informed to SAC within 48 hrs. Further activities shall be carried out in consultation with SAC.

D. SAC/ISRO PARTICIPATION

12. SAC reserves the right to participate in Screening tests.
13. Vendor shall inform SAC in advance both starting and expected date of completion of the lot manufacturing. SAC shall also be informed after completion of the manufacturing, to plan for the participation in the Screening test.
14. Vendor shall provide a minimum of 2 weeks for participation in test from the date of completion of manufacturing.

E. DATA PACKAGE

1. Screening test data pertaining to all the measurements taken at various stages of Screening.
2. Summary sheet for the Screening tests giving details of tests done, test conditions, date of test, number of chip capacitors subjected to test, number passed etc.

F. OTHER REQUIREMENTS

3. Each line item shall be produced as a single lot for homogeneity.

4. Data sheet/specification shall be provided along with the quotation.
5. Any change in the process or inspection shall be carried out only with the concurrence of SAC.
6. Each device type shall be supplied from lots with same date code. The devices shall be drawn from lots manufactured within 2 years of the date of shipment.
7. Vendor shall report all NCR/DCN to SAC during Procurement/Testing.
8. Capacitors shall be supplied in a packing that bears a label, which gives the details like 1. Part number 2. Value 3. Tolerance 4. Rated voltage 5. Date code 6. Temperature characteristic.
9. Package material shall be ESD compliant.

Chart 1: Screening Test