

**Request for Proposal (RFP) of
Delivery of FM & QM
Digital Processing Unit (DPU) Subsystem**

This document contains proprietary information of SAC/ISRO, Ahmedabad and is protected by copyright laws and international treaties. Unauthorized copy or reproduction of this document in whole or in part without the prior written consent of SAC/ISRO is strictly forbidden and constitutes a copyright infringement.

SAC/ISRO reserves the right to alter this information at any time without notice.

© Copyright 2025, by SAC/ISRO, Ahmedabad

Contents

1	Scope of Work and General Guidelines	1
1.1	Introduction	1
1.1.1	Introduction of Digital Processing Unit (DPU)	1
1.2	Scope of Work	2
1.2.1	Procurement of Passive Components.....	3
1.2.2	Free Issue Material List.....	3
1.2.3	Printed Circuit Boards (PCB)	3
1.2.4	Drawings of Mechanical Jigs, Trays and packages.....	3
1.2.5	Procurement of materials	3
1.2.6	Mechanical Fabrication.....	4
1.2.7	Electronic Fabrication	4
1.2.8	PCB and mechanical package assembly	5
1.2.9	Ground Checkout Unit (GCU).....	5
1.2.10	Preparation of harness for functional testing of sub-system	5
1.2.11	Functional Testing using the GCU.....	5
1.2.12	Functional Test results review by SAC.....	5
1.2.13	Functional/Acceptance/Qualification level testing using the GCU	5
1.2.14	Environmental Test results review by SAC and Acceptance by SAC	6
1.2.15	Packing and delivering the sub-system to SAC	6
1.2.16	Delivery of GCU and Test Harness to SAC.....	6
1.3	Responsibilities of Vendor and SAC	6
1.3.1	SAC Responsibilities	6
1.3.2	Vendor’s Responsibilities	7
1.3.3	Process Flow Details and responsibility bifurcation	8
1.4	Deliverables by the vendor	9
1.5	Bid submission details and Bid format	9
1.6	Vendor Evaluation and Selection Criteria	10
1.7	Delivery Schedule	11
1.8	Payment terms	12
1.9	Termination Clause	12
1.10	Warranty terms	12
1.11	Parallel Contract[s]	12
1.12	Force Majeure	13
1.13	Risk Purchase	13
1.14	Subletting Of the Contract	13
1.15	Intellectual Property Rights/ Confidentiality / Non-Disclosure Clause	13
1.16	Details to be provided with the proposal	13
1.17	Inspection of Vendor’s Facilities by SAC Team	14

1.18	Other Terms and Conditions / Important Guidelines	14
ANA1	Product Assurance Requirements	15
ANA1.1	Introduction	15
ANA1.2	Applicable Documents	15
ANA1.3	Reliability	15
ANA1.3.1	Life:	15
ANA1.3.2	Operating condition for Active Components:	15
ANA1.4	Environmental Specifications	16
ANA1.4.1	Non-Operating Environment:	16
ANA1.4.2	Operating Environment:	16
ANA1.4.3	EMI / EMC:	16
ANA1.4.4	VIBRATION / SHOCK / ACCELERATION:	19
ANA1.5	Parts	19
ANA1.5.1	Qualification (QM) / Flight Model (FM) Parts Quality	19
ANA1.5.2	Inspection of parts:	19
ANA1.6	Materials	20
ANA1.7	Storage of Hardware, Parts, & Materials	21
ANA1.8	Processes	21
ANA1.9	Fabrication Documentation	22
ANA1.9.1	Product Realization Document (PRD)	22
ANA1.9.2	Process Identification Document (PID)	22
ANA1.9.3	Fabrication Sequence	22
ANA1.10	Quality Control (QC)	22
ANA1.11	QA Audit	23
ANA1.12	Marking and Identification	23
ANA1.13	Transportation	24
ANA1.14	Test Program	24
ANA1.14.1	Model Philosophy	24
ANA1.14.2	Test Plan	24
ANA1.14.3	Failure	26
ANA1.15	Tests	26
ANA1.15.1	Test condition & details	27
ANA1.16	Non-Conformance Management	32
ANA1.16.1	Major or Critical NC	32
ANA1.16.2	Minor NC	32
ANA1.17	Configuration Change Control	33
ANA1.18	Documents To Be Supplied	33
ANA1.18.1	Document supplied along with quote	33

ANA1.18.2	Documents supplied during the contract	33
ANA1.18.3	Documents supplied during the program	33
ANA1.18.4	Documents supplied for each unit	34
ANA1.18.5	Certificates	34
ANA2	Technical Details of Digital DPU-1 & DPU-2 Card.....	38
ANA2.1	Bill of Materials (BoM) for DPU Card	39
ANA2.2	Specifications and BoM of Harness set.....	47
ANA2.3	Power Supply Requirement of DPU card	48
ANA2.4	DPU Interface Signals	48
ANA2.5	Typical test setup for DPU.....	49
ANA2.6	Quantity to be fabricated and tested	51
ANA3	R&QA requirements for Procurement of Resistors and Capacitors	52

List of Figures

Figure 1. Block schematic of DPU	38
Figure 2. Top and Bottom views of the DPU PCB, PCB in Housing.....	39
Figure 3. PCB Package; Top and Bottom View	39

List of Tables

Table 1 : List of major Activities and responsibility.....	2
Table 2 : Detailed process flow with responsibility.....	8
Table 3 : Part2 (Financial bid) Template	9
Table 4 : QM Delivery Schedule	11
Table 5 : FM Delivery Schedule	11
Table 6 : Vendor's Technical Competence Details	13
Table 7 : Applicable documents.....	15
Table 8: EMI/EMC test matrix	16
Table 9 : Units Identification marking	23
Table 10 : Test Applicability	25
Table 11 : Tests applicability	25
Table 12 : Test Condition Tolerances	26
Table 13 : Resonance search.....	28
Table 14 : Sine vibration values.....	28
Table 15 : Random Vibration values for QM	29
Table 16 : Random Vibration values for FM.....	29
Table 17 : Workmanship Vibration test values.....	29
Table 18 : Shock test values.....	30
Table 19 : QA Checklist	34
Table 20: DPU-1 FM/QM ACTIVE COMPONENT BOM (FIM)	40
Table 21: DPU-2 FM ACTIVE COMPONENT BOM (FIM)	41
Table 22 : DPU-1 AND DPU-2 FM/QM PASSIVE COMPONENT BOM.....	42
Table 23. BOM for Test Harness (One Set)	47
Table 24 : Power Supply Requirements.....	48
Table 25 : DPU Interface Signals list.....	48
Table 26 : DPU Test Matrix for QM.....	49
Table 27 : DPU Test Matrix for FM	50

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 payloads for remote sensing satellites. 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 Digital Processing Unit (DPU) subsystem through the qualified vendors from the industry for fabrication and testing of Qualification & 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/spacecraft. In this context, the SAC, ISRO requests the Indian industries having the capability in the above field, to submit a detailed proposal for the Hi-Rel Space grade component procurement, Fabrication, PCB wiring, Assembly, Testing and Qualification of Sub-systems.

Only ISRO Space qualified vendors are allowed to participate in this tender. During the bidding and execution of this tender vendor must have a valid Qualification certificate from ISRO for fabrication of space qualified systems. Vendors, who do not have valid ISRO space qualification certificate, 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 the 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 into the system. For this purpose, the vendor shall follow all necessary guidelines for on-board fabrication practiced and recommended by 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.

Vendor shall provide point by point compliance to all sections of this RFP, with all the required supporting documents/ details/ certificates etc. For any partial compliance/non-compliance/deviation from the requirements, detailed technical justification shall be provided by the vendor. Sections of RFP not specifically referred by vendor /all required supporting documents not supplied shall be treated as "non-compliance".

1.1.1 Introduction of Digital Processing Unit (DPU)

The details of the proposed hardware to be fabricated and tested is provided in ANA2. It is requested to go through ANA2 to understand meaning of DPU, DPU-1, DPU-2 and ANA1.14.1 for model philosophy.

1.2 Scope of Work

The scope of this RFP includes Component procurement, Electronic wiring and Mechanical package fabrication, Assembly of populated digital PCB's with mechanical package, testing at various stages of fabrication and environmental testing.

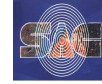
This RFP is intended for carrying out the following activities

- Components procurements as per Table 22 and Table 23 from suggested vendor.
- Wiring of Electronic components as per Table 20, Table 21 and Table 22 as per fabrication document.
- Bench Testing at various stages of fabrication as per SAC instructions
- 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 (Refer ANA1)
- Delivery of qualified Flight model subsystem

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

Table 1 : List of major Activities and responsibility

S.No.	Activity	SAC's Responsibility	Vendor's Responsibility
1.	Schematic design and layout	✓	
2.	Fabrication document details	✓	
3.	Procurement of Components as per Table 22 and Table 23		✓
4.	Mounting of CCGA/BGA/Fine Pitch components	✓	
5.	Issue of FIM as per BoM against Vendor Bank Guarantee as per Table 20/Table 21	✓	
6.	Drawings of Mechanical Jigs, Trays, Heat-sinks and packages	✓	
7.	Procurement of materials like solder wire, flux, thermal interface material (Chothem, Silver Epoxy, and H74), epoxy etc., (as per SAC R & QA guidelines, Refer ANA1) required for PCB wiring. Hardware required for mechanical assembly like fasteners, washers, PCB handing studs etc. Rugged ESD safe weather proof transportation boxes etc.		✓
8.	Fabrication of Mechanical Jigs, Trays, Heat-sinks, test fixtures and packages as per SAC approved drawings prior to wiring of the card		✓
9.	Approval of SAC for Mechanical Jigs, Trays, Heat-sinks and packages fabricated	✓	
10.	PCB Wiring and assembly (Component mounting & Testing) as per ISRO PAX 300 using SAC approved fabrication sequence		✓
11.	Mechanical assembly of wired PCB with package		✓



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.	Issue of GCU against Vendor Bank Guarantee	✓	
14.	Functional Testing using the GCU		✓
15.	Functional Test results review and acceptance	✓	
16.	Acceptance/Qualification level Environmental testing using the GCU		✓
17.	Environmental Test results review and Acceptance by SAC	✓	
18.	Packing the sub-system in rugged ESD safe boxes and Delivering the sub-system to SAC along with end item data pack.		✓

These fabrication activities are to be carried out by vendor as per ISRO qualified processes and by ISRO approved vendors, with quality control at each step, as per the ISRO approved fabrication and test documents.

Vendor should have 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 Annexure, Refer ANA1 and ANA3. The list of Passive components is provided in Table 22, in ANA2. Vendor should have controlled environment facility (refer ANA1.7) to store the procured Space Qualified components.

1.2.2 Free Issue Material List

Components as per Free Issue Materials list will be provided by SAC against Vendor submitted bank guarantee. A tentative list of components required for wiring of the PCB is provided in Table 20 & Table 21. Vendor should have controlled environment facility (refer ANA1.7) to store the FIMs issued.

1.2.3 Printed Circuit Boards (PCB)

Printed Circuit Board (PCB) for wiring will be issued as FIM to the vendor with CCGA/BGA/Fine Pitch components mentioned in Table 20 & Table 21 mounted on PCB. 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. SAC will also provide the drawings of the jigs, which are required for handling the PCBs during its wiring and testing.

1.2.5 Procurement of materials

Vendor has to procure all the material required for PCB wiring as per SAC R&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.

1.2.5.1 Material

Vendor shall ensure to use ISRO approved / qualified materials. Procurement of all the mechanical and electronic fabrication consumables and materials shall be done as per SAC Approved Declared Materials List (DML) and specifications. Vendor shall accept the procured materials from the OEMs after review of Material Test Report (MTR) & Certificate of Conformance (CoC). Non-metallic materials shall have a Total Mass Loss (TML) of less than 1% and Collectable Volatile Condensable Materials (CVCMM) of less than 0.1% when subjected to a test condition of +125°C 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. Only Space qualified Printed Circuit Boards (PCBs), approved photo mask, patterned MICs etc. shall be used during fabrication of hardware. Bare PCBs / MICs, if any, shall be procured from ISRO/ESA/MIL qualified vendor. All the materials shall be used within their shelf life. 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 weather-proof boxes, which are required for the transportation of packages to SAC.

1.2.6 Mechanical Fabrication

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

- i) Fabrication of aluminium trays and cover plates for FM & QM packages as per the design provided by SAC.
- ii) Black-anodization and Chromatization (Surface Treatment) of aluminium packages as per ISRO requirements and guidelines for ISRO certified vendors.
- iii) Jigs and mounting accessories required for fabrication and testing

Compatibility check shall be performed by the vendor to ensure the mechanical compatibility of package with the PCB.

1.2.7 Electronic Fabrication

Mounting and assembly of all components, as per the approved fabrication sequence and as per the guidelines provided in ANA1.9.1, by the ISRO certified manpower and in certified fabrication facility in accordance with ISRO-PAX-300. Minor/Any modification in the fabrication sequence, if required, may be incorporated in the fabrication sequence after vetting by SAC. Mounting of components to begin only after approval of fabrication sequence by SAC. A history sheet to 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. History sheet should be available for inspection by SAC at various stages of fabrication and testing.

It is to be noted that all the components will not be mounted in one go. Functional testing has to be carried out by the vendor at various phases of component mounting as per the fabrication and test

plan provided by SAC, before proceeding for component mounting of next phase, as per the approved fabrication plan.

1.2.8 PCB and mechanical package assembly

Mounting of PCB in its mechanical tray along with mounting of Heat Sink assemblies, has to be 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 Ground Checkout Unit (GCU)

Ground checkout units will be supplied by SAC against Vendor submitted bank guarantee. These GCUs are required for carrying out automated testing of wired PCBs at various phases. These GCUs are to be returned to SAC after completion of contract of FM/QM units.

Vendor should already possess/or purchase the standard DC Power Supply, various test instruments like Multimeter, Oscilloscope, RF Signal Generators, and RF Clock Source etc. in sufficient quantity to smoothly execute the proposed work.

Brief description of the test setup instrument along with specification is provided in Annexure – ANA2.5.

1.2.10 Preparation of harness for functional testing of sub-system

SAC will provide the details of connectors and pin details of the test harness for connecting the signals from the subsystem to GCU. Vendor needs to procure the required connectors and wires as per the SAC defined quality levels in annexure ANA2 of this RFP (Refer Table 23). Vendor has to prepare the test Harness as per the pin details provided by SAC and check the harness for continuity and correctness. Any change required in the SAC provided connection details, for whatsoever reason, will be carried out by the vendor only after prior approval from SAC.

1.2.11 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 may brief/demonstrate testing procedure using the GCU. Same procedure to be followed by vendor in various phases of testing.

1.2.12 Functional Test results review by SAC

The GCU will capture data from DUT. Vendor has to send test logs & all test data collected by GCU during all phases of testing with proper labelling. This data pack is to be submitted to SAC. Vendor has to provide any other information regarding testing procedure/results/observation etc. as demanded by SAC. SAC will review the test data and provide clearance for further process.

1.2.13 Functional/Acceptance/Qualification level testing using the GCU

1.2.13.1 Qualification Testing

The Qualification Model (QM) 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 available performance 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 of this RFP.

1.2.13.2 Acceptance Testing

All Flight Model (FM) 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 of this RFP.

1.2.14 Environmental Test results review by SAC and Acceptance by SAC

The reports generated during intermediate stages and during Environmental testing, are 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. Final acceptance of the unit will be based on test result compliance of the functional testing performed at SAC. SAC reserve the right to inspect/witness any test at any stage carried out by vendor.

1.2.15 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 weather proof boxes. All boxes are to be labelled 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.

1.2.16 Delivery of GCU and Test Harness to SAC

GCU set(s) along with test harness have to be returned to SAC after completion of contract.

1.3 Responsibilities of Vendor and SAC

Following sections describe the responsibilities of SAC and Vendor.

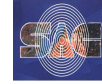
1.3.1 SAC Responsibilities

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

- a) SAC will provide the bare PCB as FIM.
- b) Approved Component Placement diagram along with component list specifying part no, circuit reference, package style, placement side, special instruction etc.
- c) Firmware Program(s) of the hardware.
- d) Ground Check-out Units (GCUs), Complete Functional Test procedure of fully wired PCB with expected result and tolerance over it
- e) SAC QA approved Mechanical package fabrication drawings, PCB & Package assembly drawing, masking drawing for surface treatment and list of accessories.
- f) Fabrication sequence of DPU with intermittent test stages wherever applicable
- g) SAC will provide the fabrication and packaging related below documents/details during fabrication activity;

1. FABRICATION RELATED

- Tinning Details
- Mounting Diagram
- Radiation Shielding Diagram/Details
- Fabrication Sequence for PCB Wiring
- Araldite Application Diagram/Details
- Component List
- Turret Location Diagram/Details
- CC Masking Diagram/Details
- Chootherm Usage Diagram/Details
- Note for Special Component Soldering



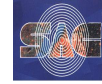
- Local Potting Diagram/Details
 - DAM Application Diagram/Details
 - Other relevant document, if any, whenever applicable
2. PACKAGING RELATED
- Mechanical Compatibility List
 - Wiring Details
 - Mechanical Assembly Diagram/Drawing
 - Fabrication Sequence for Package Integration
 - Fabrication Sequence for Box Assembly
 - Harness Details with Routing Diagram
 - Radiation Shielding Diagram for Box Wall Mounted Components
 - Radiation Shielding Diagram for Box Wall
 - Other relevant document, if any, whenever applicable

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 electronic components (as per Table 22 and Table 23) and mechanical fabrication materials including all the required consumables (which are used for electronics & mechanical realization and environmental testing) as per SAC DML.
- b) Incoming acceptance of all material/items including electronic components, PCBs and fabrication materials like solder, flux, epoxy etc.
- c) 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.
- d) Vendor shall identify a controlled environment storage area for storing the space grade components and T&E completed packages to avoid deterioration of shelf life of the components.
- e) Vendor shall entrust fabrication of the mechanical housing only after obtaining prior approval from SAC. The material to be used for enclosure / housing is Aluminium Alloy 6061 and SS-304 for the fasteners (material details and fabrication tolerances as provided in SAC provided drawings).
- f) Surface treatment of the enclosure needs to be implemented (with masking as defined in drawing), 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.
- g) 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 should be ISRO approved.
- h) Vendor to perform compatibility checks between the mechanical package, PCB and connectors before start of soldering.
- i) Populating the PCBs with all the components as per the approved layout and placement diagrams provided. The devices comprise variety of fine pitch devices that are CCGA, BGA,



Flat Pack devices, through-hole devices etc. This activity has to be carried out at a fabrication facility qualified / approved by ISRO for Flight Model fabrication work.

- j) 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 ANA2.3. 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.
- k) Assembly of PCBs in its housing (“tray”)
- l) Testing of the populated boards for compliance with the specifications as per details given.
- m) 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).
- n) Performing environmental testing including vibration, Thermovac, EMI/EMC etc. tests for DPU. The sequence and the levels for each of these tests for all the phases are provided in annexure –ANA1.
- o) Sending of test data to SAC.
- p) Generation of all the other deliverables identified in this RFP. All FM and QM DPU 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 related Information	SAC
3.	PCB fabrication	SAC
4.	Mechanical Housing Fabrication	VENDOR
5.	Submission of Bill of Material for DPU as per Table 22 and Table 23 before purchasing	VENDOR
6.	BOM clearance for DPU	SAC
7.	Procurement of components as per Table 22 and Table 23 after prior approval of SAC	VENDOR
8.	Incoming Inspection of components	VENDOR
9.	Supply of GCU, Functional test procedure, specifications with tolerance etc	SAC
10.	GCU test harness fabrication	VENDOR
11.	Compatibility Check of PCB, Connectors & mechanical tray	VENDOR
12.	CCGA/BGA/Fine Pitch Components mounting on PCB and issue of FIM	SAC
13.	Cutting and Forming of Components	VENDOR
14.	PCB wiring as per approved fabrication sequence in compliance to ISRO-PAX-300 requirements.	VENDOR
15.	Functional Testing	VENDOR
16.	Functional Test Result Review and clearance for further activity	SAC
17.	Local Potting and Conformal Coating	VENDOR
18.	Tray Assembly and cover closing	VENDOR
19.	Stacking multiple trays (if required)	VENDOR
20.	T&E approval by vendor QA	VENDOR
21.	T&E start approval by SAC.	SAC

Sr. No.	Activity	Responsibility
22.	T&E of QM and FM DPU unit	VENDOR
23.	Test Results submission to SAC	VENDOR
24.	Review of the Results	SAC
25.	Clearance for shipment	SAC
26.	Shipment of QM/FM units	VENDOR
27.	Return of GCU after SAC clearance	VENDOR

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 DPU Packages are to be delivered to SAC. Following items are to be delivered against PO:

1. Assembled, packaged and T&E completed DPUs as per the order. All FM and QM DPU 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.

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	PCB Qty	Package Type	Package Qty	Deliverable Nomenclature	Unit Rate (Rs)	Remarks
1.	Delivery of FM DPU-1 and DPU-2 (Component procurement, Fabrication and Test & Evaluation)	DPU-1 : 02 DPU-2 : 02	Type -1 package, (One DPU-1 & one DPU-2 housed in a single H-package)	02	FM DPU CONFIG-1		• Mounting of Components mentioned in Table 20 and Table 21 and Table 22 as per SAC fabrication Guidelines.

S. No	Items	PCB Qty	Package Type	Package Qty	Deliverable Nomenclature	Unit Rate (Rs)	Remarks
2.	Delivery of FM DPU-2 (Component procurement, Fabrication and Test & Evaluation)	DPU-2 : 04	Type -2 package, (Two DPU-2 housed in a single H-package)	02	FM DPU CONFIG-2		<ul style="list-style-type: none"> • Mechanical fabrication as per Mechanical drawings supplied by SAC • Test for respective units as described in ANA1.
3.	Delivery of QM DPU-1 (Component procurement, Fabrication and Test & Evaluation)	DPU-1 : 01	Type -3 package, (One DPU-1 & dummy mass housed in a single H-package)	01	QM DPU CONFIG		

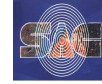
1.6 Vendor Evaluation and Selection Criteria

Only ISRO 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 Qualification Certificate, will be rejected.

It is mandatory that the vendor should have their PCB wiring and assembly facilities certified by ISRO. Vendor should have prior experience of assembly, testing and qualification of Hi-Rel Digital subsystems. Accordingly, vendor is required to submit the relevant documents along with their offer to support their claim, 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.

- Should be an Indian company with their design, fabrication and test facilities in India.
- 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, if any.
- Vendor should have sufficient technical capabilities in terms of fabrication and handling test equipment. Vendor is required to provide the details of the fabrication facilities, available test equipment like; make, brief specifications, year of procurement, number of equipment etc.
- Vendor should have a track record of procuring space components with the necessary procurement specifications, storage, and documentation. Previous purchase orders and details of storage facilities for components must be submitted.
- Vendor should have prior experience of executing similar space hardware (fabrication & testing) for any space applications. Purchase Order copies should be attached along with quote as documentary evidence.
- Vendor may choose to sub-contract to external parties after approval from SAC.



Vendor should give documentary evidence for use of third party facility like tie-up, MoU, contract or any other arrangement with third party.

Vendor has to provide explicit explanation if it is sub-contracting to third party for facilities/instruments which are available 'in-house' with vendor for execution of this contract.

- g) Vendor has to provide the complete specification of the facilities (in-house or sub-contracted) along with the compliance to the test specifications in ANA1. It is to be noted that mere compliance in vendor quotation is not sufficient. SAC will go through the specifications of the vendor facilities to arrive at conclusion whether vendor facilities are actually adequate for the test required in ANA1. Decision of SAC regarding adequacy of test facility will be final.
- h) Vendor should have adequate financial resources to execute the order with cumulative turnover greater than 30 crore over last 2 or 3 years.
- i) The responsibility of design and fabrication of required fixtures for vibration /mechanical shock test lies with Vendor.
- j) Previous experience of handling such design and vendor scope of work in execution of such contracts will also serve as a criterion for vendor evaluation.
- k) 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.

SAC decision regarding the adequacy of the vendor facilities and technical competence shall be final & binding.

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.

Commercial Offer will be evaluated for cumulative of all line items and not based on individual line item wise offers. The order cannot be split.

1.7 Delivery Schedule

A tentative schedule of milestones and delivery period is provided in the tables below. Vendor has to deliver packages as per the schedule (tentative) provided below. Please note that TQ1 and TF1 may be same or different.

Table 4 : QM Delivery Schedule

Sl. No	Milestone	Completion Time
1.	Clearance by Indenter & Issuance of FIM by SAC	TQ1
2.	Fabrication, Testing and Delivery of QM Package	TQ2 = TQ1 + 36 weeks

Table 5 : FM Delivery Schedule

Sl. No	Milestone	Completion Time
1.	Clearance by Indenter & Issuance of FIM by SAC	TF1
2.	Fabrication, Testing and Delivery of FM Package(s)	TF2 = TF1 + 24 weeks
3.	Clearance by SAC to proceed for further units	TF3 = TF2 + 3 weeks
4.	Delivery of subsequent FM Unit	One unit every 4 month after TF3

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

1.8 Payment terms

Payment will be made against delivery of individual stack/board, on pro-rata basis. Payment will be made after 45 days of acceptance of stack/board.

1.9 Termination Clause

In case the vendor undergoes insolvency or receivership, neglects or defaults or expresses inability or disinclination to honour their obligations relating to the performance of the contract or ethical standards or any other obligation that substantively affects the Purchaser's rights and benefits under the contract will amount to a breach of contract. Such defaults could include, inter-alia, default in performance and obligations, insolvency, liquidation. As soon as breach of contract is noticed a show cause notice of default shall be issued to the vendor giving two weeks' time by reserving the right to invoke contractual remedies. In the event of unsatisfactory resolution to the notice of default the Purchaser shall terminate the contract in whole or in part without any compensation to the vendor.

Such termination shall not prejudice or affect the rights and remedies which have accrued and / or shall accrue to the Purchaser. This termination shall not affect the performance of the contract to the extent not terminated and extinguish warranty obligations of the vendor for the goods already supplied.

If the contract is terminated in whole or in part, additionally, recourse may be taken to any one or more of the following actions:

- a) Temporarily withhold payments due to the vendor till recoveries due to invocation of other contractual remedies are complete.
- b) Recover payment of advances, if any, with levy of interest rate prevailing on the date of release of advance payment.
- c) Recover liquidated damages and invoke denial clause for delays.
- d) Encash and/or forfeit performance security or any other contractual securities.
- e) Initiate proceeding in a court of law for the transgression of the law, tort and loss which are not addressable by above means.

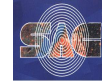
If for any unforeseen reasons the Purchaser is compelled to terminate the contract in whole or in part for its convenience, the Purchaser shall serve Notice for Determination of the Contract on the vendor indicating that the termination is for convenience of the Purchaser and the extent to which the vendor's performance is terminated with effective date for such termination. Such termination shall not prejudice or affect the rights and remedies which have accrued and / or shall accrue to the parties. Unless otherwise instructed, the vendor shall continue to perform the contract. All warranties shall survive despite the termination. Depending upon the merits of the case, the vendor may have to be suitable compensated on mutually agreed terms for terminating the contract.

1.10 Warranty terms

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

1.11 Parallel Contract[s]

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



1.12 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 as soon as possible from the time 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.

1.13 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.

1.14 Subletting Of the Contract

The vendor 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 ISRO qualified third-parties.

1.15 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 vendor shall remain the exclusive property of SAC. Vendor 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 vendor is prohibited from further utilizing or passing on any information, for 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 without explicit permission of SAC. Further, the vendor 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 confidentiality.

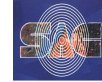
1.16 Details to be provided with the proposal

The vendor shall provide a detailed Project Execution 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 6. The vendor is encouraged to provide any relevant additional information.

Table 6 : 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.	Cumulative turnover over last 2 or 3 years	



6.	Experience of handing wiring on PCBs with CCGA/BGA devices	
7.	Employee experience to handle such design	
8.	Heritage of handing design of similar nature including full T&E cycle	
9.	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.	
10.	No. of Skilled and ISRO certified technicians for fabrication and inspection of Hi-Rel assembly work and testing	
11.	Capability of Hi-Rel fabrication and testing in terms of no. of products completed, etc.	
12.	List of in house facilities with qualification Status (Clean room facilities with area), relevant test & measurement equipment, and in-house environment test facilities etc.	

1.17 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.

1.18 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 on announced data & time. Vendors should make sure that competent technical personnel attend the same. Vendors should also be open to making presentations to SAC for explaining their proposal after bid submission, if asked for.
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 sub-contract any part of the work to other Companies, then the relevant details must be mentioned in the bid.
5. After PO, the vendor is required to submit undertaking regarding Confidentiality / Non-Disclosure Agreement (NDA) and Intellectual Property Rights (IPR).
6. SAC reserves the right to review the progress of work at any time in addition to milestones specified by the vendor.
7. The electrical and mechanical details mentioned in RFP are tentative and there may be minor variations. Final electrical and mechanical details shall be provided before clearance of unit fabrication. 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 7 : Applicable documents

ISRO-PAS-206 Issue-4, Nov 2012	Qualification requirements for Thick Film Hybrid Micro Circuits
ISRO-PAS-100 Issue-3 Nov 2012	Non-conformance control requirements for ISRO projects
ISRO-PAS-201 Issue-3 Nov 2012	Failure Reporting, Analysis and corrective Action procedures
ISRO-PAS-202 Issue-2 Aug 2014	Environmental Test Specification Requirements for ISRO Space Craft.
ISRO-PAS-207	Storage, Handling and Transportation requirements for Electronic Hardware
ISRO-PAX-300	Workmanship Standards for the Fabrication of Electronic Packages
ISRO-PAX-301 Issue-3, April 2013	Design Requirements for Printed circuit Board Layout
SAC/SRA/MQAG/T R/01/JAN/2021	Declared Material List
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 intended for on-board space use.

ANA1.3.1 Life:

- a) The unit shall meet all the fabrication requirements for use on-board spacecraft with a minimum life of 7 years.
- b) Additionally unit shall be capable of meeting all the functional requirements at various stages of spacecraft assembly and storage as follows:
 - 3 years storage and life at various levels of spacecraft assembly
 - 5 years in controlled environmental conditions.

The vendor shall inform recommended method for storage and re-test criteria, in case of longer storage.

ANA1.3.2 Operating condition for Active Components:

The electrical designs are made compliant to the SAC de-rating 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. PFM/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 10⁻⁵torr and hard vacuum of the order of 10⁻¹³torr.

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 8.

Table 8: EMI/EMC test matrix

Sr. No.	Test Description	Test Specifications	Applicability	
			QM	FM
1.	Radiated Emissions- Electric Field - (RE) 10kHz to 18GHz	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 50Hz - 1KHz: 100dBμA • 1KHz – 1MHz: 100-40dBμA • 1MHz - 50MHz: 40dBμA 	A	A

Sr. No.	Test Description	Test Specifications	Applicability	
			QM	FM
4.	Conducted Emission- Common Mode (CE-CM) – Power lines (Live and Return) (10KHz to 200MHz)	10KHz -200MHz: 60dB μ A	A	NA
5.	Conducted Emission – Time domain, Turn ON /OFF Transient (CE-Transient) CE07	<ul style="list-style-type: none"> • 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-1)	<ul style="list-style-type: none"> • For QM: <ul style="list-style-type: none"> ➤ Epeak= Bus voltage +100% of bus voltage i.e. 42V +42V=84V ➤ Pulse width:10uS \pm 20% ➤ Repetition rate: 10PPS ➤ Duration: 5- 15 minutes 	A	NA
9.	Conducted Susceptibility- Bulk Cable Injection, only on Power leads (CS-BCI-CW)	10KHz - 200MHz: 84dB μ A	A	NA

Sr. No.	Test Description	Test Specifications	Applicability	
			QM	FM
	CS114 (10KHz to 200MHz) (Note-2)			
10.	Conducted Susceptibility Test (CS115- Bulk Cable Injection, Impulse Excitation) (Note-2)	5A, 30nS transient pulse with 2nS rise and fall time, at the rate of 30Hz for one minute.	A	NA
11.	Conducted Susceptibility Test (CS116- Damped Sinusoidal Transients) (Note-2)	10kHz-1MHz: 0.01A- 10A 1MHz-30 MHz: 10A 30MHz-100MHz:10A-2A	A	NA
12.	Radiated Susceptibility- Electric Field (RS) Sweep frequency mode (CW)	<ul style="list-style-type: none"> • 50MHz -18GHz • E-field (V/m) QM: 5V/m 	A	NA
13.	Radiated Susceptibility- Electric Field (RS) Spot frequency mode	<ul style="list-style-type: none"> • Spot frequency mode (discrete): Details will be provided at the time of test • On-board spot frequencies and applicable electric field levels E-field (V/m) QM= 20V/m E-field (V/m) FM= 5V/m 	A	A
14.	ESD- Radiated Field Test	discharge voltage of 7 kV (1 discharge/sec, 30 discharges)	A	NA
15.	ESD- Single Point Discharge Test	discharge voltage of 5 kV (1 discharge/sec, 30 discharges)	A	NA
16.	ESD- Structural Current Test	discharge voltage of 5 kV (1 discharge/sec, 30 discharges)	A	NA

Legend:

A -> Applicable

NA -> Not Applicable

Note-1: Maximum rating of input components of DC-DC converter shall be verified before applying the 42V spike.

Note-2: 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.

CS-06 test to be tailored for Proto flight package 8V spikes (10µsec & 10pps) on maximum raw bus supply to be injected for Proto flight model.

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

Refer Table 20, Table 21 and Table 22 for individual parts specifications.

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 including batch acceptance report of PCB / MIC. (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.

- Material designation
- Material details (i.e. Heat Treatment, Finish, Mix ratio, Cure Time etc.)
- Applied specification, conditions
- Manufacturer and/or Vendor name,
- Application area in UNITS
- 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

Selection:

Vendor shall ensure to use of ISRO approved / qualified materials. Procurement of all the mechanical and electronic fabrication materials shall be in accordance with ISRO Approved Materials List (AML) given in document No. SAC/QACMG/MQAD/GEN/05/ APRIL-2012 followed by incoming acceptance. 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. Any other materials, which are not available in SAC DML, shall first be qualified & cleared by SAC prior to their use.

Acceptance:

Vendor shall review compliance of Material Test Report (MTR) & CoC of the manufacturer. 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 +125°C and 1×10^{-6} torr pressure for 24 hours. If CoC contains outgassing parameters or refers to data sheet compliance which in turn contains TML/CVCM, then separate test not required. All inspection and clearance records for the materials shall be maintained by the vendor.

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. Pure tin-plated (greater than 97% purity) items are not allowed due to inherent risk of tin-whisker growth.

On receipt of the material, all information inclusive of CoC, Reports and vendor's verification shall be shared with SAC for review and final approval.

Storage & Usage:

All the materials shall be stored as per manufacturer's recommendation. These shall be mandatorily used within their shelf life.

Bare PCB / Duroid / MIC Substrates / Plated / Painted Parts Procurement and Acceptance

Vendor shall procure / use only SAC/ISRO space qualified PCBs/patterned MICs/Duroid circuits/plated/painted parts etc. and subject these to SAC/ISRO acceptance plan prior to FM hardware realization.

Witness samples shall be prepared for all fabricated batches/lots of Bare PCBs / Duroid / MIC Substrates Plated / Painted mechanical parts. Batch Acceptance testing shall be carried out by

SAC-QA approved test plans. Only items from accepted batches will be cleared for use in FM fabrication. QC shall visually examine the actual parts/components at 100% basis and the same shall be cleared based on acceptance/test results of witness sample.

Any non-conformances 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.

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 bare dice and oxygen sensitive items like PCBs / mechanical hardware.

ANA1.8 Processes

Vendor shall have own line / facility qualified as per ISRO-PAX-300/305/206, whichever applicable, for electronic fabrication & assembly, wiring along with ISRO certified operators & inspectors.

ISRO-PAX-300/ISRO-PAX-305/ISRO-PAS-206 workmanship standards shall be followed for the fabrication work for PCB/MIC/HMC respectively.

All electronic fabrication processes to be used for FM hardware realization shall be ISRO space qualified. Similarly, the processes used for surface treatment of the box like plating and coating in realizing the hardware shall also be ISRO space qualified. All the processes shall be carried out in accordance with PIDs reviewed by 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 space agencies other than SAC, process qualification reports shall be submitted to 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 SAC.

Process qualification should have a validity throughout the contract period. In case of expiry of certification within contract tenure, vendor shall get him re-certified without proceeding for further work.

In case any delta qualification is required during the tenure of contract, the same shall be executed by vendor as per SAC approved qualification plan.

The vendor shall provide the list of activities carried out by their sub-contractors (if any) along with the qualification status of the processes concerned, with intimation to SAC for all such cases prior to sub-contracting.

Fabrication work shall be carried out on ISRO space qualified fabrication line by ISRO certified operators. In case, where consistent poor workmanship is observed, Verification of the Process Qualification (VOQ) / operator re-certification shall be carried out at the discretion of SAC.

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, 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 wiring and assembly activity, a generalized fabrication sequence / flowchart detailing each step of fabrication, functional verification stages, QC and QA inspection/audit etc. 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. The fabrication / assembly flowchart shall include the following minimum:

- 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 instructions, if any
- f) Permanent/Temporary torque values.
- g) Fabrication alerts/Specific instructions, caution notes etc, if any.
- h) Potting/Dam-fill requirement for components
- 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

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.

ANA1.10 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-conformances 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 by QA/ SAC from both electronic & mechanical point of view at vendor along with qualified sub-contractor 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,
 - a) Bare PCB, as applicable
 - b) Machined package/ cover etc.
 - c) Surface finishing (plating / painting)
 - d) Wired Substrate / PCB
 - e) Packaging & fixing of cards/ substrates/ connectors & internal harness
 - f) Audit for integrated package level.
 - g) 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 9, by assigning a unique serial number on the exterior surface of the package by a suitable process applicable for space use. Marking shall not degrade the performance and quality of the unit. The connector numbers are to be marked at the relevant places as per the mechanical drawing.

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. The marking method to demonstrate the same shall be specified by the manufacturer. In addition to functional markings like input / output, frequency etc. following marking shall appear on each unit.

Table 9 : Units Identification marking

Sl. No.	DPU-T-MM-ZZ-WWYY	Unit Name	DPU
---------	------------------	-----------	-----

WO. No.	<Numeric PO No>\<Work Order Serial No>	PCB QCR No.	
Name of the Manufacturer			
Date of Manufacture			

Serial Number Decoding : DPU-T-MM-YYWW-ZZ

Where

T : Type (1/2)

MM : Model (QM/FM)

ZZ : Sr. No. (01 to 99)

WWYY : Week no of the year (01 to 52) and Year (24 to 29) (e.g. WWYY : 1224)

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 electronics design of the QM unit shall be same as that for the FM units. Materials, parts, and component to be used will be same as 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.

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 DPU units 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 tolerances in the environmental level severity for the test to be performed on different units should be as listed in the following **Table 12**.

Table 10 : Test Applicability

Model Type	Levels	Remarks
QM	Qualification	As per Table 11(one QM unit)
FM	Acceptance	As per Table 11(All FM units)

DPU shall be tested in accordance with Table 11 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	✓	✓
12.	Workmanship level Vibration	-	-
13.	Sine Vibration	✓	✓
14.	Random Vibration	✓	✓
15.	Thermo-Vacuum test	✓	✓
16.	Mechanical Shock	✓	-
17.	ESD test	✓	-
18.	Life Test	✓	-
19.	Final Bench Tests (FBT)	✓	✓
20.	Final Visual inspection	✓	✓

Notes:

- Sr No. 1 to 5 are at tray level only. After Sr no. 5, package assembly will take place. Sr No. 6 onwards are at integrated package level.
- Level of Vibration tests for QM/FM units will be decided before respective unit's vibration test.
- At the end of each environmental / mechanical test and electrical performance check shall be carried out.
- 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 design 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. Vendor is required to generate test procedure, clearly showing test set-up and connection details including groundings. This test procedure shall be sent to SAC for review & clearance. Testing shall be done as per SAC approved test procedure using calibrated test & measuring instruments. It is preferred that cable types used by the vendor for harnessing during testing shall be similar or very close to cable type 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.

It is to be noted that test mentioned subsequently are derived from general test philosophy for satellite systems. **Actual levels for each test may change depending upon the project ETLs, which will be communicated to vendor at appropriate stage of execution of contract. This is applicable for the severity levels of all types of tests.**

(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 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 Below 0.1 Torr	±5% ±50%
Relative Humidity	±5%
Acceleration	±10%
Vibration Frequency	±2% above 25 Hz 0.5 Hz below 25 Hz
Sine Vibration Amplitude	±10%
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)	$\pm 10\%$
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 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 (Pre-Cap) :

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 the pre-cap 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 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 critical parameters, 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/FM units. 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 unit as per the following conditions:

Humidity : 95 % RH
Temperature : 40 °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 Table 8. 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/FM 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 :

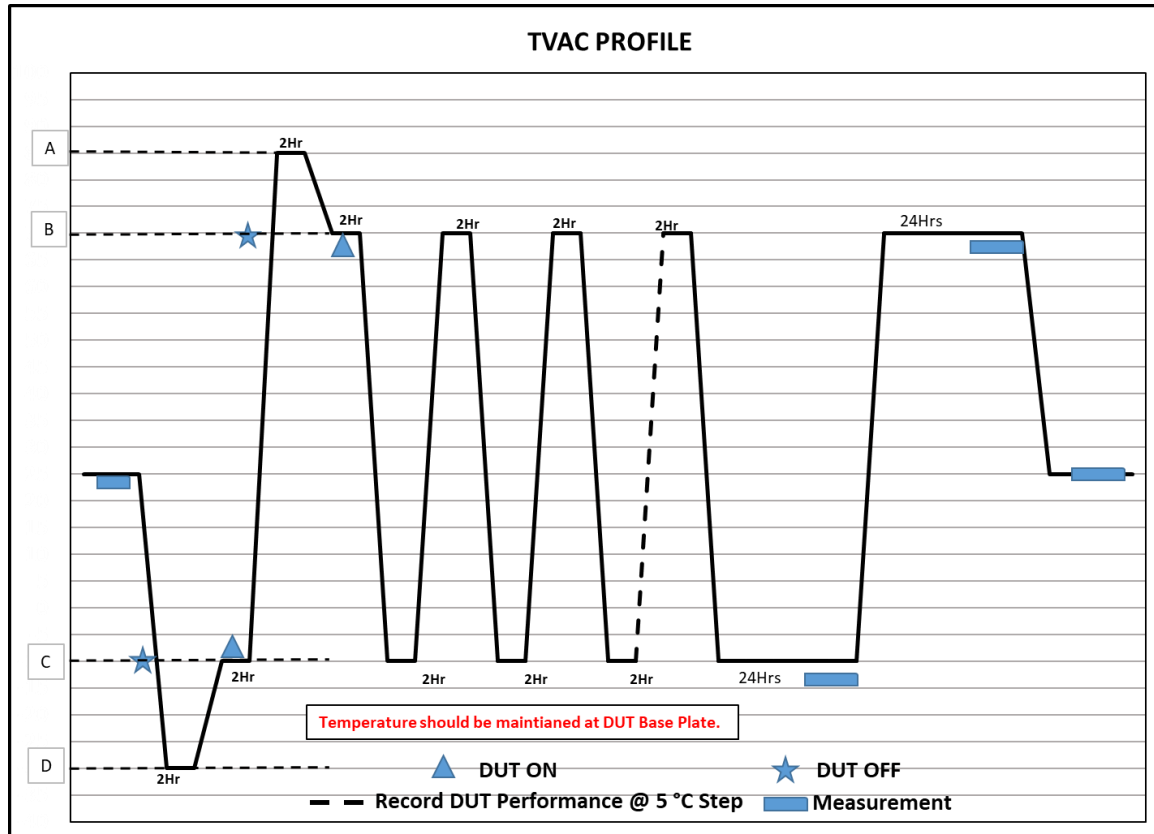
- It shall be ensured that the parameters of the thermo vacuum chamber i.e. temperature, air pressure measuring device, etc are properly calibrated prior to the start of the test.
- It should be ensured that the temperature sensors are mounted at pre-determined locations for monitoring base plate and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

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. Actual test levels & temperature profile will be provided at time actual test.

Model	A	B	C	D
QM/PFM	-30°C	55°C	-15°C	60°C
FM	-30°C	50°C	-10°C	60°C



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. The shock test will be conducted only after clearance for conducting such test is received from SAC.

Table 18 : Shock test values

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

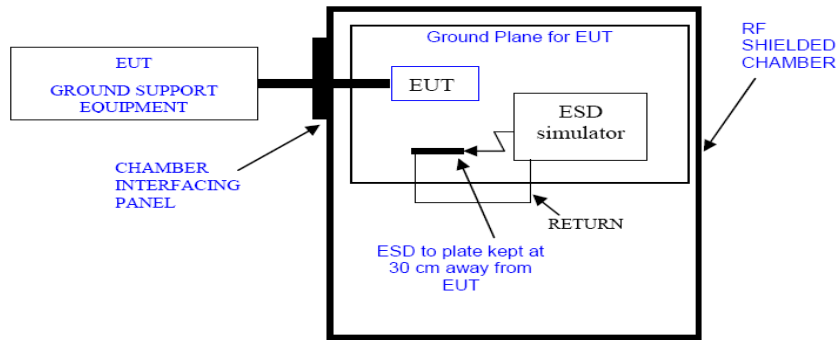
(Levels are tentative)

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

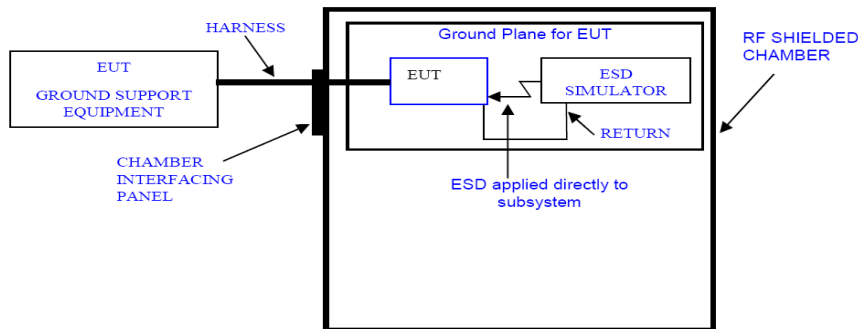
ANA1.15.1.13.1 Radiated field Test

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.



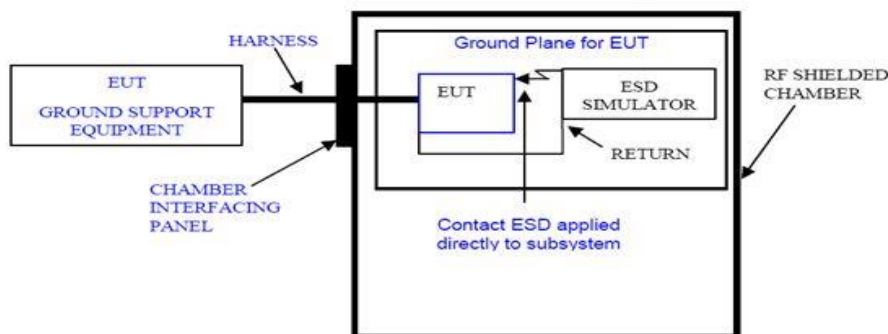
ANA1.15.1.13.2 Single point Discharge Test

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/full document.
- b) Details to be provided as per QA check list given in Annexure- ANA1.18.5.

ANA1.18.2 Documents 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 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 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 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.

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 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 (if available with vendor)	
	d) Details of other ISRO qualified processes available (if any)	
6	Details of ISRO certified fabricator and Inspector for PCB wiring and assembly as per ISRO-PAX-300	
7	Location of test facilities likely to be used for following tests shall be provided (whichever applicable).	
	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	

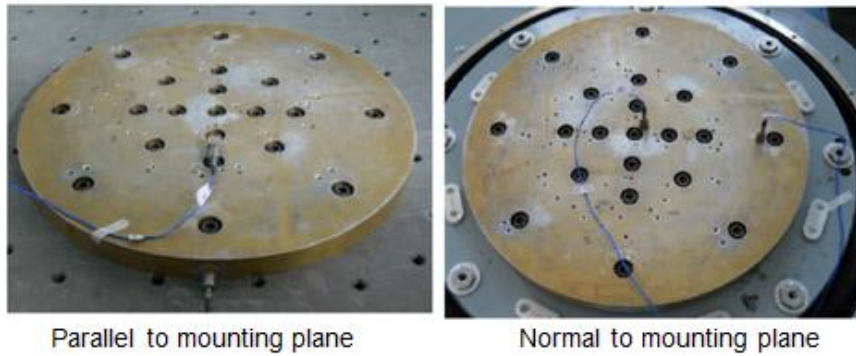
Company Logo	Name & Address of Company/Industry
REPORT No.	DATE

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

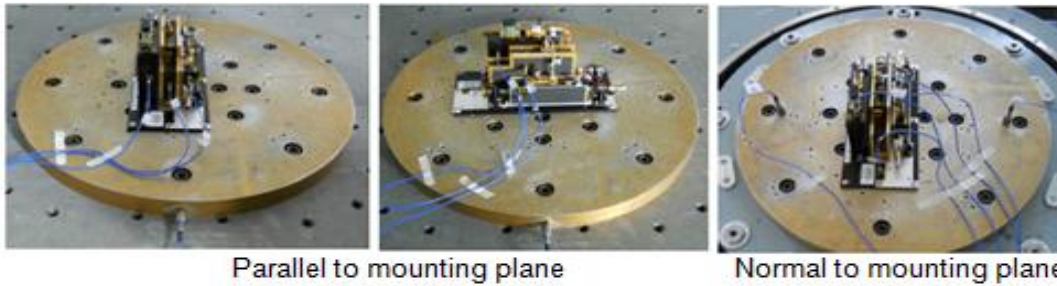
ISRO Specification Number
Subsystem
Sub Assembly details
Customer Part No
Model No
Serial No
Model
Weight
Test start date & Test End date
Drawing No. and T & E clearance certificate no with date :
Vibration Test Equipment & calibration details:

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

Fixture Characterization in LLS



Subsystem during Vibration test in each Axis



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			

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 Digital DPU-1 & DPU-2 Card

The Digital Processing Unit (DPU) is a multi-function processing unit designed by MSDG/MRSA/SAC used across various projects. It interfaces with the On Board Bus Management Unit (BMU)/NGCE to interpret all the Telecommands issued by ground segment and sets the different payload parameters according to these Telecommands. It also generates ON&OFF pulses and all timing signals required by other subsystems of the payload. The DPU card is based on the FPGA(s) (Xilinx Virtex-5), MRAM, RTIMS, SDRAM and DDC MIL-STD-1553 chip as major components. It buffers all the timing and control signals. It transmits and receives differential and level signals. Wherever DPU is referred, it refers to both DPU-1 and DPU-2 variants as mentioned in next paragraph.

The DPU PCB has approx. dimensions of 334 x 288 x 2.3 mm having all electrical interfaces through High Density D Type and/or combo RF connectors.

There are two flavours of DPU; DPU- 1 and DPU-2. Both will have the same PCB, but will be different in the sense that in DPU-2, some less components will be mounted on PCB as compared to DPU-1 (Refer Table 20 and Table 21). The package and card assembly configuration would be as per ANA2.6. The approximate dimension of the package is 316mm x 256mm x 66.2 (41.1) mm. The drawing of the package/tray will be provided by SAC. The figures below shows a glimpse of a similar hardware developed in house. It is to be noted that the figures below are just to provide the vendor with an estimate of the type and complexity of hardware envisaged for development. The hardware developed through this RFP may or may not have same appearance.

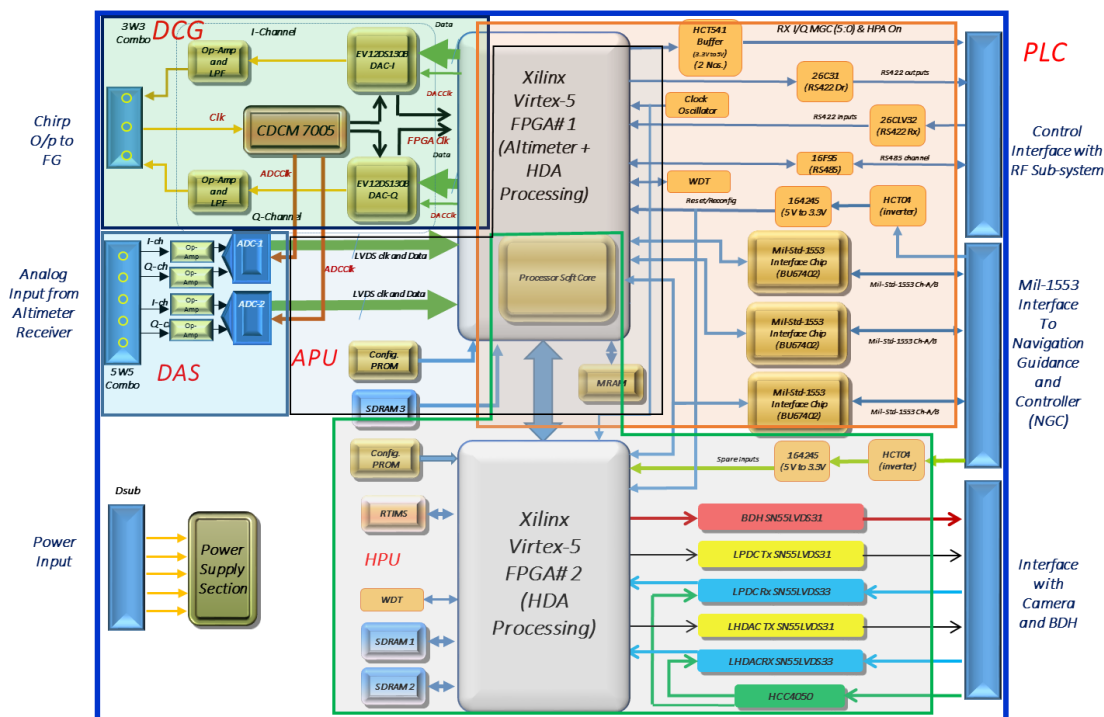


Figure 1. Block schematic of DPU



Figure 2. Top and Bottom views of the DPU PCB, PCB in Housing



DPU-1, DPU-2 stacked as H Package (Type-1/Type-2/Type-3)

Figure 3. PCB Package; Top and Bottom View

ANA2.1 Bill of Materials (BoM) for DPU Card

Following is the list of tentative components used in the DPU card. The final component list may vary slightly with respect to type and quantities. The final component list will be issued along with clearance of FM/QM fabrication activity.

Components in Table 20/ Table 21 will be issued, as Free Issue Material (FIM) against Bank Guarantee (BG). Additionally, one EPC hardware (subject to availability) may be issued, as FIM against BG, which is to be used during the environmental testing of DPU Package, in place of external power supplies. Ground Checkout Units (GCU) for functional and environmental testing will be issued as FIM against BG.

Vendor has to collect 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).

Bank Guarantee Amount for FIM:

S.No.	FIM Item	Amount
1.	FIM (one set) for FM DPU CONFIG -1	6.6 Crore
2.	FIM (one set) for FM DPU CONFIG -2	5.6 Crore
3.	FIM (one set) for QM DPU CONFIG	2.1 Crore
4.	FIM (one set) for GCU Unit	1 Cr

5.	FM EPC unit	70 Lacs
----	-------------	---------

The bank guarantee amount has to be submitted by the vendor as per the work order clearance given by Indenter for fabrication of number of FM or QM units.

Following is the tentative list of active (Table 20 and Table 21) & passive (Table 22) components used in the DPU card.

Components in Table 20 and Table 21 will be issued by SAC as FIM against Bank Guarantee. Components in Table 22 and Table 23 are to be procured by vendor from authorized supplier only. Sufficient margin should be taken by vendor in component procurement to account for minor component failure (parts failure or workmanship damage), based on their past experience such that vendor has sufficient buffer stock to handle such exigencies.

The parts for FM/QM units are to be used as per SAC BOM. Any change in BOM for QM/FM will be done in consultation with SAC. Vendor should inform SAC before generating any indent and need to take R&QA requirements from SAC for the items included in indent.

Table 20: DPU-1 FM/QM ACTIVE COMPONENT BOM (FIM)

This list of active components is per card.

Sr. No.	Package Style	Part Type / Description	Procurement Specifications	Make / Supplier	Part No. for FM Board	Part No. for QM Board	Special Requirement (LP/RS/HS/DF etc.)	Qty
1	----	PCB	----	HIQ	----	----	----	1
2	DIP/HMC 20	Buck Converter HMC-20	-	Centum	CTM8619D1103-FM	CTM8619D1103-DVM	Mounting as per defined procedure	5
3	LCCC 14	Differential Amplifier	MIL-PRF-38535	Texas Instruments	LMH5401 LCC 14 QML V (5962R1721401VXC)	LMH5401FFK/EM	----	6
4	CCGA 255	12-BIT DAC	Space Grade	E2V	EV12DS130BMGC-V CCGA 255 QML V (5962-1522202VZF)	EV12DS130BMGC	----	2
5	376 pin CCGA	ADC12D1600 CCMLS	MIL-STD-883	Space Grade	ADC12D1600CCMLS CCGA 376	ADC12D1600C CMPR CCGA 376	----	2
6	CQFP76	MRAM	MIL-PRF-38535	HONEYWELL	HXNV01600AVH QMLV (5962H1321201VXC)	HXNV01600AEN	Use Choutherm 10/15 MIL	1
7	CFP8	Watchdog Timer	MIL-PRF-38535	Intersil	ISL706AEHVF (5962R1121310VXC) FP 8 QML V	ISL706ARHF/P ROTO	----	1
8	CFP36	MIL-STD-1553 Transceiver/Transformer	MIL-STD-1553	DDC	BU-67402F80KL-431L (5962-1322502KXC)	BU-67402F80HL-100	Use Choutherm 10/15 MIL	1
9	CQFP-F52	Clock Synchronizer & Clock Cleaner	MIL-PRF-38535	Texas Instruments	CDCM7005MHFG-V (5962-0723001VXC)	CDCM7005HFG/EM	Silver Epoxy to be apply.	1
10	CCGA 1760	Virtex5 FPGA	MIL-PRF-38535	Xilinx	XQR5VFX130-1CN1752V4382 CGA1752 QMLV	XC5VFX130T-1FF1738C/ XC5VFX130T-1FF1738I	----	2

11	FP14	Hex Inverter	ESC C 9409/ 005/0 1	Inters il	HCC40106BKG (ESCC 9409/005/01)	HCC40106BKG (ESCC 9409/005/01)	----	2
12	CFP16	LINE DRIVER	MIL- PRF- 3853 5-V	Texas Instru ments	SNV55LVDS31 W (5962-9762101VFA)	SNV55LVDS31 W (5962- 9762101VFA)	----	4
13	FP38	RTIMS_FLAS H_MEMORY	ESA (PID 3300 - 0546)	3D Plus	3DSS48G08VS3772IS	3DSS48G08VS3 772IB	H74 material to be fill.	1
14	CFP48	16 bit Level Translator	MIL- PRF- 3853 5	STM	RHRAC164245K01V (5962R9858008VYC)	RHRAC164245 K01V (5962R9858008 VYC)	----	1
15	CFP16	Line Receiver	MIL- PRF- 3853 5-V	Texas Instru ments	SN55LVDS33 (5962- 0724801VFA)	SN55LVDS33 (5962- 0724801VFA)	----	2
16	CFP54	SDRAM	ESA (PID 3300 - 0546)	3D Plus	3DSD2G08VS4686SS	3DSD2G08VS46 86IB	H74 material to be fill.	2
17	FP16	BUFFER	ESC C 9202/ 046	STM	HCC4050BK (ESCC 920204601FR)	HCC4050BK (ESCC 920204601FR)	----	2
18	CFP20	OCTAL BUFFER	MIL- PRF- 3853 5	Inters il	HCTS541KMSR (5962R9575101VXC)	HCTS541KMSR (5962R9575101 VXC)	----	2
19	OSC11 57_7X 5MM	+3.3V, 4 Pin SMD Oscillator	MIL- PRF- 5531 0	QTE CH	MCM8557-1M 12.000 MHz	MCM8557-1M 12.000 MHz/EM	----	1
20	OSC11 57_7X 5MM	+3.3V, 4 Pin SMD Oscillator	MIL- PRF- 5531 0	QTE CH	MCM8557-4M 52.500 MHz	MCM8557-4M 52.500 MHz/EM	----	1
21	CFP11 2	MRAM	MIL- PRF- 3853 5	HON EYW ELL	HXNV06400BWH FP 112 QML Q (5962H1423001QXC)	HXNV06400BE N	Use Choutherm 10/15 MIL	2

Table 21: DPU-2 FM ACTIVE COMPONENT BOM (FIM)

This list of active components is per card.

S r. N o.	Package Style	Part Type / Description	Procur ement Specifi cations	Make / Supplier	Part No. for FM Board	Special Requirement (LP/RS/HS/DF etc.)	Q ty
1	----	PCB	----	HIQ	----	----	1
2	DIP/HMC 20	Buck Converter HMC-20	-	Centum	CTM8619D1103-FM	Mounting as per defined procedure	4
3	CQFP76	MRAM	MIL- PRF- 38535	HONE YWEL L	HXNV01600AVH QMLV (5962H1321201VXC)	Use Choutherm 10/15 MIL	1

4	CFP8	Watchdog Timer	MIL-PRF-38535	Intersil	ISL706AEHVF (5962R1121310VXC) FP 8 QML V	----	1
5	CFP36	MIL-STD-1553 Transceiver/Transformer	MIL-STD-1553	DDC	BU-67402F80KL-431L (5962-1322502KXC)	Use Choutherm 10/15 MIL	1
6	CCGA1760	Virtex5 FPGA	MIL-PRF-38535	Xilinx	XQR5VFX130-1CN1752V4382 CGA1752 QMLV	----	2
7	FP14	Hex Inverter	ESCC 9409/005/01	Intersil	HCC40106BKG (ESCC 9409/005/01)	----	2
8	CFP16	LINE DRIVER	MIL-PRF-38535-V	Texas Instruments	SNV55LVDS31 W (5962-9762101VFA)	----	3
9	FP38	RTIMS_FLASH_MEMORY	ESA (PID 3300-0546)	3D Plus	3DSS48G08VS3772IS	H74 material to be fill.	1
10	CFP48	16 bit Level Translator	MIL-PRF-38535	STM	RHRAC164245K01V (5962R9858008VYC)	----	1
11	CFP16	Line Receiver	MIL-PRF-38535-V	Texas Instruments	SN55LVDS33 (5962-0724801VFA)	----	2
12	CFP54	SDRAM	ESA (PID 3300-0546)	3D Plus	3DSD2G08VS4686SS	H74 material to be fill.	2
13	FP16	BUFFER	ESCC 9202/046	STM	HCC4050BK (ESCC 920204601FR)	----	2
14	CFP20	OCTAL BUFFER	MIL-PRF-38535	Intersil	HCTS541KMSR (5962R9575101VXC)	----	2
15	OSC1157_7X5MM	4 Pin SMD Oscillator	MIL-PRF-55310	QTECH	MCM8557-1M 12.000 MHz	----	1
16	OSC1157_7X5MM	4 Pin SMD Oscillator	MIL-PRF-55310	QTECH	MCM8557-4M 52.500 MHz	----	1
17	CFP112	MRAM	MIL-PRF-38535	HONEYWELL	HXNV06400BWH FP 112 QML Q (5962H1423001QXC)	Use Choutherm 10/15 MIL	2

Table 22 : DPU-1 AND DPU-2 FM/QM PASSIVE COMPONENT BOM (Non-FIM)

This list of passive components is per card.

Sr. No.	Package Style	Part Type / Description	Part Value/Rating	Tolerance	Make / Supplier	Procurement Specifications for FM and QM Board (Component Quality to be used in FM and QM Board)	Qty
1	CAP0603	Chip Capacitor	0.01uF/100V	10.00%	Exxellia	ESA Qualified	162
2	CAP0603	Chip Capacitor	100pF/100V	10.00%	Presidio	GSFC Qualified	136
3	CWR19/29E	Chip Capacitor	10uF/15V	10.00%	KEMET/AVX/Vishay	MIL-PRF-55681	33

4	CAP0603	Chip Capacitor	0.1uF/25V	10.00%	SPUR SEMICON	ESA Qualified	121
5	CKS51/CDR31	Chip Capacitor	220pF/50V	10.00%	Kemet/AVX/Vishay	MIL-PRF-55681	18
6	CWR19/29H	Chip Capacitor	220uF/10V	10.00%	KEMET/AVX/Vishay	MIL-PRF-55681	4
7	CDR12A	Chip Capacitor	1.8pF/150V	10.00%	Kemet/AVX/Vishay	MIL-PRF-55681	2
8	CDR12A	Chip Capacitor	4.7pF/150V	10.00%	Kemet/AVX/Vishay	MIL-PRF-55681	2
9	CAP0603	Chip Capacitor	1000pF/100V	10.00%	Presidio	GSFC Qualified	7
10	CDR12A	Chip Capacitor	18pF/150V	10.00%	Kemet/AVX/Vishay	MIL-PRF-55681	2
11	CDR12A	Chip Capacitor	15pF/150V	10.00%	Kemet/AVX/Vishay	MIL-PRF-55681	2
12	CDR12A	Chip Capacitor	6.2pF/150V	10.00%	Kemet/AVX/Vishay	MIL-PRF-55681	2
13	CDR12A	Chip Capacitor	2.7pF/150V	10.00%	Kemet/AVX/Vishay	MIL-PRF-55681	2
14	CDR12A	Chip Capacitor	1.2pF/150V	10.00%	Kemet/AVX/Vishay	MIL-PRF-55681	2
15	CKS51/CDR31	Chip Capacitor	0.01uF/50V	10.00%	Kemet/AVX/Vishay	MIL-PRF-55681	72
16	CDR12A	Chip Capacitor	TBD/150V	10.00%	Kemet/AVX/Vishay	MIL-PRF-55681	2
17	TES_E_7343	Tantalum Chip Capacitor	33uF/35V	10.00%	AVX	ESCC 3012/004	4
18	TES_E_7343	Tantalum Chip Capacitor	330uF/10V	10.00%	AVX	ESCC 3012/004	6
19	CKS54	Chip Capacitor	1uF/15V	10.00%	Kemet/AVX/Vishay	MIL-PRF-55681	12
20	CKS51/CDR31	Chip Capacitor	DNM/0.01uF/50V	10.00%	Kemet/AVX/Vishay	MIL-PRF-55681	1
21	CKS51/CDR31	Chip Capacitor	DNM/50V	10.00%	Kemet/AVX/Vishay	MIL-PRF-55681	4
22	SESI14/15SR	Chip Inductor	4.9uH/6A	20.00%	EXXELIA TECHNOLOGIES	ESCC 3201/009	6
23	SESI14/15SR	Chip Inductor	21uH/2.9A	20.00%	EXXELIA TECHNOLOGIES	ESCC 3201/009	2

24	CHIP_IN DUCTOR MPCI_1 0000	Chip Induct or	33nH/0.64A	5.00 %	Microspir e	M83446/5	4
25	CHIP_IN DUCTOR MPCI_1 0000	Chip Induct or	39nH/0.6A	5.00 %	Microspir e	M83446/5	2
26	CHIP_IN DUCTOR MPCI_1 0000	Chip Induct or	TBD	5.00 %	Microspir e	M83446/5	1
27	RM0705	Chip Resist or	10K/150mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	53
28	RM0705	Chip Resist or	8.2K/150mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	1
29	RM0705	Chip Resist or	51.1K/150mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	2
30	RM0705	Chip Resist or	DNM/150mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	10
31	RM0705	Chip Resist or	4.7K/150mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	43
32	RM0705	Chip Resist or	TBD/150mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	23
33	RM0705	Chip Resist or	500E/150mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	8
34	RM0402	Chip Resist or	OPEN/TBD/250mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	4
35	RM0402	Chip Resist or	75E/250mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	4
36	RM0402	Chip Resist or	100E/250mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	8
37	RM0402	Chip Resist or	TBD/240E/250mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	4
38	RM0402	Chip Resist or	39.2E/250mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	12
39	RM0402	Chip Resist or	49.9E/250mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	2
40	RM0402	Chip Resist or	121E/250mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	4
41	RM0402	Chip Resist or	150E/250mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	8
42	RM0402	Chip Resist or	TBD/100E/250mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	4
43	RM0402	Chip Resist or	TBD/200E/250mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	8
44	RM0705	Chip Resist or	3.3K/150mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	20

45	RM0705	Chip Resistor	TBD/1K//150mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	4
46	RM0705	Chip Resistor	0E/150mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	8
47	RM0705	Chip Resistor	2.2K/150mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	8
48	RM0705	Chip Resistor	100K/150mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	16
49	RM0705	Chip Resistor	8.25K/150mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	2
50	RM0705	Chip Resistor	TBD/8.25K/150mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	1
51	RM0705	Chip Resistor	OPEN/150mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	2
52	RM0705	Chip Resistor	TBD/1K/150mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	1
53	RM0705	Chip Resistor	1K/150mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	67
54	RM0705	Chip Resistor	DNM/10K/150mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	4
55	RM0705	Chip Resistor	DNM/1K/150mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	3
56	RM0705	Chip Resistor	82E/150mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	2
57	RM0705	Chip Resistor	130E/150mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	2
58	RM0705	Chip Resistor	221E/150mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	27
59	RM0705	Chip Resistor	50E/150mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	1
60	RM0705	Chip Resistor	100E/150mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	67
61	RM0705	Chip Resistor	22E/150mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	22
62	RM0705	Chip Resistor	150E/150mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	10
63	RM0705	Chip Resistor	39.2K/150mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	2
64	RM0705	Chip Resistor	TBD/39.2K/150mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	2
65	RM0705	Chip Resistor	10E/150mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	1
66	RM0705	Chip Resistor	39E/150mW	1.00 %	Vishay/M SI/SOTA	MIL-PRF-55342	144

67	RM0705	Chip Resistor	5.1K/150mW	1.00 %	Vishay/MSI/SOTA	MIL-PRF-55342	1
68	RM0705	Chip Resistor	330E/150mW	1.00 %	Vishay/MSI/SOTA	MIL-PRF-55342	6
69	RM0705	Chip Resistor	SMD PAD/150mW	1.00 %	Vishay/MSI/SOTA	MIL-PRF-55342	2
70	RM0705	Chip Resistor	1K2/150mW	1.00 %	Vishay/MSI/SOTA	MIL-PRF-55342	6
71	RM0705	Chip Resistor	18E(TBC)/150mW	1.00 %	Vishay/MSI/SOTA	MIL-PRF-55342	1
72	RM0705	Chip Resistor	56E/150mW	1.00 %	Vishay/MSI/SOTA	MIL-PRF-55342	12
73	RM0705	Chip Resistor	47.5E/150mW	1.00 %	Vishay/MSI/SOTA	MIL-PRF-55342	8
74	RM0705	Chip Resistor	221K/150mW	1.00 %	Vishay/MSI/SOTA	MIL-PRF-55342	2
75	RM0705	Chip Resistor	22.1K/150mW	1.00 %	Vishay/MSI/SOTA	MIL-PRF-55342	2
76	RM0402	Chip Resistor	TBD/250mW	1.00 %	Vishay/MSI/SOTA	MIL-PRF-55342	6
77	RWR81	Leaded Resistor	TBD_1W/1W	1.00 %	VISHAY	MIL-PRF-39007	4
Connectors & Savers							
78	5W5_CO MBO_CON_FEMALE	Combo Connector	DBM 115366-2843-C & K 90 DEG COMBO (5W5)	N.A.	C&K	DBM 115366-2843-C & K 90 DEG COMBO (5W5) (ESCC 3401/005)	1
79	D TYPE 25PIN_RA_MALE CON	D-Type Connector	340100101BDBM25PNMBFR168-ISS8	N.A.	C&K	340100101BDBM25PNMBFR168-ISS8 (ESCC 3401/003)	1
80	D TYPE 50PIN_RA_MALE CON	D-Type Connector	340100101BDDM50PNMBFR168-ISS8	N.A.	C&K	340100101BDDM50PNMBFR168-ISS8 (ESCC 3401/001)	1
81	D TYPE 78PIN_RA_FEMALE_CON	D-Type Connector	340100102BDDM78SNMB1D0N	N.A.	C&K	340100102BDDM78SNMB1D0N (ESCC 3401/001)	1
82	D TYPE 50PIN_RA_FEMALE CON	D-Type Connector	DDM-115366-2220-CDRI-07006	N.A.	C&K	DDM-115366-2220-CDRI-07006 (ESCC 3401/002)	1
83	3W3_CO MBO_CON_FEMALE	Combo Connector	DAM 115366-2841-C & K 90 DEG COMBO (3W3)	N.A.	C&K	DAM 115366-2841-C & K 90 DEG COMBO (3W3) (ESCC 3401/004)	1
84	5W5 SAVER	Combo Connector	DBBM 5W5PS NMB FR022 (saver 5W5 combo)	N.A.	C&K	DBBM 5W5PS NMB FR022 (saver 5W5 combo)	1

		ector Saver					
85	25 PIN SAVER	D-type Connector Saver	340102001BDBBMA 25PS NMB (D Saver 25 Pin)	N.A	C&K	340102001BDBBMA 25PS NMB (D Saver 25 Pin)	1
86	50 PIN SAVER	D-type Connector Saver	340102001BDBBMA 50PS NMB (D Saver 50 Pin)	N.A	C&K	340102001BDBBMA 50PS NMB (D Saver 50 Pin)	2
87	78 PIN SAVER	D-type Connector Saver	340102002B DDBMA 78PS NMB (D HD Saver 78 Pin)	N.A	C&K	340102002B DDBMA 78PS NMB (D HD Saver 78 Pin)	1
88	3W3 SAVER	Combo Connector Saver	340108001BDABM3 W3PSNMB (D Combo Saver 3W3)	N.A	C&K	340108001BDABM3W3PSNMB (D Combo Saver 3W3)	1

ANA2.2 Specifications and BoM of Harness set

Table 23. BOM for Test Harness (One Set) (Non-FIM)

S. No.	Item Name	Make	Qty per GCU set
1.	MIL-STD-1553 Dual Stub Connectorized Bus Coupler (Box Type) with Trompeter BJ77 connectors	CompuPower or Equivalent	4
2.	MIL-STD-1553 Bus Terminator compatible to Bus Coupler	Beta transformer technology corporation	4
3.	MIL-STD-1553 Vacuum compatible Cable with mating PL75 1553B Bus Plug Connectors and compatible to Bus Coupler (Length of each cable = 2m)	Trompeter/Cinch/Flu tech	6
4.	MIL-STD-1553 Vacuum compatible Cable (meter)	Trompeter/Cinch/Flu tef	20
5.	JTAG Programmer Hardware for Xilinx Virtex devices	Xilinx or Equivalent	1
6.	Male Screw locks for connector mounting (shell size A)	C&K	20
7.	Male Screw locks for connector mounting (shell size D)	C&K	20
8.	Vacuum compatible Teflon PTFE wire (26AWG) (meter)	Any make	1000
9.	C115368-3208 (78 Pin High Density D Type Male Harness Connector)	C&K	10
10.	C115368-3209 (78 Pin High Density D Type Female Harness Connector)	C&K	10
11.	DAM3W3PNMB-FR022 (3 pin Combo D Type Male Harness Connector shell)	C&K	2
12.	DAM5W5PNMB-FR022 (5 pin Combo D Type Male Harness Connector shell)	C&K	2
13.	Male SMA Harness Connectors	C&K	8
14.	C115370-3208 (50 Pin D Type Male Harness Connector)	C&K	10
15.	C115370-3209 (50 Pin D Type Female Harness Connector)	C&K	10
16.	C115370-3204 (25 Pin D Type Male Harness Connector)	C&K	10
17.	C115370-3205 (25 Pin D Type Female Harness Connector)	C&K	10

S. No.	Item Name	Make	Qty per GCU set
18.	C115370-3202 (15 Pin D Type Male Harness Connector)	C&K	10
19.	C115370-3203 (15 Pin D Type Female Harness Connector)	C&K	10
20.	C115370-3200 (9 Pin D Type Male Harness Connector)	C&K	10
21.	C115370-3201 (9 Pin D Type Female Harness Connector)	C&K	10
22.	330-8997-101-FR022 (Std Density Male Contacts)	C&K	250
23.	031-8997-101-FR022 (Std Density Female Contacts)	C&K	250
24.	330-8998-101-FR022 (High Density Male Contacts)	C&K	250
25.	031-8998-101-FR022 (High Density Female Contacts)	C&K	250
26.	DM115740-0013-FR022 (Combo Male Contacts)	C&K	15
27.	100 ohm LVDS cable (meters)	Gore	250

ANA2.3 Power Supply Requirement of DPU card

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

- A single 5V power supply will be required for powering on and testing, fully populated a DPU.
- The harness details will be provided by SAC. Harness fabrication and ensuring its correctness will be vendor's responsibility.
- Vendor should have sufficient power supplies of 5V, 2.5V, 3.3V, 1.0V, 1.8V etc in the initial stages of bringing up the board.
- Two power supplies/supply set will be needed for powering DPU-1 and DPU-2 simultaneously.

Table 24 : Power Supply Requirements

Power Supply Requirements	Power Supply - 1
Power per Unit	35 Watt (max)
Supply Voltage	+5 V (2000mA)
Line regulation	±1%
Load Regulation	±1%
Ripple	40 mV(P-P)
Overshoot at Turn ON	3% max

ANA2.4 DPU Interface Signals

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

Table 25 : DPU Interface Signals list

Type	Direction wrt DPU	No of Signals
CMOS 5V	In	10
	Out	25
CMOS 3.3 V	Out	10
	In	05
LVDS (pair)	Out	10
	In	10
Analog	In	4

	Out	2
Others	In/Out	10
1553 I/F (Diff)	In/Out	2
	Total	90

ANA2.5 Typical test setup for DPU

PXIe based Ground Checkout Unit (GCU) to be procured by the vendor and SAC will provide the firmware of GCU for testing DPU. Ground Checkout Unit (GCU) has capability of testing one DPU. Either main or redundant DPU has to be powered ON and tested, one at a time. A separate Daily Operations Record (DOR) logbook to be maintained for each hardware. All testing activities are to be recorded 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 DPU, are provided by either the GCU or the external sources. The DPU response is to be captured in the GCU. MIL-STD-1553 interface and Serial Data interface are to be tested using the GCU. All output signals of DPU package mentioned in Table 25, are to be captured manually/automated test setup 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 and Table 27. 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 26/Table 27 shows the tentative list of tests to be performed. Also refer Table 11 for tests applicable based on the type of DPU being tested.

Below is list of standard lab instruments needed for testing the DPU.

S.No.	Item Name	Item Specifications	Qty. per Test Setup
1	Oscilloscope	Tektronix 5-Series Mixed Signal Oscilloscope MSO54 (BW 2GHz, Sample Rate 6.25GS/s) or Tektronix 7000 series Digital Phosphor Oscilloscope DPO70804DX (BW 8GHz, Sample Rate 50 GS/s) or Equivalent	1
2	RF Signal Generator	Keysight N1571B-503 (EXG X-Series RF Analog Signal Generator) or Equivalent	2
3	Power Supply	TDK Lambda Benchtop Power Supply ZUP20-10 (Output Voltage DC : 0-20V, Output Current: 0-10A) or Equivalent	6
4	Power Supply	TDK Lambda Benchtop Power Supply ZUP80-5 (Output Voltage DC : 0-80V, Output Current: 0-5A) or Equivalent	1

Table 26 : DPU Test Matrix for QM

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	DPU Power On Reset Test	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	1553 command test	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	I/O Check with Scope Screenshot saving	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4	DPU functionality Test/characterization	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table 27 : DPU Test Matrix for FM

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	DPU Power On Reset Test	✓	✓	✓				✓	✓	✓	✓	✓				✓
2	1553 command test	✓	✓	✓				✓	✓	✓	✓	✓				✓
3	I/O Check with Scope Screenshot saving	✓	✓	✓				✓	✓	✓	✓	✓				✓
4	DPU functionality Test/characterization	✓	✓	✓				✓	✓	✓	✓	✓				✓

The individual parameters to be measured and recorded for each of the above tests will be provided along with the test plan to the vendor after the award of contract.

ANA2.6 Quantity to be fabricated and tested

S. No	Items	PCB Qty	Package Type	Package Qty	Deliverable Nomenclature	Unit Rate (Rs)	Remarks
1.	Delivery of FM DPU-1 and DPU-2 (Component procurement, Fabrication and Test & Evaluation)	DPU-1 : 02 DPU-2 : 02	Type -1 package, (One DPU-1 & one DPU-2 housed in a single H-package),	02	FM DPU CONFIG-1		<ul style="list-style-type: none"> • Mounting of Components mentioned in Table 20 and Table 21 and Table 22 as per SAC fabrication Guidelines. • Mechanical fabrication as per Mechanical drawings supplied by SAC • Test for respective units as described in ANA1.
2.	Delivery of FM DPU-2 (Component procurement, Fabrication and Test & Evaluation)	DPU-2 : 04	Type -2 package, (Two DPU-2 housed in a single H-package)	02	FM DPU CONFIG-2		
3.	Delivery of QM DPU-1 (Component procurement, Fabrication and Test & Evaluation)	DPU-1 : 01	Type -3 package, (One DPU-1 & dummy mass housed in a single H-package)	01	QM DPU CONFIG		

ANA3 R&QA requirements for Procurement of Resistors and Capacitors

QA REQUIREMENTS FOR RM STYLE RESISTORS		
Sr. No.	Quality Requirement description	Compliance Remark(s)
1	The Chip Resistors should be qualified to and as per the latest MIL-PRF-55342 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. <i>A copy of Qualification Certificate and relevant pages of the QML-55342 be attached in the quote.</i>	
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 <u>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.</u>	
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. <i>The provided datasheet must be endorsed by the vendor.</i>	
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. <i>Failing so the offer shall be rejected.</i>	
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. <u>The relevant detail/information, substantiating the compliance endorsed by OEM, shall also be provided along with.</u> <i>Failing so the offer shall be rejected. Simple tick mark or blank will be considered as non-compliance.</i>	

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	<u>Copy of latest authorization letter</u>	
6c	The latest data sheet of the offered part(s) indicating electrical, mechanical, environmental specifications and engineering drawing.	
6d	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 CTC21E CAPACITORS

Sr. No.	Quality requirement description	Compliance Remark(s)
1	<i>The capacitors, to be supplied, shall be as per the latest ESCC 3012/003 specification with Level 'B' and LAT-2 (Lot Acceptance Testing -2).</i>	
2	The deliverable capacitors shall preferably have a Single Lot Date Code (SLDC) not older than two years from the date of shipment.	
3	The capacitors shall be supplied in standard packages.	
4	The following details shall be supplied along with proposal.	
4a	Name of the Original Part Manufacturer.	
4b	Latest copy of authorization letter endorsed by the Original Part Manufacturer in case quote is not from OEM.	
4c	Cross reference of Manufacturer part no and ESCC part no.	
4d	Unit price as well as pricing for LAT-2 testing separately with no. of samples required for LAT. Common LAT-2 testing shall be recommended as per ESCC 3012. <u>Applicability of LAT testing (part type & value) and samples will be decided at the time of ordering.</u>	
4e	The latest data sheet(s) of the offered part(s) indicating electrical, mechanical, environmental specifications and engineering drawing. <i>The attached data-sheet shall be endorsed by the vendor/supplier.</i>	
5	The followings shall be supplied along with the deliverable components.	
5a	Certificate of Compliance (CoC) from the original part manufacturer.	
5b	Certificate of Compliance (CoC) from the vendor/supplier.	
5c	Complete soft copy of data package mandatory as per the ESCC 3012/003 specification.	
6	Important notes:	
6a	The vendors, authorized by the Original Part Manufacturer, to source/sell the space grade parts in India, shall only be considered. Hence, <u>QA compliance with the relevant certificate and document, endorsed by the original part Manufacturer, must be enclosed with the quote. Failing so the offer shall be rejected.</u>	

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. <i>The offered part(s) and the part manufacturer should be listed on the latest ESCC QPL.</i>	
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/markings 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	<u>Tape & reel packaging shall not be acceptable.</u>	
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. <u>Latest copy of authorization letter and point by point compliance endorsed by the Original Part Manufacturer in case quote is not from OEM.</u> 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. <i>The attached data-sheet shall be endorsed by the vendor/supplier.</i>	
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 which the offer is liable to be rejected.</u>	

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 ANA5.	
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 ANA5.	
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, <u>the relevant technical certificate and supporting documents, endorsed by the original part Manufacturer, must be enclosed with the quote.</u> <i>Failing which the offer shall be rejected.</i>	
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. <i>Failing which the offer shall be rejected. Simple tick mark or blank will be considered as non-compliance.</i>	

Ceramic Chip Capacitor (CDR) from ISRO qualified Vendors

A. QUALITY REQUIREMENTS

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

B. COMPONENT SPECIFICATION

- | | | |
|---|---|--|
| <ol style="list-style-type: none">1. Style2. Value3. Dielectric material4. Tolerance5. Rated voltage6. Termination finish: | } | As per Indent Technical Specifications |
| | } | 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

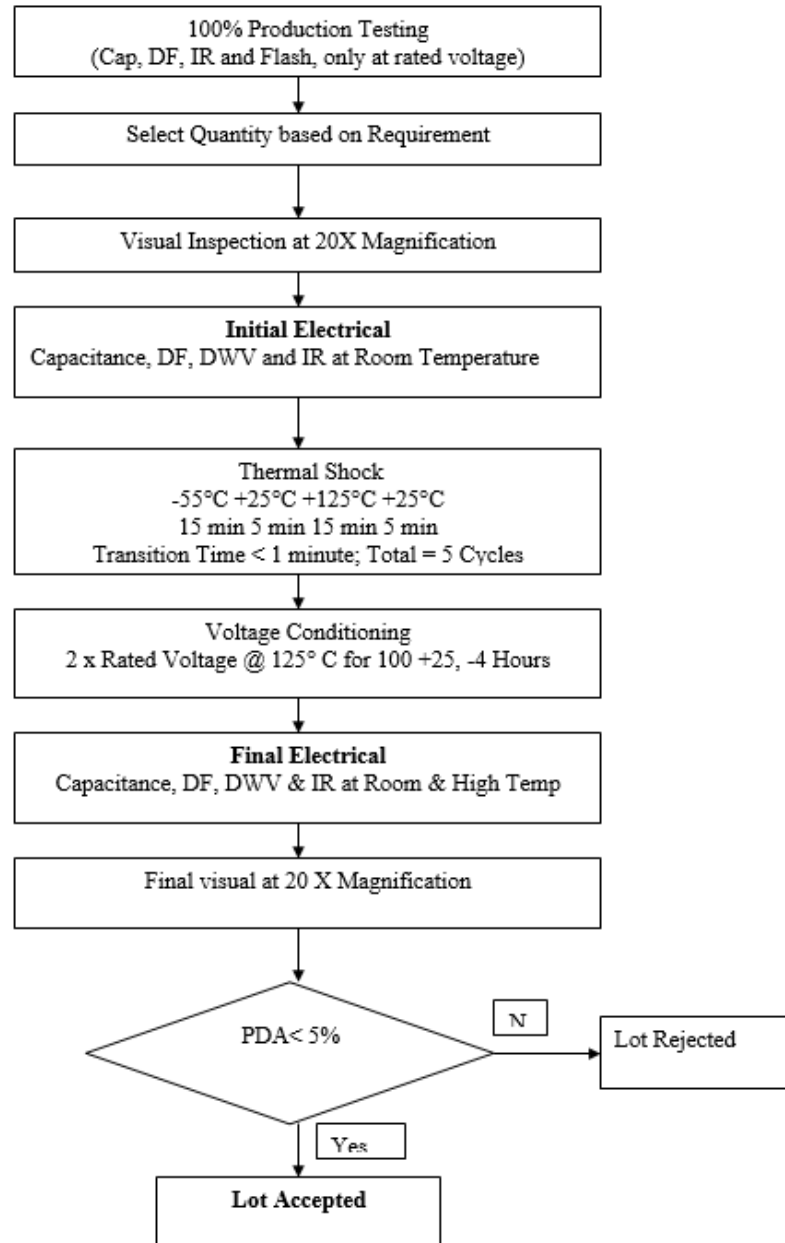
1. Screening test data pertaining to all the measurements taken at various stages of Screening.
2. Summary sheet for the Screening tests giving details of tests done, test conditions, date of test, number of chip capacitors subjected to test, number passed etc.

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



10.

QA REQUIREMENTS FOR BME CERAMIC CAPACITORS

Sr. No.	SAC requirement description	Compliance Remark(s)
1	The capacitors, to be supplied, shall fully comply with any one of the quality requirements described in 1a/1b as below:	
1a	Qualified to and as per the latest ESCC 3009/041 applicable specification with in process inspection, chart F2 and F3 testing.	
1b	Qualified to and as per the latest MIL-PRF-32535 applicable specification with high reliability 'T' level including Group A & B.	
2	Parts shall be listed on QPL of applicable MIL/ESCC specification.	
3	The deliverable capacitors shall have a Single Lot Date Code (SLDC) (preferable) and not older than two years (mandatory) from the date of shipment to SAC.	
4.	PIN marking on component/component bag shall be as per applicable ESCC/MIL standard with logo.	
5	Capacitors shall be clean, dry, and packaged as per the part number designation, in an electrostatic discharge (ESD) safe <u>waffle package</u> , in a secure manner that will offer adequate protection against corrosion, deterioration, and physical damage. <u>Tape & reel packaging shall not be acceptable.</u>	
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);</u> Copy of latest authorization letter and point by point compliance endorsed by the HRPPA.	
7	The followings shall be supplied along with the deliverable components.	
7a	Certificate of Conformance (CoC) from the original part manufacturer.	
7b	Certificate of Conformance (CoC) from the vendor/supplier.	
7c	Soft copy of test data package as per applicable.MIL/ESCC standard	
7d	A copy of guideline/application note pertaining to the handling, storage, mounting, soldering/fabrication of the offered capacitors if any.	
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 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). <i>A copy of test report/detail of the same shall be provided with quote.</i>	
6f	The status of qualification (to ESCC 3201/009), of offered part and part-manufacturer. <i>A copy of Qualification Certificate and relevant pages shall be attached in the quote.</i>	
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. <i>Failing so the offer shall be rejected.</i>	
9b	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. <i>Failing so the offer shall be rejected. Simple tick mark or blank will be considered as non-compliance.</i>	

QA requirements for Inductors, Fixed SMD		
Sr. No.	SAC Requirement description	Compliance Remark(s)
1	<p>The parts to be supplied, shall be either;</p> <p>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</p> <p>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.</p>	
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	<p>Soft copy of Test reports of Group 'A' inspection, for parts as per the MIL-PRF-83446/05.</p> <p>OR</p> <p>Complete Data Package (mandatory to be supplied with deliverables) as per the ESCC 3201 specification.</p>	
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/markings 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, <u>the relevant certificate and document, issued by and duly authorized & endorsed by the original part Manufacturer, must be enclosed with the quote.</u>	

5b	<p>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.</p> <p><i>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. FAILING WHICH THE OFFER MAY BE TREATED AS INELIGIBLE FOR EVALUATION FROM QA ASPECTS AND CAUSE FOR REJECTION.</i></p>	
----	---	--

R & QA REQUIREMENT FOR D SUB CONNECTORS		
	Requirement description	Compliance by the vendor
1.	The parts shall meet the following requirements of quality and testing.	
1a	Qualified to and as per the latest ESCC 3401 applicable Specification with level 'B' testing.	
2	The manufacturer shall be qualified and listed on latest ESCC QPL for the offered parts.	
3	The manufacturer shall provide the following details along with the proposal.	
3a	Name of the original part manufacturer.	
3b	The latest technical data sheet of the offered part indicating electrical, mechanical, environmental specifications and engineering drawing.	
3d	A latest copy of authorization letter issued by the original part manufacturer, in case quote is not from OEM	
3e	Qualification status on ESCC QPL/QML with a copy of certificates.	
4	The manufacturer shall provide the following details along with the deliverable parts.	
4a	Certificate of Compliance (CoC) from the original part manufacturer.	
4b	Certificate of compliance (CoC) from the vendor.	
4c	Complete data package mandatory as per the applicable ESCC 3401/** specification.	
5	General requirements	
5a	The parts supplied by the manufacturer shall be preferably from a Single Lot Date Code not older than two years (mandatory) from the date of shipment.	
5b	The marking (Part Identification Number), shall be as per the applicable ESCC specification, bearing ESCC logo (for ESCC qualified parts).	
5c	Each connector shall be packed individually in a separate bag/packet and there shall be no relative motion within the package. Pink poly foam shall not be used for packing of the parts.	
5d	With each connector, its antistatic dust cap shall also be provided.	
6	Important notes	
6a	The Vendors/suppliers, who are authorized by the original part manufacturer, to source/sell space grade parts for INDIA will only be considered. Hence, point by point QA compliance with supporting documents issued by the original part Manufacturer shall be enclosed with the offer.	