

Reliability and Quality Assurance (R & QA) Requirements
Space Qualified RF Flexible Cable Assemblies, Coaxial, Low Power
(Extended Temperature range)

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RELIABILITY AND QUALITY ASSURANCE REQUIREMENTS

INTRODUCTION

Reliability and Quality are important prerequisites of any Space programme hardware. It is therefore very essential for the vendor to understand and implement the R & QA requirements judiciously. This annexure details the R & QA requirements, which shall be assured for **fabrication, testing and delivery of RF flexible cable assemblies**.

1. Unit Specifications and Configuration

The performance of **Space Qualified RF Flexible Cable Assemblies, Coaxial, Low Power** (referred to as 'unit' through this annexure) shall conform to all specifications as defined through technical exhibits under specified environmental conditions.

2. Reference Documents

- MIL-DTL-17
- MIL-PRF-39012
- MIL-STD-202
- MIL-G-45204
- MIL-PRF-55427
- ESCC 3902
- ESCC 3402

3. Reliability

3.1 On-Board Life

The units shall meet all the design requirements for use onboard spacecraft with a minimum life for **18 years** in environmental conditions as specified.

3.2 Storage and Assembly Life

In addition to on-board life, the units shall be capable of meeting all the functional requirements at various stages of storage and subsystem assembly as follows:

- 5 years in controlled environmental conditions
- 3 years of storage at various levels of subsystem assembly

4. Environmental Conditions

4.1 Operating and non-operating environment

The design, construction and performance of the units shall be capable of withstanding the environmental conditions specified in **Table 1: Environmental Conditions**.

4.2 Vibration

The unit shall be designed and fabricated to meet the vibration requirements as mentioned in this annexure.

4.3 EMI / EMC Shielding

RF Cable assemblies shall meet the RF shielding effectiveness when tested as per MIL-STD-461E.

5. Parts, Materials and Processes

5.1 Parts

5.1.1 Quality requirement for RF flexible Co-axial cables

RF flexible co-axial cable to be used shall be taken from ESCC / MIL approved supplier and shall be meet the qualification requirements of ESCC 3902/MIL-DTL-17. These shall be tested per:

- a) Final production test and LAT level 1 tests as per ESCC 3902,
OR
- b) Screening, Group-A, Group-B and Group-C as per MIL-PRF-17

The selected part shall have sufficient space flight history/heritage for the required frequency and power level.

SAC will decide upon the requirement of performing LAT1 (ESCC plan) or Group-B and Group-C tests (MIL plan) based on QPL status of the offered cables, at the time of ordering.

5.1.2 Quality requirement for RF Co-axial connectors

RF co-axial connectors to be used shall be taken from ESCC / MIL approved supplier and shall be meet the qualification requirements of ESCC 3402/MIL-PRF-39012. These shall be tested per:

- a) Final production test and LAT level 1 tests as per ESCC 3402
OR
- b) Screening, Group-A, Group-B and Group-C as per MIL-PRF-39012

The selected part shall have sufficient space flight history/heritage for the required frequency and power level.

SAC will decide upon the requirement of performing LAT1 (ESCC plan) or Group-B and Group-C tests (MIL plan) based on QPL status of the offered connectors, at the time of ordering.

5.2 Materials

- 5.2.1** All constituent materials including epoxies, potting compound, solder material etc., used for manufacturing of RF cable assemblies must be space qualified and procured from a qualified manufacturer (source).
- 5.2.2** These materials shall have Total Mass Loss (TML) less than 1% and Collected Volatile Condensable Material (CVCM) of less than 0.1% when subjected to test condition (125°C and 10-6 torr pressure for 24 hours).

Compliance including source and inspection details of all constituents of RF cable assembly shall accompany the technical offer.

5.3 Processes

- 5.3.1** RF cable assemblies shall be fabricated on a line qualified for onboard RF cable assemblies. All fabrication processes involved shall be qualified processes for space applications.
- 5.3.2** Vendors shall submit process qualification details along with the technical proposal.
- 5.3.3** No non-qualified process shall be used for fabrication of RF cable assemblies.
- 5.3.4** Further, all RF cable assemblies shall have a single date code not older than two years from the date of shipment to SAC.

6. Marking and Identification

- 6.1** The unit shall be identified by assigning unique serial number on the exterior surface by a suitable process applicable for space use. Marking shall not degrade the performance of the unit. In addition to functional markings like input/output, port markings etc. following marking shall appear on each unit:
- **Part Number** (*mandatory on unit*)
 - **Serial Number** (*mandatory on unit*)
 - **Date Code** (*in YYWW format, YY=last two digit of year, WW is week number; eg: 1946 for 46th week in year 2019*)
 - **Manufacturer's Name/Logo**
 - **LAT unit** (*Applicable to units tested to LAT levels only, vendor to specify any suitable marking method to identify LAT units from Flight (FM) units*)
- 6.2** Vendor to suggest part number and details of other 'on-unit' markings along with technical offer.
- 6.3** 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 test method to demonstrate the same shall be specified by the vendor.

7. Packaging, Storage & Transportation

- 7.1** Suitable packing shall be provided for the transportation of the units by air, ship or road without any degradation/damage. The transportation package shall protect the unit from rough handling. Wherever required, the transportation container shall have nitrogen-purging facility so that the unit before shipment is purged with dry nitrogen to prevent contamination and corrosion.
- 7.2** 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.
- 7.3** All interfaces (connectors) shall be suitably protected to prevent contamination entering the units, during handling and transportation. The unit shall be packaged in separate containers to protect against electrical, mechanical and environmental damage. Each individual container shall have a moisture absorbing material inside.
- 7.4** Units subjected to Lot Acceptance Test shall be clearly marked as "LAT unit" and "NOT FOR FM".
- 7.5** 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 package shall be fixed within the shipping package in such a way that they will be resistant to mechanical shock, humidity and dust. The shipping package shall contain all the necessary technical documents as specified and the necessary commercial documents.
- 7.6** Vendor to provide details of their standard shipping package for space components, for evaluation by SAC (with the technical offer).
- 7.7** In addition to other mandatory shipping markings, the following additional marking shall appear on the shipping packages in bold letters:

HANDLE WITH CARE

ESD SENSITIVE

TO BE OPENED UNDER CLEAN ENVIRONMENT WITH ESD PROTECTION ONLY

STORE IN A COOL AND DRY PLACE

- 7.8** The shipping documentation shall be enclosed in the shipping packages.

8. Design Qualification and Space Heritage Requirements

- 8.1** The unit design shall be a qualified design, i.e. units having similar electrical, mechanical and thermal design are qualified for HI-REL space use. The qualified design shall have similar operating frequency and power levels.
- 8.2** The units shall be fabricated and assembled on a line having well defined, controlled and repeatable processes, with adequate checks and controls to monitor and assure the quality of fabricated units. The data for the critical parameters shall be logged and produced, whenever necessary. The line must be qualified for the fabrication of High-Rel RF cables for space use.
- 8.3** Only the vendors having fabricated and qualified similar cable assemblies for space use will be considered for this program.
- 8.4 The following details shall be supplied along with the technical offer:**
 - 8.4.1** As a pre-requisite to fabrication, evaluation and testing of space grade units, manufacturer should have adequate capability and experience to supply similar units for space/ Hi-Rel programs. Relevant details shall be supplied with technical offer.
 - 8.4.2** Summary of manufacturer's capability to design, fabricate and testing of similar units
 - 8.4.3** Details of the fabrication processes involved along with their qualification status
 - 8.4.4** Technical specifications of qualified RF cable assemblies realized on the proposed fabrication line
 - 8.4.5** Qualification Test plan including test conditions and qualification test report summary
 - 8.4.6** Name of Space Program & agency to which the qualified cable assemblies were supplied
 - 8.4.7** Space flight history with details regarding the frequency of operation, the power level and configuration (connector style & cable length)
- 8.5** Based on technical details supplied by vendor, SAC will assess suitability of the proposed part for required application as well as suitability of the manufacturer for the fabrication of Space Grade RF cable assemblies.
- 8.6** After thorough assessment of the supplied technical details of the quoted design from the vendor, the programme will be executed as FM + LAT.
- 8.7** Only vendors with proven track record of successfully delivering similar units for space shall quote against this requirement. Quotes from vendor with no space heritage and/or qualification for these categories of space products will not be accepted.

9. Test Programme

9.1 Tests as per SAC plan

- 9.1.1** After thorough technical assessment of details supplied by vendor, the total programme will be executed as fabrication, testing as per SAC test plan (screening and LAT as defined in this annexure) and delivery of RF cable assemblies.

9.2 Tests as per manufacturer's Hi Rel test plan

9.2.1 As an alternative to SAC plan (but not limited to), vendor having process qualified for space with space heritage for flexible RF cable assemblies, may propose tests as per internal Hi-Rel test plan (including quality assurance requirements for parts, materials and process), meeting or exceeding the requirements described in this annexure (screening and LAT). ***The acceptability of manufacturer's Hi Rel plan is subject to technical review and approval by SAC.***

9.3 Lot Formation

9.3.1 The term LOT is defined to be consisting of each type of units manufactured together (at the same time) from the same batch of raw materials on the same production and assembly line, having all the provisions for quality assurance. The unit shall satisfy all design, performance and environmental requirements of the specifications.

9.3.2 All the units fabricated as one LOT shall undergo Screening and Lot Acceptance Test (LAT) as per **Table 2: Test Matrix for FM (Screening)** and **Table 3: Lot Acceptance Tests (LAT) test flow** with the execution flow as per **Figure 1: Flow Chart For Screening And Lot Acceptance Programme** before they are acceptable to SAC.

9.3.3 LAT shall be selected from each fabricated lot, with sample selection as defined in this annexure.

9.3.4 Vendor may provide details of the number of lots to be fabricated required to meet ordered quantity.

9.3.5 The execution of LAT on one/more than one/all ordered types will be decided by SAC at the ordering stage, based on supplied technical details.

9.4 Production Control, Assembly Sequence and In-Process Inspection

9.4.1 Vendor shall specify and provide the details of production control, assembly sequence and in-process inspection stages before the units are finally ready for acceptance (screening) tests.

9.5 Screening and Lot Acceptance Test (LAT)

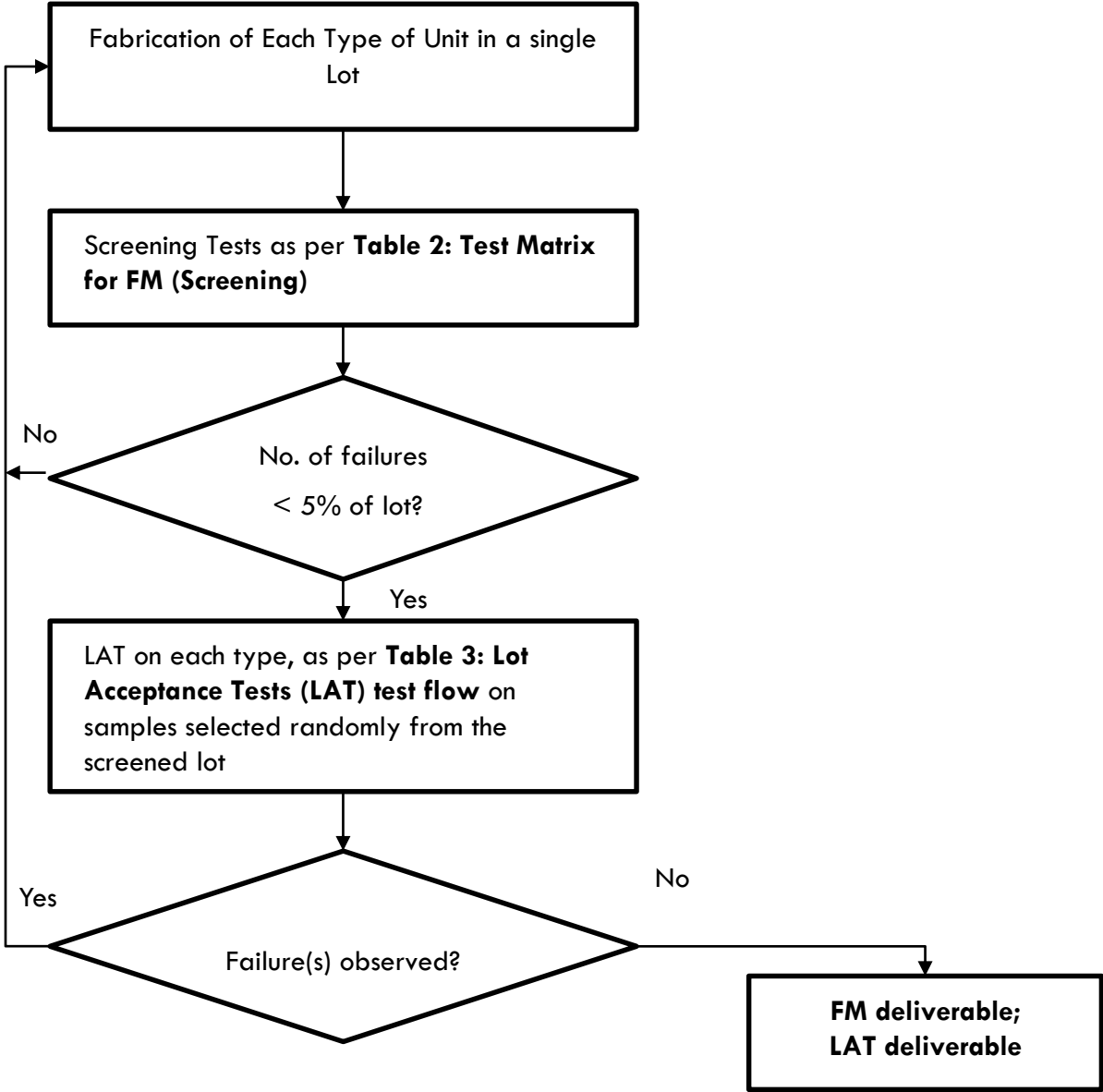
9.5.1 Screening

All the units fabricated in a single Lot shall undergo Screening (FM) Test as per **Table 2: Test Matrix for FM (Screening)**. A maximum of 5% failures are allowed during screening. Units exceeding the specified limits shall be removed from the lot.

9.5.2 Lot Acceptance Testing

On successful completion of Screening Test, the Lot Acceptance Test (LAT) shall be carried out on 5% samples (minimum one unit of each type), randomly selected from screened lot of each type, as per **Table 2: Test Matrix for FM (Screening)****Table 3: Lot Acceptance Tests (LAT) test flow**. No failure/ deviation shall be allowed for LAT unit(s).

Figure 1: Flow Chart For Screening And Lot Acceptance Programme



10. Test Procedures, test parameters and failure Criteria

10.1 Generation and approval of test procedure

10.1.1 Vendor shall submit the test procedure for the functional and environmental tests to be conducted on the units during the Screening (ATP) and LAT (QTP) test programme. This shall include, but not limited to, the tests and specification as indicated in **Table 2: Test Matrix for FM (Screening)** and **Table 3: Lot Acceptance Tests (LAT) test flow**

10.1.2 The test procedure shall also include the steps for conducting each test, the test equipment used and their calibration, total uncertainty for each test set-up and parameter tolerance/limits for the unit under test. Suitable buffer connections shall be provided during testing. Sample test data log format shall be supplied for each test described in **Table 2: Test Matrix for FM (Screening)** and **Table 3: Lot Acceptance Tests (LAT) test flow**.

10.1.3 It is preferable that test data are logged in electronic form compatible with electronic spreadsheet processing tools.

10.1.4 Only after submission of the test procedures including test data log format (screening and LAT) by vendor and subsequent approval by SAC, testing shall commence.

10.1.5 Units tested through unapproved test procedures are not acceptable.

10.2 Performance measurement stages

10.2.1 The performance of units shall be recorded at performance measurement stages, but not limited to, defined through SAC approved test procedure.

10.3 Tolerance On Test Conditions

10.3.1 Maximum allowed tolerances on test conditions are as per **Table 4: Tolerance on test conditions**.

10.4 Failure Criteria

10.4.1 The details of the unit fall-out during Screening or LAT shall be informed to SAC. Maximum of 5% of failures are allowed during screening. No failure is allowed during LAT.

10.4.2 **Number of failures more than 5% of lot during screening and any failure during LAT shall be a cause for lot rejection.** However, depending on the type of failure and failure mechanism established based on the failure analysis, usability of the Lot will be reviewed. Failure at any stage shall be reported to SAC immediately. This shall be followed by detailed failure analysis. Based on failure analysis, SAC shall decide for the acceptance of lot, the requirement of corrective actions and retest plan, which shall be decided by SAC and implemented by vendor.

11. Tables

Table 1: Environmental Conditions

The units shall be capable to withstand the following environmental conditions:

S.No.	Parameter	Specifications
1.	Non-operating temperature range	-55°C to +155°C
2.	Operating temperature range (FM/Screening)	-50°C to +150°C
3.	Operating temperature range (LAT)	-50°C to +150°C
4.	Pressure	Ambient, vacuum better than 1×10^{-5} torr
5.	Relative humidity (<i>applicable for testing at ground only</i>)	Upto 95% RH @ 40°C w/o condensation of water

Table 2: Test Matrix for FM (Screening), 100%

Sr. No.	TEST	Test Conditions & Acceptance criteria
1	External Visual Inspection	<ul style="list-style-type: none"> ▪ Units shall be inspected for defects related to material, finish, surface, workmanship. ▪ The visual inspection criteria should necessarily include the inspection of connectors, required port markings, on-body markings, any damages, if any subsequent to environmental tests etc. ▪ Further details shall be specified by the vendor with detailed accept/reject criteria.
2	Physical Dimensions	<ul style="list-style-type: none"> ▪ Mechanical dimensions of the unit with respect to the SAC approved ICD shall be measured. ▪ ICD shall specify the surface finish also, and the same shall be verified on sample basis. ▪ Interface dimensions of the connectors shall be measured and shall meet the requirements of MIL-STD-348. ▪ Test details to be specified by the manufacturer.
3	Initial Performance Test	<ul style="list-style-type: none"> ▪ As per electrical specifications, for all applicable paths as per TEST PROCEDURE approved by SAC.
4	Thermal Shock	<ul style="list-style-type: none"> ▪ As per MIL-STD-202, Method 107, Condition 'A', non-operating temperatures as per Table 1: Environmental Conditions. Test shall be conducted with cold cycle first. The number of cycles shall be 10 (during Screening).
5	Random Vibration*	<ul style="list-style-type: none"> ▪ * Random vibration shall be performed on LAT subgroup (as defined in this annexure) only. However, based on supplied qualification details, SAC may decide upon performing random vibration on 10% of FM units, to be decided at the time of ordering. ▪ Test levels shall be as per Table 6: Random Vibration.
6	Radiography	<ul style="list-style-type: none"> ▪ Radiographic inspection shall be carried out as per MIL-STD-202, method 209.
7	Final Performance Test	<ul style="list-style-type: none"> ▪ As per electrical specifications, for all applicable paths as per TEST PROCEDURE approved by SAC.

Sr. No.	TEST	Test Conditions & Acceptance criteria
8	Final Visual inspection	<ul style="list-style-type: none">Units shall be inspected for defects related to material, finish, surface, workmanship.The visual inspection criteria should necessarily include the inspection of connectors, required port markings, on-body markings, any damages, if any subsequent to environmental tests etc.Further details shall be specified by the vendor with detailed accept/reject criteria.

Note: At the end of each environmental test electrical performance check (VSWR and Attenuation as specified, as minimum) shall be performed as per SAC approved test procedure.

Sampling plan for LAT: As defined below, samples from each screened lot)

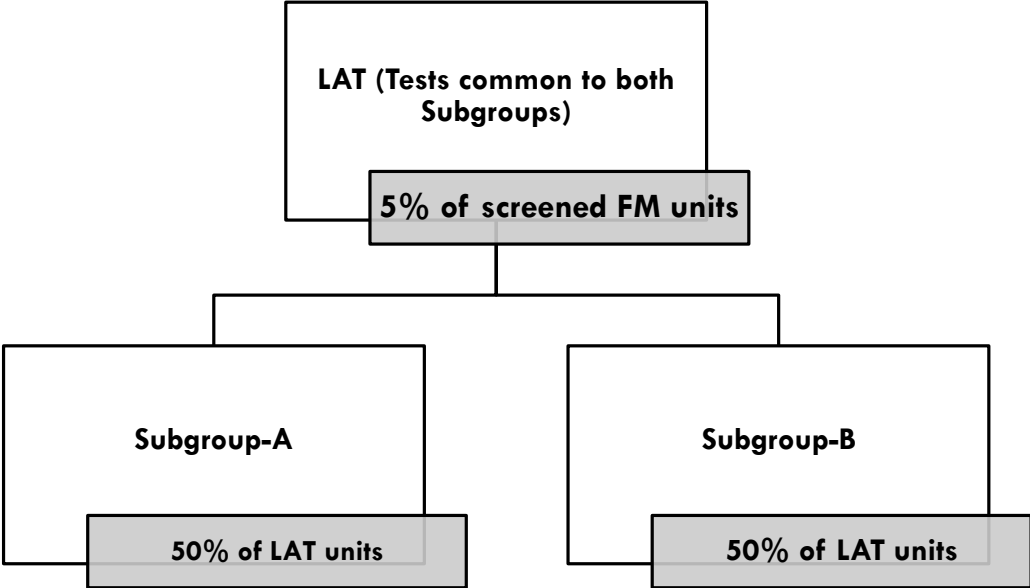


Figure 2: LAT Samples and distribution among LAT subgroups

Table 3: Lot Acceptance Tests (LAT) test flow

Group	Sr. No.	Test	Test conditions & acceptance criteria
Tests Common to Subgroup-A and Subgroup-B	1.	External Inspection Visual	<ul style="list-style-type: none"> ▪ Units shall be inspected for defects related to material, finish, surface, workmanship. ▪ The visual inspection criteria should necessarily include the inspection of connectors, required port markings, on-body markings, any damages, if any subsequent to environmental tests etc. <p>Further details shall be specified by the vendor with detailed accept/reject criteria.</p>
	2.	Initial Performance Test	<ul style="list-style-type: none"> ▪ As per electrical specifications, for all applicable paths as per TEST PROCEDURE approved by SAC.
	3.	Thermal Shock	<ul style="list-style-type: none"> ▪ As per MIL-STD-202, Method 107, Condition 'A', non-operating temperatures as per Table 1: Environmental Conditions. Test shall be conducted with cold cycle first. The number of cycles shall be 25 (during LAT).
	4.	Operational Temperature	<ul style="list-style-type: none"> ▪ Record unit performance at specified minimum operating temperatures, maximum operating temperature and ambient (after stabilization).
Subgroup-A	5.	Sine Vibration	<ul style="list-style-type: none"> ▪ Test levels shall be as per Table 5: Sine Vibration
	6.	Random Vibration	<ul style="list-style-type: none"> ▪ Test levels shall be as per Table 6: Random Vibration.

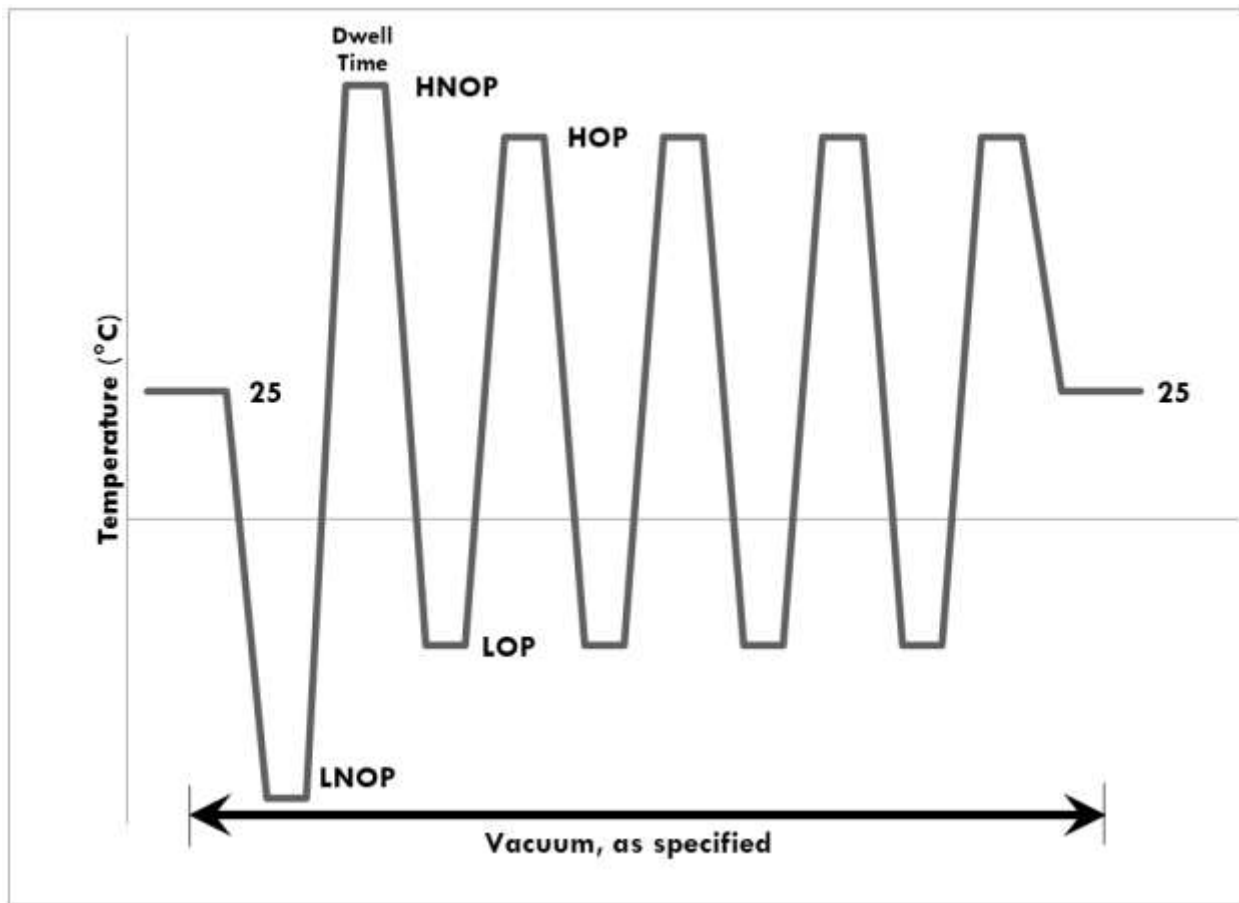
Group	Sr. No.	Test	Test conditions & acceptance criteria
	7.	Thermal Vacuum	<ul style="list-style-type: none"> ▪ As per Figure 3: Thermo-Vacuum Test Profile ▪ Temperature limits: As per Table 1: Environmental Conditions ▪ Dwell time: 2 hours, for all cycles, may be extended for completion of performance measurement tests. ▪ Monitor: Performance of each unit under test at each dwell, also record performance during transition from each temperature extreme. ▪ Unit(s) shall be operated within operating temperature limits only.
	8.	EMI / EMC Test	<ul style="list-style-type: none"> ▪ RF leakage specifications as per electrical specifications shall be demonstrated through test.
	9.	Radiography	<ul style="list-style-type: none"> ▪ Radiographic inspection shall be carried out as per MIL-STD-202, method 209.
	10.	Final Performance Test	<ul style="list-style-type: none"> ▪ As per electrical specifications, for all applicable paths as per TEST PROCEDURE approved by SAC.
	11.	Final Visual inspection	<ul style="list-style-type: none"> ▪ Units shall be inspected for defects related to material, finish, surface, workmanship. ▪ The visual inspection criteria should necessarily include the inspection of connectors, required port markings, on-body markings, any damages, if any subsequent to environmental tests etc. ▪ Further details shall be specified by the vendor with detailed accept/reject criteria.

Group	Sr. No.	Test	Test conditions & acceptance criteria
Subgroup-B	12.	Flexure Test	<ul style="list-style-type: none"> ▪ The cable assembly shall be suspended vertically, supported by the connector at one end with the specified force (as per part data sheet) applied to the units in the downward vertical direction. The connector shall be rotated 90 degC from the vertical in one direction and the 90 degC from the vertical in the opposite direction. This shall be done for the number of times specified through SAC specifications. The procedure shall be repeated with the cable assembly turned end to end. ▪ This shall be followed by electrical and visual inspection as described in this annexure.
	13.	EMI / EMC Test	<ul style="list-style-type: none"> ▪ RF leakage specifications as per electrical specifications shall be demonstrated through test.
	14.	Cable retention test (axial pull)	<ul style="list-style-type: none"> ▪ Vendor shall provide details of tests conducted during cable assembly qualification with respect to cable retention (axis pull). ▪ A longitudinal force (as defined in part data sheet) shall be applied to the connector at each end of the cable assembly for 30 seconds. ▪ This shall be followed by electrical and visual inspection as described in this annexure. ▪ <i>Vendor shall specify cable retention force of offered cable assembly with technical offer.</i>
	15.	Radiography	<ul style="list-style-type: none"> ▪ Radiographic inspection shall be carried out as per MIL-STD-202, method 209.
	16.	Final Performance Test	<ul style="list-style-type: none"> ▪ As per electrical specifications, for all applicable paths as per TEST PROCEDURE approved by SAC.

Group	Sr. No.	Test	Test conditions & acceptance criteria
	17.	Final Visual inspection	<ul style="list-style-type: none"> ▪ Units shall be inspected for defects related to material, finish, surface, workmanship. ▪ The visual inspection criteria should necessarily include the inspection of connectors, required port markings, on-body markings, any damages, if any subsequent to environmental tests etc. ▪ Further details shall be specified by the vendor with detailed accept/reject criteria.

Note: At the end of each environmental test electrical performance check (VSWR and Attenuation as specified, as minimum) shall be performed as per SAC approved test procedure.

Figure 3: Thermo-Vacuum Test Profile



Legend: **LNOP:** Lowest non-operating temperature; **HNOP:** Highest non-operating temperature; **LOP:** Lowest operating temperature; **HOP:** Highest operating temperature; **Dwell time:** 2hours.

Table 4: Tolerance on test conditions

Temperature	: $\pm 3^{\circ}\text{C}$
Atmospheric Pressure	
Greater than 0.1 torr	: $\pm 5\%$
Less than 0.1 torr	: $\pm 50\%$
Relative Humidity	: +0%, -5%
Acceleration	: $\pm 10\%$
Vibration	
Frequency	: $\pm 2\%$ above 20 Hz, 0.5 Hz, for $f \leq 20$ Hz
Sinusoidal Amplitude	: $\pm 10\%$
Random (g-rms)	: $\pm 10\%$
Power Spectral Density	
20-300 Hz	: ± 1.5 dB
300-2000 Hz	: ± 3.0 dB

Table 5: Sine Vibration

Sine Vibration test shall be carried out as per MIL-STD-202, Method 204, condition 'E', except the following:

- **10 to 2000 Hz to 10Hz, 20 g peak.**
- **Sweep Rate: 2 Octaves / min.**
- **No. of sweeps: 4 per axis**
- **Axes: X, Y, Z**

Table 6: Random Vibration

The test shall be carried out as per MIL-STD-202, Method 214, following conditions shall apply:

Frequency (Hz)	PSD (g^2/Hz)	
	Screening	LAT
20-50	+ 6 dB/Octave	+ 6 dB/Octave
50-1200	0.20 g^2/Hz	0.45 g^2/Hz
1200-2000	- 6 dB/Octave	- 6 dB/Octave
Overall Level	18.2 g_{rms}	27.2 g_{rms}
Duration	1 minute/axis	4 minute/axis
Axes	All axes	All axes

12. Technical Documents Required Along with The Quote

The following technical details shall accompany the technical quote:

- 12.1** Detailed Point by point compliance including all relevant technical documents in support of the compliance to each section of this annexure
- 12.2** Space History/Space Programme to which similar items have been supplied
- 12.3** Generic test data of proposed part/similar part
- 12.4** Generic radiation test report for the quoted design
- 12.5** Authorization certificate from original part manufacturer, in case the offer is from an authorized representative.
- 12.6** Technical compliance to RFP including R&QA requirements shall be endorsed (approved) by original part manufacturer and shall accompany the technical offer.
- 12.7** List of qualified Parts, Materials and Process proposed to be used for this programme
- 12.8** Screening/Qualification Plans through which the proposed design is qualified for space use
- 12.9** Non-conformance Control Plan

13. Technical Documents to Be Supplied during Contract

The documents/reports (specified through final purchase order) shall be supplied during contract, at the stages mentioned below. These shall be full reports (not the summary reports):

- 13.1 DOCUMENTS to be supplied after receipt of purchase Order and before fabrication**
 - 13.1.1** List of qualified Parts, Materials and Processes, their quality levels, derating criterion followed, traceability data, procurement history etc. proposed to be used for this programme, for review and subsequent approval by SAC
 - 13.1.2** Details of assembly sequence and Final Production Tests
 - 13.1.3** Configuration change control Plan, for review and subsequent approval by SAC
 - 13.1.4** Non-conformance Control Plan, for review and subsequent approval by SAC
- 13.2 DOCUMENTS to be supplied before testing (screening and LAT)**
 - 13.2.1** Documents containing test procedures (ATP & QTP with test set up details), test and calibration facilities, environmental facilities and relevant operation details. This document shall include Interface Control Drawing (ICD) and clearly address all tests with accept/reject criteria as defined in this annexure, for review and subsequent approval by SAC.
 - 13.2.2** Screening and LAT Test report format, for review and subsequent approval by SAC.
 - 13.2.3** Non-conformance parts and material test reports (if any), for review and subsequent approval by SAC
- 13.3 DOCUMENTS to be supplied if failures/non-conformances observed**
 - 13.3.1** Failures encountered, if any, shall be duly recorded and failure reports (for catastrophic failures), mechanical or handling failures, malfunctioning or

operative deviations from the specifications along with corrective actions, for review and subsequent approval by SAC

- 13.3.2** Non-conformance parts and material reports (if any), for review and subsequent approval by SAC

13.4 DOCUMENTS to be supplied before shipment

- 13.4.1** Summary sheet of all the tests performed as per SAC approved test plan. This shall have serial numbers of the units over which tests were performed, test conditions for each test and outcome of each test, for review and subsequent approval by SAC (shipment clearance).

13.5 DOCUMENTS to be supplied along with deliverables

- 13.5.1** Certificate of Conformance (CoC)
- 13.5.2** Final Test reports of Screening and LAT (as per final purchase order) along with the deliverable units, for review and subsequent approval by SAC.
- 13.5.3** All technical documents/reports as per the requirements of SAC purchase order