# ULTRA VIOLET IMAGING TELESCOPE (UVIT)

## Thermo-Vac Test-Report

**UVIT-CDR-01-003.1**

**Indian Institute of Astrophysics**
**Bangalore-560034**

# Test Report
# For
# Thermo-VAC Test of EM - UVIT Payload

**Version 1.1**
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**Documents to be Referred:**

1. ASTROSAT-Contamination Control notes V0.1
2. UVIT-990-00001-PRO Rev 1_5 - Functional Test Procedure.
3. UVIT-990-00002-PRO Rev 1_5 - Performance Test Procedure.

# 1.0 Introduction

This document describes the Engineering Model (EM) Thermo-Vacuum (TVAC) test plan for the UVIT system. The document describes the sequence of tests that will be performed during TVAC testing. As well, the document describes the equipment and facilities required for testing. This document is valid for flight model also wherein the test has to be carried out for acceptance level. The test profile includes the acceptance level testing of flight model.

# 2.0 Test Plan

## *2.1 Test Objectives*

The objective of the testing is to show that the Engineering Model (EM) version of the UVIT system remains operational and not damaged during and after exposures to qualification levels of thermo vacuum conditions specified by ETLS. This test will also give us an experience and modalities that need to be addressed for achieving the cleanliness and to minimize the contamination levels for flight model payload/ spacecraft tests.

## *2.2 Test Description*

Typical test profile and temperature limits for qualification level TVAC test with durations are shown in figure 2.1 and table 2.1.

In vacuum, verifying that the system is operational over repeated hot and cold cycles of prescribed temperatures. See figure 2.1 for the temperature profile.

In vacuum, verifying that the system is operation during a long duration hot and cold dwell temperature cycles.

The UVIT system has supplied items like door, primary and secondary mirror, filter wheel motor and its electronics, HVU (High Voltage Unit), detector and cables. These supplied items have been qualified separately. The other elements are only the telescope tubes, baffles, rings and other metallic structures. The engineering model of the UVIT system has one NUV channel and the mass simulated FUV channel. **During the TVAC test CPU, HVU, EU, FWM and FWDE will be powered ON.** Details of the test to be done on UVIT DS (CPU, HVU and EU), FWM and FWDE during TVAC test is explained in appendix A and B. For TVAC profile of individual subsystems which have undergone TVAC test, please refer Appendix D.

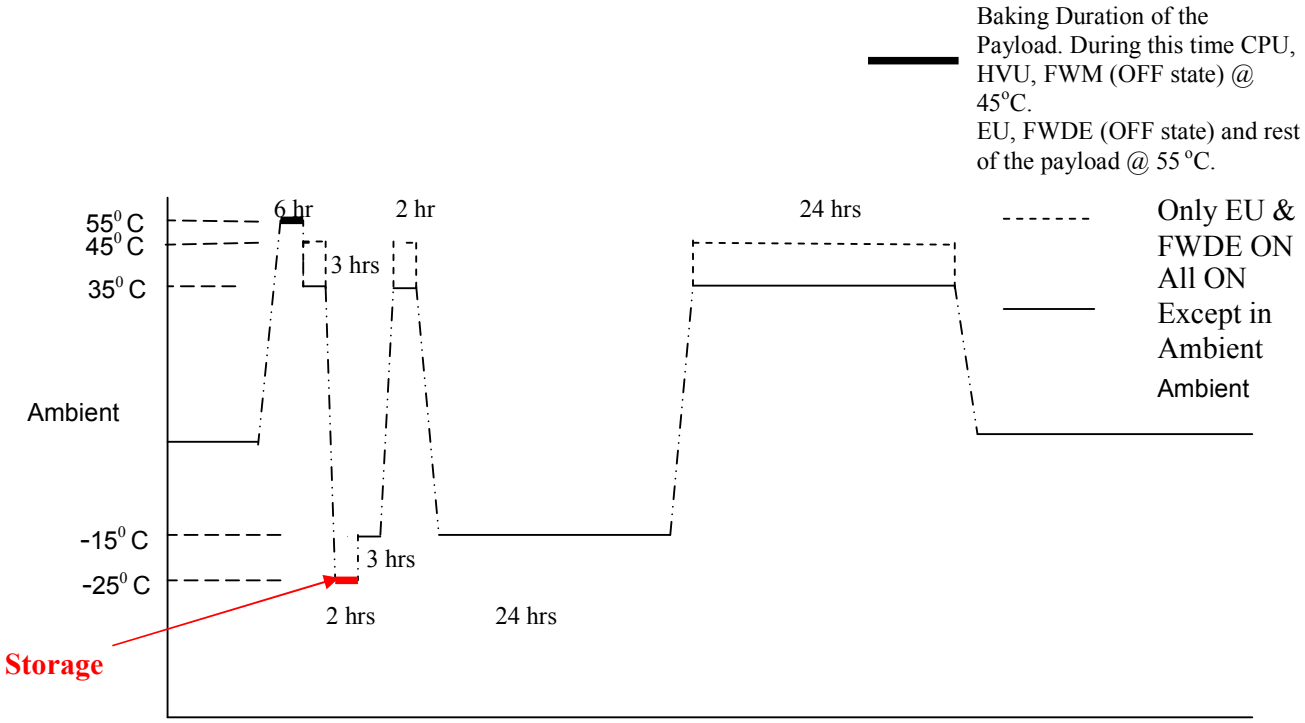



**Figure 2. 1 EM UVITDS TVAC test Profile (Qualification Levels)**

**Table 2. 1 List of Environmental Temperature (Qualification) Limits of UVIT Subsystems**

| Name of Subsystem | Temperature Limits (ON State) | | Temperature Limits (OFF State) | | |
|---|---|---|---|---|---|
| CPU | -15°C | +35°C | -25°C | +45°C | |
| HVU | -15°C | +35°C | -25°C | +45°C | |
| EU | -15°C | +45°C | -25°C | +55°C | |
| FWM | -15°C | +35°C | -25°C | +45°C | |
| FWDE | -15°C | +45°C | -25°C | +55°C | |
| PMA | -5°C | +45°C | -5°C | +45°C | |
| SMA | -5°C | +45°C | -5°C | +45°C | |

**Critical Temperatures which need to be monitored and control**

| Name of Subsystem | Temperature Limits (ON State) | | Temperature Limits (OFF State) | | Temp. Sensor ID | IR Lamp ID |
|---|---|---|---|---|---|---|
| **CPU** | **-15°C** | **+35°C** | **-25°C** | **+45°C** | **841** | **L73 to L110** |
| **HVU** | **-15°C** | **+35°C** | **-25°C** | **+45°C** | **4572** | |
| **EU** | **-15°C** | **+45°C** | **-25°C** | **+55°C** | **TC 45/46** | **L 111 to L 114** |
| **Door HOP Actuator** | | **+40°C +/- 2 °C** | | **+40°C +/- 2 °C** | **TC 5/6** | **L 1 to 12** |
| **PMA** | **-5°C** | **+45°C** | **-5°C** | **+45°C** | | |
| **SMA** | **-5°C** | **+45°C** | **-5°C** | **+45°C** | | |

**PMA: Primary Mirror Assembly** **SMA: Secondary Mirror Assembly** (ref: UVIT-CDR-June-11)

## *2.3 Test Facility Aspects*

The tests are planned in 6 mtrs CATVAC chamber at ISITE test facilities. The facility is chosen because of the better clean room environment. The chamber is in the clean room of 1 lakh class. However, it has been observed that cleanliness achieved in terms of particle count is better than 15000 with controlled man-material movement. The facility is equipped with TCQM equipment (for molecular contamination measurements) and also Residual Gas Analysis system within the chamber.

### 2.3.1. Test Methodology

In view of the high cleanliness and contamination requirements of the payload, it is required to adopt the test methodology of keeping the Shroud Temperature always at a constant Low temperature of -80 deg C and achieve the required differential temperature limits on the payload subsystems by using the combination of Heaters and the IR lamps.

The chamber need to develop a vacuum level better than 1 X $10^{-6}$ mbar as part of standard test specifications for performing the TVac tests.

### 2.3.2 Thermal Test Contigency Procedures/Saftey Measures

The vacuum level requirements and the contingency procedures/safety measures shall be same as the one used for spacecraft level tests. The details of the same are reproduced below.

| Sl. No. | Types of failures | Consequences or impact on temperature control | Contingency measures |
|---|---|---|---|
| 1. | KEB power failure | Lamps/heaters - off | • Generator power is available within 10 minutes. Power controllers will be powered using DG supply. DACS is connected to UPS. |
| | | Cooling of P/L. Marginal impact on PAYLOAD package temperatures for short durations. However, it is critical during cold cycle/soak. | • When KEB power failure occurs, the power supplies becomes off. It is recovered after power returns/power availability. |
| 2 | KEB power and UPS system | Lamps/heaters - off | • Generator power is available within 10 minutes through same electrical points. Thermal power supplies will be powered using DG supply. |
| | | Cooling of P/L ,it is critical during cold cycle/soak. | • When KEB power failure occurs, the power supplies becomes off. It is recovered after power returns/ power availability. |

| Sl. No. | Types of failures | Consequences or impact on temperature control | Contingency measures |
|---|---|---|---|
| 3 | Power Supply failures | | |
| | Case-A: Power supply off/output is zero. | Local cooling in the heater/IR lamp zone. | • Connection of heater/IR lamps to spare power supply.<br>• During rectification, nearby heaters/IR lamps will be used for temperature Control. |
| | Case-B: Power supply is overloading | Localized hot spot may be created if set current limit is very high. Serious case for skin bonded heaters. | • Re-set the power supply.<br>• Put off the AC mains of power supply, if it is not possible to re-set the power supply |
| 4 | Failure of monitored T/C channel of a heater zone | No impact | • Select the redundant T/C channel. |
| 5 | 1. TPSU failure.<br>2. Failure of remote operation of PCS<br>3. DACS failure etc. | T/C monitoring is affected. Temperature control is affected | • Rectify the fault.<br>• Test heaters/IR lamps operation to be done judiciously using thermistor temperature sensor. |

| Sl. No. | Types of failures | Consequences or impact on temperature control | Contingency measures |
|---|---|---|---|
| 6 | Test heater/IR lamp failure | Failed heater/IR lamp cannot be used | Nearby heaters/IR lamps will be used to maintain the temperatures. |
| 7 | Sub-systems' temperature exceeding the upper limit. | Subsystem temperature more than upper acceptance temperature limit. | Immediately reduce the nearby IR lamp/heaters power to safe value of temp. Inform to test director nominated by Chairman, Thermovac test Committee/PD -ASTROSAT. |
| 8 | Subsystems' temperature exceeding the lower acceptance limit. | Subsystem temperature lower than the lower acceptance temperature limit. | Increase the IR lamp/heater power to the area. Nearby IR lamp/heater power may also be increased judiciously. Inform and consult the test director nominated by Chairman, Thermovac test Committee/PD –ASTROSAT. |
| 9 | Chamber leak/vacuum failures | More heat leak/loss from S/C Cooling of PAYLOAD | PAYLOAD temperatures will be maintained by increasing power to heaters/lamps to compensate the heat leakages. |
| 10 | Rise in shroud temperature | PAYLOAD temperature goes up. | Power to heaters/lamps will be reduced to maintain the temperatures. PAYLOAD load will be reduced, if required |
| 11 | PAYLOAD goes off | No thermistor temp. Data No onboard heaters control Cooling of PAYLOAD | PAYLOAD thermal health will be monitored and maintained through thermal test instrumentation except for CPU,HVU and motor. Voltage to lamp & test heaters will be maintained judiciously to keep the components in safe limits. |

### 2.3.3. Contigency Procedures/Saftey Measures During Payload Performance Tests

The payload powering and the performance verification tests will be done using the Ground Support Equipment (GSE). The GSE will be operated on UPS supplied by the facilities. The payload performance tests will be done after achieving the respective stabilized temperature limits during short cycles of Hot and Cold and also during the Long Hot & Cold cycles.

UVIT detector System need to be switched ON or Operated only at vacuum level better than $10^{-6}$ mbar. Payload will be switched OFF, in case of any power failure at facility, which may result in drop in vacuum level below the specified value ($10^{-6}$ mbar).

## *2.4 Test Sequence*

### 2.4.1 Cable Bake Out

Before putting the cable harnesses into the Thermo Vacuum chamber for testing they must be vacuum baked. Table 2.2 below lists the cables to be vacuum baked.

**Table 2. 2 Harness Assembly for Vacuum Bake Out**

| S. No. | Quantity | Description | Part Number |
|---|---|---|---|
| 1. | 1 | CPU-PB Harness Assembly (1 mt) | UVIT-952-00007-CBL-01 |
| 2. | 1 | HVU-PB Harness Assembly (1 mt) | UVIT-952-00009-CBL-01 |
| 3. | 1 | PB-EU Flange (2.2 mt, CPU) | |
| 4. | 1 | PB-EU Flange (2.2 mt, HVU) | |
| 5. | 1 | EU-TVAC Flange (3mt, DHU) | |
| 6. | 1 | EU-TVAC Flange (3mt, BMU, discrete) | |
| 7. | 1 | EU-TVAC Flange (3mt, BMU, 1553B) | |
| 8. | 1 | EU-TVAC Flange (3mt, Raw Power) | |
| 9. | 1 | FWM with Harness | |
| 10. | 1 | Harness for FWM signals | |
| 11. | 1 | Harness for thermal control | |
| 12. | 1 | FWDE-TVAC Flange | |
| 13. | 1 | Circular harness for Thermistors | |
| 14. | 1 | Circular harness for FWDE | |
| 15. | 1 | Circular harness for DHU | |
| 16. | 1 | Circular harness for Power and Discrete signals | |
| 17. | 1 | Circular harness for 1553B | |

### 2.4.2 Test Thermo Vacuum Chamber Bake Out and Cleanliness Check

The chamber shall be baked at the highest possible temperature, say at 60 C, and be monitored by TCQM (operated at – 20 C). Baking shall continue till TCQM shows a rate $<8.71\times10^{-12}\,gm/cm^2/\sec$, and a rate of change in rate of $<3.03\times10^{-16}\,gm/cm^2/\sec^2$ for 8 hrs.

TV cleanliness needs to be verified prior to placing ASTROSAT parts inside. Therefore a test thermal cycle is performed, at plateau temperatures of + 40 C for 12 hrs and then a plateau temperature of – 20 C for 12 hrs with a witness sample (Mg F2 window) placed in the chamber for monitoring; the witness sample is used after its transmission, in 120 – 180 nm range has been measured After this test thermal cycle, the witness sample is measured again for its transmission. Any reduction to < 95% of the original transmission is an indication of potential contamination in the chamber.

Finally the chamber was baked in 2 phases. In the first phase the shroud was baked at 60 deg C for 36 hours with all the fixtures and IR Lamp cage assembly inside the chamber. TCQM measurements were made by keeping the cold finger at -20 deg C to assess the contamination level inside the chamber.

In the second phase 2 witness sample window (MgF2) were placed inside the chamber and the chamber was baked at +40 deg C for 12 hours and at -20 deg C for 12 hours.
Results of the witness sample show the transmission loss is less than 5% which is an acceptable number. Hence the chamber is cleared for payload tests.

***Remark for FM TVAC Test of UVIT***

In the second phase 2 witness sample window (MgF2) were placed inside the chamber and the chamber was baked at +40 deg C for 84 hours (3.5 days) and at -20 deg C for 84 hours (3.5 days).
Results of the witness sample show the transmission loss is less than 2% which is an acceptable number. Hence the chamber is cleared for payload tests.

### 2.4.3 Test Flow

The UVIT payload [CPU, HVU, EU, FWM and FWDE] is placed in the test thermal vacuum chamber and will be operational during full TVAC test.

1. Conduct a visual inspection and electrical functional check of CPU, HVU, EU, FWM and FWDE at CREST.
2. Tie Plates between the tubes of NUV and Mass model are to be removed at CREST for easy removal of the main baffles of the mass model at ISITE.
3. Pack UVIT Payload (with the required $N_2$ supply), EU, FWDE, EGSE and FWM test setup properly at CREST. Please refer ***'procedure-cum-log-UVIT-transport-and-handling.xls'*** for full procedure of packing the UVIT Payload.
4. Pack necessary tool kit (spanner set, torque wrench, screw driver set, allen key set, packing tape, extension boards, cutting pliers, cable ties, gloves, ESD wrist strap, electrical tape, copper tape, kapton tape, 3-pin plugs) to be carried along with the payload.
5. Transport UVIT payload to ISITE TVAC facility. Monitor Shock watch monitors during transport. Also check the $N_2$ supply also.
6. Unload UVIT payload and other items at ISITE. [Request in advance to project office to provide manpower and logistics (crane, forklift etc) for unloading the payload and other items at ISITE facility].
7. Don't remove $N_2$ supply till it goes to TVAC.
8. Remove Main Baffles from mass model after loading the payload on TVAC mounting trolley.
9. Conduct a visual inspection off all the boxes. Then open all boxes and arrange the items to conduct a functional and performance test on UVIT detector subsystem and FWM as mentioned in Appendix B and Appendix A respectively.
10. After confirming the cleanliness of TVAC chamber, load UVIT payload in it.
11. Connect all the cables required for testing during TVAC test.
12. Close the chamber door but do not pump down.
13. Conduct Full Performance test of UVITDS, FWM.
14. Place the UVITDS, FWM in OFF state.
15. Start the evacuation of chamber to the required vacuum level.

**16. Hot non-Operational (also HVU venting)**

   a. Maintain the minimum value of the CPU temperature to 45 +0/-2°C
   b. Turn ON EU heater to achieve EU temperature of 55 +0/-2°C with CPU temperature of 45°C +0/-2°C.

c. Turn ON FWM heater to achieve FWM temperature of 45 +0/-2°C .
d. Turn ON FWDE heater to achieve FWDE temperature of 55 +0/-2°C.
e. **Maintain CPU, HVU & FWM at 45°C +0/-2°C and EU & FWDE at 55°C +0/-2°C for 6 hours.**

**17. Hot Operational 1**

a. Decrease the maximum temperature of the CPU, HVU & FWM to **35 +0/-2°C.**
b. Adjust EU & FWDE heater power as necessary to achieve EU & FWDE temperature of 45 +0/-2°C with CPU, HVU & FWM temperature of 35°C.
c. Conduct a full performance test of UVITDS (CPU, FWM & HVU at 35°C and EU & FWDE at 45°C), (appendix B.1, A respectively).
d. Maintain EU Temperature 45°C, by adjusting the heater.
e. Place UVITDS, in "Low Power" State, FWM in OFF and FWDE in ON state.
f. Plateau minimum duration 3 hr.
g. Put UVITDS (CPU, HVU and EU), and FWDE in OFF state.

**18. Cold Non Operational**

a. Reduce the maximum value of the UVITDS (CPU, HVU and EU) and FWM & FWDE temperatures to -25 -0/+2°C, allow to stabilize.
b. Leave UVIT Detector Subsystem "Off".
c. Plateau minimum duration 2 hrs.

**19. Cold Operational 1**

a. Increase the UVITDS (CPU, HVU and EU) and FWM & FWDE temperatures to -15 -0/+2°C.
b. Conduct a full performance test of UVITDS, FWM and FWDE (appendix B.1, A respectively).
c. Place UVITDS in "Low Power" State, FWM in OFF and FWDE in ON state.
d. Plateau minimum duration 3 hrs.
e. Put UVITDS, and FWDE in OFF state.

**20. Hot Operational 2**

a. Increase the maximum temperature of the CPU, HVU & FWM to 35 +0/-2°C.
b. Power and adjust EU & FWDE heater power as necessary to achieve EU & FWDE temperature of 45 +0/-2°C with CPU temperature of 35°C.
c. Conduct a full functional test of UVITDS, FWM and FWDE (appendix B.1, A respectively).
d. Maintain EU Temperature 45°C, by adjusting the heater.
e. Maintain FWDE temperature 45 +0/-2°C.
f. Place UVITDS, in "Low Power" State, FWM in OFF and FWDE in ON state.
g. Plateau minimum duration 2 hr.
h. Put UVITDS, and FWDE in OFF state.

**21. Cold Operational Long Duration**

a. Decrease the UVITDS (CPU, HVU and EU) and FWM & FWDE temperatures to -15 -0/+2°C.
b. Conduct a full performance test of UVITDS, FWM and FWDE (appendix B.1, A respectively).
c. Payload team may conduct testing on the Subsystem. This could include a long duration test with NUV channel imaging.
d. During this plateau, perform the following tests recommended after EM TVac:

    • Perform long imaging runs of at least 15 minutes for both the hot and cold thermal plateaus to achieve thermal balance at the STAR250 (note that GSE limitations will not permit continuous logging of image data for this test and so data logging will have to be turned on and off).

    • Record the time and all temperatures including the temperatures reported by telemetry as well as the amount of power going into the system when thermal balance is reached.
e. **Place UVITDS in "Stand By" State, FWM in OFF and FWDE in ON state.**
f. Plateau minimum duration 24 hrs.

**22. Hot Operational Long Duration**

a. Increase the maximum temperature of the CPU, HVU & FWM to 35 -0/+2°C.
b. Power and adjust EU & FWDE heater power as necessary to achieve EU & FWDE temperature of 45 -0/+2°C with CPU temperature of 35°C.
c. Conduct a full performance test of UVITDS, FWM and FWDE (appendix B.1, A respectively).
d. Maintain EU & FWDE Temperature 45°C, by adjusting the heater.
e. Payload team may conduct testing on the Subsystem. This could include a long duration test with NUV channel imaging.
f. During this plateau, perform the following tests recommended after EM TVac:

    • Perform long imaging runs of at least 15 minutes for both the hot and cold thermal plateaus to achieve thermal balance at the STAR250 (note that GSE limitations will not permit continuous logging of image data for this test and so data logging will have to be turned on and off).

    • Record the time and all temperatures including the temperatures reported by telemetry as well as the amount of power going into the system when thermal balance is reached.
g. **Place UVITDS, in "Stand By" State, FWM in OFF and FWDE in ON state.**
h. Plateau minimum duration 24 hr.
i. Put UVITDS, and FWDE in OFF state.

**23. Returning to Ambient temperature and Pressure**

a. Increase the UVITDS (CPU, HVU and EU) and FWM/ FWDE temperature to 23 +/- 2$^{o}$C (ambient).
b. Vacuum break or venting of chamber will be initiated using dry nitrogen of 99.95% purity. This purging will be done 2 times to ensure condensation doesn't occur to any subsystem under test.
c. Conduct a full functional test of UVITDS, FWM and FWDE (appendix B.1, A respectively).
d. Conduct a full performance test of UVITDS, FWM and FWDE (appendix B.1, A respectively).
e. Open Chamber and unload UVIT Payload.
f. Conduct visual inspection.

24. Remove all the cables from TVAC chamber and pack all items (EGSE, FWM test setup etc) to ship back to CREST, IIA.
25. Assemble Dummy baffles to the payload.
26. Connect the N2 Purging to the payload.
27. Cover the UVIT payload with covers & put into the inner container of transport container.
28. Pack all the tools, slings, clean room dresses.
29. Ship back all the items with payload to CREST, IIA.
30. After coming to CREST, IIA, unpack all the items. Conduct visual inspection.
31. Clean all the items with IPA.
32. Wipe the payload with Spectroscopic grade IPA.
33. Conduct performance test on UVITDS and filter wheel drive mechanism.

# 3.0 Precaution and Contamination Control:

The UVIT system is a very sensitive system. All contaminations are to be avoided. A clean environment is required to be maintained. Even while down loading of UVIT the area has to be clean. Proper identification of clean area has to be done. The system requires continuous purging with nitrogen. Adequate precaution is required to be taken by covering the system before and after test with a proper cover. Each time a fresh cover has to be used. Reuse of cover is forbidden. Another precaution is that the UVIT system is ESD (Electro Static Discharge) sensitive. Necessary precautions with proper ESD protection are to be taken while handling the system.
During the test, it should be ensured that the components like detector/ HVU/any other component does not exceed the operational limit specified. Adequate precautions are to be taken for proper temperature maintenance.

**CPU is very critical subsystem** whose temperature to be maintained strictly. Temperature limits should be maintained at 35 +0 / -2 $^{o}$C during its operation.

UVIT is prone to contamination in TVAC chamber at ISITE. A guideline to control contamination for ASTROSAT has been already issued from ASTROSAT project office. Please refer document ***"ASTROSAT-Contamination Control notes V0.1"*** for the details.
***AS a necessary precaution, the TV chamber shall be free of any silicon compounds/greases, and the O'rings shall be coated with a thin layer of LVP Crytox grease of Dupont. Inside of the chamber shall be cleaned with lint free cloth with high grade Acetone etc. to remove any traces of contaminants.***

## 3.1 Procedure for TQCM measurement

1. TCQM needs to maintain at -20$^{o}$C during measurement time and at +60$^{o}$C during baking and when not measuring the contamination.
2. Measurement of TCQM shall be made for at last 4 hours at every 15 minutes, of baking and first HOT operation cycle (combined). On completion of contamination measurements, the temperature of the TCQM need to be raised to +60$^{o}$C to ensure the TCQM surface is clean for the next measurements.
3. Next set of measurement will be done at last 8 hours of Long HOT cycle.

## 3.2 Contamination assessment using Witness Samples ($MgF_2$ window)

Two samples of MgF2 windows are placed in TVAC chamber to asses the cumulative contamination 7 days empty chamber before test and during the test. These samples will be taken out after completion of tests and transmission loss will be measured at IIA facility.
Cumulative transmission loss should be less than 2% through $MgF_2$ windows as measure of contamination during the period as mentioned above.

## 4.0 Test set up:

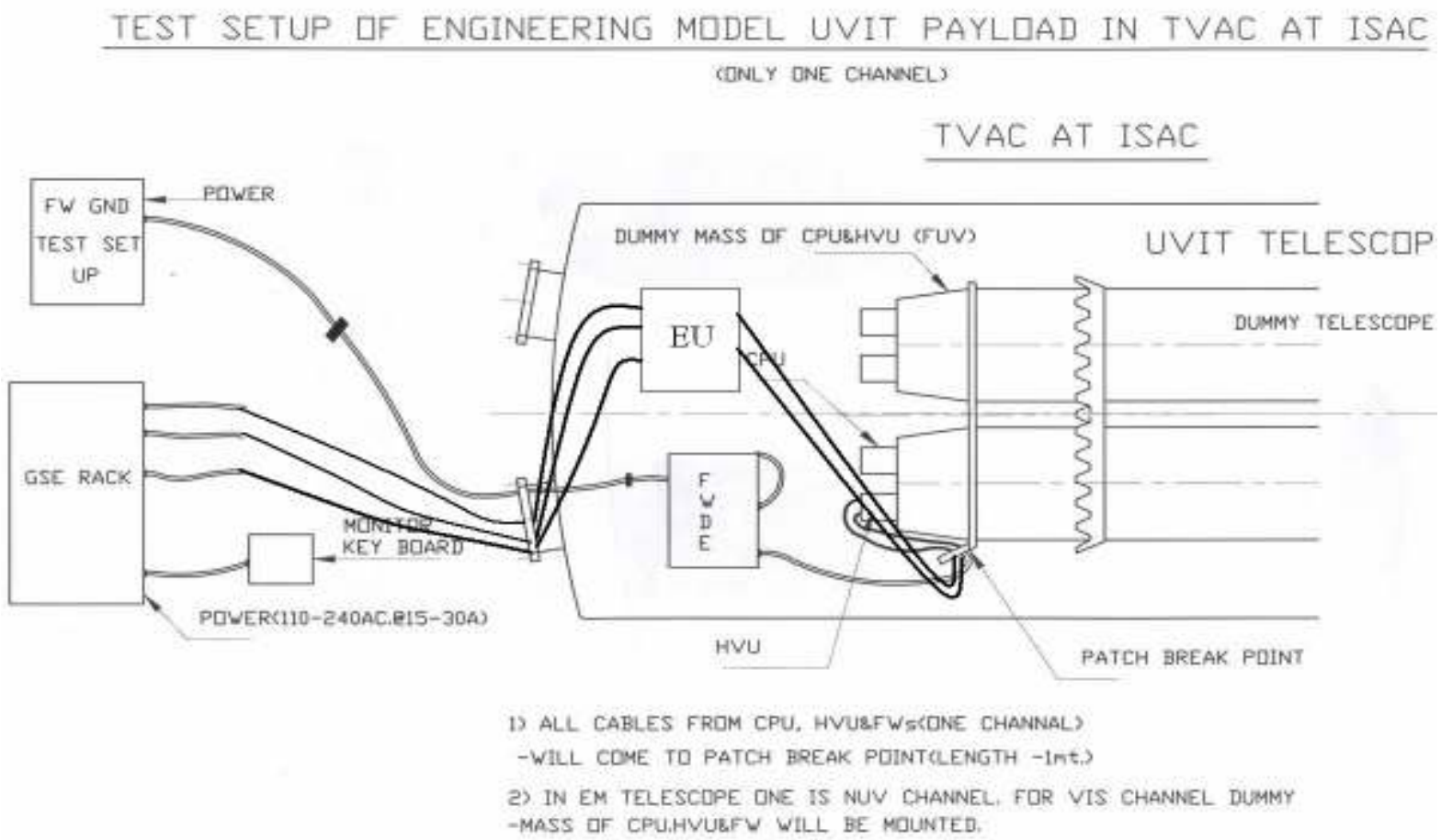



**Figure 4. 1 Test Setup of EM UVIT Payload in TVAC at ISITE**

## *4.1 Mounting Fixtures*

The figure 4.2 and 4.3 shows the UVIT system with the special mounting fixtures. The mounting fixtures are designed to withstand the weight of the UVIT system. The mounting fixtures are further designed to withstand the temperature environment faced in the thermo-vacuum chamber and also to ensure that it does not load the UVIT system. The UVIT system along with the mounting fixtures will be inside the thermo-vacuum chamber during the test. During the test the temperature of the thermo-vacuum shroud is monitored. The system has several temperature sensors. These will be monitored. During the test, it should be ensured that the components like detector/ HVU/any other component does not exceed the operational limit specified. Adequate precautions are to be taken for proper temperature maintenance.

After the test is over the system should be immediately covered with proper cover. Also minimum electrical functional tests and mechanical checks will be carried out to ensure the system is functioning after thermo-vacuum test.

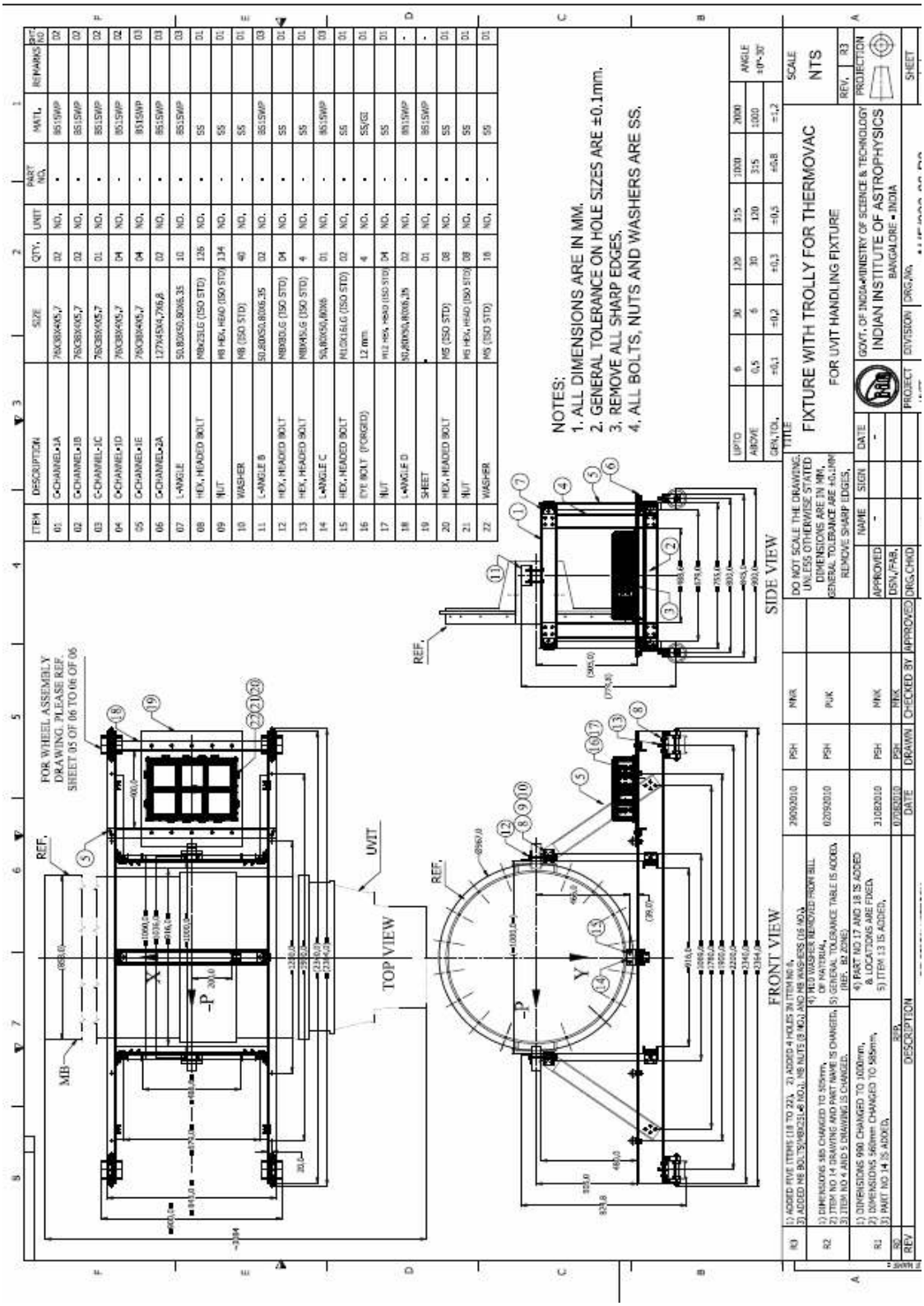



**Figure 4. 2 Mounting Fixture for UVIT payload in TVAC**

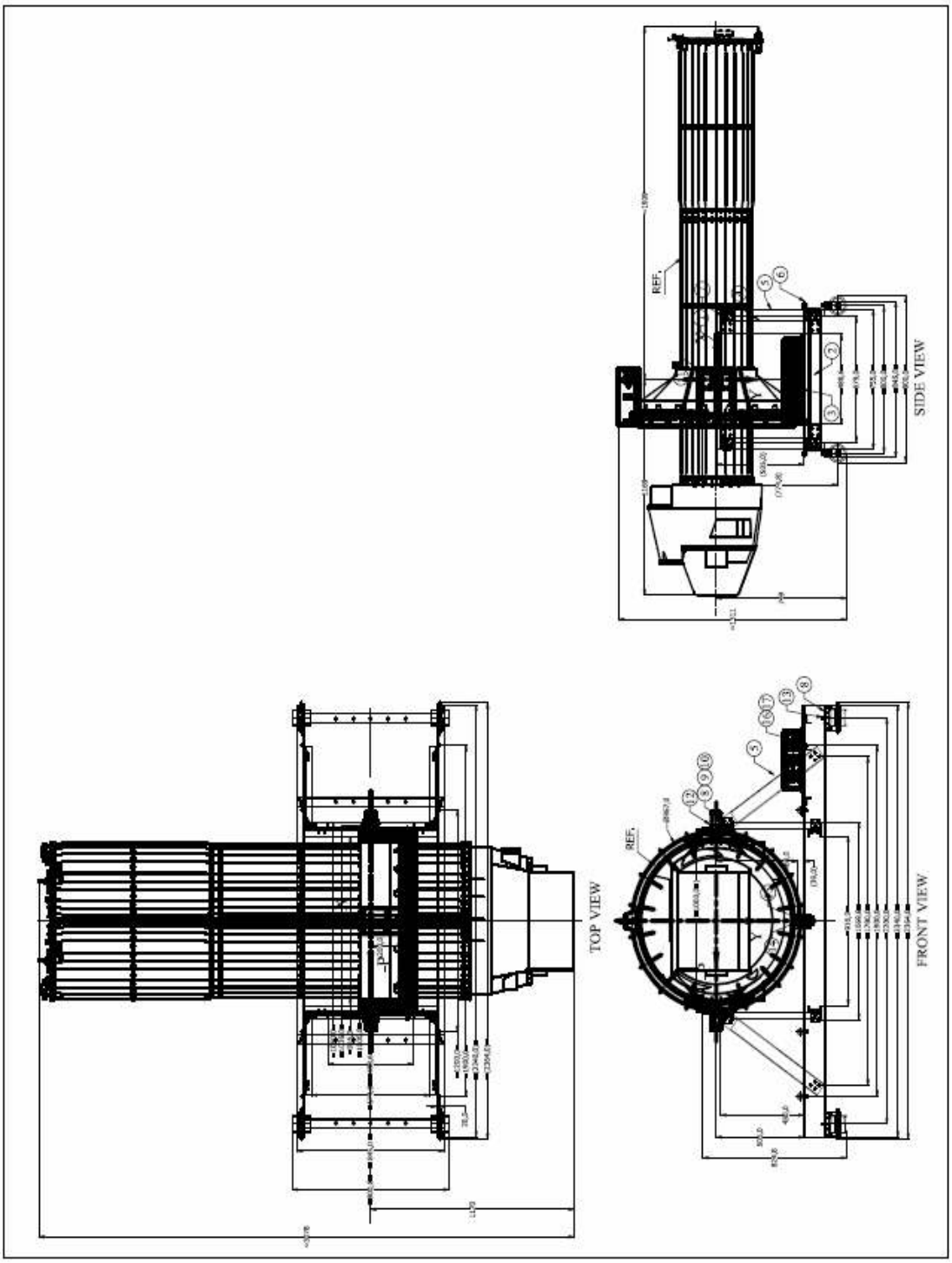



**Figure 4. 3 UVIT payload on mounting fixture in TVAC**

## *4.2 Instrumentation*

Both, Thermal instrumentation aspects (IR Lamps, Heaters, Thermistors and Thermo couples and payload performance verification related instrumentation aspects are explained here.

### 4.2.1 Thermal Instrumentation:

Combination of Infra Red Lamps (mounted on IR cage) and foil heaters (bonded on the bottom surface of plate used for mounting EU and FWDE packages) are being used to realize the required temperature limits for different units of the payload system.
The temperature measurements are being done with the help of thermistors and thermocouples. The list of thermistors mounted on the payload area given in Table-E.1, given in Appendix-E. The details of the IR lamps and the temperature monitoring sensors and their locations are given in Appendix-E.

#### 4.2.2 Payload Instrumentation

The payload performance in ambient and during Tvac tests will be performed with the help of Ground Support Equipments (GSE) developed by payload team. GSE will help in testing the detector system, Filter wheel motor with drive electronics and for monitoring the temperature at 13 locations on payload at the hot and cold plateaus during TVAC test of the UVIT payload.

For UVIT detector system, there is a dedicated system which will serve to supply Raw Power, Pulse commands, Tele-commands and receive telemetry and science data of the detector system.

**Figure 4. 4 Ground Support Equipment for UVIT Detector System**

For FWM and FWDE, there is a Labview based system, which will supply pulse commands and receive analog and digital telemetry of the FWM.

**Figure 4. 5 Ground Support Equipment for FWM and FWDE**

For Thermistors temperature monitoring also we have Labview based system, which can monitor and record the temperature of 14 thermistors at a time.
Following table 4.1 lists the location of thermistors fixed on the payload.
To supply data of thermistors from IIA system to TVAC facility system a RS232 based interface has been developed for 75 mt of cable length. The programming of RS 232 data transfer also has been done on Labview platform.

## *4.3 Harness Routing Plan for TVAC test*

As shown in figure 4.1, the connection between EU, FWDE, thermistors and GSE will be make through ISO320 K flange using circular feed-through.

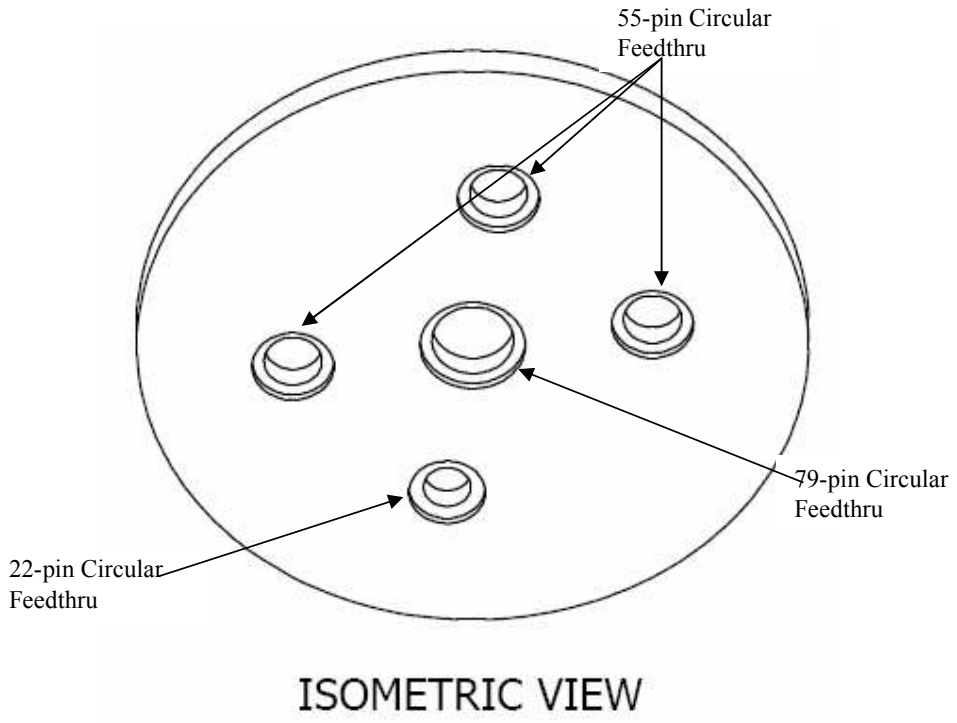



**Figure 4. 6 ISO 320 K Flange**

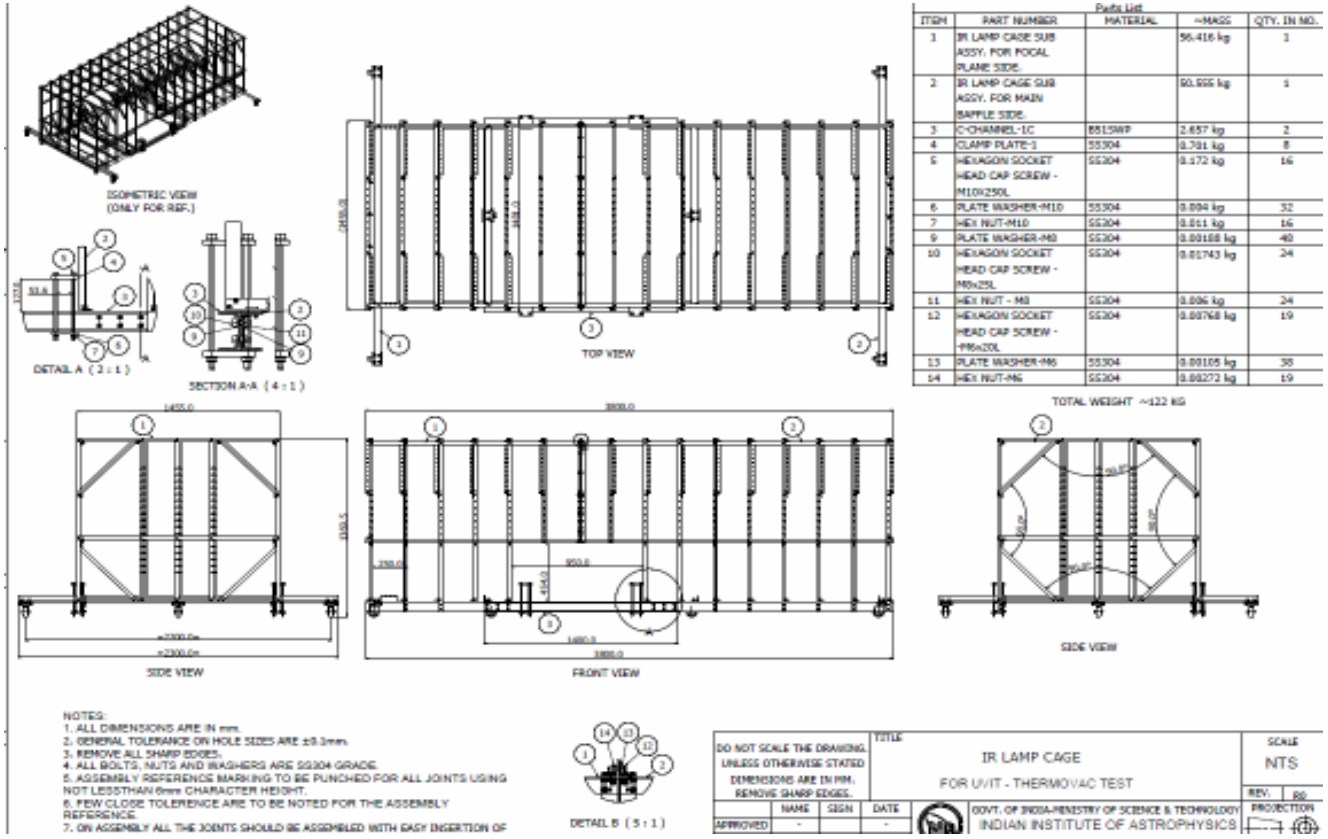
### 4.3.1 Grounding Requirement for UVITDS

UVITDS need to be connect a Grounding point (isolated from heavy electrical grounding point of Lab). EU box and CPU, HVU will be connected through existing EMI braid on the payload.

So we need a grounding connection till EU mounting plate from Lab isolated ground plane.

## *4.4 Thermal Control Implementation*

To control the temperature of EM UVIT payload, thermal control hardware (i.e IR lamps, heaters and thermocouple) will be implemented by ISAC thermal group. To fix IR lamps around the payload, an IR Lamp cage has been designed and fabricated by IIA, see figure 4.7.




Parts List

| ITEM | PART NUMBER | MATERIAL | ~MASS | QTY. IN NO. |
|---|---|---|---|---|
| 1 | IR LAMP CAGE SUB ASSY. FOR FOCAL PLANE SIDE. | | 56.416 kg | 1 |
| 2 | IR LAMP CAGE SUB ASSY. FOR MAIN BAFFLE SIDE. | | 60.888 kg | 1 |
| 3 | C-CHANNEL-1C | BS15WP | 2.657 kg | 2 |
| 4 | CLAMP PLATE-1 | SS304 | 0.701 kg | 8 |
| 5 | HEXAGON SOCKET HEAD CAP SCREW - M10X25DL | SS304 | 0.172 kg | 16 |
| 6 | PLATE WASHER-M10 | SS304 | 0.004 kg | 32 |
| 7 | HEX NUT-M10 | SS304 | 0.011 kg | 16 |
| 9 | PLATE WASHER-M8 | SS304 | 0.00188 kg | 40 |
| 10 | HEXAGON SOCKET HEAD CAP SCREW - M8x25L | SS304 | 0.01743 kg | 24 |
| 11 | HEX NUT - M8 | SS304 | 0.006 kg | 24 |
| 12 | HEXAGON SOCKET HEAD CAP SCREW - M6x20L | SS304 | 0.00768 kg | 19 |
| 13 | PLATE WASHER-M6 | SS304 | 0.00105 kg | 38 |
| 14 | HEX NUT-M6 | SS304 | 0.00272 kg | 19 |

**Figure 4. 7 IR Lamp cage**

# 5. Test Results

## *5.1 Contamination Measurement*

### 5.1.1 From Witness Samples

Two number of witness sample ($MgF_2$ window) was kept near (front and back) the payload inside TVAC chamber during the test.
Transmission loss was measured on the witness sample.
Attenuation in the transmission at 130nm-160nm band is the following:
i) 1-1.5% during the first phase of chamber baking (without payload, with IR Lamp Cage and mounting fixture).
ii) 2-2.5% during the TVAC test. See Table 5.1 for details.

### 5.1.2 From Residual Gas Analyzer (RGA)

Data is not yet received from CATVAC Facility team.

### 5.1.3. From TCQM

TCQM of CATVAC facility was not working properly and there is lack of data. So, no conclusion can be made, based on TCQM measurement.

**Table 5. 1 Contamination Monitoring from Witness Samples ($MgF_2$ window)**

6/5/2011 **CONTAMINATION MONITORING DURING EM-UVIT THERMO-VAC TEST AT ISITE**

| | W-56 Transmission Values | | | | | W-57 Transmission Values | | | | | W-06 Control Window | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wavelength λ(nm) | Measured on 16 March After cleaning with IPA | Measured on 12 April after exposing to TVAC chamber at ISITE | Measured on 22 April before sending back to ISITE | Measured on 06 May after exposing to TVAC chamber at ISITE | | Measured on 16 March After cleaning with IPA | Measured on 12 April after exposing to TVAC chamber at ISITE | Measured on 22 April before sending back to ISITE | Measured on 06 May after exposing to TVAC chamber at ISITE | | Measured on 16 March After cleaning with IPA | Measured on 12 April after exposing to TVAC chamber at ISITE | Measured on 22 April before sending back to ISITE | Measured on 06 May after exposing to TVAC chamber at ISITE |
| 126 | 0.67 | 0.71 | 0.66 | 0.64 | | 0.70 | 0.67 | 0.70 | 0.70 | | 0.61 | 0.58 | 0.62 | 0.61 |
| 127 | 0.68 | 0.69 | 0.65 | 0.63 | | 0.71 | 0.68 | 0.70 | 0.69 | | 0.61 | 0.61 | 0.61 | 0.62 |
| 128 | 0.70 | 0.69 | 0.66 | 0.65 | | 0.72 | 0.72 | 0.71 | 0.69 | | 0.63 | 0.60 | 0.63 | 0.62 |
| 129 | 0.70 | 0.70 | 0.68 | 0.66 | | 0.73 | 0.71 | 0.72 | 0.70 | | 0.64 | 0.62 | 0.64 | 0.64 |
| 130 | 0.71 | 0.71 | 0.69 | 0.67 | | 0.73 | 0.72 | 0.73 | 0.71 | | 0.64 | 0.64 | 0.64 | 0.64 |
| 131 | 0.71 | 0.72 | 0.70 | 0.67 | | 0.73 | 0.73 | 0.73 | 0.71 | | 0.64 | 0.65 | 0.64 | 0.65 |
| 132 | 0.72 | 0.72 | 0.70 | 0.67 | | 0.74 | 0.73 | 0.74 | 0.72 | | 0.65 | 0.65 | 0.65 | 0.65 |
| 133 | 0.73 | 0.73 | 0.70 | 0.68 | | 0.76 | 0.74 | 0.74 | 0.72 | | 0.66 | 0.66 | 0.66 | 0.66 |
| 134 | 0.74 | 0.74 | 0.71 | 0.69 | | 0.76 | 0.75 | 0.74 | 0.73 | | 0.67 | 0.67 | 0.67 | 0.67 |
| 135 | 0.75 | 0.73 | 0.72 | 0.70 | | 0.76 | 0.75 | 0.75 | 0.73 | | 0.68 | 0.67 | 0.68 | 0.68 |
| 136 | 0.75 | 0.75 | 0.73 | 0.70 | | 0.77 | 0.76 | 0.77 | 0.74 | | 0.69 | 0.69 | 0.69 | 0.68 |
| 137 | 0.76 | 0.75 | 0.73 | 0.71 | | 0.78 | 0.76 | 0.76 | 0.74 | | 0.69 | 0.69 | 0.69 | 0.69 |
| 138 | 0.76 | 0.76 | 0.73 | 0.72 | | 0.78 | 0.76 | 0.77 | 0.75 | | 0.69 | 0.70 | 0.70 | 0.70 |
| 139 | 0.77 | 0.76 | 0.74 | 0.72 | | 0.79 | 0.77 | 0.78 | 0.75 | | 0.70 | 0.71 | 0.71 | 0.70 |
| 140 | 0.77 | 0.77 | 0.74 | 0.73 | | 0.79 | 0.78 | 0.78 | 0.76 | | 0.71 | 0.71 | 0.71 | 0.71 |
| 141 | 0.78 | 0.76 | 0.75 | 0.73 | | 0.80 | 0.78 | 0.79 | 0.77 | | 0.72 | 0.72 | 0.72 | 0.72 |
| 142 | 0.78 | 0.77 | 0.76 | 0.74 | | 0.80 | 0.78 | 0.79 | 0.77 | | 0.72 | 0.72 | 0.72 | 0.72 |
| 143 | 0.79 | 0.78 | 0.77 | 0.75 | | 0.81 | 0.79 | 0.80 | 0.78 | | 0.73 | 0.73 | 0.73 | 0.73 |
| 144 | 0.80 | 0.79 | 0.77 | 0.75 | | 0.81 | 0.80 | 0.80 | 0.78 | | 0.73 | 0.74 | 0.74 | 0.74 |
| 145 | 0.80 | 0.80 | 0.78 | 0.76 | | 0.82 | 0.80 | 0.81 | 0.79 | | 0.75 | 0.74 | 0.74 | 0.75 |
| 146 | 0.81 | 0.80 | 0.78 | 0.77 | | 0.82 | 0.81 | 0.81 | 0.79 | | 0.76 | 0.75 | 0.75 | 0.75 |
| 147 | 0.81 | 0.80 | 0.79 | 0.78 | | 0.83 | 0.81 | 0.83 | 0.80 | | 0.76 | 0.76 | 0.76 | 0.76 |
| 148 | 0.82 | 0.81 | 0.80 | 0.78 | | 0.83 | 0.82 | 0.82 | 0.81 | | 0.76 | 0.77 | 0.77 | 0.77 |
| 149 | 0.82 | 0.81 | 0.80 | 0.79 | | 0.83 | 0.82 | 0.82 | 0.81 | | 0.77 | 0.77 | 0.77 | 0.77 |
| 150 | 0.82 | 0.82 | 0.80 | 0.79 | | 0.84 | 0.83 | 0.83 | 0.82 | | 0.78 | 0.78 | 0.78 | 0.78 |
| 151 | 0.83 | 0.82 | 0.81 | 0.80 | | 0.84 | 0.83 | 0.83 | 0.82 | | 0.79 | 0.78 | 0.78 | 0.79 |
| 152 | 0.83 | 0.83 | 0.82 | 0.80 | | 0.85 | 0.84 | 0.84 | 0.82 | | 0.79 | 0.79 | 0.79 | 0.79 |
| 153 | 0.84 | 0.83 | 0.82 | 0.81 | | 0.85 | 0.84 | 0.84 | 0.83 | | 0.80 | 0.80 | 0.80 | 0.80 |

| | W-56 Transmission Values | | | | | W-57 Transmission Values | | | | | W-06 Control Window | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wavelength λ(nm) | Measured on 16 March After cleaning with IPA | Measured on 12 April after exposing to TVAC chamber at ISITE | Measured on 22 April before sending back to ISITE | Measured on 06 May after exposing to TVAC chamber at ISITE | | Measured on 16 March After cleaning with IPA | Measured on 12 April after exposing to TVAC chamber at ISITE | Measured on 22 April before sending back to ISITE | Measured on 06 May after exposing to TVAC chamber at ISITE | | Measured on 16 March After cleaning with IPA | Measured on 12 April after exposing to TVAC chamber at ISITE | Measured on 22 April before sending back to ISITE | Measured on 06 May after exposing to TVAC chamber at ISITE |
| 158 | 0.85 | 0.85 | 0.84 | 0.83 | | 0.87 | 0.86 | 0.87 | 0.86 | | 0.83 | 0.83 | 0.83 | 0.83 |
| 159 | 0.86 | 0.85 | 0.84 | 0.83 | | 0.87 | 0.86 | 0.87 | 0.85 | | 0.83 | 0.83 | 0.83 | 0.83 |
| 160 | 0.86 | 0.85 | 0.85 | 0.84 | | 0.87 | 0.87 | 0.87 | 0.86 | | 0.84 | 0.83 | 0.83 | 0.83 |
| 161 | 0.86 | 0.86 | 0.85 | 0.84 | | 0.88 | 0.87 | 0.87 | 0.86 | | 0.84 | 0.84 | 0.84 | 0.84 |
| 162 | 0.86 | 0.86 | 0.85 | 0.85 | | 0.88 | 0.87 | 0.87 | 0.87 | | 0.84 | 0.84 | 0.84 | 0.84 |
| 163 | 0.87 | 0.86 | 0.85 | 0.85 | | 0.88 | 0.87 | 0.86 | 0.87 | | 0.85 | 0.84 | 0.84 | 0.84 |
| 164 | 0.87 | 0.86 | 0.85 | 0.85 | | 0.88 | 0.88 | 0.87 | 0.87 | | 0.85 | 0.85 | 0.85 | 0.85 |
| 165 | 0.87 | 0.86 | 0.86 | 0.85 | | 0.88 | 0.88 | 0.88 | 0.87 | | 0.85 | 0.85 | 0.85 | 0.85 |
| 166 | 0.88 | 0.87 | 0.87 | 0.86 | | 0.89 | 0.88 | 0.88 | 0.88 | | 0.86 | 0.85 | 0.86 | 0.86 |
| 167 | 0.88 | 0.87 | 0.87 | 0.86 | | 0.89 | 0.88 | 0.89 | 0.88 | | 0.86 | 0.86 | 0.86 | 0.86 |
| 168 | 0.88 | 0.88 | 0.87 | 0.86 | | 0.89 | 0.89 | 0.89 | 0.89 | | 0.86 | 0.86 | 0.86 | 0.86 |
| 169 | 0.88 | 0.88 | 0.88 | 0.87 | | 0.89 | 0.89 | 0.89 | 0.89 | | 0.86 | 0.86 | 0.86 | 0.86 |
| 170 | 0.88 | 0.88 | 0.89 | 0.88 | | 0.89 | 0.88 | 0.90 | 0.89 | | 0.86 | 0.87 | 0.87 | 0.87 |
| 171 | 0.88 | 0.88 | 0.89 | 0.88 | | 0.90 | 0.89 | 0.90 | 0.89 | | 0.87 | 0.86 | 0.87 | 0.87 |
| 172 | 0.89 | 0.88 | 0.88 | 0.88 | | 0.89 | 0.88 | 0.90 | 0.90 | | 0.88 | 0.86 | 0.88 | 0.88 |
| 173 | 0.88 | 0.89 | 0.89 | 0.88 | | 0.90 | 0.90 | 0.91 | 0.90 | | 0.87 | 0.86 | 0.87 | 0.87 |
| 174 | 0.89 | 0.89 | 0.89 | 0.88 | | 0.90 | 0.90 | 0.90 | 0.90 | | 0.87 | 0.87 | 0.88 | 0.88 |
| 175 | 0.89 | 0.89 | 0.89 | 0.88 | | 0.90 | 0.90 | 0.90 | 0.90 | | 0.87 | 0.87 | 0.89 | 0.89 |
| 176 | 0.89 | 0.90 | 0.90 | 0.89 | | 0.90 | 0.90 | 0.91 | 0.90 | | 0.88 | 0.87 | 0.88 | 0.88 |
| 177 | 0.89 | 0.90 | 0.90 | 0.89 | | 0.90 | 0.90 | 0.91 | 0.90 | | 0.88 | 0.88 | 0.89 | 0.89 |
| 178 | 0.90 | 0.91 | 0.91 | 0.90 | | 0.91 | 0.91 | 0.92 | 0.91 | | 0.89 | 0.88 | 0.89 | 0.89 |
| 179 | 0.90 | 0.90 | 0.90 | 0.89 | | 0.91 | 0.90 | 0.91 | 0.91 | | 0.89 | 0.88 | 0.89 | 0.89 |
| 180 | 0.90 | 0.90 | 0.91 | 0.90 | | 0.91 | 0.91 | 0.92 | 0.91 | | 0.89 | 0.89 | 0.89 | 0.89 |

## *5.2 Payload Performance*

### 5.2.1 Electrical Parameters Measurement

During the test and after test, instrument (UVIT detector system and Filter Wheel Mechanism) performance was normal. Please refer figure 2.1 for temperature profile, followed during TVAC test.

**Table 5. 2 Electrical Parameter Results**

| Name of Parameter | First Hot Cycle | First Cold Cycle | Second Hot Cycle | 24 Hrs Cold Cycle | 24 Hrs Hot Cycle | Post TVAC at Ambient |
|---|---|---|---|---|---|---|
| **Performance of UVITDS (CPU, HVU and EU)** | Normal | Normal | Normal | Normal | Normal | Normal |
| **Performance of FWM & FWDE** | Normal | Normal | Normal | Normal | Normal | Normal |

#### 5.2.1.1 Performance of FWM & FWDE

Performance of FWM was normal during the entire test.

**Table 5. 3 Performance Details of FWM & FWDE**

| | Expected value in Motor Enable State | Observed value in Motor Enable State | Expected value in Motor Disable State | Observed value in Motor Disable State |
|---|---|---|---|---|
| **Measurement Accuracy (TM-angle)** | +/- 30 arc minute | + 9.22 arc minute (max) during HOT cycle | +/- 30 arc minute | + 11.49 arc minute (max) during HOT cycle |
| **Motor Power Dissipation** | 3.5 W (max) as per specs | 3.2 W (Hot cycle & amb)<br>3.5 W (Cold cycle) | -- | -- |
| **FWDE Power Dissipation** | 7 W (max) as per specs | 4.8 W (Hot cycle & amb)<br>5.44 W (Cold cycle) | -- | 1.6 W (Hot cycle & amb)<br>1.92 W (Cold cycle) |

Please table 5.4 for more details.

**Table 5. 4 Analog and Digital Telemetry Data for FWM & FWDE**

**Performance Test on FWM - FWDE at ISITE on 26/04/11**
**Pre TVAC in Ambient**

| Data Command | Expected | Angle Telemetry | | | | Motor Status TM | |
|---|---|---|---|---|---|---|---|
| dir/ no. of steps | TM angle | Motor | | | | Motor | |
| | | Enable | Disable | Enable | Disable | Enable | Disable |
| | (deg) | (HEX) | (HEX) | (deg) | (deg) | (HEX) | (HEX) |
| Safe ON cmnd | x= < 1.8 | 104 | 104 | 1.428 | 1.428 | 34 | 20 |
| CCW/ 25 | x+45 | 20E0 | 20D4 | 46.2308 | 46.1649 | 12 | 0 |
| CCW/ 8 | x+59.4 | 2B34 | 2B34 | 60.7548 | 60.7548 | 12 | 0 |
| CCW/ 17 | x+90 | 40F8 | 40F0 | 91.3629 | 91.319 | 11 | 0 |
| CCW/ 17 | x+120.6 | 56C4 | 56C4 | 122.015 | 122.015 | 18 | 0 |
| CCW/ 8 | x+135 | 6118 | 6118 | 136.539 | 136.539 | 18 | 0 |
| CCW/ 25 | x+180 | 810C | 8110 | 181.473 | 181.495 | 14 | 0 |
| CCW/ 25 | x+225 | A0E8 | A0D4 | 226.276 | 226.166 | 12 | 0 |
| CCW/ 8 | x+239.4 | AB34 | AB1C | 240.756 | 240.624 | 12 | 0 |
| CCW/ 17 | x+270 | C100 | C0F8 | 271.408 | 271.364 | 11 | 0 |
| CCW/ 17 | x+300.6 | D6CC | D6CC | 302.06 | 302.06 | 18 | 0 |
| CCW/8 | x+315 | E120 | E124 | 316.584 | 316.606 | 18 | 0 |
| CCW/25 | x | F4 | E8 | 1.34 | 1.274 | 14 | 0 |
| CW/ 25 | x+315 | E12C | E130 | 316.65 | 316.672 | 38 | 20 |
| CW/ 8 | x+300.6 | D6D8 | D6D8 | 302.126 | 302.126 | 38 | 20 |
| CW/ 17 | x+270 | C110 | C10C | 271.496 | 271.474 | 31 | 20 |
| CW/ 17 | x+239.4 | AB40 | AB2C | 240.822 | 240.712 | 32 | 20 |
| CW/ 8 | x+225 | A0F4 | A0E4 | 226.342 | 226.254 | 32 | 20 |
| CW/ 25 | x+180 | 8118 | 811C | 181.539 | 181.561 | 34 | 20 |
| CW/ 25 | x+135 | 6124 | 6124 | 136.605 | 136.605 | 38 | 20 |
| CW/ 8 | x+120.6 | 56D4 | 56D0 | 122.103 | 122.081 | 38 | 20 |
| CW/ 17 | x+90 | 4108 | 4104 | 91.4508 | 91.4288 | 31 | 20 |
| CW/ 17 | x+59.4 | 2B48 | 2B44 | 60.8647 | 60.8427 | 32 | 20 |
| CW/ 8 | x+45 | 20F0 | 20E8 | 46.3187 | 46.2747 | 32 | 20 |
| CW/ 25 | x | 114 | 118 | 1.516 | 1.5381 | 34 | 20 |

**Analog Telemetry**

**After Motor Disable**
Motor Current:
Motor Temperature:
DC/DC Monitoring:

**After Motor Enable**
Motor Current:-1.629
Motor Temperature:2.545
DC/DC Monitoring:2.245

| | Power ON | | Power |
|---|---|---|---|
| | Voltage (V) | Current (A) | (W) |
| Motor Disable | 32.1V | 0.05 A | **1.6** |
| Safe Start | 32.1 V | 0.15 A | **4.815** |
| (Motor Enable) | | | |

**Performance Test on FWM - FWDE at ISITE on 30/04/11**
**First Hot Cycle** FWM at ~ +35 deg C
FWDE at ~ +45 deg C

| Angle Telemetry | | | | Motor Status TM | |
|---|---|---|---|---|---|
| Motor | | | | Motor | |
| Enable | Disable | Enable | Disable | Enable | Disable |
| (HEX) | (HEX) | (deg) | (deg) | (HEX) | (HEX) |
| F4 | E0 | 1.3403 | 1.2305 | 34 | 20 |
| 20E0 | 20D0 | 46.2308 | 46.1429 | 12 | 0 |
| 2B2C | 2B1C | 60.7108 | 60.623 | 12 | 0 |
| 40F8 | 40F4 | 91.3629 | 91.3409 | 11 | 0 |
| 56C8 | 56C8 | 122.0369 | 122.0369 | 18 | 0 |
| 6104 | 60F0 | 136.4291 | 136.3193 | 18 | 0 |
| 80FC | 80F4 | 181.3855 | 181.3415 | 14 | 0 |
| A0F8 | A0F8 | 226.3638 | 226.3638 | 12 | 0 |
| AB40 | AB3C | 240.8219 | 240.7999 | 12 | 0 |
| C100 | C0F8 | 271.408 | 271.3641 | 11 | 0 |
| D6C8 | D6C8 | 302.0381 | 302.0381 | 18 | 0 |
| E118 | E118 | 316.5402 | 316.5402 | 18 | 0 |
| F4 | E8 | 1.3403 | 1.2744 | 14 | 0 |
| E120 | E120 | 316.5841 | 316.5841 | 38 | 20 |
| D6D8 | D6D4 | 302.126 | 302.104 | 38 | 20 |
| C110 | C10C | 271.4959 | 271.4739 | 31 | 20 |
| AB4C | AB48 | 240.8878 | 240.8658 | 32 | 20 |
| A104 | A104 | 226.4297 | 226.4297 | 32 | 20 |
| 8108 | 8104 | 181.4514 | 181.4294 | 34 | 20 |
| 6110 | 6100 | 136.495 | 136.4071 | 38 | 20 |
| 56D8 | 56D8 | 122.1248 | 122.1248 | 38 | 20 |
| 410C | 4108 | 91.4728 | 91.4508 | 31 | 20 |
| 2B40 | 2B30 | 60.8207 | 60.7328 | 32 | 20 |
| 20E4 | 20D4 | 46.2527 | 46.1649 | 32 | 20 |
| F8 | EC | 1.3623 | 1.2964 | 34 | 20 |

**After Motor Disable**
Motor Current: 0.0831
Motor Temperature: 1.9212
DC/DC Monitoring: 2.5248

**After Motor Enable**
Motor Current:-1.5833
Motor Temperature:1.8535
DC/DC Monitoring:2.5258

| Power ON | | Power |
|---|---|---|
| Voltage (V) | Current (A) | (W) |
| 32 | 0.05 | **1.6** |
| 32 | 0.15 | **4.8** |

**Performance Test on FWM - FWDE at ISITE on 01/05/11**
**First Cold Cycle** FWM at ~ -15 deg C
FWDE at ~ -15 deg C

| Data Command | Expected | Angle Telemetry | | | | Motor Status TM | |
|---|---|---|---|---|---|---|---|
| dir/ no. of steps | TM angle | Motor | | | | Motor | |
| | | Enable | Disable | Enable | Disable | Enable | Disable |
| | (deg) | (HEX) | (HEX) | (deg) | (deg) | (HEX) | (HEX) |
| Safe ON cmnd | x= < 1.8 | F8 | EC | 1.3623 | 1.2964 | 34 | 20 |
| CCW/ 25 | x+45 | 20E4 | 20D8 | 46.2527 | 46.1868 | 12 | 0 |
| CCW/ 8 | x+59.4 | 2B2C | 2B14 | 60.7108 | 60.579 | 12 | 0 |
| CCW/ 17 | x+90 | 40F4 | 40EC | 91.3409 | 91.297 | 11 | 0 |
| CCW/ 17 | x+120.6 | 56C4 | 56C4 | 122.015 | 122.015 | 18 | 0 |
| CCW/ 8 | x+135 | 6114 | 6114 | 136.517 | 136.517 | 18 | 0 |
| CCW/ 25 | x+180 | 80F4 | 80E9 | 181.3415 | 181.2756 | 14 | 0 |
| CCW/ 25 | x+225 | A0F0 | A0EC | 226.3198 | 226.2979 | 12 | 0 |
| CCW/ 8 | x+239.4 | AB3C | AB38 | 240.7999 | 240.7779 | 12 | 0 |
| CCW/ 17 | x+270 | C108 | C108 | 271.452 | 271.452 | 11 | 0 |
| CCW/ 17 | x+300.6 | D6CC | D6CC | 302.0601 | 302.0601 | 18 | 0 |
| CCW/8 | x+315 | E11C | E11C | 316.5621 | 316.5621 | 18 | 0 |
| CCW/25 | x | F8 | E8 | 1.3623 | 1.2744 | 14 | 0 |
| CW/ 25 | x+315 | E128 | E128 | 316.628 | 316.628 | 38 | 20 |
| CW/ 8 | x+300.6 | D6D4 | D6D8 | 302.104 | 302.126 | 38 | 20 |
| CW/ 17 | x+270 | C114 | C118 | 271.5179 | 271.5399 | 31 | 20 |
| CW/ 17 | x+239.4 | AB48 | AB44 | 240.8658 | 240.8439 | 32 | 20 |
| CW/ 8 | x+225 | A0F8 | A0F8 | 226.3638 | 226.3638 | 32 | 20 |
| CW/ 25 | x+180 | 8100 | 80FC | 181.4074 | 181.3855 | 34 | 20 |
| CW/ 25 | x+135 | 611C | 6120 | 136.561 | 136.5829 | 38 | 20 |
| CW/ 8 | x+120.6 | 56CC | 56CC | 122.0589 | 122.0589 | 38 | 20 |
| CW/ 17 | x+90 | 4100 | 4100 | 91.4068 | 91.4068 | 31 | 20 |
| CW/ 17 | x+59.4 | 2B38 | 2B28 | 60.7768 | 60.6889 | 32 | 20 |
| CW/ 8 | x+45 | 20F0 | 20F0 | 46.3187 | 46.3187 | 32 | 20 |
| CW/ 25 | x | 104 | 100 | 1.4282 | 1.4063 | 34 | 20 |

**Analog Telemetry**

**After Motor Disable**
Motor Current: 0.0834
Motor Temperature: 4.0604
DC/DC Monitoring: 2.5993

**After Motor Enable**
Motor Current:-1.8139
Motor Temperature:3.9715
DC/DC Monitoring:2.5922

| | | Power ON | | Power |
|---|---|---|---|---|
| | | Voltage (V) | Current (A) | (W) |
| Motor Disable | | 32 | 0.06 | **1.92** |
| Safe Start | | 32 | 0.17 | **5.44** |
| (Motor Enable) | | | | |

**Performance Test on FWM - FWDE at ISITE on 01/05/11**
**Second Hot Cycle** FWM at ~ +35 deg C
FWDE at ~ +45 deg C

| Data Command | Expected | Angle Telemetry | | | | Motor Status TM | |
|---|---|---|---|---|---|---|---|
| dir/ no. of steps | TM angle | Motor | | | | Motor | |
| | | Enable | Disable | Enable | Disable | Enable | Disable |
| | (deg) | (HEX) | (HEX) | (deg) | (deg) | (HEX) | (HEX) |
| Safe ON cmnd | x= < 1.8 | F8 | F4 | 1.3623 | 1.3403 | 34 | 20 |
| CCW/ 25 | x+45 | 20E4 | 20E0 | 46.2527 | 46.2308 | 12 | 0 |
| CCW/ 8 | x+59.4 | 2B28 | 2B14 | 60.6889 | 60.579 | 12 | 0 |
| CCW/ 17 | x+90 | 40F8 | 40F4 | 91.3629 | 91.3409 | 11 | 0 |
| CCW/ 17 | x+120.6 | 56D4 | 56E0 | 122.1028 | 122.1688 | 18 | 0 |
| CCW/ 8 | x+135 | 6114 | 6114 | 136.517 | 136.517 | 18 | 0 |
| CCW/ 25 | x+180 | 80F4 | 80F0 | 181.3415 | 181.3195 | 14 | 0 |
| CCW/ 25 | x+225 | A0EC | A0E8 | 226.2979 | 226.2759 | 12 | 0 |
| CCW/ 8 | x+239.4 | AB38 | AB34 | 240.7779 | 240.756 | 12 | 0 |
| CCW/ 17 | x+270 | C104 | C100 | 271.43 | 271.408 | 11 | 0 |
| CCW/ 17 | x+300.6 | D6D0 | D6D0 | 302.0821 | 302.0821 | 18 | 0 |
| CCW/8 | x+315 | E114 | E110 | 316.5182 | 316.4962 | 18 | 0 |
| CCW/25 | x | E0 | FF | 1.2305 | 1.4008 | 14 | 0 |
| CW/ 25 | x+315 | E124 | E120 | 316.6061 | 316.5841 | 38 | 20 |
| CW/ 8 | x+300.6 | D6E0 | D6E0 | 302.1699 | 302.1699 | 38 | 20 |
| CW/ 17 | x+270 | C118 | C118 | 271.5399 | 271.5399 | 31 | 20 |
| CW/ 17 | x+239.4 | AB4C | AB44 | 240.8878 | 240.8439 | 32 | 20 |
| CW/ 8 | x+225 | A0F8 | A0F4 | 226.3638 | 226.3418 | 32 | 20 |
| CW/ 25 | x+180 | 8104 | 8104 | 181.4294 | 181.4294 | 34 | 20 |
| CW/ 25 | x+135 | 6124 | 6124 | 136.6049 | 136.6049 | 38 | 20 |
| CW/ 8 | x+120.6 | 56E4 | 56F0 | 122.1907 | 122.2567 | 38 | 20 |
| CW/ 17 | x+90 | 410C | 410C | 91.4728 | 91.4728 | 31 | 20 |
| CW/ 17 | x+59.4 | 2B3C | 2B3C | 60.7987 | 60.7987 | 32 | 20 |
| CW/ 8 | x+45 | 20F4 | 20F0 | 46.3406 | 46.3187 | 32 | 20 |
| CW/ 25 | x | 108 | 104 | 1.4502 | 1.4282 | 34 | 20 |

**After Motor Disable**
Motor Current: 0.0818
Motor Temperature: 1.6780
DC/DC Monitoring: 2.5232

**After Motor Enable**
Motor Current:-1.5469
Motor Temperature:1.6309
DC/DC Monitoring:2.5226

| Power ON | | Power |
|---|---|---|
| Voltage (V) | Current (A) | (W) |
| 32 | 0.05 | **1.6** |
| 32 | 0.15 | **4.8** |

| | | Long Cold Cycle | FWM at ~ -15 deg C<br>FWDE at ~ -15 deg C | | | | | Long Hot Cycle | FWM at ~ +35 deg C<br>FWDE at ~ +45 deg C | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Data Command** | **Expected** | **Angle Telemetry** | | | | **Motor Status TM** | | **Angle Telemetry** | | | | **Motor Status TM** | |
| dir/ no. of steps | **TM angle** | **Motor** | | | | **Motor** | | **Motor** | | | | **Motor** | |
| | | Enable | Disable | Enable | Disable | Enable | Disable | Enable | Disable | Enable | Disable | Enable | Disable |
| | (deg) | (HEX) | (HEX) | (deg) | (deg) | (HEX) | (HEX) | (HEX) | (HEX) | (deg) | (deg) | (HEX) | (HEX) |
| Safe ON cmnd | x= < 1.8 | E8 | B8 | 1.2744 | 1.0107 | 34 | 20 | E0 | C0 | 1.2305 | 1.0547 | 34 | 20 |
| CCW/ 25 | x+45 | 20E4 | 20E0 | 46.2527 | 46.2308 | 12 | 0 | 20E0 | 20E0 | 46.2308 | 46.2308 | 12 | 0 |
| CCW/ 8 | x+59.4 | 2B28 | 2B18 | 60.6889 | 60.601 | 12 | 0 | 2B24 | 2B14 | 60.6669 | 60.579 | 12 | 0 |
| CCW/ 17 | x+90 | 40F8 | 40F0 | 91.3629 | 91.319 | 11 | 0 | 40F8 | 40F8 | 91.3629 | 91.3629 | 11 | 0 |
| CCW/ 17 | x+120.6 | 56C0 | 56BC | 121.993 | 121.971 | 18 | 0 | 56C0 | 56C0 | 121.993 | 121.993 | 18 | 0 |
| CCW/ 8 | x+135 | 6110 | 610C | 136.495 | 136.4731 | 18 | 0 | 610C | 6108 | 136.4731 | 136.4511 | 18 | 0 |
| CCW/ 25 | x+180 | 80FC | 80F8 | 181.3855 | 181.3635 | 14 | 0 | 80F8 | 80F4 | 181.3635 | 181.3415 | 14 | 0 |
| CCW/ 25 | x+225 | A0EC | A0E4 | 226.2979 | 226.2539 | 12 | 0 | A0EC | A0E8 | 226.2979 | 226.2759 | 12 | 0 |
| CCW/ 8 | x+239.4 | AB40 | AB3C | 240.8219 | 240.7999 | 12 | 0 | AB40 | AB3C | 240.8219 | 240.7999 | 12 | 0 |
| CCW/ 17 | x+270 | C100 | C0F8 | 271.408 | 271.3641 | 11 | 0 | C104 | C100 | 271.43 | 271.408 | 11 | 0 |
| CCW/ 17 | x+300.6 | D6C8 | D6C8 | 302.0381 | 302.0381 | 18 | 0 | D6D0 | D6D0 | 302.0821 | 302.0821 | 18 | 0 |
| CCW/8 | x+315 | E118 | E118 | 316.5402 | 316.5402 | 18 | 0 | E118 | E118 | 316.5402 | 316.5402 | 18 | 0 |
| CCW/25 | x | F4 | E4 | 1.3403 | 1.2524 | 14 | 0 | F0 | E0 | 1.3184 | 1.2305 | 14 | 0 |
| CW/ 25 | x+315 | E128 | E128 | 316.628 | 316.628 | 38 | 20 | E128 | E128 | 316.628 | 316.628 | 38 | 20 |
| CW/ 8 | x+300.6 | D6CC | D6CC | 302.0601 | 302.0601 | 38 | 20 | D6E0 | D6E0 | 302.1699 | 302.1699 | 38 | 20 |
| CW/ 17 | x+270 | C10C | C10C | 271.4739 | 271.4739 | 31 | 20 | C118 | C118 | 271.5399 | 271.5399 | 31 | 20 |
| CW/ 17 | x+239.4 | AB4C | AB4C | 240.8878 | 240.8878 | 32 | 20 | AB50 | AB4C | 240.9098 | 240.8878 | 32 | 20 |
| CW/ 8 | x+225 | A0F4 | A0F0 | 226.3418 | 226.3198 | 32 | 20 | A0F8 | A0F4 | 226.3638 | 226.3418 | 32 | 20 |
| CW/ 25 | x+180 | 8108 | 8108 | 181.4514 | 181.4514 | 34 | 20 | 8108 | 8108 | 181.4514 | 181.4514 | 34 | 20 |
| CW/ 25 | x+135 | 6118 | 6118 | 136.539 | 136.539 | 38 | 20 | 611C | 6118 | 136.561 | 136.539 | 38 | 20 |
| CW/ 8 | x+120.6 | 56C8 | 56C8 | 122.0369 | 122.0369 | 38 | 20 | 56D0 | 56D0 | 122.0809 | 122.0809 | 38 | 20 |
| CW/ 17 | x+90 | 4104 | 4104 | 91.4288 | 91.4288 | 31 | 20 | 410C | 410C | 91.4728 | 91.4728 | 31 | 20 |
| CW/ 17 | x+59.4 | 2B38 | 2B2C | 60.7768 | 60.7108 | 32 | 20 | 2B3C | 2B30 | 60.7987 | 60.7328 | 32 | 20 |
| CW/ 8 | x+45 | 20F4 | 20F4 | 46.3406 | 46.3406 | 32 | 20 | 20F8 | 20F8 | 46.3626 | 46.3626 | 32 | 20 |
| CW/ 25 | x | F4 | FF | 1.3403 | 1.4008 | 34 | 20 | F4 | DC | 1.3403 | 1.2085 | 34 | 20 |

**Analog Telemetry**

**After Motor Disable**
Motor Current: 0.0863
Motor Temperature: 4.0746
DC/DC Monitoring: 2.5915

**After Motor Enable**
Motor Current:-1.8767
Motor Temperature:4.0047
DC/DC Monitoring:2.5941

| | | **Power ON** | | **Power** |
|---|---|---|---|---|
| | | Voltage (V) | Current (A) | (W) |
| Motor Disable | | 32 | 0.05 | **1.6** |
| Safe Start | | 32 | 0.17 | **5.44** |
| (Motor Enable) | | | | |

**After Motor Disable**
Motor Current: 0.0802
Motor Temperature: 1.7817
DC/DC Monitoring: 2.5248

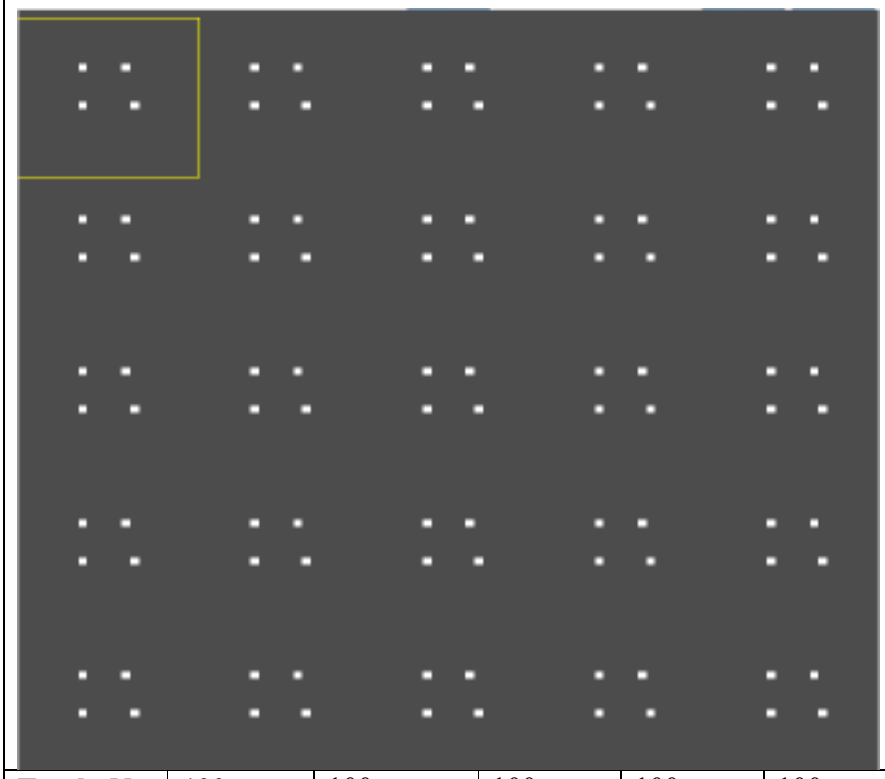
**After Motor Enable**
Motor Current:-1.5765
Motor Temperature:1.7256
DC/DC Monitoring:2.5226

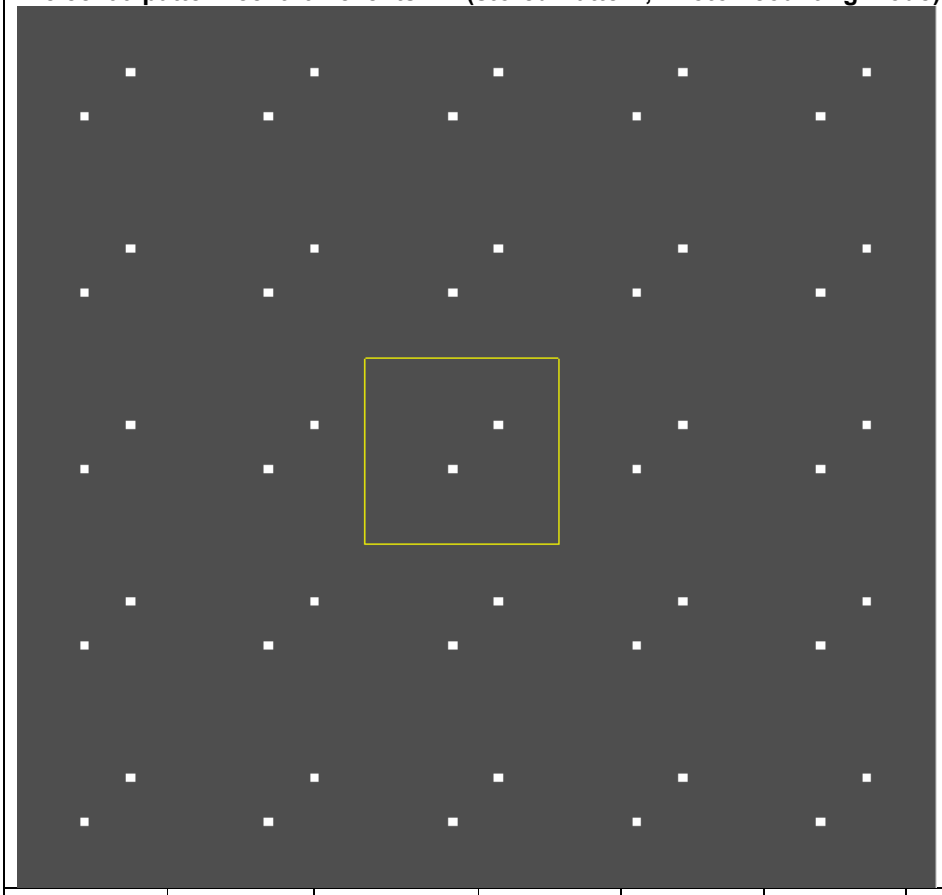
| **Power ON** | | **Power** |
|---|---|---|
| Voltage (V) | Current (A) | (W) |
| 32 | 0.05 | **1.6** |
| 32 | 0.15 | **4.8** |
| | | |

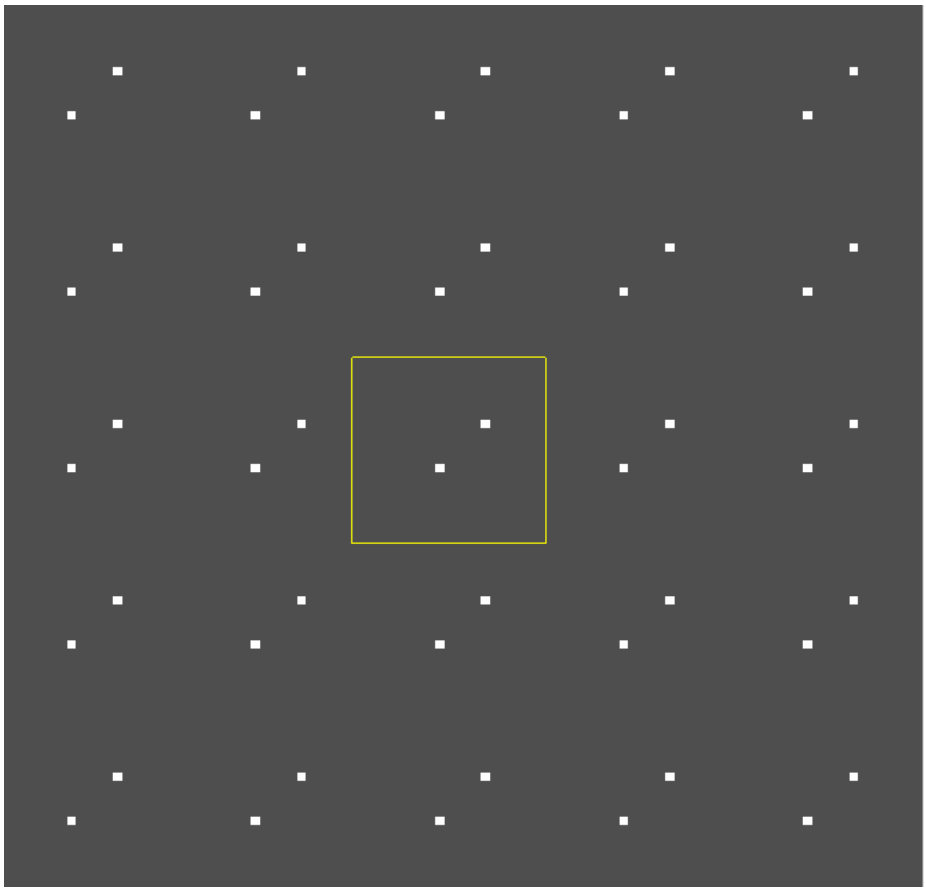
### 5.2.1.2 Performance of UVITDS (CPU, HVU & EU)

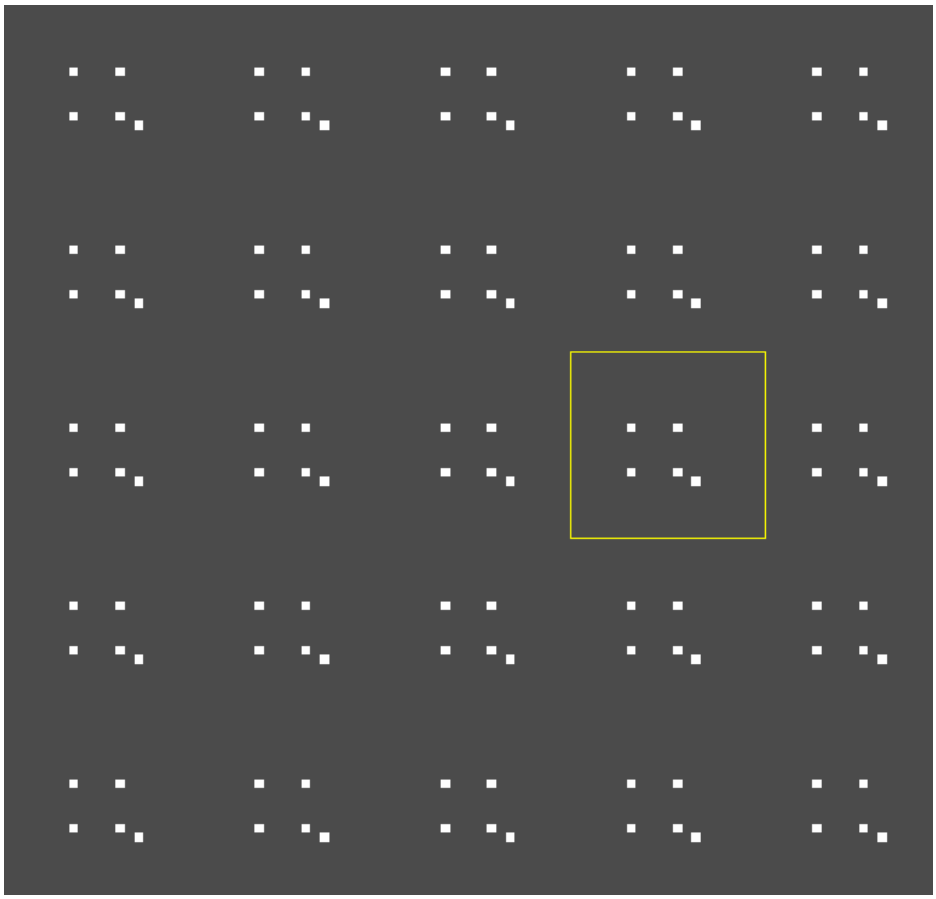
Following are parameters observed during the test and performance of UVITDS was normal.

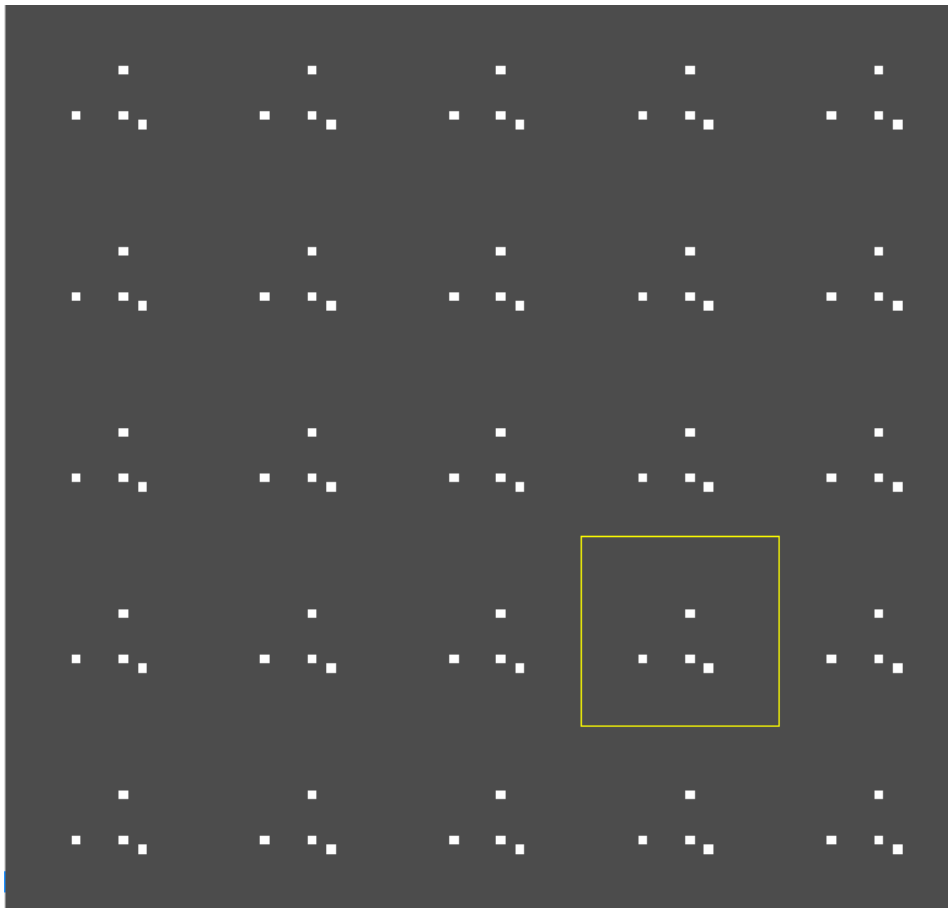
**Table 5. 5 Measurement of UVITDS-Parameters**

| **Pass Fail Criteria** | | **First Hot Cycle** | **First Cold Cycle** | **Second Hot Cycle** | **24 Hrs Cold Cycle** | **24 Hrs Hot Cycle** | **Post TVAC at Ambient** |
|---|---|---|---|---|---|---|---|
| **Name of Parameter** | **Expected Value** | Observed Value | Observed Value | Observed Value | Observed Value | Observed Value | Observed Value |
| **Std. Deviation** | **< 30** | 6.59 **(6.37;Pre-Tvac)** | 5.61 | 7.87 | 5.61 | 6.94 | 6.49 |
| **A-elec100 Pattern-cent10-4events-EE (stored pattern, Photon counting mode)**  | | | | | | | |
| **Total No. of events** | **100** | 100**(100Pre-Tvac)** | 100 | 100 | 100 | 100 | 100 |
| **Window Size** | **100x 100** | 100x 100 | 100x 100 | 100x 100 | 100x 100 | 100x 100 | 100x 100 |
| **Total num of pixels** | **10000** | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 |
| **Num of Bright Pixels** | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| **Num of dark Pixels** | 9900 | 9900 | 9900 | 9900 | 9900 | 9900 | 9900 |

| | | First Hot Cycle | First Cold Cycle | Second Hot Cycle | 24 Hrs Cold Cycle | 24 Hrs Hot Cycle | Post TVAC at Ambient |
|---|---|---|---|---|---|---|---|
| **Name of Parameter** | **Expected Value** | Observed Value | Observed Value | Observed Value | Observed Value | Observed Value | Observed Value |
| **Event Grouping** | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| **X-Y Cordinates** | No shift | Pass | Pass | Pass | Pass | Pass | Pass |
| **B-elec100-pattern-cent10-2events-EE (stored Pattern, Photon counting mode)**  | | | | | | | |
| **Total No. of events** | **50** | 50 | 50 | 50 | 50 | 50 | 50 |
| **Window Size** | **100x 100** | 100x 100 | 100x 100 | 100x 100 | 100x 100 | 100x 100 | 100x 100 |
| **Total num of pixels** | **10000** | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 |
| **Num of Bright pixels** | **50** | 50 | 50 | 50 | 50 | 50 | 50 |
| **Num of dark Pixels** | **9950** | 9950 | 9950 | 9950 | 9950 | 9950 | 9950 |
| **Event Grouping** | **2** | 2 | 2 | 2 | 2 | 2 | 2 |
| **X-Y Cordinates** | **No Shift** | Pass | Pass | Pass | Pass | Pass | Pass |

| | | First Hot Cycle | First Cold Cycle | Second Hot Cycle | 24 Hrs Cold Cycle | 24 Hrs Hot Cycle | Post TVAC at Ambient |
|---|---|---|---|---|---|---|---|
| **Name of Parameter** | **Expected Value** | Observed Value | Observed Value | Observed Value | Observed Value | Observed Value | Observed Value |
| **C-elec100-pattern-cent10-2events-EE (Stored Pattern, Photon counting mode)** | | | | | | | |
| | |  | | | | | |
| **Total No. of events** | **50** | 50 | 50 | 50 | 50 | 50 | 50 |
| **Window Size** | **100x 100** | 100x 100 | 100x 100 | 100x 100 | 100x 100 | 100x 100 | 100x 100 |
| **Total num of pixels** | **10000** | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 |
| **Num of Bright pixels** | **50** | 50 | 50 | 50 | 50 | 50 | 50 |
| **Num of dark Pixels** | **9950** | 9950 | 9950 | 9950 | 9950 | 9950 | 9950 |
| **Event Grouping** | **2** | 2 | 2 | 2 | 2 | 2 | 2 |
| **X-Y Cordinates** | **No Shift** | Pass | Pass | Pass | Pass | Pass | Pass |

| | | First Hot Cycle | First Cold Cycle | Second Hot Cycle | 24 Hrs Cold Cycle | 24 Hrs Hot Cycle | Post TVAC at Ambient |
|---|---|---|---|---|---|---|---|
| **Name of Parameter** | **Expected Value** | Observed Value | Observed Value | Observed Value | Observed Value | Observed Value | Observed Value |
| **P-elec100-pattern-cent01-5events-EE (stored pattern, Photon counting mode)** | | | | | | | |
| | |  | | | | | |
| **Total No. of events** | **125** | 125 | 125 | 125 | 125 | 125 | 125 |
| **Window Size** | **100x 100** | 100x 100 | 100x 100 | 100x 100 | 100x 100 | 100x 100 | 100x 100 |
| **Total num of pixels** | **10000** | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 |
| **Num of Bright pixels** | **125** | 125 | 125 | 125 | 125 | 125 | 125 |
| **Num of dark Pixels** | **9875** | 9875 | 9875 | 9875 | 9875 | 9875 | 9875 |
| **Event Grouping** | **5** | 5 | 5 | 5 | 5 | 5 | 5 |
| **X-Y Cordinates** | **No Shift** | Pass | Pass | Pass | Pass | Pass | Pass |

| | | First Hot Cycle | First Cold Cycle | Second Hot Cycle | 24 Hrs Cold Cycle | 24 Hrs Hot Cycle | Post TVAC at Ambient |
|---|---|---|---|---|---|---|---|
| **Name of Parameter** | **Expected Value** | Observed Value | Observed Value | Observed Value | Observed Value | Observed Value | Observed Value |
| **Q-elec100-pattern-cent00-4events-EE (Stored Pattern, Photon counting mode)** | | | | | | | |
| | |  | | | | | |
| **Total No. of events** | **100** | 100 | 100 | 100 | 100 | 100 | 100 |
| **Window Size** | **100x 100** | 100x 100 | 100x 100 | 100x 100 | 100x 100 | 100x 100 | 100x 100 |
| **Total num of pixels** | **10000** | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 |
| **Num of Bright pixels** | **100** | 100 | 100 | 100 | 100 | 100 | 100 |
| **Num of dark Pixels** | **9900** | 9900 | 9900 | 9900 | 9900 | 9900 | 9900 |
| **Event Grouping** | **4** | 4 | 4 | 4 | 4 | 4 | 4 |
| **X-Y Cordinates** | **No Shift** | Pass | Pass | Pass | Pass | Pass | Pass |

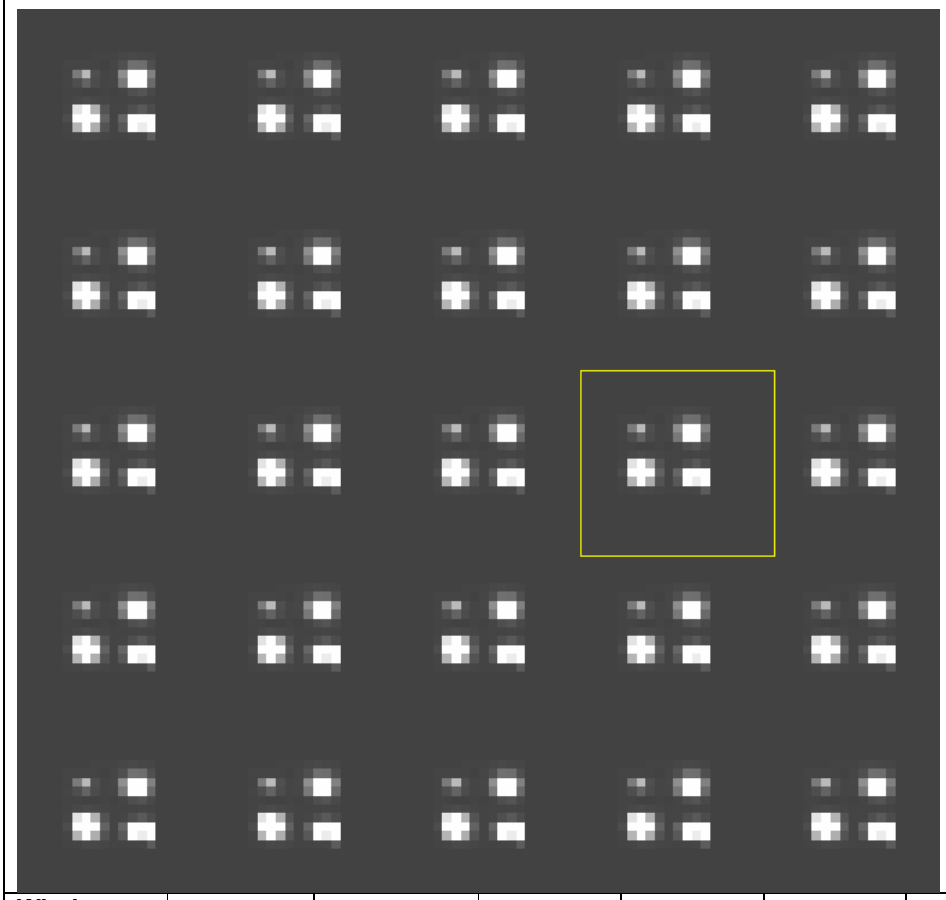
| | | First Hot Cycle | First Cold Cycle | Second Hot Cycle | 24 Hrs Cold Cycle | 24 Hrs Hot Cycle | Post TVAC at Ambient |
|---|---|---|---|---|---|---|---|
| **Name of Parameter** | **Expected Value** | Observed Value | Observed Value | Observed Value | Observed Value | Observed Value | Observed Value |
| **N-elec100-Pattern_int (Single Frame, Integration Mode)** | | | | | | | |
| | |  | | | | | |
| **Window Size** | **100x 100** | 100x 100 | 100x 100 | 100x 100 | 100x 100 | 100x 100 | 100x 100 |
| **Event Grouping** | **4** | 4 | 4 | 4 | 4 | 4 | 4 |
| **X-Y Cordinates** | **No shift** | Pass | Pass | Pass | Pass | Pass | Pass |
| **Power Dissipation (W) at 36V (35.9V actual) [For One channel only]** | | | | | | | |
| **Low Power Mode** | **9 (+/-10%)** | 8.257 **(8.257; Pre)** | 9.334 | 8.257 | 9.334 | 8.616 | 8.257 |
| **Stand-By Mode & Active Mode** | **18 (+/-10%)** | 18.309 **(17.591; Pre-Tvac)** | 17.591 | 17.95 | 17.591 | 18.668 | 17.95 |
| **All Digital Telemetry (Voltages & current)** | **Normal** (as per nominal value given) | Normal **(Normal; Pre-Tvac)** | Normal | Normal | Normal | Normal | Normal |

**Table 5. 6 Digital Telemetry Data of EM-UVITDS (NUV Channel) During Long Cold Cycle**

Telemetry Parameters of EM-UVITDS to be Monitored During TVAC 24 hrs Cold Cycle (-15 deg C) — Every 30 mins

| Warning: Please maintain Temp -15deg C +2/-0 | | | | (-13 Deg C to -15deg C) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Date | 2/5/11 | 2/5/11 | | | | | | | |
| | Time | 12:45 Pm | 1:15 Pm | 1:45PM | 2:25PM | 2:55PM | 3:40PM | 4:10PM | 4:40PM | 5:10PM |
| Name of Parameter | Expected Values | | | | -13.8 | | | | | |
| CPU Temp (From 2nd Rack Monitor) | (-15 deg C) Max | -13.6 | -13.1 | | ~~-15 deg~~ | | -13.5 | | | |
| EU Plate Thermocouple Temp (from Thermal group) Coll 5268 | (-15 deg C) Max | | | -15.5 | -15.5 | | | | -15 to -16 | |
| | | | | | | | | | | |
| Detector State | Stand By | STAND BY | STAND BY | StandBy | StandBy | StandBy | Standby | Standby | Standby | Standby |
| REA +5 V | ~ +5V (+/- 10%) | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.91 | 4.90 | 4.90 | 4.91 |
| REA +3.3 V | ~ +3.3V (+/- 10%) | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 |
| REA +12 V | ~ +12V (+/- 10%) | 11.86 | 11.86 | 11.84 | 11.84 | 11.84 | 11.84 | 11.86 | 11.86 | 11.86 |
| REA -12 V | ~ -12V (+/- 10%) | -11.89 | -11.88 | -11.86 | -11.89 | -11.89 | -11.86 | -11.88 | -11.86 | -11.86 |
| REA +5V Current (A) | Fill as actuals | 3.02 | 2.98 | 2.97 | 2.97 | 3.0 | 2.40 | 2.97 | 3.05 | 2.97 |
| REA +12V Current (A) | Fill as actuals | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 |
| REA -12V Current (A) | Fill as actuals | -0.03 | -0.03 | -0.03 | -0.03 | -0.03 | -0.03 | -0.03 | -0.03 | -0.03 |
| REA +3V Current (A) | Fill as actuals | 0.83 | 0.82 | 0.82 | 0.84 | 0.90 | 0.83 | 0.82 | 0.81 | 0.83 |
| REA FPGA Temp | Fill as actuals | -1.02 | ~~0.17~~ | 0.29 | 0.05 | -0.28 | -0.62 | -0.73 | -1.30 | -1.57 |
| REA DC/DC Temp | Fill as actuals | 0.88 | 1.66 | 1.98 | +1.75 | 1.39 | 1.15 | 0.99 | 0.29 | 0.27 |
| REA Oscillator Temp | Fill as actuals | 1.39 | 2.24 | 2.63 | 2.45 | 2.18 | 1.81 | 1.70 | 1.10 | 0.89 |
| CPU +12 V | ~ +12V (+/- 10%) | 11.83 | 11.81 | 11.81 | 11.80 | 11.80 | 11.81 | 11.83 | 11.83 | 11.83 |
| CPU -12 V | ~ -12V (+/- 10%) | -11.81 | -11.89 | -11.91 | -11.89 | -11.89 | -0.03 | -11.89 | -11.91 | -11.91 |
| CPU +12V Current | Fill as actuals | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.00 | 0.10 | 0.10 | 0.10 |
| CPU -12V Current | Fill as actuals | -0.05 | -0.05 | -0.05 | -0.05 | -0.05 | -0.00 | -0.05 | -0.05 | -0.05 |
| STAR 250 temp | Fill as actuals | -11.13 | -10.87 | -11.66 | -11.73 | -11.80 | -11.37 | -11.66 | -12.45 | -12.60 |
| HVU +15 V | ~ +15V (+/- 10%) | 14.72 | 14.76 | 14.76 | 14.76 | 14.76 | 14.76 | 14.77 | 14.76 | 14.76 |
| HVU +30V | ~ +21V (+/- 10%) | 22.69 | 22.76 | 22.95 | 22.86 | 22.78 | 22.65 | 22.60 | 22.39 | 22.34 |
| HVU -15V | ~ -15V (+/- 10%) | -15.37 | -15.35 | -15.37 | -15.37 | -15.34 | -15.35 | -15.35 | -15.37 | -15.37 |
| HVU +30 V Current | Fill as actuals | 0.04 | 0.04 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.04 | 0.03 |
| HVU +15 V Current | Fill as actuals | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 |
| HVU -15 V Current | Fill as actuals | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 |
| HVU Anode Voltage | less than 25 V | 11.59 | 11.59 | 11.59 | 2.17 | 11.59 | 11.59 | 11.59 | 11.59 | 11.59 |
| HVU MCP Voltage | less than 10V | 7.81 | 7.81 | 3.10 | 7.81 | 0.02 | 7.81 | 3.10 | 7.81 | 3.10 |
| HVU Cathode Voltage | positive voltage (less than 60V) | 55.61 | 55.14 | 55.61 | 55.61 | 55.63 | 55.61 | 55.61 | 55.61 | 55.61 |
| HVU Temp | Fill as actuals | ~~6.38~~ | 6.38 | 6.31 | 6.53 | 6.44 | 6.99 | 6.92 | 6.56 | 6.36 |

**Telemetry Parameters of EM-UVITDS to be Monitored During TVAC 24 hrs Cold Cycle (-15 deg C)** Every 30 mins

| **Warning: Please maintain Temp -15deg C +2/-0** (-13 deg C to -15 Deg C) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Date** | 2/5/11. | 2/5/11. | 2/5/11. | 2/5/11 | 2/5/11 | | | | |
| | **Time** | 05:40pm | 06:10pm | 6:40pm | 7:10pm | 7:40 | | | | |
| **Name of Parameter** | **Expected Values** | | | | | | | | | |
| CPU Temp (From 2nd Rack Monitor) | (-15 deg C) Max | -14.6 | -14.3 | -14.5 | -14.3 | | | | | |
| EU Plate Thermocouple Temp (from Thermal group) Call 5268 | (-15 deg C) Max | -15 to -16 | | | -15 to -16 | | | | | |
| | | | | | | | | | | |
| Detector State | Stand By | Standby. | Standby | Standby | Standby. | Standby | | | | |
| REA +5 V | ~ +5V (+/- 10%) | 4.92 | 4.90 | 4.90 | 4.90 | 4.90 | | | | |
| REA +3.3 V | ~ +3.3V (+/- 10%) | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | | | | |
| REA +12 V | ~ +12V (+/- 10%) | 11.86 | 11.86 | 11.86 | 11.85 | 11.86 | | | | |
| REA -12 V | ~ -12V (+/- 10%) | -11.86 | -11.86 | -11.84 | -11.84 | -11.86 | | | | |
| REA +5V Current (A) | Fill as actuals | 3.02 | 3.02 | 3.02 | 3.0 | 3.02 | | | | |
| REA +12V Current (A) | Fill as actuals | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | | | | |
| REA -12V Current (A) | Fill as actuals | -0.03 | -0.03 | -0.03 | -0.03 | -0.03 | | | | |
| REA +3V Current (A) | Fill as actuals | 0.79 | 0.83 | 0.84 | 0.83 | 0.83 | | | | |
| REA FPGA Temp | Fill as actuals | -1.41 | -1.13 | -1.07 | -0.94 | -1.81 | | | | |
| REA DC/DC Temp | Fill as actuals | 0.44 | 0.72 | 0.88 | 0.83 | -0.16 | | | | |
| REA Oscillator Temp | Fill as actuals | 1.10 | 1.37 | 1.50 | 1.44 | 0.66 | | | | |
| CPU +12 V | ~ +12V (+/- 10%) | 11.81 | 11.81 | 11.81 | 11.81 | 11.80 | | | | |
| CPU -12 V | ~ -12V (+/- 10%) | -11.89 | -11.89 | -11.89 | -11.91 | -11.89 | | | | |
| CPU +12V Current | Fill as actuals | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | | | | |
| CPU -12V Current | Fill as actuals | -0.05 | -0.05 | -0.05 | -0.05 | -0.05 | | | | |
| STAR 250 temp | Fill as actuals | -12.24 | -12.30 | -12.02 | -12.01 | -11.98 | | | | |
| HVU +15 V | ~ +15V (+/- 10%) | 14.76 | 14.76 | 14.76 | 14.74 | 14.76 | | | | |
| HVU +30V | ~ +21V (+/- 10%) | 22.37 | 22.47 | 22.54 | 22.55 | 22.23 | | | | |
| HVU -15V | ~ -15V (+/- 10%) | -15.35 | -15.35 | -15.35 | -15.37 | -15.35 | | | | |
| HVU +30 V Current | Fill as actuals | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | | | | |
| HVU +15 V Current | Fill as actuals | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | | | | |
| HVU -15 V Current | Fill as actuals | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | | | | |
| HVU Anode Voltage | less than 25 V | 11.59 | 11.59 | 11.59 | 11.59 | 11.59 | | | | |
| HVU MCP Voltage | less than 10V | 7.81 | 7.81 | 7.81 | 7.81 | 7.81 | | | | |
| HVU Cathode Voltage | positive voltage (less than 60V) | 55.61 | 55.61 | 55.61 | 55.61 | 56.08 | | | | |
| HVU Temp | Fill as actuals | 6.16 | 6.41 | 6.38 | 6.73 | 6.70 | | | | |

**Table 5. 7 Digital Telemetry Data of EM-UVITDS (NUV Channel) During Long Hot Cycle**

Telemetry Parameters of EM-UVITDS to be Monitored During TVAC 24 hrs Hot Cycle (+35 deg C +0/-2 deg C) Every 30 Mins

| Warning: Please maintain Temp CPU, HVU (+35 deg C) & EU (+45 deg C) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Date | 3/5/11 | | | | | | | | | |
| | Time | 9:00AM | 10:AM | 10:30 | 11:00AM | 11:30AM | 12:00 | 12:45 | 1-15PM | 1-45PM | |
| Name of Parameter | Expected Values | | | | | | | | | | |
| CPU Temp (From 2nd Rack Monitor) | (+35 deg C) Max | 34.5°C | 29.9°C | 30.7 | 32.5 | 33.5 | 33.8 | 34.5° | 34.7° | 34.9° | |
| EU Plate Thermocouple Temp (from Thermal group) call 5268 | (+45 deg C) Max | 41.5°C | 41.5°C | 41.0°C | 41°C | 45.5°C | 45.5°C | 40.4 | | | |
| | | | | | | | | | | | |
| Detector State | Stand By | Stand By | Stand By | Stand By | Stand By | Stand By | Stand By | Stand By | Stand by | Stand by | Stand by |
| REA +5 V | ~ +5V (+/- 10%) | 4.91 | 4.91 | 4.91 | 4.88 | 4.88 | 4.88 | 4.92 | 4.89 | 4.88 | |
| REA +3.3 V | ~ +3.3V (+/- 10%) | 3.23 | 3.22 | 3.24 | 3.23 | 3.23 | 3.23 | 3.28 | 3.23 | 3.23 | |
| REA +12 V | ~ +12V (+/- 10%) | 11.84 | 11.86 | 11.86 | 11.84 | 11.84 | 11.86 | 11.84 | 11.84 | 11.84 | |
| REA -12 V | ~ -12V (+/- 10%) | -11.84 | -11.88 | -11.86 | -11.83 | -11.81 | -11.83 | -11.88 | -11.86 | -11.83 | |
| REA +5V Current (A) | Fill as actuals | 3.43 | 3.75 | 3.53 | 3.53 | 3.38 | 3.54 | 3.48 | 3.52 | 3.17 | |
| REA +12V Current (A) | Fill as actuals | 0.06 | 0.06 | 0.06 | 0.05 | 0.05 | 0.05 | 0.07 | 0.06 | 0.05 | |
| REA -12V Current (A) | Fill as actuals | -0.03 | -0.03 | -0.03 | -0.03 | -0.03 | -0.03 | -0.03 | -0.03 | -0.03 | |
| REA +3V Current (A) | Fill as actuals | 1.03 | 1.26 | 1.05 | 1.08 | 1.06 | 1.05 | 1.06 | 1.07 | 1.06 | |
| REA FPGA Temp | Fill as actuals | 54.26 | 58.09 | 58.84 | 59.62 | 59.87 | 60.37 | 59.17 | 60.20 | 59.86 | |
| REA DC/DC Temp | Fill as actuals | 58.19 | 61.52 | 62.60 | 63.53 | 63.81 | 64.12 | 61.89 | 63.91 | 63.72 | |
| REA Oscillator Temp | Fill as actuals | 56.72 | 60.48 | 61.25 | 62.24 | 62.53 | 62.88 | 61.34 | 62.62 | 62.51 | |
| CPU +12 V | ~ +12V (+/- 10%) | 11.80 | 11.80 | 11.78 | 11.78 | 11.80 | 11.78 | 11.78 | 11.80 | 11.80 | |
| CPU -12 V | ~ -12V (+/- 10%) | -11.89 | -11.91 | -11.91 | -11.89 | -11.91 | -11.91 | -11.89 | -11.89 | -11.91 | |
| CPU +12V Current | Fill as actuals | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | |
| CPU -12V Current | Fill as actuals | -0.05 | -0.05 | -0.05 | -0.05 | -0.05 | -0.05 | -0.05 | -0.05 | -0.05 | |
| STAR 250 temp | Fill as actuals | 3592 | 30.30 | 32.09 | 34.17 | 34.77 | 36.65 | 35.49 | 36.36 | 38.57 | |
| HVU +15 V | ~ +15V (+/- 10%) | 14.74 | 14.74 | 14.73 | 14.73 | 14.74 | 14.73 | 14.79 | 14.73 | 14.74 | |
| HVU +30V | ~ +30V (+/- 10%) | 29.83 | 29.83 | 29.83 | 29.83 | 29.83 | 29.83 | 29.84 | 29.83 | 29.83 | |
| HVU -15V | ~ -15V (+/- 10%) | -15.37 | -15.35 | -15.37 | -15.37 | -15.37 | -15.37 | -15.39 | -15.37 | -15.37 | |
| HVU +30 V Current | Fill as actuals | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | |
| HVU +15 V Current | Fill as actuals | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | |
| HVU -15 V Current | Fill as actuals | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | |
| HVU Anode Voltage | less than 25 V | 11.59 | 11.59 | 11.59 | 11.59 | 11.59 | 11.59 | 11.59 | 11.59 | 11.59 | |
| HVU MCP Voltage | less than 10V | 3.10 | 7.81 | 7.81 | 7.81 | 7.81 | 7.81 | 7.81 | 7.81 | 7.81 | |
| HVU Cathode Voltage | positive voltage (less than 60V) | 55.61 | 55.61 | 56.08 | 56.08 | 56.08 | 56.08 | 55.61 | 55.61 | 55.61 | |
| HVU Temp | Fill as actuals | 49.52 | 51.11 | 51.63 | 53.05 | 53.36 | 54.26 | 49.93 | 54.85 | 55.38 | |

**Telemetry Parameters of EM-UVITDS to be Monitored During TVAC 24 hrs Hot Cycle (+35 deg C +0/-2 deg C)** Every 30 Mins

| Warning: Please maintain Temp CPU, HVU (+35 deg C) & EU (+45 deg C) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Date | 3/5/11 | | | | | | 3/5/11 | | | 3/5/11 | 3/5/11 | |
| | Time | 2-15 Pm | 2-45 Pm | 3-15 Pm | 3-45 Pm | 4-15 Pm | 4-45 Pm | 5 25 pm | 6.00 pm | 6:30 pm | 7.00 pm | 7.30 pm | |
| Name of Parameter | Expected Values | | | | | | | | | | | | |
| CPU Temp (From 2nd Rack Monitor) | (+35 deg C) Max | 35.02° | 34.7° | 34.2° | 34.1° | 33.3° | 32.8° | 32.6° | 31.7° | 31.36° | 31.1° | 30.8°c | |
| EU Plate Thermocouple Temp (from Thermal group) call 5268 | (+45 deg C) Max | | 44.4 | | 44.3 | | | 44.2 | | | 38.67° | | |
| | | | | | | | | | | | | | |
| Detector State | Stand By | Stand By | Stand By | Stand By | Stand By | Stand By | | Standby | Standby | Standby | Standby | Standby | |
| REA +5 V | ~ +5V (+/- 10%) | 4.88 | 4.92 | 4.87 | 4.87 | 4.87 | 4.92 | 4.87 | 4.87 | 4.88 | 4.87 | 4.88 | |
| REA +3.3 V | ~ +3.3V (+/- 10%) | 3.23 | 3.24 | 3.23 | 3.23 | 3.23 | 3.23 | 3.23 | 3.23 | 3.23 | 3.24 | 3.23 | |
| REA +12 V | ~ +12V (+/- 10%) | 11.86 | 11.86 | 11.86 | 11.84 | 11.84 | 11.84 | 11.84 | 11.84 | 11.86 | 11.86 | 11.86 | |
| REA -12 V | ~ -12V (+/- 10%) | -11.83 | -11.81 | -11.81 | -11.83 | -11.83 | -11.83 | -11.83 | -11.83 | -11.83 | -11.81 | -11.81 | |
| REA +5V Current (A) | Fill as actuals | 3.53 | 3.49 | 3.52 | 3.59 | 3.24 | 3.46 | 3.31 | 3.41 | 3.22 | 3.4 | 3.49 | |
| REA +12V Current (A) | Fill as actuals | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | |
| REA -12V Current (A) | Fill as actuals | -0.03 | -0.03 | -0.03 | -0.03 | -0.03 | -0.03 | -0.03 | -0.03 | -0.03 | -0.03 | -0.03 | |
| REA +3V Current (A) | Fill as actuals | 1.04 | 1.08 | 1.09 | 1.06 | 1.06 | 1.02 | 1.07 | 1.06 | 1.08 | 1.10 | 1.05 | |
| REA FPGA Temp | Fill as actuals | 59.70 | 59.62 | 59.53 | 59.60 | 59.45 | 59.43 | 59.36 | 59.36 | 59.34 | 59.34 | 59.36 | |
| REA DC/DC Temp | Fill as actuals | 63.61 | 63.46 | 63.36 | 63.27 | 63.36 | 63.27 | 63.27 | 63.18 | 63.25 | 63.25 | 63.18 | |
| REA Oscillator Temp | Fill as actuals | 62.33 | 62.24 | 62.08 | 62.15 | 61.99 | 61.89 | 61.89 | 61.89 | 61.89 | 61.97 | 61.80 | |
| CPU +12 V | ~ +12V (+/- 10%) | 11.78 | 11.78 | 11.76 | 11.78 | 11.80 | 11.87 | 11.80 | 11.78 | 11.78 | 11.80 | 11.78 | |
| CPU -12 V | ~ -12V (+/- 10%) | -11.89 | -11.89 | -11.91 | -11.89 | -11.89 | -11.89 | -11.91 | -11.89 | -11.91 | -11.89 | -11.89 | |
| CPU +12V Current | Fill as actuals | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | |
| CPU -12V Current | Fill as actuals | -0.05 | -0.05 | -0.05 | -0.05 | -0.05 | -0.05 | -0.05 | -0.05 | -0.05 | -0.05 | -0.05 | |
| STAR 250 temp | Fill as actuals | 36.54 | 36.21 | 35.82 | 35.53 | 34.75 | 34.19 | 33.58 | 32.99 | 32.62 | 32.34 | 32.19 | |
| HVU +15 V | ~ +15V (+/- 10%) | 14.73 | 14.74 | 14.74 | 14.74 | 14.73 | 14.74 | 14.74 | 14.73 | 14.73 | 14.74 | 14.73 | |
| HVU +30V | ~ +30V (+/- 10%) | 29.24 | 29.84 | 29.84 | 29.84 | 29.84 | 29.83 | 29.83 | 29.83 | 29.84 | 29.83 | 29.84 | |
| HVU -15V | ~ -15V (+/- 10%) | -15.37 | -15.37 | -15.37 | -15.37 | -15.37 | -15.37 | -15.37 | -15.37 | -15.37 | -15.37 | -15.37 | |
| HVU +30 V Current | Fill as actuals | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | |
| HVU +15 V Current | Fill as actuals | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | |
| HVU -15 V Current | Fill as actuals | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | |
| HVU Anode Voltage | less than 25 V | 21.01 | 11.59 | 11.59 | 11.59 | 11.59 | 11.59 | 11.59 | 11.59 | 11.59 | 11.59 | 11.59 | |
| HVU MCP Voltage | less than 10V | 7.81 | 7.81 | 7.81 | 7.81 | 7.81 | 7.81 | 7.81 | 7.81 | 7.81 | 7.81 | 7.81 | |
| HVU Cathode Voltage | positive voltage (less than 60V) | 55.61 | 55.61 | 55.61 | 55.61 | 55.61 | 56.08 | 55.61 | 55.61 | 55.61 | 55.61 | 56.08 | |
| HVU Temp | Fill as actuals | 55.48 | 55.38 | 55.38 | 54.94 | 54.62 | 54.03 | 54.09 | 53.20 | 52.90 | 52.49 | 52.40 | |

**Telemetry Parameters of EM-UVITDS to be Monitored During TVAC 24 hrs Hot Cycle (+35 deg C +0/-2 deg C)** Every 30 Mins

| Warning: Please maintain Temp CPU, HVU (+35 deg C) & EU (+45 deg C) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Date | 3/5/11 | | | | | | | | |
| | Time | 8:00pm | 8:30pm | 9.00 PM | 9:30pm | 10:00pm | 10:30pm | 11:00pm | 11:30pm | 12:00am |
| Name of Parameter | Expected Values | 8 | | | | | | | | |
| CPU Temp (From 2nd Rack Monitor) | (+35 deg C) Max | 30.6° | 30.8 | 31.0 | 31.2 | 31.3. | 31.4 | 31.2 | 31.4 | 31.4 |
| EU Plate Thermocouple Temp (from Thermal group) call 5268 | (+45 deg C) Max | | 38 to 40 | 38 to 40 | 38 to 40. | 38 to 40 | 38 to 40 | 38 to 40 | 37 to 39 Lug. | 44.3 Top |
| | | | | | | | | | | |
| Detector State | Stand By | Stand By | Standby | StandBy | StandBy | Standby | Standby | standby | Standby | Standby |
| REA +5 V | ~ +5V (+/- 10%) | 4.88 | 4.91 | 4.90 | 4.88 | 4.92 | 4.88 | 4.87 | 4.90 | 4.88 |
| REA +3.3 V | ~ +3.3V (+/- 10%) | 3.23 | 3.23 | 3.24 | 3.24 | 3.23 | 3.23 | 3.23 | 3.24 | 3.23 |
| REA +12 V | ~ +12V (+/- 10%) | 11.84 | 11.84 | 11.84 | 11.86 | 11.84 | 11.84 | 11.83 | 11.84 | 11.84 |
| REA -12 V | ~ -12V (+/- 10%) | -11.83 | -11.83 | -11.83 | -11.83 | -11.83 | -11.83 | -11.81 | -11.81 | -11.83 |
| REA +5V Current (A) | Fill as actuals | 3.23 | 3.46 | 3.47 | 3.38 | 3.53 | 3.53 | 3.56 | 3.05 | 3.47 |
| REA +12V Current (A) | Fill as actuals | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| REA -12V Current (A) | Fill as actuals | -0.03 | -0.03 | -0.03 | -0.03 | -0.03 | -0.03 | -0.03 | -0.03 | -0.03 |
| REA +3V Current (A) | Fill as actuals | 1.07 | 1.06 | 1.04 | 1.06 | 1.07 | 1.07 | 1.06 | 1.07 | 1.07 |
| REA FPGA Temp | Fill as actuals | 59.43 | 59.34 | 59.34 | 59.43 | 59.36 | 59.36 | 59.42 | 59.51 | 59.43 |
| REA DC/DC Temp | Fill as actuals | 63.25 | 63.23 | 63.25 | 63.18 | 63.25 | 63.27 | 63.18 | 63.25 | 63.25 |
| REA Oscillator Temp | Fill as actuals | 61.89 | 61.97 | 61.97 | 61.89 | 61.89 | 62.81 | 61.97 | 62.89 | 61.39 |
| CPU +12 V | ~ +12V (+/- 10%) | 11.78 | 11.80 | 11.78 | 11.78 | 11.78 | 11.78 | 11.78 | 11.80 | 11.80 |
| CPU -12 V | ~ -12V (+/- 10%) | -11.89 | -11.89 | -11.89 | -11.91 | -11.91 | -11.91 | -11.91 | -11.89 | -11.91 |
| CPU +12V Current | Fill as actuals | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 |
| CPU -12V Current | Fill as actuals | -0.05 | -0.05 | -0.05 | -0.05 | -0.05 | -0.05 | -0.05 | -0.05 | -0.05 |
| STAR 250 temp | Fill as actuals | 31.93 | 32.06 | 32.42 | 32.62 | 32.78 | 32.83 | 32.78 | 32.93 | 32.96 |
| HVU +15 V | ~ +15V (+/- 10%) | 14.74 | 14.73 | 14.74 | 14.74 | 14.74 | 14.74 | 14.74 | 14.74 | 14.73 |
| HVU +30V | ~ +30V (+/- 10%) | 29.84 | 29.83 | 29.83 | 29.83 | 29.84 | 29.81 | 29.84 | 29.83 | 29.84 |
| HVU -15V | ~ -15V (+/- 10%) | -15.37 | -15.37 | -15.37 | -15.39 | -15.37 | -15.37 | -15.37 | -15.37 | -15.37 |
| HVU +30 V Current | Fill as actuals | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| HVU +15 V Current | Fill as actuals | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 | 0.11 |
| HVU -15 V Current | Fill as actuals | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 |
| HVU Anode Voltage | less than 25 V | 11.59 | 11.59 | 11.59 | 21.01 | 11.59 | 11.59 | 11.59 | 11.59 | 11.59 |
| HVU MCP Voltage | less than 10V | 7.81 | 7.81 | 7.81 | 7.81 | 7.81 | 7.81 | 7.81 | 7.81 | 7.81 |
| HVU Cathode Voltage | positive voltage (less than 60V) | 55.61 | 55.61 | 55.61 | 55.61 | 55.61 | 55.61 | 55.61 | 55.61 | 55.61 |
| HVU Temp | Fill as actuals | 51.98 | 52.11 | 52.11 | 52.25 | 52.20 | 52.32 | 52.47 | 52.41 | 52.47 |

### 5.2.2 Temperature Measurements

The temperature of payload was measured as mentioned in 4.2.1. Thermistors were monitored by IIA checkout system. Thermistors were supplied by ISAC thermal group but the temperature curve was not given along with the Thermistors. So, there is a small deviation in temperature measurements of the Thermistors.
At the highest (lowest) temperatures, the temperature given by ISRO-table would have been higher (lower), i.e. if at all the errors have led to small over-testing.

**Table 5. 8 Resistance Vs Temperature**

| **Resistance (Ohms)** | **Temp (deg C) by formula used by IIA during Test** | **Temp (deg C) by Thermistor table** |
|---|---|---|
| 3640 | 50 | ~ 51.5 |
| 5350 | 40 | ~ 41 |
| 8050 | 30 | ~ 30.5 |
| 12500 | 20 | ~ 19.5 |
| 19950 | 10 | ~ 9.5 |
| 32995 | 0 | ~ (-2) |
| 56550 | -10 | ~ (-12.5) |
| 101000 | -20 | ~ (-24) |
| 137000 | -25 | ~ (-29) |

# Appendix A

## *A.1 Functional Test on FWM*

Refer Document “FWM-Functional-testV0.1”.

## *A.2 Reading Thermistors from IIA test setup*

Refer Document “Proce-temp-monitor-1.xls”

# Appendix B

## *B.1 Functional Test on UVIT DS.*

Refer document “UVITDS-Functional-Test-Procedure-2.4” to perform the test.

## *B.2 Performance Test on UVIT DS*

Refer document “UVIT-990-00002-PRO Rev 1_5 - Performance Test Procedure” from Routes (CSA) to perform the test.

## *B.3 List of Cables for TVAC test*

For details of Harness, please refer the document “TV-test-EMFM-cable-details0.2.xls”.

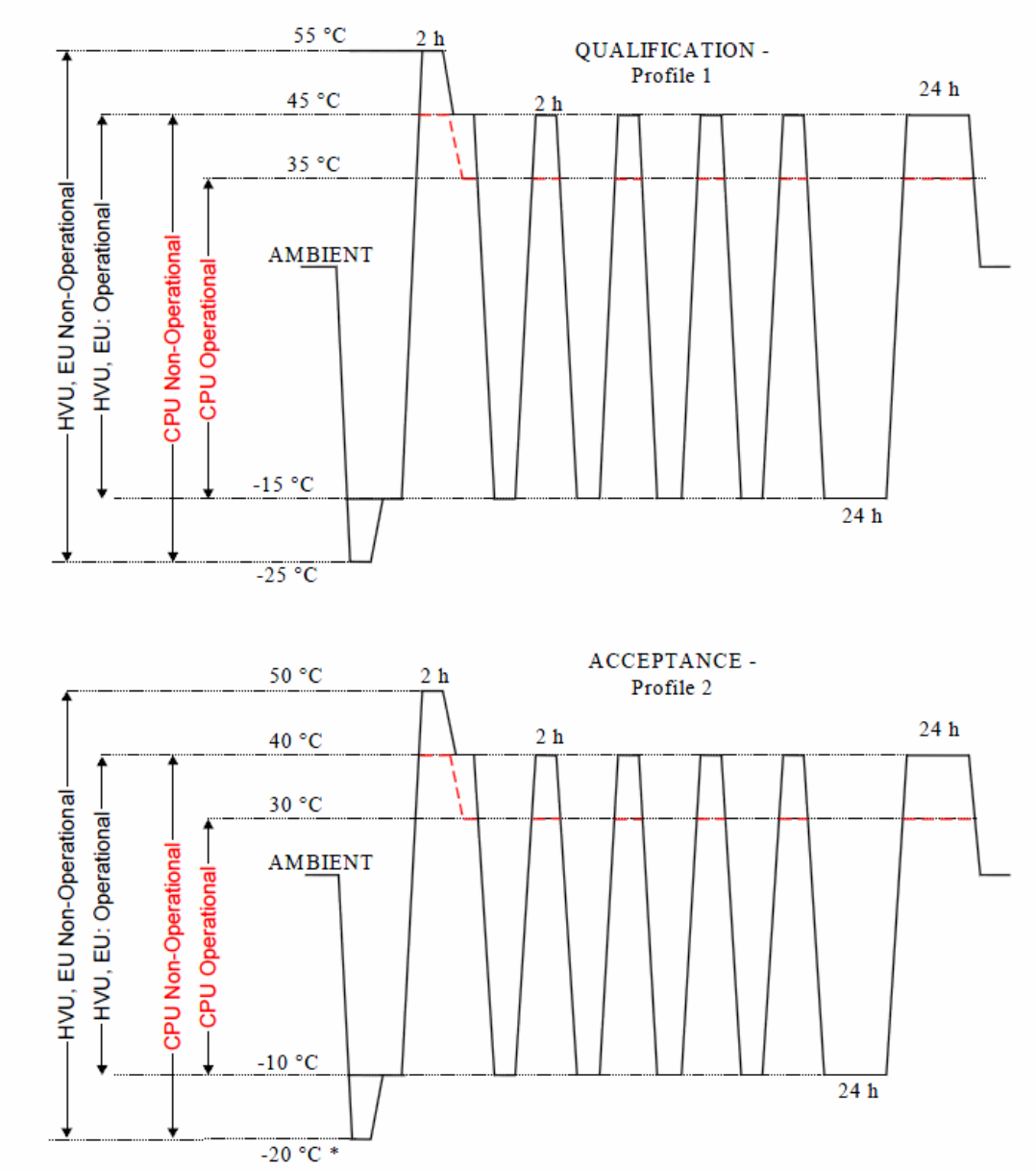
# Appendix C

## *Cleaning, Assembly, and Handling of TVAC Trolley and IR Lamp Cage*

1. TVAC trolley will be delivered to ISITE after cleaning with IPA.
2. Unassembled IR Lamp Cage will be delivered to ISITE after cleaning with IPA.
3. In ISITE, IR Lamp cage will be assembled.
4. IR lamps will be mounted on IR Lamp cage.
5. It will be integrated with TVAC trolley, without payload.
6. After this it will be lifted, and placed in TVAC chamber to check it in TVAC chamber.
7. After this whole assembly will be baked to clean the fixtures and TVAC chamber as per the details mentioned in ***ASTROSAT Contamination Control notes V0.1.***

# Appendix D

TVAC test Profile and Temperature limits, which subsystems have undergone TVAC tests at manufacturers' place.



# Appendix-E (Instrumentation Aspects)

Details of the thermistors used for temperature measurement on the payload are given below

**Table E. 1 List of Thermistors mounted on EM UVIT Payload**

| S.No. | Location of Thermistor | Thermistor ID No. | Resistance Value @ ambient (KΩ) | Remarks |
|---|---|---|---|---|
| 1. | MB1 | 959 | 11.48 | |
| 2. | MB2 | 4831 | 11.36 | |
| 3. | TT1 Top | 4576 | 11.16 | |
| 4. | TT1 Bottom | 4807 | 11.85 | |
| 5. | TT2 Top | 4462 | 11.46 | |
| 6. | TT2 Bottom | 4815 | 11.4 | |
| 7. | TT3 Top | 4486 | 10.98 | |
| 8. | TT3 Bottom | 4584 | 11.07 | |
| 9. | DMB NUV Top | 4483 | 11.37 | |
| 10. | DMB NUV Middle | 810 | 11.15 | |
| 11. | NUV Filter Wheel cover | 4610 | 11.39 | |
| 12. | CPU | 841 | | |
| 13. | HVU | 4572 | | |

**Figure E. 1 Position of IR Lamps on the IR Cage (which is mounted around the payload)**

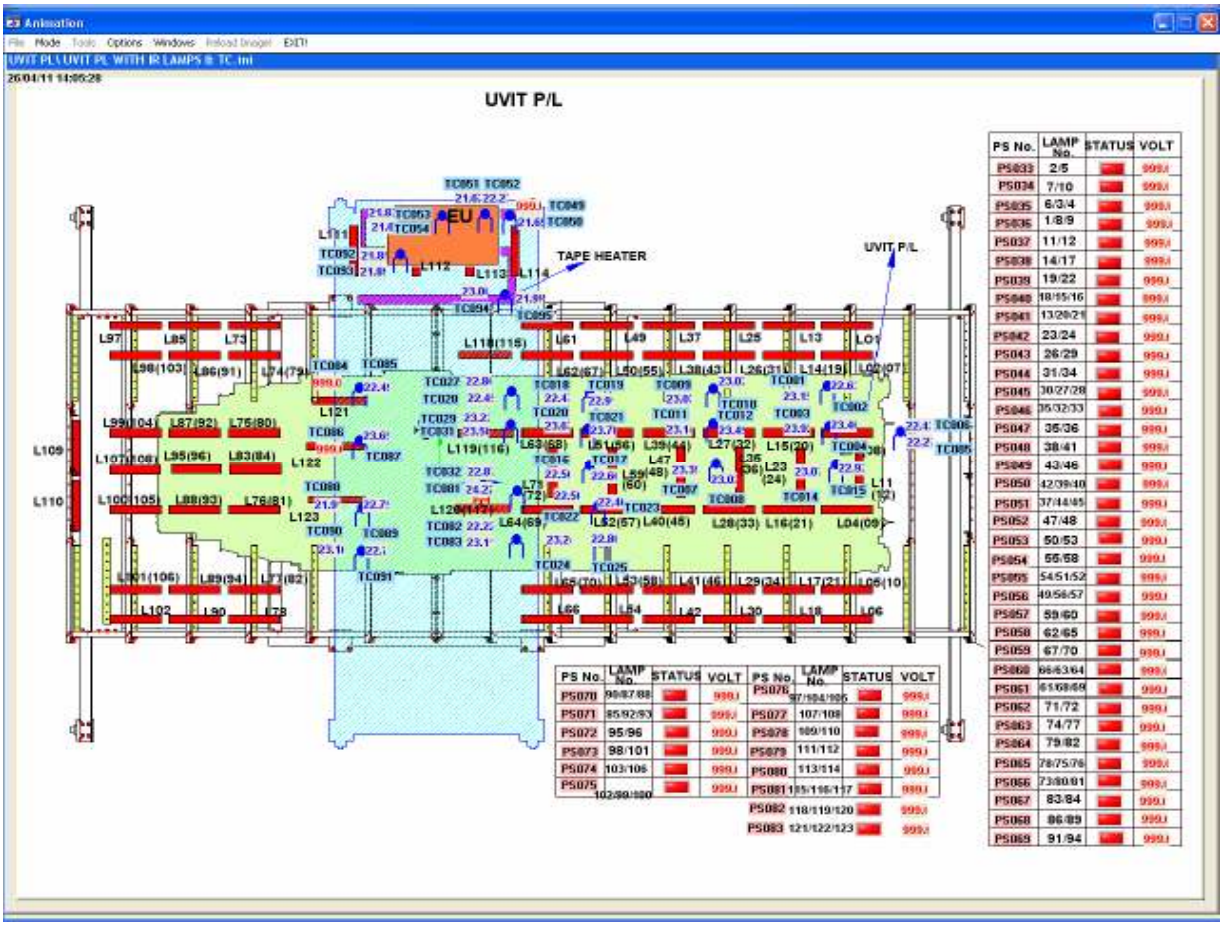


**Figure E. 2 Position of Thermocouples and Heaters**

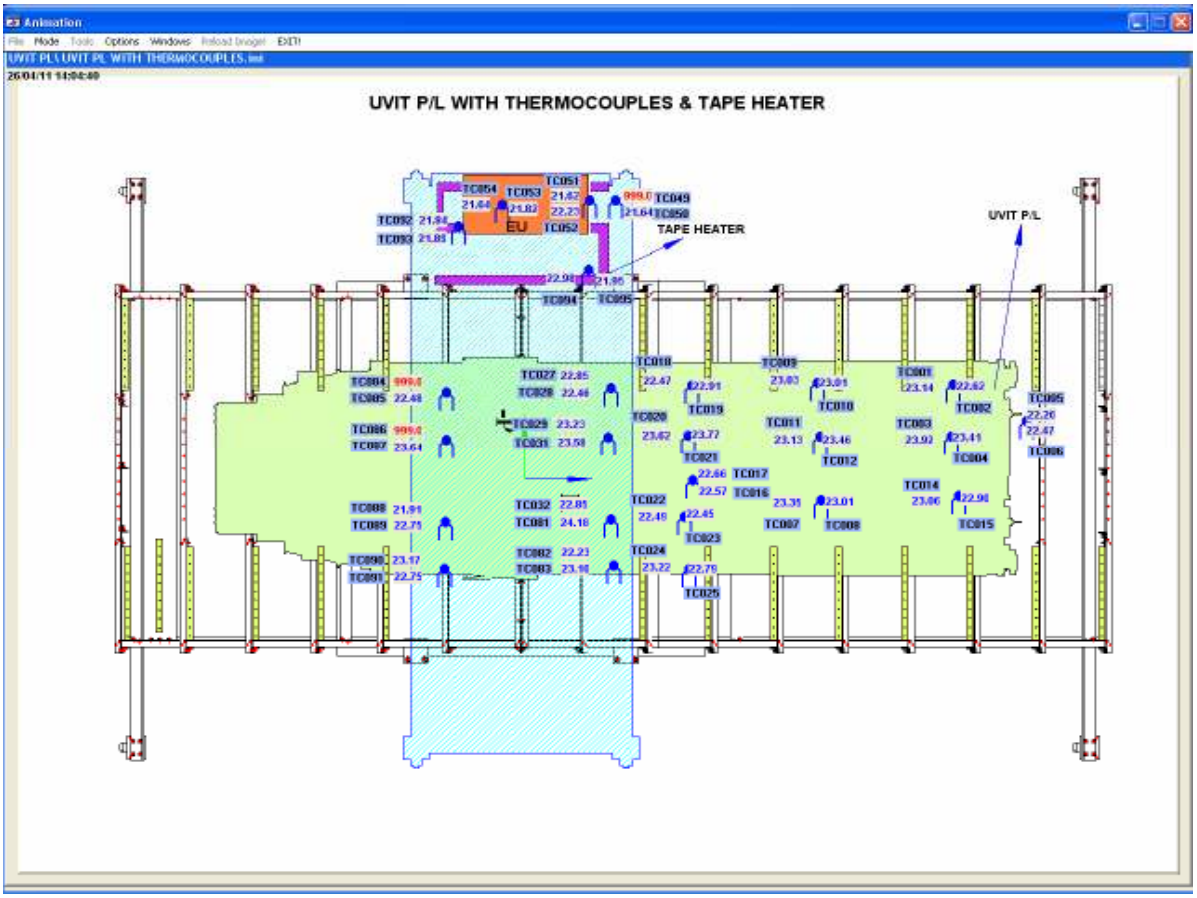


**Table E. 2 ELECTRICAL POWERING SCHEME FOR TEST HEATER / IR LAMP**

| SL. NO. | IR LAMP/ HTRCODE | LOCATION | INSIDE CHAMBER | | POWER SUPPLY | |
|---|---|---|---|---|---|---|
| | | | CON. NO. | PIN NO. | NO | RATING |
| | | | | | | |
| 01 | L02/05 | UVIT TELESCOPE BAFFEL-1(TC01/02) | TBC05A | A,B | 033 | 60V/8A |
| 02 | L07/10 | UVIT TELESCOPE BAFFEL-1(TC01/02) | TBC05A | C,D | 034 | 60V/8A |
| 03 | L06/03/04 | UVIT TELESCOPE BAFFEL-1(TC03/04/05/06) | TBC05A | E,F | 035 | 60V/8A |
| 04 | L01/08/09 | UVIT TELESCOPE BAFFEL-1(TC03/04/05/06) | TBC05A | G,H | 036 | 60V/8A |
| 05 | L11/12 | UVIT TELESCOPE BAFFEL-1(TC13/14/05/06) | TBC05A | J,K | 037 | 60V/8A |
| 06 | L14/17 | UVIT TELESCOPE BAFFEL-1(TC01/02) | TBC05B | A,B | 038 | 60V/8A |
| 07 | L19/22 | UVIT TELESCOPE BAFFEL-1(TC01/02) | TBC05B | C,D | 039 | 60V/8A |
| 08 | L18/15/16 | UVIT TELESCOPE BAFFEL-1(TC01/02) | TBC05B | E,F | 040 | 60V/8A |
| 09 | L13/20/21 | UVIT TELESCOPE BAFFEL-1(TC01/02) | TBC05B | G,H | 041 | 60V/8A |
| 10 | L23/24 | UVIT TELESCOPE BAFFEL-1(TC13/14) | TBC05B | J,K | 042 | 60V/8A |
| 11 | L26/29 | UVIT TELESCOPE BAFFEL-2(TC09/10) | TBC05C | A,B | 043 | 60V/8A |
| 12 | L31/34 | UVIT TELESCOPE BAFFEL-2(TC09/10) | TBC05C | C,D | 044 | 60V/8A |
| 13 | L30/27/28 | UVIT TELESCOPE BAFFEL-2(TC11/12/07/08) | TBC05C | E,F | 045 | 60V/8A |
| 14 | L35/32/33 | UVIT TELESCOPE BAFFEL-2(TC09/10) | TBC05C | G,H | 046 | 60V/8A |
| 15 | L35/36 | UVIT TELESCOPE BAFFEL-2(TC07/08) | TBC05C | J,K | 047 | 60V/8A |
| 16 | L38/41 | UVIT TELESCOPE BAFFEL-2(TC09/10) | TBC06A | A,B | 048 | 60V/8A |
| 17 | L43/46 | UVIT TELESCOPE BAFFEL-2(TC09/10) | TBC06A | C,D | 049 | 60V/8A |
| 18 | L42/39/40 | UVIT TELESCOPE BAFFEL-2(TC11/12) | TBC06A | E,F | 050 | 60V/8A |
| 19 | L37/44/45 | UVIT TELESCOPE BAFFEL-2(TC09/10) | TBC06A | G,H | 051 | 60V/8A |
| 20 | L47/48 | UVIT TELESCOPE BAFFEL-2(TC07/08) | TBC06A | J,K | 052 | 60V/8A |
| 21 | L50/53 | UVIT TELESCOPE TOP(TC17/18) | TBC06B | A,B | 053 | 60V/8A |
| 22 | L55/58 | UVIT TELESCOPE TOP(TC17/18) | TBC06B | C,D | 054 | 60V/8A |
| 23 | L54/51/52 | UVIT TELESCOPE TOP(TC19/20/23/24) | TBC06B | E,F | 055 | 60V/8A |

**Table E.2 ELECTRICAL POWERING SCHEME FOR TEST HEATER / IR LAMP (contd)**

| SL. NO. | IR LAMP/ HTRCODE | LOCATION | INSIDE CHAMBER | | POWER SUPPLY | |
|---|---|---|---|---|---|---|
| | | | CON NO. TDAC(CH.) | PIN NO. | NO. | RATING |
| | | | | | | |
| 24 | L49/56/57 | UVIT TELESCOPE TOP(TC17/18) | TBC06B | G,H | 56 | 60V/8A |
| 25 | L59/60 | UVIT TELESCOPE TOP(TC15/16) | TBC06B | J,K | 57 | 60V/8A |
| 26 | L62/65 | UVIT TELESCOPE TOP/MID(TC17/18/25/26) | TBC06C | A,B | 58 | 60V/8A |
| 27 | L67/70 | UVIT TELESCOPE TOP/MID(TC17/18/25/26) | TBC06C | C,D | 59 | 60V/8A |
| 28 | L66/63/64 | UVIT TELESCOPE TOP/MID(TC19/20/23/24) | TBC06C | E,F | 60 | 60V/8A |
| 29 | L61/68/69 | UVIT TELESCOPE TOP/MID(TC17/18/25/26) | TBC06C | G,H | 61 | 60V/8A |
| 30 | L71/72 | UVIT TELESCOPE TOP/MID(TC15/16) | TBC06C | J,K | 62 | 60V/8A |
| 31 | L74/77 | UVIT TELE BOTTOM &PROCESSOR/HV UNIT | TBC07A | A,B | 63 | 60V/8A |
| 32 | L79/82 | UVIT TELE BOTTOM &PROCESSOR/HV UNIT | TBC07A | C,D | 64 | 60V/8A |
| 33 | L78/75/76 | UVIT TELE PROCESSOR TOP | TBC07A | E,F | 65 | 60V/8A |
| 34 | L73/80/81 | UVIT TELE PROCESSOR BOT | TBC07A | G,H | 66 | 60V/8A |
| 35 | L83/84 | UVIT TELE PROCESSOR TOP | TBC07A | J,K | 67 | 60V/8A |
| 36 | L86/89 | UVIT PROCESSOR/HV UNIT SIDE | TBC07B | A,B | 68 | 60V/8A |
| 37 | L91/94 | UVIT PROCESSOR/HV UNIT SIDE | TBC07B | C,D | 69 | 60V/8A |
| 38 | L90/87/88 | UVIT PROCESSOR/HV UNIT TOP | TBC07B | E,F | 70 | 60V/8A |
| 39 | L85/92/93 | UVIT PROCESSOR/HV UNIT BOT | TBC07B | G,H | 71 | 60V/8A |
| 40 | L95/96 | UVIT PROCESSOR/HV UNIT TOP | TBC07B | J,K | 72 | 60V/8A |
| 41 | L98/101 | UVIT PROCESSOR/HV UNIT SIDE | TBC07C | A,B | 73 | 60V/8A |
| 42 | L103/106 | UVIT PROCESSOR/HV UNIT SIDE | TBC07C | C,D | 74 | 60V/8A |
| 43 | L102/99/100 | UVIT PROCESSOR/HV UNIT TOP | TBC07C | E,F | 75 | 60V/8A |
| 44 | L97/104/105 | UVIT PROCESSOR/HV UNIT BOT | TBC07C | G,H | 76 | 60V/8A |
| 45 | L107/108 | UVIT PROCESSOR/HV UNIT TOP | TBC07C | J,K | 77 | 60V/8A |
| 46 | L109/110 | HVU BOX END | TBC08A | A,B | 78 | 60V/8A |
| 47 | L111/112 | ABOVE EU BOX | TBC08A | C,D | 79 | 60V/8A |
| 48 | L113/114 | ABOVE FWDE BOX | TBC08A | E,F | 80 | 60V/8A |
| 49 | L115/116/117 | UVIT TELE MID(UNDER | TBC08A | G,H | 81 | 60V/8A |
| 50 | L118/119/120 | UVIT TELE MID(TOP) (TC25/26/27/28/29/30) | TBC08A | J,K | 82 | 60V/8A |
| 51 | L121/122/123 | UVIT TELE BOT(TOP) (TC33/34/35/36/37/38) | TBC08B | A,B | 83 | 60V/8A |

**Table E.2 ELECTRICAL POWERING SCHEME FOR TEST HEATER / IR LAMP (contd)**

| SL. NO. | IR LAMP/ HTRCODE | LOCATION | INSIDE CHAMBER | | POWER SUPPLY | |
|---|---|---|---|---|---|---|
| | | | CON. NO. | PIN NO. | NO. | RATING |
| 52 | PLT01 | ON AL. PLATE | TBC01 | A,B | 001 | 60V/4A |
| 53 | PLT02 | ON AL. PLATE | TBC01 | C,D | 002 | 60V/4A |
| 53 | | | TBC01 | E,F | 003 | 60V/4A |
| 54 | | | TBC01 | G,H | 004 | 60V/4A |
| 55 | | | TBC01 | J,K | 005 | 60V/4A |
| 56 | | | TBC01 | L,M | 006 | 60V/4A |

**Table E. 3 : List of thermocouples**

Page Display System - 1

Page

PAGE DISPLAY SYSTEM - 1

UVIT

Test Type: ACCEPTANCE TEST  Page Name: 1. ALL TC PAGE-1  Test Mode: Ambient

| Channel Name | Channel Description | Limits (High/Low) | Units | 26/04/11 13:33:27 | Channel Name | Channel Description | Limits (High/Low) | Units | 26/04/11 13:33:27 |
|---|---|---|---|---|---|---|---|---|---|
| TC001 | FUV BAFFLE-1 SIDE-M | 35/0 | Deg C | 22.99 | TC002 | FUV BAFFLE-1 SIDE-R | 35/0 | Deg C | 22.46 |
| TC003 | FUV BAFFLE-1 TOP-M | 35/0 | Deg C | 23.74 | TC004 | FUV BAFFLE-1 TOP-R | 35/0 | Deg C | 23.24 |
| TC005 | NUV BAFFLE-1 SIDE-M | 35/0 | Deg C | 22.09 | TC006 | NUV BAFFLE-1 SIDE-R | 35/0 | Deg C | 22.30 |
| TC007 | NUV BAFFLE-1 TOP-M | 35/0 | Deg C | 23.19 | TC008 | NUV BAFFLE-1 TOP-R | 35/0 | Deg C | 22.86 |
| TC009 | FUV BAFFLE-2 SIDE-M | 35/0 | Deg C | 22.86 | TC010 | FUV BAFFLE-2 SIDE-R | 35/0 | Deg C | 22.83 |
| TC011 | FUV BAFFLE-2 TOP-M | 35/0 | Deg C | 22.97 | TC012 | FUV BAFFLE-2 TOP-R | 35/0 | Deg C | 23.31 |
| TC014 | NUV BAFFLE-2 SIDE-M | 35/0 | Deg C | 22.89 | TC015 | NUV BAFFLE-2 SIDE-R | 35/0 | Deg C | 22.74 |
| TC016 | NUV BAFFLE-2 TOP-M | 35/0 | Deg C | 22.37 | TC017 | NUV BAFFLE-2 TOP-R | 35/0 | Deg C | 22.48 |
| TC018 | FUV TELE-TOP SIDE-M | 35/0 | Deg C | 22.29 | TC019 | FUV TELE-TOP SIDE-R | 35/0 | Deg C | 22.73 |
| TC020 | FUV TELE-TOP TOP-M | 35/0 | Deg C | 23.48 | TC021 | FUV TELE-TOP TOP-R | 35/0 | Deg C | 23.62 |
| TC022 | NUV TELE-TOP SIDE-M | 35/0 | Deg C | 22.34 | TC023 | NUV TELE-TOP SIDE-R | 35/0 | Deg C | 22.29 |
| TC024 | NUV TELE-TOP TOP-M | 35/0 | Deg C | 23.09 | TC025 | NUV TELE-TOP TOP-R | 35/0 | Deg C | 22.64 |
| TC027 | FUV TELE-MID SIDE-M | 35/0 | Deg C | 22.67 | TC028 | FUV TELE-MID SIDE-R | 35/0 | Deg C | 22.27 |
| TC029 | FUV TELE-MID TOP-M | 35/0 | Deg C | 23.07 | TC031 | FUV TELE-MID TOP-R | 35/0 | Deg C | 23.47 |
| TC032 | NUV TELE-MID SIDE-M | 35/0 | Deg C | 22.72 | TC049 | EU PKG NBY LUG M | 50/-15 | Deg C | Open |
| TC050 | EU PKG NBY LUG R | 50/-15 | Deg C | 21.42 | TC051 | EU PKG LUG M | 50/-15 | Deg C | 21.42 |
| TC052 | EU PKG LUG R | 50/-15 | Deg C | 22.00 | TC053 | EU PKG TOP M | 50/-15 | Deg C | 21.56 |
| TC054 | EU PKG TOP R | 50/-15 | Deg C | 21.38 | TC081 | NUV TELE-MID SIDE-R | 35/0 | Deg C | Open |
| TC082 | NUV TELE-MID TOP-M | 35/0 | Deg C | 22.05 | TC083 | NUV TELE-MID TOP-R | 35/0 | Deg C | 22.94 |
| TC084 | FUV TELE-BOT SIDE-M | 35/0 | Deg C | Open | TC085 | FUV TELE-BOT SIDE-R | 35/0 | Deg C | 22.31 |
| TC086 | FUV TELE-BOT TOP-M | 35/0 | Deg C | Open | TC087 | FUV TELE-BOT TOP-R | 35/0 | Deg C | 23.51 |
| TC088 | NUV TELE-BOT SIDE-M | 35/0 | Deg C | 21.73 | TC089 | NUV TELE-BOT SIDE-R | 35/0 | Deg C | 22.61 |
| TC090 | NUV TELE-BOT TOP-M | 35/0 | Deg C | 22.95 | TC091 | NUV TELE-BOT TOP-R | 35/0 | Deg C | 22.54 |
| TC092 | EU SINK PLATE HTR1M | 50/-15 | Deg C | 21.67 | TC093 | EU SINK PLATE HTR1R | 50/-15 | Deg C | 21.69 |
| TC094 | EU SINK PLATE HTR2M | 50/-15 | Deg C | 22.74 | TC095 | EU SINK PLATE HTR2R | 50/-15 | Deg C | 21.70 |

Orbit Number: None  Orbit Position: None  Total Power: 0.000 KWatts

CTile: None

ALARM  P3PU  GCO  FAC

SYSTEM HEALTH  T3PU1  T3PU2  P3PU1  P3PU2  GCO  FAC