

# **SERMS**

Laboratorio per lo Studio degli  
Effetti delle Radiazioni sui  
Materiali per lo Spazio  
Via Pentima Bassa, 21 Terni - 05100 TR  
phone/fax: +39.0744.49.29.13

## **TEST REPORT THERMO-VACUUM TEST**



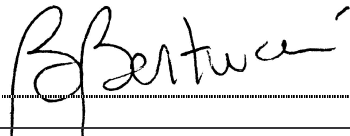
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crates tvt  
data: 09/12/08  
rev: A01  
pag: 1 di 14  
file: ENVRPT34-1-  
S3021R-9DEC2K8.doc

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## **TEST REPORT THERMO VACUUM TEST**

ENVRPT34\_S3021R-UG crate FS\_TVT-9DEC2K8.doc  
date: December 09<sup>th</sup>, 2008  
Prot.: 002-09/SERMS

signature

test report prepared by:	09/12/08 <i>data</i>	Ing. Serena Borsini <i>Test responsible</i>	
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### **change record**

<b>date</b>	<b>change description</b>	<b>revision</b>
09/12/08	first issue	A01

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#### **TEST REPORT DESCRIPTION**

This document is generated by the S.E.R.M.S. Laboratory and reports on the setup, the operation and the results of the test performed on the customer Device Under Test (D.U.T.); several sections compose this report: all of them have been integrated and adapted to the specific tests performed on the D.U.T.

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### GENERAL INFORMATION

**Job Number:**

S3021R

**Test performed on:**

UG crate FS and UGPD FM

**Contractor:**

INFN - Roma

**Contractor responsible:**

B.Borgia

**Test responsible:**

Two subjects - INFN Roma and S.E.R.M.S. - have participated to this test. The applicable procedure has been written by INFN Roma (B.Borgia) **UG electronics FM Crate Thermal Stress and Thermal-Vacuum Test Procedure.doc**.

Roles and responsibilities of the participating subjects are defined as follow:

- Test conduction has been responsibility of INFN Roma. The test procedure as well as its modifications have been issued by INFN Roma. INFN Roma personnel unit at SERMS has contributed to the setup.
- All the recorded data from the electronics functional test, switch-on/switch-off operations and monitoring are under responsibility of INFN Roma. Personnel units from INFN Roma have contributed to the disassembly phases.
- SERMS has been responsible for the test facility and the measurement hardware (thermal chamber, thermal sensors, data acquisition chain) and has insured a continuous monitoring of the test execution.
- SERMS has been responsible of the environmental parameters along the whole test. Recorded data have been handled only by SERMS qualified personnel.

The SERMS project manager responsible for the test has been Ing. Serena Borsini.

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### **APPLICABLE LAWS AND RULES**

#### **CUSTOMER TEST PROCEDURE**

UG electronics FM Crate Thermal Stress and Thermal-Vacuum Test Procedure.doc  
<http://ams.cern.ch/AMS/Electronics/SubD/qa/>

#### **D.L. 19 settembre 1994, n.626**

Attuazione delle direttive 89/391/CEE, 89/654/CEE, 89/655/CEE, 89/656/CEE, 90/269/CEE, 90/270/CEE, 90/394/CEE e 90/679/CEE riguardanti il miglioramento della sicurezza e della salute dei lavoratori sul luogo di lavoro, e successive modifiche;

#### **MIL-HDBK-831 23 Aprii 1999**

Preparation of Test Reports (guidance only);

#### **UNI -10653 – November 1997**

Quality product technical documentation (guidance only) ;

#### **UNI CEI EN45001**

general criterion for test laboratory operation;

#### **UNI CEI 70001**

norm certificate test laboratory terms and definitions;

#### **UNI CEI 70011**

guide for test result presentation;

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### TEST LEVEL SUMMMARY

The thermal profile of the test is schematically presented in Figure 1.

It derives from the approved reference profile on the AMS procedure:

- UG electronics FM Crate Thermal Stress and Thermal-Vacuum Test Procedure.doc.
- <http://ams.cern.ch/AMS/Electronics/SubD/qa/>

and the related modifications issued by B.Borgia & G.Ambrosi.

The test temperature profiles are sketched in Figure 1 with the following definition of temperature levels:

- $T_{AMB}$  = ambient temperature
- $T_{NO-max}$  = hot storage, non-operating temperature = +80 °C
- $T_{NO-min}$  = cold storage non-operating temperature = -40 °C
- $T_{Q-max}$  = hot operating temperature = +50 °C
- $T_{Q-min}$  = cold operating temperature = -20 °C

The pressure must be below  $10^{-4}$  mbar to set the first hot storage temperature, and below  $10^{-5}$  mbar before the first switch on operation.

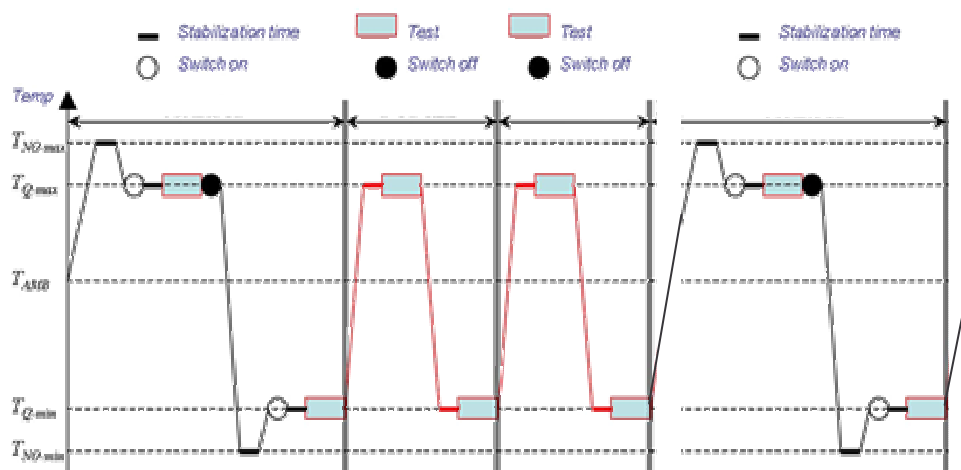


Figure 1 – TVT temperature profile.

The stabilization time is defined by the following condition:

the condition  $|\Delta T|/\Delta t < 1$  °C/hour is reached and maintained for at least 1 hour.

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### **TEST DIARY**

test begun: .....September 15<sup>th</sup> 2008  
test completed: .....September 22<sup>nd</sup>, 2008

### **TEST SET-UP**

The UG and UGPD electronics have been tested in the Thermo Vacuum Chamber fixed to the lower cold plate by an Aluminium alloy fixture. The fixture of the UG-crate has a black surface treatment.

During the set up phase the main activities performed have been:

- unpackage and cleaning of the crates (both internally and externally), the Aluminium fixture and the screws needed to place the fixture on cold plate.
- thermal sensors positioning in the TVC
- thermal sensors positioning on the DUTs
- positioning of the MLI to cover the DUTs

### ***UNPACKAGE AND POSITIONING***



**FIGURE 2 –UG CRATE INSIDE THE TVC, FIXED TO THE LOWER COLD PLATE.**

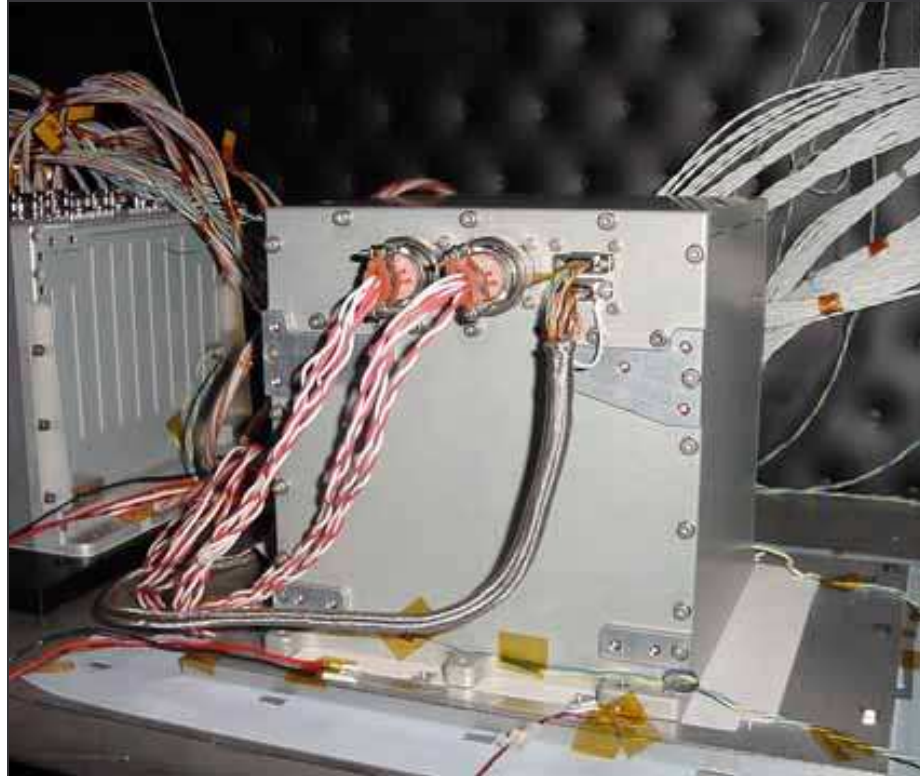
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**FIGURE 3 - UGPD CRATE INSIDE THE TVC, FIXED TO THE LOWER COLD PLATE, NEAR THE UG CRATE.**

The Aluminium alloy fixture reproduces the same I/F conditions as in the flight configuration; in order to have a good thermal connection between the DUTs, the fixture and the cold plate, a layer of thermal conductive material (Cho-Term) was placed both between the crate and the fixture (the one for the UG crate has been provided by the customer) and between the fixture and cold plate (Cho-term 1674 from Chomerics from SERMS srl).



**FIGURE 4 - DETAIL OF CHO-TERM LAYER PLACED BETWEEN THE AL FIXTURE AND THE COLD PLATE.**



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### ***THERMAL SENSORS POSITIONING ON THE DUT***

A total amount of:

- 2 Chamber Thermal Sensors (PT100 sensors S651) have been installed on the UG crate by S.E.R.M.S. personnel under the direction of INFN of Rome personnel in order to control the temperature of the device (TRP sensors); the channel numbers are n°10 and 17;
- 2 Chamber Thermal sensors (PT100 sensors S651) have been installed inside the UGPD crate by S.E.R.M.S. personnel under the direction of INFN of Rome personnel in order to control the temperature of the device (TRP sensors); the channel numbers are n° 18 and 19.

All the temperature sensors used were the chamber sensors and they were installed using Kapton tape.

After positioning, all sensors (TRP and internal sensors) have been tested to verify possible failures after installation.

### ***POSITIONING OF MLI***

The DUT was covered with MLI blanket in order to reproduce the flight conditions.



**FIGURE 5 – UG AND UGPD CRATES INSIDE THE TVC COVERED WITH MLI BLANKET.**

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### **TEST RESULTS**

The UG flight spare model and UGPD flight model crates have been tested at S.E.R.M.S. in the Thermal Vacuum Chamber (TVC) during the period September 15<sup>th</sup> – September 22<sup>nd</sup> 2008.

In order to reduce the time for the test and due to the fact that all the FS and FM model must be tested in the Thermo vacuum chamber using the same thermal profile, the UG crate FS has been tested together with the TTCE flight spare model.

The test has been performed according to the test profile shown in the previous section of this report. INFN-Roma experts have attended the test and operated the electronics during the switch-on/switch-off and functional test phases. The functional test report has been issued by INFN (INFN Roma AMS 11/08).

No malfunctioning has been observed in the S.E.R.M.S equipment: the environmental parameters in the TVC matched the customer requests and were continuously recorded.

The UG and UGPD electronics temperatures have been continuously monitored:

- N° 2 chamber sensors (part # S651) placed on two opposite side walls of the UG crate near the feet; these sensors were the temperature reference points during the test (Chamber Ch10-TRP1 and Ch17-TRP2);
- N° 2 chamber sensors (part # S651) placed on two opposite side walls of the UGPD crate; these sensors were the temperature reference points during the test (Chamber Ch18-TRP1 and Ch19-TRP2);

The complete set of recorded data can be provided on request. In this report will be summarized only the most significant test data.

All the commitments of S.E.R.M.S. with the customer have been fulfilled and the test can be declared successfully completed for what concerns the items under S.E.R.M.S. responsibility.

### **REMARKS**

All the functional test on the equipment are reported on the following customer document:

**UG Crate FM acceptance test, AMS Roma 02/08 (5/5/2008)**

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### **TEST GRAPHS**

All the control and environmental parameters in the TVC have been continuously monitored and recorded during the test. The UG and UGPD crates temperatures have been continuously monitored in all the locations and their values recorded during the whole test period.

In this section, the graphs summarizing the temporal evolution of all measured quantities during the whole test period are reported.

Hereby the S.E.R.M.S. guarantees that:

- the handling of the test data has been done only by qualified members of the S.E.R.M.S staff.
- all graphs presented in this report are a truthful representation of the recorded data and have been solely produced by the S.E.R.M.S. engineer in charge of the test.

The complete set of recorded data and more detailed graphs relative to specific measurements can be provided on request.

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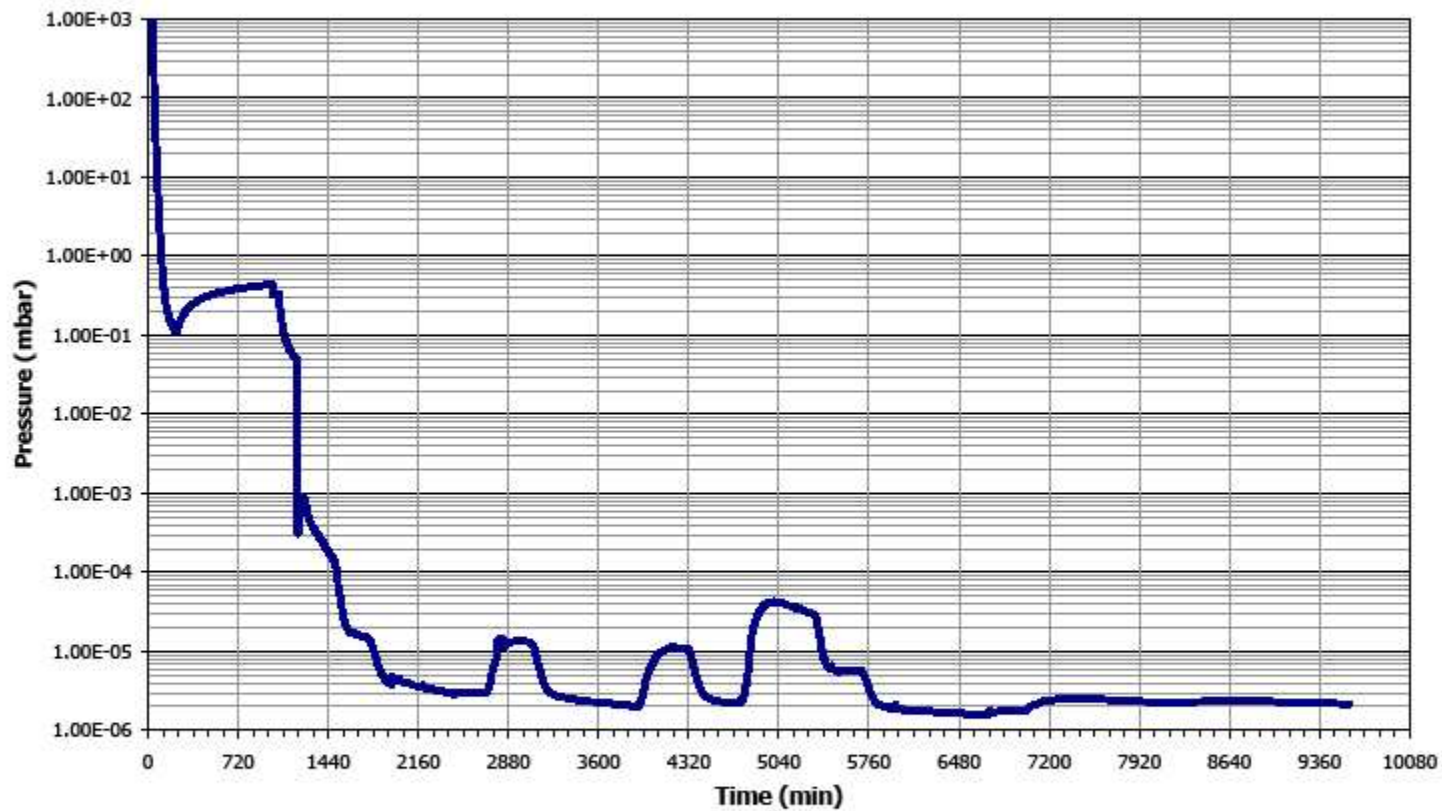
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### PRESSURE PROFILE



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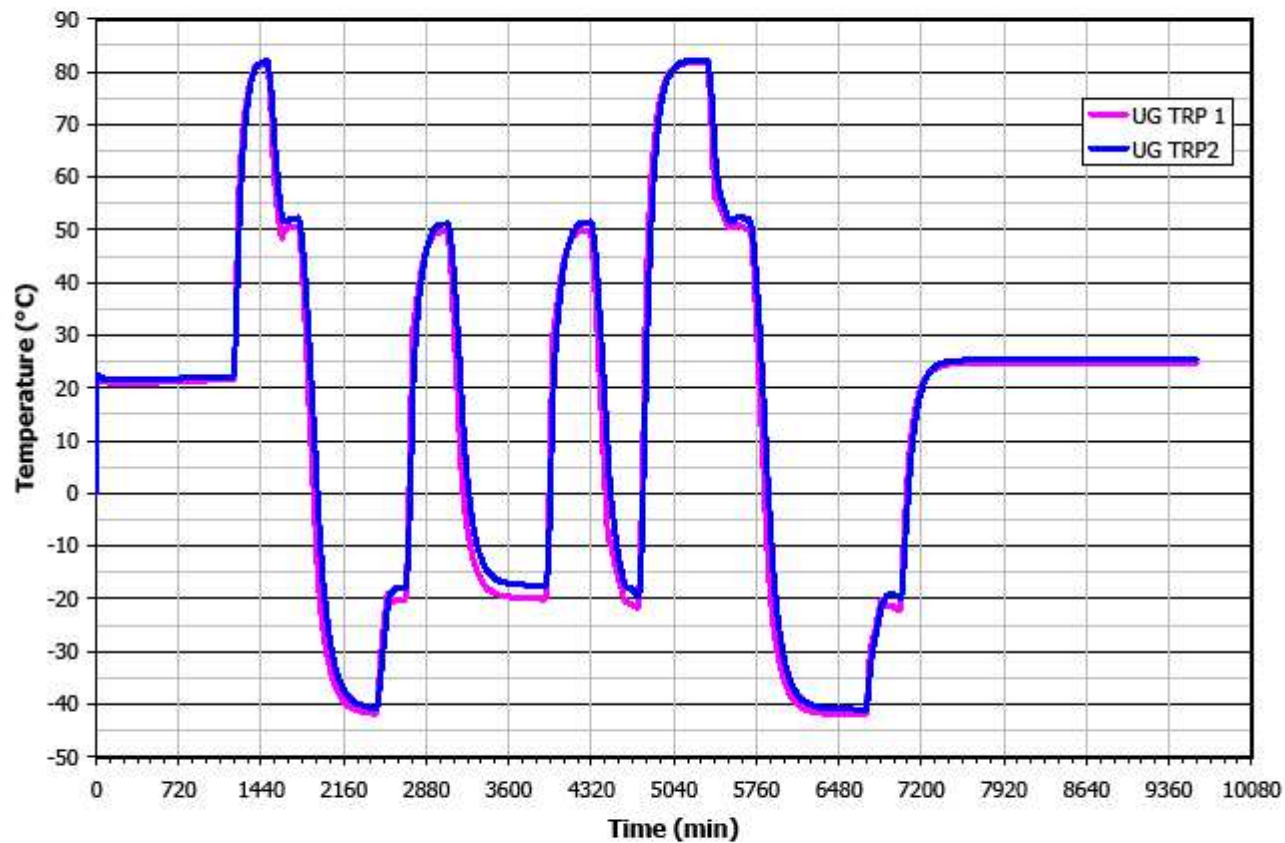
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### UG-crate TEMPERATURE REFERENCE POINTS (TRP) PROFILE



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### UGPD-crate TEMPERATURE REFERENCE POINTS (TRP) PROFILE

