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Reference Load Samples Procedures**

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## TABLE OF CONTENTS

<b>1</b>	<b>ABSTRACT.....</b>	<b>1</b>
<b>2</b>	<b>KEYWORDS/ACRONYMS .....</b>	<b>1</b>
<b>3</b>	<b>INTRODUCTION.....</b>	<b>2</b>
3.1	PURPOSE AND SCOPE.....	2
3.2	STRUCTURE OF THE DOCUMENT.....	2
<b>4</b>	<b>APPLICABLE AND REFERENCE DOCUMENTS.....</b>	<b>3</b>
4.1	APPLICABLE DOCUMENTS .....	3
4.2	REFERENCE DOCUMENTS .....	3
<b>5</b>	<b>EXPERIMENTAL SETUP .....</b>	<b>4</b>
5.1	ENVIRONMENTAL CONDITIONS .....	4
5.2	THERMO-VACUUM TUBE.....	4
<b>6</b>	<b>SAMPLE PREPARATION.....</b>	<b>5</b>
<b>7</b>	<b>THERMAL CYCLES PROCEDURE .....</b>	<b>5</b>





## 1 ABSTRACT

This document contains the procedures for the thermal shock tests of the QM-like 4 K Reference Load targets bonded on Aluminum without envelop.

## 2 KEYWORDS/ACRONYMS

RL Reference Load  
DUT Device Under Test  
SUT Sample Under Test  
RF Radio Frequency  
QM Qualification Model  
FM Flight Model





### **3 INTRODUCTION**

Due to QM 4K RL damages after thermal cycles, a number of studies have to be performed to verify cleaning and assembly procedures. Thermal shocks in a N<sub>2</sub> bath controlled environment are foreseen to verify resistance to thermal stress.

#### **3.1 PURPOSE AND SCOPE**

The purpose of this document is to provide procedures to perform thermal shock tests in a controlled environment for the samples

#### **3.2 STRUCTURE OF THE DOCUMENT**

T.B.W.





## 4 APPLICABLE AND REFERENCE DOCUMENTS

### 4.1 APPLICABLE DOCUMENTS

- [AD 1] *FIRST/Planck Instrument Interface Document, Part A* (SCI-PT-IIDA-04624, 3/0)
- [AD 2] *FIRST/Planck Instrument Interface Document, Part B* (SCI-PT-IIDB/LFI-04142, 2/0)
- [AD 3] *LFI Interface Control Document* (PL-LFI-PST-ID-010, 2.0)
- [AD 4] *LFI/HFI Interface Document* (PL-LFI-PST-ID-001, 1.0)
- [AD 5] *LFI Specification* (PL-LFI-PST-SP-001, 3.0)
- [AD 6] *Planck LFI Instrument Design and Development Plan* (PL-LFI-PST-PL-002, 2.0)
- [AD 7] *Planck LFI Product Assurance Plan* (PL-LFI-PST-PL-003, 3.0)
- [AD 8] *Planck LFI Assembly Integration & Verification Plan* (PL-LFI-PST-PI-004, 3.0)
- [AD 9] *FIRST/Planck Operations Interface Requirements Document* (SCI-PT-RS-07360, 2/1)
- [AD 10] *LFI Configuration and Data Management CADM Plan* (PL-LFI-PST-PL-001, 3.0)
- [AD 11] *LFI Instrument Deliverable Documentation List (DDL)* (PL-LFI-PST-LI-007, 1.0)
- [AD 12] *4K Reference Load Requirement Specification* (PL-LFI-TES-SP-001, 3.1)
- [AD 13] *4K Reference Load Test Plan* (PL-LFI-TES-PL-001)

### 4.2 REFERENCE DOCUMENTS

- [RD 1] *IMI GE Varnish data sheet*



## 5 EXPERIMENTAL SETUP

### 5.1 ENVIRONMENTAL CONDITIONS

Tests will be performed in a dedicated very small cryo chamber in the IR laboratory at IASF-CNR in Bologna. The cleanliness standard of the laboratory is that of a “visible clean”.

Table 5.2.1 environmental conditions shall apply.

Table 5.2.1

Parameter	Nominal value	Measured value
Relative Humidity [RH %]	20-60 %	
Temperature [°C]	22°± 4° C	

### 5.2 THERMO-VACUUM TUBE

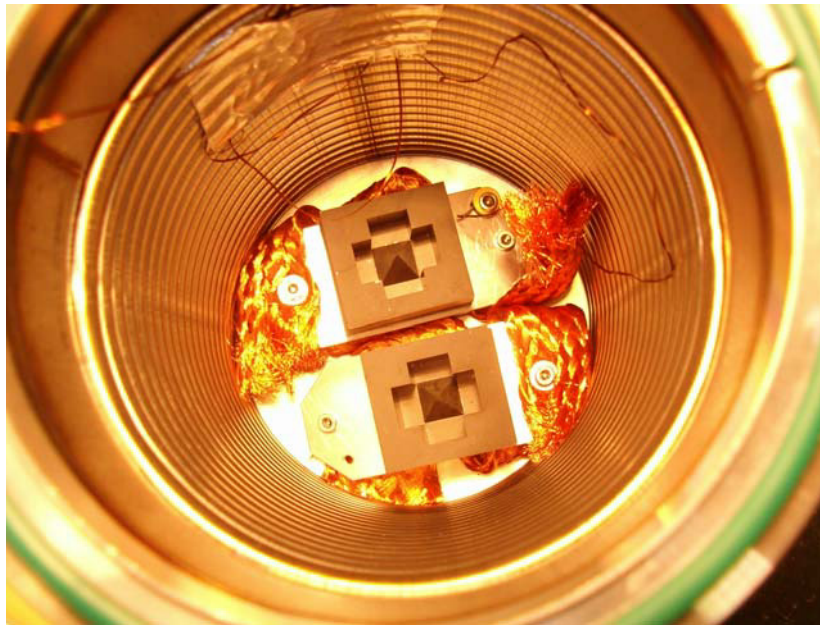
An ad-hoc hermetic small chamber was designed for this test (Fig. 1). In this way the samples mounted inside the chamber do not get in touch with liquid Nitrogen.



Fig. 1 The small chamber used in the tests(left) and a view of the vacuum setup (right). Also the pump is visible behind the Nitrogen bath.



The samples are screwed inside the chamber and copper thermal strap create a link on the bottom of the tube in order to allow a fast cooling down (). Temperature is monitored on the Aluminum support by a silicon diode.



*Fig. 2 Samples mounted inside the tub. Copper thermal straps and the temperature sensor are visible.*

## **6 SAMPLE PREPARATION**

Two 30 GHz targets are prepared. The two samples are assembled with normal 30 GHz target assembly procedure. One of the sample (Sample 1) will be cleaned with acetone, while the other (Sample 2) will be cleaned using isopropyl alcohol.

## **7 THERMAL CYCLES PROCEDURE**

After cleaning, the samples are mounted in the chamber. Procedure steps for cycles are as follows:

1. Close the chamber.
2. Switch-on the pump and then open vacuum valve.
3. When pressure drops below  $10^{-2}$  mBar, close vacuum valve and switch off the pump.
4. Insert the chamber in the Nitrogen bath.
5. Wait the temperature sensor reach the minimum temperature.
6. After at least 10 min of steady cold temperature, get the chamber off the bath and wait for the warm up to room temperature.
7. Check pressure: if it is below  $10^{-2}$  mBar repeat Points 4-7, other wise repeat Points 2-7.





Visual inspection will be performed after cycle 1, 3, 5, 9, 11, 21. During visual inspection after cycle 11, a the face of sample 1 will be coated with IMI-GE varnish.

