Title: **Procedure for Instrument Thermal Behaviour and Straylight Tests on PLM EQM Level**

CI-No: 153 000

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Issue 1	01.12. 2005	All	Initial Issue	

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1 Introduction

1.1 Scope

This document comprises the procedure for the specific thermal behaviour and straylight tests to be carried out in the frame of the PLM EQM programme as requested in ESA fax SCI-PT/38109.

1.2 Objective

The objective and purpose of these tests are

1) To measure the thermal impact of operating one instrument after another on the stability of level 0, 1 and 2 temperatures.
This test shall support the validation of the predicted thermal behaviour of the instruments and the upper part of the cryostat, as far as possible with the limitations of the existing EQM hardware. This shall be accomplished by comparison of the measured thermal behaviour with the TMM predictions and with the STM /TV test results, taking into account the existing differences between EQM and TMM/STM (TBC).
The following operations scenario has been defined:

- HIFI - PACS - HIFI - SPIRE -HIFI. The operation of PACS and SPIRE includes the cooler recycle.

In addition specific HIFI FPU thermal tests will be performed:

- Loading the HIFI FPU with predefined power to verify the thermal property of thermal junction between HIFI FPU and thermal links (L0 and L1).
- Switching from band 3 to a dummy band to determine the HIFI FPU internal thermal behaviour.

2) To investigate the cause of the high background radiation measured by PACS during IMT (HP-2-ASED-NC-1675).
By analysis several potential straylight sources have been identified. The analysis shall be support by actual measurements. This shall be achieved by varying the temperature of the suspicious straylight sources and to monitor the effect on the background radiation measurements. The measurements are performed by PACS in spectrometry or in photometry and mode; the spectrometry mode allows recording the Planck-curve - with some limitations - and such to get a hint on the straylight source temperature. With photometry mode mappings of the cryocover mirror and herewith a localisation the straylight source could be possible.
Three different tests have been defined:

- Background radiation measurements during decreasing cryocover temperature after cryocover decontamination. Goal is to get a qualitative assessment whether or not the straylight is caused by water ice on the cryocover mirrors. PACS in spectroscopy mode.
- Background radiation measurements during modulated radiation through the LO window during switching between a heat source and a reflective cover in front of the LO band 3

window. Goal is to determine potential straylight impact via the LO path. Note: on EQM all LO windows except for band 3 are replaced by an aluminium plate and both alignment windows are covered with an aluminium cap with low ε. PACS in photometry mode.

- Background radiation measurements with two different shield and HTT temperatures to determine any potential impact of the heat shield and HTT temperature on the straylight.. PACS in spectroscopy mode.

2 Documents/Drawings

2.1 Applicable Documents

The following documents in their latest issue are applicable to this procedure:

AD 01	HP-2-ASED-PL-0007	Herschel PA Plan	Issue 2.1
AD 02	HP-2-ASED-PL-0023	Herschel Contamination Control Plan	Issue 2
AD 03	SCI-PT-IIDB/SPIRE-02124	Herschel/Planck Instrument Interface Document, Part B, Instrument “SPIRE”	Issue 3.3
AD 04	SCI-PT-IIDB/HIFI-02125	Herschel/Planck Instrument Interface Document, Part B, Instrument “HIFI”	Issue 3.2
AD 05	SCI-PT-IIDB/PACS-02126	Herschel/Planck Instrument Interface Document, Part B, Instrument “PACS”	Issue 3.3
AD 06	SCI-PT-IIDA-04624	Herschel/Planck Instrument Interface Document, Part A	Issue 3.3

2.2 Reference Documents

In this section all documents which are called up in this procedure are listed (e. g. for cryostat operation, for instrument operation, …).

RD 01	HP-2-ASED-PR-0035	EGSE configuration procedure (include switch on procedures)	Issue 4
RD 02	HP-2-ASED-TP-0091	Herschel Cover Flushing Procedure	Issue 1
RD 03	SRON-G/HIFI/PR/2005-101	HIFI EQM IST & EMC Test Procedures	Issue 1.4
RD 04	PACS-ME-TP-021	PACS IMT Procedure (includes EMC)	Issue 1.0
RD 05	SPIRE-RAL-PRC-002494	SPIRE SFT Procedure	Issue 1.3
RD 06	SPIRE-RAL-PRC-002512	SPIRE IMT Procedure	Issue 1.1
RD 07	FPSS-00786	Thermal behaviour test HIFI FPU EQM	Issue 1

3 Configuration

3.1 Principle Test Set-up

The principle H-EPLM EQM test set-up is shown in Figure 3-1.

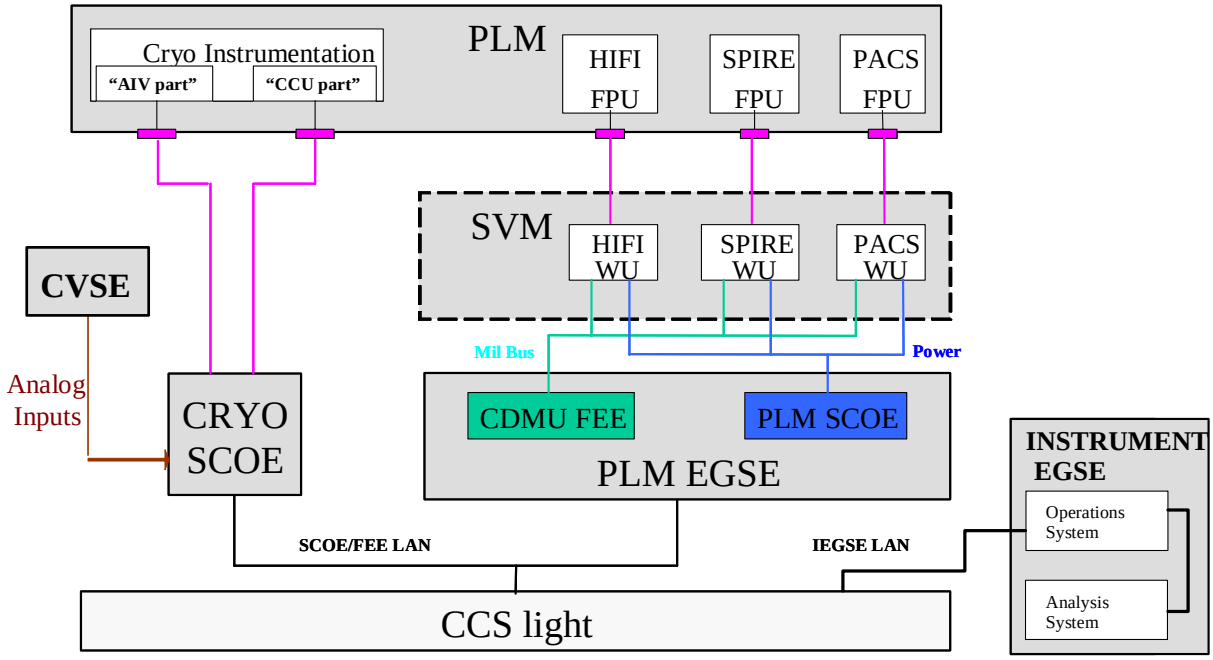


Figure 3-1: Principle Test Set-up for EQM Tests

3.2 H-EPLM Configuration

Figure 3-2 shows the configuration of the EPML EQM (modified ISO cryostat) for this test.

The AXT is pumped down to He II and provides the L0 interfaces; the vent line from the AXT provides the L1, L2 and L3 interfaces. The mass flow can be forced by heaters on the AXT.

The HTT is depleted and evacuated. The heat shields are cooled instead by helium flushing from an external dewar with 150 mg/s to 250 mg/s.

The cover is also cooled by helium flushing from an external dewar with a variable flow rate. The temperature is controlled throttling at the transfer line valve and adjusting the dewar pressure.

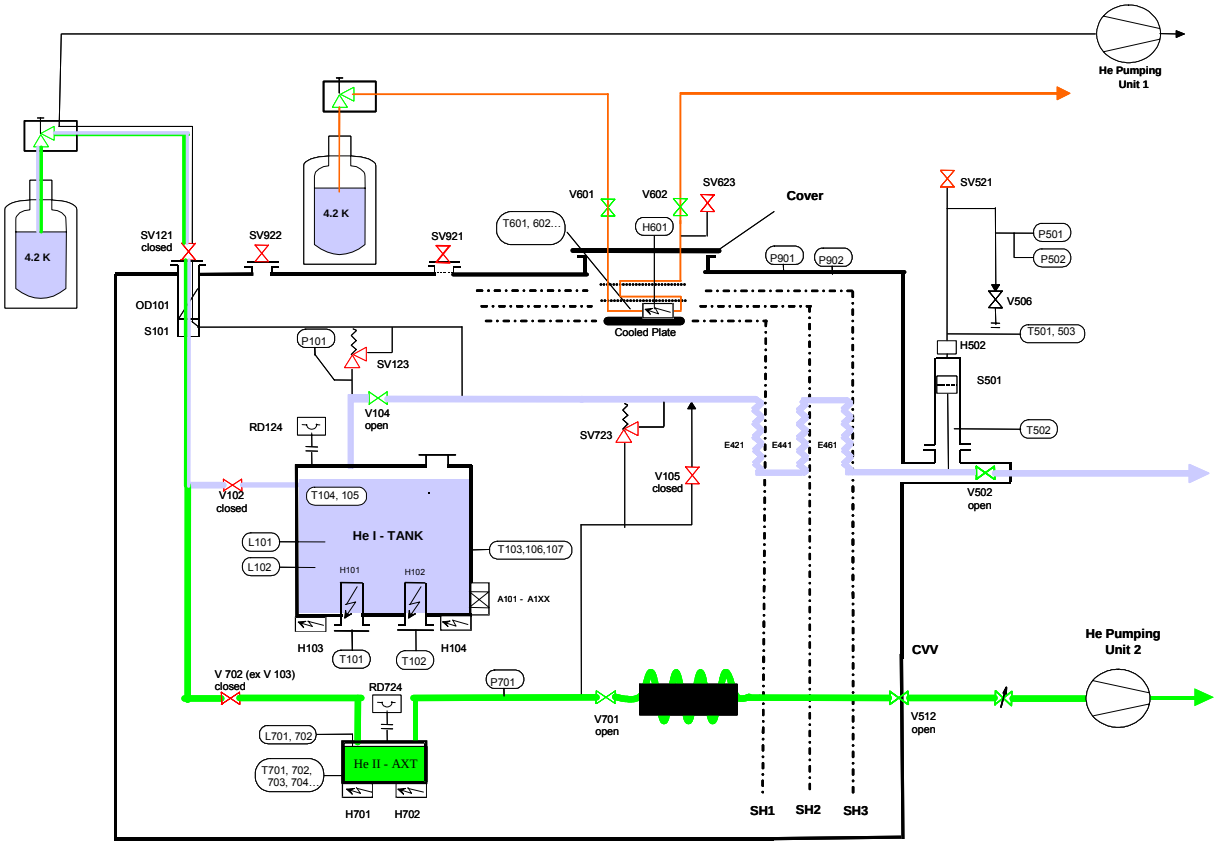


Figure 3-2: EPLM EQM Helium Flow Scheme

3.3 Configuration of Instruments

The as-built status of the instruments is shown in Table 3-1:

CI Number	Description	Built Status
153 100	HIFI Instrument	EQM
153 200	SPIRE Instrument	EQM
153 300	PACS Instrument	EQM

Table 3-1: As-built Status of Instruments

The detailed hardware and software as-built standard of the Instruments shall be validated at the TRR and reported in the TRR minutes and in the test report.

3.4 GSE Configuration

3.4.1 MGSE

- PLM EQM Test Dolly
- SVM simulator
- Tables to carry the instrument specific EGSE (ext. power supplies, etc.) in ESD protected area

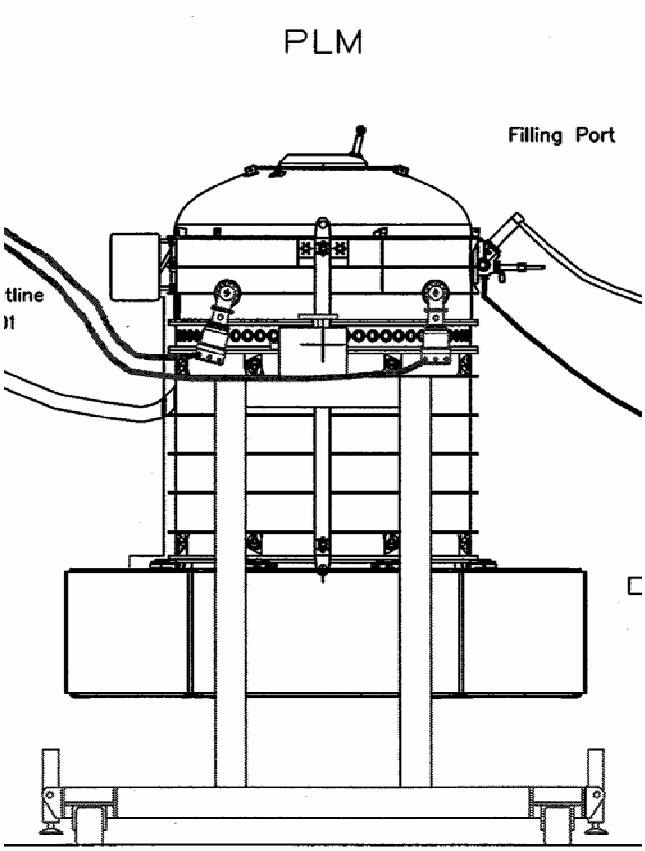


Figure 3-3: Herschel EQM mounted on Test Dolly during EQM Tests (Tilting not shown here)

3.4.2 CVSE

For the cryostat operation the following CVSE is required. The relevant cryo operations are described in the related user manuals.

- He Pumping unit I
- He Pumping unit II
- Set of filling and venting lines for LHe I and LHe II operations
- 450 l LHe dewars

- Flow meters
- Scaffolding
- Safety unit

3.4.3 EGSE

3.4.3.1 ASED EGSE

- CCS
- PLM EGSE with PLM SCOE to power instruments and CDMU DFE to command and control instruments
- Cryo SCOE in EQM configuration

3.4.3.2 Instrument Delivered EGSE

Common EGSE

- I-EGSE (connected to CCS)

HIFI Specific EGSE

- LSU simulator plus synthesiser and power supply
- Waveguide to connect LSU simulator with LOU waveguides

PACS Specific EGSE

- Ext. power supply for BOLC
- Ext. ICU reset switch

SPIRE Specific EGSE

- Ext. power supply for FCU
- Ext. power supply for mechanisms
- Ext. DRCU switch

3.4.4 Laboratory Equipment

The laboratory equipment list defines the instruments and tools to be used for this test. All equipment shall be calibrated and shall be within the calibration period during the test time.

Item	Manufacturer	Model No.	Serial No. or Invent. No.	Calib.	Used during integration
Standard tooling to exchange dewars					

Table 3-2: Laboratory Equipment

3.5 Facilities

The activities detailed in this procedure shall be carried out in the EADS Astium clean room in Ottobrunn.

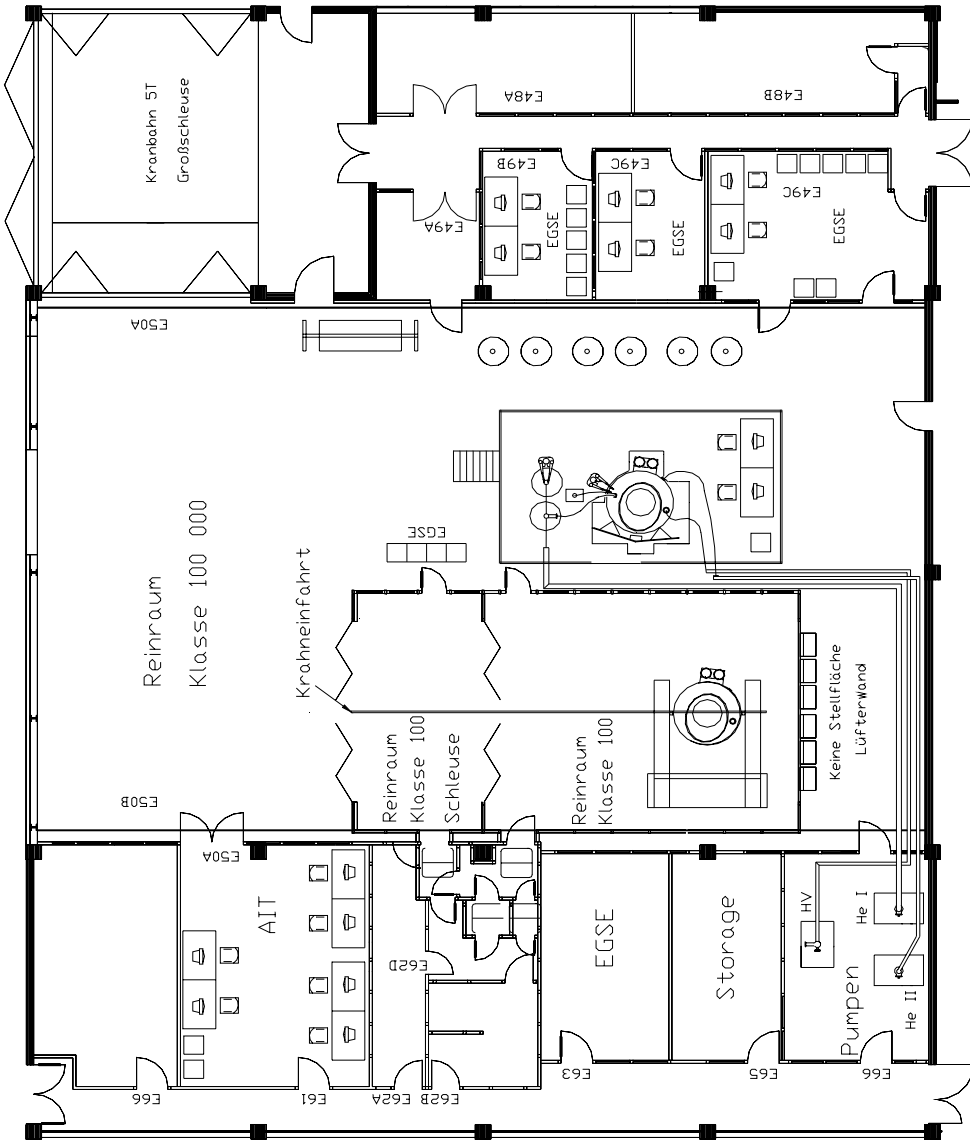


Figure 3-4: Herschel EQM test Set-up in Astrium Ottobrunn Clean-Room

4 Conditions and Constraints

4.1 Environmental Conditions

All activities specified in this procedure have to be performed in a **clean room class 100000** federal standard 209 E.

Temperature: 22°C ± 3°C

Relative Humidity: 40% to 55%

The cleanliness requirements of FED 209E will be observed throughout the activities, and the overall contamination control requirements identified in the Herschel Contamination Control Plan (AD 2) will be observed.

4.2 Cryostat conditions

Throughout the test the cryostat conditions shall be kept constant at appropriate values. The cryostat parameters shall be adjusted such that the following starting conditions are achieved:

- HIFI L0: < 2 K
- HIFI L1: < 6 K
- HIFI L2: < 20 K
- PACS L0: < 1.8 K
- PACS L1: < 5 K
- SPIRE L0: < 1.8 K
- SPIRE L1: < 5 K
- Cryocover: < 20 K for thermal behaviour test, for straylight test as per procedure

The available cryostat parameters are the following:

- Mass flow through shields to adjust temperatures of thermal shields *)
- AXT heating to force the mass flow through the vent line and thus to lower the L1, L2 and L3 temperatures
- Mass flow through cryocover to adjust cryocover temperature

*) Note that IMT revealed that L1 and L2 are affected by the shield temperature

**) Note that during IMT a high impact of cryocover temperature on L1 has been observed (in particular for SPIRE)

4.3 Precautions and Safety

4.3.1 General Safety

The following general rules have to be regarded:

- Respect standard technical rules for mechanical and electrical integration and test activities.
- Special hazard precautions are not expected, except for the comments below and the comments mentioned in the step by step procedure.
- The hardware has to be handled by authorized personnel only.

The following specific rules have to be regarded:

- In case of an unexpected large release of helium it may be necessary to treat victims for suffocation and cold burns. If required, remove the victim from immediate vicinity of the leak
- In case of operation of the Cryostat safety system the following immediate activities shall be performed:
  - operation of safety valve: everybody has to leave the test room, except test conductor and necessary CVSE operations personnel
  - operation of burst disc: everybody has to leave the test room

Contact facility emergency services immediately and explain nature and location of accident.

4.4 Quality Assurance

Quality Assurance shall monitor all operations (handling, transportation, disassembly, installation and test) as necessary to assure compliance with this procedure and the applicable requirements of the Herschel PA Plan (AD 1).

In the course of this procedure PA shall pay particular attention to:

- the application of adequate protections to critical surfaces
- the records in the log-sheet
- the recording of the serial number of the test equipment used
- ensure that the test equipment used is within actual calibration cycle

PA has to make sure that NCR's are raised when applicable and treated by NRB procedure as defined in the Herschel PA Plan (AD 1).

After the conclusion that an activity is successfully completed, this activity has to be signed by the responsible AIT- and PA engineer in the step by step procedure. Also relevant log sheets have to be filled out and signed.

Before start of the test activities a Test Readiness Review (TRR) shall be held. A Post Test Review (PTR) shall finally conclude on the test.

4.5 Personnel

The following manpower is required to perform the activities described in this procedure:

Title	Function	Name*)
Test Manager	Overall responsible	
EGSE Operator	Operates EGSE (CCS, PLM SCOE, CDMU DFE, Cryo SCOE)	
Mech. Operator(s)	Performs all mech. integration activities, handles the PLM during testing (e.g. tilting of PLM), supports instrument test team	
Cryo Operators	Operates the cryostat during testing and maintains the required temperatures	
HIFI AIT Engineer	Supports HIFI related test activities, operates I-EGSE and evaluates/analyses instrument data	
PACS AIT Engineer	Supports PACS related test activities, operates I-EGSE and evaluates/analyses instrument data	
SPIRE AIT Engineer	Supports SPIRE related test activities, operates I-EGSE and evaluates/analyses instrument data	
PA Representative	Ensures that PA requirements are met	
Spacecraft AIT Engineer (Alcatel/ESA)	Supervises all AIT activities	

*) Names to be registered prior to start of test activities

Table 4-1: Personnel

5 Activities Flow

The following table depicts the flow of the activities described in this procedure.

Day / Time	HIFI Mode	PACS Mode	SPIRE Mode	Cryostat
0 / 18:00	Stand-by	Stand-by	Stand-by	Adjust required cryostat starting conditions and allow stabilisation
1 / 08:00	Primary Mode	Stand-by	Stand-by	Keep mass flow through heat shields, AXT heating and cryocover temperature constant, as far as possible, throughout these test steps. Record all cryostat related activities (dewar exchanges, etc.) and cryostat parameters (mass flows, temperatures, etc.).
1 / 13:00	Stand-by	Cooler recycle	Stand-by	
1 / 15:00	Stand-by	Dual-Band Photometry Mode	Stand-by	
1 / 18:00	Primary Mode	Stand-by	Stand-by	
2 / 08:00	Primary Mode	Stand-by	Cooler recycle	
2 / 10:00	Stand-by	Stand-by	Photometry Mode	
2 / 13:00	Primary Mode	Stand-by	Stand-by	
2 / 18: 00	Stand-by	Stand-by	Stand-by	
3 / 08: 00	HIFI FPU Thermal Tests	Stand-by	Stand-by	
3 / 18:00	Stand-by	Stand-by	Stand-by	Warm up cryocover to decontaminate
4 / 08:00	Stand-by	Cooler recycle	Stand-by	
4 / 10:00	Stand-by	Spectroscopy Mode	Stand-by	Slowly decrease cryocover temperature. Perform background radiation measurements versus cryocover temperature.
4 / 14:00	Stand-by	Stand-by	Stand-by	Prepare for LO window illumination.
4 / 15:00	Stand-by	Photometry Mode	Stand-by	Perform background radiation measurements with and without LO window illumination

4 / 18:00	Stand-by	Stand-by	Stand-by	Stop mass flow through heat shields.
5 / 08:00	Stand-by	Spectroscopy Mode	Stand-by	Adjust nominal mass flow through heat shield again. Perform background radiation measurements at different heat shield temperature (during heat shield cool down).
5 / 14:00	Off	Off	Off	PTR / Margin until 17:00

Table 5-1: Test Flow

Note: The above schedule is to be considered as a guideline. The duration of this test is fixed to 5 working days, from Monday to Friday. To optimise the test schedule it is envisaged to include the Friday prior to the test week (Day 0) for switching the instruments to stand-by. Requirement for the thermal behaviour test is that the temperatures shall have stabilised prior to switching from one instrument to another.

6 Step by Step Procedure

6.1 Test Preparation

6.1.1 EGSE and Cryostat Setup

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
1	Set-up PLM EGSE & CCS.			As per RD 01		
2	Ensure that all cryostat related activities (dewar exchanges, etc.) and cryostat parameters (mass flows, temperatures, etc.) are recorded throughout the test.					
3	Adjust mass flow through heat shields.	200 mg/s (TBC)		Mass flow to b decided prior to test.		
4	Adjust mass flow through cryocover to achieve the required cover temperature:	< 20 K (TBC), stable		Cryo cover temperature to b decided prior to test.		

Location:	PA: Name Date:	Operator: Date:		

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
5	Adjust mass flow through AXT to achieve the required L0, L1 and L2 temperatures: HIFI L0 HIFI L1 HIFI L2 PACS L0 PACS L1 SPIRE L0 SPIRE L1	 < 2 K < 6 K < 20 K < 1.8 K < 5 K < 1.8 K < 5 K				
6	Allow shield temperatures, L0, L1 and L2 temperatures and cryocover temperature to stabilise. In case of exceeding of the limits repeat steps 3 to 5 above.					

6.1.2 Switch HIFI from Off to Stand-by Mode

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
1	Load HIFI_prime_inst.pst bus profile on CDMU DFE.					
2	Execute TCL script HIFI_POWER_ON.tcl. from CCS.					
3	Switch HK rate to once every 5 sec by a manual stack command from CCS.					

Location:	PA: Name Date:	Operator: Date:		

6.1.3 Switch PACS from Off to Stand-by Mode

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
1	Load PACS_prime_inst.pst bus profile on CDMU DFE.					
2	Execute TCL script PACS_POWER_ON.tcl from CCS					

6.1.4 Switch SPIRE from Off to Stand-by Mode

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
1	Load SPIRE_prime_inst.pst bus profile on CDMU DFE					
2	Execute TCL script SFT-SPIRE-CCS-DPU-ON.tcl from CCS			see RD 5, Appendix 1		
3	Execute TCL script SFT-SPIRE-CCS-DRCU-ON.tcl from CCS			see RD 5, Appendix 1		
4	Execute TCL script SFT-SPIRE-CCS-FUNC-SCU-03.tcl from CCS			see RD 5, Appendix 1		
5	Execute TCL script SFT-SPIRE-CCS-FUNC-SCU-06.tcl from CCS			see RD 5, Appendix 1		

Location:	PA: Name Date:	Operator: Date:		

6.2 Thermal Behaviour Test

6.2.1 Switch HIFI from Stand-by to Primary Mode

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
1	Check that cryostat temperatures have stabilised: HIFI L0 HIFI L1 HIFI L2 PACS L0 PACS L1 SPIRE L0 SPIRE L1 Cryocover	 < 2 K < 6 K < 20 K < 1.8 K < 5 K < 1.8 K < 5 K < 20 K				
2	Load HIFI_prime_inst.pst bus profile on CDMU DFE.					
3	Execute script IST_HIFI_Thermal_Init__Band3cold.config__wb2__807.tcl. This takes about 80 sec.					
4	Switch RF on.					
5	Execute script IST_HIFI_SPT_LO_tune__Band3cold.config__807__63.tcl. This takes about 18 sec.					

Location:	PA: Name Date:	Operator: Date:		

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6	Execute script IST_HIFI_Thermal_Test__Band3cold.config__wb2__H__807__575.tcl. This takes around 20 min. of integration, with 30 extra seconds between the switch on of the FPU and the effective start (this is mostly due to the time needed to do the Hot/Cold reference).					
7	Execute script IST_WU_Init_FPU__Band0.config.tcl. This is to switch to band0 without resetting any of the other subsystems.					
8	Execute script IST_HIFI_Thermal_Void_30.tcl. Repeat script until FPU temperatures have stabilized (about 1/2 hr). Use different parameters as required: IST_HIFI_Thermal_Void_xx.tcl with xx = 10, 20, 30, 40, 50 or 60 (xx expresses the minutes how long the script shall run). The script performs the record of the temperatures.					
9	Execute again script IST_HIFI_Thermal_Test__Band3cold.config__wb2__H__807__575.tcl. This takes around 20 min. of integration, with 30 extra seconds between the switch on of the FPU and the effective start (this is mostly due to the time needed to do the Hot/Cold reference).					

Location:	PA: Name Date:	Operator: Date:		

6.2.2 Switch HIFI from Primary to Stand-by Mode

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
1	Check that temperatures (switching transients) have stabilised.					
2	Switch LSU simulator RF off.					
3	Execute TCL script IST_HIFI_standby_internal_source_ON__Band0.config__807__wb2.tcl. This takes about 58 sec.					

6.2.3 PACS Cooler Recycle

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
1	Load PACS_prime_inst.pst bus profile on CDMU DFE.					
2	Execute TCL script BOLO_cooler_OBS_shell.tcl from CCS					

Location:	PA: Name Date:	Operator: Date:		

6.2.4 Switch PACS to Prime Mode (Dual-Band Photometry)

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
1	Execute TCL script PHOT_setup_OBS_shell.tcl from CCS					
2	Execute TCL script PACS_PHOT_SPU_setup.tcl from CCS					
3	Execute TCL script Chop_mov_abs_obs_shell.tcl from CCS					

6.2.5 Switch PACS from Prime (Dual-Band Photometry) to Stand-by Mode

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
1	Check that temperatures (switching transients) have stabilised.					
2	Execute TCL script ENTER_SAFE_Mode_Shell.tcl from CCS					

Location:	PA: Name Date:	Operator: Date:		

6.2.6 Switch HIFI from Stand-by to Primary Mode

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
1	Load HIFI_prime_inst.pst bus profile on CDMU DFE.					
2	Execute script IST_HIFI_Thermal_Init__Band3cold.config__wb2__807.tcl. This takes about 80 sec.					
3	Switch RF on.					
4	Execute script IST_HIFI_SPT_LO_tune__Band3cold.config__807__63.tcl. This takes about 18 sec.					
5	Execute script IST_HIFI_Thermal_Test__Band3cold.config__wb2__H__807__575.tcl. This takes around 20 min. of integration, with 30 extra seconds between the switch on of the FPU and the effective start (this is mostly due to the time needed to do the Hot/Cold reference).					
6	Execute script IST_WU_Init_FPU__Band0.config.tcl. This is to switch to band0 without resetting any of the other subsystems.					
7	Execute script IST_HIFI_Thermal_Void_30.tcl. Repeat script until FPU temperatures have stabilized (about 1/2 hr). Use different parameters as required: IST_HIFI_Thermal_Void_xx.tcl with xx = 10, 20, 30, 40, 50 or 60 (xx expresses the minutes how long the script shall run). The script performs the record of the temperatures.					

Location:	PA: Name Date:	Operator: Date:		

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
8	Execute again script IST_HIFI_Thermal_Test__Band3cold.config__wb2__H__807__575.tcl. This takes around 20 min. of integration, with 30 extra seconds between the switch on of the FPU and the effective start (this is mostly due to the time needed to do the Hot/Cold reference).					

6.2.7 Switch HIFI from Primary to Stand-by Mode

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
1	Check that temperatures (switching transients) have stabilised.					
2	Switch LSU simulator RF off.					
3	Execute TCL script IST_HIFI_standby_internal_source_ON__Band0.config__807__wb2.tcl. This takes about 58 sec.					

Location:	PA: Name Date:	Operator: Date:		

6.2.8 SPIRE Cooler Recycle

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
1	Load SPIRE_prime_inst.pst bus profile on CDMU DFE.					
2	Execute TCL script SPIRE-IMT-CREC.tcl from CCS					

6.2.9 Switch SPIRE to Observe Mode (Photometry)

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
1	Execute TCL script SPIRE-IMT-PHOTSTBY.tcl from CCS					

6.2.10 Switch SPIRE from Observe Mode (Photometry) to Stand-by Mode

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
1	Check that temperatures (switching transients) have stabilised.					
2	Execute TCL script SPIRE-IMT-PHTREDY.tcl from CCS					

6.2.11 Switch HIFI from Stand-by to Primary Mode

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
1	Load HIFI_prime_inst.pst bus profile on CDMU DFE.					
2	Execute script IST_HIFI_Thermal_Init__Band3cold.config__wb2__807.tcl. This takes about 80 sec.					
3	Switch RF on.					
4	Execute script IST_HIFI_SPT_LO_tune__Band3cold.config__807__63.tcl. This takes about 18 sec.					

Location:	PA: Name Date:	Operator: Date:		

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
5	Execute script IST_HIFI_Thermal_Test__Band3cold.config__wb2__H__807__575.tcl. This takes around 20 min. of integration, with 30 extra seconds between the switch on of the FPU and the effective start (this is mostly due to the time needed to do the Hot/Cold reference).					
6	Execute script IST_WU_Init_FPU__Band0.config.tcl. This is to switch to band0 without resetting any of the other subsystems.					
7	Execute script IST_HIFI_Thermal_Void_30.tcl. Repeat script until FPU temperatures have stabilized (about 1/2 hr). Use different parameters as required: IST_HIFI_Thermal_Void_xx.tcl with xx = 10, 20, 30, 40, 50 or 60 (xx expresses the minutes how long the script shall run). The script performs the record of the temperatures.					
8	Execute again script IST_HIFI_Thermal_Test__Band3cold.config__wb2__H__807__575.tcl. This takes around 20 min. of integration, with 30 extra seconds between the switch on of the FPU and the effective start (this is mostly due to the time needed to do the Hot/Cold reference).					

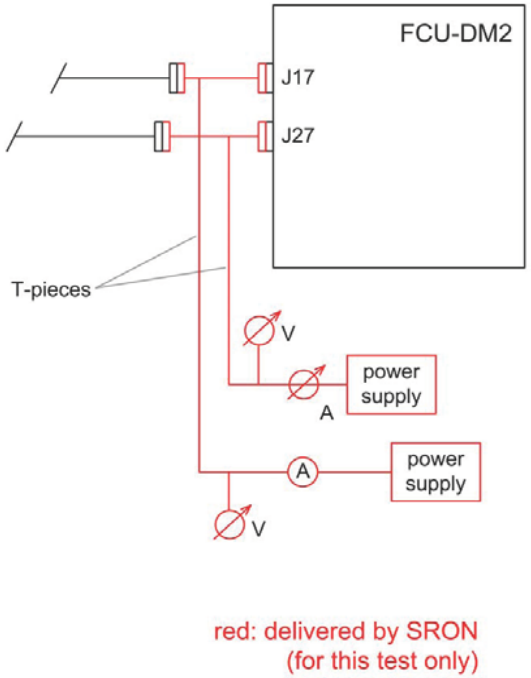
Location:	PA: Name Date:	Operator: Date:		

6.2.12 Switch HIFI from Primary to Stand-by Mode

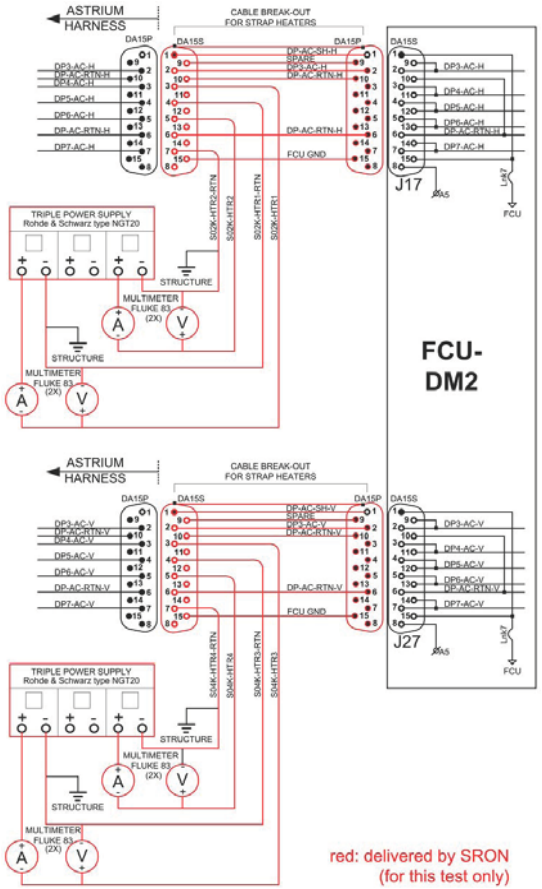
Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
1	Check that temperatures (switching transients) have stabilised.					
2	Switch LSU simulator RF off.					
3	Execute TCL script IST_HIFI_standby_internal_source_ON__Band0.config__807__wb2.tcl. This takes about 58 sec.					

Location:	PA: Name Date:	Operator: Date:		

6.2.13 HIFI FPU Thermal Tests

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
1	Connect power supplies for the heaters as shown below.  			See also RD 07		

Location:	PA: Name Date:	Operator: Date:		

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
						

Location:	PA: Name Date:	Operator: Date:		

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
2						
3	Power the heaters sequentially with 2, 4, 6 and 0 mW, both L0 and L1. Wait after each power step until temperatures have stabilised. This takes about 90 minutes. During that time execute and repeat script IST_HIFI_Thermal_Void_xx.tcl. with xx = 10, 20, 30, 40, 50 or 60 as required (xx expresses the minutes how long the script shall run).					
4	Execute script IST_HIFI_Thermal_Init__Band3cold.config__wb2__807.tcl. This takes about 80 sec.					
5	Switch RF on.					
6	Execute script IST_HIFI_SPT_LO_tune__Band3cold.config__807__63.tcl. This takes about 18 sec.					
7	Execute script IST_HIFI_Thermal_Void_30.tcl. Repeat script until FPU temperatures have stabilized (about 1/2 hr). Use different parameters as required: IST_HIFI_Thermal_Void_xx.tcl with xx = 10, 20, 30, 40, 50 or 60, xx expresses the minutes how long the script shall run. The script performs the record of the temperatures.					
8	Power heaters of L0 with TBD mW equal to an active band (heaters of L1 are kept on 0 mW). Continue execution of script IST_HIFI_Thermal_Void_xx.tcl with xx = 10, 20, 30, 40, 50 or 60 as required (xx expresses the minutes how long the script shall run), until temperature has stabilized.					
9	Switch off heaters.					

Location:	PA: Name Date:	Operator: Date:		

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
10	Execute script IST_HIFI_Thermal_Test__Band3cold.config__wb2__B__807__575.tcl. This takes about 20 min. of integration, with 30 extra seconds between the switch on of the FPU and the effective start (this is mostly due to the time needed to do the Hot/Cold reference). This script switches on both polarizations to get a representative dissipation in the FPU.					
11	Switch LSU simulator RF off.					
12	Execute TCL script IST_HIFI_standby_internal_source_ON__Band0.config__807__wb2.tcl. This takes about 58 sec.					
13	Remove t-adapters from FCU J17 and J27 and re-connect harness.					

Location:	PA: Name Date:	Operator: Date:		

6.3 Straylight Measurement I (Cryocover Contamination)

6.3.1 Cryostat Setup

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
1	Ensure that all cryostat related activities (dewar exchanges, etc.) and cryostat parameters (mass flows, temperatures, etc.) are recorded throughout the test.					
2	Adjust mass flow through heat shields.	200 mg/s (TBC)				
3	Adjust mass flow through AXT to achieve the required L0 and L1 temperatures to allow proper PACS cooler recycle and PACS operation PACS L0 PACS L1	 < 1.8 K < 5 K				
4	Adjust high cryocover temperature by flushing with normal helium from pressurised bottle.	> 200 K		Objective is to decontaminate the cryocover mirrors.		

Location:	PA: Name Date:	Operator: Date:		

6.3.2 PACS Cooler Recycle

Note: Cooler recycle is not needed for spectroscopy mode but should nevertheless be performed in case measurements in photometry mode turn out to be required, pending the results of spectroscopy, and in test steps 6.4.x photometry mode is required anyway.

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
1	Load PACS_prime_inst.pst bus profile on CDMU DFE.					
2	Execute TCL script BOLO_cooler_OBS_shell.tcl from CCS					

6.3.3 Perform Background Radiation Measurements with PACS versus Cryocover Temperature

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
1	Execute TCL script SetupSpectroscopyEQMIMT_Shell.tcl from CCS.					
2	Decrease cryocover temperature from > 200 K to < 20 K with a rate of approx. 100 K per hour by appropriate flushing.					
3	In parallel to step 2 perform straylight spectrum measurements by PACS: Execute TCL script Background_Adjustment_Shell_01.tcl as many times as needed (each execution takes about 950 sec).					

Location:	PA: Name Date:	Operator: Date:		

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
4	In parallel to step 2 perform Planck curve measurements at TBD cryocover temperatures. Most of the test requires manual commanding since the grating is not performing correctly. At each step we wait 30 seconds to acquire data for the selected grating positions/wavelengths. The entire set of grating positions will allow reconstructing a rough spectral shape of the cryostat background. The data shall be recorded on the I-EGSE in one single telemetry file. For each Planck curve measurement open telemetry file and perform steps 5 to 16.			This test step is optional and pending the results of step 3. It is recommended to record the Planck curve three times, for hot, intermediate and cold cryocover.		
5	Execute TCL scripts : a) rsrf_SPEC_cre_setup.tcl b) rsrf_SPEC_spu_setup.tcl These scripts configure the spectroscopy detectors and the on-board data processing.					
6	Step 1 - gratpos 250000 : samples 101 um and 202 um DMC_MOVE_GRAT_ABS 250000 wait 30 seconds DMC_MOVE_CHOP_ABS 25000 wait 30 seconds					

Location:	PA: Name Date:	Operator: Date:		

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
7	Step 2 - gratpos 350000 : samples 96 um and 193 um DMC_MOVE_GRAT_ABS 350000 wait 30 seconds DMC_MOVE_CHOP_ABS 0 wait 30 seconds					
8	Step 3 - gratpos 450000 : samples 91 um and 182 um DMC_MOVE_GRAT_ABS 450000 wait 30 seconds DMC_MOVE_CHOP_ABS 25000 wait 30 seconds					
9	Step 4 - gratpos 550000 : samples 85 um and 171 um DMC_MOVE_GRAT_ABS 550000 wait 30 seconds DMC_MOVE_CHOP_ABS 0 wait 30 seconds					
10	Step 5 - gratpos 650000 : samples 79 um and 158 um DMC_MOVE_GRAT_ABS 650000 wait 30 seconds DMC_MOVE_CHOP_ABS 25000 wait 30 seconds					

Location:	PA: Name Date:	Operator: Date:		

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
11	Step 6 - gratpos 750000 : samples 72 um and 145 um DMC_MOVE_GRAT_ABS 750000 wait 30 seconds DMC_MOVE_CHOP_ABS 0 wait 30 seconds					
12	Step 7 - gratpos 850000 : samples 131 um DMC_MOVE_GRAT_ABS 850000 wait 30 seconds DMC_MOVE_CHOP_ABS 25000 wait 30 seconds					
13	Step 8 - gratpos 950000 : samples 116 um DMC_MOVE_GRAT_ABS 950000 wait 30 seconds DMC_MOVE_CHOP_ABS 0 wait 30 seconds					
14	Step 9 - Grating to default position DMC_MOVE_GRAT_ABS 500000					
15	Step 10 - CRE is already in default configuration, stop SPU dataflow Execute tcl scripts: rsrf_SPEC_spu_reset.tcl End of the procedure					
16	Close telemetry file recording on I-EGSE					

Location:	PA: Name Date:	Operator: Date:		

6.3.4 Switch PACS from Prime to Stand-by Mode

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
1	Execute TCL script ENTER_SAFE_Mode_Shell.tcl from CCS					

Location:	PA: Name Date:	Operator: Date:		

6.4 Straylight Measurement II (LO Windows)

6.4.1 Cryostat Setup

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
1	Ensure that all cryostat related activities (dewar exchanges, etc.) and cryostat parameters (mass flows, temperatures, etc.) are recorded throughout the test.					
2	Adjust mass flow through heat shields.	200 mg/s (TBC)				
3	Adjust mass flow through AXT to achieve the required L0 and L1 temperatures to allow proper PACS cooler recycle and PACS operation PACS L0 PACS L1	 < 1.8 K < 5 K				
4	Adjust mass flow through cryocover to achieve the required cover temperature:	< 20 K, stable				

Location:	PA: Name Date:	Operator: Date:		

6.4.2 Perform Background Radiation Measurements with PACS during LO window illumination

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
1	Execute TCL script PHOT_setup_OBS_shell.tcl from CCS					
2	Put in front of LO window band 3 a heat source (e. g. metal halide lamp) and remove it after 1 minute. Then put a reflecting metal plate in front of the window. Repeat that several times. Switch off on clean room lights. Record CCS time for all activities.					
3	In parallel to step 2 perform background radiation spectrum measurements by PACS. Execute TCL script PACS_PHOT_SPU_Setup.tcl. Eventually it will require also another script, which is new: PACS_PHOT_CHOP_CS2_obs_shell.tcl. Ensure proper synchronisation of activities in step 2 and step 3 (e. g. generate separate telemetry files for heat source, metal plate and clean room lights switching).					
4	In parallel to step 2 perform focal plane map during each illumination and after removal of illumination. For each focal plane map perform steps 5 to 10.			This test step is optional and pending the results of step 3.		
5	Phot_Focal_Map_Obs_shell.tcl FOV scan with 50 chopper steps in both filters Duration =0.15h					
6	Enter SAFE mode					

Location:	PA: Name Date:	Operator: Date:		

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
7	Phot_Setup_Obs_Shell.tcl Nominal photometry setup Duration=0.45h					
8	Phot_Focal_Map_Obs_shell.tcl FOV scan with 50 chopper steps in both filters Duration=0.15h					
9	PHOT_Stray_Light_Obs_shell.tcl Detailed FOV scan with 500 chopper steps in both filters Duration =0.6h					
10	Phot_Stray_Light_A_Obs_Shell.tcl Phot_Stray_Light_B_Obs_Shell.tcl Detailed FOV scan with 500 chopper steps in both filters Duration =0.6h					

6.4.3 Switch PACS from Prime to Stand-by Mode

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
1	Execute TCL script ENTER_SAFE_Mode_Shell.tcl from CCS					

Location:	PA: Name Date:	Operator: Date:		

6.5 Straylight Measurement III (Heat Shield)

6.5.1 Cryostat Setup

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
1	Ensure that all cryostat related activities (dewar exchanges, etc.) and cryostat parameters (mass flows, temperatures, etc.) are recorded throughout the test.					
2	Stop mass flow through heat shield and allow warm up during night.					
3	Adjust mass flow through AXT to achieve the required L0 and L1 temperatures to allow proper PACS cooler recycle and PACS operation PACS L0 PACS L1	 < 1.8 K < 5 K				
4	Adjust mass flow through cryocover to achieve the required cover temperature:	< 20 K, stable				

Location:	PA: Name Date:	Operator: Date:		

6.5.2 Perform Background Radiation Measurements with PACS versus Heat Shield and HTT Temperature

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
1	Execute TCL script SetupSpectroscopyEQMIMT_Shell.tcl from CCS.					
2	Adjust mass flow through heat shield to After heat shield coll down warm up HTT by switching the heaters for valves 102 and 104 and the heaters on the bottom of the HTT.	250 mg/sec (TBC)				
3	Perform straylight spectrum measurements during heat shield cool down and HTT warm up: Execute TCL script Background_Adjustment_Shell_01.tcl for TBD heat shield temperatures (each execution takes about 950 sec).					
4	In parallel to step 2 perform Planck curve measurements at TBD cryocover temperatures. Most of the test requires manual commanding since the grating is not performing correctly. At each step we wait 30 seconds to acquire data for the selected grating positions/wavelengths. The entire set of grating positions will allow reconstructing a rough spectral shape of the cryostat background. The data shall be recorded on the I-EGSE in one single telemetry file. For each Planck curve measurement open telemetry file and perform steps 5 to 16.			This test step is optional and pending the results of step 3. It is recommended to record the Planck curve three times, for hot, intermediate and cold cryocover.		

Location:	PA: Name Date:	Operator: Date:		

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
5	Execute TCL scripts : a) rsrf_SPEC_cre_setup.tcl b) rsrf_SPEC_spu_setup.tcl These scripts configure the spectroscopy detectors and the on-board data processing.					
6	Step 1 - gratpos 250000 : samples 101 um and 202 um DMC_MOVE_GRAT_ABS 250000 wait 30 seconds DMC_MOVE_CHOP_ABS 25000 wait 30 seconds					
7	Step 2 - gratpos 350000 : samples 96 um and 193 um DMC_MOVE_GRAT_ABS 350000 wait 30 seconds DMC_MOVE_CHOP_ABS 0 wait 30 seconds					
8	Step 3 - gratpos 450000 : samples 91 um and 182 um DMC_MOVE_GRAT_ABS 450000 wait 30 seconds DMC_MOVE_CHOP_ABS 25000 wait 30 seconds					

Location:	PA: Name Date:	Operator: Date:		

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
9	Step 4 - gratpos 550000 : samples 85 um and 171 um DMC_MOVE_GRAT_ABS 550000 wait 30 seconds DMC_MOVE_CHOP_ABS 0 wait 30 seconds					
10	Step 5 - gratpos 650000 : samples 79 um and 158 um DMC_MOVE_GRAT_ABS 650000 wait 30 seconds DMC_MOVE_CHOP_ABS 25000 wait 30 seconds					
11	Step 6 - gratpos 750000 : samples 72 um and 145 um DMC_MOVE_GRAT_ABS 750000 wait 30 seconds DMC_MOVE_CHOP_ABS 0 wait 30 seconds					
12	Step 7 - gratpos 850000 : samples 131 um DMC_MOVE_GRAT_ABS 850000 wait 30 seconds DMC_MOVE_CHOP_ABS 25000 wait 30 seconds					

Location:	PA: Name Date:	Operator: Date:		

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
13	Step 8 - gratpos 950000 : samples 116 um DMC_MOVE_GRAT_ABS 950000 wait 30 seconds DMC_MOVE_CHOP_ABS 0 wait 30 seconds					
14	Step 9 - Grating to default position DMC_MOVE_GRAT_ABS 500000					
15	Step 10 - CRE is already in default configuration, stop SPU dataflow Execute tcl scripts: rsrf_SPEC_spu_reset.tcl End of the procedure					
16	Close telemetry file recording on I-EGSE					

Location:	PA: Name Date:	Operator: Date:		

6.5.3 Switch PACS from Prime to Stand-by Mode

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
1	Execute TCL script ENTER_SAFE_Mode_Shell.tcl from CCS					

Location:	PA: Name Date:	Operator: Date:		

6.6 Switch off Instruments

6.6.1 Switch off HIFI

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
1	Load HIFI_prime_inst.pst bus profile on CDMU DFE.					
2	Execute TCL script HIFI_POWER_OFF.tcl from CCS					

6.6.2 Switch off PACS

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
1	Load PACS_prime_inst.pst bus profile on CDMU DFE.					
2	Execute TCL script PACS_POWER_OFF.tcl from CCS					

6.6.3 Switch off SPIRE

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
1	Load SPIRE_prime_inst.pst bus profile on CDMU DFE.					
2	Execute TCL script SFT-SPIRE-CCS-THO.tcl from CCS			see RD 5, Appendix 2		
3	Execute TCL script SFT-SPIRE-CCS-DRCU-OFF.tcl from CCS			see RD 5, Appendix 2		
4	Execute TCL script SFT-SPIRE-CCS-DPU-OFF.tcl from CCS			see RD 5, Appendix 2		

Location:	PA: Name Date:	Operator: Date:		

7 Summary Sheets

7.1 Procedure Variation Summary

The table below lists all activities which have been executed in the frame of this procedure but which deviate from the defined step by step procedure.

ACS - No.	ACS - Title	Date	Status	PA sign

Table 7-1: List of ACS's

7.2 Non Conformance Report (NCR) Summary

This table lists all non-conformances generated during this test shall be recorded in the table below:

NCR - No.	NCR - Title	Date	Status	PA sign

Table 7-2: List of NCR's

7.3 Sign-off Sheet

	Date	Signature
Test Manager		
Operator		
PA Responsible		

E N D O F D O C U M E N T

	Name	Dep./Comp.		Name	Dep./Comp.
	Alberti von Mathias Dr.	AOE22	x	Schink Dietmar	AED44
	Barlage Bernhard	AED11	x	Schlosser Christian	OTN/AOA54
	Bayer Thomas	AOA52		Schmidt Rudolf	FAE22
	Brune Holger	AOA55		Schweickert Gunn	AOE22
	Fehringer Alexander	AOE13		Sonn Nico	AOE51
x	Fricke Wolfgang Dr.	AED 65		Steininger Eric	AED32
	Geiger Hermann	AOA52		Stritter Rene	AED11
	Gerner Willi	AED11		Suess Rudi	AOA54
	Grasl Andreas	OTN/AOA54		Thörmer Klaus-Horst Dr.	OTN/AED65
	Grasshoff Brigitte	AET12		Wagner Klaus	AOE22
	Hauser Armin	AOE22	x	Wietbrock Walter	AET12
x	Hendry David	Terma Resid.		Wöhler Hans	AOE22
	Hengstler Reinhold	AOA 5		Wössner Ulrich	ASE442
	Hinger Jürgen	AOE22	x	Alcatel	ASP
	Hofmann Rolf	ASE442	x	ESA/ESTEC	ESA
x	Hohn Rüdiger	AED65		**Instruments:**	
	Hölzle Edgar Dr.	AED44	x	MPE (PACS)	MPE
	Huber Johann	AOA52	x	RAL (SPIRE)	RAL
	Hund Walter	ASE442	x	SRON (HIFI)	SRON
x	Idler Siegmund	AED312		**Subcontractors:**	
x	Ilsen Stijn	Terma Resid.		Air Liquide, Space Department	AIR
	Ivády von András	FAE22		Air Liquide, Space Department	AIRS
	Jahn Gerd Dr.	AOE22		Air Liquide, Orbital System	AIRT
	Kalde Clemens	APE3		Alcatel Bell Space	ABSP
	Kameter Rudolf	OTN/AOA54		Astrium Sub-Subsyst. & Equipment	ASSE
	Kettner Bernhard	AET42		Austrian Aerospace	AAE
	Knoblauch August	AET32		Austrian Aerospace	AAEM
	Koelle Markus	AOA53		APCO Technologies S. A.	APCO
	Koppe Axel	AED312		Bieri Engineering B. V.	BIER
x	Kroeker Jürgen	AED65		BOC Edwards	BOCE
	Kunz Oliver Dr.	AOE22		Dutch Space Solar Arrays	DSSA
	Lamprecht Ernst	OTN/ASI21		EADS CASA Espacio	CASA
	Lang Jürgen	ASE442		EADS CASA Espacio	ECAS
	Langenstein Rolf	AED15		EADS Space Transportation	ASIP
	Langfermann Michael	AOA51		Eurocopter	ECD
	Mack Paul	OTN/AOA54		European Test Services	ETS
	Maute Thomas	AOA52		HTS AG Zürich	HTSZ
	Müller Jörg	AOA52		Linde	LIND
	Müller Martin	AOA53		Patria New Technologies Oy	PANT
	Müller Ralf	FAE22		Phoenix, Volkmarsen	PHOE
	Peltz Heinz-Willi	AOE13		Prototech AS	PROT
	Pietroboni Karin	AED65		QMC Instruments Ltd.	QMC
	Platzer Wilhelm	AED22		Rembe, Brilon	REMB
	Reichle Konrad	AOA52		Rosemount Aerospace GmbH	ROSE
	Reuß Friedhelm	AED62		RYMSA, Radiación y Microondas	RYM
	Rühe Wolfgang	AED6		SENER Ingenieria SA	SEN
	Runge Axel	OTN/AOA54		Stöhr, Königsbrunn	STOE
	Sachsse Bernt	AED21		Terma A/S, Herlev	TER