SPIRE-AST-PRC-002440

Title: **Instrument PLM EQM Level Test Procedure**

CI-No: 153 000

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Issue 1	26.04. 2005	All	Initial Issue	
Issue 1.1	24.06. 2005		Update references. Electrical integration divided in warm units and SIH. Add Herschel QM cryostat flow diagram, & SVM dummy. Include test durations. Include instrument test sequences summary & detailed reference to instruments procedures.	

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1 Introduction

1.1 Scope

This procedure defines the activities to be carried out for the electrical integration and testing of the three instruments HIFI, PACS and SPIRE on PLM EQM level as specified in the test plan/specification "Instrument Testing on PLM EQM Level" (AD 04).

The procedure is divided in several sub-procedures with individual test configurations. The principle sequence of the sub-procedures is defined in section 5 below. The sub-procedures are self-standing which allows a (limited) change of the defined sequence, if required to cope with higher level needs.

For dedicated test steps reference is made to other procedures. For these steps this procedure shall have the character of a leading procedure.

1.2 Objective

The objective and purpose of the activities described in this procedure is

- the electrical connection of the instrument FPU's with the instrument Warm units via the SIH,
- the electrical integration of the instruments with the PLM EGSE (CDMU and power lines),
- the functional check out of the instruments after the electrical integration and
- the test of the instruments function and performance in the PLM EQM configuration. The instrument tests comprise the SFT, the IMT and the EMC test.

Further objective is the training and pre-validation of the instrument integration and test procedures which are called up herein in view of the PFM programme.

1.3 Requirements to be verified

The tests described herein shall verify the instruments function and performance in an as much as possible flight representative condition, with the cryostat EQM serving as test bed. The individual requirements to be verified are defined by the instruments and are listed in the relevant instrument test procedures which are called up herein.

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	HP-2-ASED-PL-0022	Herschel PLM EQM AIT Plan	Issue 2.2
AD 04	HP-2-ASED-PL-0021	Instrument Testing on PLM EQM Level	Issue 3.1 draft
AD 05	HP-2-ASED-PR-0012	Herschel PLM/EQM General AIT Procedure	Issue 1
AD 06	HP-2-ASED-PR-0014	Herschel EQM Integration Part 2	Issue 1
AD 07	TBD	Herschel Safety Requirements	
AD 08	SCI-PT-IIDB/SPIRE-02124	Herschel/Planck Instrument Interface Document, Part B, Instrument “SPIRE”	Issue 3.3
AD 09	SCI-PT-IIDB/HIFI-02125	Herschel/Planck Instrument Interface Document, Part B, Instrument “HIFI”	Issue 3.2
AD 10	SCI-PT-IIDB/PACS-02126	Herschel/Planck Instrument Interface Document, Part B, Instrument “PACS”	Issue 3.3
AD 11	SCI-PT-IIDA-04624	Herschel/Planck Instrument Interface Document, Part A	Issue 3.3

2.2 Reference Documents

2.2.1 ASED Reference Documents

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

RD 01	HP-2-ASED-PR-0035	EGSE configuration procedure (include switch on procedures)	Issue 3 21.06.2005
RD 02	HP-2-ASED-TP-0055	EQM-PACS Warm Units Integration with IDAS	Issue 1 12.05.2005
RD 03	HP-2-ASED-TP-0057	EQM-SPIRE Warm Units Integration	Issue 1

		with IDAS	09.05.2005
RD 04	HP-2-ASED-TP-0058	EQM-HIFI Warm Units Integration with IDAS	Issue 1 19.05.2005
RD 05	HP-2-ASED-PR-0033	PLM EQM EMC Test Procedure	Issue 1 04.06.2005
RD 06	HP-2-ASED-TP-0072	Herschel EQM Cool Down & Filling Procedure	Issue draft 14.06.2005
RD 07	TBW	Herschel EQM He II Production and Top Up Procedure	Issue TBD
RD 08	TBW	Herschel EQM Depletion & Warm Up Procedure	Issue TBD
RD 09	TBW	Herschel Cover Flushing Procedure	Issue TBD
RD10	TBW	Herschel QM Tilting Procedure	Issue TBD
RD 11 - 20	empty		

2.2.2 HIFI Reference Documents

In this section all documents issued by HIFI which are called up in this procedure are listed.

RD 21	SRON-U-HIFI-PR-2004-007	HIFI Warm Units Electrical Interface Test Procedure	Issue 3, 30.03.2005
RD 22	SRON-G/HIFI/PR/2005-101	HIFI EQM IST & EMC Test Procedures	Issue 1.2, 20.05.2005
RD 23	SRON-U/HIFI/PR/2004-001	HIFI EMC Test Specification	Issue 1.3, 13.04.2005
RD 24	MPIfR/HIFI/PR/2004-560	QM LOU Handling Utilisation Transport and Storage Document	Issue 1.1, 20.04.2005
RD 25	TBD	HIFI LOU Electrical Integration Procedure	
RD 26	SRON-G/HIFI/LI/2005-100	HIFI EQM Critical HK Channel List	Issue 0.1 20.05.2005
RD 27	TBD	Connect LSU Simulator Waveguides to LOU Waveguides	
RD 28	TBD	Installation and Operation of EMC Test Source	

RD29	ICC/2004-013	CUS Scripts for HIFI QM tests	Issue Draft-013 20.05.2005
RD 30 - 40	empty		

2.2.3 PACS Reference Documents

In this section all documents issued by PACS which are called up in this procedure are listed.

RD 41	PACS-ME-TP-016	Test Procedure for PACS WE Tests with PACS EGSE and CCS	Issue 1.2, 15.12.2004
RD 42	PACS-ME-TP-017	PACS Short Functional Test Warm & Cold	Issue 1.2, 17/05/2005
RD 43	PACS-ME-TP-021	PACS IMT Procedure (includes EMC)	Issue 1.0 17/06/2005
RD 44	TBD	PACS EMC Test Procedure	
RD 45	PACS-ME-TP-024	PACS/SPIRE Parallel Mode Test for EQM IMT	Issue 1.1 23.06.2005
RD 46	PACS-ME-TP-025	PACS SIH Mating Procedure	Issue 1 30.06.2005
RD 47 - 60	empty		

2.2.4 SPIRE Reference Documents

In this section all documents issued by SPIRE which are called up in this procedure are listed.

RD 61	SPIRE-RAL-NOT-002028	Making SPIRE ESD Safe	Issue 2, 28.10.2004
RD 62	SPIRE-RAL-PRC-001923	SPIRE FPU Handling and Integration Procedure	Issue 3, 06.12.2004
RD 63	SPIRE -RAL-PRC-002181	SPIRE Warm Electronics Handling and Integration Procedure	Issue 3, 15.04.2005
RD 64	SPIRE-RAL-NOT-002396	SPIRE Warm Unit Checkout Procedure	Issue 0.1, 06.04.2005
RD 65	SPIRE-RAL-NOT-002397	SPIRE Warm Functional Check Out Procedure after Electrical SIH	Issue 0.1, 06.04.2005

		Integration	
RD 66	SPIRE-RAL-NOT-002398	SPIRE SFT Cold Procedure	Issue 0.1, 06.04.2005
RD 67	SPIRE-RAL-NOT-002284	SPIRE Integrated Module Test Sequence for EQM Testing	Issue 2.0, 14.04.2005
RD 68	SPIRE-RAL-NOT-002402	SPIRE EMC Test Sequence for EQM Testing	Issue 1.0, 15.04.2005
RD 69	SPIRE-RAL-PRC-002422	SPIRE Warm Functional Test Procedure	Issue 1 27.04.2005

2.3 On-Hand Documents

The following documents have to be in the clean room to perform the tasks described in this procedure:

- all documents called up by the step by step procedure.

3 Configuration

3.1 Principle Test Set-up

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

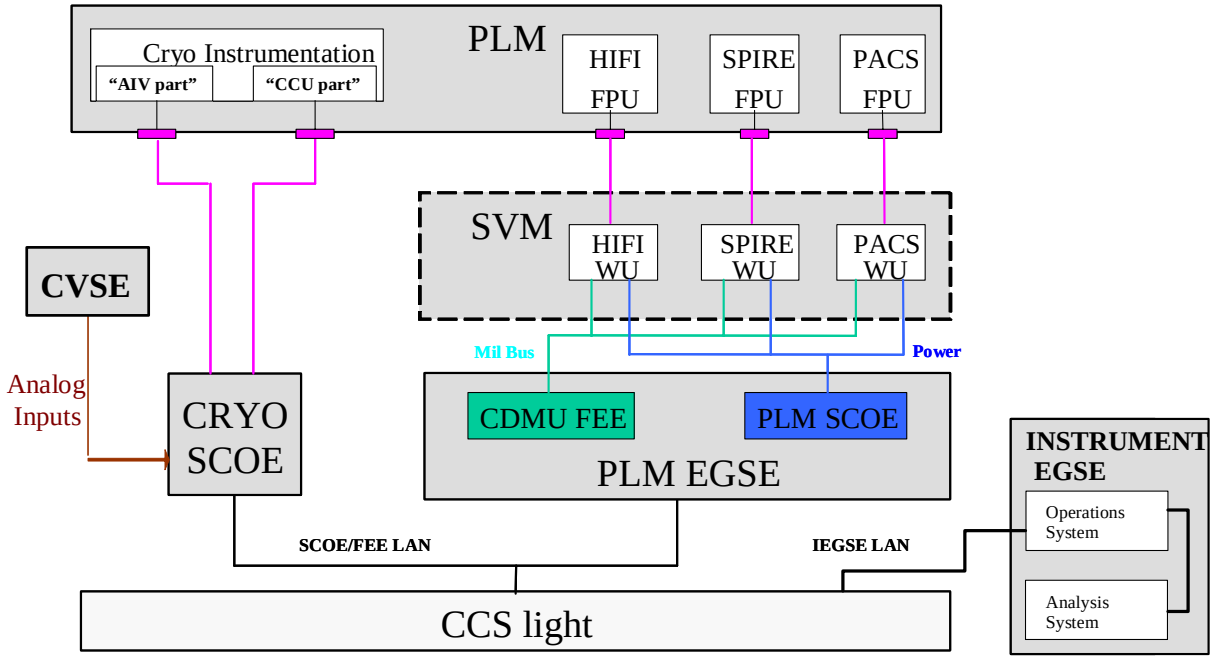

Figure 3-1: Principle Test Set-up for EQM Tests

The actual hardware and software configuration of the GSE shall be validated at the TRR and reported in the test report.

3.2 Evolutions of PLM Configuration

For the different tests different PLM configurations are defined:

Test	Configuration
Connection of PLM EGSE primary power and bus to HIFI/PACS/SPIRE Warm Units incl. interface verification and functional tests after mating	A
Mating of SIH to HIFI/PACS/SPIRE Warm Units and FPU and functional test after mating	B

Test	Configuration
HIFI LOU electrical integration and functional test after integration	C
HIFI/PACS/SPIRE SFT warm after cryostat evacuation	D
HIFI/PACS/SPIRE SFT cold at He I	E
HIFI/PACS/SPIRE SFT cold at He II	E
HIFI/PACS/SPIRE IMT	E
HIFI/PACS/SPIRE EMC Test	E

Table 3-1: PLM Configuration Applicability Matrix

Configuration A: CVV WARM & OPEN – before SVM mating

Mechanical:

- Shields, upper bulkhead and cryostat cover not yet integrated, OBA protected by dust cover
- HIFI/PACS/SPIRE FPU/JFETs integrated on OBA
- HIFI/PACS/SPIRE Warm Units integrated on SVM Simulator

Electrical:

- HIFI/PACS/SPIRE FPU and Warm Units bonding successfully verified by measurement
- HIFI/PACS/SPIRE WIH installed and mated
- HIFI/PACS/SPIRE Warm Units bench test (stand-alone test with instrument provided EGSE) performed

Configuration B: WARM & OPEN – after SVM mating

As configuration A with the following differences

Mechanical:

- Shields, upper bulkhead and cryostat cover not yet integrated, OBA protected by dust cover
- HIFI/PACS/SPIRE FPU/JFETs integrated on OBA
- HIFI/PACS/SPIRE Warm Units integrated on SVM Simulator
- SVM Simulator finally mated to PLM

Electrical:

- HIFI/PACS/SPIRE SIH integrated and successfully verified by measurement with IDAS
- HIFI/PACS/SPIRE primary power and data bus harness integrated and successfully verified by measurement with IDAS
- HIFI/PACS/SPIRE FPU and Warm Units bonding successfully verified by measurement
- HIFI/PACS/SPIRE WIH installed
- HIFI/PACS/SPIRE Warm Units bench test (stand-alone test with instrument provided EGSE) performed

Configuration C: WARM & CLOSED

As configuration B with the following differences

Mechanical:
- Shields, upper bulkhead and cryostat cover integrated
- HIFI LOU mechanically integrated and aligned
- Waveguides integrated and connected between LOU and LSU simulator

Electrical:
- HIFI/PACS/SPIRE Warm Units connected to SIH and PLM EGSE, functional check out performed

Configuration D: WARM & CLOSED & EVACUATED

As configuration C with the following differences

Mechanical:
- Cryostat evacuated

Electrical:
- LOU and LCU connected to SIH, functional check out performed

Configuration E: COLD

As configuration D with the following differences

Mechanical:
- Cryostat cooled down

Electrical:
- None

3.3 Configuration of Items to be tested

The following hardware items will be tested within this procedure:

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

Table 3-2: Items to be tested

The actual hardware and software configuration of the item to be tested shall be validated at the TRR and reported in the test report.

3.4 H-PLM EQM during functional test Configuration

The following flow diagram shows the configuration of the H-PML EQM (modified ISO cryostat) for instrument functional tests.

The HTT (ISO tank) is filled with helium I at 4.2 K to vent the shields, and protect the HXT.

The HXT is pumped down to He II, and provide L0 interface, together with the vented L1 to L3 interface.

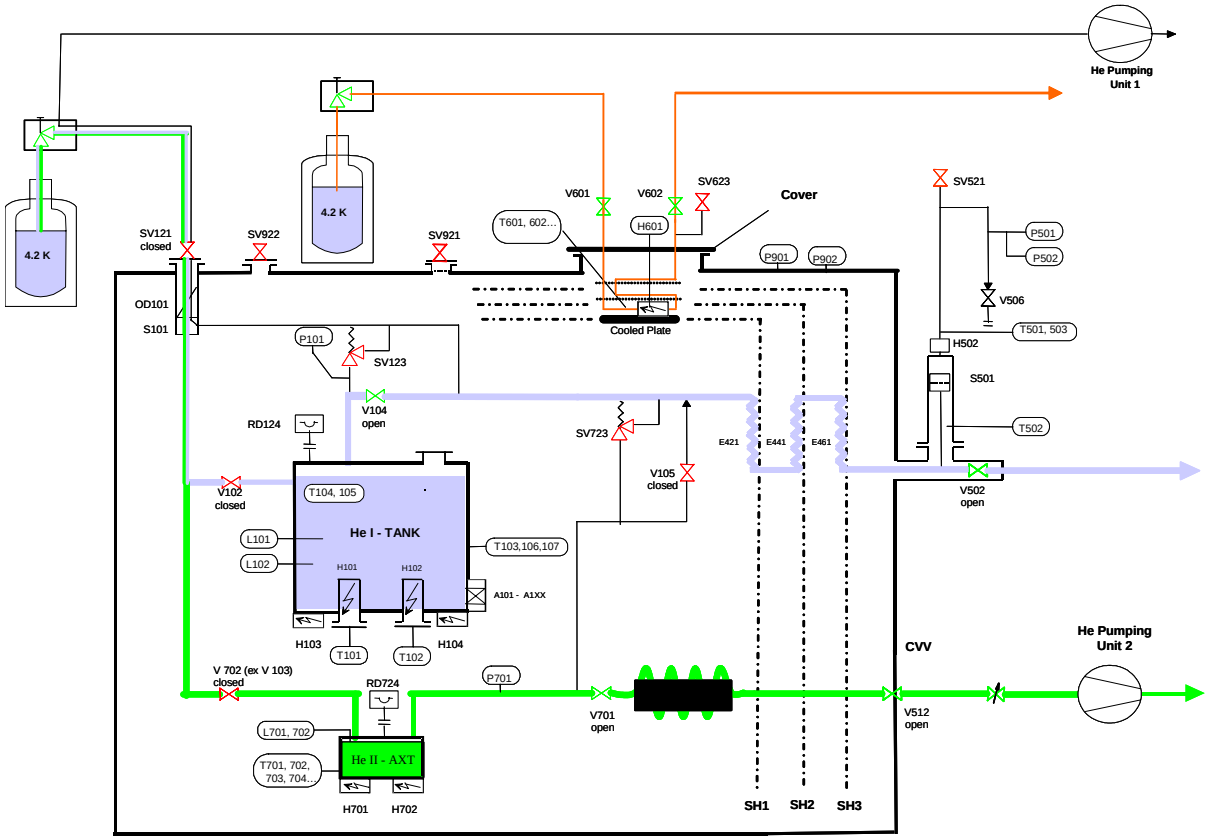

Figure 3-2: EQM cryostat flow diagram

3.5 SVM simulator during EQM tests

The following image gives the SVM simulator configuration during EQM tests: This SVM simulates the shape of the SVM. It is attached to the cryostat, and will tilt with it.

PACS external power supply can be accommodated inside this SVM. HIFI external power supply cannot, and will be mounted on a table nearby.

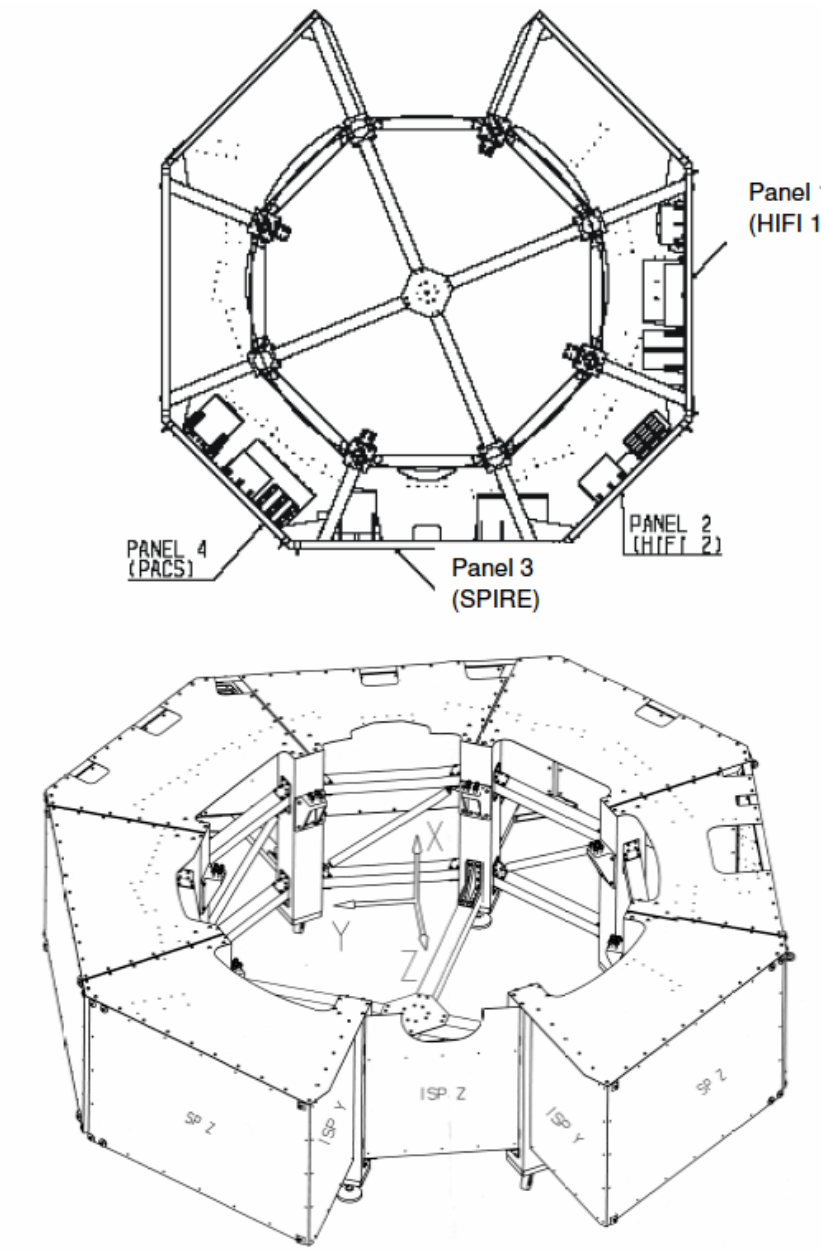

Figure 3-3: SVM Simulator for Herschel EQM tests

3.6 GSE Configuration

3.6.1 MGSE

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

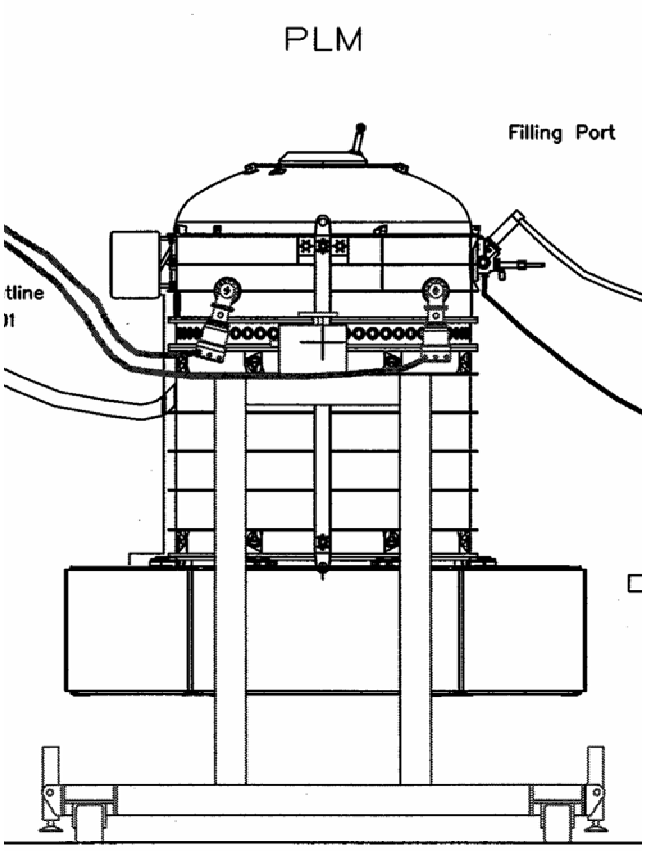

Figure 3-4: Herschel EQM mounted on Test Dolly during EQM Tests

3.6.2 CVSE

To perform some of the tests of this procedure 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

3.6.3 EGSE

3.6.3.1 ASED EGSE

- CCS
- PLM EGSE with PLM SCOE to power instruments and CDMU DFE to command and control instruments
- 1553 bus monitor (as part of CDMU DFE)
- IDAS for primary power and data bus interface verification
- Cryo SCOE in EQM configuration

3.6.3.2 Instrument Delivered EGSE

Common EGSE

- I-EGSE (connected to CCS)

HIFI Specific EGSE

- LSU simulator
- Synthesiser for LSU simulator
- Power supply for LSU simulator
- Waveguide to connect LSU simulator with LOU waveguides
- Ext. power supply for FCU
- CW test signal source with LO beam splitter

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

3.6.4 OGSE

Not needed for the activities listed in this procedure.

3.6.5 Special Equipment

Not needed for the activities listed in this procedure (no purging required for EQM).

3.6.6 Laboratory Equipment

The laboratory equipment list defines the instruments and tools to be used during instrument testing. All test hardware 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
Digital Multi-meter					
Break-out-box					
Oscilloscope					

Table 3-3: Laboratory Equipment

3.7 Facilities

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

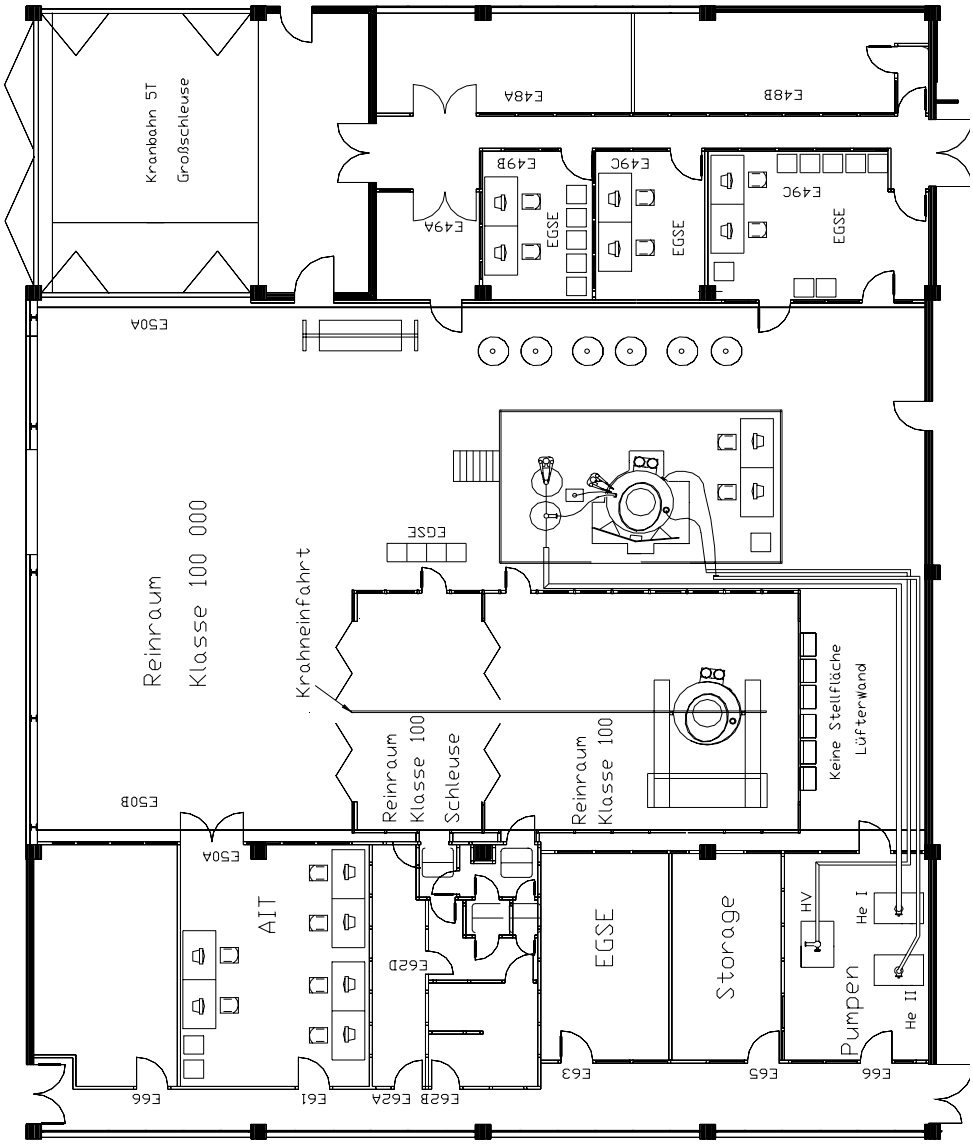

Figure 3-5: Herschel EQM test Set-up in Astrium Ottobrunn Clean-Room

4 Requirements

4.1 General Requirements

General instructions are given in the Herschel PLM/EQM General AIT Procedure (AD 4) and have to be respected accordingly.

4.2 Environmental Conditions

All activities specified in this procedure with configuration B, C, D and E 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.

4.3 Precautions and Safety

4.3.1 General Safety Requirements

During cryogenic operation specific safety measures must be taken (evacuation of the room in case of activation of the burst disk). Details see AD 07.

Lower level procedures called up by this procedure may define additional safety requirements in the relevant chapters which must be respected accordingly.

4.3.2 ESD Constraints

In order to prevent ESD sensitive H/W from any possible damages by accidental electrostatic discharges an ESD protected area must be defined and setup during ESD sensitive activities (harness connection):

- Floor and test bench of the ESD protected area has to be covered with anti-static mats
- During all handling activities (as transport, mounting, mating/de-mating of connectors, measurements with individual measurement devices, etc.) the operator has to work on anti static mats with correct clothing and personal grounding-straps
- Adequate ESD clothing is required:

- Anti static coat
- Anti static gloves
- Anti static boots

- Transportation of ESD sensitive H/W will be made only in ESD protective bag or box

In addition the following instrument specific ESD requirements are applicable (e. g. use of ESD caps):

- See RD 61.

4.4 Activities Management

4.4.1 Pre-Test Activities

At least the following tasks have to be successfully completed before start of integration and test activities according this procedure:

- This procedure released and accepted
- Incoming inspection performed by PA
- Formal release to start given by the board following review of relevant test procedures and test configuration (incl. ABCL for on-board and GSE hardware and software, software listings and check sum).

4.4.2 Procedure Variation

Major activities deviating from the approved test procedure require the agreement of Project, AIV and PA responsible, and shall be documented via Activity Control Sheets (ACS). All ACS's generated in the frame of the execution of this procedure shall be listed in the ACS Summary Sheet in section 7.1 of this procedure.

4.4.3 Criteria for Failure

If the results of any test performed using this procedure or a lower level procedure which this procedure refers to yields a value which lies outside the specified limits, it shall be considered as a non-conformance. Initial analysis of the result will be applied to establish whether the result is due to measurement error or incorrect specification limits. A NCR will then be raised to report the non-conformance. Depending on the magnitude of the non-conformance, and its impact, either a minor or a major NCR will be raised. In case of major NCR the test shall be continued only upon written or verbal authorisation of Customer (Alcatel and ESA). All NCR's raised in the frame of the execution of this procedure shall be listed in the NCR Summary Sheet in section 7.2 of this procedure.

The NCR process is described in the Herschel PA Plan (AD 1).

4.4.4 Test Completion and Post-Test Activities

All data that has been recorded during the integration and test activities specified in this procedure shall be collected and retained in a centralised reference volume, and will include:

- EQM PLM logbook
- Relevant CCS logs
- Photographs and plots
- Filled out test procedure
- Activity Control Sheets (ACS), if any
- Copies of NCR's, if any

All these test data shall be available for presentation at the Post Test review (PTR) which will finally conclude on the test.

A test report shall be produced in accordance to the AIT Plan (AD 3) whose contents shall be as follows:

- Brief summary of the test results
- PLM and instrument build standard summary
- "As-run" test procedure as an annex (this includes housekeeping data, temperature curves, etc.).
- List of NCR's raised
- List of ACS's generated.
- Relevant meeting minutes (e. g. TRR, TRB)
- Filled out Sign-off Sheet (see section 7.3 of this procedure).
- Evaluation of test results (might be in separate document)

4.5 PA Requirements

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.

4.6 Personnel

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

Title	Function	Name*)
Test Manager	Overall responsible	
EGSE Operator	Operate EGSE (CCS, PLM SCOE, CDMU DFE, Cryo SCOE)	
IDAS Operator	Operates IDAS during electrical integration	
Mech. Operator(s)	Performs all mech. integration activities, handles the PLM during testing (e.g. tilting of PLM), supports instrument test team	
Cryo Operators	Operate the cryostat during testing and maintain the required temperatures	
Harness operators	Connects SIH to instruments	
Spacecraft AIT Engineer (Alcatel)	Supervises all AIT activities	
EGSE Expert (Alcatel)	Supports EGSE operator and maintains EGSE (CCS, PLM SCOE, CDMU DFE). Available on call.	
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	Support SPIRE related test activities, operates I-EGSE and evaluates/analyses instrument data	
PA Representative	Ensures that PA requirements are met	

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

Table 4-1: Personnel

Work packages performed according an autonomous procedure define their own personnel in the relevant chapters and must be respected accordingly.

5 Activities Flow

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

The instrument test activities are embedded in the overall PLM EQM integration and test flow (see AD 03, AD 04, AD 05 and AD 06). Activities not directly related to instrument electrical and functional testing are listed in the test flow for information only and are not part of this procedure.

The procedure is divided in sub-procedures which can be exchanged with certain limitations, if required (see section 4.4.2).

No	Activity	Remark
-	HIFI/PACS/SPIRE SIH integration and verification with IDAS	Not part of this procedure
-	HIFI/PACS/SPIRE primary power and data bus harness integration and verification with IDAS	Not part of this procedure
-	Instruments Warm Units mechanical integration on SVM Simulator	Not part of this procedure
-	Instruments Warm Units WIH integration	Not part of this procedure
-	Instruments Warm Units bench test (stand-alone test with instrument provided EGSE)	Not part of this procedure
-	PLM activities (cleanliness protection of cryostat open part, etc.)	Not part of this procedure
	Instruments electrical integration	
	Instruments warm units electrical integration	
1	Test preparation	See sub-procedure 6.1.1.1
2	SPIRE Warm Units electrical integration (connection of PLM EGSE primary power and bus to SPIRE Warm Units incl. interface verification and functional tests without FPU)	See sub-procedure 6.1.1.2
3	PACS Warm Units electrical integration (connection of PLM EGSE primary power and bus to PACS Warm Units incl. interface verification and functional tests without FPU)	See sub-procedure 6.1.1.3
4	HIFI Warm Units electrical integration (connection of PLM EGSE primary power and bus to HIFI Warm Units incl. interface verification and functional tests with FPU/LOU simulator after mating)	See sub-procedure 6.1.1.4

	Instruments SIH electrical integration	
5	Test preparation	See sub-procedure 6.1.2.1
6	PACS SIH electrical integration (mating of SIH to PACS Warm Units, mating of SIH to PACS FPU, PACS functional test after mating)	See sub-procedure 6.1.2.2
7	HIFI SIH electrical integration (mating of SIH to HIFI Warm Units, mating of SIH to HIFI FPU, HIFI functional test after mating)	See sub-procedure 6.1.2.3
8	SPIRE SIH electrical integration (mating of SIH to SPIRE Warm Units, mating of SIH to SPIRE FPU, SPIRE functional test after mating)	See sub-procedure 6.1.2.4
-	PLM activities (closure of cryostat, completion of PLM external integration, mechanical integration and alignment of HIFI LOU incl. EMC test source, integration of waveguides, etc.)	Not part of this procedure
	HIFI LOU electrical integration	
9	Test preparation	See sub-procedure 6.2.1
10	HIFI LOU electrical integration (mating of SIH to HIFI LOU and HIFI functional test after mating of LOU)	See sub-procedure 6.2.2
-	PLM activities (pump down, etc.)	
	SFT warm & open (before closing CVV upper bulkhead, and without LOU	
11	Test preparation	See sub-procedure 6.3.1
12	HIFI SFT warm	See sub-procedure 6.3.2
13	PACS SFT warm	See sub-procedure 6.3.3
14	SPIRE SFT warm	See sub-procedure 6.3.4
	SFT warm & closed (can be limited to LOU)	
-	PLM activities (cool down and filling, etc.)	See RD 06 & 07
	SFT cold He I	
15	Test preparation	See sub-procedure 6.4.1
16	HIFI SFT cold at He I	See sub-procedure 6.4.2
17	PACS SFT cold at He I	See sub-procedure 6.4.3
18	SPIRE SFT cold at He I	See sub-procedure 6.4.4
-	PLM activities (cool down to He II, etc.)	Not part of this procedure

	SFT cold He II	
19	Test preparation	See sub-procedure 6.5.1
20	HIFI SFT cold at He II	See sub-procedure 6.5.2
21	PACS SFT cold at He II	See sub-procedure 6.5.3
22	SPIRE SFT cold at He II	See sub-procedure 6.5.4
	IMT	
23	Test preparation	See sub-procedure 6.6.1
24	HIFI IMT	See sub-procedure 6.6.2
25	PACS IMT	See sub-procedure 6.6.3
26	SPIRE IMT	See sub-procedure 6.6.4
27	PACS/SPIRE Parallel Mode IMT	See sub-procedure 6.6.5
28	Test completion	See sub-procedure 6.6.6
	EMC test	
29	Test preparation	See sub-procedure 6.7.1
30	EMC test PACS	See sub-procedure 6.7.2
31	EMC test SPIRE	See sub-procedure 6.7.3
32	EMC test HIFI	See sub-procedure 6.7.4
	PLM activities (H-PLM QM depletion & warm up)	See RD-08

Table 5-1: Test Flow

Test	**Duration**
Connection of PLM EGSE primary power and bus to HIFI/PACS/SPIRE Warm Units incl. interface verification and functional tests after mating	4 days per instrument
Mating of SIH to HIFI/PACS/SPIRE Warm Units and FPU and functional test after mating	4 days per instrument
HIFI LOU electrical integration and functional test after integration	3 days
HIFI/PACS/SPIRE SFT warm after cryostat evacuation	1 day for all instruments
HIFI/PACS/SPIRE SFT cold at He I	1 day for all instruments
HIFI/PACS/SPIRE SFT cold at He II	1 day for all instruments

Test	Duration
HIFI/PACS/SPIRE IMT	5 days per instrument + 5 days for parallel mode / margin (total 4 weeks)
HIFI/PACS/SPIRE EMC Test	5 days per instrument, + 5 days for parallel mode/margin. (total 4 weeks)

Note: SFT, IMT & EMC test durations are based on day works (no night shifts foreseen)

Table 5-2: Time allocation for each phase is as follows:

6 Step by Step Procedure

6.1 Instruments Electrical Integration

6.1.1 Instruments Warm Units Electrical Integration

This sub-procedure describes the electrical connection of the instrument Warm Units with the PLM EGSE (PDU/CDMS simulator) and the related electrical interface tests prior and after mating and functional check out after the electrical integration. The interface checks consist of automatic electrical measurements of the primary power lines and the MIL-1553 bus, both in unloaded (prior to mating) and loaded (after mating) conditions by the IDAS.

6.1.1.1 Test Preparation

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.1.1.1.1	Check SVM simulator ready for instrument warm units electrical integration					
6.1.1.1.2	Define and verify appropriate ESD protected area.					
6.1.1.1.3	Check PLM EGSE & CCS is ready for operation.					

Location:	PA: Name Date:	Operator: Date:		

6.1.1.2 SPIRE Warm Units Electrical Integration

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.1.1.2.1	Perform EGSE set-up as per ASED procedure RD 01.					
6.1.1.2.2	Define and record test session name.			Test session name:		
6.1.1.2.3	Perform verification and mating of primary power and bus to SPIRE Warm Units as per ASED procedure RD 03, taking into account the SPIRE procedures RD 63 and RD 62.			Respect ESD requirements (see also SPIRE ESD requirements RD 61). Test report:		
6.1.1.2.4	Switch on SPIRE primary power as per ASED procedure RD 01, sect. 4.3.					
6.1.1.2.5	Perform functional test of WU as per SPIRE procedure RD 64 (without FPU connected).			Test report:		
6.1.1.2.6	Switch off SPIRE primary power as per ASED procedure RD 01, sect. 4.4.					

Location:	PA: Name Date:	Operator: Date:		

6.1.1.3 PACS Warm Units Electrical Integration

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.1.1.3.1	Perform EGSE set-up as per ASED procedure RD 01.					
6.1.1.3.2	Define and record test session name.			Test session name:		
6.1.1.3.3	Perform verification and mating of primary power and bus to PACS Warm Units as per ASED procedure RD 02.			Respect ESD requirements. Test report:		
6.1.1.3.4	Switch on PACS primary power as per ASED procedure RD 01, sect. 4.5.					
6.1.1.3.5	Perform functional test of WU as per PACS procedure RD 41 (without FPU connected).			Test report:		
6.1.1.3.6	Switch off PACS primary power as per ASED procedure RD 01, sect. 4.6.					

Location:	PA: Name Date:	Operator: Date:		

6.1.1.4 HIFI Warm Units Electrical Integration

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.1.1.4.1	Perform EGSE set-up as per ASED procedure RD 01.					
6.1.1.4.2	Define and record test session name.			Test session name:		
6.1.1.4.3	Perform verification and mating of primary power and bus to HIFI Warm Units as per ASED procedure RD 04, taking into account the HIFI procedure RD 21.			Respect ESD requirements. Test report:		
6.1.1.4.4	Switch on HIFI primary power as per ASED procedure RD 01, sect. 4.3 taking into account HIFI procedure RD 26.					
6.1.1.4.5	Perform functional test of WU as per HIFI procedure RD 22, section 5 (with FPU simulator and LOU simulator connected).			Test report:		
6.1.1.4.6	Switch off HIFI primary power as per ASED procedure RD 01, sect. 4.4 taking into account HIFI procedure RD 26.					

Location:	PA: Name Date:	Operator: Date:		

6.1.2 Instruments SIH Electrical Integration

This sub-procedure describes the electrical connection of the SIH to the instrument Warm Units and the FPU and the instruments functional check out after the electrical integration.

6.1.2.1 Test Preparation

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.1.2.1.1	Check PLM ready for SIH electrical connection to instrument WU and FPU					
6.1.2.1.2	Define and verify appropriate ESD protected area.					
6.1.2.1.3	Check PLM EGSE & CCS is ready for operation.					

6.1.2.2 PACS SIH Electrical Integration

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.1.2.2.1	Perform mating of SIH to Warm Units and FPU as per PACS procedure RD 46.			Respect ESD requirements		

Location:	PA: Name Date:	Operator: Date:		

<table>
<tr><th>Step-No.</th><th>Test-Step-Description</th><th>Nominal Value</th><th>Actual Value</th><th>Comments</th><th>P</th><th>N</th></tr>
<tr><td>6.1.2.2.2</td><td>Record all mates/de-mates in the logbook.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6.1.2.2.3</td><td>Perform EGSE set-up as per ASED procedure RD 01, sect. 4.1.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6.1.2.2.4</td><td>Define and record test session name.</td><td></td><td></td><td>Test session name:</td><td></td><td></td></tr>
<tr><td>6.1.2.2.5</td><td>Switch on primary power as per ASED procedure RD 01, sect. 4.5.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6.1.2.2.6</td><td>Perform SFT warm as per PACS procedure RD 42.
<table>
<tr><th>Step</th><th>Test description</th><th>RD</th><th>Section</th></tr>
<tr><td>1</td><td>Chopper</td><td>RD-42</td><td>4</td></tr>
<tr><td>2</td><td>Grating Open Launch Lock</td><td>RD-42</td><td>4</td></tr>
<tr><td>3</td><td>Grating Health Check</td><td>RD-42</td><td>4</td></tr>
<tr><td>4</td><td>~~Grating Close Launch Lock~~</td><td>removed</td><td></td></tr>
<tr><td>~~5~~</td><td>Calibration sources</td><td>RD-42</td><td>4</td></tr>
<tr><td>6</td><td>~~Filterwheel Spectroscopy~~</td><td>removed</td><td>4</td></tr>
<tr><td>~~7~~</td><td>Filterwheel Photometry</td><td>RD-42</td><td>4</td></tr>
<tr><td>8</td><td>FPU Temperature sensors</td><td>RD-42</td><td>4</td></tr>
<tr><td>9</td><td>Ge:Ga Detector Chain</td><td>RD-42</td><td>4</td></tr>
<tr><td>10</td><td>Bolometer Detector Chain</td><td>RD-42</td><td>4</td></tr>
</table></td><td></td><td></td><td>Test report:</td><td></td><td></td></tr>
<tr><td>6.1.2.2.7</td><td>Switch off primary power as per ASED procedure RD 01, sect 4.6.</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Location:	PA: Name Date:	Operator: Date:		

6.1.2.3 SPIRE SIH Electrical Integration

<table>
<tr><th>Step-No.</th><th>Test-Step-Description</th><th>Nominal Value</th><th>Actual Value</th><th>Comments</th><th>P</th><th>N</th></tr>
<tr><td>6.1.2.3.1</td><td>Perform mating of SIH to FPU and Warm Units as per SPIRE procedure RD 62.</td><td></td><td></td><td>Respect ESD requirements (see also SPIRE ESD requirements RD 61).</td><td></td><td></td></tr>
<tr><td>6.1.2.3.2</td><td>Record all mates/de-mates in the logbook.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6.1.2.3.3</td><td>Perform EGSE set-up as per ASED procedure RD 01, sect. 4.1.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6.1.2.3.4</td><td>Define and record test session name.</td><td></td><td></td><td>Test session name:</td><td></td><td></td></tr>
<tr><td>6.1.2.3.5</td><td>Switch on primary power as per ASED procedure RD 01, sect. 4.3.

<table>
<tr><th>Step</th><th>Test description</th><th>RD</th></tr>
<tr><td>1</td><td>Switch on DPU and boot</td><td>RD-1</td></tr>
<tr><td>2</td><td>Switch on the DRCU</td><td>RD-1</td></tr>
</table>
</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Location:	PA: Name Date:	Operator: Date:		

<table>
<tr><th>Step-No.</th><th>Test-Step-Description</th><th>Nominal Value</th><th>Actual Value</th><th>Comments</th><th>P</th><th>N</th></tr>
<tr><td>6.1.2.3.6</td><td>Perform functional test as per SPIRE procedure RD 65, being detailed in RD 69.

<table>
<tr><th>Step</th><th>Test Description</th><th>RD</th></tr>
<tr><td>1</td><td>SCU Science Packet Generation Check</td><td>RD-65</td></tr>
<tr><td>2</td><td>SCU Science data check</td><td>RD-65</td></tr>
<tr><td>3</td><td>SCU Test pattern test</td><td>RD-65</td></tr>
<tr><td>4</td><td>SCU PCAL check</td><td>RD-65</td></tr>
<tr><td>5</td><td>SCU SCAL check</td><td>RD-65</td></tr>
<tr><td>6</td><td>SCU cooler heaters check</td><td>RD-65</td></tr>
<tr><td>7</td><td>SCU DC Thermometry Check</td><td>RD-65</td></tr>
<tr><td>8</td><td>SCU AC Thermometry Check</td><td>RD-65</td></tr>
<tr><td>9</td><td>DCU Science Packet generation check</td><td>RD-65</td></tr>
<tr><td>10</td><td>DCU Science data check</td><td>RD-65</td></tr>
<tr><td>11</td><td>DCU Test pattern test</td><td>RD-65</td></tr>
<tr><td>12</td><td>DCU Photometer and Spectrometer LIAs switch on. (Only one procedure as the QM1 DRCU switches on both sets of LIAs)</td><td>RD-65</td></tr>
</table>
</td><td></td><td></td><td>Test report:</td><td></td><td></td></tr>
<tr><td>6.1.2.3.7</td><td>Switch off primary power as per ASED procedure RD 01, sect. 4.4.</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Location:	PA: Name Date:	Operator: Date:		

6.1.2.4 HIFI SIH Electrical Integration

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.1.2.4.1	Perform mating of SIH to FPU and Warm Units. No specific sequence required.			Respect ESD requirements		
6.1.2.4.2	Record all mates/de-mates in the logbook.					
6.1.2.4.3	Perform EGSE set-up as per ASED procedure RD 01, sect. 4.1.					
6.1.2.4.4	Define and record test session name.			Test session name:		
6.1.2.4.5	Switch on primary power as per ASED procedure RD 01, section 4.3 taking into account HIFI procedure RD 26, sect. 2.4.2.					

Location:	PA: Name Date:	Operator: Date:		

<table>
<tr><th>Step-No.</th><th>Test-Step-Description</th><th>Nominal Value</th><th>Actual Value</th><th>Comments</th><th>P</th><th>N</th></tr>
<tr><td>6.1.2.4.6</td><td>Perform SFT warm as per HIFI procedure RD 22, section 6.4 (LOU simulator connected instead of LOU). Monitor HK values listed in RD 26 throughout the test (manual monitoring).
<table>
<tr><th>Step</th><th>Test Description</th><th>RD</th><th>Section</th></tr>
<tr><td>1</td><td>Initialise subsystems in WU context and gather HK</td><td>RD-22</td><td>6.4.1</td></tr>
<tr><td>2</td><td>Check-out spectrometer readout</td><td>RD-22</td><td>6.4.1</td></tr>
<tr><td>3</td><td>Reset LO to standby in preparation for check-out of 3B chain</td><td>RD-22</td><td>6.4.1</td></tr>
<tr><td>4</td><td>Check-out 3B chain</td><td>RD-22</td><td>6.4.1</td></tr>
<tr><td>5</td><td>Configure HIFI to standby</td><td>RD-22</td><td>6.4.1</td></tr>
<tr><td>6</td><td>Prepare for power-down of HIFI</td><td>RD-22</td><td>6.4.2</td></tr>
</table></td><td></td><td></td><td>Test report:</td><td></td><td></td></tr>
<tr><td>6.1.2.4.7</td><td>Switch off primary power as per ASED procedure RD 01, section 4.4 taking into account HIFI procedure RD 26, sect. 2.4.4.</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Location:	PA: Name Date:	Operator: Date:		

6.2 HIFI LOU Electrical Integration

This sub-procedure describes the electrical connection of the HIFI LOU to the HIFI FCU and the functional check out after the electrical integration.

6.2.1 Test Preparation

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.2.1.1	Turn PLM in upright position.					
6.2.1.2	Define and verify appropriate ESD protected area.					
6.2.1.3	Perform EGSE set-up as per ASED procedure RD 01, sect. 4.1.					

6.2.2 HIFI LOU Electrical Integration

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.2.2.1	Perform mating of SIH to HIFI LOU and HIFI LCU as per HIFI procedure RD 25.			Respect ESD requirements		

Location:	PA: Name Date:	Operator: Date:		

<table>
<tr><th>Step-No.</th><th>Test-Step-Description</th><th>Nominal Value</th><th>Actual Value</th><th>Comments</th><th>P</th><th>N</th></tr>
<tr><td>6.2.2.2</td><td>Record all mates/de-mates in the logbook.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6.2.2.3</td><td>Define and record test session name.</td><td></td><td></td><td>Test session name:</td><td></td><td></td></tr>
<tr><td>6.2.2.4</td><td>Switch on primary power as per ASED procedure RD 01, section 4.3 taking into account HIFI procedure RD 26, sect. 2.4.2.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6.2.2.5</td><td>Perform SFT warm as per HIFI procedure RD 22, section 6.4 (LOU connected). Monitor HK values listed in RD 26 throughout the test (manual monitoring).
<table>
<tr><th>Step</th><th>Test Description</th><th>RD</th><th>Section</th></tr>
<tr><td>1</td><td>Initialise subsystems in WU context and gather HK</td><td>RD-22</td><td>6.4.1</td></tr>
<tr><td>2</td><td>Check-out spectrometer readout</td><td>RD-22</td><td>6.4.1</td></tr>
<tr><td>3</td><td>Reset LO to standby in preparation for check-out of 3B chain</td><td>RD-22</td><td>6.4.1</td></tr>
<tr><td>4</td><td>Check-out 3B chain</td><td>RD-22</td><td>6.4.1</td></tr>
<tr><td>5</td><td>Configure HIFI to standby</td><td>RD-22</td><td>6.4.1</td></tr>
<tr><td>6</td><td>Prepare for power-down of HIFI</td><td>RD-22</td><td>6.4.2</td></tr>
</table></td><td></td><td></td><td>Test report:</td><td></td><td></td></tr>
</table>

Location:	PA: Name Date:	Operator: Date:		

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.2.2.6	Switch off primary power as per ASED procedure RD 01, section 4.4 taking into account HIFI procedure RD 26, sect. 2.4.4.					

6.3 SFT Warm & open

This sub-procedure describes the Short Functional Test (SFT) in "warm" conditions, i. e. the cryostat is not yet closed & the LOU not yet integrated. Test objective is, just after the cryoharness connection, to check the instrument the switch on/off, command and control functions and to functionally verify the instrument interfaces. The test evaluation is based on housekeeping data. Test duration is about 1 h per instrument.

6.3.1 Test Preparation

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.3.1.1	Perform EGSE set-up as per ASED procedure RD 01, sect. 4.1.					
6.3.1.2	Define and record test session name.			Test session name:		

Location:	PA: Name Date:	Operator: Date:		

6.3.2 HIFI SFT warm

<table>
<tr><th>Step-No.</th><th>Test-Step-Description</th><th>Nominal Value</th><th>Actual Value</th><th>Comments</th><th>P</th><th>N</th></tr>
<tr><td>6.3.2.1</td><td>Switch on primary power as per ASED procedure RD 01, section 4.3 taking into account HIFI procedure RD 26, sect. 2.4.2.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6.3.2.2</td><td>Perform SFT warm as per HIFI procedure RD 22, section 6.4 (LOU simulator connected instead of LOU). Monitor HK values listed in RD 26 throughout the test (manual monitoring).
<table>
<tr><th>Step</th><th>Test Description</th><th>RD</th><th>Section</th></tr>
<tr><td>1</td><td>Initialise subsystems in WU context and gather HK</td><td>RD-22</td><td>6.4.1</td></tr>
<tr><td>2</td><td>Check-out spectrometer readout</td><td>RD-22</td><td>6.4.1</td></tr>
<tr><td>3</td><td>Reset LO to standby in preparation for check-out of 3B chain</td><td>RD-22</td><td>6.4.1</td></tr>
<tr><td>4</td><td>Check-out 3B chain</td><td>RD-22</td><td>6.4.1</td></tr>
<tr><td>5</td><td>Configure HIFI to standby</td><td>RD-22</td><td>6.4.1</td></tr>
<tr><td>6</td><td>Prepare for power-down of HIFI</td><td>RD-22</td><td>6.4.2</td></tr>
</table></td><td></td><td></td><td>Test report:</td><td></td><td></td></tr>
<tr><td>6.3.2.3</td><td>Switch off primary power as per ASED procedure RD 01, section 4.4 taking into account HIFI procedure RD 26, sect. 2.4.4.</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Location:	PA: Name Date:	Operator: Date:		

6.3.3 PACS SFT warm

<table>
<tr><th>Step-No.</th><th>Test-Step-Description</th><th>Nominal Value</th><th>Actual Value</th><th>Comments</th><th>P</th><th>N</th></tr>
<tr><td>6.3.3.1</td><td>Switch on primary power as per ASED procedure RD 01, sect. 4.5.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6.3.3.2</td><td>Perform SFT warm as per PACS procedure RD 42.
Steps 4 and 6 are removed.

<table>
<tr><th>Step</th><th>Test description</th><th>RD</th><th>Section</th></tr>
<tr><td>1</td><td>Chopper</td><td>RD-42</td><td>4</td></tr>
<tr><td>2</td><td>Grating Open Launch Lock</td><td>RD-42</td><td>4</td></tr>
<tr><td>3</td><td>Grating Health Check</td><td>RD-42</td><td>4</td></tr>
<tr><td>4</td><td>~~Grating Close Launch Lock~~</td><td>removed</td><td></td></tr>
<tr><td>~~5~~</td><td>Calibration sources</td><td>RD-42</td><td>4</td></tr>
<tr><td>6</td><td>~~Filter wheel Spectroscopy~~</td><td>removed</td><td>4</td></tr>
<tr><td>~~7~~</td><td>Filter wheel Photometry</td><td>RD-42</td><td>4</td></tr>
<tr><td>8</td><td>FPU Temperature sensors</td><td>RD-42</td><td>4</td></tr>
<tr><td>9</td><td>Ge:Ga Detector Chain</td><td>RD-42</td><td>4</td></tr>
<tr><td>10</td><td>Bolometer Detector Chain</td><td>RD-42</td><td>4</td></tr>
</table></td><td></td><td></td><td>Test report:</td><td></td><td></td></tr>
<tr><td>6.3.3.3</td><td>Switch off primary power as per ASED procedure RD 01, sect 4.6.</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Location:	PA: Name Date:	Operator: Date:		

6.3.4 SPIRE SFT warm

<table>
<tr><th>Step-No.</th><th>Test-Step-Description</th><th>Nominal Value</th><th>Actual Value</th><th>Comments</th><th>P</th><th>N</th></tr>
<tr><td>6.3.4.1</td><td>Switch on primary power as per ASED procedure RD 01, sect. 4.3.

<table><tr><th>Step</th><th>Test description</th><th>RD</th></tr><tr><td>1</td><td>Switch on DPU and boot</td><td>RD-1</td></tr><tr><td>2</td><td>Switch on the DRCU</td><td>RD-1</td></tr></table></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

<table>
<tr><th>Step-No.</th><th>Test-Step-Description</th><th>Nominal Value</th><th>Actual Value</th><th>Comments</th><th>P</th><th>N</th></tr>
<tr><td>6.3.4.2</td><td>Perform functional test as per SPIRE procedure RD 65, being detailed in RD 69.

<table>
<tr><th>Step</th><th>Test Description</th><th>RD</th></tr>
<tr><td>1</td><td>SCU Science Packet Generation Check</td><td>RD-65</td></tr>
<tr><td>2</td><td>SCU Science data check</td><td>RD-65</td></tr>
<tr><td>3</td><td>SCU Test pattern test</td><td>RD-65</td></tr>
<tr><td>4</td><td>SCU PCAL check</td><td>RD-65</td></tr>
<tr><td>5</td><td>SCU SCAL check</td><td>RD-65</td></tr>
<tr><td>6</td><td>SCU cooler heaters check</td><td>RD-65</td></tr>
<tr><td>7</td><td>SCU DC Thermometry Check</td><td>RD-65</td></tr>
<tr><td>8</td><td>SCU AC Thermometry Check</td><td>RD-65</td></tr>
<tr><td>9</td><td>DCU Science Packet generation check</td><td>RD-65</td></tr>
<tr><td>10</td><td>DCU Science data check</td><td>RD-65</td></tr>
<tr><td>11</td><td>DCU Test pattern test</td><td>RD-65</td></tr>
<tr><td>12</td><td>DCU Photometer and Spectrometer LIAs switch on. (Only one procedure as the QM1 DRCU switches on both sets of LIAs)</td><td>RD-65</td></tr>
</table>
</td><td></td><td></td><td>Test report:</td><td></td><td></td></tr>
<tr><td>6.3.4.3</td><td>Switch off primary power as per ASED procedure RD 01, sect. 4.4.</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Location:	PA: Name Date:	Operator: Date:		

6.4 SFT Cold at He I

This sub-procedure describes the Short Functional Test (SFT) in "cold He I" conditions, i. e. the cryostat cooled down, the He in fluid condition. Test objective is to check the instrument the switch on/off, command and control functions and to functionally verify the instrument interfaces. The test evaluation is based on housekeeping data. Test duration is about 1 h per instrument.

6.4.1 Test Preparation

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.4.1.1	Turn PLM in upright position.					
6.4.1.2	Refill HTT and AXT, if required, according to dedicated procedures.					
6.4.1.3	Check and record cryostat temperatures. HTT AXT	 4.2 K 4.2 K				
6.4.1.4	Perform EGSE set-up as per ASED procedure RD 01, sect. 4.1.					
6.4.1.5	Define and record test session name.			Test session name:		

Location:	PA: Name Date:	Operator: Date:		

6.4.2 HIFI SFT Cold at He I

<table>
<tr><th>Step-No.</th><th>Test-Step-Description</th><th>Nominal Value</th><th>Actual Value</th><th>Comments</th><th>P</th><th>N</th></tr>
<tr><td>6.4.2.1</td><td>Switch on primary power as per ASED procedure RD 01, section 4.3 taking into account HIFI procedure RD 26, sect. 2.4.2.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6.4.2.2</td><td>Perform SFT Cold at He I as per HIFI procedure RD 22, sect. 7.4. Monitor HK values listed in RD 26 throughout the test (manual monitoring).
<table>
<tr><th>Step</th><th>Test sequence / objective</th><th>RD</th><th>Section</th></tr>
<tr><td>1</td><td>Verify LSU simulator is inactive</td><td>RD-22</td><td>7.4.1</td></tr>
<tr><td>2</td><td>Perform functional test unpumped</td><td>RD-22</td><td>7.4.2</td></tr>
<tr><td>3</td><td>Perform chopper Scan</td><td>RD-22</td><td>7.4.2</td></tr>
<tr><td>4</td><td>Initialise subsystems in Cold context and gather HK</td><td>RD-22</td><td>7.4.2</td></tr>
<tr><td>5</td><td>Reset LO to standby in preparation for check-out of 3B chain</td><td>RD-22</td><td>7.4.2</td></tr>
<tr><td>6</td><td>Check-out 3B chain</td><td>RD-22</td><td>7.4.2</td></tr>
<tr><td>7</td><td>Configure HIFI to standby</td><td>RD-22</td><td>7.4.2</td></tr>
<tr><td>8</td><td>Prepare for power-down of HIFI</td><td>RD-22</td><td>7.4.3</td></tr>
</table></td><td></td><td></td><td>Test report:</td><td></td><td></td></tr>
</table>

Location:	PA: Name Date:	Operator: Date:		

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.4.2.3	Switch off primary power as per ASED procedure RD 01, section 4.4 taking into account HIFI procedure RD 26, sect. 2.4.4.					

6.4.3 PACS SFT Cold at He I

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.4.3.1	Switch on primary power as per ASED procedure RD 01, sect. 4.5.					

<table>
<tr><th>Step-No.</th><th>Test-Step-Description</th><th>Nominal Value</th><th>Actual Value</th><th>Comments</th><th>P</th><th>N</th></tr>
<tr><td>6.4.3.2</td><td>Perform SFT Cold at He I as per PACS procedure RD 42.

The grating launch lock has been open in last warm SFT and do not need to be opened nor closed. Steps 15 & 17 are removed. The spectroscopy filter wheel is not present therefore step 19 is also removed.

<table>
<tr><th>Step</th><th>Test description</th><th>RD</th><th>Section</th></tr>
<tr><td>14</td><td>Chopper</td><td>RD-42</td><td>5</td></tr>
<tr><td>~~15~~</td><td>~~Grating Open Launch Lock~~</td><td>removed</td><td></td></tr>
<tr><td>16</td><td>Grating Health Check</td><td>RD-42</td><td>5</td></tr>
<tr><td>~~17~~</td><td>~~Grating Close Launch Lock~~</td><td>removed</td><td></td></tr>
<tr><td>18</td><td>Calibration sources</td><td>RD-42</td><td>5</td></tr>
<tr><td>~~19~~</td><td>~~Filter wheel Spectroscopy~~</td><td>removed</td><td>5</td></tr>
<tr><td>20</td><td>Filter wheel Photometry</td><td>RD-42</td><td>5</td></tr>
<tr><td>21</td><td>FPU Temperature Sensors</td><td>RD-42</td><td>5</td></tr>
<tr><td>22</td><td>Ge:Ga Detector Chain</td><td>RD-42</td><td>5</td></tr>
<tr><td>22</td><td>Sorption Cooler</td><td>RD-42</td><td>5</td></tr>
<tr><td>23</td><td>Bolometer Detector Chain</td><td>RD-42</td><td>5</td></tr>
</table>
</td><td></td><td></td><td>Test report:</td><td></td><td></td></tr>
<tr><td>6.4.3.3</td><td>Switch off primary power as per ASED procedure RD 01, sect 4.6.</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Location:	PA: Name Date:	Operator: Date:		

6.4.4 SPIRE SFT Cold at He I

<table>
<tr><th>Step-No.</th><th>Test-Step-Description</th><th>Nominal Value</th><th>Actual Value</th><th>Comments</th><th>P</th><th>N</th></tr>
<tr><td>6.4.4.1</td><td>Switch on primary power as per ASED procedure RD 01, sect. 4.3.

<table><tr><th>Step</th><th>Test description</th><th>RD</th></tr><tr><td>1</td><td>Switch on DPU and boot</td><td>RD-1</td></tr><tr><td>2</td><td>Switch on the DRCU</td><td>RD-1</td></tr></table></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Location:	PA: Name Date:	Operator: Date:		

<table>
<tr><th>Step-No.</th><th>Test-Step-Description</th><th>Nominal Value</th><th>Actual Value</th><th>Comments</th><th>P</th><th>N</th></tr>
<tr><td>6.4.4.2</td><td>Perform SFT Cold at He I as per SPIRE procedure RD 66.

<table>
<tr><th>Step</th><th>Test Description</th><th>RD</th></tr>
<tr><td>1</td><td>SCU Science Packet Generation Check</td><td>RD-66</td></tr>
<tr><td>2</td><td>SCU Test pattern test</td><td>RD-66</td></tr>
<tr><td>3</td><td>SCU PCAL check</td><td>RD-66</td></tr>
<tr><td>4</td><td>PCAL characterisation test</td><td>RD-66</td></tr>
<tr><td>5</td><td>SCU SCAL check</td><td>RD-66</td></tr>
<tr><td>6</td><td>SCAL characterisation test</td><td>RD-66</td></tr>
<tr><td>7</td><td>SCU cooler heaters check</td><td>RD-66</td></tr>
<tr><td>8</td><td>DCU Science Packet generation check</td><td>RD-66</td></tr>
<tr><td>9</td><td>DCU Science data check</td><td>RD-66</td></tr>
<tr><td>10</td><td>DCU Test pattern test</td><td>RD-66</td></tr>
<tr><td>11</td><td>DCU Photometer and Spectrometer LIAs switch on. (Only one procedure as the QM1 DRCU switches on both sets of LIAs)</td><td>RD-66</td></tr>
</table>
</td><td></td><td></td><td>Test report:</td><td></td><td></td></tr>
<tr><td>6.4.4.3</td><td>Switch off primary power as per ASED procedure RD 01, sect. 4.4.</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Location:	PA: Name Date:	Operator: Date:		

6.5 SFT Cold at He II

This sub-procedure describes the Short Functional Test (SFT) in "cold He I" conditions, i. e. the cryostat cooled down, the He in super fluid condition. Test objective is to check the instrument the switch on/off, command and control functions and to functionally verify the instrument interfaces. The test evaluation is based on housekeeping data. Test duration is about 1 h per instrument.

6.5.1 Test Preparation

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.5.1.1	Turn PLM in upright position.					
6.5.1.2	Refill HTT and AXT, if required, according to dedicated procedures.					
6.5.1.3	Check and record cryostat temperatures. HTT AXT	 4.2 K < 1.8 K				
6.5.1.4	Perform EGSE set-up as per ASED procedure RD 01.					
6.5.1.5	Define and record test session name.			Test session name:		

Location:	PA: Name Date:	Operator: Date:		

6.5.2 HIFI SFT Cold at He II

<table>
<tr><th>Step-No.</th><th>Test-Step-Description</th><th>Nominal Value</th><th>Actual Value</th><th>Comments</th><th>P</th><th>N</th></tr>
<tr><td>6.5.2.1</td><td>Switch on primary power as per ASED procedure RD 01, section 4.3 taking into account HIFI procedure RD 26, sect. 2.4.2.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6.5.2.2</td><td>Perform SFT Cold at He II as per HIFI procedure RD 22, sect. 8.4. Monitor HK values listed in RD 26 throughout the test (manual monitoring).
<table>
<tr><th>Step</th><th>Test sequence / objective</th><th>RD</th><th>Section</th></tr>
<tr><td>1</td><td>Verify LSU simulator is inactive</td><td>RD-22</td><td>8.4.1</td></tr>
<tr><td>2</td><td>Perform functional test unpumped</td><td>RD-22</td><td>8.4.2</td></tr>
<tr><td>3</td><td>Perform chopper Scan</td><td>RD-22</td><td>8.4.2</td></tr>
<tr><td>4</td><td>Initialise subsystems in Cold context and gather HK</td><td>RD-22</td><td>8.4.2</td></tr>
<tr><td>5</td><td>Reset LO to standby in preparation for check-out of 3B chain</td><td>RD-22</td><td>8.4.2</td></tr>
<tr><td>6</td><td>Check-out 3B chain</td><td>RD-22</td><td>8.4.2</td></tr>
<tr><td>7</td><td>Configure HIFI to standby</td><td>RD-22</td><td>8.4.2</td></tr>
<tr><td>8</td><td>Prepare for power-down of HIFI</td><td>RD-22</td><td>8.4.3</td></tr>
</table></td><td></td><td></td><td>Test report:</td><td></td><td></td></tr>
</table>

Location:	PA: Name Date:	Operator: Date:		

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.5.2.3	Switch off primary power as per ASED procedure RD 01, section 4.4 taking into account HIFI procedure RD 26, sect. 2.4.4.					

6.5.3 PACS SFT Cold at He II

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.5.3.1	Switch on primary power as per ASED procedure RD 01, sect. 4.5.					
6.5.3.2	Perform SFT Cold at He II as per PACS procedure RD 42. The grating launch lock has been open in last warm SFT and do not need to be opened nor closed. Steps 15 & 17 are removed. The spectroscopy filter wheel is not present therefore step 19 is also removed. Step / Test description / RD / Section 14 Chopper RD-42 5 ~~15 Grating Open Launch Lock~~ removed 16 Grating Health Check RD-42 5 ~~17 Grating Close Launch Lock~~ removed			Test report:		

Location:	PA: Name Date:	Operator: Date:		

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
	18 Calibration sources RD-42 5 ~~19 Filter wheel Spectroscopy~~ removed 5 20 Filter wheel Photometry RD-42 5 21 FPU Temperature Sensors RD-42 5 22 Ge:Ga Detector Chain RD-42 5 22 Sorption Cooler RD-42 5 23 Bolometer Detector Chain RD-42 5					
6.5.3.3	Switch off primary power as per ASED procedure RD 01, sect 4.6.					

6.5.4 SPIRE SFT Cold at He II

Location:	PA: Name Date:	Operator: Date:		

<table>
<tr><th>Step-No.</th><th>Test-Step-Description</th><th>Nominal Value</th><th>Actual Value</th><th>Comments</th><th>P</th><th>N</th></tr>
<tr><td>6.5.4.1</td><td>Switch on primary power as per ASED procedure RD 01, sect. 4.3.

<table><tr><td>Step</td><td>Test description</td><td>RD</td></tr><tr><td>1</td><td>Switch on DPU and boot</td><td>RD-1</td></tr><tr><td>2</td><td>Switch on the DRCU</td><td>RD-1</td></tr></table></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6.5.4.2</td><td>Perform SFT Cold at He I as per SPIRE procedure RD 66.

<table><tr><th>Step</th><th>Test Description</th><th>RD</th></tr><tr><td>1</td><td>SCU Science Packet Generation Check</td><td>RD-66</td></tr><tr><td>2</td><td>SCU Test pattern test</td><td>RD-66</td></tr><tr><td>3</td><td>SCU PCAL check</td><td>RD-66</td></tr><tr><td>4</td><td>PCAL characterisation test</td><td>RD-66</td></tr><tr><td>5</td><td>SCU SCAL check</td><td>RD-66</td></tr><tr><td>6</td><td>SCAL characterisation test</td><td>RD-66</td></tr><tr><td>7</td><td>SCU cooler heaters check</td><td>RD-66</td></tr><tr><td>8</td><td>DCU Science Packet generation check</td><td>RD-66</td></tr><tr><td>9</td><td>DCU Science data check</td><td>RD-66</td></tr><tr><td>10</td><td>DCU Test pattern test</td><td>RD-66</td></tr><tr><td>11</td><td>DCU Photometer and Spectrometer LIAs</td><td>RD-66</td></tr></table></td><td></td><td></td><td>Test report:</td><td></td><td></td></tr>
</table>

Location:	PA: Name Date:	Operator: Date:		

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
	switch on. (Only one procedure as the QM1 DRCU switches on both sets of LIAs)					
6.5.4.3	Switch off primary power as per ASED procedure RD 01, sect. 4.4.					

Location:	PA: Name Date:	Operator: Date:		

6.6 IMT

This sub-procedure describes the Instrument Module Test (IMT) with the cryostat cooled down, the He in super fluid condition. Test objective is the verification of the functional performance and the measurement performance of the integrated instrument as far as possible with the PLM EQM configuration. The test evaluation is based on housekeeping and scientific measurement data. 5 days per instrument are allocated for that test plus 5 days for the PACS/SPIRE Parallel Mode test.

6.6.1 Test Preparation

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.6.1.1	Turn PLM in upright position for refilling (step 6.6.1.2). Turn PLM in tilted position to 30° in y-direction for PACS and SPIRE cooler recycle. For all other steps no requirements exist for the PLM positioning, i. e. the PLM can be positioned as adequate.					
6.6.1.2	Refill HTT and AXT, if required, according to dedicated procedures.					
6.6.1.2	Check and record cryostat temperatures. HTT AXT	 4.2 K < 1.8 K (TBC)				
6.6.1.3	Check all instrument specific EGSE being correctly positioned and connected to facility power.					

Location:	PA: Name Date:	Operator: Date:		

<table>
<tr><th>Step-No.</th><th>Test-Step-Description</th><th>Nominal Value</th><th>Actual Value</th><th>Comments</th><th>P</th><th>N</th></tr>
<tr><td>6.6.1.4</td><td>Perform EGSE set-up as per ASED procedure RD 01, sect. 4.1.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6.6.1.5</td><td>Define and record test session name.</td><td></td><td></td><td>Test session name:</td><td></td><td></td></tr>
<tr><td>6.6.1.6</td><td>Switch on HIFI primary power as per ASED procedure RD 01, section 4.3 taking into account HIFI procedure RD 26, sect. 2.4.2.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6.6.1.7</td><td>Switch on PACS primary power as per ASED procedure RD 01, sect. 4.5.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6.6.1.8</td><td>Switch on SPIRE primary power as per ASED procedure RD 01, sect. 4.3.

<table><tr><th>Step</th><th>Test description</th><th>RD</th></tr><tr><td>1</td><td>Switch on DPU and boot</td><td>RD-1</td></tr><tr><td>2</td><td>Switch on the DRCU</td><td>RD-1</td></tr></table></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6.6.1.9</td><td>Switch ALL instruments in Stand-By Mode.</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Location:	PA: Name Date:	Operator: Date:		

6.6.2 HIFI IMT

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.6.2.1	Connect LSU simulator waveguides to LOU waveguides flange as per HIFI procedure RD 27.					
6.6.2.2	Check cryostat set-up. Check and adjust mass flow through optical bench.	~ 2.2 mg/s				
6.6.2.3	Perform IMT post integration test as per HIFI procedure RD 22, sect. 9			Check and record cryostat temperatures throughout IMT. Test report:		

Initialise LSU Simulator for 807GHz		RD-22	9.4.1
	Tune LSU simulator for 807 GHz	RD-22	9.4.1
Integration test – 807 GHz		RD-22	9.4.3
	Perform chopper Scan	RD-22	9.4.3
	Perform functional test pumped and set spectrometer attenuators	RD-22	9.4.3
	Perform functional test unpumped	RD-22	9.4.3
	Perform diplexer scan – H and V polarisations	RD-22	9.4.3
	Perform LO scan	RD-22	9.4.3
	Configure HIFI to standby	RD-22	9.4.3
Initialise LSU Simulator for 901.584 GHz		RD-22	9.4.4
	Tune LSU simulator for 901.584 GHz	RD-22	9.4.4

Location:	PA: Name Date:	Operator: Date:		

Step-No.	Test-Step-Description			Nominal Value	Actual Value	Comments	P	N
	Integration test – 901.584 GHz	RD-22	9.4.5					
	Perform chopper Scan	RD-22	9.4.5					
	Perform functional test pumped and set spectrometer attenuators	RD-22	9.4.5					
	Perform functional test unpumped	RD-22	9.4.5					
	Perform diplexer scan – H and V polarisations	RD-22	9.4.5					
	Perform LO scan	RD-22	9.4.5					
	Configure HIFI to standby	RD-22	9.4.5					
	Perform IMT as per HIFI procedure RD 22, sect. 10							
	Initialise LSU Simulator for 901.584 GHz	RD-22	10.4.1					
	Tune LSU simulator for 901.584 GHz	RD-22	10.4.1					
	Restart HIFI (optional – only if HIFI has been powered down)	RD-22	10.4.2					
	Initialise FPU	RD-22	10.4.2					
	IMT – 901.584 GHz	RD-22	10.4.3					
	Perform functional test pumped and set spectrometer attenuators	RD-22	10.4.3					
	Perform functional test unpumped	RD-22	10.4.3					
	Perform diplexer Slow scan	RD-22	10.4.3					
	LO Standing Wave test	RD-22	10.4.3					

Location:	PA: Name Date:	Operator: Date:		

Step-No.	Test-Step-Description				Nominal Value	Actual Value	Comments	P	N
		Configure HIFI to standby	RD-22	10.4.3					
	Initialise LSU Simulator for 807GHz		RD-22	10.4.4					
		Tune LSU simulator for 807 GHz	RD-22	10.4.4					
	IMT – 807 GHz		RD-23	10.4.5					
		Perform functional test pumped and set spectrometer attenuators	RD-24	10.4.5					
		Perform functional test unpumped	RD-25	10.4.5					
		Perform diplexer Slow scan	RD-26	10.4.5					
		LO Standing Wave test	RD-27	10.4.5					
		EMC test dry run to check source operation and level	RD-28	10.4.5					
		Stability test	RD-29	10.4.5					
	Standby - Long Duration		RD-22	10.4.6					
		Configure HIFI to standby for a period of > 1 week	RD-22	10.4.6					

Location:	PA: Name Date:	Operator: Date:		

6.6.3 PACS IMT

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.6.3.1	For cooler recycle: Tilt cryostat to >30° to +y-direction according to tilting procedure RD10.	30° to +y-direction		Tilt is required only during the cooler recycling, no instrument requirements for other operations.		
6.6.3.2	Perform cover flushing as per ASED procedure RD 09.					
6.6.3.3	Fine tuning cover background radiation as per PACS procedure RD 43.					
6.6.3.4	Check cryostat set-up. Check and adjust mass flow through optical bench	 ~ 2.2 mg/s				
6.6.3.5	Perform IMT as per PACS procedure RD 43. PACS IMT is composed of 3 sequences: • Full Functional Test, • Short Performance test, • AOT **(Astronomical observation Template)**			Check and record cryostat temperatures throughout IMT. Test report:		

Location:	PA: Name Date:	Operator: Date:		

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

The sequence of each test is given below:

	Full Functional Test (execution time: 8:30+analysis)		
Test ID	Test description	RD	Section
402	Memory Management Test	RD-43	4.2
403	PACS Setup of Spectroscopy with CSs off and Open Grating Launch Lock	RD-43	4.3
404	Grating Test	RD-43	4.4
~~405~~	~~Filterwheel Spectroscopy~~	removed	
406	Thermal Behaviour Test in Spectroscopy	RD-43	4.6
407	Setup Spectroscopy, Data Rate and Cryostat Background Adjustment	RD-43	4.7
408	Chopper Full FOV Scan in Spectroscopy.	RD-43	4.8
409	Reconfiguration and Optional Switch-off/on Cycle	RD-43	4.9
410	Cooler Recycling.	RD-43	4.10
411	Thermal Behaviour Test in Photometry.	RD-43	4.11
412	PACS Setup of Photometry, FW Photometry and Data Rate	RD-43	4.12
413	Bolometers Saturation Check	RD-43	4.13

	Short Performance Test (execution time: 13:30+analysis)		

Location:	PA: Name Date:	Operator: Date:		

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

Test ID	Test description	RD	Section
516	Detector Dark Current on Internal Calibration Sources.	RD-43	5.2
517	Grating Performance Test	RD-43	5.3
518	Chopper Performance Test Spectroscopy.	RD-43	5.4
519	Emissivity of internal calibration sources	RD-43	5.5
520	Quick Wavelength Check	RD-43	5.6
521	Grating Relative Spectral Response on Internal Calibration Source	RD-43	5.7
522	S/N as a Function of Reset Interval	RD-43	5.8
523	Different Bias settings for Ge:Ga detectors	RD-43	5.9
524	Test of Internal Calibration Recipes in Spectroscopy.	RD-43	5.10
525	Time Constants for Flux Changes in Spectroscopy	RD-43	5.11
526	Internal Calibration Sources Performance Test	RD-43	5.12
527	Detector Selection Table Test Spectroscopy	RD-43	5.13
528	SPU Compression/Reduction Mode Test Spectrometer	RD-43	5.14
529	Switch off.	RD-01	4.6
530	Switch on (optional).	RD-01	4.5
531	Cooler Recycling.	RD-43	5.17
532	Setup Photometry.	RD-43	5.18
533	Test of Internal Calibration Recipes in Photometry.	RD-43	5.19
534	Focal Plane Map with Calibration Sources and representative thermal Background.	RD-43	5.20

Location:	PA: Name Date:	Operator: Date:		

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

535	Staring Measurement on Calibration Source for low Frequency Noise	RD-43	5.21
536	Detector Selection Table Test Photometer.	RD-43	5.22
537	SPU Compression/Reduction Mode Test Photometer	RD-43	5.23
538	Test Pattern Photometry	RD-43	5.24

	AOT (Astronomical observation Template) Test (execution time: 9:00+analysis)		
Test ID	Test description	RD	Section
641	Cooler Recycling	RD-43	6.2
642	Setup Photometry	RD-43	6.3
643	Tutti Frutti AOT Test Photometry	RD-43	6.4
644	Internal Calibration Blocks Photometry	RD-43	6.5
645	Two/Three position chopping with/without internal calibration block	RD-43	6.6
646	PACS Setup of Spectroscopy	RD-43	6.7
647	Tutti Frutti AOT Test Spectroscopy	RD-43	6.8
648	Medium Sampling Grating Scan Test.	RD-43	6.9
649	Sparsely sampled scan on CS1.	RD-43	6.10
650	Internal Calibration Blocks Spectroscopy.	RD-43	6.11
651	Wavelength Switching Test	RD-43	6.12

Location:	PA: Name Date:	Operator: Date:		

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
	652 Line Scan AOT with variation of internal calibration concept — RD-43 — 6.13					

6.6.4 SPIRE IMT

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.6.4.1	For cooler recycle: Tilt cryostat to >30° to +y-direction according to tilting procedure RD10.	30° to +y-direction		Tilt is required only during the cooler recycling, no instrument requirements for other operations.		
6.6.4.2	Perform cover flushing as per ASED procedure RD 09.					
6.6.4.3	Fine tuning of cover background radiation as per SPIRE procedure RD 67.					
6.6.4.4	Check cryostat set-up. Check and adjust mass flow through optical bench	 ~ 2.2 mg/s				

Location:	PA: Name Date:	Operator: Date:		

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.6.4.5	Perform IMT as per SPIRE procedure RD 67. **SPIRE Integrated Module Test sequence for EQM testing**			Check and record cryostat temperatures throughout IMT. Test report:		

Step	Description	
1	Check the noise in the PLW JFETs with shorted inputs versus Vss (detectors at ~2K)	RD-67
2	Noise versus bias using spectrometer side of instrument and STM JFETS	RD-67
3	Analyse data – verify no excess system noise	RD-67
Thermal case 1		RD-67
4	Switch off detectors	RD-67
5	Recycle cooler	RD-67
6	Switch to Photometer Standby	RD-67
7	Wait until temperature stabilises	RD-67
7a	During stabilisation we can check noise versus bias level and frequency with reduced number of bias levels and frequencies or it will take all day	RD-67
8	Analyse data – determine noise is o.k. and optimum frequency setting – analysis procedure exists	RD-67
9	Set for clean bias frequency and nominal bias (~15 mV)	RD-67
10	Phase up to maximise signal	RD-67
11	Loadcurve at fixed frequency and phase	RD-67
12	Loadcurve at fixed frequency and phase+90	RD-67

Location:	PA: Name Date:	Operator: Date:		

Step-No.	Test-Step-Description			Nominal Value	Actual Value	Comments	P	N
	13	Loadcurve at fixed frequency and phase-90	RD-67					
	14	Analyse data – determine detector temperature and estimate background loading	RD-67					
	15	Set detector for optimum bias setting and reset offsets	RD-67					
	16	Rephase detector at optimum bias setting	RD-67					
	17	Run PCAL static test to check calibration against CBB	RD-67					
	18	- Analyse data – determine absolute signal versus voltage calibration –	RD-67					
		Can now use SPIRE to determine ambient background for (almost) any setting of the cryo-cover	RD-67					
	19	Photometer scan mode	RD-67					
	20	Photometer chop mode	RD-67					
	21	Switch photometer to spectrometer	RD-67					
	22	Spectrometer mode	RD-67					
	Wait for cooler exhaustion approx 30-32 hours after recycle							

Location:	PA: Name Date:	Operator: Date:		

6.6.5 SPIRE/PACS Parallele mode IMT

<table>
<tr><th>Step-No.</th><th>Test-Step-Description</th><th>Nominal Value</th><th>Actual Value</th><th>Comments</th><th>P</th><th>N</th></tr>
<tr><td>6.6.5.1</td><td>For cooler recycle: Tilt cryostat to >30° to +y-direction according to tilting procedure RD10.</td><td>>30° to +y-direction</td><td></td><td>Tilt is required only during the cooler recycling, no instrument requirements for other operations.</td><td></td><td></td></tr>
<tr><td>6.6.5.2</td><td>Perform cover flushing as per ASED procedure RD-09, if required.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6.6.5.3</td><td>Fine tuning of cover background radiation will be done as per instrument procedure.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6.6.5.4</td><td>Check cryostat set-up.
Check and adjust mass flow through optical bench</td><td>
~ 2.2 mg/s</td><td></td><td></td><td></td><td></td></tr>
<tr><td>6.6.5.5</td><td>Perform IMT (SPIRE/PACS Parallel Mode) as per PACS procedure RD 45.
<table>
<tr><th colspan="2">Operation Description/comment</th><th>RD</th><th>Section</th><th>Step</th></tr>
<tr><th>PACS</th><th>SPIRE</th><th></th><th></th><th></th></tr>
<tr><td>PACS Switch On -> REDY MODE</td><td></td><td>RD-1</td><td>4.5</td><td>1</td></tr>
<tr><td></td><td>SPIRE Switch ON -> SAFE MODE</td><td>RD-45</td><td>4.3</td><td>1bis</td></tr>
<tr><td></td><td>SPIRE Cooler recycle</td><td>RD-45</td><td>5</td><td>1</td></tr>
</table></td><td></td><td></td><td>Check and record cryostat temperatures throughout IMT.
Test Report:</td><td></td><td></td></tr>
</table>

Location:	PA: Name Date:	Operator: Date:		

Step-No.	Test-Step-Description					Nominal Value	Actual Value	Comments	P	N
	PACS Cooler recycle Start 30 minutes after SPIRE cooler recy-cling has started (step 1).		RD-45	5	2					
		SPIRE to photometer standby	RD-45	5	3					
		SPIRE to parallel mode	RD-45	5	4					
	PACS - Thermal Behaviour Test in Photometry		RD-45	5	5					
	PACS Setup Photometry		RD-45	5	6					
	Single Band Photometry		RD-45	5	7					
	Dual Band Photometry		RD-45	5	8					
		SPIRE to photometer standby from parallel mode stop data generation and reset back to nominal PLW settings	RD-45	5	9					
		SPIRE to ready from photometer standby	RD-45	5	10					
	PACS Switch off		RD-1	4.6	1					
		SPIRE Switch off	RD-45	4.4	2					

Location:	PA: Name Date:	Operator: Date:		

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

6.6.6 Test Completion

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.6.6.1	Switch off HIFI primary power as per ASED procedure RD 01, section 4.4 taking into account HIFI procedure RD 26, sect. 2.4.4.	OK				
6.6.6.2	Switch off PACS primary power as per ASED procedure RD 01, sect. 4.6.					
6.6.6.3	Switch off SPIRE primary power as per ASED procedure RD 01, sect 4.4.					

Location:	PA: Name Date:	Operator: Date:		

6.7 EMC Test

This sub-procedure describes the EMC Test with the cryostat cooled down, the He in super fluid condition. Test objective is the verification of the functional performance and the measurement performance of the integrated instrument under electromagnetic worst case conditions as far as possible with the PLM EQM configuration. The test evaluation is based on housekeeping and scientific measurement data. 5 days per instrument are allocated for that test.

Switch to EMC leading procedure RD-05

<table>
<tr><th>Step-No.</th><th>Test-Step-Description</th><th>Nominal Value</th><th>Actual Value</th><th>Comments</th><th>P</th><th>N</th></tr>
<tr><td>6.7.1</td><td>Perform EMC test as per ASED procedure RD 05 taking into account HIFI procedures RD 22, 23 and 29, PACS procedure RD 44 and SPIRE procedure RD 6
<table>
<tr><th colspan="2" rowspan="2">Step Activity</th><th colspan="2">EMC</th><th colspan="2">Instrument</th></tr>
<tr><th>RD</th><th>Section</th><th>RD</th><th>Section</th></tr>
<tr><td>0</td><td>Power all instruments and switch them to stand-by mode.</td><td>RD 01</td><td></td><td></td><td></td></tr>
<tr><td>1</td><td>PACS EMC Test</td><td>RD-05</td><td>7.1</td><td></td><td></td></tr>
<tr><td>1.1</td><td><s>Set-up instrument to standby mode</s> (see step 0)</td><td>RD-05</td><td>7.1</td><td></td><td></td></tr>
<tr><td>1.2</td><td>Perform PACS Cooler Recycle and beginning of each test day if instrument in photometer mode</td><td>RD-05</td><td>7.1</td><td></td><td></td></tr>
</table></td><td></td><td></td><td>Test report:</td><td></td><td></td></tr>
</table>

Location:	PA: Name Date:	Operator: Date:		

Step-No.	Test-Step-Description							Nominal Value	Actual Value	Comments	P	N
	1.3	Set PACS tests in spectrometer mode and perform reference	RD-05	7.1								
	1.4	Perform H-field test in spectrometer mode (3 antenna positions)	RD-05	7.1								
	1.5	Set PACS in photometer mode and perform reference tests	RD-05	7.1								
	1.6	Perform H-field test in photometer mode (3 antenna positions)	RD-05	7.1								
	1.7	Perform E-field test in photometer mode (3 antenna positions x 2 polarisations)	RD-05	7.1								
	1.8	Set PACS tests in spectrometer mode and perform reference	RD-05	7.1								
	1.9	Perform E-field test in spectrometer mode (3 antenna positions x 2 polarisations)	RD-05	7.1								
	1.1	Perform off-line performance evaluation via QLA	RD-05	7.1								
	2	SPIRE EMC Test	RD-05	7.2								
	2.1	~~Set-up instrument to standby mode~~ (see step 0)	RD-05	7.2								
	2.2	Perform SPIRE Cooler Recycle and beginning of each test day if instrument in photometer (=nominal) mode	RD-05	7.2								

Location:	PA: Name Date:	Operator: Date:		

Step-No.	Test-Step-Description							Nominal Value	Actual Value	Comments	P	N
	2.3	Set SPIRE in nominal mode and perform reference tests. Reference test to be repeated every 90 (TBC) min.	RD-05	7.2								
	2.4	Perform H-field test in nominal mode (3 antenna positions for sweeps and for SPOTs). Reference test to be repeated every 90 (TBC) min.	RD-05	7.2								
	2.5	Perform E-field test in nominal mode (3 antenna positions horizontal for sweep, horz + vert. for SPOTs). Reference test to be repeated every 90 (TBC) min.	RD-05	7.2								
	2.6	Perform off-line performance evaluation via QLA for the SPOTs if necessary	RD-05	7.2								
	3	HIFI EMC Test	RD-05	7.3								
	3.1	After 1 hour stabilization time switch to primary mode	RD-05	7.3								
	3.2	Perform HIFI Reference Tests at beginning of each test day	RD-05	7.3								
	3.3	Set HRS into susceptibility mode	RD-05	7.3								
	3.4	Perform H-field test in susceptibility mode (3 antenna positions)	RD-05	7.3								
	3.5	Perform E-field test in susceptibility mode (3 antenna positions x 2 polarizations)	RD-05	7.3								

Location:	PA: Name Date:	Operator: Date:		

Step-No.	Test-Step-Description						Nominal Value	Actual Value	Comments	P	N
	3.6	Perform HIFI Reference Tests at end of each test day (for both HRS frequency bands, lower and upper)	RD-05	7.3							
	3.7	Perform off-line performance evaluation via QLA	RD-05	7.3							
	4	Final Complementary Tests See para 7.4	RD-05	7.4							
	4.1	Set-up instrument to standby mode and after 1 hour stabilization time switch to primary mode	RD-05	7.4							
	4.2	Perform HIFI Reference Tests at beginning of each test day (for both HRS frequency bands, lower and upper)	RD-05	7.4							
	4.3	Set instrument into emission mode, HRS upper band (6 to 8 GHz)	RD-05	7.4							
	4.4	Perform CE tests	RD-05	7.4							
	4.5	Set instrument into susceptibility mode	RD-05	7.4							
	4.6	Perform CS tests	RD-05	7.4							
	4.7	Perform Off-line evaluation if necessary	RD-05	7.4							
	4.9	Switch off all instruments	RD 01	4.4							

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		
Alcatel Representative		
ESA Representative		

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	Wietbrock Walter	AET12
	Barlage Bernhard	AED11		Wöhler Hans	AOE22
X	Bayer Thomas	AOA52			
	Fehringer Alexander	AOE13			
	Geiger Hermann	AOA52			
	Gerner Willi	AED11			
x	Grasl Andreas	OTN/AET52			
	Grasshoff Brigitte	AET12			
	Hauser Armin	AOE22			
x	Hendry David	Terma Resid.		Alcatel	ASP
	Hinger Jürgen	AOE22	x	ESA/ESTEC	ESA
x	Hohn Rüdiger	AED65			
	Huber Johann	AOA52		**Instruments:**	
	Hund Walter	ASE442	x	MPE (PACS)	MPE
x	Idler Siegmund	AED432	x	RAL (SPIRE)	RAL
	Ivády von András	FAE22	x	SRON (HIFI)	SRON
	Jahn Gerd Dr.	AOE22			
	Kalde Clemens	APE3		**Subcontractors:**	
	Kameter Rudolf	OTN/AET52		Air Liquide, Space Department	AIR
	Kettner Bernhard	AET42		Air Liquide, Space Department	AIRS
	Knoblauch August	AET32		Air Liquide, Orbital System	AIRT
x	Koelle Markus	AOA53		Alcatel Bell Space	ABSP
	Kroeker Jürgen	AED65		Astrium Sub-Subsyst. & Equipment	ASSE
	Kunz Oliver Dr.	AOE22		Austrian Aerospace	AAE
x	Lamprecht Ernst	OTN/ASI21		Austrian Aerospace	AAEM
	Lang Jürgen	ASE442		APCO Technologies S. A.	APCO
	Langfermann Michael	AOA51		Bieri Engineering B. V.	BIER
x	Mack Paul	OTN/AET52		BOC Edwards	BOCE
	Müller Jörg	AOA52		Dutch Space Solar Arrays	DSSA
	Pastorino Michel	ASPI Resid.		EADS CASA Espacio	CASA
	Peltz Heinz-Willi	AOE13		EADS CASA Espacio	ECAS
	Pietroboni Karin	AED65		EADS Space Transportation	ASIP
	Platzer Wilhelm	AED22		Eurocopter	ECD
x	Rebholz Reinhold	AOA51		HTS AG Zürich	HTSZ
	Reuß Friedhelm	AED62		Linde	LIND
	Rühe Wolfgang	AED65		Patria New Technologies Oy	PANT
	Runge Axel	OTN/AET52		Phoenix, Volkmarsen	PHOE
	Sachsse Bernt	AED21		Prototech AS	PROT
x	Schink Dietmar	AED44		QMC Instruments Ltd.	QMC
x	Schlosser Christian	OTN/AET52		Rembe, Brilon	REMB
	Schmidt Rudolf	FAE22		Rosemount Aerospace GmbH	ROSE
	Schweickert Gunn	AOE22		RYMSA, Radiación y Microondas S.A.	RYM
	Steininger Eric	AED44		SENER Ingenieria SA	SEN
x	Stritter Rene	AED11		Stöhr, Königsbrunn	STOE
	Tenhaeff Dieter	AOE22		Terma A/S, Herlev	TER
	Thörmer Klaus-Horst Dr.	OTN/AED65			
	Wagner Klaus	AOE22			