






SPIRE-AST-PRC-002440

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

CI-No: 153 000

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Issue	Date	Sheet	Description of Change	Release
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Table of Content

1	Introduction	8
1.1	Scope	8
1.2	Objective	8
1.3	Requirements to be verified	8
2	Documents/Drawings	9
2.1	Applicable Documents	9
2.2	Reference Documents	9
2.2.1	ASED Reference Documents	9
2.2.2	HIFI Reference Documents	10
2.2.3	PACS Reference Documents	10
2.2.4	SPIRE Reference Documents	11
2.3	On-Hand Documents	11
3	Configuration	12
3.1	Principle Test Set-up	12
3.2	PLM Configuration	12
3.3	Configuration of Items to be tested	14
3.4	GSE Configuration	16
3.4.1	MGSE	16
3.4.2	CVSE	16
3.4.3	EGSE	16
3.4.4	OGSE	17
3.4.5	Special Equipment	17
3.4.6	Laboratory Equipment	18
3.5	Facilities	19
4	Requirements	20
4.1	General Requirements	20
4.2	Environmental Conditions	20
4.3	Precautions and Safety	20
4.3.1	General Safety Requirements	20
4.3.2	ESD Constraints	20
4.4	Activities Management	21
4.4.1	Pre-Test Activities	21

4.4.2	Procedure Variation	21
4.4.3	Criteria for Failure	21
4.4.4	Test Completion and Post-Test Activities	22
4.5	PA Requirements	22
4.6	Personnel	23
5	Activities Flow	25
6	Step by Step Procedure	28
6.1	Instruments Electrical Integration	28
6.1.1	Test Preparation	28
6.1.2	PACS Electrical Integration	29
6.1.3	SPIRE Electrical Integration	30
6.1.4	HIFI Electrical Integration	32
6.2	HIFI LOU Electrical Integration	34
6.2.1	Test Preparation	34
6.2.2	HIFI LOU Electrical Integration	34
6.3	SFT Warm	36
6.3.1	Test Preparation	36
6.3.2	HIFI SFT warm	36
6.3.3	PACS SFT warm	37
6.3.4	SPIRE SFT warm	38
6.4	SFT Cold at He I	39
6.4.1	Test Preparation	39
6.4.2	HIFI SFT Cold at He I	40
6.4.3	PACS SFT Cold at He I	40
6.4.4	SPIRE SFT Cold at He I	41
6.5	SFT Cold at He II	41
6.5.1	Test Preparation	41
6.5.2	HIFI SFT Cold at He II	42
6.5.3	PACS SFT Cold at He II	43
6.5.4	SPIRE SFT Cold at He II	43
6.6	IMT	44
6.6.1	Test Preparation	44
6.6.2	HIFI IMT	46
6.6.3	PACS IMT	47
6.6.4	SPIRE IMT	48
6.6.5	SPIRE/PACS IMT	49
6.6.6	Test Completion	50
6.7	EMC Test	50

7	Summary Sheets	51
7.1	Procedure Variation Summary	51
7.2	Non Conformance Report (NCR) Summary	52
7.3	Sign-off Sheet	53

Table of Figures

<i>Figure 3-1: Principle Test Set-up for EQM Tests</i>	12
<i>Figure 3-2: Set-up in Astrium Clean-Room</i>	19

List of Tables

<i>Table 3-1: PLM Configuration Applicability Matrix</i>	<i>13</i>
<i>Table 3-2: Items to be tested</i>	<i>14</i>
<i>Table 3-3: Laboratory Equipment.....</i>	<i>18</i>
<i>Table 4-1: Personnel.....</i>	<i>23</i>
<i>Table 5-1: Test Flow</i>	<i>27</i>
<i>Table 7-1: List of ACS's.....</i>	<i>51</i>
<i>Table 7-2: List of NCR's.....</i>	<i>52</i>

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 3.2

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	TBD	EGSE Set-up Procedure	
RD 02	HP-2-ASED-TP-0055	EQM-PACS Warm Units Integration with IDAS	Issue TBD
RD 03	HP-2-ASED-TP-0057	EQM-SPIRE Warm Units Integration with IDAS	Issue TBD
RD 04	HP-2-ASED-TP-0058	EQM-HIFI Warm Units Integration with IDAS	Issue TBD

RD 05	HP-2-ASED-PR-0033	PLM EQM EMC Test Procedure	Issue TBD
RD 06	empty		
	- 20		

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	Draft 1.0, 06.04.2005
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	TBD	Switch-on and Switch-off FCU Secondary Power	
RD 27	TBD	Connect LSU Simulator Waveguides to LOU Waveguides	
RD 28	TBD	Installation and operation of EMC Test Source	
RD 29	empty		
	- 40		

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 1.1, 06.12.2004
RD 42	PACS-ME-TP-017	PACS Short Functional Test Warm & Cold	Issue 1.1, 07.04.2005

RD 43	TBD	PACS IMT Procedure
RD 44	TBD	PACS EMC Test Procedure
RD 45	empty	

- 60

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 Integration	Issue 0.1, 06.04.2005
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

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.

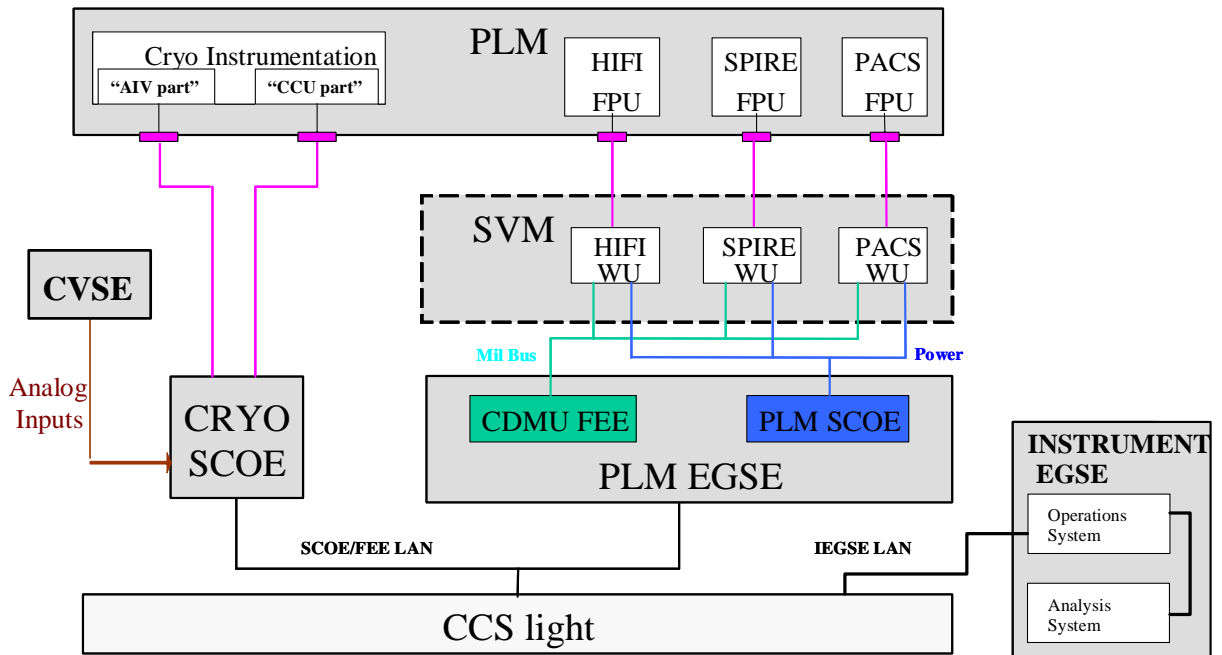


Figure 3-1: Principle Test Set-up for EQM Tests

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

3.2 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 (or B)
Mating of SIH to HIFI/PACS/SPIRE Warm Units and FPU and functional test after mating	B

HIFI LOU electrical integration	C
HIFI/PACS/SPIRE SFT warm	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:

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

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 and mated
- HIFI/PACS/SPIRE Warm Units bench test (stand-alone test with instrument provided EGSE) performed

Configuration C

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

As configuration C with the following differences

Mechanical:

- None

Electrical:

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

Configuration E

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 GSE Configuration

3.4.1 MGSE

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

3.4.2 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

3.4.3 EGSE

3.4.3.1 ASED EGSE

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

3.4.3.2 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

3.4.4 OGSE

Not needed for the activities listed in this procedure.

3.4.5 Special Equipment

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

3.4.6 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

3.5 Facilities

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

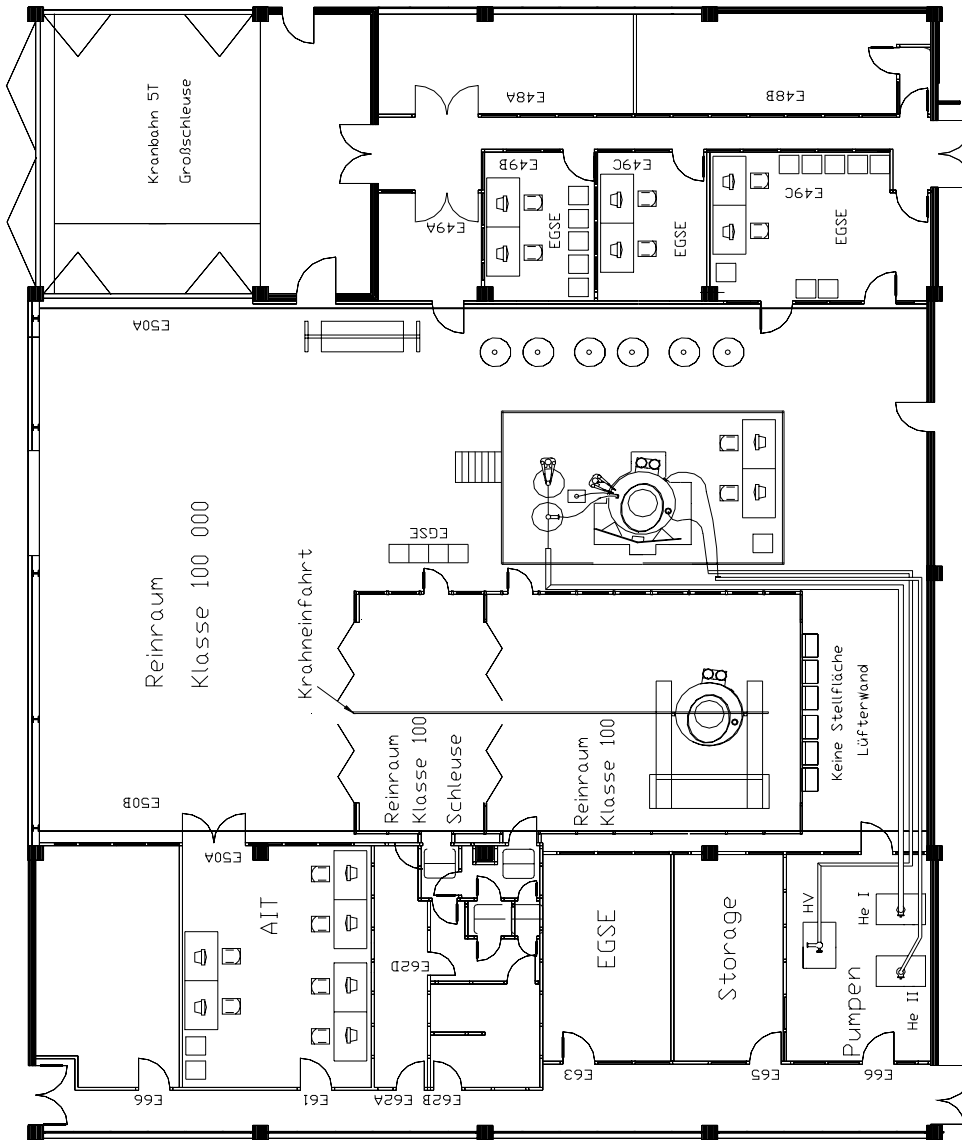


Figure 3-2: Set-up in Astrium Clean-Room

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 Conductor	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
	<i>Instruments electrical integration</i>	
1	Test preparation	See sub-procedure 6.1.1
2	PACS electrical integration (connection of PLM EGSE primary power and bus to PACS Warm Units incl. interface verification and functional tests without FPU, mating of SIH to PACS Warm Units, mating of SIH to PACS FPU, PACS functional test after mating)	See sub-procedure 6.1.2
3	SPIRE electrical integration (connection of PLM EGSE primary power and bus to SPIRE Warm Units incl. interface verification and functional tests without FPU, mating of SIH to SPIRE Warm Units, mating of SIH to SPIRE FPU, SPIRE functional test after mating)	See sub-procedure 6.1.3
4	HIFI electrical integration (connection of PLM EGSE primary power and bus to HIFI Warm Units incl. interface verification and functional tests with	See sub-procedure 6.1.4

No	Activity	Remark
	FPU/LOU simulator, mating of SIH to HIFI Warm Units, mating of SIH to HIFI FPU, HIFI functional test after mating)	
-	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	
5	Test preparation	See sub-procedure 6.2.1
6	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.)	Not part of this procedure
	SFT warm	
7	Test preparation	See sub-procedure 6.3.1
8	HIFI SFT warm	See sub-procedure 6.3.2
9	PACS SFT warm	See sub-procedure 6.3.3
10	SPIRE SFT warm	See sub-procedure 6.3.4
-	PLM activities (cool down and filling, etc.)	Not part of this procedure
	SFT cold He I	
11	Test preparation	See sub-procedure 6.4.1
12	HIFI SFT cold at He I	See sub-procedure 6.4.2
13	PACS SFT cold at He I	See sub-procedure 6.4.3
14	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	
15	Test preparation	See sub-procedure 6.5.1
16	HIFI SFT cold at He II	See sub-procedure 6.5.2
17	PACS SFT cold at He II	See sub-procedure 6.5.3
18	SPIRE SFT cold at He II	See sub-procedure 6.5.4
	IMT	
19	Test preparation	See sub-procedure 6.6.1
20	HIFI IMT	See sub-procedure 6.6.2

No	Activity	Remark
21	PACS IMT	See sub-procedure 6.6.3
22	SPIRE IMT	See sub-procedure 6.6.4
23	PACS/SPIRE Parallel Mode IMT	See sub-procedure 6.6.5
24	Test completion	See sub-procedure 6.6.6
	EMC test	
25	Test preparation	See sub-procedure 6.7.1
26	EMC test PACS	See sub-procedure 6.7.2
27	EMC test SPIRE	See sub-procedure 6.7.3
28	EMC test HIFI	See sub-procedure 6.7.4

Table 5-1: Test Flow

6 Step by Step Procedure

6.1 Instruments Electrical Integration

This sub-procedure describes the electrical connection of the instrument FPU's with the instrument Warm Units and 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 Test Preparation

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

Location:	PA: Name	Date:	Operator:		
			Date:		

6.1.2 PACS Electrical Integration

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.1.2.1	Perform EGSE set-up as per ASED procedure RD 01.					
6.1.2.2	Define and record test session name.			Test session name:		
6.1.2.3	Perform verification and mating of primary power and bus to PACS Warm Units as per ASED procedure RD 02.			Respect ESD requirements. Test report:		
6.1.2.4	Perform functional test of WU as per PACS procedure RD 41 (without FPU connected).			Test report:		
6.1.2.5	Switch off primary power.					
6.1.2.6	Perform mating of SIH to Warm Units. No specific sequence required.			Respect ESD requirements		
6.1.2.7	Perform mating of SIH to FPU. No specific sequence required.			Respect ESD requirements		
6.1.2.8	Record all mates/de-mates in the logbook.					

Location:	PA: Name	Date:	Operator:		
			Date:		

Doc. No: HP-2-ASED-PR-0051

Issue: Issue 1

Date: 26.04.2005

File: HP-2-ASED-PR-0051_1 Instrument PLM EQM Level Test Procedure.doc

Page **29**

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.1.2.9	Define and record test session name.			Test session name:		
6.1.2.10	Switch on primary power.					
6.1.2.11	Perform SFT warm as per PACS procedure RD 42.			Test report:		
6.1.2.12	Switch off primary power.					

6.1.3 SPIRE Electrical Integration

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

Location:	PA: Name	Date:	Operator:		
			Date:		

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.1.3.3	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:		
6.1.3.4	Perform functional test of WU as per SPIRE procedure RD 64 (without FPU connected).			Test report:		
6.1.3.5	Switch off primary power.					
6.1.3.6	Perform mating of SIH to FPU and Warm Units as per SPIRE procedure RD 62.			Respect ESD requirements (see also SPIRE ESD requirements RD 61).		
6.1.3.7	Record all mates/de-mates in the logbook.					
6.1.3.8	Define and record test session name.			Test session name:		
6.1.3.9	Switch on primary power.					
6.1.3.10	Perform functional test as per SPIRE procedure RD 65.			Test report:		

Location:	PA: Name	Date:	Operator:		
			Date:		

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.1.3.11	Switch off primary power.					

6.1.4 HIFI Electrical Integration

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.1.4.1	Perform EGSE set-up as per ASED procedure RD 01.					
6.1.4.2	Define and record test session name.			Test session name:		
6.1.4.3	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:		
6.1.4.4	Perform functional test of WU as per HIFI procedure RD 22, section 2 (with FPU simulator and LOU simulator connected).			Test report:		
6.1.4.5	Switch off primary power taking into account HIFI procedure RD 26.					

Location:	PA: Name	Date:	Operator:		
			Date:		

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.1.4.6	Perform mating of SIH to Warm Units. No specific sequence required.			Respect ESD requirements		
6.1.4.7	Perform mating of SIH to FPU. No specific sequence required.			Respect ESD requirements		
6.1.4.8	Record all mates/de-mates in the logbook.					
6.1.4.9	Define and record test session name.			Test session name:		
6.1.4.10	Switch on primary power taking into account HIFI procedure RD 26.					
6.1.4.11	Perform SFT warm as per HIFI procedure RD 22, section 3 (but without LOU).			Test report:		
6.1.4.12	Switch off primary power taking into account HIFI procedure RD 26.					

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.					

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:		

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.2.2.2	Record all mates/de-mates in the logbook.					
6.2.2.3	Define and record test session name.			Test session name:		
6.2.2.4	Switch on primary power taking into account HIFI procedure RD 26.					
6.2.2.5	Perform SFT warm as per HIFI procedure RD 22, section 3.			Test report:		
6.2.2.6	Switch off primary power taking into account HIFI procedure RD 26.					

Location:	PA: Name	Date:	Operator:		
			Date:		

6.3 SFT Warm

This sub-procedure describes the Short Functional Test (SFT) in "warm" conditions, i. e. the cryostat is evacuated but not cooled down. 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.

6.3.1 Test Preparation

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

6.3.2 HIFI SFT warm

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.3.2.1	Switch on primary power taking into account HIFI procedure RD 26.					

Location:	PA: Name	Date:	Operator:		
			Date:		

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.3.2.2	Perform SFT warm as per HIFI procedure RD 22, section 3.			Test report:		
6.3.2.3	Switch off primary power taking into account HIFI procedure RD 26.					

6.3.3 PACS SFT warm

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.3.3.1	Switch on primary power.					
6.3.3.2	Perform SFT warm as per PACS procedure RD 42.			Test report:		
6.3.3.3	Switch off primary power.					

Location:	PA: Name	Date:	Operator:		
			Date:		

Doc. No: HP-2-ASED-PR-0051

Issue: Issue 1

Date: 26.04.2005

File: HP-2-ASED-PR-0051_1 Instrument PLM EQM Level Test Procedure.doc

Page **37**

6.3.4 SPIRE SFT warm

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.3.4.1	Switch on primary power.					
6.3.4.2	Perform SFT warm as per SPIRE procedure RD 64.			Test report:		
6.3.4.3	Switch off primary power.					

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 (TBC).					
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.					
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

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.4.2.1	Switch on primary power taking into account HIFI procedure RD 26.					
6.4.2.2	Perform SFT Cold at He I as per HIFI procedure RD 22, section 4.			Test report:		
6.4.2.3	Switch off primary power taking into account HIFI procedure RD 26.					

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.					
6.4.3.2	Perform SFT Cold at He I as per PACS procedure RD 42.			Test report:		
6.4.3.3	Switch off primary power.					

Location:	PA: Name	Date:	Operator:		
			Date:		

6.4.4 SPIRE SFT Cold at He I

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.4.4.1	Switch on primary power.					
6.4.4.2	Perform SFT Cold at He I as per SPIRE procedure RD 66.			Test report:		
6.4.4.3	Switch off primary power.					

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
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Location:	PA: Name	Date:	Operator:		
			Date:		

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.5.1.1	Turn PLM in upright position (TBC).					
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:		

6.5.2 HIFI SFT Cold at He II

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.5.2.1	Switch on primary power taking into account HIFI procedure RD 26.					
6.5.2.2	Perform SFT Cold at He II as per HIFI procedure RD 22, section 5.			Test report:		

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 taking into account HIFI procedure RD 26.					

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.					
6.5.3.2	Perform SFT Cold at He II as per PACS procedure RD 42.			Test report:		
6.5.3.3	Switch off primary power.					

6.5.4 SPIRE SFT Cold at He II

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.5.4.1	Switch on primary power.					
Location:		PA: Name	Date:	Operator:		
				Date:		

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.5.4.2	Perform SFT Cold at He II as per SPIRE procedure RD 66.			Test report:		
6.5.4.3	Switch off primary power.					

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 HIFI IMT and in tilted position to $>30^\circ$ in y-direction for PACS and SPIRE IMT.					
6.6.1.2	Refill HTT and AXT, if required, according to dedicated procedures.					

Location:	PA: Name	Date:	Operator:		
			Date:		

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
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.					
6.6.1.4	Perform EGSE set-up as per ASED procedure RD 01.					
6.6.1.5	Define and record test session name.			Test session name:		
6.6.1.6	Switch on primary power of all instruments. HIFI: Switch on primary power taking into account HIFI procedure RD 26.					
6.6.1.7	Switch all instruments in Stand-By Mode.					

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	Check PLM position.	Upright				
6.6.2.2	Connect LSU simulator waveguides to LOU waveguides flange as per HIFI procedure RD 27.					
6.6.2.3	Check cryostat set-up. Check and adjust mass flow through optical bench.	~ 2.2 mg/s				
6.6.2.4	Perform IMT as per HIFI procedure RD 22, section 6 and 7.			Check and record cryostat temperatures throughout IMT. Test report:		

Location:	PA: Name	Date:	Operator:		
			Date:		

Doc. No: HP-2-ASED-PR-0051

Issue: Issue 1

Date: 26.04.2005

File: HP-2-ASED-PR-0051_1 Instrument PLM EQM Level Test Procedure.doc

Page 46

6.6.3 PACS IMT

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.6.3.1	Check PLM position.	>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 PACS procedure RD 43.					
6.6.3.3	Fine tuning of 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.			Check and record cryostat temperatures throughout IMT. Test report:		

Location:	PA: Name	Date:	Operator:		
			Date:		

6.6.4 SPIRE IMT

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.6.4.1	Check PLM position.	>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 SPIRE procedure RD 67.					
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				
6.6.4.5	Perform IMT as per SPIRE procedure RD 67.			Check and record cryostat temperatures throughout IMT. Test report:		

Location:	PA: Name	Date:	Operator:		
			Date:		

Doc. No: HP-2-ASED-PR-0051

Issue: Issue 1

Date: 26.04.2005

File: HP-2-ASED-PR-0051_1 Instrument PLM EQM Level Test Procedure.doc

Page 48

6.6.5 SPIRE/PACS IMT

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.6.5.1	Check PLM position.	>30° to +y-direction		Tilt is required only during the cooler recycling, no instrument requirements for other operations.		
6.6.5.2	Perform cover flushing as per procedure TBD, if required.					
6.6.5.3	Fine tuning of cover background radiation as per SPIRE procedure RD 67.					
6.6.5.4	Check cryostat set-up. Check and adjust mass flow through optical bench	~ 2.2 mg/s				
6.6.5.5	Perform IMT (SPIRE/PACS Parallel Mode) as per SPIRE procedure RD 67.			Check and record cryostat temperatures throughout IMT. Test Report:		

Location:	PA: Name	Date:	Operator:		
			Date:		

Doc. No: HP-2-ASED-PR-0051

Issue: Issue 1

Date: 26.04.2005

File: HP-2-ASED-PR-0051_1 Instrument PLM EQM Level Test Procedure.doc

Page 49

6.6.6 Test Completion

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.6.6.1	Switch off primary power of all 3 instruments HIFI: Switch off primary power taking into account HIFI procedure RD 26.	OK				

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.

Step-No.	Test-Step-Description	Nominal Value	Actual Value	Comments	P	N
6.7.1	Perform EMC test as per procedure RD 04 taking into account HIFI procedures RD 22, 23 and 29, PACS procedure RD 44 and SPIRE procedure RD 68.			Test report:		

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		

END OF DOCUMENT

	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
	Ivány 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			