Title: **SPIRE IST Specific Performance Test**

CI-No: 125200

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Issue	Date	Sheet	Description of Change	Release
1.0	25.01.08	All	First Formal Issue	
1.1	24.07.08	14, 100,	Implementation of updated RAL procedure, ref. SPIRE-RAL-PRC-2704, issue 3.2	
		92	SPIRE I-EGSE Disconnection procedure adapted	
1.2	13.08.08	14	Implementation of updated RAL procedure, ref. SPIRE-RAL-PRC-2704, issue 3.4	
		23	note: Temperature for JFET switch on "~~will~~ **may**" be adjusted	
		25	EGSE / OBSW versions updated	
		33	Step 7.5.1.6 - new Step 7.5.1.7 - new	
		34	Step 7.5.1.11: test script name updated Step 7.5.1.12: typo in parameter removed	
		93	Step 7.5.7.5 - new Step 7.5.7.6 - new	

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1 Scope

This test procedure defines the instructions for the conducting of the SPIRE Specific Performance Test (SPT) to be performed in He II conditions. The corresponding as-run procedure will become part of the test report.

This procedure covers only operational aspects, as e.g. commanding and monitoring of the instrument and science data acquisition. The real time analysis of the acquired science data concerning performance aspects will be done by RAL using separate procedures and tools (e.g. on the I-EGSE) in parallel.

This procedure is based on the requirements of the Test Specification for HERSCHEL Instruments FM tests performed at satellite level (AD6). The EMC tests run overnight require a specific test set-up which will be covered by a separate procedure.

Major input to this test procedure is the SPIRE IST Specific Performance Test Procedure from RAL. The relevant test steps of the RAL procedure (AD9, attached as ANNEX 2) are called up in section 7 (step-by-step procedure). No redundancies are tested within this sequence.

The following tests from the SPIRE procedure (AD9) are not included:

Tests not included in schedule	**Reason**
SPEC high resolution mode SOF1	Cannot be done with cryostat vertical
Spectrometer Mechanism Microvibration Test	Cannot be done with cryostat vertical
EMC - Photometer most sensitive mode	N/A - to be used during EMC testing
EMC – Spectrometer most sensitive mode	N/A - to be used during EMC testing
EMC – SPIRE most Emissive mode	N/A - to be used during EMC testing
300mk Stage Decontamination	No time
Photometer noise stability versus bias frequency under flight ambient condition	No time
Phot scan mode POF5	No time

Constraints

- This procedure requires the presence of SPIRE personnel as the I-EGSE will be required to assess the results online as part of the pass/fail criteria.
- Before carrying out the next procedure within the test sequence, always ask for the go ahead by the RAL staff.

- Chapter 4 of this document specifies the sequence to be executed. Each of the steps in the sequence corresponds to procedures in section 7.5.
- The procedure tables in section 7.5 include blank boxes where the actual values of parameters can be noted. Based on the comparison with the expected values the success or failure of a step should be recorded in the final column of the table.
- The last two columns in a procedure table shall be used to record the overall Pass/Fail result of each test.
- Any text in boldface in the procedural steps generally indicates an action which may have to be performed manually by the CCS staff.
- The total available test duration are 3 days for SPT and 2 nights for EMC testing?
- For the micro-vibration test the accelerometer acquisition needs to be activated and the test coordinated with the ETS team.
- To perform the overnight EMC tests, the test adapter for the noise injection must have been installed between the PCDU and the SPIRE FCU.

1.1 Objective

The objective of the SPIRE SPT is:

- Verification of the correct performance of the SPIRE instrument and the compatibility with the spacecraft and
- Verification of operation procedures which will be executed during the mission

1.2 Test Flow

This test flow is structured to reflect nominal operations of the FM SPIRE.

The flow is as follows:

1. Power ON and configure SPIRE I-EGSE for test
2. Power ON SPIRE Prime and enable Mil1553B-bus interface
3. Run test sequence according to AD6, chapter 4.7.3.3

SPIRE SPT Day 1

Step	Test Name	Description/Purpose	Time Required (nominal)	Start Mode	End Mode	Lid Temp
1	Cooler recycle (manual)	First time the cooler is recycled we take it one step at a time	2	REDY	REDY	<15 K
2	Switch to PHOT STBY	Switch the instrument on in photometer mode using ILT settings and Vss from CFT DCU-07P	0,25	REDY	PHOT STBY	<15 K
3	Wait for stabilisation	Need to wait until 300 mK stage is drifting slowly enough to allow detector characterisation	0	PHOT STBY	PHOT STBY	<15 K
4	BSM Control Loop Setting	Sets up the parameters of the BSM control loop - can be carried out during stabilisation	1	PHOT STBY	PHOT STBY	<15 K
5	Photometer bias phase optimisation	Sets up a grid of phase versus bias frequency for photometer BDAs	2	PHOT STBY	PHOT STBY	<15 K
	SHIFT 1 CONTINGENCY	**END OF SHIFT TIDY UP READY FOR HANDOVER**	**1**			
6	Photometer noise stability versus bias frequency	Determination of the noise spectrum versus bias frequency under dark conditions	2	PHOT STBY	PHOT STBY	<15 K
7	Photometer bias noise optimisation	Sets up the optimum bias setting for lowest noise in the photometer	2	PHOT STBY	PHOT STBY	<15 K

		BDAs				
8	Photometer Ambient Background Verification	First loadcurve to determine straylight environment under standard ground conditions	1	PHOT STBY	PHOT STBY	<15 K
9	PTC Headroom Characterisation	Provides data necessary for evaluation of PTC operations	3	PHOT STBY	PHOT STBY	<15 K
10	PCAL Photometer Characterisation	Verification that PCAL illumination levels are as expected compared to EQM and ILT	0,5	PHOT STBY	PHOT STBY	<15 K
	SHIFT 2 CONTINGENCY	**END OF SHIFT TIDY UP READY FOR OVERNIGHT**	**1**			**TBD**
11	**Overnight Hold on Test Activities**		7,25	PHOT STBY	PHOT OBSV	TBD

SPIRE SPT Day 2

Step	Test Name	Description/Purpose	Time Required (nominal)	Start Mode	End Mode	Lid Temp
	Test preparation	Get cryostat into correct state for continuation of SPIRE testing. Low drifts and lid <15 K	2	PHOT STBY	PHOT STBY	TBC
12	PCAL Flash	Standard PCAL flash sequence to check detector operation	0,25	PHOT STBY	PHOT STBY	<15 K
13	Photometer thermal stability versus bias amplitude	Determine thermal response of the detectors to a step change bias	3	PHOT STBY	PHOT STBY	<15 K
14	Change lid temperature	Move lid to nominal telescope flight temperature	2	PHOT STBY	PHOT STBY	Variable
15	Photometer Thermal Control Verification	First test of PTC VM using predetermined parameters from Day 1	0	PHOT STBY	PHOT STBY	Variable
	SHIFT 1 CONTINGENCY	**END OF SHIFT TIDY UP READY FOR HANDOVER**	**1**			
16	Photometer bias phase optimisation	Sets up a grid of phase versus bias frequency for photometer BDAs under flight conditions	1	PHOT STBY	PHOT STBY	70<T<90K
17	Photometer Ambient Background Verification	Loadcurve to determine environment under close to flight conditions	1	PHOT STBY	PHOT STBY	70<T<90K
18	SPIRE to REDY Mode	Switches off spectrometer mode and switches to REDY	0,25	PHOT STBY	REDY	70<T<90K
19	Switch to SPEC STBY	Switch the instrument to in spectrometer mode (sans SMEC) using ILT settings and Vss from CFT DCU-07P	0,25	REDY	SPEC STBY	70<T<90K

20	Spectrometer bias phase optimisation	Sets up a grid of phase versus bias frequency for spectrometer BDAs under flight conditions	1	SPEC STBY	SPEC STBY	70<T<90K
21	Spectrometer bias noise optimisation	Sets up the optimum bias setting for lowest noise in the spectrometer BDAs under flight conditions	1	SPEC STBY	SPEC STBY	70<T<90K
22	Spectrometer noise stability versus bias frequency	Determination of the noise spectrum versus bias frequency close to flight conditions	1	SPEC STBY	SPEC STBY	70<T<90K
23	Spectrometer Ambient Background Verification	Loadcurve to determine environment under close to flight conditions	1	SPEC STBY	SPEC STBY	70<T<90K
24	PCAL Spectrometer Characterisation	Verification that PCAL illumination levels are as expected compared to ILT	0,5	SPEC STBY	SPEC STBY	70<T<90K
	SHIFT 2 CONTINGENCY	**END OF SHIFT TIDY UP READY FOR OVERNIGHT**	1	SPEC STBY	SPEC STBY	TBD
25	**Overnight Hold on Test Activities**		7,75	SPEC STBY	SPEC STBY	TBD

SPIRE SPT Day 3

Step	Test Name	Description/Purpose	Time Required (nominal)	Start Mode	End Mode	Lid Temp
	Test preparation	Get cryostat into correct state for continuation of SPIRE testing. Low drifts and lid <15 K	0	SPEC STBY	SPEC STBY	TBC
	Switch to REDY	Switch from SPEC STBY (assumed overnight status) to REDY mode in prep for cooler recylce		PHOT STBY	REDY	<15 K
26			0,25			
27	Cooler recycle (automatic)	First automatic cooler recylce	2	REDY	REDY	<15 K
	Wait for stabilisation	Need to wait until 300 mK stage is drifting slowly enough to allow detector characterisation	1	SPEC STBY	SPEC STBY	<15 K
28						
29	Spectrometer bias phase optimisation	Sets up a grid of phase versus bias frequency for spectrometer BDAs	1	SPEC STBY	SPEC STBY	<15 K
30	Spectrometer bias noise optimisation	Sets up the optimum bias setting for lowest noise in the spectrometer BDAs	1	SPEC STBY	SPEC STBY	<15 K
31	Spectrometer noise stability versus bias frequency	Determination of the noise spectrum versus bias frequency under dark conditions	2	SPEC STBY	SPEC STBY	<15 K
	SHIFT 1 CONTINGENCY	**END OF SHIFT TIDY UP READY FOR HANDOVER**	**1**			

32	SCAL Characteristion	Check of SCAL operation and illumination	2	SPEC STBY	SPEC STBY	<15 K
33	Microphonics Prep	Switch ON ACMS, RWLs and initiate ETS recording of accelerometers	0.5			
34	Spectometer Detector Microphonics Test	Not fully defined - requires discussion with S/C operators	1,5	SPEC STBY	SPEC STBY	<15 K
35	SPIRE to REDY Mode	Switches off spectrometer mode and switches to REDY	0,25	SPEC STBY	REDY	<15 K
36	SPIRE to PHOT STBY Mode	Switches on photometer	0,25	REDY	PHOT STBY	<15 K
37	Photometer Detector Microphonics Test	Not fully defined - requires discussion with S/C operators	1,5	PHOT STBY	PHOT STBY	<15 K
38	Microphonics De-Prep	Stop ACMS and stop ETS accelerometer recording	0.5			
	SHIFT 2 CONTINGENCY	**END OF SHIFT TIDY UP READY FOR OVERNIGHT**	**2**			
39	**Switch SPIRE to OFF**	Switch the instrument off and go home	0,5	SPEC STBY	OFF	

4. Power OFF SPIRE Prime and disable Mil1553B-bus interface
5. Power OFF SPIRE I-EGSE

2 Documents/Drawings

2.1 Applicable Documents

AD 1	FM SPIRE PFM Final Electrical Integration Procedure	HP-2-ASED-TP-0166
AD 2	Herschel PCDU & CDMS Nominal Switch On/Off Procedure	HP-2-ASED-PR-0070
AD 3	Herschel SAT Emergency Switch Off Procedure	HP-2-ASED-PR-0071
AD 4	PA Plan	HP-2-ASED-PL-0007
AD 5	SPIRE I-EGSE Set-Up	SPIRE-RAL-DOC-002841, iss. 2.2
AD 6	Test Specification for Herschel Instrument AVM & FM Tests Performed at Satellite Level	H-P-2-ASP-TS-1083, issue 2
AD 7	H-P GDIR	H-P-1-ASPI-SP-0027
AD 8	HERSCHEL Instrument Power ON-OFF and Mode Switching Procedure for Functional Testing	HP-2-ASED-TP-0206, Iss.1
AD 9	SPIRE IST Specific Performance Test Procedures	SPIRE-RAL-PRC-2704, iss. 3.4
AD 10	SPIRE System Level CS Test Procedure	SPIRE-RAL-PRC-003040, iss. 1.0

2.2 Reference Documents

RD 1	Herschel Planck Central Checkout System System User Manual	H-P-4-TE-MA-0010
RD 2	Herschel CDMU ASW S/W Interface Control Document	H-P-4-SSF-IC-0001
RD 3	Herschel CDMU BSW S/W Interface Control Document	H-P-4-SES-NT-0076
RD 4	SPIRE IID-B	SCI-PT-IIDB/SPIRE-02124
RD 5	SPIRE Functional Test Specification Iss. 1.4	SPIRE-RAL-DOC-001652
RD 6	SPIRE Instrument User Manual Iss. 1.0	SPIRE-RAL-PRJ-002395
RD 7	H/P OBT-UTC Time Synchronisation Technical Note Iss. 1.3	PT-CMOC-OPS-TN-6604-OPS-OGH
RD8	HERSCHEL FM Micro-vibration Test Specification	H-P-2-ASP-SP-1280, iss. 1

2.3 Other Documents

None

2.4 Acronyms & Abbreviations

1553	MIL-STD-1553B conform communication interface
AAD	Attitude Anomaly Detector
ACC	ACMS Control Computer
ACMS	Attitude Control and Measurement Subsystem
AD	Applicable Document
AIR	ACC In Reconfiguration
AIT	Assembly, Integration and Test
AIV	Assembly, Integration and Verification
APID	Application Process ID
ASW	Application Software
AVM	Avionics Model
BOLC	BOLometer Control unit (PACS)
BSW	Basic Software
CBH	Catalyst Bed Heater
CCS	Central Check-out System
CCSDS	Consultative Committee for Space Data Systems
CDMU	Control and Data Management Unit
CDMS	Control and Data Management Sub-system
CIR	CDMU In Reconfiguration
CLCW	Command Link Control Word
CLTU	Command Link Transmission Unit
CPDU	Command Pulse Distribution Unit
CRS	Coarse Rate Sensor
CTR	Central on board Reference Time
DCU	Detector Control Unit (SPIRE)
DEC	Detectors Electronics Control unit (PACS)

DMC	Detector and Mechanism Control unit (PACS)
DPU	Digital Processing Unit
DRCU	Detector Readout & Control Unit (SPIRE)
EEPROM	Electrically Erasable PROM
EGSE	Electrical Ground Support Equipment
FCL	Fold-back Current Limiter
FCU	FPU Control Unit (Spire)
FCV	Flow Control Valves
FDIR	Failure Detection, Isolation, and Recovery
FPU	Focal Plane Unit
GDIR	General Design and Interface Requirement
GRP	Group Heaters Switch
HBR	High Bit Rate
HL/HLC	High Level command
HP/HPC	High Priority commands
HPLM	Herschel PayLoad Module
HPSDB	Herschel Planck System Data Base
HW	Hardware
i.a.w.	In accordance with
I/F	InterFace
I/O	Input/Output
ICD	Interface Control Document
IST	Integrated System Test
LCL	Latching Current Limiter
LV	Latching Valves
LBR	Low Bit Rate
MAP	Multiplexed Access Point
MBR	Medium Bit Rate
MCU	Mechanisms Control Unit (SPIRE)
MEC	Mechanisms Electronics Control unit (PACS)
ML 16	Memory Load command (ML 16)
MM	Memory Module

MOIS	Mission Operations Information System
MTL	Mission Timeline
NRZ-L	Non Return to Zero – Litton
OBCP	On-Board Control Procedure
OBDH	On-Board Data Handling
OBMF	On-Board Monitoring Function
OBRT/OBT	On-Board Reference Time
OIRD	Operation Interface Requirement Document
PACS	Photodetector Array Camera & Spectrometer
P/L	Payload
PCDU/PCS	Power Control Distribution Unit/Power Control Subsystem
PM	Processor Module
PROM	Programmable Read Only Memory
PSK	Phase Shift Keying
RA	Rate Anomaly
RAM	Random Access Memory
RCS	Reaction Control Subsystem
RD	Reference Document
RF	Radio Frequency
RM	Reconfiguration Module
RT	1553 Remote Terminal
RTU	RT Unit
RTA	RTU
RWL	Reaction Wheel Assembly
SA	1553 Remote Terminal Sub Address
SAS	Sun Acquisition Sensor
SCOE	Special Check-out Equipment
SCU	Subsytems Control Unit (SPIRE)
SIR	S/C In Reconfiguration
SIT	Subsystem Integrated Test
SP	Sun Pointing
SPIRE	Spectral & Photometric Imaging Receiver

SPU	Signal Processing Unit (PACS)
SSMM	Solid State Mass Memory
STR	Star Tracker
SVM	Service Module
SW	Software
TAI	International Atomic Time
TC	TeleCommand
TFG	Transfer Frame Generator
TM	TeleMetry
TTC	Telemetry Tracking & Command subsystem
TTR	Telemetry Telecommand and Reconfiguration
UFT	Unit Functional Test
VC	Virtual Channel
WD	Watchdog

3 Configuration

3.1 Satellite Configuration

The test requires use of the HERSCHEL S/C integrated with HSS and telescope, powered on in its basic test mode (i.e. quick switch on (PCDU & CDMS), in accordance with AD 2. SPIRE FM units will be powered ON as per this procedure on the basis that the FPU has already been successfully integrated and tested including the warm units.

The test shall be executed at He-II conditions and its duration shall not exceed three days of testing.

3.2 EGSE Configuration

This test requires the EGSE to be configured and elements powered on in accordance with AD 2.

I-EGSE shall be configured and connected to the HPCCS in accordance with AD5.

3.3 Set-up

SPIRE Test Scripts for the test must be loaded on to the HPCCS and checked in prior to start of test.

4 Test Sequence

4.1 Test Flow

The SPIRE Special Performance Test sequence during IST 1 including EMC CS shall be executed following chapter 4.7.3.2 of AD6, recalled hereafter:

SPIRE Special Performance Test (SPT/IMT) during IST1 (3 days) + EMC CS				69:15:00	SPIRE-RAL-PRC-002704_2.4 - SPIRE_SPT_Procedures	section
SPIRE SPT Day 1				24:00:00		
			SVM and SPIRE Switch ON	1:00:00		
D1		1	Cooler recycle (manual)	2:00:00	Procedure: Cooler recycle (manual)	2.2
D1		2	Switch to PHOT STBY	0:15:00		
D1		3	Wait for stabilisation	0:00:00		
D1		4	BSM Control Loop Setting	1:00:00	Procedure: BSM Control Loop Setting	2.1
D1		5	Photometer bias phase optimisation	2:00:00	Procedure: Photometer bias phase optimisation	2.4
D1			SHIFT 1 CONTINGENCY	1:00:00		
D1		6	Photometer noise stability versus bias frequency	2:00:00	Procedure: Photometer noise stability versus bias frequency	2.6
D1		7	Photometer bias noise optimisation	2:00:00	Procedure: Photometer bias noise optimisation	2.5
D1		8	Photometer Ambient Background Verification	1:00:00	Procedure: Photometer Ambient Background Verification	2.8
D1		9	PTC Headroom Characterisation	3:00:00	Procedure: PTC Headroom Characterisation	2.9
D1		10	PCAL Photometer Characterisation	0:30:00	Procedure: PCAL Photometer Characterisation	2.11
D1			SHIFT 2 CONTINGENCY	1:00:00		
D1		11	Overnight EMC CS test (frequency search)	8:15:00		
SPIRE SPT Day 2				22:00:00		
D2			Test preparation	0:00:00		
D2		12	PCAL Flash	0:15:00		
D2		13	Photometer thermal stability versus bias amplitude	3:00:00	Procedure: Photometer thermal stability versus bias amplitude	2.7
D2		14	Change lid temperature	2:00:00		
D2		15	Photometer Thermal Control Verification	0:00:00	Procedure: Photometer Thermal Control Verification	2.10
D2			SHIFT 1 CONTINGENCY	1:00:00		
D2		16	Photometer bias phase optimisation	1:00:00	Procedure: Photometer bias phase optimisation	2.4
D2		17	Photometer Ambient Background Verification	1:00:00	Procedure: Photometer Ambient Background Verification	2.8
D2		18	SPIRE to REDY Mode	0:15:00		
D2		19	Switch to SPEC STBY	0:15:00		
D2		20	Spectrometer bias phase optimisation	1:00:00	Procedure: Spectrometer bias phase optimisation	2.12
D2		21	Spectrometer bias noise optimisation	1:00:00	Procedure: Spectrometer bias noise optimisation	2.13
D2		22	Spectrometer noise stability versus bias frequency	1:00:00	Procedure: Spectrometer noise stability versus bias frequency	2.14
D2		23	Spectrometer Ambient Background Verification	1:00:00	Procedure: Spectrometer Ambient Background Verification	2.15
D2		24	PCAL Spectrometer Characterisation	0:30:00	Procedure: PCAL Spectrometer Characterisation	2.16
D2			SHIFT 2 CONTINGENCY	1:00:00		
D2		25	Overnight Hold on Test Activities	7:45:00		
SPIRE SPT Day 3				22:15:00		
D3			Test preparation	0:00:00		
D3		26	Switch to REDY	0:15:00		
D3		27	Cooler recycle (automatic)	2:00:00	Procedure: Cooler recycle (automatic)	2.3
D3		28	Wait for stabilisation	1:00:00		
D3		29	Spectrometer bias phase optimisation	1:00:00	Procedure: Spectrometer bias phase optimisation	2.12
D3		30	Spectrometer bias noise optimisation	1:00:00	Procedure: Spectrometer bias noise optimisation	2.13
D3		31	Spectrometer noise stability versus bias frequency	2:00:00	Procedure: Spectrometer noise stability versus bias frequency	2.14
D3			SHIFT 1 CONTINGENCY	1:00:00		
D3		32	SCAL Characteristion	2:00:00		
D3		33	Spectometer Detector Microphonics Test	1:30:00	Procedure: Spectometer Detector Microphonics Test	2.21
D3		34	SPIRE to REDY Mode	0:15:00		
D3		35	SPIRE to PHOT STBY Mode	0:15:00		
D3		36	Photometer Detector Microphonics Test	1:30:00	Procedure: Photometer Detector Microphonics Test	2.20
D3			SHIFT 2 CONTINGENCY	2:00:00		
D3			Overnight EMC CS test (susceptibility level at spot	6:00:00		
D3		37	Switch SPIRE to OFF	0:30:00		

The HPCSS must also have the following MIB files for SPIRE loaded:

HPCCS Software	Version	Comment	Confirmed Installed
SPIRE MIB version			

The SPIRE I-EGSE will be running the following software for the test:

I-EGSE Software	Version	Comment
SPIRE MIB version		
SCOS version		

5 Conditions

5.1 Personnel

Responsibility	Name / Organisation
Test Director	
Test Conductor	
EGSE Operator	
PA Responsible	
Instrument Representative	
Customer Representative	
ESA Representative	

5.2 Environmental

The actual clean room environmental conditions for the test shall be recorded below.

Environmental	Nominal	Actual
Clean Room Class	class 100 000 or better	
Temperature	22°C ± 3°C	
Rel. Humidity	40 % - 60 %	
Pressure	Ambient	

5.3 Cryostat

During the SPT the HTT shall be closed (i.e. V102/V104 closed), and the cooling of the OBA and shields shall be provided by an external Dewar (baseline) or HOT (optional), with Helium flow rate adjusted to about 100 mg/s to 1 g/s.

The test will be performed on the MPT with the S/C vertical and tilted by 20° from z-axis and +y-axis down.

The cryo-cover mirror shall be cooled down to < 20 K by He flushing from an external Dewar. The cryo-cover temperature shall be controlled by adjusting the He flow with valves at the Dewar and the transfer line.

The relevant parameters shall be adjusted such that the following conditions are achieved for the duration of a day shift:

Level	Requirements acc. to IID-A, Table 7.3.5-1 [K]	Test Specification (AD6) [K]	Temperature Sensors	Actual Values		
				Day 1	Day 2	Day 3
SPIRE L0	T < 2.0 K	T < 1.9	T225, T226, T227			
SPIRE L1	T < 6.2 K	4.3 < T <4.5	T235, T236			
SPIRE L2	T < 12 K	T < 6.0	T254, T256, T258			
SPIRE L3	T < 15 K	10 < T <15 *)	T246, T247			

*) may be adjusted for JFET switch ON only

5.4 Operational

The SPIRE commanding shall be performed using the delivered and released set of scripts which are generated from the SPIRE database. The instrument HK telemetry packets shall be received and visualized on the instrument SCOS 2000 monitors. Real time analysis shall be performed by means of IEGSE by RAL. The entire related TC and TM of each test step shall be stored and made available for further analysis within a few minutes after the end of the particular test step.

All SCOS 2000 displays are defined as part of the SPIRE MIB, which will be delivered via the HPSDB. All TC´s which are send during the execution of the TOPE-Tcl scripts are defined in this database as well.

- **Note: FDIR is not required for this SPIRE test.**

5.5 General Precautions and Safety

Non-test specific precautions and safety considerations are detailed in section 5.3 of AD 2. Specific safety issues and general precautions for the tests to be performed are detailed in the following sections.

5.5.1 General Safety Requirements, Precautions

In the event of unrecoverable anomaly requiring emergency switch off of the satellite, the switch off shall be performed in accordance with AD 3.

5.5.2 ESD constraints

Normal ESD constraints are to be observed during the test.

5.5.3 Special QA Requirements

None.

5.6 GSE

Non-test specific GSE details are provided in section 5.4 of AD 2. Specific GSE needs for the tests to performed are detailed in the following sections.

5.6.1 MGSE

S/C on MPT

5.6.2 CVSE

Dewar to flush shield and cover

5.6.3 EGSE/Software

The I-EGSE is required for this test and shall be connected to the HPCCS in accordance with AD 5.

The SPIRE IEGSE shall be running with the following software version for the test:

- HPSDB: HP-ASP-LI-1441_10
- SPIRE scripts with release note: SPIRE_FM_SPTs_12August2008_release_note.txt, dated 16th July 2008
- SPIRE merged MIB: Release note H-P-2-ASP-LI-1424_4, “SPIRE –cryo- Merged Database”

On-Board S/W:

CDMS ASW: Version 3.4.0.9

SPIRE OBS version:

Version DPU 2.2.H Partition 1 ; main and redundant
Version DPU 2.2.H partition 2 ; main and redundant

5.6.4 OGSE

None.

5.6.5 Special Equipment

For the EMC tests overnight specific equipment is required which is, however, detailed in the respective EMC procedure.

6 Requirements to be verified and Test Criteria

This is a performance check of the SPIRE FM under He II conditions.

This test is a specific performance test (SPT) of the SPIRE PFM instrument integrated on the HERSCHEL spacecraft under He II conditions. The instrument performance requirements to be verified by this test are specified by ESA versus RAL. Specific restrictions for this test are highlighted in chapter 7.4 of this procedure.

This test procedure covers the operational aspect of the SPT only. The related pass/fail criteria is to compare for each test step the actual (achieved) results with the nominal (expected) results, as defined in chapter 7 (step-by-step procedure).

The real time analysis of the acquired science data concerning performance aspects will be done by RAL. Also the evaluation of the scientific data and reporting of the evaluation results will be done by RAL. RAL will finally assess the achieved performance versus the requirements.

Typically, the Post Test Review (PTR) will be held before the completion of the scientific data evaluation and, therefore, only a preliminary assessment of the test success can be made at the PTR.

The test is considered as preliminary successful if all steps defined in the step-by-step procedure (chapter 7) reveal compliant results. If all commands have been successfully executed and the housekeeping data have not indicated any anomalies or faults, the science data could be correctly downloaded and the real time analyses performed by RAL have not revealed any degradation of the instrument performance.

The final conclusion of the test will be drawn after the completion of the post processing of the SPIRE science data and comparison of the results with the predictions.

It should be noted that the EMC CS procedures according to AD10 are attached (ANNEX 3). These allow the instrument been set up in the correct mode at the end of each test day for the overnight EMC test activities. The EMC test activities are described in a dedicated separate ASED procedure.

7 Test Procedure

7.1 Initial EGSE and Satellite Configuration for the Test

The Spire FM Final Integration according to the Test Procedure ref. AD 1 must be successfully completed before the execution of this procedure.
The EGSE and Satellite must be configured according to AD 2 prior to start of test. Before executing any of the procedures, please, always check with the Instrument-EGSE staff.

In the event of emergency the Satellite SHALL be switched down according to AD 3.

The CCS is only required to check changes in instrument configuration related HK parameters.
For each test the instrument will be in a pre-defined mode as listed in the IUM (RD07).
For the SPIRE Cooler recycle it is assumed that the Herschel cryostat will be tilted about the z-axis ≥ +20 degrees (such that the plane of the SOB is at least 20 degrees from the vertical with the +Y Spacecraft axis downwards).
The procedures should be suitable for operation of the Prime side of the instrument.
Several manual procedures are present in this document for which TCL scripts are used for command sequence generation. The procedures require minimal action from the CCS operator and will be clearly explained within this document.

The converted TM parameter values are extracted from the MIB in use for PFM ILT. These values are subject to change for both prime and redundant operations.

7.2 Open Issues

- The ability to operate the PTC control loop is not yet confirmed – some extra interactive testing may be required to allow this to happen
- The sequencing of the tests and under which phase of the test plan they are to be done is not implied by the order of the procedures in this note.

7.3 Duration

The allocated duration for executing the entire sequence of procedures, including switch off of the SPIRE instrument afterwards is 3 days according to AD6.

7.4 Operational Constraints for Procedures

The table given here lists the requirements for the cryo-operational conditions that must be met in order to carry out the SPT procedures listed in this document.

Colour coding

No restriction
Some Restriction
Very Restricted

Procedure	Description	Type	Hel	Hell	Orient	Cover	Notes
SPIRE-FM-DPU-ON-P	DPU PRIME Power up and OBS start	IST-FT	YES	YES	Any	Any	
SPIRE-FM-DRCU-ON-P	DRCU PRIME Power up	IST-FT	YES	YES	Any	Any	
SPIRE-FM-FUNC-SCU-02-P	SCU Nom. Science Contents check PRIME	IST-FT	YES	YES	Any	Any	
SPIRE-FM-FUNC-SCU-03-P	SCU DC Thermometry check PRIME	IST-FT	YES	YES	Any	Any	
SPIRE-FM-FUNC-SCU-06-P	SCU AC Thermometry check PRIME	IST-FT	YES	YES	Any	Any	
SPIRE-FM-FUNC-SCU-07-P	Sorption Cooler Heaters Check PRIME	IST-FT	YES	YES	Any	Any	
SPIRE-FM-FUNC-PCAL-01-P	PCAL Characterisation Test PRIME	IST-FT	YES	YES	Any	Any	
SPIRE-FM-FUNC-SCAL-01-P	SCAL Characterisation Test PRIME	IST-FT	YES	YES	Any	Any	

Procedure	Description	Type	Hel	Hell	Orient	Cover	Notes
SPIRE-FM-FUNC-SCAL-02-P (TBC)	SCAL PID Check PRIME (TBC)	IST-FT	YES	YES	Any	Any	
SPIRE-FM-FUNC-MCU-01-P	MCU Boot Check PRIME	IST-FT	YES	YES	Any	Any	
SPIRE-FM-FUNC-MCU-03-P	MCU Nom. Science Contents Check PRIME	IST-FT	YES	YES	Any	Any	
SPIRE-FM-FUNC-BSM-01-P	BSM Chop/Jiggle Sensors check PRIME	IST-FT	YES	YES	Any	Any	
SPIRE-FM-FUNC-BSM-03-P	BSM Open Loop Dynamics Check PRIME	IST-FT	YES	YES	Any	Any	
SPIRE-FM-FUNC-BSM-05A-P	BSM Open Loop Chop Test PRIME	IST-FT	YES	YES	Any	Any	
SPIRE-FM-FUNC-BSM-05B-P	BSM Close Loop Chop Test PRIME	IST-FT	YES	YES	Any	Any	
SPIRE-FM-BSM-0FF-P	BSM switch OFF	IST-FT	YES	YES	Any	Any	
SPIRE-FM-FUNC-SMEC-02A-P	Unlatch the SMEC	IST-FT	YES	YES	Y vertical	Any	
SPIRE-FM-FUNC-SMEC-03-P	SMEC Encoder Levels Check PRIME	IST-FT	YES	YES	Y vertical	Any	
SPIRE-FM-FUNC-SMEC-01-P	SMEC Encoder and LVDT check PRIME	IST-FT	YES	YES	Y vertical	Any	
SPIRE-FM-FUNC-SMEC-04A-P	SMEC Open Loop Position check PRIME	IST-FT	YES	YES	Y vertical	Any	
SPIRE-FM-FUNC-SMEC-09-P	SMEC Open Loop Scan check PRIME	IST-FT	YES	YES	Y vertical	Any	
SPIRE-FM-FUNC-SMEC-04B-P	SMEC Close Loop Position check PRIME	IST-FT	YES	YES	Y vertical	Any	

Procedure	Description	Type	Hel	Hell	Orient	Cover	Notes
SPIRE-FM-FUNC-SMEC-07-P	SMEC Close Loop Scan check PRIME	IST-FT	YES	YES	Y vertical	Any	
SPIRE-FM-SMEC-OFF-P	SMEC switch OFF	IST-FT	YES	YES	Y vertical	Any	
SPIRE-FM-FUNC-SMEC-02B-P	Latch the SMEC	IST-FT	YES	YES	Y vertical	Any	
SPIRE-FM-FUNC-DCU-02-P	DCU Nominal Sci. Contents Check PRIME	IST-FT	YES	YES	Any	Any	
SPIRE-FM-FUNC-DCU-11-PHOT-P	Phot. BDAs Switch ON Check PRIME	IST-FT	YES	YES	Any	Any	
SPIRE-FM-FUNC-DCU-13-PHOT-P	Phot. BDAs Integrity Check PRIME	IST-FT	YES	YES	Any	Any	
SPIRE-FM-FUNC-DCU-14-PHOT-P	Phot. BDAs Noise Check PRIME	IST-FT	YES	YES	Any	Any	
SPIRE-FM-FUNC-DCU-11-SPEC-P	Spec. BDAs Integrity Check PRIME	IST-FT	YES	YES	Any	Any	
SPIRE-FM-FUNC-DCU-13-SPEC-P	Spec. BDAs Integrity Check PRIME	IST-FT	YES	YES	Any	Any	
SPIRE-FM-FUNC-DCU-14-SPEC-P	Spec. BDAs Noise Check PRIME	IST-FT	YES	YES	Any	Any	
SPIRE-FM-SDET-OFF-P	Spec. BDAs switch OFF	IST-FT	YES	YES	Any	Any	
SPIRE-FM-MCU-OFF-P	MCU switch OFF PRIME	IST-FT	YES	YES	Any	Any	
SPIRE-FM-SCU-OFF-P	SCU switch OFF PRIME	IST-FT	YES	YES	Any	Any	
SPIRE-FM-DRCU-OFF-P	DRCU power OFF PRIME	IST-FT	YES	YES	Any	Any	
SPIRE-FM-DPU-OFF-P	DPU power OFF PRIME	IST-FT	YES	YES	Any	Any	

SPT Procedures from HERE							
BSM Control Loop Setting		SPT	YES	YES	Any	Any	
Cooler recycle (manual)		SPT	NO	YES	Y +20 to 30	Any	Orientation is minimum - can also be done with Y horizontal
Cooler recycle (automatic)		SPT	NO	YES	Y +20 to 30	Any	Orientation is minimum - can also be done with Y horizontal
Photometer bias optimisation		SPT	NO	YES	Y +20 to 30	Cold <15K	Orientation is minimum - can also be done with Y horizontal
Photometer noise stability versus bias frequency		SPT	NO	YES	Y +20 to 30	Cold <15K	Orientation is minimum - can also be done with Y horizontal
Photometer thermal stability versus bias amplitude		SPT	NO	YES	Y +20 to 30	Cold <15K	Orientation is minimum - can also be done with Y horizontal
Photometer Ambient Background Verification		SPT	NO	YES	Y +20 to 30	Variable	Orientation is minimum - can also be done with Y horizontal
PTC Headroom Characterisation		SPT	NO	YES	Y +20 to 30	Cold <15K	Orientation is minimum - can also be done with Y horizontal
Photometer Thermal Control Verification		SPT	NO	YES	Y +20 to 30	Cold <15K	Orientation is minimum - can also be done with Y horizontal
PCAL Photometer Characterisation		SPT	NO	YES	Y +20 to 30	Cold <15K	Orientation is minimum - can also be done with Y horizontal
Spectrometer bias optimisation		SPT	NO	YES	Y +20 to 30	Cold <15K	Orientation is minimum - can also be done with Y horizontal
Spectrometer noise stability versus bias frequency		SPT	NO	YES	Y +20 to 30	Cold <15K	Orientation is minimum - can also be done with Y horizontal
Spectrometer Ambient Background Verification		SPT	NO	YES	Y +20 to 30	Variable	Cryostat lid can be at any temperature during procedure but some tests will require various and stable lid temperatures
PCAL Spectrometer Characterisation		SPT	NO	YES	Y +20 to 30	Cold <15K	Orientation requirement is only for cooler recycle - once completed can be any orientation
Photometer scan mode POF5		SPT	NO	YES	Y +20 to 30	Variable	Cryostat lid can be at any temperature during procedure but some tests will require various and stable lid temperatures

SPT Procedures from HERE							
Photometer chop/jiggle mode POF2		SPT	NO	YES	Y +20 to 30	Variable	Cryostat lid can be at any temperature during procedure but some tests will require various and stable lid temperatures
SPEC high resolution mode SOF1		SPT	NO	YES	Y vertical	Variable	Cryostat lid can be at any temperature during procedure but some tests will require various and stable lid temperatures
Photometer Detector Microphonics Test		SPT	NO	YES	Y +20 to 30	Cold <15K	Orientation is minimum - can also be done with Y horizontal
Spectometer Detector Microphonics Test		SPT	NO	YES	Y +20 to 30	Cold <15K	Orientation is maximum - SMEC should be against end stop for this test
Spectrometer Mechanism Microvibration Test		SPT	NO	YES	Y vertical	Variable	Cryostat lid can be at any temperature during procedure but some tests will require various and stable lid temperatures
Spectrometer SCAL check		SPT	NO	YES	Y vertical	Variable	Cryostat lid can be at any temperature during procedure but some tests will require various and stable lid temperatures
EMC - Photometer most sensitive mode		SPT	NO	YES	Y +20 to 30	Cold <15K	Orientation is minimum - can also be done with Y horizontal
EMC – Spectrometer most sensitive mode		SPT	NO	YES	Y +20 to 30	Cold <15K	Orientation is minimum - can also be done with Y horizontal
EMC – SPIRE most Emissive mode		SPT	NO	YES	Y vertical	Any	Cryostat lid can be at any temperature
300mk Stage Decontamination		SPT	NO	YES	Y +20 to 30	Any	Cryostat lid can be at any temperature

7.5 Step by Step Procedure

Any text in **boldface** in the procedural steps generally indicates an action which has to be performed manually by the I-EGSE staff.
The last row in a procedure table should be used to record the overall Pass/Fail result of each test.

7.5.1 S/C Power ON & SPIRE I-EGSE Configuration/Connection

Step-No.	Test-Step-Description	Nominal Value	Tolerance	Actual Value	Remarks	P	N
	SPIRE I-EGSE Configuration/Connection						
7.5.1.1	Confirm I-EGSE physically connected to HPCCS	OK					
7.5.1.2	If not already ON, switch ON HPCCS, SCOEs and Satellite/SVM and configure into basic test mode i.a.w. AD2 chapt. 7.1 to 7.5	OK					
7.5.1.3	Confirm that EGSE and Satellite are in correct configuration	OK					
7.5.1.4	From HPCCS power ON CCU A & CCU B by executing the test script: **K102999ECVT001_ASDGENCCU_ABPWRON**	OK					
7.5.1.5	From HPCCS enable monitoring mode 1 (512 sec cycle) for CCU A & B by executing test script: **K102999ECVT001_ASDGENCCU_MnEBOTH1**	OK					
7.5.1.6	From HPCCS Test Conductor console issue command to connect to CryoSCOE if connected to main temperature sensors in place of CCUA: **connect PFM_CRYO**	OK					
7.5.1.7	Confirm that from HPCCS that the Cryo SCOE connection has been established.	YZS11940= CONNECTED					

Enter Date / Time:			Location:		Sign OFF:	TD:	PA: