EADS astrium

Test Procedure

Herschel

Title:

TBTV

SPIRE Functional Test Procedure

CI-No: 125300

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Issue	Date	Sheet	Description of Change	Release
1	06.11.08	All	Initial issue	
2	13.11.08	All	Correction of TBTV SPIRE WU Switch ON an Operating limits in sections 7.2 and 7.29 Typographical Bring step no.s in line with section no.s	

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1 Scope

1.1 Scope

This Test Procedure contains the step by step procedure for the SPIRE functional tests to be performed during TBTV in Helium ll conditions (refs. AD1 and RD3). It includes initial configuration of the Instrument EGSE for the test as well as the TBTV specific power on/off procedure for both Nominal and Redundant SPIRE units.

The SPIRE SFT to be performed as part of TBTV is an existing separate standalone procedure detailed in AD5 and therefore not included herein.

The Spacecraft start-up configuration for the test and shutdown afterwards is covered by AD2.

The leading procedure also contains the definition of the relevant supporting infrastructure and pre test conditions required for the TBTV tests to be performed correctly. However, any specific supporting hardware or software required specifically for SPIRE is detailed within this procedure.

1.2 Objective

The objective of the SPIRE TBTV Test is the functional and to a certain extent performance verification of SPIRE in HeII conditions when in a flight representative Satellite configuration and environment.

1.3 Test Flow

This functional test flow is structured as follows:

DAY 1

1. Cooler recycle (manual) – ca. 2.5 hr
2. Stabilisation in PHOTSTBY – 1.25 hr
3. Photometer bias phase optimisation - ca. 4.0 hr
4. Shift Handover – ca. 1.0 hr
5. Photometer bias phase characterisation with PCAL Flashes - ca. 0.5 hr
6. Photometer bias noise optimisation - ca. 4.5 hr
7. Photometer Ambient Background Verification – ca. 1.0 hr
8. Shift Handover – ca. 1.0 hr
9. PCAL Photometer Photometric Characterisation – ca. 0.75 hr

10. Photometer chop/jiggle mode POF2 – ca. 1hr
11. Photometer chop/jiggle mode POF3 – ca. 1hr
12. Transition to REDY – ca. 0.25 hr
13. Shift Handover – ca. 1.25 hr

Duration Estimate for Day 1: 20.00 hrs

DAY 2

14. Cooler recycle (manual) – ca. 2.50 hr
15. Transition to PHOTSTBY – ca. 0.25 hr
16. Photometer Thermal Control (PTC) Verification – ca. 1.0 hr
17. Transition from PHOTSTBY to SPECSTBY via REDY – ca. 0.75 hr
18. Spectrometer bias phase optimisation – ca. 4.0 hr
19. Shift Handover – ca. 1.0 hr
20. Spectrometer bias phase characterisation with PCAL Flashes – ca. 0.5 hr
21. Spectrometer bias noise optimisation – ca. 4.5 hr
22. Level 1 Herschel-SPIRE Interface Test - High Resolution Mode Simulation – ca. 2.0 hr
23. Shift Handover – ca. 1.0 hr
24. Level 1 Herschel-SPIRE Interface Test - Constant SMEC Power – ca. 2.0 hr
25. Spectrometer Ambient Background Verification – ca. 0.75 hr
26. PCAL Spectrometer Photometric Characterisation – ca. 0.75 hr
27. SCAL Photometric Verification – ca. 3.0 hr
28. Transition to REDY – ca. 0.25 hr
29. 300 mK Stage Decontamination - ca. 3.0 hr

Duration Estimate for Day 2: 27.25 hrs

Total estimated duration: 47.25 hrs

NOTE: The estimated duration for executing the TB/TV sequence of procedures, excluding switch on/off of the SPIRE instrument is estimated to be about 48 hours in total.

Power ON/OFF of SPIRE is treated separately based on the needs of the Test Specification (AD 4) and controlled by Herschel EGSE SAT and Instruments Procedure for the SAT TB/TV Testing (AD 2).

SPIRE TV/TB Day 1: First half of main 48 hour section								
Step	**Test Name**	**Description/Purpose**	**Time Required / hh:mm**	**Start Mode**	**End Mode**	**Running Time / hours**	**Comments**	**Nom start time**
1	Test preparation	Get cryostat into correct state for SPIRE testing. Low drifts and cryocover <100 K.	00:00	REDY	REDY	00:00	What temperature is the lid at the start of the SPIRE shift? **It is planned to run a 30 hours hot SVM TB case for Herschel concurrently. We can recycle the cooler whenever it runs out though.**	07:00
2	Mode transitions	Prior to test SPIRE has been switched on and left in REDY mode.	00:30	REDY	REDY	00:30	Spare time to get in correct mode if not in REDY at start of 48 hours.	07:30
3	Cooler recycle (Manual)	Manual Cooler Recycle. Hold time is likely to be ~20 hours so cooler recycles repeated as necessary during day 1 and 2.	02:30	REDY	REDY	03:00		10:00
4	Switch to PHOT STBY	Switch the instrument on in photometer mode using ILT settings and Vss from CFT DCU-07P (SPT 2704_3.4 used)	00:15	REDY	PHOT STBY	03:15		10:15
5	Wait for stabilisation	Need to wait until 300 mK stage is drifting slowly enough to allow detector characterisation	01:00	PHOT STBY	PHOT STBY	04:15	Knowledge of the stabilisation times for the detectors is a HIGH priority for SPIRE. Gives baseline for instrument operating temperature with everything OFF.	11:15

SPIRE TV/TB Day 1: First half of main 48 hour section								
Step	**Test Name**	**Description/Purpose**	**Time Required / hh:mm**	**Start Mode**	**End Mode**	**Running Time / hours**	**Comments**	**Nom start time**
6	Photometer bias phase optimisation	Find the optimum bias phase versus frequency for operating the photometer under IST ground nominal conditions. UPDATE CUS PARAMETERS "detector nominal settings.txt"	04:00	PHOT STBY	PHOT STBY	08:15	Check the overall FPU transient behaviour without PTC control in flight like environment.	15:15
7	**SHIFT 1 CONTINGENCY**	**END OF SHIFT TIDY UP READY FOR HANDOVER.**	**01:00**			09:15	**This is where we change crew - we should assume that all has not gone to plan and some time is required to finish at a test boundary/ have handover meeting etc**	16:15
8	Photometer bias phase characterisation with PCAL Flash	PCAL Flashes throughout to check for He leaks onto BDAs. Load curves to check for straylight and the measure accurately the temperature of the BDAs. UPDATE CUS PARAMETERS "detector nominal settings.txt"	00:30	PHOT STBY	PHOT STBY	09:45		16:45
9	Photometer bias noise optimisation	Find the optimum bias level and frequency for operating the photometer under IST ground nominal conditions.	04:30	PHOT STBY	PHOT STBY	14:15		21:15

SPIRE TV/TB Day 1: First half of main 48 hour section								
Step	**Test Name**	**Description/Purpose**	**Time Required / hh:mm**	**Start Mode**	**End Mode**	**Running Time / hours**	**Comments**	**Nom start time**
10	Photometer Ambient Background Verification	Determine the optical power load onto the photometer detectors using a detector “loadcurve” at fixed frequency and phase to measure the detector temperature.	01:00	PHOT STBY	PHOT STBY	15:15	"load curve"	22:15
11	**SHIFT 2 CONTINGENCY**	**END OF SHIFT TIDY UP READY FOR OVERNIGHT.**	**01:00**			**16:15**		**23:15**
12	PCAL Photometer Photometric Characterisation	Determine the absorbed power from PCAL by taking a load curve with PCAL set to its nominal PCAL flash output power	00:45	PHOT STBY	PHOT STBY	17:00	Must be done after Photometer bias optimisations. We have done during SPT so this is a thermal test.	00:00
13	Photometer chop/jiggle mode POF2	POF2 - See the thermal effects on the instrument of the heat flows from operating the photometer with the BSM chopping.	01:00	PHOT STBY	PHOT STBY	17:15		00:15
14	Photometer small map mode POF3	POF3 - See the thermal effects on the instrument of the heat flows from operating the photometer with the BSM chopping. Tests VM.	01:00	PHOT STBY	PHOT STBY	18:00		01:00

SPIRE TV/TB Day 1: First half of main 48 hour section								
Step	**Test Name**	**Description/Purpose**	**Time Required / hh:mm**	**Start Mode**	**End Mode**	**Running Time / hours**	**Comments**	**Nom start time**
15	Switch to REDY	For handover to day 2.	0:15	PHOT STBY	REDY	18:15		03:00
16	SHIFT 3 CONTINGENCY	END OF SHIFT TIDY UP READY FOR OVERNIGHT. UPDATE CUS PARAMETERS IF NECESSARY.	01:15			21:15	WE EXPECT COOLER HOLD TIME TO RUN OUT DURING SVM TB HOT CASE ABOUT NOW. NO LONG TESTS HERE.	04:15

SPIRE TV/TB Day 2 second half of main 48 hour section								
17	Test preparation	Make sure cryostat is still in correct state for continuation of SPIRE testing. Low drifts and cryocover <100 K. No time allocated as hopefully should continue from yesterday.	00:00	REDY	REDY	21:15		04:15
18	Manual Cooler Recycle. The order may change depending on the hold time from the first recycle.	A second manual cooler recycle will be required after the first hold time finishes. Test new PTC control VM after second cooler recycle.	02:30	REDY	REDY	23:45		06:45
19	Switch from REDY to PHOT STBY	Switch the instrument on in photometer mode using ILT settings and Vss from CFT DCU-07P	00:15	REDY	PHOT STBY	24:00		07:00

SPIRE TV/TB Day 2 second half of main 48 hour section								
20	Photometer Thermal Control (PTC) Verification	To test detector thermal stability whilst under PTC control – this can be carried out at any point	01:00	PHOT STBY	PHOT STBY	25:00		08:00
21	Switch from PHOT STBY to REDY	PJETs and photometer detectors off.	00:15	PHOT STBY	REDY	25:15		08:15
22	Switch to SPEC STBY	Switch to SPEC STBY	00:30	REDY	SPEC STBY	25:45		08:45
23	Spectrometer bias phase optimization	Spectrometer bias phase optimization. UPDATE CUS PARAMETERS AFTER	04:00	SPEC STBY	SPEC STBY	29:45		12:45
24	**SHIFT 1 CONTINGENCY**	**END OF SHIFT TIDY UP READY FOR HANDOVER. HANDOVER DURING STEP 22.**	**01:00**			30:45		13:45
25	Spectrometer bias phase characterisation with PCAL Flashes	Spectrometer bias phase characterisation with PCAL Flashes. UPDATE CUS PARAMETERS AFTER.	00:30	SPEC STBY	SPEC STBY	31:15		14:15
26	Spectrometer bias noise optimisation	Spectrometer bias noise optimisation. UPDATE CUS PARAMETERS AFTER.	04:30	SPEC STBY	SPEC STBY	35:45		18:45
27	Level 1 Herschel-SPIRE Interface Test - High Resolution Mode Simulation	High Resolution Scan - SOF1 emulation - Variable SMEC encoder power	02:00	SPEC STBY	SPEC STBY	37:45	New test. Duration TBD	20:45

SPIRE TV/TB Day 2 second half of main 48 hour section								
28	**SHIFT 2 CONTINGENCY**	**END OF SHIFT TIDY UP READY FOR OVERNIGHT**	**01:00**			38:45		21:45
29	Level 1 Herschel-SPIRE Interface Test - Constant SMEC Power	Constant SMEC encoder power - L1 interface test	02:00	SPEC STBY	SPEC STBY	40:45	New test. Duration TBD	23:45
30	Spectrometer Ambient Background Verification	Spectrometer Ambient Background Verification	00:45	SPEC STBY	SPEC STBY	41:30	"load curve"	00:30
31	PCAL Spectrometer Photometric Characterisation	Determine the absorbed power from PCAL by taking a load curve with PCAL set to its nominal PCAL flash output power	00:45	SPEC STBY	SPEC STBY	42:15	Must be done after spectrometer bias optimisations. **Does PCAL flash affect the mode?**	01:15
32	SCAL Photometric Verification	See thermal effects on Instrument from spectrometer calibration source 1st SCAL 2 (2nd SCAL 4 - not likely to have enough time)	03:00	SPEC STBY	SPEC STBY	45:15	Must be done after spectrometer bias optimisations. SCAL4 could be cut if running out of time.	04:15
33	Switch from SPEC STBY to REDY	Switch to REDY	00:15	SPEC STBY	REDY	45:30		04:30
34	300 mK Stage Decontamination	To remove any traces of Helium deposited over the 300 mK stage during the SPT testing.	03:00	REDY	REDY	48:30	Duration 2-4 hrs	07:30

SPIRE TV/TB Day 2 second half of main 48 hour section								
35	Switch SPIRE OFF	Switch the instrument off and on to the next instrument/test section.	00:30	REDY	OFF	49:00	The extent of the cooler hold-time is of major interest so leaving it for as long as possible is a HIGH priority for SPIRE. • THIS SHOULD BE LAST TEST TO BE RUN BEFORE THE END OF TV/TB	08:00
36	**SHIFT 3CONTINGENCY**	**END OF SHIFT TIDY UP READY FOR OVERNIGHT**	**01:00**			50:00		09:00
37	Overnight Hold on Test Activities/ Swap to next instrument's test sequence		01:30			51:30	IF COOLER HOLD TIME IS <24 HOURS THEN MIGHT NEED 3 HOURS MORE.	10:30

2 Documents/Drawings

This document incorporates, by dated or undated references, provisions from other publications. These normative references are cited at appropriate places in the text and publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these apply to this document only when incorporated into it by amendment or revision. For undated references, the latest edition of the publication referred to apply.

2.1 Applicable Documents

Id	Title	Number	Issue
AD 1	Test Specification for Herschel Instruments FM tests performed at Satellite Level	H-P-2-ASP-TS-1083	2
AD 2	Herschel EGSE SAT and Instruments Procedure for the SAT TB/TV Testing	HP-2-ASED-TP-0236	
AD 3	SPIRE I-EGSE Set-Up	SPIRE-RAL-DOC-002841	2.1
AD 4	HERSCHEL FM TV/TB TEST SPECIFICATION	H-P-2-ASP-TS-0997	
AD 5	SPIRE FM Short Functional Test (Warm or Cold)	HP-2-ASED-TP-0212	1.3
AD 6	Herschel FM Thermal Test Leading Procedure	HP-2-ASED-TP-0200	
AD 7	Integrated Test Procedure for Herschel FM TB/TV	HP-2-ASED-TP-0177	
AD 8	Herschel PA Plan	HP-2-ASED-PL-0007	
AD 9	IID-A	SCT-PT-IIDA-04624	4
AD 10	S/C Configuration for IST Instrument Commissioning	HP-2-ASED-TP-0237	1

2.2 Reference Documents

Id	Title	Number	Issue
RD 1	SPIRE Instrument User Manual	SPIRE-RAL-PRJ-002395	1.4
RD 2	SPIRE IID-B	SCI-PT-IIDB/SPIRE-02124	
RD 3	SPIRE IST Thermal Vacuum/Balance Test Procedures	SPIRE-RAL-PRC-3042	1.7
RD 4	Herschel Planck Central Checkout System User Manual	H-P-4-TE-MA-0010	

2.3 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 Requirements to be verified

This test is primarily a full functional test of the SPIRE instrument integrated in the spacecraft.

The related pass/fail criteria is to compare for each test step the actual (achieved) results with the nominal (expected) results, as defined in section 7 (step-by-step procedure).

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 IEGSE).

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 completion of scientific data evaluation and therefore only a preliminary assessment of the test success can be made at the PTR.

The test is considered as preliminarily successful if all test steps defined in section 7 reveal compliant results, if all commands have been successfully executed and the housekeeping data have not indicated any anomalies or faults and the science data could be correctly downloaded and the real time analysis (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 comparing the results with the test predictions.

Specific requirements verified by the test are addressed in the top level TBTV Procedure (AD 6).

4 Configuration and Set-up

4.1 Configuration

4.1.1 Hardware

Ref. AD2

4.1.2 Software

The actual software versions to be used for the test shall be identified at the TRR and documented in the minutes of meeting of the TRR.

4.1.3 Test software

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

The following ASED Power ON/OFF test scripts are required for execution of the test:

Number	Tcl Script Name	Comment
1.	S102999SCVT027_ASDSPTSPIR_PWR_ON_P	
2.	S102999SCVT028_ASDSPTSPIR_PWR_OFF_P	
3.	S102999SCVT029_ASDSPTSPIR_PWR_ON_R	
4.	S102999SCVT030_ASDSPTSPIR_PWR_OFF_R	

Table 4-1. List of SPIRE Power ON/OFF Test Scripts

The following scripts are provided for SPIRE TBTV tests but may not be called explicitly from the procedure. If any need to be executed during the test then a PVS must be raised to control their execution.

Number	Tcl Script Name	Comment
1.	SPIRE-IST-RESET-PHOT-OFFSETS.tcl	
2.	SPIRE-IST-RESET-SPEC-OFFSETS.tcl	
3.	SPIRE-IST-START-PHOT-DATA.tcl	
4.	SPIRE-IST-START-SPEC-DATA.tcl	

5.	SPIRE-IST-STOP-DCU-DATA.tcl	
6.	SPIRE-IST-GO2REDY.tcl	
7.	SPIRE-IST-START-TEST.tcl	
8.	SPIRE-IST-END-TEST.tcl	
9.	SPIRE-IST-CPS-PHOT.tcl	
10.	SPIRE-IST-CPS-SPEC.tcl	
11.	SPIRE-IST-CRECm.tcl	
12.	SPIRE-IST-SPTMONITORING.tcl	

Table 4-2. List of Supplementary SPIRE TBTV Test Scripts

The actual test scripts and IEGSE software versions shall be identified at the TRR and documented in the minutes of meeting of the TRR.

4.2 Set-up

Ref. AD2

4.3 GSE

4.3.1 MGSE

No specific MGSE required.

4.3.2 CVSE

Ref. AD2.

4.3.3 EGSE

The figure below shows the detailed EGSE configuration to be used for the TBTV.

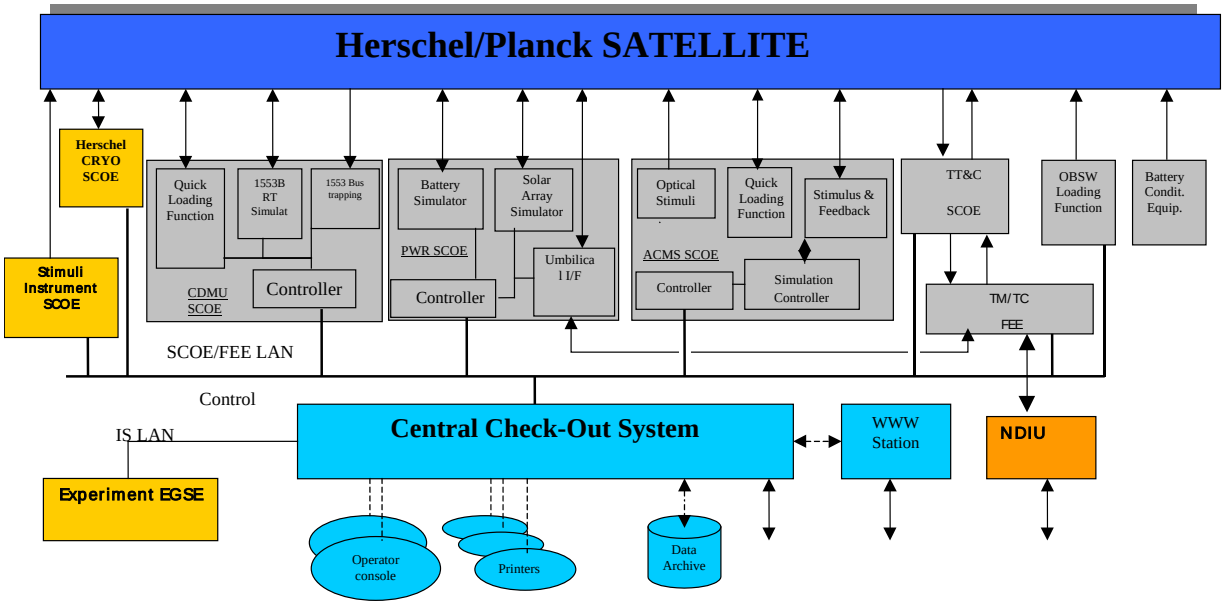

Figure 4-1: EGSE Configuration

The following additional EGSE is required:

- Monitor which displays the real time cryostat telemetry, to be positioned close to IEGSE monitors.

4.3.4 OGSE

None.

4.3.5 Special Equipment

None.

4.4 Test Facility

The test shall be performed at ESTEC premises Noordwijk in the LSS.

5 Test Conditions and Constraints

5.1 Environmental Conditions

All activities specified in this procedure shall be performed in the ESTEC LSS, the associated conditions are defined in Ref. AD2.

5.2 Cryostat Conditions

During the test the HTT shall be closed with shield cooling provided by an external Dewar.

HeII conditions, however there are no constraints if cryostat temperatures are in the ranges given in section 7:

5.3 Expected Anomalies

The following anomalies are expected during the test:

- 3955 (if current MIB is used)
- 4495 (if current OBSW 2.2H is used)
- 4462 (if current OBSW 2.2H is used)
- 4457 (if current OBSW 2.2H is used)
- 4423 (SPIRE IEGSE affected)
- 4289 (SCAL TEMP - not corrected for TBTV)
- 4199 (Invalid OOL checks – not corrected for TBTV)
- 4195 (DPUM15V OOL – not corrected for TBTV)
- 4105 (Missing Text Calibs - not clear if MIB will be fixed for TBTV)
- 3512 (Missing Time Sync Pulse)
- 4517 (Time sync after reconfiguration – no response if this affects SPIRE)

5.4 Quality Assurance, Safety & Constraints

Ref. AD2

5.5 Precautions and Safety

Ref: AD2

5.6 Operational Constraints

SPIRE telecommanding shall be performed using the delivered and agreed set of SPIRE tcl scripts which are generated from the SPIRE CUS database (see the relevant release note for the script delivery to be used for the test. **Table 4-1** details the top-level scripts called during the test. SPIRE instrument housekeeping telemetry packets shall be received and presented on the instrument SCOS2000 monitors. Real time analysis of SPIRE science data packets shall be performed on the IEGSE by MPE. All SPIRE telemetry displayed on the SCOS2000 monitors is defined by the HPSDB (which uses the SPIRE MIB as input). All telecommands which are sent during the execution of the SPIRE tcl scripts are defined in the HPSDB as well (again based on SPIRE MIB).

5.6.1 General instructions for executing test procedures

- Before executing any of the procedures please always check with the Instrument-EGSE staff
- 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.
- 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. They are given in the attached spreadsheet.

5.6.2 Assumptions/Pre-requisite Conditions

- 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 (**RD 1**).
- For the SPIRE Cooler recycle the Herschel cryostat must be tilted such that the plane of the SOB is at 20˚ from the vertical with the +Y Spacecraft axis downwards
- Correct parameters from SPT testing should be added to the CUS on the I-EGSE before TV/TB testing.
- The cryo cover temperature will be about 100 K rather than <15 K i.e. no active cooling.
- 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.

5.6.3 Open Issues

- The ability to operate the PTC control loop is not yet confirmed – some extra interactive testing maybe required to allow this to happen and Photometer Thermal Control (PTC) Verification may overrun.
- SCAL4 photometric verification may be cut for time purposes but is included under SCAL Photometric Verification.
- If SPIRE needs three cooler recycles, RAL would prefer to run the 300 mK decontamination at some other point outside of the 48 hours TV/TB part of the Herschel test sequence. RAL could then leave the instrument in REDY mode at the end of 48 hours to find out the third hold time. (300 mK decontamination would heat the cooler and shorten the length).

5.7 Required Documents

The following SPIRE specific documents shall be on-hand at the TRR and during the entire test.

- This test procedure to be filled out and signed off page by page by the operator and PA.
- SPIRE I-EGSE User Manual (AD 3).

For potential failure investigations further documents might be required. Those have to be defined at the corresponding NRBs.

6 Responsibilities

The list below defines the allocation of responsibilities (nomination at TRR).

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

7 Step-by-step Procedure

7.0 Test Preparation

Test Location:	
Test Session Id:	
Test Environment:	

Step-No.	Test-Step-Description	Nominal Value	Tolerance	Actual Value	Remarks	P	N
	SPIRE: OFF						
0.1	Check that all open work identified at the TRR is closed	OK					
0.2	Check SPIRE FPU interface temperatures (throughout the test):						
	Level 0 (HTT upper bulk) T222	As per TRR					
	Level 1 (Vent line) T234	As per TRR					
	Level 2 (OBA) T242	As per TRR					
0.3	No constraints on thermal shield or CVV	N/A					
0.4	Check cover temperature	80 – 110 K			(90 – 100 K in SPIRE XLS schedule v8)		
0.5	Stabiliity (drifting)	Flow rate of 4mg/sec					
	L0	< 0.21 K/h					

Enter Date/Time:			**Sign Off:**	

Step-No.	Test-Step-Description	Nominal Value	Tolerance	Actual Value	Remarks	P	N
	L1/L2	<250mK / hr on L1 No constraints on L2					
0.6	Check cryostat angle	As per TBTV test phase			.		
	SPIRE: OFF						

Enter Date/Time:			Sign Off:	

7.1 SPIRE I-EGSE Configuration

Step-No.	Test-Step-Description	Nominal Value	Tolerance	Actual Value	Remarks	P	N
	SPIRE: OFF						
1.1	Switch ON & configure SPIRE-IEGSE						
1.2	Confirm SPIRE I-EGSE is in correct configuration						
1.3	From HPCCS Test Conductor console issue command to connect to SPIRE I-EGSE: **connect HSPIREEGSE**	YZS29940= CONNECTED					
1.4	Verify correct connection and time synchronisation with IEGSE: **Y102999ETVT036_ASDGEN_VERSPIREIEGSE**	OK					
1.5	On HPCCS start the following test script: **SPIRE_ALL_SubscribeParams**	OK					
1.6	If not running already, start the instrument temperature logging: **Z102999SCVT025_ASDGEN_INSTTEMP_LOG**	OK					
	SPIRE IEGSE ready for Test						

Enter Date/Time:			Sign Off:	

7.2 Switch On Nominal SPIRE to Standby (REDY) Mode

During Power ON of SPIRE a number of soft/hard OOLs are reported due to the sequential switch ON of the units. This is expected and will clear when SPIRE is in REDY mode. When in REDY mode one parameter remains OOL (soft), namely SMD2V505, which is also expected.

Duration: 0.5 hours

Step-No.	Test-Step-Description	Nominal Value	Tolerance	Actual Value	Remarks	P	N
	SPIRE: OFF						
2.0	Verify the following TCS baseplate temperature for SPIRE Warm Units before switching ON: **HSDCU (DEA88710)**	> -30°C & < +45 °C					
2.1	On HPCCS start Packet History displays for the following APIDs:1280,1282	OK					
2.2	From the HPCCS test conductor console start the test script to power on SPIRE Prime: **S102999SCVT027_ASDSPTSPIR_PWR_ON_P**	OK			AND: ZAD07999, ZAD14999 MIM: LCL_HERSCHEL		
2.3	On HPCCS when prompted: `"SPIRE Switch ON for SPTs in Hel/Hell conditions ONLY - Select NO to abort TS if not correct"` **Select YES**	YES					

Enter Date/Time:			Sign Off:	

Step-No.	Test-Step-Description	Nominal Value	Tolerance	Actual Value	Remarks	P	N
	The test script will go on to automatically power on all SPIRE warm units, force boot the DPU ASW (from secondary partition) and configure the instrument to Standby mode. Reply to prompts as indicated below.						
2.4	On HPCCS when prompted: `"Check Telemetry Updating Correctly and OBT is Consistent with CDMU - OK to continue"` **Select OK**	OK			**AND: SA_1_559**		
2.5	If I-EGSE connected when prompted on HPCCS, perform check requested then **select OK:** `"Check IEGSE Time Consistent - OK to continue when RAL confirm"`	OK					
2.6	On HPCCS when prompted: `"Check Telemetry No Longer Updating - OK to continue"` Check that parameters: THSK TM2N Select OK to continue	 Not refreshing Not incrementing OK					
2.7	On HPCCS when prompted: `"Check Telemetry Updating Correctly - OK to continue"` Check that parameters: THSK	 Refreshing @ 1Hz			**AND: SA_1_559**		

Enter Date/Time:			Sign Off:	

Step-No.	Test-Step-Description	Nominal Value	Tolerance	Actual Value	Remarks	P	N
	TM2N Select OK to continue	Incrementing by 1 @ 1Hz OK					
2.8	On HPCCS when all autonomous actions have been completed by the power on script S102999SCVT027_ASDSPTSPIR_PWR_ON_P it will prompt: "Set Bus Profile Back to Original Setting?" Select NO	NO					
2.9	At the prompt: "Bus Profile left unchanged" Select OK to continue	OK					
2.10	Verify HK TM packets are being received on APIDs 1280 & 1282	OK					
2.11	On authorisation of SPIRE responsible execute the following test script: SPIRE-IST-SPTMONITORING	OK					
2.12	Verify the following TCS baseplate temperature for SPIRE Warm Units before operating SPIRE: **HSDCU (DEA88710)**	> -15°C & < +45 °C					
	SPIRE: DPU & DRCU powered and in REDY mode (nom.)						

Enter Date/Time:			**Sign Off:**	

7.3 Procedure: Cooler recycle (manual)

Version: 1.0
Date: 24th July 2006
Purpose:
Recycle the cooler with operator intervention

Duration: ~2 hours

Preconditions:

- Manual recycle carried out under nominal temperature and cryostat operational conditions. (Manual will give best indication of hold time in flight.)
- **The calibration table CoolerRecycling.txt has been updated in the CUS following the manual cooler recycle**
- **Mission configuration changed on the I-EGSE (if the CUS scripts or Calibration tables have been updated)**
- SPIRE is as close to Flight nominal operating temperature and temperatures are as stable as possible
- Cryostat flow rates are at natural flow rates ~4 mg/s
- Herschel tilted such that SOB is tilted 20˚ from vertical towards +Y direction
- Level 0 temperature: <1.85 K predicted (Best <1.7 K – critical that this is maintained throughout recycle to ensure efficient condensation.)
- Level 1 temperature: < 5 K – not critical
- Level 2 temperature: No constraint

Initial Configuration:
SPIRE in REDY mode

Enter Date/Time:			Sign Off:	

Procedure Steps:

Step	Description	Parameters	Expected Values	Actual Values	Success/ Failure
1	Execute TCL script SPIRE-IST-CRECm.tcl	SUBKTEMP	AFTER RECYCLE < 300mK		
Test Result (Pass/Fail):					
Duration of SPIRE Cooler Recycle Procedure:					

Test Pass/Fail Criteria
Pump Temperature ≥ 45K during whole condensation phase. Scripts run successfully or not at this point
Final Configuration: SPIRE in REDY mode with cooler recycled and detectors at <= 300 mK.

Enter Date/Time:			Sign Off:	

7.4 Procedure: Switch from REDY to PHOTSTBY

Duration: 0.25 hrs

Test Script	Description	Parameters	Expected Values Before/After	Actual Values Before/After
SPIRE-IST-SPT-BSM-ON.tcl	Switches on the BSM	CHOPSENSPWR JIGGSENSPWR MODE	0/1 0/1 REDY/BSM_ON	
SPIRE-IST-SPT-BSM-INIT.tcl	Initialises the BSM	CHOPLOOPMODE JIGGLOOPMODE MODE	0/1 0/1 BSM_ON/BSM_INIT	
SPIRE-IST-SPT-PDET-ON.tcl	Switches on the Photometer arrays	MODE	BSM_INIT/PHOTSTBY	

This is followed by a stabilisation period/contingency.

Duration: 1.0 hours

7.5 Procedure: Photometer bias phase optimisation

Version: 1.4
Date: 31st July 2008
1.0-1.1 Split previous detector bias optimisation into two following Tanya's recommendation
1.2-1.3 Set bias freq, amplitudes and phase range
1.3-1.4 Test sequence and script names defined
1.4-1.5 Cut stability tests as they replicate this test

Purpose:
Find the optimum bias phase versus frequency for operating the photometer under IST ground nominal conditions

Duration: (1hr stabilisation +) 4 hours

Preconditions:

- Functional tests SPIRE-IST-COLD-FUNC-DCU-04P,13P and SPIRE-IST-COLD-PHOT-VSS have been carried out successfully.
- SPIRE is at ground nominal operating temperature and temperatures are as stable as possible
- Cryostat flow rates are at ground nominal
- The cooler is recycled, the detectors are at <300 mK and the detector temperatures are as stable as possible
- The establishment of the correct Vss settings (SPIRE-IST-COLD-PHOT-VSS)
- Level 0 temperature: < 1.85 K drift < 0.21 K/hr (predicted)
- Level 1 temperature: < 5 K drift <0.25 K/hr
- Level 2 temperature: < 12 K no drift constraint

PTC NOT operating during this test
Bias amplitudes 15, 30, 50 mV
Bias frequencies 70, 100, 130, 190 Hz
Phase Range – FM_IST SPT central phase +/-8.4 ˚ in steps of 1.4 ˚

Enter Date/Time:			Sign Off:	

Initial Configuration:
SPIRE in PHOTSTBY

Procedure Steps:

Step	Description	Parameters	Expected Values	Actual Values	Success/ Failure
1	Execute TCL script SPIRE-IST-DNS-PHOT.tcl. (Resets SPIRE photometer bias and readout parameters to the IST nominal)	JFET voltage	~34 mV	N/A	
2	Execute TCL script SPIRE-IST-PHASEUP-PHOT70.tcl • Observe signal levels and determine optimum phase setting for IST bias levels at 70Hz bias frequency • 3 bias amplitudes, with each phase up taking ~20 minutes each	N/A	N/A	N/A	
3	Execute TCL script SPIRE-IST-PHASEUP-PHOT100.tcl • Observe signal levels and determine optimum phase setting for IST bias levels at 100Hz bias frequency • 3 bias amplitudes, with each phase up taking ~20 minutes each	N/A	N/A	N/A	
4	Execute TCL script SPIRE-IST-PHASEUP-PHOT130.tcl • Observe signal levels and determine optimum phase setting for IST bias levels at 130Hz bias frequency • 3 bias amplitudes, with each phase up taking ~20 minutes each	N/A	N/A	N/A	
5	Execute TCL script SPIRE-IST-PHASEUP-PHOT190.tcl • Observe signal levels and determine optimum phase setting for IST bias levels at 190Hz bias frequency • 3 bias amplitudes, with each phase up taking ~20 minutes each	N/A	N/A	N/A	
6	If requested by the I-EGSE, execute the TCL script SPIRE-IST-DNS-SPEC.tcl to set the IST nominal detector settings	N/A	N/A	N/A	
7	Analyse data in real time to determine IST ground nominal operating parameters and compare to ILT results – confirm ILT table entries.				
Test Result (Pass/Fail):					
Test Pass/Fail Criteria: Scripts run successfully or not at this point. Analysis of data required by off-line processing					

Enter Date/Time:			**Sign Off:**	

Step	Description	Parameters	Expected Values	Actual Values	Success/ Failure
Approximate optimum phase settings for each detector: **Bias Level** **Frequency** **PSW Phase** **PMW Phase** **PLW Phase** **15** **70** **30** **70** **50** **70** **.** **.** **Create a new calibration table Phot_Noise_Settings.txt:** **Bias F, Samp F, PSW bias, PMW bias, PLW bias, PSW phase, PMW phase, PLW phase** **70** **100** **130** **190**					

Final Configuration:
SPIRE in PHOTSTBY mode with bias set to IST nominal values

7.6 Procedure: Photometer bias phase characterisation with PCAL Flashes

Version: 1.4
Date: 31st July 2008
1.0-1.1 Photometer bias phase characterisation
1.0-1.2 Use FM IST SPT phase as central phase

Purpose:
Calibrate responsivity vs phase for the photometer under IST ground nominal conditions.

Duration: 0.5 hours

Preconditions:
- Functional tests SPIRE-IST-COLD-FUNC-DCU-04P,13P and SPIRE-IST-COLD-PHOT-VSS have been carried out successfully.
- SPIRE is at ground nominal operating temperature and temperatures are as stable as possible
- Cryostat flow rates are at ground nominal
- The cooler is recycled, the detectors are at <300 mK and the detector temperatures are as stable as possible
- The establishment of the correct Vss settings (SPIRE-IST-COLD-PHOT-VSS)
- Level 0 temperature: < 1.85 K drift < 0.21 K/hr (predicted)
- Level 1 temperature: < 5 K drift <0.25 K/hr
- Level 2 temperature: < 12 K no drift constraint
- **PTC NOT operating during this test**

Bias amplitudes 33 mV
Bias frequencies 130 Hz
Phase Range – FM_IST SPT central phase +70.0˚ in steps of 10˚

Initial Configuration:
SPIRE in PHOTSTBY

Enter Date/Time:			Sign Off:	

Procedure Steps:

Step	Description	Parameters	Expected Values	Actual Values	Success/ Failure
1	Execute TCL script SPIRE-IST-DNS-PHOT.tcl. (Resets SPIRE photometer bias and readout parameters to the IST nominal)	JFET voltage	~34 mV	N/A	
2	Execute TCL script SPIRE-IST-CPS-PHASEUP-SPEC160.tcl 1. Standard PCAL flash for spectrometer. Observe signal levels and determine response for the phase step. 2. Repeat one for next phase step for 7 steps.	Detector signal	N+/-dN mV	N/A	
3	If requested by the I-EGSE, execute the TCL script SPIRE-IST-DNS-SPEC.tcl to set the IST nominal detector settings	N/A	N/A	N/A	
4	Analyse data in real time to determine IST ground nominal operating parameters and compare to ILT results – confirm ILT table entries.				

Test Result (Pass/Fail):

Test Pass/Fail Criteria: Scripts run successfully or not at this point. Analysis of data required by off-line processing

Approximate optimum phase settings for each detector:

Bias Level	Frequency	PSW Phase	PMW Phase	PLW Phase
33	**130**			

Create a new calibration table Phot_Noise_Settings.txt:

Phase, Samp F, PSW bias, PMW bias, PLW bias, PSW phase, PMW phase, PLW phase
n˚
n+10˚

Final Configuration: SPIRE in PHOTSTBY mode with bias set to IST nominal values

Enter Date/Time:			Sign Off:	

7.7 Procedure: Photometer bias noise optimisation

Version: 1.2
Date: 31st July 2008
1.0-1.1 Split previous detector bias optimisation into two following Tanya's recommendation
1.1-1.2 Test sequence and script names defined
1.2-1.5 Remover 190 Hz.

Purpose:
Find the optimum bias level and frequency for operating the photometer under IST ground nominal conditions.

Duration: Approximately 4.5 hours

Preconditions:

- Functional tests SPIRE-IST-COLD-FUNC-DCU-04P,13P and SPIRE-IST-COLD-PHOT-VSS have been carried out successfully.
- SPIRE is at ground nominal operating temperature and temperatures are as stable as possible
- Cryostat flow rates are at ground nominal
- The cooler is recycled, the detectors are at <300 mK and the detector temperatures are as stable as possible
- The establishment of the correct Vss settings (SPIRE-IST-COLD-PHOT-VSS)
- The establishment of the correct bias phase versus frequency and amplitude done during test 2.4
- **The input PSW, PMW and PLW phases to the CUS scripts SPIRE_IST_DNA_PHOT_AMP15/30/50 have been updated following phase-ups**
- **Mission configuration changed on the I-EGSE (if the CUS scripts or Calibration tables have been updated)**
- Level 0 temperature: < 1.85 K drift < 0.21 K/hr (predicted)
- Level 1 temperature: < 5 K drift <0.25 K/hr
- Level 2 temperature: < 12 K no drift constraint

Bias and phases to use as per "Photometer bias phase optimisation" procedure.

Initial Configuration: SPIRE in PHOTSTBY

Procedure Steps:

Step	Description	Parameters	Expected Values	Actual Values	Success/ Failure
1	Execute TCL script SPIRE-IST-DNS-PHOT.tcl. (Resets SPIRE photometer bias and readout parameters to the IST nominal)	JFET voltage	~34 mV	N/A	
2	Execute TCL script SPIRE-IST-DNA-PHOT-AMP15.tcl • Set bias amplitude to 15mV • Set frequency to 70 Hz and predetermined phase – observe signal and measure noise • Set frequency to 100 Hz and predetermined phase – observe signal and measure noise • Set frequency to 130 Hz and predetermined phase – observe signal and measure noise If requested by the I-EGSE, execute the TCL script SPIRE-IST-DNS-phot.tcl to set the IST nominal detector settings	N/A	N/A	N/A	
3	Execute TCL script SPIRE-IST-DNA-PHOT-AMP30.tcl • Set bias amplitude to 30mV • Set frequency to 70 Hz and predetermined phase – observe signal and measure noise • Set frequency to 100 Hz and predetermined phase – observe signal and measure noise • Set frequency to 130 Hz and predetermined phase – observe signal and measure noise If requested by the I-EGSE, execute TCL script Execute the TCL script SPIRE-IST-DNS-PHOT.tcl to set the IST nominal detector settings	N/A	N/A	N/A	

Enter Date/Time:			**Sign Off:**	

Step	Description	Parameters	Expected Values	Actual Values	Success/ Failure
4	Execute TCL script SPIRE-IST-DNA-PHOT-AMP50.tcl • Set bias amplitude to 50mV • Set frequency to 70 Hz and predetermined phase – observe signal and measure noise • Set frequency to 100 Hz and predetermined phase – observe signal and measure noise • Set frequency to 130 Hz and predetermined phase – observe signal and measure noise If requested by the I-EGSE, execute the TCL script SPIRE-IST-DNS-PHOT.tcl to set the IST nominal detector settings	N/A	N/A	N/A	
5	Analyse data in real time to determine IST ground nominal operating parameters	N/A	N/A	N/A	
6	If requested by the I-EGSE, execute TCL script SPIRE-IST-DNS-PHOT.tcl to apply the IST nominal bias settings	N/A	N/A	N/A	

Test Result (Pass/Fail):

Test Pass/Fail Criteria: Scripts run successfully or not at this point. Analysis of data required by off-line processing

Approximate optimum bias settings each detector: Note that the bias frequency has to be the same for all three arrays.

Bias Frequency:

	Bias Level	**Phase**
PSW		
PMW		
PLW.		

Final Configuration: SPIRE in PHOTSTBY mode with bias set to IST nominal values

Enter Date/Time:			**Sign Off:**	

7.8 Procedure: Photometer Ambient Background Verification

Version: 1.2
Date: 31st July 2008
Purpose: Determine the optical power load onto the photometer detectors using a detector "loadcurve" at fixed frequency and phase to measure the detector temperature.
1.1-1.2 Test sequence and script names defined

Duration: ~ 1 hour

Preconditions:

- Photometer IST Ground Nominal bias setting have been determined by procedure "Photometer bias optimisation"
- SPIRE is at ground nominal operating temperature and temperatures are as stable as possible
- Cryostat flow rates are at ground nominal
- The cooler is recycled, the detectors are at <300 mK and the detector temperatures are as stable as possible
- **If the IST optimum phases are significantly different from the ILT values then the input phases in CUS script SPIRE_IST_LC_PHOT will need to be modified and the Mission Configuration updated on the I-EGSE.**
- Level 0 temperature: < 1.85 K drift < 0.21 K/hr (predicted)
- Level 1 temperature: < 5 K drift <0.25 K/hr
- Level 2 temperature: < 12 K no drift constraint

Initial Configuration:
SPIRE is set to PHOTSTBY

Procedure Steps:

Step	Description	Parameters	Expected Values	Actual Values	Success/ Failure
1	Execute TCL script SPIRE-IST-CPS-PHOT.tcl • Standard PCAL flash for photometer	N/A	Detector signal N+/-dN mV		
2	Execute TCL script SPIRE-IST-LC-PHOT.tcl • Standard Load Curve	N/A	N/A		
3	Execute TCL script SPIRE-IST-CPS-PHOT.tcl • Standard PCAL flash for photometer	N/A	Detector signal N+/-dN mV		
4	If requested by the I-EGSE, execute TCL script SPIRE-IST-DNS-PHOT.tcl to apply the IST nominal bias settings	N/A	N/A	N/A	
Test Result (Pass/Fail):					
Test Pass/Fail Criteria: Scripts run successfully or not at this point. Analysis of data required by off-line processing.					

Final Configuration:
SPIRE in PHOTSTBY mode with bias set to IST Ground Nominal

This is followed by a shift tidy up/contingency.

Duration: 1.0 hour

Enter Date/Time:			Sign Off:	

7.9 Procedure: PCAL Photometer Photometric Characterisation

Version: 1.0
Date: 10th October 2008

Purpose: Determine the absorbed power from PCAL by taking a load curve with PCAL set to its nominal PCAL flash output power

Duration: Approximately 0.75 hours

Preconditions:

- Functional test SPIRE-IST-COLD-FUNC-PCAL-01 has been carried out successfully
- Photometer IST Ground Nominal bias settings have been determined by procedure “Photometer bias optimisation”
- SPIRE is as close to Flight nominal operating temperature and temperatures are as stable as possible
- Cryostat flow rates are at natural flow rates ~4 mg/s
- The cooler is recycled, the detectors are at <300 mK and the detector temperatures are as stable as possible
- Level 0 temperature: < 1.85 K drift < 0.21 K/hr (predicted)
- Level 1 temperature: < 5 K drift <0.25 K/hr
- Level 2 temperature: < 12 K no drift constraint

Initial Configuration:

SPIRE is set to PHOTSTBY with ground nominal detector bias settings

Procedure Steps:

Step	Description	Parameters	Expected Values	Actual Values	Success/ Failure
1	Execute TCL script SPIRE-IST-PON-PHOT.tcl • Set PCAL bias to 3.8 mA • Wait for 10 seconds	N/A	N/A	N/A	
2	Execute TCL script SPIRE-IST-LC-PHOT.tcl	N/A	N/A	N/A	
3	Execute TCL script SPIRE-IST-POF-PHOT.tcl • Set PCAL bias to 0 mA Wait for 10 seconds				
4	If requested by the I-EGSE, execute the TCL script SPIRE-IST-DNS-PHOT.tcl to set the IST nominal detector settings				
Test Result (Pass/Fail):					
Test Pass/Fail Criteria: Scripts run successfully or not at this point.					

Final Configuration:

SPIRE in PHOTSTBY mode with bias set to IST Ground Nominal

Enter Date/Time:			**Sign Off:**	

7.10 Procedure: Photometer chop/jiggle mode POF2

Version: 1.0
Date: 24th July 2006
Purpose:
To exercise the photometer POF2 AOT (7 point jiggle map). Test chop and jiggle functions. – also sets photometer mode for thermal tests etc

Duration: ~1 hour

Preconditions:

- Photometer IST Ground Nominal bias setting have been determined by procedure “Photometer bias optimisation”
- SPIRE is as close to Flight nominal operating temperature and temperatures are as stable as possible
- Cryostat flow rates are at natural flow rates ~4 mg/s
- The cooler is recycled, the detectors are at <300 mK and the detector temperatures are as stable as possible
- “PTC Headroom” procedure has been carried out and power setting has been determined
- Level 0 temperature: < 1.85 K drift < 0.21 K/hr (predicted)
- Level 1 temperature: < 5 K drift <0.25 K/hr
- Level 2 temperature: < 12 K no drift constraint

Initial Configuration: SPIRE in PHOTSTBY

Step	Description	Parameters	Expected Values	Actual Values	Success/ Failure
1	Execute TCL script SPIRE-IST-AOT-PHOTO-POINT-JIGGLE.tcl	N/A	N/A		
Test Result (Pass/Fail):					
Test Pass/Fail Criteria: Scripts run successfully or not.					

Final Configuration: SPIRE in PHOTSTBY

Enter Date/Time:			**Sign Off:**	

7.11 Procedure: Photometer small map mode POF3

Version: 1.0
Date: 24th July 2006
Purpose:
To exercise the photometer POF3 AOT (64 point jiggle map). Test chop and jiggle functions. – also sets photometer mode for thermal tests etc

Duration: ~1 hour

Preconditions:

- Photometer IST Ground Nominal bias setting have been determined by procedure “Photometer bias optimisation”
- SPIRE is as close to Flight nominal operating temperature and temperatures are as stable as possible
- Cryostat flow rates are at natural flow rates ~4 mg/s
- The cooler is recycled, the detectors are at <300 mK and the detector temperatures are as stable as possible
- “PTC Headroom” procedure has been carried out and power setting has been determined
- Level 0 temperature: < 1.85 K drift < 0.21 K/hr (predicted)
- Level 1 temperature: < 5 K drift <0.25 K/hr
- Level 2 temperature: < 12 K no drift constraint

Initial Configuration: SPIRE in PHOTSTBY

Step	Description	Parameters	Expected Values	Actual Values	Success/ Failure
1	Execute TCL script SPIRE-IST-AOT-PHOTO-SMALLMAP-JIGGLE.tcl	N/A	N/A		
Test Result (Pass/Fail):					
Test Pass/Fail Criteria: Scripts run successfully or not.					

Final Configuration: SPIRE in PHOTSTBY

Enter Date/Time:			Sign Off:	

7.12 Procedure: Switch from PHOTSTBY to REDY

Duration: 0.25 hrs

Test Script	Description	Parameters	Expected Values Before/After	Actual Values Before/After
SPIRE-IST-SPT-PDET-OFF.tcl	Switches off the Photometer arrays	MODE	PHOTSTBY/PDET_OFF	
SPIRE-IST-SPT-BSM-OFF.tcl	Switches off the BSM	CHOPSENSPWR JIGGSENSPWR MODE	1/0 1/0 PDET_OFF/REDY	

This is followed by a shift tidy up a possible update of CUS parameters/contingency.

Duration: 1.25 hours

7.13 Procedure: Cooler recycle (manual)

Version: 1.0
Date: 24th July 2006
Purpose:
Recycle the cooler with operator intervention (when required, i.e. may be performed at another point in the procedure – PVS to be raised if this is the case)

Duration: ~2 hours

Preconditions:

- Manual recycle carried out under nominal temperature and cryostat operational conditions. (Manual will give best indication of hold time in flight.)
- **The calibration table CoolerRecycling.txt has been updated in the CUS following the manual cooler recycle**
- **Mission configuration changed on the I-EGSE (if the CUS scripts or Calibration tables have been updated)**
- SPIRE is as close to Flight nominal operating temperature and temperatures are as stable as possible
- Cryostat flow rates are at natural flow rates ~4 mg/s
- Herschel tilted such that SOB is tilted 20˚ from vertical towards +Y direction
- Level 0 temperature: <1.85 K predicted (Best <1.7 K – critical that this is maintained throughout recycle to ensure efficient condensation.)
- Level 1 temperature: < 5 K – not critical
- Level 2 temperature: No constraint

Initial Configuration:
SPIRE in REDY mode

Procedure Steps:

Step	Description	Parameters	Expected Values	Actual Values	Success/ Failure
1	Execute TCL script SPIRE-IST-CRECm.tcl	SUBKTEMP	AFTER RECYCLE < 300mK		
Test Result (Pass/Fail):					
Duration of SPIRE Cooler Recycle Procedure:					

Test Pass/Fail Criteria
Pump Temperature ≥ 45K during whole condensation phase. Scripts run successfully or not at this point
Final Configuration: SPIRE in REDY mode with cooler recycled and detectors at <= 300 mK.

Enter Date/Time:			Sign Off:	

7.14 Procedure: Switch from REDY to PHOTSTBY

Duration: 0.25 hrs

Test Script	Description	Parameters	Expected Values Before/After	Actual Values Before/After
SPIRE-IST-SPT-BSM-ON.tcl	Switches on the BSM	CHOPSENSPWR JIGGSENSPWR MODE	0/1 0/1 REDY/BSM_ON	
SPIRE-IST-SPT-BSM-INIT.tcl	Initialises the BSM	CHOPLOOPMODE JIGGLOOPMODE MODE	0/1 0/1 BSM_ON/BSM_INIT	
SPIRE-IST-SPT-PDET-ON.tcl	Switches on the Photometer arrays	MODE	BSM_INIT/PHOTSTBY	

Enter Date/Time:			Sign Off:	

7.15 Procedure: Photometer Thermal Control (PTC) Verification

Version: 2.0
Date: 24th Jan 2008
1.0-1.1 Changed to add in ability to vary tuning parameters for control algorithm – three iterations of the test are expected
1.1-1.2- Test sequence and script names defined

Purpose:
To test detector thermal stability whilst under PTC control – this can be carried out at any point. (Failed during SPT.)

Duration: 1 hour

Preconditions:
- Functional test SPIRE-IST-COLD-FUNC-DCU-13P has been carried out successfully
- Photometer IST Ground Nominal bias settings have been determined by procedure “Photometer bias optimisation”
- SPIRE is as close to Flight nominal operating temperature and temperatures are as stable as possible
- Cryostat flow rates are at natural flow rates ~4 mg/s
- The cooler is recycled, the detectors are at <300 mK and the detector temperatures are as stable as possible
- The “PTC Headroom” procedure has been carried out and the optimum PTC power setting has been established
- Level 0 temperature: < 1.85 K drift < 0.21 K/hr (predicted)
- Level 1 temperature: < 5 K drift <0.25 K/hr
- Level 2 temperature: < 12 K no drift constraint

Initial Configuration: SPIRE is in PHOTSTBY

Procedure Steps:

Step	Description	Parameters	Expected Values	Actual Values	Success/ Failure
1	Execute TCL script SPIRE-IST-START-TEST.tcl This sets the OBSID for the test	N/A	N/A	N/A	
2	Execute one of the following stand alone TCL scripts to switch PTC on and put it in VM control mode. The script to be run will be specified by the I-EGSE 1. SPIRE-IST-PTC-VM-PSWT1.tcl 2. SPIRE-IST-PTC-VM-SUBKTEMP.tcl 3. SPIRE-IST-PTC-VM-TC2.tcl	N/A	N/A	N/A	
3	Stop VM using pop up button when advised by I-EGSE staff • It may be necessary to edit one or more of command parameters in these scripts and rerun the script. • It may also be necessary to set the PTC heater power by sending the SEND_DRCU_COMMAND(0xA0C6xxxx,0), where xxxx will be specified by the I-EGSE. Value Entered:				

Enter Date/Time:			Sign Off:	

Step	Description	Parameters	Expected Values	Actual Values	Success/ Failure
4	Execute TCL script SPIRE-IST-END-TEST.tcl This resets the OBSID for the test	N/A	N/A	N/A	
5	Repeat above steps as requested by I-EGSE staff. Three repeats are expected but may require more.				
6	If requested by the I-EGSE, execute TCL script SPIRE-IST-DNS-PHOT.tcl to apply the IST nominal bias settings.	N/A	N/A	N/A	
Test Result (Pass/Fail):					
Test Pass/Fail Criteria: Scripts run successfully or not at this point. SPIRE is in PHOTSTBY with detector temperature under PTC control					

Final Configuration: SPIRE is in PHOTSTBY with detector temperature under PTC control.

7.16 Procedure: Switch from PHOTSTBY to REDY

Duration: 0.25 hrs

Test Script	Description	Parameters	Expected Values Before/After	Actual Values Before/After
SPIRE-IST-SPT-PDET-OFF.tcl	Switches off the Photometer arrays	MODE	PHOTSTBY/PDET_OFF	
SPIRE-IST-SPT-BSM-OFF.tcl	Switches off the BSM	CHOPSENSPWR JIGGSENSPWR MODE	1/0 1/0 PDET_OFF/REDY	

7.17 Procedure: Switch from REDY to SPECSTBY

Duration: 0.5 hrs

Test Script	Description	Parameters	Expected Values Before/After	Actual Values Before/After
SPIRE-IST-SPT-BSM-ON.tcl	Switches on the BSM	CHOPSENSPWR JIGGSENSPWR MODE	0/1 0/1 REDY/BSM_ON	
SPIRE-IST-SPT-BSM-INIT.tcl	Initialises the BSM	CHOPLOOPMODE JIGGLOOPMODE MODE	0/1 0/1 BSM_ON/BSM_INIT	
SPIRE-IST-SPT-SDET-ON.tcl	Switches on the Spectrometer arrays	MODE	BSM_INIT/SPECSTBY	

Enter Date/Time:			Sign Off:	

7.18 Procedure: Spectrometer bias phase optimisation

Version: 1.1

Date: 31st July 2008

Split previous detector bias optimisation into two following Tanya's recommendation
1.0-1.1 Test sequence and script names defined.
1.0-1.2 Use SPT central phase. Correction of step size to 1.4˚.

.

Purpose:

Find the optimum bias phase versus frequency for operating the spectrometer under IST ground nominal conditions

Duration: 4.0 hours

Preconditions:

- Functional tests SPIRE-IST-FUNC-DCU-04S,13S and SPIRE-IST-COLD-SPEC-VSS have been carried out successfully.
- SPIRE is at ground nominal operating temperature and temperatures are as stable as possible
- Cryostat flow rates are at ground nominal
- The cooler is recycled, the detectors are at <300 mK and the detector temperatures are as stable as possible
- The establishment of the correct Vss settings (SPIRE-IST-COLD-SPEC-VSS)
- Level 0 temperature: < 1.85 K drift < 0.21 K/hr (predicted)
- Level 1 temperature: < 5 K drift <0.25 K/hr
- Level 2 temperature: < 12 K no drift constraint

Bias amplitudes 15, 30, 50 mV

Bias frequencies 80, 160, 240 Hz

Phase Range – FM-IST SPT central phase +/-8.4 ˚ in steps of 1.4 ˚

Initial Configuration:

SPIRE in IST-SPECSTBY

Enter Date/Time:			Sign Off:	

Procedure Steps:

Step	Description	Parameters	Expected Values	Actual Values	Success/ Failure
	Set offsets				
1	Execute TCL script SPIRE-IST-PHASEUP-SPEC80.tcl • Observe signal levels and determine optimum phase setting for IST bias levels • 3 bias amplitudes, with each phase up taking ~30 minutes each	N/A	N/A	N/A	
2	Execute TCL script SPIRE-IST-PHASEUP-SPEC160.tcl • Observe signal levels and determine optimum phase setting for IST bias levels • 3 bias amplitudes, with each phase up taking ~30 minutes each	N/A	N/A	N/A	
3	Execute TCL script SPIRE-IST-PHASEUP-SPEC240.tcl • Observe signal levels and determine optimum phase setting for IST bias levels • 3 bias amplitudes, with each phase up taking ~30 minutes each	N/A	N/A	N/A	
4	If requested by the I-EGSE, execute TCL script SPIRE-IST-DNS-SPEC.tcl to apply the IST nominal bias settings	N/A	N/A	N/A	
5	Analyse data in real time to determine IST ground nominal operating parameters and compare to ILT results – confirm ILT table entries.				

Test Result (Pass/Fail):

Approximate optimum phase settings for each detector:

Bias Level	Frequency	SSW Phase	SLW Phase
15	**80**		
30	**80**		
50	**80**		

Enter Date/Time:			**Sign Off:**	

Test Pass/Fail Criteria & Final Configuration:
Scripts run successfully or not at this point. Analysis of data required by off-line processing.
SPIRE in IST-SPECSTBY mode with bias set to IST nominal values.

This is followed by a shift tidy up/contingency.

Duration: 1.0 hour

Enter Date/Time:			Sign Off:	

7.19 Procedure: Spectrometer bias phase characterisation with PCAL Flashes

Version: 1.1

Date: 31st July 2008

Split previous detector bias optimisation into two following Tanya's recommendation
1.0-1.1 Test sequence and script names defined.
1.0-1.2 Change to use FM-IST SPT central phase.

.

Purpose:

Calibrate responsivity vs phase for the spectrometer under IST ground nominal conditions

Duration: 0.5 hours

Preconditions:

- Functional tests SPIRE-IST-FUNC-DCU-04S,13S and SPIRE-IST-COLD-SPEC-VSS have been carried out successfully.
- SPIRE is at ground nominal operating temperature and temperatures are as stable as possible
- Cryostat flow rates are at ground nominal
- The cooler is recycled, the detectors are at <300 mK and the detector temperatures are as stable as possible
- The establishment of the correct Vss settings (SPIRE-IST-COLD-SPEC-VSS)
- Level 0 temperature: < 1.85 K drift < 0.21 K/hr (predicted)
- Level 1 temperature: < 5 K drift <0.25 K/hr
- Level 2 temperature: < 12 K no drift constraint

Bias amplitudes 33 mV
Bias frequencies 160 Hz
Phase Range – FM IST SPT central phase +70˚ in steps of 10˚
Full PCAL current = 7 mA.

Initial Configuration:

SPIRE in IST-SPECSTBY

Enter Date/Time:			Sign Off:	

Procedure Steps:

Step	Description	Parameters	Expected Values	Actual Values	Success/ Failure
1	Execute the TCL script SPIRE-IST-DNS-SPEC.tcl to set the IST nominal detector settings	N/A	N/A	N/A	
2	Execute TCL script SPIRE-IST-CPS-PHASEUP-SPEC160.tcl 1. Standard PCAL flash for spectrometer. Observe signal levels and determine response for the phase step. 2. Repeat one for next phase step.	N/A	Detector signal N+/-dN mV (for PCAL flash)	N/A	
3	If requested by the I-EGSE, execute the TCL script SPIRE-IST-DNS-SPEC.tcl to set the IST nominal detector settings	N/A	N/A	N/A	
4	Analyse data in real time to determine IST ground nominal operating parameters and compare to ILT results – confirm ILT table entries.				

Test Result (Pass/Fail):

Approximate optimum phase settings for each detector:

Bias Level	Frequency	SSW Phase	SLW Phase
33	**160**		
33	**160**		
33	**160**		
.			
.			

Test Pass/Fail Criteria & Final Configuration:

Scripts run successfully or not at this point. Analysis of data required by off-line processing.
SPIRE in IST-SPECSTBY mode with bias set to IST nominal values.

Enter Date/Time:			Sign Off:	

7.20 Procedure: Spectrometer bias noise optimisation

Version: 2.2
Date: 31st July 2008
V1.0 to 1,1 – changed to "Set bias amplitude" and phase up per frequency setting – referred to setting "Frequency" before – didn't make sense.
V1.1 to V2.0 – split into two following Tanya's recommendation
V2.1 – text changed – incorrect description – removed switch and start from IST-SPECSTBY
V2.1-V2.2 - Test sequence and script names defined

Purpose:
Find the optimum bias level and frequency for operating the spectrometer under IST ground nominal conditions

Duration: 4.5 hours

Preconditions:
- Functional tests SPIRE-IST-FUNC-DCU-04S,13S have been carried out successfully.
- SPIRE is at ground nominal operating temperature and temperatures are as stable as possible
- Cryostat flow rates are at ground nominal
- JFET Vss set correctly for optimum noise (SPIRE-IST-COLD-SPEC-VSS)
- Phase for each bias setting has been determined using test 2.12
- **The input SSW and SLW phases to the CUS scripts SPIRE_IST_DNA_SPEC_AMP15/30/50 have been updated following phase-ups**
- **Mission configuration changed on the I-EGSE (if the CUS scripts or Calibration tables have been updated)**
- The cooler is recycled, the detectors are at <300 mK and the detector temperatures are as stable as possible
- Level 0 temperature: < 1.85 K drift < 0.21 K/hr (predicted)
- Level 1 temperature: < 5 K drift <0.25 K/hr
- Level 2 temperature: < 12 K no drift constraint

Initial Configuration:
SPIRE in IST-SPECSTBY

Enter Date/Time:			Sign Off:	

Procedure Steps:

Step	Description	Parameters	Expected Values	Actual Values	Success/ Failure
	Set offsets				
1	Execute TCL script SPIRE-IST-DNA-SPEC-AMP15.tcl • Set frequency to 80 Hz and IST nominal setting • Set bias amplitude to each predetermined level and phase - observe signal at each level and measure noise • Set frequency to 160 Hz and IST nominal setting • Set bias amplitude to each predetermined level and phase - observe signal at each level and measure noise • Set frequency to 240 Hz and IST nominal setting If requested by the I-EGSE, execute TCL script SPIRE-IST-DNS-SPEC.tcl to apply the IST nominal bias settings	N/A	N/A	N/A	
2	Execute TCL script SPIRE-IST-DNA-SPEC-AMP30.tcl • Set frequency to 80 Hz and IST nominal setting • Set bias amplitude to each predetermined level and phase - observe signal at each level and measure noise • Set frequency to 160 Hz and IST nominal setting • Set bias amplitude to each predetermined level and phase - observe signal at each level and measure noise • Set frequency to 240 Hz and IST nominal setting If requested by the I-EGSE, execute TCL script SPIRE-IST-DNS-SPEC.tcl to apply the IST nominal bias settings	N/A	N/A	N/A	
3	Execute TCL script SPIRE-IST-DNA-SPEC-AMP50.tcl • Set frequency to 80 Hz and IST nominal setting • Set bias amplitude to each predetermined level and phase - observe signal at each level and measure noise • Set frequency to 160 Hz and IST nominal setting	N/A	N/A	N/A	

Enter Date/Time:			Sign Off:	

Step	Description	Parameters	Expected Values	Actual Values	Success/ Failure
	• Set bias amplitude to each predetermined level and phase - observe signal at each level and measure noise • Set frequency to 240 Hz and IST nominal setting If requested by the I-EGSE, execute TCL script SPIRE- IST -DNS-SPEC.tcl to apply the ILT nominal bias settings				
4	Analyse data in real time to determine IST ground nominal operating parameters	N/A	N/A	N/A	
Test Result (Pass/Fail):					
Approximate optimum bias settings each detector: Note that the bias frequency has to be the same for both arrays. **Nominal Bias Frequency:** **Bias Level** **Phase** **SSW** **SLW**					

Test Pass/Fail Criteria & Final Configuration:

Scripts run successfully or not at this point. Analysis of data required by off-line processing.

SPIRE in IST-SPECSTBY mode with bias set to IST nominal values

Enter Date/Time:			Sign Off:	

7.21 Procedure: Level 1 Herschel-SPIRE Interface Test - High Resolution Mode Simulation

Version: 1.0
Date: 15th February 2008
Purpose:
To measure the Level 1 conductance to the HOB from a simulation of the SPIRE SMEC High Resolution Mode.

NOTE THIS NEEDS TO BE DONE AS OPEN LOOP SCANS.

Duration: 2hr

Preconditions:

- SPIRE is as close to Flight nominal operating temperature and temperatures are as stable as possible
- Cryostat flow rates are at natural flow rates ~4 mg/s
- Herschel tilted such that SOB is tilted 20˚ from vertical towards +Y direction
- Level 0 temperature: < 1.85 K drift < 0.21 K/hr (predicted)
- Level 1 temperature: < 5 K drift <0.25 K/hr
- Level 2 temperature: < 12 K no drift constraint

Initial Configuration: SPIRE is in SPEC STBY

Procedure Steps:

Step	Description	Parameters	Expected Values	Actual Values	Success/ Failure
1	Execute SPIRE-IST-HIGH-RES-SMEC-L1.tcl	MODE SMECMOTORCURR	SPEC STBY Follows sawtooth pattern		
Test Result (Pass/Fail):					
Test Pass/Fail Criteria: Scripts run successfully or not at this point. Analysis of data required by off-line processing.					

Final Configuration:
SPIRE is in the mode we started from – SPEC STBY

This is followed by a shift tidy /contingency.

Duration: 1.0 hour

7.22 Procedure: Level 1 Herschel-SPIRE Interface Test - Constant SMEC Power

Version: 1.0
Date: 15th February 2008
Purpose:
To measure the Level 1 conductance to the HOB from a constant power dissipation from the SPIRE SMEC Drive Coil.

Duration: 2hr

Preconditions:

- SPIRE is as close to Flight nominal operating temperature and temperatures are as stable as possible
- Cryostat flow rates are at natural flow rates ~4 mg/s
- Herschel tilted such that SOB is tilted 20˚ from vertical towards +Y direction
- Level 0 temperature: < 1.85 K drift < 0.21 K/hr (predicted)
- Level 1 temperature: < 5 K drift <0.25 K/hr
- Level 2 temperature: < 12 K no drift constraint

Initial Configuration: SPIRE is in SPEC STBY

Procedure Steps:

Step	Description	Parameters	Expected Values	Actual Values	Success/ Failure
1	Execute SPIRE-IST-CONST-SMEC-L1.tcl	MODE SMECMOTORCURR	SPEC STBY Commanded Value		
Test Result (Pass/Fail):					
Test Pass/Fail Criteria: Scripts run successfully or not at this point. Analysis of data required by off-line processing					

Final Configuration: SPIRE is in the mode we started from – SPEC STBY

Enter Date/Time:			**Sign Off:**	

7.23 Procedure: Spectrometer Ambient Background Verification

Version: 1.2
Date: 31st July 2008
Purpose: Determine the optical power load onto the photometer detectors using a detector "loadcurve" at fixed frequency and phase to measure the detector temperature.
*1.1-1.2 Test sequence and script names defined***.**

Duration: ~ 0.75 hours

Preconditions:

- Spectrometer IST Ground Nominal bias setting have been determined by procedure "Spectrometer bias optimisation"
- SPIRE is at ground nominal operating temperature and temperatures are as stable as possible
- Cryostat flow rates are at natural flow rates ~4 mg/s
- The cooler is recycled, the detectors are at <300 mK and the detector temperatures are as stable as possible
- **If the IST optimum phases are significantly different from the ILT values then the input phases in CUS script SPIRE_IST_LC_SPEC will need to be modified and the Mission Configuration updated on the I-EGSE.**
- Level 0 temperature: < 1.85 K drift < 0.21 K/hr (predicted)
- Level 1 temperature: < 5 K drift <0.25 K/hr
- Level 2 temperature: < 12 K no drift constraint

Initial Configuration:
SPIRE is set to SPECSTBY

Procedure Steps:

Step	Description	Parameters	Expected Values	Actual Values	Success/ Failure
1	Execute TCL script SPIRE-IST-CPS-SPEC.tcl • Standard PCAL flash for spectrometer	N/A	Detector signal N+/-dN mV		
2	Execute TCL script SPIRE-IST-LC-SPEC.tcl • Main load curve script	N/A	N/A		
3	Execute TCL script SPIRE-IST-CPS-SPEC.tcl • Standard PCAL flash for spectrometer	N/A	Detector signal N+/-dN mV		
4	If requested by the I-EGSE, execute TCL script SPIRE-IST-DNS-SPEC.tcl to apply the IST nominal bias settings	N/A	N/A	N/A	
Test Result (Pass/Fail):					
Test Pass/Fail Criteria: Scripts run successfully or not at this point. Analysis of data required by off-line processing					

Final Configuration:

SPIRE in IST-SPECSTBY mode with bias set to IST Ground Nominal

Enter Date/Time:			**Sign Off:**	

7.24 Procedure: PCAL Spectrometer Photometric Characterisation

Version: 1.0
Date: 31st July 2008
*V1.0-V1.1 Test sequence and script names defined**.** Added test script for PCAL flash characterisation*

Version: 1.0
Date: 10th October 2008

Purpose: Determine the absorbed power from PCAL by taking a load curve with PCAL set to its nominal PCAL flash output power

Duration: 0.75 hours

Preconditions:

- Functional test SPIRE-IST-COLD-FUNC-PCAL-01 has been carried out successfully
- Photometer IST Ground Nominal bias settings have been determined by procedure “Photometer bias optimisation”
- SPIRE is as close to Flight nominal operating temperature and temperatures are as stable as possible
- Cryostat flow rates are at natural flow rates ~4 mg/s
- The cooler is recycled, the detectors are at <300 mK and the detector temperatures are as stable as possible
- Level 0 temperature: < 1.85 K drift < 0.21 K/hr (predicted)
- Level 1 temperature: < 5 K drift <0.25 K/hr
- Level 2 temperature: < 12 K no drift constraint

Initial Configuration:
SPIRE is set to SPECSTBY with ground nominal detector bias settings

Procedure Steps:

Step	Description	Parameters	Expected Values	Actual Values	Success/ Failure
1	Execute TCL script SPIRE-IST-PON-SPEC.tcl • Set PCAL bias to 7 mA • Wait for 10 seconds	N/A	N/A	N/A	
2	Execute TCL script SPIRE-IST-LC-SPEC.tcl	N/A	N/A	N/A	
3	Execute TCL script SPIRE-IST-POF-SPEC.tcl • Set PCAL bias to 0 mA Wait for 10 seconds				
4	If requested by the I-EGSE, execute the TCL script SPIRE-IST-DNS-SPEC.tcl to set the IST nominal detector settings				
Test Result (Pass/Fail):					
Test Pass/Fail Criteria: Scripts run successfully or not at this point.					

Final Configuration:

SPIRE in IST-SPECSTBY mode with bias set to IST Ground Nominal

Enter Date/Time:			**Sign Off:**	

7.25 Procedure: SCAL Photometric Verification

Version: 1.1
Date: 31st July 2008
Invented to allow SCAL characterisation with the cryostat in the vertical position and SMEC inoperable.
Note we will only be able to do one of the calibration sources – suggest SCAL2
V1.0-v1.1 Test sequence and script names defined. Scripts also available for SCAL4

Purpose:
Determine the optical power load onto the spectrometer detectors from the calibration source using a detector "loadcurve" at fixed frequency and phase to measure the detector temperature.

Duration: 3 hours

Preconditions:
- Spectrometer IST Ground Nominal bias setting have been determined by procedure "Spectrometer bias optimisation"
- SPIRE is as close to Flight nominal operating temperature and temperatures are as stable as possible
- Cryostat flow rates are at natural flow rates ~4 mg/s
- The cooler is recycled, the detectors are at <300 mK and the detector temperatures are as stable as possible
- Level 0 temperature: < 1.85 K drift < 0.21 K/hr (predicted)
- Level 1 temperature: < 5 K drift <0.25 K/hr
- Level 2 temperature: < 12 K no drift constraint

Initial Configuration:
SPIRE is set to IST-SPECSTBY

Procedure Steps:

Step	Description	Parameters	Expected Values	Actual Values	Success/ Failure

Enter Date/Time:			Sign Off:	

Step	Description	Parameters	Expected Values	Actual Values	Success/ Failure
1	Execute TCL script SPIRE-IST-CPS-SPEC.tcl • Standard PCAL flash for spectrometer	N/A	Detector signal N+/-dN mV		
2	Set SCAL2 to 25K Execute standalone script SPIRE-IST-SCAL2-WARMUP.tcl Wait for SCAL2 to reach 25K Initially SCAL2 will be set to 25K.	SCAL2 temperature	SCAL2TEMP T +/- dT K		
3	Execute TCL script SPIRE-IST-CPS-SPEC.tcl Standard PCAL flash for spectrometer	N/A	Detector signal N+/-dN mV		
4	Execute TCL script SPIRE-IST-LC-SPEC.tcl	N/A	N/A		
5	Execute TCL script SPIRE-IST-CPS-SPEC.tcl • Standard PCAL flash for spectrometer	N/A	Detector signal N+/-dN mV		
6	Execute SPIRE-IST-SCAL2-COOLDOWN.tcl 1. Press ok to Switch off SCAL2				
7	**If SCAL2 is to be set to a different temperature then the CUS script StartSCAL2VM will first need to be modified and the Mission Configuration updated by the I-EGSE staff.**	N/A	N/A		
8	**Corresponding TCL scripts are also available for SCAL4, i.e. SPIRE-IST-SCAL4-WARMUP.tcl and SPIRE-IST-SCAL4-COOLDOWN.tcl.** **It may be necessary to run these if advised by the I-EGSE staff.**	N/A	N/A		
9	If requested by the I-EGSE staff, execute TCL script SPIRE-IST-RESET-SPEC-OFFSETS.tcl	N/A	N/A		
Test Result (Pass/Fail):					
Test Pass/Fail Criteria: Scripts run successfully or not at this point. Analysis of data required by off-line processing.					

Final Configuration:

Enter Date/Time:			**Sign Off:**	

SPIRE in IST-SPECSTBY mode with bias set to IST Ground Nominal and SCAL2 cooling to base temperature
The offsets will need resetting once base temperature is reached (~1 hour later)

Enter Date/Time:			Sign Off:	

7.26 Procedure: Switch from SPECSTBY to REDY

Duration: 0.25 hrs

Test Script	Description	Parameters	Expected Values Before/After	Actual Values Before/After
SPIRE-IST-SPT-SDET-OFF.tcl	Switches off the Spectrometer arrays	MODE	SPECSTBY/SDET_OFF	
SPIRE-IST-SPT-BSM-OFF.tcl	Switches off the BSM	CHOPSENSPWR JIGGSENSPWR MODE	1/0 1/0 SDET_OFF/REDY	

7.27 Procedure: 300 mK Stage Decontamination

Version: 1.1
Date: 31st July 2008
V1.0-V1.1 Test sequence and script names defined. **Only to be run once all the other tests have been completed.**

Purpose:
To remove any traces of Helium deposited over the 300 mK stage during testing

Duration: ~3hrs

Preconditions:

- Functional test SPIRE-IST-FUNC-SCU-07 has been carried out successfully.
- SPIRE is as close to Flight nominal operating temperature and temperatures are as stable as possible
- Cryostat flow rates are at natural flow rates ~4 mg/s
- Herschel tilted such that SOB is tilted 20˚ from vertical towards +Y direction
- Level 0 temperature: < 1.85 K drift < 0.21 K/hr (predicted)
- Level 1 temperature: < 5 K drift <0.25 K/hr
- Level 2 temperature: < 12 K no drift constraint
- **All SPIRE tests have been completed.**
- **THIS SHOULD BE LAST TEST TO BE RUN BEFORE THE END OF TV/TB**

Initial Configuration: SPIRE is in REDY

Enter Date/Time:			Sign Off:	

Procedure Steps:

Step	Description	Parameters	Expected Values	Actual Values	Success/ Failure
1	Execute SPIRE-IST-DECONTAMINATE.tcl (Heat Switches are both set to OFF. Once PUMPHSTEMP =12 K, pump heater dissipation is set to 400 mW (then adjusted by CCS command with parameters from SPIRE I-EGSE personnel) to warm up the 300mK system ≥ 4 K for >1 hrs)	MODE	REDY		
Test Result (Pass/Fail):					
Test Pass/Fail Criteria: Scripts run successfully or not at this point. Analysis of data required by off-line processing.					

Final Configuration:

SPIRE is in the mode we started from – REDY

7.28 Switch Off Nominal SPIRE

Duration: 0.5 hours

Step-No.	Test-Step-Description	Nominal Value	Tolerance	Actual Value	Remarks	P	N
	SPIRE: in Standby (REDY) (nom.)						
28.1	From the HPCCS test conductor console start the test script to power OFF SPIRE Prime: **S102999SCVT028_ASDSPTSPIR_PWR_OFF_P**	OK					
28.2	On HPCCS when prompted: `"SPIRE Switch OFF for SPTs in Hel/Hell conditions ONLY - Select NO to abort TS if not correct"` **Select YES**	YES					
	If **YES** is selected the test script will go on to automatically power off all SPIRE warm units.						

Enter Date/Time:			**Sign Off:**	

Step-No.	Test-Step-Description	Nominal Value	Tolerance	Actual Value	Remarks	P	N
	During Switch OFF of SPIRE the following (5,2) and (5,4) event messages on APID 1280 may be expected and do not indicate a problem: EVID 1313 No_MCU_Response_Error EVID 21773 ALARM_LSMCU_DEAD						
28.3	On HPCCS when prompted: "Check Telemetry No Longer Updating - OK to continue" Check that parameters: THSK TM2N	 Not refreshing Not incrementing			**AND: SA_1_559**		
28.4	Select OK to continue	OK					
28.5	On HPCCS when all autonomous actions have been completed by the power on script S102999SCVT028_ASDSPTSPIR_PWR_OFF_P it will prompt: "Bus profile left as SPIRE PRIME, change manually after if required - OK to continue"						
28.6	Select OK to continue	OK					
28.7	On HPCCS stop Packet History displays for the following APIDs:1280,1282	OK					
	SPIRE: OFF						

Enter Date/Time:			**Sign Off:**	

7.29 Switch On Redundant SPIRE to Standby (REDY) Mode for TBTV

During Power ON of SPIRE a number of soft/hard OOLs are reported due to the sequential switch ON of the units. This is expected and will clear when SPIRE is in REDY mode. When in REDY mode one parameter remains OOL (soft), namely SMD2V505, which is also expected.

Duration: 0.5 hours

Step-No.	Test-Step-Description	Nominal Value	Tolerance	Actual Value	Remarks	P	N
	SPIRE: OFF						
29.0	Verify the following TCS baseplate temperature for SPIRE Warm Units before switching ON: **HSDCU (DEA88710)**	> -30°C & < +45 °C					
29.1	On HPCCS start Packet History displays for the following APIDs:1281,1283	OK					
29.2	From the HPCCS test conductor console start the test script to power on SPIRE Redundant: **S102999SCVT029_ASDSPTSPIR_PWR_ON_R**	OK			AND: ZAD07999, ZAD14999 MIM: LCL_HERSCHEL		
29.3	On HPCCS when prompted: `"SPIRE Switch ON for SPTs in Hel/Hell conditions ONLY - Select NO to abort TS if not correct"` **Select YES**	YES					

Enter Date/Time:			Sign Off:	

Step-No.	Test-Step-Description	Nominal Value	Tolerance	Actual Value	Remarks	P	N
	The test script will go on to automatically power on all SPIRE warm units, force boot the DPU ASW (from primary partition) and configure the instrument to Standby mode. Reply to prompts as indicated below.						
29.4	On HPCCS when prompted: `"Check Telemetry Updating Correctly and OBT is Consistent with CDMU - OK to continue"` **Select OK**	OK			**AND: SA_1_559**		
29.5	If I-EGSE connected when prompted on HPCCS, perform check requested then **select OK:** `"Check IEGSE Time Consistent - OK to continue when RAL confirm"`	OK					
29.6	On HPCCS when prompted: `"Check Telemetry No Longer Updating - OK to continue"` Check that parameters: THSK TM2N Select OK to continue	 Not refreshing Not incrementing OK					
29.7	On HPCCS when prompted: `"Check Telemetry Updating Correctly - OK to continue"` Check that parameters: THSK	 Refreshing @ 1Hz			**AND: SA_1_559**		

Enter Date/Time:			Sign Off:	

Step-No.	Test-Step-Description	Nominal Value	Tolerance	Actual Value	Remarks	P	N
	TM2N Select OK to continue	Incrementing by 1 @ 1Hz OK					
29.8	On HPCCS when all autonomous actions have been completed by the power on script S102999SCVT029_ASDSPTSPIR_PWR_ON_R it will prompt: "Set Bus Profile Back to Original Setting?" Select NO	NO					
29.9	At the prompt: "Bus Profile left unchanged" Select OK to continue	OK					
29.10	Verify HK TM packets are being received on APIDs 1281 & 1283	OK					
29.11	On authorisation of SPIRE responsible execute the following test script: SPIRE-IST-SPTMONITORING	OK					
29.12	Verify the following TCS baseplate temperature for SPIRE Warm Units before operating SPIRE: **HSDCU (DEA88710)**	> -15°C & < +45 °C					
	SPIRE: DPU & DRCU powered and in REDY mode (red.)						

Enter Date/Time:			**Sign Off:**	

7.30 Switch OFF Redundant SPIRE for TBTV

The following procedure will switch SPIRE Redundant from Standby (REDY) to OFF.

Duration: 0.5 hours

Step-No.	Test-Step-Description	Nominal Value	Tolerance	Actual Value	Remarks	P	N
	SPIRE: in Standby (REDY) (red.)						
30.1	From the HPCCS test conductor console start the test script to power OFF SPIRE Prime: **S102999SCVT030_ASDSPTSPIR_PWR_OFF_R**	OK					
30.2	On HPCCS when prompted: `"SPIRE Switch OFF for SPTs in Hel/Hell conditions ONLY - Select NO to abort TS if not correct"` **Select YES**	YES					
	If **YES** is selected the test script will go on to automatically power off all SPIRE warm units.						

Enter Date/Time:			**Sign Off:**	

Step-No.	Test-Step-Description	Nominal Value	Tolerance	Actual Value	Remarks	P	N
	During Switch OFF of SPIRE the following (5,2) and (5,4) event messages on APID 1281 may be expected and do not indicate a problem: EVID 1313 No_MCU_Response_Error EVID 21773 ALARM_LSMCU_DEAD						
30.3	On HPCCS when prompted: "Check Telemetry No Longer Updating - OK to continue" Check that parameters: THSK TM2N	 Not refreshing Not incrementing			**AND: SA_1_559**		
30.4	Select OK to continue	OK					
30.5	On HPCCS when all autonomous actions have been completed by the power on script S102999SCVT030_ASDSPTSPIR_PWR_OFF_R it will prompt: "Bus profile left as SPIRE PRIME, change manually after if required - OK to continue"						
30.6	Select OK to continue	OK					
30.7	On HPCCS stop Packet History displays for the following APIDs:1281,1283	OK					
	SPIRE: OFF						

Enter Date/Time:			**Sign Off:**	

7.31 IEGSE Disconnection (optional)

Step-No.	Test-Step-Description	Nominal Value	Tolerance	Actual Value		P	N
	SPIRE: OFF						
	Initial Conditions: Nominal & Redundant SPIRE warm units OFF						
31.1	From HPCCS Test Conductor console issue command to disconnect from SPIRE I-EGSE **disconnect HSPIREEGSE**	OK					
31.2	On HPCSS terminate **SPIRE_ALL_SubscribeParams.**tcl test script.	OK					
31.3	Confirm from HPCSS and SPIRE I-EGSE that the disconnection was successful	**YZS29940= DISCONNECTED**					
31.4	If required Switch OFF I-EGSE i.a.w. AD 3	OK					
	SPIRE IEGSE: DISCONNECTED						

Enter Date/Time:			**Sign Off:**	

8 Summary Sheets

8.1 Procedure Variation Summary

	Test Change	Curr. No.: Date Page of	
Test designation	Test Procedure	Issue	Rev.
Test step changed	Reason for Change		
Prepared by:	Resp. Test Leader	Project Engineer	
PA/QA	Prime	Customer	

Table 8-1: Procedure Variation Sheet

8.2 Non Conformance Report (NCR) Summary

NCR - No.	NCR - Title	Date	Open Closed	PA sig.

Table 8-2: Non-Conformance Record Sheet

8.3 Sign-off Sheet

	Date	Signature
Test Director		
Test Conductor		
Test Operator		
PA Responsible		
ESA Representative		

9 ANNEX A – Cryo Requirements

Colour coding						
No restriction						
Some Restriction						
Very Restricted						
Procedure	**Description**	**Type**	**HeI**	**HeII**	**Orient**	**Cover**
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
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
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
TV/TB Procedures from HERE						
Procedure	**Type**	**Hel**	**Hell**	**Orient**	**Cover**	**Notes**
Cooler recycle (manual)	TV-TB	NO	YES	Y +20 to 30	Any	Orientation is minimum - can also be done with Y horizontal
Photometer Thermal Control Verification	TV-TB	NO	YES	Y +20 to 30	Cold <15K	Orientation is minimum - can also be done with Y horizontal
PCAL Photometer Photometric Characterisation	TV-TB	NO	YES	Y +20 to 30	Cold <15K	Orientation is minimum - can also be done with Y horizontal
SCAL Photometric Characterisation	TV-TB	NO	YES	Y +20 to 30	Cold <15K	Orientation requirement is only for cooler recycle - once completed can be any orientation
PCAL Spectrometer Photometric Characterisation	TV-TB	NO	YES	Y +20 to 30	Cold <15K	Orientation requirement is only for cooler recycle - once completed can be any orientation
Photometer chop/jiggle mode POF2	TV-TB	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
300mk Stage Decontamination	TV-TB	NO	YES	Y +20 to 30	Any	Orientation is minimum - can also be done with Y vertical
Spectrometer Ambient Background Verification	TV-TB	NO	YES	Y +20 to 30	Variable	Orientation is minimum - can also be done with Y vertical
Photometer Ambient Background Verification	TV-TB	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
Level 1 Herschel-SPIRE Interface Test - High Resolution Mode Simulation	TV-TB	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. Y tilt OK for the emulation as the SMEC is not

						moved.
Level 1 Herschel-SPIRE Interface Test - Constant SMEC Power	TV-TB	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. Y tilt OK for the emulation as the SMEC is not moved.
Photometer bias phase characterisation with PCAL Flash	TV-TB	NO	YES	Y +20 to 30	Cold <15K	Orientation is minimum - can also be done with Y vertical
Photometer bias phase optimisation	TV-TB	NO	YES	Y +20 to 30	Cold <15K	Orientation is minimum - can also be done with Y vertical
Photometer bias noise optimisation	TV-TB	NO	YES	Y +20 to 30	Cold <15K	Orientation is minimum - can also be done with Y vertical
Spectrometer bias phase optimisation	TV-TB	NO	YES	Y +20 to 30	Cold <15K	Orientation is minimum - can also be done with Y vertical
Spectrometer bias noise optimisation	TV-TB	NO	YES	Y +20 to 30	Cold <15K	Orientation is minimum - can also be done with Y vertical
Spectrometer bias phase characterisation with PCAL Flash	TV-TB	NO	YES	Y +20 to 30	Cold <15K	Orientation is minimum - can also be done with Y vertical

END OF DOCUMENT

	Name	Dep./Comp.		Name	Dep./Comp.
	Baldock Richard	FAE12		Sonn Nico	ASG51
	Barlage Bernhard	AED13		Steininger Eric	AED321
	Bayer Thomas	ASA42	X	Stritter Rene	AED11
	Brune Holger	ASA45		Suess Rudi	OTN/ASA44
X	Chen Bing	HE Space		Theunissen Martijn	DSSA
X	Davis William	Captec	X	Vascotto Riccardo	HE Space
	Edelhoff Dirk	AED21		Wagner Klaus	ASG23
	Fehringer Alexander	ASG15	X	Wietbrock Walter	AET12
X	Fricke Wolfgang Dr.	AED 65		Wöhler Hans	ASG23
	Geiger Hermann	ASA42		Wössner Ulrich	ASE252
	Grasl Andreas	OTN/ASA44		Zumstein Armin	AED15
X	Grasshoff Brigitte	AET12			
X	Hamer Simon	Terma			
	Hanka, Erhard	FI522			
X	Hendrikse Jeffrey	HE Space			
X	Hendry David	Terma			
	Hengstler Reinhold	ASA42			
	Hinger Jürgen	ASG23			
X	Hohn Rüdiger	AED65			
	Hopfgarten Michael	AET32			
	Huber Johann	ASA42			
	Hund Walter	ASE252			
X	Idler Siegmund	AED312			
	Iványi von András	FAE12			
	Jahn Gerd Dr.	ASG23			
	Jolk Matthias	AET1	X	ESA/ESTEC	ESA
X	Klenke Uwe	ASG72	X	Thales Alenia Space Cannes	TAS-F
	Kölle Markus	ASA43		Thales Alenia Space Torino	TAS-I
	König Werner	AET32			
X	Koppe Axel	AED312			
X	Kroeker Jürgen	AED65		**Instruments:**	
X	La Gioia Valentina	Terma		MPE (PACS)	MPE
	Lang Jürgen	ASE252	X	RAL (SPIRE)	RAL
	Langenstein Rolf	AED15		SRON (HIFI)	SRON
X	Langfermann Michael	ASA41			
	Leitermann Stefan	AET12			
X	Liberatore Danilo	Rhea		**Subcontractors:**	
X	Martin Olivier	Altec		Austrian Aerospace	AAE
X	Maukisch Jan	ASA43		Austrian Aerospace	AAEM
X	Much Christoph	ASA43		BOC Edwards	BOCE
X	Müller Martin	ASA43		Dutch Space Solar Arrays	DSSA
	Pietroboni Karin	AED65		EADS Astrium Sub-Subsyst. & Equipment	ASSE
	Reichle Konrad	ASA42		EADS CASA Espacio	CASA
	Runge Axel	OTN/ASA44		EADS CASA Espacio	ECAS
	Saal Christoph	External		European Test Services	ETS
	Schink Dietmar	AED321		Patria New Technologies Oy	PANT
	Schmidt Thomas	AED15		SENER Ingenieria SA	SEN
	Schweickert Gunn	ASG23		Thales Alenia Space, Antwerp	TAS-ETCA