SPIRE Integrated Module Test sequence for EQM testing

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Scope

Description of the sequence of procedures to be used during the SPIRE CQM Integrated Module Test (IMT) once integrated into the Herschel EQM Payload Module at EADS Astrium in Ottobrun. The pre-requisites for the test are set out followed by a table setting out the steps in the test sequence; the names of the procedures to be executed from CCS and the references to any manual procedures required for, for instance, setting the power in the dummy mechanisms; and the estimated start time and duration of each part of the test.

The timing of this test sequence is based on the assumption of normal working hours for the testing (~8:30 to 17:00 each day). This does not allow the SPIRE team to carry out the thermal balance tests specified in RD2 in a timely and efficient manner and, given the nature of cryogenic systems, probably prevents them resulting in any useful data. It is strongly preferred that the working day is extended during these tests to allow SPIRE to carry out the testing in an efficient manner – this can be seen in the fact we have to break up the Thermal Balance Tests overnight and reconfigure the cryostat each time – this is wasteful and will (fatally) compromise the quality of the test results.

Change notes

0.1	7 January 2005	Draft for checking – procedure names to be added/checked
1.0	5 April 2004	First issue name corrected to SPECIFIC from SHORT Specific procedure names added Manual procedures to be added after discussion with Astrium
2.0	6 September 2005	Name of document changed to reflect change in name of test Timeline for each test day added PACS Parallel Mode removed to separate procedure EMC Test Setup removed to separate procedure
2.1	14 September	Reviewed by Asier Aramburu and Anneso Goizel - detailed changes to procedure order - definition of required temperatures. - extended test times and repeat of photometer standby case before off case

Applicable Documents

AD1 SPIRE Short Functional Test (SFT) Procedures for the CCS - SPIRE-RAL-PRC-002494
AD2 SPIRE Integrated Module Test (IMT) Procedures for CCS SPIRE-RAL-PRC-002512

Reference Documents

RD1 SPIRE Thermal Balance Test Sequence and Requirements for EQM Testing SPIRE-RAL-NOT-002319

Prerequisites for carry out the IMT test sequence

FPU is integrated onto HOB
WE integrated with CCE
WE integrated with harness and FPU
Warm SFT test done in accordance with RD1
Cold functional test done at “4K” and “1.7K” as per AD1
FPU in OFF mode

Prerequisites for data analysis

SCOS is running and display screens are available with conversion curves loaded
QLA sequences ready for display of data and FITS output
IDL V 6.0 or later present on local machine (laptop if necessary) with access to FITS filestore via FTP or other method

DAY 1

Cryostat set up

Flow rate at "ground nominal" : i.e. whatever is required to get stable temperatures – this is a variation to the requirement in section 4.2.2 of RD2. This change has been agreed with Anneso Goizel.

Temperatures required: Det Box 2K; Pump 2K; Evap 1.85 at cryostat/SPIRE interface

SPIRE Detector box strap interface 2 K
SPIRE Cooler pump strap interface 2 K
SPIRE Cooler evaporator strap interface 1.85 K

Cryostat tilted to allow cooler recycle

Lid cooled to lowest possible temperature (<20 K)

Step	Start Time (local)	Description	Procedure Name	Estimated Duration
1	08:30	Turn the instrument from OFF to REDY	**Note:** Follow SPIRE switch ON procedure specified in AD1 Appendix 1	30 minutes
2	09:10	Check the noise in the PLW JFETs with shorted inputs versus Vss (detectors at ~2K)	SPIRE-IMT-NOISE-P	30 minutes
3	10:00	Noise versus bias using spectrometer side of instrument and STM JFETS	SPIRE-IMT-NOISEVBIAS-S	30 minutes
		Run QLA export tool to generate FITS files Transfer data to PC Analyse data – verify no excess system noise	*IDL code*	In parallel with continuing tests
Thermal case 1				
4	10:45	Cooler Pump Test	SPIRE-IMT-PUMP-CHAR	120 minutes
	12:30	**Lunch for Operators**		60 minutes
5	13:30	Recycle cooler	SPIRE-IMT-CREC	120 minutes (TBD) Depends on response of cryostat

Step	Start Time (local)	Description	Procedure Name	Estimated Duration
6	15:45	Switch to Photometer Standby	SPIRE-IMT-REDYPHT	10 minutes
		Wait until temperature stabilises	N/A	TBD – overnight
7	16:00	During stabilisation we can check noise versus bias level and frequency with reduced number of bias levels and frequencies or it will take all day Each procedure covers a different bias level/frequency range	SPIRE-IMT-DNA-P	60 minutes
8		Setup Photometer data generation	SPIRE-IMT-SETUP-P	10 minutes
9		Start Photometer data generation for overnight tests	SPIRE-IMT-START-P	5 minutes
	17:00	End of Astrium working day?		
Instrument to be left on overnight with detectors at ILT determined bias settings				
		Run QLA export tool to generate FITS files Transfer data to PC Analyse data – determine noise is o.k. and optimum bias level and frequency	*IDL code*	Overnight

DAY 2

Cryostat set up
Flow rate at "ground nominal" : i.e. whatever is required to get stable temperatures
Temperatures required: Det Box 2K; Pump 2K; Evap 1.85 at cryostat/SPIRE interface
SPIRE Detector box strap interface 2 K
SPIRE Cooler pump strap interface 2 K
SPIRE Cooler evaporator strap interface 1.85 K
Cryostat can be any orientation
Lid cooled to lowest possible temperature (<20 K) at start of day – to be varied as indicated

Step	Start Time (local)	Description	Procedure Name	Estimated Duration
Evaporator temperature must have stabilised before next test				
10	08:30	Stop overnight Photometer data generation	SPIRE-IMT-STOP-P	5 minutes
11	09:20	Loadcurve at fixed frequency and phase	SPIRE-IMT-LC-P	15 minutes (TBC)
		Stop data generation	SPIRE-IMT-STOP-P	5 minutes
12	09:40	Loadcurve at fixed frequency and phase+90	SPIRE-IMT-LC-PLUS90-P	15 minutes (TBC)
		Stop data generation	SPIRE-IMT-STOP-P	5 minutes
13	10:00	Loadcurve at fixed frequency and phase-90	SPIRE-IMT-LC-MINUS90-P	15 minutes (TBC)
		Stop data generation	SPIRE-IMT-STOP-P	5 minutes
		Run QLA export tool to generate FITS files Transfer data to PC Analyse data – determine detector temperature and estimate background loading	*IDL code*	90 minutes (approx)
15	11:40	Setup the OBS to execute the Flash command list	SPIRE-IMT-LOAD-COMMAND-LIST	10 minutes
16	11:55	Run PCAL static test to check calibration against CBB	SPIRE-IMT-PCAL-LEVEL	15 minutes (TBC)

Step	Start Time (local)	Description	Procedure Name	Estimated Duration
		Run QLA export tool to generate FITS files Transfer data to PC Analyse data – determine absolute signal versus voltage calibration. Can now use SPIRE to determine ambient background for (almost) any setting of the cryo-cover	*IDL Code*	In parallel with continuing tests
Thermal Balance Test 2				
17	12:15	Set instrument to Photometer Standby Set OBSID and collect data continuously	SPIRE-IMT-T2C1-START	1 minutes
18	12:15	Set cryocover temperature to replicate Herschel telescope background – 80K Leave to stabilise	**Astrium Procedure**	?
	12:30	**Lunch**		60 minutes
		Reset Photometer Offsets if necessary	SPIRE-IMT-RESET-OFFSETS-P	10 minutes
		Stop data generation	SPIRE-IMT-STOP-P	5 minutes
19	13:30	PCAL Flash	SPIRE-IMT-PCAL-FLASH	10 minutes
20	14:30	PCAL flash	SPIRE-IMT-PCAL-FLASH	10 minutes
21	15:30	PCAL flash	SPIRE-IMT-PCAL-FLASH	10 minutes
22	16:00	Loadcurve at fixed frequency and phase	SPIRE-IMT-LC-P	15 minutes (TBC)
23	16:30	Stop thermal test case	SPIRE-IMT-T2C1-STOP	1 minute
24	16:30	Setup Photometer data generation	SPIRE-IMT-SETUP-P	10 minutes
25	16:45	Start Photometer data generation for overnight tests	SPIRE-IMT-START-P	5 minutes
Instrument to be left on overnight to monitor temperatures and detector thermal stability				
		Run QLA export tool to generate FITS files Transfer data to PC Analyse data – determine load from lid and detector temperatures	*IDL code*	Overnight

Step	Start Time (local)	Description	Procedure Name	Estimated Duration
Wait for cooler exhaustion approx 30-32 hours after recycle				

DAY 3

Cryostat set up
Flow rate initially set "ground nominal" to achieve stable temperatures during cooler recycle
Temperatures set to near flight for recycle plus a few hours:
SPIRE detector box strap 1.71K
SPIRE Cooler pump strap 2K
SPIRE Cooler evaporator strap 1.75K
Switch to 2.2 mg/s of L1 for thermal balance test as indicated in test sequence
Cryostat tilted to allow cooler recycle
Lid at 80 K

Step	Start Time (local)	Description	Procedure Name	Estimated Duration
26	08:30	Stop overnight Photometer data generation	SPIRE-IMT-STOP-P	5 minutes
27	08:40	Set instrument to REDY mode from Photometer standby	SPIRE-IMT-PHTREDY	10 minutes
Temperatures must be stable before the next step – assume 1 hour?				
28	10:00	Recycle cooler	SPIRE-IMT-CREC	120 minutes (TBD) Depends on response of cryostat
Thermal Balance Test 1				
29	12:00	Switch to Photometer Standby	SPIRE-IMT-REDYPHT	10 minutes
30	12:15	Case 1 PHOT STBY	SPIRE-IMT-T1C1-START	1 minute
31	12:16	PCAL Flash	SPIRE-IMT-PCAL-FLASH	10 minutes
	12:30	**Lunch**		

Step	Start Time (local)	Description	Procedure Name	Estimated Duration
32	13:40	Case 2 - switch to Spectrometer Scan mode	SPIRE-IMT-T1C2 SPIRE-IMT-PHOT2SPEC SPIRE-IMT-SET-POWER-SPEC *Manual procedure to set equivalent power in BSM coils –* ***to be agreed with Astrium***	10 minutes
33	15:40	Switch to Photometer Standby	SPIRE-IMT-SPEC2PHOT	10 minutes
34	15:45	Case 3 – Photometer Scan high JFET dissipation	SPIRE-IMT-T1C3 SPIRE-IMT-SET-POWER-PHOT *Manual procedure to set equivalent power in BSM coils –* ***to be agreed with Astrium***	10 minutes
35	16:00	PCAL Flash	SPIRE-IMT-PCAL-FLASH	10 minutes
36	17:00	Set Instrument for overnight – to photometer STBY – dissipation to 0	SPIRE-IMT-PHTSTBY SPIRE-IMT-SET-POWER-OFF *Manual procedure to set power in BSM coils to zero –* ***to be agreed with Astrium***	10 minutes
37	17:20	Setup Photometer data generation	SPIRE-IMT-SETUP-P	10 minutes
38	17:30	Start Photometer data generation for overnight tests	SPIRE-IMT-START-P	5 minutes
Instrument to be left on overnight to monitor temperatures and detector thermal stability				

DAY 4

Cryostat set up
Flow rate initially set "ground nominal" to achieve stable temperatures during cooler recycle
Temperatures set to near flight for recycle plus a few hours:
SPIRE detector box strap 1.71K
SPIRE Cooler pump strap 2K
SPIRE Cooler evaporator strap 1.75K
Switch to 2.2 mg/s of L1 for thermal balance test as indicated in test sequence
Lid at 80 K

Step	Start Time (local)	Description	Procedure Name	Estimated Duration
Thermal Balance Test 1 (ctd)				
39	08:30	PCAL Flash	SPIRE-IMT-PCAL-FLASH	10 minutes
40	09:00	Case 4 - switch to Photometer Chop mode	SPIRE-IMT-PHOTCHOP SPIRE-IMT-SET-POWER-CHOP *Manual proedure to set equivalent power in BSM coils –* ***to be agreed with Astrium***	10 minutes
41	10:00	PCAL Flash	SPIRE-IMT-PCAL-FLASH	10 minutes
42	11:00	PCAL Flash	SPIRE-IMT-PCAL-FLASH	10 minutes
43	12:00	PCAL Flash	SPIRE-IMT-PCAL-FLASH	10 minutes
44	12:15	Switch to Photometer STBY – dissipation to 0	SPIRE-IMT-PHTSTBY SPIRE-IMT-SET-POWER-OFF	10 minute
45	12:30	Case 1 repeat	SPIRE-IMT-T1C1a-START	1 minute
	12:30	**Lunch**		60 minutes

Step	Start Time (local)	Description	Procedure Name	Estimated Duration
46	13:30	PCAL Flash	SPIRE-IMT-PCAL-FLASH	10 minutes
47	13:45	Loadcurve and fixed bias frequency	SPIRE-IMT-LC-P	15 minutes (TBC)
48	14:45	PCAL Flash	SPIRE-IMT-PCAL-FLASH	10 minutes
49	15:00	End of Case 1 repeat	SPIRE-IMT-T1C1a-STOP	1 minute
Thermal Balance Test 3				
50	15:10	SPIRE to OFF	SPIRE-IMT-OFF	10 minutes
51	15:30	TB3 Case 1 SPIRE off mode flight flow rate	SPIRE-THERM-T3C1-START	1 minute
52	17:00	End of TB3 Case 1	SPIRE-THERM-T3C1-STOP	1 minute
End of nominal SPIRE Testing				

Day 5 taken as contingency