SPIRE

SUBJECT: **SPIRE PFM Power Dissipation Summary**

PREPARED BY: **E Sawyer**

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1. SCOPE

This document summarises the power dissipation of all SPIRE FM units

2. APPLICABLE DOCUMENTS

AD 1	SCI-PT-IIDB/SPIRE-02124	SPIRE IID-B
AD 2	SAp-SPIRE- HT-0425-06 V1.0	DCU functional test report
AD 3		DPU EIDP section 25, mass and power summary
AD 4	SAp-SPIRE-HT-xxx-06	FCU functional test report
AD 5	SPIRE-RAL-REP-002843	SPIRE Thermal Performance Flight Predictions,

3. BUILD STANDARD

All units measured are full flight configuration except where indicated in the individual test reports.

4. MEASUREMENT METHOD.

All the measurements listed here were taken during the PFM4 and PFM5 test campaigns October 2006 to March 2007.
The DPU is powered by a bench power supply (EGSE)
The DRCU (PCU + FCU) is powered by a bench power supply (EGSE)

5. POWER DISSIPATION OUTSIDE THE CRYOSTAT

For each instrument mode listed the current and voltage were recorded form the power supplies
All measurements were taken at 28v.
These measurements represent average dissipation at BOL

Unit	Measured value during PFM 4 (W)				ref	IID-B values (W) Max Average
	Observing		Ready	Cooler recycle		
	Phot	Spec				
HSFCU	60	38	24.4	24.4		42.9
HSDCU						37
HSDPU	12.8	12.8	12.8	12.8		15.3
HSWIH	Included in above					0.1

6. POWER DISSIPATION INSIDE THE CRYOSTAT

The figures quoted are based on measurements performed during PFM4 and PFM5 test campaigns.

6.1 Photometer Modes

OBSERVATION	OBSERVATORY FUNCTION	Name	Comments
Point source photometry	POF1	Chop without jiggling	Accurate pointing and source position
	POF2	Seven-point jiggle map	Inaccurate pointing or source position
Jiggle mapping	POF3	n-point jiggle map	Field mapping
	POF4	Raster map	Extended field mapping
Scan mapping	POF5	Scan map without chopping	Large-area mapping
	POF6	Scan map with chopping	Large area mapping (with 1/f noise)
Peak-up	POF7	Photometer peak-up (TBD)	Determination of pointing offsets
Calibrate	POF8	Photometer calibrate	Responsivity tracking
Engineering modes	POF9	Special engineering/ commissioning modes (TBD)	TBD

Photometer Observatory Functions (SPIRE-RAL-DOC-000320, Issue 3)

Observations in photometer mode consist mainly of POF1, POF2, POF3, POF5 and POF8.

Photometer Power Budget

The table below describes the power dissipated by the SPIRE BSM and PJFET when operating in photometer mode. The dissipations represent the "average power" dissipated during a given mode of observation i.e. the power dissipated by the BSM at the various chop/jiggle positions of the 7pt jiggle map varies between 0mW and 0.7mW. The 0.3mW given in the table represents the average dissipation for all positions of a single map. The duty cycle gives an indication of the amount of time which will be allocated to the various observation modes for a nominal observation period of 46hr i.e. the chopping mode is to be used for only a quarter of the overall 46hr period.

Mechanisms	Ref	Average Dissipation [mW]	Duty Cycle [%] (*)
BSM – POF8 – Calibration with PCAL	2	0.0243	100
BSM Sensors	1	0.8	100
BSM Motor - POF1 – Chopping (+/- 63")	1	0.548	25
BSM Motor - POF2 – 7pt Jiggle Map	1	0.3	25
BSM Motor - POF3 – 64pt Jiggle Map	1	1.55	25
BSM Motor – POF5 – Scan	1	0.0	25
Extra power component during BSM dynamic switching	1	0.25	100
Photometer JFETs	3	56.64	100

(*) Over a nominal 46hr observation period in photometer mode.

Assumptions:

- It is currently assumed that POF1, POF2, POF3 and POF5 will be equally used. This will depend on the scientific community needs.

6.2 Spectrometer Mode

OBSERVATION	OBSERVATORY FUNCTION	Name	Comments
Point source spectrometry	SOF1	Continuous Scan	Accurate pointing & source posn.
	SOF3	Step-and-Integrate	Accurate pointing & source posn.
Mapping spectrometry	SOF2	Continuous Scan	Field mapping
	SOF4	Step-and-Integrate	Field mapping

Spectrometer Observatory Functions (SPIRE-RAL-DOC-000320, Issue 3)

Spectrometer Power Budget

The table below describes the power dissipated by the SPIRE SMEC, SCAL, BSM, PCAL and SJFET when operating in spectrometer mode. The dissipations represent the "average power" dissipated during a given mode of observation i.e. the power dissipated by the SMEC actuator during a high resolution scan varies quadratically between 0 and ~17mW. The 3.56mW given in the table represents the integrated power dissipation of the actuator over the full scan range. The duty cycle gives an indication of the amount of time which will be allocated to the various observation modes for a nominal observation period of 46hr i.e. the SMEC HI resolution mode is to be used half the time of the overall 46hr period.

Mechanisms	Ref	Average Dissipation [mW]	Duty Cycle [mW] (*)
SCAL2 at 80K	2	2	100
Extra power component during SCAL dynamic switching	2	0.87	50
SMEC Actuator R1000 (HI Resolution)	4	3.56	50
SMEC Actuator R100 (MED Resolution)	4	0.46	25
SMEC Actuator R10 (L0 Resolution)	4	0.43	25
SMEC Encoder (Level 2)	4, 5	1.2	100
SMEC LVDT	5	0.112	100
BSM Sensors	1	0.8	100
BSM Motor - POF3 – 64pt Jiggle Map	1,6,7	1.55	50
Extra power component during BSM dynamic switching	1, 6	0.25	50
BSM Calibrator (PCAL)	2	0.0243	100
Spectrometer JFETs	3	**15.17**	**100**

(*) Over a nominal 46hr operation period in Spectrometer mode.

Reference:

[1] – Measured at unit level on PFM unit, please refer to Bryan Stobie's email on 09/02/04.

[2] – Measured as part of instrument PFM3 test campaign, please refer to PFM3 Thermal Test Report, section 4.8.1.

[3] – Measured as part of instrument PFM3 test campaign, please refer to HR-SP-RAL-RFW-005v1.

[4] – Measured as part of instrument PFM4 test campaign, please refer to PFM4 Thermal Test Report (including short section on latest PFM5 test results).

[5] – Measured at unit level on CQM unit, please refer to SMEC CQM Cryogenic Test Results (LAM.ELE.SPI.PRV.040731_01).

[6] – Emails from Bruce Swinyard on 05/12/05.

[7] – SPIRE Operating Modes Document (SPIRE-RAL-DOC-000320, Issue 3).