



SPIRE Beam Steering Mirror PFM Test Report
v 1.0

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Author: DMcN
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1. OVERVIEW

1.1 Introduction

The testing of the Spire Beam Steering Mirror Proto Flight Model took place end 2003 / early 2004.

1.2 Scope

The Beam Steering Mirror Prototype Flight Model (PFM) is a deliverable model of flight standard suitable for use on the SPIRE Instrument. Testing was carried out in accordance with the Test Plan

1.3 Applicable documents

Applicable documents are project specific and may be assumed to apply fully to the BSM, unless stated otherwise

Ref	Title	Author	Reference	Ver	Date
AD 1	SPIRE Beam Steering Mirror Subsystem Specification	P. Parr-Burman	SPIRE-ATC-PRJ-000460	3.7	11 Sep 03
AD 2	SPIRE Beam Steering Mirror Subsystem Development plan	I Pain	SPIRE-ATC-PRJ-0466	5.1	30.Jan.02
AD 3	SPIRE Beam Steering Mirror Design Description	I Pain	SPIRE-ATC-PRJ-000466	4.1	20.Feb.02
AD 4	SPIRE BSM Product Assurance Plan	B. Graham	SPIRE-ATC-PRJ-000711	1.5	09 Jun 03
AD 5	SPIRE BSM Test Plan	D. McNeil	SPIRE-ATC-PRJ-000736	4.0	10 Nov 03

1.4 Reference documents

Reference documents are generic and may only apply in part to the project, or may be for information or reference only.

Ref	Title	Author	Reference	Ver	Date

1.5 Glossary

AD	Applicable Document	MCU	Mechanism Control Unit
ADP	Acceptance Data Package	MIP	Mandatory Inspection Point
ARB	Acceptance Review Board	MGSE	Mechanical Ground Support Equipment
BSM	Beam Steering Mirror	MSSL	Mullard Space Science Laboratory
BSMe	Beam Steering Mirror electronics	NA	Not Applicable
CoG	Centre of Gravity	NCR	Non Conformance Report
CIL	Critical Items List	NCRP	Non Conformance Review Panel
CoC	Certificate of Conformance	OGSE	Optical Ground Support Equipment
CQM	Cryogenic Qualification Model	PA	Product Assurance
CTD	Change to Drawing/Document	PFM	Proto Flight Model
DCL	Declared Components List	PPARC	Particle Physics and Astronomy Research Council
DM	Development Model	PI	Principal Investigator
DML	Declared Materials List	QA	Quality Assurance
DPA	Destructive Physical Analysis	RAL	Rutherford Appleton Laboratory
DRB	Delivery Review Board	RAL SSD	RAL Space Science Department
ECSS	European Cooperation for Space Standardisation	RD	Reference Document
EGSE	Electrical Ground Support Equipment	SMEC	Spectrometer Mechanism
EIDP	End Item Data Pack	SPIRE	Spectral and Photometric Imaging REceiver
ESA	European Space Agency	STM	Structural & Thermal Model
FPU	Focal Plane Unit	TBC	To Be Confirmed
FSM	Flight Spare model	TBD	To Be Defined
GSE	Ground Support Equipment	TBW	To Be Written
HoS	Head of Specialism	UK ATC	United Kingdom Astronomy Technology Centre
Herschel	ESA Mission name (formerly FIRST)	UK SPO	UK SPIRE Project Office
IBDR	Instrument Baseline Design Review	WE	Warm Electronics
KIP	Key Inspection Point		
LAM	Laboratoire d'Astrophysique de Marseille		
LAT	Lot Acceptance Tests		



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2. TEST RESULTS

This section of the document should be read in conjunction with the 'SPIRE Beam Steering Mirror Subsystem Test Plan' section 4: 'Performance Verification Tests'. The tests are performed in accordance with the test descriptions in that document unless otherwise noted.

SPIRE BSM LAB TESTS LOG SHEET.

2.1 Subsystem Test Plan Test 4.1: Mirror Surface Flatness.

Date: / /	SPIRE Model: PFM
Tester	
Test description: Test completed, to be written up for Thursday 25 th March.	
Apparatus used:	
Notes on Test:	
Results:	
Conclusion:	



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SPIRE BSM LAB TESTS LOG SHEET.

2.2 Subsystem Test Plan Test 4.2: Fail Safe (No Drive Signal) Position.

Date: 10 / 03 / 04	SPIRE Model: PFM
Tester: D. McNeill	
Test description: Test Performed at 5.5K	
Apparatus used:	
Notes on Test: Test Carried out in accordance with Method outlined in SPIRE BSM Subsystem Test Plan. Test Performed at 5.5K.	
Rest Position information: Rest Position spot was 4.5 (+/-0.1) cm away from alignment mirror spot: 4.3cm in the direction of positive chop (+0.246 deg), and 1.45cm in the direction of positive jiggle (+0.083 deg). This measurement was taken at a distance of 499.8cm from the mirror.	
Rest position is 0.258 deg away from the alignment position. This is not within the +/-0.18 deg required by specification.	
Voltages from prime sensors at this rest position: (7.1 deg K)	
Chop	
V2,21 = -0.27460V	
V21,3 = -0.23093V	
Jiggle	
V5,24 = -0.24100V	
V24,6 = -0.23805V	
The following are measurements for the bsm return commanded to be coincident with the alignment mirror return. These measurements are taken at a distance of 699.5cm from the mirror.	
Voltages from prime sensors at this aligned position. (6.8K)	
Chop	
V2,21 = -0.26679V	
V21,3 = -0.23850V	
Jiggle	
V5,24 = -0.23624V	
V24,6 = -0.24253V	
Note that the numbers 'V2,21' etc. in these measurements refer to measurements taken at the D-type connector pins.	
Results & Conclusion: Rest position is not within Spec of +/- 0.18 deg. See Request for Waiver / NCR.	

2.3 Subsystem Test Plan Test 4.3: Mass Test of Proto-Flight Model BSM.

Date: 13 / 01 / 04

SPIRE Model: PFM

Tester: T. Baillie

Test description:

Apparatus used:

Orange Scales: Ascom Hasler MH34, Ser. No. 2972.

Notes on Test:

Note that the PFM model BSM does not have the PCAL unit attached for this mass test.

PFM is otherwise complete with baffle on front and back-plate on rear, and shoe for attachment to SOB (Spire Optical Bench). PFM has trailing wires ready for attachment of PCAL unit.

Scales switched on. Placed PFM onto scales and read number off scales. Lift off scales and repeat, recording readings. See photograph of test.

Results:

749g

749g

750g

750g

Average: 749.5g (+/- 1g)

Conclusion:

Fully assembled PFM BSM model with trailing leads for PCAL but no PCAL attached weighs 749.5 (+/- 1) g.

SPIRE BSM LAB TESTS LOG SHEET.

2.4 Subsystem Test Plan Test 4.4: Operating Temperature.

Date: / /

SPIRE Model: PFM

Tester

Test description:

Test not completed as yet – no actual traces have been recorded, however, it does work warm: sensors read back and motors perform, though not to specification, as is understood.

Apparatus used:

Notes on Test:

Results:

Conclusion:



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SPIRE BSM LAB TESTS LOG SHEET.

2.5 Subsystem Test Plan Test 4.5:Angular Travel.

Date: / / SPIRE Model: PFM

Tester

Test description:

Apparatus used:

Notes on Test:

Results:

Conclusion:



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2.6 Subsystem Test Plan Test 4.6:Minimum Step Size.

Date: / /

SPIRE Model: PFM

Tester

Test description:

Apparatus used:

Notes on Test:

Results:

Conclusion:



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2.7 Subsystem Test Plan Test 4.7:Position Measurement.

Date: / /

SPIRE Model: PFM

Tester

Test description:

Apparatus used:

Notes on Test:

Results:

Conclusion:



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2.8 Subsystem Test Plan Test 4.8:Resolution.

Date: / /

SPIRE Model: PFM

Tester

Test description:

Apparatus used:

Notes on Test:

Results:

Conclusion:



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2.9 Subsystem Test Plan Test 4.9:Position Stability.

Date: / /

SPIRE Model: PFM

Tester

Test description:

Apparatus used:

Notes on Test:

Results:

Conclusion:



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2.10 Subsystem Test Plan Test 4.10: Holding Position.

Date: / /

SPIRE Model: PFM

Tester

Test description:

Apparatus used:

Notes on Test:

Results:

Conclusion:



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2.11 Subsystem Test Plan Test 4.11: Repeatability.

Date: / /

SPIRE Model: PFM

Tester

Test description:

Apparatus used:

Notes on Test:

Results:

Conclusion:



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2.12 Subsystem Test Plan Test 4.12: Frequency.

Date: / /

SPIRE Model: PFM

Tester

Test description:

Apparatus used:

Notes on Test:

Results:

Conclusion:



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2.13 Subsystem Test Plan Test 4.13: Settling Time.

Date: / /

SPIRE Model: PFM

Tester

Test description:

Apparatus used:

Notes on Test:

Results:

Conclusion:



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2.14 Subsystem Test Plan Test 4.14: Cold Power Dissipation.

Date: / /

SPIRE Model: PFM

Tester

Test description:

Apparatus used:

Notes on Test:

Results:

Conclusion:



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2.15 Subsystem Test Plan Test 4.15: Operating Modes.

Date: / /

SPIRE Model: PFM

Tester

Test description:

Apparatus used:

Notes on Test:

Results:

Conclusion:

2.16 Subsystem Test Plan Test 4.16: Measurement of PCal Alignment Surface and BSM Mirror with respect to BSM Shoe.

Date: / /

SPIRE Model: PFM

Tester T. Baillie

Test description:

Apparatus used:
SPIRE BSM PFM.
UKATC Coordinate Measuring Machine

Notes on Test:
Test performed in accordance with description in the Subsystem Test Plan.

Results:
Angle 'A': 89 deg 58' 56".
Angle 'B': +0 deg 2' 15".
Dimension C: 72.603mm

Conclusion:
yes



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Date: / /

SPIRE Model: PFM

Tester

Test description:
Subsystem Test Plan Test 4

Apparatus used:

Notes on Test:

Results:

Conclusion: