



SPIRE - 300mK PMW-PFM filter stack

End Item Data Package (EIDP)

SPIRE - 300mK PMW-PFM filter stack

SPIRE Ref.: SPIRE-UCF-DOC-001929

Cardiff Ref.: HSO-CDF-EIDP-057 Issue 1.0

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Change Record

Issue	Section	Date	Changes

Table of contents

Section	Contents	Req.	Comments
1	Shipping Documents	X	
2	Transportation, Packing, Handling & Integration Procedures	X	
3	Certificate of Conformance / Delivery Review Board MoM Ai-Lists	X	
4	Qualification Status List / Test Matrix	X	
5	Top Level Drawings (inc. Family Tree)	X	
6	Interface Drawings	X	
7	Functional, Block & Mechanical Drawings	X	
8	Electrical Circuit Drawings		
9	As Built Parts List	X	
10	Serialised Components List		
11	List of Waivers		
12	Copies of Waivers		
13	Operational Manual		
14	Historical Record	X	
15	Logbook / Diary of Events	X	
16	Operating Time / Cycle Record	X	
17	Connector Mating Record		
18	Age Sensitive Items Record		
19	Pressure Vessel History / Test Record		
20	Calibration Data Record	X	
21	Temporary Installation Record	X	
22	Open Work / Deferred Work / Open Tests	X	
23	List of Non-Conformance Reports	X	
24	Copies of Non-Conformance Reports	X	
25	Test Reports	X	
26	Proof Load Certificates		
27	Reference List of EIDP's		

	(Lower Level / Associated)		
28	Mass Records / Power Budget	X	
29	Cleanliness Statement	X	
30	Other Useful Information	X	

SECTION 01 - Shipping Documents

W:\Cardiff_workpackages\Deliverables\Shipped\Filters\PFM-300mK-filters\PFM-300mK-PMW-EIDP\300mK_PMW_PFM_HSO-CDF-EIDP-057.doc	SPIRE - 300mK PMW-PFM filter stack End Item Data Package (EIDP)	Page 5 of 32
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SECTION 02 - Transportation, Packing, Handling & Integration Procedures

**This package contains flight hardware.
To be opened only by authorised SPIRE personnel in clean room conditions.**

Do not touch filter surface.

Handle only by Aluminium frame.

To be integrated to SPIRE flight model PMW BDA according to JPL procedure.

Hand over to JPL Cognisant Engineer – Mark Weilert

Mark Weilert

M/S 79-24

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SECTION 03 - Certificate of Conformance

Cardiff University Astronomy Instrumentation Group hereby certifies that the following equipment,		
Spacecraft / Project:	Herschel	
Instrument:	SPIRE	
Model:	PFM	
Subsystem:	300mK PMW filter stack	
Serial No:	FILT-PFM-240	
As described in this End Item Data Package: HSO-CDF-EIDP-057		
Complies with the requirements set out in: SPIRE-RAL-PRJ-000034		
Responsible Authority		Signature
Cardiff Filter Management	Prof P.A.R.Ade	
	Dr C.E.Tucker	
Cardiff Product Assurance	Dr I.Walker	
Cardiff SPIRE Management	Dr P.Hargrave	

SECTION 04 - Qualification Status List / Compliance Matrix

Test	Status	Test Institute
	PFM-PMW - FILT-PFM-240	
Spectral behaviour - Near-band transmission	Tested at component and assembly level. Compliant.	UWC
Spectral behaviour - out-of-band blocking, at $\lambda < 15\mu\text{m}$	Open test. Off-cuts to be tested once facility commissioned	UWC
Dimension and tolerances to specification	Compliant	UWC
Filter flatness	Not applicable	UWC
Inspection for surface defects	Passed	UWC
Mass	Compliant	
Thermal cycling (5 cycles 300K-77K-300K)	Passed	UWC
Cold vibration	Not tested	RAL
Environmental condition - Vacuum $3 \times 10^{-1} \text{mBar}$	Passed	UWC
Differential pressure (a pumping-out rate of 10mB/sec)	Passed	UWC
Pre-bake out (not exceeding 80°C)	Passed	UWC
Outgassing	Test not performed. All materials used within ESA / NASA specifications	
Cleanliness checks, by visual inspection.	Passed	UWC
Degradation due to high energy radiation.	Not tested	

SECTION 05 - Top Level Drawings (Inc. Family Tree)

TOP LEVEL DRAWING LIST

Drawing No.	Title
FILT-CQM/PFM-200-03.001	300mK Filter Assembly

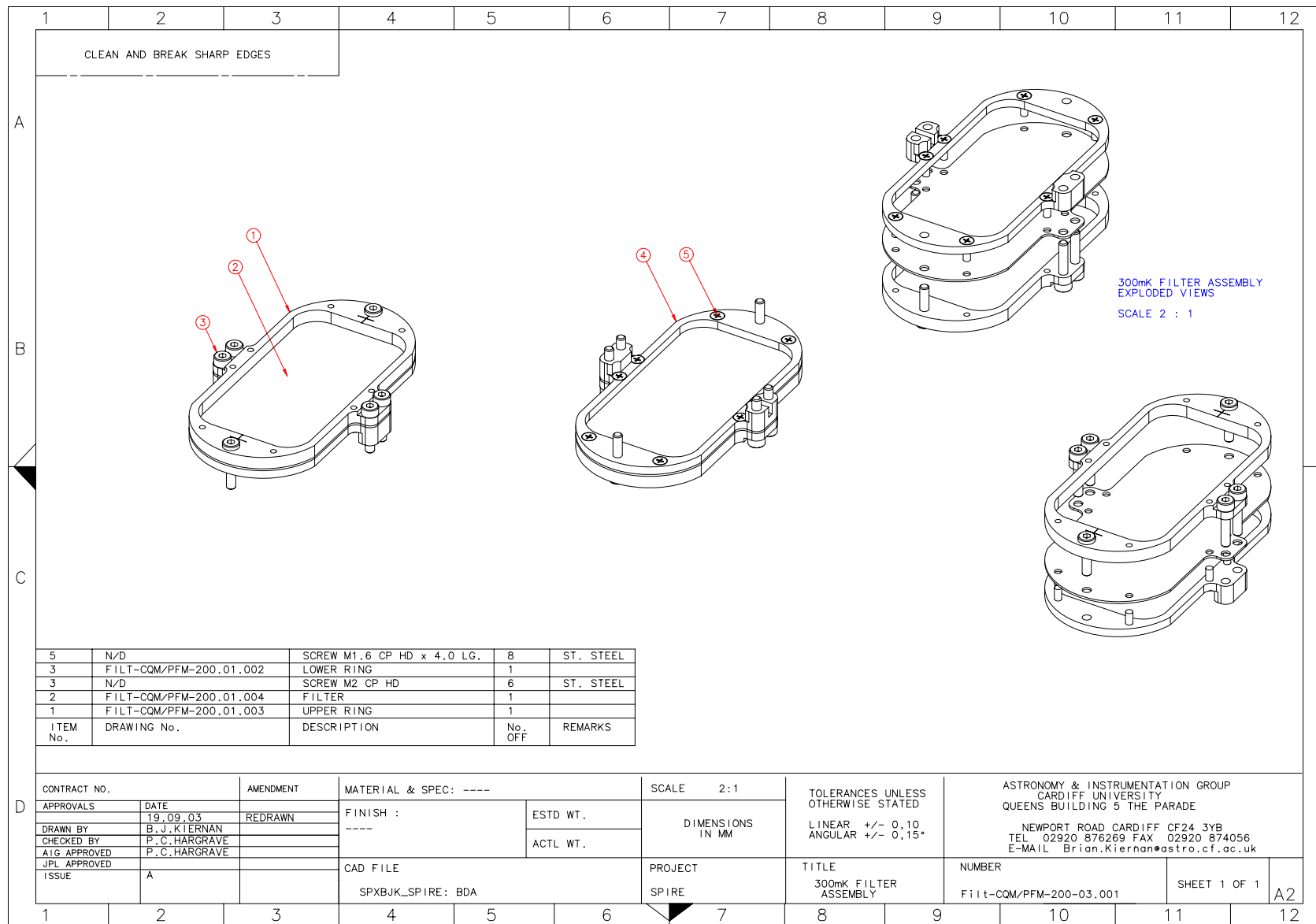


Figure 1 300mK filter stack assembly

SECTION 06 - Interface Drawings

INTERFACE DRAWING LIST

Drawing No.	Title
FILT-CQM/PFM-200	300mK Filter ICD

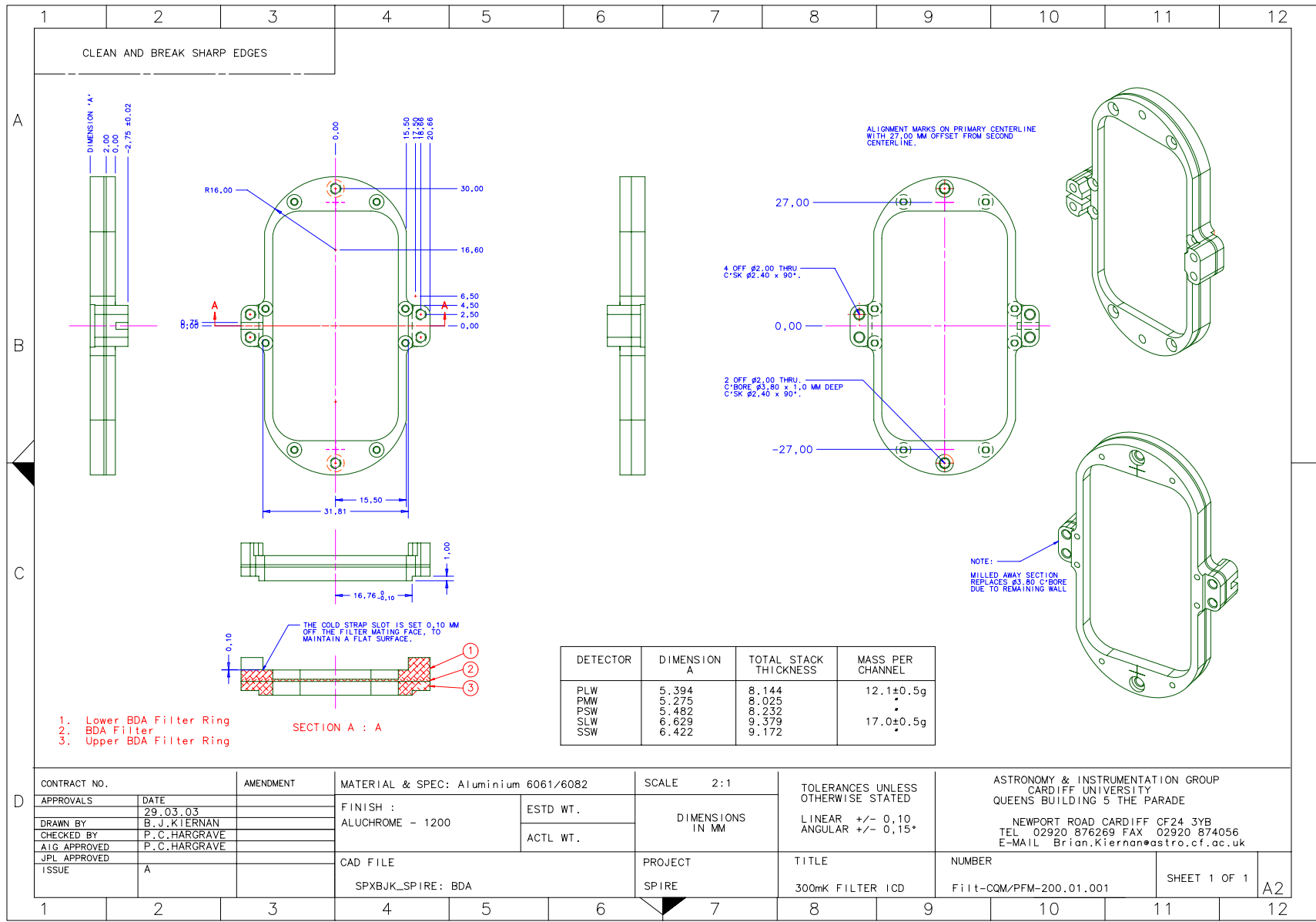


Figure 2 Interface drawing for 300mK filters

SECTION 07 - Functional, Block & Mechanical Drawings

Component drawings are given in this section. Also shown, for illustration purposes, are details of the mounting of the HDPE lens for each filter stack assembly.

FUNCTIONAL & BLOCK DRAWING LIST

Drawing No.	Title

MECHANICAL COMPONENT DRAWING LIST

Drawing No.	Title
FILT-CQM/PFM-200-01-004	300mK Filter
FILT-CQM/PFM-200-01-003	300mK Filter Upper Ring
FILT-CQM/PFM-200-01-002	300mK Filter Lower Ring

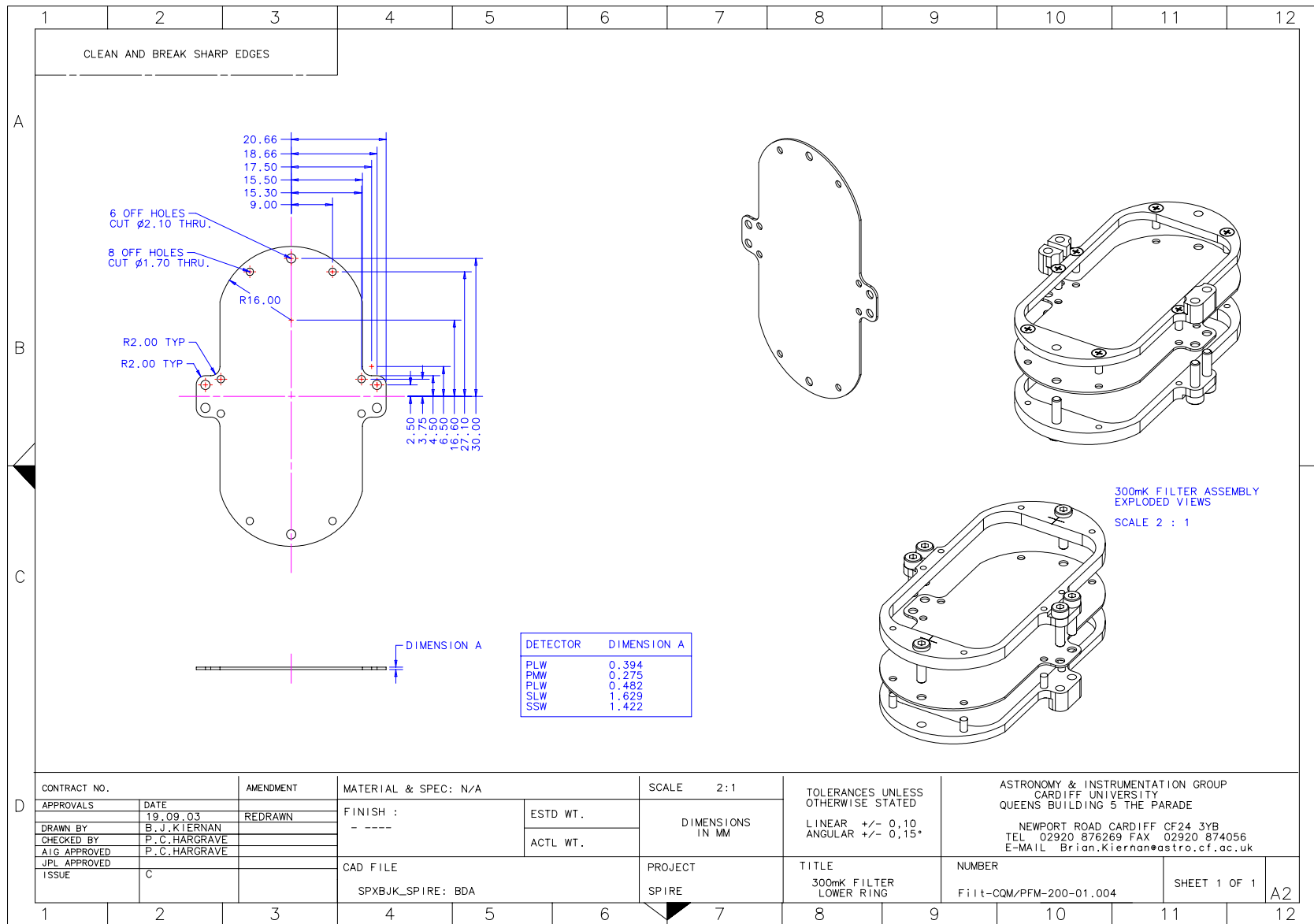


Figure 3 300mK Filter

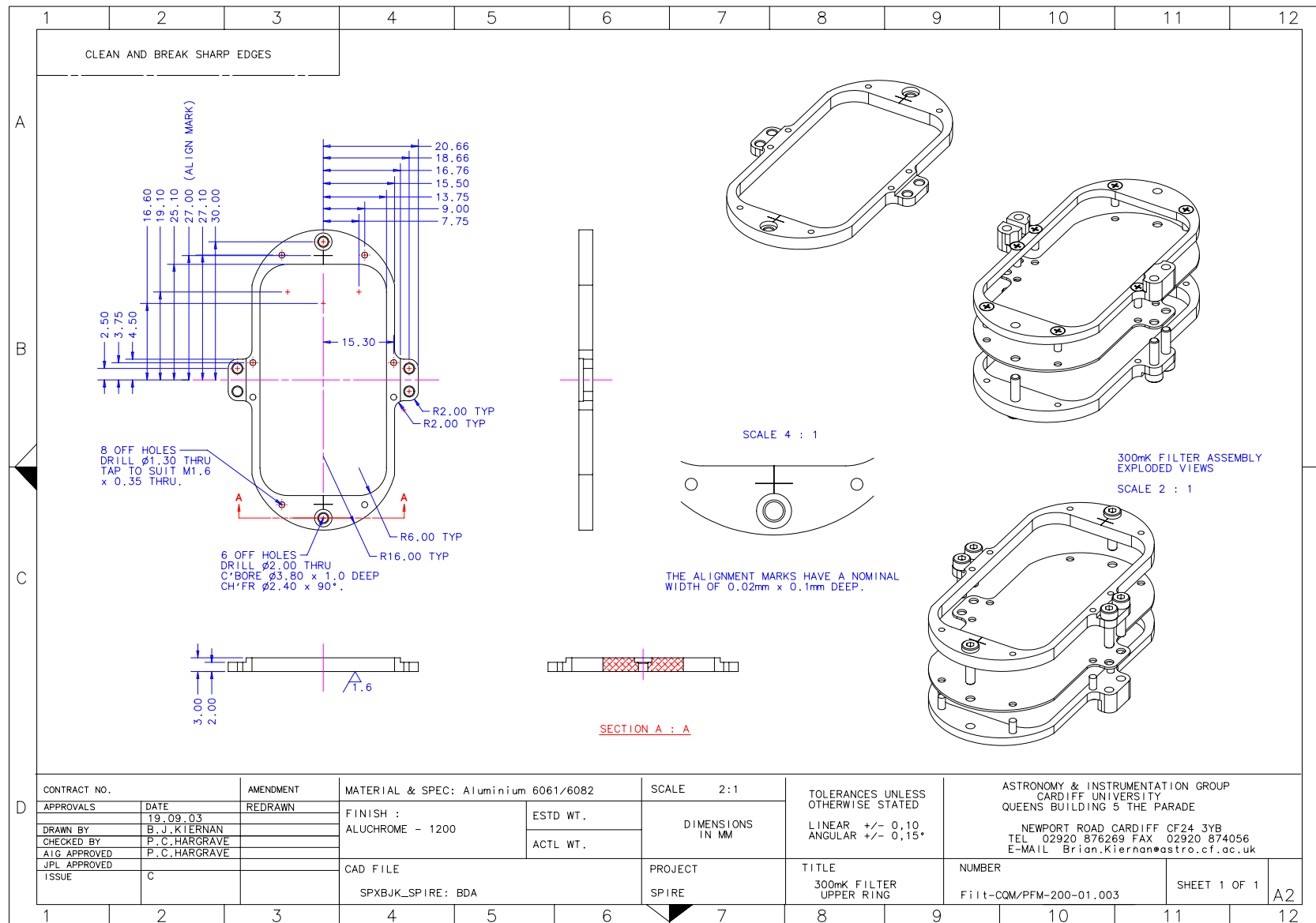


Figure 4 300mK Filter Upper Ring

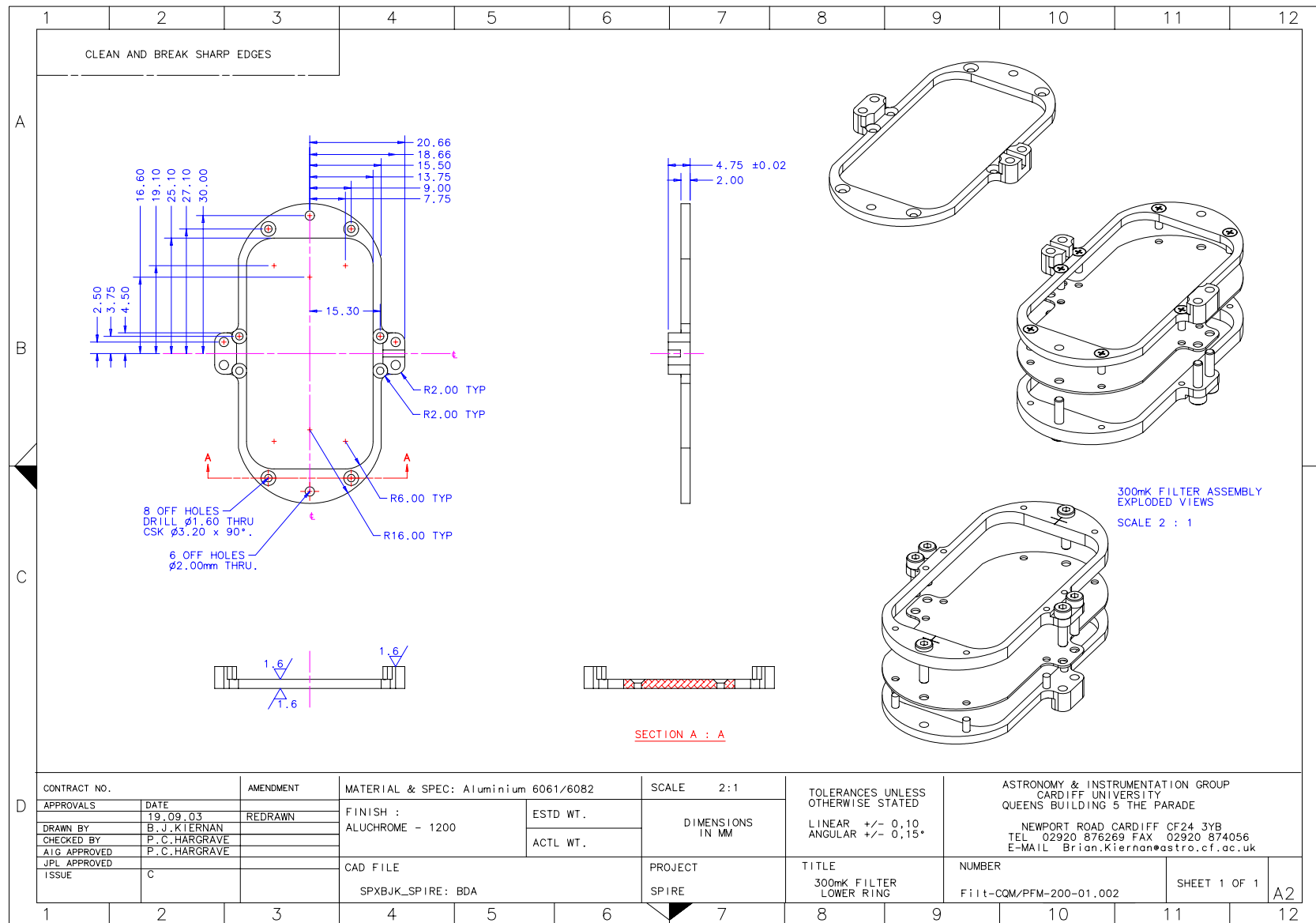


Figure 5 300mK Filter Lower Ring

SECTION 09 - As Built Configuration Items Status List

Item	Reference	Location	Notes
Filter drawings and manufacturing files		\\Darkstar\Astroworld\Projects\SPIRE\Cardiff_workpackages\Configured_documents\Filters\Drawings\300MK-filter-CQM-PFM.doc	
Material certificates of conformance		Available at Cardiff for inspection	
FILT-PFM-240 Spectroscopic test data PMW-PFM assembly		\\Darkstar\Astroworld\Projects\SPIRE\Cardiff_workpackages\Configured_documents\Issued\Data\FILT-PFM-240_PMW_assembly_January2004.xls	

Part number	Description	Details
FILT-PFM-240	PFM PMW FILTER ASSEMBLY	
FILT-PFM-241	PMW PFM lower filter ring	Aluminium-6082 – Aluchrom 1200 coated
FILT-PFM-242	PMW-PFM upper filter ring	Aluminium-6082 – Aluchrom 1200 coated
FILT-PFM-243	PFIL4M – PFM – B734 filter	43cm ⁻¹ (232.6µm) LPE blocking filter

SECTION 11 - List of Waivers

SECTION 12 - Copies of Waivers

SECTION 13 - Operations Manual

SECTION 14 - Historical Record

The following table contains *brief* historical details of the manufacture, assembly and testing of the PFM 300mK PMW filter assembly, including the levels of environmental cleanliness.

A *full* historical record of every stage of manufacture for each individual grid integral to the final mounted filter is traceable at UWC, in both hard copy log-book format and on a Microsoft Access database.

Filter PFIL4M

Date	Action	UWC Test reference
10/10/03	Filter B734 manufactured in class 1000 clean room	
13/10/03	Filter B734 spectroscopically tested in the range 3-40cm ⁻¹	T0198r7
14/10/03	Filter B734 spectroscopically tested in the range 10-140cm ⁻¹	T0199r43
19/12/03	Filter B488 thermally shocked 5 times between 300K and 77K	THERM 0132
19/12/03	Filter B734 cut to PFIL4M drawing	Process HC1
6/1/04	Filter PFIL4M spectroscopically tested in the range 0-145cm ⁻¹ at three locations over area	T0247r22, T0247r16, T0247R19
7/1/04	Filter PFIL4M mounted in PFM-PMW stack	
7/1/04	PFM-PMW stack spectroscopically tested in the range 20-650cm ⁻¹	T0248r4
7/1/04	PFM-PMW stack thermally cycled 300K-77K-300K	THERM 0133
7/1/04	PFM-PMW stack spectroscopically tested in the range 10-145cm ⁻¹	T0248r13
7/1/04	PFM-PMW stack baked for 17hrs at 350K	THERM 0134
8/1/04	PFM-PMW stack spectroscopically tested in the range 0-145cm ⁻¹ at three locations over area	T0250r4, T0250r7, T0250r13,
8/1/04	PFM-SLW stack final clean, 24Hr bake-out at 350K	
12/1/04	PFM-SLW packed in class 1000 clean room & shipped to JPL	

SECTION 15 - Logbook / Diary of Events

Not provided – available from subsystem provider upon request.

SECTION 16 - Operating Time / Cycle Record

SECTION 20 - Calibration Data Record

The recommended total stack transmission for the PMW channel to be used for calibration purposes is indicated in this section, with traces shown for the ranges 3-650cm⁻¹, 20-100cm⁻¹, and 15-40cm⁻¹.

These are the measured transmission spectra prior to final cleaning and packing.

The raw data is stored in the file \\Darkstar\Astroworld\Projects\SPIRE\Cardiff_workpackages\Configured_documents\Issued\Data\FILT-PFM-240_PMW_assembly_January2004.xls (Microsoft Excel workbook). This file is available from Cardiff, and is under configuration control on Livelink (managed by RAL).

Transmission spectrum of SPIRE PFM PFIL4M from 3-650cm-1

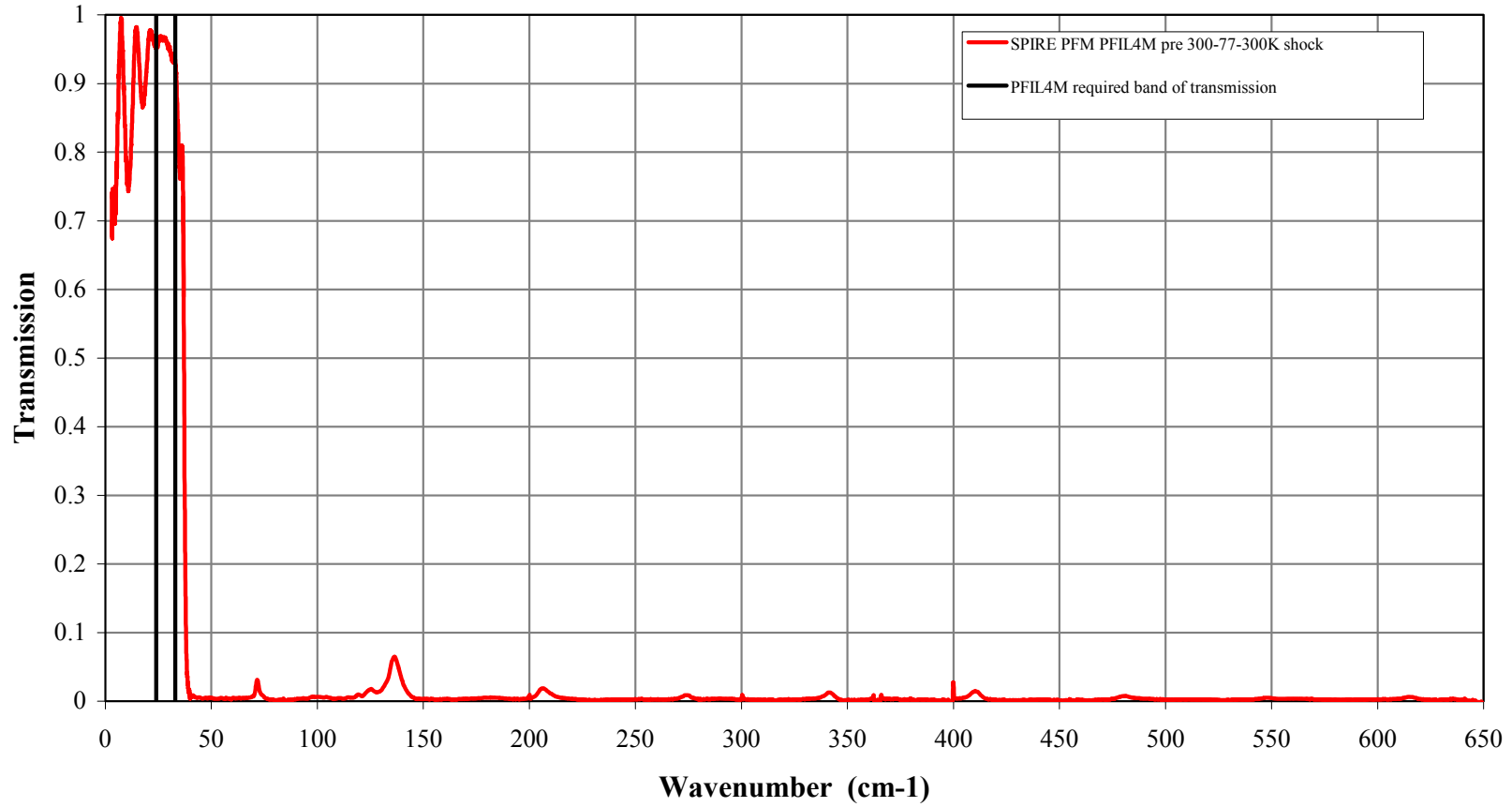


Figure 6 Spectroscopic data for PFM-PMW stack

Transmission spectrum of SPIRE PFM PFIL4M

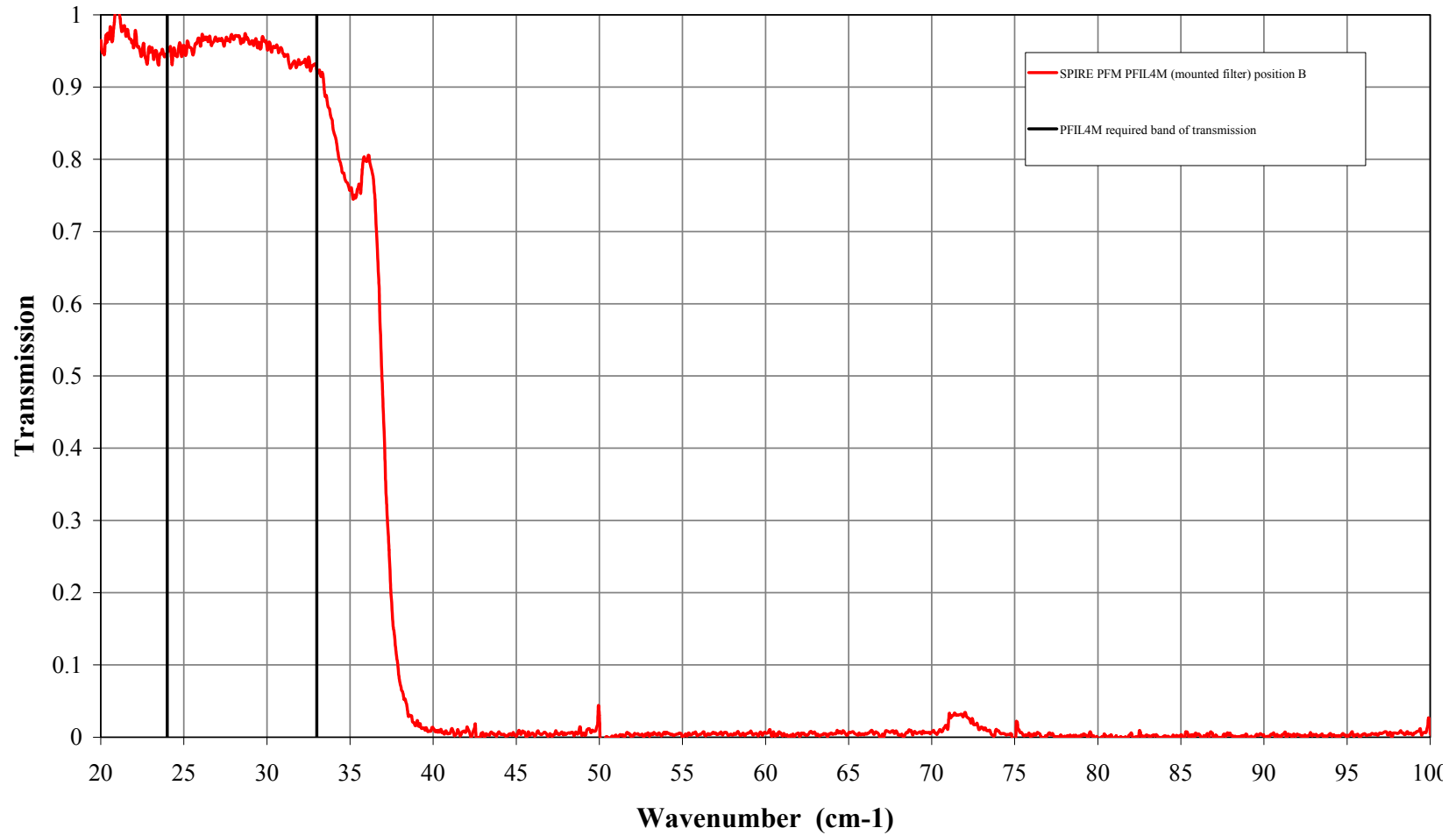


Figure 7 Spectroscopic data for PFM-PMW stack

Transmission spectrum of SPIRE PFM PFIL4M

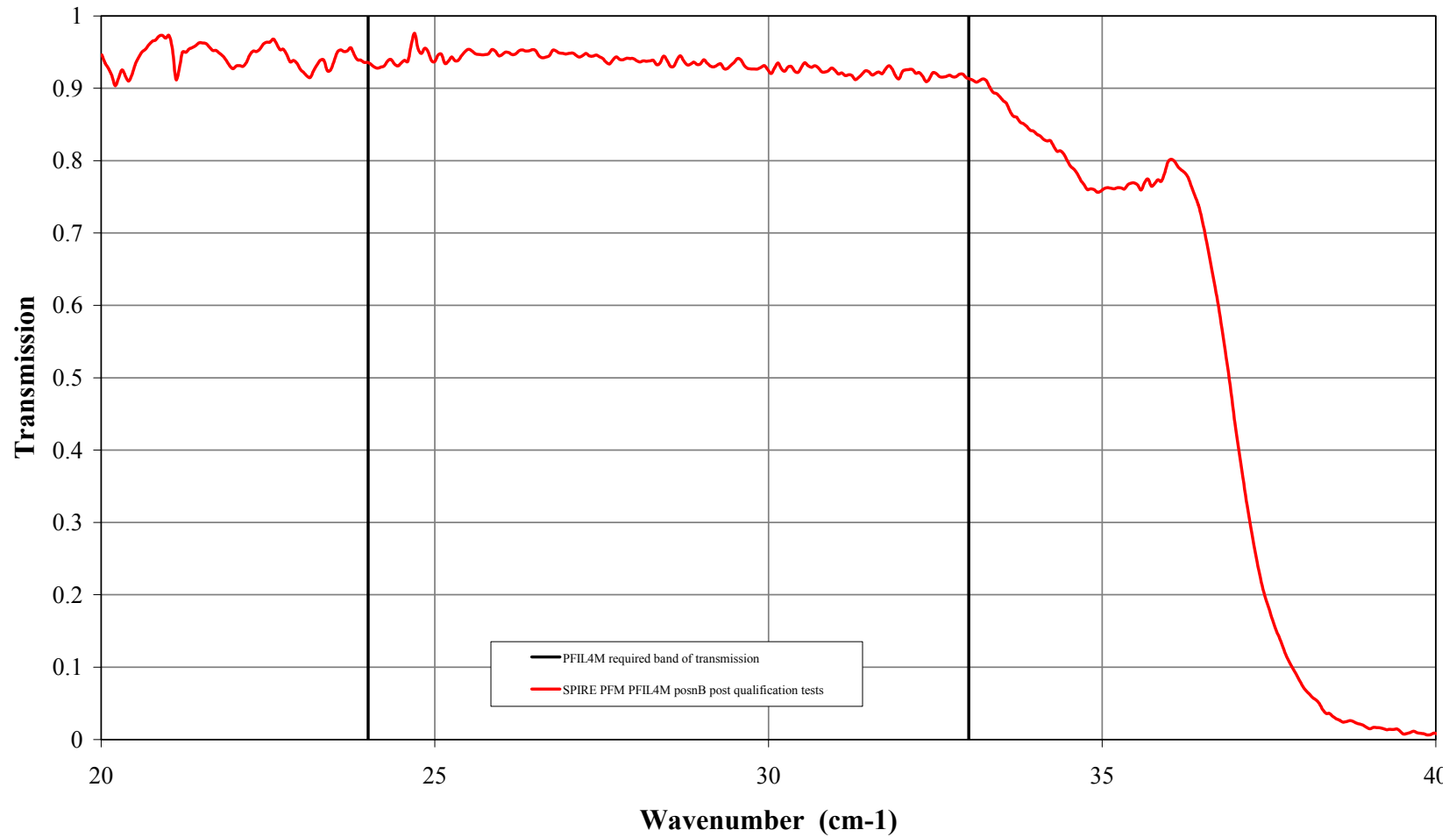


Figure 8 Spectroscopic data for PFM-PMW stack

SECTION 21 - Temporary Installation Record

SECTION 22 - Open Work / Deferred Work / Open Tests

Off-cuts of the filter material will be measured below 15µm using the Bomen spectrometer, once this facility is fully commissioned.

SECTION 23 - List of Non-Conformance Reports

SECTION 24 - Copies of Non-Conformance Reports

SECTION 25 - Test Reports

The filter module (PMW assembly) underwent the following series of qualification tests:-

- a) Post-manufacture spectroscopic measurements – 3-40cm⁻¹ and 10-140cm⁻¹
- b) Thermal shocks of the filter material. This consisted of five cycles of:-
 - Plunge filter material at room temperature into bath of liquid nitrogen and leave for 2 minutes
 - Remove filter material from LN₂ and place in oven at 320K for 10 minutes
- c) Visual inspection
- d) Cutting to size
- e) Visual inspection
- f) Spectroscopic measurements of filter material at three points over the filter area – 0-145cm⁻¹ range
- g) Cleaning and mounting in clamp
- h) Spectroscopic measurements in the range 20-650cm⁻¹
- i) PFM-PMW stack thermally cycled 300K-77K-300K
- j) Spectroscopic measurements - 10-145cm⁻¹ range
- k) PFM-PLW stack baked for 17Hrs at 350K
- l) Visual inspection under microscope
- m) Spectroscopic measurements of mounted assembly at three points over the filter area – 0-145cm⁻¹ range
 - Uniformity checks:-
 - The filter assembly was checked for uniformity at three points along the filters long axis - at the centre of the filter, and at two points along the long axis, 16mm either side of the central point.
 - The FTS geometric beam footprint was approximately 7mm diameter.

Spectroscopic tests – index

Spectroscopic tests were carried out according to standard UWC FTS procedures. Refer to historical record for index.

B734 uniformity check post mounting, pre thermal tests (300-77-300) (300-370-300)

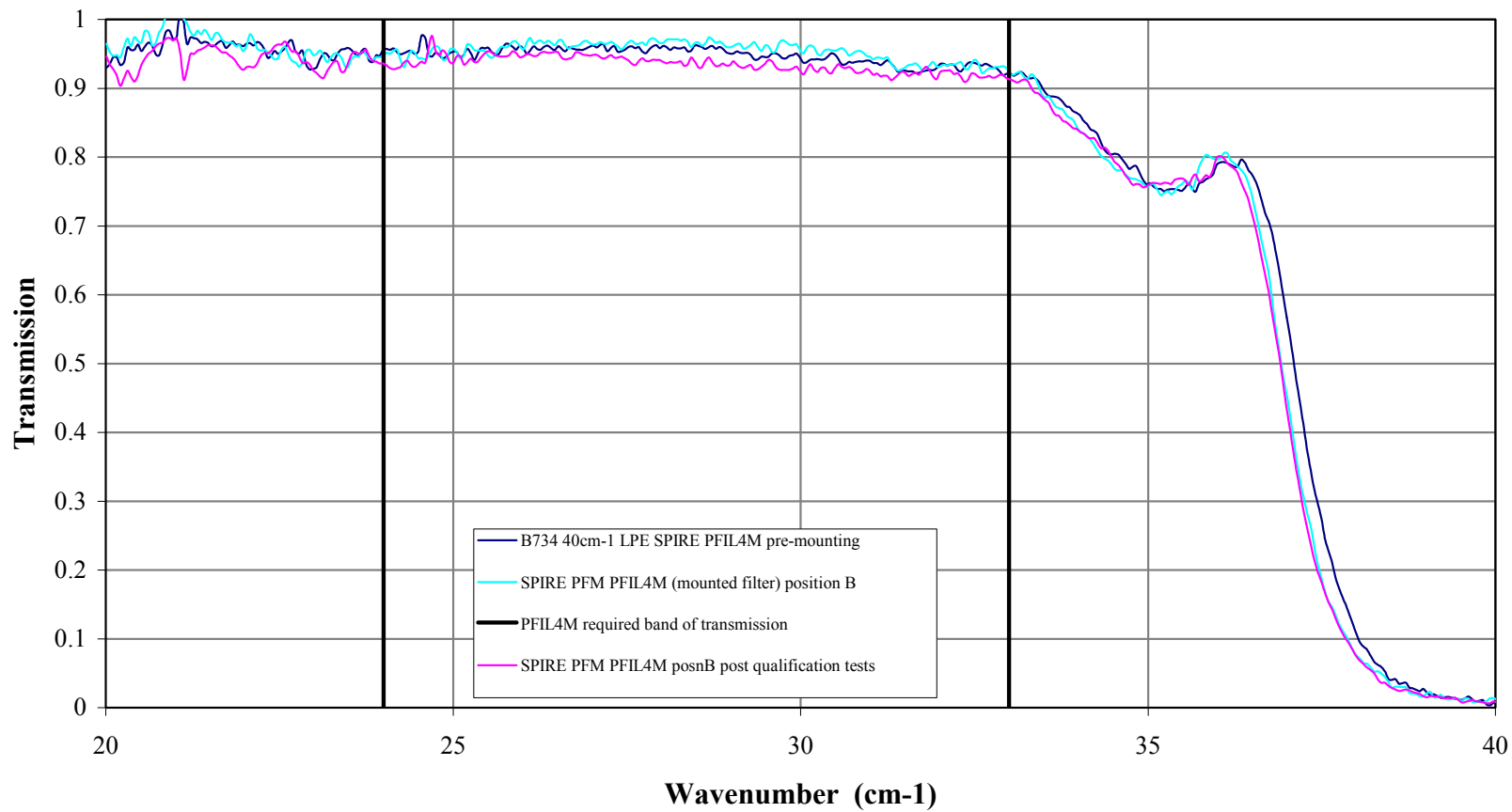


Figure 9 B734 filter uniformity post-mounting – 3-40cm⁻¹

Uniformity check post mounting, pre thermal tests (300-77-300) (300-370-300)

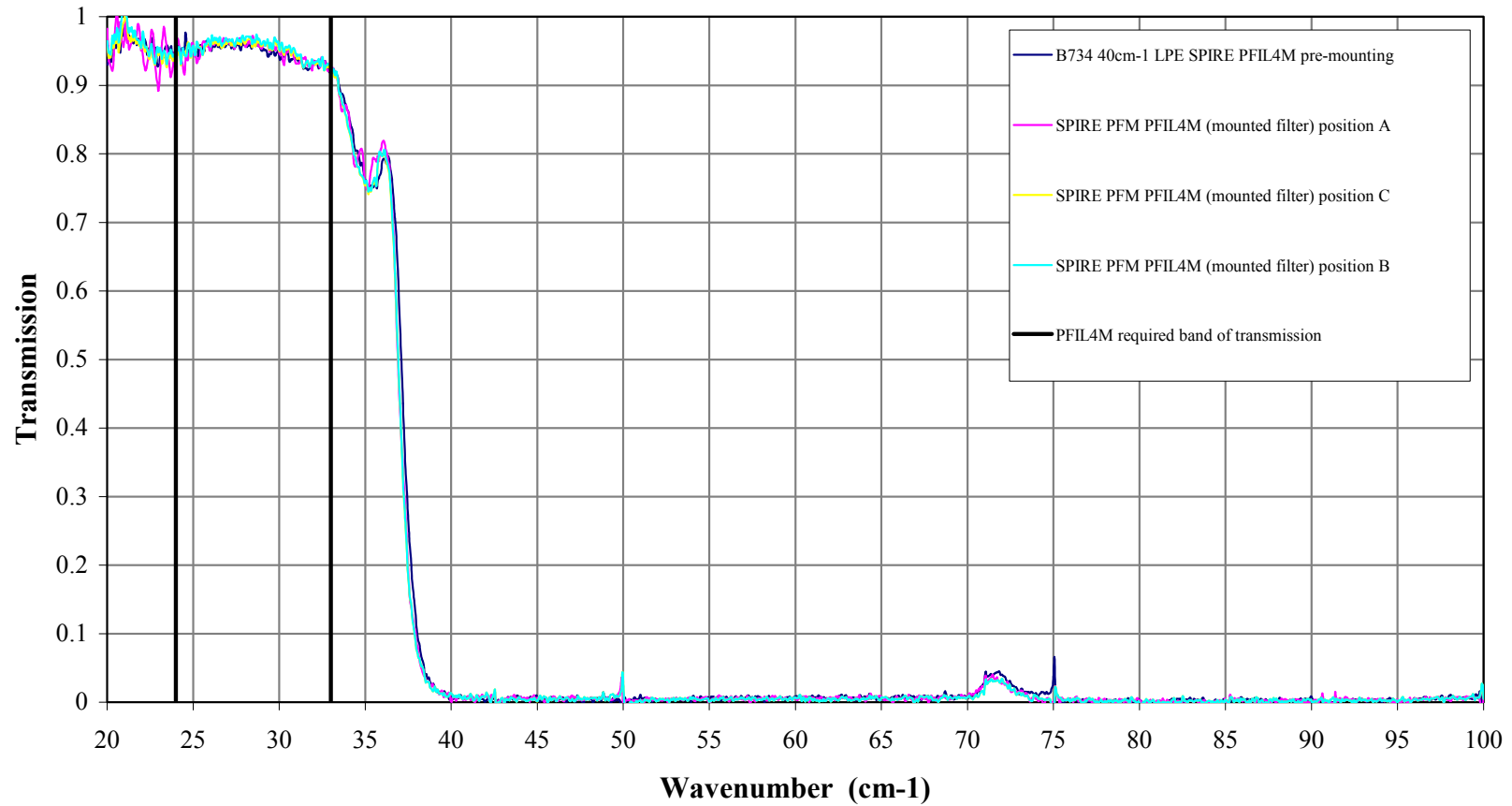


Figure 10 B734 filter uniformity post-mounting – 10-140cm⁻¹

B734 uniformity check post mounting, post thermal tests (300-77-300) (300-370-300)

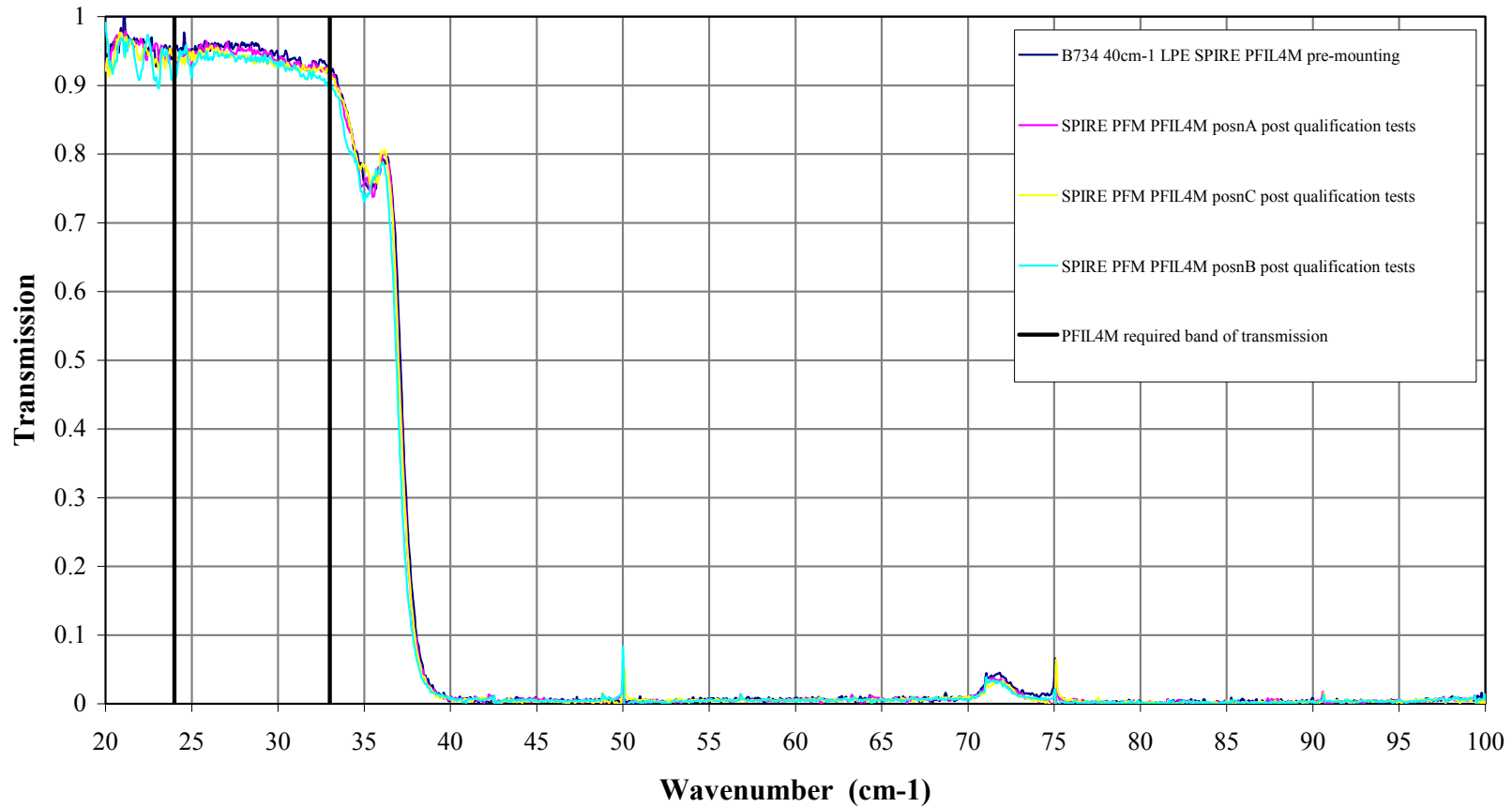


Figure 11 B734 filter uniformity post-mounting and thermal shocks/cycles – 10-140cm⁻¹

Transmission spectrum of SPIRE PFM PFIL4M from 3-650cm⁻¹

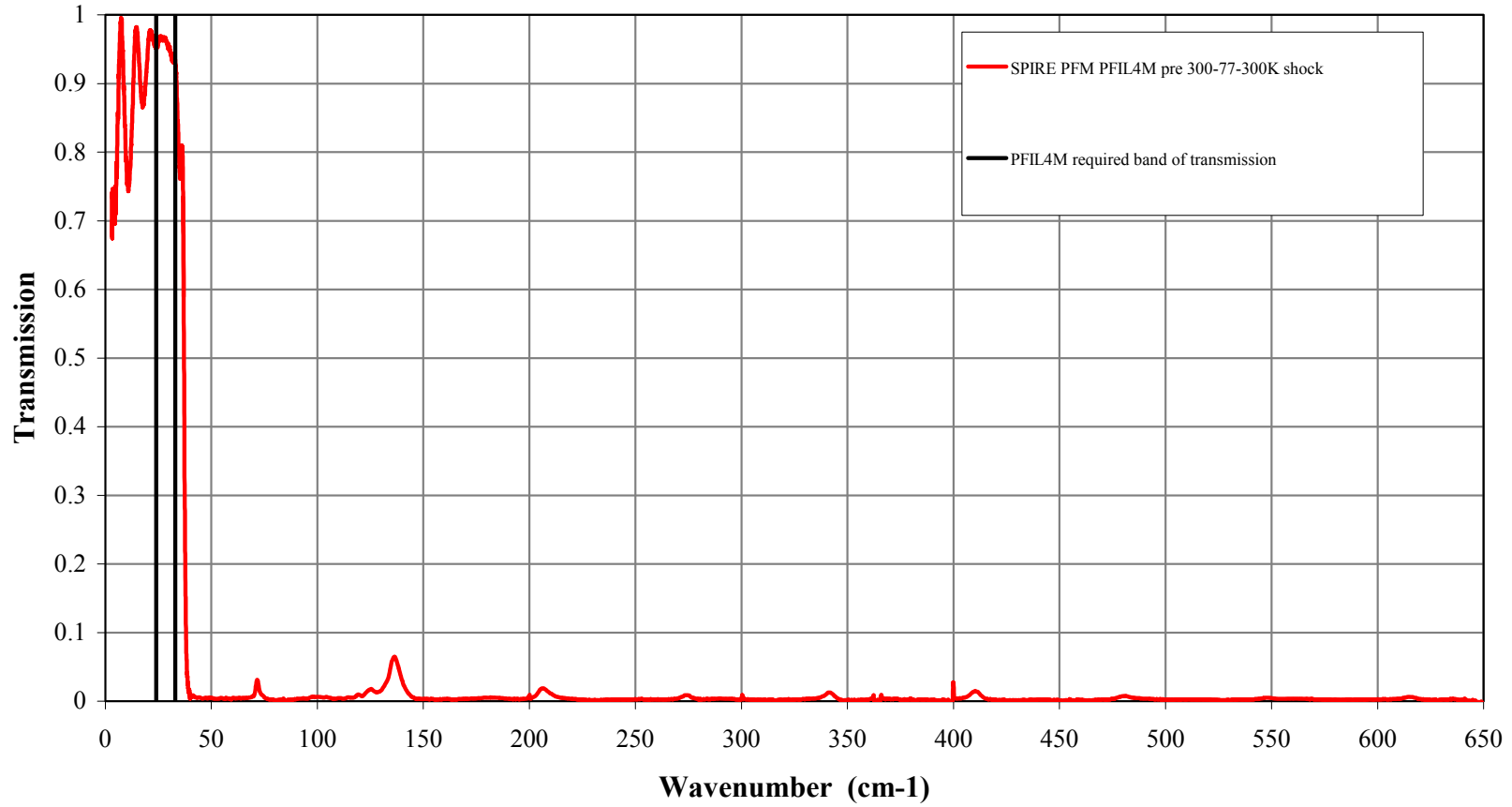


Figure 12 B734 filter assembly performance – 20-650cm⁻¹

SECTION 27 - Reference List of EIDP's

Associated

<u>Title</u> (Listed in alphabetical order)	<u>ID</u> (Serial No.)	<u>Acronym</u>	<u>Document No.</u>	<u>Issue</u>	<u>Date</u>
PLW BDA CQM EIDP					

Lower Level

<u>Title</u> (Listed in alphabetical order)	<u>ID</u> (Serial No.)	<u>Acronym</u>	<u>Document No.</u>	<u>Issue</u>	<u>Date</u>

SECTION 28 - Mass Records

Assembly	Final measured mass
FILT-PFM-240 – PFM PMW assembly	8.47 ± 0.01 g

SECTION 29 - Cleanliness Statement

SECTION 30 - Other Useful Information

SECTION 31 - DPL/DML etc

SECTION 32 – List of Appendices/Attachments

<u>Appendix #</u>	<u>Title</u> (Listed in alphabetical order)	<u>Document No.</u>	<u>Issue</u>	<u>Date</u>	<u>Notes</u>