
SPIRE

SUBJECT: SPIRE PFM FPU ISOLATION MEASUREMENTS PROCEDURE

PREPARED BY: Eric Sawyer

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Date:

APPROVED BY :

Date:

Change Record

ISSUE	DATE	
1.0	18-5-2007	Initial release -
1.1	24/5/07	As run procedure with results from test on 24/5/07

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1. APPLICABLE/REFERENCE DOCUMENTS

Number	TITLE	Document Number	Issue
AD 1	SPIRE FPU Handling and Mechanical Integration Procedure	SPIRE-RAL-PRC-002802	2
AD 2	Making SPIRE ESD Safe	SPIRE-RAL-NOT-002028	2
AD 3	ESD-Rules for Herschel PLM & Integration Activities	HP-2-ASED-PR-0062	1
AD 4			

Number	TITLE	Document Number	Issue
RD1	Cryo Harness Interconnection Diagram SPIRE (PFM)	2547-121430-030-01-0B	B
RD2	Cryo-Harness Interconnection Diagram SPIRE (PFM)	HP-2-ASED-ID-0091-01-0B	B
RD3			
RD4			

2. SCOPE AND INTRODUCTION

The SPIRE FPU was integrated both mechanically and electrically in April 2007. The initial measurements taken at the start of the electrical integration 19/4/07, indicated that the FPU and it's associated grounds were isolating as expected.

The electrical integration was completed and a further set of measurements taken which again indicated correct isolation. However the isolation of the detector boxes to FPU chassis was not remeasured at that time. (see SPIRE-RAL-PRC-002882_2_PFM-CVVint_SIH Electrical-Integration_180407_JL_as-run)

Subsequently on 2/5/07 measurements were repeated at Astrium, by Astrium staff and a short between detector box and FPU chassis was recorded. This short appeared to go away when the satellite was rotated and then return when rotated back such that SPIRE was upside down, hanging down from the OBA. NCR was raised by Astrium (HP-112000-ASED-NC-3278).

This procedure describes measurements to be taken to investigate this anomaly.

2.1 Detailed Step-by-step Procedure

No:	Activity	Remarks/Results	Sign off
	Isolation check		
	With the Satellite orientated such that the OBA is at the bottom		
1	Verify that SPIRE Safeing Plug Type-VII is mated to CVV FTHR 211121 J22 . If not installed, then mate	Ok, the safe plug of the correct type is fitted	
2	Verify that SPIRE Safeing Plug Type-VII is mated to CVV FTHR 211121 J23 . If not installed, then mate	Ok	
3	Verify that SPIRE Safeing Plug Type-VII is mated to CVV FTHR 211121 J24. If not installed, then mate	Ok	
4	Verify that SPIRE Safeing Plug Type-VII is mated to CVV FTHR 211121 J25. If not installed, then mate	Ok	
5	Verify that SPIRE Safeing Plug Type-V is mated to CVV FTHR 211121 J26. If not installed, then mate	Ok	
6	Verify that SPIRE Safeing Plug Type-VII is mated to CVV FTHR 211121 J27. If not installed, then mate	Ok	
7	Verify that SPIRE Safeing Plug Type-VII is mated to CVV FTHR 211121 J28. If not installed, then mate	Ok	
8	Verify that SPIRE Safeing Plug Type-VIII is mated to CVV FTHR 211121 J29. If not installed, then mate	Ok	
9	Verify that SPIRE Safeing Plug Type-VIII is mated to CVV FTHR 211121 J30. If not installed, then mate	Ok	
10	Verify that SPIRE Safeing Plug Type-VII is mated to CVV FTHR 211121 J31. If not installed, then mate	Ok	
11	Verify that SPIRE Safeing Plug Type-VI is mated to CVV FTHR 211121 J32. If not installed, then mate	Ok	

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No:	Activity	Remarks/Results	Sign off																				
12	Verify that SPIRE Safeing Plug Type-VII is mated CVV FTHR 211121 J33. If not installed, then mate	Ok																					
13	Verify that SPIRE Safeing Plug Type-VII is mated to CVV FTHR 211121 J34. If not installed, then mate	Ok																					
14	The Pump L0 strap and the Evaporator L0 strap should be electrically connected inside the FPU, Verify this by measuring between points A and B in Fig 1	0.230 (0.180 lead resistance) ohms																					
15	Carry out isolation check by completing the table below.																						
	<table border="1"><thead><tr><th></th><th>Pump L0 (phot detector box)</th><th>Spectrometer L0</th><th>FPU</th></tr><tr><th></th><th>B</th><th>C</th><th>D</th></tr></thead><tbody><tr><td>Spectrometer L0 C</td><td>199kO, 253kO</td><td></td><td></td></tr><tr><td>FPU D</td><td>4.6 O, 4.6 O</td><td>191kO, 235kO,</td><td></td></tr><tr><td>OBA E</td><td>55kO, 76kO</td><td>115kO, 199kO</td><td>55kO, 76kO</td></tr></tbody></table>		Pump L0 (phot detector box)	Spectrometer L0	FPU		B	C	D	Spectrometer L0 C	199kO, 253kO			FPU D	4.6 O, 4.6 O	191kO, 235kO,		OBA E	55kO, 76kO	115kO, 199kO	55kO, 76kO		
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OBA E	55kO, 76kO	115kO, 199kO	55kO, 76kO																				
	Note, two values are shown for each measurement. This indicates the results when the position of the probes is reversed.																						
16	Remove SPIRE Safeing Plug Type-V from CVV FTHR 211121 J26	Ok, plug removed																					
17	Remove SPIRE Safeing Plug Type-VI from CVV FTHR 211121 J32	Ok																					
18	Remove SPIRE Safeing Plug Type-VIII from CVV FTHR 211121 J30	Ok																					
19	Remove SPIRE Safeing Plug Type-VIII from CVV FTHR 211121 J29	Ok																					
20	Carry out isolation check by completing the table below																						
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	oc indicates open circuit																						

No:	Activity	Remarks/Results	Sign off																				
21	If results are still anomalous remove remaining safeing plugs and repeat measurements	OK, all safe plugs removed																					
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OBA E	>27MO, oc	>27MO, oc	>27MO, oc																				
22	Refit SPIRE Safeing Plug Type-V from CVV FTHR 211121 J26	Ok																					
23	Refit SPIRE Safeing Plug Type-VI from CVV FTHR 211121 J32	Ok																					
24	Refit SPIRE Safeing Plug Type-VIII from CVV FTHR 211121 J30	Ok																					
25	Refit SPIRE Safeing Plug Type-VIII from CVV FTHR 211121 J29	Ok																					
26	Refit remaining safe plugs if removed at step 21	Ok																					
	<p>The test was terminated at this point, as we wanted to investigate while the short was present, rotation may have caused the short to go away, which would have been harder to trace.</p> <p>After further discussion it was decided to remove the cryoharness from the photometer JFET in the reverse sequence as carried out during integration. This was carried out by Juergen and Andreas.</p> <p>Starting from J04 and ending at J016, followed by the bias connectors J25 to J28.</p> <p>The ground short was monitored continuously, no change until J16 was disconnected, then the short went away.</p> <p>When reconnected short returned.</p> <p>J16 was removed and samples of other connectors were re-mated, no change to isolation.</p> <p>The bias connectors remained mated throughout.</p> <p>The disconnected harness was left disconnected at this stage pending further investigation.</p>	<p>See annex 1 for detailed log</p> <p>Further investigation of the cryoharness is recommended</p>																					

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No:	Activity	Remarks/Results	Sign off																				
27	Rotate spacecraft such that the OBA is on top																						
28	Carry out isolation check by completing the table below.																						
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30	Remove SPIRE Safeing Plug Type-VI from CVV FTHR 211121 J32																						
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	B	C	D																				
Spectrometer L0	C																						
FPU	D																						
OBA	E																						
35	If removed, refit SPIRE Safeing Plug Type-VII is mated to CVV FTHR 211121 J22 .																						

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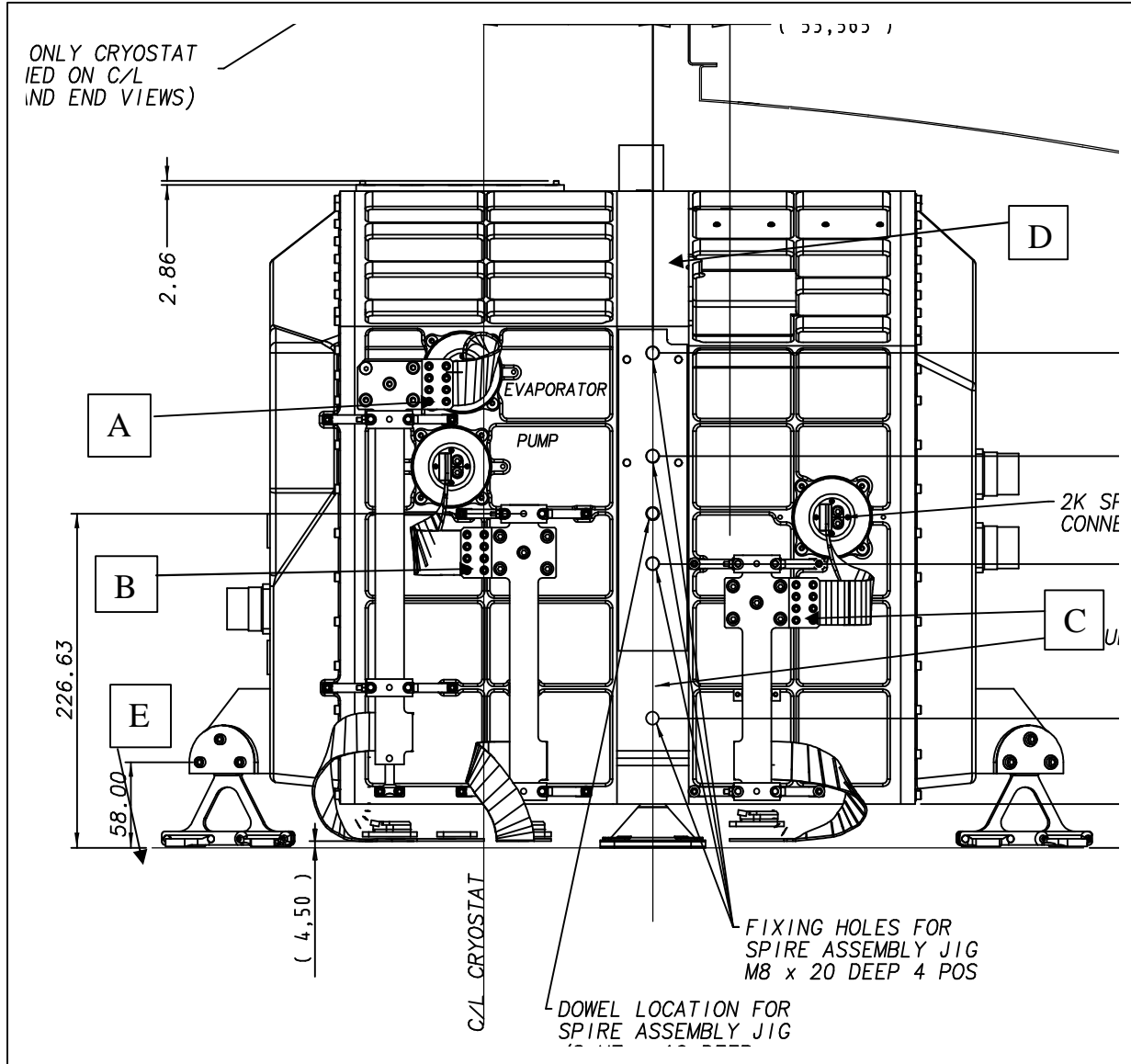
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No:	Activity	Remarks/Results	Sign off
36	If removed, refit SPIRE Safeing Plug Type-VII is mated to CVV FTHR 211121 J23 .		
37	If removed, refit SPIRE Safeing Plug Type-VII is mated to CVV FTHR 211121 J24.		
38	If removed, refit SPIRE Safeing Plug Type-VII is mated to CVV FTHR 211121 J25.		
39	If removed, refit SPIRE Safeing Plug Type-V is mated to CVV FTHR 211121 J26.		
40	If removed, refit SPIRE Safeing Plug Type-VII is mated to CVV FTHR 211121 J27.		
41	If removed, refit SPIRE Safeing Plug Type-VII is mated to CVV FTHR 211121 J28.		
42	If removed, refit SPIRE Safeing Plug Type-VIII is mated to CVV FTHR 211121 J29.		
43	If removed, refit SPIRE Safeing Plug Type-VIII is mated to CVV FTHR 211121 J30.		
44	If removed, refit SPIRE Safeing Plug Type-VII is mated to CVV FTHR 211121 J31.		
45	If removed, refit SPIRE Safeing Plug Type-VI is mated to CVV FTHR 211121 J32.		
46	If removed, refit SPIRE Safeing Plug Type-VII is mated CVV FTHR 211121 J33. If		
47	If removed, refit SPIRE Safeing Plug Type-VII is mated to CVV FTHR 211121 J34.		

Diagnostic Table

	Pump L0 (phot detector box) (Phot. Analogue Ground) B	Spectrometer L0 (Spect. Analogue Ground) C	FPU (FPU Faraday Shield) D
Spectrometer L0 C	<p>Notes:</p> <ul style="list-style-type: none"> • A low impedance short here would create a large loop area. <p>Failure Modes:</p> <ul style="list-style-type: none"> • 2K Det Box Strap Joint Failure • 300-mK Isolation Joint Failure 		
FPU D	<p>Notes:</p> <p>Failure Modes:</p> <ul style="list-style-type: none"> • Cooler HS Isolation • Phot. Detector Box feet • Bad jacket on thermistor harnesses shield • FPU Stray-light baffles (Thermal) • Short within detector harnesses • Short within cryo harness • Short within safeplugs/incorrect safeplugs 	<p>Notes:</p> <p>Failure Modes:</p> <ul style="list-style-type: none"> • Spect Detector box feet • FPU Stray-light baffles (Thermal) • Bad jacket on thermistor harness shield • Short within detector harnesses 	
OBA E	<p>Notes:</p> <ul style="list-style-type: none"> • Shorting plugs makes this ~55k when mated <p>Failure Modes:</p> <ul style="list-style-type: none"> • Interconnection within cryoharness • Failure of the L0 isolation 	<p>Notes:</p> <ul style="list-style-type: none"> • Shorting plug makes this ~115k when mated <p>Failure Modes:</p> <ul style="list-style-type: none"> • Interconnection within cryoharness (?) • Failure of the L0 isolation 	<p>Notes:</p> <ul style="list-style-type: none"> • Should be shorted when Red-tag Instrument Grounding strap is connected <p>Failure Modes:</p> <ul style="list-style-type: none"> • FPU feet short • Instrument L1 Thermal isolation failure • JFP L3 Isolation Failure • JFS L3 Isolation Failure • JFET isolation failure



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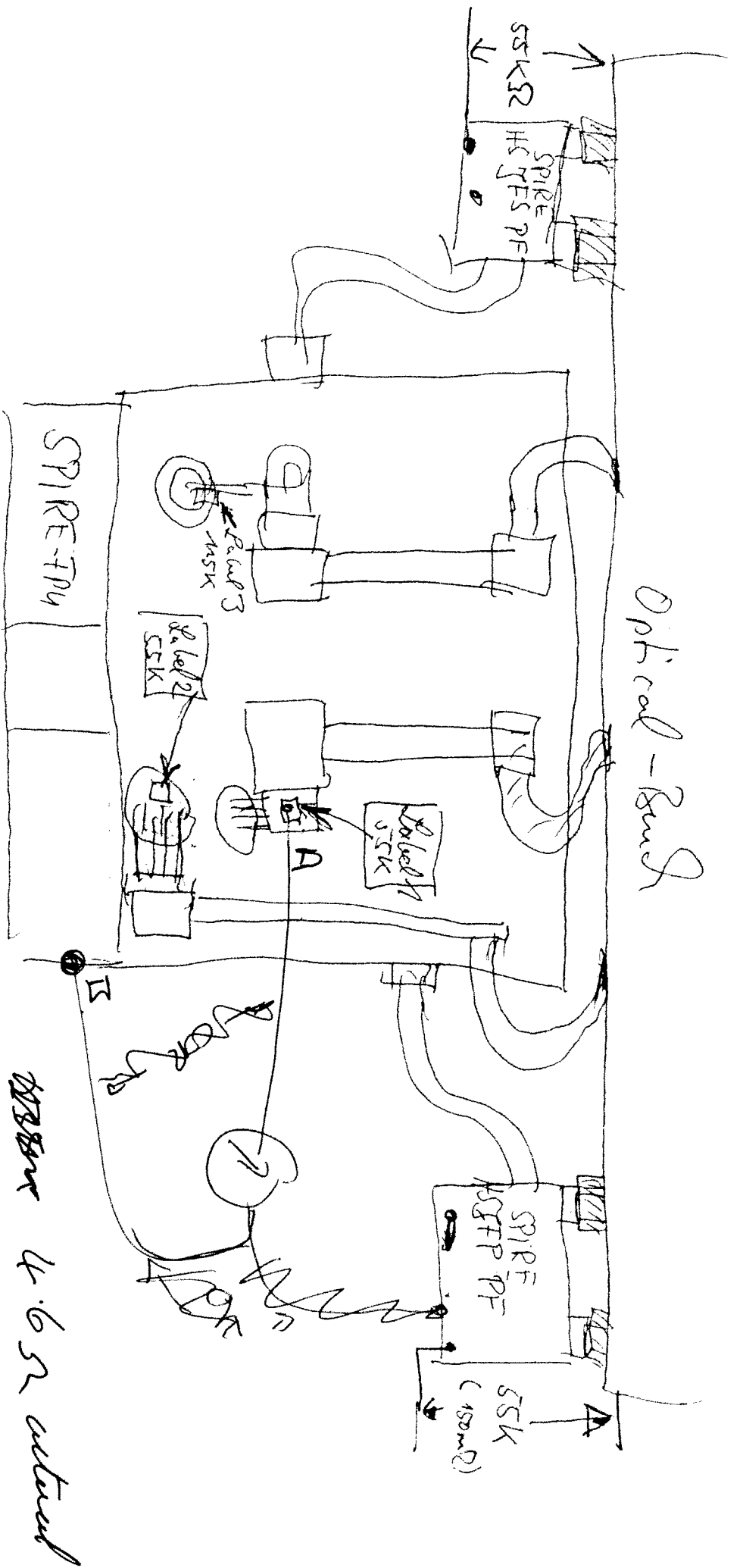
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Annex 1

As run log sheet



Resistance Measurement. 8.5.2007

SPIRE-FPU → to Opt. Bench = 55kΩ (8.5.07)

" " Ruler 1 - pair to Opt. Bench = 55k (8.5.07)

" " Ruler 2 - pair to Opt. Bench = 55k (8.5.07)

" " Ruler 3 - pair to Opt. Bench = 110k (earlier 115k)

SPIRE JF-PNs to Opt. Bench = 55k $\xrightarrow{8.5.07}$ 150mΩ incl. Power Leads 3.5.07

SPIRE JFS-Ns to Opt. Bench = 55k $\xrightarrow{8.5.07}$

~~150mΩ~~ 4.6Ω returned

Should be 100k+

Stop 74. → 34 disconnected.

TP-150

Alfred

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No:	Activity	Remarks/Results	Sign off
67	Remove and store ESD cover from JFP 121210 J09 Mate JFP P09 Measure FPU Isolation Resistance to OBA structure [R > 1MΩ] Perform torque of 0,33 Nm	5.04 A → B	16.23
68	Remove and store ESD cover from JFP 121210 J11 Mate JFP SIH 121210 P11 Measure FPU Isolation Resistance to OBA structure [R > 1MΩ] Perform torque of 0,33 Nm	4.71 A → B	
69	Remove and store ESD cover from JFP 121210 J12 Mate JFP SIH 121210 P12 Measure FPU Isolation Resistance to OBA structure [R > 1MΩ] Perform torque of 0,33 Nm	4.71 A → B	
70	Remove and store ESD cover from JFP 121210 J08 Mate JFP SIH 121210 P08 Measure FPU Isolation Resistance to OBA PUMP LO structure [R > 1MΩ] Perform torque of 0,33 Nm	4.71 A → B	16.21
71	Remove and store ESD cover from JFP 121210 J07 Mate JFP SIH 121210 P07 Measure FPU Isolation Resistance to OBA structure [R > 1MΩ] Perform torque of 0,33 Nm	4.70 A → B	
72	Remove and store ESD cover from JFP121210 J03 Mate JFP P03 Measure FPU Isolation Resistance to OBA structure [R > 1MΩ] Perform torque of 0,33 Nm	4.71 A → B	
73	Remove and store ESD cover from JFP 121210 J04 Mate JFP SIH 121210 P04 Measure FPU Isolation Resistance to OBA structure [R > 1MΩ] Perform torque of 0,33 Nm	4.958 A → B Step 1 de-mated	16.05.07
74	Record mate/demate activities in paper EIDP log	Record in E-PLM Mating / Demating DB too	

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No:	Activity	Remarks/Results	Sign off
60	Remove and store ESD cover from JFP 121210 J19 Mate JFP SIH 121210 P19 Measure FPU Isolation Resistance to OBA structure [R > 1MΩ] Perform torque of 0,33 Nm	5.04 A-B	16.28
61	Remove and store ESD cover from JFP 121210 J20 Mate JFP SIH 121210 P20 Measure FPU Isolation Resistance to OBA structure [R > 1MΩ] Perform torque of 0,33 Nm	5.04 A-B	
62	Remove and store ESD cover from JFP 121210 J02 Mate JFP SIH 121210 P02 Measure FPU Isolation Resistance to OBA structure [R > 1MΩ] Perform torque of 0,33 Nm	5.04 A-B	
63	Remove and store ESD cover from JFP 121210 J01 Mate JFP SIH 121210 P01 Measure FPU Isolation Resistance to OBA structure [R > 1MΩ] Perform torque of 0,33 Nm	5.04 A-B	
64	Remove and store ESD cover from JFP 121210 J05 Mate JFP SIH 121210 P05 Measure FPU Isolation Resistance to OBA structure [R > 1MΩ] Perform torque of 0,33 Nm	5.04 A-B	
65	Remove and store ESD cover from JFP 121210 J06 Mate JFP SIH 121210 P06 Measure FPU Isolation Resistance to OBA structure [R > 1MΩ] Perform torque of 0,33 Nm	5.04 A-B	
66	Remove and store ESD cover from JFP 121210 J10 Mate JFP SIH 121210 P10 Measure FPU Isolation Resistance to OBA structure [R > 1MΩ] Perform torque of 0,33 Nm	5.04 A-B	16.28

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No:	Activity	Remarks/Results	Sign off
53	Remove and store ESD cover from JFP 121210 J14 Mate JFP P14 Perform torque of 0,33 Nm	5.05 A-B	16.33
54	Remove and store ESD cover from JFP 121210 J18 Mate JFP SIH 121210 P18 Measure FPU Isolation Resistance to OBA structure [R > 1MΩ] Perform torque of 0,33 Nm	5.05 A-B	
55	Remove and store ESD cover from JFP 121210 J17 Mate JFP P17 Measure FPU Isolation Resistance to OBA structure [R > 1MΩ] Perform torque of 0,33 Nm	5.05 A-B	
56	Remove and store ESD cover from JFP 121210 J21 Mate JFP SIH 121210 P21 Measure FPU Isolation Resistance to OBA structure [R > 1MΩ] Perform torque of 0,33 Nm	5.06 A-B	
57	Remove and store ESD cover from JFP 121210 J22 Mate JFP SIH 121210 P22 Measure FPU Isolation Resistance to OBA structure [R > 1MΩ] Perform torque of 0,33 Nm	5.04 A-B	
58	Remove and store ESD cover from JFP 121210 J24 Mate JFP SIH 121210 P24 Measure FPU Isolation Resistance to OBA structure [R > 1MΩ] Measure FPU Isolation Resistance to OBA structure [R > 1MΩ] Perform torque of 0,33 Nm	5.04 A-B	
59	Remove and store ESD cover from JFP 121210 J23 Mate JFP P23 Measure FPU Isolation Resistance to OBA structure [R > 1MΩ] Perform torque of 0,33 Nm	5.04 A-B	16.28

5.15E

all in Ω

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No:	Activity	Remarks/Results	Sign off
43	Mate JFP SIH 121210 P25 to J25 Measuere FPU Isolation Resistance to OBA structure [R > 1MΩ] Perform torque of 0,33 Nm		
44	Remove and store SPIRE Safeing Plug Type-III from JFP 121210 J27	Store Saving-plugs in RED-TAG Item cubboard	
45	Mate JFP SIH 121210 P27 to J27 Measuere FPU Isolation Resistance to OBA structure [R > 1MΩ] Perform torque of 0,33 Nm		
46	Remove and store SPIRE Safeing Plug Type-III from JFP 121210 J26	Store Saving-plugs in RED-TAG Item cubboard	
47	Mate JFP SIH 121210 P26 to J26 Measuere FPU Isolation Resistance to OBA structure [R > 1MΩ] Perform torque of 0,33 Nm		
48	Remove and store SPIRE Safeing Plug Type-III from JFP 121210 J28	Store Saving-plugs in RED-TAG Item cubboard	
49	Mate JFP SIH 121210 P28 to J28 Measuere FPU Isolation Resistance to OBA structure [R > 1MΩ] Perform torque of 0,33 Nm		
50	Remove and store ESD cover from JFP121210 J16 Mate JFP SIH 121210 P16 Measuere FPU Isolation Resistance to OBA structure [R > 1MΩ] Perform torque of 0,33 Nm	open circuit	
51	Remove and store ESD cover from JFP 121210 J15 Mate JFP SIH 121210 P15 Measuere FPU Isolation Resistance to OBA structure [R > 1MΩ] Perform torque of 0,33 Nm	5.05 A-B	
52	Remove and store ESD cover from JFP 121210 J13 Mate JFP SIH 121210 P13 Measuere FPU Isolation Resistance to OBA structure [R > 1MΩ] Perform torque of 0,33 Nm	6.05 A-B	16.32

only 15,16 mated : ~~15.16~~ 6.0 R
 25-28 mated :
 - make 15 :
 6.4 R
 3.) make 15 : 5.07
 all in life

4.) demate 16 → open circuit
Harness manipulation → 7,6 MΩ

5.) mate 16 → 5.06 R
25 → 28 mated
15 mated

Harness manip. 16 → 5.06 R
Harness mpt. 15 → 5.05 R

6.) demate 15 → 5.05 R
manipulate harness 5.05 R

7.) demate 16 → open circuit
manipulate after 3 sec → continuous
resistance decrease
to 8,7 MΩ

8.) mate 16 5 Ω (all other demated)
discriminated 16 mate 1 8 MΩ
demate 1 mate P03 26 mΩ

9.) all demated 30 mΩ → runs down
to 12 mΩ

10.) mate 16 5 Ω.