1. INTRODUCTION

This document reports on the third and final COLD functional tests performed on the SPIRE instrument during the IST test campaign. The tests were conducted at the CSG in Kourou, French Guiana.

1.1 SCOPE

To judge the success or failure of a cold functional test by checking that:

- The telecommand sequence generated for a particular functional test is correctly received and executed on board by the SPIRE DPU.
- No error/event reports or command failures are generated during the execution of these commands.
- Telemetry is generated by the instrument as a result of telemetry requests to its different subunits.
- Particular telemetry parameters for each functional test change in an expected manner.
- A particular success criterion (specified in this document) is met.

1.2 REFERENCE DOCUMENTS

Ref	Document	Name	Version/Issue No.
RD01	SPIRE-RAL-DOC-001652	SPIRE Functional Tests Specification	Issue 1.4
RD02	SPIRE-RAL-DOC-001630	SPIRE I-EGSE Set-up Procedure	Issue 2.3
RD03	SPIRE-RAL-PRJ-001078	SPIRE Data ICD	Issue 2.1
RD04	Sap-SPIRE-CCa-076-02	DRCU/DPU Interface Control Document	Issue 1.3
RD05	LAM.PJT.SPI.NOT.011011	MCU/DPU Command List ICD	Issue 5.0
RD06	SPIRE-IFS-PRJ-001391	SPIRE OBS User Manual	Issue 3.0.B
RD07	SPIRE-RAL-PRC-002398	SPIRE FM Cold Functional Test Procedures	Issue 2.6
RD08	SPIRE-RAL-REP-003147	FM IST COLD FUNCTIONAL DETECTOR CHECK REPORT – Prime & Redundant Side	Issue 1.0
RD09	HP-2-ASED-SD-0203	SPIRE WFT after repair of pixel anomalies on SVM-SIH connectors based on HP-112000-ASED-NC-3725	Issue 01
RD10	SPIRE-RAL-PRJ-003018	SPIRE Commissioning Phase Plan	Issue 1.2 6th March 2009

1.3 CHANGE RECORD

Document	Change date	Changes
Issue 1	12th March 2009	First Version

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2. FUNCTIONAL TEST CONFIGURATION

2.1 Software Configuration

Write down in the table the current EGSE software configuration for the tests:

EGSE component	Version/Build number	Comment
SCOS2000	2.3eP5	
HCSS	v0.6.1 Build (#1430)	
QLA	v3.3	Redundant side SCALTEMP (SCAL structure temperature) calibration table patched on spireqla in directories ~/spire/lib/herschel/spire/qla/tables/ and ~/spire/lib/herschel/spire/qla/tables/SPIRE_PFM5_V1. CVS version of table: `$Id: SCALTEMP_T_SCST.ATAB_R,v 1.2 2009/01/21 17:19:01 ssidher Exp $`
QLA scripts	Latest versions from CVS	
CCS scripts	CVS Tag SPIRE_CFT_PROC_V2_7	
CUS Scripts	Mission configs in I-EGSE DB spire_fm_ist_db1@spireqla: Prime side: fm_ist_cft_config19p_Kourou in DB spire_fm_ist_db1 Redundant side: fm_ist_cft_config19r_Kourou in DB spire_fm_ist_db1	

2.2 EGSE Configuration Checks

To check for the success of failure of a functional test, the real time telemetry of the instrument has to be monitored. The following applications must be running to do so. Before the test sequence starts, make the following checks:

Workstation	EGSE component	Status	Check
hspireegse	EGSE router	Started	✓
hspireegse	EGSE Gateway	Started	✓
hspireegse	Pipe Gateway	Started	✓
hspireqla	Telemetry Ingestion	Started	✓
hspireqla	Packet Display	Started	✓
spires2k	SCOS2000	Started	✓
hspireqla	CCS Handler (Server)	Started	✓

3. TEST PROCEDURE

The following two sections describe general pass/fail criteria (Section 3.1), the general test layout (Section 3.2) and the detailed procedure for each functional test (Section 3.3).

3.1 GENERAL PASS/FAIL CRITERIA

The general criteria for declaring a single test failed is the repeated failure of 2 consecutive runs of this test. In that case the functional test procedure should be aborted and the overall functional testing declared FAILED.
In the case of a 'first run' failure followed by a successful execution a third run of the same test should be performed and in the unlikely event of this third run being a failure the test procedure should be also aborted and the overall functional testing declared FAILED, as this would imply a not reliable operability of the instrument.
As a general remark ANY failure should be closely analysed.

Note: If the functional test is declared FAILED refer to section 4.1 for instrument switch OFF.

3.2 GENERAL TEST PROCEDURE LAYOUT

The table below shows the general CFT sequence as it should be performed. In each step of this procedure the operator should refer to the detailed procedure in Section 3.3 .Test Control TCL scripts are available to invoke the correspondent CUS script stored in the HCSS database for each functional test. These CUS scripts will generate the appropriate command sequence for the particular functional test.

Step #	Procedure Name	Test Purpose	Duration /min
1	SPIRE-IST-COLD-DPU-ON-P	DPU PRIME Power up and OBS start	5
2	SPIRE-IST-COLD-DRCU-ON-P	DRCU PRIME Power up	4
3	SPIRE-IST-COLD-FUNC-SCU-02-P	SCU Nominal Science Contents check PRIME	5
4	SPIRE-IST-COLD-FUNC-SCU-03-P	SCU DC Thermometry check PRIME	8
5	SPIRE-IST-COLD-FUNC-SCU-06-P	SCU AC Thermometry check PRIME	2
6	SPIRE-IST-COLD-FUNC-SCU-07-P	Sorption Cooler Heaters Check PRIME	5
7	SPIRE-IST-COLD-FUNC-PCAL-01-P	PCAL Characterisation Test PRIME	5
8	SPIRE-IST-COLD-FUNC-SCAL-01-P	SCAL Characterisation Test PRIME	18
9	SPIRE-IST-COLD-FUNC-MCU-01-P	MCU Boot Check PRIME	5
10	SPIRE-IST-COLD-FUNC-MCU-03-P	MCU Nom. Science Contents Check PRIME	5
11	SPIRE-IST-COLD-FUNC-BSM-01-P	BSM Chop/Jiggle Sensors check PRIME	5
12	SPIRE-IST-COLD-FUNC-BSM-03-P	BSM Open Loop Dynamics Check PRIME	5
13	SPIRE-IST-COLD-FUNC-BSM-05A-P	BSM Open Loop Chop Test PRIME	5
14	SPIRE-IST-COLD-FUNC-BSM-05B-P	BSM Close Loop Chop Test PRIME	5
15	SPIRE-IST-COLD-FUNC-BSM-06-P	BSM Close Loop Operational Mode Chop Test PRIME	5
16	SPIRE-IST-COLD-BSM-0FF-P	BSM switch OFF PRIME	5
17	SPIRE-IST-COLD-FUNC-SMEC-01-	SMEC Encoder and LVDT check PRIME	5

Step #	Procedure Name	Test Purpose	Duration /min
	P		
18	SPIRE-IST-COLD-FUNC-SMEC-03-P	SMEC Encoder Levels Check PRIME	5
19	SPIRE-IST-COLD-SMEC-OFF-P	SMEC switch OFF PRIME	5
20	SPIRE-IST-COLD-FUNC-DCU-02-P	DCU Nominal Science Contents Check PRIME	5
21	SPIRE-IST-COLD-FUNC-DCU-11-PHOT-P	Photometer BDAs Switch ON Check PRIME	7
22	SPIRE-IST-COLD-FUNC-DCU-13-PHOT-P	Photometer BDAs Integrity Check PRIME	15
23	SPIRE-IST-COLD-FUNC-DCU-14-PHOT-P	Photometer BDAs Noise Check PRIME	5
24	SPIRE-IST-COLD-PHOT-VSS-P	Photometer BDAs Vss Test PRIME	40
25	SPIRE-IST-COLD-PDET-OFF-P	Photometer BDAs Switch OFF PRIME	3
26	SPIRE-IST-COLD-FUNC-DCU-11-SPEC-P	Spectrometer BDAs Switch ON Check PRIME	7
27	SPIRE-IST-COLD-FUNC-DCU-13-SPEC-P	Spectrometer BDAs Integrity Check PRIME	12
28	SPIRE-IST-COLD-FUNC-DCU-14-SPEC-P	Spectrometer BDAs Noise Check PRIME	5
29	SPIRE-IST-COLD-SPEC-VSS-P	Spectrometer BDAs Vss Test PRIME	40
30	SPIRE-IST-COLD-SDET-OFF-P	Spectrometer BDAs switch OFF	3
31	SPIRE-IST-COLD-MCU-OFF-P	MCU switch OFF PRIME	2
32	SPIRE-IST-COLD-SCU-OFF-P	SCU switch OFF PRIME	2
33	SPIRE-IST-COLD-DRCU-OFF-P	DRCU power OFF PRIME	5
34	SPIRE-IST-COLD-DPU-OFF-P	DPU power OFF PRIME	5
35	Switch to redundant side on the I-EGSE and CCS		15
36	**Repeat steps 1-34 in the above sequence for the REDUNDANT SIDE. Procedure names for Redundant side end in "-R"**		**~300**
Total Duration ~ 10-11 Hours (PRIME and REDUNDANT)			

Table 1. General CFT sequence

***Note 1:** This procedure is not a functional test, is a close loop initialisation procedure required to test the close loop operability of the BSM.

***Note 2:** This procedure is not a functional test, is a close loop initialisation procedure required to test the close loop operability of the SMEC.

3.3 DETAILED TEST PROCEDURE

The following is a detailed (test by test) procedure including the steps required to perform each functional test individually.

3.3.1 SPIRE-IST-COLD-DPU-ON-P

Version	2.4
Date	6th December 2007
Purpose	To switch on the SPIRE DPU PRIME and start generating housekeeping
Initial configuration	SPIRE DPU and DRCU PRIME are switched off
Final configuration	SPIRE DPU PRIME is ON and SPIRE HK is being produced , SPIRE DRCU PRIME is OFF
Preconditions	• SPIRE FM DPU is electrically integrated with the Herschel Satellite • SPIRE MIB PRIME is imported in the CCS database. • CCS is up and running • FUNCTIONAL TEST PARAMETERS display is selected on the CCS
Duration	5 minutes
Pass/Fail Criteria	Nominal and critical HK reports start being generated at their nominal rates of 1Hz and 0.5Hz respectively.

Procedure Steps:

Step	Description	Parameter	Expected Values Before/After	Actual Values Before/After	Pass/ Fail
1	Select DPU AND OBS PARAMETERS display is on the CCS	—	—	—	**Pass**
2	**Power ON the SPIRE DPU PRIME unit using the dedicated spacecraft LCL line and configure 1553 Spacecraft bus for SPIRE DPU PRIME (RT = 21)**	—	—	—	**Pass**
3	Wait for the boot software to produce at least 2 event packets (5,1)	—	—	—	**Pass**
4	Execute TCL script SPIRE-IST-COLD-DPU-START-P.tcl	—	—	—	**Pass**
5	Check that Nominal and Critical HK packets are arriving at the CCS: **SPIRE Nominal HK:** • (type ,subtype) : (3,25) • APID : 0x502 **SPIRE Critical HK:** • (type ,subtype) : (3,25) • APID: 0x500	—	—	—	**Pass**
6	Check that THSK parameter is refreshing every second	THSK	Refreshing @ 1 Hz	—	**Pass**
7	Check that TM2N parameter is incrementing by 1 every second	TM2N	Incrementing by 1 @ 1Hz	—	**Pass**
8	Check that TM1N parameter is incrementing by 1 every 2 second	TM1N	Incrementing by 1 @ 0.5Hz	—	**Pass**
9	**On CCS check the consistency of the SPIRE on board time to the HCDMU time and the CCS. ***	—	—	—	**Pass**
10	On I-EGSE check the consistency between SCOS time and THSK and QLA time.	THSK	Incrementing once per second	—	**Pass**

Test Result (Pass/Fail): Pass – Booted from the secondary partition
DPU Current drawn:
Spacecraft measured value SpireHsN_L11_I (parameter WM308565 on display ZAWS1999) – 0.45A As expected

Start time: 00:55 (27th Feb 2009)
OBSID: 0xb00017bc

** Assuming that OBT is provided by the HCDMU following RD02, i.e, OBT is TAI, there should be a 33 second difference between OBS and CCS time (assuming CCS is using UTC). In the case the HCDMU is using UTC to specify the on board time, there should be no difference between THSK and the CCS/I-EGSE system time.*

3.3.2 SPIRE-IST-COLD-DRCU-ON-P

Version	2.4
Date	6th December 2007
Purpose	To switch on the SPIRE DRCU PRIME and start generating housekeeping
Initial configuration	SPIRE DPU PRIME is ON and DRCU PRIME is switched OFF
Final configuration	SPIRE DPU and DRCU PRIME are ON and SPIRE HK is being produced
Preconditions	• SPIRE FM DRCU is electrically integrated with the Herschel Satellite • SPIRE DRCU is switched OFF • SPIRE MIB PRIME is imported in the CCS database. • CCS is up and running • FUNCTIONAL TEST PARAMETERS display is selected on the CCS
Duration	5 minutes
Pass/Fail Criteria	DRCU voltages show expected ‘ON’ values

Procedure steps:

Step	Description	Parameter	Expected Values Before/After	Actual Values Before/After	Success/ Failure
1	Execute TCL script SPIRE-IST-COLD-DRCU-START-P-STEP1.tcl	—	—	—	**Pass**
2	Check that THSK parameter is not refreshing anymore	THSK	Not refreshing	—	**Pass**
3	Check that TM2N parameter is not incrementing anymore	TM2N	Not incrementing	—	**Pass**
4	**Power ON the SPIRE DRCU PRIME unit using the dedicated spacecraft LCL line.**	—	—	—	**Pass**
5	Execute TCL script SPIRE-IST-COLD-DRCU-START-P-STEP2.tcl Note: The two TCs to clear the SPIRE Critical and Nominal HK reports will fail during execution of this script. These should be ignored because the HK reports will already have been cleared by script SPIRE-IST-COLD-DRCU-START-P-STEP1.tcl	—	—	—	**Pass**
6	Check that THSK parameter is again refreshing every second	THSK	Refreshing @ 1Hz	—	**Pass**
7	Check that TM2N parameter is again incrementing every second	TM2N	Incrementing by 1 @ 1Hz	—	**Pass**
8	Check that the SCU/DCU voltages show nominal values	SCUP5V SCUP9V SCUM9V BIASP5V BIASP9V BIASM9V	~ 5.2 ± 0.5V ~ 9.0 ± 0.2V ~ -9.0 ± 0.2V ~ 5.1 ± 0.5V ~ 9.0 ± 0.2V ~ -9.0 ± 0.2V	5.24 V 9.09 V -9.08 V 5.18V 8.99V -9.05V **BIASTEMP 297.14K DAQTEMP 298.7K**	**Pass**

Test Result (Pass/Fail): Pass
DRCU Current taken from S/C (parameter WM408565 Display ZAWS1999)
SpireHsfN_L51_I 0.44583 A
OBSID: 0xb00017be
Start time: 01:06 UT

3.3.3 SPIRE-IST-COLD-FUNC-SCU-02-P

Version	2.4
Date	6th December 2007
Purpose	SCU Nominal Science Contents Check PRIME
Initial configuration	SPIRE DPU and DRCU PRIME are switched ON, SPIRE HK is being produced
Final configuration	Unchanged
Preconditions	• **SPIRE-IST-COLD-DPU-ON-P** and **SPIRE-IST-COLD-DRCU-ON-P** procedures have been executed. • SPIRE MIB PRIME is imported in the CCS database. • CCS is up and running • I-EGSE is up and running • DPU AND OBS PARAMETERS & FUNCTIONAL TEST PARAMETERS displays are selected on the CCS
Duration	5 minutes (CUS = 35.0)
Success Criteria:	Test passed if : 1. The SPIRE HK parameter SCUFRAMECNT increments 0/31. 2. The SPIRE HK parameter SCUFRAMECNT increments 0x3FFF/1 3. No events are generated during the frame generation. QLA to give go ahead.
CUS Parameters	CUS parameter - scuframes = 0x1f = 31

Test Procedure:

Step#	Action
0	Open **SCU_PARAMETERS** display on SCOS Alpha Numeric Displays.
1	Write down the initial value of the SCUFRAMECNT and TM5N parameters located in SCU_PARAMETERS display.
2	Run QLA script FUNC-SCU-02.py on QLA console.
3	Write down the final value of SCUFRAMECNT and TM5N.
4	Contingency: If test fails repeat steps 1 to 4.

Test Log:

Step	Description	Parameter	Expected Values Before/ After	Actual Values Before /After	Success/ Failure
1	Execute TCL script SPIRE-IST-COLD-FUNC-SCU-02-P.tcl	SCUFRAMECNT TM5N	0/31 0x3FFF/1		PASS

Start time @: 01:17 UT
End time @:
OBSID:0xb00017bf
Comments:
SCU frame count 0 at start and 31 at end

```
FUNC-SCU-02 version: 1.5

Housekeeping @  Fri Feb 27 01:17:10 UTC 2009
SCU Science @ Fri Feb 27 01:17:05 UTC 2009

 Name           HSK value  SCU value     Equal (within 10 raw units)?
TCHTRV          20.0       19.0          True
PCALCURR        11.0       9.0           True
SCAL4CURR       9.0        9.0           True
SCAL2CURR       10.0       10.0          True
PCALV           9.0        8.0           True
SCAL4V          11.0       9.0           True
SCAL2V          11.0       11.0          True
PUMPHTRTEMP     65448.0    65448.0       True
PUMPHSTEMP      136.0      133.0         True
EVAPHSTEMP      65442.0    65442.0       True
SHUNTTEMP       65272.0    65272.0       True
EMCFILTEMP      65522.0    65521.0       True
SL0TEMP         222.0      223.0         True
PL0TEMP         65357.0    65355.0       True
OPTTEMP         53.0       54.0          True
BAFTEMP         26.0       27.0          True
BSMIFTEMP       98.0       98.0          True
SCAL2TEMP       12.0       11.0          True
SCAL4TEMP       65398.0    65397.0       True
SCALTEMP        65419.0    65420.0       True
SMECIFTEMP      14.0       14.0          True
SMECTEMP        65433.0    65432.0       True
BSMTEMP         164.0      164.0         True
SUBKTEMP        32756.0    32756.0       True
```

Test Result (Pass/Fail): PASS

3.3.4 SPIRE-IST-COLD-FUNC-SCU-03-P

Test Id:	SPIRE-IST-COLD-FUNC-SCU-03-P
Test Purpose:	FPU DC Thermometry Check
Initial Configuration:	DRCU_ON + AC/DC thermometry ON
Final Configuration:	DRCU_ON + AC/DC thermometry ON
Duration	8 minutes (CUS = 38.0)
Success Criteria:	Test passed if thermometry channels show temperature values indicating a correct functioning of the sensor, not open/short-circuited. If ANY reading is anomalous check RAW sensor reading. **Open Circuit Criterion:** **RAW reading in the range [0, -100]** **Short Circuit Criterion:** **RAW reading of -32768**
CUS Parameters	CUS parameter dcparam = 0xffff = 65535

Test Procedure:

Step#	Action
1	Run QLA script FUNC-SCU-03.py on QLA console.
2	Run SPIRE-IST-COLD-FUNC-SCU-03-P.tcl test procedure from the CCS.
3	Contingency: If test fails: 1. Execute SCU_OFF procedure. 2. Execute SPIRE-IST-COLD-FUNC-SCU-03-P.tcl procedure. 3. Repeat step 1 of the Test Procedure.

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
FUNC-SCU-03	**SCUTEMPSTAT**	**0xFFFF/0xFFFF**	**0xFFFF/0xFFFF**	**N/A**	PASS

Start time @: 01:20
End time @:
OBSID: 0xb00017c0

Comments: We took the cryo-scoe and CCU measurements at 27th Feb 2009 00:40 UT

Level	Sensor Description	SCOS Sensor Name	SCOS mnemonic	SCOS Display	Temp/K
L0	Cooling Strap 5; to "SPIRE SM Detector enclosure"	C100_1_T225	KD203303	ZAK10999	5.6
L0	Cooling Strap 6; to "SPIRE Cooler Pump HS"	C100_3_T226	KD209303	ZAK10999	5.56
L0	Cooling Strap 7; to "SPIRE Cooler Evaporator HS"	C100_2_T227	KD206302	ZAK08999	5.62
L1	Ventline upstream strap 4 to "SPIRE Optical Bench"	C100_3_T235	KD211303	ZAK10999	10.54
L1	Ventline downstream strap 4 to "SPIRE Optical Bench"	C100_3_T236	KD211302	ZAK08999	12.73
L2	Spire 2-JFET (JFET-Spec)	C100_4_T250	KD224302	ZAK08999	N/C
L2	Spire 6-JFET (JFET-Phot)	C100_4_T252	KD224303	ZAK10999	N/C
L3	Ventline to 6-JFET Phot	C100_4_T246	KD223302	ZAK08999	N/C
L3	Ventline to 2-JFET Spec	C100_4_T247	KD223303	ZAK10999	N/C
L3	Cooling strap to JFET-S	PT1000_t249	YM238958	YASC2958	26.38
L3	Cooling strap to JFET-P	PT1000_T251	YM239958	YASC2958	26.38

QLA script did not trigger live but OK in playback mode:

```
SCU-03 Thermometry Check
OBSID = 0xb00017c0

PUMPHTRTEMP  6.62   55447
PUMPHSTEMP   9.55   51241
EVAPHSTMP    8.99   51583
SHUNTTEMP    5.43   50853
EMCFILTMP    14.46   59936
SL0TEMP      5.45   51075
PL0TEMP      5.55   51516
OPTTEMP      14.50   57016
BAFTEMP      15.07   58398
BSMIFTEMP    14.63   55523
SCAL2TEMP    14.52   57362
SCAL4TEMP    14.34   57347
SCALTEMP     14.63   56013
SMECIFTEMP   14.26   55904
SMECTEMP     14.33   42104
BSMTEMP      12.80   32768
```

3.3.5 SPIRE-IST-COLD-FUNC-SCU-06-P

Test Id:	SPIRE-IST-COLD-FUNC-SCU-06-P
Test Purpose:	SCU/FPU AC Thermometry Check
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON
Duration	2 minutes
Success Criteria:	At ~ 4K the SUBKTEMP reading should calibration should start being in range. **Open Circuit Criterion:** **RAW reading in the range 0 -100** **Short Circuit Criterion:** **RAW reading of -32768**
CUS Parameters	acparam = 0x1

Test Procedure:

Step#	Action
1	Run SPIRE-IST-COLD-FUNC-SCU-06-P.tcl test procedure from the CCS.
2	Contingency: If test fails : 1. Send manual command: SEND_DRCU_COMMAND Parameter1 = 0xA0860000 Parameter2 = 0 2. Then repeat steps 1 and 2 of the Test Procedure. **Note:** **If the test fails and the SUBKTEMP channel is switched OFF manually, the expected value before/after execution of FUNC-SCU-06 for SUBKSTAT is 0/1**

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
FUNC-SCU-06	**SUBKSTAT** **SUBKTEMP**	**0/1** **He I (~4K)** **He II (~1.7K)**	0/1	**N/A**	PASS

Start time @: 01:26 UT
End time @:
OBSID: 0xb00017c1

Comments:
SUBKTEMP ~5.67 K

QLA script did not trigger live but OK in playback mode:

```
SCU-06
Start time @: 27-Feb 01:25:40
End time @: 27-Feb 01:25:51
OBSID: 0xB00017C1

SUBKSTAT:
Start value: 0x0
End value: 0x1

SUBKTEMP
RAW value before: 32757

RAW value after: 32646
Converted after: 5808 mK
```

3.3.6 SPIRE-IST-COLD-FUNC-SCU-07-P

Test Id:	**SPIRE-IST-COLD-FUNC-SCU-07-P**
Test Purpose:	Sorption Cooler Heater Check (Not at He II)
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON
Constraints	**This test should not be performed at He II temperatures, unless specifically instructed to do so by the I-EGSE staff.**
Duration	5 minutes (CUS 95.0)
Success Criteria:	Test passed if : • Sorption cooler heat switches and pump heater show expected voltages • PCALCURR HK parameter shows the commanded current. • PCALV parameter shows a linear increase proportional to the bias applied. (the proportionality constant in this case should be the PCAL resistor value) i.e.
CUS Parameters	evaphs = 0.804 pumphs = 0.804

SCU HK parameter	RAW	Converted
SPHSV	**~12715**	**~323mV**
EVHSV	**~12715**	**~323mV**
SPHTRV	**~14390**	**~ 8 V**

	pumpht = 21.85

Procedure Steps:

Step	Description	Parameter – Unit	Expected Values Before/ During/ After	Actual Values Before/ During/ After	Success/ Failure
1.	**Open** SCU_PARAMETERS **display on SCOS Alpha Numeric Displays.**				
2.	Run SPIRE-IST-COLD-FUNC-SCU-07-P.tcl test procedure from the CCS.				
3.	Execute TCL script SPIRE-IST-COLD-FUNC-SCU-07-P.tcl	—	—	—	
4.	**Wait for the parameter BBFULLTYPE to get set to Cooler_Htr_Chk**	BBFULLTYPE	Cooler_Htr_Chk		
5.	Record the value of parameter SPHSV – the Sorption Pump Heat Switch Voltage. *This voltage stays on for ~20 seconds. Wait for the voltage to go to zero to continue.*	SPHSV – mV	0/~323/0		
6.	Record the value of parameter EVHSV – the Evaporator Heat Switch Voltage. *This voltage stays on for ~20 seconds. Wait for the voltage to go to zero to continue.*	EVHSV – mV	0/~323/0		
7.	Record the value of parameter SPHTRV – the Sorption Pump Heater Voltage. *This voltage stays on for ~20 seconds.Wait for the voltage to go to zero to continue.*	SPHTRV – V	0/~8.8/0		
8.	**Wait for the I-EGSE staff to confirm the success or failure of this test. If test fails repeat.**	—	—	—	
Test Result (Pass/Fail):					

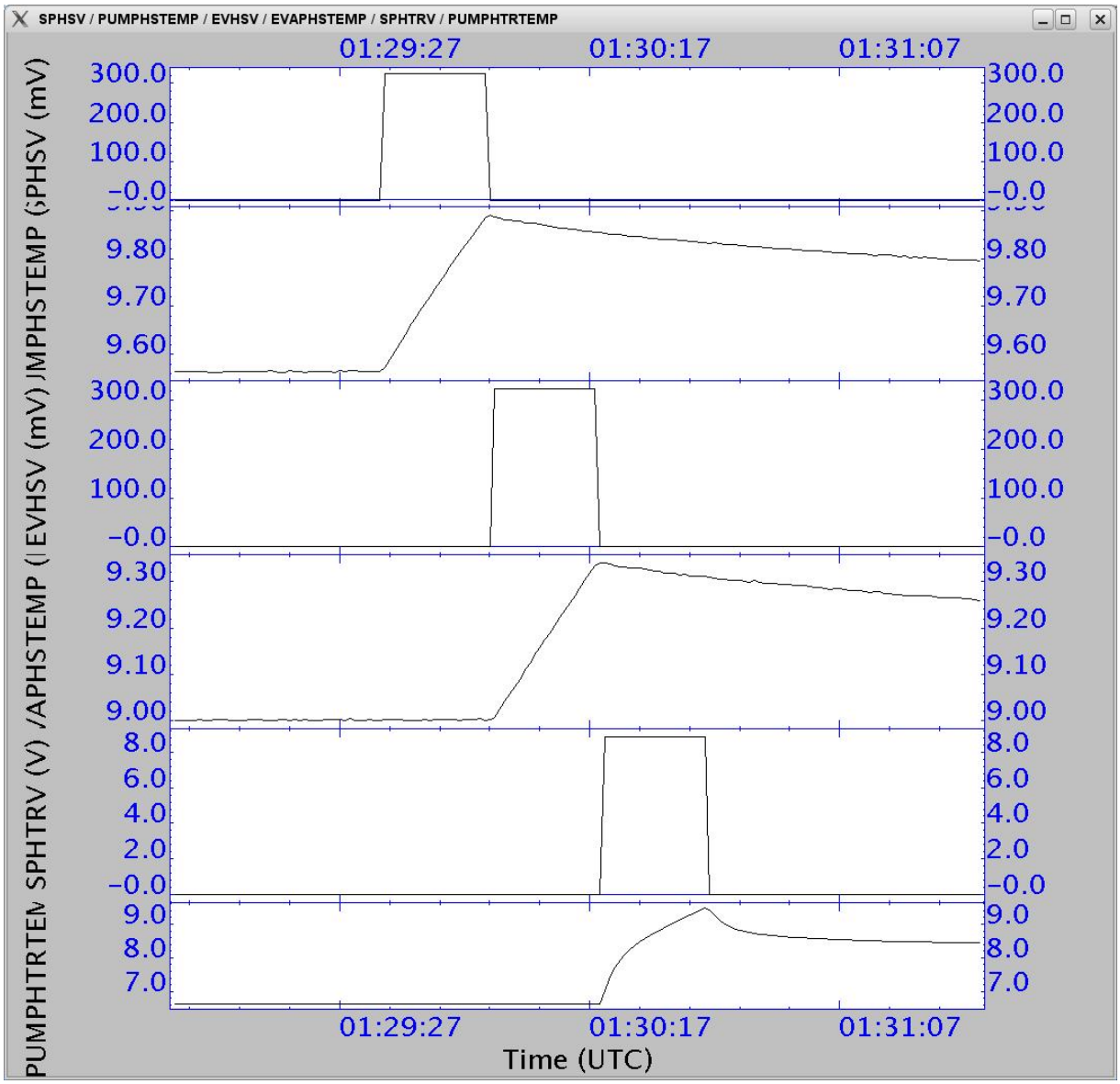
Test Log:

Test Id	Key Parameter(s)	Expected Value Before/During test	Actual Value Before/After	No. of frames received	Test Result

SPIRE-IST-COLD-FUNC-SCU-07-P.tcl	**SPHSV** **EVHSV** **SPHTRV**	**0/ ~ 323 mV** **0/ ~ 323 mV** **0/ ~ 8.8 V**	~0. / 324.14 mV ~0 / 324.05 mV ~0 / 8.85 V	**N/A**	PASS

Start time @: 01:30 UT
End time @:
OBSID: 0xb00017c2

Comments:



3.3.7 SPIRE-IST-COLD-FUNC-PCAL-01-P

Test Id:	SPIRE-IST-COLD-FUNC-PCAL-01-P
Test Purpose:	Photometer Calibrator Characterisation
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON
Duration	5 minutes (CUS 216.0)
Success Criteria:	Test passed if : • PCALCURR HK parameter shows the commanded current. • PCALV parameter shows a linear increase proportional to the bias applied. (the proportionality constant in this case should be the PCAL resistor value)

CUS Parameters	p_start = 1.0; // Start input bias (mA)
	p_end = 7.0; // End input bias (mA)
	p_step = 1.0; // Step input bias (mA)

Test Procedure

Step#	Action
1	Run QLA script FUNC-PCAL-01.py on QLA console.
2	Run SPIRE-IST-COLD-FUNC-PCAL-01-P test procedure from the CCS.
3	Contingency: If test fails repeat steps 1 and 2.

Test Log:

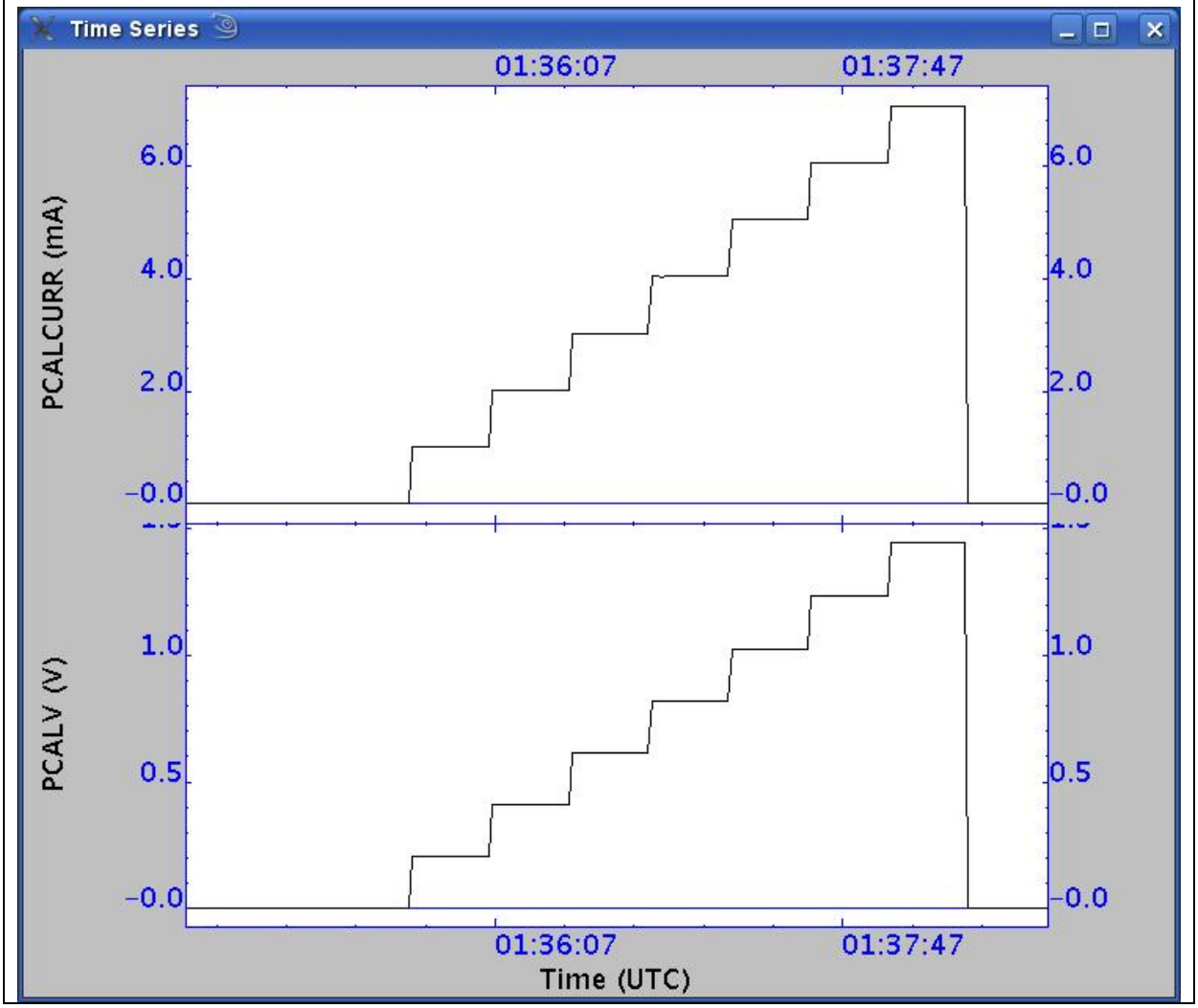
Test Id	Key Parameter(s)	Expected Value Before/During test	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-PCAL-01-P	**PCALCURR PCALV**	**Starts at 0 then steps through 1, 2, 3 .. and ends at 7mA**	See plot below	**N/A**	PASS

Start time @: 01:36 UT
End time @:
OBSID: 0xb00017c3

Comments:

Monitored PCAL current on SCOS – PCAL current settings OK

Better plots to be added



3.3.8 SPIRE-IST-COLD-FUNC-SCAL-01-P

Test Id:	SPIRE-IST-COLD-FUNC-SCAL-01-P
Test Purpose:	Spectrometer Calibrator Characterisation
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON
Duration	18 minutes (CUS 926)
Success Criteria:	Test passed if : • SCAL4CURR HK parameter shows the commanded current sequence (1,2,3,4,5,5.5mA) • SCAL2CURR HK parameter shows the commanded current sequence(1,2,3,4,5,5.5mA) • SCA2LV parameter shows a linear increase proportional to the bias applied. (the proportionality constant in this case should be the SCAL2V resistor value) • SCAL4V parameter shows a linear increase proportional to the bias applied. (the proportionality constant in this case should be the SCAL4V resistor value) • SCAL2TEMP and SCAL4TEMP values follow the increased bias settings
CUS Parameters	s2_start = 1.0 \\ S2 Bias RAW s2_end = 5.0 \\ S2 Bias RAW s2_step = 1. 0 \\ S2 Bias RAW s4_start = 1.0 \\ S4 Bias RAW s4_end = 5.0 \\ S4 Bias RAW s4_step = 1.0 \\ S4 Bias RAW

Test Procedure

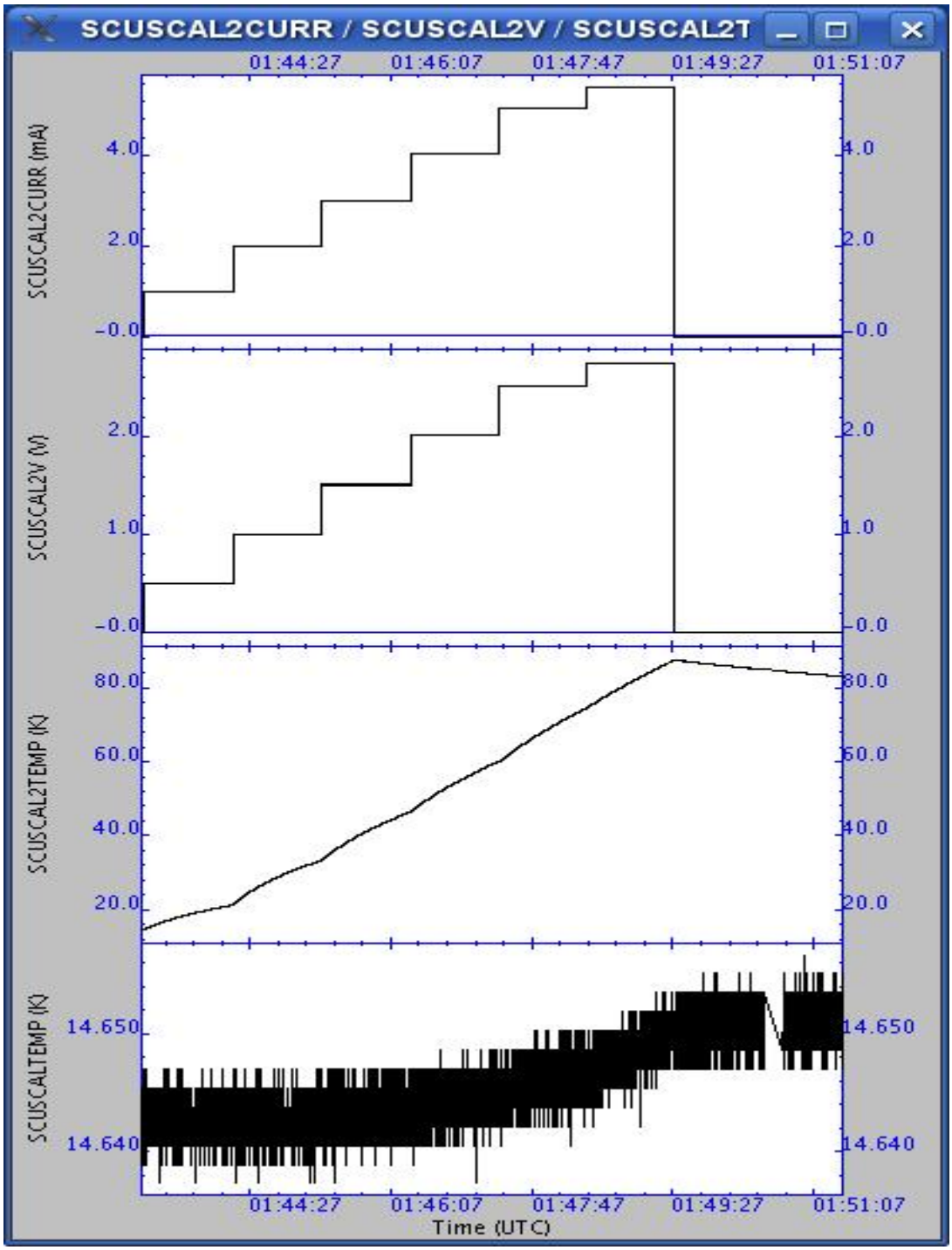
Step#	Action
1	Run QLA script FUNC-SCAL-01.py on QLA console.
2	Run SPIRE-IST-COLD-FUNC-SCAL-01-P test procedure from the CSS.
3	Contingency: If test fails repeat steps 1 and 2.

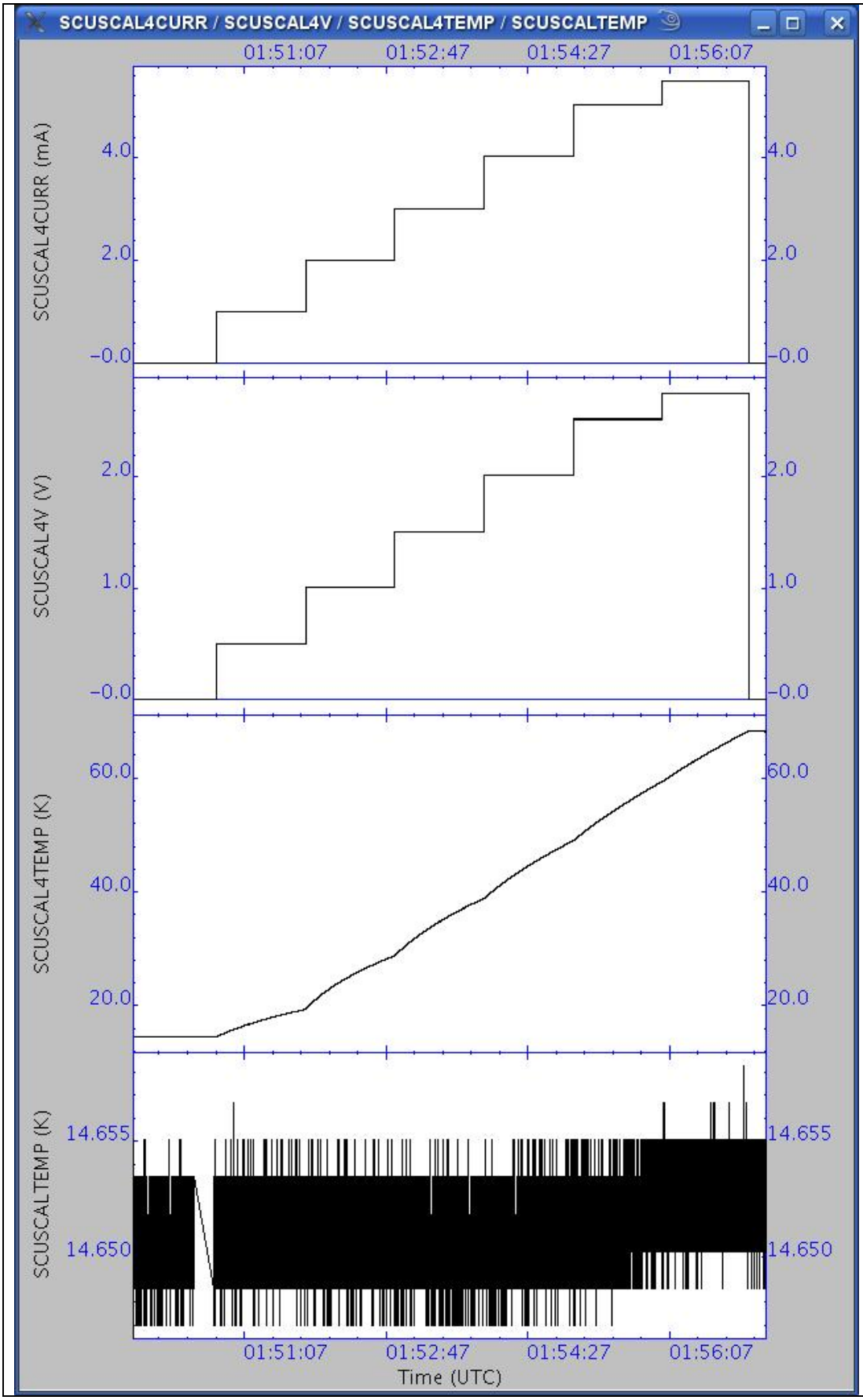
Test Log:

Test Id	Key Parameter(s)	Expected Value Before/During test	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-SCAL-01-P	**SCAL2CURR** **SCAL4CURR** **SCAL2V** **SCAL4V** **SCAL2TEMP** **SCAL4TEMP**	**0/1,2,3,4,5,5.5mA** **0/1,2,3,4,5,5.5mA** **0/0.5,1.0,1.5,2.0,2.5.2.75V** **0/0.5,1.0,1.5,2.0,2.5.2.75V**	See plots below	**N/A**	Pass
Note: First SCAL2CURR starts at 0 then steps through 1, 2, 3 .. and ends at 7mA, then the same for SCAL4CURR					

Start time @: 01:43 UT
End time @:
OBSID: 0xb00017c4

Comments: Test completed successfully. SCAL2 reached ~87K and SCAL4 reached ~68K




SCUSCAL4CURR / SCUSCAL4V / SCUSCAL4TEMP / SCUSCALTEMP
01:51:07
01:52:47
01:54:27
01:56:07
SCUSCAL4CURR (mA)
4.0
2.0
-0.0
SCUSCAL4V (V)
2.0
1.0
-0.0
SCUSCAL4TEMP (K)
60.0
40.0
20.0
SCUSCALTEMP (K)
14.655
14.650
Time (UTC)

3.3.9 SPIRE-IST-COLD-FUNC-MCU-01-P

Test Id:	SPIRE-IST-COLD-FUNC-MCU-01-P
Test Purpose:	MCU Boot Check
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON
Duration	5 mins (CUS 64.0)
Success Criteria:	Test passed if: 1. MCU boots. 2. MCU voltages show expected values. 3. MAC Board Temperature Reading shows ambient temperature.

Test Procedure:

Step#	Action
1	Run SPIRE-IST-COLD-FUNC-MCU-01-P test procedure from the CCS.
2	When procedure is finished, write down the values of the MCU voltages.
3	Contingency: If test fails repeat steps 1 and 2.

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-MCU-01-P	**MCUP5V** **MCUP15V** **MCUP14V** **MCUM14V** **MCUM15V** **MCUMACTEMP** **MCUBSMTEMP** **MCUSMECTEMP**	**N/A/ ~ 5V** **N/A / ~15V** **N/A / ~ 14V** **N/A / ~ -14V** **N/A / ~ -15V** **N/A / ~ 300K** **N/A / ~ 300K** **N/A / ~ 300K**	5.01 V 15.54 V 14.15V -14.47 V -15.63 V 295.04 K 299.12 K 299.83 K	**N/A**	PASS

Start time @: 02:01
End time @:
DRCU Current taken from S/C (parameter WM408565 Display ZAWS1999)
SpireHsfN_L51_I 0.83 A at switch on now 0.89165 A

OBSID: 0xb00017c5
Comments:
MCU booted OK

3.3.10 SPIRE-IST-COLD-FUNC-MCU-03-P

Test Id:	SPIRE-IST-COLD-FUNC-MCU-03-P
Test Purpose:	MCU Nominal Science Generation Check
Initial Configuration:	DRCU_ON + AC/DC thermometry ON +MCU ON
Final Configuration:	DRCU_ON + AC/DC thermometry ON +MCU ON
Duration	5 mins (CUS 69.0)
Success Criteria:	Test passed if : 1. MCU produces each type of the frames requested and with the following characteristics. 2. No events are generated during the different frames generation.

CUS Parameters	n_eng_frames = 100; //number of engineering frames
	f_eng_frames = 64.1; //frequency of engineering frames generation
	n_smec_frames = 100; //number of smec frames
	f_smec_frames = 250.0; //frequency of smec frames generation
	n_bsm_frames = 100; //number of bsm frames
	f_bsm_frames = 64.1; //frequency of bsm frames generation
	ftime = 10; //time for continuous generation

Frame	APID	Type	Subtype	SID	FrameID	Frame length
Eng.	**0x508**	**21**	**3**	**0x814**	**0x14**	**0x15**
BSM	**0x508**	**21**	**1**	**0x612**	**0x12**	**0xD**
SMEC	**0x508**	**21**	**1**	**0x410**	**0x10**	**0xC**
BSM +SMEC						

Test Procedure:

Step#	Action
1	Write down the current value of MCUFRAMECNT located in MCU_PARAMETERS display
2	Run SPIRE-IST-COLD-FUNC-MCU-03-P test procedure from the CCS.
3	When test is finished Write down the current value of MCUFRAMECNT.
4	Contingency: If test fails repeat steps 1 to 4.

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-MCU-03-P.tcl	MCUFRAMECNT	0/ ~ 297	0 / 297		Pass

Start time @: 02:07
End time @:
OBSID: 0xb00017c6

Comments:

QLA-MCU-03_B00017C6_8901.txt

Housekeeping Fri Feb 27 02:06:54 UTC 2009
Science Fri Feb 27 02:06:53 UTC 2009

Name	HK before	Science	HK after	Equal (within 10%)?
SMECENCSIG1	12410.0	12408.0	12410.0	True
SMECENCSIG2	20070.0	20072.0	20075.0	True
SMECLVDTDCSIG	32758.0	32760.0	32758.0	True
SMECLVDTACSIG	27348.0	27350.0	27351.0	True
SMECMOTORCURR	32784.0	32782.0	32780.0	True
SMECMOTORVOLT	32772.0	32770.0	32778.0	True
CHOPSENSSIG	32763.0	32765.0	32764.0	True
CHOPMOTORCURR	32779.0	32778.0	32778.0	True
CHOPMOTORVOLT	32762.0	32765.0	32766.0	True
JIGGSENSSIG	32759.0	32758.0	32755.0	True
JIGGMOTORCURR	32776.0	32775.0	32773.0	True
JIGGMOTORVOLT	32762.0	32764.0	32767.0	True

Empty file QLA-MCU-03_B00017C6_8902.txt but OK when in playback mode:

QLA-MCU-03_B00017C6_8903.txt:

Housekeeping Fri Feb 27 02:07:27 UTC 2009
Science Fri Feb 27 02:07:26 UTC 2009

Name	HK before	Science	HK after	Equal (within 10%)?
CHOPSENSSIG	32765.0	32766.0	32764.0	True
CHOPDACVAL	32768.0	32768.0	32768.0	True
CHOPMOTORVOLT	32764.0	32761.0	32761.0	True
JIGGSENSSIG	32756.0	32758.0	32754.0	True
JIGGDACVAL	32768.0	32768.0	32768.0	True
JIGGMOTORVOLT	32766.0	32766.0	32770.0	True

Step#	Action	Comments
0	Open BSM PARAMETERS display on SCOS Alpha Numeric Displays.	

3.3.11 SPIRE-IST-COLD-FUNC-BSM-01-P

Test Id:	SPIRE-IST-COLD-FUNC-BSM-01-P
Test Purpose:	BSM Switch ON Check
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON + BSM ON (open loop)
Duration	5 mins (CUS 24.0)
Success Criteria:	Test passed if: 1. CHOPSENSPWR HK parameter goes from 0 to 1 2. CHOPSENSIG HK parameter changes 3. JIGGSENSPWR HK parameter goes from 0 to 1 4. JIGGSENSSIG HK parameter changes

Test Procedure

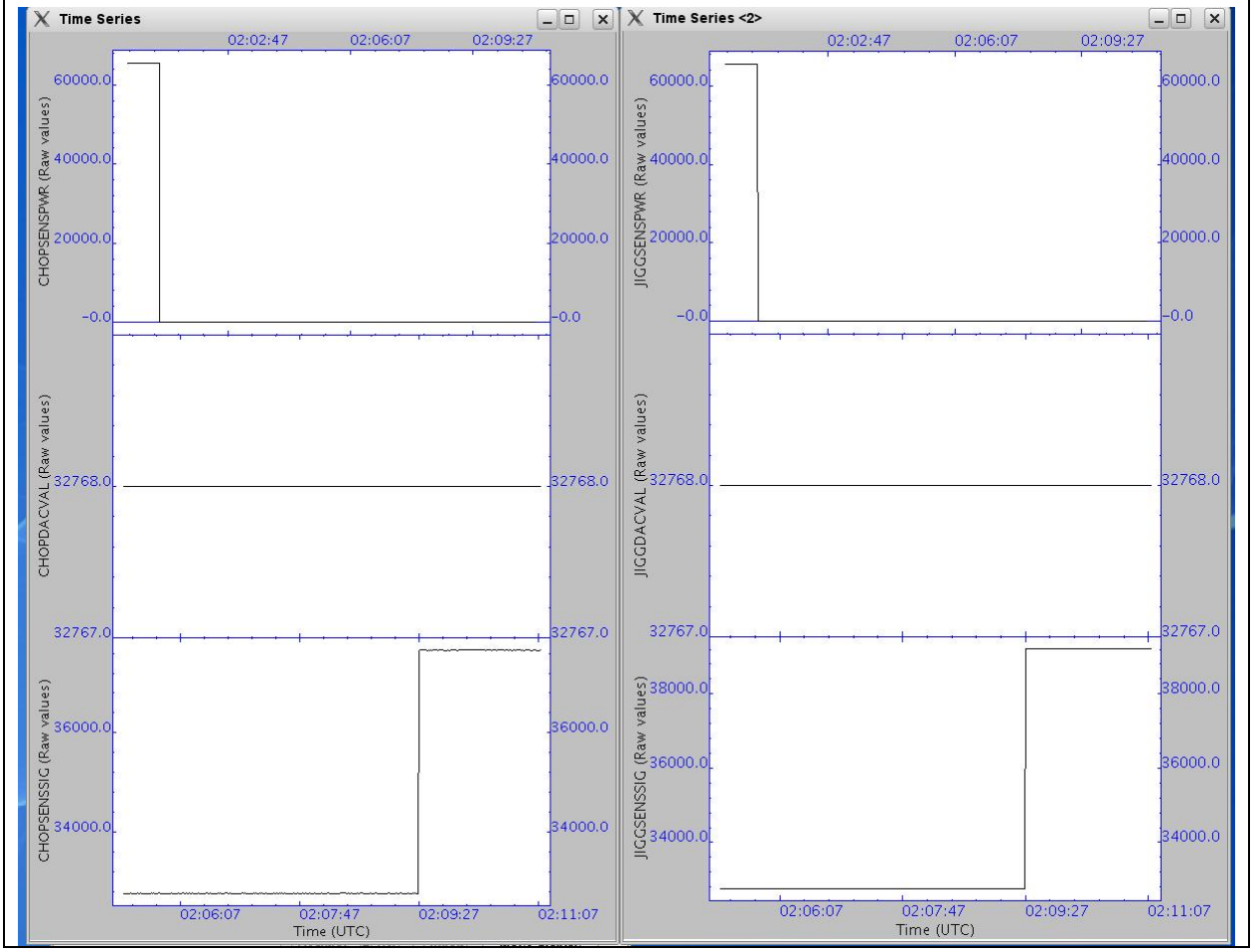
Step#	Action
1	Run SPIRE-IST-COLD-FUNC-BSM-01-P test procedure from the CCS.
2	When the test is finished record all the Key parameters noted below
3	Contingency: If test fails repeat steps 1 and 2.

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
FUNC-BSM-01	**CHOPSENSPWR** **CHOPLOOPMODE** **CHOPSENSSIG** **JIGGSENSPWR** **JIGGLOOPMODE** **JIGGSENSSIG**	**0/1/1** **3/3** **?/?** **0/1/1** **3/3** **?/?**	0 / 1 3 / 3 7FFD /931D 0 / 1 3 / 3 7FF4 / 992C	**N/A**	Pass

Start time @: 02:09
End time @:
OBSID: 0xb00017c7

Comments:



3.3.12 SPIRE-IST-COLD-FUNC-BSM-03-P

Test Id:	SPIRE-IST-COLD-FUNC-BSM-03-P
Test Purpose:	BSM Open Loop dynamics Check
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON + BSM ON (open loop)
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON + BSM ON (open loop)
Duration	5 mins (CUS 269.0)
Success Criteria:	Test passed if the chop sensor signal evolves in the same way as the positions set (i.e. if choppos2 > choppos1 ➔ chopsenssig2 > chopsenssig1) for each jiggle position.

CUS Parameters	frametype = "BSM"; // Specifyes MCU frame type [BSM,SMEC,BSM+SMEC,ENG,TEST]
	framerate = 64.0; // Specifies the frame rate
	j_start = 0x4000; // RAW jiggle target start position
	j_end = 0xc000; // RAW jiggle target end position
	j_step = 0x4000; // RAW jiggle target step in position
	j_delay = 2; // Time at each jiggle target position in seconds
	c_start = 0x3000; // RAW chop target start position
	c_end = 0xf000; // RAW chop target end position
	c_step = 0x1000; // RAW chop target step in position
	c_delay = 5; // Time at each chop target position in seconds

Test Procedure

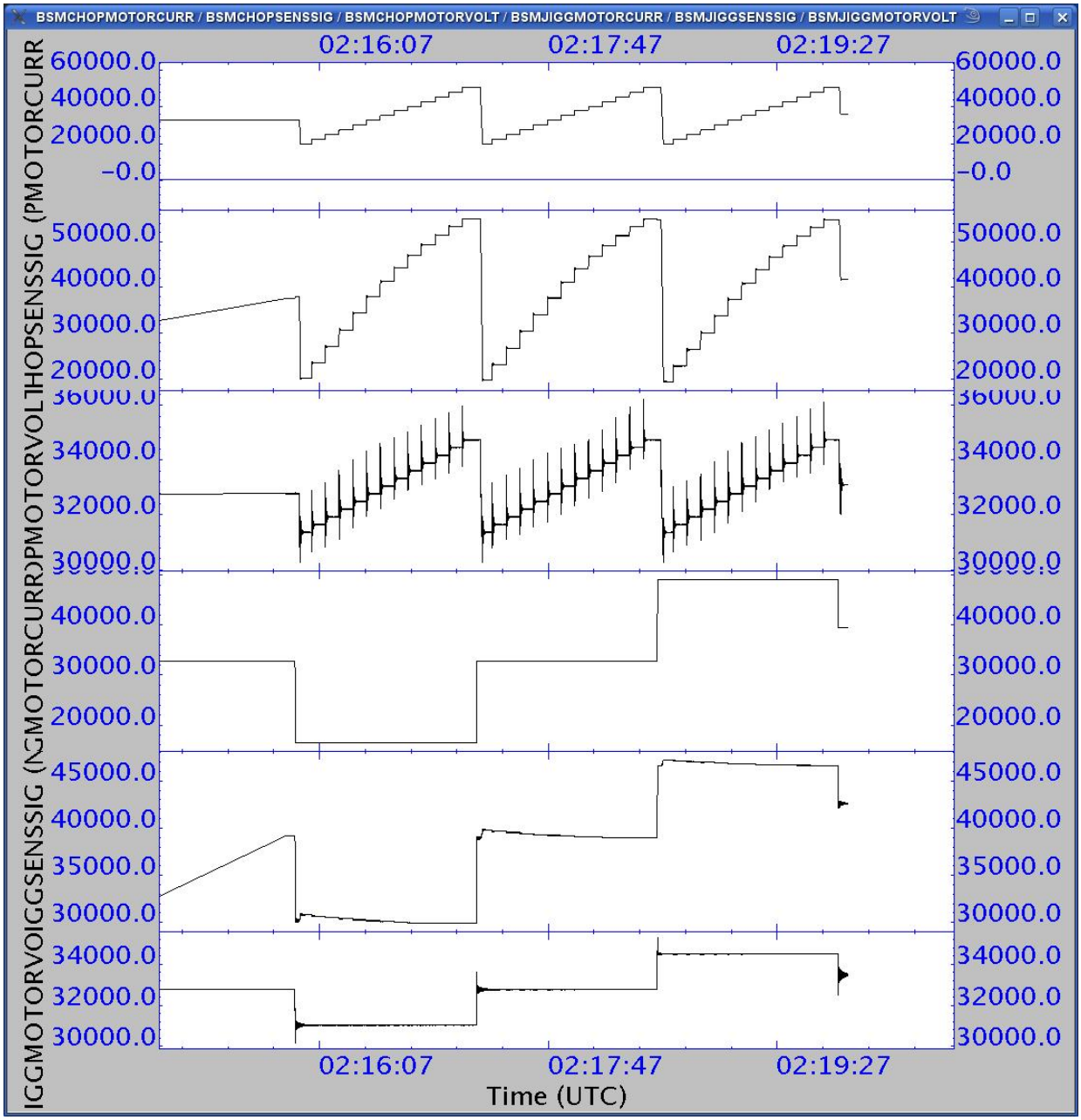
Step#	Action
1	**On QLA open up 2 time series display with the following HK parameters in each display:** **Display 1:** *HK* : CHOPPOSN *BSM Nominal Science*: BSMCHOPMOTORCURR BSMCHOPSENSSIG BSMCHOPMOTORVOLT **Display2:** *HK* : JIGGPOSN *BSM Nominal Science*: BSMJIGGMOTORCURR BSMJIGGSENSSIG BSMJIGGMOTORVOLT
2	**Run SPIRE-IST-COLD-FUNC-BSM-03-P test procedure from the CCS**
3	Contingency: If test fails repeat step 2.

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-BSM-03-P				N/A	**Pass**

Start time @: 02:16 UT
End time @:
OBSID: 0xb00017c8

Comments: **Nominal behaviour.**



3.3.13 SPIRE-IST-COLD-FUNC-BSM-05A-P

Test Id:	SPIRE-IST-COLD-FUNC-BSM-05A-P.tcl
Test Purpose:	BSM Open Loop chop test (Degraded operational mode check)
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON + BSM ON (open loop)
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON + BSM ON (open loop)
Duration	5 mins (CUS 75.0)
Success Criteria:	**Note:** **The purpose of this test is to check the effectiveness of the dumping of the natural oscillations of the BSM in chop axis via motor bemf, through the use of the commendable motor resistance value.** **As it is now is just a check of the default motor resistance value.** **NO adjusting of this value should be attempted during this test.** **The success criteria are therefore not applicable.**

CUS Parameters	frametype = "BSM"; // Specifyes MCU frame type [BSM,SMEC,BSM+SMEC,ENG,TEST]
	framerate = 125.0; // Specifies the frame rate
	on_source_chop = 0xa000; // On source chop position
	on_source_jiggle = 0x8000; // On source jiggle position
	off_source_chop = 0x8000; // Off source chop position
	off_source_jiggle = 0x8000; // Off source jiggle position
	ncycles = 50; //Number of chop cycles
	chop_period = 500000; //period of chop cycles in microsec
	dcumode = 0; //Data type
	dcusample = 4; //Number of DCU samples per chop position
	dcudelay = 34959; //Dealy to start sampling the DCU
	bsmsample = 31; //Number of BSM samples per position

Test Procedure

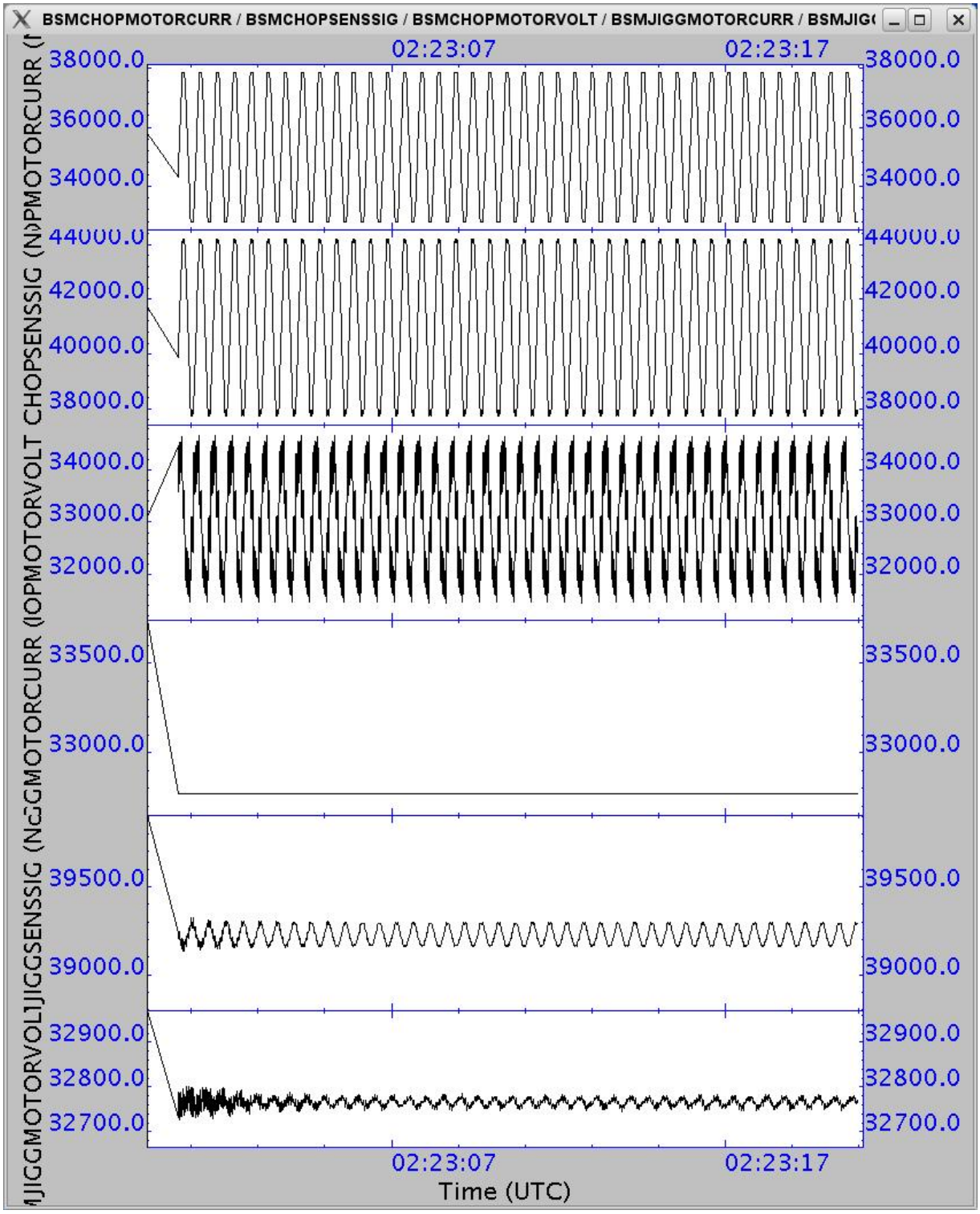
Step#	Action
1	**On QLA open up a time series display of BSM science parameters:** BSMCHOPSENSSIG BSMCHOPMOTORCURR BSMCHOPMOTORVOLT
2	**Run SPIRE-IST-COLD-FUNC-BSM-05A-P.tcl test procedure from the CCS.**
3	Contingency: None contemplated.

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-BSM-05A-P.tcl	BSMCHOPSENSSIG BSMCHOPMOTORCURR BSMCHOPMOTORVOLT	?/? ?/? ?/?		N/A	Pass

Start time @: 02:23
End time @:
OBSID: 0xb00017c9

Comments: All looks like it should



3.3.14 SPIRE-IST-COLD-FUNC-BSM-05B-P

Test Id:	SPIRE-IST-COLD-FUNC-BSM-05B-P
Test Purpose:	BSM Close Loop chop test
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON + BSM ON (OPEN loop)
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON + BSM ON (CLOSED loop)
Duration	5 mins (CUS 72.0)
Success Criteria:	**Note:** **Currently this test does not differ at ALL from the next one.** **In any case the success/fail criteria are NOT applicable for this test.**

CUS Parameters	frametype = "BSM"; // Specifyes MCU frame type [BSM,SMEC,BSM+SMEC,ENG,TEST]
	framerate = 125.0; // Specifies the frame rate
	on_source_chop = 0xb600; // On source chop position (46592)
	on_source_jiggle = 0x9a60; // On source jiggle position (39520)
	off_source_chop = 0x6a28; // Off source chop position (27176)
	off_source_jiggle = 0x9a60; // Off source jiggle position (39520)
	ncycles = 50; //Number of chop cycles
	chop_period = 500000; //period of chop cycles in microsec
	dcumode = 0; //Data type
	dcusample = 4; //Number of DCU samples per chop position
	dcudelay = 34959; //Dealy to start sampling the DCU
	bsmsample = 31; //Number of BSM samples per position

Test Procedure

Step#	Action
1	Execute SPIRE-IST-COLD-BSM-INIT-P.tcl from the CCS.
2	On QLA open up a time series display of BSM science parameters: BSMCHOPSENSSIG BSMCHOPMOTORCURR BSMCHOPMOTORVOLT
3	Run SPIRE-IST-COLD-FUNC-BSM-05B-P.tcl test procedure from the CCS.

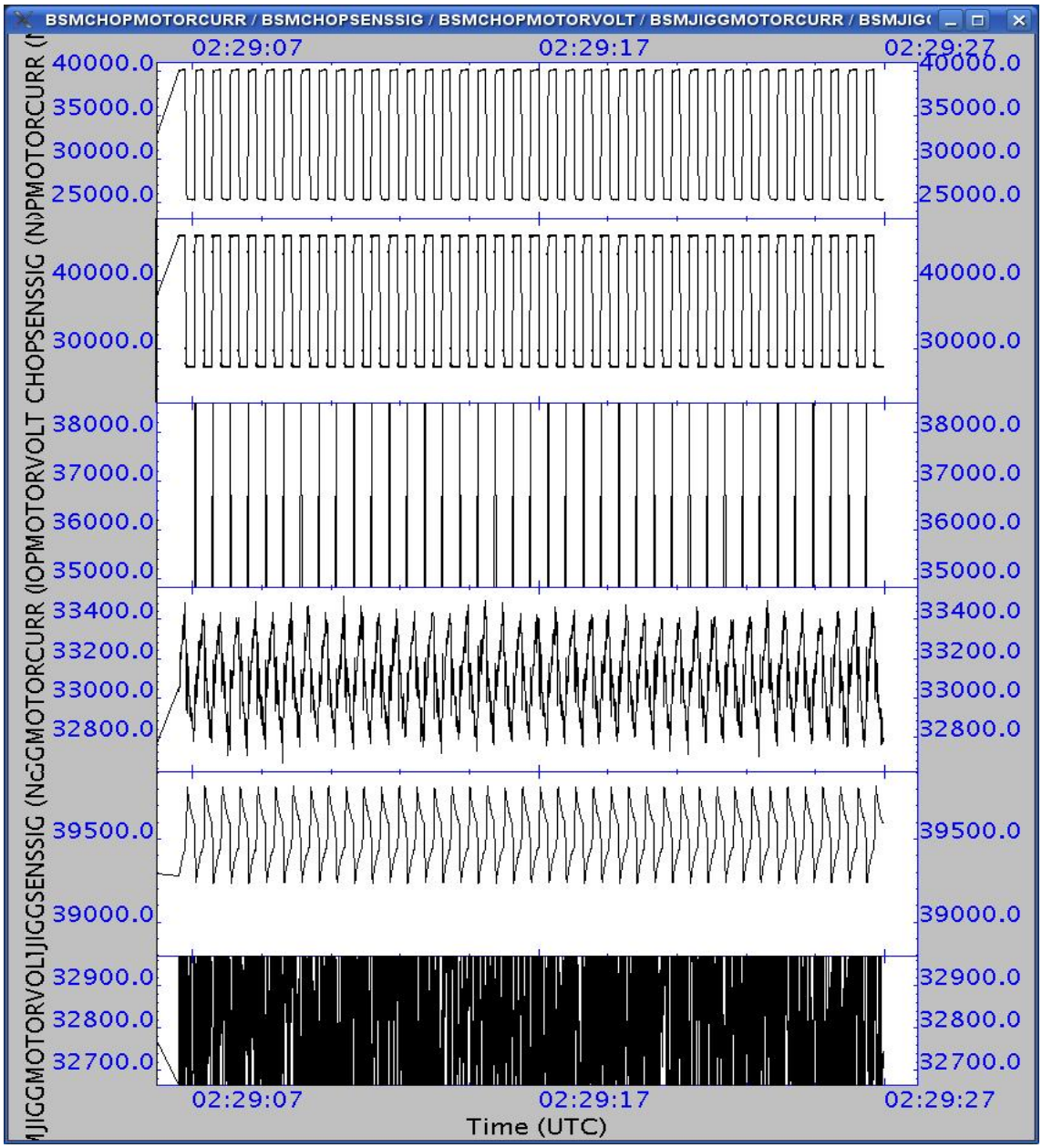
Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-BSM-INIT-P.tcl	**CHOPLOOPMODE** **JIGGLOOPMODE**	**3/-/1** **3/-/1**	**3/-/1** **3/-/1**	**N/A**	**Pass**
SPIRE-IST-COLD-FUNC-BSM-05B-P.tcl	**BSMCHOPSENSSIG** **BSMCHOPMOTORCURR** **BSMCHOPMOTORVOLT**	**?/?** **?/?** **?/?**	See plots below	**N/A**	**Pass**

BSM_INIT:
Start Time: 02:27
End Time:
OBSID: 0xb00017ca

FUNC-BSM-05B
Start time: 02:29
End time:
OBSID: 0xb00017cb

Comments: Chopping OK. Settling time ~40 ms.



3.3.15 SPIRE-IST-COLD-FUNC-BSM-06-P

Test Id:	SPIRE-IST-COLD-FUNC-BSM-06-P
Test Purpose:	BSM Operational Mode Check
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON + BSM ON (open loop)
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON + BSM ON (open loop)
Duration	5 mins (CUS 72.0)
Success Criteria:	**Note:** **The purpose of this test is to check the effectiveness of the BSM close loop initialisation procedure and the default PID parameters.** **If the dynamical behaviour of the BSM during chopping with these PID parameters is close or within requirements this indicates that the PID parameters used can be applied to cold testing with certain adjustment.** **If NOT these indicates that the PID parameters need further tuning BUT NOT TO BE DONE DURING THESE TEST.** **In any case the success/fail criteria are NOT applicable for this test.**

CUS Parameters	frametype = "BSM"; // Specifyes MCU frame type [BSM,SMEC,BSM+SMEC,ENG,TEST]
	framerate = 125.0; // Specifies the frame rate
	on_source_chop = 0x5279; // On source chop position (21113)
	on_source_jiggle = 0x8d00; // On source jiggle position (36096)
	off_source_chop = 0xad87; // Off source chop position (44423)
	off_source_jiggle = 0x8d00; // Off source jiggle position (36096)
	ncycles = 50; //Number of chop cycles
	chop_period = 500000; //period of chop cycles in microsec
	dcumode = 0; //Data type
	dcusample = 4; //Number of DCU samples per chop position
	dcudelay = 34959; //Dealy to start sampling the DCU
	bsmsample = 65535; //Number of BSM samples per position

Test Procedure

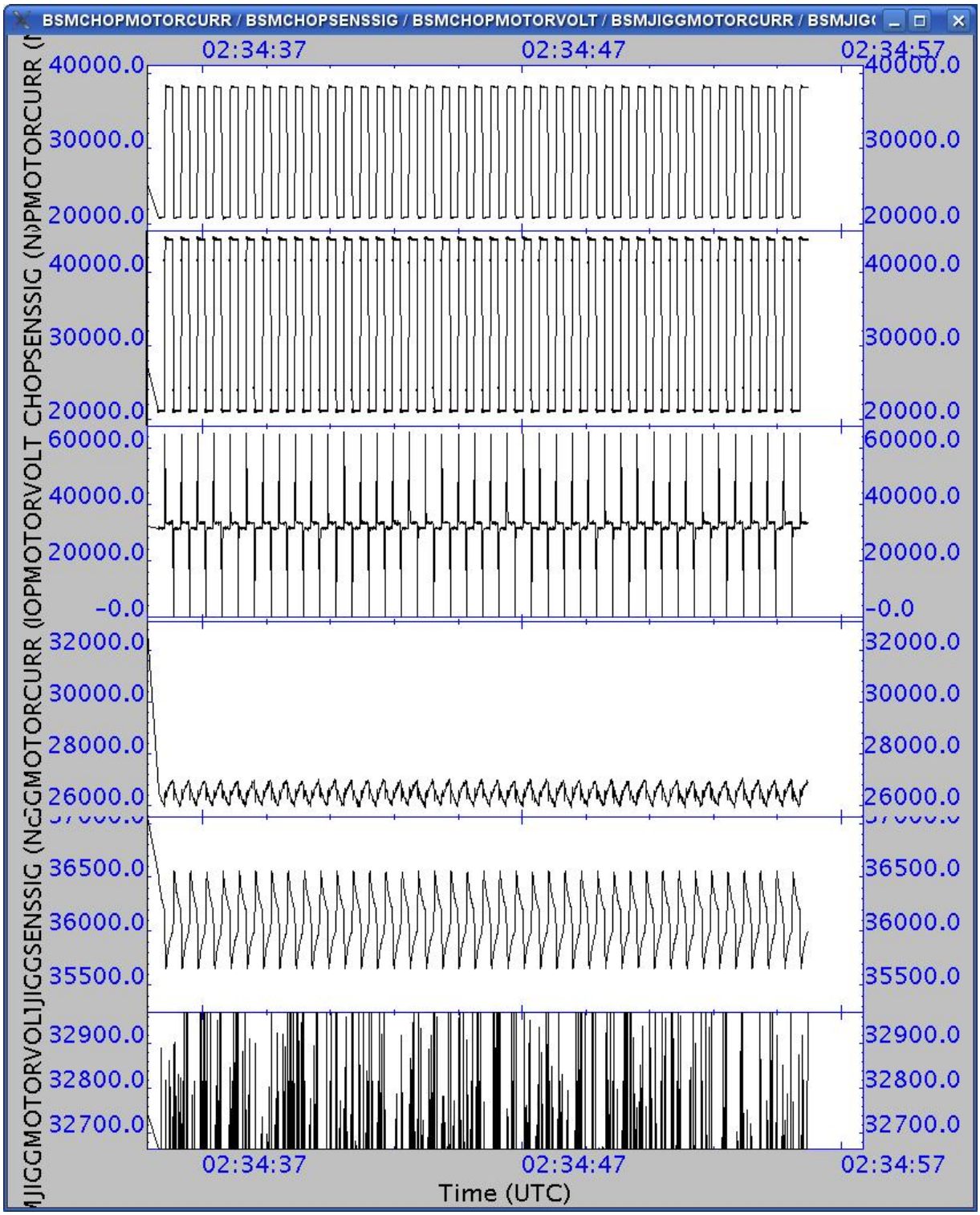
Step#	Action
1	**On QLA open up a time series display of BSM science parameters:** BSMCHOPSENSSIG BSMCHOPMOTORCURR BSMCHOPMOTORVOLT
2	**Run SPIRE-IST-COLD-FUNC-BSM-06-P test procedure from the CCS.**

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-BSM-06-P	CHOPLOOPMODE JIGGLOOPMODE	1/1/1 1/1/1	1/1/1 1/1/1		
	BSMCHOPSENSSIG BSMCHOPMOTORCURR BSMCHOPMOTORVOLT	?/? ?/? ?/?	See plots below	N/A	N/A

Start time @: 02:34
End time @:
OBSID: 0xb00017cc

Comments: Settling time ~40 ms



Step#	Action	Comments
4	Execute SPIRE-IST-COLD-BSM-OFF-P	Start Time: 02:38 End Time: OBSID: 0xb00017cd

Step#	Action	Comments
0	Open SMEC PARAMETERS display on SCOS Alpha Numeric Displays.	

3.3.16 SPIRE-IST-COLD-FUNC-SMEC-01-P

Test Id:	**SPIRE-IST-COLD-FUNC-SMEC-01-P**
Test Purpose:	SMEC Switch ON Check. Encoder and LVDT alive check.
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON+ SMEC ON (open loop)
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON+ SMEC ON (open loop)
Duration	5 Minutes (CUS 40.0)
Success Criteria:	Test passed if : 1. SMECENCPWR HK parameter changes from 0 to 1. 2. SMEC encoder signals 1 and 2 show variation when encoder is switched ON. 3. SMEC LVDT is switched ON. 4. SMEC LVDT DC and AC signals show variation when LVDT is switched ON.

Test Procedure:

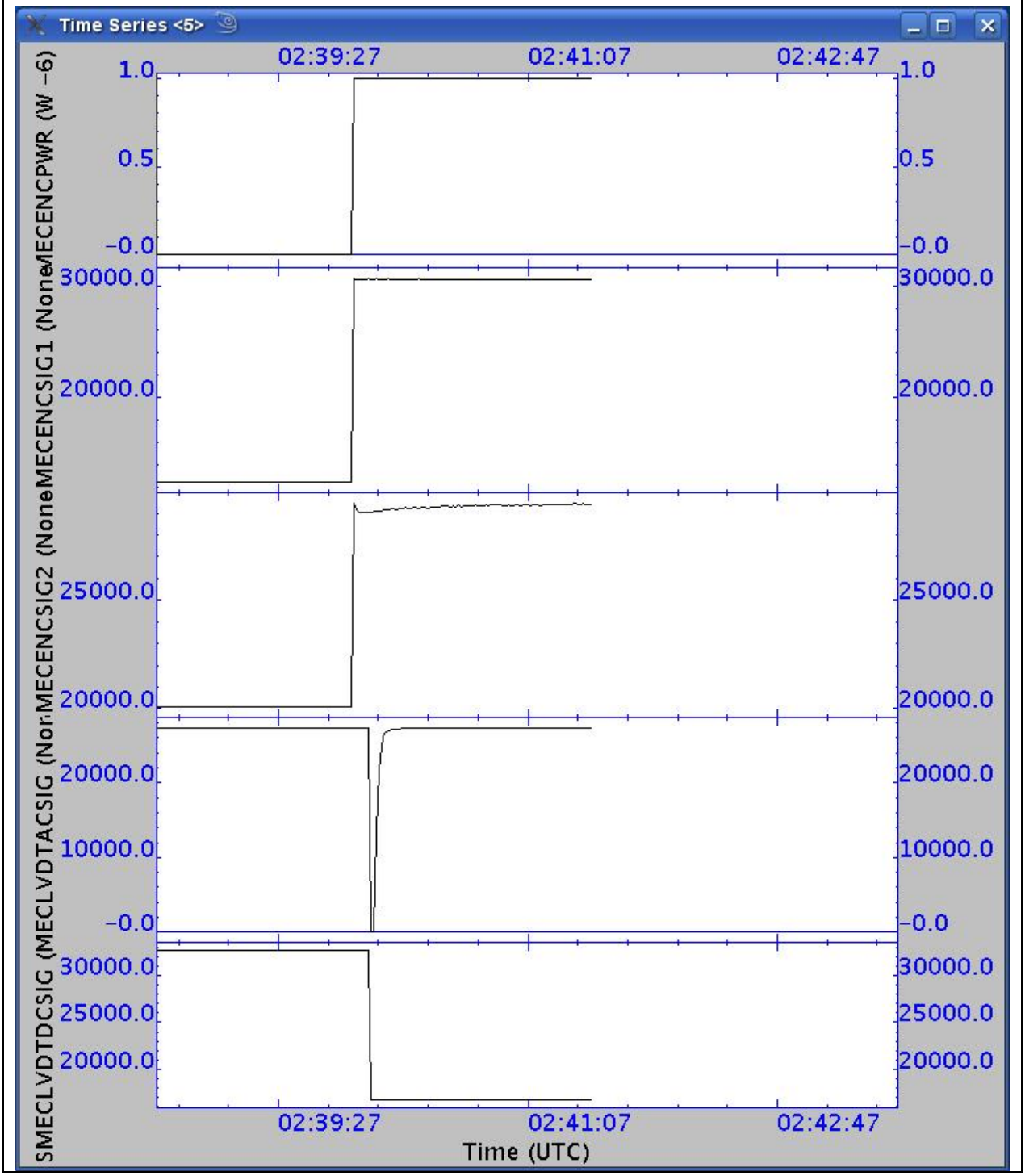
Step#	Action	Comments
1	Run FUNC-SMEC-01.py script on QLA	
2	Run SPIRE-IST-COLD-FUNC-SMEC-01-P test procedure from the CCS.	
3	Contingency: If test fails repeat steps 1.	

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-SMEC-01-P	**SMECENCPWR** **SMECLVDTPWR** **SMECENCSIG1** **SMECENCSIG2**	0/-/1 0/-/1	0/-/1 0/-/1 0x7724 0x72D4	**N/A**	**Pass**

Start time @: 02:40 UT
End time @:
OBSID: 0xb00017ce

Comments: Passed OK at this temperature no problems



3.3.17 SPIRE-IST-COLD-FUNC-SMEC-03-P

Test Id:	SPIRE-IST-COLD-FUNC-SMEC-03-P
Test Purpose:	SMEC (PRIME) Encoder Integrity Check.
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON+ SMEC ON (open loop)
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON+ SMEC ON (open loop)
Duration	5 minutes (CUS 49.0)
Success Criteria:	Test passed if: SMEC encoder signals 1 and 2 show a variation on their amplitudes from one LED illumination level to another. (i.e. MCUENGSMECENCSIG1/2 increase as the encoder power is increased.)

CUS Parameters	frametype = "ENG"; // Specifies MCU frame type [BSM,SMEC,BSM+SMEC,ENG,TEST]
	framerate = 64.0; // Specifies the frame rate
	framenumber = 0xffff; // Frame number
	level_init = 1; //
	level_start = 1;
	level_end = 3;
	level_step = 1;
	led_delay = 5; // Time at each level in seconds

Test Procedure:

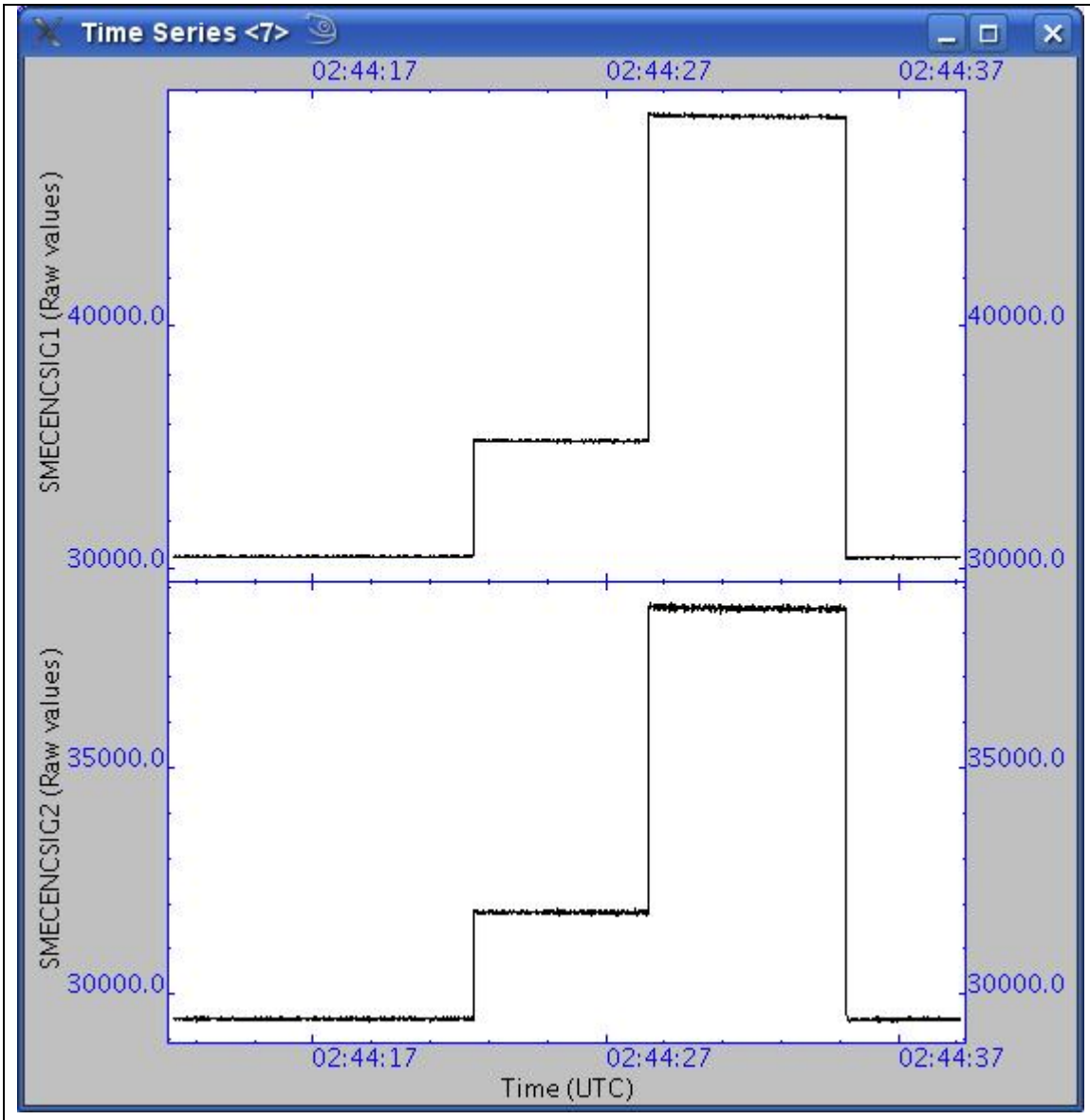
Step#	Action
1	**Run FUNC-SMEC-03.py script on QLA**
2	**Run SPIRE-IST-COLD-FUNC-SMEC-03-P test procedure from the CCS.**
3	Contingency: If test fails repeat steps 1 and 2.

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-SMEC-03-P	SMECENCPWR SMECENCSIG1 SMECENCSIG2		See plots below		**Pass**

Start time @: 02:44
End time @:
OBSID: 0xb00017cf

Comments: Encoder signals did not saturate.


Time Series <7>
02:44:17
02:44:27
02:44:37
SMECENCSIG1 (Raw values)
40000.0
30000.0
SMECENCSIG2 (Raw values)
35000.0
30000.0
Time (UTC)

3.3.18 SPIRE-IST-COLD-FUNC-SMEC-OFF-P

Test Id:	SPIRE-IST-COLD-FUNC-SMEC-OFF-P
Test Purpose:	SMEC (PRIME) Switch OFF
Initial Configuration:	DRCU_ON + AC/DC thermometry ON +MCU ON+ SMEC ON (open loop)
Final Configuration:	DRCU_ON + AC/DC thermometry ON +MCU ON+ SMEC OFF
Duration	3 minutes
Success Criteria:	HK Parameters SMECENCPWR and SMECLVDTPWR show expected OFF values.

Test Procedure:

Step#	Action
1	Run Execute SPIRE-IST-COLD-SMEC-OFF-P.tcl test procedure from the CCS.

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-SMEC-OFF-P	SMECENCPWR SMECLVDTPWR	1/-/0 1/-/0	**1/0** **1/0**		**Pass**

Start time @: 02:47 UT
End time @:
OBSID: 0xb00017d0

Comments:

Step#	Action	Comments
0	Open DCU PARAMETERS SCOS Alpha Numeric Display	

3.3.19 SPIRE-IST-COLD-FUNC-DCU-02-P

Test Id:	**SPIRE-IST-COLD-FUNC-DCU-02-P**
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON
Duration	5 Minutes (CUS 140.0)
Success Criteria:	Test passed if DCUFRAMECNT goes from n to n+700 and the frametime difference between consecutive frames computed by QLA script is in agreement with the expected differences based on commanded sampling rate: 1. Photometer Sampling rate is 15.3Hz → Δt ~ 65.5 ms 2. Spectrometer Sampling rate is 80Hz → Δt = 12.5 ms

CUS Parameters	photbiasfreq = 200.0;
	photsampfreq = 15.3;
	specbiasfreq = 160.0;
	specsampfreq = 80.0;
	frames = 100;

Test Procedure:

Step#	Action	Comments
1	Write the current value of DCUFRAMECNT located in DCU PARAMETERS	
2	Run QLA script FUNC-DCU-02.py on QLA console.	
3	Run SPIRE-IST-COLD-FUNC-DCU-02-P test procedure from the CCS.	
4	Write the current value of DCUFRAMECNT	
5	Contingency: If test fails repeat steps 1 to 4.	

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	Nb. of frames received	Test Result
SPIRE-IST-COLD-FUNC-DCU-02-P	DCUFRAMECNT	n/n+700	1200/1900	**700**	**Success**

Start time @: 02:51
End time @:
OBSID: 0xb00017d1

Comments: Temps are OK see entry for SCU-03

QLA script successfully produced files.

3.3.20 SPIRE-IST-COLD-FUNC-DCU-11-PHOT-P

Test Id:	SPIRE-IST-COLD-FUNC-DCU-11-PHOT-P
Test Purpose:	Photometer BDAs Switch ON Check
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON+ Photometer LIAs ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON+ Photometer LIAs ON + Photometer BIAS ON +Photometer JFETs ON
Duration	7 minutes (CUS 122.0)
Success Criteria:	Test passed if Photometer JFET source and drain voltages are correct: 1. PSWJFETVSS1/2/3/4/5/6 (values according to latest Vss). 2. PMLWJFETVSS1/2/3/4 (values according to latest Vss). 3. PSWJFETSTAT = 0x3F 4. PMLWJFETSTAT = 0x7F

CUS Parameters	heater_V = 0; // Specifies if the heater is to be switched ON or not
	array = "PF"; //default array to switch ON

Test Procedure:

Step#	Action
1	Run SPIRE-IST-COLD-FUNC-DCU-11-PHOT-P test procedure from the CCS. with default input parameters
2	After the test, write down the values RAW and converted values of: PSWJFETSTAT, PMLWJFETSTAT, PSWJFET1/2/3/4/5/6V PMWJFET1/2/3/4V PLWJFET1/2V located in the DCU PARAMETERS display
3	Contingency: If test fails repeat steps 1 and 2.

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-DCU-11-PHOT-P	**PSWJFETSTAT** **PMLWJFETSTAT** **PLIABITSTAT** **PLIAP5V** **PLIAP9V** **PLIAM9V**	**0/0x3f** **0/0x7f** **1** **~0/ ~+5.17 ± 0.1V** **~0/ ~+11.53 ± 0.1V** **~0/ ~-11.53 ± 0.1V**	**OK** **OK** **1** **5.23V** **11.58V** **-11.58V**	**N/A**	**Pass**

Start time @: 03:11
End time @:
OBSID: 0xb00017d2

Comments:
Flow rate is at 22.5 mg/sec

Used JPL approved switch-on procedure for the JFETs.

Initial Vss values were -1.47V.
Final Vss values were consistent with Jamie Bock's spreadsheet (least noise).

See Annexe 1 for the load curve plots

3.3.21 SPIRE-IST-COLD-FUNC-DCU-13-PHOT-P

Test Id:	SPIRE-IST-COLD-FUNC-DCU-13-PHOT-P
Test Purpose:	Photometer Detectors Integrity Check
Initial Configuration:	DRCU_ON + AC/DC thermometry ON+MCU ON+ Photometer LIAs ON + Photometer BIAS ON +Photometer JFETs ON
Final Configuration:	DRCU_ON + AC/DC thermometry ON+MCU ON+ Photometer LIAs ON + Photometer BIAS ON +Photometer JFETs ON
Duration	15 minutes (CUS 726)
Success Criteria:	Test passed if : The photometer detectors show a small linear variation on the output voltage when different bias is applied through the load curve.

CUS Parameters	dcumode = "PF"; // Specifies array in which to perform LC
	mclkdiv = 0x95; // Master clock divisor ,which specifies bias freq
	biasdiv = 0x6; // Sampling divisor ,which specifies sampling rate
	psw_phase = 0x80; // PSW demod phase
	pmw_phase = 0x80; // PMW demod phase
	plw_phase = 0x80; // PLW demod phase
	ftime = 10; // Time at each bias level

Test Procedure:

Step#	Action
1	Run FUNC-DCU-13P.py script on QLA
2	Run SPIRE-IST-COLD-FUNC-DCU-13-PHOT-P test procedure from the CCS. With default input parameters
3	Contingency: If test fails repeat step 1 and 2.

Test Log:

Test Id	Key Parameter(s)	Expected Value Before	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-DCU-13-PHOT-P	PLIABITSTAT PSWJFETSTAT PMLWJFETSTAT	1/1 0x3F/0x3F 0x7F/0x7F	1/1 0x3F/0x3F 0x7F/0x7F		**Pass**

OBSID: 0xb00017d3
Start: 03:19 UT
End:
DRCU Current taken from S/C (parameter WM408565 Display ZAWS1999)
SpireHsfN_L51_I 2.1242 A

Comments: Ran visual check on all JFETs – all look OK

See Annexe 1 for Load Curve plots – all the plots are the same as before.

The calculated bolometer resistances are in Annexe 2.

3.3.22 SPIRE-IST-COLD-FUNC-DCU-14-PHOT-P

Test Id:	SPIRE-IST-COLD-FUNC-DCU-14-PHOT-P
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON + Photometer LIAs ON + Photometer BIAS ON + Photometer JFETs ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON + Photometer LIAs ON + Photometer BIAS ON + Photometer JFETs ON
Duration	5 minutes
Success Criteria:	Test passed if : The Photometer detectors do not show excess noise.

Test Procedure:

Step#	Action	Comments
1	**Run SPIRE-IST-COLD-FUNC-DCU-14-PHOT-P test procedure from the CCS.**	
2	Contingency: If test fails repeat step 1.	

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	Nb. of frames received	Test Result
SPIRE-IST-COLD-FUNC-DCU-14-PHOT-P	PLIABITSTAT PSWJFETSTAT PMLWJFETSTAT	1/1 0x3F/0x3F 0x7F/0x7F	1/1 0x3F/0x3F 0x7F/0x7F		**PASS**

Start time @: 03:35
End time @:
OBSID: b00017d4

Comments:

3.3.23 SPIRE-IST-COLD-PHOT-VSS-P

Test Id:	SPIRE-IST-COLD-PHOT-VSS-P
Purpose:	Photometer BDAs Vss Test PRIME
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON + Photometer LIAs ON + Photometer BIAS ON + Photometer JFETs ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON + Photometer LIAs ON + Photometer BIAS ON + Photometer JFETs ON
Duration	40 minutes
Success Criteria:	Test passed if the Photometer detectors do not show excess noise.

Procedure Steps:

Step	Description	Parameter - Unit	Expected Values Before/ During/ After	Actual Values Before/ During/ After	Success/ Failure
1	Check that Photometer LIAs and detectors are switched on	PLIABITSTAT PSWJFETSTAT PMLWJFETSTAT	1/1 0x3F/0x3F 0x7F/0x7F		
2	Execute TCL script SPIRE-IST-COLD -PHOT-VSS-P.tcl	—	—	—	
3	**Wait for the I-EGSE staff to confirm the success or failure of this test**	—	—	—	
Test Result (Pass/Fail):					

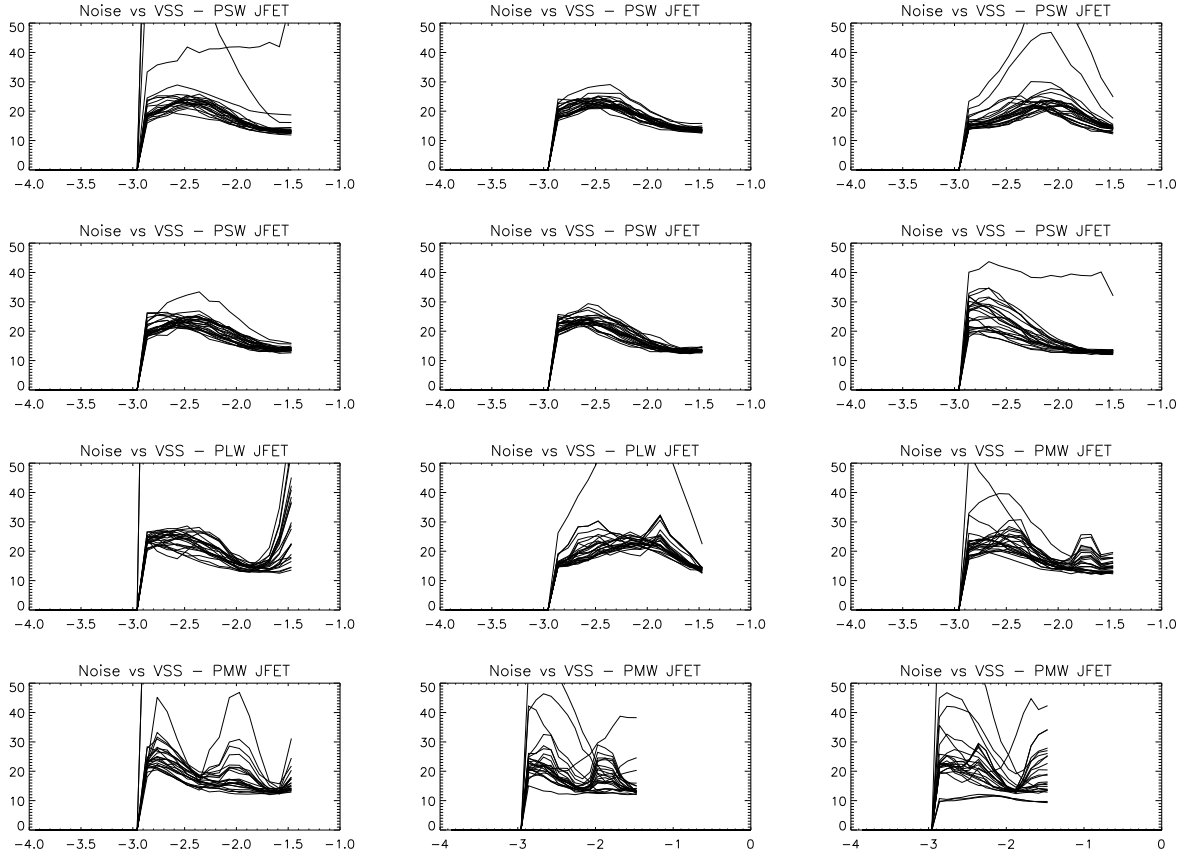
Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	Nb. of frames received	Test Result
SPIRE-IST-PHOT-VSS-P	PLIABITSTAT PSWJFETSTAT PMLWJFETSTAT	1/1 0x3F/0x3F 0x7F/0x7F	1/1 0x3F/0x3F 0x7F/0x7F	NA	**Pass**

Start time @: 03:40
End time @:
OBSID: 0xb00017d5

Comments:

Script executed successfully.

See Noise (nV/√Hz) v. Vss plot below



3.3.24 SPIRE-IST-COLD-PDET-OFF-P

Test Id:	SPIRE-IST-COLD-PDET-OFF-P
Test Purpose:	Photometer BDAs Switch OFF
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON + Photometer BDAs ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON + Photometer BDAs OFF
Duration	3 minutes
Success Criteria:	Test passed if SCUDCDCSTAT goes from 4 to 6, Spectrometer LIAs voltages are correct and SJFET voltages are also correct.

Procedure Steps:

Step	Description	Parameter - Unit	Expected Values Before/ During/ After	Actual Values Before/ During/ After	Success/ Failure
1	Execute TCL script SPIRE-IST-COLD-PDET-OFF-P.tcl	—	—	—	
2	Check that the Photometer detectors are switched off	PSWJFETSTAT PMLWJFETSTAT	0x3F/-/0 0x7F/-/0		
3	Check that the Photometer LIAs are switched off	PLIABITSTAT	1/-/0		
4	**Wait for the I-EGSE staff to confirm the success or failure of this test**	—	—	—	
Test Result (Pass/Fail):					

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	Nb. of frames received	Test Result
SPIRE-IST-PDET-OFF-P	PLIABITSTAT PSWJFETSTAT PMLWJFETSTAT	1/0 0x3F/0 0x7F/0	1/0 0x3F/0 0x7F/0	N/A	Pass

Start time @: 04:46
End time @:
OBSID: 0xb00017d9

Comments: First attempt failed with mismatch between the number of TCs in the CCS template and the I-EGSE CUS DB.

Stopped CCS Handler
Changed mission configuration to fm_ist_cft_config14p – restarted CCS Handler

Success.

3.3.25 SPIRE-IST-COLD-FUNC-DCU-11-SPEC-P

Test Id:	SPIRE-IST-COLD-FUNC-DCU-11-SPEC-P
Test Purpose:	Spectrometer BDAs switch ON check
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON + Spectrometer LIAs ON + Spectrometer BIAS ON + Spectrometer JFETs ON
Duration	7 minutes
Success Criteria:	Test passed if SCUDCDCSTAT goes from 4 to 6, Spectrometer LIAs voltages are correct and SJFET voltages are also correct.

CUS Parameters	heater_V = 0; //Specifies if the heater is to be switched ON
	array = "SF"; //default array to swicth ON

Test Procedure:

Step#	Action
1	**Run SPIRE-IST-COLD-FUNC-DCU-11-SPEC-P test procedure from the CCS.**
2	**After the test Write down the values RAW and converted values of:** LIASTAT SLIAP5V, SLIAP9V, SLIAM9V SSWJFETSTAT,SLWJFETSTAT SSWJFET1V,SLWJFET2d located in on the DCU PARAMETERS display.
3	Contingency: If test fails repeat steps 1 and 2.

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-DCU-11-SPEC-P	**SPECJFETSTAT** **SSWJFET1V** **SSWJFET2V** **SLWJFET1V** **SLIABITSTAT** **SLIAP5V** **SLIAP9V** **SLIAM9V**	**0/7** **0V/-1.5V** **0V/-1.5V** **0V/-1.5V** **1** **~0/ ~+5.23 ± 0.1V** **~0/ ~+11.57 ± 0.1V** **~0/ ~-11.54 ± 0.1V**	**0 / 7** **0 / -V** **0 / -V** **0 / -V** **See plots below** **5.25V** **11.59V** **-11.57V**	**N/A**	**Pass**

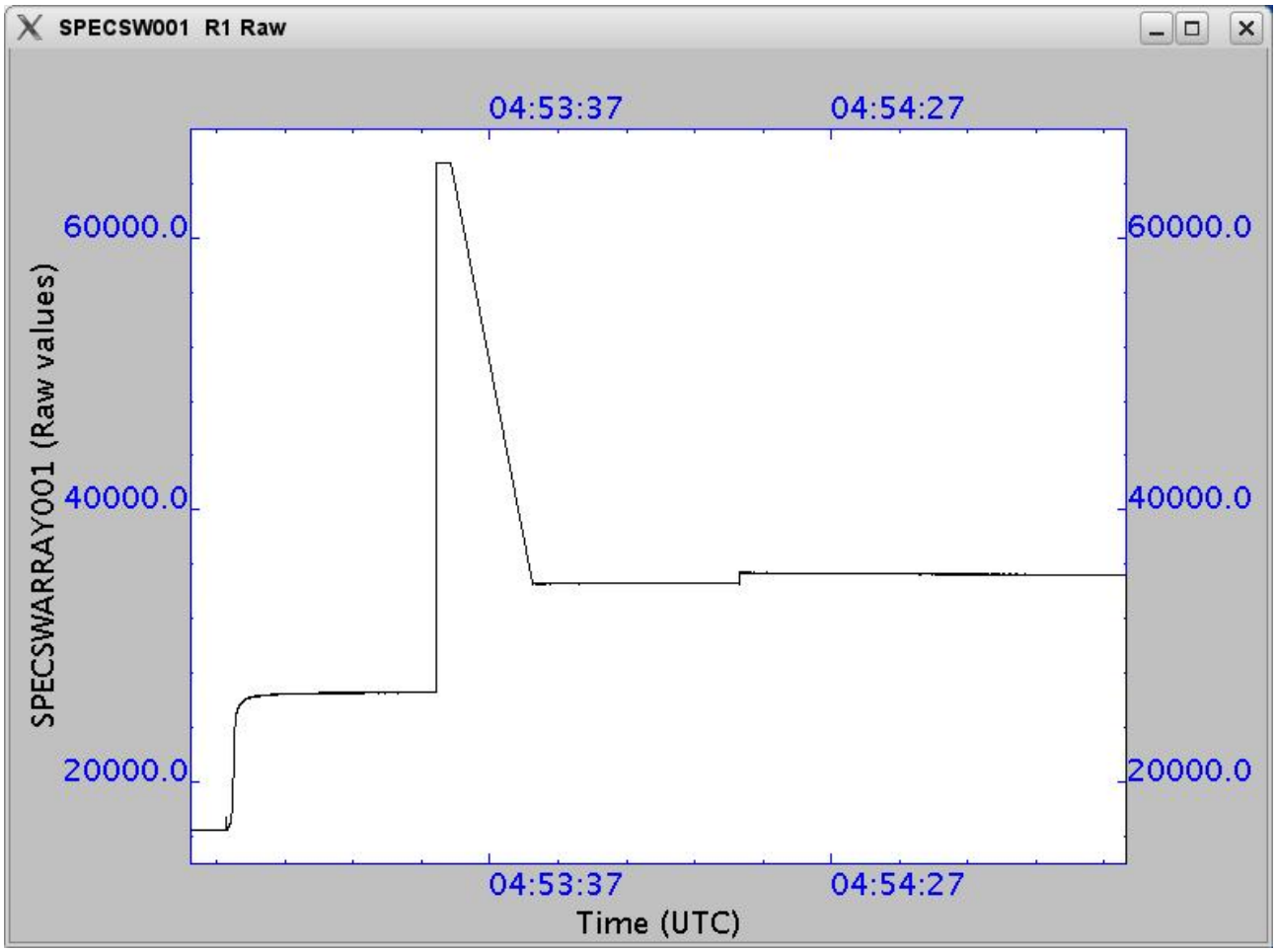
Changed config back to fm_ist_cft_config19p_Kourou and restarted CCS Handler

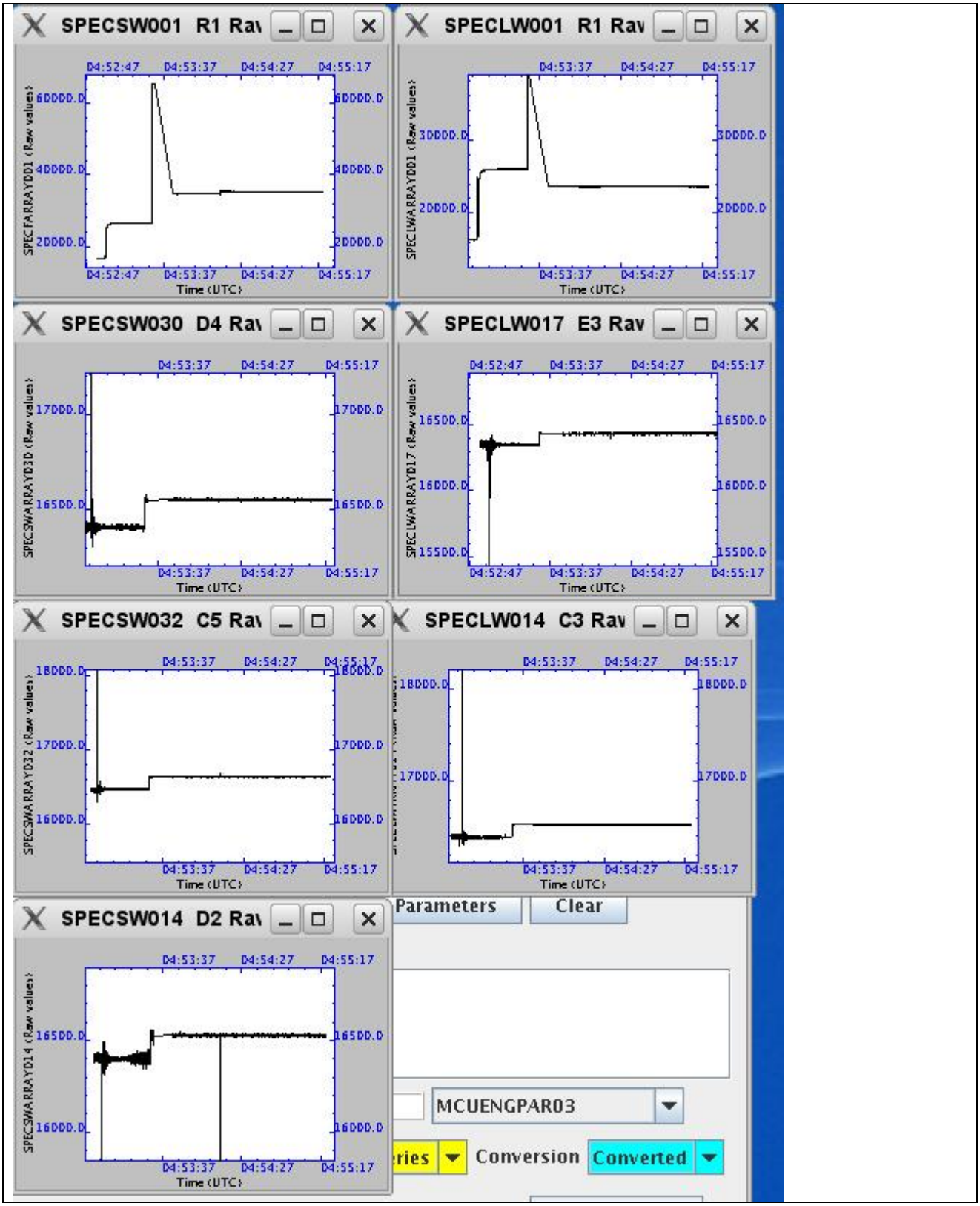
First attempt will be to switch on the Spec JFETs at the nominal Vss values of ~-1.5V

- **Check mission configuration to ensure the right Vss values are used – Config is fm_ist_cft_config19p_Kourou**

Start time @: 04:53
End time @:
OBSID: 0xb00017da

Comments: JFETs were turned on using the default PFM Vss settings (-1.47 V for all membranes). Both SSW membranes responded immediately – looks like we have proved the case that the failure to switch on is associated with the JFET temperature.




SPECSW001 R1 Rav
SPECLW001 R1 Rav
SPECSW030 D4 Rav
SPECLW017 E3 Rav
SPECSW032 C5 Rav
SPECLW014 C3 Rav
SPECSW014 D2 Rav
Time (UTC)
Parameters
Clear
MCUENGPAR03
Conversion
Converted

3.3.26 SPIRE-IST-COLD-FUNC-DCU-13-SPEC-P

Test Id:	SPIRE-IST-COLD-FUNC-DCU-13-SPEC-P
Test Purpose:	Spectrometer detectors check
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON + Spectrometer LIAs ON + Spectrometer BIAS ON + Spectrometer JFETs ON
Final Configuration:	Unchanged
Duration	12 minutes
Success Criteria:	The spectrometer detectors show a small linear variation on the output voltage when different bias is applied through the load curve.

CUS Parameters	dcumode = "SF"; //DCU data mode
	mclkdiv = 0x79; //Master clock divisor
	biasdiv = 0x1; // Bias divisor
	ssw_phase = 0x80; // SSW demod phase
	slw_phase = 0x80; // SLW demod phase
	ftime = 10; // Time at each bias level

Test Procedure:

Step#	Action	Comments
1	On QLA bring up a time series display of a couple of pixels on each of the spectrometer BDAs	
2	Run SPIRE-IST-COLD-FUNC-DCU-13-SPEC-P test procedure from the CCS.	
3	Contingency: If test fails repeat steps 1 and 2	

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-DCU-13-SPEC-P	SPECJFETSTAT SLIABITSTAT	7 1	7 1	N/A	**Pass**

Start time @: 05:02
End time @:
OBSID: 0xb00017dc

The OBSID skips from a to c because CCS templates were being checked using the DB.

Load Curve plots look OK.

See Annexe 1 for the load curve plots.

The calculated bolometer resistances are in Annexe 2.

3.3.27 SPIRE-IST-COLD-FUNC-DCU-14-SPEC-P

Test Id:	SPIRE-IST-COLD-FUNC-DCU-14-SPEC-P
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON + Spectrometer LIAs ON + Spectrometer BIAS ON + Spectrometer JFETs ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON + Spectrometer LIAs ON + Spectrometer BIAS ON + Spectrometer JFETs ON
Duration	5 minutes (CUS 146.0)
Success Criteria:	The Spectrometer detectors don't show excess noise.

CUS Parameters	dcumode = "SF"; //Array
	ftime = 120; //time

Test Procedure:

Step#	Action	Comments
1	**Run SPIRE-IST-COLD-FUNC-DCU-14-SPEC-P test procedure from the CCS.**	
2	Contingency: If test fails repeat step 1.	

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	Nb. of frames received	Test Result
SPIRE-IST-COLD-FUNC-DCU-14-SPEC-P	SPECJFETSTAT SLIABITSTAT	7 1	7 1	N/A	Pass

Start time @: 05:14
End time @:
OBSID: b00017dd

Comments:

3.3.28 SPIRE-IST-COLD- SPEC-VSS-P

Test Id:	SPIRE-IST-COLD-SPEC-VSS-P
Purpose	Spectrometer BDAs Vss Test PRIME
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON + Spectrometer LIAs ON + Spectrometer BIAS ON + Spectrometer JFETs ON
Final Configuration:	Unchanged
Duration	40 minutes (CUS 906.0)
Success Criteria:	Spectrometer BDA Vss values are optimised

CUS Parameters	jfet_Vss_start = -1.5; //Starting JFET source voltage
	jfet_Vss_end = -4.0; //ending JFET source voltage
	jfet_Vss_step = -0.1; //steping JFET source volatge
	ftime = 60; //wait time at each level;

Procedure Steps:

Step	Description	Parameter - Unit	Expected Values Before/ During/ After	Actual Values Before/ During/ After	Success/ Failure
1	Check that the Spectrometer detectors and LIAs are switched on	SPECJFETSTAT SLIABITSTAT	7 1		
2	Execute TCL script SPIRE-IST-COLD- SPEC-VSS-P.tcl	—	—	—	
3	**Wait for the I-EGSE staff to confirm the success or failure of this test**	—	—	—	
Test Result (Pass/Fail):					

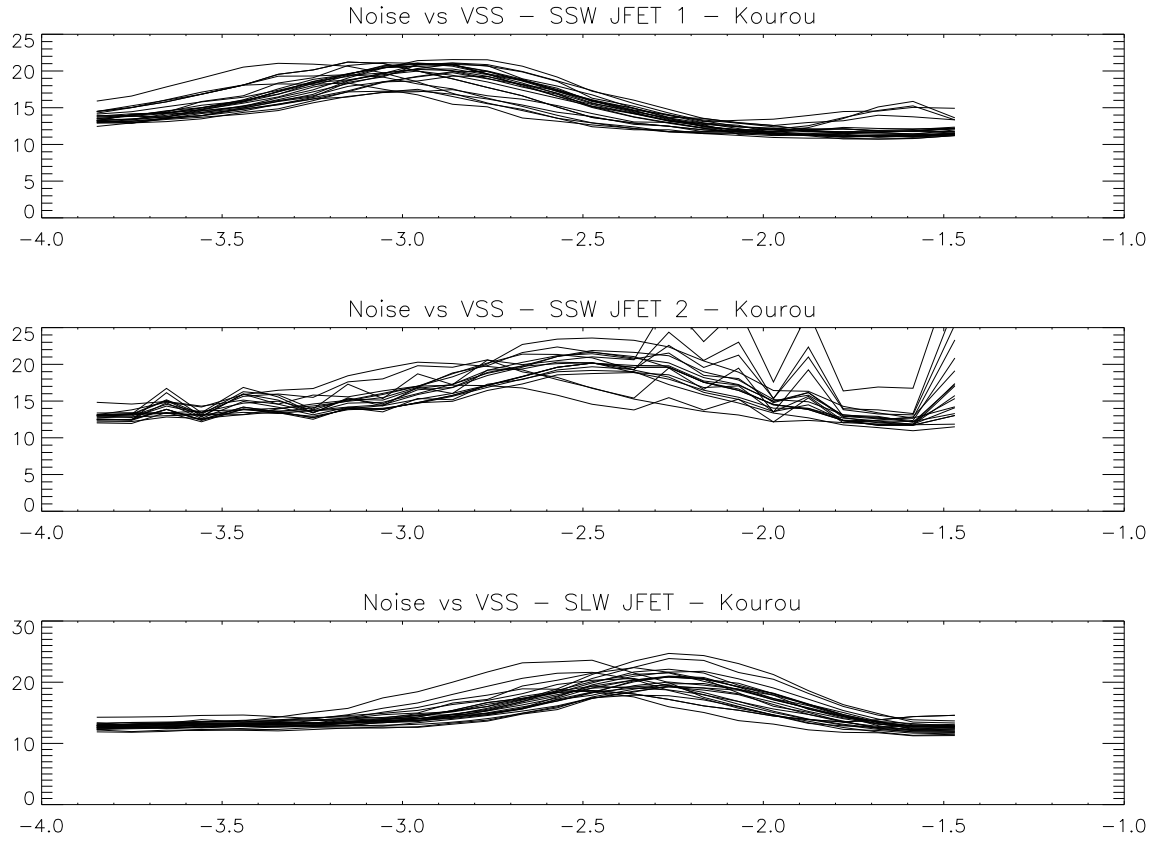
Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	Nb. of frames received	Test Result
SPIRE-IST-COLD-SPEC-VSS-P	**SPECJFETSTAT SLIABITSTAT**	**7 1**	**7 1**	**N/A**	**Pass**

Start time @: 05:19
End time @:
OBSID: 0xb00017de

Comments:

Detectors settings:
Bias frequency: 160.09 Hz
Sampling frequency: 80.05 Hz
SSW phase: 180.71 deg
SLW phase: 180.71 deg
SSW bias : ~ 31mV
SLW bias : ~ 31mV

See Noise (nV/√Hz) v. Vss plot below



3.3.29 SPIRE-IST-COLD-SDET-OFF-P

Test Id:	SPIRE-IST-COLD-SDET-OFF-P
Purpose	Spectrometer BDAs Switch OFF
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON + Spectrometer LIAs ON + Spectrometer BIAS ON + Spectrometer JFETs ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON + Spectrometer BDAS OFF
Duration	3 minutes
Success Criteria:	DCU HK parameters show expected values

Procedure Steps:

Step	Description	Parameter - Unit	Expected Values Before/ During/ After	Actual Values Before/ During/ After	Success/ Failure
1	Execute TCL script SPIRE-IST-COLD-SDET-OFF-P.tcl	—	—		**OK**
2	Check that the Spectrometer detectors are switched off	SPECJFETSTAT	7/-/0	7/-/0	**OK**
3	Check that the Spectrometer LIAs are switched off	SLIABITSTAT	1/-/0	1/-/0	**OK**
4	**Wait for the I-EGSE staff to confirm the success or failure of this test**	—	—	—	**OK**
Test Result (Pass/Fail):					

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	Nb. of frames received	Test Result
SPIRE-IST-COLD-SDET-OFF-P	**SPECJFETSTAT** **SLIABITSTAT**	**7** **1**		**N/A**	**PASS**

Stopped CCS Handler
Changed mission configuration to fm_ist_cft_config14p – restarted CCS Handler

Start time @: 05:51
End time @:
OBSID: 0xb00017df

Comments: Switched off successfully.

Modified the CUS script to not switch-on SSW JFET-2
Stopped CCS Handler
Changed mission configuration to fm_ist_cft_config20p_Kourou – restarted CCS Handler

SPIRE-IST-COLD-FUNC-DCU-11-SPEC-P
OBSID: 0xb00017e1
Start time: 06:03

Confirmed that the correct JFET is left switched OFF.

Changed mission configuration back to fm_ist_cft_config14p – restarted CCS Handler
SPIRE-IST-COLD-SDET-OFF-P
OBSID: 0xb00017e2
Start time: 06:08

CCS switched the CDMS to Bus B

3.3.30 SPIRE-IST-COLD-MCU-OFF-P

Test Id:	SPIRE-IST-COLD-MCU-OFF-P
Purpose	MCU Prime Switch OFF
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU Prime ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU Prime OFF
Duration	5 minutes
Success Criteria:	MCU HK parameters show expected values

Procedure Steps:

Step	Description	Parameter – Unit	Expected Values Before/ During/ After	Actual Values Before/ During/ After	Success/ Failure
1	Execute SPIRE-IST-COLD-MCU-OFF-P.tcl	—	—	—	**OBSID: 0xb00017e3 06:16**
2	Check that the MCU is switched off	MCUBITSTAT	1/-/0	1/-/0	**OK**
Test Result (Pass/Fail): PASS					

3.3.31 SPIRE-IST-COLD-SCU-OFF-P

Test Id:	SPIRE-IST-COLD-SCU-OFF-P
Purpose	SCU Prime Switch OFF
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry OFF
Duration	5 minutes
Success Criteria:	SCU HK parameters show expected values

Procedure Steps:

Step	Description	Parameter - Unit	Expected Values Before/ During/ After	Actual Values Before/ During/ After	Success/ Failure
1	Execute TCL script SPIRE-IST-COLD-SCU-OFF-P.tcl	—	—	—	**OBSID: 0xb00017e4 06:19**
2	A few seconds later record the value of parameter SCUTEMPSTAT	SCUTEMPSTAT	0xFFFF/-/0	0xFFFF/-/0	**OK**
3	A few seconds later record the value of parameter SUBKSTAT	SUBKSTAT	1/-/0	1/-/0	**OK**
Test Result (Pass/Fail): PASS					

3.3.32 SPIRE-IST-COLD-DRCU-OFF-P

Test Id:	SPIRE-IST-COLD-DRCU-OFF-P
Purpose	DRCU PRIME Switch OFF
Initial Configuration:	SPIRE DPU and DRCU PRIME are ON and SPIRE HK is being produced and AC/DC thermometry is ON.
Final Configuration:	SPIRE DPU PRIME is ON, SPIRE DRCU PRIME is OFF and SPIRE HK is not being produced.
Duration	5 minutes
Success Criteria:	THSK and TM2N stop refreshing/incrementing

Procedure Steps:

Step	Description	Parameter - Unit	Expected Values Before/ During/ After	Actual Values Before/ During/ After	Success/ Failure
1	Execute TCL script SPIRE-IST-COLD-DRCU-OFF.tcl	—	—	—	**OK**
2	Check that THSK parameter is not refreshing anymore	THSK	Not refreshing	—	**OK**
3	Check that TM2N parameter is not incrementing anymore	TM2N	Not incrementing	—	**OK**
4	**Power OFF the SPIRE DRCU PRIME unit.**	—	—	—	

Test Result (Pass/Fail): **PASS**

OBSID: 0xb00017e5
06:21

3.3.33 SPIRE-IST-COLD-DPU-OFF-P

Test Id:	SPIRE-IST-COLD-DPU-OFF-P
Purpose	DPU PRIME Switch OFF
Initial Configuration:	SPIRE DPU PRIME is ON but not generating HK.
Final Configuration:	SPIRE DPU PRIME is OFF.
Duration	5 minutes
Success Criteria:	Power to SPIRE DPU PRIME is OFF

Procedure Steps:

Step	Description	Parameter – Unit	Expected Values Before/ During/ After	Actual Values Before/ During/ After	Success/ Failure
1	**Power OFF the SPIRE DPU PRIME unit.**	—	—	—	**OK**

Test Result (Pass/Fail): PASS

Switched off at 06:23

3.3.34 SPIRE-IST-COLD-DPU-ON-R

Version	2.4
Date	6th December 2007
Purpose	To switch on the SPIRE DPU RED and start generating housekeeping
Initial configuration	SPIRE DPU and DRCU RED are switched off
Final configuration	SPIRE DPU RED is ON and SPIRE HK is being produced , SPIRE DRCU RED is OFF
Preconditions	• SPIRE FM DPU is electrically integrated with the Herschel Satellite • SPIRE MIB RED is imported in the CCS database. • CCS is up and running • FUNCTIONAL TEST PARAMETERS display is selected on the CCS
Duration	5 minutes
Pass/Fail Criteria	Nominal and critical HK reports start being generated at their nominal rates of 1Hz and 0.5Hz respectively.

Procedure Steps:

Step	Description	Parameter	Expected Values Before/After	Actual Values Before/After	Pass/ Fail
1	Select DPU AND OBS PARAMETERS display is on the CCS	—	—	—	**Pass**
2	**Power ON the SPIRE DPU RED unit using the dedicated spacecraft LCL line and configure 1553 Spacecraft bus for SPIRE DPU RED (RT = 22)**	—	—	—	**Pass**
3	Wait for the boot software to produce at least 2 event packets (5,1)	—	—	—	**Pass**
4	Execute TCL script SPIRE-IST-COLD-DPU-START-R.tcl	—	—	—	**Pass**
5	Check that Nominal and Critical HK packets are arriving at the CCS: **SPIRE Nominal HK:** • (type ,subtype) : (3,25) • APID : 0x503 **SPIRE Critical HK:** • (type ,subtype) : (3,25) • APID: 0x501	—	—	—	**Pass**
6	Check that THSK parameter is refreshing every second	THSK	Refreshing @ 1 Hz	—	**Pass**
7	Check that TM2N parameter is incrementing by 1 every second	TM2N	Incrementing by 1 @ 1Hz	—	**Pass**
8	Check that TM1N parameter is incrementing by 1 every 2 second	TM1N	Incrementing by 1 @ 0.5Hz	—	**Pass**
9	**On CCS check the consistency of the SPIRE on board time to the HCDMU time and the CCS. ***	—	—	—	**Pass**
10	On I-EGSE check the consistency between SCOS time and THSK and QLA time.	THSK	Incrementing once per second	—	**Pass**

Test Result (Pass/Fail): Pass **– Booted from the secondary partition**

Start time: 06:39
OBSID: 0xb00017e7

DPU current switched on from S/C – parameter SpireHsdR_L12_I (WM808565) is 0.45 A

** Assuming that OBT is provided by the HCDMU following RD02, i.e, OBT is TAI, there should be a 33 second difference between OBS and CCS time (assuming CCS is using UTC). In the case the HCDMU is using UTC to specify the on board time, there should be no difference between THSK and the CCS/I-EGSE system time.*

3.3.35 SPIRE-IST-COLD-DRCU-ON-R

Version	2.4
Date	6th December 2007
Purpose	To switch on the SPIRE DRCU RED and start generating housekeeping
Initial configuration	SPIRE DPU RED is ON and DRCU RED is switched OFF
Final configuration	SPIRE DPU and DRCU RED are ON and SPIRE HK is being produced
Preconditions	• SPIRE FM DRCU is electrically integrated with the Herschel Satellite • SPIRE DRCU is switched OFF • SPIRE MIB RED is imported in the CCS database. • CCS is up and running • FUNCTIONAL TEST PARAMETERS display is selected on the CCS
Duration	5 minutes
Pass/Fail Criteria	DRCU voltages show expected ‘ON’ values

Procedure steps:

Step	Description	Parameter	Expected Values Before/After	Actual Values Before/After	Success/ Failure
1	Execute TCL script SPIRE-IST-COLD-DRCU-START-R-STEP1.tcl	—	—	—	**Pass**
2	Check that THSK parameter is not refreshing anymore	THSK	Not refreshing	—	**Pass**
3	Check that TM2N parameter is not incrementing anymore	TM2N	Not incrementing	—	**Pass**
4	**Power ON the SPIRE DRCU RED unit using the dedicated spacecraft LCL line.**	—	—	—	**Pass**
5	Execute TCL script SPIRE-IST-COLD-DRCU-START-R-STEP2.tcl Note: The two TCs to clear the SPIRE Critical and Nominal HK reports will fail during execution of this script. These should be ignored because the HK reports will already have been cleared by script SPIRE-IST-COLD-DRCU-START-R-STEP1.tcl	—	—	—	**Pass**
6	Check that THSK parameter is again refreshing every second	THSK	Refreshing @ 1Hz	—	**Pass**
7	Check that TM2N parameter is again incrementing every second	TM2N	Incrementing by 1 @ 1Hz	—	**Pass**
8	Check that the SCU/DCU voltages show nominal values	SCUP5V SCUP9V SCUM9V BIASP5V BIASP9V BIASM9V	~ 5.2 ± 0.5V ~ 9.0 ± 0.2V ~ -9.0 ± 0.2V ~ 5.1 ± 0.5V ~ 9.0 ± 0.2V ~ -9.0 ± 0.2V	5.23V 9.09V -9.11V 5.16V 9.01V -9.07V	**Pass**

Test Result (Pass/Fail): Pass
OBSID: 0xb00017e9
Start time: 06:43

DRCU Current measured by S/C parameter SpireHsfR_L52_I (WM798565) 0.45 A

3.3.36 SPIRE-IST-COLD-FUNC-SCU-02-R

Version	2.4
Date	6th December 2007
Purpose	SCU Nominal Science Contents Check RED
Initial configuration	SPIRE DPU and DRCU RED are switched ON, SPIRE HK is being produced
Final configuration	Unchanged
Preconditions	• **SPIRE-IST-COLD-DPU-ON-R** and **SPIRE-IST-COLD-DRCU-ON-R** procedures have been executed. • SPIRE MIB RED is imported in the CCS database. • CCS is up and running • I-EGSE is up and running • DPU AND OBS PARAMETERS & FUNCTIONAL TEST PARAMETERS displays are selected on the CCS
Duration	5 minutes (CUS = 35.0)
Success Criteria:	Test passed if : 4. The SPIRE HK parameter SCUFRAMECNT increments 0/31. 5. The SPIRE HK parameter SCUFRAMECNT increments 0x3FFF/1 6. No events are generated during the frame generation. QLA to give go ahead.
CUS Parameters	CUS parameter - scuframes = 0x1f = 31

Test Procedure:

Step#	Action
0	Open **SCU_PARAMETERS** display on SCOS Alpha Numeric Displays.
1	Write down the initial value of the SCUFRAMECNT and TM5N parameters located in SCU_PARAMETERS display.
2	Run QLA script FUNC-SCU-02.py on QLA console.
3	Write down the final value of SCUFRAMECNT and TM5N.
4	Contingency: If test fails repeat steps 1 to 4.

Test Log:

Step	Description	Parameter	Expected Values Before/ After	Actual Values Before /After	Success/ Failure
1	Execute TCL script SPIRE-IST-COLD-FUNC-SCU-02-R.tcl	SCUFRAMECNT TM5N	0/31 0x3FFF/1		PASS

Start time @: 06:46
End time @:
OBSID:0xb00017ea
Comments:
SCU frame count 0 at start and 31 at end

```
FUNC-SCU-02 version: 1.5

Housekeeping @  Fri Feb 27 06:46:07 UTC 2009
SCU Science @ Fri Feb 27 06:45:59 UTC 2009

 Name           HSK value  SCU value     Equal (within 10 raw units)?
TCHTRV          14.0       16.0          True
PCALCURR        6.0        7.0           True
SCAL4CURR       10.0       8.0           True
SCAL2CURR       7.0        8.0           True
PCALV           10.0       12.0          True
SCAL4V          5.0        8.0           True
SCAL2V          9.0        8.0           True
PUMPHTRTEMP     65419.0    65421.0       True
PUMPHSTEMP      65346.0    65348.0       True
EVAPHSTEMP      65379.0    65380.0       True
SHUNTTEMP       65461.0    65460.0       True
EMCFILTEMP      65453.0    65453.0       True
SL0TEMP         181.0      180.0         True
PL0TEMP         36.0       37.0          True
OPTTEMP         40.0       40.0          True
BAFTEMP         61.0       64.0          True
BSMIFTEMP       65448.0    65445.0       True
SCAL2TEMP       4.0        2.0           True
SCAL4TEMP       34.0       36.0          True
SCALTEMP        65359.0    65360.0       True
SMECIFTEMP      65469.0    65469.0       True
SMECTEMP        374.0      376.0         True
BSMTEMP         65325.0    65323.0       True
SUBKTEMP        32767.0    32767.0       True
```

Test Result (Pass/Fail): PASS

3.3.37 SPIRE-IST-COLD-FUNC-SCU-03-R

Test Id:	SPIRE-IST-COLD-FUNC-SCU-03-R
Test Purpose:	FPU DC Thermometry Check
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON
Duration	8 minutes (CUS = 38.0)
Success Criteria:	Test passed if thermometry channels show temperature values indicating a correct functioning of the sensor, not open/short-circuited. If ANY reading is anomalous check RAW sensor reading. **Open Circuit Criterion:** **RAW reading in the range [0, -100]** **Short Circuit Criterion:** **RAW reading of -32768**
CUS Parameters	CUS parameter dcparam = 0xffff = 65535

Test Procedure:

Step#	Action
1	Run QLA script FUNC-SCU-03.py on QLA console.
2	Run SPIRE-IST-COLD-FUNC-SCU-03-R.tcl test procedure from the CCS.
3	Contingency: If test fails: 4. Execute SCU_OFF procedure. 5. Execute SPIRE-IST-COLD-FUNC-SCU-03-R.tcl procedure. 6. Repeat step 1 of the Test Procedure.

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
FUNC-SCU-03	**SCUTEMPSTAT**	**0xFFFF/0xFFFF**	**0xFFFF/0xFFFF**	**N/A**	PASS

Start time @: 06:47
End time @:
OBSID: 0xb00017eb

Comments: All temps on alright – as for prime side

QLA script did not trigger but OK in playback mode:

```
SCU-03 Thermometry Check
OBSID = 0xb00017eb

PUMPHTRTEMP  6.98   54437
PUMPHSTEMP   9.13   51402
EVAPHSTMP    8.71   52110
SHUNTTEMP    5.45   50282
EMCFILTMP    13.69   60223
SL0TEMP      5.53   51030
PL0TEMP      5.56   52370
OPTTEMP      13.82   57350
BAFTEMP      14.34   58682
BSMIFTEMP    13.78   55877
SCAL2TEMP    13.52   57263
SCAL4TEMP    13.53   55988
SCALTEMP     13.58   47209
SMECIFTEMP   13.45   55873
SMECTEMP     13.41   43380
BSMTEMP      13.13   32768
```

3.3.38 SPIRE-IST-COLD-FUNC-SCU-06-R

Test Id:	SPIRE-IST-COLD-FUNC-SCU-06-R
Test Purpose:	SCU/FPU AC Thermometry Check
Initial Configuration:	DRCU_ON + AC/DC thermometry ON
Final Configuration:	DRCU_ON + AC/DC thermometry ON
Duration	2 minutes
Success Criteria:	At ~ 4K the SUBKTEMP reading should calibration should start being in range. **Open Circuit Criterion:** **RAW reading in the range 0 -100** **Short Circuit Criterion:** **RAW reading of -32768**
CUS Parameters	acparam = 0x1

Test Procedure:

Step#	Action
1	Run SPIRE-IST-COLD-FUNC-SCU-06-R.tcl test procedure from the CCS.
2	Contingency: If test fails : 3. Send manual command: SEND_DRCU_COMMAND Parameter1 = 0xA0860000 Parameter2 = 0 4. Then repeat steps 1 and 2 of the Test Procedure. **Note:** **If the test fails and the SUBKTEMP channel is switched OFF manually, the expected value before/after execution of FUNC-SCU-06 for SUBKSTAT is 0/1**

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
FUNC-SCU-06	**SUBKSTAT** **SUBKTEMP**	**0/1** **He I (~4K)** **He II (~1.7K)**	0/1	**N/A**	PASS

Start time @: 06:51
End time @:
OBSID: 0xb00017ec

Comments:
SUBKTEMP ~6.2 K

QLA script did not trigger but OK in playback mode:

```
SCU-06
Start time @: 27-Feb 06:50:58
End time @: 27-Feb 06:51:12
OBSID: 0xB00017EC

SUBKSTAT:
Start value: 0x0
End value: 0x1

SUBKTEMP
RAW value before: 32767

RAW value after: 32686
Converted after: 6168 mK
```

3.3.39 SPIRE-IST-COLD-FUNC-SCU-07-R

Test Id:	**SPIRE-IST-COLD-FUNC-SCU-07-R**
Test Purpose:	Sorption Cooler Heater Check (Not at He II)
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON
Constraints	**This test should not be performed at He II temperatures, unless specifically instructed to do so by the I-EGSE staff.**
Duration	5 minutes (CUS 95.0)
Success Criteria:	Test passed if : • Sorption cooler heat switches and pump heater show expected voltages • PCALCURR HK parameter shows the commanded current. • PCALV parameter shows a linear increase proportional to the bias applied. (the proportionality constant in this case should be the PCAL resistor value) i.e.

SCU HK parameter	RAW	Converted
SPHSV	**~12715**	**~323mV**
EVHSV	**~12715**	**~323mV**
SPHTRV	**~14390**	**~ 8 V**

CUS Parameters	evaphs = 0.804

	pumphs = 0.804 pumpht = 21.85

Procedure Steps:

Step	Description	Parameter – Unit	Expected Values Before/ During/ After	Actual Values Before/ During/ After	Success/ Failure
9.	**Open** SCU_PARAMETERS **display on SCOS Alpha Numeric Displays.**				
10	Run SPIRE-IST-COLD-FUNC-SCU-07-R.tcl test procedure from the CCS.				
11	Execute TCL script SPIRE-IST-COLD-FUNC-SCU-07-R.tcl	—	—	—	
12	**Wait for the parameter BBFULLTYPE to get set to Cooler_Htr_Chk**	BBFULLTYPE	Cooler_Htr_Chk		
13	Record the value of parameter SPHSV – the Sorption Pump Heat Switch Voltage. *This voltage stays on for ~20 seconds. Wait for the voltage to go to zero to continue.*	SPHSV – mV	0/~323/0		
14	Record the value of parameter EVHSV – the Evaporator Heat Switch Voltage. *This voltage stays on for ~20 seconds. Wait for the voltage to go to zero to continue.*	EVHSV – mV	0/~323/0		
15	Record the value of parameter SPHTRV – the Sorption Pump Heater Voltage. *This voltage stays on for ~20 seconds.Wait for the voltage to go to zero to continue.*	SPHTRV – V	0/~8.8/0		
16	**Wait for the I-EGSE staff to confirm the success or failure of this test. If test fails repeat.**	—	—	—	
Test Result (Pass/Fail):					

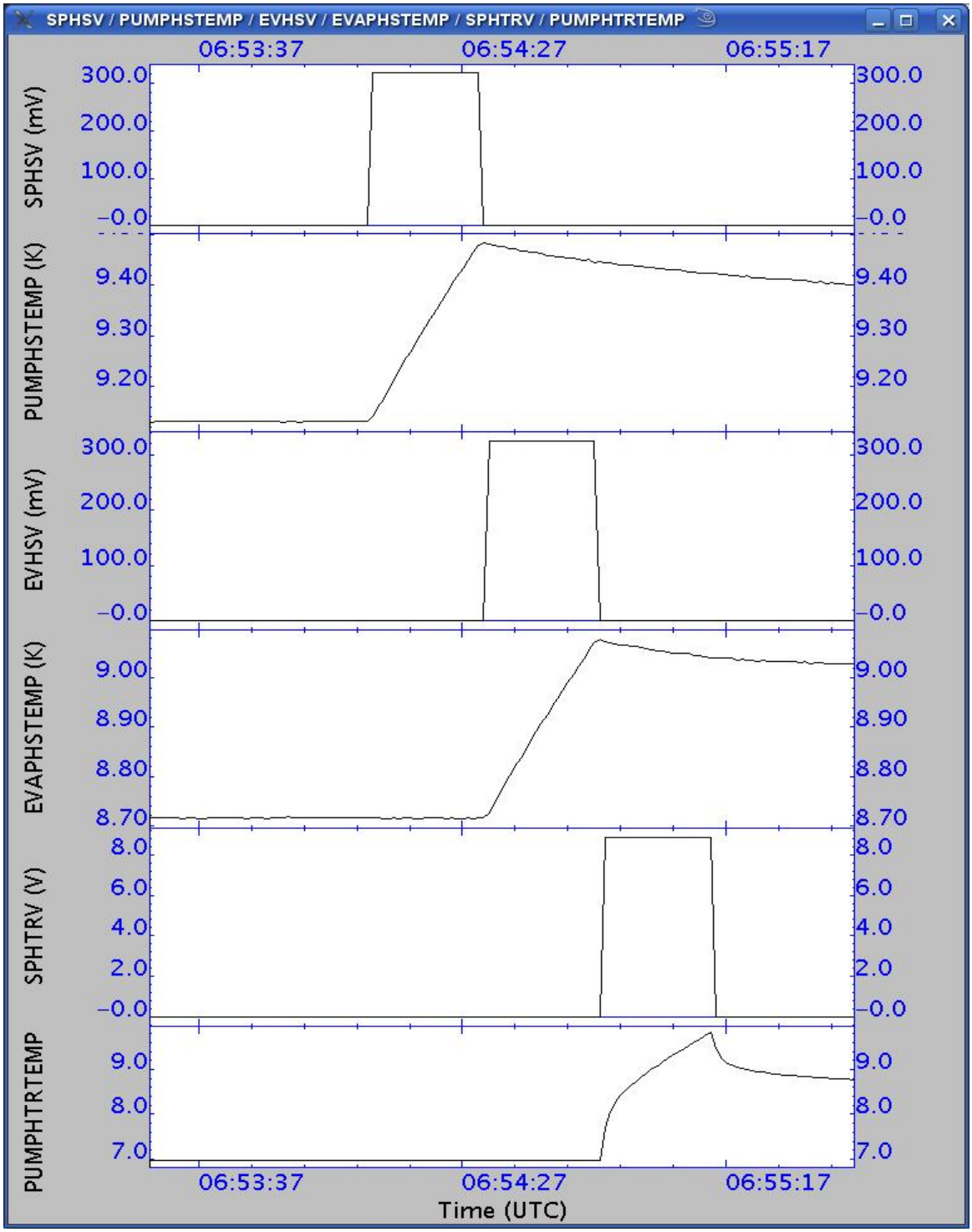
Test Log:

Test Id	Key Parameter(s)	Expected Value Before/During test	Actual Value Before/After	No. of frames received	Test Result

SPIRE-IST-COLD-FUNC-SCU-07-R.tcl	**SPHSV** **EVHSV** **SPHTRV**	**0/ ~ 323 mV** **0/ ~ 323 mV** **0/ ~ 8.8 V**	~0. / 323.78 mV ~0 / 324.78mV ~0 / 8.85V	**N/A**	

Start time @: 06:54
End time @:
OBSID: 0xb00017ed

Comments:



3.3.40 SPIRE-IST-COLD-FUNC-PCAL-01-R

Test Id:	SPIRE-IST-COLD-FUNC-PCAL-01-R
Test Purpose:	Photometer Calibrator Characterisation
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON
Duration	5 minutes (CUS 216.0)
Success Criteria:	Test passed if : • PCALCURR HK parameter shows the commanded current. • PCALV parameter shows a linear increase proportional to the bias applied. (the proportionality constant in this case should be the PCAL resistor value)

CUS Parameters	p_start = 1.0; // Start input bias (mA)
	p_end = 7.0; // End input bias (mA)
	p_step = 1.0; // Step input bias (mA)

Test Procedure

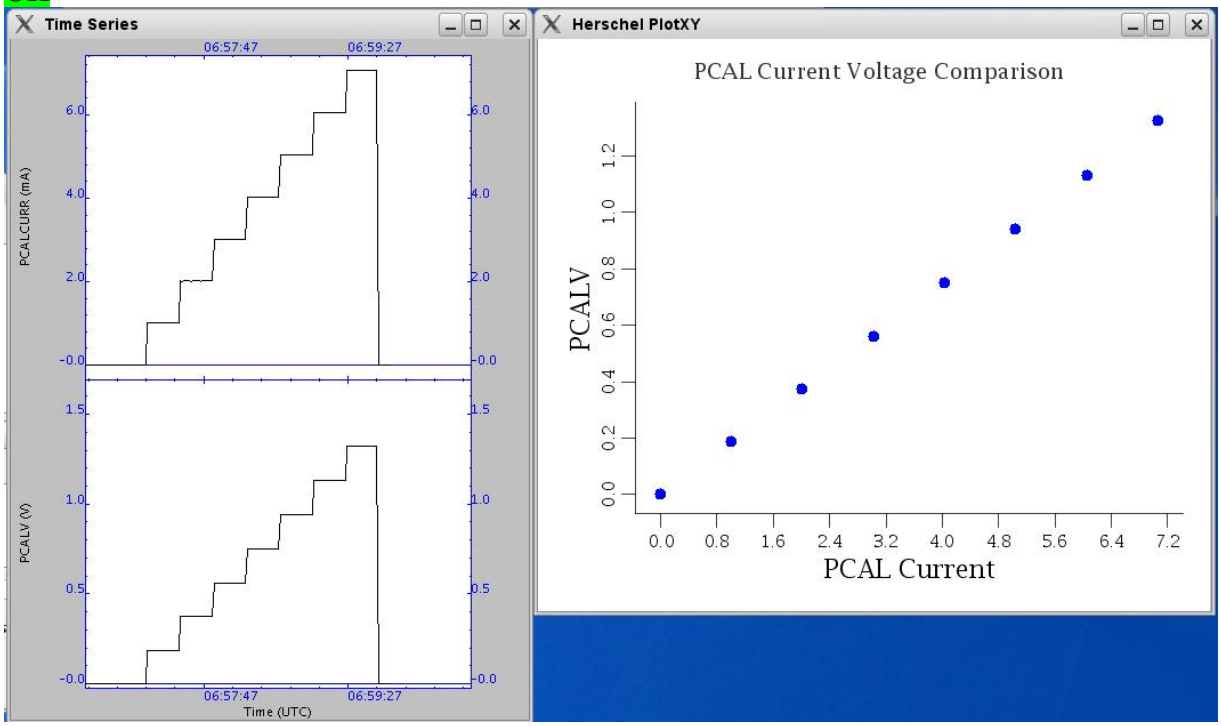
Step#	Action
1	Run QLA script FUNC-PCAL-01.py on QLA console.
2	Run SPIRE-IST-COLD-FUNC-PCAL-01-R test procedure from the CCS.
3	Contingency: If test fails repeat steps 1 and 2.

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/During test	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-PCAL-01-R	**PCALCURR PCALV**	**Starts at 0 then steps through 1, 2, 3 .. and ends at 7mA**	See plot below	**N/A**	PASS

Start time @: 06:57
End time @:
OBSID: 0xb00017ee

Comments: **Levels**
OK



3.3.41 SPIRE-IST-COLD-FUNC-SCAL-01-R

Test Id:	SPIRE-IST-COLD-FUNC-SCAL-01-R
Test Purpose:	Spectrometer Calibrator Characterisation
Initial Configuration:	DRCU_ON + AC/DC thermometry ON
Final Configuration:	DRCU_ON + AC/DC thermometry ON
Duration	18 minutes (CUS 926)
Success Criteria:	Test passed if : • SCAL4CURR HK parameter shows the commanded current sequence (1,2,3,4,5,5.5mA) • SCAL2CURR HK parameter shows the commanded current sequence(1,2,3,4,5,5.5mA) • SCA2LV parameter shows a linear increase proportional to the bias applied. (the proportionality constant in this case should be the SCAL2V resistor value) • SCAL4V parameter shows a linear increase proportional to the bias applied. (the proportionality constant in this case should be the SCAL4V resistor value) • SCAL2TEMP and SCAL4TEMP values follow the increased bias settings
CUS Parameters	s2_start = 1.0 \\ S2 Bias RAW s2_end = 5.0 \\ S2 Bias RAW s2_step = 1. 0 \\ S2 Bias RAW s4_start = 1.0 \\ S4 Bias RAW s4_end = 5.0 \\ S4 Bias RAW s4_step = 1.0 \\ S4 Bias RAW

Test Procedure

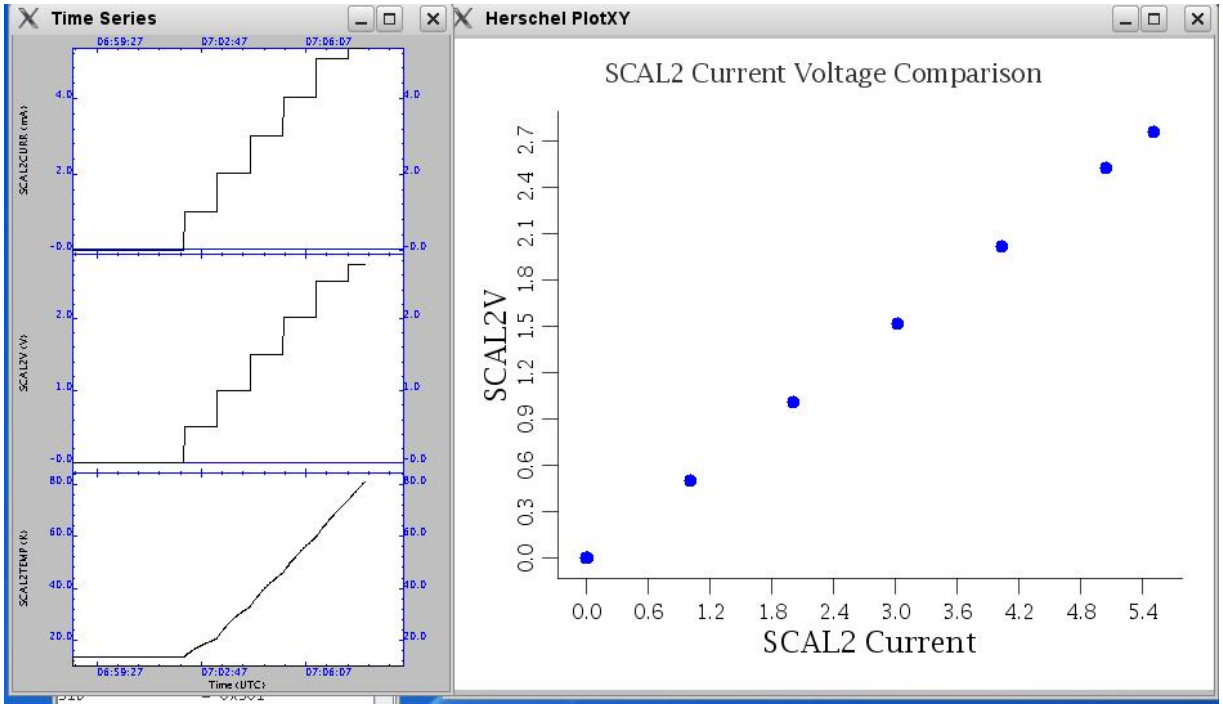
Step#	Action
1	Run QLA script FUNC-SCAL-01.py on QLA console.
2	Run SPIRE-IST-COLD-FUNC-SCAL-01-R test procedure from the CSS.
3	Contingency: If test fails repeat steps 1 and 2.

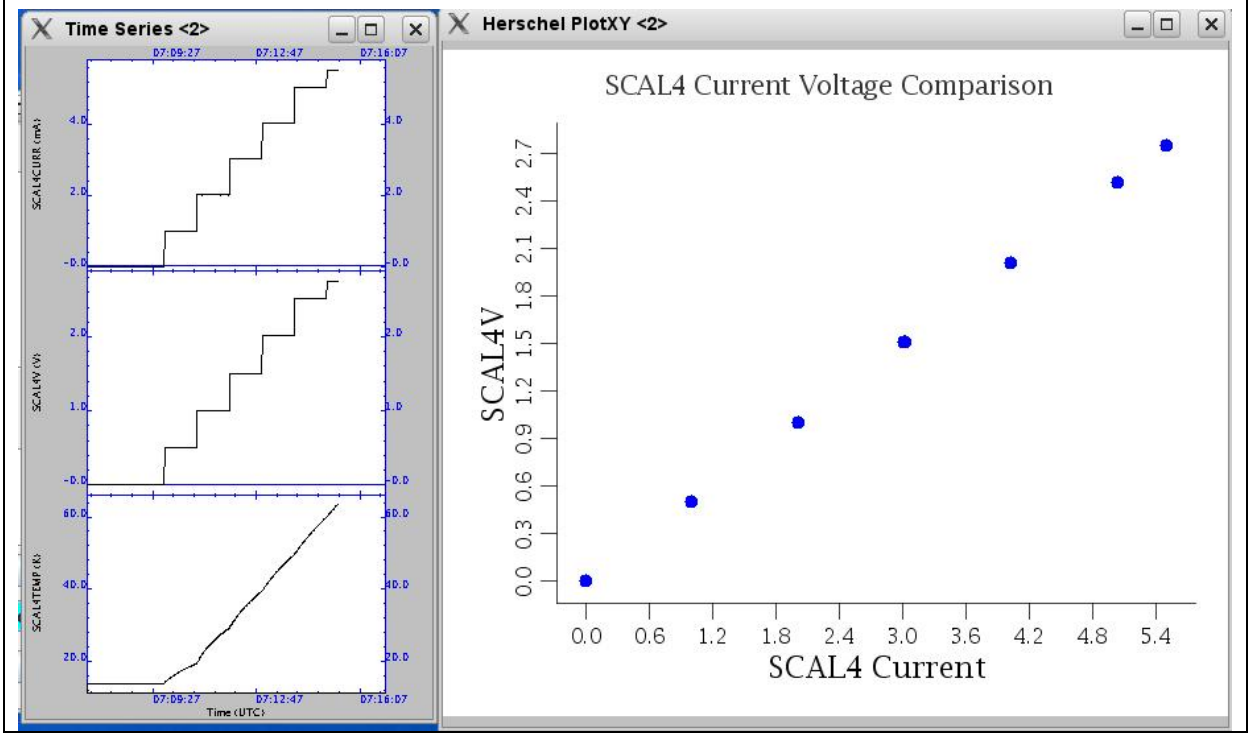
Test Log:

Test Id	Key Parameter(s)	Expected Value Before/During test	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-SCAL-01-R	**SCAL2CURR** **SCAL4CURR** **SCAL2V** **SCAL4V** **SCAL2TEMP** **SCAL4TEMP**	**0/1,2,3,4,5,5.5mA** **0/1,2,3,4,5,5.5mA** **0/0.5,1.0,1.5,2.0,2.5.2.75V** **0/0.5,1.0,1.5,2.0,2.5.2.75V**	See plots below	**N/A**	Pass
Note: First SCAL2CURR starts at 0 then steps through 1, 2, 3 .. and ends at 7mA, then the same for SCAL4CURR					

Start time @: 07:02
End time @:
OBSID: 0xb00017ef

Comments: Test completed successfully. SCAL2 reached ~87K and SCAL4 reached ~68K





3.3.42 SPIRE-IST-COLD-FUNC-MCU-01-R

Test Id:	SPIRE-IST-COLD-FUNC-MCU-01-R
Test Purpose:	MCU Boot Check
Initial Configuration:	DRCU_ON + AC/DC thermometry ON
Final Configuration:	DRCU_ON + AC/DC thermometry ON +MCU ON
Duration	5 mins (CUS 64.0)
Success Criteria:	Test passed if: 4. MCU boots. 5. MCU voltages show expected values. 6. MAC Board Temperature Reading shows ambient temperature.

Test Procedure:

Step#	Action
1	Run SPIRE-IST-COLD-FUNC-MCU-01-R test procedure from the CCS.
2	When procedure is finished, write down the values of the MCU voltages.
3	Contingency: If test fails repeat steps 1 and 2.

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-MCU-01-R	MCUP5V MCUP15V MCUP14V MCUM14V MCUM15V MCUMACTEMP MCUBSMTEMP MCUSMECTEMP	N/A/ ~ 5V N/A / ~15V N/A / ~ 14V N/A / ~ -14V N/A / ~ -15V N/A / ~ 300K N/A / ~ 300K N/A / ~ 300K	5.00 V 15.50 V 14.13V -14.49 V -15.61 V 297.96 K 301.69 K 302.15 K	N/A	PASS

Start time @: 07:19
End time @:

OBSID: 0xb00017f0
Comments:
MCU booted OK

3.3.43 SPIRE-IST-COLD-FUNC-MCU-03-R

Test Id:	**SPIRE-IST-COLD-FUNC-MCU-03-R**
Test Purpose:	MCU Nominal Science Generation Check
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON
Duration	5 mins (CUS 69.0)
Success Criteria:	Test passed if : 3. MCU produces each type of the frames requested and with the following characteristics. 4. No events are generated during the different frames generation.

CUS Parameters	n_eng_frames = 100; //number of engineering frames
	f_eng_frames = 64.1; //frequency of engineering frames generation
	n_smec_frames = 100; //number of smec frames
	f_smec_frames = 250.0; //frequency of smec frames generation
	n_bsm_frames = 100; //number of bsm frames
	f_bsm_frames = 64.1; //frequency of bsm frames generation
	ftime = 10; //time for continuous generation

Frame	APID	Type	Subtype	SID	FrameID	Frame length
Eng.	**0x509**	**21**	**3**	**0x814**	**0x14**	**0x15**
BSM	**0x509**	**21**	**1**	**0x612**	**0x12**	**0xD**
SMEC	**0x509**	**21**	**1**	**0x410**	**0x10**	**0xC**
BSM +SMEC						

Test Procedure:

Step#	Action
1	Write down the current value of MCUFRAMECNT located in MCU_PARAMETERS display
2	Run SPIRE-IST-COLD-FUNC-MCU-03-R test procedure from the CCS.
3	When test is finished Write down the current value of MCUFRAMECNT.
4	Contingency: If test fails repeat steps 1 to 4.

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-MCU-03-R.tcl	**MCUFRAMECNT**	**0/ ~ 297**	**0 / 297**	297	Pass

Start time @: 07:21
End time @:
OBSID: 0xb00017f1

Comments:

QLA-MCU-03_B00017F1_8901.txt

Housekeeping Fri Feb 27 02:06:54 UTC 2009
Science Fri Feb 27 02:06:53 UTC 2009

Name	HK before	Science	HK after	Equal (within 10%)?
SMECENCSIG1	12410.0	12408.0	12410.0	True
SMECENCSIG2	20070.0	20072.0	20075.0	True
SMECLVDTDCSIG	32758.0	32760.0	32758.0	True
SMECLVDTACSIG	27348.0	27350.0	27351.0	True
SMECMOTORCURR	32784.0	32782.0	32780.0	True
SMECMOTORVOLT	32772.0	32770.0	32778.0	True
CHOPSENSSIG	32763.0	32765.0	32764.0	True
CHOPMOTORCURR	32779.0	32778.0	32778.0	True
CHOPMOTORVOLT	32762.0	32765.0	32766.0	True
JIGGSENSSIG	32759.0	32758.0	32755.0	True
JIGGMOTORCURR	32776.0	32775.0	32773.0	True
JIGGMOTORVOLT	32762.0	32764.0	32767.0	True

Empty file QLA-MCU-03_B00017F1_8902.txt

Empty file QLA-MCU-03_B00017F1_8903.txt:

Step#	Action	Comments
0	Open CHOP PARAMETERS display on SCOS Alpha Numeric Displays.	

3.3.44 SPIRE-IST-COLD-FUNC-BSM-01-R

Test Id:	SPIRE-IST-COLD-FUNC-BSM-01-R
Test Purpose:	BSM Switch ON Check
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON + BSM ON (open loop)
Duration	5 mins (CUS 24.0)
Success Criteria:	Test passed if: 5. CHOPSENSPWR HK parameter goes from 0 to 1 6. CHOPSENSIG HK parameter changes 7. JIGGSENSPWR HK parameter goes from 0 to 1 8. JIGGSENSSIG HK parameter changes

Test Procedure

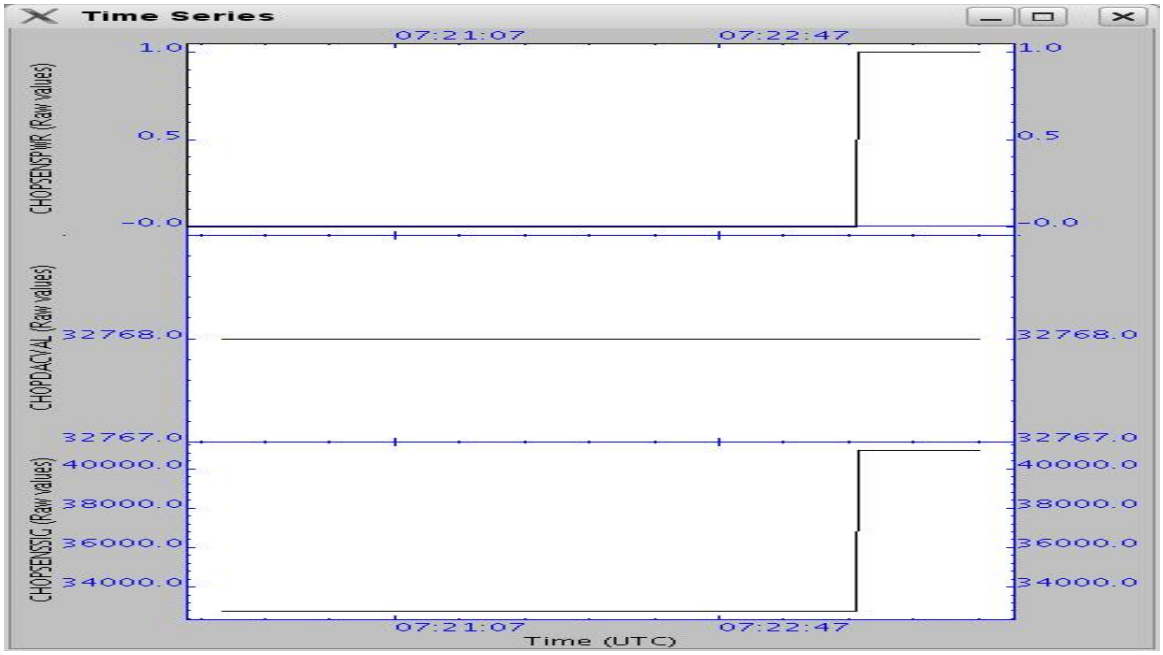
Step#	Action
1	Run SPIRE-IST-COLD-FUNC-BSM-01-R test procedure from the CCS.
2	When the test is finished record all the Key parameters noted below
3	Contingency: If test fails repeat steps 1 and 2.

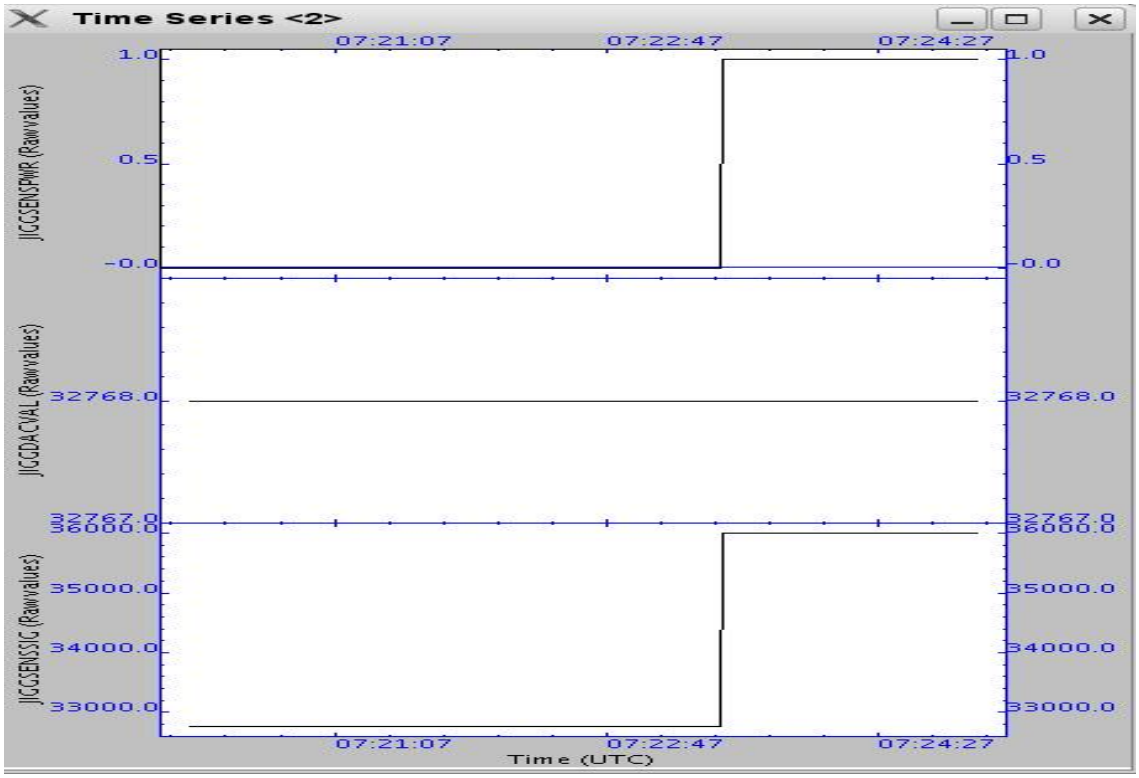
Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
FUNC-BSM-01	**CHOPSENSPWR** **CHOPLOOPMODE** **CHOPSENSSIG** **JIGGSENSPWR** **JIGGLOOPMODE** **JIGGSENSSIG**	**0/1/1** **3/3** **?/?** **0/1/1** **3/3** **?/?**	0 / 1 3 / 3 7FFD / 0x9fec 0 / 1 3 / 3 7FF4 / 0x8cf4	**N/A**	Pass

Start time @: 07:23
End time @:
OBSID: 0xb00017f2

Comments:





3.3.45 SPIRE-IST-COLD-FUNC-BSM-03-R

Test Id:	SPIRE-IST-COLD-FUNC-BSM-03-R
Test Purpose:	BSM Open Loop dynamics Check
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON + BSM ON (open loop)
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON + BSM ON (open loop)
Duration	5 mins (CUS 269.0)
Success Criteria:	Test passed if the chop sensor signal evolves in the same way as the positions set (i.e. if choppos2 > choppos1 ➔ chopsenssig2 > chopsenssig1) for each jiggle position.

CUS Parameters	frametype = "BSM"; // Specifyes MCU frame type [BSM,SMEC,BSM+SMEC,ENG,TEST]
	framerate = 64.0; // Specifies the frame rate
	j_start = 0x4000; // RAW jiggle target start position
	j_end = 0xc000; // RAW jiggle target end position
	j_step = 0x4000; // RAW jiggle target step in position
	j_delay = 2; // Time at each jiggle target position in seconds
	c_start = 0x3000; // RAW chop target start position
	c_end = 0xf000; // RAW chop target end position
	c_step = 0x1000; // RAW chop target step in position
	c_delay = 5; // Time at each chop target position in seconds

Test Procedure

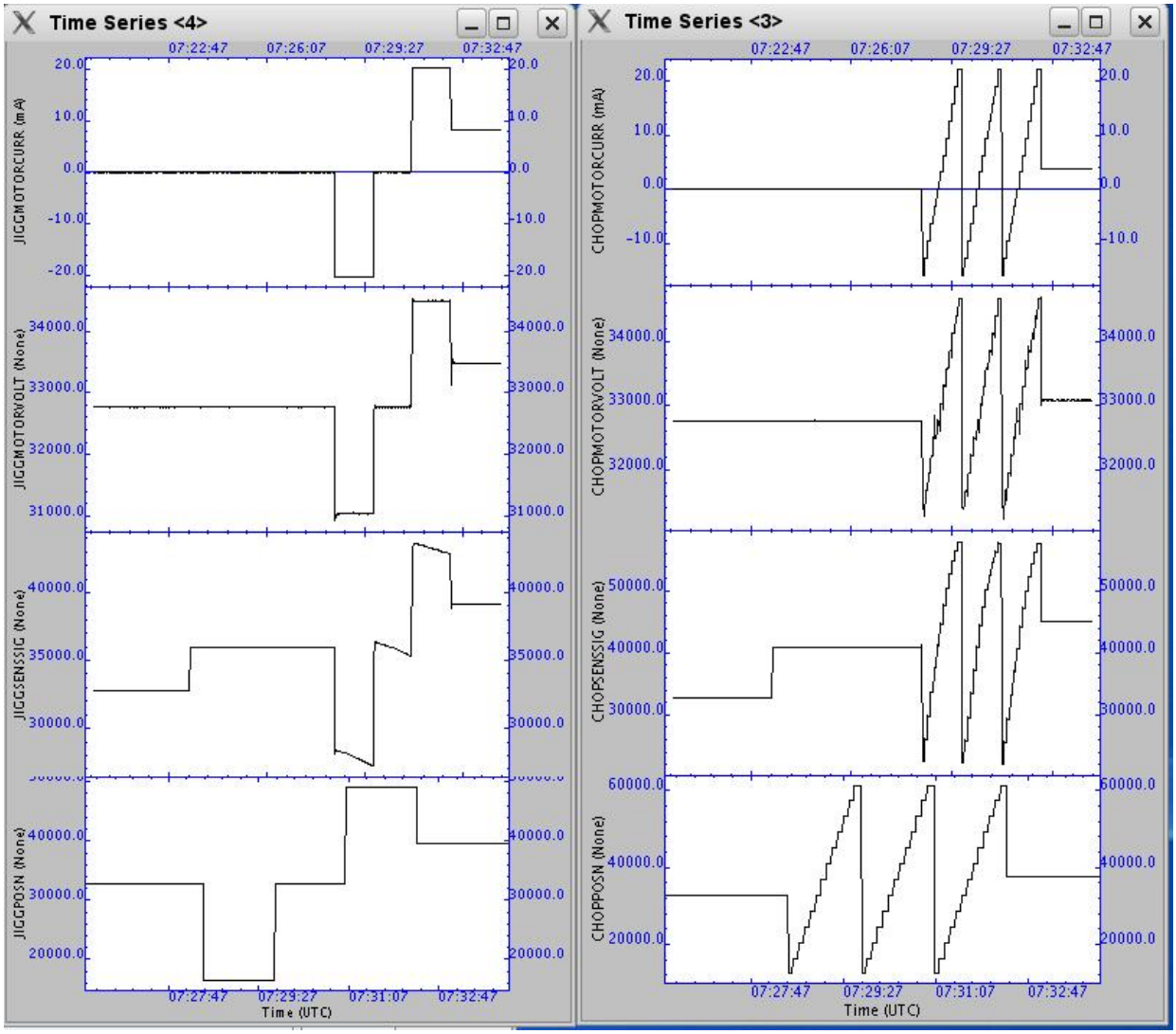
Step#	Action
1	**On QLA open up 2 time series display with the following HK parameters in each display:** **Display 1:** *HK* : CHOPPOSN *BSM Nominal Science*: BSMCHOPMOTORCURR BSMCHOPSENSSIG BSMCHOPMOTORVOLT **Display2:** *HK* : JIGGPOSN *BSM Nominal Science*: BSMJIGGMOTORCURR BSMJIGGSENSSIG BSMJIGGMOTORVOLT
2	**Run SPIRE-IST-COLD-FUNC-BSM-03-R test procedure from the CCS**
3	Contingency: If test fails repeat step 2.

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-BSM-03-R				N/A	**Pass**

Start time @: 07:28
End time @:
OBSID: 0xb00017f3

Comments: Nominal behaviour.



3.3.46 SPIRE-IST-COLD-FUNC-BSM-05A-R

Test Id:	SPIRE-IST-COLD-FUNC-BSM-05A-R.tcl
Test Purpose:	BSM Open Loop chop test (Degraded operational mode check)
Initial Configuration:	DRCU_ON + AC/DC thermometry ON +MCU ON + BSM ON (open loop)
Final Configuration:	DRCU_ON + AC/DC thermometry ON +MCU ON + BSM ON (open loop)
Duration	5 mins (CUS 75.0)
Success Criteria:	**Note:** **The purpose of this test is to check the effectiveness of the dumping of the natural oscillations of the BSM in chop axis via motor bemf, through the use of the commendable motor resistance value.** **As it is now is just a check of the default motor resistance value.** **NO adjusting of this value should be attempted during this test.** **The success criteria are therefore not applicable.**

CUS Parameters	frametype = "BSM"; // Specifyes MCU frame type [BSM,SMEC,BSM+SMEC,ENG,TEST]
	framerate = 125.0; // Specifies the frame rate
	on_source_chop = 0xa000; // On source chop position
	on_source_jiggle = 0x8000; // On source jiggle position
	off_source_chop = 0x8000; // Off source chop position
	off_source_jiggle = 0x8000; // Off source jiggle position
	ncycles = 50; //Number of chop cycles
	chop_period = 500000; //period of chop cycles in microsec
	dcumode = 0; //Data type
	dcusample = 4; //Number of DCU samples per chop position
	dcudelay = 34959; //Dealy to start sampling the DCU
	bsmsample = 31; //Number of BSM samples per position

Test Procedure

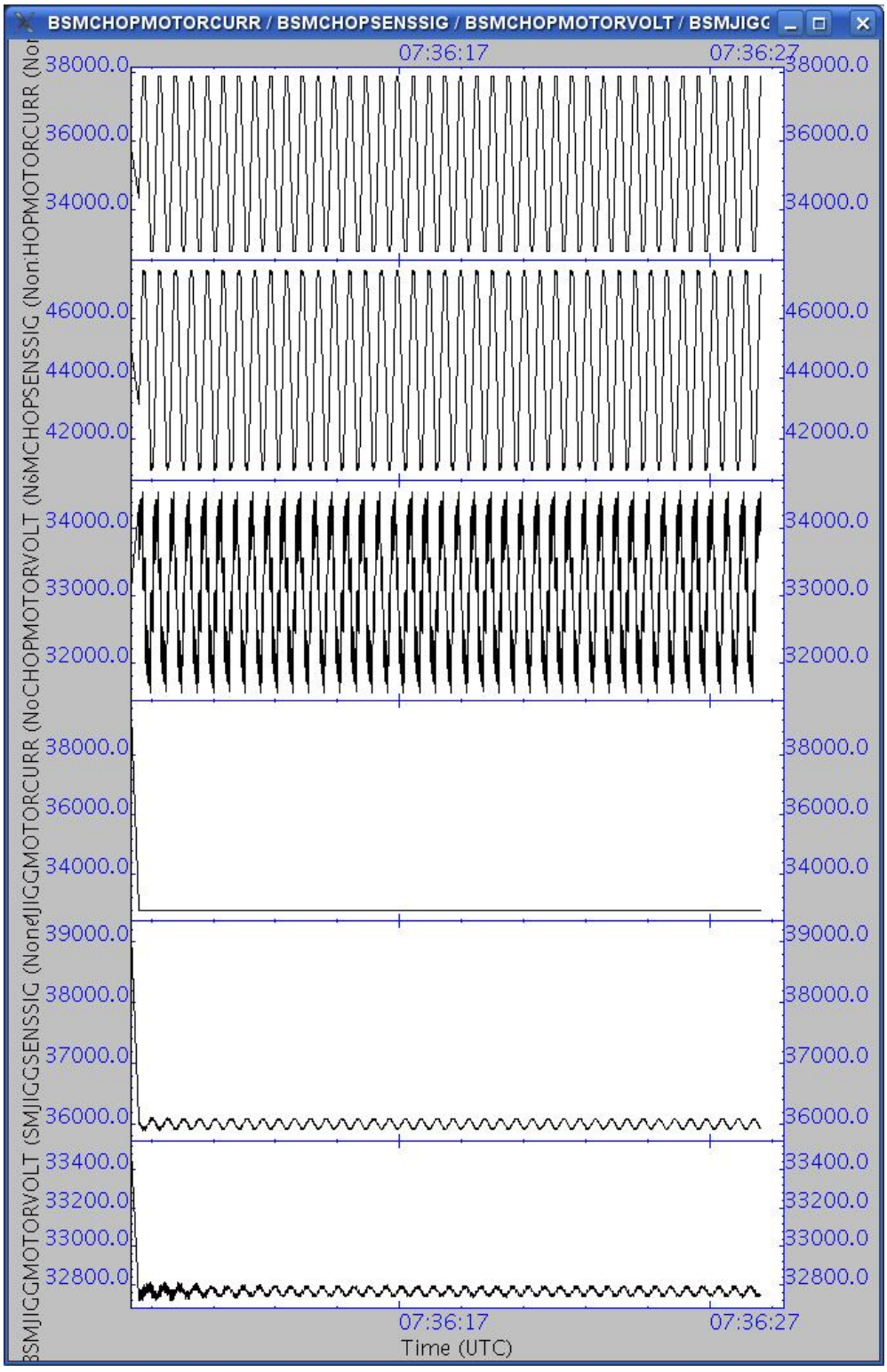
Step#	Action
1	**On QLA open up a time series display of BSM science parameters:** BSMCHOPSENSSIG BSMCHOPMOTORCURR BSMCHOPMOTORVOLT
2	**Run SPIRE-IST-COLD-FUNC-BSM-05A-R.tcl test procedure from the CCS.**
3	Contingency: None contemplated.

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-BSM-05A-R.tcl	BSMCHOPSENSSIG BSMCHOPMOTORCURR BSMCHOPMOTORVOLT	?/? ?/? ?/?		N/A	Pass

Start time @: 07:36
End time @:
OBSID: 0xb00017f4

Comments: It chopped OK in open loop



3.3.47 SPIRE-IST-COLD-FUNC-BSM-05B-R

Test Id:	SPIRE-IST-COLD-FUNC-BSM-05B-R
Test Purpose:	BSM Close Loop chop test
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON + BSM ON (OPEN loop)
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON + BSM ON (CLOSED loop)
Duration	5 mins (CUS 72.0)
Success Criteria:	**Note:** **Currently this test does not differ at ALL from the next one.** **In any case the success/fail criteria are NOT applicable for this test.**

CUS Parameters	frametype = "BSM"; // Specifyes MCU frame type [BSM,SMEC,BSM+SMEC,ENG,TEST]
	framerate = 125.0; // Specifies the frame rate
	on_source_chop = 0xb600; // On source chop position (46592)
	on_source_jiggle = 0x9a60; // On source jiggle position (39520)
	off_source_chop = 0x6a28; // Off source chop position (27176)
	off_source_jiggle = 0x9a60; // Off source jiggle position (39520)
	ncycles = 50; //Number of chop cycles
	chop_period = 500000; //period of chop cycles in microsec
	dcumode = 0; //Data type
	dcusample = 4; //Number of DCU samples per chop position
	dcudelay = 34959; //Dealy to start sampling the DCU
	bsmsample = 31; //Number of BSM samples per position

Test Procedure

Step#	Action
1	Execute SPIRE-IST-COLD-BSM-INIT-R.tcl from the CCS.
2	On QLA open up a time series display of BSM science parameters: BSMCHOPSENSSIG BSMCHOPMOTORCURR BSMCHOPMOTORVOLT
3	Run SPIRE-IST-COLD-FUNC-BSM-05B-R.tcl test procedure from the CCS.

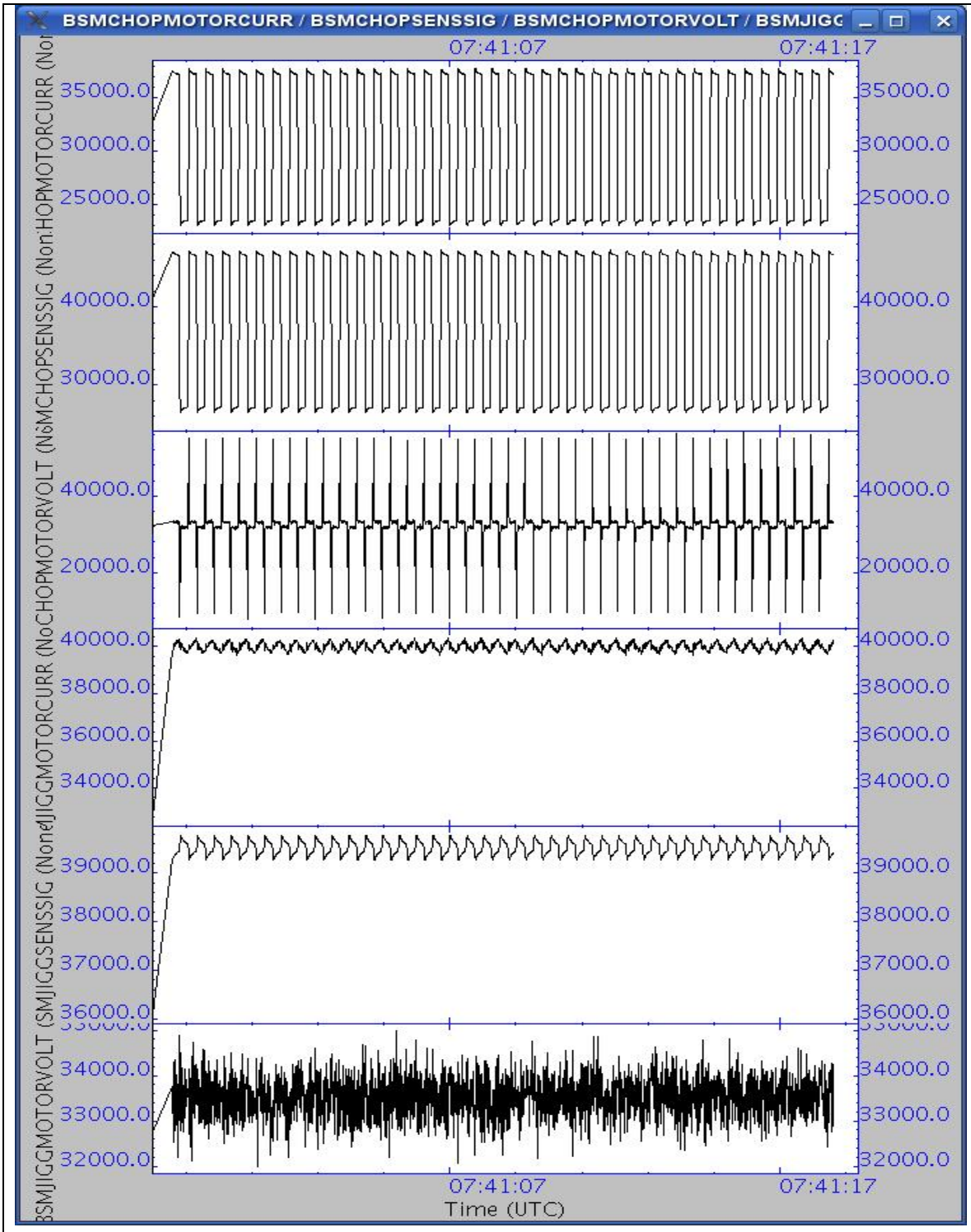
Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-BSM-INIT-R.tcl	**CHOPLOOPMODE** **JIGGLOOPMODE**	**3/-/1** **3/-/1**	**3/-/1** **3/-/1**	**N/A**	**Pass**
SPIRE-IST-COLD-FUNC-BSM-05B-R.tcl	**BSMCHOPSENSSIG** **BSMCHOPMOTORCURR** **BSMCHOPMOTORVOLT**	**?/?** **?/?** **?/?**	See plots below	**N/A**	**Pass**

BSM_INIT:
Start Time: 07:39
End Time:
OBSID: 0xb00017f5

FUNC-BSM-05B
Start time: 07:41
End time:
OBSID: 0xb00017f6

Comments: Chopping OK. Settling time ~40 ms.


BSMCHOPMOTORCURR / BSMCHOPSENSSIG / BSMCHOPMOTORVOLT / BSMJIGG
07:41:07
07:41:17
35000.0
30000.0
25000.0
40000.0
30000.0
40000.0
20000.0
40000.0
38000.0
36000.0
34000.0
39000.0
38000.0
37000.0
36000.0
34000.0
33000.0
32000.0
BSMJIGGMOTORVOLT (SMJIGGSENSSIG (NoneMJIGGMOTORCURR (NoCHOPMOTORVOLT (NoMCHOPSENSSIG (NonHOPMOTORCURR (No
07:41:07
07:41:17
Time (UTC)

3.3.48 SPIRE-IST-COLD-FUNC-BSM-06-R

Test Id:	SPIRE-IST-COLD-FUNC-BSM-06-R
Test Purpose:	BSM Operational Mode Check
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON + BSM ON (open loop)
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON + BSM ON (open loop)
Duration	5 mins (CUS 72.0)
Success Criteria:	**Note:** **The purpose of this test is to check the effectiveness of the BSM close loop initialisation procedure and the default PID parameters.** **If the dynamical behaviour of the BSM during chopping with these PID parameters is close or within requirements this indicates that the PID parameters used can be applied to cold testing with certain adjustment.** **If NOT these indicates that the PID parameters need further tuning BUT NOT TO BE DONE DURING THESE TEST.** **In any case the success/fail criteria are NOT applicable for this test.**

CUS Parameters	frametype = "BSM"; // Specifyes MCU frame type [BSM,SMEC,BSM+SMEC,ENG,TEST]
	framerate = 125.0; // Specifies the frame rate
	on_source_chop = 0x5279; // On source chop position (21113)
	on_source_jiggle = 0x8d00; // On source jiggle position (36096)
	off_source_chop = 0xad87; // Off source chop position (44423)
	off_source_jiggle = 0x8d00; // Off source jiggle position (36096)
	ncycles = 50; //Number of chop cycles
	chop_period = 500000; //period of chop cycles in microsec
	dcumode = 0; //Data type
	dcusample = 4; //Number of DCU samples per chop position
	dcudelay = 34959; //Dealy to start sampling the DCU
	bsmsample = 65535; //Number of BSM samples per position

Test Procedure

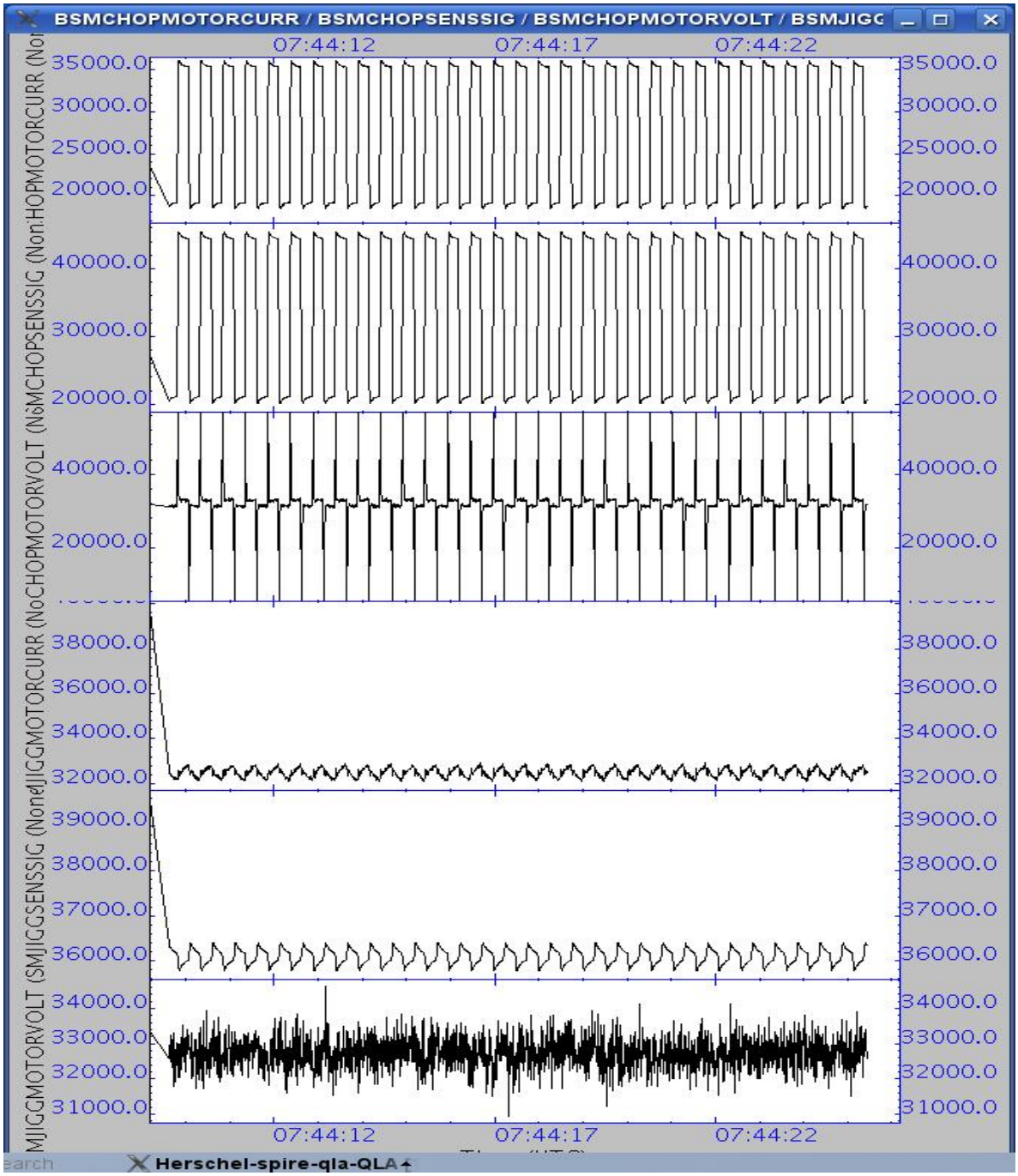
Step#	Action
1	**On QLA open up a time series display of science parameters:** BSMCHOPSENSSIG BSMCHOPMOTORCURR BSMCHOPMOTORVOLT
2	**Run SPIRE-IST-COLD-FUNC-BSM-06-R test procedure from the CCS.**

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-BSM-06-R	CHOPLOOPMODE JIGGLOOPMODE	1/1/1 1/1/1	1/1/1 1/1/1	N/A	PASS
	BSMCHOPSENSSIG BSMCHOPMOTORCURR BSMCHOPMOTORVOLT	?/? ?/? ?/?	See plots below	N/A	PASS

Start time @: 07:44
End time @:
OBSID: 0xb00017f8

Comments:



Step#	Action	Comments
4	Execute SPIRE-IST-COLD-BSM-OFF-R	Start Time: 07:46 End Time: OBSID: 0xb00017f9

Step#	Action	Comments
0	Open SMEC PARAMETERS display on SCOS Alpha Numeric Displays.	

3.3.49 SPIRE-IST-COLD-FUNC-SMEC-01-R

Test Id:	**SPIRE-IST-COLD-FUNC-SMEC-01-R**
Test Purpose:	SMEC Switch ON Check. Encoder and LVDT alive check.
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON+ SMEC ON (open loop)
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON+ SMEC ON (open loop)
Duration	5 Minutes (CUS 40.0)
Success Criteria:	Test passed if : 5. SMECENCPWR HK parameter changes from 0 to 4. 6. SMEC encoder signals 1 and 2 show variation when encoder is switched ON. 7. SMEC LVDT is switched ON. 8. SMEC LVDT DC and AC signals show variation when LVDT is switched ON.

Test Procedure:

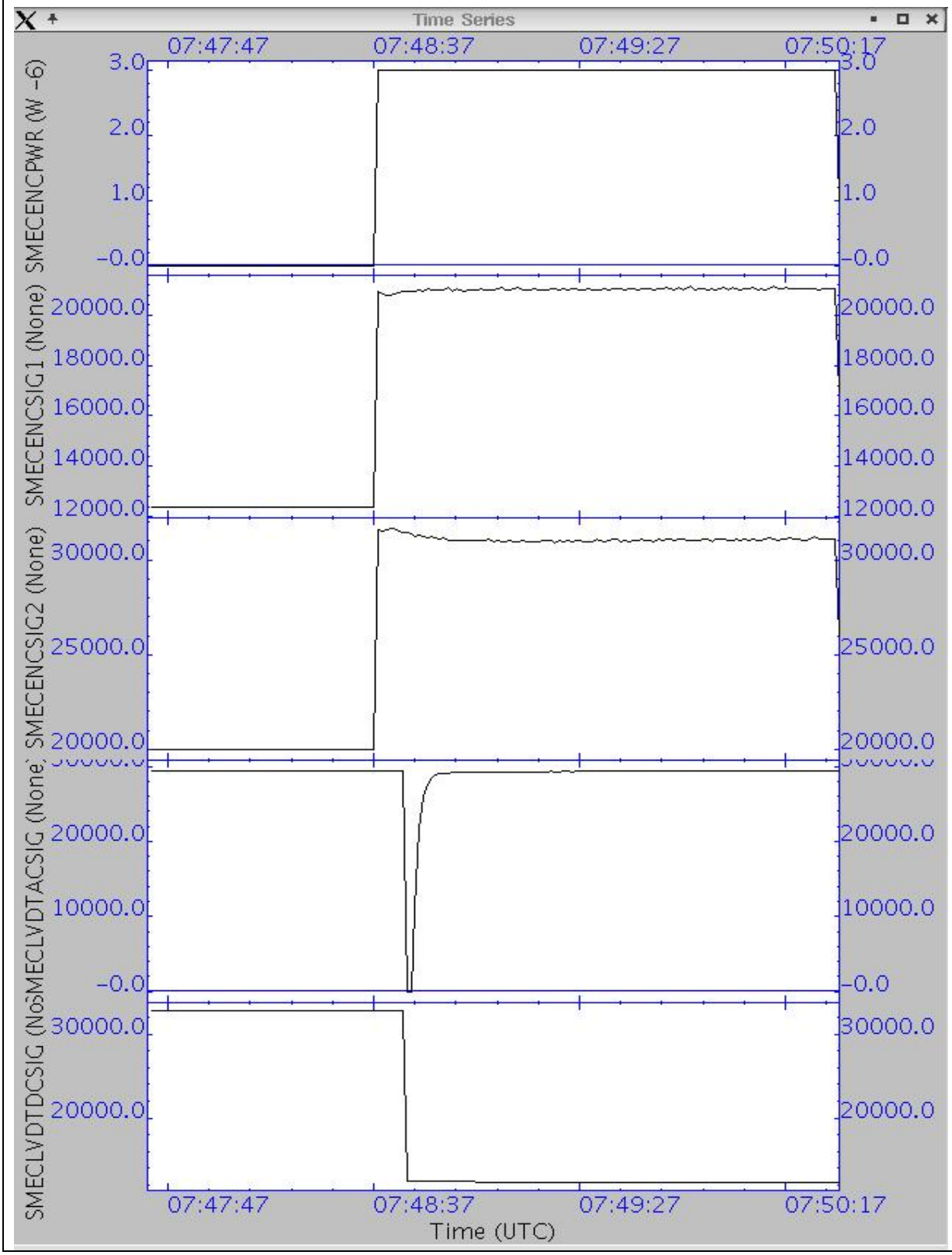
Step#	Action	Comments
1	Run FUNC-SMEC-01.py script on QLA	
2	Run SPIRE-IST-COLD-FUNC-SMEC-01-R test procedure from the CCS.	
3	Contingency: If test fails repeat steps 1.	

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-SMEC-01-R	**SMECENCPWR** **SMECLVDTPWR** **SMECENCSIG1** **SMECENCSIG2**	0/-/3 0/-/1	0/-/3 0/-/1 0x521c 0x7943	**N/A**	**Pass**

Start time @: 07:49
End time @:
OBSID: 0xb00017fa

Comments:



3.3.50 SPIRE-IST-COLD-FUNC-SMEC-03-R

Test Id:	SPIRE-IST-COLD-FUNC-SMEC-03-R
Test Purpose:	SMEC (RED) Encoder Integrity Check.
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON+ SMEC ON (open loop)
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON+ SMEC ON (open loop)
Duration	5 minutes (CUS 49.0)
Success Criteria:	Test passed if: SMEC encoder signals 1 and 2 show a variation on their amplitudes from one LED illumination level to another. (i.e. MCUENGSMECENCSIG1/2 increase as the encoder power is increased.)

CUS Parameters	frametype = "ENG"; // Specifies MCU frame type [BSM,SMEC,BSM+SMEC,ENG,TEST]
	framerate = 64.0; // Specifies the frame rate
	framenumber = 0xffff; // Frame number
	level_init = 1; //
	level_start = 1;
	level_end = 3;
	level_step = 1;
	led_delay = 5; // Time at each level in seconds

Test Procedure:

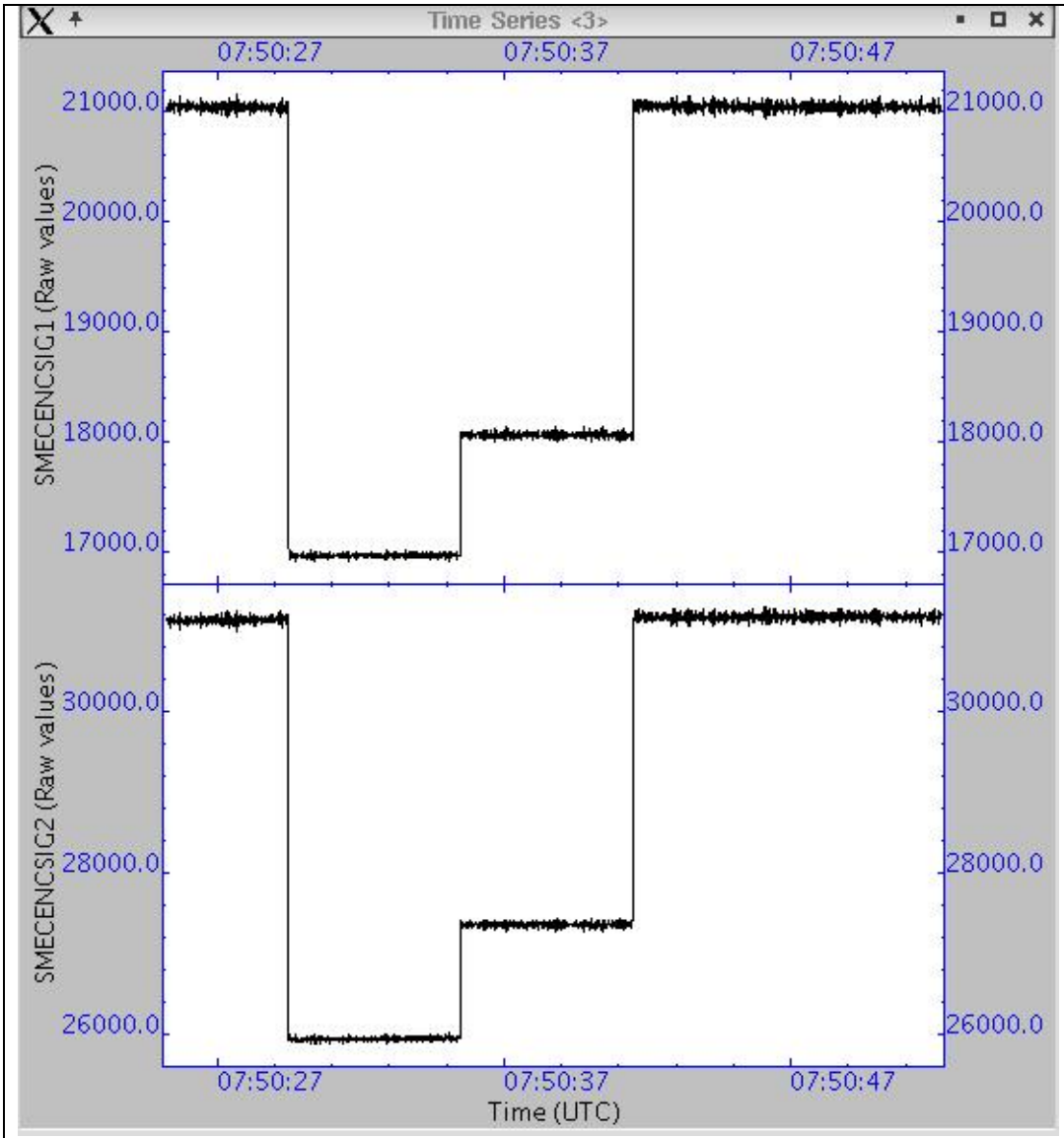
Step#	Action
1	**Run FUNC-SMEC-03.py script on QLA**
2	**Run SPIRE-IST-COLD-FUNC-SMEC-03-R test procedure from the CCS.**
3	Contingency: If test fails repeat steps 1 and 2.

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-SMEC-03-R	SMECENCPWR SMECENCSIG1 SMECENCSIG2		See plots below		**Pass**

Start time @: 07:50
End time @:
OBSID: 0xb00017fb

Comments: Encoder signals 1 & 2 are not saturated at encoder levels 1 to 3.


Time Series <3>
07:50:27
07:50:37
07:50:47
21000.0
20000.0
19000.0
18000.0
17000.0
SMECENCSIG1 (Raw values)
30000.0
28000.0
26000.0
SMECENCSIG2 (Raw values)
Time (UTC)

3.3.51 SPIRE-IST-COLD-FUNC-SMEC-OFF-R

Test Id:	SPIRE-IST-COLD-FUNC-SMEC-OFF-R
Test Purpose:	SMEC (RED) Switch OFF
Initial Configuration:	DRCU_ON + AC/DC thermometry ON +MCU ON+ SMEC ON (open loop)
Final Configuration:	DRCU_ON + AC/DC thermometry ON +MCU ON+ SMEC OFF
Duration	3 minutes
Success Criteria:	HK Parameters SMECENCPWR and SMECLVDTPWR show expected OFF values.

Test Procedure:

Step#	Action
1	Run Execute SPIRE-IST-COLD-SMEC-OFF-R.tcl test procedure from the CCS.

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-SMEC-OFF-R	SMECENCPWR SMECLVDTPWR	1/-/0 1/-/0	**1/0** **1/0**		**Pass**

Start time @: 07:53
End time @:
OBSID: 0xb00017fc

Comments:

Step#	Action	Comments
0	Open DCU PARAMETERS SCOS Alpha Numeric Display	

3.3.52 SPIRE-IST-COLD-FUNC-DCU-02-R

Test Id:	**SPIRE-IST-COLD-FUNC-DCU-02-R**
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON
Duration	5 Minutes (CUS 140.0)
Success Criteria:	Test passed if DCUFRAMECNT goes from n to n+700 and the frametime difference between consecutive frames computed by QLA script is in agreement with the expected differences based on commanded sampling rate: 3. Photometer Sampling rate is 15.3Hz → Δt ~ 65.5 ms 4. Spectrometer Sampling rate is 80Hz → Δt = 12.5 ms

CUS Parameters	photbiasfreq = 200.0;
	photsampfreq = 15.3;
	specbiasfreq = 160.0;
	specsampfreq = 80.0;
	frames = 100;

Test Procedure:

Step#	Action	Comments
1	Write the current value of DCUFRAMECNT located in DCU PARAMETERS	
2	Run QLA script FUNC-DCU-02.py on QLA console.	
3	Run SPIRE-IST-COLD-FUNC-DCU-02-R test procedure from the CCS.	
4	Write the current value of DCUFRAMECNT	
5	Contingency: If test fails repeat steps 1 to 4.	

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	Nb. of frames received	Test Result
SPIRE-IST-COLD-FUNC-DCU-02-R	DCUFRAMECNT	n/n+700	1200/1900	**700**	**Success**

Start time @: 07:56
End time @:
OBSID: 0xb00017fd

Comments: OK

3.3.53 SPIRE-IST-COLD-FUNC-DCU-11-PHOT-R

Test Id:	SPIRE-IST-COLD-FUNC-DCU-11-PHOT-R
Test Purpose:	Photometer BDAs Switch ON Check
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON+ Photometer LIAs ON + Photometer BIAS ON +Photometer JFETs ON
Duration	7 minutes (CUS 122.0)
Success Criteria:	Test passed if Photometer JFET source and drain voltages are correct: 5. PSWJFETVSS1/2/3/4/5/6 (values according to latest Vss). 6. PMLWJFETVSS1/2/3/4 (values according to latest Vss). 7. PSWJFETSTAT = 0x3F 8. PMLWJFETSTAT = 0x7F

CUS Parameters	heater_V = 0; // Specifies if the heater is to be switched ON or not
	array = "PF"; //default array to switch ON

Test Procedure:

Step#	Action
1	Run SPIRE-IST-COLD-FUNC-DCU-11-PHOT-R test procedure from the CCS. with default input parameters
2	After the test, write down the values RAW and converted values of: PSWJFETSTAT, PMLWJFETSTAT, PSWJFET1/2/3/4/5/6V PMWJFET1/2/3/4V PLWJFET1/2V located in the DCU PARAMETERS display
3	Contingency: If test fails repeat steps 1 and 2.

Test Log:

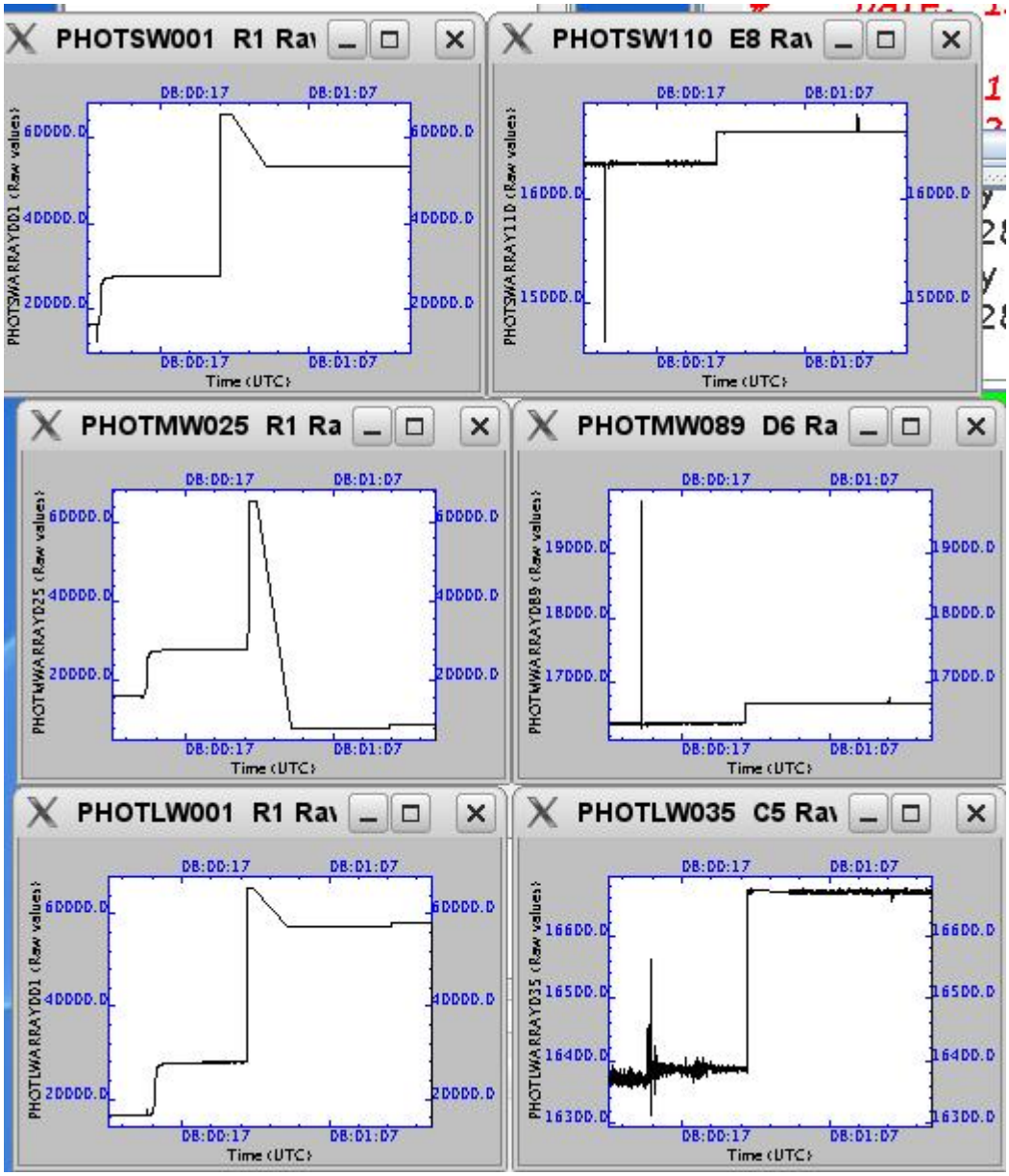
Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-DCU-11-PHOT-R	**PSWJFETSTAT** **PMLWJFETSTAT** **PLIABITSTAT** **PLIAP5V** **PLIAP9V** **PLIAM9V**	**0/0x3f** **0/0x7f** **1** **~0/ ~+5.17 ± 0.1V** **~0/ ~+11.53 ± 0.1V** **~0/ ~-11.53 ± 0.1V**	**OK** **OK** **1** **5.24V** **11.60V** **-11.59V**	**N/A**	**Pass**

Start time @: 08:00
End time @:
OBSID: 0xb00017fe

Comments:
All the photometer JFETs switched on OK

Used JPL approved switch-on procedure for the JFETs.

Initial Vss values were -1.47V.
Final Vss values were consistent with Jamie Bock's spreadsheet (least noise).



3.3.54 SPIRE-IST-COLD-FUNC-DCU-13-PHOT-R

Test Id:	SPIRE-IST-COLD-FUNC-DCU-13-PHOT-R
Test Purpose:	Photometer Detectors Integrity Check
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON+ Photometer LIAs ON + Photometer BIAS ON +Photometer JFETs ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON+ Photometer LIAs ON + Photometer BIAS ON +Photometer JFETs ON
Duration	15 minutes (CUS 726)
Success Criteria:	Test passed if : The photometer detectors show a small linear variation on the output voltage when different bias is applied through the load curve.

CUS Parameters	dcumode = "PF"; // Specifies array in which to perform LC
	mclkdiv = 0x95; // Master clock divisor ,which specifies bias freq
	biasdiv = 0x6; // Sampling divisor ,which specifies sampling rate
	psw_phase = 0x80; // PSW demod phase
	pmw_phase = 0x80; // PMW demod phase
	plw_phase = 0x80; // PLW demod phase
	ftime = 10; // Time at each bias level

Test Procedure:

Step#	Action
1	Run FUNC-DCU-13P.py script on QLA
2	Run SPIRE-IST-COLD-FUNC-DCU-13-PHOT-R test procedure from the CCS. With default input parameters
3	Contingency: If test fails repeat step 1 and 2.

Test Log:

Test Id	Key Parameter(s)	Expected Value Before	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-DCU-13-PHOT-R	PLIABITSTAT PSWJFETSTAT PMLWJFETSTAT	1/1 0x3F/0x3F 0x7F/0x7F	1/1 0x3F/0x3F 0x7F/0x7F		**TEST NOT DONE**

OBSID:
Start:
End:

Comments: **TEST SKIPPED AS NO NEW INFORMATION**

3.3.55 SPIRE-IST-COLD-FUNC-DCU-14-PHOT-R

Test Id:	SPIRE-IST-COLD-FUNC-DCU-14-PHOT-R
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON + Photometer LIAs ON + Photometer BIAS ON + Photometer JFETs ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON + Photometer LIAs ON + Photometer BIAS ON + Photometer JFETs ON
Duration	5 minutes
Success Criteria:	Test passed if : The Photometer detectors do not show excess noise.

Test Procedure:

Step#	Action	Comments
1	**Run SPIRE-IST-COLD-FUNC-DCU-14-PHOT-R test procedure from the CCS.**	
2	Contingency: If test fails repeat step 1.	

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	Nb. of frames received	Test Result
SPIRE-IST-COLD-FUNC-DCU-14-PHOT-R	PLIABITSTAT PSWJFETSTAT PMLWJFETSTAT	1/1 0x3F/0x3F 0x7F/0x7F			**TEST NOT DONE**

Start time @:
End time @:
OBSID:

Comments: **TEST SKIPPED AS NO NEW INFORMATION**

3.3.56 SPIRE-IST-COLD-PHOT-VSS-R

Test Id:	SPIRE-IST-COLD-PHOT-VSS-R
Purpose:	Photometer BDAs Vss Test REDUNDANT
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON + Photometer LIAs ON + Photometer BIAS ON + Photometer JFETs ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON + Photometer LIAs ON + Photometer BIAS ON + Photometer JFETs ON
Duration	40 minutes
Success Criteria:	Test passed if the Photometer detectors do not show excess noise.

Procedure Steps:

Step	Description	Parameter - Unit	Expected Values Before/ During/ After	Actual Values Before/ During/ After	Success/ Failure
1	Check that Photometer LIAs and detectors are switched on	PLIABITSTAT PSWJFETSTAT PMLWJFETSTAT	1/1 0x3F/0x3F 0x7F/0x7F		
2	Execute TCL script SPIRE-IST-COLD -PHOT-VSS-R.tcl	—	—	—	
3	**Wait for the I-EGSE staff to confirm the success or failure of this test**	—	—	—	
Test Result (Pass/Fail):					

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	Nb. of frames received	Test Result
SPIRE-IST-PHOT-VSS-R	PLIABITSTAT PSWJFETSTAT PMLWJFETSTAT	1/1 0x3F/0x3F 0x7F/0x7F	1/1 0x3F/0x3F 0x7F/0x7F		**TEST NOT DONE**

Start time @:
End time @:
OBSID:

Comments: **TEST SKIPPED AS NO NEW INFORMATION**

3.3.57 SPIRE-IST-COLD-PDET-OFF-R

Test Id:	SPIRE-IST-COLD-PDET-OFF-R
Test Purpose:	Photometer BDAs Switch OFF
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON + Photometer BDAs ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON + Photometer BDAs OFF
Duration	3 minutes
Success Criteria:	Test passed if SCUDCDCSTAT goes from 4 to 6, Spectrometer LIAs voltages are correct and SJFET voltages are also correct.

Procedure Steps:

Step	Description	Parameter - Unit	Expected Values Before/ During/ After	Actual Values Before/ During/ After	Success/ Failure
1	Execute TCL script SPIRE-IST-COLD-PDET-OFF-R.tcl	—	—	—	
2	Check that the Photometer detectors are switched off	PSWJFETSTAT PMLWJFETSTAT	0x3F/-/0 0x7F/-/0		
3	Check that the Photometer LIAs are switched off	PLIABITSTAT	1/-/0		
4	**Wait for the I-EGSE staff to confirm the success or failure of this test**	—	—	—	
Test Result (Pass/Fail):					

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	Nb. of frames received	Test Result
SPIRE-IST-PDET-OFF-R	PLIABITSTAT PSWJFETSTAT PMLWJFETSTAT	1/0 0x3F/0 0x7F/0	1/0 0x3F/0 0x7F/0	N/A	Pass

Stopped CCS Handler
Changed mission configuration to fm_ist_cft_config14p – restarted CCS Handler

Start time @: 08:11
End time @:
OBSID: 0xb00017ff

Comments: Switched off OK.

3.3.58 SPIRE-IST-COLD-FUNC-DCU-11-SPEC-R

Test Id:	SPIRE-IST-COLD-FUNC-DCU-11-SPEC-R
Test Purpose:	Spectrometer BDAs switch ON check
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON + Spectrometer LIAs ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON + Spectrometer LIAs ON + Spectrometer BIAS ON + Spectrometer JFETs ON
Duration	7 minutes
Success Criteria:	Test passed if SCUDCDCSTAT goes from 4 to 6, Spectrometer LIAs voltages are correct and SJFET voltages are also correct.

CUS Parameters	heater_V = 0; //Specifies if the heater is to be switched ON
	array = "SF"; //default array to swicth ON

Test Procedure:

Step#	Action
1	**Run SPIRE-IST-COLD-FUNC-DCU-11-SPEC-R test procedure from the CCS.**
2	**After the test Write down the values RAW and converted values of:** LIASTAT SLIAP5V, SLIAP9V, SLIAM9V SSWJFETSTAT,SLWJFETSTAT SSWJFET1V,SLWJFET2V located in on the DCU PARAMETERS display.
3	Contingency: If test fails repeat steps 1 and 2.

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-DCU-11-SPEC-R	**SPECJFETSTAT** **SSWJFET1V** **SSWJFET2V** **SLWJFET1V** **SLIABITSTAT** **SLIAP5V** **SLIAP9V** **SLIAM9V**	**0/7** **0V/-1.5V** **0V/-1.5V** **0V/-1.5V** **1** **~0/ ~+5.23 ± 0.1V** **~0/ ~+11.57 ± 0.1V** **~0/ ~-11.54 ± 0.1V**	**0 / 7** **0 / -V** **0 / -V** **0 / -V** **See plot below** **5.25V** **11.59V** **-11.57V**	**N/A**	**Pass**

First attempt will be to switch on the Spec JFETs at the nominal Vss values of ~-1.5V

- **Check mission configuration to ensure the right Vss values are used.**

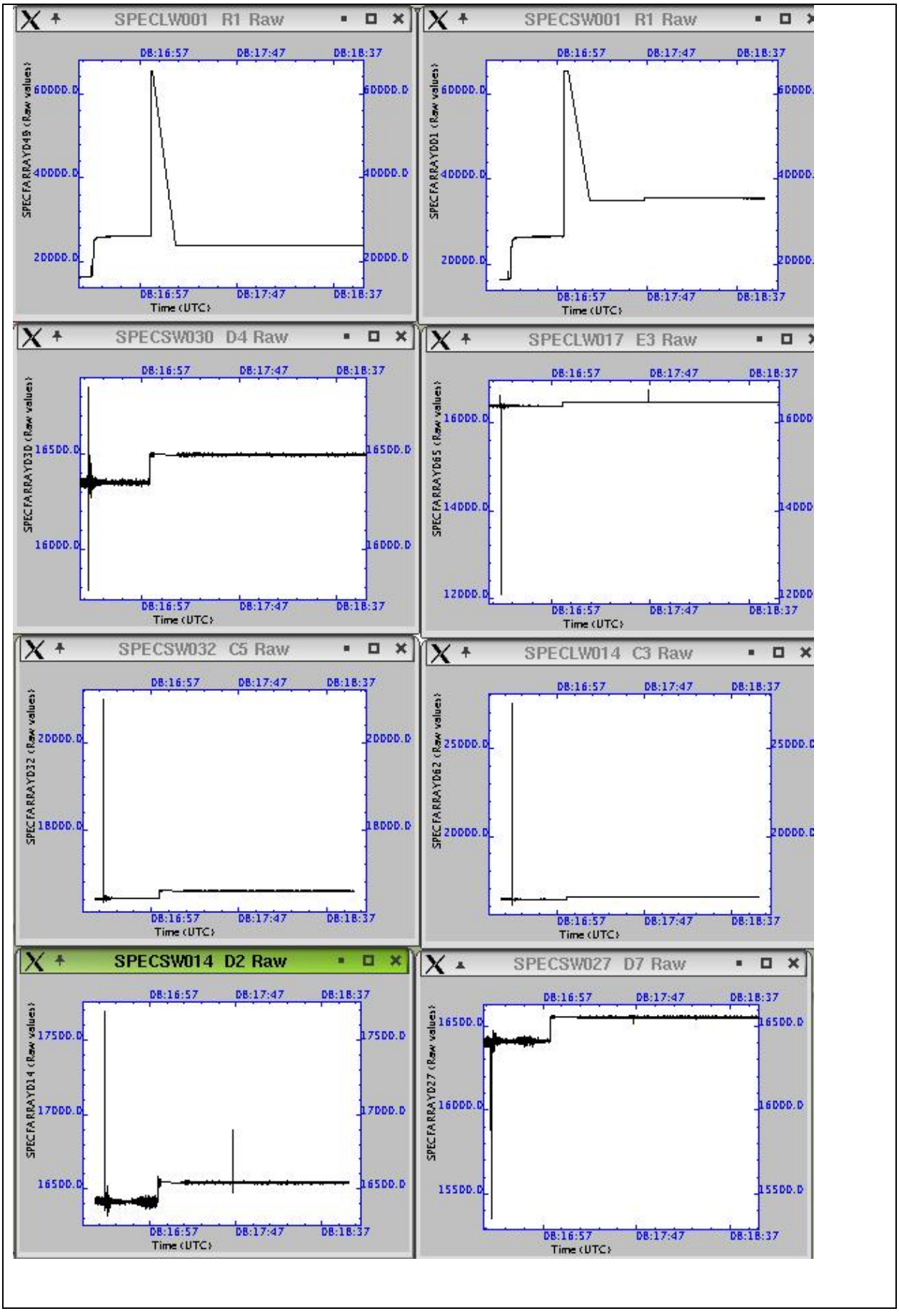
Stopped CCS Handler
Changed mission configuration to fm_ist_cft_config19p_Kourou – restarted CCS Handler

Start time @: 08:16
End time @:
OBSID: 0xb0001800

Comments:
All JFET membranes switched on as before

Final Vss values were consistent with Jamie Bock's spreadsheet (least noise).

S-LIA temperatures ~300K


SPECLW001 R1 Raw
SPECSW001 R1 Raw
SPECSW030 D4 Raw
SPECLW017 E3 Raw
SPECSW032 C5 Raw
SPECLW014 C3 Raw
SPECSW014 D2 Raw
SPECSW027 D7 Raw
Time (UTC)

3.3.59 SPIRE-IST-COLD-FUNC-DCU-13-SPEC-R

Test Id:	SPIRE-IST-COLD-FUNC-DCU-13-SPEC-R
Test Purpose:	Spectrometer detectors check
Initial Configuration:	DRCU_ON + AC/DC thermometry ON+MCU ON + Spectrometer LIAs ON + Spectrometer BIAS ON + Spectrometer JFETs ON
Final Configuration:	Unchanged
Duration	12 minutes
Success Criteria:	The spectrometer detectors show a small linear variation on the output voltage when different bias is applied through the load curve.

CUS Parameters	dcumode = "SF"; //DCU data mode
	mclkdiv = 0x79; //Master clock divisor
	biasdiv = 0x1; // Bias divisor
	ssw_phase = 0x80; // SSW demod phase
	slw_phase = 0x80; // SLW demod phase
	ftime = 10; // Time at each bias level

Test Procedure:

Step#	Action	Comments
1	On QLA bring up a time series display of a couple of pixels on each of the spectrometer BDAs	
2	Run SPIRE-IST-COLD-FUNC-DCU-13-SPEC-R test procedure from the CCS.	
3	Contingency: If test fails repeat steps 1 and 2	

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-DCU-13-SPEC-R	SPECJFETSTAT SLIABITSTAT	7 1	7 1	N/A	TEST NOT DONE

Start time @:
End time @:
OBSID:

Comment: TEST SKIPPED AS NO NEW INFORMATION

3.3.60 SPIRE-IST-COLD-FUNC-DCU-14-SPEC-R

Test Id:	SPIRE-IST-COLD-FUNC-DCU-14-SPEC-R
Initial Configuration:	DRCU_ON + AC/DC thermometry ON+MCU ON + Spectrometer LIAs ON + Spectrometer BIAS ON + Spectrometer JFETs ON
Final Configuration:	DRCU_ON + AC/DC thermometry ON+MCU ON + Spectrometer LIAs ON + Spectrometer BIAS ON + Spectrometer JFETs ON
Duration	5 minutes (CUS 146.0)
Success Criteria:	The Spectrometer detectors don't show excess noise.

CUS Parameters	dcumode = "SF"; //Array
	ftime = 120; //time

Test Procedure:

Step#	Action	Comments
1	**Run SPIRE-IST-COLD-FUNC-DCU-14-SPEC-R test procedure from the CCS.**	
2	Contingency: If test fails repeat step 1.	

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	Nb. of frames received	Test Result
SPIRE-IST-COLD-FUNC-DCU-14-SPEC-R	SPECJFETSTAT SLIABITSTAT	7 1		N/A	TEST NOT DONE

Start time @:
End time @:
OBSID:

Comments: TEST SKIPPED AS NO NEW INFORMATION

3.3.61 SPIRE-IST-COLD- SPEC-VSS-R

Test Id:	
Purpose	Spectrometer BDAs Vss Test REDUNDANT
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON + Spectrometer LIAs ON + Spectrometer BIAS ON + Spectrometer JFETs ON
Final Configuration:	Unchanged
Duration	40 minutes (CUS 906.0)
Success Criteria:	Spectrometer BDA Vss values are optimised

CUS Parameters	jfet_Vss_start = -1.5; //Starting JFET source voltage
	jfet_Vss_end = -4.0; //ending JFET source voltage
	jfet_Vss_step = -0.1; //steping JFET source volatge
	ftime = 60; //wait time at each level;

Procedure Steps:

Step	Description	Parameter - Unit	Expected Values Before/ During/ After	Actual Values Before/ During/ After	Success/ Failure
1	Check that the Spectrometer detectors and LIAs are switched on	SPECJFETSTAT SLIABITSTAT	7 1		
2	Execute TCL script SPIRE-IST-COLD- SPEC-VSS-R.tcl	—	—	—	
3	**Wait for the I-EGSE staff to confirm the success or failure of this test**	—	—	—	
Test Result (Pass/Fail):					

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	Nb. of frames received	Test Result
SPIRE-IST-COLD-SPEC-VSS-R	**SPECJFETSTAT SLIABITSTAT**	**7 1**	**7 1**	**N/A**	**TEST NOT DONE**

Start time @:
End time @:
OBSID:

Comments: **TEST SKIPPED AS NO NEW INFORMATION**

3.3.62 SPIRE-IST-COLD-SDET-OFF-R

Test Id:	SPIRE-IST-COLD-SDET-OFF-R
Purpose	Spectrometer BDAs Switch OFF
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON + Spectrometer LIAs ON + Spectrometer BIAS ON + Spectrometer JFETs ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON + Spectrometer BDAS OFF
Duration	3 minutes
Success Criteria:	DCU HK parameters show expected values

Procedure Steps:

Step	Description	Parameter - Unit	Expected Values Before/ During/ After	Actual Values Before/ During/ After	Success/ Failure
1	Execute TCL script SPIRE-IST-COLD-SDET-OFF-R.tcl	—	—		
2	Check that the Spectrometer detectors are switched off	SPECJFETSTAT	7/-/0	7/-/0	
3	Check that the Spectrometer LIAs are switched off	SLIABITSTAT	1/-/0	1/-/0	
4	**Wait for the I-EGSE staff to confirm the success or failure of this test**	—	—	—	
Test Result (Pass/Fail):					

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	Nb. of frames received	Test Result
SPIRE-IST-COLD-SDET-OFF-R	**SPECJFETSTAT** **SLIABITSTAT**	**7/0** **1/0**	**7/0** **1/0**	**N/A**	**PASS**

Stopped CCS Handler
Changed mission configuration to fm_ist_cft_config14p – restarted CCS Handler

Start time @: 08:27
End time @:
OBSID: 0xb0001801

Comments:

Switched CDMS Bus from A to B

3.3.63 SPIRE-IST-COLD-MCU-OFF-R

Test Id:	SPIRE-IST-COLD-MCU-OFF-R
Purpose	MCU RED Switch OFF
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU RED ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU RED OFF
Duration	5 minutes
Success Criteria:	MCU HK parameters show expected values

Procedure Steps:

Step	Description	Parameter – Unit	Expected Values Before/ During/ After	Actual Values Before/ During/ After	Success/ Failure
1	Execute SPIRE-IST-COLD-MCU-OFF-R.tcl	—	—	—	**OBSID: 0xb0001802 08:34**
2	Check that the MCU is switched off	MCUBITSTAT	1/-/0	1/-/0	**OK**
Test Result (Pass/Fail): PASS					

3.3.64 SPIRE-IST-COLD-SCU-OFF-R

Test Id:	SPIRE-IST-COLD-SCU-OFF-R
Purpose	SCU RED Switch OFF
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry OFF
Duration	5 minutes
Success Criteria:	SCU HK parameters show expected values

Procedure Steps:

Step	Description	Parameter - Unit	Expected Values Before/ During/ After	Actual Values Before/ During/ After	Success/ Failure
1	Execute TCL script SPIRE-IST-COLD-SCU-OFF-R.tcl	—	—	—	**OBSID: 0xb0001803 08:36**
2	A few seconds later record the value of parameter SCUTEMPSTAT	SCUTEMPSTAT	0xFFFF/-/0	0xFFFF/-/0	**OK**
3	A few seconds later record the value of parameter SUBKSTAT	SUBKSTAT	1/-/0	1/-/0	**OK**
Test Result (Pass/Fail): PASS					

3.3.65 SPIRE-IST-COLD-DRCU-OFF-R

Test Id:	SPIRE-IST-COLD-DRCU-OFF-R
Purpose	DRCU RED Switch OFF
Initial Configuration:	SPIRE DPU and DRCU RED are ON and SPIRE HK is being produced and AC/DC thermometry is ON.
Final Configuration:	SPIRE DPU RED is ON, SPIRE DRCU RED is OFF and SPIRE HK is not being produced.
Duration	5 minutes
Success Criteria:	THSK and TM2N stop refreshing/incrementing

Procedure Steps:

Step	Description	Parameter - Unit	Expected Values Before/ During/ After	Actual Values Before/ During/ After	Success/ Failure
1	Execute TCL script SPIRE-IST-COLD-DRCU-OFF.tcl	—	—	—	
2	Check that THSK parameter is not refreshing anymore	THSK	Not refreshing	—	**OK**
3	Check that TM2N parameter is not incrementing anymore	TM2N	Not incrementing	—	**OK**
4	**Power OFF the SPIRE DRCU RED unit.**	—	—	—	

Test Result (Pass/Fail):

OBSID: 0xb0001804
08:38

3.3.66 SPIRE-IST-COLD-DPU-OFF-R

Test Id:	SPIRE-IST-COLD-DPU-OFF-R
Purpose	DPU RED Switch OFF
Initial Configuration:	SPIRE DPU RED is ON but not generating HK.
Final Configuration:	SPIRE DPU RED is OFF.
Duration	5 minutes
Success Criteria:	Power to SPIRE DPU RED is OFF

Procedure Steps:

Step	Description	Parameter – Unit	Expected Values Before/ During/ After	Actual Values Before/ During/ After	Success/ Failure
1	**Power OFF the SPIRE DPU RED unit.**	—	—	—	**OK**

Test Result (Pass/Fail): PASS

DPU Redundant Side LCL opened at 08:41

4. CONCLUSIONS

- All the CFTs were successfully executed.
- NCR-4705 (SPIRE TB/TV SSW JFET problem) can be closed on a “use as is” basis. To ensure safe operation in flight, the SSW JFET will not be turned on until L3 has reached operational temperature of ~12-15K (see .
- The SPIRE instrument is therefore ready for flight.

5. ANNEXE 1 (RESULTS OF LOAD CURVES – PRIME SIDE)

The following graphs (1-12) show the response of the 288 Photometer detectors to the input voltage during the Load Curve (FUNC-DCU-13). The graph (13) shows the response of the 3 PTC channels to the input voltage during the Load Curve. The graphs (14-16) show the spectrometer 78 detectors output voltage during the load curve performed on the spectrometer side. These plots are for the PRIME SIDE tests: OBSIDs 0xB00017D3 for photometer and 0xB00017DC for spectrometer.

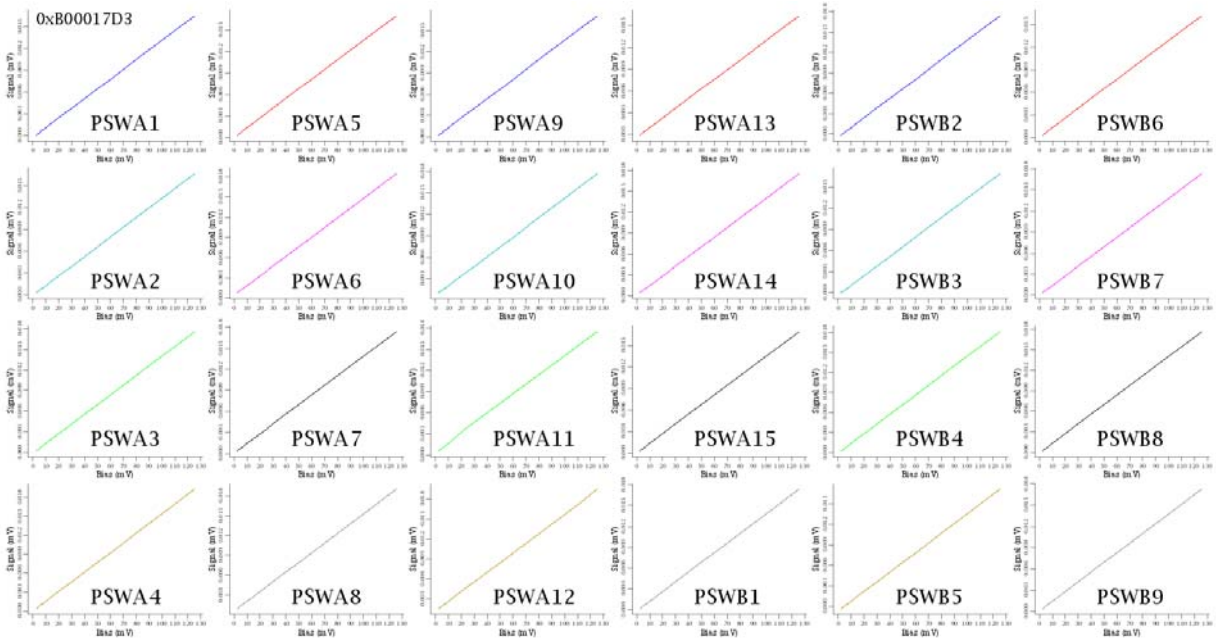


Figure 1. PSW Detectors (1)

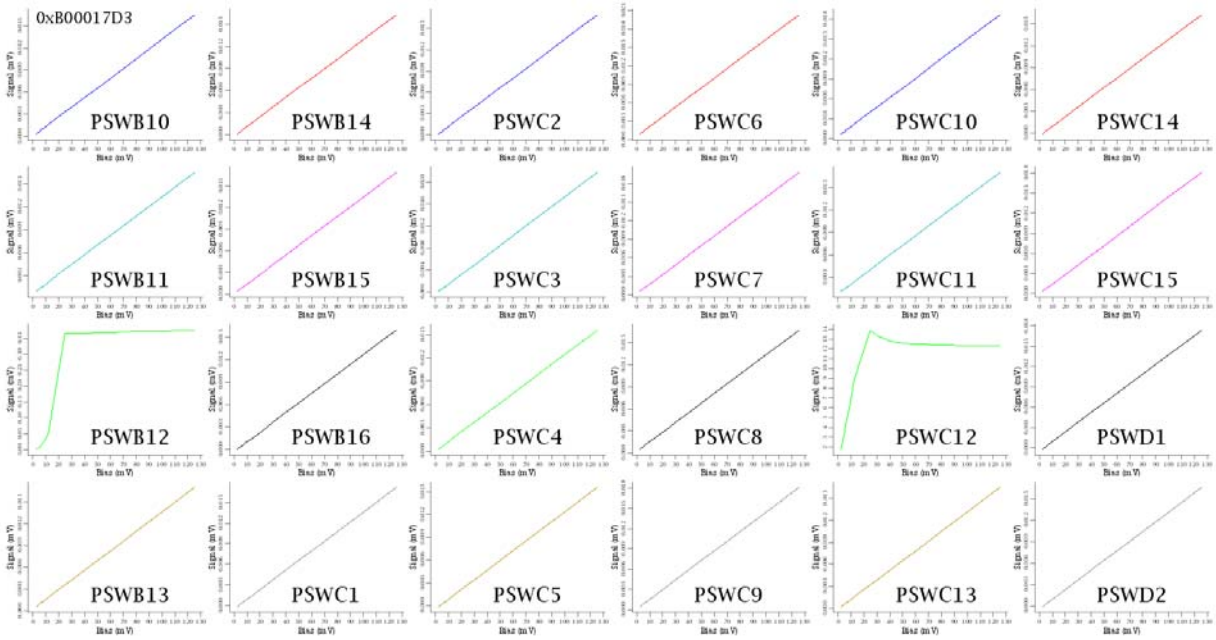


Figure 2. PSW Detectors (2)

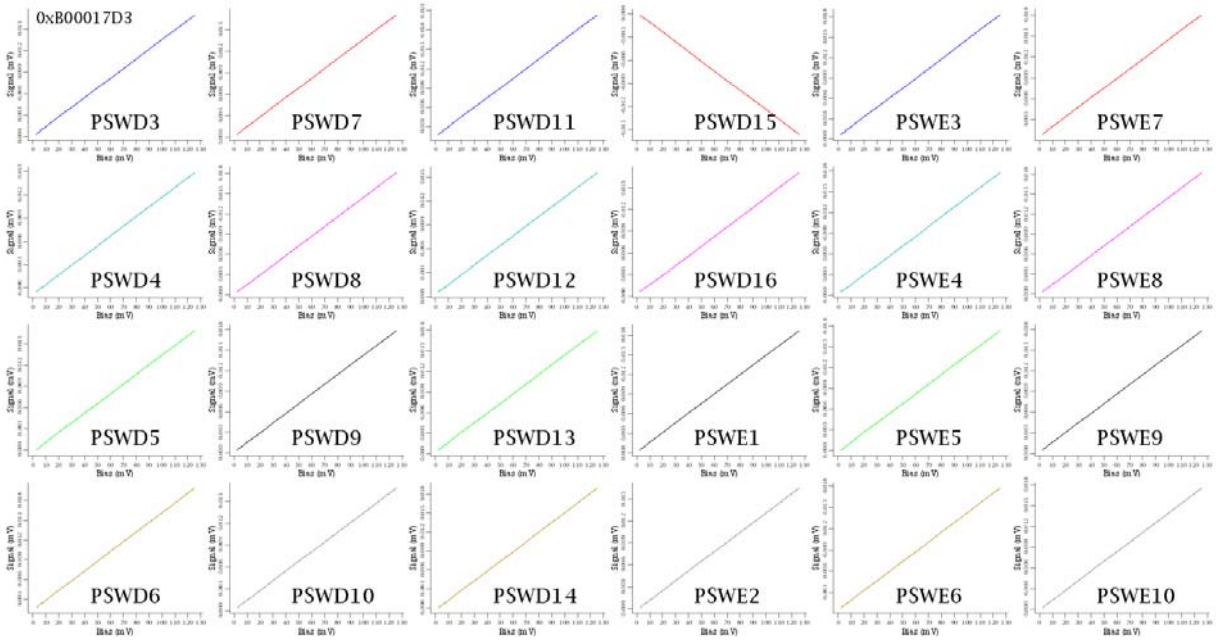


Figure 3. PSW Detectors (3)

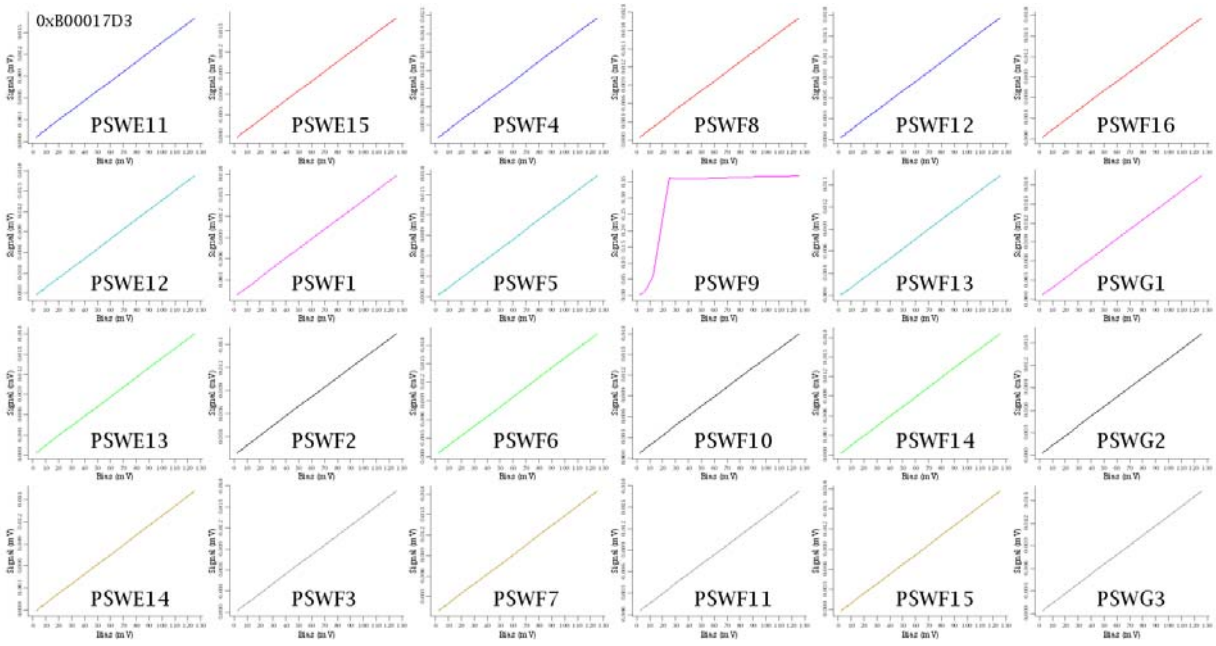


Figure 4. PSW Detectors (4)

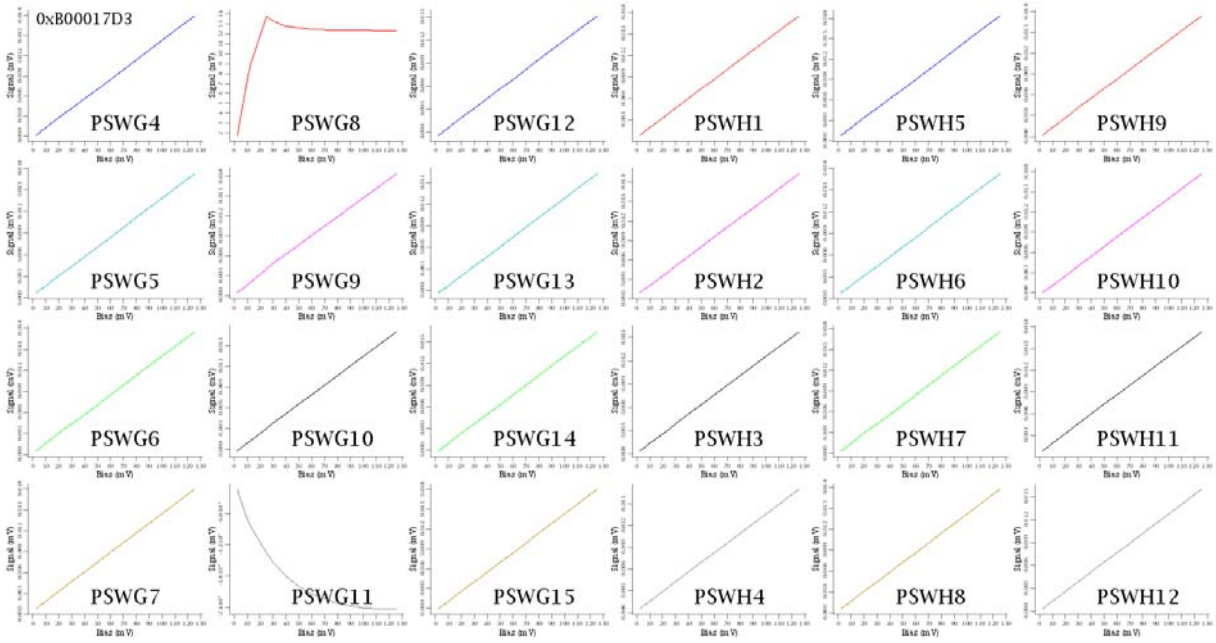


Figure 5. PSW Detectors (5)

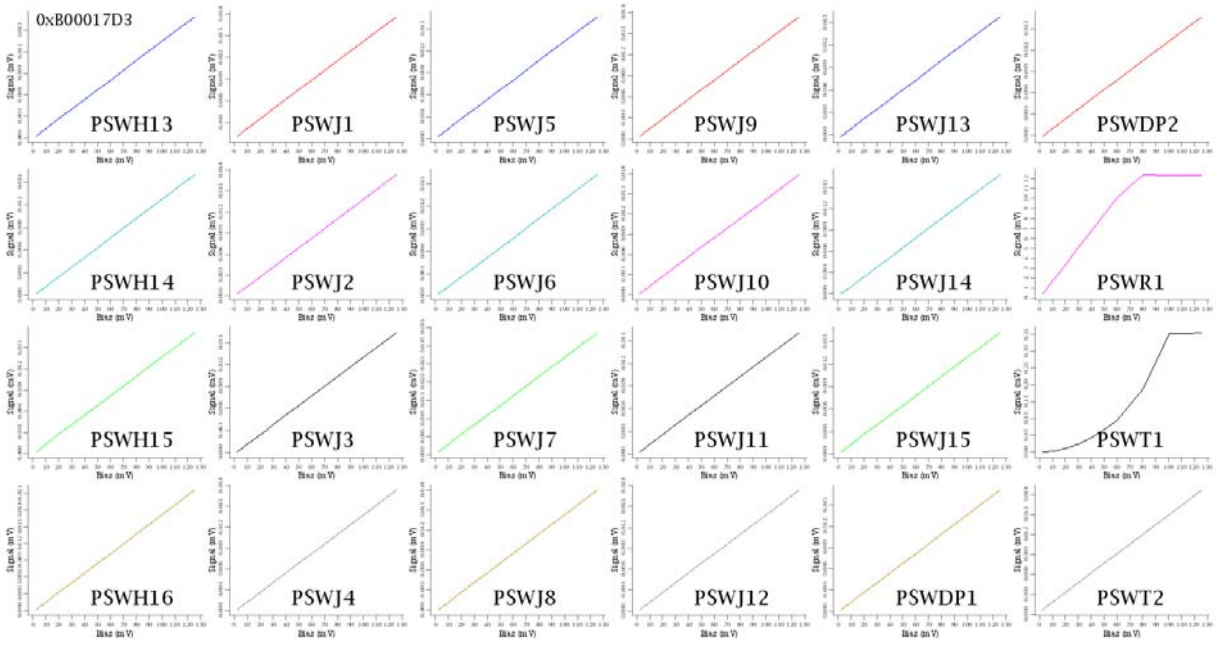


Figure 6. PSW Detectors (6)

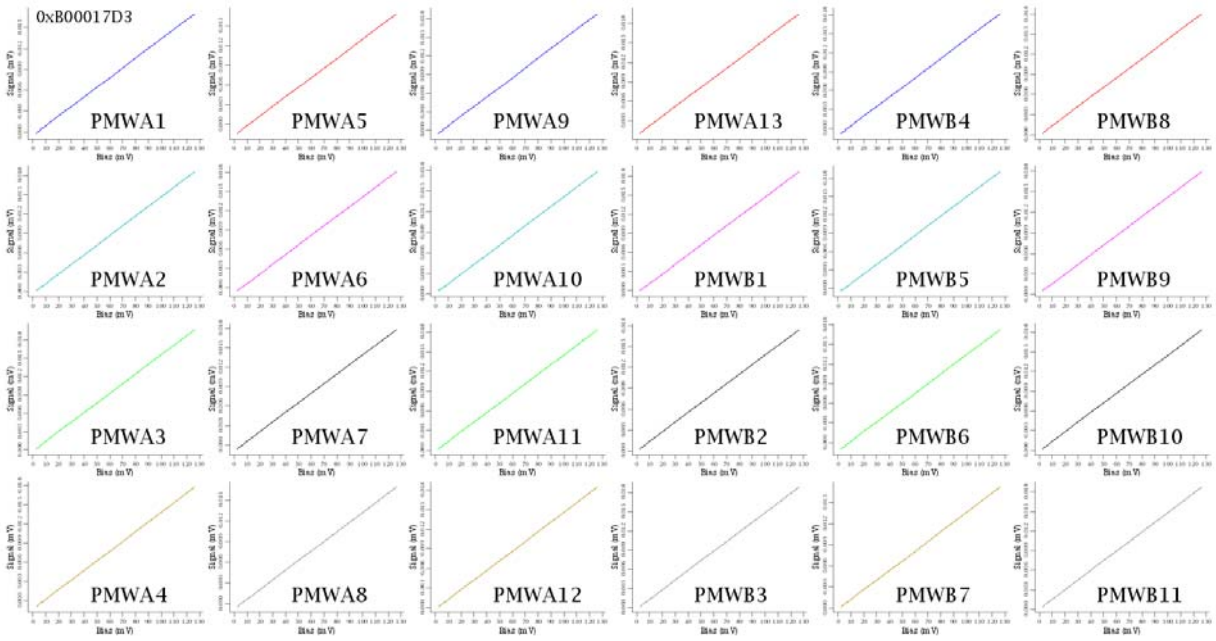


Figure 7. PMW Detectors (1)

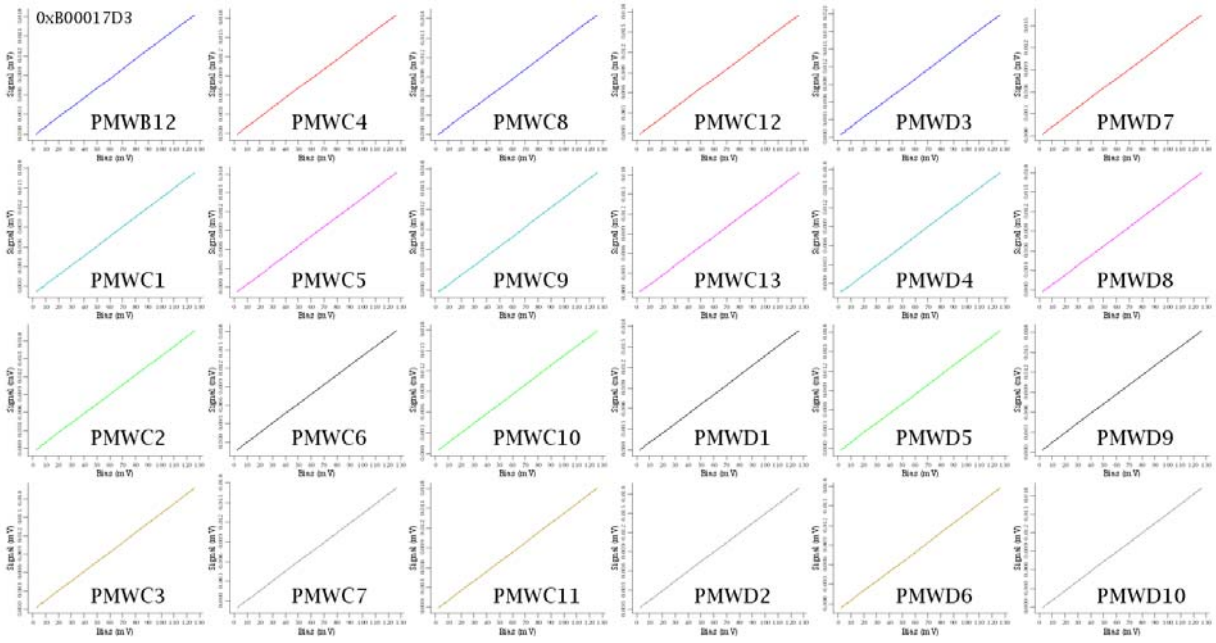


Figure 8. PMW Detectors (2)

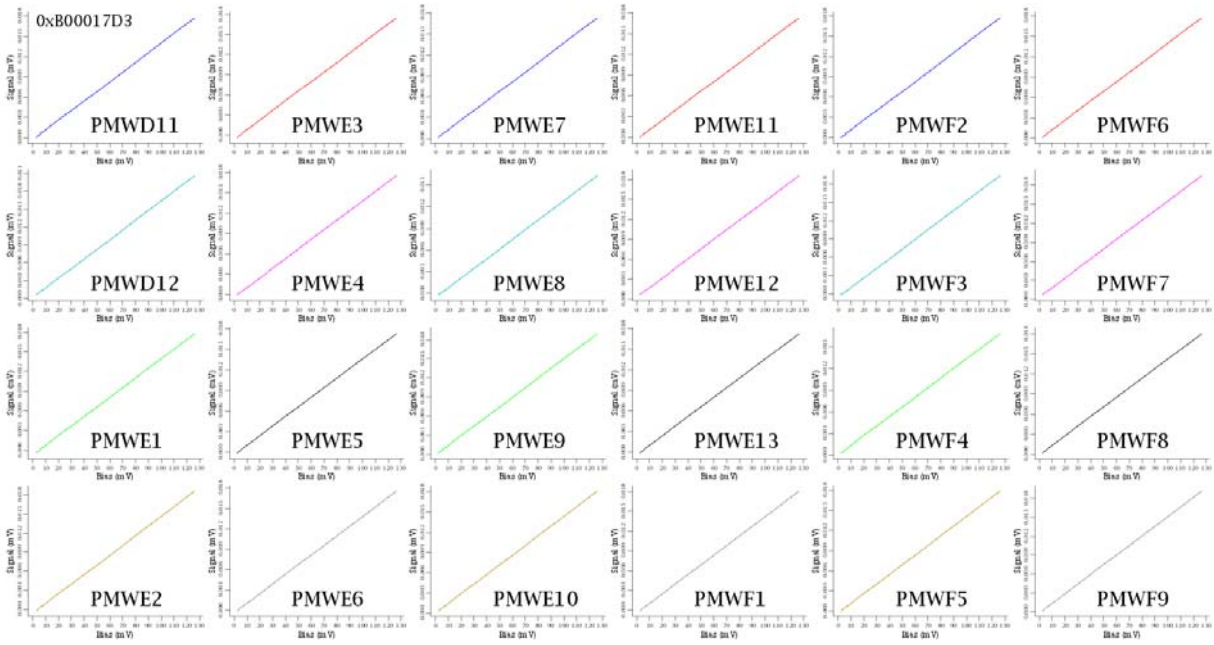


Figure 9. PMW Detectors (3)

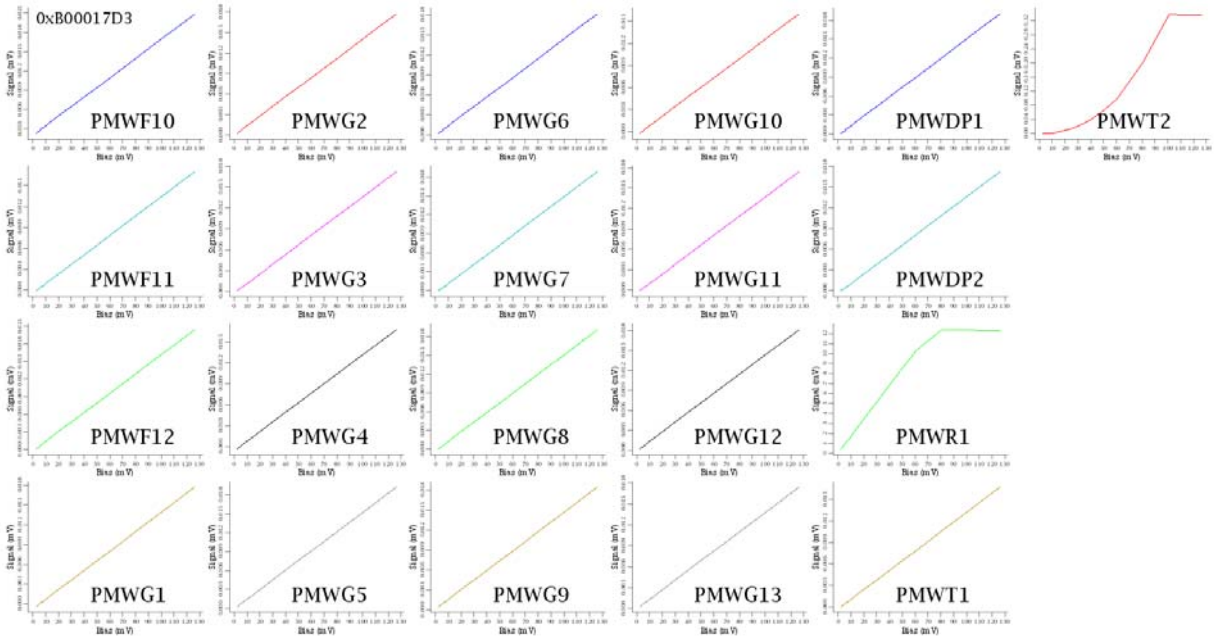


Figure 10. PMW Detectors (4)

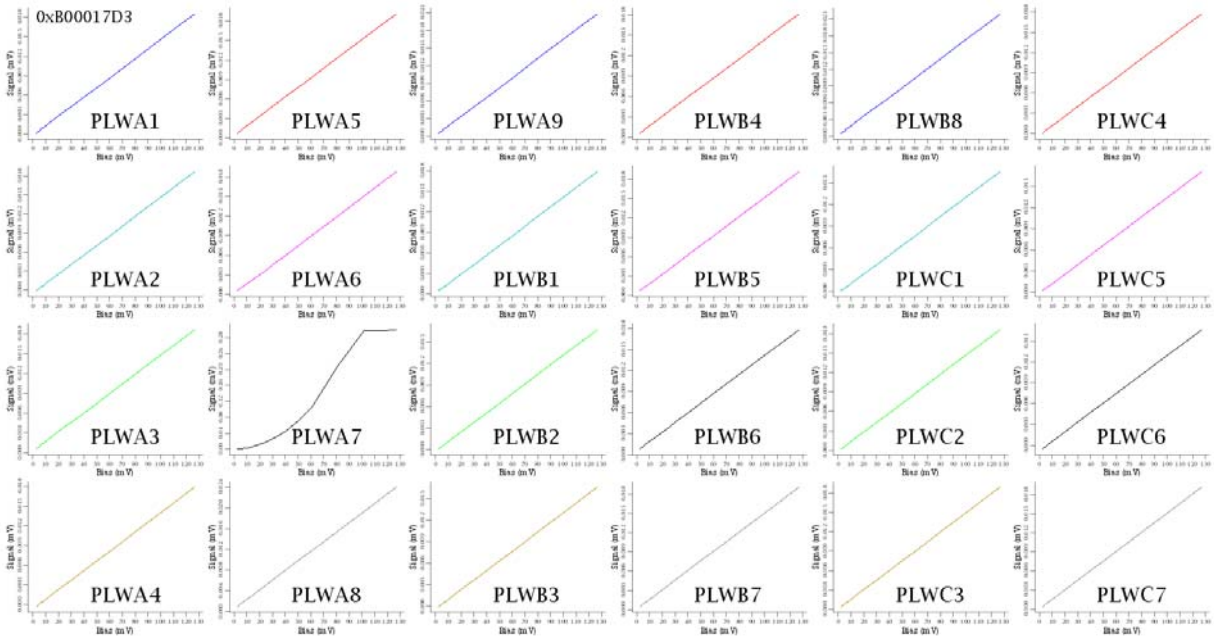


Figure 11. PLW Detectors (1)

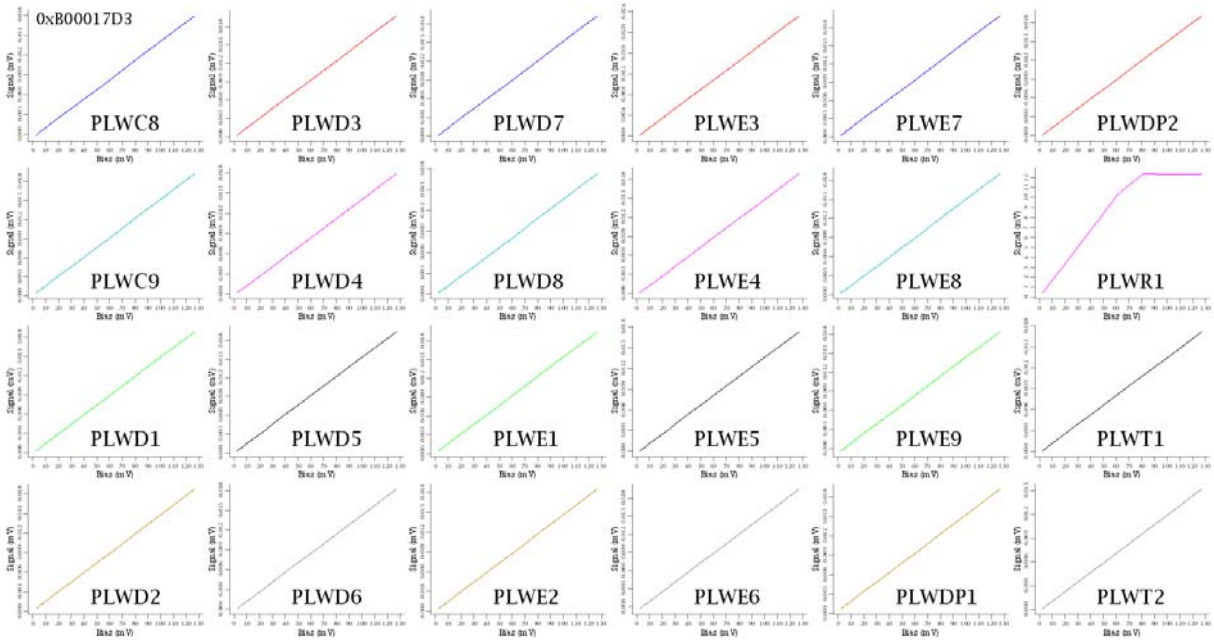


Figure 12. PLW Detectors (2)

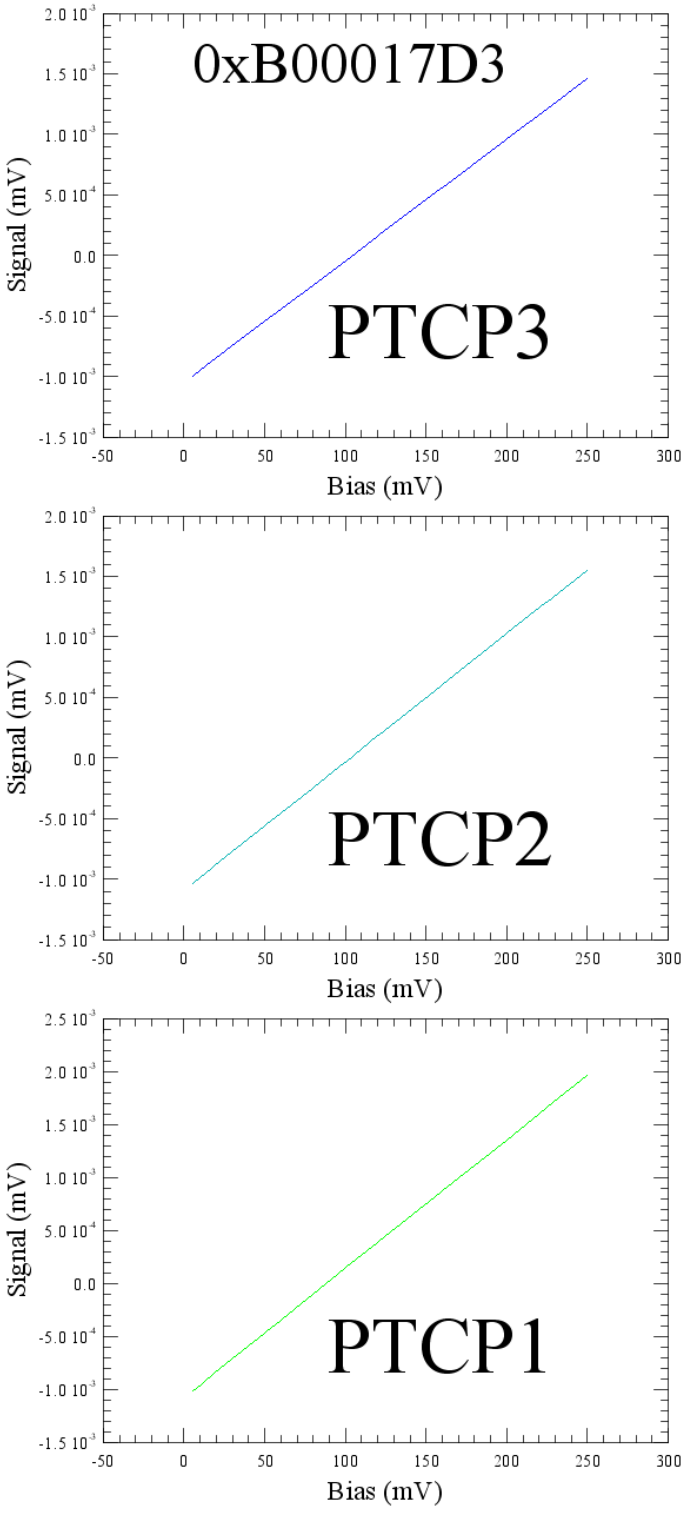


Figure 13. PTC Detectors (1)

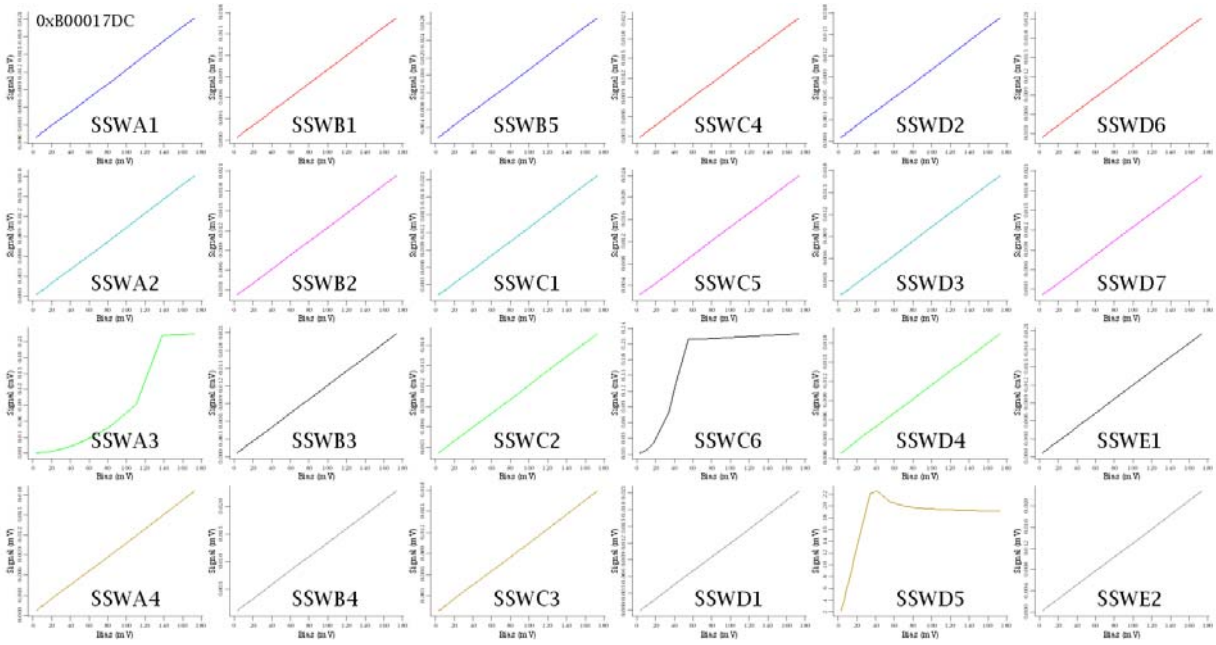


Figure 14. SSW Detectors (1)

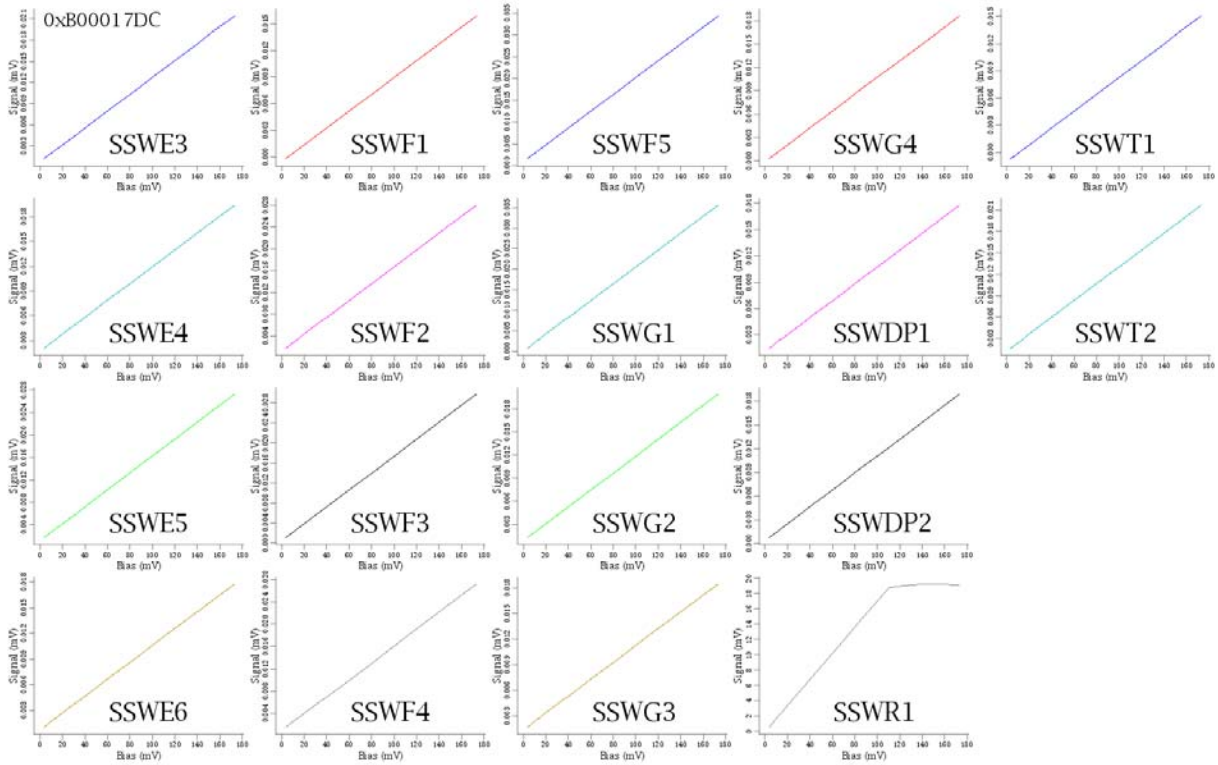


Figure 15. SSW Detectors (2)

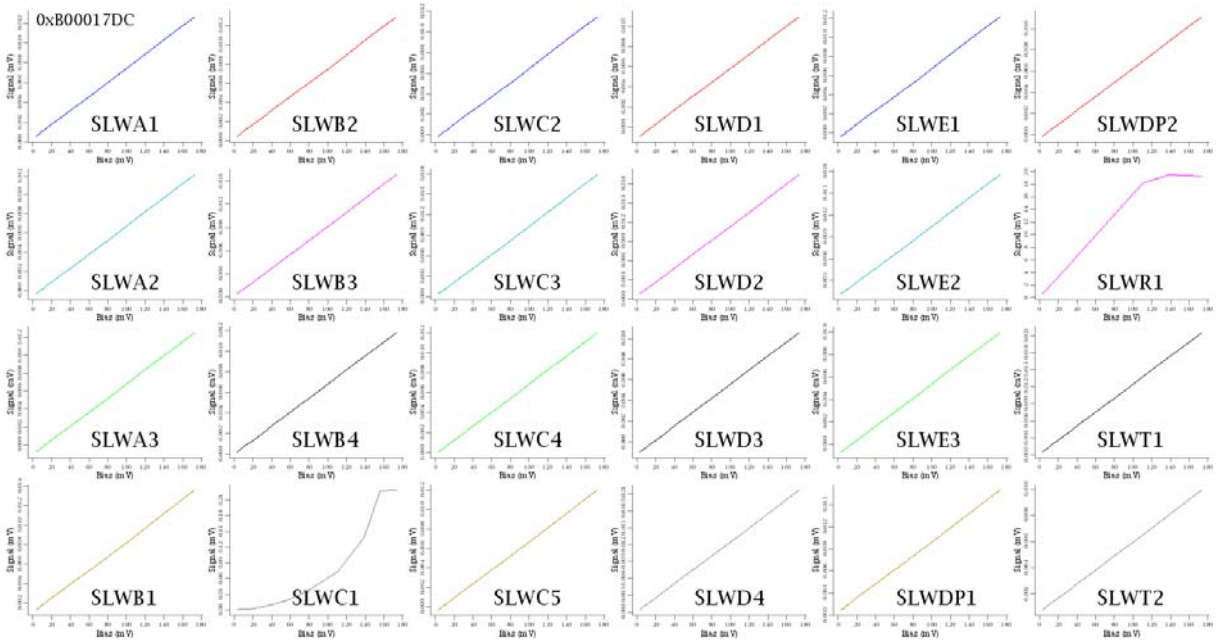


Figure 16. SLW Detectors (1)

6. ANNEXE 2 (BOLOMETER RESISTANCES – PRIME SIDE)

6.1 PSW

```
# Average Resistances: Stddev kOhm  Resistance kOhm
# Calculated by fitting a straight line to points 2-9 in the load curve
PSWA1  3.1211  133.0545
PSWA2  3.0950  132.9591
PSWA3  3.2579  138.8930
PSWA4  3.5657  152.3806
PSWA5  3.1467  134.0753
PSWA6  3.3219  140.7130
PSWA7  3.1886  135.1939
PSWA8  3.3626  143.0413
PSWA9  3.1590  134.1209
PSWA10  3.1603  134.1812
PSWA11  3.4303  147.0977
PSWA12  3.4069  145.9793
PSWA13  3.1583  135.9004
PSWA14  3.2830  140.9579
PSWA15  3.1959  136.5930
PSWB1  3.2616  138.8687
PSWB2  3.3277  140.2731
PSWB3  3.1956  136.7864
PSWB4  3.3720  144.4657
PSWB5  3.2655  139.7488
PSWB6  3.0114  128.3763
PSWB7  3.1998  135.7571
PSWB8  3.2836  139.5427
PSWB9  3.1720  134.2511
PSWB10  3.0341  128.9201
PSWB11  3.0222  129.2566
PSWB12  289.9168  46032.3915
PSWB13  3.1479  134.8716
PSWB14  3.1218  133.4770
PSWB15  3.1938  137.0032
PSWB16  3.0480  131.4372
PSWC1  3.2681  139.8053
PSWC2  3.1765  134.8493
PSWC3  4.0880  174.6267
PSWC4  2.9025  124.7170
PSWC5  2.9544  126.5292
PSWC6  3.6598  155.8232
PSWC7  3.6200  153.9904
PSWC8  3.0434  128.5561
PSWC9  3.3088  139.9345
PSWC10  3.4096  144.1766
PSWC11  3.0580  130.2619
PSWC12  9005.9606  3622703.1649
PSWC13  3.1264  133.3724
PSWC14  3.1302  133.9973
PSWC15  3.3868  145.5329
PSWD1  3.3484  142.1967
PSWD2  3.1530  135.3322
PSWD3  3.1515  134.3904
PSWD4  2.8999  123.2773
PSWD5  3.1928  136.1663
PSWD6  3.4335  146.5707
```

PSWD7	3.1412	132.8955
PSWD8	3.3164	140.4826
PSWD9	3.2748	139.3112
PSWD10	3.0825	130.4699
PSWD11	3.5400	150.4953
PSWD12	2.8791	122.4254
PSWD13	3.3285	142.4881
PSWD14	3.6217	155.5163
PSWD15	-2.9642	125.3249
PSWD16	3.1238	138.6415
PSWE1	3.4654	148.0683
PSWE2	3.0622	130.4609
PSWE3	3.3040	140.8968
PSWE4	3.2050	137.6540
PSWE5	3.2593	139.4333
PSWE6	3.1673	134.4204
PSWE7	3.2098	136.9955
PSWE8	3.3687	142.5533
PSWE9	3.2657	138.7032
PSWE10	3.2596	138.6435
PSWE11	3.1585	135.4584
PSWE12	3.2535	138.6362
PSWE13	3.3031	141.1766
PSWE14	3.0376	129.8405
PSWE15	3.1442	134.5176
PSWF1	3.2320	137.5713
PSWF2	2.9746	127.0718
PSWF3	3.1906	136.5420
PSWF4	3.6762	156.6885
PSWF5	3.2233	137.5196
PSWF6	3.5124	149.5995
PSWF7	3.2131	136.0764
PSWF8	3.6361	153.2090
PSWF9	272.2095	43056.0778
PSWF10	3.2252	136.4039
PSWF11	3.1050	131.2438
PSWF12	3.2014	137.2406
PSWF13	3.0183	128.5930
PSWF14	3.4070	145.0834
PSWF15	3.3089	142.0014
PSWF16	3.2480	138.1698
PSWG1	3.5766	152.6214
PSWG2	2.9927	127.9166
PSWG3	2.9598	125.8698
PSWG4	3.3181	141.6872
PSWG5	3.0343	129.0626
PSWG6	3.1199	132.0181
PSWG7	3.2052	135.3441
PSWG8	8641.4531	3449715.1285
PSWG9	3.5476	152.4596
PSWG10	3.2271	135.8947
PSWG11	-0.9513	60.0776
PSWG12	2.8896	122.4540
PSWG13	3.0941	132.1025
PSWG14	3.1177	133.2335
PSWG15	3.3555	143.4892
PSWH1	3.1824	135.9552
PSWH2	3.4954	150.0920
PSWH3	2.8880	124.1396
PSWH4	3.0852	132.2800
PSWH5	3.2989	140.9589

```
PSWH6  3.0515  129.4490
PSWH7  3.2003  135.7914
PSWH8  3.1695  133.8602
PSWH9  3.2234  135.9838
PSWH10  3.2821  139.0818
PSWH11  3.0251  128.0868
PSWH12  2.9005  123.1877
PSWH13  3.0771  130.8857
PSWH14  2.9452  125.1181
PSWH15  3.1611  134.5624
PSWH16  3.9895  169.9276
PSWJ1  3.1818  135.9346
PSWJ2  3.2258  138.2375
PSWJ3  3.0797  132.7876
PSWJ4  3.2211  137.6643
PSWJ5  3.0204  128.5640
PSWJ6  2.9564  125.3042
PSWJ7  6.0177  255.6801
PSWJ8  3.3118  139.7302
PSWJ9  3.1468  132.9661
PSWJ10  3.3464  141.6901
PSWJ11  2.9386  125.5826
PSWJ12  3.2003  136.1417
PSWJ13  2.9933  127.8342
PSWJ14  3.1589  134.5884
PSWJ15  2.9645  125.8523
PSWDP1  3.2010  135.9524
PSWDP2  3.1446  134.3303
PSWR1  5208.9361  221143.7822
PSWT1  26.7042  3140.5212
PSWT2  3.4253  146.2919
```

6.2 PMW

```
# Average Resistances: Stddev kOhm  Resistance kOhm
# Calculated by fitting a straight line to points 2-9 in the load curve
PMWA1  3.3862  143.7576
PMWA2  3.6580  154.9591
PMWA3  3.8599  164.1033
PMWA4  3.6932  157.0846
PMWA5  3.5109  148.8750
PMWA6  3.5263  148.5276
PMWA7  3.5644  150.6696
PMWA8  3.2322  135.9415
PMWA9  3.6249  152.8435
PMWA10  3.2328  136.9470
PMWA11  3.3871  144.3560
PMWA12  3.4023  144.6926
PMWA13  3.3985  143.5801
PMWB1  3.7532  159.3096
PMWB2  3.3654  142.7556
PMWB3  3.7112  156.4181
PMWB4  3.7181  157.5546
PMWB5  3.8169  161.1178
PMWB6  3.5277  149.0762
PMWB7  3.1477  133.6725
PMWB8  3.3503  142.0089
PMWB9  3.2664  138.1186
PMWB10  3.4232  145.2030
PMWB11  3.4070  144.7306
```

PMWB12	3.3988	144.3386
PMWC1	3.6206	153.0924
PMWC2	3.9964	169.3513
PMWC3	3.8174	161.7702
PMWC4	3.6419	154.0456
PMWC5	3.7039	156.9000
PMWC6	3.8048	160.9837
PMWC7	3.5557	150.5882
PMWC8	3.5077	149.2732
PMWC9	3.2885	139.3876
PMWC10	3.2540	137.8700
PMWC11	3.3889	144.0222
PMWC12	3.2938	139.5849
PMWC13	3.3761	143.1069
PMWD1	3.1060	132.2896
PMWD2	3.7084	156.5367
PMWD3	3.6774	156.3129
PMWD4	3.7356	158.3191
PMWD5	3.3680	142.1801
PMWD6	3.6056	152.2641
PMWD7	3.1017	131.5281
PMWD8	3.4078	144.8996
PMWD9	3.4059	144.9962
PMWD10	3.6122	153.7925
PMWD11	3.2904	140.2192
PMWD12	3.7363	158.0531
PMWE1	3.2818	138.0883
PMWE2	3.3700	142.9618
PMWE3	3.2525	137.3253
PMWE4	3.2136	136.2866
PMWE5	3.2115	136.4061
PMWE6	3.1957	136.3147
PMWE7	3.2325	137.4009
PMWE8	3.1154	132.1932
PMWE9	3.5579	150.7354
PMWE10	3.4160	145.0607
PMWE11	3.3256	141.4605
PMWE12	3.4832	147.6467
PMWE13	3.2285	137.3462
PMWF1	3.2566	138.2740
PMWF2	3.1940	135.3896
PMWF3	3.5705	151.1932
PMWF4	3.0444	129.0022
PMWF5	3.2668	138.6411
PMWF6	3.2169	136.6156
PMWF7	3.5432	150.1335
PMWF8	3.3911	143.5288
PMWF9	3.5944	152.6155
PMWF10	3.5454	150.0892
PMWF11	3.3021	139.5802
PMWF12	3.9473	167.5172
PMWG1	3.2594	137.2333
PMWG2	3.1727	134.7352
PMWG3	3.1110	132.5795
PMWG4	3.1664	133.7364
PMWG5	3.4909	148.1798
PMWG6	3.2857	139.9700
PMWG7	3.4759	147.5574
PMWG8	3.6272	154.1358
PMWG9	3.4224	144.7833
PMWG10	3.0895	131.2730

```
PMWG11  3.3566  142.0084
PMWG12  3.4824  147.5680
PMWG13  3.3065  140.2661
PMWDP1  3.7894  159.9707
PMWDP2  3.3523  142.3611
PMWR1  4973.4816  209792.7382
PMWT1  3.0772  130.8884
PMWT2  23.3372  3401.9909
```

6.3 PLW

```
# Average Resistances: Stddev kOhm  Resistance kOhm
# Calculated by fitting a straight line to points 2-9 in the load curve
PLWA1  3.4432  146.6281
PLWA2  3.5273  149.4608
PLWA3  3.3747  142.7390
PLWA4  3.3722  143.4630
PLWA5  3.4141  145.3407
PLWA6  3.3057  143.2571
PLWA7  27.6652  3330.9493
PLWA8  4.1966  178.0078
PLWA9  3.7300  158.3429
PLWB1  3.2688  139.1475
PLWB2  3.1138  132.5329
PLWB3  3.0917  131.9642
PLWB4  3.3094  140.6482
PLWB5  3.4509  146.5089
PLWB6  3.1649  134.3463
PLWB7  3.4247  145.0486
PLWB8  3.9433  167.3805
PLWC1  3.0096  128.6913
PLWC2  3.4343  145.8552
PLWC3  3.3475  142.5869
PLWC4  3.3022  140.5680
PLWC5  3.0787  130.4474
PLWC6  3.1336  131.8557
PLWC7  3.4707  147.6832
PLWC8  3.2755  139.0979
PLWC9  3.4492  147.8602
PLWD1  3.3756  144.1988
PLWD2  3.3018  139.9852
PLWD3  3.5575  150.9106
PLWD4  3.2209  136.7464
PLWD5  3.4868  148.7408
PLWD6  3.2922  139.6916
PLWD7  3.4818  148.2899
PLWD8  3.1211  131.8682
PLWE1  3.4491  146.0849
PLWE2  3.2758  139.2820
PLWE3  4.1707  177.4245
PLWE4  3.4157  145.0076
PLWE5  3.1548  134.3122
PLWE6  3.5850  152.4329
PLWE7  3.5821  152.1071
PLWE8  3.4441  146.6492
PLWE9  3.4155  144.1003
PLWDP1  3.4719  148.0081
PLWDP2  3.4929  148.8808
PLWR1  5079.2353  215740.0666
PLWT1  3.1802  134.2559
PLWT2  2.7284  116.2262
```

6.4 SSW

```
# Resistances: Stddev kOhm  Resistance kOhm
# Calculated by fitting a straight line to points 2-9 in the load curve
SSWA1  2.8577  122.5250
SSWA2  2.5273  108.2335
SSWA3  10.8133  1204.9392
SSWA4  2.5113  107.5987
SSWB1  2.3624  100.7645
SSWB2  2.5958  109.9756
SSWB3  2.8461  121.1614
SSWB4  3.0015  128.0691
SSWB5  3.8920  165.8447
SSWC1  2.8099  119.7291
SSWC2  2.5307  107.7984
SSWC3  2.4312  104.0837
SSWC4  2.5316  108.8775
SSWC5  2.9494  125.8302
SSWC6  100.7318  10926.5564
SSWD1  3.0444  129.6700
SSWD2  2.4061  102.3140
SSWD3  2.3624  100.5529
SSWD4  2.5909  110.0620
SSWD5  13962.6005  4175521.6101
SSWD6  2.5739  109.7305
SSWD7  2.4787  105.6269
SSWE1  2.8821  122.5061
SSWE2  3.1515  134.4571
SSWE3  2.8634  122.1972
SSWE4  2.3638  100.4737
SSWE5  3.4463  146.7329
SSWE6  2.2648  96.1702
SSWF1  2.3188  99.1578
SSWF2  3.6927  157.1835
SSWF3  4.0984  174.2489
SSWF4  3.4103  145.9901
SSWF5  4.4756  190.6329
SSWG1  5.0421  214.5679
SSWG2  2.6653  113.2890
SSWG3  2.2629  96.1015
SSWG4  2.5761  109.8769
SSWDP1  2.3109  98.9176
SSWDP2  2.4457  104.0742
SSWR1  5233.0358  222400.1115
SSWT1  2.2711  95.8132
SSWT2  2.7610  117.5364
```

6.5 SLW

```
# Resistances: Stddev kOhm  Resistance kOhm
# Calculated by fitting a straight line to points 2-9 in the load curve
SLWA1  2.3860  101.6372
SLWA2  2.4995  105.0423
SLWA3  2.7274  115.8536
SLWB1  2.3874  99.5642
SLWB2  2.4663  104.1326
SLWB3  3.1291  133.5279
```

SLWB4	2.3597	100.4424
SLWC1	11.3460	1388.5064
SLWC2	2.2878	96.5151
SLWC3	3.5015	148.5875
SLWC4	2.4005	102.1434
SLWC5	2.4915	106.1133
SLWD1	2.3465	98.6642
SLWD2	3.7250	158.5713
SLWD3	2.3302	99.7380
SLWD4	4.3388	184.5205
SLWE1	2.4720	103.1275
SLWE2	3.2728	138.9283
SLWE3	2.1447	90.3086
SLWDP1	3.1614	134.6025
SLWDP2	2.2708	96.4016
SLWR1	6824.6523	290084.4215
SLWT1	4.1090	175.4242
SLWT2	1.8746	79.6532