1. INTRODUCTION

This document reports on the short functional tests (80K) carried out on the 2nd May 2006 on the SPIRE FM instrument during the PFM3 test campaign

1.1 SCOPE

To judge the success or failure of a warm 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/criteria (specified in this document) is/are met.

1.2 REFERENCE DOCUMENTS

Ref	Document	Name	Version/Issue Nb.
RD01	SPIRE-RAL-DOC-001652	SPIRE Functional Tests Specification	Issue 1.4
RD02	SPIRE-RAL-DOC-001630	SPIRE EGSE-ILT Start-Up Procedures	Issue 0.7
RD03	SPIRE-RAL-PRC-002222	DRCU Switch ON Procedure	Issue 1.0
RD04	SPIRE-RAL-PRJ-001078	SPIRE Data ICD	Issue 2.0
RD05	Sap-SPIRE-CCa-076-02	DRCU/DPU Interface Control Document	Issue 1.2
RD06	LAM.PJT.SPI.NOT.011011	MCU/DPU Command List ICD	Issue 5.0
RD07	SPIRE-IFS-PRJ-001391	SPIRE OBS User Manual	Issue 2.1
RD08		SPIRE ILT Functional Testing Overview	

1.3 CHANGE RECORD

Document	Change date	Changes
Issue 1.0	02/05/06	Document created

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2. FUNCTIONAL TEST CONFIGURATION

2.1 Software Configuration

Annotate in the table the current EGSE software configuration for the tests:

EGSE component	Version/Build number	Comment
SCOS2000	**2.3eP5**	Archive PFM3_TEST2
HCSS	**v0.3.3 Build#812**	
QLA	**V3.3**	
QLA scripts		
Test Control scripts	**See Annexe1**	
CUS Scripts	**See Annexe2**	

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
Lichfield	EGSE router	Started	✓
Lichfield	EGSE Gateway	Started	✓
Lichfield	Telemetry Ingestion	Started	✓
Lichfield	Packet Display	Started	✓
Lincoln	SCOS2000	Started	✓
Lincoln	EXIF + TOPE	Started	✓
Lincoln	Manual Stack	Started	✓
Gordon	CDMS Simulator	Started	✓
Lincoln	Test Control Server	Started	✓

2.3 SPIRE Instrument Configuration

The functional test flow is such that at a given time during the procedure is possible that the instrument configuration does not conform to any nominal configuration as specified in Annexe 1. Nevertheless the configuration prior and after a test is specified for each functional test, and were applicable and the instrument configuration is in accordance to Anexe1, this will be denoted by showing the main configuration in blue bold font and any additional subsystems configuration in black.
The **initial** instrument configuration for Short WFT does conform to a 'known' configuration and should be SPIRE **DRCU_ON**.
Perform the following actions to ensure that the instrument is in the correct configuration for the tests.

Step#	Action	Comments (Write any comments under this tab)	Check
1	In SCOS open **DPU_AND_OBS_PARAMETERS display** Check if : TM2N is incrementing by one @1Hz. TM1N is incrementing by one @0.5Hz. - If they are, go to step 5. - If they are not, go to step 2.	**TM2N is incrementing by 1 @ 1Hz TM1N is fixed (Critical HK has been previously cleared to avoid unnecessary filling of the SCOS archive)** **Comment: procedure should include this possible situation and which action to take then.** **Will go to step 5**	✓
2	Check if the DPU is powered ON: - If ON, the DPU power supply LCD will show ~ 28V and 0.40A, go to step 4. - If not ON, power ON DPU see comments on the right, then go to step 3.		
3	In SCOS open **Boot_ROM_Memory_Check display** and check no errors are reported: - If no errors are reported, execute DPU_ON from HCSS Test Procedures. Then repeat step 1. - If the (5,2) contains errors: Check the error code in RD07. Then switch OFF the DPU and repeat step 2		
4	Execute **define_new_HK_report.tcl** HCSS Test procedure. Repeat step 1.		
5	In SCOS open **SCU_PARAMETERS display** - If SCUP5V/P9V/M9V are jittering and **BIAS_PARAMETERS display** - If BIAS1TEMP,BIAS2TEMP,… show ambient temperature, the DRCU is ON.Go to step 6. - If DRCU is not ON, refer to RD03 on how to start up the DRCU.	**SCUP5V/ SCUP9V/SCUM9V are jittering as specified but : There is only one BIASTEMP parameter under BIAS_PARAMETERS display. Procedure should include**	✓

		other parameters aswell which are relevant like BIASP5V, BIASP9V, BIASM9V **Will go to step 6**	
6	**In SCOS open** DPU_AND_OBS_PARAMETERS display **and check that the MODE housekeeping parameter is DRCU_ON.**	**MODE parameter is DRCU_ON**	✓

Table 1. Initial configuration check

3. TEST PROCEDURE

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

3.1 GENERAL PASS/FAIL CRITERIA

The general criterion 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 analyzed.

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 Short WFT sequence as it should be performed. In each step of this procedure the operator should refer to the detailed procedure in Section 3.2 .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	Subsystem tested	Test Id	Test Purpose
1	SCU	FUNC-SCU-01	SCU Nominal Science Generation Check
2		FUNC-SCU-03	FPU DC Thermometry Check
3		FUNC-SCU-06	FPU AC Thermometry Check
4		FUNC-SCU-07	Sorption Cooler Check
5		FUNC-SCU-04	Photometer Calibrator Check
6		FUNC-SCU-05	Spectrometer Calibrators Check
9	MCU	FUNC-MCU-01	MCU Boot Check
10		FUNC-MCU-02	MCU Nominal Science Generation Check
11	BSMm	FUNC-BSM-01	BSM Switch ON Check
12		FUNC-BSM-03	BSM Open Loop dynamics Check
13	SMECm	FUNC-SMEC-02A/B*	SMEC Launch Latch Open/Close Check
14		FUNC-SMEC-01	SMECm Switch ON Check
15		FUNC-SMEC-03	SMEC LED Integrity Check
16		FUNC-SMEC-04	SMEC Positioning Test (Open Loop)
17	DCU	FUNC-DCU-01	DCU Nominal Science Generation Check
18	Photometer LIAs	FUNC-DCU-04P	Photometer LIAs Check
19	Spectrometer LIAs	FUNC-DCU-04S	Spectrometer LIAs Check

Table 2. General Short WFT sequence

3.3 DETAILED TEST PROCEDURE

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

Step#	Action	Comments
0	Open **SCU_PARAMETERS** display on SCOS Alpha Numeric Displays.	

3.3.1 FUNC-SCU-01

Test Id:	**FUNC-SCU-01**
Initial Configuration:	**DRCU_ON**
Final Configuration:	**DRCU_ON**
Success Criteria:	Test passed if : 1. Two SCU Nominal Science Report telemetry packets are received on QLA with the following characteristics: 2. The frame time difference between consecutive SCU frames within these packets corresponds to the sampling rate. Nominal SCU sampling rate is 80Hz ➔ Δt = 12.5 ms 3. The SPIRE HK parameter SCUFRAMECNT increments by 31. 4. No events are generated during the frame generation. **QLA to give go ahead.**

APID	Type	Subtype	SID	FrameID	Frame length
0x508	21	1	0xA20	0x20	0x1E

Test Procedure:

Step#	Action
1	**Annotate the initial value of SCUFRAMECNT parameter located in SCU_PARAMETERS display.**
2	**Run QLA script FUNC-SCU-01.py on QLA console.**
3	**Run FUNC-SCU-01 test procedure from the HCSS Test Procedure window on TOPE**
4	**Annotate the final value of SCUFRAMECNT.**
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
FUNC-SCU-01	**SCUFRAMECNT**	**n/ n+ 31**	0/ 31	31	**Passed**

Start time @: 13:20
End time @: 13:21
OBSID: 0x3000E12E
Comments:

QLA script created file QLA-SCU-01_3000E12E.txt. This file contains the following:

****
SCU: APID = 0x508, SID = 0xa20

Parameter Initial Final Increment Expect Incre. Packet Chars.

SCUFRAMECNT 0 31 31 31 Packet type = 0x15
TM5N 3284 3286 2 2 subtype = 0x1
FrameTime 12.4960 12.4992 Frame ID = 0x20
Frame Len = 0x1E
STATISTICS ON TIME BETWEEN RECEPTION OF 2 CONSECUTIVE FRAMES:
mean = 12.49793 ms
sigma = 0.00161 ms

3.3.2 FUNC-SCU-03

Test Id:	FUNC-SCU-03
Initial Configuration:	DRCU_ON
Final Configuration:	DRCU_ON + DC thermometry ON
Success Criteria:	Test passed if all FPU DC thermometry sensors 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** **Note:** At warm (what **does warm mean in the context of this procedure??**) temperature most of the FPU thermometers should be short circuited.

Test Procedure:

Step#	Action
1	**Run FUNC-SCU-03 test procedure from the HCSS Test Procedure window on TOPE**
2	**When the test is finished annotate the current value of SCUTEMPSTAT and the RAW/converted values of the 16 FPU temperatures located in SCU_PARAMETERS display.**
3	**Contingency:** **If test fails execute SCU_OFF procedure from HCSS Test Procedure window on TOPE and then repeat steps 1 and 2.**

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	Nb. of frames received	Test Result
FUNC-SCU-03	**SCUTEMPSTAT**	**0/0xFFFF**	0xFFFF/0xFFFF	**N/A**	**Passed**

Start time @: 13:25
End time @: 13:40
OBSID: N/A
Comments:

Procedure should clarify that this is a check that if done during cooldown does not required the execution of a script, just the check is required.

FPU TEMP	TEMP(K)	TEMP(RAW)
Pumphtrtemp	55.22	-32768 (still out of range)
Pumphstemp	37.52	-32768 (still out of range)
Evaphstemp	38.52	-32768 (still out of range)
Shunttemp	19.94	-32768 (still out of range)
Emcfiltemp	78.38	-13678
Sl0temp	19.89	-32768 (still out of range)
Pl0temp	21.30	-32768 (still out of range)
Optemp	78.11	-22142
Baftemp	79.84	-18760
Bsmiftemp	78.37	-28363
Scal2temp	77.45	-30807
Scal4temp	77.75	-30259
Scaltemp	79.47	-30600
Smeciftemp	78.71	-29661
Smectemp	8.39	-32768 (still out of range)

3.3.3 FUNC-SCU-06

Test Id:	FUNC-SCU-06
Initial Configuration:	DRCU_ON + DC thermometry ON
Final Configuration:	DRCU_ON + AC/DC thermometry ON
Success Criteria:	Test passed if SUBKSTAT parameter went from 0 to 1. **Open Circuit Criterion:** **RAW reading in the range 0 -100** **Short Circuit Criterion:** **RAW reading of -32768**

Test Procedure:

Step#	Action
1	**Run FUNC-SCU-06 test procedure from the HCSS Test Procedure window on TOPE.**
2	**When the test is finished annotate the current value of SUBKSTAT located in SCU_PARAMETERS display. Also write down the RAW value of the SUBKTEMP parameter.**
3	Contingency: If test fails : 1. Send manual command:

	SEND_DRCU_COMMAND Parameter1 = 0xA0860000 Parameter2 = 0 2. Then repeat steps 1 and 2.

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	Nb. of frames received	Test Result
FUNC-SCU-06	**SUBKSTAT**	**0/1**	1/1	**N/A**	**Passed**

Start time @: 13:41
End time @: 13:42
OBSID: N/A
Comments:

Procedure should clarify that this is a check that if done during cooldown does not required the execution of a script, just the check is required.

FPU TEMP	TEMP(K)	TEMP(RAW)
Subktemp	**169**	**32730 (still out of range)**

3.3.4 FUNC-SCU-07

Test Id:	**FUNC-SCU-07**
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON
Success Criteria:	Test passed if during the execution of the test the following SCU HK parameters give correspondent readings of:

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

Test Procedure:

Step#	Action
1	**Run FUNC-SCU-07 test procedure from the HCSS Test Procedure window on TOPE.**
2	**While the test is running annotate the values of current values of SPHSV, EVHSV, SPHTRV located in SCU_PARAMETERS display. (RAW and CONVERTED)**
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	Nb. of frames received	Test Result
FUNC-SCU-07	**SPHSV** **EVHSV** **SPHTRV**	**0/ ~ 323 mV** **0/ ~ 323 mV** **0/ ~ 8 V**	**0/323.22mV** **0/322.49mV** **0/8.83V**	**N/A**	**PASS**

Start time @: 13:49
End time @: 13:51
OBSID: 0x3000E12F
Comments:

3.3.5 FUNC-SCU-04

Test Id:	FUNC-SCU-04
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON
Success Criteria:	Test passed if PCALCURR/PCALV SCU HK parameters show the following values: • PCALCURR HK parameter which shows the measured PCAL current is ~ 0.1 mA. • PCALV HK parameter which shows the measured PCAL voltage is ~ 0.02V

Test Procedure:

Step#	Action	Comments
1	Annotate the current value of PCALV and PCALCURR located in SCU_PARAMETERS display.	
2	Run FUNC-SCU-04 test procedure from the HCSS Test Procedure window on TOPE	
3	While the test is running Annotate the values of PCALV and PCALCURR.	
4	Contingency: If test fails repeat steps 1 to 3.	

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/During test	Actual Value Before/ During test	Nb. of frames received	Test Result
FUNC-SCU-04	**PCALCURR** **PCALV**	**0/0.1mA** **0/0.02V**	**0/0.0981mA** **0/0.02V**	**N/A**	**PASS**

Start time @: 13:58
End time @:13:59
OBSID: 0x3000E130
Comments:

3.3.6 FUNC-SCU-05

Test Id:	FUNC-SCU-05
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON
Success Criteria:	Test passed if : • SCAL2CURR ,SCAL4CURR HK parameters which show the measured current read ~ 0.1 mA • SCAL2V,SCAL4V parameters which show the measured voltage read ~ 0.05V.

Test Procedure

Step#	Action	Comments
1	Annotate the current value of SCAL2V ,SCAL2CURR,SCAL4V,SCAL4CURR located in SCU_PARAMETERS display.	
2	Run FUNC-SCU-05 test procedure from the HCSS Test Procedure window on TOPE	
3	While the test is running write the values of SCAL2V ,SCAL2CURR,SCAL4V,SCAL4CURR.	
4	Contingency: If test fails repeat steps 1 to 3.	

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/During test	Actual Value Before/After	Nb. of frames received	Test Result
FUNC-SCU-05	**SCAL2CURR** **SCAL2V** **SCAL4CURR** **SCAL4V**	**0/0.1mA** **0/0.05V** **0/0.1mA** **0/0.05V**	**0/0.099mA** **0/0.0498V** **0/0.1mA** **0/0.05V**	**N/A**	**PASS**

Start time @: 13:59
End time @: 14:00
OBSID: 0x3000E131
Comments: SCAL4 followed by SCAL2

Step#	Action	Comments
0	Open **MCU_PARAMETERS** display on SCOS Alpha Numeric Displays.	

3.3.7 FUNC-MCU-01

Test Id:	FUNC-MCU-01
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON
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** FUNC-MCU-01 **test procedure from the HCSS Test Procedure window on TOPE**
2	**When procedure is finished Annotate 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	Nb. of frames received	Test Result
FUNC-MCU-01	**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**	/ 5.0V / 15.52V /14.53V / -14.61V /-15.6V / 289.14K /293.78K /293.23K	**N/A**	**Pass**

Start time @: 14:35
End time @:14:36
OBSID: 0x3000E132
Comments:

3.3.8 FUNC-MCU-02

Test Id:	FUNC-MCU-02
Initial Configuration:	DRCU_ON + AC/DC thermometry ON +MCU ON
Final Configuration:	DRCU_ON + AC/DC thermometry ON +MCU ON
Success Criteria:	Test passed if : 1. MCU produces each type of the frames requested and with the following characteristics.

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						

2. No events are generated during the different frames generation.

Test Procedure:

Step#	Action
1	**Annotate the current value of MCUFRAMECNT located in MCU_PARAMETERS display**
2	**Run QLA script FUNC-MCU-02.py on QLA console.**
3	**Run FUNC-MCU-02 test procedure from the HCSS Test Procedure window on TOPE**
4	**When test is finished annotate the current value of MCUFRAMECNT.**
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
FUNC-MCU-02	**MCUFRAMECNT**	**0/ ~ 6600**	10008/ 16534	6526	**Pass**

Start time @: 14:40
End time @: 14:42
OBSID: 0x3000E133
Comments:

QLA produced file QLA-MCU-02_3000E133.txt. It contains:

****
MCUENG: APID = 0x508, SID = 0x814

Parameter	Initial	Final	Increment	Expect Incre.	Packet Chars.
MCUFRAMECNT	10008	10649	641	609	Packet type = 0x15
TM5N	3286	3314	28	27	subtype = 0x3
FrameTime	15.5776	15.5807			Frame ID = 0x14
					Frame Len = 0x15

STATISTICS ON TIME BETWEEN RECEPTION OF 2 CONSECUTIVE FRAMES:
mean = 15.58035 ms
sigma = 0.00121 ms

****
BSM: APID = 0x508, SID = 0x612

Parameter	Initial	Final	Increment	Expect Incre.	Packet Chars.
MCUFRAMECNT	10649	11290	641	609	Packet type = 0x15
TM5N	3314	3331	17	17	subtype = 0x1
FrameTime	15.5807	15.5809			Frame ID = 0x12
					Frame Len = 0xD

STATISTICS ON TIME BETWEEN RECEPTION OF 2 CONSECUTIVE FRAMES:
mean = 15.58036 ms
sigma = 0.00111 ms

****
SMEC: APID = 0x508, SID = 0x410

Parameter	Initial	Final	Increment	Expect Incre.	Packet Chars.
MCUFRAMECNT	11290	13665	2375	2375	Packet type = 0x15
TM5N	3331	3389	58	58	subtype = 0x1
FrameTime	4.2112	4.2112			Frame ID = 0x10
					Frame Len = 0xC

STATISTICS ON TIME BETWEEN RECEPTION OF 2 CONSECUTIVE FRAMES:
mean = 4.21091 ms
sigma = 0.00093 ms

****
SMEC+BSM: APID = 0x508, SID = 0x612

Parameter	Initial	Final	Increment	Expect Incre.	Packet Chars.
MCUFRAMECNT	13665	16534	2869	2850	Packet type = 0x15
TM5N	3389	3460	71	71	subtype = 0x1
FrameTime SMEC	4.2112	4.2112			Frame ID = 0x10, Len = 0xC
FrameTime BSM	30.2146	30.2146			Frame ID = 0x12, Len = 0xD

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

3.3.9 FUNC-BSM-01

Test Id:	**FUNC-BSM-01**
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON + BSM ON (open loop)
Success Criteria:	Test passed if: 1. CHOPSENSPWR HK parameter goes from 0 to 1 2. CHOPDACVAL HK parameter goes from 0 to 0x8000 3. CHOPSENSIG HK parameter shows variation from off to on 4. JIGGSENSPWR HK parameter goes from 0 to 1 5. JIGGDACVAL parameter goes from 0 to 0x8000 6. JIGGSENSSIG HK parameter shows variation from off to on

Test Procedure

Step#	Action
1	**On QLA bring up a time series display of the following HK parameters:** **CHOPSENSPWR** **CHOPDACVAL** **CHOPSENSSIG** **JIGGSENSPWR** **JIGGDACVAL** **JIGGSENSSIG**
2	**Run FUNC-BSM-01 test procedure from the HCSS Test Procedure window on TOPE**
3	**When the test is finished record all the Key parameters noted bellow**
	Contingency: If test fails repeat steps 1 and 2.

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	Nb. of frames received	Test Result
FUNC-BSM-01	**CHOPSENSPWR** **CHOPLOOPMODE** **CHOPDACVAL** **CHOPFFGAIN** **CHOPSENSSIG** **JIGGSENSPWR** **JIGGLOOPMODE** **JIGGDACVAL** **JIGGFFGAIN** **JIGGSENSSIG**	**0/1** **3/3** **0x8000/0x8000** **0/0xBEB** **0/?** **0/1** **3/3** **0x8000/0x8000** **0/0xBEB** **0/?**	0/1 3/3 0x8000/0x8000 0xBEB/0xBEB 0x7FED/~ 0x92DE 0/1 3/3 0x8000/0x8000 0xBEB/0xBEB 0x7FE4/0xA0F5	**N/A**	**Pass**

Start time @:15:00
End time @:15:01
OBSID:0x3000E134
Comments:

BSM switched ON normally

3.3.10 FUNC-BSM-03

Test Id:	FUNC-BSM-03
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)
Success Criteria:	Test passed if the chop sensor signal evolves in the same way as the positions set.(i.e if (pos1 > pos2 ➔ sig1 > sig2) for each jiggle position. **Note:** During warm tests the voltages on both chop and jiggle motors are likely to be saturated (CHOP/JIGGMOTORVOLT RAW values of ~ 0xFFFF) due to the high resistance of the motor coil at ambient temperature.

Test Procedure

Step#	Action
1	**On QLA open up a time series display of HK parameters:** **CHOPPOSN** **CHOPDACVAL** **CHOPMOTORCURR** **CHOPSENSSIG** **CHOPMOTORVOLT** **JIGGPOSN** **JIGGDACVAL** **JIGGMOTORCURR** **JIGGSENSSIG** **JIGGMOTORVOLT**
2	**Run FUNC-BSM-03 test procedure from the HCSS Test Procedure window on TOPE**
3	Contingency: If test fails repeat step 2.

Test Log:

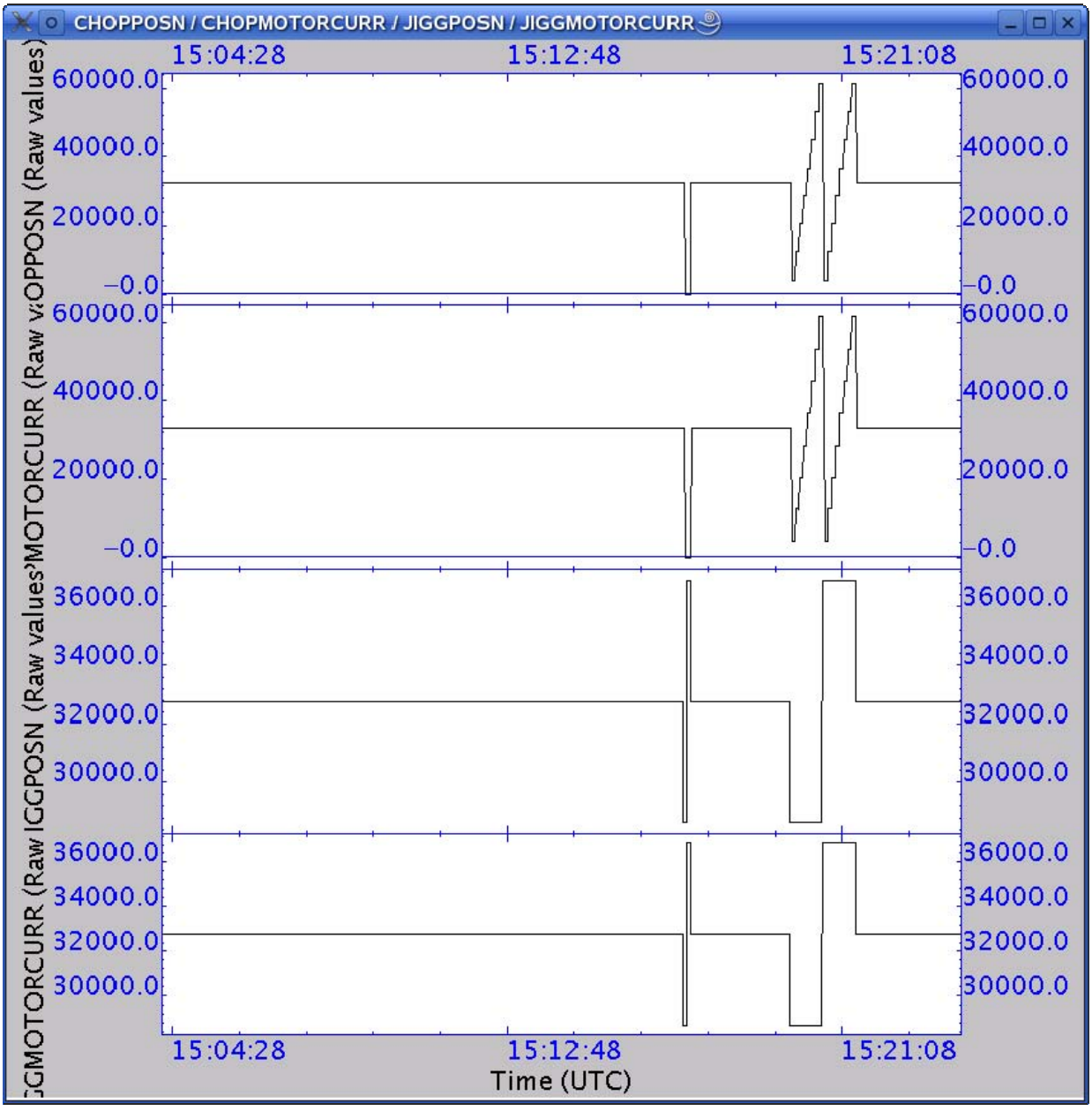
Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	Nb. of frames received	Test Result
FUNC-BSM-03				**N/A**	**Pass**

Start time @: 15:18
End time @: 15:30
OBSID: 0x3000E135
Comments:

Run the test with the following parameters:

BSM sampling 125Hz
Chop start position = 0x1000
Chop end position = 0xf000
Chop step = 0x1000
Jigg start position = 0x7000
Jigg end position = 0x9000
Jigg step =0x2000
Time at each position = 3 sec

Must have input the wrong parameter the first time by hand so repeated with Obsid 0x3000E126



Step#	Action	Comments
4	Execute BSM_OFF from HCSS Test Procedures	

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

3.3.11 FUNC-SMEC-01

Test Id:	**FUNC-SMEC-01**
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)
Success Criteria:	Test passed if : 1. SMECENCPWR HK parameter changes from 0 to 6. 2. SMEC encoder signals 1 and 2 amplitude 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
1	**On QLA bring up a display of the following HK parameters:** **SMECENCPWR** **SMECENCSIG1** **SMECENCSIG2** **SMECLVDTDCSIG** **SMECLVDTACSIG**
2	**Run FUNC-SMEC-01 test procedure from the HCSS Test Procedure window on TOPE**
	Contingency: If test fails repeat steps 1.

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	Nb. of frames received	Test Result
FUNC-SMEC-01	**SMECENCPWR** **SMECLVDTPWR** **SMECENCSIG1** **SMECENCSIG2**		0/ 6 0/ 1	**N/A**	**Pass**

Start time @: 15:35
End time @: 15:37
OBSID: 0x3000E138
Comments:

Script still asks for the SMEC orientation, this input parameter should be removed from the script.

3.3.12 FUNC-SMEC-03

Test Id:	FUNC-SMEC-03
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)
Success Criteria:	Test passed if: SMEC encoder signals 1 and 2 show a variation from one LED illumination level to another.

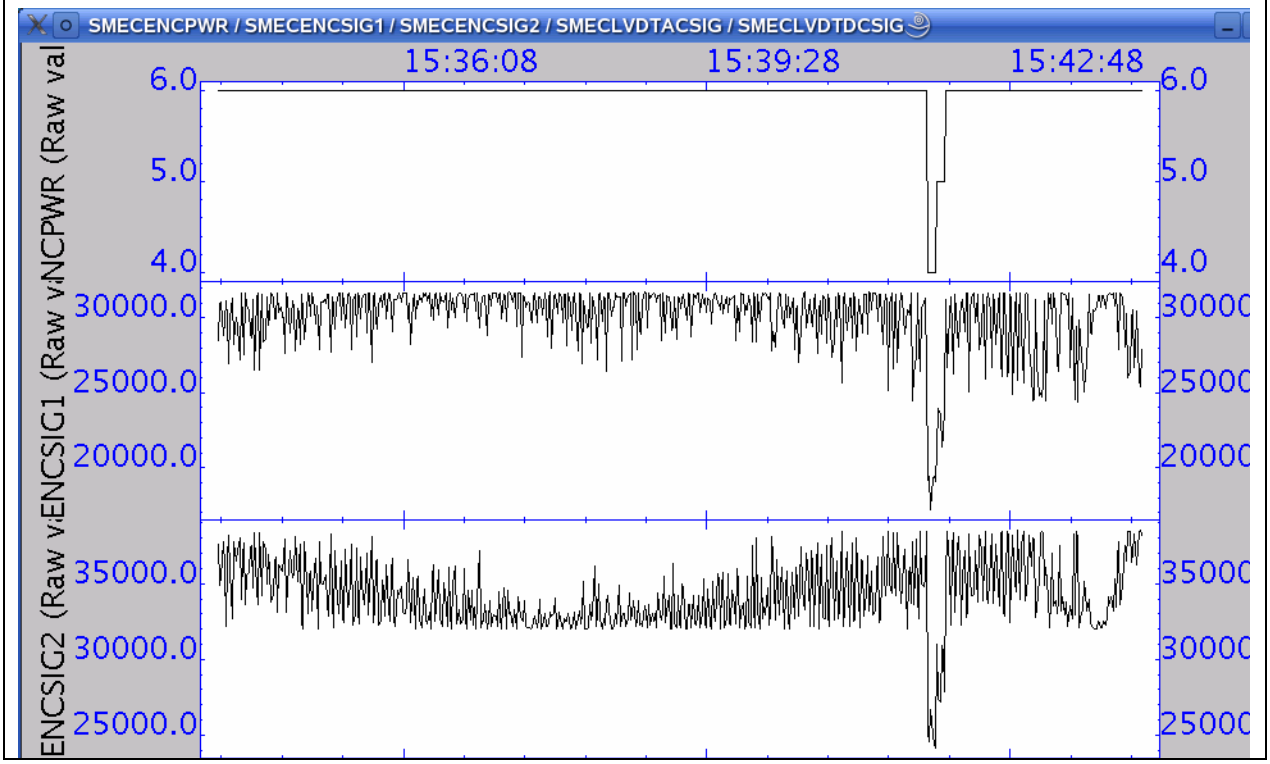
Test Procedure:

Step#	Action
1	**On QLA bring up a time series display of the following Nominal HK parameters:** **SMECENCPWR** **SMECENCSIG1** **SMECENCSIG1**
2	**Run FUNC-SMEC-03 test procedure from the HCSS Test Procedure window on TOPE**
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	Nb. of frames received	Test Result
FUNC-SMEC-03	**SMECENCPWR** **SMECENCSIG1** **SMECENCSIG2**		Values changed from 4 to 5 to 6 as expected	N/A	**Pass**

Start time @: 15:42
End time @: 15:43
OBSID: 0x3000E13A
Comments:



3.3.13 FUNC-SMEC-04a

Test Id:	FUNC-SMEC-04a
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)
Success Criteria:	Test passed if SMECLVDTDCSIG parameter shows a variation according to the different positions set.

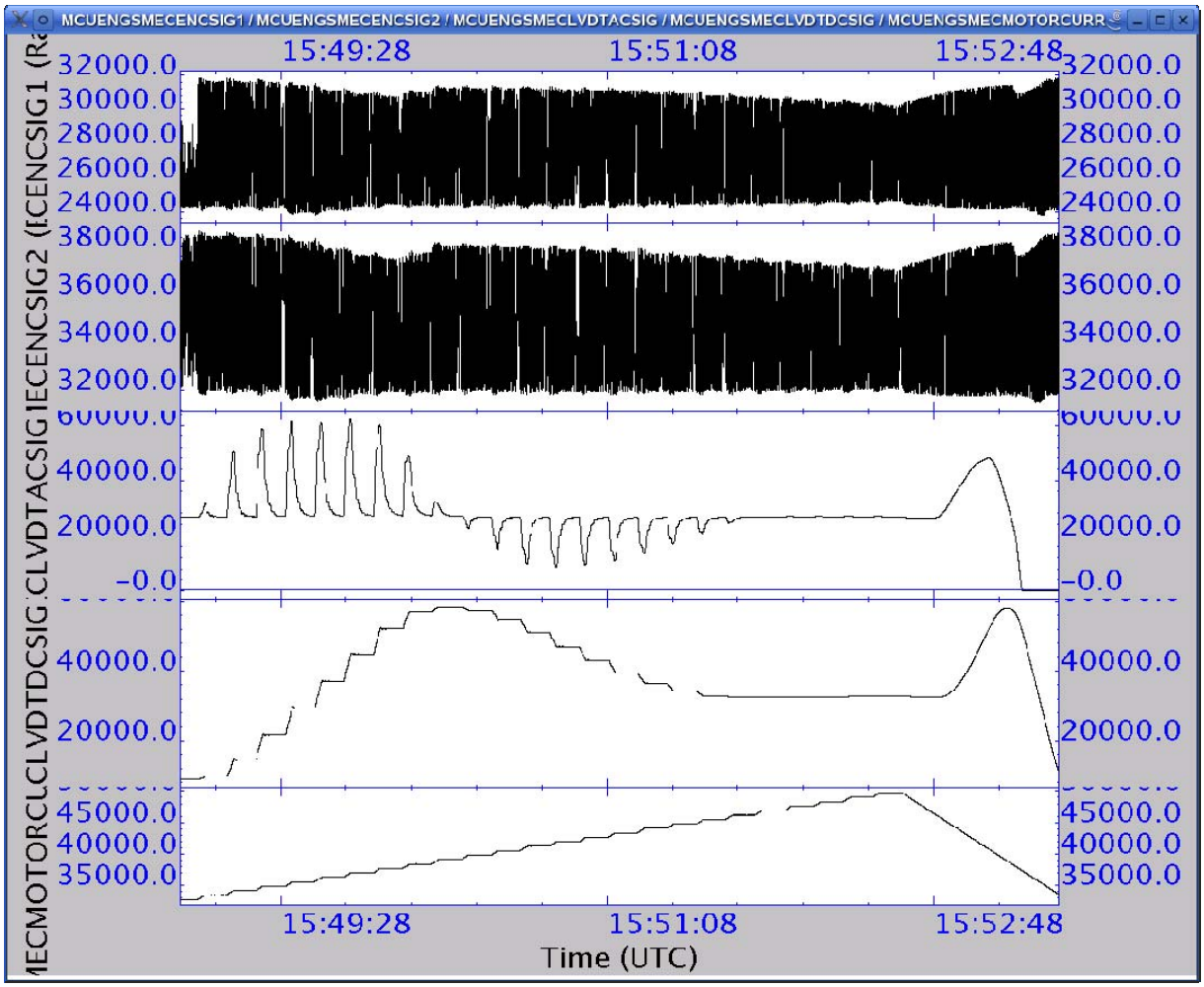
Test Procedure:

Step#	Action
1	**On QLA bring up a time series display of the following Nominal HK parameters:** **SMECENCSIG1** **SMECENCSIG2** **SMECLVDTDCSIG** **SMECLVDTACSIG** **SMECMOTORCURR** **This should be MCU ENG frame parameters not HK parameters**
2	**Run FUNC-SMEC-04a test procedure from the HCSS Test Procedure window on TOPE**
3	Contingency: If test fails repeat steps 1.

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	Nb. of frames received	Test Result
FUNC-SMEC-04a	**SMECLVDTDCSIG**				**Pass**

Start time @: 15:49
End time @: 15:54
OBSID: 0x3000E13B
Comments:



Step#	Action	Comments
4	Execute SMEC_OFF from HCSS Test Procedures	

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

3.3.14 FUNC-DCU-01

Test Id:	**FUNC-DCU-01**
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON
Success Criteria:	Test passed if: 1. DCU produces each type of DCU nominal science frame with the following characteristics.

APID	Type	S.type	SID	Frame ID	Frame type	Nb. Of frames	Nb. of pkts.
0x504	**21**	**1**	**0x200**	**0**	**PF**	**100**	**100**
0x506	**21**	**1**	**0x201**	**1**	**SF**	**100**	**17**
0x504	**21**	**2**	**0x102**	**2**	**PSW**	**100**	**34**
0x504	**21**	**2**	**0x103**	**3**	**PMW**	**100**	**25**
0x504	**21**	**2**	**0x104**	**4**	**PLW**	**100**	**12**
0x506	**21**	**2**	**0x105**	**5**	**SSW**	**100**	**12**
0x506	**21**	**2**	**0x106**	**6**	**SLW**	**100**	**7**

2. The frame time difference between consecutive DCU frames of each type corresponds to the sampling rate.
   Photometer Sampling rate is 15.3Hz → $\Delta t \sim 65.5$ ms
   Spectrometer Sampling rate is 80Hz → $\Delta t = 12.5$ ms
3. The SPIRE HK parameter DCUFRAMECNT increments by 700.
4. No events are generated during the frames generation.

Test Procedure:

Step#	Action
1	**Annotate the current value of DCUFRAMECNT located d in DCU PARAMETERS AND**
	Step missing to run QLA script!
2	**Run FUNC-DCU-01 test procedure from the HCSS Test Procedure window on TOPE**
3	**Annotate the current value of DCUFRAMECNT located d in DCU PARAMETERS AND**
4	Contingency:

	If test fails repeat steps 1 to 3.

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	Nb. of frames received	Test Result
FUNC-DCU-01	**DCUFRAMECNT**	**0/700**	5215/ 5915	700	**Pass**

Start time @: 16:02
End time @: 16:04
OBSID: 0x3000E13D
Comments:

QLA wrote the following file QLA-DCU-01_3000E13D.txt:

```
**************************************************************************
PHOTF: APID = 0x504, SID  = 0x200
_________________________________________________________________________
Parameter      Initial    Final     Increment Expect Incre. Packet Chars.

DCUFRAMECNT    5215       5315      100       100        Packet type = 0x15
TM3N           2285       2385      100       100          subtype = 0x1
FrameTime      53.7600    53.7600                          Frame ID  = 0x0
                                                 Frame Len = 0x126
STATISTICS ON TIME BETWEEN RECEPTION OF 2 CONSECUTIVE FRAMES:
mean  = 53.75883 ms
sigma = 0.00160 ms

**************************************************************************
PHOTSW: APID = 0x504, SID  = 0x102
_________________________________________________________________________
Parameter      Initial    Final     Increment Expect Incre. Packet Chars.

DCUFRAMECNT    5315       5415      100       100        Packet type = 0x15
TM3N           2385       2419      34        34           subtype = 0x2
FrameTime      53.7600    53.7568                          Frame ID  = 0x2
                                                 Frame Len = 0x96
STATISTICS ON TIME BETWEEN RECEPTION OF 2 CONSECUTIVE FRAMES:
mean  = 53.75880 ms
sigma = 0.00144 ms

**************************************************************************
PHOTMW: APID = 0x504, SID  = 0x103
_________________________________________________________________________
Parameter      Initial    Final     Increment Expect Incre. Packet Chars.

DCUFRAMECNT    5415       5515      100       100        Packet type = 0x15
TM3N           2419       2444      25        25           subtype = 0x2
FrameTime      53.7600    53.7568                          Frame ID  = 0x3
                                                 Frame Len = 0x66
STATISTICS ON TIME BETWEEN RECEPTION OF 2 CONSECUTIVE FRAMES:
mean  = 53.75880 ms
sigma = 0.00161 ms

**************************************************************************
PHOTLW: APID = 0x504, SID  = 0x104
_________________________________________________________________________
Parameter      Initial    Final     Increment Expect Incre. Packet Chars.

DCUFRAMECNT    5515       5615      100       100        Packet type = 0x15
TM3N           2444       2456      12        12           subtype = 0x2
FrameTime      53.7568    53.7600                          Frame ID  = 0x4
                                                 Frame Len = 0x36
STATISTICS ON TIME BETWEEN RECEPTION OF 2 CONSECUTIVE FRAMES:
mean  = 53.75880 ms
sigma = 0.00162 ms


**************************************************************************
SPECF: APID = 0x506, SID  = 0x201
_________________________________________________________________________
Parameter      Initial    Final     Increment Expect Incre. Packet Chars.

DCUFRAMECNT    5615       5715      100       100        Packet type = 0x15
```

3.3.15 FUNC-DCU-04P

Test Id:	FUNC-DCU-04P
Initial Configuration:	DRCU_ON + AC/DC thermometry ON+MCU ON
Final Configuration:	DRCU_ON + AC/DC thermometry ON+MCU ON + Photometer LIAs ON
Success Criteria:	Test passed if : 1. SCUDCDCSTAT parameter goes from 4 to 5. 2. Photometer LIA card voltages are showing correct readings of +5V,+9V,-9V. 3. Photometer LIA temperatures show an increase indicating that they are ON.

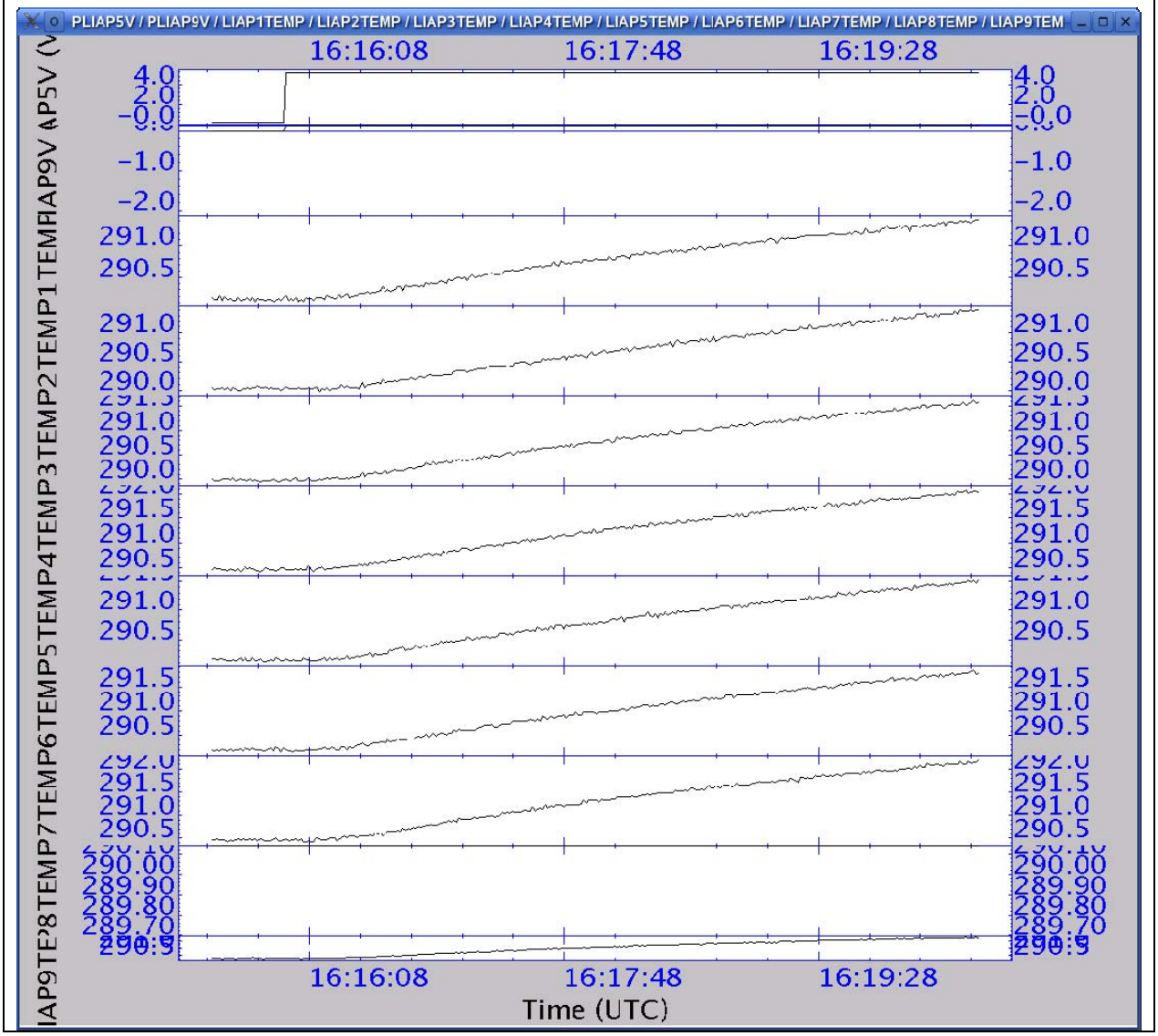
Test Procedure:

Step#	Action
1	**On QLA bring up a time series display of the HK parameters:** **PLIAP5V** **PLIAP9V** **PLIAM9V** **LIAP1/2/3/4/5/6/7/8/9TEMP**
2	**Run FUNC-DCU-04P test procedure from the HCSS Test Procedure window on TOPE**
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	Nb. of frames received	Test Result
FUNC-DCU-04P	**SCUDCDCSTAT** **PLIAP5V** **PLIAP9V** **PLIAM9V** **LIA1/2/3/4/5/6/7/9TEMP**	**4/5** **0/~ +5V** **0/~+9V** **0/~-9V** **N/A/ [290-300]K**	4/5 0.18V/5.19V 0.0027V/ 11.52V 0.0027V/ -11.52V ~ 290K/ 290K and warming up	N/A	**Pass**

Start time @: 16:17
End time @: 16:18
OBSID:0x3000E13E
Comments:



Step#	Action	Comments
4	Execute PLIA_OFF from HCSS Test Procedures	

3.3.16 FUNC-DCU-04S

Test Id:	FUNC-DCU-04S
Initial Configuration:	DRCU_ON + AC/DC thermometry ON+MCU ON

Final Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU ON + Spectrometer LIAs ON
Success Criteria:	Test passed if : 1. SCUDCDCSTAT parameter goes from 4 to 6. 2. Spectrometer LIA card voltages are showing correct readings of +5V,+9V,-9V. 3. Spectrometer LIA temperatures show an increase indicating that they are ON.

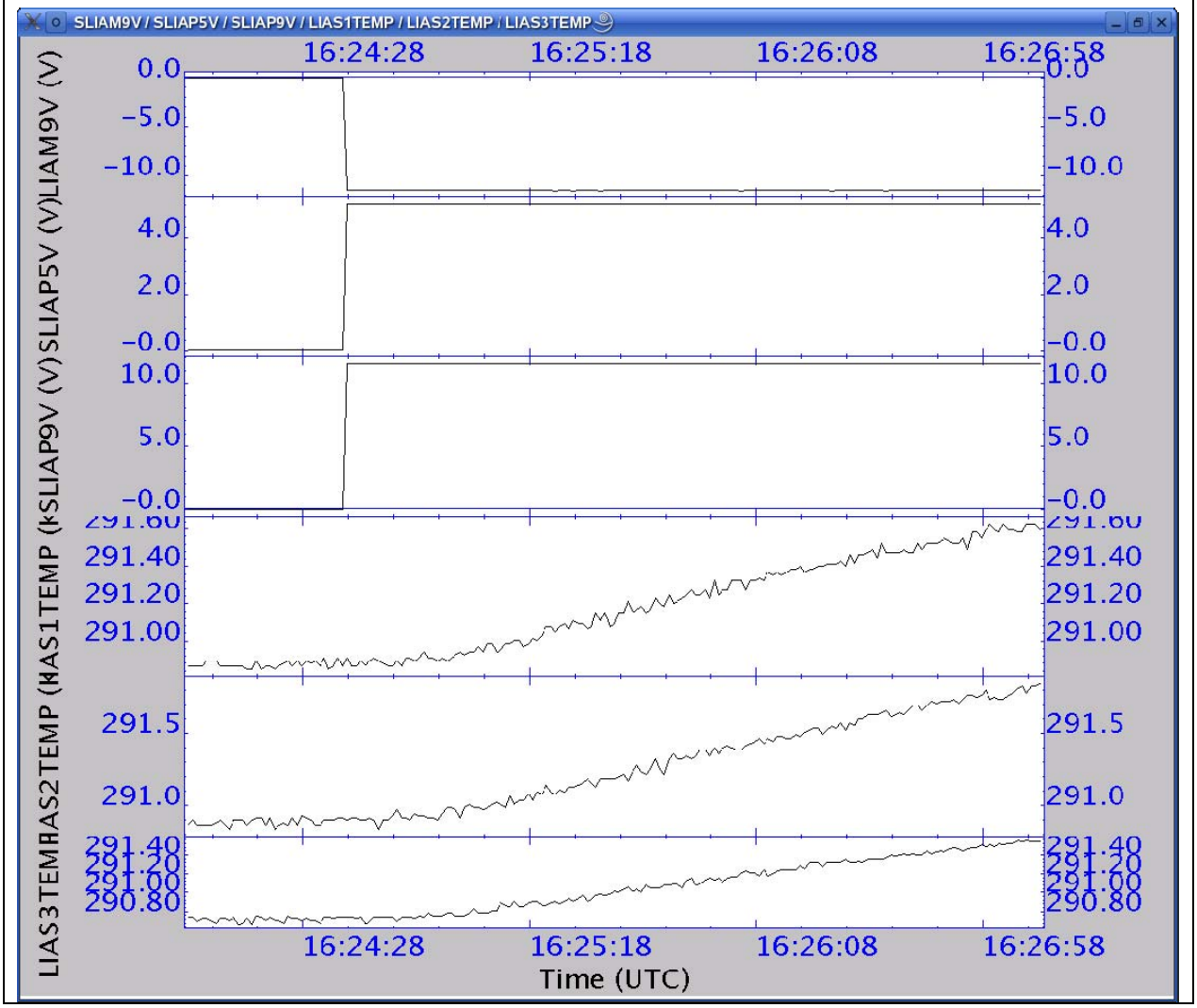
Test Procedure:

Step#	Action
1	**On QLA bring up a time series display of the HK parameters:** **SLIAP5V** **SLIAP9V** **SLIAM9V** **LIAS1/2/3TEMP**
2	**Run FUNC-DCU-04S test procedure from the HCSS Test Procedure window on TOPE**
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	Nb. of frames received	Test Result
FUNC-DCU-04S	**SCUDCDCSTAT** **SLIAP5V** **SLIAP9V** **SLIAM9V** **LIA1/2/3TEMP**	**4/6** **0/~ +5V** **0/~+9V** **0/~-9V** **N/A/ [290-300]K**	4/6 0.075V/ 5.22V 0.0036V/ 11.53V 0.0027V/ -11.52V ~ 290K/ 290K and warming up	N/A	**Pass**

Start time @:16:25
End time @:16:26
OBSID: 0x3000E13F
Comments:



Step#	Action	Comments
4	Execute SLIA_OFF from HCSS Test Procedures	

4. END TEST SEQUENCE

4.1 NORMAL END TEST SEQUENCE

The following table shows the necessary steps to be followed to end the warm functional test sequence.

Step#	Action	HK parameters	Expected Value	Comments	Check
1	Check BSM is OFF	CHOPSENSPWR JIGGSENSPWR	0 0		✓ ✓
2	Check SMEC is OFF	SMECENCPWR	0		✓
3	Run MCU-OFF from the HCSS Test Procedure window on TOPE	SCUDCDCSTAT	0		✓
4	Check Instrument Configuration	MODE	0x100/ DRCU_ON		✓
* These following two steps should ONLY be executed if the functional test takes place BEFORE the instrument is placed in the test cryostat. If the instrument is already in the cryostat and the cryo-harness are connected this steps should NOT be executed.					
5*	Run SCU_OFF from the HCSS Test Procedure window on TOPE	SCUDCDCSTAT SUBKSTAT	0 0		
6*	Run DRCU_OFF from the HCSS Test Procedure window on TOPE	MODE	0/ DPU_ON		

FINAL INSTRUMENT CONFIGURATION IN THE CASE STEPS 1 to 4 are executed is DRCU_ON
FINAL INSTRUMENT CONFIGURATION IN THE CASE STEPS 1 to 6 are executed is DPU_ON

4.2 END TEST SEQUENCE WHEN THE FUNCTIONAL TEST HAS FAILED

The following table shows the necessary steps to be followed to end the warm functional test sequence when this has been declared failed.

Step#	Action	HK parameters	Expected Value	Comments	Check
1	Check BSM is OFF	CHOPSENSPWR JIGGSENSPWR	0 0		
2	Check SMEC is OFF	SMECENCPWR	0		
3	Run MCU-OFF from the HCSS	SCUDCDCSTAT	0		

	Test Procedure window on TOPE				
4	**Check Instrument Configuration**	**MODE**	**0x100/ DRCU_ON**		
5	**Run SCU_OFF from the HCSS Test Procedure window on TOPE**	**SCUDCDCSTAT** **SUBKSTAT**	**0** **0**		
6	**Run DRCU_OFF from the HCSS Test Procedure window on TOPE**	**MODE**	**0/ DPU_ON**		

FINAL INSTRUMENT CONFIGURATION IN THE CASE STEPS DPU_ON

5. ANNEXE1 (INSTRUMENT NOMINAL CONFIGURATION/MODES)

	OFF	INIT	DPU_ON	DRCU_ON	REDY	PHOT STBY	SPEC STBY	CREC	SAFE
DPU		**ON**	**ON**	**ON**	**ON**	**ON**	**ON**	**ON**	**ON**
Essential Hsk packets			0.5Hz	0.5Hz	0.5Hz	0.5Hz	0.5Hz	0.5Hz	0.5Hz
Normal Hsk packets			1.0Hz	1.0Hz	0.25Hz	0.25Hz	0.25Hz	1.0Hz	0.25Hz
TC Acceptance		TBC	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Event packets		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Science packets									
VM								Cooler_Recycle	
VM1						Det_Temp_Ctrl			
VM2									
VM3									
MODE			0x0000	0x0100	0x0200	0x0300	0x0400	0x0600	0x0900
DRCU			**ON**	**ON**	**ON**	**ON**	**ON**	**ON**	
SCU									
Temp Channels powered					Yes	Yes	Yes	Yes	
SubK Channel powered					Yes	Yes	Yes	Yes	
PCAL source powered									
SCAL sources powered							TBD		
TC Heater powered						Yes			
Cooler SP Heater powered								Yes	
Cooler EV HS powered								Yes	
Cooler SP HS powered					Yes	Yes	Yes	Yes	
DCU									
Photometer BIAS						Yes			
Photometer JFETS						Yes			
Photometer LIAs						Yes			
TC BIAS						Yes			
TC JFETS						Yes			
TC LIAs						Yes			
Spectrometer BIAS							Yes		
Spectrometer JFETS							Yes		
Spectrometer LIAs							Yes		
MCU									

DSP					On	On	On	On	
BSM						Hold	Hold		
SMEC							Hold		