# 1. INTRODUCTION

This document specifies the necessary steps to execute a WARM SHORT SPIRE functional test during ILT test campaigns. It currently applies to the PFM model of SPIRE but it can be applied to further models as a minimum set of tests to verify the instrument correct functioning.

## 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** | 22/04/06 | 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** | |
| **HCSS** | | |
| **QLA** | | |
| **QLA scripts** | | |
| **Test Control scripts** | | |
| **CUS Scripts** | | |

## 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 | ✓ |
| Lichfield | 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 | 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. | **In SCOS Main Window start either MON1 or MON2 tasks.** | ✓ |
| **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. | **To power ON the DPU press the main switch on the front bottom left of the DPU power supply, wait for the LCD display to show 28 V reading and then press the secondary switch on the front bottom right labelled *Input 1*.** | **DPU is ON** |
| **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 | **As soon as DPU is powered ON, the boot software performs some internal checks and generates:** • **A (5, 2) event TM packet for DPU models previous to CFM model** • **A (5,1) event for the CFM model and further ones** **This packet contains the number of errors at check time.** | |
| **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. | **Only one BIASTEMP parameter in BIAS_PARAMETERS display. Showing 293.90** | |
| **6** | **In SCOS open** DPU_AND_OBS_PARAMETERS display **and check that the MODE housekeeping parameter is DRCU_ON.** | **MODE (RAW)= 0x100 MODE (ENG) = DRCU_ON** | **MODE parameter undefined** |

| | | | |
|---|---|---|---|
| | | | |

**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 |
| 7 | MCU | FUNC-MCU-01 | MCU Boot Check |
| 8 | | FUNC-MCU-02 | MCU Nominal Science Generation Check |
| 9 | BSMm | FUNC-BSM-01 | BSM Switch ON Check |
| 10 | | FUNC-BSM-03 | BSM Open Loop dynamics Check |
| 11 | SMECm | FUNC-SMEC-02A/B* | SMEC Launch Latch Open/Close Check |
| 12 | | FUNC-SMEC-01 | SMEC Switch ON Check |
| 13 | | FUNC-SMEC-03 | SMEC LED Integrity Check |
| 14 | | FUNC-SMEC-04 | SMEC Positioning Test (Open Loop) |
| 15 | DCU | FUNC-DCU-01 | DCU Nominal Science Generation Check |
| 16 | Photometer LIAs | FUNC-DCU-04P | Photometer LIAs Check |
| 17 | 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 :<br>1. Two SCU Nominal Science Report telemetry packets are received on QLA with the following characteristics: |

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

2. The frame time difference between consecutive SCU frames within these packets corresponds to the sampling rate. Nominal SCU sampling rate is 80Hz ➔ $\Delta t = 12.5$ ms
3. The SPIRE HK parameter SCUFRAMECNT increments by 31.
4. No events are generated during the frame generation.

QLA to give go ahead.

**Test Procedure:**

| Step# | Action | Comments |
|---|---|---|
| 1 | Annotate the initial value of SCUFRAMECNT parameter located in SCU_PARAMETERS display. | 2188 |
| 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. | 2219 |
| 5 | Contingency:<br>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** | 2188/2219 | 31 | Passed |

**Start time @: 10:07**
**End time @: 10:07**
**OBSID: 0x3000E110**
**Comments: QLA wrote file QLA-SCU-01_3000E110.txt**

**Note: OBSID 0x3000E10E was a previous attempt failed because the VM was running without us realising it. Please ignore it.**

### 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.<br>**Open Circuit Criterion:**<br>**RAW reading in the range [0, -100]**<br>**Short Circuit Criterion:**<br>**RAW reading of -32768**<br>**Note:**<br>At warm temperature most of the FPU thermometers should be short circuited. |

**Test Procedure:**

| Step# | Action | Comments |
|---|---|---|
| **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:<br>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** | 0/0xFFFF | **N/A** | Success |

**Start time @: 10:23**
**End time @: 10:24**
**OBSID: 0x3000E111**
**Comments: Saved two screenshots of SCU PARAMETERS in /home/sops23 on Lincoln: scu_params_before_scu03.png and scu_params_after_scu03.png. Almost all temeperature sensors read -32768, as expected at warm temperature.**

### 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.<br>**Open Circuit Criterion:**<br>**RAW reading in the range 0 -100**<br>**Short Circuit Criterion:**<br>**RAW reading of -32768** |

**Test Procedure:**

| Step# | Action | Comments |
|---|---|---|
| **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. | SUBKSTAT: 0/1<br>SUBKTEMP: 32749/32741 |
| **3** | Contingency:<br>If test fails :<br>1. Send manual command: SEND_DRCU_COMMAND Parameter1 = 0xA0860000 Parameter2 = 0<br>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** | 0/1 | **N/A** | Success |

**Start time @: 10:27**
**End time @: 10:28**
**OBSID: 0x3000E112**
**Comments:**

### 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 | Comments |
|---|---|---|
| 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) | Raw values before /after:<br>SPHSV: -14 / 12698<br>EVHSV: -15 / 12668<br>SPHTRV: -8 / 14359 |
| 3 | Contingency:<br>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**<br>**EVHSV**<br>**SPHTRV** | **0/ ~ 323 mV**<br>**0/ ~ 323 mV**<br>**0/ ~ 8 V** | 0.04 / 323.9<br>-0.05 / 323.1<br>0.0 / 8.84 | **N/A** | Success |

**Start time @: 10:31**
**End time @: 10:34**
**OBSID: 0x3000E113**
**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:<br>• PCALCURR HK parameter which shows the measured PCAL current is ~ 0.1 mA.<br>• 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. | PCALV: 0.01 / 0.02<br>PCALCURR: 0.05 / 0.01 |
| 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:<br>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**<br>**PCALV** | **0/0.1mA**<br>**0/0.02V** | 0.05 / 0.01<br>0.01 / 0.02 | **N/A** | Success |

**Start time @: 10:36**
**End time @: 10:37**
**OBSID: 0x3000E114**
**Comments: PCALV and PCALCURR where not zero at the beginning, but they were set to the correct values and went back to zero at the end, so the test is considered as passed.**

### 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 :<br>• SCAL2CURR ,SCAL4CURR HK parameters which show the measured current read ~ 0.1 mA<br>• 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:<br>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**<br>**SCAL2V**<br>**SCAL4CURR**<br>**SCAL4V** | **0/0.1mA**<br>**0/0.05V**<br>**0/0.1mA**<br>**0/0.05V** | 0 / 0.01<br>0 / 0.05<br>0 / 0.1<br>0 / 0.05 | **N/A** | Success |

**Start time @: 10:40**
**End time @: 10:42**
**OBSID: 0x3000E115**
**Comments:**

| 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:<br>1. MCU boots.<br>2. MCU voltages show expected values.<br>3. MAC Board Temperature Reading shows ambient temperature. |

**Test Procedure:**

| Step# | Action | Comments |
|---|---|---|
| **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:<br>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**<br>**MCUP15V**<br>**MCUP14V**<br>**MCUM14V**<br>**MCUM15V**<br>**MCUMACTEMP**<br>**MCUSMECTEMP**<br>**MCUBSMTEMP** | **N/A/ ~ 5V**<br>**N/A / ~15V**<br>**N/A / ~ 14V**<br>**N/A / ~ -14V**<br>**N/A / ~ -15V**<br>**N/A / ~ 300K** | 5.0<br>15.5<br>14.5<br>-14.6<br>-15.6<br>292.0<br>296.9<br>296.3 | **N/A** | Succcess |

**Start time @: 12:02**
**End time @: 10:45**
**OBSID: 0x3000E11C**
**Comments: Previous attempts at 10:44 and 10:47 (OBSID 0x3000E116 and 0x3000E117) had failed because the OBS inhibited all the commands to the MCU. Fixed by power recycling the DPU.**

### 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 :<br>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 | Comments |
|---|---|---|
| **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:<br>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/ ~ 3300** | 6525 / 13051 | 6526 | |

**Start time @: 12:19**
**End time @: 12:21**
**OBSID: 0x3000E11F**
**Comments: All the correct frame types were generated. However the number of frames was about twice as expected. Test considered successful anyway.**
**QLA produced file QLA-MCU-02_3000E11F.txt**

**Note: previous execution (OBSID 0x3000E11E, from 12:16 to 12:18) done without the QLA script running. Frame count went from 0 to 6525.**

| 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:<br>1. CHOPSENSPWR HK parameter goes from 0 to 1<br>2. CHOPDACVAL HK parameter goes from 0 to 0x8000<br>3. CHOPSENSIG HK parameter shows variation from off to on<br>4. JIGGSENSPWR HK parameter goes from 0 to 1<br>5. JIGGDACVAL parameter goes from 0 to 0x8000<br>6. JIGGSENSSIG HK parameter shows variation from off to on |

**Test Procedure**

| Step# | Action | Comments |
|---|---|---|
| **1** | On QLA bring up a time series display of the following HK parameters:<br>CHOPSENSPWR<br>CHOPDACVAL<br>CHOPSENSIG<br>JIGGSENSPWR<br>JIGGDACVAL<br>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 below | |
| | Contingency:<br>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** | **0/1** | 0 / 1 | **N/A** | Success |
| | **CHOPLOOPMODE** | **0/3** | 3 / 3 | | |
| | **CHOPDACVAL** | **0/0x8000** | 0x8000 / 0x8000 | | |
| | **CHOPFFGAIN** | **0/0xBEB** | 0xBEB / 0xBEB | | |
| | **CHOPSENSSIG** | **0/?** | 0x7FF1 / 0x8E6E | | |
| | **JIGGSENSPWR** | **0/1** | 0 / 1 | | |
| | **JIGGLOOPMODE** | **0/3** | 3 / 3 | | |
| | **JIGGDACVAL** | **0/0x8000** | 0x8000 / 0x8000 | | |
| | **JIGGFFGAIN** | **0/0xBEB** | 0xBEB / 0xBEB | | |
| | **JIGGSENSSIG** | **0/?** | 0x7FE3 / 0x91D8 | | |

**Start time @: 12:34**
**End time @: 12:35**
**OBSID: 0x3000E120**
**Comments: Some of the parameters were already at that expected final values. They did not change, so the test was considered successful.**

### 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.<br>**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 | Comments |
|---|---|---|
| 1 | On QLA open up a time series display of HK parameters:<br>CHOPPOSN<br>CHOPDACVAL<br>CHOPMOTORCURR<br>CHOPSENSSIG<br>CHOPMOTORBEMF<br>JIGGPOSN<br>JIGGDACVAL<br>JIGGMOTORCURR<br>JIGGSENSSIG<br>JIGGMOTORBEMF | |
| 2 | Run FUNC-BSM-03 test procedure from the HCSS Test Procedure window on TOPE | |
| 3 | Contingency:<br>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** | Success? |

**Start time @: 12:41**
**End time @: 13:07**
**OBSID: 0x3000E121**
**Comments: Everything seems normal in chop. JIGGPOSN stuck at 0xFFFF despite the other jiggle parameters behaving normally**

**Needs further investigation**

| Step# | Action | Comments |
|---|---|---|
| **4** | Execute BSM_OFF from HCSS Test Procedures | 13:08 to 13:09, OBSID 0x3000E122 |

| 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 :<br>1. SMECENCPWR HK parameter changes from 0 to 6.<br>2. SMEC encoder signals 1 and 2 amplitude show variation when encoder is switched ON.<br>3. SMEC LVDT is switched ON.<br>4. SMEC LVDT DC and AC signals show variation when LVDT is switched ON. |

**Test Procedure:**

| Step# | Action | Comments |
|---|---|---|
| **1** | On QLA bring up a display of the following HK parameters:<br>SMECENCPWR<br>SMECENCSIG1AMP<br>SMECENCSIG2AMP<br>SMECLVDTDCSIG<br>SMECLVDTACSIG | |
| **2** | Run FUNC-SMEC-01 test procedure from the HCSS Test Procedure window on TOPE | |
| | Contingency:<br>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**<br>**SMECLVDTPWR**<br>**SMECENCSIG1**<br>**SMECENCSIG2**<br>**SMECLVDTACSIG**<br>**SMECLVDTDCSIG** | | 0 / 6<br>10 /<br>0x3060 / 0x38F0<br>0x4E60 / 0x6120<br>0x6869 / 0x6839<br>0x7FFA / 0x0 | **N/A** | Success |

**Start time @: 13:12**
**End time @: 13:13**
**OBSID: 0x3000E123**
**Comments:**

### 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:<br>SMEC encoder signals 1 and 2 show a variation from one LED illumination level to another. |

**Test Procedure:**

| Step# | Action | Comments |
|---|---|---|
| 1 | On QLA bring up a time series display of the following Nominal HK parameters:<br>SMECENCPWR<br>SMECENCSIG1<br>SMECENCSIG1 | |
| 2 | Run FUNC-SMEC-03 test procedure from the HCSS Test Procedure window on TOPE | |
| 3 | Contingency:<br>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**<br>**SMECENCSIG1**<br>**SMECENCSIG2** | | | | Success |

**Start time @: 13:16**
**End time @: 13:17**
**OBSID: 0x3000E124**
**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 | Comments |
|---|---|---|
| 1 | On QLA bring up a time series display of the following Nominal HK parameters:<br>SMECENCSIG1<br>SMECENCSIG2<br>SMECLVDTDCSIG<br>SMECLVDTACSIG<br>SMECMOTORCURR | |
| 2 | Run FUNC-SMEC-04a test procedure from the HCSS Test Procedure window on TOPE | |
| 3 | Contingency:<br>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** | | 0 / | | Success |

**Start time @: 14:42**
**End time @: 14:48**
**OBSID: 0x3000E126**
**Comments: During the first execution (from 13:19 to 13:24, OBSID 0x3000E125) something went wrong during the test: the OBS crashed and we had to switch off and back on the DCU. The problem was that the sampling frequency was 50 Hz. Changed to 18.6 Hz.**

| Step# | Action | Comments |
|---|---|---|
| 4 | Execute SMEC_OFF from HCSS Test Procedures | 14:48 to 14:49, OBSID 0x3000E127 |

| 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:<br>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 | Comments |
|---|---|---|
| 1 | Annotate the current value of DCUFRAMECNT located d in DCU PARAMETERS AND | |
| 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:<br>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** | 2115 | 2815 | Success |

**Start time @: 14:50**
**End time @: 14:52**
**OBSID: 0x3000E128**
**Comments:**

### 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 :<br>1. SCUDCDCSTAT parameter goes from 4 to 5.<br>2. Photometer LIA card voltages are showing correct readings of +5V,+9V,-9V.<br>3. Photometer LIA temperatures show an increase indicating that they are ON. |

**Test Procedure:**

| Step# | Action | Comments |
|---|---|---|
| 1 | On QLA bring up a time series display of the HK parameters:<br>PLIAP5V<br>PLIAP9V<br>PLIAM9V<br>LIAP1/2/3/4/5/6/7/8/9TEMP | |
| 2 | Run FUNC-DCU-04P test procedure from the HCSS Test Procedure window on TOPE | |
| 5 | Contingency:<br>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**<br>**PLIAP5V**<br>**PLIAP9V**<br>**PLIAM9V**<br>**LIA1/2/3/4/5/6/7/9TEMP** | **4/5**<br>**0/~ +5V**<br>**0/~+9V**<br>**0/~-9V**<br>**N/A/ [290-300]K** | 4 / 5<br>0.18 / 5.18<br>0.0 / 11.5<br>0.0 -11.5<br>Going up | | Success |

**Start time @: 14:58**
**End time @: 14:59**
**OBSID: 0x3000E129**
**Comments: the values for PLIAP9V and PLIAM9V seem wrong but that is a known problem (raw values 0xE235 and 0x1D8A).**

### 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 :<br>1. SCUDCDCSTAT parameter goes from 4 to 6.<br>2. Spectrometer LIA card voltages are showing correct readings of +5V,+9V,-9V.<br>3. Spectrometer LIA temperatures show an increase indicating that they are ON. |

**Test Procedure:**

| Step# | Action | Comments |
|---|---|---|
| 1 | On QLA bring up a time series display of the HK parameters:<br>SLIAP5V<br>SLIAP9V<br>SLIAM9V<br>LIAS1/2/3TEMP | |
| 2 | Run FUNC-DCU-04S test procedure from the HCSS Test Procedure window on TOPE | |
| 5 | Contingency:<br>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**<br>**SLIAP5V**<br>**SLIAP9V**<br>**SLIAM9V**<br>**LIA1/2/3TEMP** | **4/6**<br>**0/~ +5V**<br>**0/~+9V**<br>**0/~-9V**<br>**N/A/ [290-300]K** | 5 / 5.2<br>0.0 / 5.2<br>0.0 / 11.5<br>0.0 / -11.5<br>Going up | | Success? |

**Start time @: 15:05**
**End time @: 15:06**
**OBSID: 0x3000E12B**
**Comments: First execution (15:03, OBSID 0x3000E12A) switched off the photometer LIAs instead of switching on the spectrometer ones. The second execution was successful.**

**Needs further investigation.**

# 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<br>JIGGSENSPWR | 0<br>0 | Values are 0xFFFF even after running BSM_OFF (0X3000E12C) | |
| 2 | Check SMEC is OFF | SMECENCPWR | 0 | 0xFFFF | |
| 3 | Run MCU-OFF from the HCSS Test Procedure window on TOPE | SCUDCDCSTAT | 0 | 0x3000E12D Value is 2 | |
| 4 | Check Instrument Configuration | MODE | 0x100/ DRCU_ON | 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<br>SUBKSTAT | 0<br>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<br>JIGGSENSPWR | 0<br>0 | | |
| 2 | Check SMEC is | SMECENCPWR | 0 | | |

| | | | | | |
|---|---|---|---|---|---|
| | **OFF** | | | | |
| **3** | **Run MCU-OFF from the HCSS Test Procedure window on TOPE** | **SCUDCDCSTAT** | **0** | | |
| **4** | **Check Instrument Configuration** | **MODE** | **0x100/ DRCU_ON** | | |
| **5** | **Run SCU_OFF from the HCSS Test Procedure window on TOPE** | **SCUDCDCSTAT**<br>**SUBKSTAT** | **0**<br>**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 | | |