SUBJECT:	SPIRE Functional test specifications	
PREPARED BY:	Samuel Ronayette (U of L/RAL) Asier Abreu (U of L/RAL)	
DOCUMENT No:	SPIRE-RAL-DOC-001652	
ISSUE:	**Issue 1.4**	**Date:** **22/07/2005**
CHECKED BY:	Asier Abreu (U o L/ RAL)	**Date:** **15/06/2005**
APPROVED BY:		Date:

Distribution

RAL	Dave Smith
	Ken King
	Bruce Swinyard
	Tanya Lim
	Sunil Sidher
	Eric Sawyer
	Doug Griffin
	Eric
UofCardiff	Tim Waskett
	Peter Hargrave
Imperial College	Davide Rizzo

Change Record

ISSUE	DATE	Changes
0.1	08th April 2003	1st Draft for comment
0.2	28th April 2003	Updated Draft incorporating comments
0.3	23rd May 2003	test FUNC-MCU-05 changed into test FUNC-SMEC-02 10 DCU test specification added
0.3_1	2nd June 2003	Page Headers Corrected
0.4	20th June 2003	test FUNC-DCU-06 updated
0.5	25th July 2003	LEDs test added (FUNC-SMEC-04) DCU tests modified, new numbering
0.6		Characterisation tests described in more details FUNC-SMEC-01 includes initialisation and SMEC initialisation removed Definition of a switch on detector "test" Test condition summary added Test flow added
0.7	2nd Sept. 2003	New format Command names added Values of parameters added
1.0 (draft 1)	22/09/2003	BSM-04 modified FUNC-SCAL-02 modified FUNC-SCU-07 modified FUNC-DCU-04 to FUNC-DCU-11 split in photometer and spectrometer tests FUNC-DCU-08 split in short and full test "switch off" procedure added in each test concerned Use of the command SetDRelOnOff corrected
1.0 (draft 2)	05/12/2003	New definition of BSM tests (open loop)
1.0	23/12/2003	New BSM test (BSM-05c and j) Other BSM tests revised Spectro sampling frequency corrected (in DCU tests) Flow chart updated SMEC launch latch test modified Other SMEC test revised (cf use of open loop command)
1.1	?	?
1.2	05/07/2004 06/08/2004	Correct current values for SCU-07 Cooler Heater Check DCU Frequency test: new frequencies BBID and STEPS added (Asier) Several updates to the functional tests specification. Functional tests affected : SCU-FUNC-03 comments added (see comments) SCU-FUNC-07 command specification corrected DCU-FUNC-04 comments added DCU-FUNC-05 to 08(P/S) step setting corrected
1.3	11/11/04 20/12/04	MCU, SMEC and BSM tests updated according to the new MCU IDC (V4.0) BBIDs and STEPs added to MCU,SMEC and BSM functionsl tests SCU-04 and SCU-05 (PCAL and SCAL): current parameter modified
1.4	16/05/05-15/06/05	Changes to the BSM functional test sequence.

		Changes to the commanding sequence definition

TABLE OF CONTENTS

FIGURES

TABLES

Glossary

AD	Applicable Document
AIV	Assembly Integration and Verification
AVM	Avionics Model
BSM	Beam Steering Mechanism
CQM	Cryogenic Qualification Model
DCU	Detector Control Unit
DPU	Digital Processing Unit
DRCU	Detector Readout and Control Unit
EGSE	Electrical Ground Support Equipment
FLT	Flight Level Test
FTS	Fourier Transform Spectrometer
HOB	Herschel Optical Bench
ILT	Instrument Level Test
IST	Integrated System Test
MCU	Mechanism Control Unit
MGSE	Mechanical Ground Support Equipment
N/A	Not Applicable
PCAL	Photometer Calibrator source
PFM	Proto-Flight Model
PLT	Payload Level Test
RAL	Rutherford Appleton Laboratory
RD	Reference Document
SCAL	Spectrometer Calibrator source
SCU	Subsystem Control Unit
SMEC	Spectrometer Mechanism
SPIRE	Spectral and Photometric Imaging Receiver
STM	Structural Test Model
TBC	To Be Confirmed
TBD	To Be Defined
TFCS	Test Facility Control System
AD	Applicable Document
AIV	Assembly Integration and Verification
AVM	Avionics Model

1. INTRODUCTION

1.1 Scope

This document contains the functional test specification for SPIRE. These are tests of different subsystems (SCU, MCU, SMEC, BSM, PCAL, SCAL, DCU) that will be performed on different model of the instrument (AVM, CQM, PFM, FS). They consist of integrity check and characterisation tests. These tests are not calibration or performance tests.

1.2 Structure of Document

A summary of each test is given first (name, short description) and in the following section, we give the specification of each test. They are grouped together per subsystem (respectively SCU, MCU, SMEC, BSM, PCAL, SCAL, and DCU)

1.3 Documents

Applicable Documents

	Title	Author	Reference	Date
AD 1	SPIRE Data ICD	K.J. King	SPIRE-RAL-PRJ-001078, issue 1.0	15/01/2003
AD2	MCU/DCU Command list ICD an user manual	Didier Ferrand	LAM/ELE/SPI/011011, issue 3.0	15/01/2003
AD3	DRCU/DPU ICD	Pinsard, Ferrand, Mur	Sap-SPIRE-Cca-076-02, issue 1.0	14/02/2003

Reference Documents

	Title	Author	Reference	Date
RD 1	Subsystem reaction for specification for the instrument simulator	Bruce Swinyard	SPIRE-RAL-NOT-001715, issue 1.0	11/06/2003
RD 2	Operating modes for the SPIRE instrument	Bruce Swinyard, Matt Griffin	SPIRE-RAL-DOC-000320, issue 3.0	04/01/2002
RD 3	MCU/BSM DM Mechanism, Integration and test report	Didier Ferrand	LAM/ELE/SPI/031020, issue 1.0	20/10/2003
RD4	Instrument Requirements Document	Bruce Swinyard	SPIRE-RAL-PRJ-000034 Issue 1.1	10/01/2002

2. TEST SUMMARIES

2.1 SCU tests

2.1.1 FUNC-SCU-01, SCU Science packet generation check

To check the integrity of SCU science packet interface and that the SCU generates the nominal science frame data. Request SCU science frame and check that all the frames are received correctly by the DPU

2.1.2 FUNC-SCU-02, SCU Science data check

Checking the integrity of the SCU science data. Request science frames and housekeeping data and compare content

2.1.3 FUNC-SCU-03, SCU DC thermometry check

To check the integrity of thermometers. Switch on thermometers all at once and check values

2.1.4 FUNC-SCU-04, SCU PCAL check

Checking the integrity of PCAL. Switch on PCAL, set a current and check voltage and current, then switch off

2.1.5 FUNC-SCU-05, SCU SCAL check

Checking the integrity of SCAL. Switch on SCAL, set a current and check voltage, current and temperature changes, then switch off

2.1.6 FUNC-SCU-06, SCU AC thermometry check

Checking the integrity of the AC thermometer. Switch on AC thermometers and check values

2.1.7 FUNC-SCU-07, SCU cooler heater check

Checking the integrity of the cooler heaters. Switch on heaters, check voltage

2.1.8 FUNC-SCU-08, SCU Test pattern test

Checking the integrity of SCU test pattern packet. Load test pattern and check content of packets

2.2 MCU tests

2.2.1 FUNC-MCU-01, MCU power on

To power on the MCU into a state ready to execute SMEC or BSM commands.
This procedure also tests the low speed interface to the MCU, used for command and housekeeping data transfer.
Apply power to MCU from SCU and boot the MCU DSP ROM software, checking voltages and status

2.2.2 FUNC-MCU-02, MCU Science packet generation check

To check the integrity of MCU science packet interface and that the MCU generates all the nominal science data frames. Generate science data from the SMEC and BSM at typical data rates and check that all the frames are received correctly by the DPU.

2.2.3 FUNC-MCU-03, MCU Science data check

Checking the integrity of MCU science data. Compare science data with HK. Perform test for each type of packet. (SMEC, BSM, ENG)

2.2.4 FUNC-MCU-04, MCU test pattern test

Checking the integrity of MCU test pattern packets. Load MCU test pattern and check contents of packets.

2.3 SMEC tests

2.3.1 FUNC-SMEC-01, SMEC switch on and initialisation

Switching on and initialising SMEC. SMEC ends up at home position and is ready for following tests. Switch on various part of the SMEC system then initialise it. Check parameters

2.3.2 FUNC-SMEC-02, SMEC launch latch check

Checking that the launch latch works properly. Open launch latch, move SMEC short distance and check response

2.3.3 FUNC-SMEC-03, SMEC LEDs test

Checking integrity of the LEDs. Switch on LEDs and step up voltages

2.3.4 FUNC-SMEC-04, SMEC position test

Checking that SMEC moves to the position commanded. Move to set positions and measure read back position, currents, back emf

2.3.5 FUNC-SMEC-05, SMEC multiple position test

Characterising SMEC movement for a step-and-look scan. Perform a step-and-look scan, measure positions, current, back emf

2.3.6 FUNC-SMEC-06, SMEC saw tooth scan test

Characterising SMEC movement during a saw tooth scan. Scan over range and measure positions, current, back-emf – repeat for different scans

2.3.7 FUNC-SMEC-07, SMEC triangular scan test

Characterising SMEC movement during a triangular scan. Scan over range and measure positions, current, back-emf – repeat for different scans

2.3.8 FUNC-SMEC-08, SMEC open loop position test

Characterisation test. Move SMEC to a position in open loop. Scale BEMF. Move to a new position

2.3.9 FUNC-SMEC-09, SMEC open loop scan test

Identical to FUNC-SMEC-07 but with control lop open

2.4 BSM tests

2.4.1 FUNC-BSM-01c/j, BSM power on motor and sensor

Checking the integrity of BSM motors and sensors. Switch BSM motors on. Check telemetry responses, consumed power. Perform a small step

2.4.2 FUNC-BSM-02c/j, position test, open loop

Observing the behaviour of the BSM in open loop. Determining sensor sensibility and scaling the back emf

2.4.3 FUNC-BSM-03c/j, BSM raster test, open loop

2.4.4 FUNC-BSM-04c/j, BSM position test, close loop

2.4.5 FUNC-BSM-05c/j, BSM scan test, close loop

2.4.6 FUNC-BSM-06, BSM operating mode test

Characterising BSM movement on chop axis for various positions on jiggle axis. Set BSM to each mode (Chop, jiggle…). Check telemetry response, consumed power

2.5 PCAL test

2.5.1 FUNC-PCAL-01, PCAL characterisation test

Characterising PCAL. Go through each setting and measure telemetry response

2.6 SCAL tests

2.6.1 FUNC-SCAL-01, SCAL characterisation test

Characterising SCAL. Set current and record temperatures

2.6.2 FUNC-SCAL-02, SCAL PID test

Verifying that the PID controller works properly. Set temperatures and record temperatures

2.7 DCU tests

2.7.1 FUNC-DCU-01, DCU Science Packet generation check

Checking the integrity of the DCU science packet generation. Request DCU science packet and check that the number of frames generated matches the number commanded

2.7.2 FUNC-DCU-02, DCU Science data check

Checking the integrity of the DCU science packet. Request DCU science packet and check some values

2.7.3 FUNC-DCU-03, DCU Test pattern test

Checking the integrity of the DCU test pattern. Load test pattern and check content of packets. Perform for each type of packet (Photometer and Spectrometer)

2.7.4 FUNC-DCU-04P/S, DCU LIAs switch on

Checking the integrity of the LIAs. Switch on LIAs. Check parameter values

2.7.5 FUNC-DCU-05P/S, DCU Offset test

Characterising the detector output for various values of offset. Change offsets up and down, record output and analyse off line

2.7.6 FUNC-DCU-06P/S, DCU JFET heaters

Characterising influence of JFET heaters on detectors output. Switch on JFET heaters. Record detector signal, derive noise

2.7.7 FUNC-DCU-07P/S, DCU JFET test

Characterising detector signal for various JFET drain voltages. Switch on JFETS with Vdd on. Activate auto-offset control. Measure noise. Vary Vss and measure noise

2.7.8 FUNC-DCU-08P/S_full, DCU Phase shift test

Adjusting the demodulation phase. Adjust phase by small amounts until maximum signal is found

2.7.9 FUNC-DCU-08P/S_short, DCU Phase shift test

Shorter version of the previous

2.7.10 FUNC-DCU-09P/S, DCU Bias frequency test

Characterising detector signal for various bias frequencies. Set up bias frequency. Measure noise

2.7.11 FUNC-DCU-10P/S, DCU Bias amplitude test

Characterising detector signal for various bias amplitudes. Set bias amplitude. Measure change in signal level, measure noise, read out offsets

2.7.12 FUNC-DCU-11P/S, DCU detectors switch on

Switching on the all chain for reading detectors signal. This procedure must be performed before test FUNC-DCU-08, FUNC-DCU-09 and FUNC-DCU-10 – see flowchart p17

2.7.13 FUNC-DCU-12P/S, DCU detectors settings

Setting sampling frequency, bias frequency, bias amplitude and demodulation phase when LIA and JFET are already on. This procedure must be performed after FUNC-DCU-04 and FUNC-DCU-07 before carrying on with tests FUNC-DCU-08, FUNC-DCU-09 and FUNC-DCU-10. – see flowchart p17

3. SUMMARY OF TEST CONDITION AND TEST FLOW

In this section is table that sum up the condition in which each test is performed, i.e. instrument configuration, if the test is performed during short functional test, during warm functional test. It is followed by the test flow

3.1 Summary of test condition

S: performed during Short functional test
F: performed during Full functional test
W: performed during Warm functional test
C: performed during Cold functional test
*: test that have a short and a full version (refer to procedure for details)
!: different script according to instrument model (refer to procedure for details)
?: TBD or TBC

TEST	TEST CONDITION				Estimated dur.
FUNC-SCU-01	S	F	W	C	
FUNC-SCU-02		F	W	C	
FUNC-SCU-03	S	F	W	C	
FUNC-SCU-04	S	F	W	C	
FUNC-SCU-05	S	F	W	C	
FUNC-SCU-06	S	F	W	C	
FUNC-SCU-07	S	F	W	C	
FUNC-SCU-08		F	W	C	
FUNC-MCU-01	S	F	W	C	
FUNC-MCU-02	S	F	W	C	
FUNC-MCU-03		F	W	C	
FUNC-MCU-04		F	W	C	
FUNC-SMEC-01	S	F	W	C	
FUNC-SMEC-02	S	F	W	C	
FUNC-SMEC-03	S	F	W	C	
FUNC-SMEC-04	S	F	W	C	
FUNC-SMEC-05		F		C	
FUNC-SMEC-06		F		C	
FUNC-SMEC-07		F		C	
FUNC-SMEC-08		F		C	
FUNC-SMEC-09		F		C	
FUNC-BSM-01	S	F	W	C	
FUNC-BSM-02		F		C	
FUNC-BSM-03		F		C	
FUNC-BSM-04		F		C	
FUNC-BSM-05		F		C	
FUNC-BSM-06		F		C	
FUNC-PCAL-01		F	W	C	

FUNC-SCAL-01		F	W?	C			
FUNC-SCAL-02		F	W?	C			
FUNC-DCU-01	S	F	W	C	*		
FUNC-DCU-02		F	W	C	*		
FUNC-DCU-03		F	W	C	*		
FUNC-DCU-04P/S	S	F	W	C			
FUNC-DCU-05P/S		F		C		!	
FUNC-DCU-06P/S		F		C		!	
FUNC-DCU-07P/S		F		C		!	
FUNC-DCU-08P/S_full		F		C		!	
FUNC-DCU-08P/S_short		F		C		!	
FUNC-DCU-09P/S		F		C		!	
FUNC-DCU-10P/S		F		C		!	
FUNC-DCU-11P/S		F		C		!	
FUNC-DCU-12P/S							

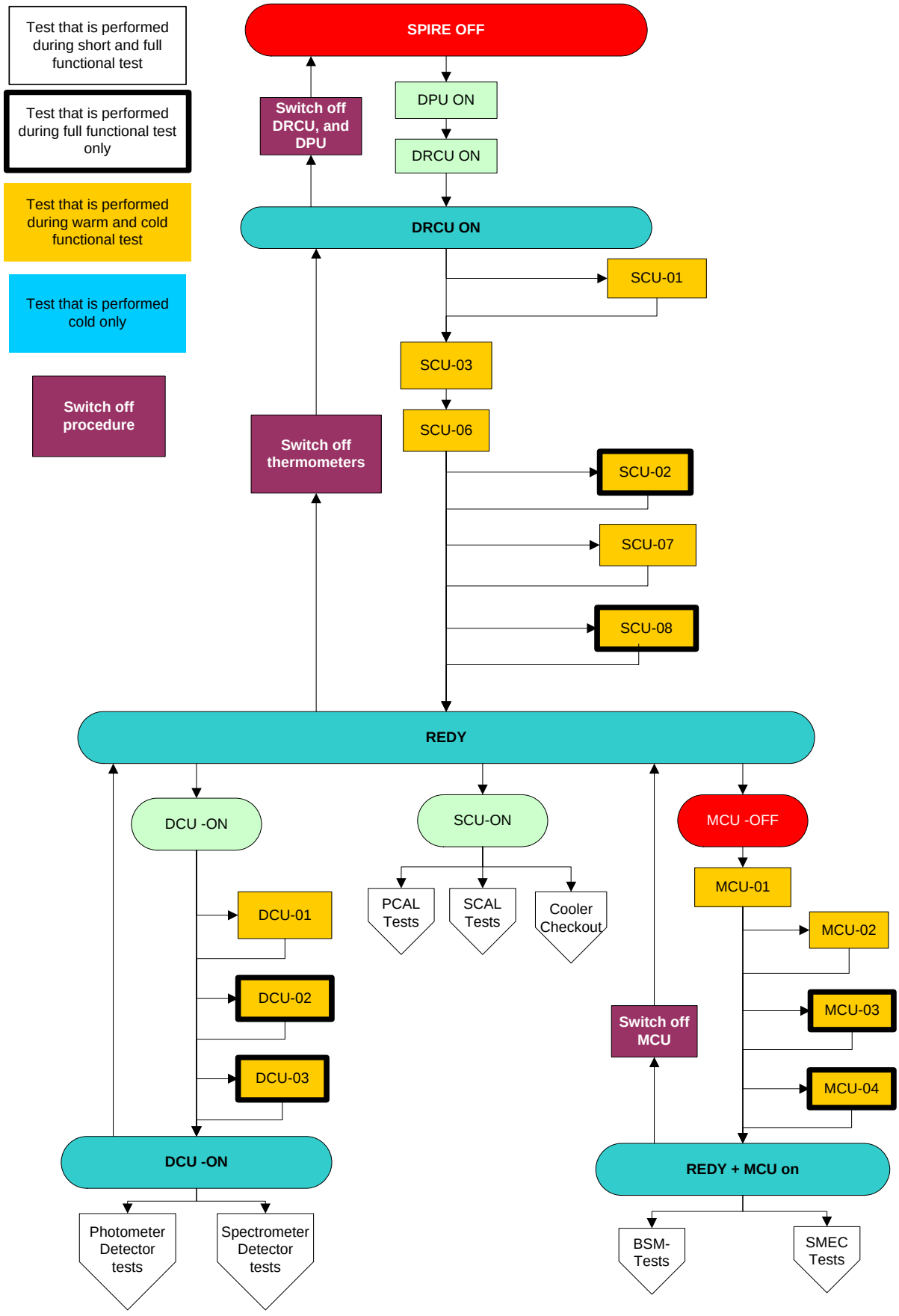
Total duration:

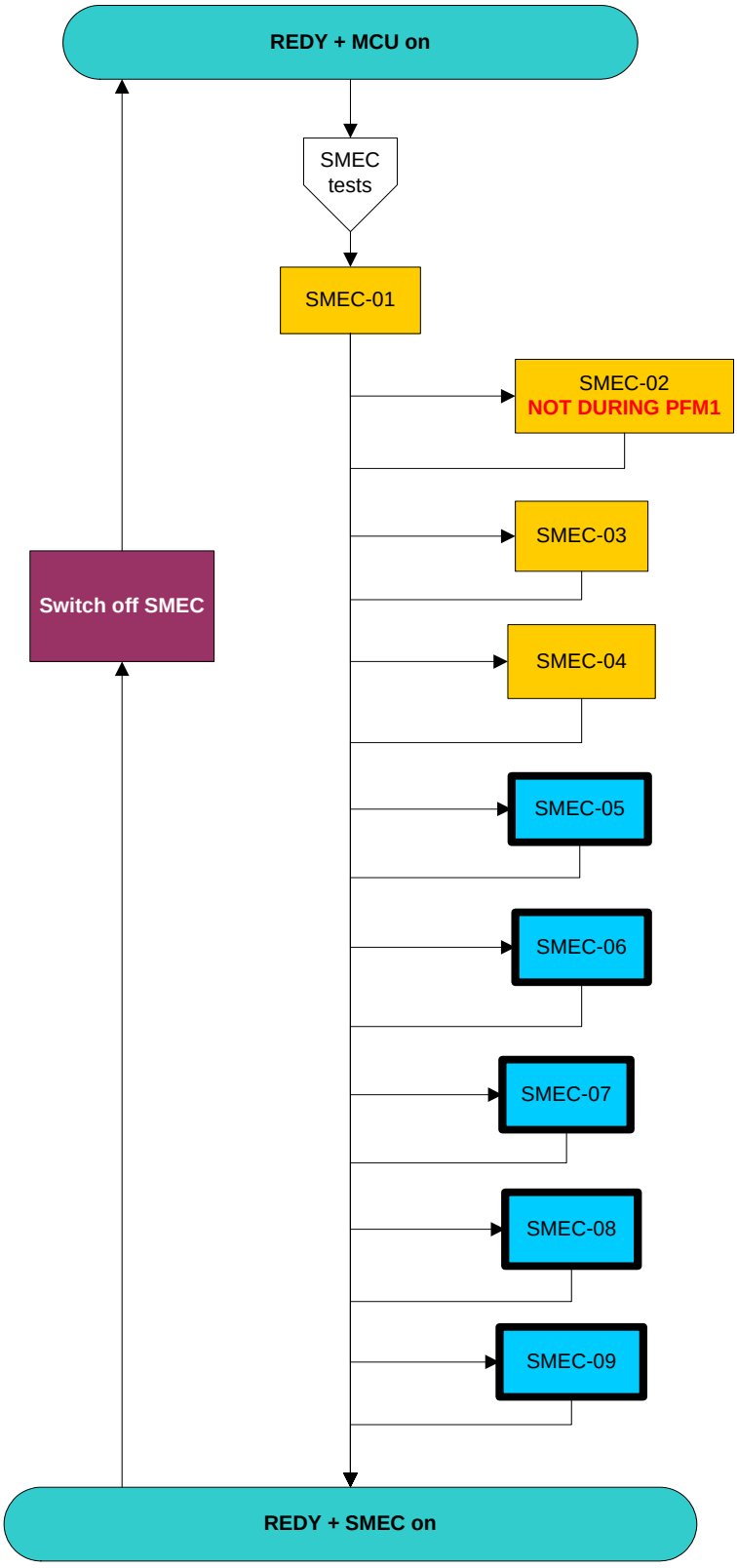
Comment/open issues
-There might be other tests that deserve a * (different short and full), TBD

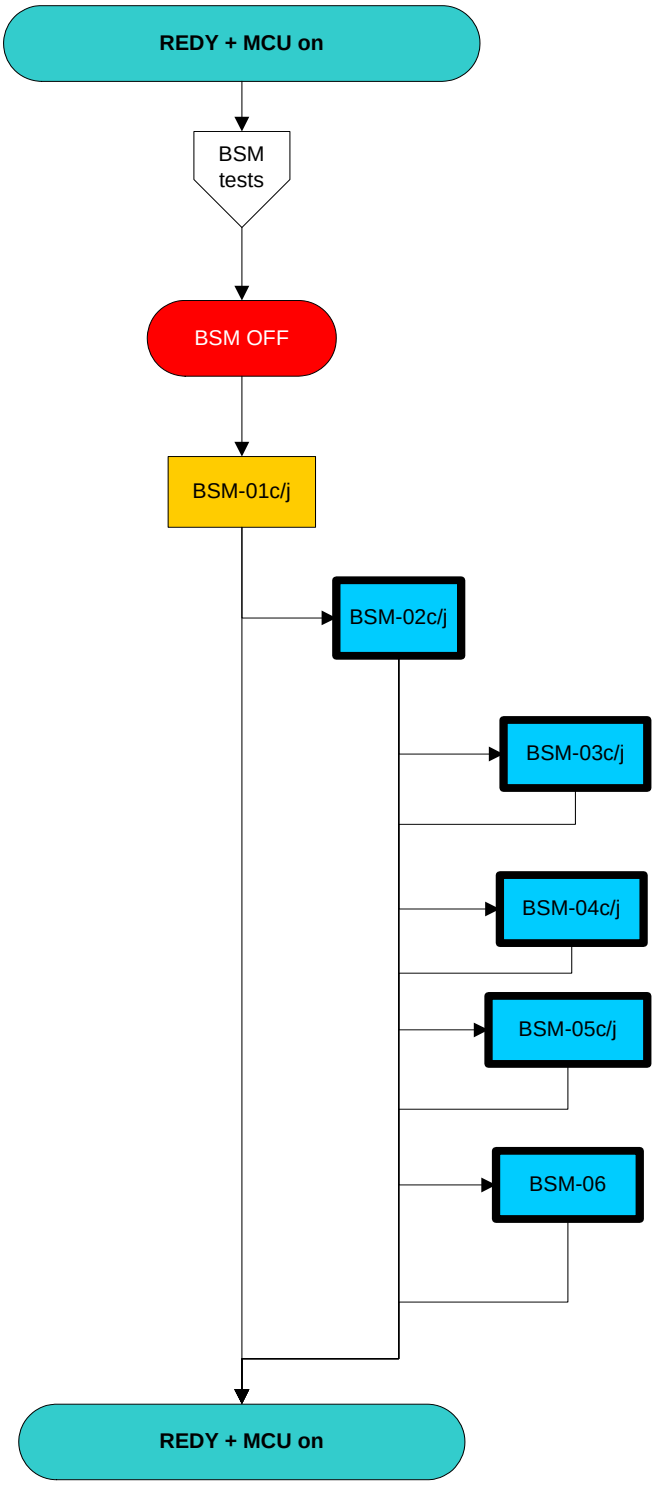
3.2 Test flow

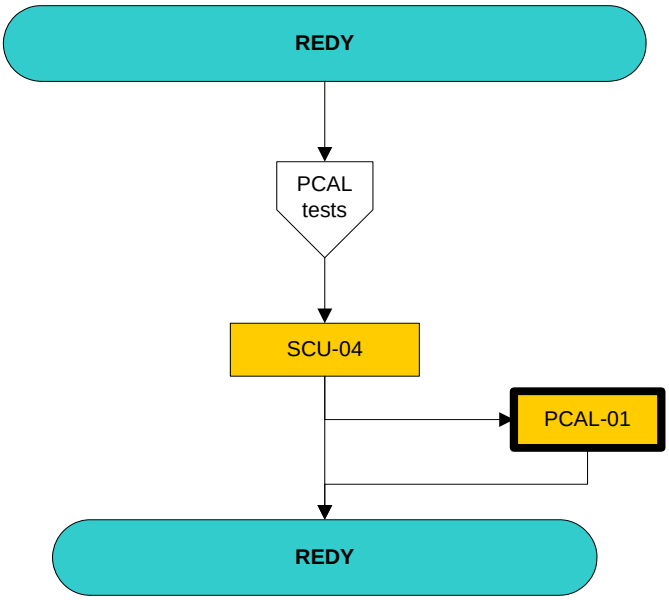
Warm short functional test: perform test in yellow boxes only
Warm full functional test: perform test in yellow and pink boxes only
Cold short functional test: perform test in yellow and blue boxes only
Cold full functional test: perform all tests
Test into brackets: cannot be performed with the CQM

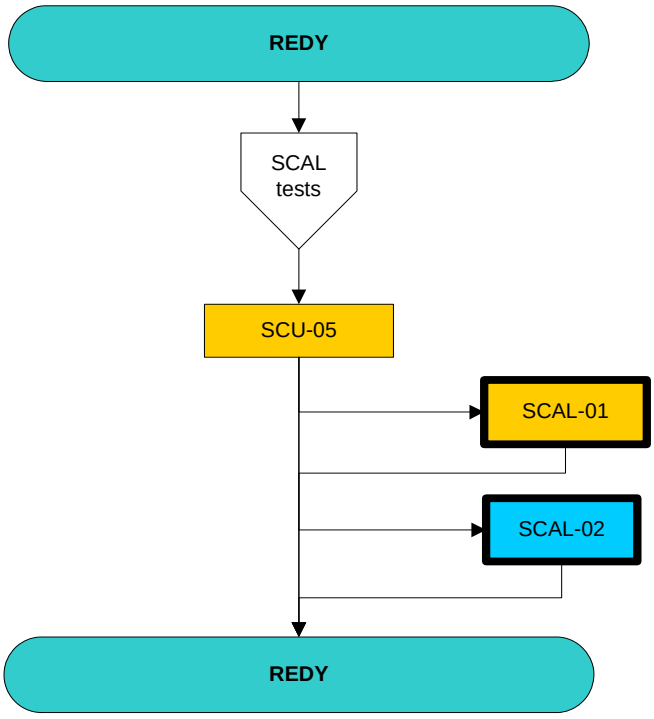
Comment/open issues:
-Maybe FUNC-SCU-06 (AC thermometry) should be repeated when the detectors are at 300 mK?

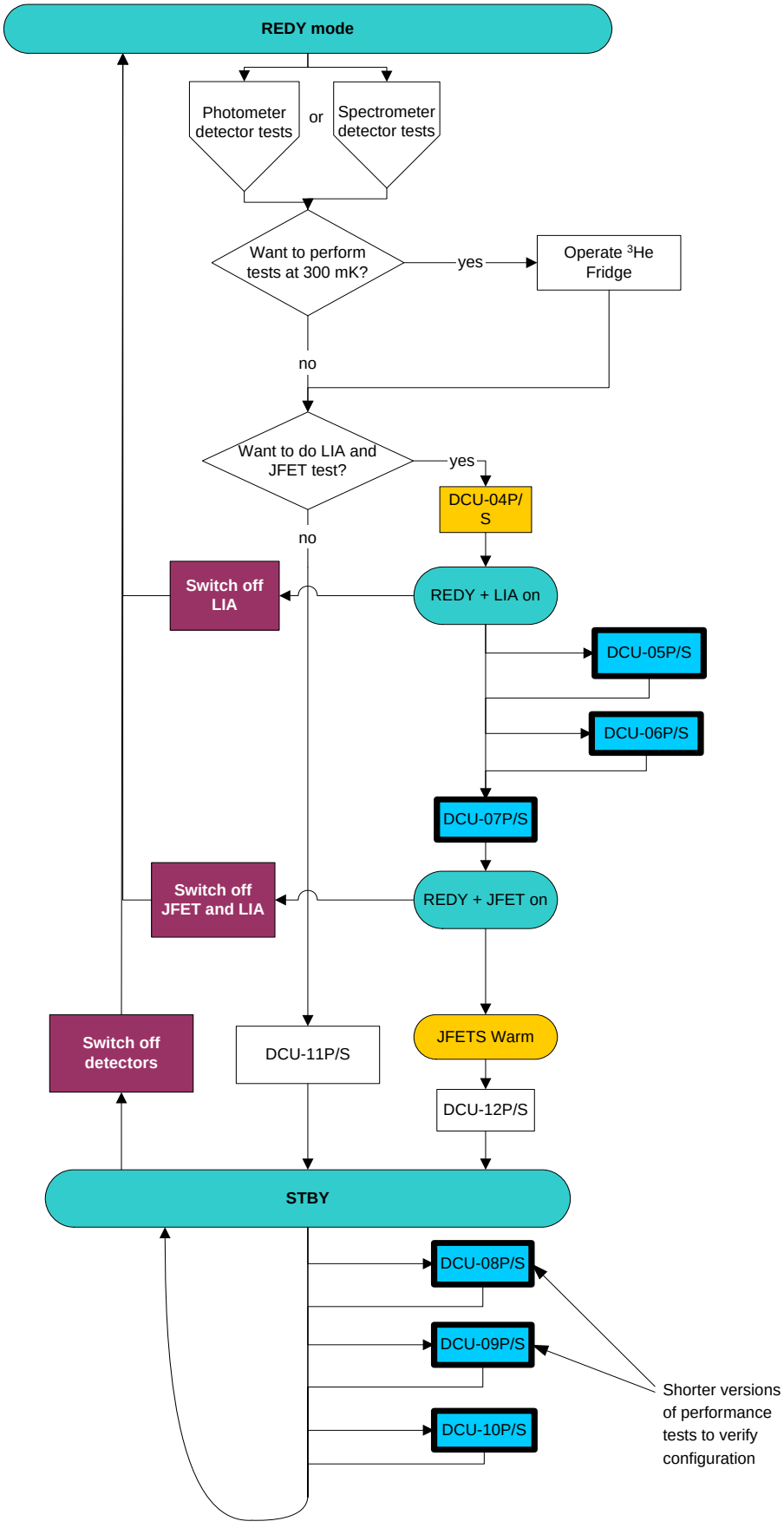

Test that is performed during short and full functional test
Test that is performed during full functional test only
Test that is performed during warm and cold functional test
Test that is performed cold only
Switch off procedure
SPIRE OFF
DPU ON
DRCU ON
Switch off DRCU, and DPU
DRCU ON
SCU-01
SCU-03
SCU-06
Switch off thermometers
SCU-02
SCU-07
SCU-08
REDY
DCU -ON
SCU-ON
MCU -OFF
DCU-01
DCU-02
DCU-03
PCAL Tests
SCAL Tests
Cooler Checkout
MCU-01
MCU-02
MCU-03
MCU-04
Switch off MCU
DCU -ON
REDY + MCU on
Photometer Detector tests
Spectrometer Detector tests
BSM-Tests
SMEC Tests


REDY + MCU on
SMEC tests
SMEC-01
SMEC-02
NOT DURING PFM1
SMEC-03
SMEC-04
SMEC-05
SMEC-06
SMEC-07
SMEC-08
SMEC-09
Switch off SMEC
REDY + SMEC on


REDY + MCU on
BSM tests
BSM OFF
BSM-01c/j
BSM-02c/j
BSM-03c/j
BSM-04c/j
BSM-05c/j
BSM-06
REDY + MCU on


REDY
PCAL tests
SCU-04
PCAL-01
REDY


REDY
SCAL tests
SCU-05
SCAL-01
SCAL-02
REDY


REDY mode
Photometer detector tests
or
Spectrometer detector tests
Want to perform tests at 300 mK?
yes
Operate ³He Fridge
no
Want to do LIA and JFET test?
yes
DCU-04P/S
no
Switch off LIA
REDY + LIA on
DCU-05P/S
DCU-06P/S
DCU-07P/S
Switch off JFET and LIA
REDY + JFET on
Switch off detectors
DCU-11P/S
JFETS Warm
DCU-12P/S
STBY
DCU-08P/S
DCU-09P/S
DCU-10P/S
Shorter versions of performance tests to verify configuration

4. TEST SPECIFICATIONS

4.1 FUNC-SCU-01, SCU science packet generation check

ID:	FUNC-SCU-01
Purpose	To check the integrity of SCU science packet interface and that the SCU generates the nominal science frame data
Description of test:	Request SCU science frame and check that all the frames are received correctly by the DPU
Test Type:	Integrity Check
Instrument Models:	AVM/CQM/PFM/FS
Redundancy:	prime and redundant
Initial configuration	SPIRE in REDY mode
Final configuration:	Idem
EGSE Configuration:	SCOS-2000 required
Level	ILT/PLT/IST/FLT
Test Conditions:	Warm or Cold
Total duration	< 1 min
Constraints:	None

Procedure and analysis

Step	Action	Command/TM	Comment/notes
1	**Select SCOS display** *(DPU and OBS PARAMETER)*		
2	**Request nominal SCU science frames** a) Check frame counter b) Set OBS STEP 1 c) Request 31 SCU TM frames, sampled at 80Hz d) Flush SCU FIFO e) Set OBS STEP(0xffff)	a) Read SCUFRAMECNT b) Set_OBS_STEP(0x0001) *c)* SetFrameConf(0x0000) A0830000 SetSeqLength(0x001F) A084001F SetFrameCtrl(0x0001) A0820001 d) TM(8,4: CA-02) (0x4000) e) Set_OBS_STEP(0xffff)	
3	**Check generation of packets** a) Check that frame counter has incremented by ~31 b) Check No Science Packet Events occurred	a) Read SCUFRAMECNT b) ?	

Success/Failure Criteria: Test passed if correct number of frame generated

Comments/Open issues:

4.2 FUNC-SCU-02, SCU Science data check

ID:	FUNC-SCU-02
Purpose	Checking the integrity of the SCU science data
Description of test:	Request science frames and housekeeping data and compare content
Test Type:	Integrity Check
Instrument Models:	AVM/CQM/PFM/FS
Redundancy:	prime and redundant
Initial Configuration:	SPIRE in REDY mode
Final configuration	Idem
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT
Test Conditions:	Warm or Cold
Total duration	2 min
Constraints:	SCU thermometry needs to be switched on – see test FUNC-SCU-03 and FUNC-SCU-06 FUNC-SCU-01 successfully passed

Procedure and analysis

Step	Action	Command/TM	Comment/notes
1	**Run QLA script FUNC-SCU-02**		
2	**With SCOS, request nominal SCU science frames** **a) Mark beginning of test (BBId+Step)** b) Request 31 SCUTM frames, sampled at 80Hz c) Flush SCU FIFO **d) Mark end of data stream (step to 0xffff)** e) Once all packet are received, mark end of test (reset BBId to 0x8000000)	**a) BBTYPE =0x8A00 ,STEP=0x0001** b) SetFrameConf(0x0000) A0830000 SetSeqLength(0x001F) A084001F SetFrameCtrl(0x0001) A0820001 c) TM(8,4: CA-02) (0x4000) **d) STEP=0xffff** **e) BBTYPE =0x8000**	
3	**Display parameters with QLA** a) Display the last science packet received b) Display the HK parameters received just after BBId changed to 0x8000000	TCHeaterVolt, PhCalCur, SCal4Cur, SCal2Cur, PhCalVolt, SCal4Volt, SCal2Volt, CPHPtemp, CPHStemp, CEHStemp, CSHTtemp, SOBtemp, SL0temp, PL0temp, SUBtemp, BAFtemp, BSMStemp, SCL2temp, SCL4temp, SCSTtemp, FTSStemp, FTSMtemp, BSMMtemp, CEVTemp	
4	**Analyse with QLA** **a) Compare that the values of the SCU science frame are similar to those in the SCU HK.** b) Write in log file the result of the comparison	a) Check values on the 'clock' displays on the screen	

Success/Failure Criteria: Test passed if values in the science frame are identical to those in the HK nominal report.

Comments/Open issues:

4.3 FUNC-SCU-03, SCU DC thermometry check

ID:	FUNC-SCU-03
Purpose	To check the integrity of thermometers
Description of test:	Switch on thermometers all at once and check values
Test Type:	Integrity
Instrument Models:	CQM/PFM/FS
Redundancy:	prime and redundant
Initial configuration:	SPIRE in REDY mode - DC thermometers off
Final configuration	SPIRE in REDY mode - DC thermometers on
EGSE Configuration:	SCOS-2000 required
Level	ILT/PLT/IST/FLT
Test Conditions:	Warm or Cold
Total duration	1 min
Constraints:	None

Procedure and analysis

Step	Action	Command/TM	Comment/notes
1	**Select SCOS display** (SCU parameters)		
2	**Switch On thermometers** a) Switch on SCU DC Thermometers, all at once b) Wait 5 seconds (time for sensor to activate)	a) TempOnOff(0xFFFF) A085FFFF b) Wait 5 seconds	
3	**Check parameters values**	**SCUTEMPSTAT =0xffff** CPHPtemp= CPHStemp= CEHStemp= CSHTtemp= SOBtemp = SL0temp = PL0temp = SUBtemp= BAFtemp = BSMStemp= SCAL2TEMP= SCAL4TEMP = SCSTtemp = FTSStemp= FTSMtemp= BSMMtemp=	**Readings will vary depending on FPU temperature.**

Switch off procedure:

Action	Command
Switch off thermometers	TempOnOff(0x0000) A0850000

Success/Failure Criteria: Test passed if all thermometer channels are reading expected values.

Comments/Open issues: **Have to check with Dave what would be the indication for a sensor that is not working properly**
A not connected thermometer will read a very small raw value. A non working thermometer will read a wrong value?.

4.4 FUNC-SCU-04, SCU PCAL check

ID:	FUNC-SCU-04
Purpose	Checking the integrity of PCAL
Description of test:	Switch on PCAL, set a current and check voltage and current, then switch off
Test Type:	Integrity
Instrument Models:	CQM/PFM/FS
Redundancy:	prime and redundant
Initial configuration	SPIRE in REDY mode
Final configuration	Idem
EGSE Configuration:	SCOS-2000 required
Level	ILT/PLT/IST/FLT
Test Conditions:	Warm and cold
Total duration	< 1 min
Constraints:	None

Procedure and analysis:

Steps	Action	Command/TM	Comment/notes
1	**Select SCOS display** (SCU parameters)		
2	**Switch On PCAL** a) Set a small current (0.1 mA) b) Wait 2 seconds	a) SetPhCalBias(0x003D) A0C8003D b) Wait 2 seconds	
3	**Check parameters values**	a) PCALCURR = 0x0191 (0.1 mA) b) PCALV = 0x01EE (25.2 mV)	
4	**Switch off PCAL**	SetPhCalbias(0x0000) A0C80000	

Success/Failure Criteria: Test passed if value of current read = current set and voltage has value expected

Comments/Open issues:
This test needs a calibration curve. Voltage expected is dependent on instrument model and version of MIB

4.5 FUNC-SCU-05, SCU SCAL check

ID:	FUNC-SCU-05
Purpose	Checking the integrity of SCAL
Description of test:	Switch on SCAL, set a current and check voltage, current and temperature changes, then switch off
Test Type:	Integrity
Instrument Models:	CQM/PFM/FS
Redundancy:	prime and redundant
Initial configuration	SPIRE in REDY mode
Final configuration	Idem
EGSE Configuration:	SCOS-2000 required
Level	ILT/PLT/IST/FLT
Test Conditions:	Warm and cold
Total duration	3 min
Constraints:	None

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**Select SCOS display** (SCU parameters)		
2	**Switch on SCAL-4** a) Set a small current (0.1 mA) b) Wait 10 sec	a) SetSCal4Bias(0x004D) A0CC004D b) Wait 10 sec	
3	**Check parameters values for SCAL-4**	a) SCAL4CURR = 0x0232 (0.1mA) b) SCAL4V = 0x01F3 (50mV) c) SCAL4TEMP = 0x	
4	**Switch off SCAL-4** **Set Scal4Bias to 0**	a) SetScal4Bias(0x0000) A0CC0000	
5	**Switch on SCAL-2** a) Set a small current (0.1 mA) **Wait 10 sec**	SetSCal2Bias(0x004D) A0CA004D Wait 10 sec	
6	a) Check parameters values for SCAL-2	a) SCAL2CURR = 0x0233 (0.1mA) b) SCAL2V = 0x0x01F3 (50mV) a) SCAL2TEMP = 0x	
	Switch off SCAL-2 **Set Scal2Bias to 0**	a) SetScal2Bias(0x0000) A0CA0000	

Success/Failure Criteria Test passed if value of current read = current set and voltage and temperature have values expected

Comments/Open issues:
This test needs a calibration curve.
Time constant is long and may be we do not wait enough for the stable temperature to be achieved, but it is not the purpose of this test. We just make sure that the wires are OK (shall we wait even less than 1 min then?)

4.6 FUNC-SCU-06, SCU AC thermometry check

ID:	FUNC-SCU-06
Purpose	Checking the integrity of the AC thermometer
Description of test:	Switch on AC thermometers and check values
Test Type:	Integrity
Instrument Models:	CQM/PFM/FS
Redundancy:	prime and redundant
Initial configuration:	SPIRE in REDY mode – AC thermometers off
Final configuration	SPIRE in REDY mode – AC thermometers on
EGSE Configuration:	SCOS-2000 required
Level	ILT/PLT/IST/FLT
Test Conditions:	Warm and cold
Total duration	< 1 min
Constraints:	None

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**Select SCOS display** (SCU PARAMETERS)		
2	**Switch on thermometer** a) Switch on AC thermometer b) Wait 5 seconds	a) SubKOnOff(0x0001) A0860001 *b) Wait 5 seconds*	
3	**Check parameter value**	CEVtemp (SUBKTEMP)	

Switch off procedure:

Action	Command
Switch off thermometer	SubKOnOff(0x0000) A0860000

Success/Failure Criteria: Test passed if thermometer channel is reading expected value

Comments/Open issues:
Temperature is dependent on cooler condition. If SPIRE is in REDY mode, temperature expected is > 4K If in STAND-BY mode, temperature expected is 300 mK

4.7 FUNC-SCU-07, SCU cooler heaters check

ID:	FUNC-SCU-07
Purpose	Checking the integrity of the cooler heaters
Description of test:	Switch on heaters, check voltage
Test Type:	Integrity
Instrument Models:	CQM/PFM/FS
Redundancy:	prime and redundant
Initial configuration	SPIRE in REDY mode
Final configuration	Idem
EGSE Configuration:	SCOS-2000 required
Level	ILT/PLT/IST/FLT
Test Conditions:	Warm and cold
Total duration	2 min
Constraints:	FUNC-SCU-06 should be completed successfully

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**Select SCOS display** (SCU PARAMETERS)		
2	**Heaters switch on** a) Apply current to SPHS heater **b) Wait 45 sec** **c) Swich it off** d) Apply current to EVHS heater **e) Wait 45 sec** **f) Switch it off** g) Apply current to SP heater **h) Wait 45 sec** **i) Switch it off**	a) SetSPHSHeatB(0x0800) A0C40800 b) Wait 45 sec c) SetSPHSHeatB(0x0000) A0C40000 d) SetEVHSHeatB(0x0800) A0C50800 e) Wait 45 sec f) SetEVHSHeatB(0x0000) A0C50000 g) SetSPHeaterB(0x0708) A0C70708 h) Wait 45 sec i) SetSPHeaterB(0x0000) A0C70000	
3	**Check parameter values after each voltage setting**	a) SPHSHeatVolt = 0x31CC (324.38 mV) EVHSHeatVolt = 0x31CC (324.38 mV) SPHeaterVolt = 0x388D (8.828 V)	

Success/Failure Criteria: Test passed if voltages are read and have the value expected

Comments/Open issues:
Waiting 1 minute is not enough for the voltage to stabilize but it is not the purpose of this test. It is long enough for the voltage to move. We just check that we can measure something

4.8 FUNC-SCU-08, SCU Test pattern test

ID:	FUNC-SCU-08
Purpose	Checking the integrity of SCU test pattern packet
Description of test:	Load test pattern and check content of packets
Test Type:	Integrity
Instrument Models:	AVM/CQM/PFM/FS
Redundancy:	prime and redundant
Initial configuration	SPIRE in REDY mode
Final Configuration	Idem
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT
Test Conditions:	warm and cold
Total duration	1 min
Constraints:	None

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**Run QLA script FUNC-SCU-08**		
2	**With SCOS, request nominal SCU science frames** **f) Mark beginning of test (change BBId)** g) Request 31 SCUTEST frames, sampled at 80Hz h) Flush SCU FIFO **i) Mark end of data stream (step to 0xffff)** j) Once all packet are received, mark end of test (reset BBId to 0x8000000) k) Display contents of last test packet	 **f) BBTYPE =0x8A07 ,STEP=0x0001** g) SetFrameConf(0x0000) A0838000 SetSeqLength(0x001F) A084001F SetFrameCtrl(0x0001) A0820001 h) TM(8,4: CA-02) (0x4000) **i) STEP=0xffff** **j) BBTYPE =0x8000**	
3	**Analysis with QLA** a) Compare test pattern with the one obtained during previous run of this test b) Write in log file the result of the comparison	a) Read previous file stored on QLA computer e.g. using Notepad Run QLA script FUNC-SCU-08 Wait for telemetry stream to stop Compare values on the screen with those from the previous file b) Use 'save' button to save an ascii file containing the values of the parameters in the last test frame	

Success/Failure criteria: Test passed if test pattern generated is similar to the one generated during previous run of this test.

Comments/Open issues:

4.9 FUNC-MCU-01, MCU power on

ID:	FUNC-MCU-01
Purpose	To power on the MCU into a state ready to execute SMEC or BSM commands. This procedure also tests the low speed interface to the MCU, used for command and housekeeping data transfer
Description of test:	Apply power to MCU from SCU and boot the MCU DSP ROM software, checking voltages and status
Test Type:	Configuration
Instrument Models:	AVM/CQM/PFM/FS
Redundancy:	prime and redundant
Initial configuration:	SPIRE in REDY mode, MCU off
Final configuration	SPIRE in REDY mode, MCU on
EGSE Configuration:	SCOS-2000 required
Level	ILT/PLT/IST/FLT
Test Conditions:	Warm and cold
Total duration	1 min
Constraints:	None

Procedure and analysis

Step	Action	Command/TM	Comment/notes
0	**Select SCOS display *(MCU_PARAMETERS)***		
1	**Mark beginning of building block**	SET_BBID(0x89000001)	
2	**Power on MCU from SCU**	If LIAs are OFF SetDRelOnOff(0x0004) *A0870004* If LIAs are ON SetDRelOnOff(0x0005) *A087005*	If nominal configuration of the instrument is followed then LIA will be switched OFF later than the MCU
3	**Check MCU power status** a) Check parameters values	a) SCUDCDCSTAT = 4 (or 5) b) MCU+5V = ~ + 5V c) MCU+15V = ~ +15V d) FUNC-MCU-15V = ~ -15V e) MCU+13V = ~ +13V f) FUNC-MCU-13V = ~-13V g) MCUMACTEMP = 0x1000 h) MCUSMECTEMP = 0x1000 i) MCUBSMTEMP = 0x1000	All these vales should be recorded in the Functional Test Procedure document .
4	**Check threshold flag**		
5	**Reset MCU Subsystem** a) Reset on b) Wait 5 seconds c) Reset off d) Wait 5 seconds e) Reset on f) Wait 5 seconds g) Reset off h) Wait 5 seconds i) Check Boot Status j) Check Interface Status	a) SetMCUCmdIfCtrl(0x0005) *90010005* *b) Wait 5 seconds* c) SetMCUCmdIfCtrl(0x0007) *90010007* *d) Wait 5 seconds* *e)* SetMCUCmdIfCtrl(0x0005) *90010003* *f) Wait 5 seconds* *g)* SetMCUCmdIfCtrl(0x0005) *90010007* *h) Wait 5 seconds* i) MCUBOOTSTAT = 0x0000 j) MCUIFSTAT = 0x0000	MCUIFSTAT parameter may NOT equal to zero after the interface reset process, but this does not mean that the process was not successful.

Step	Action	Command/TM	Comment/notes
6	**Boot MCU** a) Download Code to RAM b) Wait 5 seconds c) Check Boot Status d) Start Code in RAM	a) SetDownloadConfig(0xC000) *9021C000* *b) Wait 5 seconds* c) MCUBOOTSTAT = 0x0001 d) SetBootRam(0x0001) *90240001*	
7	**Check MCU status**	a) MCUBOOTSTAT = 0 b) MCUERR = 0x0000 c) MCUSCHEDCNTLSW = TBD d) MCUSCHEDCNTMSW = TBD	MCUBOOTSTAT will ONLY have value 1 DURING boot. When boot is finished MCUBOOTSTAT=0

Switch off procedure

Action	Command
Switch off MCU from SCU	SetDRelOnOff(0x0000) A0870000

Success/Failure Criteria Procedure completed with no errors

Comment/Open Issue:
How does this change for testing the redundant MCU?
If DSP is not booted correctly, then should the OBS cope with this?

4.10 FUNC-MCU-02, MCU Science Packet Generation Test

ID:	FUNC-MCU-02
Purpose	To check the integrity of MCU science packet interface and that the MCU generates all the nominal science data frames
Description of test:	Generate science data from the SMEC and BSM at typical data rates and check that all the frames are received correctly by the DPU.
Test Type:	Integrity
Instrument Models:	AVM/CQM/PFM/FS
Redundancy:	prime and redundant
Initial configuration:	SPIRE in REDY mode -MCU Powered on (following FUNC-MCU-01)
Final configuration	Idem
EGSE Configuration:	SCOS-2000 required
Level	ILT/PLT/IST/FLT
Test Conditions:	Warm and cold
Total duration	3 min
Constraints:	FUNC-MCU-01 successful

Procedure and analysis

Step	Action	Command/TM	Comment/notes
1	**Select SCOS display(s)** ***(DPU PARAMETERS, OBS PARAMETERS)***		
2	**Request ENG Frames** a) Check Frame Counter **b) Mark beginning of building block** **c) Set step 1** d) Set ENG TM Packet Sampling to 64.1Hz e) Set no SMEC, no BSM, no TEST to be sent f) Set number of frames to be sent to N=0xffff (continuous generation) g) Start sending ENG TM Packet h) Wait 10 sec i) Stop Packet generation j) Flush MCU FIFO **k) Set step 0xffff** l) Check Frame counter has incremented by ~640 m) Check No Science Packet Events occurred	a) Read MCUFRAMECNT **b) SET_BBID(0x89010001)** c) **SET_OBS_STEP(0x0001**) d) SetTP14SampFreq(0x002C) *91C40027* e) *91C00000*, *91C2000*, *91C50000* f) SetFrameNumber(0xFFFF) *91C3FFFF* g) SetFrameStart(0x0001) *91C10001* h) Wait 10 seconds i) SetFrameStart(0x0000) *91C10000* j) TM(8,4: CA-02) (0x2000) **k) SET_OBS_STEP(0xffff)** l) Read MCUFRAMECNT m) *????*	

Step	Action	Command/TM	Comment/notes
3	**Request SMEC Frames** a) Check Frame Counter **b) Mark beginning of building block** **n) Set step 1** c) Set SMEC TM Packet Sampling to 250 Hz d) Set no ENG, no BSM, no TEST to be sent e) Set number of frames to be sent to N=0xFFFF (continuous generation) f) Start sending SMEC TM Packet g) Wait 10 seconds h) Stop Packet generation i) Flush MCU FIFO **j) Set step 0xffff** k) Check Frame counter has incremented by ~2500 l) Check No Science Packet Events occurred	a) Read MCUFRAMECNT **b) SET_BBID(0x89020001)** **n) SET_OBS_STEP(0x0001)** c) SetTP10SampFreq(0x002C) *91C0000B* d) *91C40000*, *91C2000*, *91C50000* e) SetFrameNumber(0xFFFF) *91C3FFFF* f) SetFrameStart (0x0001) *91C10001* g) Wait seconds h) SetFrameStart(0x0000) *91C10000* i) TM(8,4: CA-02) (0x2000) **j) SET_OBS_STEP(0xffff)** k) Read MCUFRAMECNT l) *????*	
4	**Request BSM Frames** a) Check Frame Counter **b) Mark beginning of building block** **c) Set step to 1** d) Set BSM TM Packet Sampling to 64.1 Hz e) Set no SMEC, no ENG, no TEST to be sent f) Set number of frames to be sent to N=0xFFFF (continuous generation) g) Start sending BSM TM Packet h) Wait i) Stop Packet generation j) Flush MCU FIFO **k) Set step to 0xffff** l) Check Frame counter has incremented by ~640 m) Check No Science Packet Events occurred	a) Read MCUFRAMECNT **b) SET_BBID(0x89030001)** **c) SET_OBS_STEP(0x0001)** d) SetTP12SampFreq(0x002C) *91C20039* e) *91C00000*, *91C40000*, *91C50000* f) SetFrameNumber(0xFFFF) *91C3FFFF* g) SetFrameStart (0x0001) *91C10001* h) Wait 10 seconds i) SetFrameStart(0x0000) *91C10000* j) TM(8,4: CA-02) (0x2000) **k) SET_OBS_STEP(0xffff)** l) Read MCUFRAMECNT m) *????*	

Step	Action	Command/TM	Comment/notes
5	**Request SMEC+BSM Frames** a) Check Frame Counter **b) Mark beginning of building block** **c) Set step to 1** d) Set BSM TM Packet Sampling to 50 Hz e) Set SMEC TM Packet Sampling to 250 Hz f) Set no ENG, no TEST to be sent g) Set number of frames to be sent to N=0xFFFF (continuous generation) h) Start sending TM Packet i) Wait 10 seconds j) Stop Packet generation k) Flush MCU FIFO **l) Set step to 0xffff** m) Check Frame counter has incremented by ~ 3000 n) Check No Science Packet Events occurred	a) Read MCUFRAMECNT **b) SET_BBID(0x89040001)** **c) SET_OBS_STEP(0x0001)** d) SetTP12SampFreq(0x0032) *91C20032* e) SetTP10SampFreq(0x000A) *91C0000A* f) *91C40000*, *91C50000* g) SetFrameNumber(0xFFFF) *91C3FFFF* h) SetFrameStart (0x0001) *91C10001* i) Wait 10 seconds j) SetFrameStart(0x0000) *91C10000* k) TM(8,4: CA-02) (0x2000) **l) SET_OBS_STEP(0xffff)** m) Read MCUFRAMECNT n) *????*	

Success/Failure Criteria: Correct number of frames generated for each frame type

Comment/Open Issue:

4.11 FUNC-MCU-03, MCU Science data check

ID:	FUNC-MCU-03
Purpose of test	Checking the integrity of MCU science data
Description of test:	Compare science data with HK. Perform test for each type of packet. (SMEC, BSM, ENG)
Test Type:	Integrity
Instrument Models:	AVM/CQM/PFM
Redundancy:	prime and redundant
Initial configuration:	SPIRE in REDY mode- MCU Powered on (following FUNC-MCU-01)
Final configuration	Idem
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT
Test Conditions:	Warm and cold
Total duration	8 min
Constraints:	FUNC-MCU-01 and FUNC-MCU-02 successfully passed

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**Run QLA script FUNC-MCU-03**		
2	**Request ENG Frames** **a) Mark beginning of ENG building block** **b) Set step to 1** c) Request ENG TM as in step 2 of test MCU-02 d) Flush MCU FIFO **e) Set step 0xffff** f) Display science parameters from last frame g) Display HK parameters received just after BBId changed to value3	**a) SET_BBID(0x89010001)** **b) SET_OBS_STEP(0x0001)** c) see step 2 of MCU-02 d) TM(8,4: CA-02) (0x2000) **e) SET_OBS_STEP(0xffff)** f) SMECENCSIG1, 2 and 3, SMECLVDTACSIG, SMECLVDTDCSIG, SMECMOTORCURR, CHOPSENSSIG, CHOPMOTORCURR, JIGGSENSSIG, JIGGMOTORCURR	
3	**Request SMEC science Frames** **a) Mark beginning of SMEC building block** **b) Set step to 1** c) Request SMEC TM frames, as in step3 of test MCU-02 d) Flush MCU FIFO **e) Set step to 0xffff** f) Display science parameters from last frame g) Display HK parameters received just after BBId changed to value5	**a) SET_BBID(0x89020001)** **b) SET_OBS_STEP(0x0001)** c) see step 3 of MCU-02 d) TM(8,4: CA-02) (0x2000) e) **SET_OBS_STEP(0xffff)** f) SMECENCPOSN, SMECENCFINEPOSN, SMECLVDTPOSN, SMECMOTORBEMF	

Step	Action	Command/TM	Comment/notes
4	**Request BSM Frames** **a) Mark beginning of BSM building block** **b) Set step to 1** c) Request SMEC TM frames, as in step3 of test MCU-02 d) Flush MCU FIFO **e) Set step 0xffff** f) Display science parameters from last frame g) Display HK parameters received just after BBId changed to value7	**a) SET_BBID(0x89030001)** **b) SET_OBS_STEP(0x0001)** c) see step 4 of test MCU-02 d) TM(8,4: CA-02) (0x2000) **e) SET_OBS_STEP(0xffff)** f) CHOPSENSSIG, CHOPMOTORCURR, JIGGSENSSIG, JIGGMOTORCURR	
5	**Analyse with QLA** a) Compare science frame with HK b) Write in a file the result of the comparison	a) Compare the parameters in the two 'clock displays on the screen for each type of packet (ENG, SMEC and BSM) b) Write the results of the comparison to a file using the 'save' button on the FUNC-MCU-03 GUI	

Success/failure criteria: test passed if values in HK are identical to those in the science frames

Comments/Open issues: Jigg, Chop, Smec motor voltages are in science frame but not in HK. BEMFs are in HK but not in science frame, except for SMEC

4.12 FUNC-MCU-04, MCU test pattern test

ID:	FUNC-MCU-04
Purpose	Checking the integrity of MCU test pattern packets
Description of test:	Load MCU test pattern and check contents of packets
Test Type:	Integrity
Instrument Models:	AVM/CQM/PFM/FS
Redundancy:	prime and redundant
Initial configuration:	SPIRE in REDY mode- MCU Powered on (following FUNC-MCU-01)
Final configuration	Idem
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT/PLT/IST/FLT
Test Conditions:	Warm and cold
Total duration	1 min
Constraints:	FUNC-MCU-01 successful

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**Run QLA script FUNC-MCU-04**		
2	**Request TEST Frames** a) Check Frame Counter **b) Mark beginning of TEST frames building block** **c) Set step to 1** d) Set TEST TM Packet Sampling to 64.1 Hz e) Set no SMEC, no BSM, no ENG to be sent f) Set number of frames to be sent to N=100 g) Start sending TEST TM Packet h) Wait i) Stop Packet generation j) Flush MCU FIFO **k) Set step 0xffff** l) Check Frame counter has incremented by ~100 m) Display test pattern with QLA	a) Read MCUFRAMECNT **b) SET_BBID(0x89050001)** **c) SET_OBS_STEP(0x0001)** d) SetTP15SampFreq(0x002C) *91C50039* e) *91C00000*, *91C20000*, *91C40000* f) SetFrameNumber(0x0064) *91C30064* g) SetFrameStart (0x0001) *91C10001* h) Wait N/frequency i) SetFrameStart(0x0000) *91C10000* j) TM(8,4: CA-02) (0x2000) **k) SET_OBS_STEP(0xffff)** l) Read MCUFRAMECNT m) The content of the test data is TBD	
3	**Analysis with QLA** a) Compare test pattern with the one obtained during previous run of this test b) Write in log file the result of the comparison	a) Read previous file stored on QLA computer e.g. using Notepad Run QLA script FUNC-MCU-04 Wait for telemetry stream to stop Compare values on the screen with those from the previous file b) Use ‘save’ button to save an ascii file containing the values of the parameters in the last test frame	

Success/Failure criteria: test passed is test pattern is properly generated

Comments/Open issues:

4.13 FUNC-SMEC-01, SMEC switch on and initialisation

ID:	FUNC-SMEC-01
Purpose	Switching on and initialising SMEC. SMEC ends up at home position and is ready for following tests
Description of test:	Switch on various part of the SMEC system then initialise it. Check parameters
Test Type:	Integrity
Instrument Models:	PFM/FS
Redundancy:	prime and redundant
Initial configuration:	SPIRE in REDY mode, SMEC off
Final configuration	SPIRE in REDY mode , SMEC on and initialised, at home position
EGSE Configuration:	SCOS-2000 required
Level	ILT/PLT/IST/FLT
Test Conditions:	Warm and cold
Total duration	2-3 min
Constraints:	FUNC-MCU-01 successfully passed

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
0	**Select SCOS Alpha Numeric Display SMEC PARAMETERS**		
1	**Mark beginning of building block**	**SET_BBID(0x82000001)**	**BBTYPE=0x8200**
	Set up open loop feed forward gain **and feed forward offset**	If cold: 0 ?? if warm: 0x90541899 90558000	
2	**Encoder set-up** a) Set encoder LED power b) Set signal 1 offset c) Set signal2 offset d) Check SMECStatus e) Check SMECENCSIG1 f) Check SMECENCSIG2	If COLD / If WARM a) 0x90400004 / 0x90400006 b) 0x90587A44 / 0x90586590 c) 0x905A927C / 0x905A7918 d) SMECSTAT = 0x00002 e) SMECENCSIG1=0x7FFF f) SMECENCSIG2=0xC9E8	
3	**LVDT set-up (only needed for degraded mode operation)** a) Power on LVDT b) Set LVDT scale c) Set LVDT Offset d) Check LVDTAC e) Check LVDTDC f) Check LVDT position	If COLD / If WARM a) 0x90410001 / 0x90410001 b) 0x905F9157 / 0x905F161C c) 0x905E1F40 / 0x905E1F40 d) SMECLVDTACSIG = 0x1DB7 e) SMECLVDTDCSIG = 0x1DBA f) SMECLVDTPOSN = 0x0000	
4	**Set PID Control parameters** a) Set Kp b) Set Kd c) Set Ki d) Set Integration limit e) Set Rate limit	a) 0x904A07D0 b) 0x904B02BC c) 0x904D03E8 d) 0x904E07D0 e) 0x9051012C	

Step	Action	Command/TM	Comment/notes
5	**Initialise SMEC** a) Set SMEC to hold mode b) c) Apply –50mA current on SMEC d) Wait 15 seconds e) Set end traj to 0 f) Set start trajectory to 0 g) Move SMEC to 0 h) Read trajectory position i) Set traj modeEncoder initialisation j) Set Traj mode to 1 k) Apply 0mA to release l) Wait 15 seconds m) Close loop n) Check SMECStatus o) Check SencoderSignal1 p) Check SencoderSignal2 q) Check SencoderSignal3 r) Check LVDTAC s) Check LVDTDC t) Check LVDT position u) Check motor current v) Check back emf w) Check encoder increment position x) Check encoder fine position	a) SetSTrajMode(0x0000), 0x90490000 b) c) SetSFeedForwardOffset(0x4000), 0x90554000 d) Wait(15) e) 0x90450000 f) 0x90460000 g) 0x90490001 *h) cf param on HK* *i)* 90490004 *j)* 90490001 k) SetSFeedForwardOffset(0x8000), 0x90558000 l) Wait(15) m) 0x90440001 n) SMECSTAT = 0x0188 o) SMECENCSIG1=0xD527 p) SMECENCSIG2=0x5A4F q) SMECENCSIG3=0x5085 r) SMECLVDTACSIG = 0x315F s) SMECLVDTDCSIG = 0x3165 t) SMECLVDTPOSN = 0x0709 u) SMECMOTORCURR = 0x03E8 v) SMECBEMF = 0x03E8 w) SMECENCPOSN = 0x0708 x) SMECENCFINEPOS = 0x0000	

Success/Failure Criteria Test passed if SMEC ends up at home position ,loop is closed ,and parameters values reflect this
Comment/Open Issue: Need conversion curve between signals and physical position. D. Ferrand will give actual values for all the parameters after all tests at ambient and 4K are done

Switch off procedure:

Action	Command
a) Send SMEC to mechanical limit	a) SetSTrajMode(0x0001) 0x90490001 SetSTrajEnd(0x0000), 0x90450000 SetSFeedForwardOffset(0x4000), 0x90554000

b) Engage launch latch c) Apply 0 mA d) Switch off LVDT and encoder	b) SetSLaunchLatch(0x0001) 0x90430001 c) SetSFeedForwardOffset(0x8000), 0x90558000 d) SetSLVDTPwr(0x0000) 0x90410000 and SetSEncoderPwr(0x0000) 0x90400000

4.14 FUNC-SMEC-02, SMEC launch latch check – not to perform during PFM1

ID:	FUNC-SMEC-02
Purpose	Checking that the launch latch works properly
Description of test:	Open launch latch, move SMEC short distance and check response
Test Type:	Integrity
Instrument Models:	PFM/FS
Redundancy:	prime and redundant
Initial configuration:	SPIRE in REDY mode + MCU on + SMEC on and initialised, at home position
Final configuration	Idem
EGSE Configuration:	SCOS-2000
Level	ILT/PLT/IST
Test Conditions:	Warm and cold
Total duration	2-3 min
Constraints:	FUNC-MCU-01 and FUNC-SMEC-01 successfully passed

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
0	**Select SCOS display *(SMEC PARAMETERS)***		
1	**Mark beginning of building block**	**SET_BBID(0x82040001)**	**BBTYPE=0x8204**

Step	Action	Command/TM	Comment/notes
2	**Send SMEC to position for launch latch** a) Move SMEC to position b) Read SMEC position	a) SetTrajEndPosition(0x0000) 90450000 SetSTrajMode(0x0001) 90490001 b) SMECENCPOSN=0x???? SMECENCFINEPOSN=0x???? SMECLVDTACSIG=0x???? SMECLVDTPOSN=0x???? SMECPOSNDELTA=0x????	
3	**Test launch latch** a) Engage launch latch b) Check latch status c) Try and move SMEC by a short distance (500 um) d) Make sure SMEC hasn't moved e) Go back to 0 f) Disengage launch latch g) Check latch status	a) SetSLaunchLatch(0x0001) 0x90430001 b) SMECLATCHSTAT=0x0001 a) SetTrajEndPosition(0x01F4) 0x904501F4 b) Check values on SCOS display c) SetTrajEndPosition(0x01F4) 0x90450000 d) SetSLaunchLatch(0x0002) 0x90430002 c) SMECLATCHSTAT=0x0002	
4	**Check** a) Move SMEC by a short distance (500 um) b) Read SMEC position c) Make sure that SMEC moved by the distance requested	a) SetTrajEndPosition(0x01F4) 0x904501F4 b) SMECENCPOSN=0x???? SMECENCFINEPOSN=0x???? SMECLVDTACSIG=0x???? SMECLVDTPOSN=0x???? SMECPOSNDELTA=0x???? c) Check values on SCOS display	
5	**Drive SMEC back to its home position**	SetTrajEndPosition(0x0000) 0x90450000	

Success/Failure Criteria: Test passed if launch latch is successfully engaged/disengaged
Comments/Open issues:
Is the actuator for the latch redundant?
Would it be safer to move SMEC to position using SetFeedForwardOffset rather than SetTrajEndPosition? What happen if SMEC is not in position and the command Engage Latch issued?

4.15 FUNC-SMEC-03, SMEC LEDs test

ID:	FUNC-SMEC-03
Purpose	Checking integrity of the LEDs
Description of test:	Switch on LEDs and step up voltages
Test Type:	Integrity
Instrument Models:	PFM/FS
Redundancy:	prime and redundant
Initial configuration:	SPIRE in REDY mode, SMEC on and initialised, at home position
Final configuration	Idem
EGSE Configuration:	SCOS-2000 required QLA
Level	ILT/PLT/IST/FLT
Test Conditions:	Warm and cold
Total duration	2 min
Constraints:	None

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
0	**Select SCOS display *(SMEC PARAMETERS)***		
1	**Request MCU ENG frames at 64Hz**	SetTP14SampFreq(0x0027) 0x91C40027 SetFrameNumber(0xFFFF) 0x91C3FFFF SetFrameStart(0x0001) 0x91C10001	
2	**Mark beginning of bb for QLA triggering** **Set Step to 1**	**SET_BBID(0x82050001)** **SET_OBS_STEP(0x0001)**	**BBTYPE=0x8205**
3	**Test LED** **a)** Apply power to **LEDs** by stepping up voltages from 0 to 5V increasing the step number each time **(this voltage is dependent on temperature) Same bias is applied to resistor for a given LED level but the resistance drops exponentially approaching cold temperatures.** **Record MCUSMECENCSIG1, MCUSMECENCSIG2 frame parameters FOR EACH STEP** **b) Make 3 QLA plots at the end of the sequence of :** • **Plot 1: MCUSMECENCSIG1 and 2 against encoder level** • **Plot 2 : SMECTEMP and SMECIFTEMP HK parameters against time** • **Plot 3 : MCUSMECENCSIG1 and 2 against SMECTEMP HK** c) Stop data generation.	a) SET_OBS_STEP(0x0001) **Qla operation** SetSEncoderPwr(0x0001) 0x90400001 Wait 5 sec SET_OBS_STEP(0xFFFF) SET_OBS_STEP(0x0002) **Qla operation** SetSEncoderPwr(0x0001) 0x90400002 Wait 5 sec SET_OBS_STEP(0xFFFF) … SET_OBS_STEP(0x0001) **Qla operation** SetSEncoderPwr(0x0006) 0x90400006 Wait 5 sec SET_OBS_STEP(0xFFFF) b) **Qla operation** c) SetFrameStart(0x0000) 0x91C10000 FLUSH_FIFO (Fifo flags =0x2000)	
3	**Power off LED or leave at TBD level if necessary**	SetSEncoderPwr(0x0000) 0x90400000	

Success/Failure Criteria: Test passed if encoder signal increases as expected, i.e. with the power applied to the LEDs
Comment/open issues: **Need the expected SMEC encoder signals 1 and 2 levels from Dominique Poulenquin**

FUNC-SMEC-04a, SMEC open loop position test

ID:	FUNC-SMEC-04a
Purpose	Checking that SMEC moves to the position commanded, in open loop
Description of test:	Move to set positions and measure read back position, currents, back emf
Test Type:	Integrity
Instrument Models:	PFM/FS
Redundancy:	prime and redundant
Initial configuration	SPIRE in REDY mode + MCU on + SMEC on and initialised for open loop operation at home position
Final configuration	Idem
EGSE Configuration:	SCOS-2000 required QLA
Level	ILT/PLT/IST/FLT
Test Conditions:	Warm and cold
Total duration	3 min
Constraints:	FUNC-MCU-01 and FUNC-SMEC-01 successfully passed

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
0	**Select SCOS display *(SMEC PARAMETERS)***		
1	**Run QLA script in order to:** **Record SMEC frame parameters** **SMECSCANLVDTPOSN** **SMECSCANMOTORBEMF** **SMECCMDMOTORCURR** **Record MCU ENG frame parameters** **MCUENGSMECLVDTACSIG** **MCUENGSMECLVDTDCSIG**		
2	**Start SMEC frame generation @ 250Hz and MCU ENG frame generation @ 64Hz**	**SetTelemetryPacket10Sampl(10) 0x91C0000A** **SetTelemetryPacket14Sampl(39) 0x91C00027** **SetFrameNumber(0xFFFF) 0x91C3FFFF** **SetStartFrame 0x91C10001**	
3	**Mark beginning of building block**	**SET_BBID(0x82060001)**	**BBTYPE=0x8206**

Step	Action	Command/TM	Comment/notes
4	**Move SMEC** a) Force open loop operation b) Set Step to 1 **c) Start recording the SMEC frame parameters described in 1** d) Set a position to reach (e.g. +1mm from mechanical stop) e) Move SMEC to first position f) Wait n sec g) Set trajectory end position to next position h) Wait n sec i) …Repeat steps f) to h) for a set of positions j) Set step to 0xffff **k) Stop recording parameters**	a) SetSLoopMode(0x0001) 0x90440006 **b) SET_OSB_STEP(0x0001)** **c) Qla operation** d) SetTrajEndPosition(0x03E8) 0x904503E8 e) SetSTrajMode(0x0001) 0x90490001 f) Wait n sec g) SetTrajEndPosition(0x1B58) 0x90451B58 h) Wait n sec i) … **j) SET_OBS_STEP(0xffff)** **k) Qla operation** l) SMECENCPOSN=0x03E8 SMECENCFINEPOSN=0x???? SMECLVDTACSIG=0x1DB7 SMECLVDTPOSN=0x03E8 SMECPOSNDELTA=0x0000 m) SMECMOTORCURR = 0x???? n) SMECMOTORBEMF = 0x????	**We don't set Step to 0xffff each SMEC step because we need a continuous graphic at the end.**
5	**Set of position** If QLA is available, send SMEC science frames and check sensor signal of graph display	SetTrajEndPosition 0x90451B58 SetTrajEndPosition 0x90451F40 SetTrajEndPosition 0x90452328 SetTrajEndPosition 0x90452710 SetTrajEndPosition 0x90452AF8 SetTrajEndPosition 0x90452EE0 SetTrajEndPosition 0x904532C8 SetTrajEndPosition 0x904536B0 SetTrajEndPosition 0x90453A98 SetTrajEndPosition 0x90453E80	
6	**Drive SMEC back to the start position**	SetTrajEndPosition(0x0000) 0x90450000	

Success/Failure Criteria: Test passed if SMEC moves to the set position and current and back emf have expected values
Comment/Open issue: Need conversion curve between signal and physical position. I need to specify some of the values expected. I use conversion curves in Bruce's document

4.16 FUNC-SMEC-04b, SMEC closed loop position test

ID:	FUNC-SMEC-04b
Purpose	Checking that SMEC moves to the position commanded, in open loop
Description of test:	Move to set positions and measure read back position, currents, back emf
Test Type:	Integrity
Instrument Models:	PFM/FS
Redundancy:	prime and redundant
Initial configuration	SPIRE in REDY mode + MCU on + SMEC on, initialised for close loop operation at home position
Final configuration	Idem
EGSE Configuration:	SCOS-2000 required
Level	ILT/PLT/IST/FLT
Test Conditions:	Warm and cold
Total duration	3 min
Constraints:	FUNC-MCU-01 and FUNC-SMEC-01 successfully passed

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
0	**Select SCOS display *(SMEC PARAMETERS)***		
1	**Run QLA script in order to:** **Record SMEC frame parameters :** **SMECENCPOSN** **SMECSCANLVDTPOSN** **SMECSCANMOTORBEMF** **SMECCMDMOTORCURR** **Record MCU ENG frame parameters :** **MCUENGSMECLVDTACSIG** **MCUENGSMECLVDTDCSIG**		
2	**Start SMEC frame generation @ 250Hz and MCU ENG frame generation @ 64Hz**	**SetTelemetryPacket10Sampl(10) 0x91C0000A** **SetTelemetryPacket14Sampl(39) 0x91C00027** **SetFrameNumber(0xFFFF) 0x91C3FFFF** **SetStartFrame 0x91C10001**	
3	**Mark beginning of building block**	**SET_BBID(0x82060001)**	**BBTYPE=0x8206**
4	**Move SMEC** a) Force open loop operation b) Set Step to 1 **c) Start recording the SMEC frame parameters described in 1** d) Set a position to reach (e.g. +1mm from mechanical stop) e) Move SMEC to first position f) Wait n sec	a) SetSLoopMode(0x0001) 0x90440006 **b) SET_OSB_STEP(0x0001)** **c) Qla operation** d) SetTrajEndPosition(0x03E8) 0x904503E8 e) SetSTrajMode(0x0001) 0x90490001 f) Wait n sec	**We don't set Step to 0xffff each SMEC step because we need a continuous graphic at the end.**

Step	Action	Command/TM	Comment/notes
5	**Repeat for a small set of** a) 2mm from mechanical stop b) 3mm from mechanical stop c) 4mm from mechanical stop d) 5mm from mechanical stop e) 6mm from mechanical stop f) 7mm from mechanical stop g) 8mm from mechanical stop h) 9mm from mechanical stop i) 10mm from mechanical stop j) 11mm from mechanical stop	 a) SetTrajEndPosition (0x904507D0) b) SetTrajEndPosition (0x90450BB8) c) SetTrajEndPosition (0x90450FA0) d) SetTrajEndPosition (0x90451388) e) SetTrajEndPosition (0x90451770) f) SetTrajEndPosition (0x90451F40) g) SetTrajEndPosition (0x90452328) h) SetTrajEndPosition (0x90452710) i) SetTrajEndPosition (0x90452AF8) j) SetTrajEndPosition (0x90452EE0)	
6	a) Set STEP to 0xffff b) Stop MCU frame generation	a) SET_OBS_STEP(0xFFFF) b) SetStartFrame (0x91C10000) FLUSH_FIFO (Fifo flags = 0x2000)	
5	**Drive SMEC back to its home position**	SetTrajEndPosition(0x????) 0x9045????	

Success/Failure Criteria: Test passed if SMEC moves to the set position and current and back emf have expected values
Comment/Open issue: Need conversion curve between signal and physical position. I need to specify some of the values expected

4.17 FUNC-SMEC-05, SMEC step and look scan test

ID:	FUNC-SMEC-05
Purpose	Characterising SMEC movement for a step-and-look scan
Description of test:	Perform a step-and-look scan, measure positions, current, back emf
Test Type:	Characterisation
Instrument Models:	PFM/FS
Redundancy:	prime and redundant
Initial configuration:	SPIRE in REDY mode + SMEC on and initialised for closed loop operation at home position
Final configuration	Idem
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT
Test Conditions:	Cold
Total duration	~18 min
Constraints:	FUNC-MCU-01 and FUNC-SMEC-01 successfully passed

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
0	**Select SCOS display *(SMEC PARAMETERS)***		
1	**Mark beginning of building block** **Set Step to 1**	**SET_BBID(0x8207000)** **SET_OBS_STEP(0x0001)**	**BBTYPE=0x8207**
2	**Start MCU ENG and SMEC packet sampling at 64Hz and 250Hz**	SetTP10SampFreq(0x000B) 0x91C0000A SetTP14SampFreq(0x0027) 0x91C40027 SetFrameNumber(0xFFFF) 0x91C3FFFF SetFrameStart(0x0001) 0x91C10001	
3	**Run QLA script FUNC-SMEC-05 in order to:** **a) Display SMEC parameters** **b) Record a time series of the same SMEC frame parameters** **c) Record a time series of Full Spectrometer detector data**	**a) b) SMECENCPOSN, SMECENCFINEPOSN, SMECLVDTACSIG, SMECMOTORBEMF, SMECOTORCURR, SMECMOTORBEMF, (+others?)** **c)SPECFARRAY01…SPECFARRAY294**	

Step	Action	Command/TM	Comment/notes

4	**Move SMEC**
	a) Set SMEC to hold mode
	b) Set scan speed to max (2000 um/sec)
	c) Set speed for fly back (2000 um/sec)
	d) Set start position of the scan (e.g. –1.0 mm from ZPD)
	e) Move to position
	f) Set step to 1
	g) Record parameters for 10 sec
	h) Set step to 0xffff
	i) For i=1..100{
	increment position to reach by 10 um
	move to position
	Set step to i+1
	Record parameters for 10 sec
	Set step to 0xffff
	}
		a) SetSTrajMode(0x0000) 0x90490000
		b) SetScanFwdSpeed 0x90474E20
		c) Set Scan RevSpeed 0x90564E20
		d) SetSTrajEndPosition(0x1B58) 0x90451B58
		e) SetSTrajMode(0x0001) 0x90490001
		f) SET_OBS_STEP(0x0001)
		g) *Wait 10 sec*
		h) SET_OBS_STEP(0xffff)
		
		i) pos = 0x1B58 + i*0x000A
		j) SetSTrajEndPosition(0x(pos)) 0x9045(pos)
		k) SET_OBS_STEP(0x000i+1)
		l) *Wait 10 sec*
		m) SET_OBS_STEP(x0xffff)	

5	**Write in a file the parameters recorded with QLA**		
6	**Drive SMEC back to its home position**	SetTrajEndPosition(0x????) 0x9045????	
7	**Stop TM packet sampling**	SetTP10SampFreq(0x0000) *0x91C00000*	
8	**Offline analysis** **Characterise SMEC scans**	**Derive** **a) Average value of each parameter for each step and plot average value vs position** **b) compare LVDT and encoder signal (plot LVDT vs encoder)** **c) consumed power**	

Success/Failure Criteria Test passed if SMEC does the scan required
Comment/Open issue:
Need conversion curve between signals and physical position. I use conversion curves in Bruce's document

4.18 FUNC-SMEC-06, SMEC saw tooth scan test

ID:	FUNC-SMEC-06
Purpose	Characterising SMEC movement during a saw tooth scan
Description of test:	Scan over range and measure positions, current, back-emf – repeat for different scans
Test Type:	Characterisation
Instrument Models:	PFM/FS
Redundancy:	prime and redundant
Initial configuration:	SPIRE in REDY mode + MCU on + SMEC on and initialised for closed loop operation at home position
Final configuration	Idem
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT
Test Conditions:	Cold
Total duration	10 min
Constraints:	FUNC-MCU-01 and FUNC-SMEC-01 successfully passed

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
0	**Select SCOS display *(SMEC PARAMETERS)***		
1	**Mark beginning of building block** **Set Step to 1**	**SET_BBID(0x82080000)** **SET_OBS_STEP(0x0001)**	**BBTYPE=0x8208**
1	**Run QLA script FUNC-SMEC-06 in order to:** **Display SMEC frame parameters** **Record a time series of all the SMEC frame parameters**	**SMECENCPOSN, SMECENCFINEPOSN, SMECLVDTACSIG, SMECOTORCURR, SMECMOTORBEMF,SMECENCSIG1,SMECENCSIG2**	
2	**Start MCU ENG and SMEC packet sampling at 64Hz and 250Hz**	SetTP10SampFreq(0x000B) 0x91C0000A SetTP14SampFreq(0x0027) 0x91C40027 SetFrameNumber(0xFFFF) 0x91C3FFFF SetFrameStart(0x0001) 0x91C10001	
3	**Move SMEC** a) Set SMEC to hold mode b) Set a scan speed (500 um/s) c) Set fly back speed (2000 um/sec) d) Set number of scan to 2 a) Set a start position (-1mm from ZPD) b) Set end position (+1 mm from ZPD) **c) Set step to 1** d) Start the scan e) Wait for scan to finish **f) Set step to 0xffff**	a) SetSTrajMode(0x0000) 0x90490000 b) SetSScanSpeedForward(0x1388) 0x90471388 c) SetSScanRevSpeed(0x4E20) 0x90564E20 d) SetSScanNumber(0x0002) 0x90480002 e) SetStrajStartPosition(0x1B58) 0x90461B58 f) SetSTrajEndPosition(0x2328) 0x90452328 **g) SET_OBS_STEP(0x0001)** h) SetSTrajMode(0x0002) 0x90490002 i) Wait **j) SET_OBS_STEP(0xffff)**	
3’	**Repeat scan for different scan distance and speed.** **Each new scan will be assigned a new obsid.**		

Step	Action	Command/TM	Comment/notes
4	**Repeat for different scan amplitude** a) Set SMEC to hold mode b) Set scan amplitude from –4 to +4 mm e) Set number of scan to 2 **f) Set step to 1** c) Run the scan d) Wait for scan to finish **e) Set step to 0xffff**	 a) SetSTrajMode(0x0000) 0x90490000 b) SetStrajStartPosition(0x0FA0) 0x90460FA0 SetSTrajEndPosition(0x2EE0) 0x90452EE0 c) SetSScanNumber(0x0002) 0x90480002 **d) SET_OBS_STEP(0x0001)** e) SetSTrajMode(0x0002) 0x90490002 f) Wait **g) SET_OBS_STEP(0xffff)**	
5	**Repeat for different scan speed** a) Set SMEC to hold mode b) Reset scan amplitude +/- 1mm c) Set the speed to 1mm/s d) Set number of scan to 2 **e) Set step to 1** f) Run the scan g) Wait for scan to finish **h) Set step to 0xffff** i) Set SMEC to hold mode j) Set the speed to 0.2mm/s k) Set number of scan to 2 **l) Set step to 1** m) Run the scan n) Wait for scan to finish **o) Set step to 0xffff**	 a) SetSTrajMode(0x0000) 0x90490000 b) SetStrajStartPosition(0x1B58) 0x90461B58 SetSTrajEndPosition(0x2328) 0x90452328 c) SetSScanSpeedForward(0x2710) 0x90472710 d) SetSScanNumber(0x0002) 0x90480002 **e) SET_OBS_STEP(0x0001)** f) SetSTrajMode(0x0002) 0x90490002 g) Wait **h) SET_OBS_STEP(0xffff)** i) SetSTrajMode(0x0000) 0x90490000 j) SetSScanSpeedForward(0x07D0) 0x904707D0 k) SetSScanNumber(0x0002) 0x90480002 **l) SET_OBS_STEP(0x0001)** m) SetSTrajMode(0x0002) 0x90490002 n) Wait **o) SET_OBS_STEP(0xffff)**	
6	**Write in a file the parameters recorded with QLA**		
7	**Drive SMEC back to its home position**	SetSTrajMode(0x0000) 0x90490000 SetSTrajEndPosition(0x0000) 0x90450000 SetSTrajMode(0x0001) 0x90490001	
8	**Stop TM packet sampling**	SetTP10SampFreq(0x0000) *0x91C00000*	

Step	Action	Command/TM	Comment/notes
9	**Offline analysis** Characterise SMEC motion	Derive: a) scan length, accuracy of position reached b) velocity, velocity stability c) consumed power	

Success/Failure Criteria: Test passed if SMEC does the scan required

Comment/Open issue:

4.19 FUNC-SMEC-07, SMEC triangular scan test

ID:	FUNC-SMEC-07
Purpose	Characterising SMEC movement during a triangular scan
Description of test:	Scan over range and measure positions, current, back-emf – repeat for different scans
Test Type:	Characterisation
Instrument Models:	PFM/FS
Redundancy:	prime and redundant
Initial configuration:	SPIRE in REDY mode + MCU on + SMEC on and initialised for closed loop operation, at home position
Final configuration	Idem
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT
Test Conditions:	Cold
Total duration	5 min
Constraints:	FUNC-MCU-01 and FUNC-SMEC-01 successfully passed

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
0	**Select SCOS display *(SMEC PARAMETERS)***		
1	**Mark beginning of building block** **Set Step to 1**	**SET_BBID(0x82090000)** **SET_OBS_STEP(0x0001)**	**BBTYPE=0x8209**
2	**Run QLA script FUNC-SMEC-06 in order to:** **Display SMEC parameters** **Record a time series of the parameters**	**SMECENCPOSN, SMECENCFINEPOSN, SMECLVDTACSIG, SMECMOTORBEMF, SMECOTORCURR, SMECENCSIG1,SMECENCSIG2, (+others???)**	
3	**Start MCU ENG and SMEC packet sampling at 64Hz and 250Hz**	SetTP10SampFreq(0x000B) 0x91C0000A SetTP14SampFreq(0x0027) 0x91C40027 SetFrameNumber(0xFFFF) 0x91C3FFFF SetFrameStart(0x0001) 0x91C10001	
4	**Move SMEC** a) Set SMEC to hold mode b) Set a scan speed (500 um/s) c) Set fly back speed (500 um/sec) d) Set number of scan to 2 g) Set a start position (-1mm from ZPD) h) Set end position (+1 mm from ZPD) **i) Set step to 1** j) Run the scan k) Wait for scan to finish **l) Set step 0xffff**	a) SetSTrajMode(0x0000) 0x90490000 b) SetSScanSpeedForward(0x1388) 0x90471388 c) SetSScanRevSpeed(0x1388) 0x90561388 d) SetSScanNumber(0x0002) 0x90480002 e) SetStrajStartPosition(0x1B58) 0x90461B58 f) SetSTrajEndPosition(0x2328) 0x90452328 **g) SET_OBS_STEP(0x0001)** h) SetSTrajMode(0x0002) 0x90490002 i) Wait **j) SET_OBS_STEP(0xffff)**	
4’	**Repeat scan for different scan distance and speed.** **Each new scan will be assigned a new obsid.**		

Step	Action	Command/TM	Comment/notes
5	**Repeat for different scan amplitude** a) Set SMEC to hold mode b) Set scan amplitude from –4 to +4 mm c) Set number of scan to 2 **d) Set step to 1** e) Run the scan f) Wait for scan to finish **g) Set step 0xffff**	a) SetSTrajMode(0x0000) 0x90490000 b) SetStrajStartPosition(0x0FA0) 0x90460FA0 SetSTrajEndPosition(0x2EE0) 0x90452EE0 c) SetSScanNumber(0x0002) 0x90480002 d) **SET_OBS_STEP(0x0001)** e) SetSTrajMode(0x0002) 0x90490002 f) Wait **g) SET_OBS_STEP(0xffff)**	
6	**Repeat for different scan speed** a) Set SMEC to hold mode b) Reset scan amplitude +/- 1mm c) Set the speed to 1mm/s d) Set number of scan to 2 **e) Set step to 1** f) Run the scan g) Wait for scan to finish **h) Set step 0xffff** i) Set SMEC to hold mode j) Set the speed to 0.2mm/s k) Set number of scan to 2 **l) Set step to 1** m) Run the scan n) Wait for scan to finish **o) Set step 0xffff**	a) SetSTrajMode(0x0000) 0x90490000 b) SetStrajStartPosition(0x1B58) 0x90461B58 SetSTrajEndPosition(0x2328) 0x90452328 c) SetSScanSpeedForward(0x2710) 0x90472710 SetSScanRevSpeed(0x2710) 0x90562710 d) SetSScanNumber(0x0002) 0x90480002 **e) SET_OBS_STEP(0x0001)** f) SetSTrajMode(0x0002) 0x90490002 g) Wait **h) SET_OBS_STEP(0xffff)** i) SetSTrajMode(0x0000) 0x90490000 j) SetSScanSpeedForward(0x07D0) 0x904707D0 SetSScanRevSpeed(0x07D0) 0x905607D0 k) SetSScanNumber(0x0002) 0x90480002 **l) SET_OBS_STEP(0x0001)** m) SetSTrajMode(0x0002) 0x90490002 n) Wait **o) SET_OBS_STEP(0xffff)**	
7	**Write in a file the parameters recorded with QLA**		
8	**Drive SMEC back to its home position**	SetSTrajMode(0x0000) 0x90490000 SetSTrajEndPosition(0x0000) 0x90450000 SetSTrajMode(0x0001) 0x90490001	

Step	Action	Command/TM	Comment/notes
9	**Stop TM packet sampling**	SetTP10SampFreq(0x0000) *0x91C00000*	
10	**Offline analysis** Characterise SMEC motion	Derive: a) scan length, accuracy of position reached b) velocity, velocity stability c) consumed power	

Success/Failure Criteria: Test passed if SMEC does the scan required

Comment/Open issue:
I use conversion curves in Bruce's document

4.20 FUNC-SMEC-08, SMEC open loop position test

ID:	FUNC-SMEC-08
Purpose	Moving SMEC in open loop mode. Scaling back emf
Description of test:	Move SMEC short distance and check response
Test Type:	Integrity
Instrument Models:	PFM/FS
Redundancy:	prime and redundant
Initial configuration:	SPIRE in REDY mode + MCU on + SMEC on and initialised, at home position
Final configuration	Idem
EGSE Configuration:	SCOS-2000 and QLA
Level	ILT/PLT/IST
Test Conditions:	Cold
Total duration	5 min
Constraints:	FUNC-MCU-01 and FUNC-SMEC-01 successfully passed

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
0	**Select SCOS display *(SMEC PARAMETERS)***		
1	**Mark beginning of building block** **Set Step to 1**	**SET_BBID(0x820A0000)** **SET_OBS_STEP (0x0001)**	**BBTYPE=0x820A**
1	**Start MCU ENG and SMEC packet sampling at 250Hz and 250Hz**	SetTP10SampFreq(0x000B) 0x91C0000A SetTP14SampFreq(0x0027) 0x91C4000A SetFrameNumber(0xFFFF) 0x91C3FFFF SetFrameStart(0x0001) 0x91C10001	
2	**Move SMEC** a) Set SMEC to Hold mode b) Open loop c) Set a position to reach (ZPD -1mm) **d) Start recording parameters with QLA** **e) Set step to 1** f) Move SMEC g) Wait for position to be reached **h) Set step to 0xffff**	a) SetSTrajMode(0x0000) 0x90490000 b) SetSLoopMode 0x90440006 c) SetTrajEndPosition 0x90451B58 **d) SMECLVDTDCSIG, SMECENCPOSN, SMECMOTORBEMF** **e) SET_OBS_STEP(0x0001)** f) SetTrajMode 0x90490001 g) Wait **h) SET_OB_STEP(0xffff)**	
3	**Scale back emf** TBD	SetMotorResistance	
4	**Move SMEC to a new position** a) Set SMEC to Hold mode b) Set a position to reach (ZPD+1mm) **c) Start recording parameters with QLA** **d) Set step to 2** e) Move SMEC f) Wait for position to be reached **g) Set step to 0xffff**	a) SetSTrajMode(0x0000) 0x90490000 b) SetTrajEndPosition 0x90452328 **c) SMECLVDTDCSIG, SMECENCPOSN, SMECMOTORBEMF** **d) SET_OBS_STEP(0x0002)** e) SetTrajMode 0x90490001 f) Wait **g) SET_OBS_STEP(0xffff)**	

Step	Action	Command/TM	Comment/notes
7	**Drive SMEC back to its home position**	SetSTrajMode(0x0000) 0x90490000 SetSTrajEndPosition(0x0000) 0x90450000 SetSTrajMode(0x0001) 0x90490001	

FUNC-SMEC-09, SMEC open loop scan test

ID:	FUNC-SMEC-09
Purpose	Scanning in open loop mode (feedback on back emf only)
Description of test:	Scan over range and measure positions, current, back-emf – repeat for different scans. Test identical to SMEC-07 but with open loop
Test Type:	Characterisation
Instrument Models:	PFM/FS
Redundancy:	prime and redundant
Initial configuration:	SPIRE in REDY mode + MCU on + SMEC on and initialised, at home position
Final configuration	Idem
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT
Test Conditions:	Cold
Total duration	5 min
Constraints:	FUNC-MCU-01 and FUNC-SMEC-01 and SMEC-08 successfully passed

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
0	**Select SCOS display *(SMEC PARAMETERS)***		
1	**Mark beginning of building block** **Set Step to 1**	**SET_BBID(0x820B0000)** **SET_OBS_STEP (0x0001)**	**BBTYPE=0x820B**
1	**Start MCU ENG and SMEC packet sampling at 64Hz and 250Hz**	SetTP10SampFreq(0x000B) 0x91C0000A SetTP14SampFreq(0x0027) 0x91C40027 SetFrameNumber(0xFFFF) 0x91C3FFFF SetFrameStart(0x0001) 0x91C10001	
2	**Run QLA script FUNC-SMEC-07 in order to:** **a) Display SMEC parameters** **b) Record a time series of the parameters**	**SMECENCPOSN, SMECENCFINEPOSN, SMECENCPOSN, SMECLVDTACSIG, SMECMOTORBEMF, SMECOTORCURR, (+others???)**	
3	**Move SMEC** a) Set SMEC to hold mode b) Open loop (no sensor) c) Set a scan speed (500 um/s) d) Set fly back speed (500 um/sec) e) Set number of scan to 2 f) Set a start position (ZPD-1mm) g) Set end position (ZPD+1 mm) **h) Set step to 1** i) Run the scan j) Wait for scan to finish **k) Set step 0xffff**	a) SetSTrajMode(0x0000) 0x90490000 b) SetSLoopMode(0x0006) 0x90440006 c) SetSScanSpeedForward(0x1388) 0x90471388 d) SetSScanRevSpeed(0x1388) 0x90561388 e) SetSScanNumber(0x0002) 0x90480002 f) SetStrajStartPosition(0x1B58) 0x90461B58 g) SetSTrajEndPosition(0x2328) 0x90452328 **h) SET_OBS_STEP(0x0001)** i) SetSTrajMode(0x0002) 0x90490002 j) Wait **k) SET_OBS_STEP(0xffff)**	
3’	**Repeat for different scan distances and speed.** **Each new scan will have a new obsid**		

Step	Action	Command/TM	Comment/notes
4	**Repeat for different scan amplitude** a) Set SMEC to hold mode b) Set scan amplitude (+/-4mm) c) Set number of scan to 2 **d) Set step to 1** e) Run the scan f) Wait for scan to finish **g) Set step to 0xffff**	a) SetSTrajMode(0x0000) 0x90490000 b) SetStrajStartPosition(0x0FA0) 0x90460FA0 SetSTrajEndPosition(0x2EE0) 0x90452EE0 c) SetSScanNumber(0x0002) 0x90480002 **d) SET_OBS_STEP(0x0001)** e) SetSTrajMode(0x0002) 0x90490002 f) Wait **g) SET_OBS_STEP(0xffff)**	
5	**Repeat for different scan speed** a) Set SMEC to hold mode b) Reset scan amplitude +/- 1mm c) Set the speed to 1mm/s d) Set number of scan to 2 **e) Set step to 1** f) Run the scan g) Wait for scan to finish **h) Set step to 0xffff** i) Set SMEC to hold mode j) Set the speed to 0.2mm/s k) Set number of scan to 2 **l) Set step to 1** m) Run the scan n) Wait for scan to finish **o) Set step to 0xffff**	a) SetSTrajMode(0x0000) 0x90490000 b) SetStrajStartPosition(0x1B58) 0x90461B58 SetSTrajEndPosition(0x2328) 0x90452328 c) SetSScanSpeedForward(0x2710) 0x90472710 SetSScanRevSpeed(0x2710) 0x90562710 d) SetSScanNumber(0x0002) 0x90480002 **e) SET_OBS_STEP(0x0001)** f) SetSTrajMode(0x0002) 0x90490002 g) Wait **h) SET_OBS_STEP(0xffff)** i) SetSTrajMode(0x0000) 0x90490000 j) SetSScanSpeedForward(0x07D0) 0x904707D0 SetSScanRevSpeed(0x07D0) 0x905607D0 k) SetSScanNumber(0x0002) 0x90480002 **l) SET_OBS_STEP(0x0001)** m) SetSTrajMode(0x0002) 0x90490002 n) Wait **o) SET_OSB_STEP(0xffff)**	
6	**Write in a file the parameters recorded with QLA**	Use save button on QLA GUI	

Step	Action	Command/TM	Comment/notes
7	**Drive SMEC back to its home position**	SetSTrajMode(0x0000) 0x90490000 SetSTrajEndPosition(0x0000) 0x90450000 SetSTrajMode(0x0001) 0x90490001	
8	**Stop TM packet sampling**	SetTP10SampFreq(0x0000) *0x91C00000*	
9	**Offline analysis** **Characterise SMEC movement:**	**Derive:** **a) scan length, accuracy of position reached** **b) velocity, velocity stability** **c) consumed power**	

Success/Failure Criteria: Test passed if SMEC does the scan required

Comment/Open issue:
I use conversion curves in Bruce's document

4.21 FUNC-BSM-01c, BSM power on chop, perform small step

ID:	FUNC-BSM-01c
Purpose	Checking the integrity of BSM motors and sensors on chop axis.
Description of test:	Switch BSM chop motors on. Check telemetry responses, consumed power – perform a small step in open loop
Test Type:	Integrity
Instrument Models:	CQM/PFM/FS
Redundancy:	prime and redundant
Initial configuration:	SPIRE in REDY mode + BSM chop sensor OFF
Final configuration	SPIRE in REDY mode + BSM chop sensor ON
EGSE Configuration:	SCOS-2000 required
Level	ILT/PLT/IST/FLT
Test Conditions:	Warm and cold
Total duration	1 min
Constraints:	FUNC-MCU-01 successful

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**Select SCOS display (*CHOP PARAMETERS)***		
2	**Mark beginning of building block**	**SET_BBID(0x81000001)**	
3	**Switch on BSM chop axis** Power on chop MR sensor Force open loop in chop axis Set Chop and Jiggle to move independently Record chop status Record chop magneto resistive signal Record chop motor current Record chop motor voltage Record Chop DAC value	 SetCSensorPwr(0x0001) 0x90C00001 SetChopLoopMode 0x90C20003 SetBSMMove(0x0000), 0x90C60000 BSMSTAT CHOPSENSSIG CHOPMOTORCURR CHOPMOTORVOLT CHOPDACVAL	
4	**Evaluate consumed power**	Proportional to (CHOPMOTORCURR)^2	**There is an offset between measured current and DAC value. In order to do a correct evaluation so substract the offset read when no current is applied.** **This offset is the value of getMotorcurrent when dac value is set to 0x8000.** **We can know the coil resistance because we measure both current and voltage. The motor coil voltage read by mean of the ADC is** **(Motor Voltage ADCvalue - 32768)/32768*10Volts/19.71** **(19.71 is the voltage amplification in BSM board which amplifies the motor coil voltage.** **The resistance is given by measured voltage/measured current (take many points to get a mean value).**

Step	Action	Command/TM	Comment/notes
5	**Perform a small step in open loop** Send to position 35000 (<0.2 degree) Check parameters	SetChopTargetPosition 0x90C388B8 CHOPSENSSIG, CHOPMOTORCURR, CHOPMOTORVOLT, CHOPDACVAL	**The conversion between position on the sky and target position is dependent on version of the electronics, BSM model and prime or redundant channel use. The commanded target position that appears here is just a guide.** **The current which is sent is:** **The DAC value sent is:** **DAC Input=** **(ChopTarget Position-32768)*CHOPFFGAIN/3051.757813 + 32768** **The DAC output voltage (Volt) is:** **DAC output volts = (DACinput-32768)/32768*10 Volts** **The current sent in coil is:** **DAC output volts*60mA/10V** **So a target position of 35000 sends a current of 4.1 mA**
6	**Return to 0**	SetChopTargetPosition 0x90C38000	

Success/Failure Criteria:
Test passed if:
- **BSM sensors are switched on and the small angular step is performed.**

DF Comments: test is passed if:
- **The measured current given by CHOPMOTORCURRENT is close from CHOPDACVALUE (there is a small offset and little gain difference between desired current which is the DAC value and the actual measured current by ADC.**
- **The magnetoresistive signal evolves in the same direction as the motor current (but gains are different because the scale of the sensor is different and depends on magnetoresistors themselves. THIS TESTS THE POLARITY COMPATIBILITY.**

Comment/Open issue:
Need conversion curve of angle vs target position.

4.22 FUNC-BSM-01j, BSM power on jiggle, perform small step

ID:	FUNC-BSM-01j
Purpose	Checking the integrity of BSM motors and sensors in jiggle axis
Description of test:	Switch BSM jiggle motors on. Check telemetry responses, consumed power – perform a small step in open loop
Test Type:	Integrity
Instrument Models:	CQM/PFM/FS
Redundancy:	prime and redundant
Initial configuration:	SPIRE in REDY mode + BSM jiggle sensor OFF
Final configuration	SPIRE in REDY mode + BSM sensor ON
EGSE Configuration:	SCOS-2000 required
Level	ILT/PLT/IST/FLT
Test Conditions:	Warm and cold
Total duration	1 min
Constraints:	FUNC-MCU-01 successful

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**Select SCOS display (*JIGGLE PARAMETERS*)**		
2	**Mark beginning of building block**	**SET_BBID(0x81010001)**	
3	**Switch on BSM jiggle axis** Power on jiggle sensors Force open loop in jiggle axis Set Chop and Jiggle to move independently Record jiggle status Record jiggle magneto resistive signal Record jiggle motor current Record jiggle motor voltage Record Jiggle DAC value	 SetJSensorPwr(0x0001) 0x91400001 SetJigLoopMode 0x91420003 SetBSMMove(0x0000), 0x90C60000 BSMSTAT JIGGSENSSIG JIGGMOTORCURR JIGGMOTORVOLT JIGGDACVAL	
4	**Evaluate consumed power**	Proportional to (JIGGMOTORCURR)^2	
5	**Perform a small step in open loop** Send to position 35000 (<0.05 degree) Check parameters	 SetJiggTargetPosition 0x914388B8 JIGGSENSSIG, JIGGMOTORCURR, JIGGMOTORVOLT, JIGGDACVAL	**Same comments as for chop axis**
6	**Return to 0**	SetJiggTargetPosition 0x91438000	

Success/Failure Criteria:
Test passed if:
- **BSM sensors are switched on and the small angular step is performed.**

DF Comments: test is passed if:
- **The measured current given by JIGGMOTORCURRENT is close from JIGGDACVALUE (there is a small offset and little gain difference between desired current which is the DAC value and the actual measured current by ADC.**
- **The magnetoresistive signal evolves in the same direction as the motor current (but gains are different because the scale of the sensor is different and depends on magnetoresistors themselves. THIS TESTS THE POLARITY COMPATIBILITY.**

Comment/Open issue:
Need conversion curve of angle vs target position.

4.23 FUNC-BSM-02c, BSM chop axis in open loop

ID:	BSM-02c
Purpose	Scaling the back emf to observe the BSM behaviour on degraded mode operation.
Description of test:	Perform a step of 1 deg, record sensor signal and plot it with QLA. Set the chop motor resistance in order to damp the natural axis oscillation. Set a new target value, record and plot sensor signal.
Test Type:	Characterisation
Instrument Models:	PFM/FS
Redundancy:	
Initial configuration:	SPIRE in REDY mode + BSM ON
Final configuration	SPIRE in REDY mode + BSM ON
EGSE Configuration:	SCOS-2000 QLA
Level	ILT/PLT/IST/FLT
Test Conditions:	Cold
Total duration	2 min
Constraints:	MCU-01, BSM-01 successful

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**Select SCOS display (*CHOP PARAMETERS*)**		
2	**Run QLA script FUNC-BSM-02c**		
3	**Mark beginning of building block**	**SET_BBID(0x81020001)**	

Step	Action	Command/TM	Comment/notes
4	**Setup BSM movement in open loop with backemf use** a) Set Chop and Jiggle to move independently b) Set the open loop constant between target position and DAC value = 1/32768 c) Set slew rate limit d) Set mode to open loop (no sensor) e) **Scaling the back emf** **Set Cmotor resistance to :** **the mean value of R(calculated on BSM03c)*10000** **Apply some gain on the feedback**	 a) SetBSMMove(0x0000) (0x90C60000) b) SetCPositionScaleFactor(S=1/32768) (0x90D60BEB) c) SetCRateLimit(C=1000) (0x90D103E8) d) SetChopLoopMode(Mode= 3) (0x90C20003) e) **SetCmotor resistance 0x90D3(0xValue)** **SetCmotorbackEmfGain 0x90D2????**	
5	**Start BSM frame generation @ 250Hz**	SetTelemetryPacket12Sample(s=10) (0x91C2000A) SetFrameNumber(0xFFFF) (0x91C3FFFF) SetFrameStart(0x0001) (0x91C10001).	

Step	Action	Command/TM	Comment/notes
	Move BSM in chop axis **Set step to 1** **Start recording BSMCHOPSENSSIG with QLA** Wait 1 sec Perform a step to 20000 (~-1 degree) Wait 1 sec **Set step to 0xffff** **Stop recording BSMCHOPSENSSIG** **Make a time series QLA plot of BSMCHOPSENSSIG BSM frame parameter** **Set step to 2** **Start recording BSMCHOPSENSIG with QLA** Wait 1 sec Perform a step to 40000 (~+0.25 degree) Wait 1 sec **Set step to 0xffff** **Stop recording BSMCHOPSENSSIG** **Make a time series QLA plot of BSMCHOPSENSSIG BSM frame parameter** Move BSM to 0 Stop BSM packet telemetry **Flush MCU FIFO**	 **SET_OBS_STEP(0x0001)** **Qla operation** Wait 1 sec SetChopTargetPosition(20000) (0x90C34E20) Wait 1 sec **SET_OBS_STEP(0xffff)** **Qla operation** **Make a time series QLA plot of BSMCHOPSENSSIG BSM frame parameter** **SET_OBS_STEP(0x0002)** **Qla operation** Wait 1 sec SetChopTargetPosition (0x90C39C40) Wait 1 sec **SET_OBS_STEP(0xffff)** **Qla operation** **Make a time series QLA plot of BSMCHOPSENSSIG BSM frame parameter** SetChopTargetPosition (0x90C38000) SetFrameStart(0x0000) (0x91C10000) **FLUSH_FIFO(0x2000)**	 **Plot should show large oscillation (during ~1sec) when backemf is not used. Oscillations should be much smaller (during ~100ms) when backemf is used.**

Test passed if:
- **BSM moves as required and back emf use is effective in damping the natural axis oscillation.**

Comment/open issues: Need conversion curve of angle vs target position.

4.24 FUNC-BSM-02j, BSM jiggle axis in open loop

ID:	BSM-02j
Purpose	Scaling the back emf to observe the BSM behaviour on degraded mode operation.
Description of test:	Perform a step of 0.25 deg, record sensor signal and plot it with QLA. Then set the jiggle motor resistance in order to damp the natural axis oscillation. Set a new target value, record and plot sensor signal.
Test Type:	Characterisation
Instrument Models:	PFM/FS
Redundancy:	
Initial configuration:	SPIRE in REDY mode + BSM ON
Final configuration	SPIRE in REDY mode + BSM ON
EGSE Configuration:	SCOS-2000 QLA
Level	ILT/PLT/IST/FLT
Test Conditions:	Cold
Total duration	2 min
Constraints:	MCU-01, BSM-01 successful

Procedure and analysis:

Step	Action	Command/TM	**Comment/notes**
1	**Select SCOS display (*JIGGLE PARAMETERS*)**		
2	**Run QLA script FUNC-BSM-02j**		
3	**Mark beginning of building block**	**SET_BBID(0x81030001)**	

Step	Action	Command/TM	**Comment/notes**
4	**Setup BSM movement in open loop with backemf use** a) Set Chop and Jiggle to move independently b) Set the open loop constant between target position and DAC value = 1/32768 c) Set slew rate limit d) Set mode to open loop (no sensor) e) **Scaling the back emf** **Set Jmotor resistance to :** **the mean value of R(calculated on BSM03j)*10000** **Apply some gain on the feedback**	a) SetBSMMove(0x0000) (0x90C60000) b) SetJPositionScaleFactor(S=1/32768) (0x914D0BEB) c) SetJRateLimit(C=1000) (0x915103E8) d) SetJiggLoopMode(Mode= 3) (0x91420003) e) **SetJmotor resistance 0x9153(0xValue)** **SetJmotorbackEmfGain 0x9152????**	
5	**Start BSM frame generation @ 250Hz**	SetTelemetryPacket12Sample(s=10) (0x91C2000A) SetFrameNumber(0xFFFF) (0x91C3FFFF) SetFrameStart(0x0001) (0x91C10001).	

Step	Action	Command/TM	**Comment/notes**
6	**Move BSM in jiggle axis** **Set step to 1** **Start recording BSMJIGGSENSSIG with QLA** Wait 1 sec Perform a step to 20000 (~-1 degree) Wait 1 sec **Set step to 0xffff** **Stop recording BSMJIGGSENSSIG** **Make a time series QLA plot of BSMJIGGSSENSSIG BSM frame parameter** **Set step to 2** **Start recording BSMJIGGSENSSIG with QLA** Wait 1 sec Perform a step to 40000 (~+ 0.25degree) Wait 1 sec **Set step to 0xffff** **Stop recording BSMJIGGSENSSIG** **Make a time series QLA plot of BSMCHOPSENSSIG BSM frame parameter** Move BSM to 0 Stop BSM packet telemetry **Flush MCU FIFO**	 **SET_OBS_STEP(0x0001)** **Qla operation** Wait 1 sec SetJIggTargetPosition(20000) (0x91434E20) Wait 1 sec **SET_OBS_STEP(0xffff)** **Qla operation** **Make a time series QLA plot of BSMJIGGSENSSIG BSM frame parameter** **SET_OBS_STEP(0x0002)** **Qla operation** Wait 1 sec SetJIggTargetPosition (0x91439C40) Wait 1 sec **SET_OBS_STEP(0xffff)** **Qla operation** **Make a time series QLA plot of BSMCHOPSENSSIG BSM frame parameter** SetJIggTargetPosition (0x91438000) SetFrameStart(0x0000) (0x91C10000) **FLUSH_FIFO(0x2000)**	**Plot should show large oscillation (during ~1sec) when backemf is not used. Oscillations should be much smaller (during ~100ms) when backemf is used.**

Test passed if:

- **BSM moves as required and back emf use is effective in damping the natural axis oscillation**.

Comment/open issues: Need conversion curve of angle vs target position.

4.25 FUNC-BSM-03c, BSM open loop raster, chop axis

ID:	FUNC-BSM-03c
Purpose	Characterising BSM movement for a single scan on chop axis in open loop.
Description of test:	Move BSM to multiple set positions. Check telemetry response, evaluate consumed power, evaluate chop motor resistance value necessary to test BSM degraded mode.
Test Type:	Characterisation
Instrument Models:	CQM/PFM
Redundancy:	prime and redundant
Initial configuration	SPIRE in REDY mode + BSM ON
Final configuration	SPIRE in REDY mode + BSM ON
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT
Test Conditions:	Cold
Total duration	5 min
Constraints:	FUNC-MCU-01, BSM-01c, 02c successful

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**Select SCOS display (*CHOP PARAMETERS*)**		
2	**Run QLA script FUNC-BSM-03c in order to:** Record a time series of BSM HK parameters Record a time series of BSM frame parameters	 CHOPMOTORCURR, CHOPMOTORVOLT, CHOPSENSSIG, JIGGMOTORCURR, JIGGMOTORVOLT, JIGGSENSSIG BSMCHOPMOTORCURR, BSMCHOPMOTORVOLT, BSMCHOPSENSSIG	
3	**Mark beginning of building block**	**SET_BBID(0x81080001)**	
4	**Start TM packet sampling of BSM science frames at 64Hz**	SetTP12SampFreq(0x002C) *0x91C2002C* SetFrameNumber(0xFFFF) 0x91C3FFFF SetFrameStart(0x0001) 0x91C10001	
5	**Move BSM on chop axis** a) Set Chop and Jiggle to move independently b) Open loop (no sensor) **c) Send BSM to one end of the chop axis travel** **d) Set step to 1** **e) Record BSM HK and frame params specified in 2 parameters for 3 sec** **f) Set step to 0xffff** g) Perform a step of 0x1000 **h) Set step to 2** **i) Record BSM HK and frame params specified in 2 parameters for 3 sec** **j) Set step to 0xffff** k) … **l) Perform a step of 0x1000** **m) Set step to 16** **n) Record BSM HK and frame params specified in 2 parameters for 3 sec** **o) Set step to 0xffff**	 a) SetBSMMove(0x0000), 0x90C60000 b) SetChopLoopMode 0x90C20003 **c) SetChopTargetPosition 0x90C30000** **d) SET_OBS_STEP(0x0001)** e) *Wait 3 sec* **f) SET_OBS_STEP(0xffff)** **g) SetChopTargetPosition 0x90C31000** **h) SET_OBS_STEP(0x0002)** i) W*ait 3 sec* **j) SET_OBS_STEP(0xffff)** k) … **l) SetChopTargetPosition 0x90C3F000** **m) SET_OBS_STEP(0x0010)** n) W*ait 3 sec* **o) SET_OBS_STEP(0xffff)**	

Step	Action	Command/TM	Comment/notes
6	**With QLA make 2 time series plots FOR EACH STEP of:** **1. BSMCHOPSENSSIG against time.** **2. (BSMCHOPMOTORVOLT-32768) / (BSMCHOPMOTORCURR-32768) against time.** **At the end of the sequence step up sequence, make a QLA plot of HK params:** **CHOPSENSSIG vs CHOPDACVAL** **Also write in a file a table with the maximum of each of the ratios given in 2 against commanded target position and then calculate the mean value and standard deviation.**		
5	**Stop TM packet sampling** **Flush MCU FIFO**	SetFrameStart(0x0000) 0x91C10000 FLUSH_FIFO (FIFO flags = 0x2000)	
6	**Offline analysis:** Characterise BSM movement	**Analysis:** **Consumed power.** **comm.Pos Vs current read – check is hysteresis occurs** **current Vs position read** **Find position where current = 0** **Find current when MR sensor value is 32768**	You can determine actual power by calculation of motor coil resistance see above. **This shall be used for sending a current offset on chopper axis to center the closed loop.**

Test passed if:
Test passed if BSM does scan required.
DF Comments: test is passed if:

- **The measured current given by CHOPMOTORCURRENT is close from CHOPDACVALUE (there is a small offset and little gain difference between desired current which is the DAC value and the actual measured current by ADC.**
- **The magnetoresistive signal evolves in the same direction as the motor current (but gains are different because the scale of the sensor is different and depends on magnetoresistors themselves. THIS TESTS THE POLARITY COMPATIBILITY.**

Comment/open issues: **Need conversion curve of angle vs target position.**

FUNC-BSM-03j, BSM scan with open loop, jiggle axis

ID:	FUNC-BSM-03j
Purpose	Characterising BSM movement for a single scan on jiggle axis in open loop
Description of test:	Move BSM to multiple set positions. Check telemetry response, consumed power.
Test Type:	Characterisation
Instrument Models:	CQM/PFM
Redundancy:	prime and redundant
Initial configuration	SPIRE in REDY mode + BSM ON
Final configuration	SPIRE in REDY mode + BSM ON
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT
Test Conditions:	Cold
Total duration	5 min
Constraints:	FUNC-MCU-01, BSM-01j, 02j successful

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**Select SCOS display (*JIGGLE PARAMETERS)***		
2	**Run QLA script FUNC-BSM-03j in order to:** Record a time series of BSM HK parameters Record a time series of BSM frame parameters	 JIGGMOTORCURR, JIGGMOTORVOLT, JIGGSENSSIG, CHOPMOTORCURR, CHOPMOTORVOLT, CHOPSENSSIG BSMJIGGMOTORCURR, BSMJIGGMOTORVOLT, BSMJIGGSENSSIG	

Step	Action	Command/TM	Comment/notes
3	**Mark beginning of building block**	**SET_BBID(0x81090001)**	
4	**Start TM packet sampling of BSM science frames at 64Hz**	SetTP12SampFreq(0x002C) *0x91C2002C* SetFrameNumber(0xFFFF) 0x91C3FFFF SetFrameStart(0x0001) 0x91C10001	
5	**Move BSM on jiggle axis** a) Set Chop and Jiggle to move independently b) Open loop (no sensor) c) Send BSM to one end of the jiggle axis travel **d) Set step to 1** **e) Record BSM HK and frame params specified in 2 parameters for 3 sec** **f) Set step to 0xffff** **g) Perform a step of 0x1000** **h) Set step to 2** **i) Record BSM HK and frame params specified in 2 parameters for 3 sec** **j) Set step to 0xffff** k) … **l) Perform a step of 0x1000** **m) Set step to 16** **n) Record BSM HK and frame params specified in 2 parameters for 3 sec** o) **Set step to 0xffff**	a) SetBSMMove(0x0000), 0x90C60000 b) SetJigLoopMode(0x0003) 0x91420003 c) SetJiggleTargetPosition(0x0000) 0x91430000 **d) SET_OBS_STEP(0x0001)** e) Wait 3 sec **f) SET_OBS_STEP(0xffff)** **g) SetJiggleTargetPosition (0x1000) 0x91431000** **h) SET_OBS_STEP(0x0002)** i) *Wait 3 sec* **j) SET_OBS_STEP(0xffff)** k) … **l) SetChopTargetPosition 0x90C3F000** **m) SET_OBS_STEP(0x0010)** n) W*ait 3 sec* o) **SET_OBS_STEP(0xffff)**	

Step	Action	Command/TM	Comment/notes
6	**With QLA make 2 time series plots FOR EACH STEP of:** **1. BSMJIGGPSENSSIG against time.** **2. (BSMJIGGMOTORVOLT-32768) / (BSMJIGGMOTORCURR-32768) against time.** **At the end of the sequence step up sequence, make a QLA plot of HK params:** **JIGGSENSSIG vs JIGGDACVAL** **Also write in a file a table with the maximum of each of the ratios given in 2 against commanded target position and then calculate the mean value and standard deviation.**		
7	**Stop TM packet sampling** **Flush MCU FIFO**	SetFrameStart(0x0000) 0x91C10000 **FLUSH_FIFO(0x2000)**	
8	**Offline analysis:** Characterise BSM movement	**Analysis:** **Consumed power.** **comm.Pos Vs current read – check if hysteresis occurs current Vs position read** **Find position where current = 0** **Find current when MR sensor value is 32768**	You can determine actual power by calculation of motor coil resistance see above. **This shall be used for sending a current offset on jiggle axis to center the closed loop.**

Success/Failure Criteria:
Test passed if BSM does the scan required
DF Comments: test is passed if:
- **The measured current given by JIGGMOTORCURRENT is close from JIGGDACVALUE (there is a small offset and little gain difference between desired current which is the DAC value and the actual measured current by ADC.**
- **The magnetoresistive signal evolves in the same direction as the motor current (but gains are different because the scale of the sensor is different and depends on magnetoresistors themselves. THIS TESTS THE POLARITY COMPATIBILITY.**

Comment/open issues: **Need conversion curve of angle vs target position.**

4.26 FUNC-BSM-04c, BSM position test with closed loop, chop axis

ID:	FUNC-BSM-04c
Purpose	Checking that BSM moves to the position commanded and that control loop on MRS works, for chop axis
Description of test:	Move BSM to a set position. Check BSMChopSensSig parameter to verify the step response
Test Type:	Integrity
Instrument Models:	PFM/FS
Redundancy:	prime and redundant
Initial configuration	SPIRE in REDY mode + BSM ON
Final configuration	SPIRE in REDY mode + BSM ON
EGSE Configuration:	SCOS-2000 required, QLA
Level	ILT/PLT/IST/FLT
Test Conditions:	Cold
Total duration	1 min
Constraints:	FUNC-MCU-01, FUNC-BSM-01c, 02c, 03c successful

Procedure and analysis:

Step	Action	Command/TM	**Comment/notes**
1	**Select SCOS display (*CHOP PARAMETERS)***		
2	**Run QLA script**		
3	**Mark beginning of building block**	**SET_BBID(0x81040001**)	
4	Set Chop and Jiggle to move independently	SetBSMMove(0x0000), 0x90C60000	
5	**Move BSM on chop axis** Start BSM packet telemetry sampling @ 250 Hz **Set step to 1** **Start recording BSMCHOPSENSIG,BSMCHOPMOTORVOLT,BSMCHOPMOTORCURR with QLA** Wait 1 s Perform a step to 20000 Wait 1sec **Set step to 0xffff** **Stop recording the previous parameters with QLA**	 SetTelemetryPacket12Sample 0x91C2000A SetFrameNumber(0xFFFF) 0x91C3FFFF SetFrameStart(0x0001) 0x91C10001 **SET_OBS_STEP(0x0001)** **Qla operation** Wait 1 sec SetChopTargetPosition 0x90C34E20 Wait 1 sec **SET_OBS_STEP(0xffff)** **Qla operation**	
6	**Show plot of BSMCHOPSENSSIG vs time in ms for the step up including requirement.** **Show plot of chop position error vs time in ms for the step up including requirement.** **Evaluate consumed power**	Plot should show a settling time of 20-30 ms Proportional to (CHOPMOTORCURR)^2	

Step	Action	Command/TM	Comment/notes
7	**Wait 5 seconds** **Set step to 2** **BSMCHOPSENSIG,BSMCHOPMOTORVOLT,BSMCHOPMOTORCURR with QLA** **with QLA** Wait 1 sec Go to position 40000 Wait 1 sec **Set step to 0xffff** **Stop recording the previous parameters with QLA** Go to position 0 Stop BSM packet telemetry	**Wait 5 seconds** **SET_OBS_STEP(0x0002)** **Qla operation** Wait 1 sec SetChopTargetPosition 0x90C39C40 Wait 1 sec **SET_OBS_STEP(0xffff)** **Qla operation** SetChopTargetPosition 0x90C38000 SetFrameStart(0x0000) 0x91C10000	
8	**Show plot of BSMCHOPSENSSIG vs time in ms for the step up including requirement.** **Show plot of chop position error vs time in ms for the step up including requirement.** **Evaluate consumed power**	Plot should show a settling time of 20-30 ms Proportional to (CHOPMOTORCURR)^2	

Success/Failure Criteria: test passed if BSM moves to the requested position meeting the requirements over chop step response time
Comment/open issues: Need conversion curve of angle vs target position. This test is more a performance test rather than a functional test so it could be skipped in the BSM functional tests sequence.

FUNC-BSM-04j, BSM position test with closed loop, jiggle axis

ID:	FUNC-BSM-04j
Purpose	Checking that BSM moves to the position commanded and that control loop on MRS works, for jiggle axis
Description of test:	Move BSM to a set position. Check telemetry response
Test Type:	Integrity
Instrument Models:	PFM/FS
Redundancy:	prime and redundant
Initial configuration	SPIRE in REDY mode + BSM ON
Final configuration	SPIRE in REDY mode + BSM ON
EGSE Configuration:	SCOS-2000 required QLA required
Level	ILT/PLT/IST/FLT
Test Conditions:	Cold
Total duration	1 min
Constraints:	FUNC-MCU-01, FUNC-BSM-01j, 02j,03j successful

Procedure and analysis:

Step	Action	Command/TM	comment
1	**Select SCOS display (*JIGGLE PARAMETERS)***		
2	**Run QLA script**		
3	**Mark beginning of building block**	**SET_BBID(0x81050001)**	
4	**Move BSM on jiggle axis** Start BSM packet telemetry **Set step to 1** **Start recording BSMJIGGSENSSIG,BSMJIGGMOTORVOLT,BSMJIGGMOTORCURR with QLA** Wait 1 sec Perform a step to 20000 Wait 1 sec **Set step 0xffff** **Stop recording the previous parameters with QLA**	 SetTelemetryPacket12Sample 0x91C20008 SetFrameNumber(0xFFFF) 0x91C3FFFF SetFrameStart(0x0001) 0x91C10001 **SET_OBS_STEP(0x0001)** **Qla operation** Wait 1 sec SetJiggTargetPosition 0x91534E20 Wait 1 sec **SET_OBS_STEP(0xffff)** **Qla operation**	
5	**Show QLA plot of BSMJIGGSENSSIG vs time in ms for the step up including requirement.** **Show plot of jiggle position error vs time in ms for the step up including requirement.** **Evaluate consumed power**	Plot should show a settling time of <100 ms Proportional to (JIGGMOTORCURR)^2	

Step	Action	Command/TM	comment
6	**Wait 5 seconds** **Set step to 2** **Start recording BSMJIGGSENSSIG,BSMJIGGMOTORVOLT,BSMJIGGMOTORCURR with QLA** Wait 1 sec Go to position 40000 Wait 1 sec **Set step to 0xffff** **Stop recording the previous parameters with QLA** Go to position 0 Stop BSM packet telemetry	**Wait 5 seconds** **SET_OBS_STEP(0x0002)** **Qla operation** Wait 1 sec SetJiggTargetPosition 0x91439C40 Wait 1 sec **SET_OBS_STEP(0xffff)** **Qla operation** SetJiggTargetPosition 0x91438000 SetFrameStart(0x0000) 0x91C10000	
7	**Show plot of BSMJIGGSENSSIG vs time in ms for the step up including requirement.** **Show plot of jiggle position error vs time in ms for the step up including requirement.** **Evaluate consumed power**	Plot should show a settling time of <100 ms Proportional to (JIGGMOTORCURR)^2	

Success/Failure Criteria: test passed if BSM moves to the requested position meeting the requirements over jiggle step response time
Comment/open issues: **Need conversion curve of angle vs target position. This test is more a performance test rather than a functional test so it could be skipped in the BSM functional tests sequence.**

4.27 FUNC-BSM-05c, BSM scan with closed loop, chop axis

ID:	FUNC-BSM-05c
Purpose	Characterising BSM movement for a single scan on chop axis, in close loop
Description of test:	Move BSM to multiple set positions. Check telemetry response, consumed power.
Test Type:	Characterisation
Instrument Models:	CQM/PFM
Redundancy:	prime and redundant
Initial configuration	SPIRE in REDY mode + BSM ON
Final configuration	Idem
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT
Test Conditions:	Cold
Total duration	5 min
Constraints:	FUNC-MCU-01, BSM-01c, 02c, 03c , 04c successful

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**Select SCOS display (*CHOP PARAMETERS)***		
2	**Run QLA script FUNC-BSM-05c in order to:** Display a time series plot of BSM frame parameter Record BSM frame parameters	 BSMCHOPSENSSIG BSMCHOPMOTORCURR, BSMCHOPMOTORVOLT, BSMCHOPSENSSIG,BSMJIGGMOTORCURR, BSMJIGGMOTORVOLT, BSMJIGGSENSSIG	
3	Mark beginning of building block	**SET_BBID(0x81060001)**	

Step	Action	Command/TM	Comment/notes
4	**Move BSM on chop axis** a) Set Chop and Jiggle to move independently b) Close loop c) Start BSM packet Telemetry @ 64Hz **d) Set step to 1** **e) Start recording frame parameters specified in 2** f) Go to BSM raster start position g) Wait for 2 sec **h) Set step 0xffff** **i) Stop recording** **j) Set step to 2** **k) Start recording frame parameters specified in 2** l) Perform a step (e.g. +800hex) m) Wait for 2 sec **n) Set step to 0xffff** **o) Stop recording** p) Repeat steps j), to o), incrementing the position by TBD step size until BSM raster end position	a) SetBSMMove(0x0000), 0x90C60000 b) SetChopLoopMode 0x90C20001 c) SetTP12SampFreq(0x002C) *0x91C2002C* SetFrameNumber(0xFFFF) 0x91C3FFFF SetFrameStart(0x0001) 0x91C10001 **d) SET_OBS_STEP(0x0001)** **e) Qla operation** f) SetChopTargetPosition 0x90C30000+xxxx g) Wait 2 sec **h) SET_OBS_STEP(0xffff)** **i) Qla operation** **j) SET_OBS_STEP(0x0002)** **k) Qla operation** l) SetChopTargetPosition 0x90C3xxxx+0x800 m) Wait 2 sec **n) SET_OBS_STEP(0xffff)** **o) Stop recording** p) SetChopTargetPosition, xxxx **SET_OBS_STEP(0x0002+i) where i=1…n** **Qla operation** **Wait 2 seconds** **SET_OBS_STEP(0xffff)** **Qla operation**	
	Stop MCU telemetry **Flush MCU FIFO**	SetFrameStart(0x0000) 0x91C10000 FLUSH_FIFO (Fifo flags = 0x2000 MCU fifo)	
5	**Write in a file the parameters recorded with QLA**		

Step	Action	Command/TM	Comment/notes
6	**Offline analysis:** Characterise BSM movement	Analysis: Consumed power. comm.Pos Vs current read – check is hysteresis occurs current Vs position read Find position where current = 0	
7	**Switch off (if required)** a) Send BSM to 0 b) Power off Chop sensors c) Open loop (DAC forced to 0)	SetChopTargetPosition(0x0000) 0x90C38000 SetCSensorPwr(0x0000) 0x90C00000 0x90C20000	

Success/Failure Criteria: test passed if BSM does the scan required
Comment/open issues: **Need conversion curve of angle vs target position**.Values for target position are "inspired" by the values in *MCU/BSM integration and Test report* LAM/ELE/SPI/031020

4.28 FUNC-BSM-05j, BSM scan with closed loop, jiggle axis

ID:	FUNC-BSM-05j
Purpose	Characterising BSM movement for a single scan on jiggle axis, in close loop
Description of test:	Move BSM to multiple set positions. Check telemetry response, consumed power.
Test Type:	Characterisation
Instrument Models:	CQM/PFM
Redundancy:	prime and redundant
Initial configuration	SPIRE in REDY mode + BSM ON
Final configuration	Idem
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT
Test Conditions:	Cold
Total duration	5 min
Constraints:	FUNC-MCU-01, BSM-01j, 02j, 03j ,04j successful

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**Select SCOS display (*CHOP PARAMETERS)***		
2	**Run QLA script FUNC-BSM-05j in order to:** Display a time series plot of BSM frame parameter Record BSM frame parameters	 BSMJIGGSENSSIG BSMCHOPMOTORCURR, BSMCHOPMOTORVOLT, BSMCHOPSENSSIG,BSMJIGGMOTORCURR, BSMJIGGMOTORVOLT, BSMJIGGSENSSIG	
3	Mark beginning of building block	**SET_BBID(0x81060001)**	

Step	Action	Command/TM	Comment/notes
4	**Move BSM on jiggle axis** a) Set Chop and Jiggle to move independently b) Close loop c) Start BSM packet Telemetry @ 64Hz **d) Set step to 1** **e) Start recording frame parameters specified in 2** f) Go to BSM raster start position g) Wait for 2 sec **h) Set step 0xffff** **i) Stop recording** **j) Set step to 2** **k) Start recording frame parameters specified in 2** l) Perform a step (e.g. +800hex) m) Wait for 2 sec **n) Set step to 0xffff** **o) Stop recording** p) Repeat steps j), to o), incrementing the position by TBD step size until BSM raster end position	a) SetBSMMove(0x0000), 0x90C60000 b) SetChopLoopMode 0x90C20001 c) SetTP12SampFreq(0x002C) *0x91C2002C* SetFrameNumber(0xFFFF) 0x91C3FFFF SetFrameStart(0x0001) 0x91C10001 **d) SET_OBS_STEP(0x0001)** **e) Qla operation** f) SetJIggTargetPosition 0x91430000+xxxx g) Wait 2 sec **h) SET_OBS_STEP(0xffff)** **i) Qla operation** **j) SET_OBS_STEP(0x0002)** **k) Qla operation** l) SetChopTargetPosition 0x9143xxxx+0x800 m) Wait 2 sec **n) SET_OBS_STEP(0xffff)** **o) Stop recording** p) SetJiggTargetPosition, xxxx **SET_OBS_STEP(0x0002+i) where i=1…n** **Qla operation** **Wait 2 seconds** **SET_OBS_STEP(0xffff)** **Qla operation**	
5	**Write in a file the parameters recorded with QLA**		
6	**Offline analysis:** Characterise BSM movement	Analysis: Consumed power. comm.Pos Vs current read – check is hysteresis occurs current Vs position read Find position where current = 0	

Step	Action	Command/TM	Comment/notes
7	**Switch off** d) Send BSM to 0 e) Power off jiggle sensors f) Open loop (DAC forced to 0)	a) SetJiggTargetPosition(0x0000) 0x91438000 b) SetJSensorPwr(0x0000) 0x91400000 c) SetJigLoopMode(0x0000) 0x91420000	

Success/Failure Criteria: test passed if BSM does the scan required
Comment/open issues: **Need conversion curve of angle vs target position**.Values for target position are "inspired" by the values in *MCU/BSM integration and Test report* LAM/ELE/SPI/031020

4.29 FUNC-BSM-06, BSM operating mode test

ID:	FUNC-BSM-06
Purpose	Characterising BSM movement on chop axis for various position on jiggle axis
Description of test:	Chop. Vary position on jiggle axis and chop again. Check telemetry response, consumed power
Test Type:	Characterisation
Instrument Models:	CQM/PFM
Redundancy:	prime and redundant
Initial configuration:	SPIRE in REDY mode + BSM ON
Final configuration	Idem
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT
Test Conditions:	Cold
Total duration	45 min
Constraints:	FUNC-MCU-01 and BSM-01c/j, 02c/j successful

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	Select SCOS display (*JIGGLE PARAMETERS)*		
2	**Run QLA script FUNC-BSM-06 in order to:** Display BSM parameters Record a time series of the parameters	CHOPMOTORCURR, CHOPMOTORVOLT, CHOPSENSSIG, JIGGMOTORCURR, JIGGBMOTORVOLT, JIGGSENSSIG	
3	Mark beginning of building block	**SET_BBID(0x81090001)**	

Step	Action	Command/TM	Comment/notes
4	**Start TM packet sampling for BSM parameters at 64Hz**	SetTP12SampFreq(0x002C) 0x91C2002C SetFrameNumber(0xFFFF) 0x91C3FFFF SetFrameStart(0x0001) 0x91C10001	
5	**Set the axis to move independently** Send command Close loop on both axis	 SetBSMMove(0x0000) 0x90C60000 0x90C20001, 0x91420001	
6	**Set position on Jiggle axis**	SetJiggTarget Position(0x8000) 0x91438000	
7	**Chop** Set a chop frequency Set a chop amplitude (e.g. 126" on-sky) Set a number of chop throw to do **Set building block Id 0x81090001** **Set step to 1** Start chopping Wait for Nchops to finish **Set step 0xffff** **Change the chop throw** **Set step tp 2** **Start chopping** **Wait for Nchop to finish** **Set step 0xffff** **Change chop throw** **…** **Repeat this sequence incrementing the step number for the list of chop throws**	 F_{chop} = 2Hz N_{chop} = 200 **SET_BBID(0x81090001)** **SET_OBS_STEP(0x0001)** **SET_OBS_STEP(0xffff)** **SET_OBS_STEP(0x0002)** **SET_OBS_STEP(0xffff)**	
8	**Repeat step 7 for different chop frequencies. Each different frequency must be recorded as a different obsid.**		

Step	Action	Command/TM	Comment/notes
10	Vary position on jiggle axis and repeat steps 4 to 7 30” 15” -15” -30”	 SetJiggTarget Position(0x9555) 0x91439555 SetJiggTarget Position(0x8AAA) 0x91438AAA SetJiggTarget Position(0x7555) 0x91437555 SetJiggTarget Position(0x6AAA) 0x91436AAA	
11	**Write in a file the parameters recorded with QLA**		
12	**Stop TM packet sampling**	SetFrameStart(0x0000) 0x91C10000	
13	**Switch off** g) Send BSM to 0 h) Power off sensors i) Open loop (DAC forced to 0)	 d) SetJiggTargetPosition(0x8000) 0x91438000 SetChopTargetPosition(0x8000) 0x90C38000 e) SetJSensorPwr(0x0000) 0x91400000 SetChopSensorPwr(0x0000) 0x90C00000 f) SetJigLoopMode(0x0000) 0x91420000 g) SetChopLoopMode(0x0000) 0x90C20000	
12	**Offline analysis:** Characterise BSM movement	 Analysis: current Vs position on chop axis for each position on the jiggle axis	

Success/Failure Criteria: test passed if BSM does the scan required
Comment/open issues: **Need conversion curve of angle vs target position**.Values for target position are “inspired” by the values in *MCU/BSM integration and Test report* LAM/ELE/SPI/031020

4.30 FUNC-PCAL-01, PCAL characterisation test

ID:	FUNC-PCAL-01
Purpose	Characterising PCAL
Description of test:	Step through each setting and measure telemetry response

Test Type:	Characterisation
Instrument Models:	CQM/PFM
Redundancy:	prime and redundant
Initial configuration	SPIRE in SPIRE in REDY mode
Final Configuration	idem
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT
Test Conditions:	Cold
Total duration	2 min
Constraints:	FUNC-SCU-04 successful

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**Run QLA script FUNC-PCAL-01 in order to**: Display PCAL parameters Record parameters at each current setting	PCALCURR, PCALV	
2	**Start SCU science packet sampling at 80 Hz** a) mark beginning of PCAL bblock	**a)** BBTYPE=0x8300 ,STEP =0x0001 SetFrameConf(0x0000) A0830000 SetSequenceLength(0x0000) A0840000 SetFrameCtrl(0x0001) A0820001	
3	**Apply current to PCAL** a) Set current to 1 mA Set STEP to 0x0002 (Read voltage) record during 5 sec	a) SetPhCalBias(0x0240) A0C80240 Set STEP= 0x0002 PCALV = 0x135B (252mV) Wait 5 sec	

Step	Action	Command/TM	Comment/notes
	Set STEP to 0xffff b) Set current to 2.5 mA Set STEP to 0x0003 (Read voltage) record during 5 sec Set STEP 0xffff c) Set current to 4 mA Set STEP to 0x0004 (Read voltage) record during 5 sec Set STEP to 0xffff d) Set current to 5.5 mA Set STEP to 0x0005 (Read voltage) record during 5 sec Set STEP to 0xffff e) Set current to 7 mA Set STEP to 0x0006 (Read voltage) record during 5 sec Set STEP to 0xffff f) Set current to 0 mA Set STEP 0x0007 (Read voltage) record during 5 sec Set STEP to 0xffff	Set STEP =0xffff b) SetPhCalBias(0x0599) A0C80599 Set STEP=0x0003 PCALV = 0x3066 (630mV) Wait 5 sec Set STEP =0xffff c) SetPhCalBias(0x08F2) A0C808F2 Set STEP =0x0004 PCALV = 0x4D70 (1.01V) Wait 5 sec Set STEP =0xffff d) SetPhCalBias(0x0C4B) A0C80C4B Set STEP=0x0005 PCALV = 0x6A7A (1.39V) Wait 5 sec Set STEP =0xffff e) SetPhCalBias(0x0FA5) A0C80FA5 Set STEP=0x0006 PCALV = 0x8784 (1.76V) Wait 5 sec STEP =0xffff f) SetPhCalBias(0x0000) A0C80000 Set STEP=0x0007 PCALV = 0x0000 Wait 5 sec STEP =0xffff	
4	**Write in a file parameters recorded**		
5	**Stop TM packet sampling**	SetFrameCtrl(0x0000) A0820000	

Step	Action	Command/TM	Comment/notes
6	**Offline analysis** Characterise PCAL	Derive for each setting: Voltage stablity Time constant (cooling and warming) Consumed power	

Success/Failure Criteria: Test passed if each bias current is set as required

Comment/Open issue:

4.31 FUNC-SCAL-01, SCAL characterisation test

ID:	FUNC-SCAL-01
Purpose	Characterising SCAL
Description of test:	Set current and record temperatures
Test Type:	Characterisation
Instrument Models:	CQM/PFM
Redundancy:	prime and redundant
Initial configuration	SPIRE in SPIRE in REDY mode
Final configuration	Idem
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT
Test Conditions:	Cold
Total duration	15 min
Constraints:	FUNC-SCU-05 successful

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	Run QLA script FUNC-SCAL-01 in order to: Display SCAL parameters a) Mark beginning od SCAL2 bblock	 SCAL2CURR, SCAL2V, SCAL2TEMP, SCAL4CURR, SCAL4V, SCAL4TEMP a) BBTYPE =0x8400 ,STEP=0x0001	
2	**Apply current to SCAL2**		

Step	Action	Command/TM	Comment/notes
	a) Set current to 1 mA Set STEP 0x0002 (Read voltage) Record during 1 min then set STEP 0xffff b) Set current to 2 mA Set STEP 0x0003 (Read voltage) Record during 1 min then set STEP 0xffff c) Set current to 3 mA Set STEP 0x0004 (Read voltage) Record during 1 min then set STEP 0xffff d) Set current to 4 mA Set STEP 0x0005 (Read voltage) Record during 1 min then set STEP 0xffff e) Set current to 5 mA Set STEP 0x0006 (Read voltage) Record during 1 min then set STEP 0xffff f) Set current to 5.5 mA Set STEP 0x0007 (Read voltage) Record during 1 min then set STEP 0xffff g) Set current to 0 mA Set STEP 0x0008 (Read voltage) Record during 1 min then set STEP 0xffff	a) SetSCal2Bias(0x02E2) A0CA02E2 STEP =0x0002 SCAL2V = 0x138E (0.5V) Wait 1 min then STEP=0xffff b) SetSCal2Bias(0x05C4) A0CA05C4 STEP=0x0003 SCAL2V = 0x271E (1V) Wait 1 min then STEP =0xffff c) SetSCal2Bias(0x08A6) A0CA08A6 STEP=0x0004 SCAL2V = 0x3AAE (1.5V) Wait 1 min then STEP=0xffff d) SetSCal2Bias(0x0B88) A0CA0B88 STEP=0x0005 SCAL2V = 0x4E3D (2V) Wait 1 min then STEP=0xffff e) SetSCal2Bias(0x0E6A) A0CA0E6A STEP =0x0006 SCAL2V = 0x61CD (2.5V) Wait 1 min then STEP=0xffff f) SetSCal2Bias(0x0FC7) A0CA0FC7 STEP =0x0007 SCAL2V = 0x6B95 (2.75V) Wait 1 min then STEP=0xffff g) SetSCal2Bias(0x0000) A0CA0000 STEP 0x0008 SCAL2V = 0x0000 Wait 1 min then STEP 0xffff	
3	**Mark beginning of SCAL4 bblock** **Repeat test for SCAL4 with the same step layout as SCAL2** a) Set current to 1 mA (Read voltage)	BBTYPE=0x8401 ,STEP=0x0001 a) SetSCal4Bias(0x02E2) A0CC02E2 SCAL2V = 0x138A (0.5V)	

Step	Action	Command/TM	Comment/notes
	Record during 1 min b) Set current to 2 mA (Read voltage) Record during 1 min c) Set current to 3 mA (Read voltage) Record during 1 min d) Set current to 4 mA (Read voltage) Record during 1 min e) Set current to 5 mA (Read voltage) Record during 1 min f) Set current to 5.5 mA (Read voltage) Record during 1 min g) Set current to 0 mA (Read voltage) Record during 1 min	Wait 1 min *b)* SetSCal4Bias(0x05C0) A0CC05C0 SCAL2V = 0x2714 (1V) *Wait 1 min* c) SetSCal4Bias(0x089E) A0CC089E SCAL2V = 0x3A9F (1.5V) *Wait 1 min* d) SetSCal4Bias(0x0B7B) A0CC0B7B SCAL2V = 0x4E2A (2V) *Wait 1 min* e) SetSCal4Bias(0x0E59) A0CC0E59 SCAL2V = 0x61B5 (2.5V) *Wait 1 min* f) SetSCal4Bias(0x0FC8) A0CC0FC8 SCAL2V = 0x6B7A (2.75V) *Wait 1 min* g) SetSCal4Bias(0x0000) A0CC0000 SCAL2V = 0x0000 *Wait 1 min*	
4	**Write in a file parameters recorded**		
5	**Offline analysis** Characterise SCAL	a) Derive for each setting: b) Temperature stablity c) Time constant (cooling and warming) d) Consumed power	

Success/Failure Criteria: Test passed if each bias current is set as required
Comment/Open issue: 1 min< SCAL time constant. Shall we record data during 10 or 15 min instead of 1?

4.32 FUNC-SCAL-02, SCAL PID test

ID:	FUNC-SCAL-02
Purpose	Verifying that the PID controller works properly
Description of test:	Set temperatures and record temperatures
Test Type:	Characterisation
Instrument Models:	CQM/PFM
Redundancy:	prime and redundant
Initial configuration:	SPIRE in SPIRE in REDY mode
Final configuration	Idem
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT
Test Conditions:	Cold
Total duration	2 hours
Constraints:	FUNC-SCU-05 successful

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**Run QLA** a) Display SCAL parameters (in HK) b) Record a time series of the parameters	 SCAL2CURR, SCAL2V, SCAL2TEMP, SCAL4CURR, SCAL4V, SCAL4TEMP	
2	**Apply current to SCAL2** a) Set current to 2.5 mA b) Start PID c) Read voltage, temperature d) Record during 1 hour e) Switch off SCAL2	 a) SetSCal2Bias(0x072E) A0CA072E b) c) SCAL2V = 0x30E6 (1.25V) SCAL2TEMP d) Wait 1 hour e) SetSCal2Bias(0x0000) A0CC0000	
3	**Apply current to SCAL4** a) Set current to 2.5 mA b) Start PID c) Read voltage, temperature d) Record during 1 hour e) Switch off SCAL4	 a) SetSCal4Bias(0x072F) A0CC072F b) c) SCAL4V = 0x30DA (1.25V) SCAL4TEMP d) Wait 1 hour e) SetSCal4Bias(0x0000) A0CC0000	
4	**Write in a file parameters recorded**		
5	**Offline analysis** Characterise SCAL PID	 Derive standard deviation around nominal temperature	

Success/Failure Criteria Test passed if bias current is set as required
Comment/Open issue:
Can't this test and the previous one be merged into a single test?
Do we have to wait until the stable temperature is achieved? I guess if the purpose of this test is indeed to see if the PID controller works well, we have to record temperature for a long time (…1 hr?)

4.33 FUNC-DCU-01, DCU Science Packet generation check

ID:	FUNC-DCU-01
Purpose	Checking the integrity of the DCU science packet generation
Description of test:	Request DCU science packet and check that the number of frames generated matches the number commanded
Test Type:	Integrity Check
Instrument Models:	AVM/CQM/PFM/FS
Redundancy:	No
Initial configuration:	SPIRE in REDY mode
Final configuration	Idem
EGSE Configuration:	SCOS-2000 required
Level	ILT/PLT/IST/FLT
Test Conditions:	Warm or Cold
Total duration	1 min (short) – 3 min (full)
Constraints:	None

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**Select SCOS display** *(DPU and OBS PARAMETER)*		

Step	Action	Command/TM	Comment/notes
2	**Request nominal DCU photometer science frames** a) Set mode to photometer full array b) Check frame counter c) Request 200 frames at 15.3Hz d) Flush DCU FIFO e) Check that frame counter has incremented by ~200 f) Check No Science Packet Events occurred	 a) SetDataMode(0x0000) 843C0000 b) Read DCUFRAMECNT c) SetFrameCount(0x00C8) 843D00C8 SetPhotoBiasFreq(0x062) 84190062 SetPhotoSampFreq(0x000C) 8418000C SetStartFrame(0x0001) 843E0001 d) TM(8,4: CA-02) (0x1000) e) Read DCUFRAMECNT f) ?	
3	**Request nominal DCU spectrometer science frames** a) Set mode to spectrometer full array b) Check frame counter c) Request 200 frames, sampled at 80Hz d) Flush DCU FIFO e) Check that frame counter has incremented by ~200 f) Check No Science Packet Events occurred	 a) SetDataMode(0x0004) 843C0004 b) Read DCUFRAMECNT c) SetFrameCount(0x00C8) 843D0008 SetSpectroBiasFreq(0x0062) 8439007A SetSpectroSampFreq(0x000C) 84380001 SetStartFrame(0x0001) 843E0001 d) TM(8,4: CA-02) (0x1000) e) Read DCUFRAMECNT f) ?	
4	**For full functional test, repeat step 3 for:** a) PSW b) PMW&T/C c) PLW d) SLW e) SSW	 a) SetDataMode(0x0001) 843C0001 b) SetDataMode(0x0002) 843C0002 c) SetDataMode(0x0003) 843C0003 d) SetDataMode(0x0005) 843C0005 e) SetDataMode(0x0006) 843C0006	

Success/Failure Criteria: Correct number of frames generated for each frame type

Comment/Open issue:

4.34 FUNC-DCU-02, DCU Science data check

ID:	FUNC-DCU-02
Purpose	Checking the integrity of the DCU science packet
Description of test:	Request DCU science packet and check some values
Test Type:	Integrity Check
Instrument Models:	AVM/CQM/PFM/FS
Redundancy:	No
Initial configuration:	SPIRE in REDY mode
Final configuration	Idem
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT
Test Conditions:	Warm or Cold
Total duration	2 min (short) – 5 min(full)
Constraints:	FUNC-DCU-01 successful

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**Run QLA script FUNC-DCU-02**		

Step	Action	Command/TM	Comment/notes
2	**Request nominal Photometer science frame** a) **Mark beginning of data bblobk** a) Request 200 frames, sampled at 15.3Hz b) Flush DCU FIFO **c) Mark end of data stream (step to 0xffff)**	 a) **BBTYPE =0x8800, STEP=0x0001** a) SetDataMode(0x0000) 843C0000 SetFrameCount(0x00C8) 843D00C8 SetPhotoBiasFreq(0x062) 84190062 SetPhotoSampFreq(0x000C) 8418000C SetStartFrame(0x0001) 843E0001 b) TM(8,4: CA-02) (0x1000) **c) STEP =0xffff**	
3	**Analyse with QLA** Check reception of packets	*Not sure what kind of analysis can be done, but for example:* Verify regularity of the reception: time difference between two consecutive frame should be constant, or time of each frame vs frame# should be linear	
4	**Repeat for spectrometer frames** a) **Mark beginning of data bblobk** a) Request 200 frames, sampled at 80Hz b) Flush DCU FIFO c) **Mark end of data stream (step to 0xffff)**	 **a) BBTYPE =0x8801, STEP=0x0001** *a)* SetDataMode(0x0004) 843C0004 SetFrameCount(0x00C8) 843D00C8 SetSpectroBiasFreq(0x0062) 8439007A SetSpectroSampFreq(0x000C) 84380001 SetStartFrame(0x0001) 843E0001 *b)* TM(8,4: CA-02) (0x1000) *c)* **STEP =0xffff**	
5	**Same analysis with QLA**		
6	**For full functional test, repeat step 2 for:** a) PSW **BBTYPE =0x8802** b) PMW&T/C **BBTYPE =0x8803** c) PLW **BBTYPE =0x8804** d) SLW **BBTYPE =0x8805** e) SSW **BBTYPE =0x8806**	 a) SetDataMode(0x0001) 843C0001 b) SetDataMode(0x0002) 843C0002 c) SetDataMode(0x0003) 843C0003 d) SetDataMode(0x0005) 843C0005 e) SetDataMode(0x0006) 843C0006	

Success/Failure Criteria: Test passed if frames are properly generated

Comment/Open issue:
Require different scripts for CQM (not all BDAs) and PFM

4.35 FUNC-DCU-03, DCU Test pattern test

ID:	FUNC-DCU-03
Purpose	Checking the integrity of the DCU test pattern
Description of test:	Load test pattern and check content of packets. Perform for each type of packet (Photometer and Spectrometer)
Test Type:	Integrity
Instrument Models:	AVM/CQM/PFM/FS
Redundancy:	No
Initial configuration:	SPIRE in REDY mode
Final configuration	Idem
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT
Test Conditions:	Warm or Cold
Total duration	2 min (short) – 5 min (full)
Constraints:	None

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**Run QLA script FUNC-DCU-03**		
2	**Request DCU photometer test frames** a) **Mark beginning of data bblobk** a) Set mode to photometer test pattern b) Request 100 frames at 15.3Hz c) Flush DCU FIFO **d) Mark end of data stream (step to 0xffff)** e) Display test pattern with QLA	 **a) BBTYPE= 0x8807 , STEP =0x0001** a) SetDataMode(0x0008) 843C0008 b) SetFrameCount(0x00C8) 843D00C8 SetPhotoBiasFreq(0x062) 84190062 SetPhotoSampFreq(0x000C) 8418000C SetStartFrame(0x0001) 843E0001 c) TM(8,4: CA-02) (0x1000) **d) STEP =0xffff** e) The content is TBD	
3	**Analysis with QLA** a) Compare test pattern with the one obtained during previous run of this test b) Write in log file the result of the comparison	a) Read previous file stored on QLA computer e.g. using Notepad Run QLA script FUNC-DCU-03-PHOT-FULL Wait for telemetry stream to stop Compare values on the screen with those from the previous file b) Use 'save' button to save an ascii file containing the values of the parameters in the last test frame	

Step	Action	Command/TM	Comment/notes
4	**Request DCU spectrometer test frames** a) **Mark beginning of data bblobk** a) Set mode to spectrometer test pattern b) Request 200 frames at 80Hz c) Flush DCU FIFO **d) Mark end of data stream (step to 0xffff)** e) Display test pattern with QLA	 **a) BBTYPE= 0x8808 , STEP =0x0001** a) SetDataMode(0x000C) 843C000C b) SetFrameCount(0x00C8) 843D0008 SetSpectroBiasFreq(0x0062) 8439007A SetSpectroSampFreq(0x000C) 84380001 SetStartFrame(0x0001) 843E0001 c) TM(8,4: CA-02) (0x1000) **d) STEP =0xffff** e) The content is TBD	
5	**Analysis with QLA** a) Compare test pattern with the one obtained during previous run of this test b) Write in log file the result of the comparison	 a) Read previous file stored on QLA computer e.g. using Notepad Run QLA script FUNC-DCU-03-SPEC-FULL Wait for telemetry stream to stop Compare values on the screen with those from the previous file b) Use 'save' button to save an ascii file containing the values of the parameters in the last test frame	
6	**For full functional test, repeat step 2 and 3 for** a) PSW **BBTYPE =0x880B** b) PMW&T/C **BBTYPE =0x880C** c) PLW **BBTYPE =0x880D** d) SLW **BBTYPE =0x880E** e) SSW **BBTYPE =0x880F**	 a) SetDataMode(0x0009) 843C0009 b) SetDataMode(0x000A) 843C000A c) SetDataMode(0x000B) 843C000B d) SetDataMode(0x000D) 843C000D *e)* SetDataMode(0x000E) 843C000E	

Success/failure criteria: Test passed if test pattern generated is similar to the one generated during previous run of this test

Comment/Open issue:
Require different scripts for CQM (not all BDAs) and PFM

4.36 FUNC-DCU-04P, DCU Photometer LIAs switch on

ID:	FUNC-DCU-04P
Purpose	Checking the integrity of the Photometer LIAs
Description of test:	Switch on photometer LIAs. Check parameter values
Test Type:	Integrity
Instrument Models:	AVM/CQM/PFM/FS
Redundancy:	No
Initial configuration:	SPIRE in REDY mode – Photometer LIAs cards off
Final configuration:	SPIRE in REDY mode + Photometer LIAs cards on
EGSE Configuration:	SCOS 2000 required
Level	ILT/PLT/IST/FLT
Test Conditions:	Warm or Cold
Total duration	1 min
Constraints:	None

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**Select SCOS display (*DCU PARAMETERS*)**		

Step	Action	Command/TM	Comment/notes
2	**Switch on photometer LIAs** a) Switch on Photometer LIA cards (command sent to SCU) b) Check status c) Read voltages d) Read temperatures	a) SetDRelOnOff(0x0001) A0870001 or SetDRelOnOff(0x0005) A0870005 if MCU is on b) PWR_STATUS = 0x01FF c) LIAP_P5 = 0xB554 LIAP_P9 = 0xE00D LIAP_N9 = 0x1FF0 d) LIA01TEMP = ? LIA02TEMP = ? LIA03TEMP = ? LIA04TEMP = ? LIA05TEMP = ? LIA06TEMP = ? LIA07TEMP = ? LIA08TEMP = ? LIA09TEMP = ?	**According to document** **DRCU QM1 Acceptance Data Package (DRAFT)** **Date 03/11/2003 Page 11** **NCR 126 – No temperature probes on BIAS board. Correspondent HK channels returns unpredictable values.**

Switch off procedure

Action	Command
Switch off Photometer LIA cards	SetDRelOnOff(0x0000) A0870000 or SetDRelOnOff(0x0004) A0870004 if MCU is on

Success/Failure Criteria: Test passed if parameters have expected values

Comment/Open issue: By using QLA, we could also look at the detector output and evaluate noise, which should be very low…should it be another test?

4.37 FUNC-DCU-04S, DCU Spectrometer LIAs switch on

ID:	FUNC-DCU-04S
Purpose	Checking the integrity of the spectrometer LIAs
Description of test:	Switch on spectrometer LIAs. Check parameter values
Test Type:	Integrity
Instrument Models:	AVM/CQM/PFM/FS
Redundancy:	No
Initial configuration:	SPIRE in REDY mode + spectrometer LIAs cards off
Final configuration:	SPIRE in REDY mode – spectrometer LIAs cards on
EGSE Configuration:	SCOS 2000 required
Level	ILT/PLT/IST/FLT
Test Conditions:	Warm or Cold
Total duration	1 min
Constraints:	None

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**Select SCOS display (*DCU PARAMETERS*)**		

Step	Action	Command/TM	Comment/notes
2	**Switch on spectrometer LIA** a) Switch on spectrometer LIA cards (command sent to SCU) b) Check status c) Read voltages d) Read temperatures	a) SetDRelOnOff(0x0002) A0870002 or SetDRelOnOff(0x0006) A0870006 if MCU is on b) PWR_STATUS = 0x0E00 c) LIAS_P5 = 0xB554 LIAS_P9 = 0xE00D LIAS_N9 = 0x1FF0 d) LIA09TEMP = ? LIA10TEMP = ? LIA11TEMP = ?	**See previous test**

Note: for QM1, the command to switch on LIA cards is SetDRelOnOff(0x0001) A0870001 or SetDRelOnOff(0x0005) A0870005 if MCU is on

Switch off procedure

Action	Command
Switch of spectrometer LIA cards	SetDRelOnOff(0x0000) A0870000 Or SetDRelOnOff(0x0004) A0870004 if MCU is on

Success/Failure Criteria: Test passed if parameters have expected values

Comment/Open issue: By using QLA, we could also look at the detector output and evaluate noise, which should be very low…should it be another test?

4.38 FUNC-DCU-05P, DCU Photometer Offset test

ID:	FUNC-DCU-05P
Purpose	Characterising the detector output for various values of offset, on the photometer side
Description of test:	Change offsets up and down, record output and analyse off line.
Test Type:	Integrity
Instrument Models:	AVM/CQM/PFM/FS
Redundancy:	No
Initial configuration:	SPIRE in REDY mode + photometer LIAs cards on
Final configuration	Idem
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT
Test Conditions:	Warm or Cold
Total duration	3 min
Constraints:	FUNC-DCU-04P successful

Procedure and analysis:

Step	Action	Command/TM	Comment/notes

Step	Action	Command/TM	Comment/notes
1	**With SCOS, request bolometer array science packet at 15.3Hz** **a) Mark beginning of data bblock**	**a) BBTYPE = 0x8816, STEP=0x0001** SetDataMode(0x0000) 843C0018 SetPhotoBiasFreq(0x062) 84190062 SetPhotoSampFreq(0x000C) 8418000C SetStartFrame(0x0001) 843E0001	
2	**Run QLA script FUNC-DCU-05P** **a) Look at the first detector of each channel to verify the signal is changing** b) Record detector signals		

Step	Action	Command/TM	Comment/notes
3	**Set photometer LIAs offsets** a) Set offset to 0V b) Set STEP to 0x0002 c) Record output during 20 sec d) Set STEP to 0xffff e) Set offset to 1V f) Set STEP to 0x0003 g) Record output during 20 sec h) Set STEP to 0xffff i) Set offset to 2V j) Set STEP to 0x0004 k) Record output during 20 sec l) Set STEP to 0xffff m) Set offset to 3V n) Set STEP to 0x0005 o) Record output during 20 sec p) Set STEP to 0xffff q) Set offset to 4V r) Set STEP to 0x0006 s) Record output during 20 sec t) Set STEP to 0xffff u) Set offset to 5V v) Set STEP to 0x0007 w) Record output during 20 sec x) Set STEP to 0xffff y) Reset offset to 0V z) Set STEP to 0x0008 aa) Record output during 20 sec bb) Set STEP to 0xffff	a) For (i=0…8) 0x84200000+i*10000 b) **STEP=0x0002** c) **Wait 20 sec** d) **STEP=0xffff** e) For (i=0…8) 0x84200000+i*10003 f) **STEP=0x0003** g) **Wait 20 sec** h) **STEP=0xffff** i) For (i=0…8) 0x84200000+i*10006 j) **STEP=0x0004** k) **Wait 20 sec** l) **STEP=0xffff** m) For (i=0…8) 0x84200000+i*10009 n) **STEP=0x0005** o) **Wait 20 sec** p) **STEP=0xffff** q) For (i=0…8) 0x84200000+i*1000c r) **STEP=0x0006** s) **Wait 20 sec** t) **STEP=0xffff** u) For (i=0…8) 0x84200000+i*1000f v) **STEP=0x0007** w) **Wait 20 sec** x) **STEP=0xffff** y) For (i=0…8) 0x84200000+i*10000 z) **STEP=0x0008** aa) **Wait 20 sec** bb) **STEP=0xffff**	
4	**Write in a file signal recorded**		
5	**Stop TM packet sampling**	SetStartFrame(0x0000) 843E0000	

Step	Action	Command/TM	Comment/notes
6	**Offline analysis**	Verify that detector signal follows the offsets Derive noise for each setting? Analyse noise Vs offset value?	

Success/Failure Criteria: Test passed if the analysis shows relevant results

Comment/Open issue:
Require different scripts for CQM and PFM. Is it the way to test it (same voltage on all channel at the same time)? Or should we do it channel par channel?

4.39 FUNC-DCU-05S, DCU Spectrometer Offset test

ID:	FUNC-DCU-05S
Purpose	Characterising the detector output for various values of offset, on the spectrometer side
Description of test:	Change offsets up and down, record output and analyse off line.
Test Type:	Integrity
Instrument Models:	AVM/CQM/PFM/FS
Redundancy:	No
Initial configuration:	SPIRE in REDY mode + spectrometer LIAs cards on
Final configuration	Idem
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT
Test Conditions:	Warm or Cold
Total duration	3 min
Constraints:	FUNC-DCU-04S successful

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**With SCOS, request bolometer array science packet at 80Hz** **a) Mark beginning of data bblock**	**a) BBTYPE = 0x8817, STEP=0x0001** SetDataMode(0x0004) 843C001C SetSpectroBiasFreq(0x0062) 8439007A SetSpectroSampFreq(0x000C) 84380001 SetStartFrame(0x0001) 843E0001	
2	**Run QLA script FUNC-DCU-05S** **c) Look at the first detector of each channel to verify the signal is changing** d) Record detector signals		
3	**Set spectrometer LIAs offsets** cc) Set offset to 0V dd) Set STEP to 0x0002 ee) Record output during 20 sec ff) Set STEP to 0xffff gg) Set offset to 1V hh) Set STEP to 0x0003 ii) Record output during 20 sec jj) Set STEP to 0xffff kk) Set offset to 2V ll) Set STEP to 0x0004 mm) Record output during 20 sec nn) Set STEP to 0xffff oo) Set offset to 3V pp) Set STEP to 0x0005 qq) Record output during 20 sec rr) Set STEP to 0xffff ss) Set offset to 4V tt) Set STEP to 0x0006 uu) Record output during 20 sec vv) Set STEP to 0xffff	cc) For (i=0…2) 0x842c0000+i*10000 dd) **STEP=0x0002** ee) **Wait 20 sec** ff) **STEP=0xffff** gg) For (i=0…2) 0x842c0000+i*10003 hh) **STEP=0x0003** ii) **Wait 20 sec** jj) **STEP=0xffff** kk) For (i=0…2) 0x842c0000+i*10006 ll) **STEP=0x0004** mm) **Wait 20 sec** nn) **STEP=0xffff** oo) For (i=0…2) 0x842c0000+i*10009 pp) **STEP=0x0005** qq) **Wait 20 sec** rr) **STEP=0xffff** ss) For (i=0…2) 0x842c0000+i*1000c tt) **STEP=0x0006** uu) **Wait 20 sec** vv) **STEP=0xffff**	

Step	Action	Command/TM	Comment/notes
	ww) Set offset to 5V xx) Set STEP to 0x0007 yy) Record output during 20 sec zz) Set STEP to 0xffff aaa) Reset offset to 0V bbb) Set STEP to 0x0008 ccc) Record output during 20 sec ddd) Set STEP to 0xffff	ww) For (i=0…2) 0x842c0000+i*1000f xx) **STEP=0x0007** yy) **Wait 20 sec** zz) **STEP=0xffff** aaa) For (i=0…2) 0x842c0000+i*10000 bbb) **STEP=0x0008** ccc) **Wait 20 sec** ddd) **STEP=0xffff**	
4	**Write in a file signal recorded**		
5	**Stop TM packet sampling**	SetStartFrame(0x0000) 843E0000	
6	**Offline analysis**	Verify that detector signal follows the offsets Derive noise for each setting? Analyse noise Vs offset value?	

Success/Failure Criteria: Test passed if the analysis shows relevant results

Comment/Open issue:
Require different scripts for CQM and PFM. Is it the way to test it (same voltage on all channel at the same time)? Or should we do it channel par channel?

4.40 FUNC-DCU-06P, DCU Photometer JFET heaters

ID:	FUNC-DCU-06P
Purpose	Characterising influence of JFET heaters on detectors output, for the photometer
Description of test:	Switch on photometer JFET heaters. Record detector signal, derive noise
Test Type:	Characterisation
Instrument model	STM/CQM
Redundancy:	No
Initial configuration	SPIRE in REDY mode – Photometer JFET heaters off
Final configuration	Idem
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT
Test Conditions:	Cold
Total duration	3 min
Constraints:	None

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**With SCOS, request bolometer array science packet at 15.3Hz** **a) Mark beginning of data bblock**	**a) BBTYPE = 0x8818, STEP=0x0001** SetDataMode(0x0000) 843C0000 SetPhotoBiasFreq(0x062) 84190062	

Step	Action	Command/TM	Comment/notes
		SetPhotoSampFreq(0x000C) 8418000C SetStartFrame(0x0001) 843E0001	
2	**Run QLA FUNC-DCU-06P** a) Look at detector signals b) Record detector signals c) Display parameter	 PHOTHTRV	
3	**apply power to photometer JFET heaters** a) Set bias voltage to 0V b) Record output for 20 sec c) Set bias voltage to -1V d) Record output for 20 sec e) Set bias voltage to -2V f) Record output for 20 sec g) Set bias voltage to -3V h) Record output for 20 sec i) Set bias voltage to -4V j) Record output for 20 sec k) Set bias voltage to -5V l) Record output for 20 sec m) Set voltage down to 0	a) SetPhotoHeaterBias(0x0000) 84110000, **then STEP=0x0002** **b) Wait 20 sec then STEP=0xffff** c) SetPhotoHeaterBias(0x0033) 84110033, **then STEP =0x0003** **d) Wait 20 sec then STEP=0xffff** e) SetPhotoHeaterBias(0x0066) 84110066, **then STEP=0x0004** **f) Wait 20 sec then STEP=0xffff** g) SetPhotoHeaterBias(0x0099) 84110099, **then STEP=0x0005** **h) Wait 20 sec then STEP=0xffff** i) SetPhotoHeaterBias(0x00CC) 841100CC, **then STEP=0x0006** **j) Wait 20 sec then STEP=0xffff** k) SetPhotoHeaterBias(0x00FF) 841100FF, **then STEP=0x0007** **l) Wait 20 sec then STEP=0xffff** m) *SetPhotoHeaterBias(0x0000) 84110000,* **then STEP=0x0008** **n) Wait 20 sec then STEP=0xffff**	
4	**Write in a file the signal recorded**		
5	**Offline analysis**	a) Derive noise for each setting b) Analyse noise Vs voltage	c)

Success/Failure Criteria: Test passed is bias voltages are set as required

Comment/Open issue:
Require different scripts for CQM and PFM
A Test Facility thermometer might be checked as well (TBC)
There should be thermometers on the instrument to check as well? But which ones?

4.41 FUNC-DCU-06S, DCU Spectrometer JFET heaters

ID:	FUNC-DCU-06S
Purpose	Characterising influence of JFET heaters on detectors output, for the spectrometer
Description of test:	Switch on Spectrometer JFET heaters. Record detector signal, derive noise
Test Type:	Characterisation
Instrument model	STM/CQM
Redundancy:	No
Initial configuration	SPIRE in REDY – Spectrometer JFET heaters off
Final configuration	Idem
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT
Test Conditions:	Cold
Total duration	3 min
Constraints:	None

Procedure and analysis:

Step	Action	Command/TM	Comment/notes

Step	Action	Command/TM	Comment/notes
1	**With SCOS, request bolometer array science packet at 15.3Hz** **a) Mark beginning of data bblock**	**a) BBTYPE = 0x8819, STEP=0x0001** SetDataMode(0x0000) 843C0004 SetSpectroBiasFreq(0x062) 84390062 SetSpectroSampFreq(0x000C) 8438000C SetStartFrame(0x0001) 843E0001	
2	**Run QLA FUNC-DCU-06S** d) Look at detector signals e) Record detector signals f) Display parameter	SPECHTRV	
3	**Apply power to spectrometer JFET heaters** n) Set bias voltage to 0V o) Record output for 20 sec p) Set bias voltage to -1V q) Record output for 20 sec r) Set bias voltage to -2V s) Record output for 20 sec t) Set bias voltage to -3V u) Record output for 20 sec v) Set bias voltage to -4V w) Record output for 20 sec x) Set bias voltage to -5V y) Record output for 20 sec z) Set voltage down to 0	o) SetSpectroHeaterBias(0x0000) 84330000, **then STEP=0x0002** **p) Wait 20 sec then STEP=0xffff** q) SetSpectroHeaterBias(0x0033) 84330033, **then STEP =0x0003** **r) Wait 20 sec then STEP=0xffff** s) SetSpectroHeaterBias(0x0066) 84330066, **then STEP=0x0004** **t) Wait 20 sec then STEP=0xffff** u) SetSpectroHeaterBias(0x0099) 84330099, **then STEP=0x0005** **v) Wait 20 sec then STEP=0xffff** w) SetSpectroHeaterBias(0x00CC)843300CC **then STEP=0x0006** **x) Wait 20 sec then STEP=0xffff** SetSpectroHeaterBias(0x00FF)843300FF, **then STEP=0x0007** **y) Wait 20 sec then STEP=0xffff** z) *SetSpectroHeaterBias(0x0000) 84330000,* **then STEP=0x0008** **aa) Wait 20 sec then STEP=0xffff**	

Step	Action	Command/TM	Comment/notes
4	**Write in a file the signal recorded**		
5	**Offline analysis**	d) Derive noise for each setting e) Analyse noise Vs voltage	f)

Success/Failure Criteria: Test passed is bias voltages are set as required
Comment/Open issue:
Require different scripts for CQM and PFM
A Test Facility thermometer might be checked as well (TBC)
There should be thermometers on the instrument to check as well? But which ones?

4.42 FUNC-DCU-07P, DCU Photometer JFET test

ID:	FUNC-DCU-07P
Purpose	Characterising detector signal for various photometer JFET drain voltages
Description of test:	Switch on Photometer JFETs with Vdd on. Activate auto-offset control. Measure noise. Vary Vss and measure noise
Test Type:	Characterisation
Instrument Models:	AVM/CQM/PFM/FS
Redundancy:	No
Initial configuration:	SPIRE in REDY mode – Photometer JFETs off
Final configuration	SPIRE in REDY mode – Photometer JFETs on and warm
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT
Test Conditions: **Total duration**	Warm or Cold 3-4 min
Constraints:	None

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**With SCOS, request bolometer array science packet at 15.3Hz** **a) Mark beginning of data bblock**	**a) BBTYPE=0x881A , STEP=0x0001** SetDataMode(0x0000) 843C0000 SetPhotoBiasFreq(0x062) 84190062 SetPhotoSampFreq(0x000C) 8418000C	

Step	Action	Command/TM	Comment/notes
		SetStarFrame(0x0001) 843E0001	
2	**Run QLA FUNC-DCU-07P** a) Look at detector signal b) Record detector signal c) Display parameters	PSWJFETSTAT, PMLWJFETSTAT, PSWJFET#V (#=1..6), PMWJFET#V (#=1..4), PLWJFET#V (#=1..2), TCJFETV	
3	**Switch on photometer JFETs** a) Switch drain voltages to high level b) Switch on JFET heaters to half power during 1 min This setting has been changed to full poswer during one minute c) Switch off heaters d) Activate auto-offset control	a) SetPhSWJfetPwr(0x003F) 8412003F SetPhMLWJfetPwr(0x007F) 8413007F b) SetPhotoHeaterBias(0x007F) 8411007F Wait 1 min 841100FF c) SetPhotoHeaterBias(0x0000) 84110000 d) SetDataMode(0x0010) 843C0010 *Wait xx sec*	
4	**Vary Vss and record signal** a) Set Vss to 0V on all channel **b) Set STEP 0x0002** c) Record signal during 20 sec ***d) Set STEP 0xffff*** e) Set Vss to -1V on all channel ***f) Set STEP 0x0003*** g) Record signal during 20 sec h) **Set STEP 0xffff** i) Set Vss to -2V on all channel	a) For #=1..6, SetPhSWJfetVSS#(0x0000) 8(404+#)0000 / For #=1..4, SetPhMWJfetVSS#(0x0000) 8(40A+#)0000 For #=1..2, SetPhLWJfetVSS#(0x0000) 8(40E+#)0000 / SetPhTCJfetVSS1(0x0000) 8414000 **b) Set STEP =0x0002** **c) Wait 20 sec** **d) Set STEP =0xffff** e) For #=1..6, SetPhSWJfetVSS#(0x0033) 8(404+#)0033 / For #=1..4, SetPhMWJfetVSS#(0x0033) 8(40A+#)0033 For #=1..2, SetPhLWJfetVSS#(0x0033) 8(40E+#)0033 / SetPhTCJfetVSS1(0x0033) 84140033 **f) Set STEP =0x0003** **g) Wait 20 sec** **h) Set STEP =0xffff** i) For #=1..6, SetPhSWJfetVSS#(0x0066) 8(404+#)0066 / For #=1..4, SetPhMWJfetVSS#(0x0066) 8(40A+#)0066 For #=1..2, SetPhLWJfetVSS#(0x0066) 8(40E+#)0066 / SetPhTCJfetVSS1(0x0066) 84140066	

Step	Action	Command/TM	Comment/notes
	j) **Set STEP 0x0004** k) Record signal during 20 sec ***l)*** **Set STEP 0xffff** m) Set Vss to -3V on all channel ***n)*** **Set STEP 0x0005** o) Record signal during 20 sec **p)** **Set STEP 0xffff** q) Set Vss to -4V on all channel ***r)*** **Set STEP =0x0006** s) Record signal during 20 sec ***t)*** **Set STEP =0xffff** u) Set Vss to -5V on all channel ***v)*** **Set STEP =0x0007** w) Record signal during 20 sec ***x)*** **Set STEP =0xffff**	**j) Set STEP =0x0004** **k) Wait 20 sec** **l) Set STEP =0xffff** m) For #=1..6, SetPhSWJfetVSS#(0x0099) 8(404+#)0099 / For #=1..4, SetPhMWJfetVSS#(0x0099) 8(40A+#)0099 For #=1..2, SetPhLWJfetVSS#(0x0099) 8(40E+#)0099 / SetPhTCJfetVSS1(0x0099) 84140099 **n) Set STEP =0x0005** **o) Wait 20 sec** **p) Set STEP =0xffff** q) For #=1..6, SetPhSWJfetVSS#(0x00CC) 8(404+#)00CC / For #=1..4, SetPhMWJfetVSS#(0x00CC) 8(40A+#)00CC For #=1..2, SetPhLWJfetVSS#(0x00CC) 8(40E+#)00CC / SetPhTCJfetVSS1(0x00CC) 841400CC **r) Set STEP =0x0006** **s) Wait 20 sec** **t) Set STEP =0xffff** u) For #=1..6, SetPhSWJfetVSS#(0x00FF) 8(404+#)00FF / For #=1..4, SetPhMWJfetVSS#(0x00FF) 8(40A+#)00FF For #=1..2, SetPhLWJfetVSS#(0x00FF) 8(40E+#)00FF / SetPhTCJfetVSS1(0x00FF) 841400FF **v) Set STEP =0x0007** **w) Wait 20 sec** **x) STEP =0xffff**	
5	**Set Vss back to 0** ***y)*** **Set STEP =0x0008** z) Record signal during 20 sec **aa)** **Set STEP =0xffff**	a) For #=1..6, SetPhSWJfetVSS#(0x0000) 8(404+#)0000 For #=1..4, SetPhMWJfetVSS#(0x0000) 8(40A+#)0000 For #=1..2, SetPhLWJfetVSS#(0x0000) 8(40E+#)0000 SetPhTCJfetVSS1(0x007F) 84140000 ***aa)*** **Set STEP =0x0008** bb) Record signal during 20 sec b) **Set STEP =0xffff**	c)
6	**Write in a file the data recorded**		
7	**Stop TM packet sampling**	SetStartFrame(0x0000) 843E0000	

Step	Action	Command/TM	Comment/notes
8	**Offline analysis**	a) Derive noise for each value of Vss b) Analyse noise vs Vss	c)

Switch off procedure

Action	Command
a) Set Vss to 0V on all channel b) Switch off drain voltages c) Switch off LIA cards	a) For #=1..6, SetPhSWJfetVSS#(0x0000) 8(404+#)0000 / For #=1..4, SetPhMWJfetVSS#(0x0000) 8(40A+#)0000 For #=1..2, SetPhLWJfetVSS#(0x0000) 8(40E+#)0000 / SetPhTCJfetVSS1(0x0000) 8414000 b) SetPhSWJfetPwr(0x0000) 84120000 SetPhMLWJfetPwr(0x0000) 84130000 e) SetDRelOnOff(0x0000) A087000 or SetDRelOnOff(0x0004) A087004 if MCU is on c)

Success/Failure Criteria: Test passed if each voltage is set as required

Comment/Open issue:
All JFETs are tested together
Refer also to performance test ILT-PERF-DAN
Require different scripts for CQM and PFM
Is that the way to turn on JFETs (drain then source)? Does the order matter?

4.43 FUNC-DCU-07S, DCU Spectrometer JFET test

ID:	FUNC-DCU-07S
Purpose	Characterising detector signal for various spectrometer JFET drain voltages
Description of test:	Switch on spectrometer JFETS with Vdd on. Activate auto-offset control. Measure noise. Vary Vss and measure noise
Test Type:	Characterisation
Instrument Models:	AVM/CQM/PFM/FS
Redundancy:	No
Initial configuration:	SPIRE in REDY mode – spectrometer JFETs off
Final configuration	SPIRE in REDY mode – spectrometer JFETs on and warm
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT
Test Conditions:	Warm or Cold
Total duration	3-4 min
Constraints:	None

Procedure and analysis:

Step	Action	Command/TM	Comment/notes

Step	Action	Command/TM	Comment/notes
1	**With SCOS, request bolometer array science packet at 80Hz** **a) Mark beginning of data bblock**	**a) BBTYPE=0x881B, STEP=0x0001** SetDataMode(0x0004) 843C0004 SetSpectroBiasFreq(0x0062) 8439007A SetSpectroSampFreq(0x000C) 84380001 SetStartFrame(0x0001) 843E0001	
2	**Run QLA FUNC-DCU-07S** d) Look at detector signal e) Record detector signal f) Display parameters	SPECJFETSTAT, SSWJFET#V (#=1..2), SLWJFETV	
3	**Switch on spectrometer JFETs** a) Switch drain voltages to high level b) Switch on JFET heaters to half power during 1 min c) Switch off heaters d) Activate auto-offset control	a) SetSpSLWJfetPwr(0x0007) 84370007 b) SetPhotoHeaterBias(0x007F) 8433007F Wait 1 min c) SetPhotoHeaterBias(0x0000) 84330000 d) SetDataMode(0x0014) 843C0014 *Wait xx sec*	

Step	Action	Command/TM	Comment/notes
4	**Vary Vss and record signal** **(Same step setting as previous test)** a) Set Vss to 0V on all channel b) Record signal during 20 sec c) Set Vss to -1V on all channel d) Record signal during 20 sec e) Set Vss to -2V on all channel f) Record signal during 20 sec g) Set Vss to -3V on all channel h) Record signal during 20 sec i) Set Vss to -4V on all channel j) Record signal during 20 sec k) Set Vss to -5V on all channel l) Record signal during 20 sec	a) For #=1..2, SetSpSWJfetVSS#(0x0000) 8(434+#)0000 SetSpLWJfetVSS(0x0000) 84340000 *b) Wait 20 sec* c) For #=1..2, SetSpSWJfetVSS#(0x0033) 8(434+#)0033 SetSpLWJfetVSS(0x0033) 84340033 *d) Wait 20 sec* e) For #=1..2, SetSpSWJfetVSS#(0x0033) 8(434+#)0066 SetSpLWJfetVSS(0x0033) 84340066 *f) Wait 20 sec* g) For #=1..2, SetSpSWJfetVSS#(0x0099) 8(434+#)0099 SetSpLWJfetVSS(0x0099) 84340099 *h) Wait 20 sec* i) For #=1..2, SetSpSWJfetVSS#(0x00CC) 8(434+#)00CC SetSpLWJfetVSS(0x00CC) 843400CC *j) Wait 20 sec* k) For #=1..2, SetSpSWJfetVSS#(0x00FF) 8(434+#)00FF SetSpLWJfetVSS(0x00FF) 843400FF l) *Wait 20 sec*	
5	**Write in a file the data recorded**		
6	**Set Vss back to 0**	a) For #=1..2, SetSpSWJfetVSS#(0x0000) 8(434+#)0000 SetSpLWJfetVSS(0x0000) 84340000	b)
7	**Stop TM packet sampling**	SetStartFrame(0x0000) 843E0000	
8	**Offline analysis**	a) Derive noise for each value of Vss b) Analyse noise vs Vss	c)

Switch off procedure

Action	Command
a) Set Vss to 0V on all channel b) Switch off drain voltages	a) For #=1..2, SetSpSWJfetVSS#(0x0000) 8(434+#)0000 SetSpLWJfetVSS(0x0000) 84340000 d) SetSpSLWJfetPwr(0x0000) 84370000

c) Switch off LIA cards	f) SetDRelOnOff(0x0000) A087000 or SetDRelOnOff(0x0004) A087004 if MCU is on

Success/Failure Criteria: Test passed if each voltage is set as required

Comment/Open issue:
All JFETs are tested together
Refer also to performance test ILT-PERF-DAN
Require different scripts for CQM and PFM
Is that the way to turn on JFETs (drain then source)? Does the order matter?

4.44 FUNC-DCU-08P_full, DCU Full photometer phase shift test

ID:	FUNC-DCU-08P_full
Purpose	Adjusting the demodulation phase
Description of test:	Set phase to 0 degrees + $d\phi * \iota$ untill maximum signal is found
Test Type:	
Instrument Models:	AVM/CQM/PFM/FS
Redundancy:	As applicable
Initial configuration:	SPIRE in PHOT-STBY mode – detectors on – demodulation phase not adjusted
Final configuration	SPIRE in PHOT-STBY mode – detectors on – demodulation phase adjusted
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT/PLT/IST/FLT
Test Conditions:	Warm or Cold
Total duration	5 min
Constraints:	Photometer detectors on (bias frequency, bias amplitude, phase are set to operating values) – see FUNC-DCU-11

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**If not already switch on detectors with operating values**	Execute test FUNC-DCU-11 to switch on photometers detectors	
2	**a) Mark beginning of test** **Set_BBID(0x881C0001)** **With SCOS, request bolometer array science packet at 15.3Hz**	a) **Set BBID =0x881C0001** SetDataMode(0x0000) 843C0000 SetPhotoBiasFreq(0x062) 84190062 SetPhotoSampFreq(0x000C) 8418000C SetStarFrame(0x0001) 843E0001	
3	**Run QLA FUNC-DCU-08P_full** Look at detector signal Record detector signal Display parameter	PSWPHASE, PMWPHASE, PLWPHASE, TCPHASE	
4	**a) Set demodulation phase to :** **(ϕ − Δϕ)+ dϕ∗ i** where ϕ = init_phase test procedure input parameter Δϕ = RAW delta phase test procedure input parameter dϕ = RAW step phase test procedure input parameter i = 0 … (2* Δϕ) / dϕ **b) Set automatic offsets** **c) Set Step 1+i** **d) Wait 10 seconds** **e) Set STEP to 0xffff** **f) Repeat steps a) to e) until the list of phases is**	a) SetPhotoDemodSW(0x0040) 841AΔ0000+ **dϕ** SetPhotoDemodMW(0x0040) 841B0000+ **dϕ** SetPhotoDemodLW(0x0040) 841C0000+ **dϕ** SetPhotoDemodTC(0x0040) 841D0000+ **dϕ** **b) SetAutomaticOffsets** **c) Set _OBS_STEP(0x0001)** **d) Wait 10 seconds** **e) Set_OBS_STEP(0xffff)** **f) Repeat**	

Step	Action	Command/TM	Comment/notes
6	**Write in file data recorded and value of dϕ**		
7	**Stop TM packet sampling**	SetStartFrame(0x0000) 843E0000	

Success/Failure Criteria: Test passed if demodulation phase is properly set to each value and detector signal is as expected.
Comment/Open issue
Require different scripts for CQM and PFM

4.45 FUNC-DCU-08P_short, DCU Short Photometer phase shift test

ID:	FUNC-DCU-08P_short
Purpose	Adjusting the demodulation phase?
Description of test:	Set phase to 0 degrees + dϕ ∗ι untill maximum signal is found. Same as previous but these one is used to refine the search of the peak phase found roughly with the previous test
Test Type:	
Instrument Models:	AVM/CQM/PFM/FS
Redundancy:	As applicable
Initial configuration:	SPIRE in PHOT-STBY mode – detectors on – demodulation phase not adjusted
Final configuration	SPIRE in PHOT-STBY mode – detectors on – demodulation phase adjusted
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT/PLT/IST/FLT
Test Conditions:	Warm or Cold
Total duration	1 min
Constraints:	Photometer detectors on (bias frequency, bias amplitude, phase are set to operating values) – see FUNC-DCU-11

Procedure and analysis:

Step	Action	Command/TM	comment
1	**If not already switch on detectors with operating values**	Execute test FUNC-DCU-11 to switch on photometers detectors	
2	**With SCOS, request bolometer array science packet at 15.3Hz** **a) Mark beginning of test**	**a) BBID =0x881C0001** SetDataMode(0x0000) 843C0000 SetPhotoBiasFreq(0x062) 84190062 SetPhotoSampFreq(0x000C) 8418000C SetStarFrame(0x0001) 843E0001	
3	**Run QLA FUNC-DCU-08P_short** Look at detector signal Record detector signal Display parameter	PSWPHASE, PMWPHASE, PLWPHASE, TCPHASE	
4	**a) Set demodulation phase to :** **(ϕ − Δϕ)+ dϕ∗ i** where ϕ = init_phase test procedure input parameter Δϕ = RAW delta phase test procedure input parameter dϕ = RAW step phase test procedure input parameter i = 0 … (2* Δϕ) / dϕ **b) Set automatic offsets** **c) Set Step 1+i** **d) Wait 10 seconds** **e) Set STEP to 0xffff** **f) Repeat steps a) to e) until the list of phases is**	g) SetPhotoDemodSW(0x0040) 841AΔ0000+ **dϕ** SetPhotoDemodMW(0x0040) 841B0000+ **dϕ** SetPhotoDemodLW(0x0040) 841C0000+ **dϕ** SetPhotoDemodTC(0x0040) 841D0000+ **dϕ** **h) SetAutomaticOffsets** **i) Set _OBS_STEP(0x0001)** **j) Wait 10 seconds** **k) Set_OBS_STEP(0xffff)** **l) Repeat**	

Step	Action	Command/TM	comment
5	**Stop TM packet sampling**	SetStartFrame(0x0000) 843E0000	

Success/Failure Criteria: Test passed if demodulation phase is properly set to each value and detector signal is as expected.

Comment/Open issue
The value of dϕ is found by FUNC-DCU-08P_full
Require different scripts for CQM and PFM

4.46 FUNC-DCU-08S_full, DCU Full spectrometer Phase shift test

ID:	FUNC-DCU-08S_full
Purpose	Adjusting the demodulation phase?
Description of test:	Set phase to 0 degrees + dϕ ∗ι untill maximum signal is found
Test Type:	
Instrument Models:	AVM/CQM/PFM/FS
Redundancy:	As applicable
Initial configuration:	SPIRE in SPEC-STBY mode – detectors on – demodulation phase not adjusted
Final configuration	SPIRE in SPEC-STBY mode – detectors on – demodulation phase adjusted
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT/PLT/IST/FLT
Test Conditions:	Warm or Cold
Total duration	5 min
Constraints:	Detectors on (bias frequency, bias amplitude, phase are set to operating values) – see FUNC-DCU-11

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**If not already switch on detectors with operating values**	Execute test FUNC-DCU-11 to switch on spectrometer detectors	
2	**With SCOS, request bolometer array science packet at 80Hz** **a) Mark beginning of test**	**a) BBID=0x881D0001** SetDataMode(0x0004) 843C0004 SetSpectroBiasFreq(0x0062) 8439007A SetSpectroSampFreq(0x000C) 84380001 SetStartFrame(0x0001) 843E0001	
3	**Run QLA FUNC-DCU-08S_full** Look at detector signal Record detector signal Display parameter	SSWPHASE, SLWPHASE	
4	**a) Set demodulation phase to :** $(\phi - \Delta\phi) + d\phi * i$ where ϕ = init_phase test procedure input parameter $\Delta\phi$ = RAW delta phase test procedure input parameter $d\phi$ = RAW step phase test procedure input parameter $i = 0 \ldots (2 * \Delta\phi) / d\phi$ **b) Set automatic offsets** **c) Set Step 1+i** **d) Wait 10 seconds** **e) Set STEP to 0xffff** **f) Repeat steps a) to e) until the list of phases is**	**a)** SetSpectroDemodSW(0x0040) 843A0000+ **dϕ** SetSpectroDemodMW(0x0040) 843B0000+ **dϕ** **b) SetAutomaticOffsets** **c) Set _OBS_STEP(0x0001)** **d) Wait 10 seconds** **e) Set_OBS_STEP(0xffff)** **f) Repeat**	
6	**Write in file data recorded and value of dϕ**		
7	**Stop TM packet sampling**	SetStartFrame(0x0000) 843E0000	

Success/Failure Criteria: Test passed if demodulation phase is properly set to each value and detector signal is as expected.

Comment/Open issue
Require different scripts for CQM and PFM

4.47 FUNC-DCU-08S_short, DCU Short spectrometer Phase shift test

ID:	FUNC-DCU-08S_short
Purpose	Adjusting the demodulation phase?
Description of test:	Set phase to 0 degrees + dϕ ∗ι untill maximum signal is found. Same as previous but these one is used to refine the search of the peak phase found roughly with the previous test
Test Type:	
Instrument Models:	AVM/CQM/PFM/FS
Redundancy:	As applicable
Initial configuration:	SPIRE in SPEC-STBY mode – detectors on – demodulation phase not adjusted
Final configuration	SPIRE in SPEC-STBY mode – detectors on – demodulation phase adjusted
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT/PLT/IST/FLT
Test Conditions:	Warm or Cold
Total duration	1 min
Constraints:	Detectors on (bias frequency, bias amplitude, phase are set to operating values) – see FUNC-DCU-11

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**If not already switch on detectors with operating values**	Execute test FUNC-DCU-11 to switch on spectrometer detectors	
2	**With SCOS, request bolometer array science packet at 80Hz** **a) Mark the beginning of test**	**a) BBID=0x881D0001** SetDataMode(0x0004) 843C0004 SetSpectroBiasFreq(0x0062) 8439007A SetSpectroSampFreq(0x000C) 84380001 SetStartFrame(0x0001) 843E0001	
3	**Run QLA FUNC-DCU-08S_short** Look at detector signal Record detector signal Display parameter	SSWPHASE, SLWPHASE	
4	**a) Set demodulation phase to :** **(ϕ − Δϕ)+ dϕ∗ i** where ϕ = init_phase test procedure input parameter Δϕ = RAW delta phase test procedure input parameter dϕ = RAW step phase test procedure input parameter i = 0 … (2* Δϕ) / dϕ **b) Set automatic offsets** **c) Set Step 1+i** **d) Wait 10 seconds** **e) Set STEP to 0xffff** **f) Repeat steps a) to e) until the list of phases is**	**g)** SetSpectroDemodSW(0x0040) 843A0000+ **dϕ** SetSpectroDemodMW(0x0040) 843B0000+ **dϕ** **h) SetAutomaticOffsets** **i) Set _OBS_STEP(0x0001)** **j) Wait 10 seconds** **k) Set_OBS_STEP(0xffff)** **l) Repeat**	
5	**Stop TM packet sampling**	SetStartFrame(0x0000) 843E0000	

Success/Failure Criteria: Test passed if demodulation phase is properly set to each value and detector signal is as expected.

Comment/Open issue
Require different scripts for CQM and PFM

4.48 FUNC-DCU-09P, DCU Photometer bias frequency test

ID:	FUNC-DCU-09P
Purpose	Characterising detector signal for various bias frequencies on photometer side
Description of test:	Set up bias frequency. Measure noise
Test Type:	Characterisation
Instrument Models:	AVM/CQM/PFM/FS
Redundancy:	prime and redundant
Initial configuration:	SPIRE in PHOT-STBY mode
Final configuration	Idem
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT
Test Conditions:	Warm or Cold
Total duration	3 min
Constraints:	Detectors on (bias frequency, bias amplitude, phase are set to operating values) – see FUNC-DCU-11

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**If not already switch on detectors with operating values**	Execute test FUNC-DCU-11 to switch on photometers detectors	

Step	Action	Command/TM	Comment/notes
2	**With SCOS, request bolometer array science packet at 15.3Hz** **a)Mark beginning of data bblock**	**a)** SetDataMode(0x0000) 843C0000 SetPhotoBiasFreq(0x062) 84190062 SetPhotoSampFreq(0x000C) 8418000C SetStarFrame(0x0001) 843E0001	
3	**Run QLA FUNC-DCU-09P** a) Look at detector signal b) Record detector signal c) Display parameters	PHOTOBIASFREQ	
4	**Vary bias frequency** a) **Mark beginning of BiasFreq block** b) Set bias frequency at 55Hz c) **Mark beginning of Phase Shift block** d) Execute phase **shift full procedure**. e) **Mark beginning of BiasFreq block** f) Set bias frequency at 130Hz g) **Mark beginning of Phase Shift block** h) Execute phase **shift full procedure**. i) **Mark beginning of BiasFreq block** j) Set bias frequency at 190Hz k) **Mark beginning of Phase Shift block** **l)** Execute phase **shift full procedure.** m)	a) **BBTYPE=0x88200001,STEP=0x0001** b) SetPhotoBiasFreq(0x01FF) 84190163 c) **BBTYPE=0x881C0001,STEP=0x0001** d) e) **BBTYPE=0x88200002,STEP=0x0001** f) SetPhotoBiasFreq(0x00C3) 84190096 g) **BBTYPE=0x881C0002,STEP=0x0001** h) i) **BBTYPE=0x88200003,STEP=0x0001** j) SetPhotoBiasFreq(0x007A) 84190066 k) **BBTYPE=0x881C0003,STEP=0x0001** **l)**	
6	**Write in a file the data recorded**		
7	**Stop TM packet sampling**	SetStartFrame(0x0000) 843E0000	
8	**Offline analysis**	a) Derive noise for each frequency b) Analyse noise vs frequency	c)

Success/Failure Criteria: Test passed if bias frequency is set to each value as required
Comment/Open issue:
Require different scripts for CQM and PFM

4.49 FUNC-DCU-09S, DCU Spectrometer bias frequency test

ID:	FUNC-DCU-09S
Purpose	Characterising detector signal for various bias frequencies on spectrometer side
Description of test:	Set up bias frequency. Measure noise
Test Type:	Characterisation
Instrument Models:	AVM/CQM/PFM/FS
Redundancy:	prime and redundant
Initial configuration:	SPIRE in SPEC-STBY
Final configuration	Idem
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT
Test Conditions:	Warm or Cold
Total duration	3 min
Constraints:	Detectors on (bias frequency, bias amplitude, phase are set to operating values) – see FUNC-DCU-11

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**If not already switch on detectors with operating values**	Execute test FUNC-DCU-11 to switch on spectrometer detectors	

Step	Action	Command/TM	Comment/notes
2	**With SCOS, request bolometer array science packet at 80Hz** **a) Mark beginning of data bblock**	**a)BBTYPE=0x8821,STEP=0x0001** SetDataMode(0x0004) 843C0004 SetSpectroBiasFreq(0x0062) 8439007A SetSpectroSampFreq(0x000C) 84380001 SetStartFrame(0x0001) 843E0001	
3	**Run QLA FUNC-DCU-09S** a) Look at detector signal b) Record detector signal c) Display parameters	SPECBIASFREQ	
4	**Vary bias frequency with same step setting as the photometer one** a) Set bias frequency at 55Hz b) Execute phase shift test (FUNC-DCU-08S_ **full**) c) Record detector signal during 20 sec d) Set bias frequency at 130Hz e) Execute phase shift test (FUNC-DCU-08S_ **full**) f) Record detector signal during 20 sec g) Set bias frequency at 190Hz h) Execute phase shift test (FUNC-DCU-08S_ **full**) i) Record detector signal during 20 sec	a) SetSpectroBiasFreq(0x01FF) 84390163 b) c) Wait 20 sec d) SetSpectroBiasFreq(0x00C3) 84390096 *e)* *f) Wait 20 sec* g) SetSpectroBiasFreq(0x007A) 84390066 *h)* i) *Wait 20 sec*	
6	**Write in a file the data recorded**		
7	**Stop TM packet sampling**	SetStartFrame(0x0000) 843E0000	
8	**Offline analysis**	d) Derive noise for each frequency e) Analyse noise vs frequency	f)

Success/Failure Criteria: Test passed if bias frequency is set to each value as required
Comment/Open issue:
Require different scripts for CQM and PFM

4.50 FUNC-DCU-10P, DCU Photometer bias amplitude test

ID:	FUNC-DCU-10P
Purpose	Characterising detector signal for various bias amplitude, on photometer side
Description of test:	Set bias amplitude. Measure change in signal level, measure noise, read out offsets
Test Type:	Characterisation
Instrument Models:	AVM/CQM/PFM/FS
Redundancy:	prime and redundant
Initial configuration:	SPIRE in PHOT-STBY
Final configuration	Idem
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT/PLT/IST/FLT
Test Conditions:	Warm or Cold
Total duration	3 min
Constraints:	Detectors on (bias frequency, bias amplitude, phase are set to operating values) – see FUNC-DCU-11

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**If not already switch on detectors with operating values**	Execute test FUNC-DCU-11 to switch on photometer detectors	
2	**With SCOS, request bolometer array science packet at 15.3Hz**		

Step	Action	Command/TM	Comment/notes
	a) Mark beginning of data bblock	SetDataMode(0x0000) 843C0000 SetPhotoBiasFreq(0x062) 84190062 SetPhotoSampFreq(0x000C) 8418000C SetStarFrame(0x0001) 843E0001	
3	**Run QLA script FUNC-DCU-10P** a) Look at detector signal b) Record detector signal c) Display parameters	 PSWBIAS, PLWBIAS, PMWBIAS, TCBIAS	

4	**Vary bias amplitude**
	a) Mark beginning of bias ampl bblock
	a) Set bias amplitude to 0mV
	
	b) Mark beginning of DCU offset bblock
	c) Run *set offset* procedure
	d)
	e) **Mark beginning of data bblock**
	f) Record signal during 20 sec then step STEP 0xffff
	g)
	h) **Mark beginning of bias ampl bblock**
	i) Set bias amplitude to 40mV
	
	j) **Mark beginning of DCU offset bblock**
	k) Run *set offset* procedure
	l)
	m) **Mark beginning of data bblock**
	n) Record signal during 20 sec then step STEP 0xffff
	o)
	p) **Mark beginning of bias ampl bblock**
		a) BBID=0x88400001,STEP=0x0001
		a) SetPhotoBiasAmplSW(0x0000) 841A0000;
		SetPhotoBiasAmplMW(0x0000) 841B0000;
		SetPhotoBiasAmplLW(0x0000) 841C0000;
		SetPhotoBiasAmplTC(0x0000) 841D0000
		
		b) **BBID=0x881E0001,STEP=0x0001**
		c) SetDataMode(0x0010) 843C0010 *Wait 10 sec*
		d)
		e) **BBID=0x88040001,STEP=0x0001**
		f) Wait 20 sec then STEP=0xffff
		g)
		h) BBID=0x88400002,STEP=0x0001
		i) SetPhotoBiasAmplSW(0x0033) 841A0033;
		SetPhotoBiasAmplMW(0x0033) 841B0033;
		SetPhotoBiasAmplLW(0x0033) 841C0033;
		SetPhotoBiasAmplTC(0x0033) 841D0033
		
		j) **BBID=0x881E0002,STEP=0x0001**
		k) SetDataMode(0x0010) 843C0010 *Wait 10 sec*
		l)
		m) **BBID=0x88040002,STEP=0x0001**
		n) Wait 20 sec then STEP=0xffff
		o)
		p) BBID=0x88400003,STEP=0x0001	

Step	Action	Command/TM	Comment/notes
	q) Set bias amplitude to 80mV	q) SetPhotoBiasAmplSW(0x0066) 841A0066; SetPhotoBiasAmplMW(0x0066) 841B0066 SetPhotoBiasAmplLW(0x0066) 841C0066; SetPhotoBiasAmplTC(0x0066) 841D0066	
	r) **Mark beginning of DCU offset bblock**	r) **BBID=0x881E0003,STEP=0x0001**	
	s) Run *set offset* procedure	s) SetDataMode(0x0010) 843C0010 *Wait 10 sec*	
	t)	t)	
	u) **Mark beginning of data bblock**	u) **BBID=0x88040003,STEP=0x0001**	
	v) Record signal during 20 sec then step STEP 0xffff	**v) Wait 20 sec then STEP=0xffff**	
	w)	**w)**	
	x) **Mark beginning of bias ampl bblock**	**x) BBID=0x88400004,STEP=0x0001**	
	y) Set bias amplitude to 120mV	y) SetPhotoBiasAmplSW(0x0099) 841A0099; SetPhotoBiasAmplMW(0x0099) 841B0099 SetPhotoBiasAmplLW(0x0099) 841C0099; SetPhotoBiasAmplTC(0x0099) 841D0099	
	z)	z)	
	aa) **Mark beginning of DCU offset bblock**	aa) **BBID=0x881E0004,STEP=0x0001**	
	bb) Run *set offset* procedure	bb) SetDataMode(0x0010) 843C0010 *Wait 10 sec*	
	cc)	cc)	
	dd) **Mark beginning of data bblock**	dd) **BBID=0x88040004,STEP=0x0001**	
	ee) Record signal during 20 sec then step STEP 0xffff	**ee) Wait 20 sec then STEP=0xffff**	
	ff)	**ff)**	
	gg) **Mark beginning of bias ampl bblock**	**gg) BBID=0x88400005,STEP=0x0001**	
	hh) Set bias amplitude to 160mV	hh) SetPhotoBiasAmplSW(0x00CC) 841A00CC; SetPhotoBiasAmplMW(0x00CC) 841B00CC SetPhotoBiasAmplLW(0x00CC) 841C00CC; SetPhotoBiasAmplTC(0x00CC) 841D00CC	
	ii)	ii)	
	jj) **Mark beginning of DCU offset bblock**	jj) **BBID=0x881E0005,STEP=0x0001**	
	kk) Run *set offset* procedure	kk) SetDataMode(0x0010) 843C0010 *Wait 10 sec*	
	ll) **Mark beginning of data bblock**	ll) **BBID=0x88040005,STEP=0x0001**	
	mm) Record signal during 20 sec then step STEP 0xffff	**mm) Wait 20 sec then STEP=0xffff**	

Step	Action	Command/TM	Comment/notes
	nn) **Mark beginning of bias ampl bblock** oo) Set bias amplitude to 200m pp) **Mark beginning of DCU offset bblock** qq) Run *set offset* procedure rr) **Mark beginning of data bblock** **ss) Record signal during 20 sec then step STEP 0xffff**	**nn) BBID=0x88400006,STEP=0x0001** *oo)* SetPhotoBiasAmplSW(0x00FF) 841A00FF; SetPhotoBiasAmplMW(0x00FF) 841B00FF SetPhotoBiasAmplLW(0x00FF) 841C00FF; SetPhotoBiasAmplTC(0x00FF) 841D00FF pp) **BBID=0x881E0006,STEP=0x0001** qq) SetDataMode(0x0010) 843C0010 *Wait 10 sec* rr) **BBID=0x88040006,STEP=0x0001** **ss) Wait 20 sec then STEP=0xffff**	
5	**Set Bias amplitude back to (0mV)**	a) SetPhotoBiasAmplSW(0x0000) 841A0000 SetPhotoBiasAmplMW(0x0000) 841B0000 SetPhotoBiasAmplLW(0x0000) 841C0000 SetPhotoBiasAmplTC(0x0000) 841D0000	b)
6	**Write in a file the data recorded**		
7	**Stop TM packet sampling**	SetStartFrame(0x0000) 843E0000	
8	**Offline analysis**	a) Evaluate change in signal level and derive noise for each value of bias amplitude b) Analyse signal level and noise Vs bias amplitude	c)

Success/Failure Criteria: Test passed if bias amplitude is set to each value as required and offset procedure works each time it is called.

Comment/Open issue:
How can we check that the offset procedure has done the job properly?
Require different scripts for CQM and PFM
What is the set offset procedure?

4.51 FUNC-DCU-10S, DCU Spectrometer bias amplitude test

ID:	FUNC-DCU-10S
Purpose	Characterising detector signal for various bias amplitude on spectrometer side
Description of test:	Set bias amplitude. Measure change in signal level, measure noise, read out offsets
Test Type:	Characterisation
Instrument Models:	AVM/CQM/PFM/FS
Redundancy:	prime and redundant
Initial configuration:	SPIRE in SPEC-STBY
Final configuration	Idem
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT/PLT/IST/FLT
Test Conditions:	Warm or Cold
Total duration	3 min
Constraints:	Detectors on (bias frequency, bias amplitude, phase are set to operating values) – see FUNC-DCU-11

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**If not already switch on detectors with operating values**	Execute test FUNC-DCU-11 to switch on spectrometer detectors	

Step	Action	Command/TM	Comment/notes
2	**With SCOS, request bolometer array science packet at 15.3Hz** **Same layout as previous test but with Spectrometer Bias Amplitud building block type 0x8841** **And spec data bblock 0x8801 if Specfull , or 0x8805 if SSW or 0x8806 if SLW**	SetDataMode(0x0004) 843C0004 SetStartFrame(0x0001) 843E0001	
3	**Run QLA script FUNC-DCU-10S** d) Look at detector signal e) Record detector signal f) Display parameters	SSWBIAS, SLWBIAS	

Step	Action	Command/TM	Comment/notes
4	**Vary bias amplitude** a) Set bias amplitude to 0mV b) Run *set offset* procedure c) Record detector signal during 20 sec d) Set bias amplitude to 40mV e) Run *set offset* procedure f) Record detector signal during 20 sec g) Set bias amplitude to 80mV h) Run *set offset* procedure i) Record detector signal during 20 sec j) Set bias amplitude to 120mV k) Run *set offset* procedure l) Record detector signal during 20 sec m) Set bias amplitude to 160mV n) Run *set offset* procedure o) Record detector signal during 20 sec p) Set bias amplitude to 200mV q) Run *set offset* procedure r) Record detector signal during 20 sec	a) SetSpectroBiasAmplSW(0x0000) 843A0000 SetSpectroBiasAmplLW(0x0000) 843B0000 b) SetDataMode(0x0014) 843C0014 *Wait 10 sec* *c) Wait 20 sec* d) SetSpectroBiasAmplSW(0x0033) 843A0033 SetSpectroBiasAmplLW(0x0033) 843B0033 e) SetDataMode(0x0014) 843C0014 *Wait 10 sec* *f) Wait 20 sec* g) SetSpectroBiasAmplSW(0x0066) 843A0066 SetSpectroBiasAmplLW(0x0066) 843B0066 h) SetDataMode(0x0014) 843C0014 *Wait 10 sec* *i) Wait 20 sec* j) SetSpectroBiasAmplSW(0x0099) 843A0099 SetSpectroBiasAmplLW(0x0099) 843B0099 k) SetDataMode(0x0014) 843C0014 *Wait 10 sec* *l) Wait 20 sec* m) SetSpectroBiasAmplSW(0x00CC) 843A00CC SetSpectroBiasAmplLW(0x00CC) 843B00CC n) SetDataMode(0x0014) 843C0014 *Wait 10 sec* *o) Wait 20 sec* p) SetSpectroBiasAmplSW(0x00FF) 843A00FF SetSpectroBiasAmplLW(0x00FF) 843B00FF *q)* SetDataMode(0x0014) 843C0014 *Wait 10 sec* r) *Wait 20 sec*	
5	**Set Bias amplitude back to (0mV)**	a) SetSpectroBiasAmplSW(0x0000) 843A0000 SetSpectroBiasAmplLW(0x0000) 843B0000	b)
6	**Write in a file the data recorded**		
7	**Stop TM packet sampling**	SetStartFrame(0x0000) 843E0000	
8	**Offline analysis**	a) Evaluate change in signal level and derive noise for each value of bias amplitude b) Analyse signal level and noise Vs bias amplitude	c)

Success/Failure Criteria: Test passed if bias amplitude is set to each value as required and offset procedure works each time it is called.

Comment/Open issue:
How can we check that the offset procedure has done the job properly?
Require different scripts for CQM and PFM
What is the set offset procedure?

4.52 FUNC-DCU-11P, DCU Photometer detector switch on

ID:	FUNC-DCU-11P
Purpose	Switching on the all chain for reading detectors signal. This procedure must be performed before test FUNC-DCU-08, FUNC-DCU-09 and FUNC-DCU-10 – see flowchart p17
Description of test:	Switch on photometer LIAs and JFETs, set sampling frequency, bias amplitude, bias frequency, demodulation phase to their operating values
Test Type:	Integrity
Instrument Models:	AVM/CQM/PFM/FS
Redundancy:	No
Initial configuration:	detectors off
Final configuration	detectors on
EGSE Configuration:	SCOS-2000 required
Level	ILT/PLT/IST/FLT
Test Conditions:	Warm or Cold
Total duration	1 min
Constraints:	None

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	a) Switch on photometer LIAs card	a) SetDRelOnOff(0x0001) A0870001 or SetDRelOnOff(0x0005) A087005 if MCU is on	
	b) Check HK parameters	b) PWR_STATUS = 0x01FF LIAP_P5 = 0xB554 LIAP_P9 = 0xE00D LIAP_N9 = 0x1FF0	
	c) Switch on JFET source voltages to level found in test FUNC-DCU-07P	c) For #=1..6, SetPhSWJfetVSS#(0x00xx) 8(404+#)007F For #=1..4, SetPhMWJfetVSS#(0x00xx)8(40A+#)00xxFor #=1..2, SetPhLWJfetVSS#(0x00xx) 8(40E+#)00xx SetPhTCJfetVSS1(0x00xx) 841400xx	
	d) Switch drain voltages to high level	*d)* SetPhSWJfetPwr(0x003F) 8412003F SetPhMLWJfetPwr(0x007F) 8413007F	
	e) Switch on JFET heaters to max power during 1 min	*e)* SetPhotoHeaterBias(0x007F) 841100FF *Wait 1 min*	
	f) Switch off JFET heaters	f) SetPhotoHeaterBias(0x0000) 84110000	
	g) Set bias frequency to 200 Hz	g) SetPhotoBiasFreq(0x0062) 84190062	
	h) Set the sampling frequency to 15.3Hz	h) SetPhotoSampFreq(0x000C) 8418000C	
	i) Set photo bias mode to “run”	i) SetPhotoBiasMode(0x00FF) 840000FF	
	j) Set bias amplitude to 60 mV	j) SetPhotoBiasAmplSW(0x004D) 841A004D SetPhotoBiasAmplMW(0x004D) 841B004D SetPhotoBiasAmplLW(0x004D) 841C004D SetPhotoBiasAmplTC(0x004D) 841D004D	
	k) Set demodulation phase to 180 degrees (or 180+ dϕ, found by test FUNC-DCU-08 ?)	k) SetPhotoDemodSW(0x007F) 841A007F SetPhotoDemodMW(0x007F) 841B007F SetPhotoDemodLW(0x007F) 841C007F SetPhotoDemodTC(0x007F) 841D007F	
	l) Activate auto-offset control	l) SetDataMode(0x0010) 843C0010 *Wait 10 sec*	

Switch off procedure

Action	Command
a) Set photo bias mode to "off"	a) SetPhotoBiasMode(0x0000) 84000000
b) Set Vss to 0V on all channel	b) For #=1..6, SetPhSWJfetVSS#(0x0000) 8(404+#)0000 / For #=1..4, SetPhMWJfetVSS#(0x0000) 8(40A+#)0000 For #=1..2, SetPhLWJfetVSS#(0x0000) 8(40E+#)0000 / SetPhTCJfetVSS1(0x0000) 8414000
c) Switch off drain voltages	c) SetPhSWJfetPwr(0x0000) 84120000 SetPhMLWJfetPwr(0x0000) 84130000
d) Switch of LIA card	g) SetDRelOnOff(0x0000) A0870000 or SetDRelOnOff(0x0004) A087004 if MCU is on

Success/Failure Criteria: Test passed if each parameter is set to the required value

Comment/Open issues:
I use the values in Bruce's document (Subsystem reaction for specification for the instrument simulator)

4.53 FUNC-DCU-11S, DCU Spectrometer detector switch on

ID:	FUNC-DCU-11S
Purpose	Switching on the all chain for reading detectors signal. This procedure must be performed before test FUNC-DCU-08, FUNC-DCU-09 and FUNC-DCU-10 – see flowchart p17
Description of test:	Switch on spectrometer LIAs and JFETs, set sampling frequency, bias amplitude, bias frequency, demodulation phase to their operating values
Test Type:	Integrity
Instrument Models:	AVM/CQM/PFM/FS
Redundancy:	No
Initial configuration:	detectors off
Final configuration	detectors on
EGSE Configuration:	SCOS-2000 required
Level	ILT/PLT/IST/FLT
Test Conditions:	Warm or Cold
Total duration	1 min
Constraints:	None

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	a) Switch on spectrometer LIAs card b) Check HK parameters c) Switch on JFET source voltages to level found in FUNC-DCU-07S d) Switch drain voltages to high level e) Switch on JFET heaters to max power during 1 min f) Switch off JFET heaters g) Set bias frequency to 200 Hz h) Set the sampling frequency to 15.3Hz i) Set spectro bias mode to "run" j) Set bias amplitude to 60 mV k) Set demodulation phase to 180 degrees (or 180+ dϕ, found by test FUNC-DCU-08 ?) l) Activate auto-offset control	a) SetDRelOnOff(0x0002) A0870002 or SetDRelOnOff(0x0006) A087006 if MCU is on b) PWR_STATUS = 0x01FF LIAP_P5 = 0xB554 LIAP_P9 = 0xE00D LIAP_N9 = 0x1FF0 c) For #=1..2, SetSpSWJfetVSS#(0x00xx) 8(434+#)00xx SetSpLWJfetVSS(0x00xx) 843400xx d) SetSpSLWJfetPwr(0x0007) 84370007 *e)* SetSpectroHeaterBias(0x007F) 843300FF *Wait 1 min* f) SetSpectroHeaterBias(0x0000) 84330000 g) SetSpectroBiasFreq(0x0062) 84390062 h) SetSpectroSampFreq(0x000C) 8438000C i) SetSpectroBiasMode(0x00FF) 843000FF j) SetSpectroBiasAmplSW(0x004D) 843A004D SetSpectroBiasAmplLW(0x004D) 843B004D k) SetSpectroDemodSW(0x007F) 843A007F SetSpectroDemodMW(0x007F) 843B007F l) SetDataMode(0x0014) 843C0014 *Wait 10 sec*	

h) Note: for QM1 the command to switch on LIA cards is SetDRelOnOff(0x0001) A0870001 or SetDRelOnOff(0x0005) A087005 if MCU is on

Switch off procedure

Action	Command
a) Set photo bias mode to "off" b) Set Vss to 0V on all channel c) Switch off drain voltages d) Switch of LIA card	a) SetSpectroBiasMode(0x0000) 84300000 b) For #=1..2, SetSpSWJfetVSS#(0x0000) 8(434+#)0000 SetSpLWJfetVSS(0x0000) 84340000 c) SetSpSLWJfetPwr(0x0000) 84370000 SetDRelOnOff(0x0000) A0870000 or SetDRelOnOff(0x0004) A087004 if MCU is on

Success/Failure Criteria: Test passed if each parameter is set to the required value

Comment/Open issues:
I use the values in Bruce's document (Subsystem reaction for specification for the instrument simulator)

4.54 FUNC-DCU-12P, DCU Photometer detector settings

ID:	FUNC-DCU-12P
Purpose	Setting sampling frequency, bias frequency, bias amplitude and demodulation phase when LIA and JFET are already on. This procedure must be performed after FUNC-DCU-04 and FUNC-DCU-07 before carrying on with tests FUNC-DCU-08, FUNC-DCU-09 and FUNC-DCU-10. – see flowchart p17
Description of test:	Set sampling frequency, bias amplitude, bias frequency, demodulation phase on photometer side to their operating values. Activate auto-offset procedure
Test Type:	Integrity
Instrument Models:	AVM/CQM/PFM/FS
Redundancy:	No
Initial configuration:	LIA, JFET on.
Final configuration	detectors on
EGSE Configuration:	SCOS-2000 required
Level	ILT/PLT/IST/FLT
Test Conditions:	Warm or Cold
Total duration	1 min
Constraints:	FUNC-DCU-04 and FUNC-DCU-07 successfully passd

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	a) Set bias frequency to 200 Hz b) Set the sampling frequency to 15.3Hz c) Set photo bias mode to "run" d) Set bias amplitude to 60 mV e) Set demodulation phase to 180 degrees (or 180+ dϕ, found by test FUNC-DCU-08 ?) f) Activate auto-offset control	a) SetPhotoBiasFreq(0x0062) 84190062 b) SetPhotoSampFreq(0x000C) 8418000C c) SetPhotoBiasMode(0x00FF) 840000FF d) SetPhotoBiasAmplSW(0x004D) **8401004D** SetPhotoBiasAmplMW(0x004D) **8402004D** SetPhotoBiasAmplLW(0x004D) **8403004D** SetPhotoBiasAmplTC(0x004D) 8404004D e) SetPhotoDemodSW(0x007F) 841A007F SetPhotoDemodMW(0x007F) 841B007F SetPhotoDemodLW(0x007F) 841C007F SetPhotoDemodTC(0x007F) 841D007F f) SetDataMode(0x0010) 843C0010 *Wait xx sec*	

Switch off procedure: see test FUNC-DCU-11P

Success/Failure Criteria: Test passed if each parameter is set to the required value

Comment/Open issues:
I use the values in Bruce's document (Subsystem reaction for specification for the instrument simulator)

4.55 FUNC-DCU-12S, DCU Detector settings

ID:	FUNC-DCU-12S
Purpose	Setting sampling frequency, bias frequency, bias amplitude and demodulation phase when LIA and JFET are already on. This procedure must be performed after FUNC-DCU-04 and FUNC-DCU-07 before carrying on with tests FUNC-DCU-08, FUNC-DCU-09 and FUNC-DCU-10. – see flowchart p17
Description of test:	Set sampling frequency, bias amplitude, bias frequency, demodulation phase on spectrometer side to their operating values. Activate auto-offset procedure
Test Type:	Integrity
Instrument Models:	AVM/CQM/PFM/FS
Redundancy:	No
Initial configuration:	LIA, JFET on.
Final configuration	detectors on
EGSE Configuration:	SCOS-2000 required
Level	ILT/PLT/IST/FLT
Test Conditions:	Warm or Cold
Total duration	1 min
Constraints:	FUNC-DCU-04 and FUNC-DCU-07 successfully passd

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	a) Set bias frequency to 200 Hz b) Set the sampling frequency to 15.3Hz c) Set spectro bias mode to "run" d) Set bias amplitude to 60 mV e) Set demodulation phase to 180 degrees (or 180+ dϕ, found by test FUNC-DCU-08 ?) f) Activate auto-offset control	a) SetSpectroBiasFreq(0x0062) 84390062 b) SetSpectroSampFreq(0x000C) 8438000C c) SetSpectroBiasMode(0x00FF) 843000FF d) SetSpectroBiasAmplSW(0x004D) 843A004D SetSpectroBiasAmplLW(0x004D) 843B004D e) SetSpectroDemodSW(0x007F) 843A007F SetSpectroDemodMW(0x007F) 843B007F f) SetDataMode(0x0014) 843C0014 *Wait xx sec*	

Switch off procedure: see test FUNC-DCU-11S

Success/Failure Criteria: Test passed if each parameter is set to the required value

Comment/Open issues:
I use the values in Bruce's document (Subsystem reaction for specification for the instrument simulator)