SUBJECT:	SPIRE Functional test specifications		
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Distribution

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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	Correct current values for SCU-07 Cooler Heater Check DCU Frequency test: new frequencies BBID and STEPS added (Asier)

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

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 para meters

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

2.4 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

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

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

2.4.3 FUNC-BSM-03c/j, position test, close loop

Checking that BSM moves to the position commanded and that the control loop on MRS works

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

Characterising BSM movement for a single scan, loop closed on MRS. Move BSM to multiple set positions. Check telemetry response, consumed power.

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

Characterising BSM movement for a single scan, loop open (no sensor). Move BSM to multiple set positions. Check telemetry response, consumed power.

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. Set phase to $\pi/2$ and $3\pi/2$ adjust phase by small amounts to find minimum – set phase back to $+d\phi$

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

Set phase at $\pi/2+d\phi$ and verify that signal = 0

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 (all?)
W: performed during Warm functional test
C: performed during Cold functional test (all?)
*: 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		1 min
FUNC-SCU-02		F	W	C		2 min
FUNC-SCU-03	S	F	W	C		1 min
FUNC-SCU-04	S	F	W	C		1 min
FUNC-SCU-05	S	F	W	C		3 min
FUNC-SCU-06	S	F	W	C		1 min
FUNC-SCU-07	S	F	W	C		2 min
FUNC-SCU-08		F	W	C		1 min
FUNC-MCU-01	S	F	W	C		1 min
FUNC-MCU-02	S	F	W	C		2 min
FUNC-MCU-03		F	W	C		2 min
FUNC-MCU-04		F	W	C		1 min
FUNC-SMEC-01	S	F	W	C		3 min
FUNC-SMEC-02	S	F	W	C		3 min
FUNC-SMEC-03	S	F	W	C		1 min
FUNC-SMEC-04	S	F	W	C	*	3 min
FUNC-SMEC-05		F	W	C		18 min
FUNC-SMEC-06		F	W	C		5 min
FUNC-SMEC-07		F	W	C		5 min
FUNC-BSM-01	S	F	W	C		1 min
FUNC-BSM-02c		F	W	C		1 min
FUNC-BSM-02j		F	W	C		5 min
FUNC-BSM-03c		F	W	C		5 min
FUNC-BSM-03j		F	W	C		5 min
FUNC-BSM-04		F	W	C		5 min
FUNC-BSM-05		F	W	C		45 min ?
FUNC-PCAL-01		F	W?	C		2 min
FUNC-SCAL-01		F	W?	C		15 min

FUNC-SCAL-02		F	W?	C		
FUNC-DCU-01	S	F	W	C	*	1 ¦ 3 min
FUNC-DCU-02		F	W	C	*	2 ¦ 5 min
FUNC-DCU-03		F	W	C	*	2 ¦ 5 min
FUNC-DCU-04P/S	S	F	W	C		1 min
FUNC-DCU-05P/S		F		C	!	3 min
FUNC-DCU-06P/S		F		C	!	3 min
FUNC-DCU-07P/S		F		C	!	4 min
FUNC-DCU-08P/S_full		F		C	!	10 min
FUNC-DCU-08P/S_short		F		C	!	3 min
FUNC-DCU-09P/S		F		C	!	3 min
FUNC-DCU-10P/S		F		C	!	3 min
FUNC-DCU-11P/S		F		C	!	1 min
FUNC-DCU-12P/S						

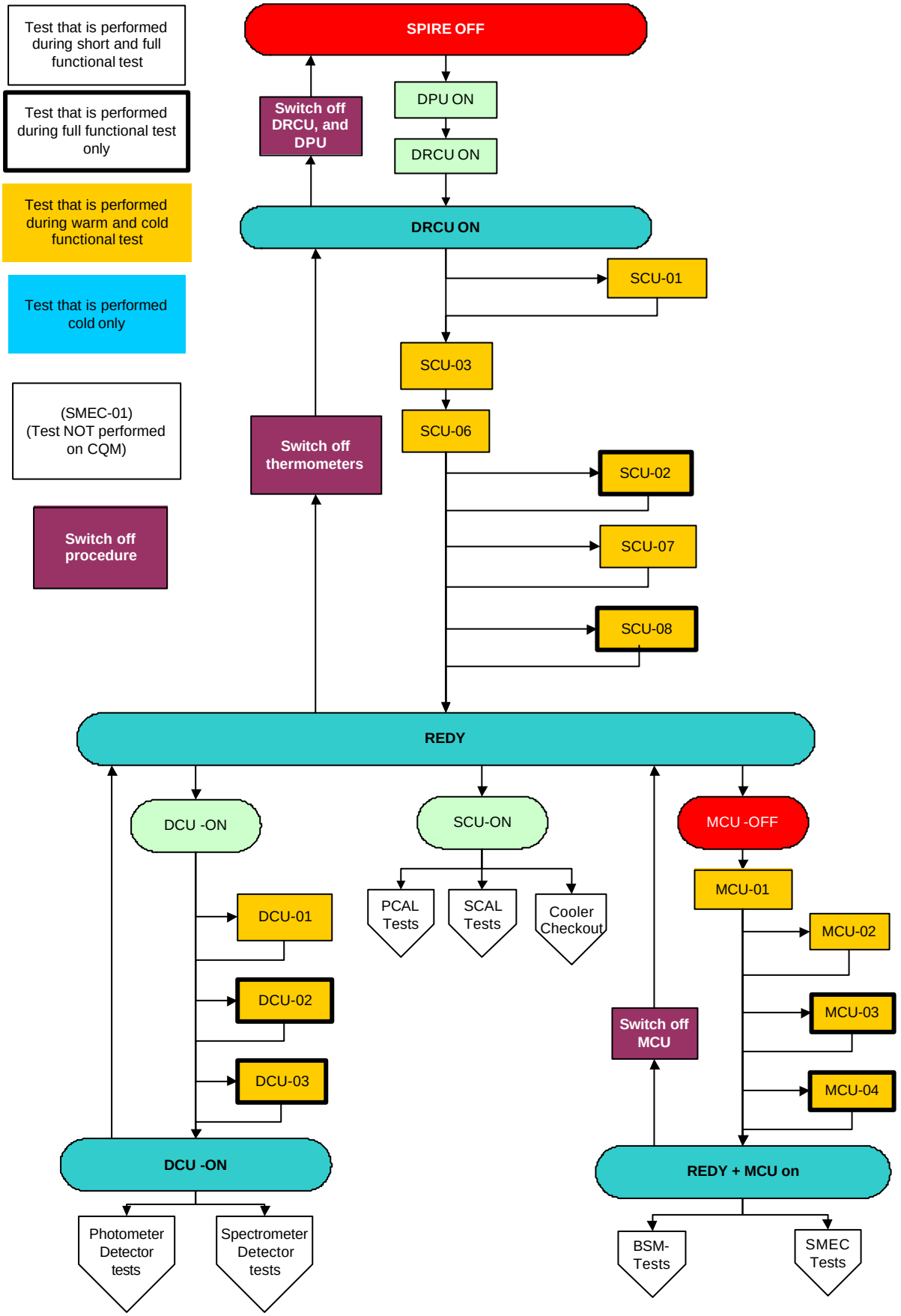
Total duration:

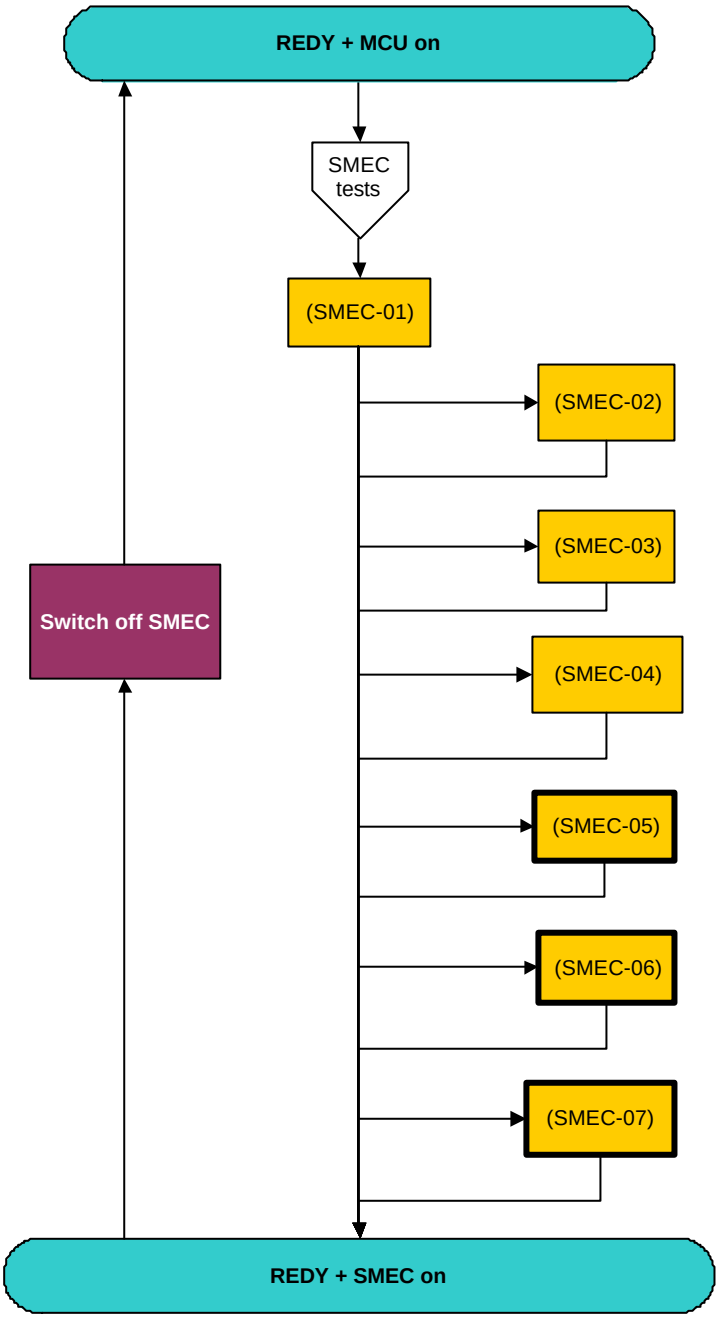
Comment/open issues
-There might be other tests that deserve a * (different short and full), TBD

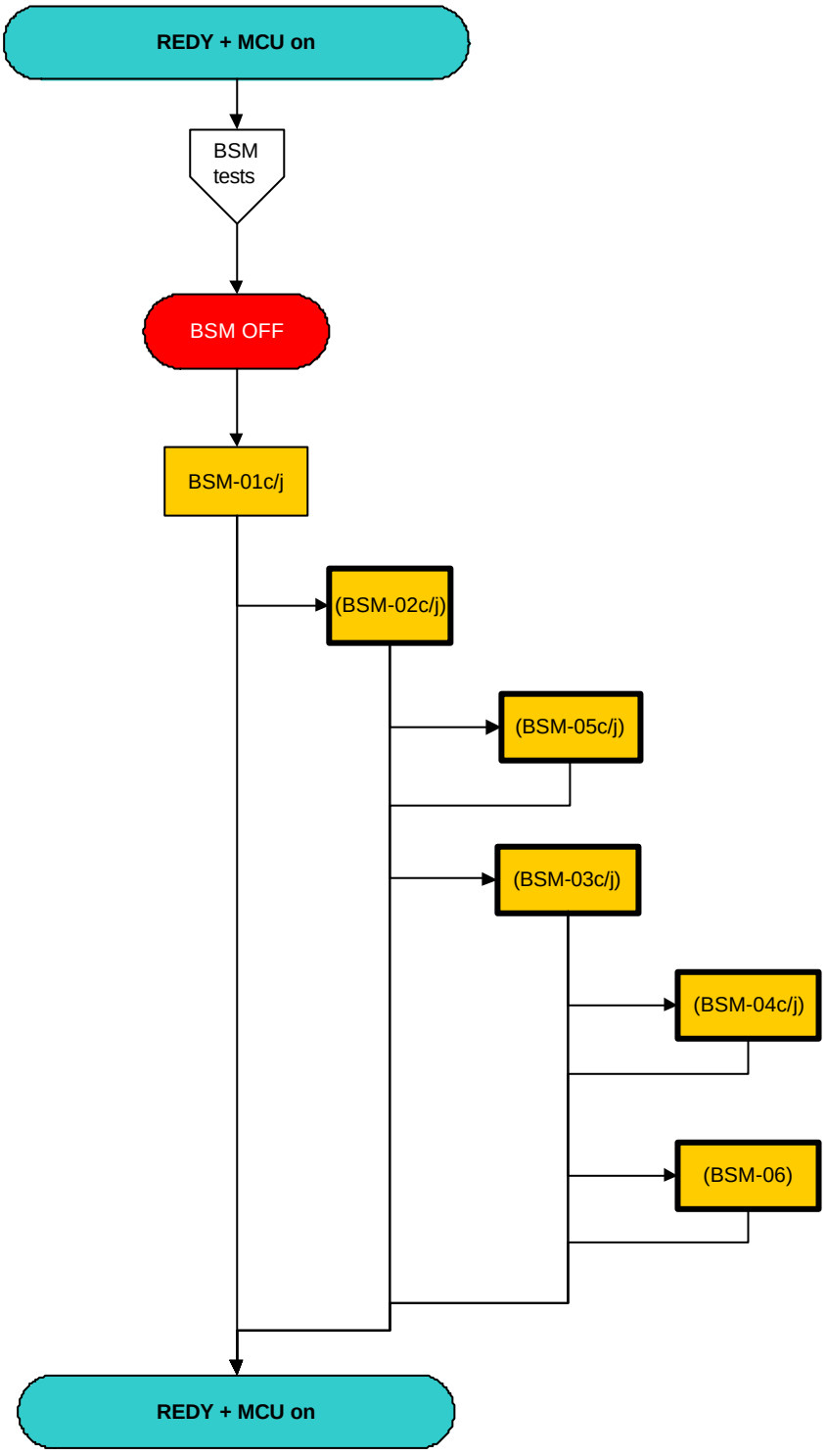
3.2 Test flow

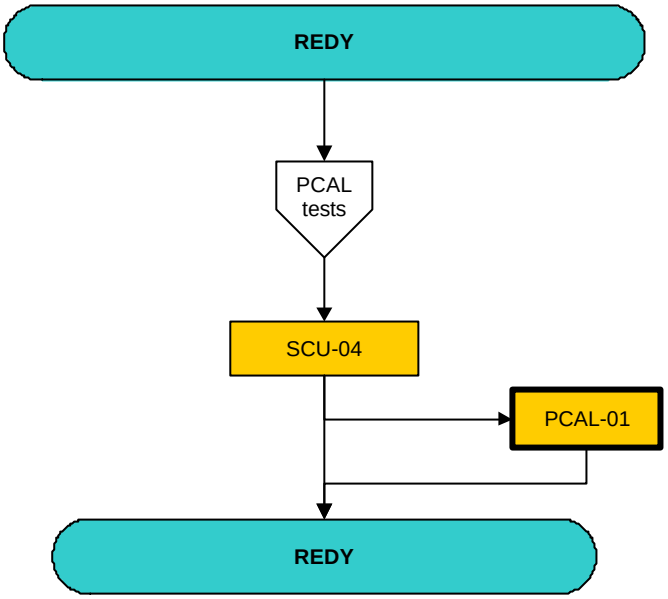
Warm short functional test: perform test in yellow boxes only
Warm full functional test: perform test in yellow and pink boxes only
Cold short functional test: perform test in yellow and blue boxes only
Cold full functional test: perform all tests
Test into brackets: cannot be performed with the CQM

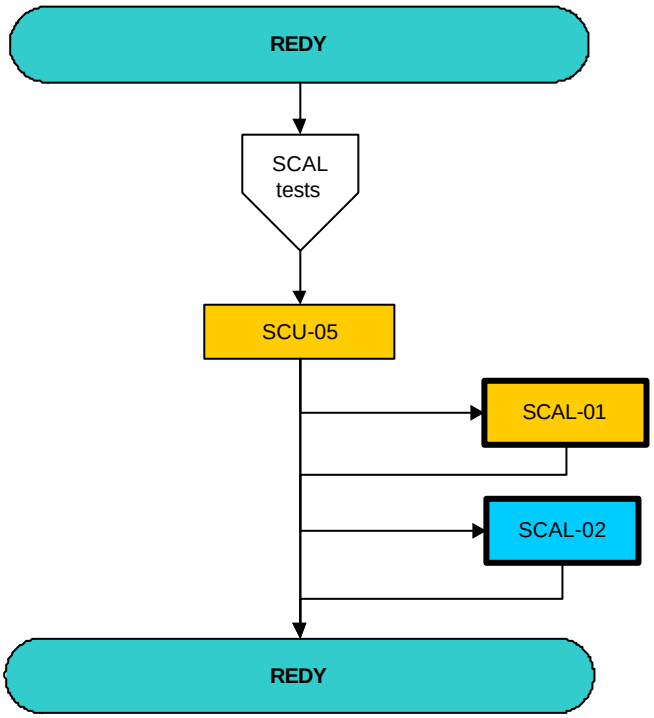
Comment/open issues:
-Maybe FUNC-SCU-06 (AC thermometry) should be repeated when the detectors are at 300 mK?

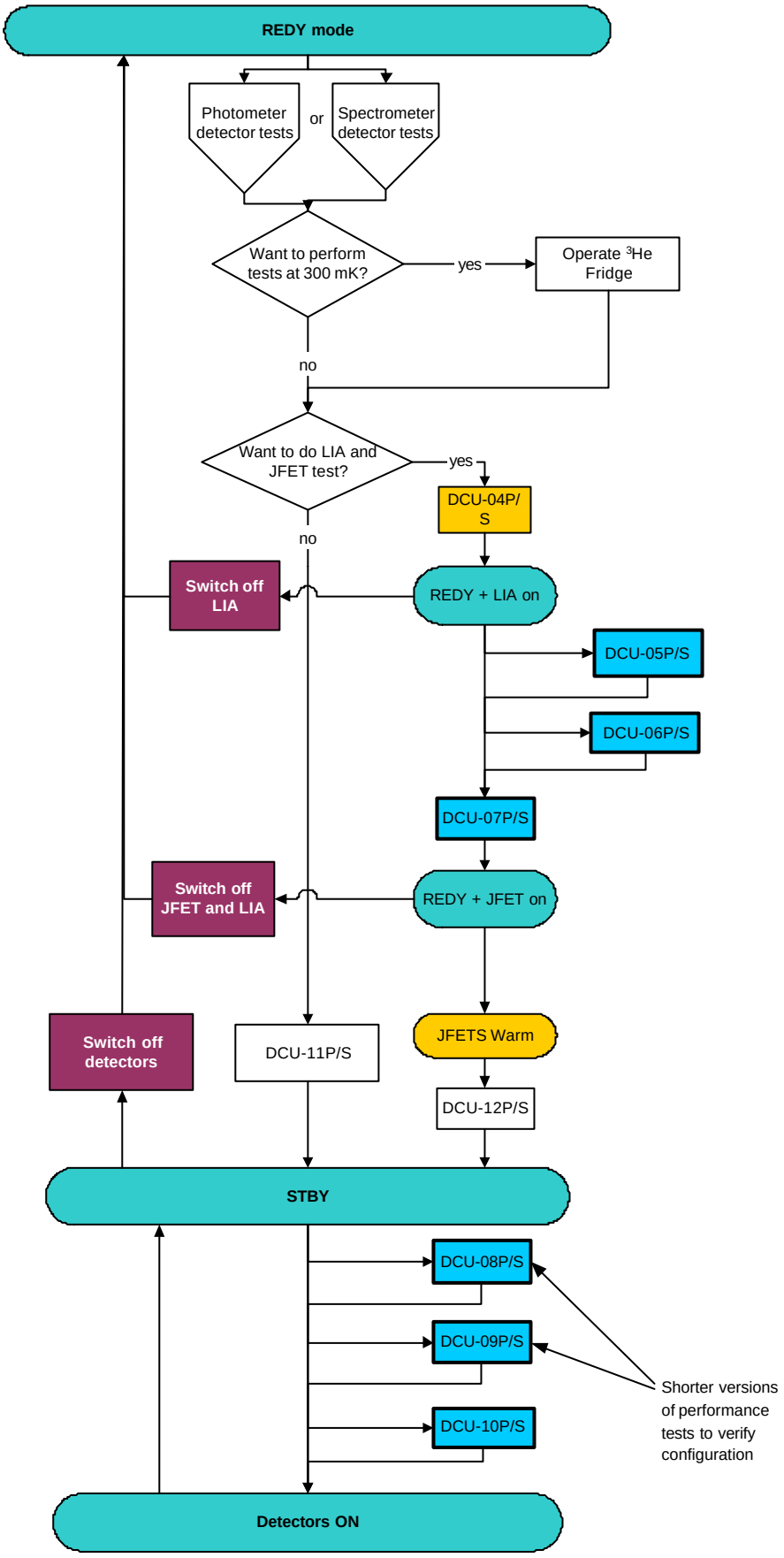

Test that is performed during short and full functional test
Test that is performed during full functional test only
Test that is performed during warm and cold functional test
Test that is performed cold only
(SMEC-01) (Test NOT performed on CQM)
Switch off procedure
SPIRE OFF
DPU ON
DRCU ON
Switch 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)
(SMEC-03)
(SMEC-04)
(SMEC-05)
(SMEC-06)
(SMEC-07)
Switch off SMEC
REDY + SMEC on


REDY + MCU on
BSM tests
BSM OFF
BSM-01c/j
(BSM-02c/j)
(BSM-05c/j)
(BSM-03c/j)
(BSM-04c/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
Detectors ON

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 200 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(0x00C8) A08400C8 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 ~200 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 (change BBId)** b) Request 200 SCU TM 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(0x00C8) A08400C8 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 science frame with 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**	CPHPtemp= 0x08CA CPHStemp= 0x08CA CEHStemp= 0x08CA CSHTtemp= 0x08CA SOBtemp= 0x08CA SL0temp= 0x0DAC PL0temp= 0x0DAC SUBtemp= 0x08CA BAFtemp= 0x08CA BSMStemp= 0x08CA SCL2temp= 0x08CA SCL4temp= 0x08CA SCSTtemp= 0x08CA FTSStemp= 0x08CA FTSMtemp= 0x08CA BSMMtemp= 0x08CA	

Switch off procedure:

Action	Command
Switch off thermometers	TempOnOff(0x0000) A0850000

Success/Failure Criteria: Test passed if all thermo meter channels are reading expected values

Comments/Open issues:

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 (TBC) 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 current (2.25 mA) b) Wait 2 seconds	a) SetPhCalBias(0x050A) A0C8050A b) Wait 2 seconds	
3	**Check parameters values**	a) PCALCURR = 0x2366 (2.25 mA) b) PCALV = 1FDD (567 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
Is it possible to perform this test warm?
Answer from Peter Hargrave: good question, I don't know, maybe, has never been done

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 current (2.5 mA) b) Wait 1 minute (TBC)	 a) SetSCal4Bias(0x072F) A0CC072F b) Wait 1 minute	
3	**Check parameters values for SCAL-4**	a) SCAL4CURR = 0x36F6 (2.5mA) b) SCAL4V = 0x30DA (1.25V) c) SCAL4TEMP = 0x	
4	**Switch on SCAL-2** a) Set a current (2.5 mA) b) Wait 1 minute (TBC)	 a) SetSCal2Bias(0x072E) A0CA072E Wait 1 minute	
5	**Check parameters values for SCAL-2**	a) SCAL2CURR = 0x36FC (2.5mA) b) SCAL2V = 0x0x30E6 (1.25V) c) SCAL2TEMP = 0x	
6	a) Switch off SCAL2 b) Switch off SCAL4	a) SetScal2Bias(0x0000) A0CC0000 b) SetScal4Bias(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) = 0x05DC or 0x0247 or…(cf comment)	

Switch off procedure:

Action	Command
Switch off thermometer	SubKOnOff(0x0000) A0850000

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 READY 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 1mA to EVHS heater b) Apply 1mA to SPHS heater c) Apply 1mA to SP heater d) Wait 1 minute	a) SetEVHSHeatB(0x09F3) A0C409F3 b) SetSPHSHeatB(0x09F2) A0C509F2 c) SetSPHeaterB(0x0054) A0C70054 *d) Wait 1 minute*	
3	**Check parameter values**	a) EVHSHeatVolt = 0x3DBA (401.99 mV) SPHSHeatVolt = 0x3DB5 (401.95 mV) SPHeaterVolt = 0x028A (401.33 mV)	
4	**Switch off heaters** a) Set all currents down to 0	a) SetEVHSHeatB(0x0000) A0C40000 SetSPHSHeatB(0x0000) A0C50000 SetSPHeaterB(0x0000) A0C70000	

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 200 SCU TEST 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(0x00C8) A08400C8 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
1	**Select SCOS display *(MCU_PARAMETERS)***		
2	**Power on MCU from SCU**	SetDRelOnOff(0x0004) *A0870004*	
3	**Check MCU power status** a) Check parameters values	a) SCUDCDCSTAT = 4 b) MCU+5V = 0xA804 c) MCU+15V = 0xF810 d) FUNC-MCU-15V = 0x07ED e) MCU+13V = 0xE80E f) FUNC-MCU-13V = 0x17EF g) MCUMACTEMP = 0x1000 h) MCUSMECTEMP = 0x1000 i) MCUBSMTEMP = 0x1000	
4	**Check threshold flag**		
5	**Reset MCU Subsystem** a) Reset on b) Wait 5 seconds c) Reset off d) Wait 5 seconds e) Check Boot Status f) Check Interface Status	a) SetMCUCmdIfCtrl(0x0005) *90010005* *b) Wait 5 seconds* c) SetMCUCmdIfCtrl(0x0007) *90010007* *d) Wait 5 seconds* e) MCUBOOTSTAT = 0x0001 f) MCUIFSTAT = 0x0000	
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*	

Step	Action	Command/TM	Comment/notes
7	**Check MCU status**	a) MCUBOOTSTAT = 0x0001 b) MCUIFSTAT = 0x0000 c) MCUERR = 0x0000 d) MCUSCHEDCNTLSW = TBD e) MCUSCHEDCNTMSW = TBD	

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	2 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) Start ENG TM Packet Sampling at 64Hz c) Wait 10 seconds d) Stop ENG TM Packet Sampling e) Flush MCU FIFO f) Check Frame counter has incremented by ~640 g) Check No Science Packet Events occurred	a) Read MCUFRAMECNT b) SetTP14SampFreq(0x002C) *91C4002C* c) *Wait 10 seconds* d) SetTP14SampFreq(0x0000) *91C40000* e) TM(8,4: CA-02) (0x2000) f) Read MCUFRAMECNT g) *????*	
3	**Request SMEC Frames** a) Check Frame Counter b) Start SMEC TM Packet Sampling at 240Hz c) Wait 10 seconds d) Stop SMEC TM Packet Sampling e) Flush MCU FIFO f) Check Frame counter has incremented by ~2400 g) Check No Science Packet Events occurred	a) Read MCUFRAMECNT b) SetTP10SampFreq(0x000B) *91C0000B* c) *Wait 10 seconds* d) SetTP10SampFreq(0x0000) *91C00000* e) TM(8,4: CA-02) (0x2000) f) Read MCUFRAMECNT g) *????*	
4	**Request BSM Frames** a) Check Frame Counter b) Start BSM TM Packet Sampling at 64Hz c) Wait 10 seconds d) Stop BSM TM Packet Sampling e) Flush MCU FIFO f) Check Frame counter has incremented by ~640 g) Check No Science Packet Events occurred	a) Read MCUFRAMECNT b) SetTP12SampFreq(0x002C) *91C2002C* c) *Wait 10 seconds* d) SetTP12SampFreq(0x0000) *91C20000* e) TM(8,4: CA-02) (0x2000) f) Read MCUFRAMECNT g) *????*	

Step	Action	Command/TM	Comment/notes
5	**Request SMEC+BSM Frames** a) Check Frame Counter b) Start SMEC TM Packet Sampling at 240Hz c) Start BSM TM Packet Sampling at 64Hz d) Wait 10 seconds e) Stop BSM TM Packet Sampling f) Stop SMEC TM Packet Sampling g) Flush MCU FIFO h) Check Frame counter has incremented by ~3040 i) Check No Science Packet Events occurred	a) Read MCUFRAMECNT b) SetTP10SampFreq(0x000B) *91C0000B* c) SetTP12SampFreq(0x002C) *91C2002C* d) *Wait 10 seconds* e) SetTP12SampFreq(0x0000) *91C20000* f) SetTP10SampFreq(0x0000) *91C00000* g) TM(8,4: CA-02) (0x2000) h) Read MCUFRAMECNT i) *????*	

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

Comment/Open Issue:
This procedure is currently only valid for QM0, which implements the start and stop of TM packets using a single SetSampFreq command. For later version sof the MCU there will be two commands: one to set the sample frequency and one to start/stop the sampling, for a number of frames.

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	2 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 test (change BBId) b) Request 256 ENG TM frames, sampled at 64Hz c) Once all packet are received, mark end of ENG packet transmission (reset BBId to 0x80000000) d) Flush MCU FIFO e) Display science parameters from last frame f) Display HK parameters received just after BBId changed to value3	a) ? b) SetTP14SampFreq(0x002C) 91C4002C Wait 4 sec SetTP14SampFreq(0x0000) 91C40000 c) ? d) TM(8,4: CA-02) (0x2000) e) SMECENCSIG1, SMECENCSIG2, SMECENCSIG3, SMECLVDTACSIG, SMECLVDTDCSIG, SMECMOTORCURR, CHOPSENSSIG, CHOPMOTORCURR, JIGGSENSSIG, JIGGMOTORCURR	
3	**Request SMEC science Frames** a) Mark beginning of SMEC packet transmission (change BBId) b) Request 720 SMEC TM frames, sampled at 240Hz c) Once all packet are received, mark end of SMEC packet transmission (reset BBId to 0x80000000) d) Flush MCU FIFO e) Display science parameters from last frame f) Display HK parameters received just after BBId changed to value5	a) ? b) SetTP10SampFreq(0x000B) 91C0000B *Wait 3 sec* SetTP10SampFreq(0x0000) 91C00000 c) ? d) TM(8,4: CA-02) (0x2000) e) SMECENCPOSN, SMECENCFINEPOSN, SMECLVDTDCSIG, SMECMOTORBEMF	

Step	Action	Command/TM	Comment/notes
4	**Request BSM Frames** a) Mark beginning of BSM packet transmission (change BBId) b) Request 256 BSM TM frames, sampled at 64Hz c) Once all packet are received, mark end of BSM packet transmission (reset BBId to 0x80000000) d) Flush MCU FIFO e) Display science parameters from last frame f) Display HK parameters received just after BBId changed to value7	a) ? b) SetTP12SampFreq(0x002C) 91C2002C *Wait 4 sec* SetTP12SampFreq(0x0000) 91C20000 c) ? d) TM(8,4: CA-02) (0x2000) e) CHOPSENSSIG, CHOPMOTORCURR, CHOPBEMF, JIGGSENSSIG, JIGGMOTORCURR, JIGGBEMF	
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: Is there a way to specify PRECISELY the number of packet desired?

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 MCU test pattern frames** a) Request 100 MCU test packet at 100Hz b) Read frame counter to know the exact number o f packet received c) Flush MCU FIFO d) Display test pattern with QLA	*a)* SetTP15SampFreq(0x001C) 91C5001C *Wait 1 sec* SetTP15SampFreq(0x0000) 91C50000 *b)* MCUFRAMECNT ~100 c) TM(8,4: CA-02) (0x2000 d) 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 : Is there a way to set PRECISELY the number of frames desired?

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 + MCU on – SMEC off
Final configuration	SPIRE in REDY mode +MCU on + 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
1	**Select SCOS display**		
2	**Switch on fringe encoder** a) Set encoder LED to half power b) Check SMECStatus c) Check SencoderSignal1 d) Check SencoderSignal2 e) Check SencoderSignal3	a) SetSEncoderPwr(0x0003) 90400003 b) SMECSTAT = 0x0080 c) SMECENCSIG1=0x7FFF d) SMECENCSIG2=0xC9E8 e) SMECENCSIG3=0x3616	
3	**Switch on LVDT** a) Power on LVDT b) Check LVDTAC c) Check LVDTDC d) Check LVDT position	a) SetSLVDTPwr(0x0001) 90410001 b) SMECLVDTACSIG = 0x1DB7 c) SMECLVDTDCSIG = 0x1DBA d) SMECLVDTPOSN = 0x0000	
4	**Switch on motors**	???	
5	**Initialise SMEC** a) Set the mode to initialisation b) Check SMECStatus c) Check SencoderSignal1 d) Check SencoderSignal2 e) Check SencoderSignal3 f) Check LVDTAC g) Check LVDTDC h) Check LVDT position i) Check motor current j) Check back emf k) Check encoder increment position l) Check encoder fine position	a) SetSTrajMode(0x0004) 90490004 b) SMECSTAT = 0x0188 c) SMECENCSIG1=0xD527 d) SMECENCSIG2=0x5A4F e) SMECENCSIG3=0x5085 f) SMECLVDTACSIG = 0x315F g) SMECLVDTDCSIG = 0x3165 h) SMECLVDTPOSN = 0x0709 i) SMECMOTORCURR = 0x03E8 j) SMECBEMF = 0x03E8 k) SMECENCPOSN = 0x0708 l) SMECENCFINEPOS = 0x0000	

Success/Failure Criteria Test passed if SMEC ends up at home position and parameters values reflect this
Comment/Open Issue: Need conversion curve between signals and physical position. Command to switch on motors?

Switch off procedure:

Action	Command
a) Send SMEC to 0	a) SetTrajEndPosition(0x0000) 90450000 SetSTrajMode(0x0001) 90490001
b) Switch off LVDT	b) SetSLVDTPwr(0x0000) 90410000
c) Switch off encoder	c) SetSEncoderPwr(0x0000) 90400000
d) Engage launch latch	d) SetSLaunchLatch(0x0001) 90430001

4.14 FUNC-SMEC-02, SMEC launch latch check

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
1	**Select SCOS display *(SMEC PARAMETERS)***		

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) Disengage launch latch f) Check latch status	 a) SetSLaunchLatch(0x0001) 90430001 b) SMECLATCHSTAT=0x0001 a) SetTrajEndPosition(0x01F4) 904501F4 SetSTrajMode(0x0001) 90490001 c) Check values on SCOS display d) SetSLaunchLatch(0x0002) 90430002 e) 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	 b) SetTrajEndPosition(0x01F4) 904501F4 SetSTrajMode(0x0001) 90490001 c) SMECENCPOSN=0x???? SMECENCFINEPOSN=0x???? SMECLVDTACSIG=0x???? SMECLVDTPOSN=0x???? SMECPOSNDELTA=0x???? d) Check values on SCOS display	
5	**Drive SMEC back to its home position**	SetSTrajMode(0x0004) 90490004	

Success/Failure Criteria: Test passed if launch latch is successfully engaged/disengaged
Comments/Open issues:
Is the actuator for the latch redundant?

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 + MCU on + SMEC on and initialised, at home position
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:

Step	Action	Command/TM	Comment/notes
1	**Select SCOS display**		
2	**Test LEDs** a) Apply power to LEDs by stepping up voltages from 0 to 5V b) Read photodiode signal for each step	a) SetSEncoderPwr(0x0000) 90400000 SetSEncoderPwr(0x0001) 90400001 SetSEncoderPwr(0x0002) 90400002 SetSEncoderPwr(0x0003) 90400003 SetSEncoderPwr(0x0004) 90400004 SetSEncoderPwr(0x0005) 90400005 SetSEncoderPwr(0x0006) 90400006 SetSEncoderPwr(0x0007) 90400007 b) SMECENCSIG1=0x???? SMECENCSIG2=0x???? SMECENCSIG3=0x????	
3	**Apply normal power to LEDs (half power?)**	SetSEncoderPwr(0x0003) 90400003	

Success/Failure Criteria: Test passed if encoder signal increases as expected, i.e. with the power applied to the LEDs

Comment/open issues:
Are they the correct parameter to check???
I need to specify the values expected

4.16 FUNC-SMEC-04, SMEC position test

ID:	FUNC-SMEC-04
Purpose	Checking that SMEC moves to the position commanded
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, 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
1	**Select SCOS display *(SMEC PARAMETERS)***		
2	**Move SMEC** a) Close loop on encoder 0^{th} and 1^{st} order b) set a position to reach (e.g. +1mm from mechanical stop) c) Move SMEC to position d) Read SMEC position e) Read motor current f) Read back emf	 a) SetSLoopMode(0x0001) 90440001 b) SetTrajEndPosition(0x03E8) 904503E8 c) SetSTrajMode(0x0001) 90490001 d) SMECENCPOSN=0x03E8 SMECENCFINEPOSN=0x???? SMECLVDTACSIG=0x1DB7 SMECLVDTPOSN=0x03E8 SMECPOSNDELTA=0x0000 e) SMECMOTORCURR = 0x???? f) SMECBEMF = 0x????	
3	**Repeat for a small set of position (for full functional test only?)** 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	 a) SetTrajEndPosition(0x07D0) 904507D0 b) SetTrajEndPosition(0x0BB8) 90450BB8 c) SetTrajEndPosition(0x0FA0) 90450FA0 d) SetTrajEndPosition(0x1388) 90451388 e) SetTrajEndPosition(0x1770) 90451770 f) SetTrajEndPosition(0x1B58) 90451B58 g) SetTrajEndPosition(0x1F40) 90451F40 h) SetTrajEndPosition(0x2328) 90452328	
4	**Drive SMEC back to its home position** Open loop (DAC to 0)	SetSTrajMode(0x0004) 90490004 SetSLoopMode 90440006	

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

4.17 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 + MCU on + SMEC on and initialised, at home position
Final configuration	idem
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT
Test Conditions:	Warm and cold
Total duration	~18 min
Constraints:	FUNC-MCU-01 and FUNC-SMEC-01 successfully passed

Procedure and analysis:

Step	Action	Command/TM	Comment/no
1	**With SCOS, start MCU ENG and SMEC packet sampling at 240Hz**	SetTP10SampFreq(0x000B) *91C0000B*	
2	**Run QLA script FUNC-SMEC-05 in order to:** a) Display SMEC parameters b) Record a time series of the parameters	SMECENCPOSN, SMECENCFINEPOSN, SMECLVDTACSIG, SMECMOTORBEMF, SMECOTORCURR, SMECMOTORVOLT, (+others???)	
3	**Move SMEC** g) Close loop on encoder 0th and 1st order h) Set start position of the scan (e.g. -0.5mm from ZPD) a) Move to position b) record parameters for 10 sec c) For i=1..100{ increment position to reach by 10 um move to position record parameters for 10 sec }	g) SetSLoopMode(0x0001) 90440001 a) SetSTrajEndPosition(0x1194) 90451194 b) SetSTrajMode(0x0001) 90490001 c) *Wait 10 sec* d) pos = 0x1194 + i*0x000A e) SetSTrajEndPosition(0x(pos)) 9045(pos) SetSTrajMode(0x0001) 90490001 f) *Wait 10 sec*	
4	**Write in a file the parameters recorded with QLA**		
5	**Stop TM packet sampling**	SetTP10SampFreq(0x0000) *91C00000*	
6	**Drive SMEC back to its home position** Open loop (DAC forced to 0)	SetSTrajMode(0x0004) 90490004 SetSLoopMode 90440006	
7	**Offline analysis** Characterise SMEC scan	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:
This test, how I've written it, is long…Shall we do less steps?

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, at home position
Final configuration	idem
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT
Test Conditions:	Warm and cold
Total duration	min
Constraints:	FUNC-MCU-01 and FUNC-SMEC-01 successfully passed

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**Run QLA script FUNC-SMEC-06 in order to:** Display SMEC parameters Record a time series of the parameters	SMECENCPOSN, SMECENCFINEPOSN, SMECENCPOSN, SMECLVDTACSIG, SMECMOTORBEMF, SMECOTORCURR, SMECMOTORVOLT, (+others???)	
2	**With SCOS, start MCU ENG and SMEC packet sampling at 240Hz**	SetTP10SampFreq(0x000B) *91C0000B*	
3	**Move SMEC** i) Close loop on encoder 0^{th} and 1^{st} order a) Set a scan speed (e.g. 500 um/s) b) Set number of scan to 2 c) Set a scan amplitude (e.g. from -1mm to +1 mm) d) Run the scan	a) SetSLoopMode(0x0001) 90440001 b) SetSScanSpeedForward(0x1388) 90471388 SetSScanRevSpeed(0xFFFF) 9056FFFF c) SetSScanNumber(0x0002) 90480002 d) SetStrajStartPosition(0x0FA0) 90460FA0 SetSTrajEndPosition(0x1770) 90451770 e) SetSTrajMode(0x0002) 90490002	
4	**Repeat for different scan amplitude** a) Set scan amplitude from –4 to +4 mm b) Run the scan	a) SetStrajStartPosition(0x03E8) 904603E8 SetSTrajEndPosition(0x2328) 90452328 b) SetSTrajMode(0x0002) 90490002	
5	**Repeat for different scan speed** a) Set the speed to 1mm/s b) Run the scan c) Set the speed to 1.5mm/s d) Run the scan e) Set the speed to 2mm/s f) Run the scan	a) SetSScanSpeedForward(0x2710) 90472710 SetSScanRevSpeed(0xFFFF) 9056FFFF b) SetSTrajMode(0x0002) 90490002 c) SetSScanSpeedForward(0x3A98) 90473A98 SetSScanRevSpeed(0xFFFF) 9056FFFF d) SetSTrajMode(0x0002) 90490002 e) SetSScanSpeedForward(0x4E20) 90474E80 SetSScanRevSpeed(0xFFFF) 9056FFFF f) SetSTrajMode(0x0002) 90490002	
6	**Write in a file the parameters recorded with QLA**		

Step	Action	Command/TM	Comment/notes
7	**Drive SMEC back to its home position** Open loop (DAC forced to 0)	SetSTrajMode(0x0004) 90490004 SetSLoopMode 90440006	
8	**Stop TM packet sampling**	SetTP10SampFreq(0x0000) *91C00000*	
9	**Offline analysis** Characterise SMEC movement:	a) Derive: b) scan length, accuracy of position reached c) velocity, velocity stability d) consumed power	

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

Comment/Open issue:
Is there something to do to perform a saw tooth scan? Or is it like a triangular scan with the reverse scan speed set to its maximum value?
I use conversion curves in Bruce's document

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, at home position
Final configuration	Idem
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT
Test Conditions:	Warm and cold
Total duration	5 min
Constraints:	FUNC-MCU-01 and FUNC-SMEC-01 successfully passed

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**With SCOS, start MCU ENG and SMEC packet sampling at 240Hz**	SetTP10SampFreq(0x000B) *91C0000B*	
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, SMECMOTORVOLT, (+others???)	
3	**Move SMEC** j) Close loop on encoder 0th and 1st order e) Set a scan speed (e.g. 500 um/s) f) Set number of scan to 2 g) Set a scan amplitude (e.g. from -1mm to +1 mm) h) Run the scan	f) SetSLoopMode(0x0001) 90440001 g) SetSScanSpeedForward(0x1388) 90471388 SetSScanRevSpeed(0x1388) 90561388 h) SetSScanNumber(0x0002) 90480002 i) SetStrajStartPosition(0x0FA0) 90460FA0 SetSTrajEndPosition(0x1770) 90451770 j) SetSTrajMode(0x0002) 90490002	
4	**Repeat for different scan amplitude** c) Set scan amplitude from –4 to +4 mm d) Run the scan	c) SetStrajStartPosition(0x03E8) 904603E8 SetSTrajEndPosition(0x2328) 90452328 d) SetSTrajMode(0x0002) 90490002	
5	**Repeat for different scan speed** g) Set the speed to 1mm/s h) Run the scan i) Set the speed to 1.5mm/s j) Run the scan k) Set the speed to 2mm/s l) Run the scan	g) SetSScanSpeedForward(0x2710) 90472710 SetSScanRevSpeed(0x2710) 90562710 h) SetSTrajMode(0x0002) 90490002 i) SetSScanSpeedForward(0x3A98) 90473A98 SetSScanRevSpeed(0x3A98) 90563A98 j) SetSTrajMode(0x0002) 90490002 k) SetSScanSpeedForward(0x4E20) 90474E80 SetSScanRevSpeed(0x4E20) 90564E20 l) SetSTrajMode(0x0002) 90490002	

Step	Action	Command/TM	Comment/notes
6	**Write in a file the parameters recorded with QLA**	Use save button on QLA GUI	
7	**Drive SMEC back to its home position** Open loop (DAC forced to 0)	SetSTrajMode(0x0004) 90490004 SetSLoopMode 90440006	
8	**Stop TM packet sampling**	SetTP10SampFreq(0x0000) *91C00000*	
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

4.20 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
Level	ILT/PLT/IST
Test Conditions:	Warm and cold
Total duration	5 min
Constraints:	FUNC-MCU-01 and FUNC-SMEC-01 successfully passed

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**Select SCOS display *(SMEC PARAMETERS)***		
1	**Start MCU ENG and SMEC packet sampling at 240Hz**	SetTP10SampFreq(0x000B) *91C0000B*	
2	**Move SMEC** a) Open loop b) Set a position to reach (e.g. 5mm for mechanical stop) c) Start recording parameters with QLA d) Move SMEC	 e) SetSLoopMode 90440006 f) SetTrajEndPosition 90451388 g) SMECLVDTDCSIG, SMECENCPOSN, SMECMOTORBEMF h) SetTrajMode 90490001	
3	**Scale back emf** TBD	SetMotorResistance	
4	**Move SMEC to a new position** i) Open loop j) Set a position to reach (e.g. 5mm for mechanical stop) k) Start recording parameters with QLA l) Move SMEC	 m) SetSLoopMode 90440006 n) SetTrajEndPosition 90451388 o) SMECLVDTDCSIG, SMECENCPOSN, SMECMOTORBEMF p) SetTrajMode 90490001	
5	**Drive SMEC back to its home position**	SetSTrajMode(0x0004) 90490004	

4.21 FUNC-SMEC-09, SMEC open loop position 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:	Warm and 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
1	**With SCOS, start MCU ENG and SMEC packet sampling at 240Hz**	SetTP10SampFreq(0x000B) *91C0000B*	
2	**Run QLA script FUNC-SMEC-07 in order to:** c) Display SMEC parameters d) Record a time series of the parameters	SMECENCPOSN, SMECENCFINEPOSN, SMECENCPOSN, SMECLVDTACSIG, SMECMOTORBEMF, SMECOTORCURR, SMECMOTORVOLT, (+others???)	
3	**Move SMEC** k) Open loop (no sensor) i) Set a scan speed (e.g. 500 um/s) j) Set number of scan to 2 k) Set a scan amplitude (e.g. from -1mm to +1 mm) l) Run the scan	k) SetSLoopMode(0x0006) 90440006 l) SetSScanSpeedForward(0x1388) 90471388 SetSScanRevSpeed(0x1388) 90561388 m) SetSScanNumber(0x0002) 90480002 n) SetStrajStartPosition(0x0FA0) 90460FA0 SetSTrajEndPosition(0x1770) 90451770 o) SetSTrajMode(0x0002) 90490002	
4	**Repeat for different scan amplitude** e) Set scan amplitude from –4 to +4 mm f) Run the scan	e) SetStrajStartPosition(0x03E8) 904603E8 SetSTrajEndPosition(0x2328) 90452328 f) SetSTrajMode(0x0002) 90490002	
5	**Repeat for different scan speed** m) Set the speed to 1mm/s n) Run the scan o) Set the speed to 1.5mm/s p) Run the scan q) Set the speed to 2mm/s r) Run the scan	m) SetSScanSpeedForward(0x2710) 90472710 SetSScanRevSpeed(0x2710) 90562710 n) SetSTrajMode(0x0002) 90490002 o) SetSScanSpeedForward(0x3A98) 90473A98 SetSScanRevSpeed(0x3A98) 90563A98 p) SetSTrajMode(0x0002) 90490002 q) SetSScanSpeedForward(0x4E20) 90474E80 SetSScanRevSpeed(0x4E20) 90564E20 r) SetSTrajMode(0x0002) 90490002	

Step	Action	Command/TM	Comment/notes
6	**Write in a file the parameters recorded with QLA**	Use save button on QLA GUI	
7	**Drive SMEC back to its home position** Open loop (DAC forced to 0)	SetSTrajMode(0x0004) 90490004 SetSLoopMode 90440006	
8	**Stop TM packet sampling**	SetTP10SampFreq(0x0000) *91C00000*	
9	**Offline analysis** Characterise SMEC movement:	Derive: d) scan length, accuracy of position reached e) velocity, velocity stability f) consumed power	

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

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

4.22 FUNC-BSM-01c, BSM power on chop motor and sensors

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
Test Type:	Integrity
Instrument Models:	CQM/PFM/FS
Redundancy:	prime and redundant
Initial configuration:	SPIRE in REDY mode +MCU on – BSM off
Final configuration	idem
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	**Switch on BSM chop axis** Open loop (no sensor) Power on chop sensors Read chop status Read chop magneto resistive signal Read chop motor current Read chop back emf	 SetCSensorPwr(0x0003) 90C00003 CHOPTSTAT CHOPSENSSIG CHOPMOTORCURR CHOPBEMF CHOPDACVAL	
3	**Evaluate consumed power**	Proportional to (CHOPMOTORCURR)^2	
4	**Switch off** Power off Chop sensors Open loop (DAC forced to 0)	 SetCSensorPwr(0x0000) 90C00000 SetChopLoopMode(0x0000) 90C20000	

Success/Failure Criteria: Test passed if BSM sensors are switched on and parameters have the values expected

Comment/Open issue:
Need conversion curve

4.23 FUNC-BSM-01j, BSM power on jiggle motor and sensors

ID:	FUNC-BSM-01j
Purpose	Checking the integrity of BSM motors and sensors in jiggle axis
Description of test:	Switch BSM jigglle motors on. Check telemetry responses, consumed power
Test Type:	Integrity
Instrument Models:	CQM/PFM/FS
Redundancy:	prime and redundant
Initial configuration:	SPIRE in REDY mode +MCU on – BSM off
Final configuration	idem
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 (*JIGG PARAMETERS)***		
2	**Switch on BSM jiggle axis** Open loop (no sensor) Power on jiggle sensors Read jiggle status Read jiggle magneto resistive signal Read jiggle motor current Read jiggle back emf	 SetJigLoopMode(0x0003) 91420003 SetJSensorPwr(0x0001) 91400001 JIGGSTAT JIGGSENSSIG JIGGMOTORCURR JIGGBEMF JIGGDACVAL	
3	**Evaluate consumed power**	Proportional to (JIGGMOTORCURR)^2	
4	**Switch off** a) Power off jiggle sensors b) Open loop (DAC forced to 0)	 a) SetJSensorPwr(0x0000) 91400000 b) SetJigLoopMode(0x0000) 91420000	

Success/Failure Criteria: Test passed if BSM sensors are switched on and parameters have the values expected

Comment/Open issue:
Need conversion curve

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

ID:	BSM-02c
Purpose	Observing BSM behaviour on chop axis in open loop. Determining the sensor sensibility and scaling the back emf
Description of test:	Perform a step of 1 deg, record sensor signal and plot it with QLA. From motor current and voltage, 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 +MCU on + BSM off
Final configuration	Idem
EGSE Configuration:	SCOS-200 QLA
Level	ILT/PLT/IST/FLT
Test Conditions:	Warm and 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 Parameter)**		
2	**Run QLA script FUNC-BSM-02c in order to**: Display BSM parameters Record parameters	CHOPSENSIG, CHOPMOTORCURR, CHOPBEMF	

Step	Action	Command/TM	Comment/notes
3	**Move BSM in open loop** Power on chop sensors Set the open loop constant between target position and DAC value = 1/32768 Set slew rate limit Set mode to open loop (no sensor) Start BSM packet telemetry Start recording CHOPSENSIG with QLA Wait 500 ms Perform a step to 20000 (–1 degree) Wait 500ms Plot CHOPSENSIG	 SetCSensorPwr(0x0001) 90C00001 SetCPositionScaleFactor 90D60BEB SetCRateLimit 90D103E8 SetChopLoopMode 90C20003 SetTelemetryPacket12Sample 91C20008 Qla operation SetChopTargetPosition 90C34E20 Plot should show oscillations during ~500 ms	
4	**Scaling the back emf** (With QLA, plot V/I (i.e. (CHOPBEMF-32768)/(CHOPMOTORCURR-32768)) Find max of the plot == R) Set Cmotor resistance with the value R*10000 in hex) Set Cmotor resistance with R=2.0224 ohms Apply some gain on the feedback	 (R = (CHOPBEMF-32768)/(CHOPMOTORCURR-32768) SetCmotor resistance 90D3(0x*Value*)) SetCmotor resistance 90D34F00 SetCmotorbackEmfGain 90D201F4	
5	**Move BSM** Start recording CHOPSENSIG with QLA Wait 500 ms Perform a step to 46000 (+1 degree) Wait 500ms Perform a step to 20000 (-1 degree) Wait 500 ms Perform a step to 0 Wait 500 ms Plot CHOPSENSIG	 SetChopTargetPosition 90C3B3B0 SetChopTargetPosition 90C34E20 SetChopTargetPosition 90C38000 Oscillations should be much smaller and during ~100ms	
6	**Switch off** Power off Chop sensors Open loop (DAC forced to 0)	 SetCSensorPwr(0x0000) 90C00000 90C20000	

Success/Failure criteria: test passed if BSM moves as required
Comment/open issues:

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

ID:	BSM-02j
Purpose	Observing BSM behaviour on jiggle axis in open loop. Determining the sensor sensibility and scaling the back emf
Description of test:	Perform a step of 1 deg, record sensor signal and plot it with QLA. From motor current and voltage, 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 +MCU on + BSM off
Final configuration	Idem +
EGSE Configuration:	SCOS-200 QLA
Level	ILT/PLT/IST/FLT
Test Conditions:	Warm and 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 Parameter)**		
2	**Run QLA script FUNC-BSM-02j in order to**: Display BSM parameters Record parameters	JIGGSENSIG, JIGGMOTORCURR, JIGGBEMF	

Step	Action	Command/TM	Comment/notes
3	**Move BSM in open loop** Power on jiggle sensor Set the open loop constant between target position and DAC value = 1/32768 Set slew rate limit Set mode to open loop (no sensor) Start BSM packet telemetry Start recording JIGGSENSIG with QLA Wait 500 ms Perform a step to 20000 (–0.25 degree) Wait 500ms Plot JIGGSENSIG	 SetJSensorPwr(0x0001) 91400001 SetJPositionScaleFactor 91560BEB SetJRateLimit 915103E8 SetJiggLoopMode 91420003 SetTelemetryPacket12Sample 91C20008 Qla operation SetJiggTargetPosition 91434E20 Plot should show oscillations	
4	**Scaling the back emf** (With QLA, plot V/I (i.e. (JIGGBEMF-32768)/(JIGGMOTORCURR-32768)) Find max of the plot == R Set Jmotor resistance with the value R*10000 in hex) Set Jmotor resistance with the value R = TBD Apply some gain on the feedback	(R = (JIGGBEMF-32768)/(JIGGMOTORCURR-32768) SetJmotor resistance 9153(0x*Value*)) SetJMotorResistance TBD SetJmotorbackEmfGain 915201F4	
5	**Move BSM** Start recording JIGGSENSIG with QLA Wait 500 ms Perform a step to 46000 (+0.25 degree) Wait 500ms Perform a step to 20000 (-0.25 degree) Wait 500 ms Perform a step to 0 Wait 500 ms Plot JIGGSENSIG	 SetJiggTargetPosition 9143B3B0 SetJiggTargetPosition 91434E20 SetJiggTargetPosition 91438000 Oscillation should be mu ch smaller	
6	**Switch off** c) Power off jiggle sensors d) Open loop (DAC forced to 0)	 c) SetJSensorPwr(0x0000) 91400000 d) 91420000	

Success/Failure criteria: test passed if BSM moves as required
Comment/open issues:

4.26 FUNC-BSM-03c, BSM position test, loop closed on MRS, chop axis

ID:	FUNC-BSM-03c
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 telemetry response
Test Type:	Integrity
Instrument Models:	PFM/FS
Redundancy:	prime and redundant
Initial configuration	SPIRE in REDY mode +MCU on + BSM off
Final configuration	idem
EGSE Configuration:	SCOS-2000 required, QLA
Level	ILT/PLT/IST/FLT
Test Conditions:	Warm and cold
Total duration	1 min
Constraints:	FUNC-MCU-01, FUNC-BSM-01c, FUNC-BSM-02c successful

Procedure and analysis:

Step	Action	Command/TM	**Comment/notes**
1	**Select SCOS display (*CHOP PARAMETERS)***		
2	**Run QLA script** Display parameter	 CHOPSENSIG, CHOPMOTORCURR, CHOPBEMF	
2	**Set the axis to move independently** Send command Check status bit	 SetBSMMove(0x0000) 90C60000 CHOPSTAT=1 JIGGSTAT=1	
3	**Closed loop settings** Power on chop sensor Go to 0 position Set PID proportional gain Set PID derivative gain Set PID integral gain Close the loop on the sensor Decrease slew rate	 SetCSensorPwr(0x0001) 90C00001 90C38000 90C84DBA 90C91A19 90CA3342 90C20001 90D10320	
4	**Move BSM on chop axis** Start BSM packet telemetry Start recording CHOPSENSIG with QLA Wait 100 ms Perform a step to 20000 (–1 degree) Wait 100ms Plot CHOPSENSIG	 SetTelemetryPacket12Sample 91C20008 Qla operation SetChopTargetPosition 90C34E20 Plot should show a settling time of about 20 ms	
5	**Evaluate consumed power**	Proportional to (CHOPMOTORCURR)^2	
6	**On SCOS display, check position error (should be 0)**	CmeanPositionError	
7	**Switch off** e) Send BSM to “off” position (where current =0?) if not already f) Power off Chop sensors g) Open loop (DAC forced to 0)	 SetChopTargetPosition(0x0000) 90C38000 SetCSensorPwr(0x0000) 90C00000 90C20000	

Success/Failure Criteria: test passed if BSM moves to the requested position

Comment/Open issue:

4.27 FUNC-BSM-03j, BSM position test, loop closed on MRS, jiggle axis

ID:	FUNC-BSM-03j
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 +MCU on + BSM off
Final configuration	idem
EGSE Configuration:	SCOS-2000 required QLA required
Level	ILT/PLT/IST/FLT
Test Conditions:	Warm and cold
Total duration	1 min
Constraints:	FUNC-MCU-01, FUNC-BSM-01j, FUNC-BSM-02j successful

Procedure and analysis:

Step	Action	Command/TM	comment
1	**Select SCOS display (*JIGG PARAMETERS)***		
2	**Run QLA script** Display parameter	 JIGGSENSIG, JIGGMOTORCURR, JIGGBEMF	
3	**Closed loop settings** Power on jiggle sensor Go to 0 position Set PID proportional gain Set PID derivative gain Set PID integral gain Close the loop on the sensor Decrease slew rate	 SetJSensorPwr(0x0001) 91400001 91438000 91484DBA 91491A19 914A3342 91420001 91510320	
4	**Move BSM on chop axis** Start BSM packet telemetry Start recording JIGGSENSIG with QLA Wait 100 ms Perform a step to 20000 (–0.25 degree) Wait 100ms Plot JIGGSENSIG	 SetTelemetryPacket12Sample 91C20008 Qla operation SetJiggTargetPosition 91534E20 Plot should show a settling time of about 20 ms	
5	**Evaluate consumed power**	Proportional to (JIGGMOTORCURR)^2	
6	**On SCOS display, check position error (should be 0)**	JmeanPositionError	
4	**Switch off** h) Send BSM to “off” position (where current =0?) if not already i) Power off jiggle sensors j) Open loop (DAC forced to 0)	 e) SetJiggTargetPosition(0x0000) 91438000 f) SetJSensorPwr(0x0000) 91400000 g) SetJigLoopMode(0x0000) 91420000	

Success/Failure Criteria: test passed if BSM moves to the requested position

Comment/Open issue:

4.28 FUNC-BSM-04c, BSM chop close loop scan test

ID:	FUNC-BSM-04c
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 +MCU on + BSM off
Final configuration	idem
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT
Test Conditions:	Warm and cold
Total duration	5 min
Constraints:	FUNC-MCU-01, BSM-01c, 02c, 03c successful

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**With SCOS, start TM packet sampling for BSM parameters at 64Hz**	SetTP12SampFreq(0x002C) *91C2002C*	
2	**Run QLA script FUNC-BSM-03 in order to:** Display BSM parameters Record a time series of the parameters	CHOPMOTORCURR, CHOPBEMF, CHOPSENSSIG, JIGGMOTORCURR, JIGGBEMF, JIGGSENSSIG	

Step	Action	Command/TM	Comment/notes
3	**Set the axis to move independently** Send command Check status bit	 SetBSMMove(0x0000) 90C60000 CHOPSTAT=1 JIGGSTAT=1	
4	**Move BSM on chop axis** Power on chop sensor Close loop Set the position to reach to -120 arcsec (on-sky) Record parameters for 2 sec For i=1..60 { set OSN for QLA to trigger increment position parameter by +4arcsec (on-sky) move to position record parameters for 2 sec set OSN for QLA to trigger }	 SetCSensorPwr(0x0001) 90C00001 90C20001 SetChopTargetPosition(0x2AAB) 90C32AAB *Wait 2 sec* pos = pos + 0x02D8 SetChopTargetPosition(0x(pos)) 90C3(pos) *Wait 2 sec*	
5	**Write in a file the parameters recorded with QLA**		
8	**Stop TM packet sampling**	SetTP12SampFreq(0x0000) *91C20000*	
9	**Offline analysis:** Characterise BSM movement	 Derive for both axis and each position: Consumed power. Plot current vs position Find position where current = 0	
7	**Switch off** k) Send BSM to “off” position (where current =0?) if not already l) Power off Chop sensors m) Open loop (DAC forced to 0)	 SetChopTargetPosition(0x0000) 90C38000 SetCSensorPwr(0x0000) 90C00000 90C20000	

Success/Failure Criteria: test passed if BSM does the scan required
Comment/Open issue: I use conversion curves in Bruce’s document

4.29 FUNC-BSM-04j, BSM jiggle close loop scan test

ID:	FUNC-BSM-04j
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 +MCU on + BSM off
Final configuration	idem
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT
Test Conditions:	Warm and cold
Total duration	5 min
Constraints:	FUNC-MCU-01, BSM-01j, 02j, 03j successful

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**With SCOS, start TM packet sampling for BSM parameters at 64Hz**	SetTP12SampFreq(0x002C) *91C2002C*	
2	**Run QLA script FUNC-BSM-03j in order to:** Display BSM parameters Record a time series of the parameters	 CHOPMOTORCURR, CHOPBEMF, CHOPSENSSIG, JIGGMOTORCURR, JIGGBEMF, JIGGSENSSIG	
6	**Move BSM on jiggle axis** Power on jigg sensors Close loop Set the position to reach to -30 arcsec (on-sky) Record parameters for 2 sec For i=1..60 { set OSN for QLA to trigger increment position parameter by +1arcsec (on-sky) move to position record parameters for 2 sec set OSN for QLA to trigger }	 SetJSensorPwr(0x0000) 91400001 SetJigLoopMode(0x0000) 91420001 SetJiggTargetPosition(0x6AAB) 90C36AAB *Wait 2 sec* pos = pos + 0x00B6 SetJiggTargetPosition(0x(pos)) 90C3(pos) *Wait 2 sec*	
7	**Write in a file the parameters recorded with QLA**		
8	**Stop TM packet sampling**	SetTP12SampFreq(0x0000) *91C20000*	
9	**Offline analysis:** Characterise BSM movement	 Derive for both axis and each position: Consumed power. Plot current vs position Find position where current = 0	
4	**Switch off** n) Send BSM to "off" position (where current =0?) if not already o) Power off jiggle sensors p) Open loop (DAC forced to 0)	 h) SetJiggTargetPosition(0x0000) 91438000 i) SetJSensorPwr(0x0000) 91400000 j) SetJigLoopMode(0x0000) 91420000	

Success/Failure Criteria: test passed if BSM does the scan required
Comment/Open issue: I use conversion curves in Bruce's document

4.30 FUNC-BSM-05c, BSM chop open loop scan test

ID:	FUNC-BSM-05c
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, consumed power.
Test Type:	Characterisation
Instrument Models:	CQM/PFM
Redundancy:	prime and redundant
Initial configuration	SPIRE in REDY mode +MCU on + BSM off
Final configuration	idem
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT
Test Conditions:	Warm and cold
Total duration	5 min
Constraints:	FUNC-MCU-01, BSM-01c, 02c successful

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**With SCOS, start TM packet sampling for BSM parameters at 64Hz**	SetTP12SampFreq(0x002C) *91C2002C*	
2	**Run QLA script FUNC-BSM-03 in order to:** Display BSM parameters Record a time series of the parameters	CHOPMOTORCURR, CHOPBEMF, CHOPSENSSIG, JIGGMOTORCURR, JIGGBEMF, JIGGSENSSIG	

Step	Action	Command/TM	Comment/notes
3	**Set the axis to move independently** Send command Check status bit	 SetBSMMove(0x0000) 90C60000 CHOPSTAT=1 JIGGSTAT=1	
4	**Move BSM on chop axis** Power on chop sensor Set mode to open loop (no sensor) Set the position to reach to -120 arcsec (on-sky) Record parameters for 2 sec For i=1..60 { set OSN for QLA to trigger increment position parameter by +4arcsec (on-sky) move to position record parameters for 2 sec set OSN for QLA to trigger }	 SetCSensorPwr(0x0001) 90C00001 90C20003 SetChopTargetPosition(0x2AAB) 90C32AAB *Wait 2 sec* pos = pos + 0x02D8 SetChopTargetPosition(0x(pos)) 90C3(pos) *Wait 2 sec*	
5	**Write in a file the parameters recorded with QLA**		
8	**Stop TM packet sampling**	SetTP12SampFreq(0x0000) *91C20000*	
9	**Offline analysis:** Characterise BSM movement	 Derive for both axis and each position: Consumed power. Plot current vs position Find position where current = 0	
7	**Switch off** q) Send BSM to "off" position (where current =0?) if not already r) Power off Chop sensors s) Open loop (DAC forced to 0)	 SetChopTargetPosition(0x0000) 90C38000 SetCSensorPwr(0x0000) 90C00000 90C20000	

Success/Failure Criteria: test passed if BSM does the scan required
Comment/Open issue:
I use conversion curves in Bruce's document

4.31 FUNC-BSM-05j, BSM jiggle open loop scan test

ID:	FUNC-BSM-05j
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 +MCU on + BSM on
Final configuration	idem
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT
Test Conditions:	Warm and cold
Total duration	5 min
Constraints:	FUNC-MCU-01, BSM-01j, 02j successful

Procedure and analysis:

Step	Action	Command/TM	Comment/notes
1	**With SCOS, start TM packet sampling for BSM parameters at 64Hz**	SetTP12SampFreq(0x002C) *91C2002C*	
2	**Run QLA script FUNC-BSM-03j in order to:** Display BSM parameters Record a time series of the parameters	 CHOPMOTORCURR, CHOPBEMF, CHOPSENSSIG, JIGGMOTORCURR, JIGGBEMF, JIGGSENSSIG	
6	**Move BSM on jiggle axis** Power on jiggle sensors Set mode to open loop (no sensor) Set the position to reach to -30 arcsec (on-sky) Record parameters for 2 sec For i=1..60 { set OSN for QLA to trigger increment position parameter by +1arcsec (on-sky) move to position record parameters for 2 sec set OSN for QLA to trigger }	 SetJSensorPwr(0x0000) 91400001 91420003 SetJiggTargetPosition(0x6AAB) 90C36AAB *Wait 2 sec* pos = pos + 0x00B6 SetJiggTargetPosition(0x(pos)) 90C3(pos) *Wait 2 sec*	
7	**Write in a file the parameters recorded with QLA**		
8	**Stop TM packet sampling**	SetTP12SampFreq(0x0000) *91C20000*	
9	**Offline analysis:** Characterise BSM movement	 Derive for both axis and each position: Consumed power. Plot current vs position Find position where current = 0	
4	**Switch off** t) Send BSM to "off" position (where current =0?) if not already u) Power off jiggle sensors v) Open loop (DAC forced to 0)	 k) SetJiggTargetPosition(0x0000) 91438000 l) SetJSensorPwr(0x0000) 91400000 m) SetJigLoopMode(0x0000) 91420000	

Success/Failure Criteria: test passed if BSM does the scan required
Comment/Open issue: I use conversion curves in Bruce's document

4.32 FUNC-BSM-06, BSM operating mode test

ID:	FUNC-BSM-06
Purpose	Characterising BSM movement on chop axis for various position on juggle 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 +MCU on + BSM on
Final configuration	Idem
EGSE Configuration:	SCOS-2000 and QLA required
Level	ILT
Test Conditions:	Warm and 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	**With SCOS, start TM packet sampling for BSM parameters at 64Hz**	SetTP12SampFreq(0x002C) 91C2002C	
2	**Run QLA script FUNC-BSM-04 in order to:** Display BSM parameters Record a time series of the parameters	 CHOPMOTORCURR, CHOPBEMF, CHOPSENSSIG, JIGGMOTORCURR, JIGGBEMF, JIGGSENSSIG	
3	**Set the axis to move independently** Send command Check status bit Power on sensors on both axis Close loop on both axis	 SetBSMMove(0x0000) 90C60000 CHOPSTAT=1 JIGGSTAT=1 90C00001 91400001 90C20001 91420001	
4	**Set position on Jiggle axis**	SetJiggTarget Position(0x8000) 91438000	
5	**Chop** Set a chop frequency Set a chop amplitude (e.g. 126” on-sky) Set a number of chop throw to do start chopping: for i=1..N_{chop} { move to 1st position Wait 1/2F_{chop} move to 2nd position Wait 1/2F_{chop} }	 F_{chop} = 2Hz POS1 = 0x5333, POS2 =0xACCD (POS2 – POS1 = 126”) N_{chop} = 20 for i=1..N_{chop} { SetChopTargetPosition(0x”POS1”) 90C3”POS1” *Wait 1/2F_{chop}* SetChopTargetPosition(0x”POS2”) 90C3”POS2” *Wait 1/2F_{chop}* }	
6	**Repeat step 4 for a set of chop frequencies**	F_{chop} = 0.2 Hz F_{chop} = 0.5 Hz F_{chop} = 1 Hz	

Step	Action	Command/TM	Comment/notes
7	**Repeat steps 4 for a set of amplitudes**	POS1 = 0x6E39, POS2 =0x91C7 (POS2 – POS1 = 50") POS1 = 0x5333, POS2 =0xA38E (POS2 – POS1 = 100") POS1 = 0x38E4, POS2 =0xC71C (POS2 – POS1 = 200")	
8	Vary position on jiggle axis and repeat steps 4 to 7 30" 15" -15" -30"	 SetJiggTarget Position(0x9555) 91439555 SetJiggTarget Position(0x8AAAA) 91438AAAA SetJiggTarget Position(0x7555) 91437555 SetJiggTarget Position(0x6AAA) 91436AAA	
9	**Write in a file the parameters recorded with QLA**		
10	**Stop TM packet sampling**	SetTP12SampFreq(0x0000) *91C20000*	
11	**Switch off** w) Send BSM to "off" position (where current =0?) if not already x) Power off sensors y) Open loop (DAC forced to 0)	 n) SetJiggTargetPosition(0x8000) 91438000 SetChopTargetPosition(0x8000) 90C38000 o) SetJSensorPwr(0x0000) 91400000 SetChopSensorPwr(0x0000) 90C00000 p) SetJigLoopMode(0x0000) 91420000 q) SetChopLoopMode(0x0000) 90C20000	
12	**Offline analysis:** Characterise BSM movement	 plot current Vs position on chop axis for each position on the jiggle axis	

Success/Failure Criteria: test passed if BSM does the scans required

Comment/Open Issue:
I use conversion curves in Bruce's document
This test is a bit long defined like this. Shall I remove some scan?

4.33 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	

Step	Action	Command/TM	Comment/notes
2	**Start SCU science packet sampling at 80 Hz** **a) mark beginning of PCAL bblock**	**a) BBTYPE=0x8300 ,STEP =0x0001** SetFrameConf(0x0000) A0830000 SetFrameCtrl(0x0001) A0820001	
2	**Apply current to PCAL** **a) Set STEP 0x0002** Set current to 1 mA (Read voltage) **record during 2 sec then Set STEP 0xffff** **b) Set STEP 0x0003** Set current to 2.5 mA (Read voltage) **record during 2 sec then Set STEP 0xffff** **c) Set STEP 0x0004** Set current to 4 mA (Read voltage) **record during 2 sec then Set STEP 0xffff** **d) Set STEP 0x0005** Set current to 5.5 mA (Read voltage) **record during 2 sec then Set STEP 0xffff** **e) Set STEP 0x0006** Set current to 7 mA (Read voltage) **record during 2 sec then Set STEP 0xffff** **e) Set STEP 0x0007** Set current to 0 mA (Read voltage) **record during 2 sec then Set STEP 0xffff** **e) Set STEP 0x0008**	**a) Set STEP= 0x0002** SetPhCalBias(0x0240) A0C80240 PCALV = 0x135B (252mV) **Wait 2 sec then STEP =0xffff** **b) Set STEP=0x0003** SetPhCalBias(0x0599) A0C80599 PCALV = 0x3066 (630mV) **Wait 2 sec then STEP =0xffff** **c) Set STEP=0x0004** SetPhCalBias(0x08F2) A0C808F2 PCALV = 0x4D70 (1.01V) **Wait 2 sec then STEP =0xffff** **d) Set STEP=0x0005** SetPhCalBias(0x0C4B) A0C80C4B PCALV = 0x6A7A (1.39V) **Wait 2 sec then STEP =0xffff** **e) Set STEP=0x0006** SetPhCalBias(0x0FA5) A0C80FA5 PCALV = 0x8784 (1.76V) **Wait 2 sec then STEP =0xffff** **e) Set STEP=0x0007** SetPhCalBias(0x0000) A0C80000 PCALV = 0x0000 **Wait 2 sec then STEP =0xffff** **e) Set STEP=0x0007**	

Step	Action	Command/TM	Comment/notes
3	**Write in a file parameters recorded**		
4	**Stop TM packet sampling**	SetFrameCtrl(0x0000) A0820000	
5	**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:

4.34 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**	

Step	Action	Command/TM	Comment/notes
2	**Apply current to SCAL2** a) Set current to 1 mA **b) Set STEP 0x0002** c) (Read voltage) **d) Record during 1 min then set STEP 0xffff** e) Set current to 2 mA **f) Set STEP 0x0003** g) (Read voltage) **h) Record during 1 min then set STEP 0xffff** i) Set current to 3 mA **j) Set STEP 0x0004** k) (Read voltage) **l) Record during 1 min then set STEP 0xffff** m) Set current to 4 mA **n) Set STEP 0x0005** o) (Read voltage) **p) Record during 1 min then set STEP 0xffff** q) Set current to 5 mA **r) Set STEP 0x0006** s) (Read voltage) **t) Record during 1 min then set STEP 0xffff** u) Set current to 5.5 mA **v) Set STEP 0x0007** w) (Read voltage) **x) Record during 1 min then set STEP 0xffff** y) Set current to 0 mA **z) Set STEP 0x0008** aa) (Read voltage) **bb) Record during 1 min then set STEP 0xffff**	a) SetSCal2Bias(0x02E2) A0CA02E2 **b) STEP =0x0002** c) SCAL2V = 0x138E (0.5V) **d) Wait 1 min then STEP=0xffff** e) SetSCal2Bias(0x05BF) A0CA05BF **f) STEP=0x0003** g) SCAL2V = 0x271E (1V) **h) Wait 1 min then STEP =0xffff** i) SetSCal2Bias(0x089D) A0CA089D **j) STEP=0x0004** k) SCAL2V = 0x3AAE (1.5V) **l) Wait 1 min then STEP=0xffff** m) SetSCal2Bias(0x0B7B) A0CA0B7B **n) STEP=0x0005** o) SCAL2V = 0x4E3D (2V) **p) Wait 1 min then STEP=0xffff** q) SetSCal2Bias(0x0E58) A0CA0E58 **r) STEP =0x0006** s) SCAL2V = 0x61CD (2.5V) **t) Wait 1 min then STEP=0xffff** u) SetSCal2Bias(0x0FC7) A0CA0FC7 **v) STEP =0x0007** w) SCAL2V = 0x6B95 (2.75V) **x) Wait 1 min then STEP=0xffff** y) SetSCal2Bias(0x0000) A0CA0000 **z) STEP 0x0008** aa) SCAL2V = 0x0000 **bb) Wait 1 min then STEP 0xffff**	

Step	Action	Command/TM	Comment/notes
3	**Mark beginning of SCAL4 bblock** **Repeat test for SCAL4 with the same step layout as SCAL2** a) Set current to 1 mA b) (Read voltage) c) Record during 1 min d) Set current to 2 mA e) (Read voltage) f) Record during 1 min g) Set current to 3 mA h) (Read voltage) i) Record during 1 min j) Set current to 4 mA k) (Read voltage) l) Record during 1 min m) Set current to 5 mA n) (Read voltage) o) Record during 1 min p) Set current to 5.5 mA q) (Read voltage) r) Record during 1 min s) Set current to 0 mA t) (Read voltage) **Record during 1 min**	**BBTYPE=0x8401 ,STEP=0x0001** a) SetSCal2Bias(0x02E2) A0CC02E2 b) SCAL2V = 0x138A (0.5V) c) Wait 1 min d) SetSCal2Bias(0x05C0) A0CC05C0 e) SCAL2V = 0x2714 (1V) *f) Wait 1 min* g) SetSCal2Bias(0x089E) A0CC089E h) SCAL2V = 0x3A9F (1.5V) i) *Wait 1 min* j) SetSCal2Bias(0x0B7B) A0CC0B7B k) SCAL2V = 0x4E2A (2V) l) *Wait 1 min* m) SetSCal2Bias(0x0E59) A0CC0E59 n) SCAL2V = 0x61B5 (2.5V) o) *Wait 1 min* p) SetSCal2Bias(0x0FC8) A0CC0FC8 q) SCAL2V = 0x6B7A (2.75V) r) *Wait 1 min* s) SetSCal2Bias(0x0000) A0CC0000 t) 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?

4.35 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?)

4.36 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:

4.37 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

4.38 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

4.39 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 = ?	

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?

4.40 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 = ?	

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 SetDRelOn Off(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?

4.41 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) 843C0000 SetPhotoBiasFreq(0x062) 84190062 SetPhotoSampFreq(0x000C) 8418000C SetStartFrame(0x0001) 843E0001	
2	**Run QLA script FUNC-DCU-05P** a) Look at detector signals b) Record detector signals		
3	**Set photometer LIAs offsets** a) Set offset to 0V b) Record output during 20 sec c) Set offset to 1V d) Record output during 20 sec e) Set offset to 2V f) Record output during 20 sec g) Set offset to 3V h) Record output during 20 sec i) Set offset to 4V j) Record output during 20 sec k) Set offset to 5V l) Record output during 20 sec m) Reset offset to 0V	a) **STEP=0x0002** b) **Wait 20 sec then STEP=0xffff** c) **STEP=0x0003** d) **Wait 20 sec then STEP=0xffff** e) **STEP=0x0004** f) **Wait 20 sec then STEP=0xffff** g) **STEP=0x0005** h) **Wait 20 sec then STEP=0xffff** i) **STEP=0x0006** j) **Wait 20 sec then STEP=0xffff** k) **STEP=0x0007** l) **Wait 20 sec then STEP=0xffff** m) **STEP=0x0008** n) **Wait 20 sec then 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?

4.42 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) 843C0004 SetSpectroBiasFreq(0x0062) 8439007A SetSpectroSampFreq(0x000C) 84380001 SetStartFrame(0x0001) 843E0001	
2	**Run QLA script FUNC-DCU-05S** c) Look at detector signals d) Record detector signals		
3	**Set spectrometer LIAs offsets** a) Set offset to 0V b) Record output during 20 sec c) Set offset to 1V d) Record output during 20 sec e) Set offset to 2V f) Record output during 20 sec g) Set offset to 3V h) Record output during 20 sec i) Set offset to 4V j) Record output during 20 sec k) Set offset to 5V l) Record output during 20 sec m) Reset offset to 0V	a) **STEP=0x0002** b) **Wait 20 sec then STEP=0xffff** c) **STEP=0x0003** d) **Wait 20 sec then STEP=0xffff** e) **STEP=0x0004** f) **Wait 20 sec then STEP=0xffff** g) **STEP=0x0005** h) **Wait 20 sec then STEP=0xffff** i) **STEP=0x0006** j) **Wait 20 sec then STEP=0xffff** k) **STEP=0x0007** l) **Wait 20 sec then STEP=0xffff** m) **STEP=0x0008** n) **Wait 20 sec then 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?

4.43 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

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 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**	

Step	Action	Command/TM	Comment/notes
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?

4.44 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?

4.45 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=0x881C , 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 c) Switch off heaters d) Activate auto-offset control	a) SetPhSWJfetPwr(0x003F) 8412003F SetPhMLWJfetPwr(0x007F) 8413007F b) SetPhotoHeaterBias(0x007F) 8411007F Wait 1 min c) SetPhotoHeaterBias(0x0000) 84110000 d) SetDataMode(0x0010) 843C0010 *Wait xx sec*	
4	**Vary Vss and record signal** **a) Set STEP 0x0002** a) Set Vss to 0V on all channel b) Record signal during 20 sec c) **Set STEP 0x0003** d) Set Vss to -1V on all channel e) Record signal during 20 sec f) **Set STEP 0x0004** g) Set Vss to -2V on all channel h) Record signal during 20 sec ***i)*** **Set STEP =0x0005**	**a) Set STEP =0x0002** 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) Wait 20 send then STEP =0xffff** **c) Set STEP =0x0003** d) 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 **e) Wait 20 send then STEP =0xffff** **f) Set STEP =0x0004** g) 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 **h) Wait 20 send then STEP =0xffff** **i) Set STEP =0x0005**	

Step	Action	Command/TM	Comment/notes
	j) Set Vss to -3V on all channel	j) 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	
	k) Record signal during 20 sec	**k) Wait 20 send then STEP =0xffff**	
	***l)* Set STEP =0x0006**	**l) Set STEP =0x0006**	
	m) Set Vss to -4V on all channel	m) 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	
	n) Record signal during 20 sec	**n) Wait 20 send then STEP =0xffff**	
	***o)* Set STEP =0x0007**	**o) Set STEP =0x0007**	
	p) Set Vss to -5V on all channel	p) 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	
	q) Record signal during 20 sec	**q) Wait 20 send then STEP =0xffff**	
	r) **Set STEP =0x0008**	r) **Set STEP =0x0008**	
5	**Set Vss back to its operating value (half level)**	a) For #=1..6, SetPhSWJfetVSS#(0x007F) 8(404+#)007F For #=1..4, SetPhMWJfetVSS#(0x007F) 8(40A+#)007F For #=1..2, SetPhLWJfetVSS#(0x007F) 8(40E+#)007F SetPhTCJfetVSS1(0x007F) 8414007F	b)
6	**Write in a file the data recorded**		
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	a) For #=1..6, SetPhSWJfetVSS#(0x0000) 8(404+#)0000 / For #=1..4, SetPhMWJfetVSS#(0x0000) 8(40A+#)0000

b) Switch off drain voltages c) Switch off LIA cards	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?

4.46 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=0x881D, 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 its operating value (half level)**	a) For #=1..2, SetSpSWJfetVSS#(0x007F) 8(434+#)007F SetSpLWJfetVSS(0x007F) 8434007F	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?

4.47 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 $\pi/2$ and $3\pi/2$ adjust phase by small amounts to find minimum – set phase back to $+d\phi$
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 data bblock Set_BBID, Set _OBS_STEP(0x0001)** **With SCOS, request bolometer array science packet at 15.3Hz**	a) **BBTYPE =0x881C , STEP =0x0001** 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	

Step	Action	Command/TM	Comment/notes
4	**Set _OBS_STEP(0x0002)** **Set phase on photometer channel** a) Set demodulation phase to π/2 on all channel **Set _OBS_STEP(0x0003)** **b) Adjust phase by small amount to find minimum signal (=0) at p/2+df then set step to 0xffff** **c) Repeat part b until minimum signal is found incrementing step by 1.** d) Set phase back to dϕ e) Check if signal changes	**Set_OBS_STEP(0x0002)** a) SetPhotoDemodSW(0x0040) 841A0040 SetPhotoDemodMW(0x0040) 841B0040 SetPhotoDemodLW(0x0040) 841C0040 SetPhotoDemodTC(0x0040) 841D0040 **Set_OBS_STEP(0x0003)** **b) Set df parameter on SCOS prompt (between 0 and 360) then set step to 0xffff** c) **Set step to 3+$i until minimum signal is obtained** c) SetPhotoDemodSW(0x00xx) 841A00xx SetPhotoDemodMW(0x00xx) 841B00xx SetPhotoDemodLW(0x00xx) 841C00xx SetPhotoDemodTC(0x00xx) 841D00xx	
5	**Set phase to 3p/2 and repeat previous part with the same step setting ,**	a) SetPhotoDemodSW(0x00BF) 841A00BF SetPhotoDemodMW(0x00BF) 841B00BF SetPhotoDemodLW(0x00BF) 841C00BF SetPhotoDemodTC(0x00BF) 841D00BF	b)
6	**Write in file data recorded and value of df**		
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

4.48 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 $\pi/2+d\phi$ and verify that signal = 0
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 data bblock**	**a) BBTYPE =0x881C , STEP =0x0001** 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 STEP 0x0002** b) Set demodulation phase to $\pi/2+d\phi$ ($d\phi$ found by FUNC-DCU-08P_full) c) Verify that signal = 0 d) Set phase back to $d\phi$	**a) Set STEP=0x0002** b) SetPhotoDemodSW(0x00xx) 841A00xx SetPhotoDemodMW(0x00xx) 841B00xx SetPhotoDemodLW(0x00xx) 841C00xx SetPhotoDemodTC(0x00xx) 841D00xx	
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 $d\phi$ is found by FUNC-DCU-08P_full
Require different scripts for CQM and PFM

4.49 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 $\pi/2$ and $3\pi/2$ adjust phase by small amounts to find minimum – set phase back to $+d\phi$
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 data bblock**	**a)BBTYPE=0x881D,STEP=0x0001** 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	**Set_OBS_STEP(0x0002)** **Set phase on spectrometer channel** a) Set demodulation phase to π/2 on all channel **Set_OBS_STEP(0x0003)** **b) Adjust phase by small amount to find minimum signal (=0) at p/2+df incrementing step in each change** c) Set phase back to dϕ d) Check if signal changes	**SET_OBS_STEP(0x0002)** *a)* SetSpectroDemodSW(0x0040) 843A0040 SetSpectroDemodLW(0x0040) 843B0040 **SET_OBS_STEP(0x0003)** **b) Set df parameter on SCOS prompt (between 0 and 360). Set STEP 3+$i** c) Set Phase to dϕ SetSpectroDemodSW(0x00xx) 843A00xx SetSpectroDemodMW(0x00xx) 843B00xx	
5	**Set phase to 3p/2 and repeat part 4 with the same step setting**	SetSpectroDemodSW(0x00BF) 843A00BF SetSpectroDemodMW(0x00BF) 843B00BF	
6	**Write in file data recorded and value of df**		
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

4.50 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 at $\pi/2+d\phi$ and verify that signal = 0
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 data bblock**	**a) BBTYPE=0x881C ,STEP =0x0001** 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	**c) Set STEP 0x0002** d) Set demodulation phase to $\pi/2+d\phi$ ($d\phi$ found by FUNC-DCU-08S_full) e) Verify that signal = 0 f) Set phase back to $d\phi$	b) **Set STEP 0x0002** SetSpectroDemodSW(0x00xx) 843A00?xx SetSpectroDemodMW(0x00xx) 843B00xx	
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

4.51 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)BBTYPE=0x8820,STEP=0x0001** 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) Set bias frequency at 55Hz **b) Set STEP 0x0002** c) Execute phase **shift full procedure**. **d) Record signal during 20 sec then set STEP 0xffff** e) Set bias frequency at 130Hz **f) Set STEP 0x0003** g) Execute phase **shift full procedure**. **h) Record signal during 20 sec then set STEP 0xffff** i) Set bias frequency at 190Hz **j) Set STEP 0x0004** **k)** Execute phase **shift full procedure.** l) **Record signal during 20 sec then set STEP 0xffff**	a) SetPhotoBiasFreq(0x01FF) 84190163 **b) STEP=0x0002** c) **d) Wait 20 sec then STEP=0xffff** e) SetPhotoBiasFreq(0x00C3) 84190096 **f) STEP=0x0003** **g)** **h) Wait 20 sec then STEP=0xffff** i) SetPhotoBiasFreq(0x007A) 84190066 **j) STEP=0x0004** **k)** **l) Wait 20 sec then STEP=0xffff**	
5	**Set Bias frequency back to its operating value (200Hz)**	SetPhotoBiasFreq(0x0062) 84190062	
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

4.52 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*	
5	**Set Bias frequency back to its operating value (160Hz)**	SetSpectroBiasFreq(0x0062) 8439007A	
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

4.53 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=0x88220001,STEP=0x0001** a) SetPhotoBiasAmplSW(0x0000) 841A0000; SetPhotoBiasAmplMW(0x0000) 841B0000; SetPhotoBiasAmp lLW(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=0x88220002,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=0x88220003,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=0x88220004,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=0x88220005,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=0x88220006,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 its operating value (60mV)**	a) SetPhotoBiasAmplSW(0x004D) 841A004D SetPhotoBiasAmplMW(0x004D) 841B004D SetPhotoBiasAmplLW(0x004D) 841C004D SetPhotoBiasAmplTC(0x004D) 841D004D	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?

4.54 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 0x8823 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 its operating value (60mV)**	a) SetSpectroBiasAmplSW(0x004D) 843A004D SetSpectroBiasAmplLW(0x004D) 843B004D	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?

4.55 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 half-level	c) For #=1..6, SetPhSWJfetVSS#(0x007F) 8(404+#)007F For #=1..4, SetPhMWJfetVSS#(0x007F) 8(40A+#)007F For #=1..2, SetPhLWJfetVSS#(0x007F) 8(40E+#)007F SetPhTCJfetVSS1(0x007F) 8414007F	
	d) Switch drain voltages to high level	*d)* SetPhSWJfetPwr(0x003F) 8412003F SetPhMLWJfetPwr(0x007F) 8413007F	
	e) Switch on JFET heaters to half power during 1 min	*e)* SetPhotoHeaterBias(0x007F) 8411007F *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” b) Set Vss to 0V on all channel c) Switch off drain voltages d) Switch of LIA card	a) SetPhotoBiasMode(0x0000) 84000000 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) SetPhSWJfetPwr(0x0000) 84120000 SetPhMLWJfetPwr(0x0000) 84130000 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)

4.56 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, demo dulation 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	a) SetDRelOnOff(0x0002) A0870002 or SetDRelOnOff(0x0006) A087006 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 half-level	c) For #=1..2, SetSpSWJfetVSS#(0x007F) 8(434+#)007F SetSpLWJfetVSS(0x007F) 8434007F	
	d) Switch drain voltages to high level	d) SetSpSLWJfetPwr(0x0007) 84370007	
	e) Switch on JFET heaters to half power during 1 min	*e)* SetSpectroHeaterBias(0x007F) 8433007F *Wait 1 min*	
	f) Switch off JFET heaters	f) SetSpectroHeaterBias(0x0000) 84330000	
	g) Set bias frequency to 200 Hz	g) SetSpectroBiasFreq(0x0062) 84390062	
	h) Set the sampling frequency to 15.3Hz	h) SetSpectroSampFreq(0x000C) 8438000C	
	i) Set spectro bias mode to “run”	i) SetSpectroBiasMode(0x00FF) 843000FF	
	j) Set bias amplitude to 60 mV	j) SetSpectroBiasAmplSW(0x004D) 843A004D SetSpectroBiasAmplLW(0x004D) 843B004D	
	k) Set demodulation phase to 180 degrees (or 180+ dϕ, found by test FUNC-DCU-08 ?)	k) SetSpectroDemodSW(0x007F) 843A007F SetSpectroDemodMW(0x007F) 843B007F	
	l) Activate auto-offset control	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”	a) SetSpectroBiasMode(0x0000) 84300000
b) Set Vss to 0V on all channel	b) For #=1..2, SetSpSWJfetVSS#(0x0000) 8(434+#)0000 SetSpLWJfetVSS(0x0000) 84340000
c) Switch off drain voltages	c) SetSpSLWJfetPwr(0x0000) 84370000
d) Switch of LIA card	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)

4.57 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)

4.58 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)