

Solar-B EIS

**MULLARD SPACE SCIENCE LABORATORY
UNIVERSITY COLLEGE LONDON**

Author: Jason A Tandy

Short Functional Test

Document Number: MSSSL/SLB-EIS/SP/025.05

24th February 2004

Author: Jason A Tandy Date:

Authorised By A. M. James Date:

Distributed: A. P. Dibbens Date:

Distribution

EIS-Science	
EIS-Tech	✓
EIS-Soft	

Change Record

ISSUE	DATE	PAGES CHANGED	COMMENTS
01 Draft	10 th June 2003	All	First version for flight PSU test. Does not include real MHC.
02 Draft	13 th June 2003	Some updates	
03 Draft	20 th June 2003		
04	6 th November 2003		
05	24 th February 2004	Some updates	Minor corrections

LIST OF CONTENTS:

1.0 Introduction	3
2.0 Test Equipment	3
3.0 Test procedure	4
Appendix 1: Sequence 1 and line list 1 structure	15

Glossary and Convention:

(b)	Binary
BC	Block Command, Solar-B Command parameter
CAM	Camera
CMD-ID	Solar-B command ID
D	Disabled
E	Enabled
EIS	Extreme-ultraviolet Imaging Spectrometer
GSE	Ground Support Equipment
I	Idle
ICD	Interface Control Document
INT	Interrupt
INV	Invalid
MHC	Mechanism and Heater controller
MID	Mission data Main Id
MSC	Mission data Main Sequence Count
MSF	Mission data Main Sequence flag
OCB	On Chip Binning (Camera function)
OVF	Overflow
PSU	Power Supply Unit
ROE	Camera Read-out Electronics
SID	Mission data Sub ID
SSC	Mission data Sub Sequence Count
SSF	Mission data Sub Sequence Flag
TI	Time Indicator (Solar-B spacecraft time)
Xf, Yf, Xb, Yb, Xp and Yp	are MDP packet image dimension [2].

Applicable references:

These references appear in [] brackets in this document (NB latest issue applies).

- 1 – EIS Science requirements: MSSL/SLB-EIS/SP007
- 2 – MDP ICU interface document: NAO/SLB-EIS/SP/MDP001
- 3 – EIS Mode definition: MSSL/SLB-EIS/SP0013
- 4 – EIS tele-commanding structure: MSSL/SLB-EIS/SP016
- 5 – EIS status: MSSL/SLB-EIS/SP017
- 6 – EIS Mission data structure: MSSL/SLB-EIS/SP018
- 7 – PM test procedures for the Solar-B EIS instrument: MSSL/SLB-EIS/SP019

1.0 Introduction:

This document describes the EIS Short Functional Test procedure, the purpose of which is to verify the integrity of the EIS Hardware.

2.0 Test Equipment:

- 1 - ICU H/W
- 2 - Camera H/W
- 3 - MHC
- 4 - EGSE PC with resident QL
- 5 - MDP simulator PC
- 6 - Power supply
- 7 - Harnesses

3.0 Solar-B EIS Short Functional Test:

SFT Number : EIS SFT _____

Test Personnel: _____ Test Date: _____

Test Environment (Where, Air/Vac, temp) : _____

Comments:-

EGSE Version	Hardware Software			
Power Supply	Type S/N			
				Comments:
ICU	FM	PFM	Other	
Box				
Backplane				
SC-Proc				
CM-Ctl				
Monitor				
PSU				
Software Version				
CAM	FM	PFM	Other	
Box				
Backplane				
Analogue				
Digital				
PSU				
CCD_A				
CCD_B				
	FM	PFM	Other	
MHC				
Software Version				
	TV	EMC	Other	
Cables				

Check setup:

	OK?
Make sure PSU output is OFF	
Set PSU to 28V	
Set PSU current limit to 3A	

Harnesses in place?	
Grounding in place?	

Check EGSE is powered and new run is started.	
Load CAL table as appropriate (PM,PFM,FM)	
Record Archive numbers? RUN: /data/eis/ _____ Press <STATUS> in SCSIM to get : /st_data	

Power on Instrument:

	Allowed range /A	Measured Current /A	Pass?
Turn PSU output ON Check current	0.01 – 0.02		
Press ON switch on Spacecraft TCI-B Simulator and wait 3 seconds	PFM 0.32 – 0.34 FM 0.28 – 0.31		
Check HK packets are received by EGSE	n/a	n/a	
Check mode is BOOT	n/a	n/a	

Monitor the housekeeping and verify the following Boot parameters:

DESCRIPTION	EXPECTED STATUS	ACTUAL STATUS	COMMENT
EIS_MODE	0X0 Boot		
MODE_EN_STAT (indicates whether mode transition is enabled)	0x1 Enabled		
ICU_SW_ID	V1 R13		
STATUS_PC (Packet Counter)	Incrementing		
PSU_STAT_ERR	0		

Load Main Software and change to Standby:

Action	OK?
Send command bytes 0x2b,0 or ,4 depending on software to be run.	Value sent?
Send change to STANDBY command	
Note 28V current. PFM 0.32 - 0.34 FM ~ 925mA (with MHC/ROE MUH ON)	
Check HK packets are received by EGSE.	
Check mode is STANDBY.	

Monitor HK and verify the following parameters:

DESCRIPTION	EXPECTED STATUS	ACTUAL STATUS	COMMENT
ICU_ERROR_F	0x0		
EIS_MODE	0X1 Standby		
MODE_EN_STAT (indicates whether mode transition is enabled)	0x2 Disabled		
ICU_SW_ID	V1 R13		
ICU_VF (Validation Flag)	0x1 valid		
PSU_VF	0x1 valid		
CAM_VF	0x2 Invalid		
MHC_VF	0x2 Invalid		
BC1	0x0		
BC2	0x0		
BC3	0x0		
CMD_LEN	0x0		
CMD_IF_ERR	0x0		
WDOG_IF STATUS	0xFA 0xBA		
STATUS_PC (Packet Counter)	Incrementing		
TC_REC_PKTC (Packets Received Counter)	0x0		
TC_FAILED_PKTC (Packet failed to execute counter)	0x0		
TC_FAILED_CMD_ID (ID of the last packet that failed to execute)	0x0		
TC_FAILED_EC (Error Code)	0x00 No Error		
PSU_STAT_ERR	0x2		

Check Make Up Heaters are on

	OK?
MHC_MHTR = 0x1 ON?	
CAM_MHTR = 0x1 ON?	

Record the following from the EGSE windows

	Parameter	Raw Value	Monitor Value	Measured Value if taken	Limits		Pass
					Lo	Hi	
PSU tab							
	Temperatures						
	CCDA Temp						
	CCDB Temp						
	ICU_PROC_TEMP						
PSU tab							
	Volts	Hex	Volts/V				
	ICU_P2V5						
	ICU_P5V						
	ICU_P15V						
	ICU_N15V						
	ICU_28V						
	Current	Hex	Current/A				
	ICU_P2V5						
	ICU_P5V						
	ICU_P15V						
	ICU_N15V						
	ICU_28V						
CAB tab							
	Volts	Hex	Volts/V				
	PSU_CAM_N8V						
	PSU_CAM_P7V						
	PSU_CAM_P8V						
	PSU_CAM_P13V						
	PSU_CAM_P39V						
	Current	Hex	Current/A				
	PSU_CAM_N8VI						
	PSU_CAM_P7VI						
	PSU_CAM_P8VI						
	PSU_CAM_P13VI						
	PSU_CAM_P39VI						

Enable mode transition

	OK?
Send ENABLE MODE transition command.	

Check the following status parameters:

DESCRIPTION	EXPECTED STATUS	ACTUAL STATUS	COMMENT
MODE_EN_STAT (indicates whether mode transition is enabled)	0x1 Enabled		
TC_REC_PKT (Packets Received Counter)	0x1		

Check of CCD Bakeout Heaters.

		OK?
	Change mode to BAKEOUT and verify in house keeping.	
PSU tab	Bakeout heater Enable should be enabled? CCDA_BHTR_EN, CCDB_BHTR_EN	
	Make up heaters should be off? MHC_MHTR, CAM_MHTR	
	Execute script 'run bakeout'	
PSU tab	Check Bakeout heaters are turned on	
	Change mode back to STANDBY	
	Verify Bakeout heaters are OFF	
	Verify Make up heaters are ON	

Change mode to Manual

Action	OK?
Send change to MANUAL command	
Note 28V currents.	
Wait five seconds and issue 'EXIT DEFAULT' command in Cam window.	
Check 28V current is stable on mains power supply for ten seconds, note current.	
Send 'STATUS CLEAR' Command.	

and check the following status parameters:

DESCRIPTION	EXPECTED STATUS	ACTUAL STATUS	COMMENT
ICU_ERROR_F	0x0		
EIS_MODE	0X1 Standby		
MODE_EN_STAT (indicates whether mode transition is enabled)	0x2 Disabled		
ICU_SW_ID	V1 R13		
ICU_VF (Validation Flag)	0x1 valid		
PSU_VF	0x1 valid		
CAM_VF	0x2 Invalid		
MHC_VF	0x2 Invalid		
BC1	0x1		
BC2	0x0		
BC3	0x0		
CMD_LEN	0x0		
CMD_IF_ERR	0x0		
WDOG_IF_STATUS	0xFA 0xBA		
STATUS_PC (Packet Counter)	Incrementing		
TC_REC_PKTC (Packets Received Counter)	0x0		
TC_FAILED_PKTC (Packet failed to execute counter)	0x0		
TC_FAILED_CMD_ID (ID of the last packet that failed to execute)	0x0		
TC_FAILED_EC (Error Code)	0x00 No Error		
PSU_STAT_ERR	0x2		

Check the following Camera parameters:

DESCRIPTION	EXPECTED STATUS	ACTUAL STATUS	COMMENT
CAM_N10V_B	0xBF		
CAM_N10V_A	0xC1		
CAM_VOD	0x99		
CAM_VRD	0x99		
CAM_VSS	0x77		

Record the following from the EGSE windows

	OK?
Check that Make Up Heaters have been turned off?	

	Parameter	Raw Value	Monitor Value	Measured Value if taken	Limits		Pass
					Lo	Hi	
PSU tab							
	Temperatures						
	CCDA Temp						
	CCDB Temp						
	ICU_PROC_TEMP						
PSU tab							
	Volts	Hex	Volts/V				
	ICU_P2V5						
	ICU_P5V						
	ICU_P15V						
	ICU_N15V						
	ICU_28V						
	Current	Hex	Current/A				
	ICU_P2V5						
	ICU_P5V						
	ICU_P15V						
	ICU_N15V						
	ICU_28V						
CAB tab							
	Volts	Hex	Volts/V				
	PSU_CAM_N8V						
	PSU_CAM_P7V						
	PSU_CAM_P8V						
	PSU_CAM_P13V						
	PSU_CAM_P39V						
	Current	Hex	Current/A				
	PSU_CAM_N8VI						
	PSU_CAM_P7VI						
	PSU_CAM_P8VI						
	PSU_CAM_P13VI						
	PSU_CAM_P39VI						

Set up MHC

	OK?
Load sequence 04	
Load sequence 05	
Select seq 04	
Goto AUTO	
See shutter rotate	
Check SEQ_STAT = stopped	
Change to MANUAL mode	

From MANUAL mode, select sequence 1 with following command:

MDP tab

Action	OK?
Record 'TC_REC_PKTC' value	
Run script 'run testseq1'	
See that 'TC_REC_PKTC' has increased by three.	
Ensure 'BUSY' is low.	
Go to AUTO	
Note Main Bus current.	
Note Main Bus current during readout.	
Note Main Bus current after readout.	
Wait for 'Seq_STAT' = Stopped and 'BUSY' = low	

Click <MISSION> in SCSIM, scroll to top of window & check Mission data first packet:

Packet Information						
Data Type	Packet Size (24bits)	PKT No Serial Packet No (32 bits)	MID Main ID (16 bits)	MSF Main Sequence Flag (2 bits)	MSC Main Sequence Count (14 bits)	Num
C3	0x80100	0	0	0x3	0	0x0201

Packet Information (cont.)								
SID Sub ID (16 bits)	SSF Sub Sequence Flag (2 bits)	SSC Sub Sequence Count (14 bits)	Xf Full Image Size x (16 bits)	Xy Full Image Size y (16 bits)	Xb Base Point Coor x (16 bits)	Yb Base Point Coor y (16 bits)	Xp Part Image Size x (16 bits)	Yp Part Image Size y (16 bits)
0	1	0	0x200	0x1000	0	0	0x200	0x200

COMP
Data Compression Information (16 bits)
0

The Exposure parameters:

PARAMETER	SIZE (BITS)	EXPECTED VALUE				ACTUAL VALUE	OK?
TI - 1 (shutter open time)	32	Variable					
TI - 2 (shutter close time)	32	Variable					
Exposure duration as measured by the MHC	32	Variable					
Exposure duration	16	3000 (unit of 10 ms)					
Table information							
Sequence number	8	1					
Line list number	8	1					
Sequence ID	16	0xAAA1					
Raster ID	16	0xAAA2					
Line List (window) information (extracted from the selected line list table) Parameters common for the window list							
Number of windows	5	4					
CCD-X-LENGTH	12	0x864					
Xws	12	0x32					
Xw	12	0x400					
Yws	10	0x001					
Yw	10	0x200					
Window header	8	0x3	0x2	0x1	0x0		
Window Xs	12	0050	1074	0050	1074		
Window X	12	1024	1024	1024	1024		
Coarse mirror position	16	Variable					
Fine mirror position	16	Variable					
Slit number	16	Variable					
X OCB	8	0x1					
Y OCB	8	0x1					
CCD RO		0x0F					
HSL Status		0x79CC					

Mission data packet header

Check Data

Using EIS QL, check the pixels data integrity:

Action	OK?
Write down the Run number	Md_data _____
Check the image.	

Switch Off Test

Action	OK?
Go back to MANUAL mode by sending the following command: CMD-ID = 0x21 Parameter = 2	
Go back to STANDBY mode by sending the following command: CMD-ID = 0x21 Parameter = 1	
Send a reset command by script 'run reset_icu'	
Verify that the ICU was reset, Status packet counter restart from 0, and mode is BOOT	
Check watchdog status after four seconds is 0x72 0x00	
Switch OFF.	

End of test.

Did test pass?	Yes / No
Comments:	

Appendix 1: Sequence 1 and line list 1 structures**Sequence 1 structure:**

```
$sequence_number = 01;

sequence_id(0xaaa1)
sequence_repeats(1)

# Program CAM Y-start and Y-height
eis_cam_prog_csg_win(0x03,0x0,0x0c,0x80)
eis_cam_prog_csg_win(0x83,0x0,0x0c,0x01)
eis_cam_prog_csg_win(0x03,0x0,0x14,0x92)
eis_cam_prog_csg_win(0x83,0x0,0x14,0x00)

# sci_ops goes here
xrt_flare_trigger = disable
eis_aec           = disable
eis_event_trigger = disable
eis_flare_trigger = disable

eis_sci_op(xrt_flare_trigger, eis_aec, eis_event_trigger,
eis_flare_trigger)

id           = 0xaaa2
mip          = 10
loop_cntr   = 1
data_comp   = 0
ocb_x       = 1
ocb_y       = 1
flush_seq_id = 2
num_flush   = 5
exp_per_ras_pos = 1
asrc_ctl    = 0x00
ro_node     = 0xF
ras_repeats = 1
asrc_skip   = 0
ro_seq_id   = 3
mirror_step = 0
line_list   = 1
#sci_op is implicitly handled by run_raster. No need to include as
parameter

eis_run_raster(id, mip, loop_cntr, data_comp, ocb_x, ocb_y, flush_seq_id,
num_flush, exp_per_ras_pos,
asrc_ctl, ro_node, ras_repeats, asrc_skip, ro_seq_id, mirror_step,
line_list)

here:

exp_time_10ms = 30 * 100

eis_start_exp(exp_time_10ms)

eis_set_seq_loop("here")

eis_stop_seq(01)
```

Line List 1

```
##### line list 01 #####  
  
$ll_number = 01;  
  
# Length will be supplied by ll_translate  
  
ccd_ro_node = 3  
num_windows = 4  
  
# Checksum will be supplied by ll_translate;  
  
ccd_length = 2148  
  
x_ws      = 50  
x_w       = 1024  
y_ws      = 1  
y_w       = 512  
  
# Software windows  
  
header    = 0x3  
xs        = 50  
x_len     = 1024  
  
header    = 0x02  
xs        = 1074  
x_len     = 1024  
  
header    = 0x1  
xs        = 50  
x_len     = 1024  
  
header    = 0x00  
xs        = 1074  
x_len     = 1024  
  
##### End
```