Solar B - EIS

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SHORT FUNCTIONAL TEST PROCEDURE (PM)

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LIST OF CONTENTS:

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.

1 – EIS Science requirements: MSSL/SLB-EIS/SP007.01
2 – MDP ICU interface document: NAO/SLB-EIS/SP/MDP001.03
3 – EIS Mode definition: MSSL/SLB-EIS/SP0013.01
4 – EIS tele-commanding structure: MSSL/SLB-EIS/SP016.02
5 – EIS status: MSSL/SLB-EIS/SP017.02
6 – EIS Mission data structure: MSSL/SLB-EIS/SP018.02
7 – PM test procedures for the Solar-B EIS instrument: MSSL/SLB-EIS/SP019.02

1.0 Introduction:

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

A more comprehensive Software Spacecraft level testing is described in [7].

2.0 Test Equipment:

1 – ICU H/W
2 – EGSE PC with resident QL
3 – MDP simulator PC

3.0 Hardware Test procedures:

3.1 Cable Connections:

	Result
Set PSU to 28V	
Set PSU current limit to approx 490mA	
Make sure PSU output is OFF	
Connect PSU power cable to EIS-ICU1 connector (Main Power In)	

Connect 5V & 2V5 rail current monitor cable to EIS-ICU7 connector	
Connect meter to measure 5V current to cable marked with RED tape	
Set meter to voltage scale	
Connect meter to measure 2V5 current other set of to cables	
Set meter to voltage scale	

Connect MSSL-MDP-IF cable to EIS-ICU3 connector (MDP-IF)	
Connect MSSL-MDP-IF cable to EGSE	

3.2 System Power ON Procedure:

	(V)	(I)	Result
Turn PSU output ON			
LEDs Indicator status	n/a	n/a	
V_5V current reading			
V_2V5 current reading			
Turn ON EIS-ICU power via RED push button	n/a	n/a	
V_5V current reading			
V_2V5 current reading			
LEDs Indicator status			
Turn ON EGSE	n/a	n/a	
V_5V current reading			
V_2V5 current reading			
LEDs Indicator status			

4.0 Software Test procedures:

4.1 EIS Initial startup (Standby mode):

Power ON EIS from a bench power supply. Capture the first status packet (disable status requests but leave memory dump requests to ensure that the ICU remains in Standby [2]. Verify the following parameters:

DESCRIPTION	STATUS	COMMENT
The ICU software version ID.	11	V1, Rev 1
The ICU mode	1	Standby mode
Mode transition status	2	D
Last TC packet failed to execute error code.	0	
Status packet counter.	0	
TC packets received counter.	0	
TC packets failed to execute counter	0	
The Command ID of the last packet failed to execute.	0	
Command buffer status	0	
XRT Flare status	2	D

DESCRIPTION	STATUS	COMMENT
EIS flare flag status	2	D
Health Monitor status	2	D
EIS AEC status	2	D
Memory dump status	2	D
Last XRT flare flag as received from the MDP	0	No flare
XRT Flare flag X-Coordinate	0	
XRT Flare flag Y-Coordinate	0	
Running sequence no.	0	
Running sequence pointer	0	
Line list no. in use	0	
MD buffer status	0	
Exposure no.	0	
Fine mirror position	0	
Current ICU status acquisition.	1	V
Current PSU status acquisition	1	V
Current CAM status acquisition	2	INV
Current MHC status acquisition	2	INV
Error flags	0	
Last command ID received	0	
Last command BC2 received.	0	
Last command BC3 received.	0	
Last command received length	0	
The ICU HW command interface status.	0x7A	No bit error, not HF, no INT active, no OVF, FIFO empty, FIFO not full and no command transmission active [5]
The ICU HW MD interface status.	0x4E or 0x5E	FIFO not full, FIFO empty, MDP not busy (or could be busy subject to EGSE configuration), no INT active, not end of packet and no MD GO [5]
The ICU HW Status interface status.	0x82	Not GO, FIFO empty, FIFO not FULL [5]
The ICU Watchdog status.	0xE8	Not WD trip (power on), WD disabled, 7 seconds selected and not ICU reset [5]

4.2 Send enable mode command:

Enable the MDP status requests and send the following command:

CMD-ID = 0x20

Check the following status parameters:

DESCRIPTION	STATUS	COMMENT
Mode transition status	1	E
Last TC packet failed to execute error code.	0	
TC packets received counter.	1	
TC packets failed to execute counter	0	
The Command ID of the last packet failed to execute.	0	
Command buffer status	0	
Current ICU status acquisition.	1	V
Current PSU status acquisition	1	V
Current CAM status acquisition	2	INV
Current MHC status acquisition	2	INV
Error flags	0	None
Last command ID received	0x20	
Last command BC2 received.	0	
Last command BC3 received	0	
Last command received length.	1	
No Change in the H/W interface status should be detected compared with test 3.1, except for the WD status (should be 0xA8, i.e. watchdog enabled).		

4.3 G0 to Manual Mode:

Change mode to Manual and check the following status parameters:

DESCRIPTION	STATUS	COMMENT
The ICU mode	2	Manual mode
Mode transition status	1	E
Last TC packet failed to execute error code.	0	
Status packet counter	++	
TC packets received counter.	2	
TC packets failed to execute counter	0	
The Command ID of the last packet failed to execute.	0	
Command buffer status	0	
XRT Flare status	2	
EIS flare flag status	2	
Health Monitor status	2	
EIS AEC status	2	
Memory dump status	2	
Last XRT flare flag as received from the MDP	0	
XRT Flare flag X-Coordinate	0	
XRT Flare flag Y-Coordinate	0	
Running sequence no.	0	
Running sequence pointer	0	
Line list no. in use	0	
MD buffer status	0	
Exposure no.	0	
Fine mirror position	0	

DESCRIPTION	STATUS	COMMENT
Current ICU status acquisition.	1	V
Current PSU status acquisition	1	V
Current CAM status acquisition	1	V, when acquired
Current MHC status acquisition	1	V, when acquired
Error flags	0	
Last command ID received	0x21	
Last command BC2 received.	2	
Last command BC3 received.	0	
Last command received length.	2	
The ICU HW command interface status.	0x7A	Hardware interface statuses
The ICU HW MD interface status.	0x5E	
The ICU HW Status interface status.	0x82	
The ICU Watchdog status.	0xA8	

4.4 PM memory dump test:

Dump a single full memory packet and verify packet structure and packet contents:

CMD-ID = 5
Address = 0x6000 (ICU program start address in bytes)
Length = 488 bytes.

Check the dump packet header:

Bit	Data	Contents
8	Blank data	00[h] 0
8	Confirmation flag	00 [h]: check, or FF [h]: don't check 00
B0-B1	Dump Sequence Flag	11[b]: Single packet 01 [b]: Start packet of a dump data 00 [b]: Middle packet of a dump data 10 [b]: End packet of a dump data 11[b]
B2-B7	Blank Data	00
16	Dump Sequence Counter	0
24	Valid data length of memory dump data	488
8	Blank data	0
B0-B3	Memory Table No.	E
B4-B7		5
8	Memory Dump	00

	Address	
8	Memory Dump Address	60
8	Memory Dump Address	00

Memory dump packet header

Check the dump packet first 6 bytes value: 0xAC, 0x1C, 0xFF, 0xFF, 0xFF and 0xFF

Check the dump packet last 6 bytes value: 0x8B, 0, 0, 0, 7 and 0x3E

4.5 Run sequence 1:

From Manual mode, select sequence 1 by sending the following command:

CMD-ID = 0x83
Parameter = 1

Before going to Auto mode, send the following EGSE commands:

```
*mdp_enbl_mdint
*mdp_md_go
```

Then go to Auto mode, by sending the following command:

CMD-ID = 0x21
Parameter = 3

Wait until the MD packet is received (single packet), and then check the following MD packet header parameter:

Packet Information						
Data Type	Packet Size (24bits)	Serial Packet No (32 bits)	Main ID (16 bits)	Main Sequence Flag (2 bits)	Main Sequence Count (14 bits)	Reserved
C2	131328	0	0	11[b]	0	0x0041

Packet Information (cont.)								
Sub ID (16 bits)	Sub Sequence Flag (2 bits)	Sub Sequence Count (14 bits)	Full Image Size x (16 bits)	Full Image Size y (16 bits)	Base Point Coor x (16 bits)	Base Point Coor y (16 bits)	Part Image Size x (16 bits)	Part Image Size y (16 bits)
0	11[b]	0	512	128	0	0	512	128

Data Compression Information (16 bits)
0

The Exposure parameters:

PARAMETER	SIZE (BITS)	NOTES
TI - 1 (shutter open time)	32	Un-known
TI - 2 (shutter close time)	32	Un-known
Exposure duration as measured by the MHC	32	0
Exposure duration	16	0X28 (unit of 50 ms)
Table information		
Sequence number	8	1
Line list number	8	1
Sequence ID	16	0X0ACE
Raster ID	16	0XC0DE
Line List (window) information (extracted from the selected line list table) Parameters **common** for the window list		
Number of windows	5	4
CCDs Read-out side	3	011[b]
CCD-X-LENGTH	12	0X800
Xws	12	0
Xw	12	0X400
Yws	10	0
Yw	10	0X200
Window header	8	0, 1, 2 and 3
Window Xs	12	0, 1024, 0, 1024
Window X	12	32, 32, 32, 32
Coarse mirror position	16	0XA
Fine mirror position	16	4
Slit number	16	1
X OCB	8	1
Y OCB	8	1

Mission data packet header

Using EIS QL, check the pixels data integrity:

Check that CCD-0 and CCD-1 side-L columns pixels data values be in the range of 0 to 31 (512 pixel per column)

Check that CCD-0 and CCD-1 side-R columns pixels data values be in the range of 0 to 31 plus an offset of 1024

4.6 Switch OFF test:

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 the following two ICU hardware reset commands (back to back)

CMD-ID = 0xF5 and
CMD-ID = 0xF5

Verify that the ICU was reset (Status packet counter restart from 0).

Then:

Switch OFF.

Appendix 1: Sequence 1 and line list 1 structures

Sequence 1 structure:

Sequence command	Description
26	Sequence length
0x0A	Sequence ID
0xCE	
0x85	Select line list
0x01	Line list 1
0x86	Run Raster
0xC0	Raster ID
0xDE	
0x00	Initial mirror position
0x04	Position 4
0x00	Loop Counter (one exposure)
0x01	
0x00	Data Compression
0x00	
0x01	OCB X
0x01	OCB Y
0x8D	Start exposure
0x00	Exposure time (unit of 50 ms)
0x28	
0x87	Step mirror
0x00	Step size (two steps)
0x01	
0x89	Loop back
0x10	To start exposure
0x81	Terminate sequence
0x00	

Line List 1

Parameter	Description
38	Length
3	CCD Read-out nodes (L & R)
4	Number of windows
0	Checksum
0x08	CCD Length (2048)
0x00	
0	CCD window X start (0)
0	
0x04	CCD window X length (1024)
0x00	
00	CCD window Y start (0)
00	
0x02	CCD window Y length (512)
0x00	
Software windows	
00	Window 1 header (0)
00	
00	Window 1 X start (0)
00	
0x00	Window 1 X length (32)
0x20	
00	Window 2 header
01	
0x04	Window 2 X start (1024)
0x00	
0x00	Window 2 X length (1024)
0x20	
00	Window 3 header
02	
00	Window 3 X start (0)
00	
0x00	Window 3 X length (1024)
0x20	
00	Window 4 header
03	
0x04	Window 4 X start (1024)
0x00	
0x00	Window 4 X length (1024)
0x20	