Solar B - EIS

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REPORT ON TESTING OF PM IN JAPAN

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GLOSSARY

BOB	Break Out Box
DHU	Data Handling Unit
ECR	Engineering Change Request
EGSE	Electrical Ground Support Equipment
EIS	Extreme Ultraviolet Imaging Spectrometer
FPGA	Field Programmable Gate Array
HCE	Heater Control Electronics
HKU	HouseKeeping Unit
ICU	Instrument Control Unit
ISAS	Institute of Space and Astronomical Science (Japan)
MDP	Mission Data Processor
MHC	Mechanisms & Heater Control
MSSL	Mullard Space Science Laboratory
PM	Prototype Model
TBD	To Be Decided
TCI-B	Telecommand Interface
XRT	X-Ray Telescope

1 Introduction

The PM tests were undertaken at ISAS between 15th August 2001 and 13th September 2001. Personnel present were Rahil Chaudery, Khalid al-Janabi, Matthew Whillock and Viggo Hansteen (University of Oslo).

2 Post-delivery Test

The EIS pm ICU was un-packed and connected to the MSSL EGSE. A software short functional test was performed to verify the ICU survived the delivery. No problems were found.

The hardware short functional test was completed successfully after a problem of current limiting was solved with the bench power supply. The software short functional test was completed successfully.

EIS power on using the TCI-B simulator was tested before connection to the MDP. Although EIS powered on successfully it revealed a large inrush current. As this was not acceptable for the system all tests with the MDP required that EIS be turned on before the MDP.

3 EIS Integration Test

A cable check prior to connection of the ICU to the MDP was not carried out to Rahil's satisfaction. The instrument grounding strap was a very long ¼" braid. The instrument was grounded via approximately 1m twisted pair leads held to the earthing strap with a croc-clip. The screening of the MDP-ICU cable was stripped approximately 3 to 4" back from the connector.

The relay status line was not initially connected to the 'D' type on the ICU (done after the integration test).

The tests performed were:

- Integration procedure 1
  measurements of status interface waveforms.
- Integration procedure 9
  measurements of transient currents, bus voltage, power consumption and voltage ripple at power on and when the ICU was in auto mode.
- Integration procedure 9
  measurements of mission data interface waveforms. These were very deformed and require further investigation.
- Integration procedure 4
  check of mission data images.

No problems were found during the testing of either the ICU hardware or software.

Between the EIS Integration Test and the EIS Performance Test the SDTP software provided by ISAS was installed on the quicklook workstation and eventually made to work.

4 EIS Performance Test

The tests performed were:

- Integration procedure 7
- Mode change tests
- Multi-sequence recursive call
- Alteration of data compression parameters
- XRT flare information acquisition
- Memory operations for program memory
- Memory operations for PROM and EEPROM
- Memory operations for observation table memory
- Auto mode emergency power-off

Analysis of the status and mission data after the tests were completed revealed 3 minor problems:

- The Main Id parameter in the mission data header packet was sometimes found to increment by 2 instead of 1. This is due to a sequence being aborted and another selected.
- The MDP Time parameter in the first status packet after a change from auto mode to manual mode appeared to go backwards. This was found to be due to the hardware timer in the ICU clocking at a faster rate than the MDP timer.
- The MDP Time parameter in the very first status packet was sometimes incorrect. This is due to the ICU software not synchronizing the time until it receives a type 1 status packet request. This was known about prior to the PM delivery and was not viewed as a problem. The solution is documented in ECR 11.

Some mistakes were found in the MSSL provided memory maps.

5 System Performance Test

Prior to starting the system performance test a check of the new EIS observing sequences was attempted. No status packets were received from EIS after the MDP was powered on. This was found to be due to a glitch on the command line when the MDP powers on. Insertion of a BOB prevented the problem from happening. EIS was connected to the MDP via the BOB for the duration of the system performance test. The problem could not be reproduced using the MSSL EGSE. According to the system side some components of the TCI-B had failed sometime after the EIS Integration Test but the EIS team had not been informed of this. This failure mode could have sent erroneous commands to EIS.

The system performance test was carried out over four days and consisted of the following tests:

- Quiet day - MDP and DHU in the nominal settings
  - Pass 0 All instruments off
  - Pass 1 Single and double control
  - Pass 2 High observation data rate

    - Pass 3 Middle observation rate
    - Pass 4 Mixed observation rates
- Flare day – MDP and DHU in nominal settings
- Contingency day – use of X-band and S-band
    - Pass 1 X-band only
    - Pass 2 S-band only
    - Pass 3 X-band only with emergency instrument turn off
    - Pass 4 X-band and S-band with accidental MDP reset

5.1 Day 1

- Mixed observations.
  All instruments on in different mission data rates. No problems for EIS.

5.2 Day 2

- Mixed observations.
  All instruments on with mixed mission data rates for each instrument. MDP crashed after approximately 3 hours when changing mission data rates of the instruments from a high rate to a lower rate. As there was no change in power consumption by any of the instruments they were all left on. After 4 hours the MDP problem was still not identified so all the instruments were turned off and MDP debugging carried on.

5.3 Day 3

- Mixed observations.
  All instruments in mixed mission data rates. No problems for EIS.
- Flare response testing.
  Simulated response of EIS to XRT flare information by manually changing to a different observation sequence. One operational error occurred when a sequence selection was performed too quickly.
- Contingency day pass 1.
  All telemetry using X-band only with all instruments in a high mission data mode. The DHU crashed due to operations error; the test was restarted with no further problems. No mission data was distributed to instrument team's quicklook workstations due to problems in the ground system. No EIS ICU problems were encountered.
- Contingency day pass 2.
  Switch to S-band only and mission data rate from the instruments changed to the middle rate. Mission data received by the quicklook systems.

5.4 Day 4

- Contingency day pass 3.
  X-band only with instruments in high data rate. Again, no mission data received by the quicklook systems in real-time or off-line. Emergency off procedures tested. All ok.
- Contingency day pass 4.
  Both X- and S-bands. Accidental MDP reset test. All ok.

6 Summary

The tests revealed the following hardware and software problems with the ICU and EGSE:

- Inrush current
- Command line noise handling
- Aborted sequence handling
- Internal ICU timer
- Time in status packets
- EGSE time generation

The following concerns were raised during the integration:

- Hardware tests and measurements must be made strictly to a prepared document in the future.
- The TCI-B circuit.
- More rigourous recording of the eeprom memory map is required.
- ‘Cloth’ type anti-static straps being used against MSSL policy.

All interface waveforms are kept by Rahil.

All packet data generated during the tests are held on the quicklook workstation (msslq7).