XMM Optical Monitor

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Detailed Test Plan Document
Software release 7

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CHANGE RECORD

Issue	**Date**	**Changes**
0	23-Dec-98	First version

Contents

1 Introduction

This is the Detailed Test Plan Document for release 7 of the ^{XMM}OM software. It describes the tests performed to check the functionality of the on-board software and the tests to check the fixes for NCR and ECR software changes.

2 Reference Documents

- **XMM-OM/MSSL/ML/0006** ^{XMM}OM VxWorks Command Summary (FM Model) (http://xmmom.mssl.ucl.ac.uk/docs/xmm-om/mssl/ml/0006/)
- **XMM-OM/MSSL/ML/0009** ^{XMM}OM User Manual (FM) - Part 2: Experiment Operations Procedures http://mssls7.mssl.ucl.ac.uk/docs/xmm-om/mssl/ml/0009/ops.ps.gz
- **XMM-OM/MSSL/SP/0207** OM FM Software Testing at MSSL (http://xmmom.mssl.ucl.ac.uk/docs/xmm-om/mssl/sp/0207/icu_fm_testing.ps.gz)
- **XMM-OM/UCSB/TR/0002** DPU Flight Software Test Report (http://xmmom.mssl.ucl.ac.uk/docs/ucsb/UCSB_TR_0002.ps.gz)
- **XMM-OM/UCSB/TC/0041** Description of DPU Flight Software Changes 5/98 – 9/98 (ftp://xmmom.physics.ucsb.edu/pub/UCSB_TC_0041.ps)
- **XMM-OM/UCSB/TC/0042** Description of DPU Flight Software Changes 9/98 – 12/98 (ftp://xmmom.physics.ucsb.edu/pub/UCSB_TC_0042.ps)

3 Overview

This document describes the software testing done to check the ^{XMM}OM flight code and to check the NCR and ECR fixes.

The general testing philosophy and test equipment is described in the "OM FM Software Testing at MSSL" document XMM-OM/MSSL/SP/0207 (http://xmmom.mssl.ucl.ac.uk/docs/xmm-om/mssl/sp/0207/).

The "DPU Flight Software Test Report" is XMMOM/UCSB/TR/0002 (http://xmmom.mssl.ucl.ac.uk/docs/ucsb/UCSB_TR_0002.ps.gz). This describes testing philosphy and the long test exposure runs.

A detailed description of DPU software changes between May 1998 and Sep. 1998 is XMMOM/UCSB/TC/0041 (ftp://xmmom.physics.ucsb.edu/pub/UCSB_TC_0041.ps)

and DPU software changes between Sep. 1998 and Dec. 1998 is XMMOM/UCSB/TC/0042 (ftp://xmmom.physics.ucsb.edu/pub/UCSB_TC_0042.ps).

4 Abbreviations

XMM	X-ray Multi Mirror Mission
OM	Optical Monitor
HK	Housekeeping
KAL	Keep Alive
IFT	Integrated Functional Test
ICU	Instrument Control Unit
DPU	Digital Processing Unit
HV	High Voltage
LUT	Lookup Table
tc	Telecommand
tm	Telemetry
MSSL	Mullard Space Science Lab (University College London)
ESA	European Space Agency
SOC	Science Operations Centre
MCP	Microchannel Plate(s)
FAQ	Field Acquisition
s/c	spacecraft
GS	guide star(s)
RBI	Remote Bus Interface
TMPSU	Telescope module power supply unit

5 Typographical and Other Conventions Used in this Document

5.1 Typographical

- Running text appears in this normal Roman font.
- *Italic font* will indicate something (*e.g.*, a parameter) that should not be taken literally.
- A `"typewriter" font` will be used to indicate Unix/VxWorks commands.

6 NCR and ECR tests

6.1 NCR 117

6.1.1 Purpose of tests

To validate the code changes made for NCR 117.

6.1.2 Test Location

MSSL

6.1.3 Test environment

- ICU breadboard.
- DPU breadboard.
- Telescope Module simulator.

6.1.4 Expected results

The DPU code should be able to be uploaded constantly at 100 kbit s^{-1} for more than 3 days.

6.1.5 Tests performed

1. Ran script "load_lotsof_dpu" which loads the DPU code hundreds of times.

6.1.6 Results

This test ran overnight twice and over a weekend without error.

6.1.7 Performed by

P. J. Smith.

6.2 NCR 118

6.2.1 Purpose of tests

To validate the code changes made for NCR 118.

6.2.2 Test Location

MSSL

6.2.3 Test environment

- ICU breadboard.
- DPU breadboard.
- Telescope Module simulator.

6.2.4 Expected results

The internal value of the bpe_binning parameters should not be affected by any changes to the detector acquistion mode.

6.2.5 Tests performed

1. The ICU and DPU codes were loaded
2. The ICU was placed in idle mode
3. The DPU was placed in known initial state by running the 'clean_slate' procedure
4. An IC_BPE_BINNING command was sent to set the bpe_binning parameter to zero
5. An IC_DUMP_LOCAL_RAM (H7216) command was sent to dump the memory location in the DPU containing the value of bpe_binning to check it was set to zero.
6. An IC_BPE_BINNING command was sent to set the bpe_binning parameter to one
7. An IC_DUMP_LOCAL_RAM (H7216) command was sent to dump the memory location in the DPU containing the value of bpe_binning to check it was set to one.
8. An MFN=H7130 command was sent to set the bpe acquisition mode to 2 (high res).
9. An IC_DUMP_LOCAL_RAM (H7216) command was sent to dump the memory location in the DPU containing the value of bpe_binning to check it was unchanged.

10. An MFN=H7130 command was sent to set the bpe acquisition mode to 3 (low res).
11. An IC_DUMP_LOCAL_RAM (H7216) command was sent to dump the memory location in the DPU containing the value of bpe_binning to check it was unchanged.

6.2.6 Results

The tests showed the expected behaviour.

6.2.7 Performed by

H. E. Huckle, P. J. Smith.

6.3 NCR 121

6.3.1 Purpose of tests

To validate the code changes made for NCR 121.

6.3.2 Test Location

MSSL

6.3.3 Test environment

- ICU breadboard.
- DPU breadboard.
- Telescope Module simulator.

6.3.4 Expected results

The values loaded in to the detector window lookup table should correspond to the value contained in the DP_WDW record plus an offset corresponding to the simulated redundant half of (64,15), this being the active area offset.

6.3.5 Tests performed

1. A standard science exposure was run.
2. The DP_WDW record issued by the DPU was extracted from telemetry.
3. The detector window coordinates supplied in that record were displayed.
4. Expected locations of these windows, including the active area offset, was calculated.
5. The OM1 simulator display showing the contents of the window table loaded during the exposure was examined and the locations of the windows noted.
6. A comparison was made with the expected numbers (see step 4).

6.3.6 Results

On all tests except the first, the expected numbers were the the same as observed. This was traced to incorrect values used in the code for the active area offset. The values were corrected and all subsequent results were as expected.

6.3.7 Performed by

H. E. Huckle

6.4 NCR 122

6.4.1 Purpose of tests

To validate the code changes made for NCR 122.

6.4.2 Test Location

MSSL

6.4.3 Test environment

- Sun

6.4.4 Expected results

The Makefile should produce a tar file containing all the appropriate .ads files.

6.4.5 Tests performed

1. Ran `make tar` on the operational code.
2. Ran `tar tvfz oper.tar.gz`

6.4.6 Results

The correct files were found in the tar file.

6.4.7 Performed by

P. J. Smith.

6.5 NCR 127

6.5.1 Purpose of tests

To validate the code changes made for NCR 127.

6.5.2 Test Location

MSSL

6.5.3 Test environment

- ICU breadboard.
- DPU breadboard.
- Telescope Module simulator.

6.5.4 Expected results

The contents of the window table loaded by the ICU when processing the DP_WDW record issued by the DPU should be scaled according to the most recent value of bpe binning specified by the IC_BPE_BINNING command.

6.5.5 Tests performed

1. The ICU and DPU codes were loaded
2. The ICU was placed in 'idle' mode
3. The DPU was placed in a known initial state using the 'clean slate' procedure
4. A packet archive file was opened
5. The acquisition test procedure was run
6. The post acquisition choose guide stars test procedure was run using a value in the IC_BPE_BINNING command of 0, corresponding to no on-chip binning.
7. The simulator display was used to indicate when the ICU finished loading the window table. This is a result of it processing the DP_WDW record issued by the DPU at the end of the choose guide stars procedure.
8. The packet archive was closed.

9. The DP_WDW record embedded in the packet archive was extracted and the detector window coordinates contained therein were noted.
10. The values of the detector windows loaded into the window lookup table were noted from the simulator display and compared with the numbers derived in step
11. They should be consistent with a scaling factor of 8 having been applied to them.
12. Steps 1–10 were repeated except that a value of 1 in the IC_BPE_BINNING command was used, corresponding to on chip binning being present. The coordinates of the windows loaded should then be consistent with a scaling factor of 4.

6.5.6 Results

The tests showed the expected behaviour.

6.5.7 Performed by

H. E. Huckle, P. J. Smith.

6.6 ECR 75

6.6.1 Purpose of tests

To validate the code changes made for ECR 75.

6.6.2 Test Location

MSSL

6.6.3 Test environment

- ICU breadboard.
- DPU breadboard.
- Telescope Module simulator.

6.6.4 Expected results

After performing the tests the operational mode should be safe mode. The filter wheel should be in the blocked position. If the high voltages were enabled then V_{mcp23} and V_{mcp1} should be at the same level at the start of the test and $V_{cathode}$ should be at zero volts.

6.6.5 Tests performed

1. ICU is reset to Basic mode.
2. Operational code loaded and switched to safe mode.
3. Switched to idle mode.
4. Filter wheel sent to datum position
5. High voltages ramped up (V_{mcp23} to 1500 V, V_{mcp1} to 550 V, $V_{cathode}$ to 290 V).
6. Instrument left soaking for 5 min.
7. VxWorks telemetry receiver task was then killed to simulate the spacecraft/CDMU crashing and the instrument left running. The time that the telemetry queue was stopped varied from 5 min to 8 hr.
8. The VxWorks crate was then reset in order to re-activate the telemetry receiver task.
9. The state of the instrument is then inspected through the housekeeping telemetry. The state of the instrument can also be observed using the Telescope Module simulator, which displays the position and movement of the filter wheel and the state of the high voltages.

The test is repeated (without going to basic mode first) so that the behaviour in Science and Engineering modes can be seen.

Additional tests were performed without the high voltages enabled and other valid combinations of high voltage settings.

6.6.6 Results

On all tests except one the ICU displayed the expected behaviour. In the one failure result no housekeeping packets were received when the telemetry task was re-started. The RBI status was normal (1014). When the ICU's memory was inspected for exceptions none were found though housekeeping packets were received soon after.

6.6.7 Performed by

M. C. R. Whillock

7 General testing

7.1 IFT

7.1.1 Test

The tests specified in the IFT document XMM-OM/MSSL/SP/0194 should be performed.

7.1.2 Result

The tests in the latest version of the document were passed.

7.2 Operations Procedures

7.2.1 Tests

The procedures documented in XMM-OM/MSSL/ML/0009 should be performed using the fast real-time PC simulator (see document XMM-OM/MSSL/SP/0207).

7.2.2 Results

All the main procedures listed below ran through correctly except for the new flatfield procedure which is still under discussion.

- Initial Switch On
- End of Science Data Acquisition
- Science Exposure
- Acquisition
- Engineering mode 0
- Engineering mode 1
- Engineering mode 2
- Engineering mode 3
- Engineering mode 4
- Engineering mode 5

- Engineering mode 6
- Post Observation
- Post Acquisition Choose Guide Stars
- Choose Guide Stars
- Old flatfield
- New flatfield: (procedure ran but output not tested)

7.3 Power-off Test

7.3.1 Test

- Turn off main power and KAL so memory is cleared
- Reload ICU code
- Reloac DPU code
- Run exposures

7.3.2 Result

This test was performed as part of the NCR 111 test (see documnet XMM-OM/UCSB/TR/0002).

7.4 Engineering modes 3, 4, 5 & 6

7.4.1 Test

Use the fast real-time PC simulator (see document XMM-OM/MSSL/SP/0207) to produce realtime data for the engineering mode.

An archive of the output data and the data is unpacked, displayed and analyzed.

7.4.2 Result

The output data displayed as expected.

See document XMM-OM/UCSB/TR/0002 for further analysis (part of the testing for NCR 131).

Tests performed in UK.

8 Windowed Exposure

See document XMM-OM/UCSB/TR/0002.

9 Many exposures

Used the VME detector simulator card with Cheng's multi-exposure scripts to run many different exposures with simulated and real observed data. Ran for many hours without a problem. See the multi-exposure part of document XMM-OM/UCSB/TR/0002.

Tests performed in USA.