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DIRECTORATE OF TECHNICAL & OPERATIONAL SUPPORT

XMM
System Validation Test - 3
(SVT-3)
Plan

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1. INTRODUCTION

The purpose of this document is to define the plan for the ESOC System Validation Test-3 (SVT-3) for the XMM mission. This test is used for validation of the XMM Science Control System (XSCS), and to terminate validation of the XMM Mission Control System (XMCS) , and the Flight Dynamics System (XFDS) which are part of the XMM Ground Segment and involves the use of the spacecraft and the Mission Operations Centre in a closed-loop configuration.

This document is defining the format and objectives of the SVT-3, as well as the required system configuration and testing constraints.

Throughout the mission preparation phase, the XMM Flight Control System and associated Ground Segment Facilities are developed on the basis of Project-supplied documentation and spacecraft characteristics, the latter one will be provided in form of the Satellite Data Base (SDB).

Development and subsequent functional testing of individual elements will be performed utilizing the XMM Spacecraft Simulator. However, it is necessary to validate the total integrated Flight Control System in a series of tests, the System Validation Tests (SVT's), requiring access to the XMM Flight Model (FM) spacecraft for closed-loop testing as follows:

a) Validation Test One (SVT-1) during a period of 6 days in March 1999.

b) Validation Test Two (SVT-2) during a period of 12 days in July 1999.

c) Validation Test Three (SVT-3) during a period of 10 days in October 1999. Present SVT-3 schedule is from 11 to 20 October 1999.

The following schedule times need to be agreed.

S/C switch-on	05:30 Kourou (08:30 GMT, 10:30 Darmstadt)
Briefing	05:45 Kourou (08:45 GMT, 10:45 Darmstadt)
Start daily test	06:00 Kourou (09:00 GMT, 11:00 Darmstadt)
End daily test	17;00 Kourou (20:00 GMT, 22:00 Darmstadt)
Debriefing	17:15 Kourou (20:15 GMT, 22:15 Darmstadt)
End daily SVT-3 activities	17:45 Kourou (20:45 GMT, 22:45 Darmstadt)

The entire XMM Ground Segment required for the SVT-3 will be under configuration control and documented in RD-1.

During the SVT's the XMM FM spacecraft will be located at KOUROU's BAF (Batiment d'Assemble Final) Facilities, requiring dedicated data and voice circuits to be established between KOUROU BAF and the OCC in Darmstadt.

This document provides the detailed outline for SVT-3 only.

1.2 Applicable Documents

AD-1 XMM System Validation Test (SVT) Plan Issue 2, Rev. 1, dated & July 1998 (XMM-MOC-PL-0015-SMD)

1.3 Reference Documents

RD-1 XMM System Validation Test SVT-3 Configuration, Issue 1(in preparation)
RD-2 XMM SVT-3 Test Procedures, Issue 1 (XMM-OPS-PR-0005 -TOS-OF) (in preparation)

2. OBJECTIVES

2.1 General

The System Validation Test Three (SVT-3) aims to confirm the interpretation of the spacecraft telemetry and telecommand characteristics as implemented in the XMM Science Control System (XSCS), the XMM Mission control System (XMCS), the Flight Dynamics System (XFDS) and to confirm the capability of the Ground Segment Facilities and Equipment to support the functions necessary for the conduct of Mission Operations.

Telemetry will be routed to the the Payload Monitoring Subsystem (PMS) and the Quick Look Analysis (QLA) which are part of the XMM Science Control System (XSCS).

During SVT-3 the XMM Flight Model (FM) satellite does consist of the Service Module (SVM) and the Payload Module (PLM).

It should be particularly noted that the SVT-3 is a SOC Validation Test and:

a) not a System Load Test
b) not a Ground Segment End to End Test
c) not a Spacecraft Integrated System Test
d) not an Instrument Functional Test.

2.2 Test Description

The SVT is an opportunity to access real-time telemetry data produced by the spacecraft and transmission of telecommands to the spacecraft, using a ground segment configuration which is as close as possible as that which will be used when the spacecraft transmits from space using its antenna.

Thus whilst the actual transmission of the TC and TM signal through space and uplink by a ground antenna, are bypassed, all other elements of the actual system are provided in a representative configuration.

Having access to real-time telemetry produced by the spacecraft, with the correct formatting, bit rates and transmission protocols enables the SVT-3:

a) To validate mission planning chain PHS, SGS and SOC interface to MOC.
b) To validate SOC TM monitoring and science processing for the available instruments modes using PMS and QLA.
c) To confirm the ability of the XSCS to receive, process and display data.
d) To validate, as far as possible, procedures and timelines in the XMM Flight Operations Plan

e) To verify that the product of the planning process (the schedule) is correctly uplinked and executed on-board the spacecraft.
f) To verify that the data is correctly extracted from TM packets and correctly interpreted.
g) To confirm the correctness and completeness of the XMM telemetry operations database.
h) To confirm the ability of the XMM Flight Dynamics System to receive, process and display ACC related and relevant housekeeping telemetry data correctly.
i) To verify that all of the XMM MCS software associated with telecommanding is correct.
j) To confirm the correctness of the XMM command operations database.
k) To confirm the ability of the ground station equipment to encode telecommands correctly.
l) To confirm the spacecraft reaction to commands to be in line with the XMM User Manual.
m) To confirm ESA's understanding of the XMM Users Manual as documented in the SVT procedures.
n) To confirm ESA's understanding of the Instrument Flight Procedures as documented in the SVT procedures.
o) To uplink all existing XMM telecommands.
p) To verify that the products of the on-board software maintenance facilities in both the MOC and the SOC can be correctly executed on-board the spacecraft.

2.3 Test Approach

To validate the XMCS and XSCS against the XMM spacecraft it is necessary to write special test description (Annex 3) and testing procedures to step each subsystem and instrument through each of its modes of operation and validate each available telecommand and telemetry parameter (RD-2). Some of these procedures may be later used in the Flight Operations Plan (FOP). However, most of the test procedures use procedures and timelines from the FOP - one of the SVT objectives being to validate the FOP (both nominal and contingency procedures) as far as possible.

The SVT procedures developed at ESOC by a combination of the Flight Control Team and Industry / Project experts will need to be tested on the XMM Simulator prior to approval for use on the spacecraft. This is primarily to ensure the procedures do not pose any danger to the spacecraft, and can suggest expected results, or even highlight areas where the tests could be improved.

It is intended to exercise all commands on both prime and redundant interfaces as far as this could effect the test results.
All redundancy switching within a subsystem will be exercised as far as possible within the constraints of the test set up.

Ideally all tests would be performed in isolation, however the time available for SVT is so limited that it may become necessary to perform some tests in parallel. This will only be attempted for tests that are believed to not interfere with one another. This scheduling will be discussed when the activities desired for SVT have been gathered, and are documented in section 7.2 (detailed Schedule)

It is necessary to perform the testing with the spacecraft in different configurations and Dornier will be expected to set the required configuration at the start of each test day (Annex 2). The desired configurations are still to be determined. Some sub-systems (e.g. the AOCS) or instruments will require extensive support from Special Check Out Equipment (SCOE) in order to generate telemetry representative of desired operational conditions (e.g. star tracker stimulation) or special support equipment to allow them to be operated under the test conditions. The specific requirements for SCOE support are still to be determined.

2.4 Test Limitations

The SVT involves the systematic validation of the telemetry and telecommand interfaces between the spacecraft platform, on one side, and the MOC on the other side. Ideally, all spacecraft platform and instrument telecommands will be exercised for both nominal and redundant modes.

It is not intended to exhaustively test all possible combinations of commands, or all allowable values of telecommand parameters. If an instrument or subsystem exhibits wildly different behaviour to that expected upon receiving certain values of a parameter, then this must be clearly flagged in the User Manual and in the comments on the test procedures returned to ESOC.

In principle, it is intended to send the complete set of telecommands to the spacecraft and instruments. It is expected that if a function cannot be exercised on the ground (such as thruster firing or mechanical release devices) it will be possible to bypass the actual operation (by disconnecting or disarming that unit). A positive means of telecommand execution verification (e.g. break-out box) which can be verbally reported to the OCC should be provided instead. The provision of break out points is to be specified.

For many different reasons, a number of telecommands and telemetry parameters might not be properly verifiable during SVT. XMM Project and Dornier must provide a list of functions, or commands that cannot be sent the SVT. These commands or functions will then be detailed in Annex 1.

3. TEST CONFIGURATIONS

3.1 Hardware

The hardware configuration and interfaces for SVT-3 will be as shown below in Figure 1:

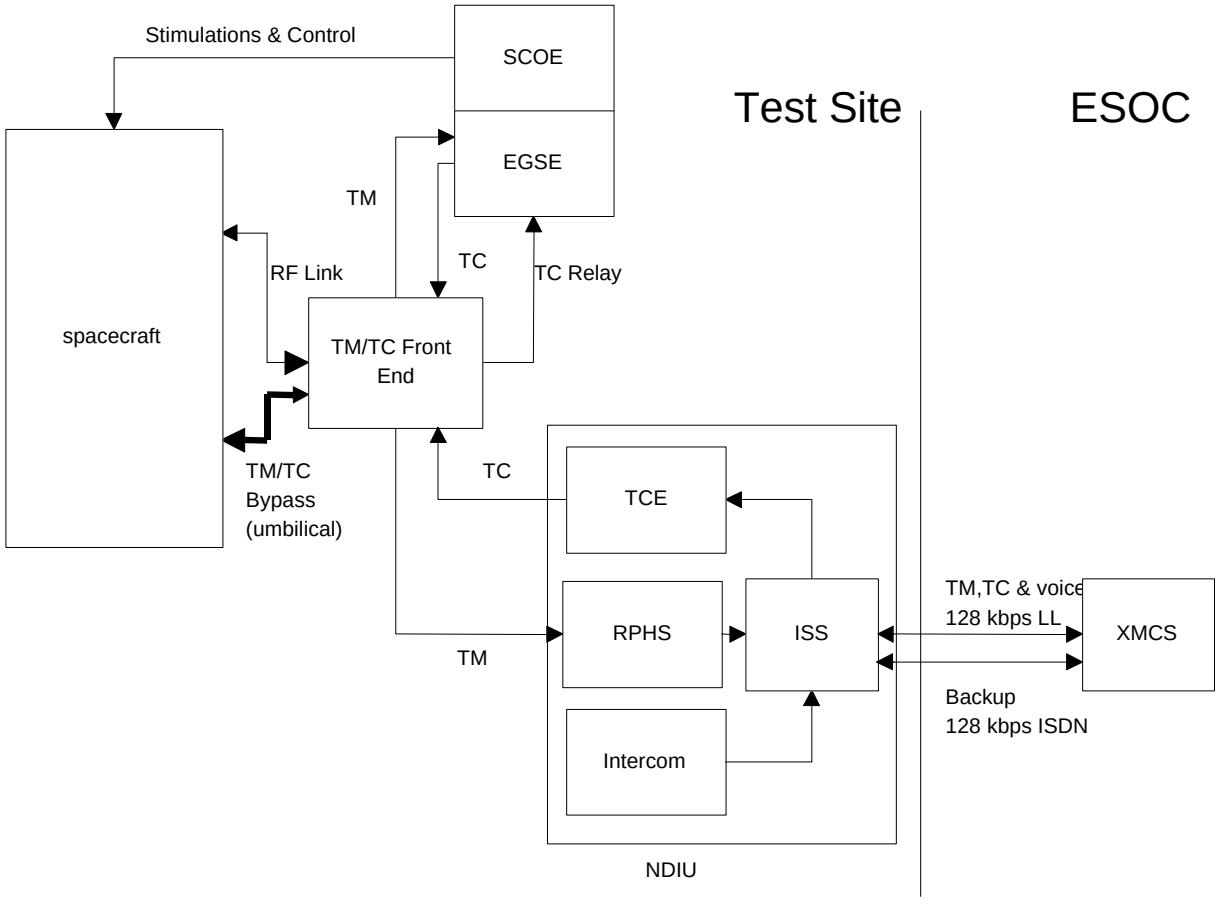

Figure 1: Hardware Configuration

ESOC will supply a Network Data Interface Unit (NDIU) which controls the traffic over the data links between the Test Site and ESOC.

The NDIU comprises a telecommand encoder (TCE), a telemetry processor (Return-link Packet Handling System, RPHS) and an X.25 node (Integrated Switching System, ISS). A voice intercom will be connected to the NDIU ISS and routed to the ESOC voice intercom systems. The NDIU will be physically accommodated in seven (TBC) 19" racks.

Dornier will provide access to the spacecraft via:

a) a hard-wired umbilical link (shown on the diagram above as TM/TC Bypass)
b) an RF front end (so that limited two-way tests may be performed via the RF link.)
c) Dornier will also provide connections from the EGSE to the NDIU via the interfaces defined in AD-1.

- Telecommand 50 Ohm BNC
- BSK modulated with subcarrier at 16 kHz
- Telemetry Serial data (NRZ-L) and clock
- Sub D 25 pin connector

- Signals according to CCITT V11

Dornier will provide a switch to allow telecommands to be sent by either the NDIU or the EGSE, but not both simultaneously. Commands from ESOC via the NDIU will be relayed to the Front End without any interaction or interference from the EGSE. No filtering or buffering of TC or TM shall be done by the EGSE or the interface unit.

When ESOC is commanding the spacecraft, the EGSE will lock on the bit stream, and will extract, process, display and store the telecommands.

DORNIER will provide the Electrical Ground Support Equipment (EGSE) and Special Checkout Equipment (SCOE) connected to the spacecraft.

3.2 Communications Lines

A 128 kbps ISDN Line provided by ESOC will be connected to the ISS in the NDIU. It will support all Telemetry, Telecommand and voice traffic simultaneously.

A second 128 kbps ISDN link also provided by ESOC will be made available if the 128 kbps the prime ISDN line is unavailable.

3.3 Back-up Public Telephone Numbers

In case of temporary communications problems, numbers for public telephone connections are required. These must be direct point-to-point connections that are dedicated exclusively to SVT matters.

ESTEC	tel	(++31) 71565 5453
	fax	(++31) 71565 4895
ESOC MOC	tel	(++49) 6151 90-3889
(XMM DCA)	fax	(++49) 6151 90-3881
KOUROU	tel	(++594) 335172
	fax	(++594) 335171

4. TEST EXECUTION

4.1 Management

The Project Team shall nominate a Test Director responsible for the overall duration of all SVT test activities on the spacecraft side, in particular responsible for:

- the satellite safety and health
- duration of test activities
- Spacecraft/EGSE configuration

The Test Director may be drawn from either the Project Team or the Dornier Team, and will draw on the support of Dornier AIV and Industry personnel. The Test Director will be present at the SVT site for every test. The Test Director will provide the interface with the ESOC Test Manager.

ESOC shall appoint a Test Manager, responsible for:

- management of test activities
- reporting ESOC readiness
- configuration/control of ground facilities

The Test Manager will coordinate all ESOC activities and will report to the Test Director. Each procedure run from ESOC will be controlled by a Test Conductor nominated by the Test Manager.

The Test Conductor will draw upon the support of relevant ESOC personnel, such as the XMM Flight Control Team, Flight Dynamics H/W and S/W support, as well as any Project / Industry experts who are on hand at ESOC whilst the SVT is being conducted.

ESOC will also assign a member of the Flight Control Team to be present at the test site to liaise between the AIV site and ESOC. This is especially important as it provides someone on-hand who is familiar with the SVT and Flight Operations Procedures.

One month before each SVT the ESOC Test Manager will distribute a detailed plan documenting the daily schedule for each test and containing the detailed test procedures for review. The plan will undergo a formal review cycle involving the XMM Project and Dornier and will be finalised prior to each test slot.

Procedures will include telecommands, timing, expected telemetry response, satellite configuration and set up of the supporting ground equipment required for the achievement of the detailed test objectives. In particular stimuli requirements will be provided, e.g. attitude, star tracker setting, power and battery stimulation etc. Generally each test will be executable as self standing test, making it important that the starting configuration of spacecraft and EGSE is correct.

Shortly before SVT-3 a Test Readiness Review should be held to confirm the following:

- all test procedures are reviewed;
- ESOC readiness;
- Spacecraft/EGSE readiness;
- Schedule agreement.

Test Readiness Review is scheduled at present for the 7th September at 14:00 local time; it will be held via Teleconference.

Only procedures which have been reviewed and agreed by the XMM Project and Dornier will be executed. Any deviations from the test procedures must be agreed by the Test Director and the ESOC Test Manager prior to implementation.

4.2 Voice Procedures

A dedicated voice intercom will be provided for co ordination between the test site (spacecraft + EGSE) and the OCC. Standard ESTRACK Voice Procedures shall be used when using the intercom. Note that any lengthy or detailed conversations should be carried out by public telephone in order to allow the voice intercom to remain available for co-ordination.

The Project/Dornier AIV Team will answer to the call sign “XMM-NDIU” and the ESOC Test Conductor will answer to the call sign “XMM-MCR”.

4.3 Test Conduct

At the start of each day, the ESOC Test Manager will conduct a briefing on the voice loop to establish contact with the test site and co ordinate the daily activities.

Prior to the start of each test day the spacecraft will be configured by DORNIER into a mode defined in the relevant SVT procedure. Special stimulation of satellite sensors or units may be necessary to allow validation of specific telemetry parameters. When necessary, this will be specified in the starting conditions for the test procedure. DORNIER will inform ESOC when the required status has been established. The Test Director will then inform ESOC that the agreed test may start, although responsibility for the health and safety of the spacecraft and instrument remains with the Test Director and overall control will rest with the XMM Project/DORNIER AIV Team.

After the tests are completed, the on-site AIV Team under the direction of the Test Director are responsible for safe configuration and switch-off of the satellite.

The test will be conducted from ESOC in the XMM DCR under the direction of a XMM Test Conductor supervised by the Test Manager. Commands will be passed through to the spacecraft without any processing by the EGSE, and TM will be routed directly to the NDIU or to the r.f. front end.

It is a requirement on the EGSE to archive TM; as well ESOC shall archive TM.
It is yet to be determined if the EGSE will screen the TCs coming from ESOC

The spacecraft will be monitored by DORNIER and ESOC at all times throughout the tests to ensure that hazardous situations do not arise. DORNIER and Instrument expert personnel present at the test site will be responsible for the operation of equipment associated with the EGSE items or Instrument test equipment set up. If any situation arises which could jeopardise the spacecraft safety, the Test Director will stop the commanding coming from ESOC and take immediate control to remedy the situation. In the case of the loss of the communications link with ESOC, the Test Director is to take over control of the spacecraft until the situation has been remedied.

The test procedures produced by ESOC will be followed on-line by all parties and any departure from these procedures will be implemented only after agreement between ESOC and the XMM Project/DORNIER. For simple changes like deletion or insertion of some telecommands verbal agreement over the voice loop (mark up changes on each side) will be sufficient. In the event of major changes the executed test will be abandoned and the S/C will be configured by DORNIER for the next test. ESOC will re-issue a new procedure (for the abandoned test) which will be implemented on a later date, after approval by Project/DORNIER.

In the event of problems occurring which result in loss of test time, ESOC/ESTEC/DORNIER will decide how to make optimum use of the remaining test period.

Any anomaly detected during the SVT will be recorded but not necessarily resolved during the test. Anomaly reports will be produced identifying problems and action will be taken off-line to resolve them. All anomalies detected during SVT-3 should ideally be rectified ASAP.

At the end of the testing period ESOC will announce that it has completed its activities and the commanding of the spacecraft will be handed back to the Project/Dornier Test Director. The ESOC Test Manager will then lead a debriefing over the voice loop.

4.4 Reporting

For any anomaly detected during the test an Anomaly Report (AR) will be produced, using a standard form. Any ARs that may require action outside ESOC (e.g. for an instrument) should be jointly dispositioned by ESOC/PROJECT/DORNIER before being forwarded to the actionee.

During execution of the tests a log of all major steps in the test procedures will be maintained, providing a list of the results achieved, a description of the problems encountered and a list of all ARs generated.

At the end of each test day the ESOC Test Manager will lead a debriefing of the days activities over the voice loop. All parties shall be represented. The new ARs will be discussed and then faxed through to the test site.

For each SVT-3 a Test Report will be produced with the following standard table of contents:

1. Introduction
2. Summary of Tests
3. Results Achieved
4. Problem Areas and Resolution
5. Conclusions
6. Anomaly Reports
7. List of all uplinked telecommands

The test report will be subject of a formal review by ESOC, PROJECT and Dornier. A review meeting will be organised in which the test results will be presented by ESOC and the status of the Anomaly Reports and related actions reviewed.

5. TEST OUTLINES

The test will comprise monitoring the spacecraft at KOUROU using the XMCS at ESOC via the established data links. The behaviour of the spacecraft will be observed on displays in the XMM MCR and the Test-SOC at ESOC after processing of the spacecraft telemetry data. Commands will be transmitted from the XMM MCR via the NDIU to the spacecraft.

5.1 Test Approach

It is planned to repeat some basic tests on the spacecraft, to continue functional testing on spacecraft, XMCS, XSCS and, if possible, to re-test items which did not function as expected during SVT-1 & SVT-2 and for which the Anomaly Report has been successfully closed by a corrective action. SVT 3 will also be used for investigation of those ARs that cannot be explained.

Furthermore, SVT-3 will be used to test the general handling of the spacecraft in a typical operational sequence (ground station pass) under the control of a mission planning schedule. This will require the FDS to generate a suitable PSF (Planning Skeleton File) and pass it via the MOC to the SOC. The SOC will need to be able to accept it, and return a POS to the FDS. The FDS must then generate the EPOS and APF for use in SVT. The planning does not need to be completed a full 14 days in advance and does not require a complete set of schedules to be generated.
In addition, on-board software maintenance procedures will be re-tested, including patching and dumping of OBDH software and instrument patch files handling for instruments not previously tested.

For any remaining time it is also planned to use the XMM Flight Operations Plan as the basis for the tests and to follow the nominal mission activities timelines. The redundant units configuration and recovery procedures will be tested.

There may be constraints related to the parallel operation of the instruments due to constraints from the ground equipment. Any such constraints must be identified.

5.2 Responsibilities

5.2.1 OCC Test Team

The OCC Test Team, headed by the Test Manager will be responsible for the overall conduct of the SVT-3.

Test procedures as documented and approved will be followed. Any departure from this will be implemented only after agreement with the Test Director.

The OCC Test Team will continously monitor the status of the spacecraft throughout the test period.

Responsibility for the NDIU rests with ESOC.

If problems are encountered during a test, resulting in loss of test time, the Test Conductor will decide how to reschedule outstanding tests to make optimum use of the remaining test time, with the concurrence of the Test Director.

5.2.2 PROJECT AIV Team

Responsibility for spacecraft health and safety rests with the Project AIV Team, under the leadership of the Test Director, who will ensure that the satellite hardware configuration is such that no dangerous spacecraft configuration may arise when following the agreed procedures.

The AIV Team will be responsible for operation of all the equipment associated with the spacecraft and check out system, the necessary preparation for each test, and the set up of the required starting conditions.

Control of the spacecraft is passed to OCC when the AIV Test Director advises the OCC Test Conductor that the EGSE and spacecraft configuration set up is completed.

The AIV Test Conductor will monitor the spacecraft telemetry through the EGSE throughout the tests and confirm the actual spacecraft status. If any situation arises where spacecraft safety is jeopardised, the AIV Test Conductor will take immediate full control of the spacecraft, i.e. for "Serious Problems" the S/C will be returned to a defined starting configuration by switching the S/C ‘OFF’ and then ‘0N’ again.

To this will be end, a permanent contact point within the AIV Team available for voice communication with the OCC.

At the end of each test period, control of the spacecraft will be returned to the AIV Team in an ‘as is' state which, it is hoped, will conform to a pre-defined configuration to permit DORNIER to depower the spacecraft as efficiently as possible.

6. TEST CONDUCT AND REPORTING

6.1 General

The tests will be conducted according to the defined SVT procedures which will be distributed prior to SVT_3.

In the event that an anomaly is detected during the course of the test, the details will be recorded on the Anomaly Report Form. Wherever possible, the test will proceed as planned, and the rectification of the anomaly will be addressed either between individual tests for simple anomalies, or at the completion of the whole SVT.

If the resolution of an anomaly is outside the scope tasks or responsibilities, the matter will be raised the Project so that a mutually satisfactory solution found.

A log of all major steps in the test procedures will be maintained and a Test Report will be prepared, providing a summary of the tests undertaken, the results of the tests, a description of any problems which arose, and a set of all Anomaly Report Forms for the tests in question.

7. TEST SCHEDULE

7.1 General

The activities to be performed during the course of SVT-3 will be the subject of some negotiation depending on the requirements on EGSE support, the built standard of the FM spacecraft, the selected sequence of test procedures and the time necessary to complete each procedure (to be determined by performing the proposed procedures using the XMM Simulator).

A detailed schedule of tests will be provided below and will be a schedule based on the use of minimum number of start and end configurations, to simplify the set up and depowering operations to be performed by DORNIER.

Any changes to the schedule will be re-issued separately.

The starting configurations identified as necessary to support the SVT-3 are defined Annex 2.

Anomalies identified in SVT-3 will have to be put under the responsibility of the Test Director and rectified ASAP.

7.2 Detailed Schedule

SVT-3 is scheduled to start on 11 October 1999 and will last for 10 days. SVT-3 will start daily at 10:00 local and terminate at 22:00 local.

Test Day	SVT Activities	Start Configuration	Test Conductor
Day 1 11-10-99 (*)	EPIC MOS1 RGS-1 EPIC RADMON PRIME	ROUTINE OPS configuration, FPA enabled, OM OFF.	F. GIANNINI K. ADAMSON E. SERPELL M. CASALE
Day 2 12-10-99 (*)	EPIC MOS2 RGS-2 EPIC RADMON RED.	ROUTINE OPS configuration, FPA enabled, OM OFF	F. GIANNINI K. ADAMSON E. SERPELL M. CASALE
Day 3 13-10-99 (*)	EPIC PN OM EPIC RADMON PRIME	ROUTINE OPS configuration, FPA enabled.	F. GIANNINI K. ADAMSON E. SERPELL M. CASALE
Day 4 14-10-99 (*)	EXTRA SCIENCE EXPOSURES (ALL INSTRUMENTS) EPIC RADMON PRIME	ROUTINE OPS configuration, FPA enabled, OM OFF	F. GIANNINI K. ADAMSON E. SERPELL M. CASALE
Day 5 15-10-99	MISSION PLAN TIMELINE PN FILTER TEST DHSS: STR L/D (1/2 H); ACC L/D (1/2 H); CDMU L/D (1/2 H)	ROUTINE OPS configuration	D. HEGER F. GIANNINI R. MAARSCH. A. MOORHOUSE E. SERPELL
Day 6 16-10-99	POWER THERMAL CMD TEST VMC_T1; VMC_T2 OBDH_T1;OBDH_T2;OBDH_T3 RF CMD TEST	ROUTINE OPS configuration	D. HEGER M. SEYMOURE R. MAARSCH.
Day 7 17-10-99	INSTRUMENTS CONTINGENCY	T.B.D.	F. GIANNINI
Day 8 18-10-99	S/C TESTS & AOCS: SC_T1; SC_T2 AOCS_T1; AOCS_T2; AOCS_T3	Pre_ROUTINE OPS configuration	O. OJANGUREN V. PAGNI
Day 9 19-10-99	AOCS: AOCS_T4; AOCS_T5; AOCS_T6	ROUTINE OPS configuration	O. OJANGUREN V. PAGNI
Day 10 20-10-99	PLATFORM / AOCS CONTINGENCY	T.B.D.	D. HEGER

(*) INSTRUMENT P.I. TEAMS ARE INVITED TO PARTICIPATE

8. ABBREVIATIONS / ACRONYMS

AIV	Assembly, Integration and Verification (Testing)
AOCS	Attitude and Orbit Control System
AR	Anomaly Report
DCR	Dedicated Control Room
EGSE	Electrical Ground Support Equipment
ESA	European Space Agency
ESOC	European Space Operations Centre
F/D	Flight Dynamics
FOP	Flight Operations Plan
ISDN	Integrated Services Digital Network
LIT	Listen-In Test
LL	Leased Line
MCR	Main Control Room
MOC	XMM Mission Operations Centre at ESOC Darmstadt
MOD	Mission Operations Department
NDIU	Network Data Interface Unit
OCC	Operations Control Centre
RF	Radio Frequency
S/C	Spacecraft
SCOE	Special Check-Out Equipment
SOC	XMM Science Operations Centre at VILSPA Villafranca
SVT	System Validation Test
TBD	To Be Defined
TBS	To Be Supplied
TC	Telecommand
TM	Telemetry
XMCS	XMM Mission Control System
XSCS	XMM Science Control System

ANNEX 1 RESTRICTED COMMANDS

It is ESOC's intention to exercise during SVT-3, every command that exists for the XMM Payload Module (PLM) and the Platform Module (SVM) commands that were not exercised in previous SVT's.

It is therefore necessary to ensure that for those commands considered to be "dangerous" when executed in the test environment, appropriate measures are taken to prevent damage to the spacecraft FM equipment when commands are executed. It is expected that DORNIER will ensure that the necessary measures are taken in accordance with the planned SVT-3 tests.

The measures necessary will be agreed with the Project and DORNIER and are to be recorded in this section of the plan.

ANNEX 2 STARTING CONFIGURATIONS

This Annex contains a description of the proposed starting configurations required to allow ESOC to perform the SVT-3.

The starting configurations for each test are specified in the Test Descriptions in ANNEX 3

The defined starting configurations are:

a) IPS in LEOP configuration.(as per Table 5.1 of XM-PR-MMB-0005)
b) IPS in Routine Operation Mode.(as per Table 5.2 of XM-PR-MMB-0005)
c) IPS in Pre-Launch configuration.

S/C configuration fine details will be discussed and agreed in advance (PX/DOR/ESOC) prior to the start of each specific test.

It shall be noted that the starting configurations chosen for AOCS do not reflect the satellite status, as it would be in any of the above modes.

It has to be noted that instruments will be in "warm" conditions during the tests.

ANNEX 3 TEST DESCRIPTIONS

This Annex contains a description of the proposed tests to be performed during SVT-3.

TEST DAY 1; 11:10:99

- **EPIC MOS 1**

Procedure ID	Description	Duration	Comments
FCP_EM1_8001	FIRST SWITCH ON	30 MINS	
FCP_EM1_	LOAD EMCR V.14	60 MINS	
FCP_EM1_8010	BASIC CONFIG – WARM	30 MINS	
FCP_EM1_8100	REFERENCE CONFIG – WARM	30 MINS	
FCP_EM1_	DIAGNOSTIC - WARM	60 MINS	
FCP_EM1_	ON GROUND SETUP - WARM	30 MINS	
FCP_EM1_	START OBS	10 MINS	TIMELINE EXECUTION
FCP_EM1_	FF IMAGING – WARM	60 MINS	TIMELINE EXECUTION
FCP_EM1_	SW IMAGING – WARM	60 MINS	TIMELINE EXECUTION
FCP_EM1_	FAST IMAGING - WARM	60 MINS	TIMELINE EXECUTION
FCP_EM1	END OBS	10 MINS	TIMELINE EXECUTION
FCP_EM1_8003	DOOR CLOSED SWITCH OFF	10 MINS	
FCP_EPN_	Untested command test	30 mins	
FCP_EPN_	Unusual packet test (HBR config in safe stby, go to prime for safe stby, etc)	30 mins	
FCP_EPN_	Substitution heater test (electronics and CCDs)	30 mins	
FCP_EPN_	Full EMDH memory upload test	1 hour	
FCP_EPN_	FW test	10 min	
FCP_EPN_	Heater tests	30 min	

- **REFLECTION GRATING SPECTROMETER_1**

Test ID: SVT_RGS1_01

Purpose: The aim of this test is exercise the Switch On and Commissioning Activities for the Reflection Grating Spectrometer 1 covering as many of the science modes as are possible in the warm ground environment using s/w versions S402. – IC F2.1, DPP V15U

Initial Configuration: The Spacecraft should be in ROUTINE OPS configuration, FPA enabled, RGS OFF.

Final Configuration: The Spacecraft should be in ROUTINE OPS configuration, FPA enabled, RGS OFF.

Stimuli Required: No external stimuli are required.

Estimated Time: Provisional Estimated duration is approximately 6+ hours.

Details: This test will cover the following sequence of activities on RGS1. OBSM must be available to support uplink of Memory Images.

- SVT_RG1_5000 SWITCH ON PRIME
- SVT_RG1_5010 KERNEL MODE CRITICAL FUNCTIONS
- SVT_RG1_5016 KERNEL MODE POWER SWITCHING
- SVT_RG1_5011 KERNEL MODE HEATER TEST
- SVT_RG1_5012 KERNEL MODE IC LOW LEVEL PATCHES
- SVT_RG1_5013 KERNEL MODE COLD RESET
- SVT_RG1_5014 TIME SYNCHRONISATION
- SVT_RG1_5015 KERNEL MODE IC CODE LOAD
- SVT_RG1_5020 SWITCH TO SETUP

- SVT_RG1_5040 CALCULATE CHECKSUM IC
- SVT_RG1_5021 LOAD DPP CODE
- SVT_RG1_5041 CALCULATE CHECKSUM DPP
- SVT_RG1_5030 SWITCH TO CONFIGURE
- SVT_RG1_5031 LOAD CSG CODE
- SVT_RG1_5042 CALCULATE CHECKSUM CSG
- SVT_RG1_5120 CHECK CCD BIAS SETTING

- SVT_RG1_5531 DIAG +TEST

- SVT_RG1_5532 SPEC +TEST (20 min exposure)
- SVT_RG1_5500 CCD CONNECTION TEST
- SVT_RG1_5032 LOAD CCD BIAS NOMINAL
- SVT_RG1_5533 HTR +TEST

Test ID: SVT_RGS1_02

Purpose: The aim of this test is exercise the Switch On and Commissioning Activities for the Reflection Grating Spectrometer 1 covering as many of the science modes as are possible in the warm ground environment using latest s/w versions S403. – IC F2.4, DPP V16A.

Initial Configuration: The Spacecraft should be in ROUTINE OPS configuration, FPA enabled, RGS OFF.

Final Configuration: The Spacecraft should be in ROUTINE OPS configuration, FPA enabled, RGS OFF.

Stimuli Required: No external stimuli are required.

Estimated Time: Provisional Estimated duration is approximately 5+ hours.

Details: This test will cover the following sequence of activities on RGS1. OBSM must be available to support uplink of Memory Images.

LOAD LATEST S/W VERSIONS

- SVT_RG1_5015 KERNEL MODE IC CODE LOAD
- SVT_RG1_5020 SWITCH TO SETUP

- SVT_RG1_5040 CALCULATE CHECKSUM IC
- SVT_RG1_5021 LOAD DPP CODE
- SVT_RG1_5041 CALCULATE CHECKSUM DPP
- SVT_RG1_5030 SWITCH TO CONFIGURE
- SVT_RG1_5035 CONFIGURE MODE COMMAND TEST
- SVT_RG1_5060 CONTROL HK
- SVT_RG1_5080 CONFIGURE MODE WARM RESET
- SVT_RG1_5020 SWITCH TO SETUP
- SVT_RG1_5030 SWITCH TO CONFIGURE
- SVT_RG1_5090 CHECK EMERGENCY STANDBY
- SVT_RG1_5020 SWITCH TO SETUP
- SVT_RG1_5030 SWITCH TO CONFIGURE
- SVT_RG1_5031 LOAD CSG CODE
- SVT_RG1_5042 CALCULATE CHECKSUM CSG
- SVT_RG1_5100 TELEMETRY CONTROL
- SVT_RG1_5110 RAE/RFC CONTROL
- SVT_RG1_5120 CHECK CCD BIAS SETTING

- SVT_RG1_5531 DIAG +TEST
- SVT_RG1_5532 SPEC +TEST (20 min exposure)
- SVT_RG1_5500 CCD CONNECTION TEST
- SVT_RG1_5032 LOAD CCD BIAS NOMINAL
- SVT_RG1_5533 HTR +TEST
- SVT_RG1_5001 SWITCH OFF PRIME
- SVT_RG1_5130 HEATER COARSE CONTROL

• EPIC RADMON PRIME

RM Test Session on SVT-3 : "RM Nominal branch"

Procedure ident	Procedure title	Duratic
FCP_ERM_0001	ERM (& EVALCOMP) Prime unit Switch on	20 min
FCP_ERM_5002	ERM Prime unit configuration (Commissioning)	30 min
FCP_ERM_5007	ERM Nominal Standby mode test (Commissioning)	5 min
FCP_ERM_5008	ERM Nominal Slow mode test (Commissioning)	20 min
FCP_ERM_5009	ERM Nominal Fast mode test (Commissioning)	20 min
FCP_ERM_5010	ERM Nominal Storage mode test (Commissioning)	30 min
FCP_ERM_0011 (at the end of the day)	ERM Prime unit Switch off	5 min

Total duration: about 2 h 15 m

TEST DAY 2; 12:10:99

- **EPIC MOS 2**

Procedure ID	Description	Duration	Comments
FCP_EM2_8001	FIRST SWITCH ON	30 MINS	
FCP_EM2_6601	VENT HOP TEST	30 MINS	
FCP_EM2_6501	DOOR HOP TEST	30 MINS	
FCP_EM2_	LOAD EMCR V.14	60 MINS	
FCP_EM2_8010	BASIC CONFIG – WARM	30 MINS	
FCP_EM2_8100	REFERENCE CONFIG – WARM	30 MINS	
FCP_EM2_	DIAGNOSTIC - WARM	60 MINS	
FCP_EM2_	ON GROUND SETUP - WARM	30 MINS	
FCP_EM2_	START OBS	10 MINS	TIMELINE EXECUTION
FCP_EM2_	FF IMAGING – WARM	60 MINS	TIMELINE EXECUTION
FCP_EM2_	SW IMAGING – WARM	60 MINS	TIMELINE EXECUTION
FCP_EM2_	FAST IMAGING - WARM	60 MINS	TIMELINE EXECUTION
FCP_EM2	END OBS	10 MINS	TIMELINE EXECUTION
FCP_EM2_8003	DOOR CLOSED SWITCH OFF	10 MINS	
FCP_EPN_	Untested commnad test	30 mins	
FCP_EPN_	Unusual packet test (HBR config in safe stby, go to prime for safe stby, etc)	30 mins	
FCP_EPN_	Substitution heater test (electronics and CCDs)	30 mins	
FCP_EPN_	Full EMDH memory upload test	1 hour	
FCP_EPN_	FW test	10 min	
FCP_EPN_	Heater tests	30 min	

- **REFLECTION GRATING SPECTROMETER 2**

Test ID: SVT_RGS2_01

Purpose: The aim of this test is exercise the Switch On and Commissioning Activities for the Reflection Grating Spectrometer 2 covering as many of the science modes as are possible in the warm ground environment using s/w versions S402. – IC F2.1, DPP V15U

Initial Configuration: The Spacecraft should be in ROUTINE OPS configuration, FPA enabled, RGS OFF.

Final Configuration: The Spacecraft should be in ROUTINE OPS configuration, FPA enabled, RGS OFF.

Stimuli Required: No external stimuli are required.

Estimated Time: Provisional Estimated duration is approximately 6 hours.

Details: This test will cover the following sequence of activities on RGS 2. OBSM must be available to support uplink of Memory Images. A subset of this sequence of events may be repeated with the latest versions of the onboard software.

- SVT_RG2_5000 SWITCH ON PRIME
- SVT_RG2_5010 KERNEL MODE CRITICAL FUNCTIONS
- SVT_RG2_5016 KERNEL MODE POWER SWITCHING
- SVT_RG2_5011 KERNEL MODE HEATER TEST
- SVT_RG2_5012 KERNEL MODE IC LOW LEVEL PATCHES
- SVT_RG2_5013 KERNEL MODE COLD RESET
- SVT_RG2_5014 TIME SYNCHRONISATION
- SVT_RG2_5015 KERNEL MODE IC CODE LOAD
- SVT_RG2_5020 SWITCH TO SETUP

- SVT_RG2_5040 CALCULATE CHECKSUM IC
- SVT_RG2_5021 LOAD DPP CODE
- SVT_RG2_5041 CALCULATE CHECKSUM DPP
- SVT_RG2_5030 SWITCH TO CONFIGURE
- SVT_RG2_5035 CONFIGURE MODE COMMAND TEST
- SVT_RG2_5060 CONTROL HK
- SVT_RG2_5080 CONFIGURE MODE WARM RESET
- SVT_RG2_5020 SWITCH TO SETUP

- SVT_RG2_5030 SWITCH TO CONFIGURE
- SVT_RG2_5090 CHECK EMERGENCY STANDBY
- SVT_RG2_5020 SWITCH TO SETUP
- SVT_RG2_5030 SWITCH TO CONFIGURE
- SVT_RG2_5031 LOAD CSG CODE
- SVT_RG2_5042 CALCULATE CHECKSUM CSG
- SVT_RG2_5100 TELEMETRY CONTROL
- SVT_RG2_5110 RAE/RFC CONTROL
- SVT_RG2_5160 CCD SWITCH ON/OFF
- SVT_RG2_5120 CHECK CCD BIAS SETTING

- SVT_RG2_5531 DIAG +TEST
- SVT_RG2_5532 SPEC +TEST (20 min exposure)
- SVT_RG2_5500 CCD CONNECTION TEST
- SVT_RG2_5032 LOAD CCD BIAS NOMINAL
- SVT_RG2_5533 HTR +TEST
- SVT_RG2_5534 TELEMETRY TEST

- SVT_RG2_5020 SWITCH TO SETUP
- SVT_RG2_5130 HEATER COARSE CONTROL

- SVT_RG2_5001 SWITCH OFF PRIME

Test ID: SVT_RGS2_02

Purpose: The aim of this test is exercise the Switch On and Commissioning Activities for the Reflection Grating Spectrometer 2 covering as many of the science modes as are possible in the warm ground environment using latest s/w versions S403. – IC F2.4, DPP V16A.

Initial Configuration: The Spacecraft should be in ROUTINE OPS configuration, FPA enabled, RGS OFF.

Final Configuration: The Spacecraft should be in ROUTINE OPS configuration, FPA enabled, RGS OFF.

Stimuli Required: No external stimuli are required.

Estimated Time: Provisional Estimated duration is approximately 5+ hours.

Details: This test will cover the following sequence of activities on RGS2. OBSM must be available to support uplink of Memory Images.

LOAD LATEST S/W VERSIONS

- SVT_RG2_5000 SWITCH ON PRIME
- SVT_RG2_5010 KERNEL MODE CRITICAL FUNCTIONS
- SVT_RG2_5015 KERNEL MODE IC CODE LOAD
- SVT_RG2_5020 SWITCH TO SETUP

- SVT_RG2_5040 CALCULATE CHECKSUM IC
- SVT_RG2_5021 LOAD DPP CODE
- SVT_RG2_5041 CALCULATE CHECKSUM DPP
- SVT_RG2_5030 SWITCH TO CONFIGURE
- SVT_RG2_5035 CONFIGURE MODE COMMAND TEST
- SVT_RG2_5060 CONTROL HK
- SVT_RG2_5080 CONFIGURE MODE WARM RESET
- SVT_RG2_5020 SWITCH TO SETUP
- SVT_RG2_5030 SWITCH TO CONFIGURE
- SVT_RG2_5090 CHECK EMERGENCY STANDBY
- SVT_RG2_5020 SWITCH TO SETUP
- SVT_RG2_5030 SWITCH TO CONFIGURE
- SVT_RG2_5031 LOAD CSG CODE
- SVT_RG2_5042 CALCULATE CHECKSUM CSG
- SVT_RG2_5100 TELEMETRY CONTROL
- SVT_RG2_5110 RAE/RFC CONTROL
- SVT_RG2_5120 CHECK CCD BIAS SETTING

- SVT_RG2_5531 DIAG +TEST
- SVT_RG2_5532 SPEC +TEST (20 min exposure)
- SVT_RG2_5500 CCD CONNECTION TEST
- SVT_RG2_5032 LOAD CCD BIAS NOMINAL
- SVT_RG2_5533 HTR +TEST
- SVT_RG2_5534 TELEMETRY TEST SVT_RG1_5130
- SVT_RG2_5130 HEATER COARSE CONTROL

- SVT_RG2_5001 SWITCH OFF PRIME

- **EPIC RADMON REDUNDANT**

RM Test Session on SVT-3 : "RM Redundant branch"

Procedure ident	Procedure title	Duratic
FCP_ERM_1001	ERM (& EVALCOMP) Redundant unit Switch on	20 min
FCP_ERM_6002	ERM Redundant unit configuration (Commissioning)	30 min
FCP_ERM_6007	ERM Redundant Standby mode test (Commissioning)	5 min
FCP_ERM_6008	ERM Redundant Slow mode test (Commissioning)	20 min
FCP_ERM_6009	ERM Redundant Fast mode test (Commissioning)	20 min
FCP_ERM_6010	ERM Redundant Storage mode test (Commissioning)	30 min
FCP_ERM_1011 (at the end of the day)	ERM Redundant unit Switch off	5 min

Total duration: about 2 h 15 m

TEST DAY 3; 13:10:99

- **EPIC PN**

Procedure ID	Description	Duration	Comments
FCP_EPN_8001	FIRST SWITCH ON	30 MINS	
FCP_EPN_8003	FIRST SWITCH OFF	10 MINS	
FCP_EPN_8011	DOOR CLOSED SWITCH ON	30 MINS	
FCP_EPN_6601	VENT HOP TEST	30 MINS	HAZARDOUS OPERATION
FCP_EPN_6501	DOOR HOP TEST	30 MINS	HAZARDOUS OPERATION
FCP_EPN_0010	CCDS OFF SETUP	30 MINS	
FCP_EPN_6100	FW TEST	30 MINS	
FCP_EPN_4200	HEATER TEST	30 MINS	HAZARDOUS OPERATION
FCP_EPN_0100	CCDS ON SETUP – WARM	60 MINS	HAZARDOUS OPERATION
FCP_EPN_	TEST IMAGE	30 MINS	
FCP_EPN	FILTER INTEGRITY TEST	TBC	TIMELINE EXECUTION
FCP_EPN_8013	DOOR CLOSED SWITCH OFF	10 MINS	
FCP_EPN_	Warm noise with back shift	2 hours	
FCP_EPN_	Untested commnad test	30 mins	
FCP_EPN_	Unusual packet test (HBR config in safe stby, go to prime for safe stby, etc)	30 mins	
FCP_EPN_	Substitution heater test (electronics and CCDs)	30 mins	
FCP_EPN_	Full EPDH, EPEA, EPCE memory upload test	1,5 hours	

- **OPTICAL MONITOR**

Test ID: SVT_OPM_01

Purpose: The aim of this test is exercise the Switch On and Commissioning Activities for the Optical Monitor covering as many of the science modes as possible on ground suing Flight software version FM –8.

Initial Configuration: The Spacecraft should be in ROUTINE OPS configuration, FPA enabled, OM OFF.

Final Configuration: The Spacecraft should be in ROUTINE OPS configuration, FPA enabled, OM OFF.

Stimuli Required: No external stimuli are required.

Estimated Time: Provisional Estimated duration is 6.5 + hours (FM8).

Details: This test will cover the following sequence of activities on OM. OBSM must be available to support uplink of patches, ICU and DPU Memory Images.

S/W Version FM 8

- SVT_OPM_5000 SWITCH ON REDUNDANT
- SVT_OPM_5020 TIME SYNCHRONISATION
- SVT_OPM_5010 BASIC MODE TEST
- SVT_OPM_5011 INTIAL MODE PATCHES
- SVT_OPM_5030 LOAD/DUMP ICU CODE
- SVT_OPM_5100 CHANGE TO FULL SAFE
- SVT_OPM_5020 TIME SYNCHRONISATION
- SVT_OPM_5060 DPU CHECK
- SVT_OPM_5061 LOAD DPU CODE
- SVT_OPM_5070 CLEAN SLATE
- SVT_OPM_5020 TIME SYNCHRONISATION
- SVT_OPM_5101 CHANGE TO IDLE MODE

- SVT_OPM_5202 FLOOD LEDs ON - LEVEL 1
- SVT_OPM_5500 PULSE HEIGHT DIST - ENG MODE 6 (30s)
- SVT_OPM_5501 CHANNEL BOUNDARY DATA - ENG MODE 3 (300s)
- SVT_OPM_5502 CENTROIDING CONF - ENG MODE 5 (1000s)

- SVT_OPM_5102 CHANGE TO SCIENCE MODE
- SVT_OPM_5600 EXPOSURE (BLOCKED) CGS, ACC+TRACK
- SVT_OPM_5504 FLATFIELD

- SVT_OPM_5110 END OF SCIENCE
- SVT_OPM_5101 CHANGE TO IDLE MODE
- SVT_OPM_5080 WARM RESET
- SVT_OPM_5020 TIME SYNCHRONISATION

Test ID: SVT_OPM_02

Purpose: The aim of this test is exercise the Switch On and Commissioning Activities for the Optical Monitor covering as many of the science modes as possible on ground suing Flight software version FM –9

Initial Configuration: The Spacecraft should be in ROUTINE OPS configuration, FPA enabled, OM OFF.

Final Configuration: The Spacecraft should be in ROUTINE OPS configuration, FPA enabled, OM OFF.

Stimuli Required: No external stimuli are required.

Estimated Time: Provisional Estimated duration is 6.5+ hours (FM9)

Details: This test will cover the following sequence of activities on OM. OBSM must be available to support uplink of patches, ICU and DPU Memory Images.

S/W Version FM 9

- SVT_OPM_5030 LOAD/DUMP ICU CODE
- SVT_OPM_5100 CHANGE TO FULL SAFE
- SVT_OPM_5020 TIME SYNCHRONISATION
- SVT_OPM_5050 OPERATIONAL MODE HEATER CONTROL TEST
- SVT_OPM_5051 OPERATIONAL MODE FILTER WHEEL TEST
- SVT_OPM_5060 DPU CHECK
- SVT_OPM_5061 LOAD/DUMP DPU CODE
- SVT_OPM_5070 CLEAN SLATE
- SVT_OPM_5020 TIME SYNCHRONISATION
- SVT_OPM_5101 CHANGE TO IDLE MODE
- SVT_OPM_5800 HIGH VOLTAGE INTERFACE VERIFICATION

- SVT_OPM_5202 FLOOD LEDs ON - LEVEL 1
- SVT_OPM_5500 PULSE HEIGHT DIST - ENG MODE 6 (30s)
- SVT_OPM_5501 CHANNEL BOUNDARY DATA - ENG MODE 3 (300s)
- SVT_OPM_5502 CENTROIDING CONF - ENG MODE 5 (1000s)
- SVT_OPM_5503 FULL FRAME HIGH RES (V) - ENG MODE 4 (8000s with 8 kbps)
- SVT_OPM_5102 CHANGE TO SCIENCE MODE
- SVT_OPM_5600 EXPOSURE (BLOCKED) CGS, ACC+TRACK
- SVT_OPM_5504 FLATFIELD

- SVT_OPM_5110 END OF SCIENCE
- SVT_OPM_5101 CHANGE TO IDLE MODE
- SVT_OPM_5005 SWITCH OFF REDUNDANT

- **EPIC RADMON PRIME**

Procedure ident	Procedure title	Duratic
FCP_ERM_0001	ERM (& EVALCOMP) Prime unit Switch on	10 min
FCP_ERM_5002	ERM Prime unit configuration (Commissioning)	15 min
FCP_ERM_0004	ERM Prime Slow mode selection (no TG)	5 min
FCP_ERM_0011 (at the end of the day)	ERM Prime unit Switch off	5 min

Total duration: about 30 min

TEST DAY 4; 14:10:99

- **EXTRA SCIENCE EXPOSURES (all instruments)**

- ~4/5 hour for all instruments setup inc code loading OM, RGSes, EMCRs (1.5h OM,1.5h RGS1, 1.5h RGS2, 1h p-n, 1.5h MOS1, 1.5h MOS2?)
- MOS1 CCDs off imaging (11 Kb/S)
- MOS2 CCDs off imaging (11 Kb/S)
- PN test image or small window with back shift (16 Kb/S)
- RGS1 Spec+test, HTR+test (5-10Kbps?)
- RGS2 Spec+test, HTR+test (5-10Kbps?)
- OM ENG4 (8000/11000 sec)
- RM slow mode all the time.
- 3-4 hours running full blast while OM is in ENG 4
- 1h switch all off

- **EPIC RADMON PRIME**

Procedure ident	Procedure title	Duratic
FCP_ERM_0001	ERM (& EVALCOMP) Prime unit Switch on	10 min
FCP_ERM_5002	ERM Prime unit configuration (Commissioning)	15 min
FCP_ERM_0004	ERM Prime Slow mode selection (no TG)	5 min
FCP_ERM_0011 (at the end of the day)	ERM Prime unit Switch off	5 min

Total duration: about 30 min

TEST DAY 5; 15:10:99

- **MISSION PLAN TIMELINE**

Two tests will be run according to the following test T/Ls.

SVT3_TIM_0003
SVT3_TIM_0004

- **PN FILTER TEST**

Procedure FCP_EPN_5300

- **DHSS TEST**

Procedure SVT3_OBS_0001: STR L/D (0.5 Hours)
Procedure SVT3_OBS_0002: ACC L/D (0.5 Hours)
Procedure SVT3_OBS_0003: CDMU L/D (0.5 Hours)

TEST DAY 6; 16:10:99

- **POWER TESTS**

The aim of SVT-3 will be to send as many of the remaining “P” and “T” commands as possible. Pre-defined Command Sequences will be used to send commands in groups.

Exercises have been broken down into groups according to the unit / functionality involved. All exercises will use first the Main commands, and repeat with Redundant commands, where required to complete command coverage.

In order to safely exercise instruments power commands all power relays in the FPA-PDU will be pre-set to the OPEN position, so that the instruments are never powered.

The S/C configuration for the Power tests will be as Nominal Operational Orbit, with the support of Pyro SCOE. It is recommended to disconnect MTCU A & B heater lines. Batteries will be simulated. Further details of S/C configuration will be discussed with Dornier.

1. Switch ON / OFF of S-PDU and F-PDU Auxiliary Converters; switch ON / OFF of S-PDU and F-PDU Timer Units – Main and Redundant commands

2. Reconfiguration from S-RTU / F-RTU A to B and back to A

3. Exercise of Battery Reconditioning relays; change of BCR and BAT charge rates; BDRs 1 –4 ON, OFF and STANDBY where appropriate

4. ENABLING / DISABLING of ECL & DNEL circuitry. Use of spacecraft-wide and unit-specific “ECL LOW” and “ECL HIGH” commands.

5. Redundant Bus – Unit Relay commands

6. S-PDU LCL switchings not previously covered – IMU 1, TRSP-TX1 if possible; SPARE LCLs not previously covered

7. F-PDU LCL switchings. Use of Power Relays to prevent instruments being powered up when LCL is switched ON

8. MTCU HLCLs B-side ON and OFF via both MTCU-A and MTCU-B

9. MTCU Vref commands, via MTCU-A and MTCU-B; MTCU TSW Timer commands

10. Remaining F-PDU Heater Switch commands: HLCLs and SPARE TSWs

11. PRU: CLOSE of all EED-Bs via PRU-A; remaining EED-As via A; close of all EED-As and EED-Bs via PRU-B; CLOSE of all THK-Bs via A; CLOSE of all THK-As and THK-Bs via PRU-B. Note none of the THKs / EEDs will ever be fired. EED Arming Relay will remain OPEN; FIRE commands will NOT be sent.

- **THERMAL COMMAND TEST**

This test will exercise the thermal commands not yet sent to the S/C

Procedure SVT3_EPS_0005

- **RF COMMAND TEST**

This test will exercise the RF commands not yet sent to the S/C

Procedure SVT3_RFT_0001

VMC TESTS

VMC_T1: Reception of the 1st and 2nd Set of VMC Images

Purpose: The aim of this test is to exercise the procedure for downlinking the 1st (separation) and the 2nd (SAG deployment) set of images from the VMC's

Initial Configuration: The Spacecraft should be in LEOP configuration (ISA) with the F-RTU powered on. The TSS and Sunshield deployment is not relevant for this test and does not need to be simulated.
Both VMC have to be powered (separation strap to be opened on request).

Final Configuration: The Spacecraft same as above however the VMC's both powered off.

Stimuli Required: Separation strap opening is to be simulated to power up the VMC timer. The protective cover of both VMC optics have to be removed.
S/C to be illuminated.

Estimated Time: Estimated duration is approximately 1 hour.

Details: Procedure FCP_VMC_0025 is to be used.

VMC_T2: VMC Image taking during LEOP

Purpose: The aim of this test is to exercise the procedure for taking further LEOP images with the VMC's.

Initial Configuration: The Spacecraft should be in LEOP configuration with the F-RTU powered on. Both VMC converters are to be off, however the separation switch for enabling the conver should be opened.

Final Configuration: The same as before the test. Both VMC's being powered off.

Stimuli Required: Separation strap open. Both protective covers of the VMC optics shall be removed. The s/c shall be illuminated.

Estimated Time: Estimated duration is approximately 1 hour.

Details: Procedure FCP_VMC_0026 is to be used.

- **OBDH TESTS**

OBDH_T1: Uplink all RTU acquisition tables

Purpose: The aim of this test is to verify the procedure for loading and all RTU tables.

Initial Configuration: The Spacecraft should be in LEOP configuration after the end of all deployments (final orbit config, with payload off).

Final Configuration: The same as before the test

Stimuli Required: No special stimuli required.

Estimated Time: Estimated duration is approximately 30 minutes

Details: Procedure FCP_DHS_0500 is to be used.

OBDH_T2: DHS_0002

Title: Test of DHS CPDU, RTU telecommands and repeat of failed SVT2 procedures

Description: The purpose of this test is to exercise those OBDH Telecommands that are routed via RTU's or the CPDUs which have not been tested in SVT 1 or 2 and are not exercised during any other tests of SVT3 (e.g. CTU switch over using CPDU-B). This test will also repeat those procedures identified as failed during SVT2

Initial Configuration: The Spacecraft should be in LEOP configuration after the end of all deployments (final orbit config, with payload off).

Final Configuration: The same as before the test

Stimuli Required: No special stimuli required.

Estimated Time: Estimated duration is approximately 1 hour

Details:

Note.- This test will be exercised if time permits.

OBDH_T3: Downlink of stored event pkts; CDMU switch over A to B; AD TC service recovery.

The procedures to be repeated from SVT2 are:

SVT2_DHS_2100 Downlink of stored event packets
SVT2_DHS_3000 CDMU switch-over 'A' to 'B'
SVT2_SYS_0010 AD TC service recovery

Note.- This tests will be exercised if time permits.

TEST DAY 7; 17:10:99

- **INSTRUMENTS CONTINGENCY DAY (TBD)**

TEST DAY 8; 18:10:99

- **S/C TESTS**

SC_T1: End-to-end tests of all deployment status switches.

Purpose: The aim of this test is to exercise the status switches.

Initial Configuration: The Spacecraft should be in Pre_Launch configuration (Details TBD)

Final Configuration: The Spacecraft should be in Pre_Launch configuration

Stimuli Required: None

Estimated Time: Provisional Estimated duration is approximately 1 hour.

Details:

SC_T2: Exercising all commands not sent to the S/C in previous SVT's

Purpose: The aim of this test is to exercise all commands not sent to the S/C in previous SVT's. It will check the completeness, integrity and behaviour of the Data Base at ESOC as well as the response of the XMCS/ XSCS.

Initial Configuration: The Spacecraft should be in IPS mode for LEOP.(Details TBD)

Final Configuration: The Spacecraft should be in IPS mode for LEOP.

Stimuli Required: Sun, dynamics and at least 1 bright star in the centre of the STR FoV

Estimated Time: Provisional Estimated duration is approximately 3 hours.

Details: This is considered an S/C test since not only AOCS cmds will be tested against the S/C.

- **AOCS**

AOCS_T1: Operations required to configure the AOCS for the operational orbit phase.

Purpose: The aim of this test is to configure the AOCS from Pre-Operational Orbit to the Operational orbit.

Initial Configuration: The Spacecraft should be in IPS mode as per table 5.1 (pages 5.1 to 5.4) of XM-PR_MMB-0005

Final Configuration: The Spacecraft should be in IPS mode for Operational Orbit.

Stimuli Required: Sun, dynamics and at least 1 bright star in the centre of the STR FoV

Estimated Time: Provisional Estimated duration is approximately 3 hours.

Details: Section 5.2 of XM-PR_MMB-0005

- Set up the basic failure detection criteria
- Set up the FDE Sunlight/Eclipse timer criteria switching and the FCE Sunlight/Eclipse Timer ESA mode controller switching.
- Set up the FDE Manoeuvre Timer criteria switching
- Set up the overall failure detection criteria such that the FDE Sunlight/Eclipse Timer and the Manoeuvre Timer perform the required switching
- Start the FDE and FCE Sunlight/Eclipse Timers (using a cluster of telecommands)
- Set up the ACC Sunlight/Eclipse Timer
- Power down all the IMUs
- Enable the IMU power off commands from the ACC to the CAE
- Enable the IMU power off commands from the FDE and CAE to accommodate the autonomy requirement
- Enable the autonomous momentum unloading function in the ACC.
- Change the ESA mode blind spot logic in the FCE from mode 4A to mode 4B.

AOCS_T2: Enabling and exercising the Autonomous Momentum Dump feature on XMM.

Purpose: The aim of this test is to enable and exercise the AMD (Autonomous Momentum Dumping) feature in XMM.

Initial Configuration: The Spacecraft should be in IPS mode for Normal Operations.

Final Configuration: The Spacecraft should be in IPS mode for Normal Operations.

Stimuli Required: Sun, dynamics and at least 1 bright star in the centre of the STR FoV

Estimated Time: Provisional Estimated duration is approximately 2 hours.

Details: Enabling of AMD is also the first operation needed to start the transition from the Pre-operational Orbit Phase to the Operational Orbit Phase. This test has as prerequisite the calculation of torques produced by each thruster in order to be able to set the thrusters on times that are used during the AMD. This has been done already in SVT_2. It is suggested to use the values calculated during SVT_2 and to exercise test after an upload ot the autonomous momentum dumping on-times IPF rrrr_nn_M.OTA; see FCP_AOC_0403.

AOCS_T3: Phase OO_002 to OO_005, Slew within the FoV of AAD_2 + Step Offset manoeuvre

Purpose: The aim of this test is to exercise the Manoeuvre timers and Sun steering Law (disable-enable) for Open Loop Slews in Operational Orbit Configuration.

Initial Configuration: The Spacecraft should be in IPS mode for Operational Orbit.

Final Configuration: The Spacecraft should be in IPS mode for Operational Orbit.

Stimuli Required: Sun, dynamics and at least 1 bright star in the centre of the STR FoV

Estimated Time: Provisional Estimated duration is approximately 2 hours.

Details: Follow FCP_AOC_2007. During SVT_2, IPF 0003_01_M.STP was generated and uplinked. The step offset seemed to have worked ok,but there is no full evidence because of the subsequent ESAM triggering.

TEST DAY 9; 19:10:99

- **AOCS**

AOCS_T4: ESAM

Purpose: The aim of this test is to exercise the ESAM recovery.

Initial Configuration: The Spacecraft should be in IPS mode for Operational Orbit

Final Configuration: The Spacecraft should be in IPS mode for Operational Orbit.

Stimuli Required: Sun, dynamics and at least 1 bright star in the centre of the STR FoV

Estimated Time: Provisional Estimated duration is approximately 5 hours.

Details: During SVT_2, ESAM recovery was tried unsuccessfully, since a critical command sequence failed. It is recommended to re-test ESAM recovery.

AOCS_T5: Phase OO_023: Spin_up in SSA Mode; Phase OO_24:AOCS inhibition following spin up in SSA Mode; Phase OO_025 AOCS re-activation into SSA Mode; Phase OO_026: despin and normal operation in SSA Mode.

Purpose: The aim of this test is to exercise the SPIN_UP, DESPIN and related operations.

Initial Configuration: The Spacecraft should be in IPS mode for Operational Orbit

Final Configuration: The Spacecraft should be in IPS mode for Operational Orbit.

Stimuli Required: Sun, dynamics and at least 1 bright star in the centre of the STR FoV

Estimated Time: Provisional Estimated duration is approximately 5 hours.

Details:

AOCS_T6: Phase OO_017 ; FSS / STR Misalignment Calibration + Calibration of FCE rate integrators

Purpose: The aim of this test is to exercise the FSS / STR misalignment calibration, while at the same time exercise the FCE rate integrators to evaluate drifts of IMUs.

Initial Configuration: The Spacecraft should be in IPS mode for LEOP Orbit.

Final Configuration: The Spacecraft should be in IPS mode for LEOP Orbit.

Stimuli Required: Sun, dynamics and at 5 bright stars in the STR FoV

Estimated Time: Provisional Estimated duration is approximately 1 hour.

Details:

TEST DAY 10; 20:10:99

- **PLATFORM & AOCS CONTINGENCY T.B.D.**