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	Subsystem/Office Electronics & DAQ Subsystem	

Document Title

LAT FSW Qualification Test Procedure:

CMDFNC_001: Soft Reset

CHANGE HISTORY LOG

Revision	Effective Date	Description of Changes
01	July 20, 2005	Initial Release.

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1. SCOPE

This document describes the procedure followed for qualification testing of the LAT FSW. This Qualification Test Procedure document describes one of the qualification tests executed to verify compliance with the requirements defined in the "Flight Software Specification – Level III" (LAT-SS-00399).

1.1 Test Suite

CMDFNC

The Test Suite is a logical grouping of a set of tests based on common functionalities and can be executed as a suite of tests in some order when the pre-conditions and post-conditions for each test within the suite have been met successfully.

This test procedure *CMDFNC_001* belongs in the Test Suite *CMDFNC* under the *FST* Project.

The CMDFNC tests verify that all LAT commands are executed through the 1553 interface with command execution and completion status reported in telemetry when command verification features are switched on. These tests also verify that the FSW validates commands and command parameters prior to command execution.

1.1.1 Relationship of CMDFNC_001 to Other Test Suites

Responsibility for verifying 1553 interface and telecommand validation and processing requirements is shared between the CMDFNC_001 test and the CMDFNC_003 test. In particular, CMDFNC_001 verifies that an external soft reset telecommand has the correct format, can be received over the 1553 interface and processed, and that a valid soft reset telecommand is correctly processed. By contrast, the CMDFNC_003 test tests the external soft reset telecommand when packet structures and parameters are *invalid*. The specific requirements shared between these test suites are identified in Section 1.3 below. See the CMDFNC_003 test procedure document for a complete discussion of how responsibility for testing the entire telecommand and telemetry interface is mapped among various qualification test suites.

The following PBC and MEM telecommands are used in this test.

PBC Telecommands

APID	FC	Cmd. Packet (L)	Description (L)
0x640	0	LPBCSTART	Boot code no-op
0x640	1	LPBCRESET	Warm reboot
0x640	2	LPBCERRDUMP	Error code pop

MEM Telecommands

0x644	4	LMEMLOADMEM	Memory Write
0x644	6	LMEMLOADREG	Processor Register Write

The following PBC telemetry is used in this test.

PBC Telemetry

APID	Tlm. Packet (L)	Description (L)
0x200	LBTHKP	Boot housekeeping telemetry

1.2 Test ID

CMDFNC_001

Test *CMDFNC_001* contains one main script, *CMDFNC_001*, which can be run when the SIU is in the Boot or Application Mode. This test verifies that the SIU performs a primary boot in response to an internal or external soft-reset command.

1.3 Requirement(s) Tested

The Qualification Test Procedure described herein is performed to verify that the FSW satisfies the following requirement(s), quoted from the Flight Software Specification – Level III.

The following requirement is fully verified in the CMDFNC_001 test.

Requirement Number	Requirement Name	Requirement	Level of Requirements Verification in This Test
5.3.1.4.1	Soft Reset	SIU FSW shall perform a primary boot in response to an internal or external soft-reset command.	Full

This test also shares verification of requirements with the CMDFNC_003 test. The requirements partially verified in this test are listed below.

Requirement Number	Requirement Name	Requirement	Level of Requirements Verification in This Test
5.2.2.1.1	Command, Telemetry, and Data Bus Protocol – SC	[2] (3.2.5.1.1) [3] (5.3.4) [4] (5.3.1) The SIU FSW shall exchange commands, low rate telemetry, time messages, and ancillary data with the SC C&DH across a MIL-STD-1553B bus, using the MIL-STD-1553B physical layer protocol.	Partial (Also see the CMDFNC_003 test)
5.2.2.1.3	Data Format	[1] (3.1.2.5.1.1) [2] (3.2.5.4.6) All data exchanged across the CTDB interface shall be formatted as CCSDS telecommand or telemetry packets, as specified in [7].	Partial (Also see the CMDFNC_003 test)
5.3.3.5	Command Format	[Derived] The FSW shall be able to process commands of the format described in [9].	Partial (Also see the CMDFNC_003 test)
5.3.3.9.1	Data Integrity Errors	[Derived] To reduce the chance of executing a corrupted command, the FSW shall validate commands prior to execution.	Partial (Also see the CMDFNC_003 test)
5.3.3.9.2	Parameter Validation	[Derived] The SIU FSW shall validate command parameters prior to execution.	Partial (Also see the CMDFNC_003 test)

If the requirement(s) quoted above cite external documents (e.g., "…Further details are provided in [11]"), consult LAT-SS-00399 for the list of citations.

2. DEFINITIONS AND ACRONYMS

The following terms, abbreviations, and acronyms are used in this document:

2.1 Definitions

Hz	Hertz, unit of frequency
V	Volt
W	Watt
s, sec	seconds

2.2 Acronyms

CAL	Calorimeter
EGSE	Electrical Ground Support Equipment
GASU	Global trigger Anti-collision Spacecraft Unit
PTR	Post Test Review
TEM	Tower Electronics Module
TKR	Tracker
TPS	Tower Power Supply
TRR	Test Readiness Review
QAE	Quality Assurance Engineer
TE	Test Engineer

3. REFERENCES

The list below provides documents that are to be used as references for this procedure:

3.1 Applicable Documents

Document Number	Description
SPECIFICATIONS	
LAT-SS-00399	LAT Flight Software Level III Specification
1196 EI-S46310-000	GLAST 1553 Bus Protocol Interface Control
LAT-TD-02659	LAT Flight Software Telecommand and Telemetry Formats
LAT-TD-0561	The Virtual Spacecraft (VSC)
PROCEDURES	
LAT-TD-TBD	CMDFNC_003: 1553 Interface and Command Functional Verification
PLANS	
LAT-MD-00039	Performance Assurance Implementation Plan
LAT-MD-00078	GLAST LAT System Safety Program Plan
LAT-MD-00404	LAT Contamination Control Plan
LAT-MD-00408	LAT Program Instrument Performance Verification Plan
LAT-SS-00296	T & DF Test Plan
LAT-TD-00297	LAT Electronics Test Plan
LAT-TD-00786	LAT Flight Software Test Plan
DRAWINGS	
N/A	
OTHER	
LAT-MD-00091	GLAST Quality Manual
LAT-MD-00471	Control of Nonconforming Product
LAT-MD-00472	Corrective and Preventative Action

4. REQUIREMENTS

This section lists the requirements that shall be followed during the LAT FSW Qualification Testing process.

The Performance Assurance Implementation Plan, LAT-MD-00039, shall be utilized to ensure that the products produced by the GLAST LAT project intended for design qualification, flight and critical ground support equipment usage meet the required levels of quality and functionality for their intended purposes.

The LAT Program Instrument Performance Verification Plan, LAT-MD-00408, shall be utilized to address the testing to be performed at the unit/subsystem and instrument level for flight qualification, proto-flight and acceptance testing phases. Also included are the necessary processes/procedures and systems assurance activities.

4.1 Test Data, Equipment and Software

This procedure shall follow the requirements found in the Control of Nonconforming Product, LAT-MD-00471. This document establishes the method to identify and control nonconforming product developed by the LAT project team.

4.2 Quality Assurance

This procedure shall follow the requirements found in the Corrective and Preventative Action document, LAT-MD-00472 and the GLAST Quality Manual, LAT-MD-00091.

The Corrective and Preventative Action document establishes the method to be used to initiate, implement, evaluate and record corrective and preventive actions. The GLAST Quality Manual defines the methods implemented by the GLAST LAT project to ensure consistent quality of all processes for procurement, design, development and production of flight hardware, flight software and all associated ground support equipment interfacing with flight hardware and software.

4.3 Safety

This procedure shall follow the requirements found in the GLAST LAT System Safety Program Plan, LAT-MD-00078. This document defines all phases of the LAT program including: design, development, fabrication, handling, transportation, storage, test, assembly and operation.

WARNING: When high voltages are present extreme care should be exercised.

4.4 Warnings, Cautions, and Notes

The following SAFETY ALERTS are intended to create awareness of the potential safety hazards and the steps that must be taken to avoid accidents. These same alerts are used throughout this document to identify specific hazards that may endanger personnel and/or equipment.

Identification of every conceivable hazardous situation is impossible. Therefore, all personnel have the responsibility to diligently exercise safe practices whenever exposed to this equipment.

WARNING: Indicates a potential hazardous situation which, if not avoided, could result in death or injury.

CAUTION: Indicates a potential hazardous situation which, if not avoided, could result in damage to equipment.

Note: Indicates a notification of information that is important, but not hazard related.

4.5 General Instructions

This qualification test procedure shall be conducted on a formal basis to its latest approved and released version. The designated Software QAE shall be notified 24 hours prior to the start of this procedure. Software QAE may monitor the execution of all or part of this procedure should they elect to do so.

The Test Engineer conducting this test shall read this document in its entirety and resolve any apparent ambiguities before beginning the procedures described herein.

Deviations from the procedures described in this document and breaks in hardware or software configuration can only be initiated by the Test Engineer, must be approved by QA, and must be documented in Appendix A.

Any nonconformance/defect/anomaly is to be reported in JIRA. Refer to the LAT Flight Software Test Plan LAT-TD-00786 for guidance. Do not alter or break configuration if a failure occurs. Notify Software Quality Assurance.

All success conditions for a test must be met for the test to pass.

5. SETUP

This section describes the hardware and software configuration used for the qualification test described later in this document. Any break from configuration or deviation from a particular procedure must be authorized by the Quality Assurance Engineer and documented in Appendix A.

5.1 Hardware Setup

The list below indicates the equipment that is used to execute the tests described in this document.

Hardware Unit	Manufacturer	GLAT Number (and Hardware Sub-Units by GLAT Number)	Firmware Version (where applicable)
Virtual Spacecraft (VSC)	SLAC		
Spacecraft Interface Unit (SIU)	SLAC		
1553 cables and couplers	SLAC		
Unix or Linux Host Establishes connection between VSC and the terminal from which the test is run.			
Power supply for SIU	SLAC		

The Figure below depicts the Testbed on which this qualification test is performed. The particular hardware units utilized in this test are itemized by GLAT number and firmware version in the preceding table.

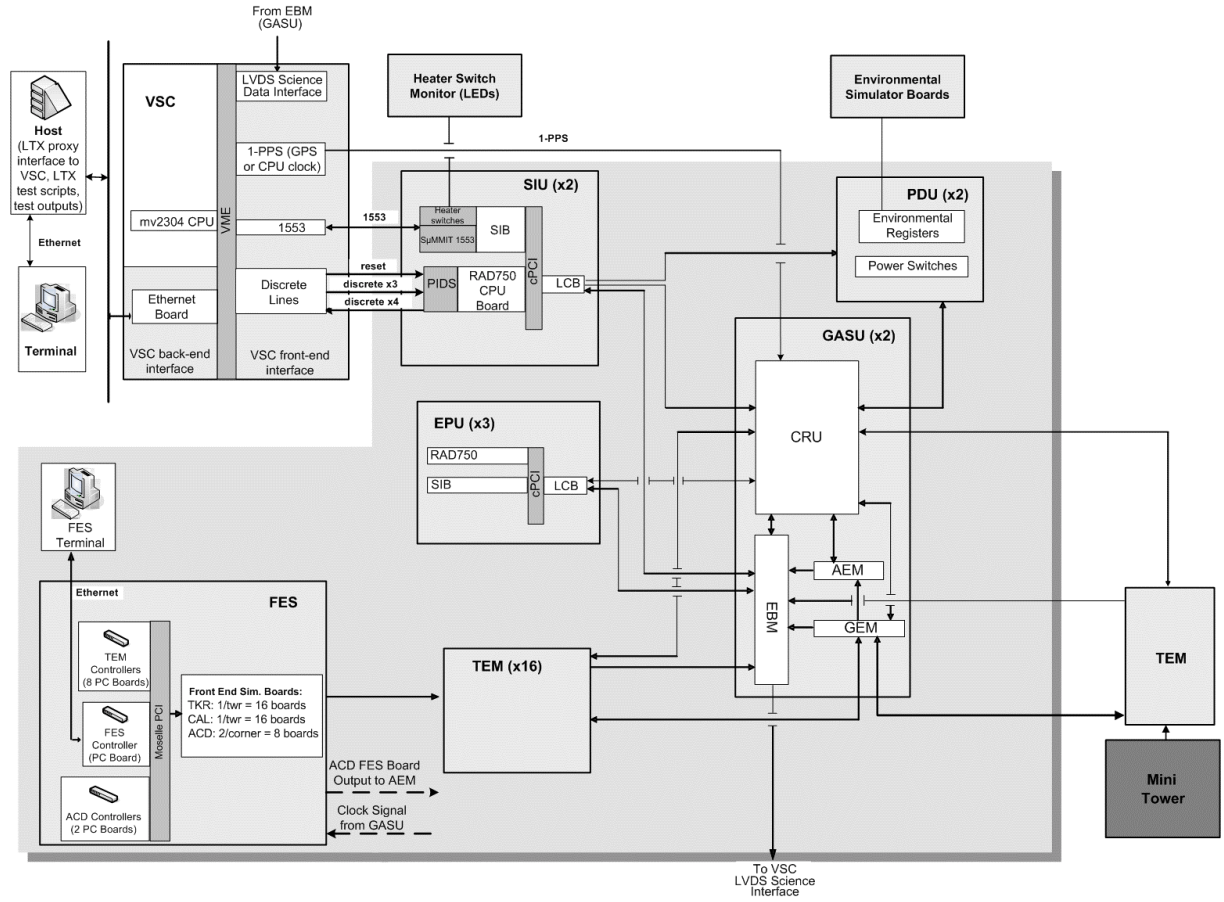

Figure 1. FSW Testbed

5.2 Software Setup

The software required to prepare for and execute the tests described in this Qualification Test Procedure document is itemized in this section.

5.2.1 Test Tools

The following table specifies the test executive used to run this qualification test, and identifies the other software tools used to support the execution of the test. The "Software Version Number" column identifies the version number of the test tool being used; alternatively, this column identifies the hardcopy attachment to this document that records the version of the tool being used (e.g., "Attachment 1"). The "Path to Attachment" column identifies the directory in which the electronic copy of any hardcopy attachment is saved (if applicable).

Software	Description of Software	Software Version Number (or Specify Attachment Number)	Path to Attachment (If Applicable)
LTX	LAT Test Executive		
VSC	Virtual Spacecraft system software		
VPI	VSC Python/Proxy Interface		

5.2.2 Test Scripts

The following table identifies the test scripts that are run to execute this qualification test. The "Script Version Number" column identifies which version of the script is being used; alternatively, this column identifies the hardcopy attachment to this document that records the version of the script being used (e.g., "Attachment 1"). The "Path to Attachment" column identifies the directory in which the electronic copy of any hardcopy attachment is saved (if applicable).

Test Script	Description of Test Script	Script Version Number (or Specify Attachment Number)	Path to Attachment (If Applicable)
CMDFNC_001.py	This script, the main test execution script, can be run in the Boot or Application Modes. It executes tests of SIU FSW. The script controls the entire test process, detecting the state of the hardware and FSW and advancing SIU through the different operational modes covered during the test.		

5.2.3 Flight Software

This qualification test is performed on a complete, integrated Candidate Release of FSW. All FSW libraries under test are final Flight Unit Candidate versions. The test described in this document is designed to evaluate the particular FSW packages and constituents listed in the following table; for clarity, only those constituents that are the focus of the test are listed below.

FSW Package	Constituent(s)
PBC	
CTDB	

FSW Package	Constituent(s)

The Candidate Release into which these FSW constituents are integrated is identified in the following table. The "Candidate Release Build Number" column specifies the build number of the FSW Candidate Release under test (e.g., "B0-0-1"). The "Candidate Release Attachment Number" column identifies which hardcopy attachment to this document confirms the name and version number of the full set of FSW packages and constituents used in the test (e.g., "Attachment 2"). The "Path to Attachment" column specifies where in the test repository an electronic copy of the hardcopy attachment has been saved.

Candidate Release Build Number	Candidate Release Attachment Number	Path to Attachment

5.3 Setup Validation

5.3.1 Hardware Validation

The following signatures confirm that the Test Engineer and Quality Assurance Engineer have verified the GLAT numbers, firmware version numbers, and the proper connection of all hardware listed in the table in Section 5.1.

Date	Time	Test Engineer	QAE

5.3.2 Software Validation

The Test Engineer performs the following procedure to validate the software setup for this qualification test and records completion of the setup validation steps in the space provided.

Step No.	Description of Step	Step Outcome
1	Record the version numbers of all test tools used to perform this qualification test in the table in Section 5.2.1	Complete/ Not Complete

Step No.	Description of Step	Step Outcome
2	Record the version numbers of all test scripts used to perform this qualification test in the table in Section 5.2.2	Complete/ Not Complete
2	Record the version numbers of the FSW constituents and the Candidate Release on which this test is performed in Section 5.2.3.	Complete/ Not Complete

The following signatures confirm that, using the procedure described in the previous table, the Test Engineer and Quality Assurance Engineer have verified that all versions of test support software, test scripts, and FSW constituents match those identified in Section 5.2.

_____	_____	_____	_____
Date	Time	Test Engineer	QAE

6. TEST PROCEDURE FOR CMDFNC_001

6.1 Test Objective

The following are the objectives of this test when tested in the Boot or Application Modes.

This test verifies that the SIU performs a primary boot in response to an internal or external soft-reset.

This Test Objective is broken down into the following Test Sub-Objectives.

Number	Test Sub-Objective
1	Verify all operations on SIU only.
2	Verify all operations in both the Boot and Application Modes
3	Verify all operations in both the Primary and Redundant SIU.
4	In the Boot and Application modes, verifies external reset by sending the LPBCRESET (Warm Reboot) command and noticing that the Boot Housekeeping Telemetry indicates that the code for COMMANDED reboot appears in the LPBCBOOTTYPE field.
5	In the Boot and Application modes, verifies internal reset with the Watchdog type of Reset. An LMEMLOADMEM command to the address 0xBF880058 with value 0 initiates this type of reset. Resultant Boot Housekeeping Telemetry is checked to verify that the code for WATCHDOG reboot appears in the LPBCBOOTTYPE field.
6	In the Boot and Application modes, verifies internal reset with the Exception type of Reset. An LMEMLOADREG command to the Register 0x9C with value 0x00000400 initiates this type of reset. Resultant Boot Housekeeping Telemetry is checked to verify that the EXCEPTION type of reboot occurred in the LPBCBOOTTYPE field.

As explained in Section 1, the CMDFNC_001 test is related to CMDFNC_003 test. CMDFNC_001 partially verifies some of the 1553 interface and command validation requirements, thus the following are also listed as Test Objectives and are verified in this test.

Number	Test Sub-Objective
7	Verify that the supported PBC Telecommands and Telemetry exchanged across the 1553 Interface conform to CCSDS packet structure:
8	Verify that the supported valid PBC Telecommands issued by S/C with LAT as their destination are received correctly and processed.

6.2 Test Input Files

The following table identifies all auxiliary files (e.g., Front End Simulator data files, GLEAM data files) used as inputs to this qualification test. Note that not all qualification tests use input data of this type. The "Input File Version Number" column identifies the version number of the auxiliary file being used; alternatively, this column identifies the hardcopy attachment to this document that records the version of the file being used (e.g., "Attachment 1"). The "Path to Attachment" column specifies where in the test repository an electronic copy of the hardcopy attachment has been saved.

Input File	Description of Input File	Input File Version Number (or Specify Attachment Number)	Path to Attachment (If Applicable)
N/A	N/A	N/A	N/A

6.3 Test Preparation

After the hardware and software setup has been validated, steps may be required to place the hardware and FSW in an operational mode in which the qualification test can be performed or otherwise complete preparations for the test to begin.

The Test Engineer carries out the following procedure to prepare for qualification tested and records completion of the test preparation steps in the space provided.

Step No.	Description of Step	Step Outcome
1	Confirm that the VSC is powered up.	Complete/ Not Complete

The Test Engineer and Quality Assurance Engineer verify that all test preparation steps are complete.

_____	_____	_____	_____
Date	Time	Test Engineer	QAE

6.4 Test Procedure and Test Analysis

This section describes the step by step procedure performed once the test preparation is complete. The test as well as analysis for each of the sub-objectives is conducted by the main test script CMDFNC_001.

The Test Engineer proceeds with the qualification test procedure itself, as described below, and records the outcome of each step during test execution. The outcome of each step is either "Complete" or "Not Complete" (for steps which involve no analysis or verification); or, "Pass" or "Fail" (for steps involved in verifying completion of test objectives and sub-objectives).

The test procedure is executed on the SIU, in both Boot Mode and Application Mode, in 3 major parts:

- SIU Boot Mode Testing
- SIU Application Mode Testing
- Review of Test Outputs

6.4.1 Part 1: SIU Boot Mode Testing

This part of the test exercises the external (commanded) and internal soft reset functionality of SIU FSW while the SIU is operating in Boot Mode.

Step No.	Description of Step	Step Outcome
1	At the test terminal, run the script CMDFNC_001 under LTX through the VSC with the following command: **$ ltx run CMDFNC_001**	Complete/ Not Complete

Step No.	Description of Step	Step Outcome
2	The test script determines whether the SIU FSW is currently operating in Boot Mode or Application Mode by detecting whether boot housekeeping or application housekeeping telemetry is being transmitted. Regardless of the SIU's current mode, the script sends the SIU the LPBCRESET telecommand to reboot the unit. The script then checks whether the SIU FSW is now operating in Boot Mode by detecting if boot housekeeping is being transmitted. If not, the script sends the LPBCRESET command and checks again. If the SIU FSW cannot be placed in Boot Mode, LTX prints an error message to the screen and exits, aborting the test. If the test is NOT aborted, mark "Complete" for the Step Outcome.	Complete/ Not Complete
3	With SIU FSW operating in Boot Mode, the test enters its Boot Mode Commanded Reset phase. The script saves the values in the LPBCSCRUBADDRHI (Hi Scrub Address), LPBCBOOTTYPE and the error fields being streamed in boot housekeeping, for later comparison. It also issues LPBCSTART which will set the LPBCLASTAPID, LPBCTCRECVCNT and LPBCTCACCCNT fields to non-zero values. Next, the test script sends the LPBCRESET telecommand to cause a soft reset of the SIU. The script then waits for the re-appearance of boot housekeeping telemetry, and examines the LPBCSCRUBADDRHI field, confirming that the Hi Scrub Address is re-initialized to 0x00000000. It is verified that the LPBCLASTAPID, LPBCTCRECVCNT and LPBCACCCNT fields are reset back to 0 by the LPBCRESET command. In addition, the script examines the LPBCBOOTTYPE field and confirms that the type of reboot is COMMANDED. The error fields are also examined and verified that they are initialized to 0. The script then issues the LPBCERRDUMP telecommand, then examines boot housekeeping telemetry to confirm that the LPBCTOTALERRCNT, LPBCQUEUEERRCNT, LPBCNEXTERRWORD, LPBCLASTERRWORD are all 0. In addition, the script checks the LPBCLASTAPID and LPBCLASTFUNC fields, confirming that APID 0x640 and function code 2 appear in the respective fields. Finally, the script sends the LPBCSTART telecommand (a no-op command) and confirms in boot housekeeping telemetry that LPBCLASTAPID is 0x640 and LPBCLASTFUNC are 0.	N/A
4	Next, the script executes its Boot Mode Watchdog Internal Reset phase. The script saves the values in the LPBCSCRUBADDRHI (Hi Scrub Address), LPBCTCRECVCNT, LPBCTCACCCNT and other fields being streamed in boot housekeeping telemetry, for later comparison. It also issues LPBCSTART command, which will set the LPBCLASTAPID, LPBCTCRECVCNT and LPBCTCACCCNT fields to non-zero values. The script executes a Watchdog reset of the SIU by sending an LMEMLOADMEM telecommand to address 0xBF880058 with value 0. Setting 0 in this address is designed to cause a Watchdog reset. The script waits for the re-appearance of boot housekeeping telemetry, then examines the LPBCBOOTTYPE field, confirming that a WATCHDOG reset was performed. In addition, the script examines the LPBCSCRUBADDRHI field, confirming that the address was re-initialized to 0x00000000. It is verified that the LPBCLASTAPID, LPBCTCRECVCNT and LPBCACCCNT fields are reset back to 0 by the LPBCRESET command. As described in Step 3, all fields that were used to see if a reset was performed are used in this step also to confirm the reset.	N/A

Step No.	Description of Step	Step Outcome
5	The test script then continues to its Boot Mode Exception Internal Reset phase. The script saves the values in the LPBCSCRUBADDRHI (Hi Scrub Address), LPBCTCRECVCNT, LPBCTCACCCNT and other fields being streamed in boot housekeeping telemetry, for later comparison. It also issues LPBCSTART which will set the LPBCLASTAPID, LPBCTCRECVCNT and LPBCTCACCCNT fields to non-zero values. The script executes an Exception reset of the SIU by sending an LMEMLOADREG telecommand to load the RAD750 CPU register at address 0x9C with a value of 0x00000400, which, as designed, initiates this type of reset. The script waits for the re-appearance of boot housekeeping telemetry, then examines the LPBCBOOTTYPE field, confirming that an EXCEPTION reset was performed. In addition, the script examines the LPBCSCRUBADDRHI field, confirming that the address was re-initialized to 0x00000000. It is verified that the LPBCLASTAPID, LPBCTCRECVCNT and LPBCACCCNT fields are reset back to 0 by the LPBCRESET command.	N/A
6	The script then continues to its Boot Mode PBC Command Data Format and Integrity Errors phase. The script confirms that the SIU boot housekeeping telemetry (LBTHKP) packets conform to the CCSDS standard. Note: In Step 3, the test verifies that the telecommands transmitted in that step have the proper data format and integrity, conforms to the CCSDS standard, and are correctly executed using the boot housekeeping telemetry fields described in that step. The complete analysis of the format and integrity of the LPBCRESET and LPBCSTART commands is recorded in the output log printed and reviewed at the end of the test.	N/A
7	The script next executes its Boot Mode PBC Command Format and Parameter Validation phase. Proper execution of telecommands that have the correct format and valid parameters is tested in Steps 3. The complete analysis of command parameter validation based on the results of Step 3 is recorded in the output log printed and reviewed at the end of the test.	N/A

6.4.2 Part 2: SIU Application Mode Testing

Once SIU Boot Mode testing is complete, the test continues to test external and internal soft reset functionality with the SIU operating in Application Mode.

Step No.	Description of Step	Step Outcome
8	The test script advances the SIU FSW to Application Mode by sending the LPBCRTOSEXEC telecommand, which commands the SIU to perform a secondary boot. The script checks that the SIU is operating in Application Mode by detecting whether Application Mode housekeeping telemetry is being transmitted. If not, the script sends the LPBCRTOSEXEC command and checks again. If the SIU FSW cannot be placed in Application Mode, LTX prints an error message to the screen and exits, aborting the test. If the test is NOT aborted, mark “Complete” for the Step Outcome.	Complete/ Not Complete
9	With SIU FSW operating in Application Mode, the test enters its Application Mode Commanded Reset phase. The test script sends the LPBCRESET telecommand to cause a soft reset of the SIU. The script then confirms that, after a period of several seconds, boot housekeeping telemetry (LBTHKP) packets are being received, signaling that the SIU FSW is operating in Boot Mode. The script examines the LPBCSCRUBADDRHI field, confirming that the Hi Scrub Address is re-initialized to 0x00000000. In addition, the script examines the LPBCBOOTTYPE field and confirms that the type of reboot is COMMANDED. The script then issues the LPBCERRDUMP telecommand, and examines boot housekeeping telemetry to confirm that the LPBCTOTALERRCNT, LPBCQUEUEERRCNT, LPBCNEXTERRWORD, LPBCLASTERRWORD are all 0. In addition, the script checks the LPBCLASTAPID and LPBCLASTFUNC fields, confirming that APID 0x640 and function code 2 appear in the respective fields. Finally, the script sends the LPBCSTART telecommand (a no-op command) and confirms in boot housekeeping telemetry that LPBCLASTAPID is 0x640 and LPBCLASTFUNC is 0.	N/A
10	The script sends the LPBCRTOSEXEC command to initiate secondary boot on the SIU. It waits to detect the appearance of Application Mode housekeeping telemetry.	N/A
11	Next, the script executes its Application Mode Watchdog Internal Reset phase. The script executes a Watchdog reset of the SIU by sending an LMEMLOADMEM telecommand to address 0xBF880058 with value 0. Setting this address in this way is designed to cause a Watchdog reset. The script then confirms that, after a period of several seconds, boot housekeeping telemetry (LBTHKP) packets are being received, signaling that the SIU FSW is now operating in Boot Mode. The script examines the LPBCBOOTTYPE field in boot housekeeping, confirming that a WATCHDOG reset was performed. In addition, the script examines the LPBCSCRUBADDRHI field, confirming that the address was re-initialized to 0x00000000.	N/A
12	The script sends the LPBCRTOSEXEC command to initiate secondary boot on the SIU. It waits to detect the appearance of Application Mode housekeeping telemetry.	N/A

Step No.	Description of Step	Step Outcome
13	The test script then continues to its Application Mode Exception Internal Reset phase. The script executes an Exception reset of the SIU by sending an LMEMLOADREG telecommand to load the RAD750 CPU register at address 0x9C with a value of 0x00000400, which, as designed, initiates this type of reset. The script waits for the re-appearance of boot housekeeping telemetry, then examines the LPBCBOOTTYPE field, confirming that an EXCEPTION reset was performed. In addition, the script examines the LPBCSCRUBADDRHI field, confirming that the address was re-initialized to 0x00000000.	N/A
14	If the SIU FSW cannot be placed in Boot Mode, LTX prints an error message to the screen and exits. Confirm that the script has placed the SIU in Boot Mode ready for another test.	Complete/ Not Complete

6.4.3 Part 3: Review of Test Outputs

This final part of the test covers detailed review of the CMDFNC_001 script output file and verification of PASS/FAIL criteria.

Step No.	Description of Step	Step Outcome
15	After the CMDFNC_001 test script has executed all parts of the test described in the previous sections, a dialogue box appears, reporting the directory location to which the test log output file is saved and instructing the test engineer to print the file for review. Print the log file, retrieve it from the printer, label it, and attach it to this test procedure. Record the label written on the printed log file: _____ Record the full path and filename of the soft copy of this output file: _____	Complete/ Not Complete

Step No.	Description of Step	Step Outcome
16	Review the log file. The file contains detailed outputs of the test script, with the names of telecommands being issued, telemetry packets being received, telemetry fields being examined, and status summaries of each major step in the test. The following log file entries appear interspersed through the log file, followed by "PASS" or "FAIL". **Boot Mode Commanded Reset** **Boot Mode Watchdog Internal Reset** **Boot Mode Exception Internal Reset** **Boot Mode PBC command Data Format and Integrity Errors** **Boot Mode PBC Command Format and Parameter Validation** **CMDFNC_001(1): Passed** Confirm that each of the above entries appears in the log file with a "PASS" indication. Successful completion of this step verifies all test objectives and sub-objectives for Boot Mode.	Pass/ Fail
17	Review the log file. The file contains detailed outputs of the test script, with the names of telecommands being issued, telemetry packets being received, telemetry fields being examined, and status summaries of each major step in the test. The following log file entries appear interspersed through the log file, followed by "PASS" or "FAIL". **Application Mode Commanded Reset** **Application Mode Watchdog Internal Reset** **Application Mode Exception Internal Reset** **CMDFNC_001(2): Passed** Confirm that each of the above entries appears in the log file with a "PASS" indication. Successful completion of this step verifies all test objectives and sub-objectives for Application Mode.	Pass/ Fail

Initial to confirm.

Date	Time	Test Engineer	QAE

7. TEST POST_CONDITIONS AND OVERALL OUTCOME

7.1 Test Post-Conditions

The following post-conditions are analyzed and verified by the test script:

No.	Post-Condition	Post-Condition Met? (Yes/No)
1	SIU in Boot Mode	
2	DAQ, GASU, PDU, and EPUs are powered off.	

The Test Engineer and Quality Assurance Engineer verify that all test post-conditions are met.

_____	_____	_____	_____
Date	Time	Test Engineer	QAE

7.2 Overall Outcome of CMDFNC_001

Based on the analysis of the test results as described in "Test Procedure and Test Analysis", the overall outcome of Test CMDFNC_001 is as follows:

☐ **Passed** - all of the expected outcomes for the test were confirmed

☐ **Failed** - one or more of the test outcomes were not confirmed

_____	_____	_____
Date	Test Engineer	QAE

8. CERTIFICATION

I certify that the information obtained under this test procedure is as represented and the information recorded in this document is complete and correct. Any deviations from test procedures described herein are identified in Appendix A.

_____	_____	_____
Date	Test Engineer (Print Name)	Test Engineer (Signature)

I certify that the information obtained through execution of this test procedure is as represented and the information recorded in this document is complete and correct. Execution of the test, storage of the results, and verification of outcomes were carried out in accordance with quality standards defined in the GLAST Quality Manual (LAT-MD-00091).

_____	_____	_____
Date	Software QA Engineer (Print Name)	Software QA Engineer (Sign)

I certify that the information obtained under this test procedure is as represented and the information recorded in this document is complete and correct. The test procedure, as designed and executed, does indeed verify that the FSW functionality under test satisfies the corresponding requirements from the Flight Software Specification – Level III.

_____	_____	_____
Date	FSW Manager (Print Name)	FSW Manager (Signature)

APPENDIX A: DEVIATIONS FROM THE QUALIFICATION TEST PROCEDURE

This section details any deviations from the hardware configuration, software configuration, or test procedure followed during the execution of the test or tests described in this Qualification Test Procedure document. All deviations from the approved procedure are agreed to by the Test Engineer and the Software Quality Engineer during the test execution session. All deviations must be reported during the Post Qualification Test Review, where their impact on the test results will be evaluated.

Hardware Deviations

Describe any deviations from the hardware configuration defined in Section 5.1. Name the hardware that was modified and describe the modifications. If hardware is *replaced* during execution of the test, name the replaced hardware, the manufacturer, and list an identification number (e.g., GLAT ID number).

Software Deviations

Describe any changes made to the software configuration under test or the software configuration used to support test execution, as defined in Section 5.2. Give version numbers of all FSW packages and test packages that were modified. Describe how the contents of the modified software load were verified. Describe these deviations for each test that was modified.

Procedural Deviations

Specify any deviations from the test procedure for the test being executed. If this document contains more than one test procedure, list the procedure by number (e.g., “CMDFNC_001”). List by number the steps modified or skipped. Provide a numbered sequence listing any added steps. Describe these deviations for each test that was modified.