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	Prepared by Marcus Ziegler Robert Johnson	Supersedes None
	Subsystem/Office Tracker Subsystem	
Document Title **Tracker MCM Environmental Acceptance Test and Burn-in Plan**		

Gamma Large Area Space Telescope (GLAST)
Large Area Telescope (LAT)

Tracker MCM Acceptance Test and Burn-in Plan

Change History Log

Revision	Effective Date	Description of Changes
1	July 31, 2003	Initial draft
2	Dec 5, 2003	Test vector descriptions added by Marcus
3	Dec 31, 2003	Edited and completed by R. Johnson

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1 PURPOSE AND SCOPE

This document describes acceptance-level environmental tests carried out on LAT Tracker MCMs after they have passed the acceptance functional tests described in LAT-TD-00249. Also described is the procedure for burn-in of the TMCMs before delivery to Italy for integration into trays. The plan and procedure documented herein is designed to assure that the handling, burn-in, and testing of the manufactured MCMs meet the requirements of the LAT Performance Assurance Implementation Plan (LAT-MD-39) and the LAT EEE Parts Plan (LAT-MD-99).

2 ACRONYMS AND DEFINITIONS

- EGSE Electrical Ground Support Equipment
- GLAST Gamma-ray Large Area Space Telescope mission
- LAT Large Area Telescope science instrument
- MCM Multi-Chip Module
- SSD Silicon Strip Detector
- TEM Tower Electronics Module
- TKR LAT Tracker Subsystem

3 APPLICABLE DOCUMENTS

[1] LAT-MD-00039 LAT Performance Assurance Implementation Plan
[2] LAT-MD-00099 LAT EEE Parts Plan
[3] LAT-TD-00153 Test Plan for the GLAST Tracker Front-End Electronics
[4] LAT-SS-00168 Tracker Readout Electronics Conceptual Design
[5] LAT-TD-00247 Tracker Front-end Readout ASIC Wafer Test Procedure
[6] LAT-TD-00248 Tracker Readout Controller ASIC Wafer Test Procedure
[7] LAT-TD-00249 LAT Tracker TMCM Test Procedure
[8] LAT-MD-00404 LAT Contamination Control Plan
[9] LAT-MD-00471 Control of Nonconforming Product
[10] LAT-SS-00778 LAT Environmental Test Specification
[11] LAT-PS-01971 LAT Tracker MCM Functional Test Procedure
[12] NASA-STD-8739.7 Electrostatic Discharge Control
[13] LAT-PR-02428 LAT Hardware Handling Procedures
[14] SLAC-I-720-0A29Z-001 SLAC Environmental Health and Safety Manual

4 INTRODUCTION

The Tracker front-end electronics for a single layer of SSDs are mounted on an MCM (see LAT-SS-168). Each MCM services 1536 detector strips, each of which requires an amplifier and discriminator. Hence there are 24 64-channel GTFE amplifier chips per MCM, plus two digital GTRC readout controller chips. LAT-TD-00153 describes the

overall test plan and flow for the Tracker front-end electronics. Complete functional testing and screening of the ASICs (prior to MCM assembly, see LAT-TD-00247 and LAT-TD-00248) and the MCMs (LAT-TD-00249) are completed prior to the procedures described herein. Completion of environmental tests and burn-in at the MCM level is important in order to avoid and minimize failures at the tray assembly level, which would risk loss of expensive SSDs.

Environmental acceptance testing of the TMCMs includes only a thermal cycling test, with ranges going at least 5 degrees beyond those limits specified in LAT-TD-00778 for the Tracker assembly. Both environmental acceptance test and burn-in of the TMCMs will be carried out at SLAC with a full tower-module of TMCMs (36) in the environmental chamber. Burn-in will immediately follow the thermal-cycling acceptance test, carried out in the same chambers with the same EGSE. Following the full set of thermal cycles and before burn-in, the full suite of electronics acceptance tests will be executed to the extent allowed by the burn-in system (for example, the cables will not allow cycling through the address set for each GTRC). The burn-in temperature level is limited by the poly-switches and hence will be 85°C for 168 hours. Above 85°C the polyswitches open, preventing operation of the MCM. During this entire burn-in period the clock is running and repeated test vectors are exercised through the system (register loading and readback and calibration/readout cycles). The burn-in system and EGSE are described in LAT-TD-00153.

Following completion of the burn-in procedure, the MCMs will finally be tested by the MCM test system (LAT-TD-00249 and LAT-PS-01971) before packaging and shipping to Italy for use in tray assembly.

5 CLEAN ROOM FACILITIES AND PROCEDURES

5.1 CONTAMINATION CONTROL

The burn-in procedures shall conform to the requirements imposed by the LAT contamination control plan, LAT-MD-404. All work will be carried out in the clean room of SLAC Building 33. All workers shall follow the posted clean-room procedures.

- MCMs normally should remain in their unopened black-plastic carrying cases throughout the test and burn-in procedures. They should arrive at SLAC with connector savers already attached, so making the required electrical connections should not normally require the carrying case to be opened.
- In the event that a case is opened, all nearby workers shall wear face masks.
- Any handling of an opened MCM shall be done with non-powdered nitrile clean-room gloves.

5.2 FLIGHT HARDWARE HANDLING

Handling of the MCMs shall at all times conform to the guidelines and requirements of Ref. [13]. In particular,

- MCMs shall not be hand carried across the clean-room or into and out of the clean-room. They shall be placed on rolling carts for all transfers.
- Appropriate torque-limiting wrenches shall be used on all fasteners involved in setting up a group of MCMs for this procedure.
- An MCM that is dropped shall be set aside pending review and an NCR shall be completed.
- ESD protection shall be maintained at all times, as detailed in Section 5.3.
- It should not normally be necessary to install or remove connectors savers on the MCMs during this procedure. However, should it be necessary to replace a connector saver, a torque-limiting wrench shall be used, calibrated to the torque requirements specified on the MCM assembly drawing. All mates and demates to the flight MCMs shall be logged.

5.3 ESD PROTECTION

The facility and procedures satisfy ESD protection requirements as specified in NASA-STD-8739.7. ESD procedures posted at the clean-room entrance in Building 33 shall be strictly followed.

- The clean-room area surrounding the thermal chamber used for burn-in shall be clearly posted as an ESD controlled area during all burn-in activity. Only ESD certified personnel may enter the ESD controlled areas. All other non-certified ESD personnel must be escorted by ESD certified personnel.
- Grounded static dissipative mats shall be present on the tabletops in the work area.
- All equipment, including the probe station, computer, VME crate, auxiliary electronics, and static dissipative mats, shall be grounded to the 3rd terminal ground of the electrical outlet.
- An ESD protecting wrist strap shall be put on prior to entering the clean room and shall be verified by the wrist-strap checker prior to handling any MCMs.
- The operator shall be grounded by the wrist strap at all times when handling the MCMs. The grounding connection shall be just under the front edge of the work table. Wrist straps shall be continuously grounded when transferring MCMs to and from the thermal chamber.
- MCMs should always be inside their static-dissipative black plastic carrying cases. Nevertheless, connector savers protrude from those cases, making the assemblies highly sensitive to ESD (most of the connector pins go directly to the I/O ports on the GTRC chips). Therefore, MCMs shall always be stored and transported inside of closed static-dissipative bags. Workers shall be properly grounded via wrist straps when removing MCMs from the bags or replacing them into the bags.

5.4 PERSONNEL TRAINING

All personnel working in the clean room during LAT Tracker Burn-in testing shall have completed a training tutorial in clean-room procedures and in ESD protection and be ESD certified. All personnel operating the burn-in system shall be trained by the SCIPP and SLAC experts on the system and shall complete a practice session on non-flight MCMs prior to working with flight MCMs.

5.5 HEALTH AND SAFETY

All testing and burn-in shall be conducted in compliance with the SLAC EH&S manual [14].

6 ACCEPTANCE TEST AND BURN-IN HARDWARE

The hardware used for acceptance test and burn-in is listed in Table 1. All equipment used for analog measurements shall be calibrated not less than one year prior to use on flight hardware.

The hardware configuration of the MCM test and burn-in systems shall be fixed prior to flight production and listed in the log attached to the equipment rack. Any change to the configuration shall be approved by the Tracker subsystem manager or delegated authority

Table 1. Hardware used for LAT Tracker MCM burn-in.

Item	Model	Calibrated	Description
Thermal Chamber	Blue-M Electric Model # ETC-04D-C	Due Dec. 5, 2004	Temperature range –73 °C to +190°C. Humidity control by flow of dry nitrogen.
Thermal-chamber PC controller	Dell		Computer for Downloading Thermal Chamber temperature profiles
LAT EGSE system	SLAC custom design		Includes a VME crate with embedded processor and SLAC custom modules, 28V power supply, TEM and power unit, cables, and standard software.
PC	Dell		Computer for data acquisition (controlling the EGSE)
8 flex-circuit cables	LAT-DS-00335		A pair of cables connect 9 MCMs to two ports of the TEM, via cable jumpers.
8 cable jumpers	Custom		Short (about 30 cm) twist-pair cables with AMP connectors on one end and Micro-D connectors on the other, to interface between the flex-circuit cables and the TEM
MCM support fixture and fasteners	Custom		4 bent aluminum boxes plus lid, to support the 36 MCMs inside the thermal chamber
MCM test system	See LAT-DS-00249	See log on the rack.	Complete system for final electrical testing of MCMs after burn-in.

and verified on a non-flight MCM prior to use on flight hardware. Each hardware configuration shall be given a version number, with all changes with respect to the previous configuration noted in the log. The current hardware configuration version number shall be noted on the traveler for each MCM.

7 BURN-IN SYSTEM SOFTWARE AND TEST SCRIPTS

All software for flight MCM environmental testing and burn-in shall be maintained under configuration control within the CVS repository. Any change to the software configuration shall be approved by the Tracker subsystem manager or delegated authority and verified on a non-flight MCM prior to use on flight hardware. The software version numbers in use shall be noted on the traveler for each MCM. There will be two such numbers: one for the thermal chamber control software and another for the test scripts. In addition, the release number for the LAT EGSE software shall be noted on the traveler.

7.1 THERMAL CHAMBER CONTROL SOFTWARE AND GUI

LL-100 tools set parameters that configure controller functions and parameters, such as PID, necessary for controller operation. The tools create program patterns/recipes used in the program controller. They download parameters or program patterns/recipe data into the controller or upload parameters contained in the controller into a PC.

The GUI saves parameters created by the LL-100 tool, or parameters uploaded from a controller, onto the hard disk of a PC.

7.2 TEST SCRIPTS

The test scripts operate in the standard LAT TEM-based EGSE system. They consist of a set of test vectors that exercise all of the MCM functionality in each of the 36 MCMs. The tests can be executed a single time to return a quality status for each MCM, or they can be executed repeatedly, as is done throughout the burn-in.

7.3 TRACKER MCM FUNCTIONALITY TESTS

7.3.1 Objective

The objective of the functionality tests is to verify that the Tracker MCM responds correctly to all command sequences from the TEM.

7.3.2 Test Configuration

The data acquisition system is used to select commands to send to the Tracker and check the data and trigger signals returned by the Tracker. Latching of the Tracker data is triggered by command from the test sequence running in the data acquisition system.

7.3.3 Power Consumption Test

The power drawn by the 3 low-voltage supplies and the bias supply is measured and recorded. The operator turns on the power to the TEM/PS and records the voltages and

current draws on the traveler, including all of DVDD, AVDDA, AVDDB, and Detector Bias (120 V). The values must be within tolerances for the testing to continue. See Table 2 for the current limits of a single MCM. The values must be multiplied by the number of MCMs connected to the TEM/PS to derive the applicable ranges.

Table 2. Power specifications for an MCM. Multiply by the number of MCMs to derive the limits for a given setup.

Power Supply	Nominal Voltage at the TEM	Minimum Current	Maximum Current
AVDDA	1.5 V	47 mA	53 mA
AVDDB	2.6 V	10 mA	16 mA
DVDD	2.6 V	47 mA	55 mA
Bias	120 V	0	100 nA

7.3.4 Listing of Functionality Tests

7.3.4.1 GTRC configuration register and readback.

The GTRC chips are sequentially addressed and their configuration registers loaded with a bit pattern. All five load-enable bits of the GTRC chips are set. Each time the GTRC configuration register is read back and checked for errors. The test is repeated with the complement of the bit pattern.

Test	Purpose	Specification	Prerequisite	Configuration
BI201	Test loading and readback of the controller-chip configuration register	LAT-SS-00152 §8.1, §8.2, §8.12 LAT-TD-00170	Power consumption measurement	In test fixture, connected to TEM and flight-like power supplies, powered, clock on.

7.3.4.2 GTRC configuration register load and readback in broadcast mode.

The GTRC chips are addressed with a broadcast address for writing and their configuration registers are loaded with a bit pattern. Then the GTRC chips are sequentially addressed and their configuration registers are read back and checked for errors. The test is repeated with the complement of the bit pattern.

Test	Purpose	Specification	Prerequisite	Configuration
BI202	Test loading and readback of the controller-chip configuration register in broadcast mode.	LAT-SS-00152 §8.1, §8.2, §8.12 LAT-TD-00170	BI201	In test fixture, connected to TEM and flight-like power supplies, powered, clock on.

7.3.4.3 Selected GTFE configuration register load and readback

The GTFE chips are sequentially addressed via the GTRC on the Low side, and their mask and DAC registers are sequentially loaded with a bit pattern. In each case the register then is read back and checked for errors. Also the mode register is read back and checked for errors. The mode register then is loaded to switch the chips to the High side GTRC. The mask and DAC registers are loaded with the complement bit pattern and read back via the High GTRC and checked. Also the content of the mode register is checked.

Test	Purpose	Specification	Prerequisite	Configuration
BI203	Test loading and readback of the 5 readout-chip configuration registers.	LAT-SS-00152 §8.1, §8.2, §8.8, §8.10, §7.6, §9.1, §9.4, §14.1 LAT-TD-00169	Bi202	In test fixture, connected to TEM and flight-like power supplies, powered, clock on.

7.3.4.4 Broadcast GTFE configuration register load and readback

The GTFE chips are addressed with a broadcast address via the GTRC on the Low side and their mask and DAC registers are sequentially loaded with a bit pattern. In each case the register then is read back and checked for errors. Here the GTFE chips are sequentially addressed. Also the mode register is read back and checked for errors. The mode register is loaded to switch the chips to the High side GTRC. The mask and DAC registers then are loaded with the complement bit pattern and read back via the High GTRC and checked. Also the content of the mode register is checked.

Test	Purpose	Specification	Prerequisite	Configuration
BI204	Test loading in broadcast and readback of the 5 readout-chip configuration registers.	LAT-SS-00152 §8.1, §8.2, §8.8, §8.10, §7.6, §9.1, §9.4, §14.1 LAT-TD-00169	BI203	In test fixture, connected to TEM and flight-like power supplies, powered, clock on.

7.3.4.5 Soft reset

Broadcast mode is used to load the GTRC configuration register with non-default bit pattern. The reset command is sent to the GTRC chips. Then all of the configuration registers are read back. The software checks that the register information received corresponds to the power-on default.

Test	Purpose	Specification	Prerequisite	Configuration
BI205	Test the reset command is sent to the GTRC chips and the power-on default values are checked.	LAT-SS-00152 §8.5, §8.6 LAT-TD-00169 LAT-TD-00170	BI204	In test fixture, connected to TEM and flight-like power supplies, powered, clock on.

7.3.4.6 Readout sequence with charge-injection

The GTFE chips all are configured to read out to the Low side. The calibration and trigger mask registers are set to enable two channels on each GTFE. The data mask is enabled for all channels. Trigger signals and readout commands are sent. The resulting data are acquired and checked for broken or misfiring channels. The test is repeated to read out all GTFE chips from the High side.

Test	Purpose	Specification	Prerequisite	Configuration
BI206	Test the readout sequence. Identify dead channels and chips.	LAT-SS-00152 §6, §8, §18 LAT-TD-00168 LAT-TD-00169 LAT-TD-00170	BI205	In test fixture, connected to TEM and flight-like power supplies, powered, clock on.

7.3.4.7 Readout sequence with TOT measurement

The GTFE chips all are configured to read out to the Low side. The calibration and trigger mask registers are set to enable one channel on the TMCM board. The data mask is enabled for all channels. Trigger signals and readout commands are sent. The resulting data are acquired and checked for broken or misfiring channels. A check made whether the corresponding GTRC chip delivers a TOT that is not zero. The test is repeated to read out all GTFE chips from the High side.

Test	Purpose	Specification	Prerequisite	Configuration
BI207	Test the internal calibration system including TOT measurement. Identify dead channels and chips.	LAT-SS-00152 §8, §9, §18 LAT-TD-00168 LAT-TD-00169 LAT-TD-00170	TEBI206	In test fixture, connected to TEM and flight-like power supplies, powered, clock on, biased, light tight.

8 TRAVELER

See the Appendix for an example of the paper traveler to be completed during MCM acceptance testing and burn-in. The traveler shall be started for each MCM, or group of up to 36 MCMs, as soon as they are taken from receiving or storage to begin this process, and it shall be kept up-to-date throughout the process and initialed by the worker at each step. Before an MCM is shipped to Italy, a representative of SLAC Quality Assurance shall have signed the traveler.

9 NON-CONFORMANCE REPORTING

All non-conformances that arise during the MCM acceptance test and burn-in process shall be entered into the SLAC NCR system and dispositioned appropriately by a Material Review Board (MRB). The MRB shall consist of at least the test technician or engineer, the Tracker engineer responsible for MCM production (or the Tracker subsystem manage), and a representative of SLAC Quality Assurance. Applicable nonconformances include, but are not limited to, the following:

- Failure of an MCM to pass any of the tests described in this document.
- Mishandling of an MCM, such as dropping it, failing to follow ESD protection procedures, etc.
- Evidence of contamination of an MCM or evidence that an MCM became wet during thermal cycling.

Any MCM with an open NCR shall not be shipped to Italy.

10 TMCM ENVIRONMENTAL ACCEPTANCE TESTING

Table 3 presents the temperature ranges for environmental testing. The indicated number of thermal cycles is performed with the power off. Each cycle begins at room temperature, ramps up to the maximum temperature at the indicated rate, soaks at the maximum temperature, ramps down to the minimum temperature, soaks at the minimum, and ramps back up to room temperature. The thermal chamber is maintained dry, with the maximum humidity as indicated, by a flow of dry nitrogen. There shall be no condensation on the MCMs or other hardware in the chamber.[1]

10.1 ENVIRONMENTAL TEST PROCEDURE

10.1.1 MCM Receiving and Unpacking

The MCMs are received from Teledyne Electronic Technologies in Building 33. LAT Building-33 personnel log the receipts as the boxes are unpacked. Each MCM arrives packaged and sealed in an ESD-protective vacuum bag. The ESD bag shall remain

[1] Note that a TEM and TEM Power Supply are also present in the chamber. The full production, therefore, will result in some 360 thermal cycles on those items, which may well result in their failure.

unopened during this procedure. The MCMs, inside their ESD bags, are carried into the clean-room on a rolling cart and stored inside the clean-room in the designated cabinet.

To begin the test and burn-in procedure, 36 MCMs (or less, if the quantity is limited) are selected from storage. A traveler is initialized for this set of MCMs, with all of the serial numbers noted.

10.1.2 Cabling and Connector Mating

The MCM Environmental Acceptance Test and Burn-In program is initialized on the PC. This brings up a table on the screen into which the test configuration is entered.

The MCMs, still in their ESD bags, are transported on the cart to the table next to the thermal chamber. The operator plugs in his ESD wrist strap and removes one MCM from its ESD bag and places it into the first slot in the bottom layer of the holding fixture, with the connector savers pointed upward and oriented according to the drawing taped to the fixture. This is repeated for 8 more MCMs, until that layer is full. All 9 MCMs must be oriented in the same sense. The configuration of this set of MCMs is entered into the table on the PC, showing which serial number is installed into each slot. A burn-in flex-circuit cable is laid across the MCMs, and the 9 Omnetics connectors are mated and all jackscrews are torqued to the value specified on the traveler. This is repeated for the second flex-circuit cable. Then the second tray is fastened to the top of the first, turned clockwise 90 degrees from the first, and the process is repeated for installation of the next 9 MCMs. This process proceeds until all 4 layers are stacked up on the table, with the cables hanging out on all 4 sides. Fewer layers may be used if not enough MCMs are available to fill 4 layers.

The ESD protective bags are discarded, as they are not resealable. New bags are to be used for storage and shipment of MCMs following this procedure.

The TEM/PS is placed on top of the stack and fastened down. A twist-pair cable extender is mated to each of the 8 flex-circuit cables, with the jackscrews torqued to the value specified on the traveler. Each cable extender is then bent upward and connected into the closest connector on the TEM, with the jackscrews torqued to specifications. The TEM and PS cables are connected, with jackscrews torqued to specifications.

10.1.3 Installation into the Thermal Chamber

The test stack is moved to the thermal chamber entrance on the rolling cart. The TEM and PS cables are fed through the chamber exit hole, and then the stack is placed into the chamber, pulling the cables through the exit hole as necessary. Then the TEM/PS cables are connected into the EGSE system.

10.1.4 Initial Chamber Setup

The operator connects the RS232 cable between the computer and the chamber and installs the temperature/humidity probe in the chamber, and then closes the chamber, latches it, and plugs the cable exit hole. Power is then turned on to the chamber and computer. The dry nitrogen purge is started, as is the temperature/humidity monitoring

software. Then the operator starts the GREEM LL100 software and loads the Ref Temp parameters from the hard drive to the chamber. He or she then presses the run button on the chamber's controller. The chamber will stabilize at 25°C and soak for a period of 10 minutes. Initial electronic testing may start only after completion of the reference temperature soak.

8.1.5 Initial Electronic Test

The operator turns on the power to the TEM/PS and records the voltages and current draws on the traveler, including all of DVDD, AVDDA, AVDDB, and Detector Bias (120 V). The currents are verified to be in conformance with Table 2. The full set of functional test vectors listed in Section 7.2 is executed, and the result are indicated on the traveler.

If the test indicates failure in any of the MCMs, then an NCR must be filled out. The test and burn-in can proceed if all failures are isolated to *individual* MCMs and do not inhibit the functionality of any of the good MCMs. Otherwise, upon approval from the MRB, the stack must be removed, disassembled, and the bad MCMs replaced.

8.1.6 Thermal Cycles

This test is performed with the hardware unpowered.

Using the GREEM LL100 software, load the Thermal Cycle parameters from the hard drive to the chamber. Press the run button on the chamber's controller. The chamber will run 20 cycles from +60 to –30 degrees C with 30-minute soaks at each temperature extreme.

8.1.7 +60°C , -25°C , +25°C Electronics Test

With the GREEM LL100 software, load the desired temperature parameters from the hard drive to the chamber. Press the run button on the chamber's controller. The chamber will stabilize at the selected temperature and soak for a period of 15 minutes. Electronic testing can start after the temperature soak has completed.

The operator turns on the power to the TEM/PS and records the voltages and current draws on the traveler, including all of DVDD, AVDDA, AVDDB, and Detector Bias (120 V). The full set of functional test vectors listed in Section 7.2 is executed, and the result is indicated on the traveler.

If the test indicates failure in any of the MCMs, then an NCR must be filled out. The test and burn-in can proceed unless the failure prevents operation of MCMs other than those that failed.

This sequence is performed for all three temperatures +60°C , –25°C , and +25°C.

11 TMCM DYNAMIC BURN-IN

Table 3. TMCM Environmental Thermal Acceptance Test Parameters, performed unpowered.

Item	Acceptance
Number of cycles	20
Minimum temperature	−30°C
Maximum temperature	60°C
Temperature ramp rate	±9°C/min
Soak time at low temperature	30 min
Soak time at high temperature	30 min
Maximum relative humidity	50%

With the GREEM LL100 software, load the dynamic burn-in parameters from the hard drive to the chamber. Press the run button on the chamber's controller. The chamber will stabilize at 85°C and soak 168 hours and return to 25°C.

The MCM dynamic burn-in is done at 85°C for 168 hours. The EGSE system continually cycles through the set of test vectors of Section 7.2 throughout the burn-in process. All anomalies in the test results are logged by the computer. The temperature and humidity are also logged at regular intervals.

During the dynamic burn-in, the operator shall monitor the system 3 times per day—early morning, noon, and early evening—to verify that the system is operating and that the temperature and humidity are holding at the proper levels. In the event that a power failure causes the system to shut down (in which case it will go back to room temperature), the operator shall look into the log on the hard disk to determine how many hours of burn-in were accomplished and then restart the system for the remaining required hours.

12 REMOVAL OF THE HARDWARE FROM THE CHAMBER

The TEM/PS power is turned off and the EGSE system shut down. The nitrogen flow is shut off and the thermal chamber powered down. The chamber is opened, the cable access plug is removed, and the TEM/PS is uncabled from the EGSE system. The hardware is removed from the chamber and placed directly onto a waiting cart, which is used to move the hardware to the work table. The TEM/PS is demated from the flex-circuit cables and removed. One by one the 4 stacks of MCMs are removed, and then the flex-circuit cables are demated from the MCMs.

13 TMCM FINAL TEST AND STORAGE

One by one, each MCMs is removed from the burn-in fixture and connected to the MCM test rack, and the test sequence is executed exactly as described in procedure LAT-PS-01971. The MCM is then placed into a new ESD-protective bag, which is then vacuum sealed and moved to the storage cabinet. All test summary reports shall be printed and attached to the corresponding MCM traveler.

Appendix: Traveler

Stanford Linear Accelerator Center
2575 Sand Hill Road
Menlo Park, CA 95025

ASSEMBLY AND INSPECTION DATA SHEET

AIDS NO. TMCM Burn-In 0001

Project	Equipment Title	Drawing/Part No.	Rev.
LAT	Tracker MCM Acceptance Test and Burn-In	LAT-DS-00898 or LAT-DS-00899	

Serial Numbers							
1		10		19		28	
2		11		20		29	
3		12		21		30	
4		13		22		31	
5		14		23		32	
6		15		24		33	
7		16		25		34	
8		17		26		35	
9		18		27		36	

Reference Designator	Subsystem	Equipment Class	Prepared By
N/A	Tracker	Preproduction or Flight	R. Johnson

Approvals

Responsible Engineer	Date	Manufacturing Engineer	Date
D. Rich		J. Clinton	
Quality Engineer	**Date**		
D. Marsh			

Step	Instructions	Oper. ID	Date	Stamp
	Notes: a. All MCM burn-in shall be performed in the SLAC Building 33 clean room in compliance with LAT-MD-00404, LAT Contamination Control Plan. b. ESD-protection procedures shall be followed, as specified in NASA-STD-8739.7, at all times when handling MCMs outside of their sealed ESD-protective packages. c. The specification for this procedure is **LAT-TD-02367**. Refer to LAT-TD-02367 for details of each of the following steps, as well as for requirements and specifications and for descriptions of the test scripts.			
10	If not already done, perform receiving inspection as follows: a. Verify that the packaging is not damaged. b. Verify that the MCMs received conform to the shipping documentation. c. Store the MCMs in the appropriate cabinet inside the Building 33 clean room, still inside their ESD-protective, vacuum-sealed packages.			

Distribution:

ASSEMBLY AND INSPECTION DATA SHEET

AIDS NO. TMCM ASIC 0001

Step	Instructions	Oper. ID	Date	Stamp
20	a. Select up to 36 MCMs for acceptance testing and burn-in and move them to the worktable next to the thermal chamber, using the cart. b. Enter the serial numbers into this form.			
30	Set up the hardware test configuration on the work table next to the thermal chamber: a. Initialize the MCM Environmental Acceptance Test and Burn-In program on the PC and check that the screen for entering the test configuration is displayed. b. Set up the first layer as follows: • Unwrap one MCM and place it into the first slot of the holding fixture bottom tray, with connector savers pointed upward and oriented according to the drawing taped to the fixture. • Repeat for up to 8 more MCMs, until the layer is full or the number of MCMs exhausted. • Enter the configuration of this set of MCMs into the PC display. • Attach two burn-in flex-circuit cables, with the jack screws of the Omnetics nano-connectors torqued to between 8 to 10 inch-oz. c. Fasten the second tray of the holding fixture to the top of the first, turned clockwise 90° from the first. d. Repeat Step (a) for loading the second tray. e. Repeat Steps (b) and (c) for the third and fourth trays, as needed for the quantity of MCMs available. f. Place the TEM/PS on top of the stack and fasten it down. g. If not already in place, mate twist-pair cable extenders to each of the flex-circuit cables. h. Connect each cable extender to the TEM.			
40	Install the test stack in the thermal chamber: a. Move the test stack to the thermal chamber on the rolling cart. b. Feed the TEM and PS cables through the chamber exit hole. c. Place the stack into the chamber. d. Connect the cables to the EGSE system.			
50	Initial Chamber Setup a. Connect the RS232 cable between the computer and chamber. b. Install the temperature/humidity probe into the chamber. c. Close and latch the chamber. d. Plug the cable exit hole. e. Power on the chamber. f. Start the dry nitrogen purge. g. Start the temperature/humidity software. h. Start the GREEM LL100 software and load the Ref Temp parameters to the chamber.			

Distribution:

ASSEMBLY AND INSPECTION DATA SHEET

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Step	Instructions	Oper. ID	Date	Stamp
	i. Press the run button to start the program and wait 10 minutes for the temperature soak at 25°C. j. **Enter the version number of the Thermal-Chamber Control Software: _____**			
60	Initial Electronic Test a. Turn on the power to the TEM/PS and record the voltages and currents. b. Check that the current draws conform to the specifications in LAT-TD-02367. c. Execute the functional test set. d. **Enter the version number of the MCM test software:_____** DVDD Current: _____ mA AVDDA Current:_____ mA AVDDB Current:_____ mA Bias Current:_____ nA Result of the functional test: Pass ☐ Fail ☐ In the event of failure or incorrect current draw, complete an NCR. NCR Number:_____ Also, enter here a brief summary of the problem and the disposition:			
70	Execute the thermal cycles: a. Load the Thermal Cycle parameters from the hard drive to the chamber. b. Press the run button to run 20 cycles from +60 to –25 degrees C.			
80	Execute the electronic functional test at 3 temperatures. Execute the following at each of +60°C, –25°C, 25°C: a. Load the temperature parameters from the hard drive to the chamber. b. Press the run button and wait 15 minutes for the temperature to stabilize. c. Turn on the TEM/PS power and check and record the current draws. d. Execute the test sequence. **Data from the test at +60°C:** DVDD Current: _____ mA AVDDA Current:_____ mA AVDDB Current:_____ mA Bias Current:_____ nA Result of the functional test: Pass ☐ Fail ☐			

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Step	Instructions	Oper. ID	Date	Stamp
	Data from the test at -25°C: DVDD Current: _____ mA AVDDA Current:_____ mA AVDDB Current:_____ mA Bias Current:_____ nA Result of the functional test: Pass ☐ Fail ☐ **Data from the test at +25°C:** DVDD Current: _____ mA AVDDA Current:_____ mA AVDDB Current:_____ mA Bias Current:_____ nA Result of the functional test: Pass ☐ Fail ☐ In the event of failure or incorrect current draw in the above tests, complete an NCR. NCR Number:_____ Also, enter here a brief summary of the problem and the disposition:			
90	Execute the Dynamic Burn-In a. Load the dynamic burn-in parameters from the hard drive to the chamber. b. Press the run button. c. Check the system 3 times each day to verify that the testing is still in progress, without errors, and that the chamber is remaining at the desired settings. If errors are detected indicating failed MCMs, then an NCR shall be written and dispositioned by the MRB. In the event of an error, enter the NCR number:_____ Also, enter here a brief summary of the problem and the disposition:			
100	Remove the MCMs from the chamber: a. Turn the power off to the TEM/PS, shut down the EGSE system, and disconnect the TEM/PS cables. b. Shut off the nitrogen flow and power down the thermal chamber.			

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Step	Instructions	Oper. ID	Date	Stamp
	c. Open the chamber, remove the access plug, pull the cables back through the hole and remove the test hardware from the chamber onto the rolling cart. d. Move the test hardware to the work table, using the cart. e. Demate and remove the TEM/PS. f. Unstack the 4 sets of MCMs and demate the MCMs from the flex-circuit cables.			
110	MCM final test. Execute the following for each MCM: a. Remove the MCM from the burn-in fixture and mate it to the MCM test system, with the jack screws of the Omnetics nano-connectors torqued to between 8 to 10 inch-oz. b. Execute the test sequence, using the procedure documented in LAT-PS-01971. c. Print and attach the test summary to the existing traveler of the MCM (not to this traveler). d. Demate the MCM from the test system and vacuum seal it in an ESD-protective bag. e. Replace the MCM into the storage cabinet.			

Distribution: