

 GLAST LAT CD TECHNICAL DOCUMENT	Document # <b>ACD-RPT-000396</b>	Date Effective 10/12/05
	Responsible Engineer(s) Michael Amato	Supersedes 9/27/05 version
	Subsystem/Office ACD Subsystem	
Document Title <b>GLAST LAT ACD ICD Verification Table</b>		

**Gamma-ray Large Area Space Telescope  
(GLAST)**

**Large Area Telescope (LAT)**

**Anticoincidence Detector (ACD)**

**LAT ACD ICD Verification Table**

**ACD-RPT-000396**

Table 1. ICD Verification Table - 9/26/05

ICD Section	Subject	Requirement	ACD /LAT	Verification Method	First (Component or Subsystem) Verification Procedure title and Doc # and WOA if known	Final (System) Verification Procedure title and Doc #	System Level Verification WOA	Important Parameters	Status
8.1.1	ACD BEA Bulkhead Connector	The connector part number is JTP02RE-20-35P(453)	ACD	Inspection	Glast FREE board to GSE GASU (G3) Safe-to-Mate Procedure, ACD-PROC-000212	ACD Safe-to-Mate Procedure, ACD-PROC-000333	ACD-INT-02329	ACD BEA bulkhead connector is a JTP02RE-20-35P(453)	Done
8.1.2	Connector at ACD BEA Side	The connector part number is JT06RT-20-35S(453)	LAT	LAT Requirement	LAT Requirement			ACD BEA connector is JT06RT-20-35S(453)	LAT must verify
8.1.4	Harness between ACD BEA and ACD Electronics Module	The harness from the ACD BEA to the LAT EMI shield is 0.75 +/-??? m long (Ref) and consists of 24 AWG wires for all signals and power	LAT	Inspection	Proposed LAT develop a verification doc	LAT	N/A	Harness is 24 AWG for signals and power	LAT must verify
		The power lines in the harness will have a harness shield, separate from the harness shield on the signal wires. These shields shall be grounded at both ends. The method used to ground these shields shall provide optimum grounding contact with the backshell and connector and should avoid using a drain wire for grounding the shield.	LAT	LAT Requirement	Proposed LAT develop a verification doc	LAT	N/A	Power lines and signal lines will have individual shields separate grounded on both ends without using a drain wire.	LAT must verify
		The overall harness shall also have a harness shield, which shall be grounded at both ends. The method used to ground these shields shall provide optimum grounding contact with the backshell and	LAT	LAT Requirement	Proposed LAT develop a verification doc	LAT	N/A	The harness will have an overall shield grounded on both ends without using a drain wire.	LAT must verify

		connector and should avoid using a drain wire for grounding the shield. The harness from the LAT EMI shield to the GASU has the same design, except that it will be fabricated with 26 AWG wire and is up to 1 m (Ref) long.	LAT	LAT Requirement	Proposed LAT develop a verification doc				
8.1.5	Naming Convention for Connector Designators	Table 1 of LAT-SS-00363 ACD-LAT ICD lists the designation for each connector at the BEA interface. The connectors mounted on the BEA shall be clearly marked with these designations. The mating connectors at the end of the DAQ cables shall be clearly labeled with these designations.	ACD	Inspection	Cetification Log, job #3194	ACD Chassis to BEA Assembly Procedure ACD-PROC-000316	One WOA for each chassis	Connector designations detailed in Table 1	Done
		The exact ACD BEA connector locations for each connector shall be documented in the ACD Outline Drawing, LAT-DS-01151.	ACD	Inspection	Cetification Log, job #3194	ACD Chassis to BEA Assembly Procedure ACD-PROC-000316	One WOA for each chassis	Connector locations defined by LAT-DS-01151	Done
8.1.6	Signal Naming	The signal name format is: ACD_nnnnnn_##xy where nnnnnn is the signal name ## is an optional 2 digit number x is A or B indicating the A or B interface y is P or M indicating positive or negative for differential signals  All digital signals except ACD_CLK are transmitted and received low true and so indicated by using "N" as the first character of the signal name.	ACD	Inspection	Drawing review, 2061840, LAT-DS-02092-102, LAT-DS-02102-082, LAT-DS-02110-082, LAT-DS-02111-112, LAT-DS-02812-082	N/A	N/A	Match signal names to format	Done
8.1.6.2	Signal List	LAT-SS-00363 lists each of the signal wires between the ACD and the AEM (A interface only).	ACD	Inspection and Test	Dwg Checker process - FREE Printed Circuit Board Flight Schematics (2061840) and FREE CPT, ACD-PROC-000051, Section 5, Electrical Safe-to-Mate of the FREE Assembly.	ACD Safe-to-Mate Procedure, ACD-PROC-000333	ACD-INT-02329	Match pin signals to Table 2	Done
8.1.7	Digital Inputs and Outputs	LVDS is used for all digital signals. The signal current is 3.5 mA, and the termination resistor is 100 ohms $\pm$ 15% .	ACD	Inspection and Test	GLAST LAT ACD GARC CPT, ACD-PROC-000063. WOA-ACD-00021 to ACD-00036	Indirectly verified by ACD Safe-to-Mate Procedure, ACD-PROC-000333	ACD-INT-02329	signal current is 3.5 mA, and the termination resistor is 100 ohms $\pm$ 15%.	Done

8.1.8	Signal Description	ACD_CLK: 20 MHz $\pm$ 1% continuous, 45-55% duty cycle clock from the ACD Electronics Module (AEM).	ACD	Test	Tested in the FREE CPT, ACD-PROC-000051, Section 11.18, Multiple System Clock Speed Test. WOA-ACD-00021 to ACD-00036	Not directly verifiable, see subsystem ver	See subsystem ver	ACD_CLK; 20MHz $\pm$ 1% continuous, 45-55% duty cycle	Done
		At initial power up of the FREE cards, the clock frequency is 1.25MHz for 1 second. The frequency is then set to 20 MHz. See section 9.4.1 for details.		Test	Tested in the FREE CPT, ACD-PROC-000051 with GSAU GFE. WOA-ACD-00021 to ACD-00036	Not directly verifiable, see subsystem ver	See subsystem ver		Done
		ACD_NSCMD: The command signal from AEM. The ACD_NSCMD signal transitions on the trailing edge of ACD_CLK and is shifted into the ACD on the leading edge of ACD_CLK. A single start bit, (logic 1), signals the beginning of a command.	ACD	Test	GLAST LAT ACD FREE CPT, ACD-PROC-000051, section 8.4. WOA-ACD-00021 to ACD-00036	Not directly verifiable, see subsystem ver	See subsystem ver	ACD_NSCMD transitions on trailing edge of ACD_CLK and shifts into ACD on leading edge	Done
		ACD_NRST: Reset from AEM. ACD_NRST is synchronous to ACD_CLK. ACD_NRST at logic one resets state machines and initializes registers and modes in ACD. The ACD_NRST is at least five ACD_CLK cycles.	ACD	Analysis and Test	Verification by analysis of design code and functionally tested in the FREE CPT, ACD-PROC-000051, Section 7.1, GARC and GAFE Reset Test. WOA-ACD-00021 to ACD-00036	Not directly verifiable, see subsystem ver	See subsystem ver	ACD_NRST; reset by AEM, is synch to ACD_CLK, at "1" resets state machines and initializes registers, is 5 ACD_CLK cycles	Done
		ACD_NSDATA: Data from ACD. The ACD_NSDATA signal transitions on the leading edge of ACD_CLK. The beginning of a data packet indicated by a single start bit.	ACD	Test	FREE CPT, ACD-PROC-000051, Section 8.51, Data Phase Command Test. WOA-ACD-00021 to ACD-00036	Not directly verifiable, see subsystem ver	See subsystem ver	ACD_NSDATA; data fr. ACD, transitions on leading edge of ACD_CLK, packet beginning indicated by 1 start bit	Done
		ACD_NCNO, ACD_NVETOs: Veto discriminator output signals from ACD. The ACD_NCNO interface signal is the OR of the selected (via command) HLD discriminators.	ACD	Test	FREE CPT, ACD-PROC-000051, Section 11.16, GAFE Characterization Using TCI. WOA-ACD-00021 to ACD-00036	Not directly verifiable, see subsystem ver	See subsystem ver	Match signals to signal Name and description list	Done
		ACD_HV: Analog monitor of the high voltage power supply voltage output. 0 - 2.5 volts indicates 0 - full-scale volts at the supply output. Pseudo differential analog, with	ACD	Test	HVBS Test Procedure, ACD-PROC-000064. WOA-ACD-00021	Not directly verifiable, see subsystem ver	See subsystem ver	Match signals to signal Name and description list	Done

		signal on ACD_HVP and ground on ACD_HVN, 10K ± 5% source impedance all lines.			to ACD-00036				
		ACD_TEMP: ACD board temperature monitor, 30K thermistor, GSFC S-311-P-18 series (YSI 44900 series).	ACD	Verification and Test	Verified on FREE PCB Bill of Materials (ACD-LIST-000165) and on the LAT ACD EEE Parts List. Measured in CPT in Section 5.2, Electrical Isolation Test. WOA-ACD-00021 to ACD-00036	Not directly verifiable, see subsystem ver	See subsystem ver	ACD_TEMP: GSFC S-311-P-18 series	Done
		ACD_VDD(0-2): +3.3V supplied by the AEM to the ACD FREE circuit cards.	LAT/ACD	Test	Glast FREE board to GSE GASU (G3) Safe-to-Mate Procedure, ACD-PROC-000212. WOA-ACD-01034 or ACD-01289.	Safe-to-Mate Procedure during LAT integration, ACD Safe-to-Mate Procedure, ACD-PROC-000333 checks EGSE GASU compliance	ACD-INT-02329	ACD_VDD(0-2): +3.3V	Done
		ACD_28V(0-1): +28V supplied by the AEM to the ACD HVBSs	LAT/ACD	Test	Glast FREE board to GSE GASU (G3) Safe-to-Mate Procedure, ACD-PROC-000212. WOA-ACD-01034 or ACD-01289.	Safe-to-Mate Procedure during LAT integration, ACD Safe-to-Mate Procedure, ACD-PROC-000333 checks EGSE GASU compliance	ACD-INT-02329	ACD_28V(0-1): +28V	Done
8.2	ACD Flight Instrumentation Connectors	The ACD shall provide two thermal instrumentation connectors, each containing temperature sensors. One connector contains only safe mode temperature sensors and interfaces to the PDU. The second connector contains only survival temperature sensors and interfaces to the Spacecraft.	ACD	Inspection	REF	REF		ICD Instrumentation Connector part #s and ICD Table in sec 8.2.1.4 for names	
8.2.1.1	ACD (Safe Mode) Instrumentation Connectors	The ACD (Safe Mode) instrumentation connector part number is JTP02RE-14-35P(453).	ACD	Inspection	WOA ACD-01413	GE2054615, Assembly Instrumentation Installation	ACD-INT-01444	Conn. PN - JTP02RE-14-35P(453)	Done
		This connector shall be located on the -X	ACD	Inspection		GE2054615,	ACD-INT-	N/A	Done

		side of the ACD. See the ACD-LAT IDD LAT-DS-00309 and ACD Outline Drawing LAT-DS-01151 for exact location of this connector.				Assembly Instrumentation Installation	01444		
8.2.1.2	Connector at ACD BEA Side,	The connector part number is MIL-C-MS27484T14F35S.	LAT	LAT Requirement					No Action
		This connector shall have an M85049/76 series right-angled backshell selected from the NPSL for cable strain relief.	LAT	LAT Requirement					LAT
8.2.1.3	Harness between ACD BEA and LAT PDU	The harness from the ACD BEA to the LAT EMI shield is 0.75 ± .?? m long (Ref) and consists of 24 AWG twisted shielded pairs for all temperature sensors. The overall harness shall also have a harness shield, which shall be grounded at both ends.	LAT	LAT Requirement					LAT
8.2.1.4	Naming Convention for Connector Designators	Table 3 lists the designation for the safe mode instrumentation connector at the BEA interface. The connector mounted on the BEA shall be clearly marked with this designation. The mating connectors at the end of the PDU cable shall be clearly labeled with this designation.	ACD/LAT	Inspection	WOA ACD-01413	ACD-INT-01444	ACD-INT-01444	Designator - TEMP1	Done
8.2.2	Signal Names	Table 4 of LAT-SS-00363 lists the signal names for each temperature sensor and the connector pin outs. ACD shall use 30K thermistors, GSFC 311-P-18-09S7R6 (YSI 44909) and Rosemont PRTs, PN: 118MF2000A.	ACD	Inspection and Test		GE2054615, Assembly Instrumentation Installation	WOA ACD-INT-01614	Match connector pinout to Table 4. Thermistor PN - GSFC 311-P-18-09S7R6 (YSI 44909).	Done
8.2.3.1	ACD (Survival) Instrumentation Connectors	The ACD (Survival) instrumentation connector part number is JTP02RE-18-35P(453)	ACD	Inspection	WOA ACD-01413	GE2054615, Assembly Instrumentation Installation	ACD-INT-01444	Conn. PN - JTP02RE-18-35P(453)	Done
	ACD (Survival) Instrumentation Connectors	This connector shall be located on the +X side of the ACD. See the ACD-LAT IDD LAT-DS-00309 and ACD Outline Drawing LAT-DS-01151 for exact location of this connector.	ACD	Inspection		GE2054615, Assembly Instrumentation Installation	ACD-INT-01444	Refer to dimensions on IDD LAT-DS-01151	Done
8.2.3.2	Connector at ACD BEA Side,	The connector part number is MIL-C-MS27484T18F35S	LAT	LAT Requirement					LAT
		This connector shall have an M85049/76 series right-angled backshell selected from the NPSL for cable strain relief.	LAT	LAT Requirement					LAT
8.2.3.3	Harness between ACD BEA and ACD Temp Sensor Bracket	Sensor Bracket harness is 1 ± ?m long (Ref) and consists of 24 AWG twisted shielded pairs for all temperature sensors. The overall harness shall also have a harness shield, which shall be grounded at both ends.	LAT	LAT Requirement					LAT
8.2.3.4	Naming Convention for	Table 5 of LAT-SS-00363 lists the designation for the survival mode	ACD	Inspection		GE2054615, Assembly	ACD-INT-		Done

	Connector Designators	instrumentation connector at the BEA interface. The connector mounted on the BEA shall be clearly marked with this designation. The mating connector at the end of the ACD Temp Sensor Bracket cable shall be clearly labeled with this designation.				Instrumentation Installation	01444		
8.2.3.5	Signal Names	Table 6 of LAT-SS-00363 lists the signal names for each temperature sensor and the connector pin outs.	ACD	Inspection and Test		GE2054615, Assembly Instrumentation Installation	ACD-INT-02272	Match pin signals to Table 6 in ICD	Done
		The ACD shall use two types of temperature sensors: 30K thermistors, PN: 311-P-18-09S7R6 (YSI 44909) and Rosemont PRTs, PN: 118MF2000A. Table 6 of LAT-SS-00363 documents the sensor type for each.	ACD	Inspection		GE2054615, Assembly Instrumentation Installation	ACD-INT-02272	Match connector pinout to Table 6. Thermistor PN - GSFC 311-P-18-09S7R6 (YSI 44909). PRT PN - 118MF2000A.	Done
8.3	Switching characteristics timing diagram – Events and VETOs	Any particle that generates an electrical signal above the VETO's threshold shall also force the GAFE's comparator to output a signal whose pulse duration is equal to the time the electrical signal is above the comparator's threshold.	ACD	Test	Tested in the FREE CPT, ACD-PROC-000051, Section 11.16, GAFE Characterization Using TCI	See subsystem ver, indirectly tested by ACD Comprehensive Performance Test (CPT) (ACD-PROC-000270) timing tests	Indirectly by ACD-INT-02318 ACD-INT-02309 (MARGIN TEST)		Done
		Two types of VETO signals shall be generated from the GAFE's comparator output, a VETO_AEM and a VETO_HITMAP as defined in Figure 6 and Figure 7 of LAT-SS-00363	ACD	Analysis and test	Tested in the FREE CPT, ACD-PROC-000051, Section 11.16, GAFE Characterization Using TCI, and Section 11.7, Test of HitMap Functionality	See subsystem ver, indirectly tested by ACD Comprehensive Performance Test (CPT) (ACD-PROC-000270) timing tests	Indirectly by ACD-INT-02318 ACD-INT-02309 (MARGIN TEST)		Done
8.3.1	VETO_AEM Signal Timing Characteristics	Each GAFE comparator output is first input to a digital delay line. A commandable delay tap (0 to 1550 nsec) is input to a deglitch circuit that looks for the delayed comparator signal to be present for at least two consecutive clock leading edges before a veto pulse is detected. Thus, the GARC will reject all input pulses of width less than 50 nsec, detect all input pulses of width greater than 100 nsec, and detect some and reject some pulses between 50 and 100 nsec in width. Once a pulse is detected, it fires a re-triggerable digital one-shot with width of 50 to 400 nsec (AEM commandable). The	ACD	Analysis and test	Tested in the FREE CPT, ACD-PROC-000051, Section 11.3, Test of VETO Signal Functionality. WOA ACD-00021 through ACD-00036.	Not directly verifiable, see subsystem ver	See subsystem ver		Done

		outputs of the one-shots are the ACD_NVETOxx signals. Note that for a minimum commanded delay of 0 nsec, the actual delay from discriminator input to ACD_NVETOxx output is 150 to 200 nsec (due to the synchronous circuitry) plus up to 20 nsec (due to I/O buffer and gate delays) in the GARC. For a maximum commanded delay of 1550 nsec, the actual delay from discriminator input to ACD_NVETOxx output is 1700 to 1750 nsec (due to the synchronous circuitry) plus up to 20 nsec (due to I/O buffer and gate delays) in the GARC.							
8.3.2	VETO_HITMAP Signal Timing Characteristics	For generation of the VETO_HITMAP signals, the GARC uses the VETO_AEM delay lines with separate, commandable taps at 850 to 2400 ns. The delayed comparator pulse is stretched by 0 to 350 ns, commandable. The pulse is further stretched if necessary to meet a minimum pulse width of 150 to 900 ns, commandable. The final stretched pulse is sampled at trigger time, and read out in the event data as the hit map.	ACD	Analysis and test	FREE CPT, ACD-PROC-000051, Section 11.7, Test of HitMap Functionality. WOA ACD-00021 through ACD-00036.	See subsystem ver, indirectly tested by ACD Comprehensive Performance Test (CPT) (ACD-PROC-000270)	See subsystem ver. Indirectly by ACD-INT-02318 ACD-INT-02309 (MARGIN TEST)		Done
8.4	Power	A and B AEM power will be wired together at each FREE board	ACD	Analysis and Test	Verified via analysis of FREE Printed Circuit Board Flight Schematics (2061840), FREE Safe-To-Mate, ACD-PROC-000212	Safe-to-Mate Procedure during LAT integration, ACD Safe-to-Mate Procedure, ACD-PROC-000333 checks EGSE GASU compliance	ACD-INT-02329		Done
		The AEM will handle the power switching, protection, sensing and conditioning.	LAT	Inspection	LAT Requirement		LAT		LAT
		The requirements on the power at the AEM interface are specified in LAT-SS-0183 Level IV Power Specification Document.	LAT		LAT Requirement		LAT		LAT
8.4.1.1	Power +28V Power supply Voltage Range	The ACD_28V, ACD_28RTN supplies power for the PMT HVBS. The ACD_28V, ACD_28RTN voltage spans +24 and +29V.	LAT	Inspection and Test	LAT	LAT, Indirectly tested via EGSE GASU with cpt 270	LAT	+28v ± 1 V	LAT
8.4.1.2	Power +28V Power Supply Noise	The noise on the ACD_28V, ACD_28RTN shall be less than 10 mV RMS from DC to 1.0 MHz. The maximum peak noise on the ACD_28V, ACD_28RTN shall be less than 10 mV.	LAT	Test	HVBS Bench testing - not sure if included in Functional - check	LAT, Indirectly tested via EGSE GASU with cpt 270	LAT	<10mV RMS on 28V from DC to 1.0 MHz	LAT

8.4.1.3	Power +28V Power Supply Power Consumption	The worst-case total consumption of the 12 HVBSs shall be less than 6.672 W	ACD	Test and Analysis	HVBS Test Procedure, ACD-PROC-000064. WOA-ACD-00321 to ACD-00350	Not really verified at system level, no current monitor on EGSE GASU, see subsystem ver	N/A		Done, cant confirm the measured number, hard to get accurately
		The nominal total consumption of the 12 HVBSs will be 3.96 W	ACD	Test and Analysis	HVBS Test Procedure, ACD-PROC-000064. WOA-ACD-00321 to ACD-00350	Not really verified at system level, no current monitor on EGSE GASU, see subsystem ver	N/A		Done, we meet this
8.4.2.1	Power +3.3V Power supply Voltage Range	The 3.3 volt VDD shall be regulated to voltages between 3.2 and 3.6 volts.	LAT	Test	LAT	LAT, EGSE GASU meets this		3.2V to 3.6V	LAT, EGSE GASU meets
8.4.2.2	Power +3.3V Power Supply Noise	The noise on the 3.3 volt VDD shall be less than 5mV from DC to 1.0 MHz. The maximum peak noise on the 3.3 volt VDD shall be less than 5 mV.	LAT	Test	LAT	LAT, EGSE GASU meets this		<5mV noise on 3.3V VDD from DC to 1.0 MHz	LAT, EGSE GASU meets
8.5.1	Grounding	The FREE circuit card is comprised of digital common, analog common, high voltage common and PMT common. All the commons are tied together on the FREE circuit card.	ACD	Analysis, Test	Verified via analysis of FREE Printed Circuit Board Flight Schematics (2061840) and FREE CPT, ACD-PROC-000051, Section 5, Electrical Safe-to-Mate of the FREE Assembly. WOAs ACD-00021 to 00036	Safe-to-Mate Procedure during LAT integration, ACD Safe-to-Mate Procedure, ACD-PROC-000333 and 000212 checks res and EGSE GASU compliance	See subsystem ver. Indirectly at system level by ACD-INT-02329		Done
		The FREE circuit card's common point shall be grounded to the AEM via the common mode choke on the power return lines.	ACD	Analysis	Verified via analysis of FREE Printed Circuit Board Flight Schematics (2061840)	Not directly verifiable	See subsystem level ver		Done
		A chassis ground wire connects the FREE board ground to the chassis ground	ACD	Inspection	Electronic Chassis Assembly Procedure, ACD-PROC-000192. WOAs ACD-01615 to 01618	Not directly verifiable	See subsystem level		Done

					and 01622 to 01625.				
8.5.2	Shielding	The cable chassis housing shall serve as the cable shield between the FREE circuit card and the BEA.	ACD	Inspection and Test	ACD GASU EMI/EMC Operational Functional Test Procedure, ACD-PROC-000247.	Chassis EMI test plan (ACD-PLAN-000215)	N/A		Done
		The cable between the BEA and the LAT EMI DAQ shall have the shields connected to chassis ground at the BEA and at the DAQ EMI.	LAT	Inspection and Test	LAT Requirement	LAT	LAT		LAT
8.6	EMI/EMC	The EMI/EMC performance is specified in the LAT Environmental Specification, LAT-SS-00778.	ACD	Test	ACD GASU EMI/EMC Operational Functional Test Procedure, ACD-PROC-000247.	Chassis EMI test plan (ACD-PLAN-000215)	Verified, some waivers for some specs WOA ACD-01742	Waiver for system level test which would not have been useful	Done
9.0	ACD Command and Data Format	All fields are MSB first (leftmost on drawings)	ACD	Test	FREE CPT, ACD-PROC-000051	Indirectly by ACD CPT, ACD-PROC-000270. Analogous to FREE CPT section.	Indirectly at system level by ACD-INT-02329		Done
		Parity is odd.	ACD	Test	FREE CPT, ACD-PROC-000051. Section 7.1, GARC and GAFE Registers Initial Reset Test and Section 8.46, Test of the GARC Parity Detection and Parity Error Generation Circuits	Indirectly by ACD CPT, ACD-PROC-000270. Analogous to FREE CPT section.	Indirectly at system level by ACD-INT-02329		Done
		The data field is 16-bits. If a value of less than 16-bit is transferred from the AEM to the ACD, then the to-be-used bits are at the end of the field (leading zero's, the data is right justified). The same is true for data sent from the ACD to the AEM.	ACD	Test	FREE CPT, ACD-PROC-000051. For example, Section 7.1, GARC and GAFE Registers Initial Reset Test and Section 8.48, MAX_PHA Return Test	Indirectly by ACD CPT, ACD-PROC-000270. Analogous to FREE CPT section.	Indirectly at system level by ACD-INT-02329		Done

9.1	AEM to ACD Command Format	The AEM shall send either a trigger command or a configuration command to the ACD.	ACD	Test	FREE CPT, ACD-PROC-000051. Section 7.1, GARC and GAFE Registers Initial Reset Test and Section 8.48, MAX_PHA Return Test	Indirectly by ACD CPT, ACD-PROC-000270. Analogous to FREE CPT section.	Indirectly at system level by ACD-INT-02329		Done
9.1.1	Trigger Command Format	Table 7 of the LAT-SS-00363 defines the trigger command format.	ACD	Test	FREE CPT, ACD-PROC-000051. Section 8.48, MAX_PHA Return Test	Indirectly by ACD CPT, ACD-PROC-000270. Analogous to FREE CPT section.	Indirectly at system level by ACD-INT-02329		Done
9.1.2	Configuration Command Format	Table 8 of the LAT-SS-00363 defines the configuration command format	ACD	Test	FREE CPT, ACD-PROC-000051, Section 7.1, GARC and GAFE Registers Initial Reset Test	Indirectly by ACD CPT, ACD-PROC-000270. Analogous to FREE CPT section.	Indirectly at system level by ACD-INT-02329		Done
9.1.3	Command Protocol	The logic on the cable is low-true, so that a disconnected LVDS cable (asserts high) won't result in start bits.	ACD	Test	FREE CPT, ACD-PROC-000051, Section 7.1, GARC and GAFE Registers Initial Reset Test	Indirectly by ACD CPT, ACD-PROC-000270. Analogous to FREE CPT section.	Indirectly at system level by ACD-INT-02329		Done
		Three types of commands may be sent to the ACD; trigger commands, write configuration commands, and read configuration commands.	ACD	Test	FREE CPT, ACD-PROC-000051. Section 7.1, GARC and GAFE Registers Initial Reset Test and Section 8.48, MAX_PHA Return Test	Indirectly by ACD CPT, ACD-PROC-000270. Analogous to FREE CPT section.	Indirectly at system level by ACD-INT-02329		Done
		The GARC does not execute a command if a parity error is detected.	ACD	Test	FREE CPT, ACD-PROC-000051, Section 8.46, Test of the GARC Parity Detection and Parity Error Generation Circuits	ACD CPT, ACD-PROC-000270. Analogous to FREE CPT section.	system level by ACD-INT-02329	Directly tested	Done
		If there is a command error, then the command is copied to command error register.	ACD	Test	FREE CPT, ACD-PROC-000051, Section 8.46, Test	ACD CPT, ACD-PROC-000270.	ACD-INT-02318 ACD-INT-		Done

					of the GARC Parity Detection and Parity Error Generation Circuits	Analogous to FREE CPT section.	02309 (MARGIN TEST)		
		If there is only a data-field error, then the data field is copied to command error register	ACD	Test	FREE CPT, ACD-PROC-000051, Section 8.46, Test of the GARC Parity Detection and Parity Error Generation Circuits	ACD CPT, ACD-PROC-000270. Analogous to FREE CPT section.	ACD-INT-02318 ACD-INT-02309 (MARGIN TEST)		Done
		If both the command and data-fields are in error, then only the command field is copied. In addition, the command and/or Data ERR bit is set.	ACD	Test	FREE CPT, ACD-PROC-000051, Section 8.46, Test of the GARC Parity Detection and Parity Error Generation Circuits	ACD CPT, ACD-PROC-000270. Analogous to FREE CPT section.	ACD-INT-02318 ACD-INT-02309 (MARGIN TEST)		Done
		Error bits are reset when readout.	ACD	Test	FREE CPT, ACD-PROC-000051, Section 8.46, Test of the GARC Parity Detection and Parity Error Generation Circuits	ACD CPT, ACD-PROC-000270. Analogous to FREE CPT section.	ACD-INT-02318 ACD-INT-02309 (MARGIN TEST)		Done
9.1.4	Command Processing Times	Command processing time is defined as the time from the leading ACD_CLK edge during the NSCMD start bit to the GARC being ready to accept another command start bit. The GARC test signal LIVE is used to measure this processing time. (The LIVE signal is only accessible at a monitoring pin inside the FREE).	ACD	Test	FREE CPT, ACD-PROC-000051, Section 11.1 , GARC Test Pin Verification. The LIVE signal is captured on the scope.	Not verifiable at system level. See subsystem.			Done
		Table 9 of the LAT-SS-00363 defines the command processing times	ACD	Analysis	GARC Functional, ACD-PROC-000062	Not directly verifiable at system level			Done
9.1.5	Trigger Processing	The Trigger detect and ADC conversion phase starts with the leading edge of ADC_CLK during the TACK start bit and ends with "data_busy" (an internal GARC signal). This takes a minimum of 10950 ns. This time is extended by the amount that Hold_Delay exceeds 2750 ns. This time is also extended by the ADC_TACQ time.  detect_convert_time = 10950 + max(0 ,	ACD	Test	FREE CPT, ACD-PROC-000051, Section 11.12 , Capture of ADC Control Signals, and Section 11.13, ADC_TACQ Test	Indirectly by ACD CPT, ACD-PROC-000270. Analogous to FREE CPT section.	Indirectly at system level by ACD-INT-02329		Done

		(Hold_Delay – 2750)) + ADC_TACQ (ns)							
		The Count PHA phase takes 50 ns per PHA channel up to 900 ns. Minimum time is zero ns if Max_PHA is set to zero. The GARC counts PHAs starting with channel 0 until Max_PHAs (above threshold if in ZS mode) are found or channel 17 is reached.	ACD	Analysis	GARC Functional, ACD-PROC-000062	Not directly verifiable at system level			Done
		The data transmission phase is from the NSDATA start bit to the end of PHA transmission. There are 39 fixed bits in the event data plus 0 to 18 15-bit PHA Words.	ACD	Test	FREE CPT, ACD-PROC-000051, Section 8.48, MAX_PHA Return Test and Section 8.49, PHA Enable/Disable Test	Indirectly by ACD CPT, ACD-PROC-000270. Analogous to FREE CPT section.	Indirectly at system level by ACD-INT-02329		Done
9.2	GAFE Registers	Table 10 of the LAT-SS-00363 defines the GAFE Registers	ACD	Test	FREE CPT, ACD-PROC-000051, Section 7.1, GARC and GAFE Registers Initial Reset Test and Section 8.4, GARC Register Read/Write Tests. Table 10	Indirectly by ACD CPT, ACD-PROC-000270. Analogous to FREE CPT section.	Indirectly at system level by ACD-INT-02329		Done
9.3	GARC Registers	Table 11 of the LAT-SS-00363 defines the GARC Registers	ACD	Test	FREE CPT, ACD-PROC-000051, Section 7.1, GARC and GAFE Registers Initial Reset Test and Section 8.4, GARC Register Read/Write Tests. Table 11.	Indirectly by ACD CPT, ACD-PROC-000270. Analogous to FREE CPT section.	Indirectly at system level by ACD-INT-02329		Done
9.4	GARC Interface Details	The GARC selects the A or B interface based on which side sent the last look_at_me command.	ACD	Test	FREE CPT, ACD-PROC-000051, Section 8.47, Look-At-Me Circuitry	ACD CPT, ACD-PROC-000270. Analogous to FREE CPT section.	ACD-INT-02329		Done
		A and B LVDS drivers for signals transmitted from the FREE to the AEM can be turned on (3.5 mA drive) and "off" (0.5 mA drive) via command	ACD	Test	FREE CPT, ACD-PROC-000051, Section 8.2, FREE Power Measurement at Nominal Supply Voltage	ACD CPT, ACD-PROC-000270. Analogous to FREE CPT section.	ACD-INT-02329		Done

9.4.1	Flip-Flop Cells, Global Clocking	The GARC and GAFE use cells from the Tanner library for all flip flop functions including DFF, DFF preset, and DFF reset.	ACD	Inspection	Inspection of the design hierarchy on a cell-by-cell basis verifies this requirement, demonstrating the use of the Agilent 0.5um Tanner design library.	Not directly verifiable	See subsystem ver	Done
		The asynchronous preset and reset are used to establish initial state and configuration values to the GARC and GAFE at power on and reset times.	ACD	Inspection	FREE CPT, ACD-PROC-000051, Section 7.1, GARC and GAFE Registers Initial Reset Test and Section 8.4, GARC Register Read/Write Tests.	Not directly verifiable	See subsystem ver	Done
		All flip-flop clocking is via the Tanner global clocking network with a loading setting of 4	ACD	Analysis	Analysis of the Tanner layout setup parameters file	Not directly verifiable	See subsystem ver	Done
		The Tanner global reset feature is used.	ACD	Analysis	Analysis of the Tanner layout setup parameters file	Not directly verifiable	See subsystem ver	Done
		Additional SEU tolerance for the high voltage enable flip-flops is achieved via triple redundancy.	ACD	Test	FREE CPT, ACD-PROC-000051, Section 9.2, Test of the HV Triple Modular Redundancy Circuitry	Not directly verifiable	See subsystem ver	Done
9.4.2	Tanner I/O Pads	Standard Tanner I/O pads will be used by the GARC, including buffered CMOS input, buffered CMOS output, power input, ground input, and unbuffered (for the LVDS and other analog functions).	ACD	Analysis	Inspection of the design hierarchy on a cell-by-cell basis verifies this requirement, demonstrating the use of the Agilent 0.5um Tanner design library.	Not directly verifiable at system level	See subsystem ver	Done
9.5.1	Configuration Readback Data	The ACD shall respond to the AEM's read configuration command with readback data.	ACD	Test	FREE CPT, ACD-PROC-000051, Section 7.1, GARC and GAFE Registers Initial Reset Test and Section 8.4, GARC Register	GLAST LAT ACD Comprehensive Performance Test (CPT) Procedure, ACD CPT, ACD-PROC-	ACD-INT-02329	Done

					Read/Write Tests.	000270. Analogous to FREE CPT section.		
		The data shall consist of thirty-two bits as defined in Table 12 of LAT-SS-00363	ACD	Test	FREE CPT, ACD-PROC-000051, Section 7.1, GARC and GAFE Registers Initial Reset Test and Section 8.4, GARC Register Read/Write Tests.	Indirectly by ACD CPT, ACD-PROC-000270. Analogous to FREE CPT section.	Indirectly at system level by ACD-INT-02329	Done
		The CMD/Data error bit is set if command or data parity error are detected by the ACD.	ACD	Test	FREE CPT, ACD-PROC-000051, Section 8.46, Test of the GARC Parity Detection and Parity Error Generation Circuits	Not directly verifiable at system level	See subsystem ver	Done
		The states of the error bits are returned with each read command.	ACD	Test	FREE CPT, ACD-PROC-000051, Section 8.46, Test of the GARC Parity Detection and Parity Error Generation Circuits	Not directly verifiable at system level	See subsystem ver	Done
		The error bits are reset when read out.	ACD	Test	FREE CPT, ACD-PROC-000051, Section 8.46, Test of the GARC Parity Detection and Parity Error Generation Circuits	Not directly verifiable at system level	See subsystem ver	Done
9.5.2	Event Data	The ACD shall send event data to the AEM upon receiving a trigger command from the AEM.	ACD	Test	FREE CPT, ACD-PROC-000051, Section 8.48, MAX_PHA Return Test	ACD CPT, ACD-PROC-000270. Analogous to FREE CPT section.	ACD-INT-02329	Done
		Table 13 of LAT-SS-00363 defines the bit assignment for event data.	ACD	Test	FREE CPT, ACD-PROC-000051, Section 8.48, MAX_PHA Return Test	Not directly verifiable at system level	See subsystem ver	Done

		The Hit Map bits indicate which channels had an active hit map signal at trigger time.	ACD	Test	FREE CPT, ACD-PROC-000051, Sections 11.7 - 11.10, HitMap Functionality Tests	Not directly verifiable at system level	See subsystem ver	Done
		The Accept Map bits indicate which PHAs will be sent in the event data packet.	ACD	Test	FREE CPT, ACD-PROC-000051, Section 8.50, PHA Threshold Verification Test	GLAST LAT ACD Comprehensive Performance Test (CPT) Procedure, ACD CPT, ACD-PROC-000270. Analogous to FREE CPT section.	ACD-INT-02329	Done
		Normal_Trigger: The PHA value of a channel is sent only if all of the following is true: (1) the channel value is above its set threshold (PHA-Threshold) (2) the channel is enabled (PHA-EN) (3) the number of channels sent preceding this one is less than MAX_PHA	ACD	Test	FREE CPT, ACD-PROC-000051, Section 8.49, PHA Enable/Disable Test	GLAST LAT ACD Comprehensive Performance Test (CPT) Procedure, ACD CPT, ACD-PROC-000270. Analogous to FREE CPT section.	ACD-INT-02329	Done
		Send_All_Trigger: Always all 18 PHA values are sent independent of the setting of PHA-Threshold, PHA-EN, or MAX_PHA.	ACD	Test	FREE CPT, ACD-PROC-000051, Section 8.48, MAX_PHA Return Test and Section 8.50, PHA Threshold Verification Test	GLAST LAT ACD Comprehensive Performance Test (CPT) Procedure, ACD CPT, ACD-PROC-000270. Analogous to FREE CPT section.	ACD-INT-02329	Done
		The "Zero-Suppress-Bit" field identifies the channels for which a PHA value is present in the PHA word field. This is true for either trigger mode. So for each Send_All_trigger all 18 bits are set in the Zero-Suppress bit field.	ACD	Test	FREE CPT, ACD-PROC-000051, Section 8.50, PHA Threshold Verification Test	GLAST LAT ACD Comprehensive Performance Test (CPT) Procedure, ACD CPT, ACD-PROC-	ACD-INT-02329	Done

						000270. Analogous to FREE CPT section.			
		PHA_EN bits are used only for normal_trigger. PHAs are sent regardless of PHA_EN for Send_All_PHAs trigger.	ACD	Test	FREE CPT, ACD-PROC-000051, Section 8.48, MAX_PHA Return Test and Section 8.49, PHA Enable/Disable Test	GLAST LAT ACD Comprehensive Performance Test (CPT) Procedure, ACD CPT, ACD-PROC-000270. Analogous to FREE CPT section.	ACD-INT-02329		Done
10.0	ACD Tile Numbering Scheme	A four digit matrix number uniquely specifies a tile and PMT. The least significant digit gives the column number, the next digit gives the row number, and the next digit gives the face number, as shown in Figure 10 of LAT-SS-00363.	ACD	Inspection	Inspection One WOA for each chassis Drawing GE2057474	ACD-PROC-000293. Source used to exercise or test. To be added to Muon Test proc.	ACD-INT-02286	Match detector tile positions and corresponding PMT locations to map in figure 8 in ICD	Done
		The side rows are numbered from the front backward and the side columns are numbered along the respective (+X, +Y) axis. The most significant digit specifies the tile mapping to a PMT channel on a FREE card. The primary PMT channel is 0 and the secondary PMT channel is 1. Each tile has two PMTs (primary, secondary) that are mapped to two channels on different FREE cards.	ACD	Inspection	Inspection One WOA for each chassis Drawing GE2057474	ACD-PROC-000293. Source used to exercise or test. To be added to Muon Test proc.	ACD-INT-02286	Match detector tile positions and corresponding PMT locations to map in figure 8 in ICD	Done
		A three-digit alphanumeric identifies each FREE Card. The least significant digit defines a primary "A" or secondary "B" board, the next digit defines the left "L" or right "R" side of the ACD face, and the next digit defines the face of the ACD where the boards are located. Figure 10 shows the PMT locations on the ACD.	ACD	Inspection	Inspection One WOA for each chassis Drawing GE2057474	ACD-PROC-000293. Source used to exercise or test. To be added to Muon Test proc.	ACD-INT-02286	Match detector tile positions and corresponding PMT locations to map in figure 8 in ICD	Done
		The ACD also has eight fiber ribbons, each connected to two PMTs (primary, secondary). The four-digit number also uniquely specifies the fiber ribbon and PMT; however, the definition of this number is different from the tile numbering definition. The two least significant form a sequential number of fiber ribbons (00-03) along either the X-axis or Y-axis. The next digit defines the axis, X is 5 and Y is 6. The most	ACD	Inspection	Inspection One WOA for each chassis Drawing GE2057474	ACD-PROC-000293. Source used to exercise or test. To be added to Muon Test proc.	ACD-INT-02286	Match detector tile positions and corresponding PMT locations to map in figure 8 in ICD	Done

		significant digit specifies the fiber ribbon mapping to a PMT channel on a FREE card. The primary PMT channel is 0 and the secondary PMT channel is 1. Each fiber ribbon has two PMTs (primary, secondary) that are mapped to two channels on the FREE cards.							
11.0	Thermal Interface and Heat Transfer	The ACD has three thermal interfaces. First, the ACD-Grid interface is the primary means for conductive heat transfer. The second interface is the radiative thermal coupling to the outer space environment, through the MLI surrounding the ACD. The final interface is the radiative thermal interface between the inside surface of the ACD and the Tracker modules and Grid. The ACD shall use the on-orbit thermal environment heat flux values and SC thermal interface definitions as listed in the LAT-SC IRD, 433-IRD-0001.	ACD	Analysis	Thermal analysis summary	Thermal balance waived, will not be verified at system level	See subsystem level waiver	LAT not sensitive to small errors in this area	Done
11.1	ACD Temperature Requirements	The ACD shall meet the temperature requirements as listed in Table 14 of LAT-SS-00363 and the LAT Environmental Specification, LAT-SS-00778.	ACD	Analysis and Test	GLAST LAT ACD FREE Thermal Performance Test, ACD-PROC-000150; ACD PMT Qualification - Thermal Vacuum and Corona Test, ACD-PROC-000260; WOAs ACD-00928 thru ACD-00942; HVBS Test Procedure, ACD-PROC-000064. WOA-ACD-00321 to ACD-00350	ACD Thermal Vacuum Procedure (ACD-PLAN-000347), ACD Comprehensive Performance Test (CPT) (ACD-PROC-000270) Flight Unit and Qualification Unit Electronic Chassis thermal Vacuum Test Procedure, ACD-PROC-000217; WOA ACD-02102	ACD-INT-02334		Done
		No ACD hardware shall be tested above 45°C.	ACD	Analysis and Test	GLAST LAT ACD FREE Thermal Performance Test, ACD-PROC-000150; ACD PMT Qualification - Thermal Vacuum and Corona Test, ACD-PROC-000260; WOAs ACD-00928 thru ACD-00942;	ACD Thermal Vacuum Procedure (ACD-PLAN-000347), ACD Comprehensive Performance Test (CPT) (ACD-PROC-000270) Flight Unit and Qualification	ACD-INT-02334		Done

					HVBS Test Procedure, ACD-PROC-000064. WOA-ACD-00321 to ACD-00350	Unit Electronic Chassis thermal Vacuum Test Procedure, ACD-PROC-000217; WOA ACD-02102			
		The cold case analysis for ACD efficiency uses an average tile temperature of -17°C.	ACD	Analysis and Test	GLAST LAT ACD FREE Thermal Performance Test, ACD-PROC-000150; ACD PMT Qualification - Thermal Vacuum and Corona Test, ACD-PROC-000260; WOAs ACD-00928 thru ACD-00942; HVBS Test Procedure, ACD-PROC-000064. WOA-ACD-00321 to ACD-00350	ACD performance report ACD-RPT-000271	N/A		Done
11.2	LAT Interface Temperature Requirements	The LAT Grid and the LAT thermal control system shall maintain the ACD within the temperatures shown Table 14 of LAT-SS-00363 and in the LAT Environmental Specification, LAT-SS-00778.	LAT	LAT Requirement					
11.4	Power Dissipation	The maximum heat dissipated in the ACD during normal operating conditions shall be no greater than ~17.6 watts.	ACD	Test	ACD-PROC-000051	ACD Thermal Vacuum Procedure (ACD-PLAN-000347	ACD-INT-02334		Done but max cond. (failed PMTS at max temp) cant be reached
		The maximum orbit-average heat dissipated in the ACD during normal (only A-side OR B-side is on) operating conditions shall be no greater than 11 watts. Changed to 11.5 W by CR	ACD	Test	ACD-PROC-000051	ACD Thermal Vacuum Procedure (ACD-PLAN-000347	LAT-XR-006636-01	11.5W allocation 11.34 W actual	Done
		The heat dissipation within the ACD shall be stable to within +/- 2 watts of the nominal during operations.	ACD	Test	ACD-PROC-000051	Thermal balance test waived	Thermal balance test waived		Thermal balance test waived
11.5	ACD-LAT Bolted	The bolted joint interface with the Grid shall	ACD	Analysis	Not verifiable at	Thermal	Thermal	Qnet-hot = -5 W	Thermal

	Joint Interface	be the primary mechanism for transferring heat into and out of the ACD. See the ACD-LAT IDD, LAT-DS-00309 for details. The net heat transfer from the ACD to the LAT will be: Qnet-hot = -5 W, Qnet-cold = -25 W			the component level	balance test waived	balance test waived	Qnet-cold = -25 W	balance test waived
11.6	Multi-Layer Insulation	ACD MLI blankets shall be constructed of 6 to 18 inner layers of 1/4 mil thick mylar aluminized on both sides, each separated by a layer of dacron netting.	ACD	Inspection	Drawing Checker - MLI assy procedure inspection	Drawing Checker - MLI assy procedure ACD-PLAN-000285 inspection	ACD-WOA-02316		Done
		The entire blanket assembly shall be sandwiched between a 3 mil thick Germanium Black Kapton (with scrim) sheet and a 1 mil thick VDA Kapton sheet.	ACD	Inspection	Drawing Checker - MLI assy procedure inspection	Pre-integration inspection ACD-PLAN-000285	ACD-WOA-02316		Done
		The micrometeoroid shield and MLI blanket cover the ACD per drawing LAT-DS-01151, ACD Outline Drawing.	ACD	Inspection	ACD-PLAN-000285	Pre-integration inspection	ACD-WOA-02316		Done
		The ACD MLI shall have an effective thru emittance, $e^*$ where $0.01 < e^* < 0.03$ . High emissivity ( $>0.78$ ), low alpha ( $<0.55$ ) on outer layer MLI blankets	ACD	analysis	ACD Thermal Vacuum Procedure (ACD-PLAN-000347	N/A	N/A		Thermal balance test waived
		The ACD MLI blanket shall be grounded at eight locations, two per side per drawing LAT-DS-01151, LAT-ACD Outline Drawing.	ACD	Inspection and Test	ACD-PLAN-000285	Post-installation resistance measurement	ACD-WOA-0133		Done
11.7	ACD Thermal Coatings	The locations and thermal coatings to be used on the ACD are defined in Table 15 of LAT-SS-00363.	ACD	Inspection	Single row channel dwg, 2054507; double row channel dwg, 2054513; electronics cover dwg, 2054562; front PMT rail dwg, 2054589; rear PMT rail dwg, 2054537; Connector bracket dwg, 2054524	Not verified at system level	See subsystem ver		Done
11.8	Tracker Surface Property Assumptions	For ACD thermal analysis, the following tracker tower and grid surface property assumptions can be made: Tracker Tower - Black anodize or black paint with $0.8 < \text{emissivity} < 0.9$ , Grid - "Alodine with emissivity $<0.2$ " to replace "Black Anodize with emissivity BOL = 0.82, EOL = 0.78"	ACD/LAT				Coating group provided an email to Peters.		Done
12.1	Cable and Connector Definitions	Cable and connector definitions are given in Section 8 of the LAT-SS-00363 and the connector locations are shown on the IDD, LAT-DS-00309	ACD	Inspection		ACD Chassis to BEA Assembly Procedure	One WOA for each chassis		Done

						ACD-PROC-000316			
12.2	Cable Routing and Support	Cable routing and cable support is detailed in the IDD, LAT-DS-00309	LAT	Inspection		LAT	LAT		LAT
13.1	Integration Stay-Clears and Access Requirements	The ACD shall be integrated to the LAT vertically, from above. The ACD shall be capable of being de-integrated from the Grid at any time.	ACD	Inspection	N/A	ACD Assembly drawing, ACD Survey porc	Survey WOA from Ken		Done
		Once the ACD is reintegrated, the only regression testing required is a limited electrical test to verify the ACD-LAT cable mates.	ACD	Inspection	N/A	Safe-to-Mate Procedure during LAT integration, ACD Safe-to-Mate Procedure, ACD-PROC-000333	ACD-INT-02329		Done
		The MLI micrometeoroid shield interface shall allow access to the LAT region under the ACD stay-clear. to replace "The MLI micrometeoroid shield shall either be integrated after the ACD, or its bottom skirt shall be able to be folded up onto the ACD during and after integration, to provide access to the LAT region under the ACD stay-clear"	ACD	Inspection	ACD-PLAN-000285	ACD-WOA-02157	ACD-WOA-2317	No longer any skirt!	Done
		The LAT will be supported at the Grid corners, with a frame that stays outside of the ACD useable envelope, as defined in the ACD-LAT IDD, LAT-DS-00309.	LAT	LAT Requirement					LAT
13.2	Provision for Surveying	Refer to the LAT I&T Survey and Alignment Plan, LAT-MD-01586 and the ACD-LAT IDD, LAT-DS-00309 for details of surveying, alignment, datum structure, and fiducial locations.	ACD		N/A	ACD survey Plan, LAT-DS-000309, ACD-PLAN-000285 Survey porc	ACD-INT-02207		Done
13.3	Instrumentation	Flight and test instrumentation (thermistors, thermocouples, accelerometers, strain gauges, etc.) used during test are defined in the LAT Instrumentation Plan, LAT-TD-00890 and the ACD Integration and Test Plan, LAT-TD-00430.	ACD	Test	N/A	GE2054615, Assembly Instrumentation Installation	ACD-INT-01444		Done
13.4	Integration GSE	ACD lifting and integration fixtures shall not violate the ACD's useable envelope as defined in the ACD-LAT IDD, LAT-DS-00309.	ACD	Inspection	N/A	ACD-PROC-000194	ACD-WOA-01064		Done
		ACD lift interface zones with allowable force and moment vectors.	ACD	Analysis			ACD-WOA-02300		Done

		During ACD integration, no GSE that would intrude in the ACD's usable envelope shall be mounted on top or on the sides of the Grid.	LAT	LAT Requirement					LAT
13.4.1	ACD Provided GSE	Development, fabrication, test, and delivery of the lifting harnesses, shackles, and any other temporary hardware needed to support the ACD during integration on the LAT.	ACD	Inspection		GE 2057546	Will send our lift sling, LAT agreed to make one for final in low clean room		Done
		Development, fabrication, test, and delivery of the handling dolly to the support and move the ACD prior to integration to the LAT.	ACD	Inspection	N/A	GE 2057516	ACD-WOA-02345		Done
		Development, fabrication, test, and delivery of any needed drill templates/pin templates.	ACD	Inspection	N/A	N/A	N/A	None	
		Development, fabrication, test, and delivery of the micrometeoroid shield/thermal blanket removal tools and lift sling if needed.	ACD	Inspection	ACD-PLAN-000285), ACD-PROC-000356, ACDPLAN-000152, 2054591, 2054500, 2072262, 2054592	GE 2082372	ACD-INT-2317, 2157, 2326		Done
		Development, fabrication, test, and delivery of the ACD multi-purpose test fixture.	ACD	Inspection		GE2068109	N/A		Done
		Development, fabrication, test, and delivery of the Hydraset capable of manipulating ACD if needed.	ACD	Inspection	N/A	N/A		Not needed	
		Development, fabrication, test, and delivery of the Helium monitoring equipment with sufficient documentation and training for operation.	ACD	Inspection	N/A	Commercial monitor manufacturer: inficon model: 12206 protec	N/A	Manual and instructions provided	Done
13.4.2	LAT Provided GSE	Development, fabrication, and test of the crane for lifting the ACD with its lifting fixture. Capacity->290 Kg.	LAT	LAT Requirement			LAT		LAT
		Development, fabrication, and test of the Lifting fixture for the ACD to be used at SLAC. Design factor of safety shall be >3 times against minimum material yield strength.	LAT	LAT Requirement			LAT		LAT
		LAT will provide enough information for ACD to manufacture a Grid simulator for testing purposes.	LAT	LAT Requirement					LAT

14.1	Venting	The major ACD vent path shall be between the BFA and MSS/MLI on the +X, +Y and -Y sides of the LAT. The ACD shall not vent directly toward the spacecraft.	ACD	Inspection	MMS/MLI development plan, ACD-PLAN-000285	MMS/MLI development plan, ACD-PLAN-000285	ACD-INT-02326		Done
14.2	Particulates and Other Contamination	The ACD shall contain all fracture-sensitive materials such that any particulates produced by a fracture are contained within the stay-clear volume of the ACD.	ACD	Inspection	N/A	ACD MMS/MLI contains particulates within the ACD volume. ACD Assembly drawing,	ACD-INT-02157		Done
		The ACD shall prevent any venting or shedding of particulates down, or out the bottom of its stayclear, to avoid possible contamination of the spacecraft star tracker.	ACD/LAT	Analysis and Inspection	N/A	MMS/MLI development plan, ACD-PLAN-000285			Done
		The ACD is sensitive to Helium and must be protected from concentrations greater than 5 parts per million, which is approximately the normal atmospheric concentration. Helium monitoring is required twice a week and whenever the ACD is moved to a new location. If the ACD is in a building with recirculated air and the building contains a source of helium then daily monitoring is required.	ACD		Helium Monitor and Control Plan, ACD-PLAN-000152	Commercial monitor manufacturer: inficon model: 12206 protec	N/A	Manual and instructions provided	Done