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	Subsystem/Office Electronics & DAQ Subsystem	
Document Title <b>Tower Electronics Module (TEM)/Tower Power Supply(TPS) Specification -  Level V Specification</b>		

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TEM Level 5 Requirements Document

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**CHANGE HISTORY LOG**

Revision	Effective Date	Description of Changes
1	1/6/2005	Original Release
2	02/14/05	Changed requirement 6.1.5 from Tracker 1.5V Analog voltage shall be $1.5 \pm 5\%$ to $1.5 \pm 10\%$ .

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## 1. **SCOPE**

This document defines the level 5 subsystem requirements for the Tower Electronics Module (TEM).

## 2. **DEFINITIONS AND ACRONYMS**

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

### 2.1 **Definitions**

A, An	Analog
A	Analysis
D, Dg	Digital
DR	Data Rate
Eff	Efficiency
F	Functional
s	microsecond
ns	nanosecond
P	Performance
P/F	Pass/Fail
V	Volt
W	Watt

### 2.2 **Acronyms**

AFEE	Analog Front End Electronics
AIDS	Assembly and Inspection Data Sheet
BOB	Break Out Box
BOC	Break Out Cable
CAL	Calorimeter
CC	Cable Controller
CSAM	Computer Scanning Acoustic Microscopy (computer sweeps the EUT with a tone to detect any voids in the ASIC)
EBM	Event Builder Module
EGSE	Electrical Ground Support Equipment
EICIT	Electrical Interface Continuity and Isolation Test (cold checks)
ETech	Electrical Technician
EUT	Equipment Under Test
FE	Front End
FIFO	First-in, First-Out

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## TEM/TPS Level 5 Requirements Document

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FPGA	Field-Programmable Gate Array
GASU	Global trigger, ACD, System Unit
GCCC	GLAST Calorimeter Cable Controller
GEM	Global-Trigger Electronics Module
GLAST	Gamma Ray Large Area Space Telescope
GTCC	GLAST Tracker Cable Controller
GTFE	GLAST Tracker Front End
GTRC	GLAST Tracker Readout Controller
HAST	Highly Accelerated Stress Test
ICD	Interface Control Document
LAT	Large Area Telescope
LATp	Large Area Telescope protocol
MCM	Multi Chip Module
MGSE	Mechanical Ground Support Equipment
STM	Safe To Mate
SVT	Stray Voltage Test (hot checks)
T&DF	Trigger and Data Flow
TACK	Trigger Acknowledge
TAM	Trigger Accept Message
TEM	Tower Electronics Module
TKR	Tracker
TPS	Tower Power Supply
TRG	Trigger

### 3. APPLICABLE DOCUMENTS

<u>Reference</u>	<u>Document Number</u>	<u>Description</u>
[1]	LAT-SS-00284	LAT Trigger Subsystems Specification – Level IV
[2]	LAT-SS-00285	LAT Dataflow Subsystems Specification – Level IV
[3]	LAT-TD-00605	TEM Programming ICD Specification
[4]	LAT-TD-00606	LAT Inter-Module Communications, Manual
[5]	LAT-SS-00183	Power Supply Modules Specification – Level IV
[6]	LAT-SS-00288	TEM Specification and ICD
[7]	GSFC 433-SPEC-0001	GLAST Mission System Specification
[8]	LAT-SS-05522	TEM Specifications – Level V Specification
[9]	LAT-SS-01281	Tower Power Supply Specification and ICD
[10]	LAT-MD-03474	Redline/Blackline Engineering Documents

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## TEM/TPS Level 5 Requirements Document

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[11]	LAT-TD-00564	LAT Mass Status Report
[12]	LAT-PS-04568	Statement of Work, LAT DAQ EMI Testing
[13]	LAT-SS-00778	LAT Environmental Specification
[14]	LAT-TD-04085-02	TEM/TPS Performance Test Procedure

### **4. REQUIREMENTS**

This section lists the requirements that shall be utilized during design, development, manufacture, assembly, testing and storage of the TEM/TPS units.

#### **4.1 Redlining and Blacklining Documents**

The users of this document shall follow the requirements found in the Redline/Blackline Engineering Documents, [10] (LAT-MD-03474).

## **5. TEM SPECIFIC REQUIREMENTS**

The TEM shall meet requirements specified in [8] (LAT-SS-05522).

## **6. TPS SPECIFIC REQUIREMENTS**

The TPS shall meet the following requirements:

### **6.1 TPS voltage specifications**

#### **6.1.1 CAL HV voltage specification**

Calorimeter HV shall be adjustable from 0 to 100 V ( $\pm 0.5\%$ ).

#### **6.1.2 CAL 3.3 V Analog voltage specification**

Calorimeter 3.3V Analog voltage shall be  $3.3 \pm 5\%$ .

#### **6.1.3 CAL 3.3 V Digital voltage specification**

Calorimeter 3.3V Digital voltage shall be  $3.3 \pm 5\%$ .

#### **6.1.4 TKR HV voltage specification**

Tracker HV shall be adjustable from 0 to 150 V ( $\pm 0.5\%$ ).

#### **6.1.5 TKR 1.5 V Analog voltage specification**

Tracker 1.5V Analog voltage shall be  $1.5 \pm 10\%$ .

#### **6.1.6 TKR 2.5 V Analog voltage specification**

Tracker 2.5V Analog voltage shall be  $2.5 \pm 5\%$ .

#### **6.1.7 TKR 2.5 V Digital voltage specification**

Tracker 2.5V Digital voltage shall be  $2.5 \pm 5\%$ .

#### **6.1.8 TEM 3.3 V Digital voltage specification**

Tracker 3.3V Digital voltage shall be  $3.3 \pm 5\%$ .

### **6.2 TPS current specifications**

#### **6.2.1 CAL HV current specification**

Calorimeter HV shall supply up to 1mA.

#### **6.2.2 TKR HV current specification**

Tracker HV shall supply up to 4mA.



### **6.2.3 TPS/TEM current specification**

Maximum input current shall be  $1A \pm 0.5$  at 28V at the maximum front-end load.

## **6.3 TPS RMS noise specifications**

### **6.3.1 CAL HV noise specification**

Calorimeter HV noise within 1MHz bandwidth shall be less than 1mV RMS.

### **6.3.2 CAL 3.3 V Analog noise specification**

Calorimeter 3.3V Analog noise within 1MHz bandwidth shall be less than 0.1mV RMS.

### **6.3.3 CAL 3.3 V Digital noise specification**

Calorimeter 3.3V Digital noise within 1MHz bandwidth shall be less than 1mV RMS.

### **6.3.4 TKR HV noise specification**

Tracker HV noise within 1MHz bandwidth shall be less than 10mV RMS.

### **6.3.5 TKR 1.5 V Analog noise specification**

Tracker 1.5V Analog noise within 1MHz bandwidth shall be less than 0.2mV RMS.

### **6.3.6 TKR 2.5 V Analog noise specification**

Tracker 2.5V Analog noise within 1MHz bandwidth shall be less than 0.2mV RMS.

### **6.3.7 TKR 2.5 V Digital noise specification**

Tracker 2.5V Digital noise within 1MHz bandwidth shall be less than 1mV RMS.

## **7. TEM/TPS REQUIREMENTS**

### **7.1 TEM/TPS Power consumption**

#### **7.1.1 Power consumption under maximum load**

TEM/TPS with maximum loads shall consume less than 28W at 28V input voltage with nominal low-voltage output levels. Combined load contribution equal to  $16W \pm 0.2W$ .

#### **7.1.2 Power consumption without any CAL/TKR load**

TEM/TPS without any CAL/TKR load and CAL/TKR power disabled shall consume  $3.4W \pm 0.4W$  at 28V supply with nominal TEM voltage levels.

### **7.2 Mass Property**

The mass of the TEM/TPS package shall not exceed the total mass as specified in [11](LAT-TD-00564).

### **7.3 Center of Gravity Property**

The center of gravity of the TEM/TPS package shall be measured and recorded to a precision of  $\pm 3$  mm.

### **7.4 EMI/EMC**

The TEM/TPS packages shall meet EMI/EMC requirements specified in [12] (LAT-PS-04568).

### **7.5 Temperature**

The TEM/TPS package shall meet all requirements over a temperature range as specified for the DAQ sub-system in [13] (LAT-SS-00778).

### **7.6 Vibration**

The TEM/TPS package shall meet all requirements after subjected to vibration level specified for the DAQ sub-system in [13] (LAT-SS-00778).