Serial Number: 008 Date: 4-2-08

Tech: T. Etzel

LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY

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CALIFORNIA INSTITUTE OF TECHNOLOGY

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Document Type	DCC Number	March 10, 2008
	T080062-00-C	
UK Satellite Amplifier Pre-Production Prototype Test Plan		
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Distribution of this draft:
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1 Introduction

The tests described below will be utilized to test the first production prototype of the Adl Quad Suspension Satellite Amplifier. These amplifiers are being designed and build by the UK group located at the University of Birmingham. The design requirements for the driver can be found in LIGO document number T060067-00-C, "AdL Quad Suspension UK Coil Driver Design Requirements". The requirements for the satellite amplifiers are not called out explicitly in the requirements document as the amplifiers are used a remote front end to amplify the OSEM photodiode currents, provide a constant 35mA current bias for the OSEM LEDs and serve as a pass through for the OSEM coil signals.

These tests are not comprehensive and will only be utilized to verify that the amplifier meets the design requirements. It is assumed that the amplifiers have been thoroughly tested by the University of Birmingham prior to shipment.

2 Test Equipment

- Stanford Research SR785 analyzer
- Voltmeter
- Oscilloscope
- Board Schematics- TBD

3 Tests

The tests are broken into three categories—photodiode amplifier noise and signal conditioning, LED current drive, and monitoring and indicators. The tests for each of these categories are described in the sections below.

3.1 Photodiode Amplifier Tests

3.1.1 Amplifier Noise

The noise floor for the B-OSEM used in the AdL Quad noise prototype is approximately $5x10^{-11}$ m/√Hz at 10 Hz. This corresponds to a current noise of 1.3pA/√Hz at the output of the B-OSEM photodiode. The gain of the photodiode amplifier circuit designed for the Satellite Amplifier is 309Kohms. This leads to an output referred noise voltage of:

$$1.3\text{pA}/\sqrt{\text{Hz}} \times 309\text{K} = 402\ \text{nV}/\sqrt{\text{Hz}},$$

where the output is defined as the output of the satellite amplifier. Therefore, the output referred noise of the satellite amplifier should be much less than this number so as not to degrade the sensitivity of the B-OSEM. In the table below, record the output voltage noise measured at 10Hz and 100Hz for each channel of the satellite amplifier. The inputs to the satellite amplifier should not be connected during the test. In addition, save the power spectrum for one representative channel to disk and record the file name in space provided below.

Channel Number (Measurement Point)	Noise at 10Hz nV/√Hz	Noise at 100Hz nV/√Hz
1 (J2-14, J2-1)	145	140
2 (J2-15, J2-2)	175	125
3 (J2-16, J2-3)	160	155
4 (J2-17, J2-4)	124	145

File Name for noise measurement (0Hz < freq < 100Hz): NOISE1

Channel Number for saved file: 1

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3.1.2 Amplifier Response

The response of the photodiode amplifier is a current to voltage converter and is flat for frequencies below 1KHz. The nominal gain is 309Kohms. The test setup for measurement of the frequency response of the amplifier is shown in the figure below.

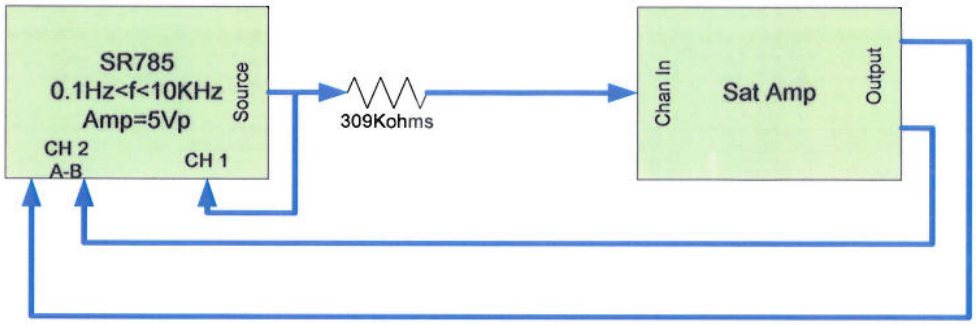

Figure 1: Photodiode Amplifier Response Test Setup

Didn't have a 309K Resistor. Used a 301K Resistor

Note that the 309Kohm resistor in series with the source should make the overall voltage gain of the setup 1.0. In the tables below, record the measured gain for each channel.

Table 1: Channel 1 Transfer Function Measurements

Freq (Hz) Input=J1-25	Nominal Gain (dBV/V) Output= J2-14, J2-1	Nominal Phase (Degrees)	Actual Gain (dBV/V)	Actual Phase (Degrees)
1	0	0	0.2	-0.05
10	0	0	0.2	-0.2
100	0	0	0.2	-1.7

Table 2: Channel 2 Transfer Function Measurements

Freq (Hz) Input=J1-22	Nominal Gain (dBV/V) Output= J2-15, J2-2	Nominal Phase (Degrees)	Actual Gain (dBV/V)	Actual Phase (Degrees)
1	0	0	0.2	-0.05
10	0	0	0.2	-0.2
100	0	0	0.2	-1.7

Table 3: Channel 3 Transfer Function Measurements

Freq (Hz) Input=J1-19	Nominal Gain (dBV/V) Output= J2-16, J2-3	Nominal Phase (Degrees)	Actual Gain (dBV/V)	Actual Phase (Degrees)
1	0	0	0.2	-0.05
10	0	0	0.2	-0.2
100	0	0	0.2	-1.7

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Table 4: Channel 4 Transfer Function Measurements

Freq (Hz) Input=J1-16	Nominal Gain (dBV/V) Output= J2-17, J2-4	Nominal Phase (Degrees)	Actual Gain (dBV/V)	Actual Phase (Degrees)
1	0	0	0.2	~~-0.2~~ -0.05
10	0	0	0.2	~~-1.7~~ -0.2
100	0	0	0.2	-1.7

3.2 LED Current Driver

The LED driver circuit is a current source that produces a constant 35mA into a load (LED). During these tests a 10 ohm resistor in place of the OSEM LED is used to measure the current source output. Connect a 10 ohm resistor between the output pins for each LED drive output and using a voltmeter record the output current for each channel. Record the results in the table below.

Resistor measured at 10.0 Ω

Table 5: LED Drive Current Measurements

Channel Number	Output Pins (Connect 10 ohms Across)	Measured Voltage Vmeas	Actual Current= Vmeas/10ohms
1	J1-24, J1-11	.346	34.6 mA
2	J1-21, J1-8	.346	34.6 mA
3	J1-18, J1-5	.347	34.7 mA
4	J1-15, J1-2	.347	34.7 mA

For convenience, it may be convenient to perform the current and voltage monitor values in section 3.3.1 of this test plan at the same time as these tests are being conducted.

3.3 Monitoring and Indicators

3.3.1 LED Current and Voltage Monitors

The test setup for these measurements is the same as that used in section 3.2 of this test plan. The nominal gain of the LED current monitor is 1V/35mA and the nominal gain of the LED voltage monitor is 1V/V. The nominal readings for the current and voltage monitors are 1V and 5.495V, respectively. In the table below record the LED current and voltage monitors for each channel.

Table 6: LED Drive Current and Voltage Monitor Measurements

Channel Number	Output Pins (Connect 10 ohms Across)	Current Monitor Pins	Measured Current Monitor Value	Voltage Monitor Pins	Measured Voltage Monitor Value
1	J1-24, J1-11	J2-5, J2-18	1.0 V	J4-2, J4-20	5.57 V
2	J1-21, J1-8	J2-6, J2-19	1.0	J4-5, J4-23	5.57
3	J1-18, J1-5	J2-7, J2-20	1.0	J4-8, J4-26	5.58
4	J1-15, J1-2	J2-8, J2-21	1.0	J4-11, J4-29	5.60

3.3.2 LED Current Source Fault Indicators

The satellite amplifier has four fault indicators that illuminate when the current output by the current source is not 35 mA, +/-TBD. With no connections to J1, verify that all four fault LEDs are illuminated and record the results below.

All four fault indicators illuminated? YES

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3.3.3 Photodiode Amplifier Local Monitor

The satellite amplifier design provides for local monitoring of the output of each photodiode amplifier. This monitor only looks at the positive output leg of each output. Using the test setup used for the transfer function measurements in section 3.1.2 with the SR785 replaced by a 1VDC source; record the monitor voltage for each channel. The nominal voltage is 0.5VDC. Record the results in the table below.

Table 7: LED Drive Current Measurements

Channel Number	Monitor Pins	Measured Voltage
1	J4-3, J4-22	0.512
2	J4-6, J4-25	0.509
3	J4-9, J4-28	0.511
4	J4-12, J4-30	0.511

Note: Measured voltages are positive if the negative (com) lead is placed on J4-3, 6, 9, 12 and positive lead on J4-22, 25, 28, 30