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# LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY

**-LIGO-**

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**MASSACHUSETTS INSTITUTE OF TECHNOLOGY**

Document Type	DCC Number	Jan 30 <sup>th</sup> , 2014
	T1400032-V2	
<b>TCS AA Chassis Continuity and Notch Test Plan</b>		
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Distribution of this draft:

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## 1 Introduction

The tests described below are required to verify the correct high-frequency operation of the TCS AA Chassis (D1300282-v1). The transfer function of this board is a 3<sup>rd</sup> order, 10KHz Butterworth low pass filter with a single notch at 65536Hz. These tests assume that the low-frequency automated tests have already been passed by the boards inside.

The chassis should be powered using a standard bench supply.

## 2 Test Equipment

Dynamic Signal Analyzer

Power supplies

## 3 Tests

### 3.1 Filter Response

(From aLIGO ISC Anti Alias/Image Chassis Test Procedure)

#### Procedure - Manual Test

- The second portion of these tests must be conducted manually, as the computer system doesn't allow us to generate sufficiently high frequencies. For this we must use an SR785, an SR560, and some switch boxes that allow us to change channels more easily. Each channel must be tested individually. Check the wiring diagram to see this configuration.
- In this manual test we are looking at each filter to record
  - The gain at 20 kHz
  - The gain at ~ 65 kHz (the designed notch frequency)
  - The central frequency of the notch
- The SR560 is used only to invert the signal. The gain should be set to 1 and "invert" should be selected.
- The appropriate settings for the SR785 are shown in the table below.
- After you have completed all parts of the automated test, the script will ask if you would like to open the .tex file to fill in the appropriate values. Enter "y".
- The .tex files are organized into 8-channel sets and labeled alphabetically. i.e. the title for the .tex file for channels 1-8 ends in "a", channels 9-16 ends in "b", etc.
- This is where you will record all of the values as you go through the manual part of the test. Use the cursor on the SR785 to locate the specific values. Once all the values are entered, save each file and close them.
- The script will then ask you if you want to organize everything, and finally, if you want to view the results.
- The combined results files can be found in the AATest or AITest directory in a folder with the DUT's serial number:
  - AATest/SXXXXXXX/plots/SXXXXXXX\_Plots.pdf
  - AATest/SXXXXXXX/plots/SXXXXXXX\_Results.pdf
- These files will also plot a reference that shows the design specifications. These can be used to determine if the device is misbehaving in any of its 8 channels.
- If the test should fail at any point, or if you wish to test the chassis again, you simply follow the same procedure. The script will notice if there is already test data for the specified serial number, copy it to a new location within the same directory, and lead you through the process again.
- Please reference document T1000673 for more detailed information of device requirements.

Serial Number: \_\_\_\_\_

Date: \_\_\_\_\_

Tech: \_\_\_\_\_

<b>SR785 Settings for AA/AI Test</b>			
<b>Frequency</b>	<b>Display Style</b>	<b>Display Options</b>	<b>Marker</b>
10 kHz	Swept Sine	Live	on
70 kHz	Freq Response	Single	Normal
Continuous	Log Mag	-	Mean
Log	Units: dBVrms	off	Spot
off	60	on	off
400	-40	10	0
-	-140	-	0
-	20	-	off
-	-	-	-
<b>Source</b>	<b>Input</b>	<b>Trigger</b>	<b>Average</b>
off	Analog	Auto arm	7.8125 ms
1V	-	-	1
off	-	-	15.625
1 V/S	-	-	10
0.0 mV	-	-	-
-	-	-	-

(From T070146-v3)

The nominal response of each channel is a 3<sup>rd</sup> order, 30KHz Butterworth low pass filter with a single notch at 65536 Hz. The tolerance on the gain and phase measurements is +/- 1 dB and 5 degrees, respectively.

<b>Chan</b>	<b>Input (Front Panel of Chassis)</b>	<b>Output (SCSI Interface Board)</b>	<b>Gain at 65536Hz &lt;-75dB?</b>	<b>Pass/ Fail</b>
1	P1-1,20	TP1-TP35		
2	P1-2,21	TP2-TP36		
3	P1-3,22	TP3-TP37		
4	P1-4,23	TP4-TP38		
5	P1-5,24	TP5-TP39		
6	P1-6,25	TP6-TP40		
7	P1-7,26	TP7-TP41		
8	P1-8,27	TP8-TP42		
9	P1-9,28	TP9-TP43		
10	P1-10,29	TP10-TP44		
11	P1-11,30	TP11-TP45		
12	P1-12,31	TP12-TP46		
13	P1-13,32	TP13-TP47		
14	P1-14,33	TP14-TP48		
15	P1-15,34	TP15-TP49		
16	P1-16,35	TP16-TP50		
17	P1-17,36	TP17-TP51		
18	P1-18,37	TP18-TP52		
19	P2-1,6	TP19-TP53		
20	P2-2,7	TP20-TP54		
21	P2-3,8	TP21-TP55		
22	P2-4,9	TP22-TP56		

Serial Number: \_\_\_\_\_

Date: \_\_\_\_\_

Tech: \_\_\_\_\_

23	P3-1,6	TP23-TP57		
24	P3-2,7	TP24-TP58		
25	P3-3,8	TP25-TP59		
26	P3-4,9	TP26-TP60		
27	P4-1,6	TP27-TP61		
28	P4-2,7	TP28-TP62		
29	P4-3,8	TP29-TP63		
30	P4-4,9	TP30-TP64		
31	P5-1,6	TP31-TP65		
32	P4-2,7	TP32-TP66		

Plots of the nominal transfer function are shown in the figure below. Note that the phase plot in the figure shows the inverting response from the previous version of the board. The v2 and v3 response is non-inverting, but has the same shape. 180 degrees should be subtracted from all points on the plot.

