LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY

LIGO Laboratory / LIGO Scientific Collaboration

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Test Result for ALS Fiber Distribution S1202530

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1 Introduction

The following Test Procedure describes the test of proper operation of the ALS fiber distribution. The RF amplifier should always be connected to an output before supplying power. Further information can be found on the wiki page.

2 Test Equipment

1. Voltmeter
2. 9kHz – 1.2Ghz Signal Generator
3. EPM Series Power Meter (N1914A)
4. 10dBm Attenuator BNC to SMA
5. RF Cable Hand Formable SMA
6. Oz optics fiber-coupled laser (OZ-2000-1064-6/125-S-40-3A-3-1-10)
7. OPHIR Vega Laser Power Monitor
8. Thorlabs Fiber Cable APC
9. 25-Pin cable
10. VCO Tester D1100545-v1
11. Current Source
12. Stanford Research Systems model SR785
13. Board Schematics, LIGO D1200136-v1

3 Tests

The ALS Fiber Distribution uses the Low Noise Power Module (D0901846, rev D) with the RF Distribution Amplifier Interface (D1000064, rev A).

1) **Verify the proper current draw.** Using a bench DC supply apply +- 24Volts to P7 and +- 17 Volts to P6 of the low noise power Module (D0901846). Measure the current draw of the board.

+24 Volt current _____ 0.1 A Nom.

-24 Volt current _____ 0.0 A Nom.

+17 Volt current _____ less than 1.1 A

-17 Volt current _____ less than 0.01 A

2) On the low noise power module check the voltage on TP 1-13.

TP1 (+17V) _____ TP2 (-17V) _____

TP3 , 4 (GND) TP5 (+ 5V)_____

TP6 (-15V) _____ TP7 (+24V) _____

TP8 (GND) TP9 (-24V) _____

TP10 (GND) TP11 (+15V) _____

TP12 (+VREF) _____ TP13 (-VREF) _____

3) If TP 1 , 2, 7 , 9 and 8 are correct then pin 5 on U1 and U7, (OK, TP14) should be Logic high ~3Volts. Confirm._____

4) The noise on TP 12, 13, 11 and 6 should be measured with a SR785 using an rms power spectrum.

TP12 noise _____less than 20 nVrms/sqrt Hz at 140 Hz

TP13 noise _____less than 20 nVrms/sqrt Hz at 140 Hz

TP11 noise _____ less than 20 nVrms/sqrt Hz at 140 Hz

TP6 noise _____ less than 30 nVrms/sqrt Hz at 140 Hz.

5) **Test the power from the RF coupler output to the AOM. Measure the output voltage M1 through the RF detector and the output voltage M1 through the controls output channel with the VCO tester.**
   a. **Use the signal generator (2) at 158.8MHz with RF power as in column 1.**
   b. **Set the signal generator (2) RF power to 0dBm. Connect the power meter (3) and the attenuator (4) to the signal generator. Adjust the offset to read 0dBm (nominal offset: +11.4dBm).**
   c. **Connect the power meter (3) and attenuator (4) to coupler.**
   d. **Connect signal generator (2) output to chassis "AOM Input" on front panel.**
   e. **Connect the VCO tester (10) with 25-pin cable (9) to the rear of the chassis.**

NOTE: Run test concurrently with step #6.

Signal Gen. output power (dBm)	Coupler OUT to AOM (dBm)	Expected RF Power (dBm)	M1 Back Panel (Volts)	M1 VCO tester (Volts)	Expected M1 (Volts)
0	22	**22**	1.017		**1**
1	23	**23**	0.991		**0.975**
2	23.9	**24**	0.965		**0.95**
3	24.9	**25**	0.940		**0.925**
4	25.8	**26**	0.913		**0.9**
5	26.7	**27**	0.888		**0.875**
6	27.6	**28**	0.862		**0.85**
7	28.4	**29**	0.836		**0.825**
8	29.3	**30**	0.811		**0.8**
9	30.2	**31**	0.785		**0.775**
10	31	**32**	0.761		**0.75**
11	31.9	**33**	0.738		**0.725**

Deviation from expected: ±2dB and ±0.1V, respectively.

Nominal Slope (mV/dBm): -24mV/dBm **Expected Slope: -25mV/dBm**

Nominal Gain: _____ **Expected Gain: 4**

Nominal Offest (Volts): 1.017V **Expected Offset (Volts): 1V**

6) **Measure Temperature Monitor 1 on VCO tester (10).**

Temp. Mon 1 (Volts): _____

7) **Measure the optical power out of X-arm with the PSL input at 5mW, while varying the AOM RF drive power at 158.8MHz.**
   a. **Use fiber-coupled laser (6) and adjust the knob to carry 5mW.**
   b. **Use optical power monitor (7) to measure the output powers.**

AOM Front Panel (dBm)	X-arm Power (mW)
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	

8) **Measure power from sample, X-arm, Y-arm, and squeezer with PSL input set at nominal 5mW.**
   a. **Use fiber-coupled laser (6) and adjust the knob to carry 5mW.**
   b. **Use optical power monitor (7) to measure to output power.**

	Sample	X-arm	Y-arm	Squeezer
Power (mW)				
Ratio				
Expected	20%	5%	5%	5%

9) **Measure the voltage output from M2 (back panel and through controls channel via VCO tester) and Int. Mon (TNC front panel) with various PSL input powers.**
   a. **Use fiber-coupled laser (6) and adjust the knob to carry the output powers.**
   b. **Use optical power monitor (7) to measure to output power (at each power setting).**
   c. **Set transimpedance to 100kΩ.**

PSL Input (mW)	M2 Back Panel (Volts)	M2 VCO Tester (Volts)	Internal Monitor (Volts)	Expected M2 (Volts)	Expected Int. Mon (Volts)
2				1.274	1.274
4				2.548	2.548
6				3.882	3.882
8				5.096	5.096
10				6.37	6.37
12				7.644	7.644

Nominal Gain for VCO: _____ Expected Gain: 4

10) **Measure the External Monitor and output voltage M3 (back panel and through controls channel via VCO tester).**
   a. **Use a current source (11) and connect to External PD Input BNC on front panel.**

Input Current (mA)	External Monitor (Volts)	M3 Back Panel (Volts)	M3 VCO Tester (Volts)	Expected M3 (volts)	Expected Ext. Mon (Volts)
10				10	10

Nominal Gain for VCO: _____ Expected Gain: 4

11) **Ensure PowerOK on VCO tester lights up when power is supplied.**

Confirm:_____

12) Measure the noise spectrum at the internal and external monitor.

Internal Monitor noise _____less than 20 nVrms/sqrt Hz at 140 Hz

External Monitor noise _____less than 20 nVrms/sqrt Hz at 140 Hz