LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY

LIGO Laboratory / LIGO Scientific Collaboration

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Test Procedure for RF Frequency Doubler

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1 Introduction

The following Test Procedure describes the test of proper operation of the RF Frequency Doubler.

2 Test Equipment

- Voltmeter
- Oscilloscope
- Stanford Research SR785 analyzer
- Tektronix AFG3101 function generator (or similar)
- RF Power Meter HP E4418A
- Board Schematics--Frequency Doubler

3 Tests

The RF Frequency Doubler comes with a number of different power supply boards so I will assume that we are using the latest which is the Low Noise Power Module (D0901846) with the RF Distribution Amplifier :Interface (D1000064).

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 1.0 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, TP14 (OK) should be Logic high ~3Volts. The front panel LED should be on.
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 200 nVrms/sqrt Hz at 140 Hz

TP13 noise _____less than 900 nVrms/sqrt Hz at 140 Hz

TP11 noise _____ less than 1 uVrms/sqrt Hz at 140 Hz

TP6 noise _____ less than 1 uVrms/sqrt Hz at 140 Hz.

5) Test the RF monitor by applying a 160 MHz RF signal to J1. Measure the output voltage at mon1.

Mon1

Nom output pwr	Input pwr dBm	Mon volt (M)	Measured volt.	Measured Pwr
13 dBm		**2.9V (0.725)**		
10 dBm		**3.2V (0.800)**		
7 dBm		**3.5V (0.875)**		
0 dBm		**4.2V (1.05)**		
-10 dBm		**5.2V (1.30)**		
-20 dBm		**6.2V (1.55)**		

6) Test the RF output powers by applying a 80 MHz/10dBm RF signal to J1. With a RF power meter measure the power at the output (13 dBm nominal). If the output power is consistently too high an attenuator A1 has to be adjusted accordingly. Nominal output power is 13 dBm.

Output: _____ (13 dBm nominal)

7) Measure the Phase noise of the RF Oscillator Source driving the RF Frequency Doubler , with 1PPS locking using the Wenzel single channel phase noise measurement technique (3.5.3), Figure 3.5.2-1, which can be found at

http://www.wenzel.com/pdffiles1/BP1000Manual/BP_1000_v101_2_.pdf .

A reasonable FFT analyzer is the SR785, which can be set to measure power units if you start in Display Setup. A Reference Source must be provided which can be just a Wenzel crystal oscillator of frequency close enough to lock, properly powered and connected to the Wenzel phase noise measurement system. The output of the RF Frequency Doubler will need to be attenuated to the amplitude needed by the wenzel phase noise measurement system (about 10 dBm). Compare to the Phase noise of the RF Oscillator Source alone, it should be within 3dB.

J2

Offset freq. Hz	Phase noise spec.	RF osc. phase noise	RF osc + doubler
10 Hz	**-110 dBc/Hz**		
100 Hz	**-140 dBc/Hz**		
1 kHz	**-160 dBc/Hz**		