LIGO Laboratory / LIGO Scientific Collaboration

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Test Procedure for Squeezer Fiber Beat Note Chassis

Nutsinee Kijbunchoo, Daniel Sigg

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This is an internal working note
of the LIGO Laboratory.

California Institute of Technology
LIGO Project – MS 18-34
1200 E. California Blvd.
Pasadena, CA 91125
Phone (626) 395-2129
Fax (626) 304-9834
E-mail: info@ligo.caltech.edu

Massachusetts Institute of Technology
LIGO Project – NW22-295
185 Albany St
Cambridge, MA 02139
Phone (617) 253-4824
Fax (617) 253-7014
E-mail: info@ligo.mit.edu

LIGO Hanford Observatory
P.O. Box 159
Richland WA 99352
Phone 509-372-8106
Fax 509-372-8137

LIGO Livingston Observatory
P.O. Box 940
Livingston, LA 70754
Phone 225-686-3100
Fax 225-686-7189

http://www.ligo.caltech.edu/

1   Testing information

BOARD SERIAL   _____

TEST DATE   _____

TESTING RESULT: **PASSED** ☐   **FAILED** ☐

2   Introduction

The following test procedure describes the test of proper operation of the Locking Fiber Beat Note Box. The Beat Box produces the locking signal for the squeezer TTFSS that stabilizes SQZ laser to the PSL. The goal of this procedure is to see that the unit has a reasonable power splitting within the box and a reasonable 160 MHz beat note output.

3   Test Equipment

In order to simulate the beat between the SQZ laser (0 Hz offset) and the sample light from the PSL (160MHz offset) we utilize an ALS Fiber Distribution Box D1200136-V2 that has a 160MHz AOM built in.

1. ALS Fiber Distribution Box. Make sure it's V2.
2. 160 MHz Signal Generator (we used a Tektronix AFG31000)
3. 160 MHz Oscilloscope
4. RF Spectrum Analyzer
5. Two power supplies (+-24 and +-18)
6. Three DVMs
7. OPHIR Nova power meter
8. Three ThorLabs Fiber Cable APC
9. Two 1kOhm resistors
10. Four TNC to BNC adapters

11. Two BNC T adaptors

12. One BNC to N cable

13. A fiber coupled 1064nm light source

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4   Tests

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1) Verify the proper current draw.

Using a bench DC supply apply ± 18 Volts to P1. Measure the current draw of the board and fill in the table below.

TEST POINT:	+ 18 V	− 18 V
Nominal current (A):	< 0.05	<0.05
Measured current (A):	_____	_____

2) Make sure the regulator outputs are within 5% of ±15V.

Check the DC voltage at the output connectors P2, P3, P4 or P5 of the chassis power regulator D1000217. Check that the front panel LEDs are on.

TEST POINT:	+ 15 V	− 15 V
Measured voltage (V):	_____	_____
Front panel LED	_____	_____

3) Power up the ALS distribution box. Insert the fiber coupled light source into the PSL mating sleeve. We recommend about 5 mW of input power.

Power going into ALS distribution box (mW):　　　　　_____

4) Drive the ALS distribution box AOM with 10dBm 160MHz sine wave.

5) Connect Squeezer output of the ALS distribution box to the PSL input of the fiber beat box.

Measured power going into beat
box PSL (mW):   _____

6) Connect ALS distribution box Sample output to the fiber beat box Squeezer input.

Measured power going into beat
box Squeezer (mW):   _____

7) Measure the laser power going into the SM05PD1A diodes

PSL MON Power (mW):   _____

Squeezer Power (mW):   _____

8) At the PSL MON and Squeezer MON, connect a 1kOhm resistors in parallel, measure the voltage at each port.

PSL MON (mV):   _____

Squeezer MON (mV):   _____

9) Convert voltage measured in 8) to current, use the current and input power from 7) to calibrate each diode responsivity.

Expected Responsivity (A/W)   ~0.3

PSL MON diode calculated
Responsivity (A/W)   _____

Squeezer MON diode calculated
Responsivity (A/W)   _____

10) Measure power going into Newport 1611

Power going into Newport 1611
diode (mW):   _____

11) Measure voltage at Beat Note DC

Beat Note DC (mV):   _____

12) Using 10kOhm transimpedance, calculate Newport 1611 responsivity from 10) and 11).

Expected Responsivity (A/W)   ~0.75

Newport 1611 calculated
Responsivity (A/W)   _____

13) Look at Beat Note AC on an RF scope to see if you have 160MHz beat note output. Wiggle the fiber around and record the maximum amount of beat note observed.

160MHz readout on the
oscilloscope (Vpk-pk):   _____

160MHz readout on the RF
spectrum analyzer (dBm):   _____

14) Unplug one input fiber at a time, write down how much is left on the beat note DC.

Beat Note DC with PSL unplugged (mV):   _____   SQZ MON (mV):   _____

Beat Note DC with SQZ unplugged (mV):   _____   PSL MON (mV):   _____

15) Unplug all the inputs to measure the 1611 dark noise

Beat Note DC with input light
source unplugged (mV)   _____

Using responsivity in 12), calculate how much light from PSL and SQZ is going into the 1611

1611 PSL (mW)   _____

1611 Squeezer (mW)   _____

Using responsivity in 9), calculate how much light from PSL and SQZ is going into each SM05PD1A from 14)

PSL MON (mW)   _____

Squeezer MON (mW)   _____

1611 PSL/PSL MON Power Ratio	1161 Squeezer/Squeezer MON Power Ratio