

LO Transmission System Status

- Photonic LO Transmitter

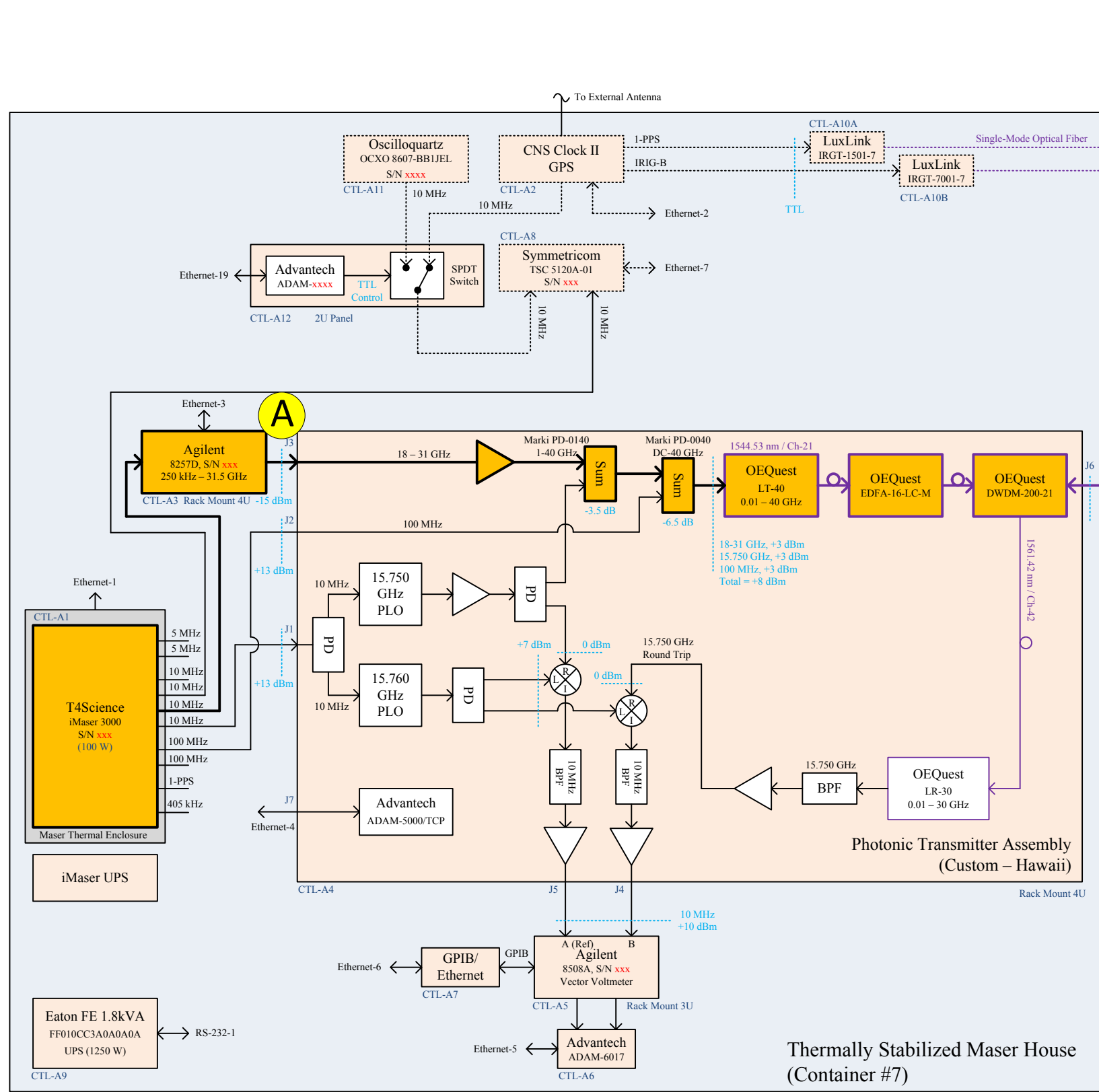
- Setup rudimentary prototype hardware in SMA vault on top of T4S iMaser
 - 18-32 GHz LO transmission (E8257D, S/N MY49060313 ALMA unit, phase locked to maser 10 MHz-4)
 - 100 MHz transmission (maser 100 MHz-1 output)
 - No 15.75 GHz pilot tone for round trip monitor

- Photonic LO Receiver

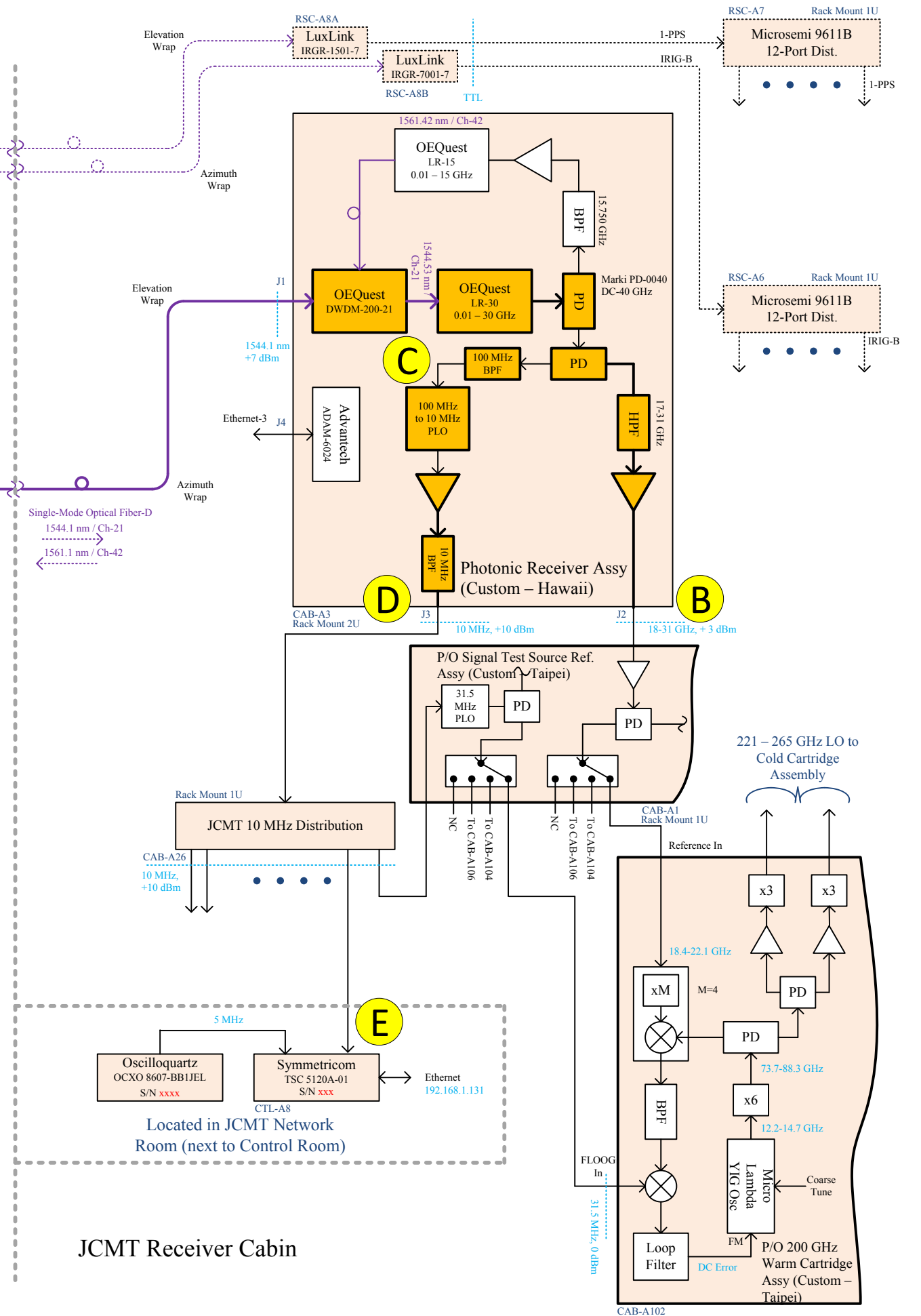
- Nearly complete assembly was installed into JCMT receiver cabin rack
 - Missing output variable attenuator to control LO power into Signal Test Source unit – using fixed attenuator
 - 10 MHz OCXO lock status not working, setup external monitor with ADAM-5017

- Transmitted LO from SMA vault to JCMT receiver cabin over Sumitomo single-mode optical fiber

- Single-mode fiber-D is dedicated for JCMT LO
 - Fusion spliced 9/14/2017 by P. Yamaguchi
- Fibers-A is a spare and was repaired by P. Yamaguchi
- Fibers-B and C are dedicated for eSMA



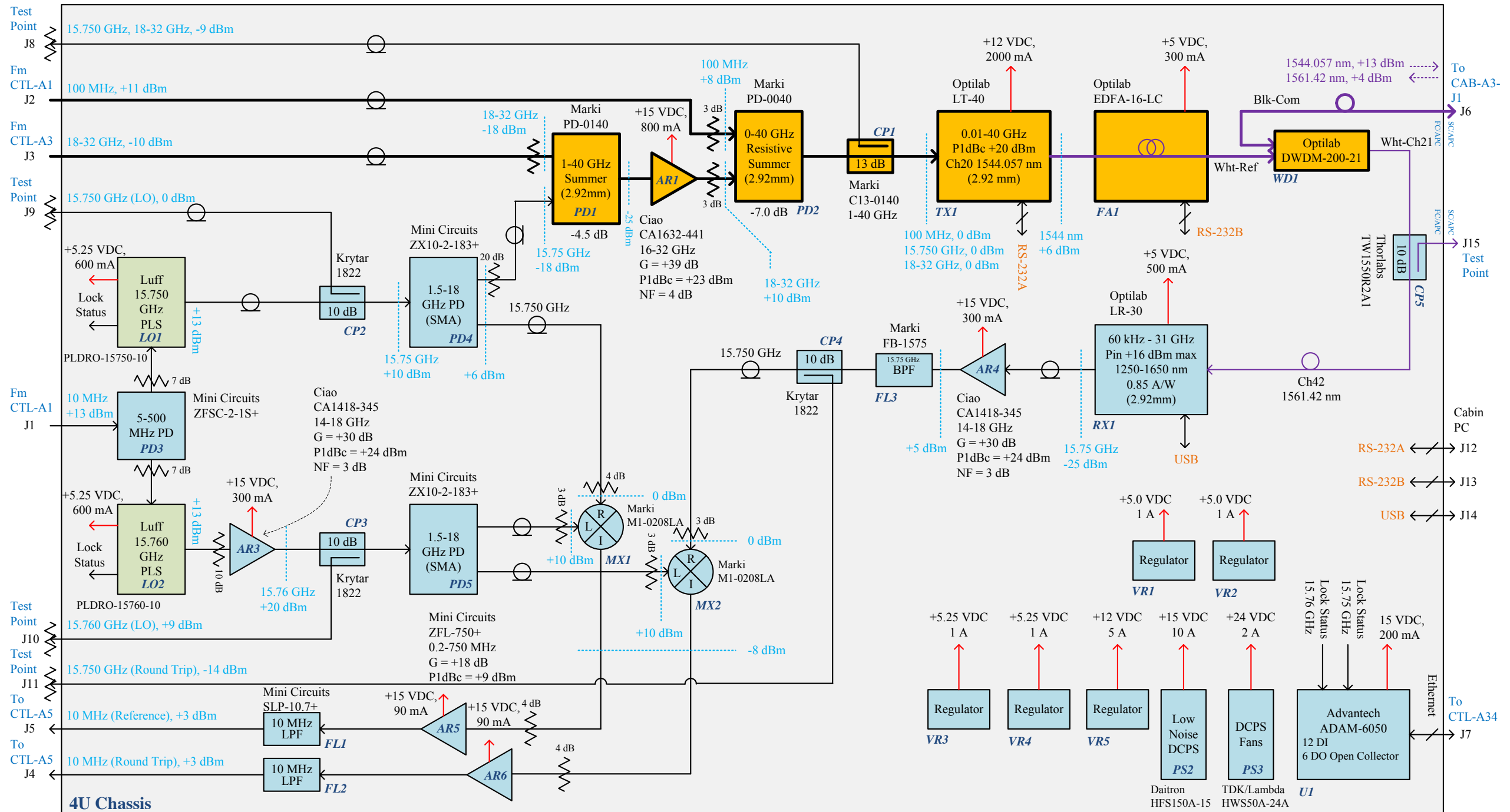
SMA Vault



JCMT Receiver Cabin

• Photonic LO Transmitter

- Only a subset of hardware shown in orange was configured for this test



Filename = Photonics_Tx_Rx_Design
Version = 2017Jul19

+15 VDC = 1.78 A +12 VDC = 2.00 A +5 VDC = 2.00 A
AR1 → 800 mA TX1 → 2000 mA LO1 → 600 mA
AR3 → 300 LO2 → 600
AR4 → 300 RX1 → 500
AR5 → 90 FA1 → 300
AR6 → 90
U1 → 200

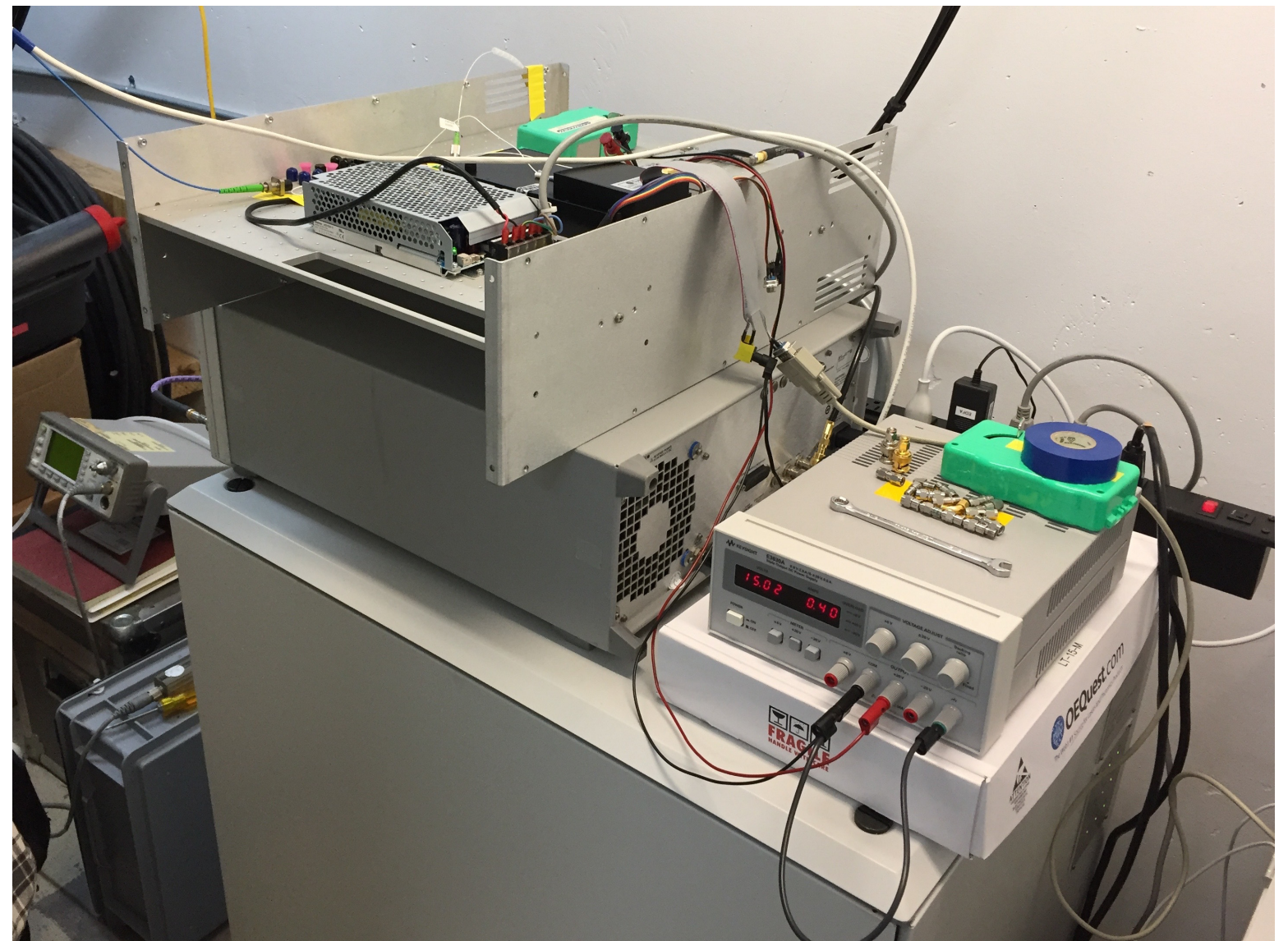
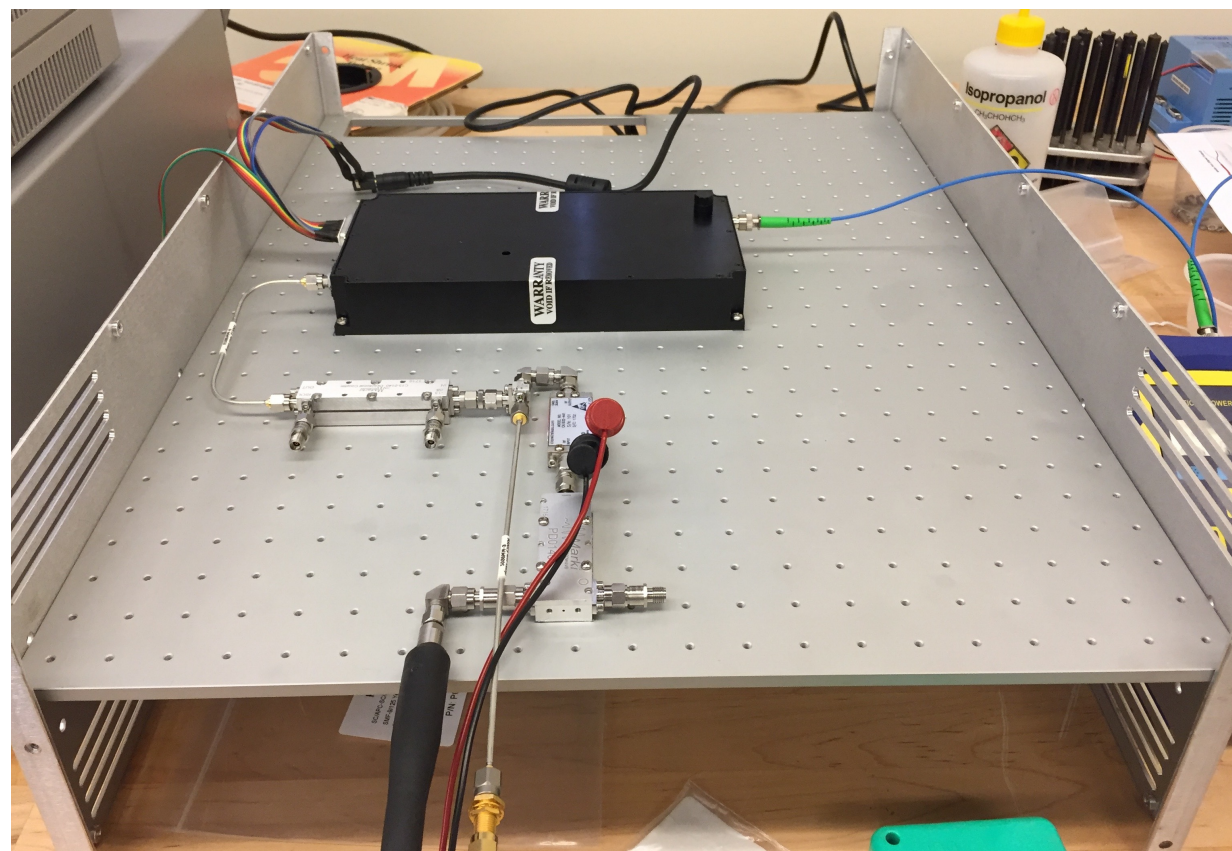
Schematic, Photonics Transmitter Assembly, 4U

Ordered Received

- Photonic LO Transmitter

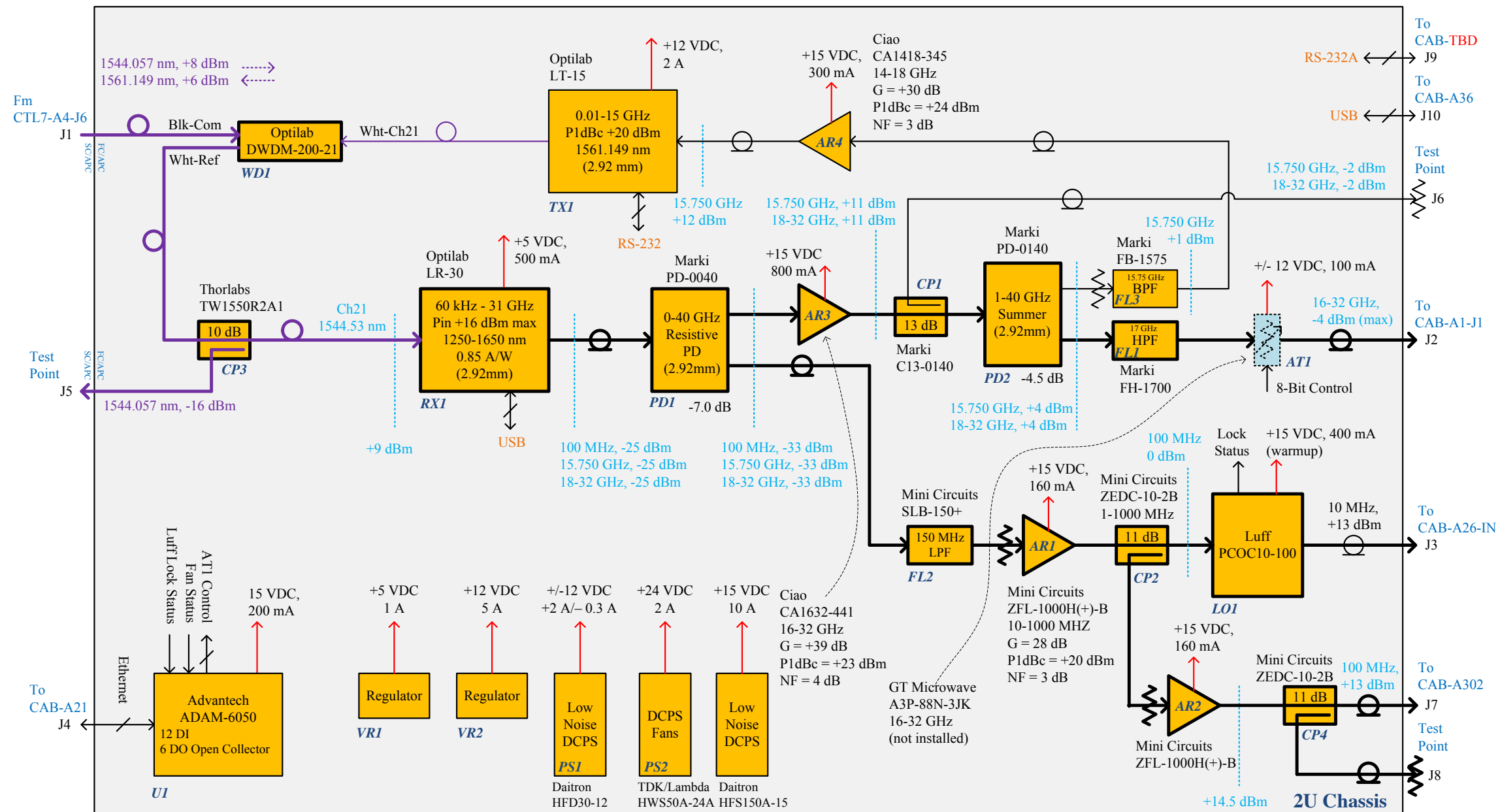
Photonic LO Transmitter resting on Agilent E8257D synthesizer (18-32 GHz) and T4S maser located in SMA vault at MK

Photonic LO Transmitter in Hilo



• Photonic LO Receiver

- Nearly complete assembly was installed into JCMT receiver cabin rack



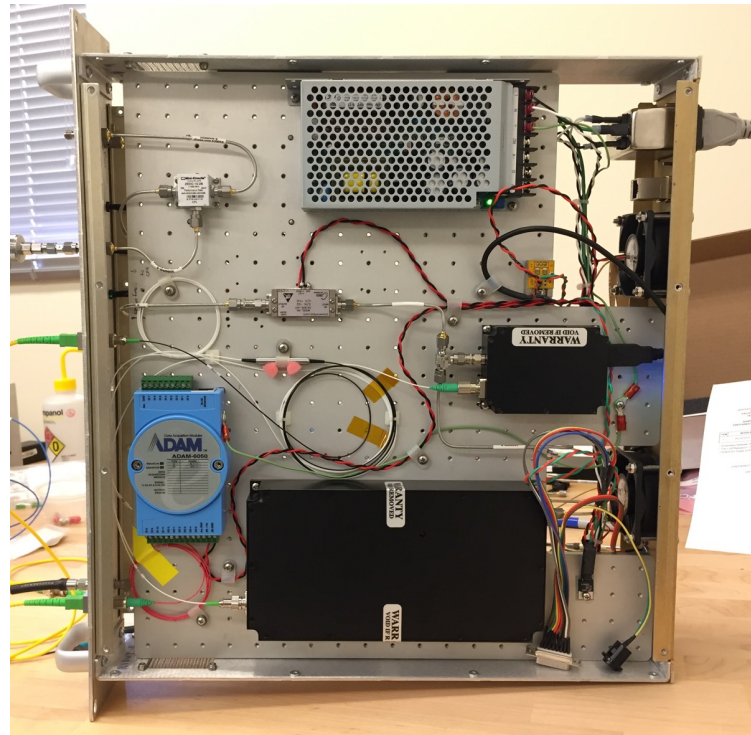
Filename = Photonics_Tx_Rx_Design
Version = 2017Jul19

Schematic, Photonics Receiver Assembly, 2U

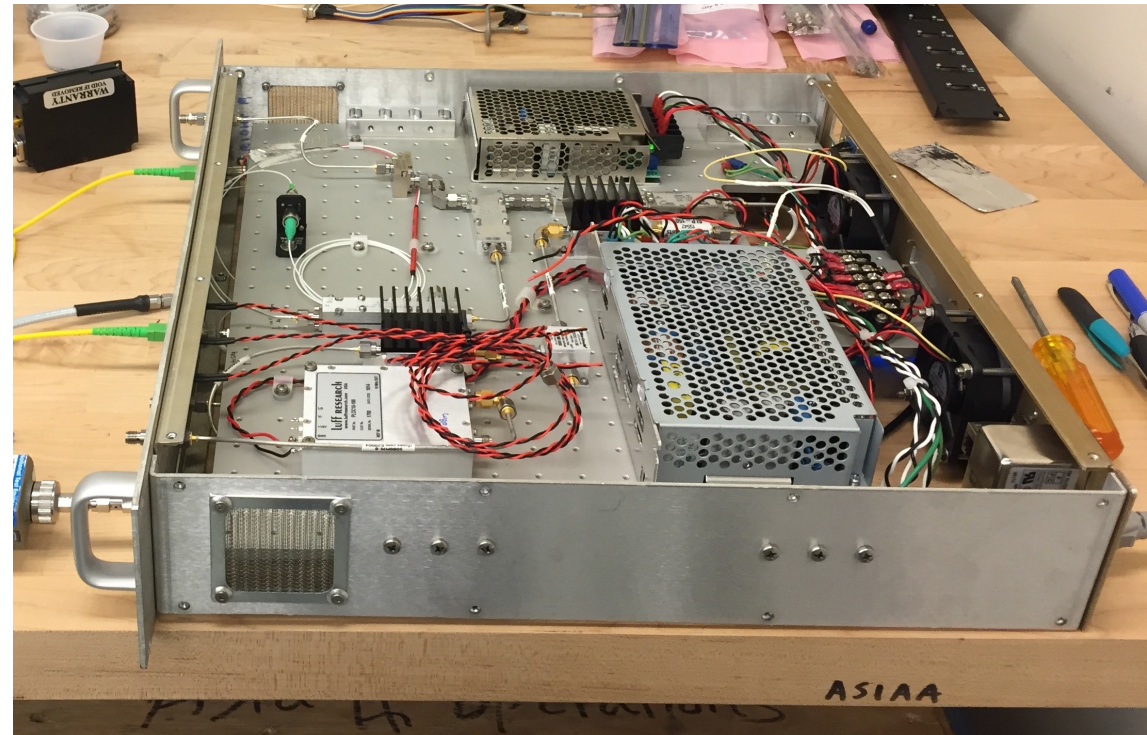
Ordered Received

+15 VDC = 2.02 A +12 VDC = 2.00 A +/- 12 VDC = +/- 0.10 A +5 VDC = 0.50 A
AR1 → 160 mA TX1 → 2000 mA AT1 → +/- 100 mA RX1 → 500 mA
AR2 → 160
AR3 → 800
AR4 → 300
LO1 → 400
UI → 200

- Photonic LO Receiver

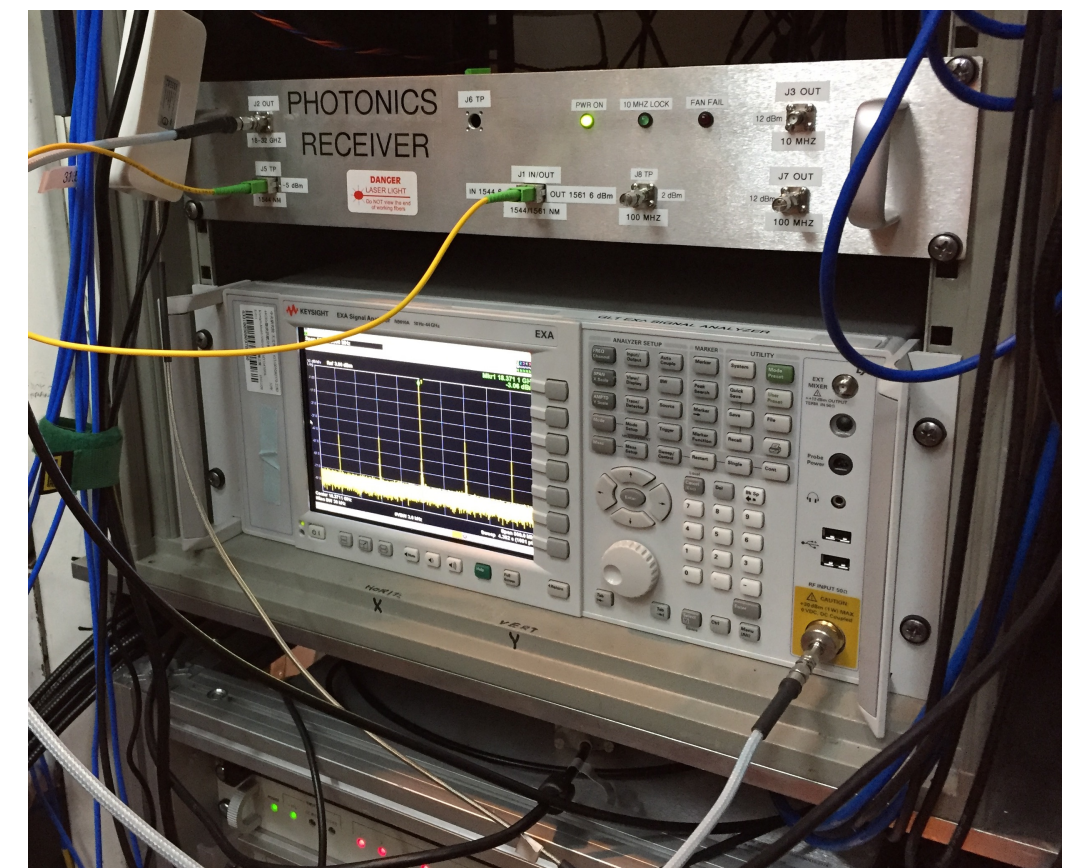


Top



Bottom

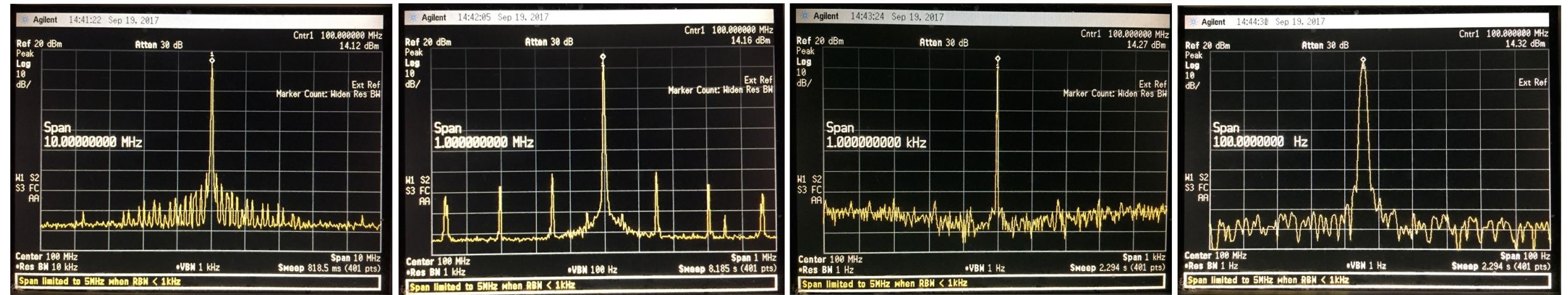
Photonic LO installed into JCMT Receiver Cabin



Output from J7 of LO Photonics Receiver assembly with EDFA and 4 dB optical pad in link

- Synthesizer Frequency = 100.000 000 000 MHz (Synthesizer Agilent 8644B)
- Synthesizer Amplitude = +12.4 dBm
- EDFA current = 35 mA
- J5 TP Power = -4.5 dBm

Transmission of 100 MHz Test Tone in Hilo Lab

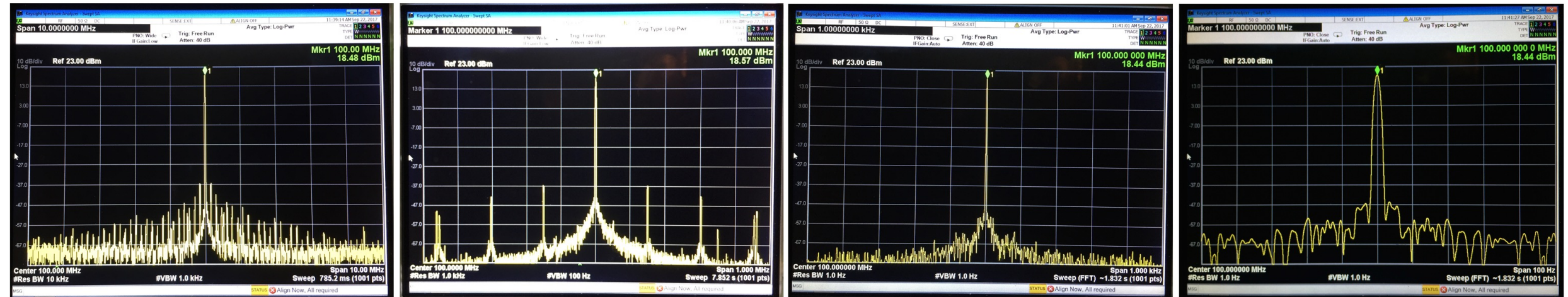


Note 150 kHz spurs is also present on 100 MHz tone

Output from J7 LO Photonics Receiver assembly at JCMT

- Source = 100 MHz Output-1 of Maser
- Amplitude = +13.0 dBm at end of cable
- EDFA current = 35 mA
- JF TP Power = -3.3 dBm

Transmission of 100 MHz Maser Signal from SMA Vault to JCMT Rx Cabin



2017-09-21
D. Kubo

Transmission of 100 MHz Maser Signal to JCMT Receiver Cabin

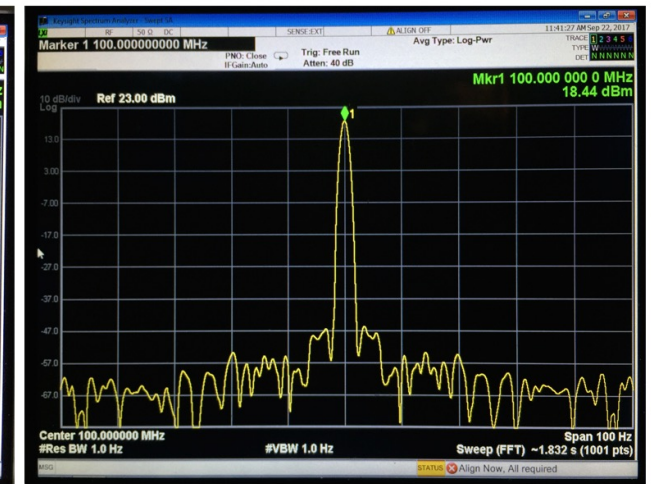
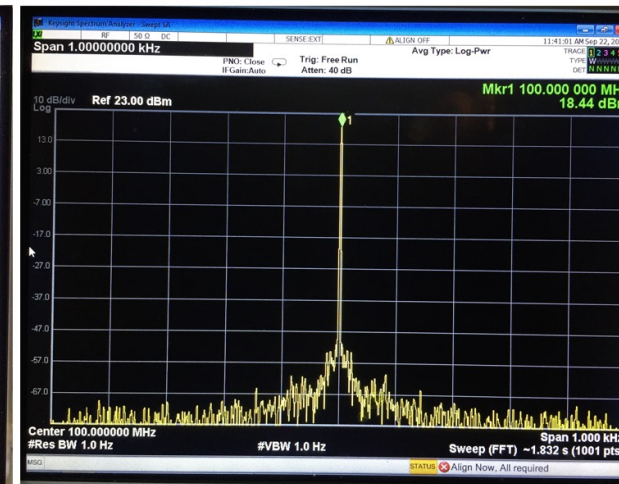
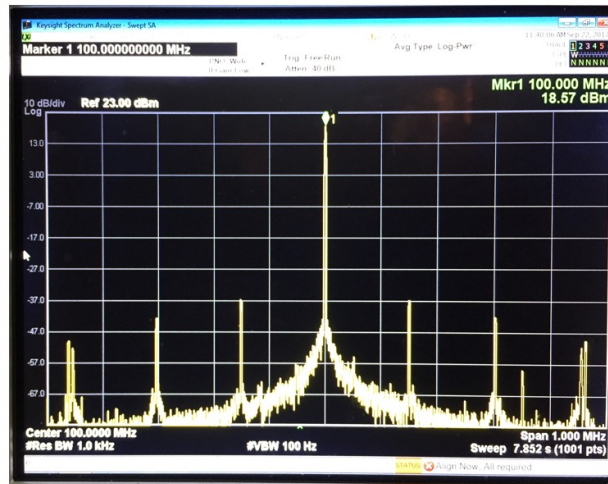
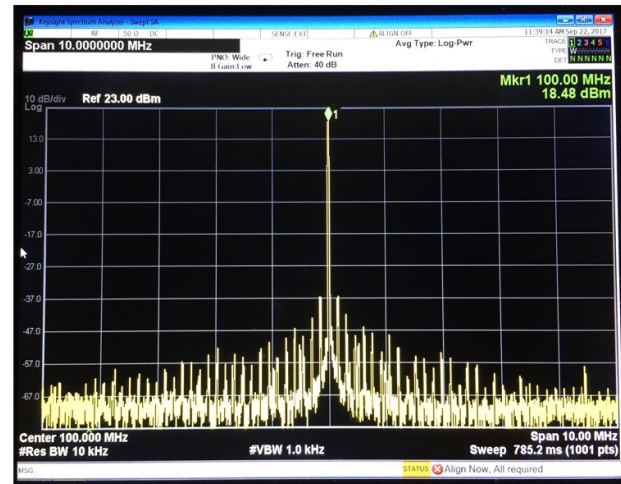
9/14/17

LO Transmission System Status

Output from J7 LO Photonics Receiver assembly at JCMT

- Source = 100 MHz Output-1 of Maser
- Amplitude = +13.0 dBm at end of cable
- EDFA current = 35 mA
- JF TP Power = -3.3 dBm

Transmission of 100 MHz Maser Signal from SMA Vault to JCMT Rx Cabin C

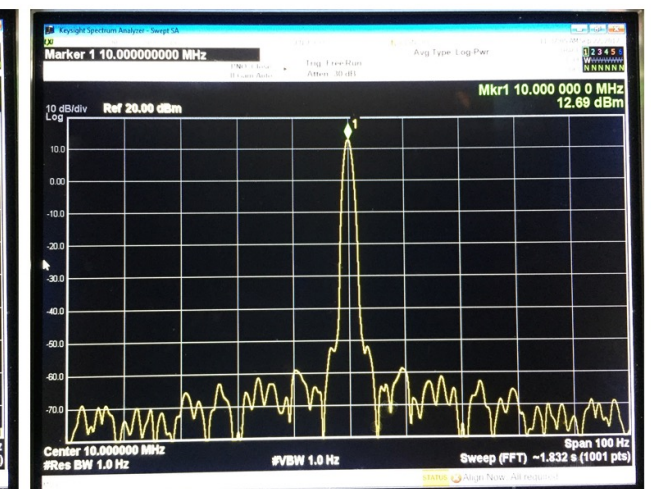
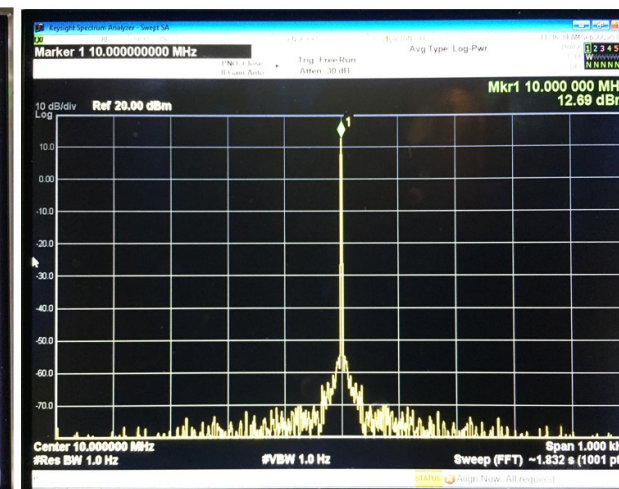
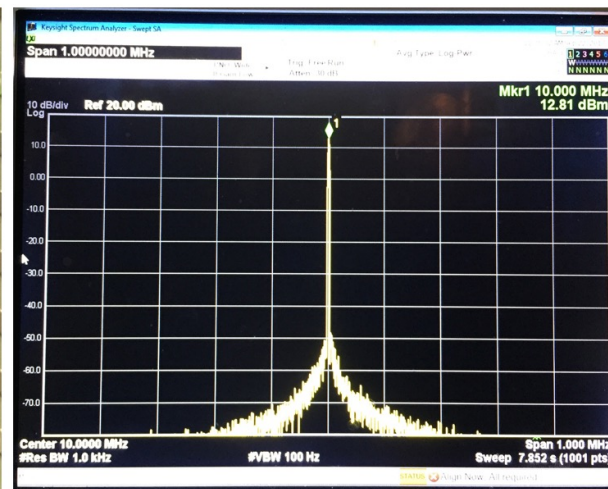
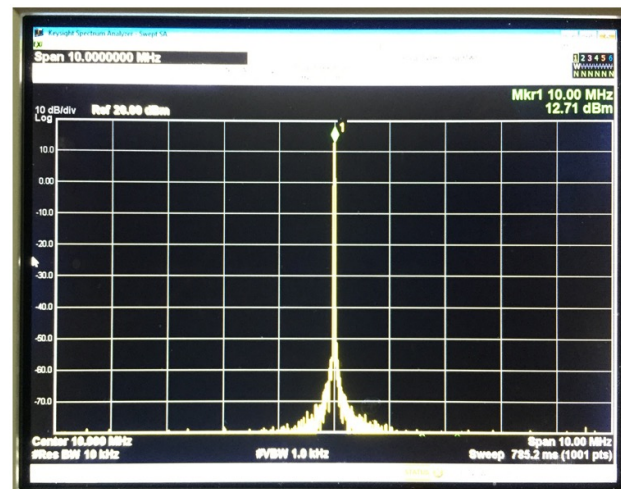


Similar signal to spur performance
Largest spur -53 dBc

Phase noise performance beyond
100 Hz from carrier is much better
than lab test, very likely from maser
being much better than 8644B

Close-in phase noise to pedestal is
about 67 dB, slightly better than lab
test

10 MHz Luff Output at JCMT Rx Cabin (derived from 100 MHz Maser Signal) D



150 kHz spurs eliminated because
outside of Luff PLL tracking bandwidth

Close-in phase noise to pedestal is
about 64 dB, 3 dB worse than 100 MHz
reference. Noise shape is very similar
to transmitted 100 MHz signal.

2017-09-21
D. Kubo

10 MHz Luff Output at JCMT Receiver Cabin (Phase Locked to 100 MHz)

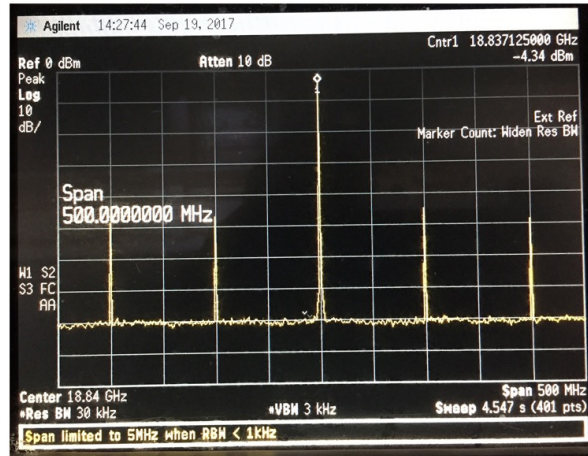
9/14/17

LO Transmission System Status

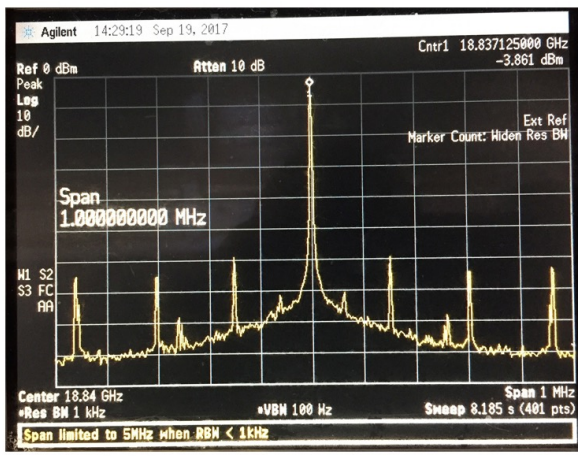
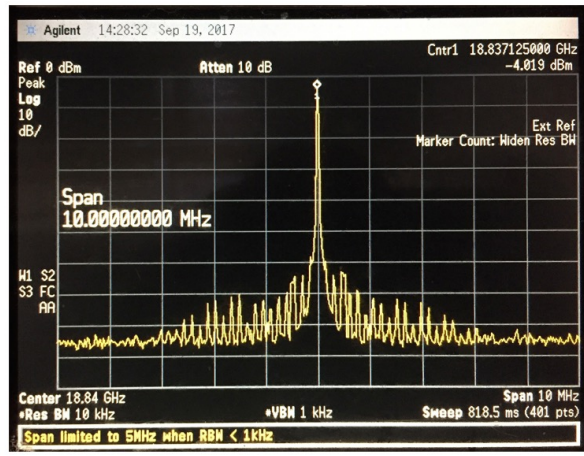
Output from J2 of LO Photonics Receiver assembly with EDFA and 4 dB optical pad in link

- Synthesizer Frequency = 18.371 125 000 GHz
- Synthesizer Amplitude = -15.0 dBm
- EDFA current = 35 mA
- J5 TP Power = -4.5 dBm

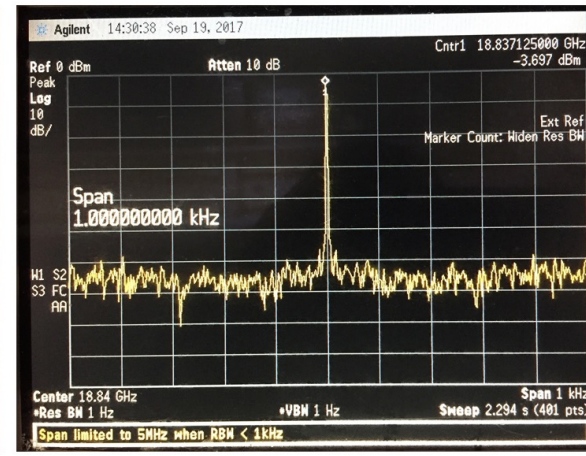
Transmission of E8257D 18 GHz LO in Hilo Lab



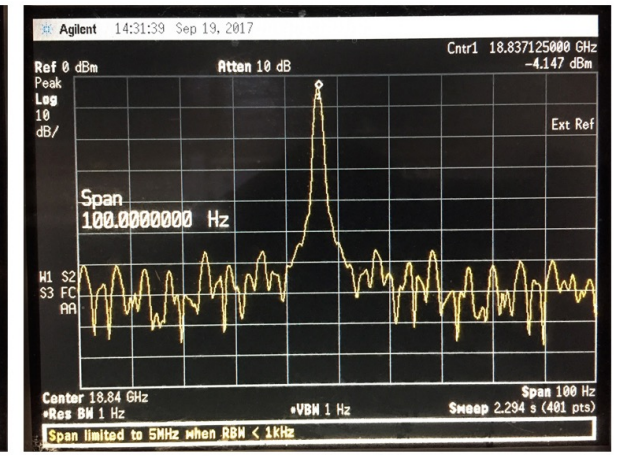
Note introduction of IM spurs from 100 MHz tone, -40 dBc



Note 100 kHz spurs, they did not go away even when powered FOTx with Daitron DCPS



Close-in noise looks remarkably similar to synthesizer output

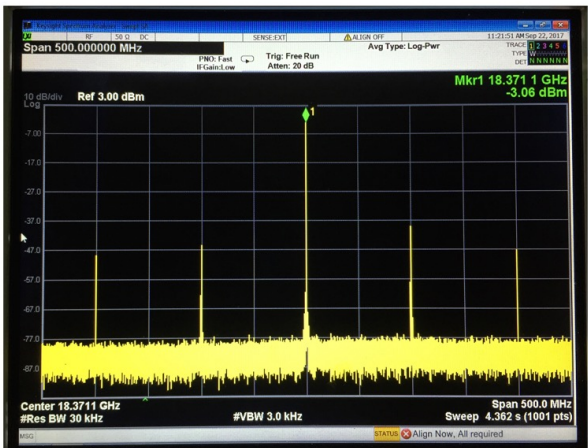


Output from J2 of LO Photonics Receiver assembly in JCMT Receiver Cabin and EDFA

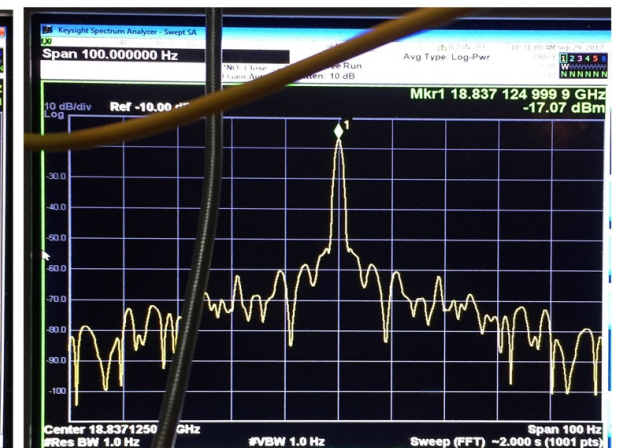
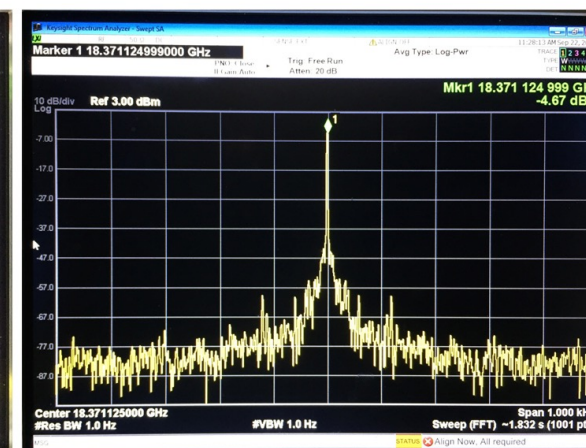
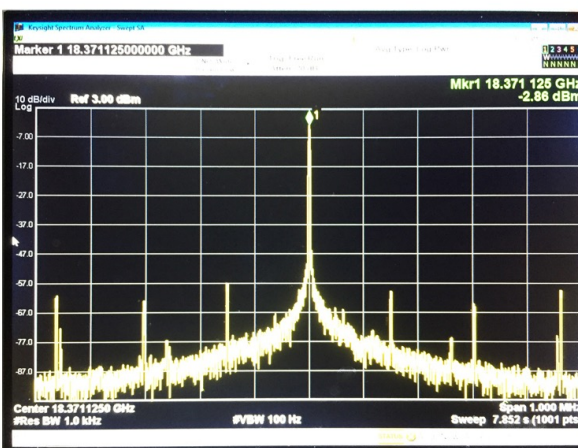
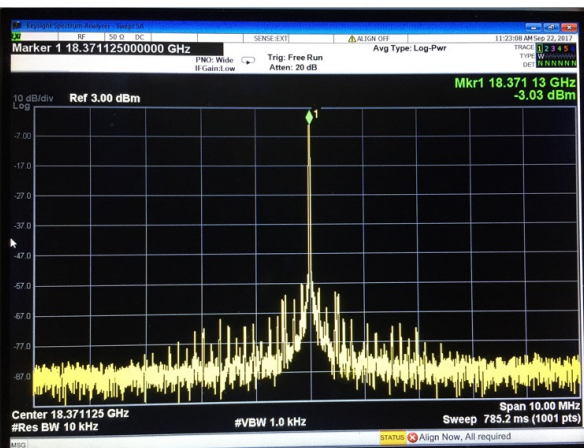
- Synthesizer Frequency = 18.371 125 000 GHz, Locked to Maser 10 MHz
- Synthesizer Amplitude = -15.0 dBm
- EDFA current = 35 mA
- J5 TP Power = -3.3 dBm

Transmission of E8257D 18 GHz LO from SMA Vault to JCMT Receiver Cabin

B



100 IM spurs grows to -36 dBc due to higher optical drive



100 Hz span taken on a different day, this one shows the tone to pedestal ratio of ~35 dB

2017-09-21
D. Kubo

Transmission of E8257D 18 GHz LO Signal to JCMT Receiver Cabin

9/14/17

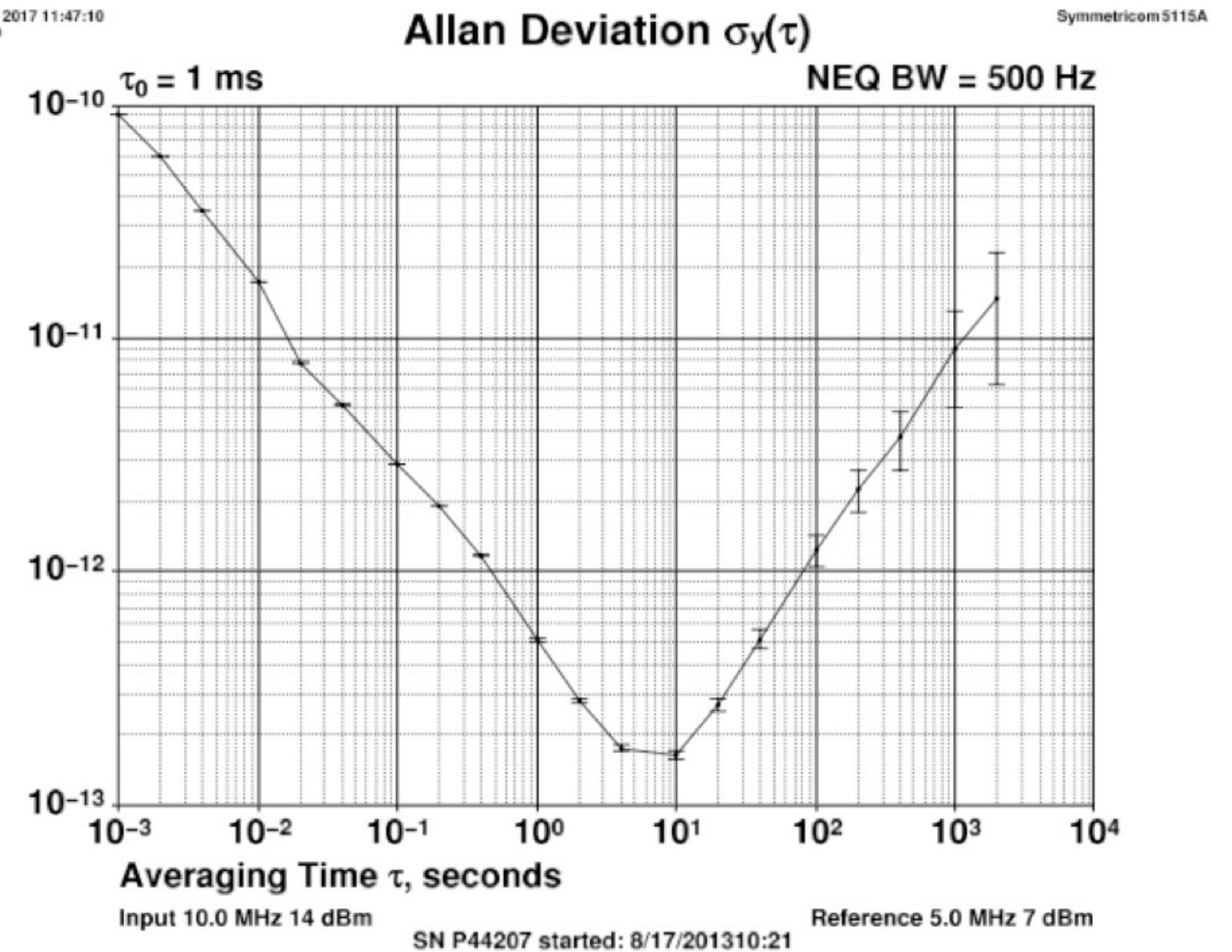
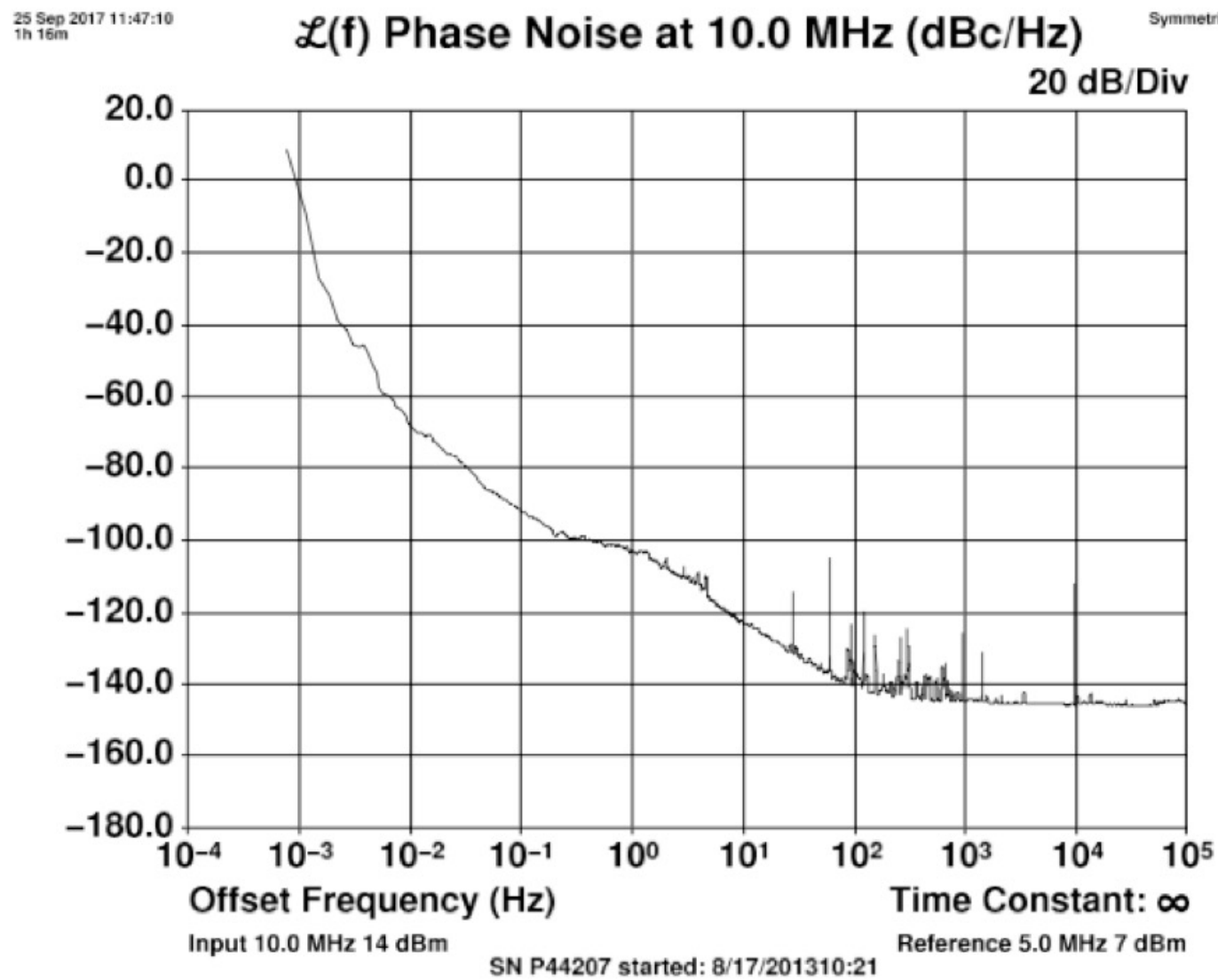
LO Transmission System Status

10

• Phase Noise and A-Dev Measured of 10 MHz at JCMT E

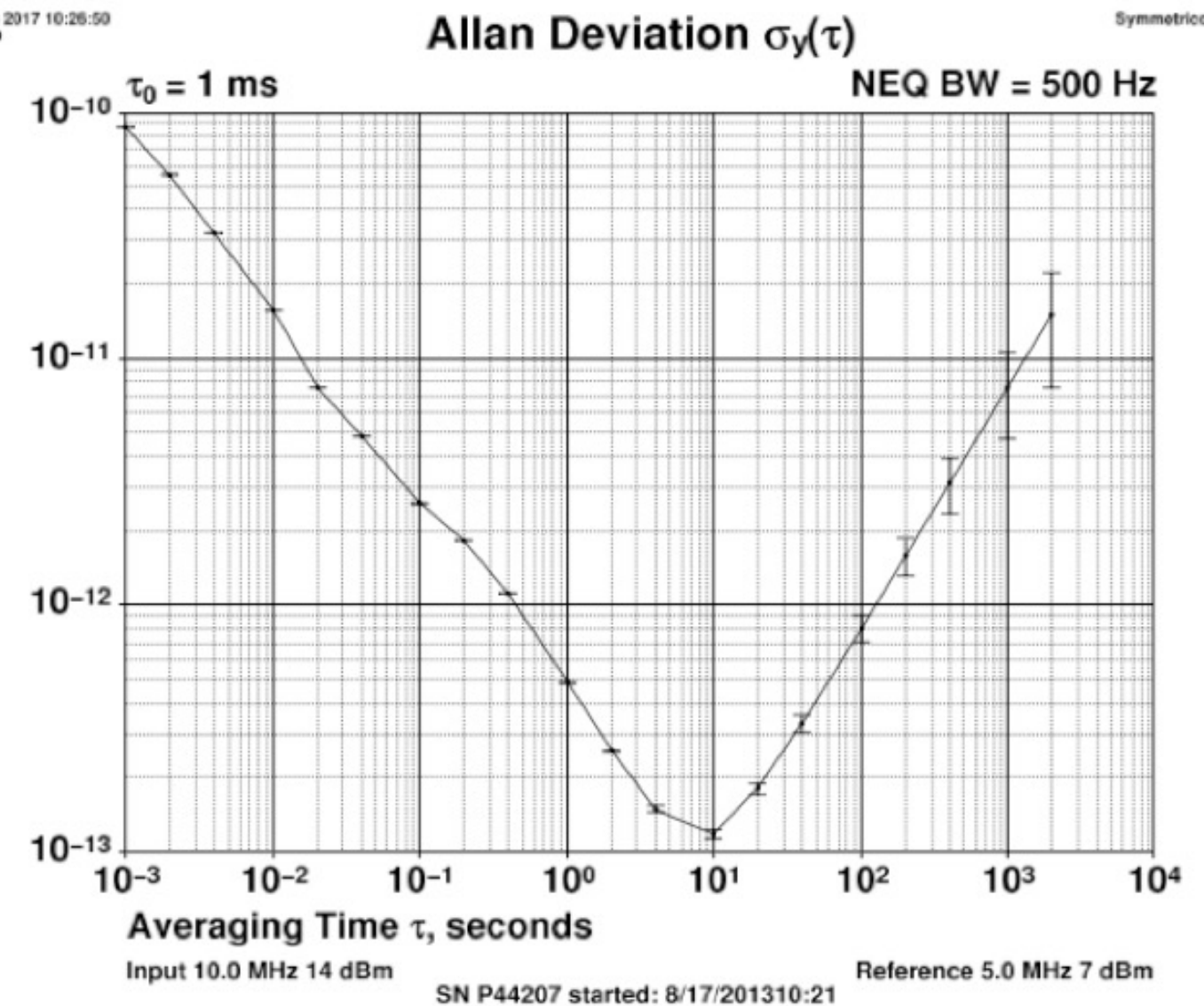
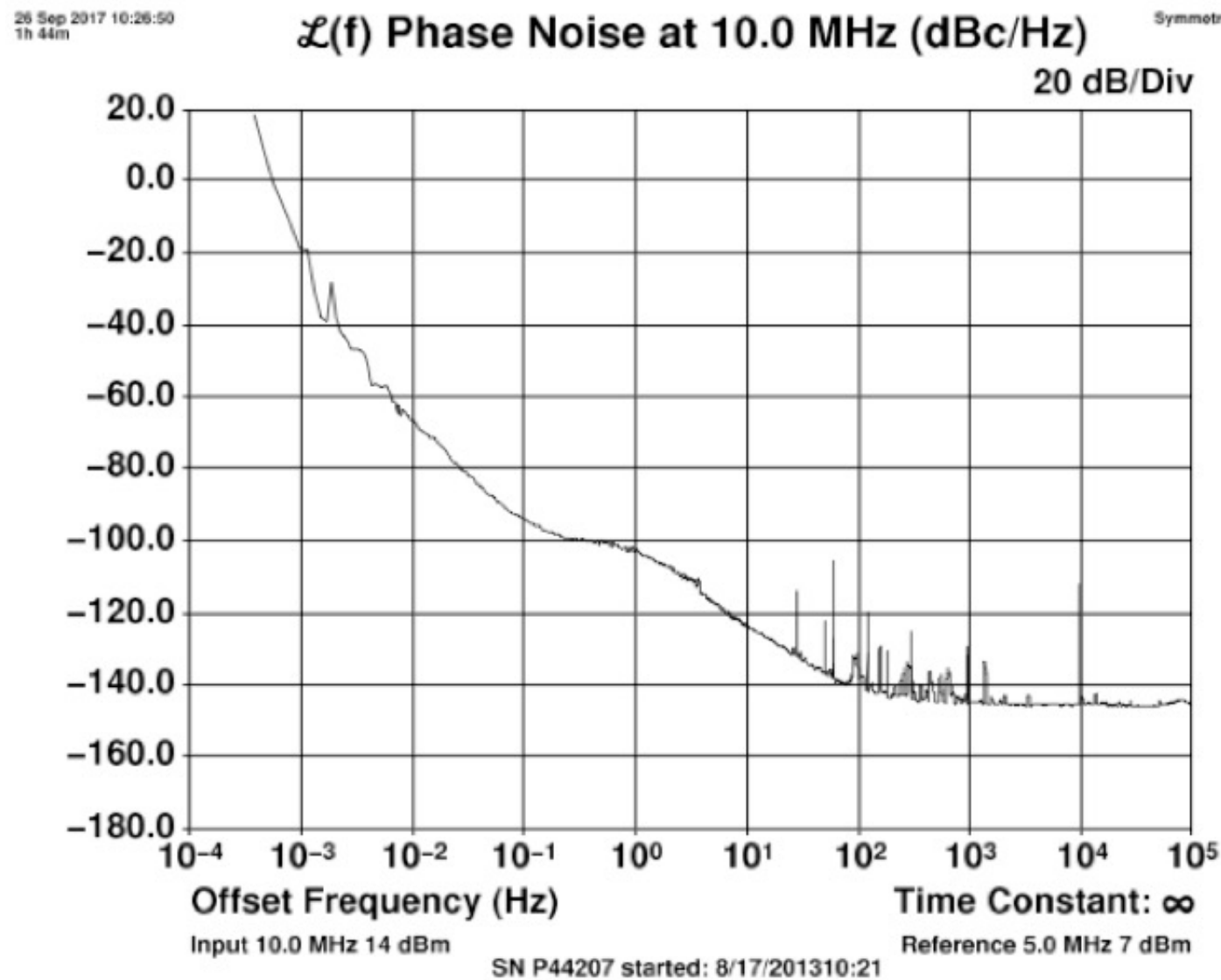
- 5 MHz Oscilloquartz (SMA's) vs 10 MHz from Photonic Receiver assembly
 - Located in JCMT computer room next to control room
 - Signal from Photonics Receiver goes through at least two 10 MHz distribution units
 - Very long cable from receiver cabin to computer room

Monday September 25



- Phase Noise and A-Dev Measured of 10 MHz at JCMT **E**
 - 5 MHz Oscilloquartz (SMA's) vs 10 MHz from Photonic Receiver assembly
 - Located in JCMT computer room next to control room

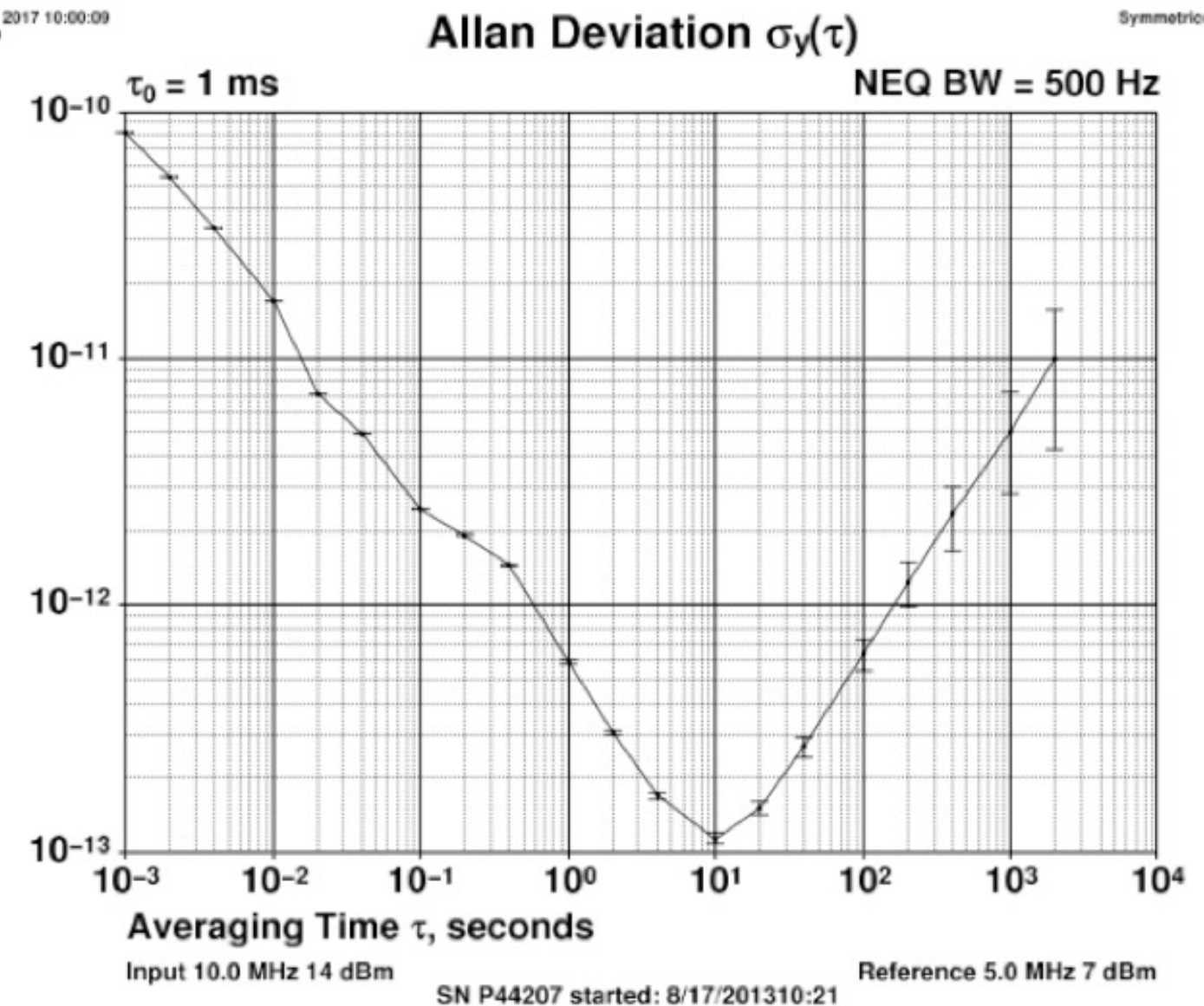
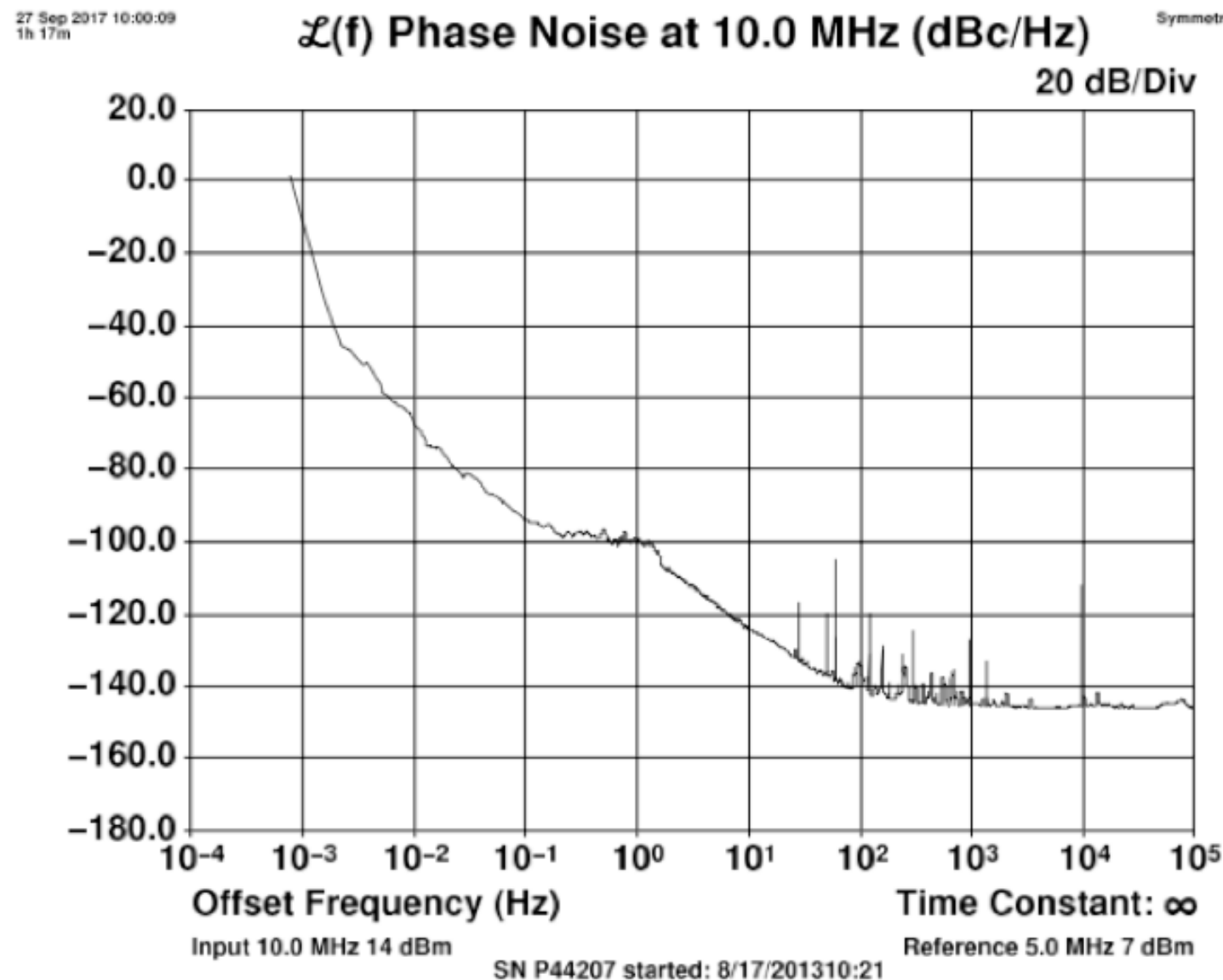
Tuesday September 26



• Phase Noise and A-Dev Measured of 10 MHz at JCMT E

- 5 MHz Oscilloquartz (SMA's) vs 10 MHz from Photonic Receiver assembly
 - Located in JCMT computer room next to control room
 - Signal from Photonics Receiver goes through at least two 10 MHz distribution units
 - Very long cable from receiver cabin to computer room

Wednesday September 27

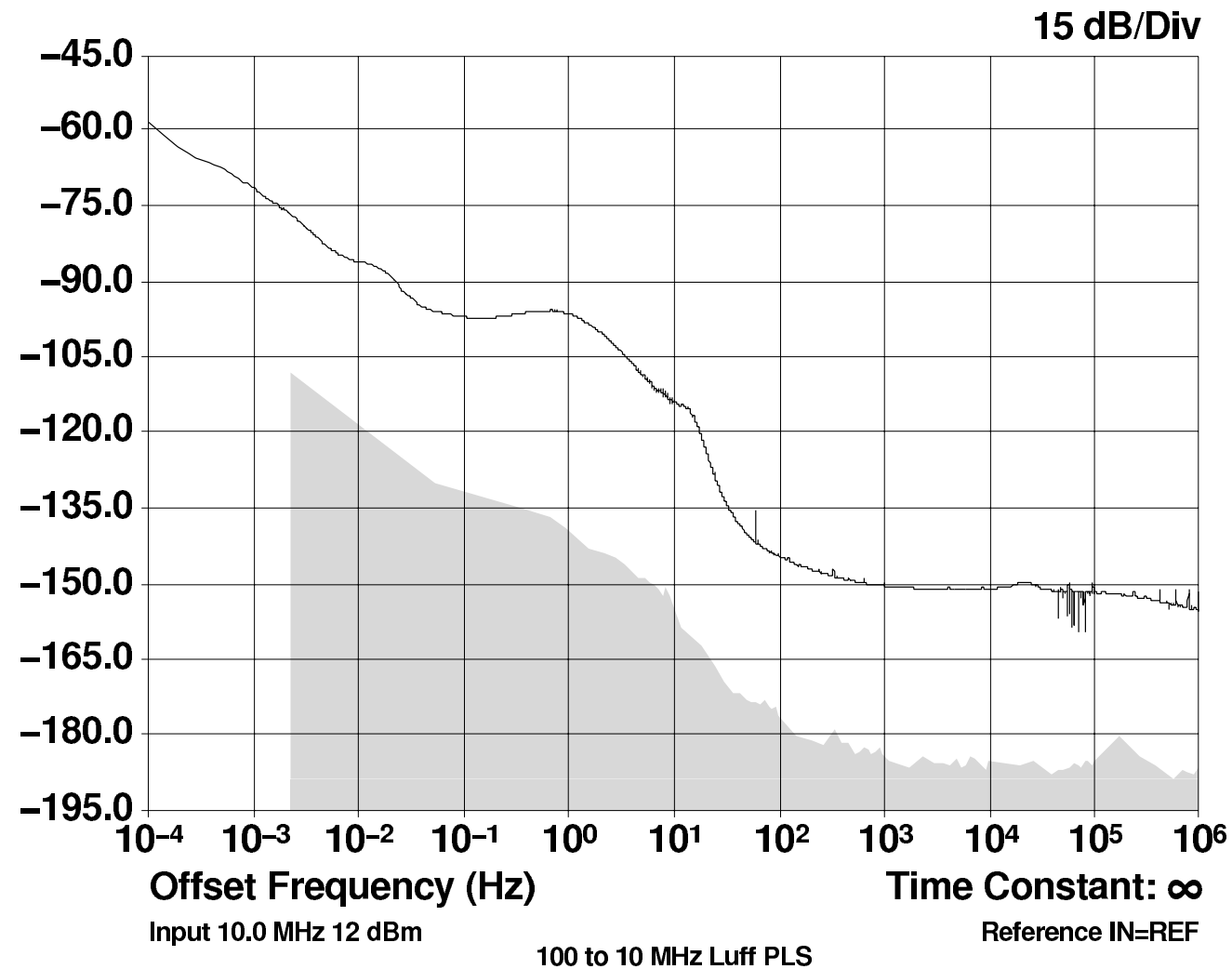


- Reference Phase Noise and A-Dev Measured in SMA Vault (2017-Feb-13 data)
 - Luff 10 MHz (locked to maser 100 MHz) vs Maser 10 MHz
 - Hardware and test equipment located in SMA vault
 - Very temperature stable environment

13 Feb 2017 17:20:46
11d 1h

$\mathcal{L}(f)$ Phase Noise at 10.0 MHz (dBc/Hz)

Symmetricom5120A-01



13 Feb 2017 17:21:01
11d 2h

Allan Deviation $\sigma_y(\tau)$

Symmetricom5120A-01

