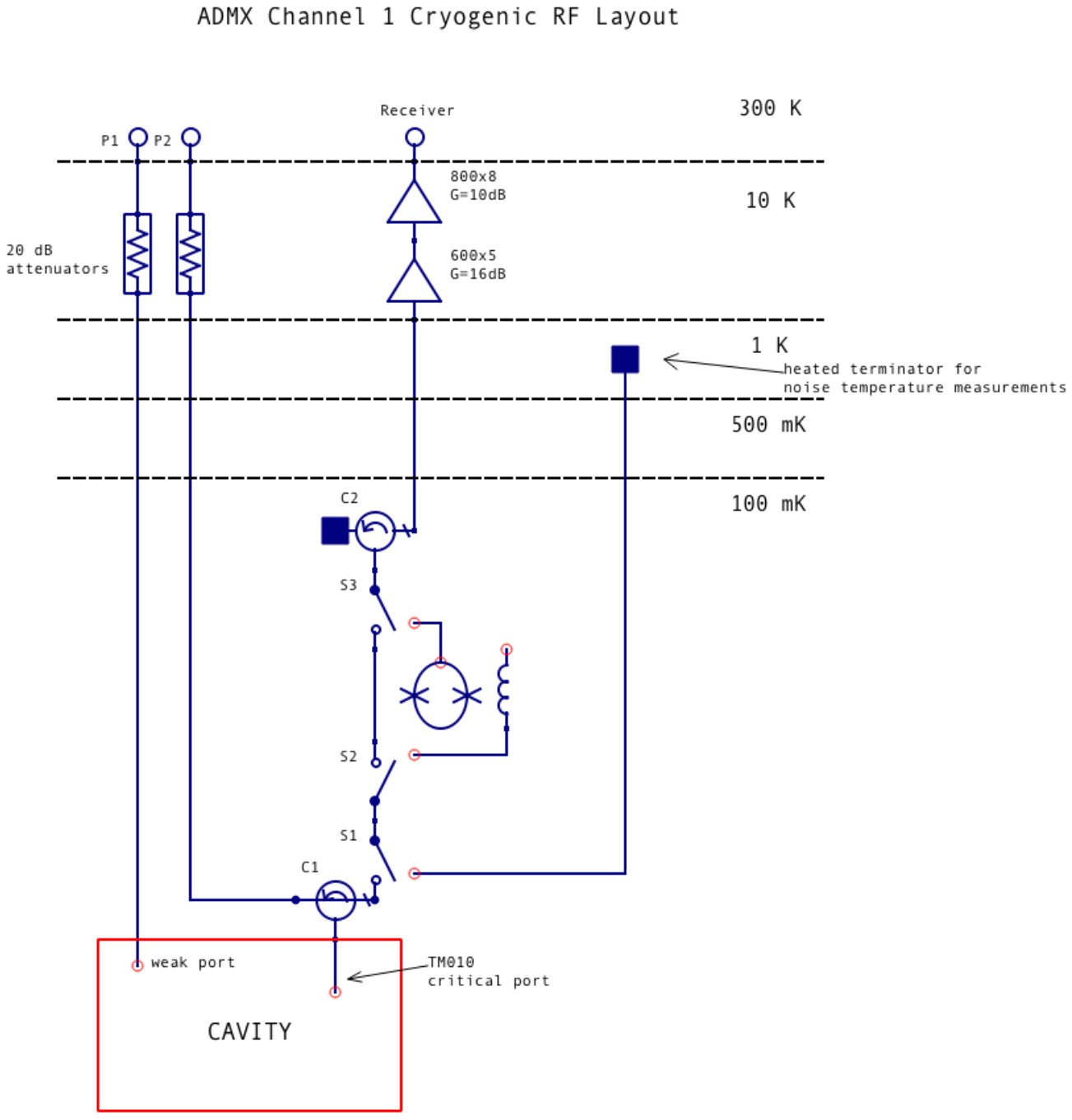
Cryo Microwave Status

Ana Malagón

May 3, 2015

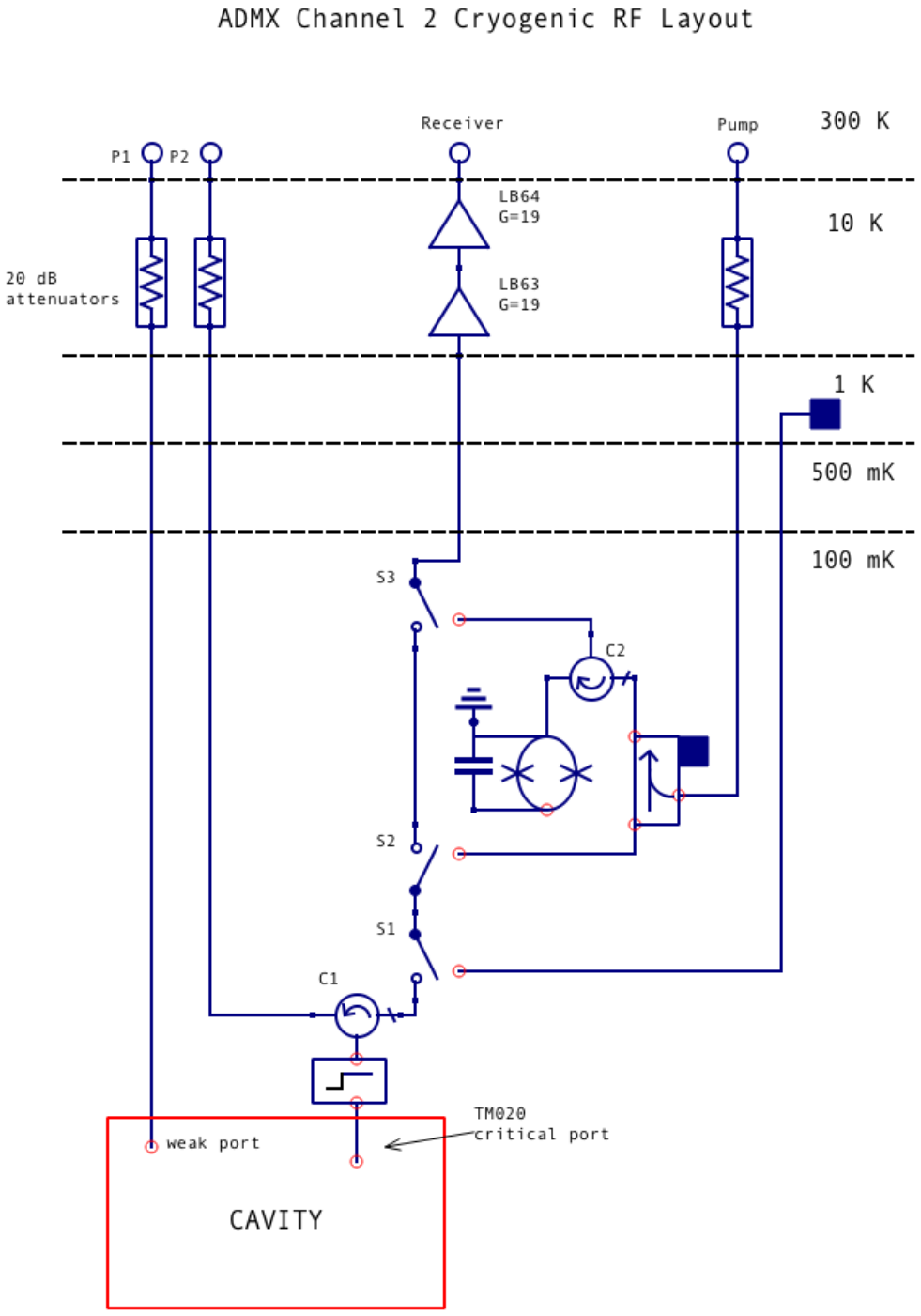


- Quinstar Circulators:

  UTE1255KCS
- MSA: LFF-12A
  T_{MSA} @ 100mK = ?

  Gain = 20 dB
- HEMTs:
  $T_{600-5} = 2$ K

  $T_{800-8} = 10$ K



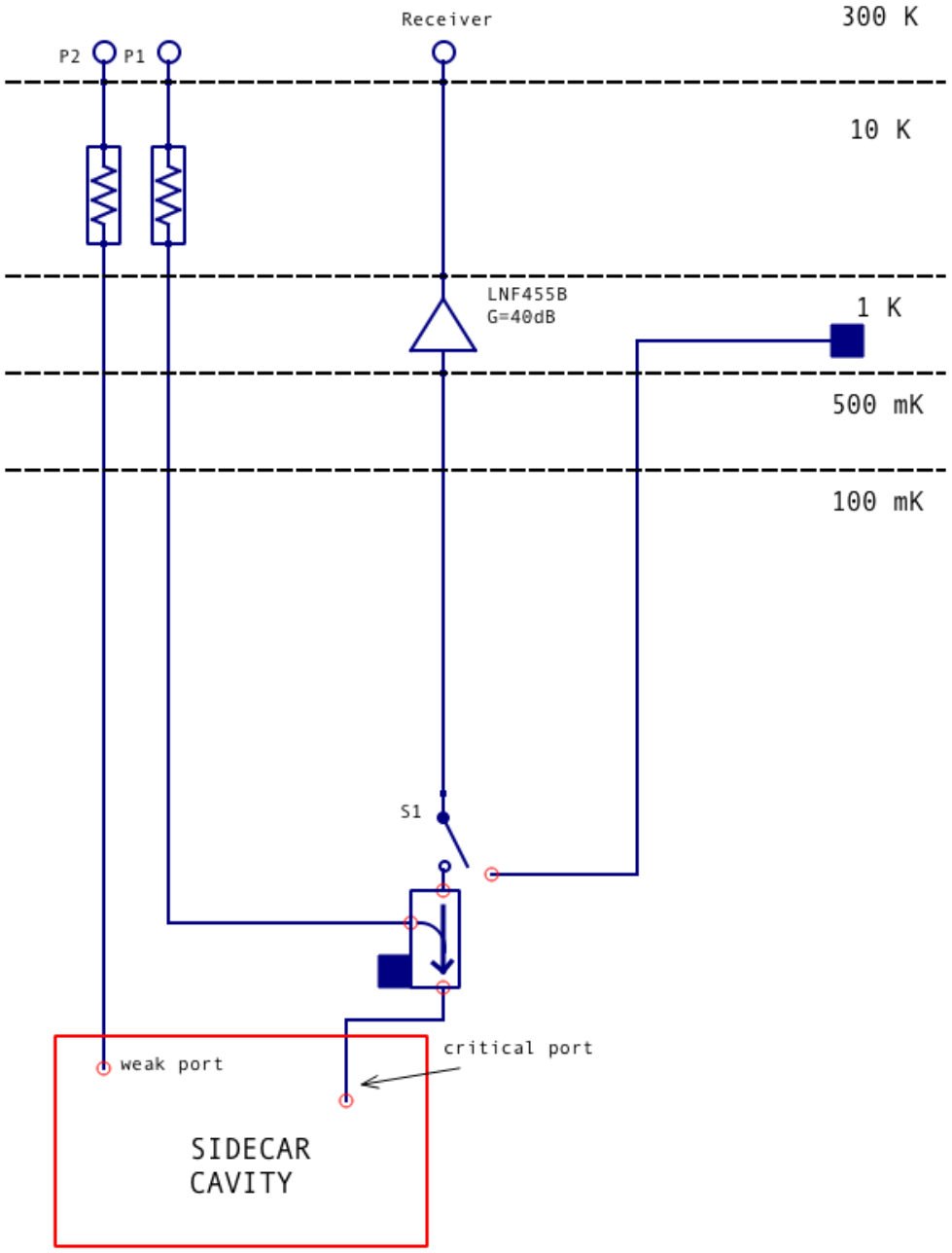
- Quinstar Circulators:

  LTG0102KCS
- JPA:
  T_{JPA} @ 100 mK = ?

  Gain = 21 dB
- HEMTs:
  $T_{LB63} = 6$ K

  $T_{LB64} = 6$ K

ADMX Sidecar Cryogenic RF Layout



- Directional Coupler: PE220120

  20dB coupling
- HEMT:

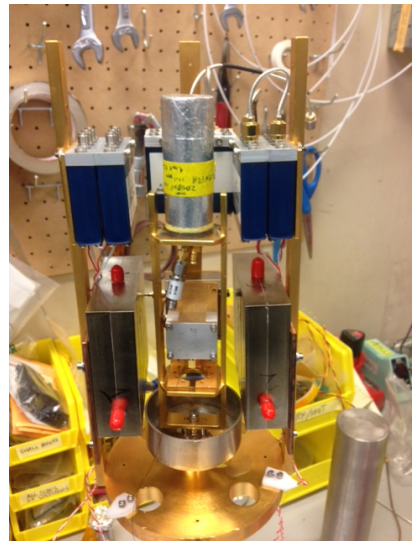
  $T_{LNF455B} = 4$ K
- * Raditek Circulator:

  SN102
- * JPA:
  T_{JPA} @ 100 mK = ?

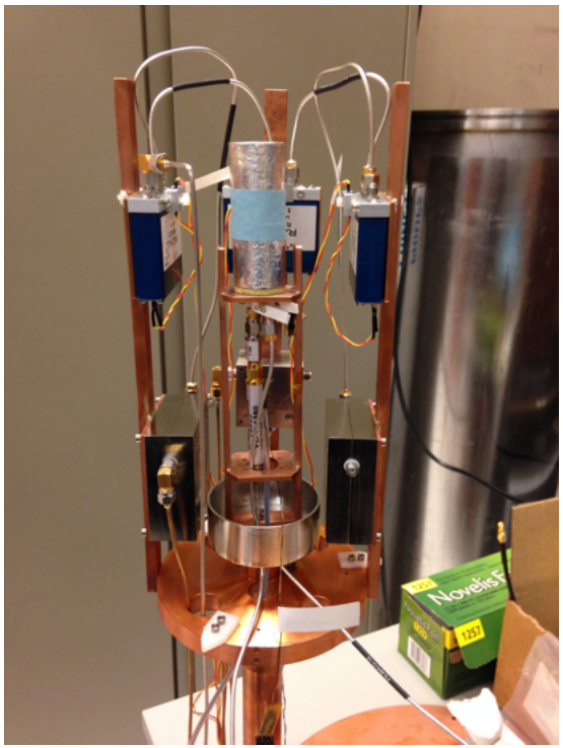
  Gain = ?

* to be put in for second iteration.

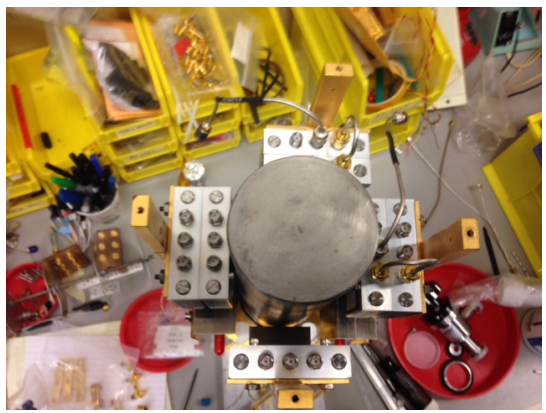
2015 Squidadel



2014 Squidadel



add 4 more switches... $\rightarrow$



controls

EPICs Driver for JPA Power Supply [Cliff]

EPICs Driver for JPA Pump Tone [Cliff]

Upgrade MSA Current Source [Cliff]

wiring/sensors

Bundle squidadel dc wiring [Gray]

Set up Cable E for Sidecar piezo/temp sensor wires + JPA bias [Cliff]

Replace RF feedthrough 'nuzzlie' [Lisa]

Remake holder for noise sources [Ana]

Mount Sidecar hall probe/temp sensor

hemts

Set up Sidecar HEMT [Gray]

Resolder LB63 connector for bias pins

Rebias Ch1 and Ch2 HEMTs

cabling

RF feedthrough collar [Dima]

Epoxy RF feedthroughs in anchoring rows [Kiva]

Install Coax Co. cables

Heat sink cables

Put in attenuators

Check transmission through cable assemblies

squidadel (this iteration)

Make adaptor plates to hold circulators on posts [Ana]

Make JPA mount [Machine Shop]

Add two more bolts to inner holder [Dima]

Remount temperature sensors and hall probe

squidadel (next iteration)

Remake posts to fit more circulators

Remake holder to fit more JPAs

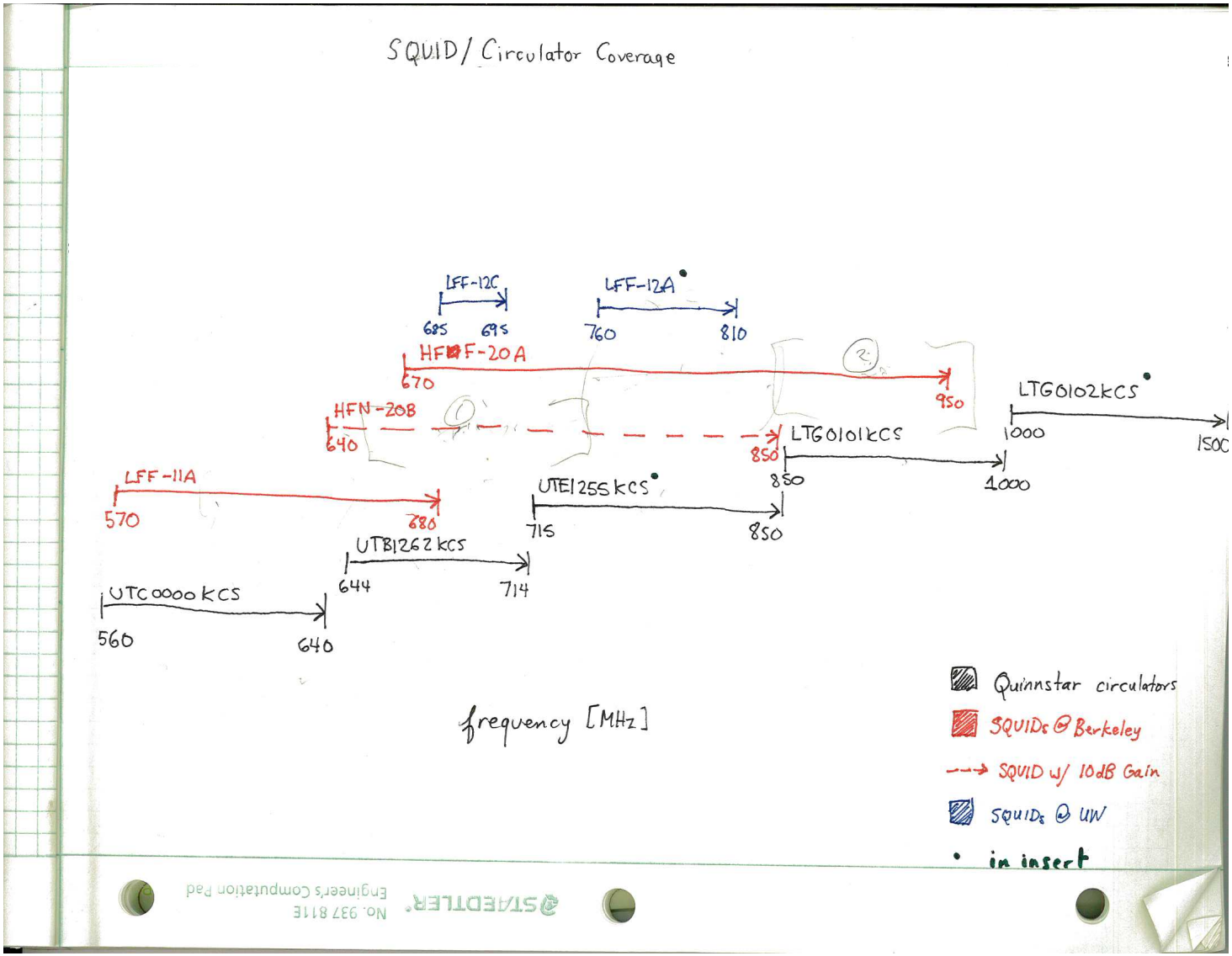
Install superconducting RF cable

Side Dewar

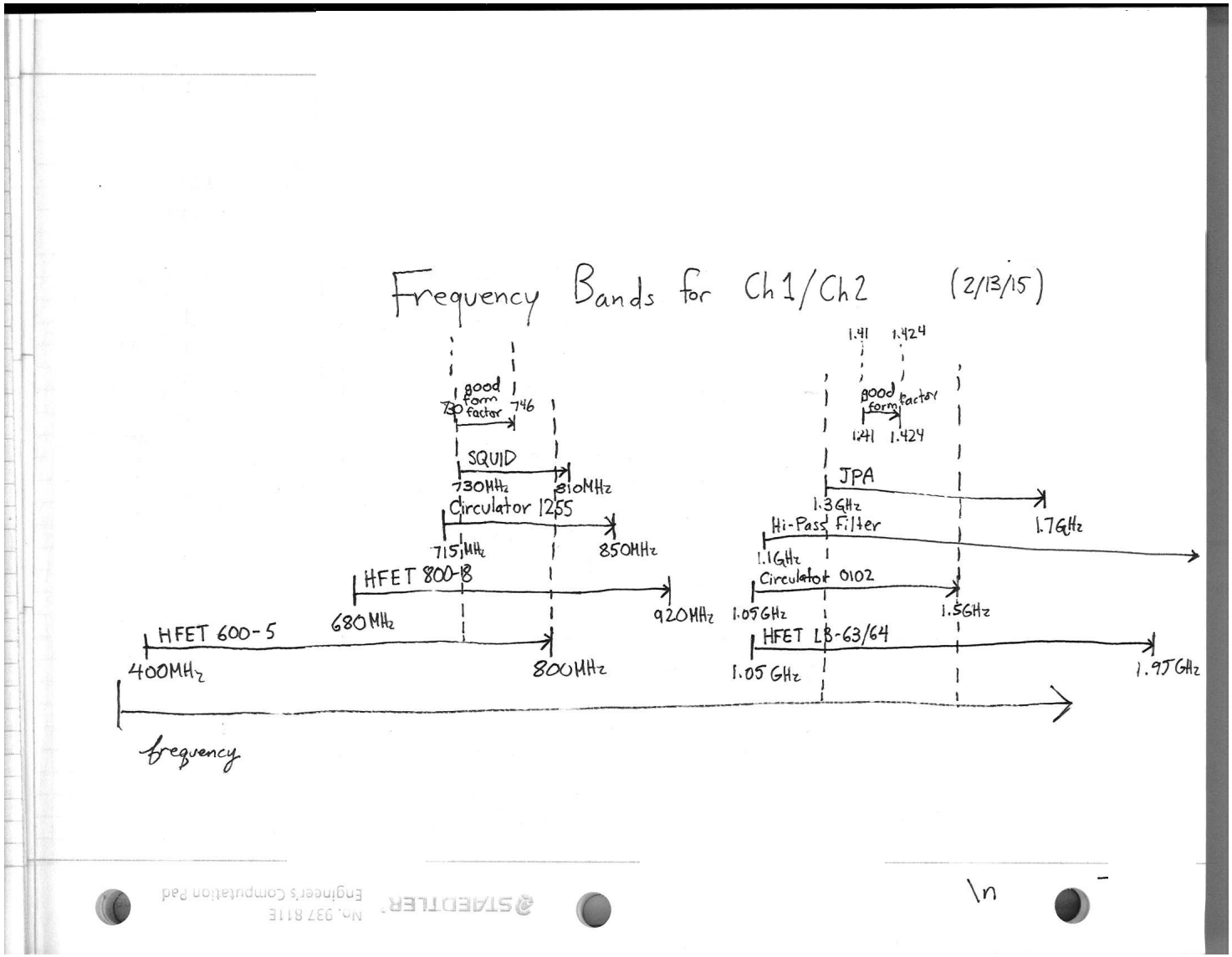

DANGER!
WEAR FACE-
SHIELD AND
CRYO GLOVES
WHEN
HANDLING
CRYOGENS!
Side Dewar

Additional

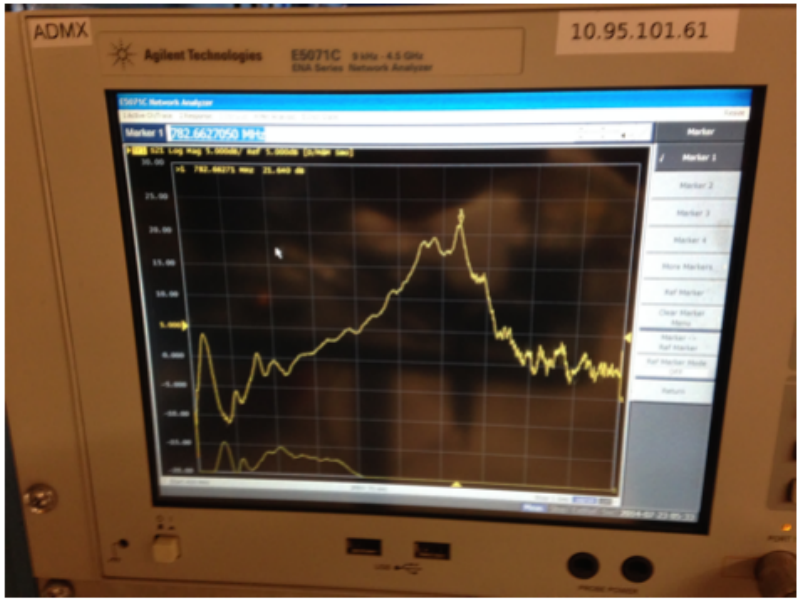
Coverage


SQUID/Circulator Coverage
LFF-12C
695
695
LFF-12A
760
810
HFF-20A
670
950
HFN-20B
640
850
LTG0102kCS
1000
1500
LTG0101kCS
850
1000
LFF-11A
570
880
UTE1255kCS
715
850
UTB1262kCS
644
714
UTC0000kCS
560
640
frequency [MHz]
Quinnstar circulators
SQUIDs @ Berkeley
SQUID w/ 10dB Gain
SQUIDs @ UW
• in insert

Run Coverage



Installation of new MSA



- New MSA designed by Sean and fabricated at NIST replaced MIT LL device
- Gain of ~20 dB near 730-760 MHz measured

http://admxdatastore.npl.washington.edu/mediawiki/images/2/20/MSA_update_sept2014_Wagner.pdf

RF Characteristics

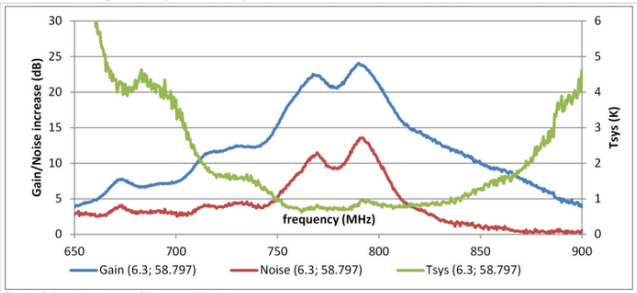
Monday, June 02, 2014 6:41 PM

http://admxdatastore.npl.washington.edu/mediawiki/index.php/Amplifiers_SQUID

Typical Performance

A note on Tsys: Tsys was calculated from S/N improvement, assuming a 10K Tsys for the amplifier chain without the MSA.

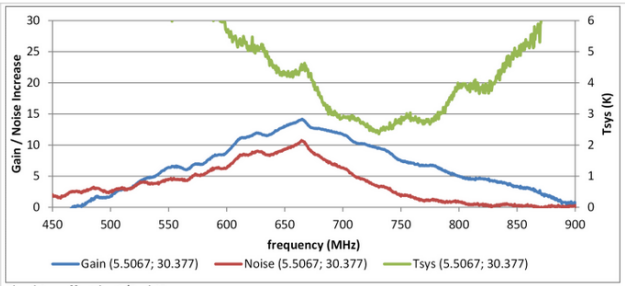
There are two local extrema for gain and noise performance, different by about 1/2 phi0 in flux bias. This data shows the higher frequency, higher gain, lower noise parameters.



Typical Gain, Noise and Tsys at 85mK

I bias= 6.3uA, flux bias current=58.8uA (flux bias current will have variable offset on each cooldown)

There

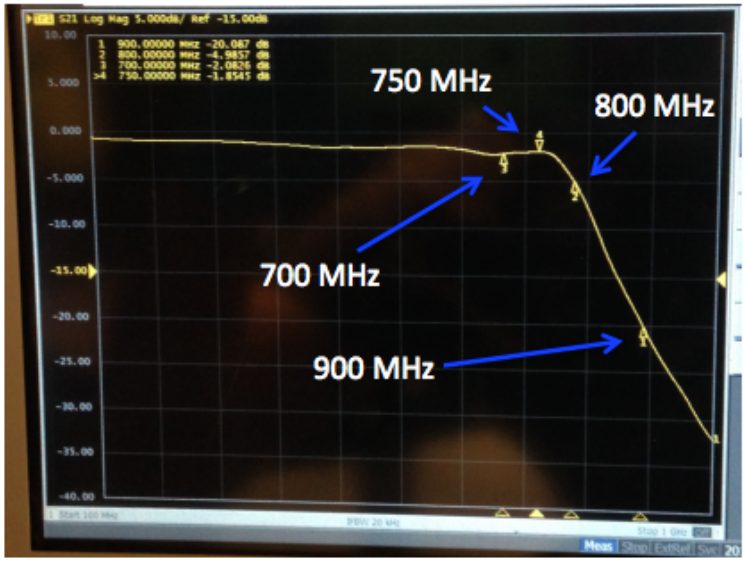


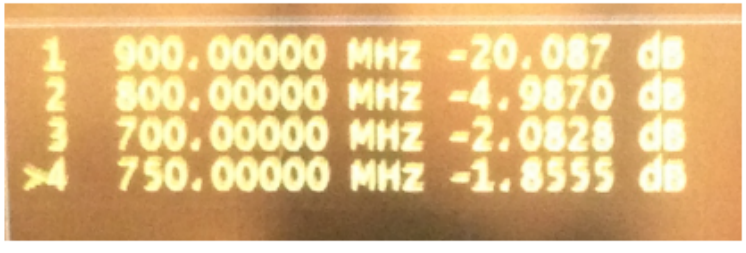
Flux bias offset by 1/2 phi0.

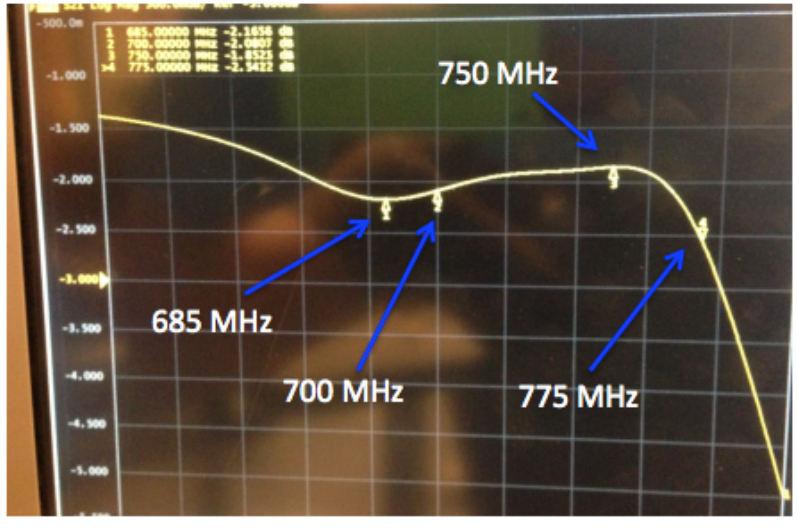
Device has lower gain and higher noise.

Very little data was taken around this bias point.

Antenna 1 Filter Cutoff

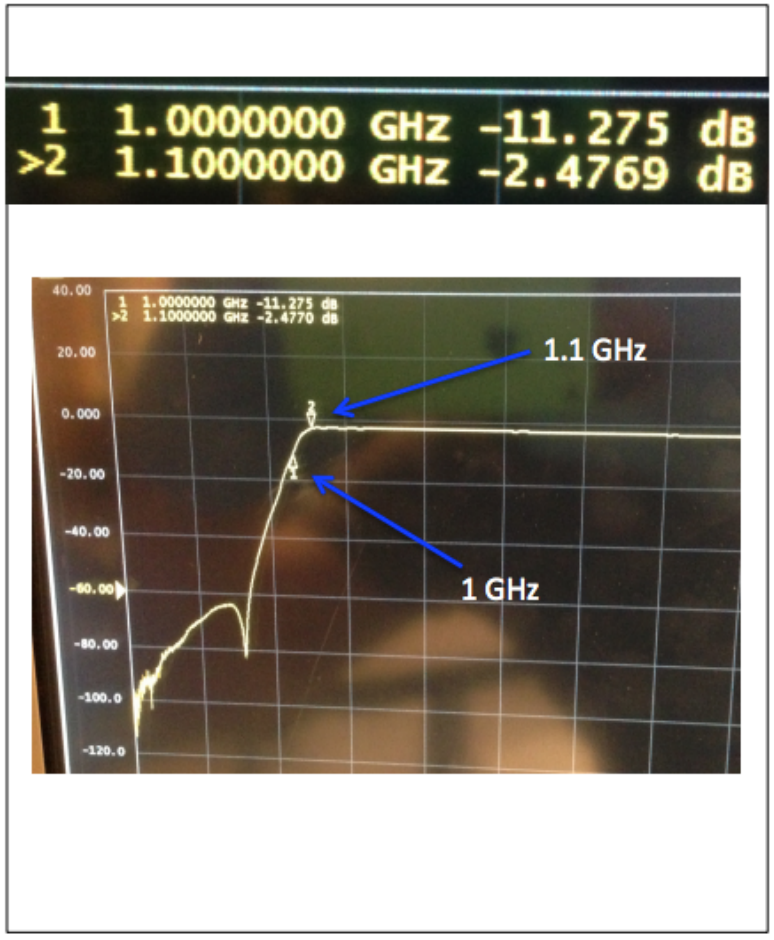


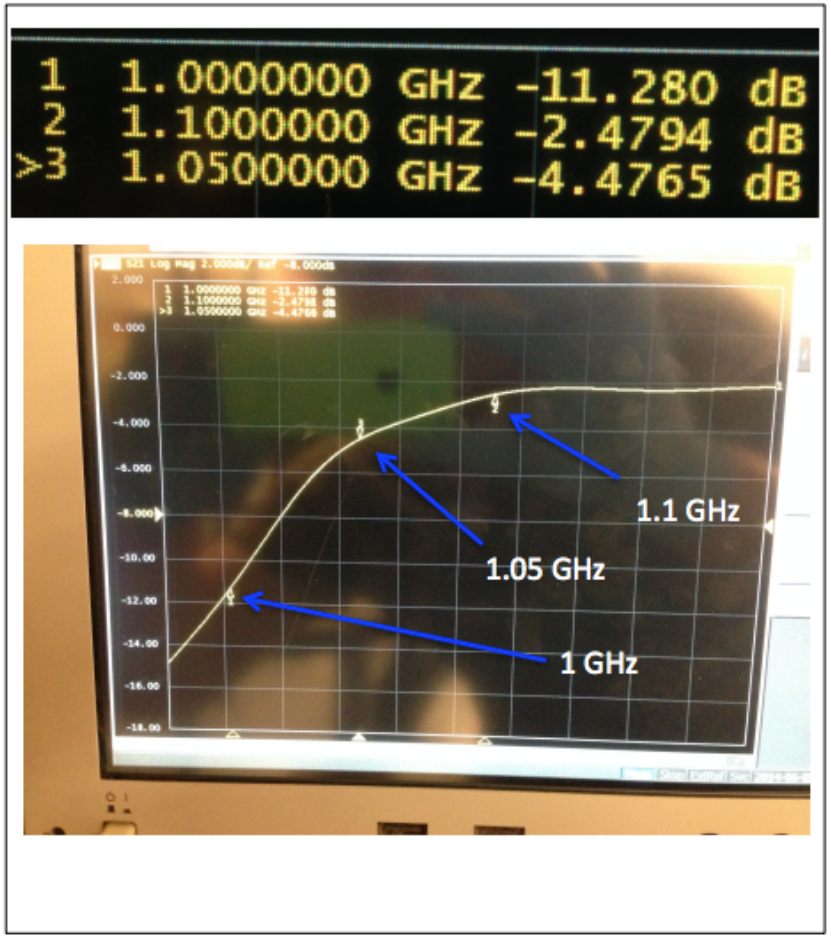




http://admxdatastore.npl.washington.edu/mediawiki/images/1/15/Antenna_1_Filter_Cutoff_.pdf

Antenna 2 Filter Cutoff





http://admxdatastore.npl.washington.edu/mediawiki/images/4/4c/Antenna_2_Filter_Cutoff.pdf