Fermilab

$\bar{P}$ NOTE #355

NOISE PERFORMANCE OF 1-2 GHZ PREAMPS

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At this time we have finished testing 1-2 GHz preamps. The tests consisted of more than 12 amplifiers including 2 from Berkeley. Testing consists of Gain & phase measurements plus noise figure measurements. All units were cryogenically cycled to either -50°C or 77°K more than 10 times. Before, during, and after measurements were made to monitor performance. ~~All units~~ None of the units suffered any gain or phase degradation. In general there is an improvement in noise figure at the solder temperature. The attached chart is a noise figure performance summary for 12 of the units. The Berkeley units ~~are~~ have by far the best noise figure though their gain, phase, and input impedance are worse than the commercial units. Individual characteristics are available in the Microwave measurement lab.

The design goal for 1-2 GHz amps was a gain of 30 dB min with 1 dB MAX noise figure. One dB N.F is an equivalent noise temperature of 75°K. 80°K is the noise temperature of the pickup electrodes. Our results show commercial amps with cooled noise temps of 59° K average and Berkeley amps of 18°K.

Insertion loss of pick up combiner boards and hybrids etc is as much as 1.5 dB. This loss is before the amps and causes signal degradation. It also deemphasizes the improved noise performance of the Berkeley amps over commercial products.

Pros & cons of each amplifier must be considered with a choice to be made in January 1984.

NOISE FIGURE DATA 1-26 Hz

FREQ IN MHz	Room Temperature							-50°C						
	1000	1200	1400	1600	1800	2000	2200	1000	1200	1400	1600	1800	2000	2200
MITEQ MODEL AFD-1020-6852 S/N #48156														
BEFORE CYCLING	1.33	1.12	1.22	1.31	1.41	1.57	2.09	1.07	.80	.89	.95	1.04	1.14	1.59
AFTER CYCLING	1.35	1.08	1.23	1.31	1.41	1.58	2.10	1.10	.82	.87	.96	1.06	1.17	1.58
MITEQ MODEL AFD-1020-6852 S/N #48157														
BEFORE CYCLING	1.25	1.10	1.19	1.32	1.46	1.63	2.00	1.00	.78	.86	.94	1.04	1.16	1.47
AFTER CYCLING	1.21	1.07	1.16	1.27	1.42	1.57	1.92	1.03	.78	.86	.97	1.07	1.17	1.47
MITEQ MODEL AFD3-1020-3 S/N #51313														
BEFORE CYCLING	1.24	.95	1.10	1.15	1.24	1.25	1.36	1.42	.72	.78	.76	.82	.84	.92
AFTER CYCLING	1.18	.85	.99	1.04	1.12	1.13	1.25	1.42	.73	.80	.80	.84	.84	.92
CALIFORNIA AMP MODEL C15613 S/N #101														
BEFORE CYCLING	1.70	1.22	1.06	.90	.92	1.20	1.96	1.32	.95	.77	.60	.60	.81	1.28
AFTER CYCLING	1.69	1.24	1.04	.87	.87	1.19	1.82	1.33	.93	.80	.63	.61	.81	1.25
CALIFORNIA AMP MODEL C15613 S/N #102														
BEFORE CYCLING	1.86	1.49	1.37	1.61	1.25	1.65	2.33	1.51	1.22	1.11	1.27	.96	1.24	1.78
AFTER CYCLING	1.87	1.51	1.37	1.59	1.25	1.61	2.33	1.49	1.21	1.10	1.29	.98	1.22	1.80
CALIFORNIA AMP MODEL C15613 S/N #103														
BEFORE CYCLING	1.78	1.19	.99	1.01	1.15	1.57	2.96	1.44	.88	.69	.79	.87	1.17	2.29
AFTER CYCLING	1.83	1.20	.97	1.03	1.17	1.63	3.06	1.40	.87	.69	.73	.83	1.15	2.32
AVANTEK ABG-2015 S/N #1668														
BEFORE CYCLING	1.33	1.60	1.78	1.83	1.83	1.69	1.96	1.06	1.34	1.52	1.53	1.56	1.36	1.58
AFTER CYCLING	—	—	—	—	—	—	—	1.11	1.36	1.54	1.55	1.57	1.40	1.69
AVANTEK ABG-2015 S/N #1669														
BEFORE CYCLING	1.27	1.42	1.53	1.58	1.62	1.58	1.87	1.04	1.26	1.83	1.80	1.79	1.55	1.64
AFTER CYCLING	—	—	—	—	—	—	—	—	—	—	—	—	—	—
AVANTEK SFT82-2414 S/N #8252-1 (77°K)														
BEFORE CYCLING	3.82	3.64	3.99	3.34	3.64	3.46	3.26	1.76	1.27	2.05	1.30	1.59	1.36	1.20
AFTER CYCLING	—	—	—	—	—	—	—	1.79	1.25	2.13	1.42	1.63	1.40	1.34
AVANTEK SFT82-2414 S/N #8252-2 (77°K)														
BEFORE CYCLING	3.51	3.87	3.38	3.24	3.38	3.20	3.24	1.51	1.86	1.47	1.30	1.47	1.22	1.04
AFTER CYCLING	3.30	5.14	3.47	2.80	3.43	3.09	3.06	1.51	1.91	1.54	1.32	1.57	1.33	1.25

FREQ. IN MHz	Room Temperature													
	1000	1200	1400	1600	1800	2000	2200	1000	1200	1400	1600	1800	2000	2200
BERKELEY AMP #1 @ 70°K														
FIRST READING	1.15	.88	.79	.89	1.04	1.37	2.02	.26	.17	.11	.09	.19	.33	.55
SECOND READING	1.17	.88	.79	.87	1.09	1.39	2.06	.26	.18	.11	.09	.21	.33	.55
BERKELEY AMP #2 @ 77°K														
FIRST READING	1.52	.91	.88	.97	1.05	1.13	1.39	.41	.21	.25	.18	.16	.09	.35
SECOND READING	1.47	.89	.85	.96	1.10	1.13	1.34	.39	.20	.24	.18	.16	.11	.35