5.1.6 NOISE CHARACTERISTICS

5.1.6.1 NAC FM NOISE CALIBRATION RESULTS

As reported in Reference 5.1.6-1

Reference 5.1.6-1 - IOM 388-PAG-CCA97-9, "NAC FM CALIBRATION RESULTS: COHERENT NOISE", C. Avis, March 13, 1997

5.1.6.1.1 INTRODUCTION

The Narrow-angle Flight Model thermal/vacuum testing included the acquisition of a set of images at -10°, 5° and 25° C for detection of any patterns of coherent noise in the images. The term ‘coherent noise’ is used to mean noise signatures which occur at consistent spatial frequencies. These signature may have electrical sources or may be due to the CCD layout.

For the purposes of this analysis, there are two types of coherent noise. The term ‘fixed pattern noise’ describes coherent noise which has a fixed phase (i.e., it begins at the same pixel on every line). This is the type of noise which the eye/brain can easily pick out of an otherwise random image. ‘Fixed pattern noise’ may be present in either the horizontal direction or the vertical direction in images. Therefore, results of analysis for both directions is described below.

The term ‘electrical noise’ is used herein to describe coherent noise whose phase may be shifting (i.e., it may begin at a different pixel on every line). This type of noise is not readily visible by eye. This type would be expected only in the horizontal direction.

All frames in this analysis were flat-field (no target) frames. All summation modes and gain states are represented in the dataset and both antiblooming states were used. In addition, lossless compression was exercised.

5.1.6.1.2 METHOD 1 - Electrical Noise

A periodic signal can be introduced by the signal processing of the lines of pixels. Because the lines may not be processed at regular intervals, the phase of the periodic signal may vary from line to line. As the phase of the signal shifts, the amplitude at a given frequency should remain constant whereas the real and imaginary components are changing.

- Filter with a large high-pass filter to dampen the low frequencies
    - Rotate image area 90 degrees, if looking for patterns in the vertical direction
    - Calculate Fourier Transform of the each line
    - Calculate the amplitude as a function of frequency for each line
    - For each frequency, calculate the mean amplitude using all lines and tabulate.

5.1.6.1.3 METHOD 2 - Fixed Pattern Noise

Some kinds of coherent noise will affect the same pixels on every line (or the same lines in every column). This is obviously the case if the source is in the CCD layout itself. Because the phase is constant, one can best isolate this signal from the random noise by averaging the signal in real-space rather that frequency-space.

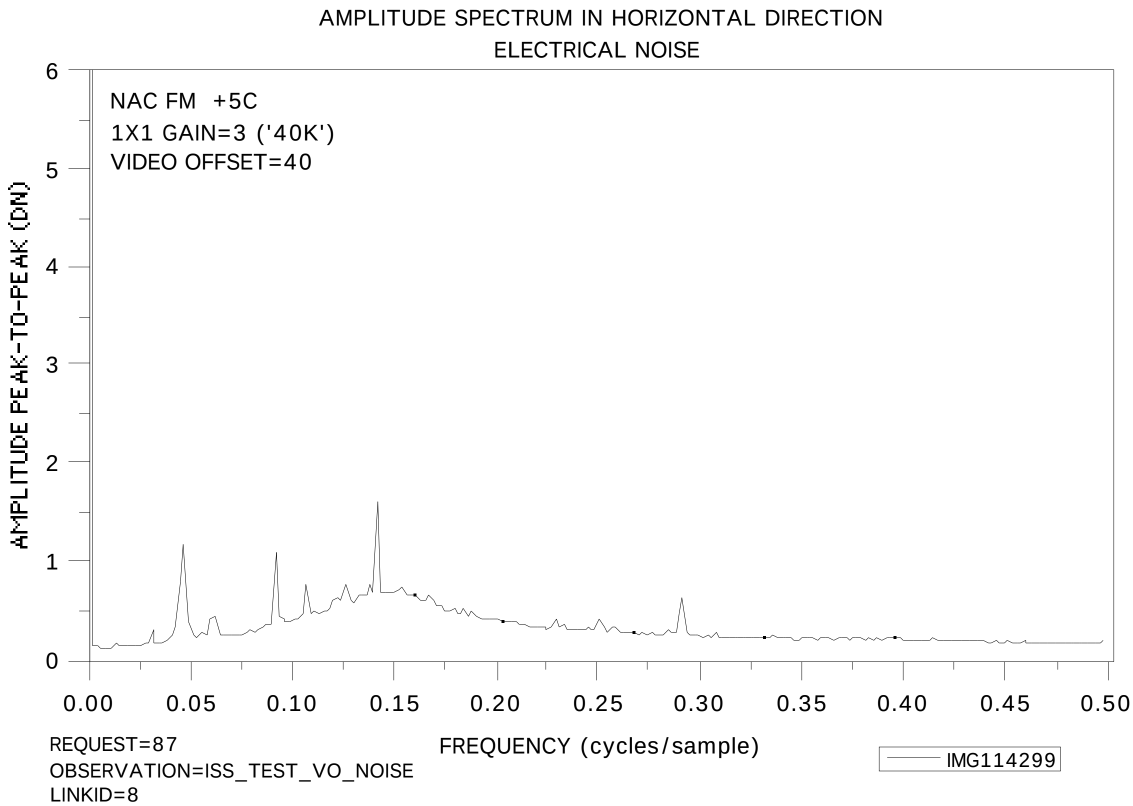
- Rotate image area 90 degrees, if looking for patterns in the vertical direction
  - Average the lines in the area
  - Filter with a large high-pass filter to dampen the low frequencies
  - Calculate Fourier Transform of the mean line
  - Calculate the amplitude and tabulate vs. frequency

5.1.6.1.4 RESULTS

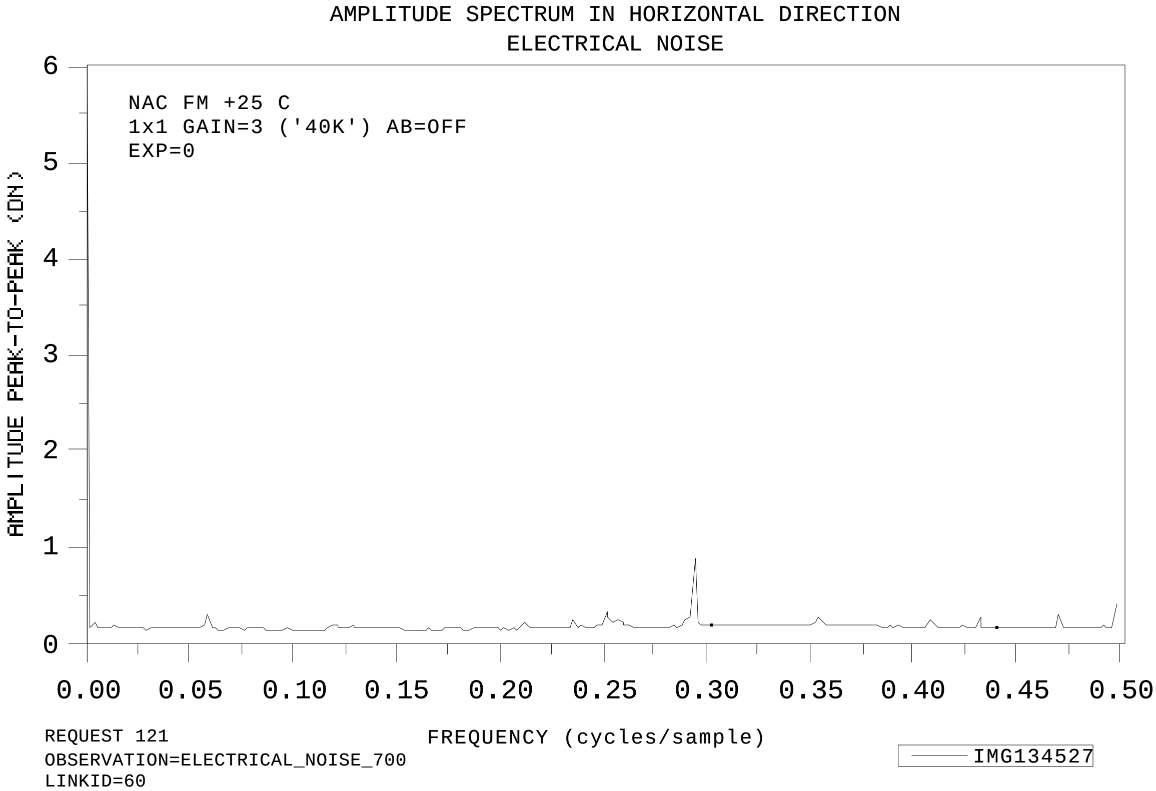
The following conclusions are drawn from this analysis.

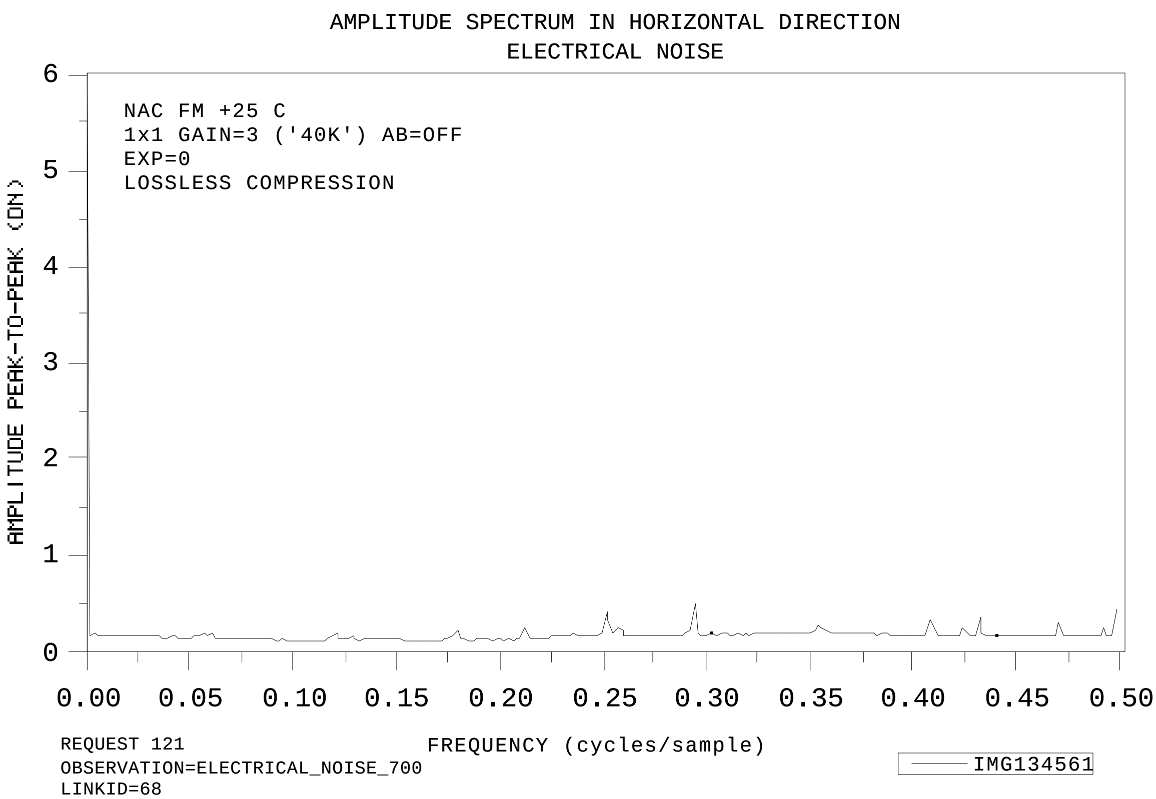
- The zero exposure frames have such low amplitude noise spectrum in the horizontal direction that the BIU transmission frequency peaks are detectable. The peak at 0.2938 is apparent in Gain 3, slightly in Gain 2 and not at all in Gain 1 or 0. Other small peaks are visible which are more variable in amplitude. All these peaks are seen in zero exposure frames but not in the lowest exposed frames available.
- The antiblooming state (‘ON’ or ‘OFF’) has a major effect on the spectrum of well-exposed frames. The amplitude of the frequencies greater than 0.1 cps is increased considerably in the vertical direction for the ‘ON’ case. The lower the signal the less this increase occurs.
- There is a significant fixed pattern noise vertically. Peaks occur at a frequency of 0.0233 and its harmonics. Zero exposure frames do not show the pattern, but exposed frames show it in all gain states. This is consistent with the “step-and-repeat” pattern of the CCD manufacturing process.
- There is also fixed pattern noise horizontally. The appearance of the spectrum from 0 cps to 0.1 cps (in 1x1 mode) is consistent and repeatable from frame to frame (exposed frames only). This set of features shows up (at lower-resolution) at the appropriate frequencies in the summation modes. This is probably due to the ”step-and-repeat” pattern of the CCD manufacturing process.
- No vertical electrical noise is apparent, as expected.
- The LOSSLESS compression data is identical to that with no compression.
- Temperature had no effect on the spectra, so the plots below don’t show multiple temperatures.

The following plot shows the electrical noise spectrum at zero exposure for an early thermal/vacuum frame. The noise 'hump' appeared occasionally in other frames throughout the calibration period. The source of this noise and the severe spikes was never found and an environmental source is suspected. However, it did not appear in the test data used for this report.

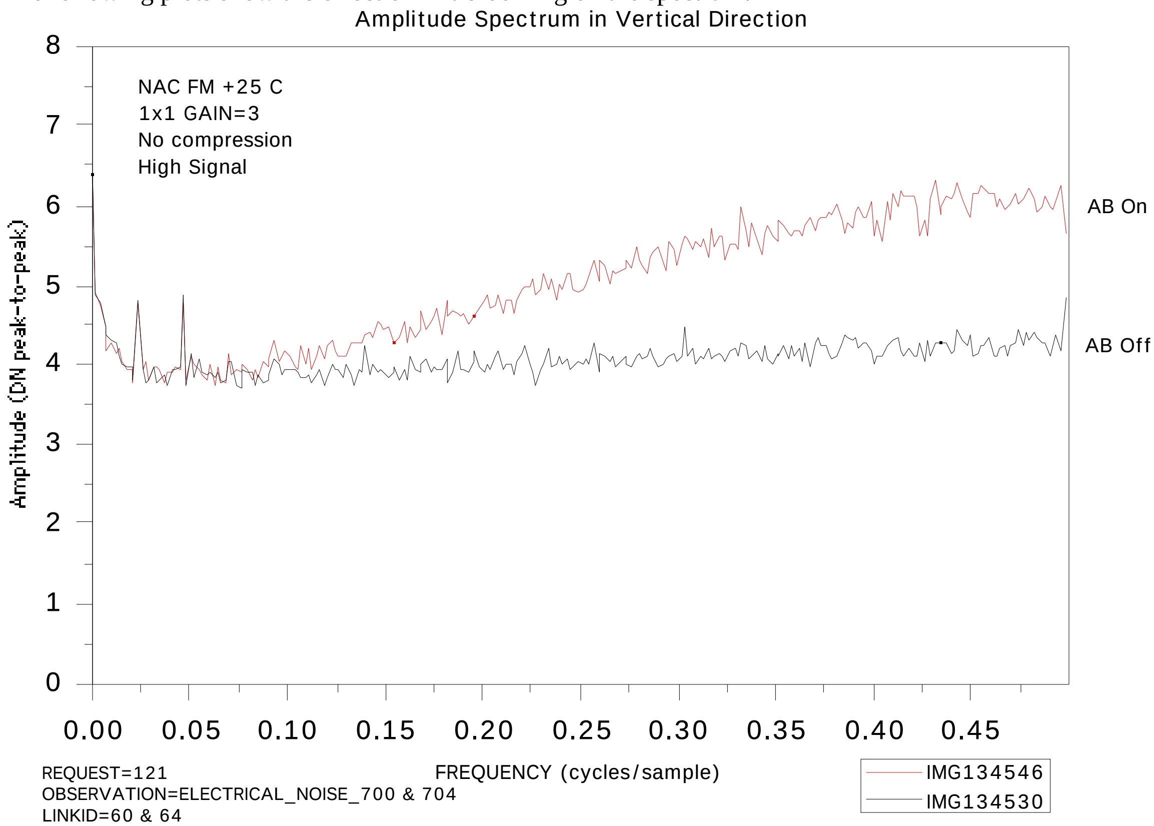


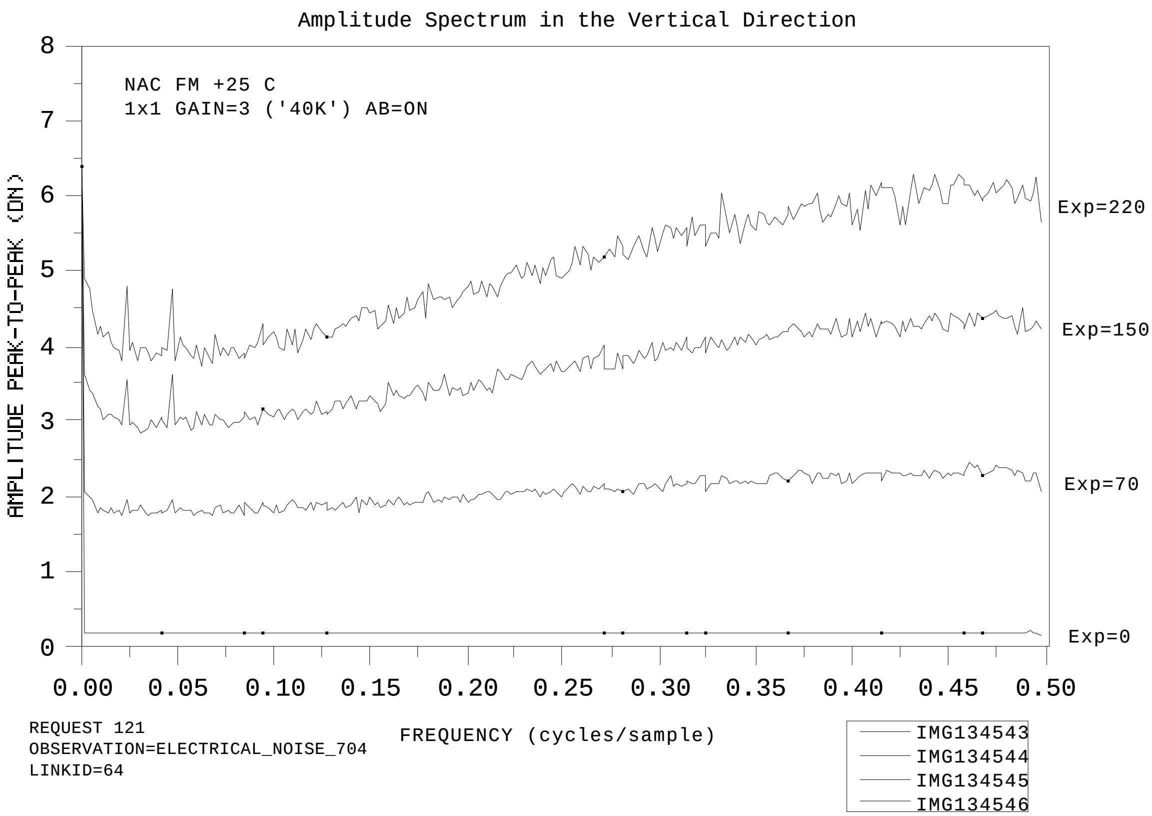
The following plots show the electrical noise spectrum at zero exposure for two frames. The peaks due to the BIU transmission frequency are visible and somewhat variable.



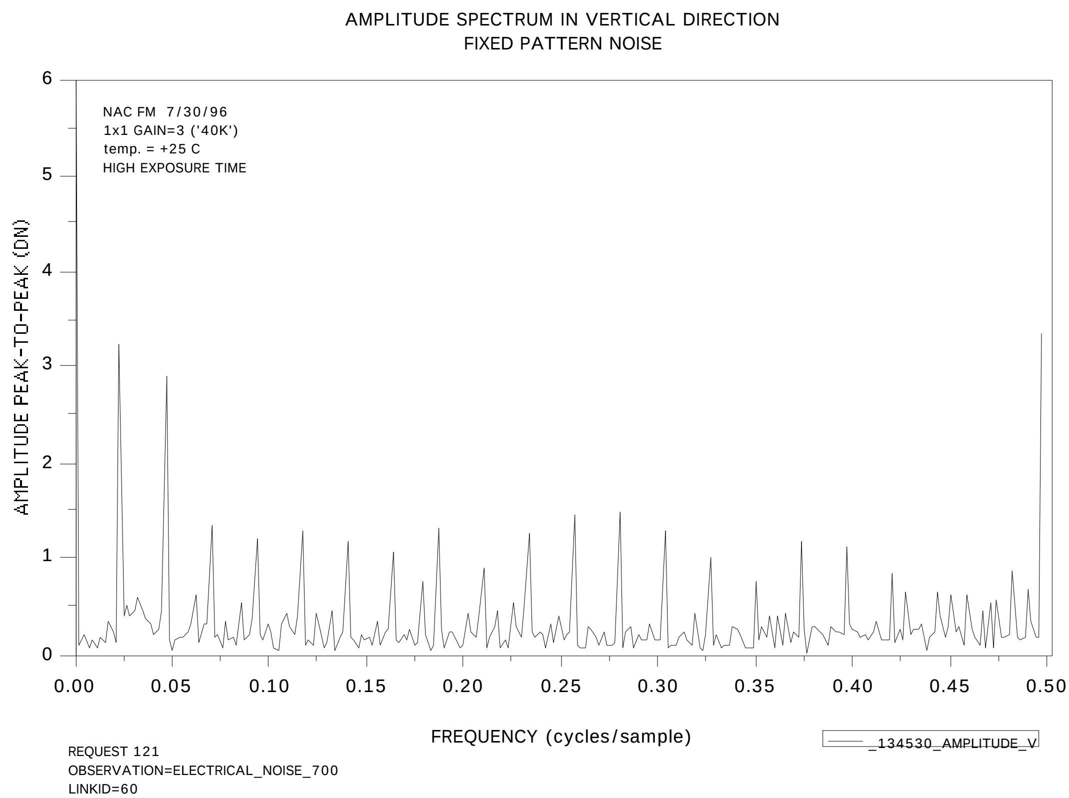


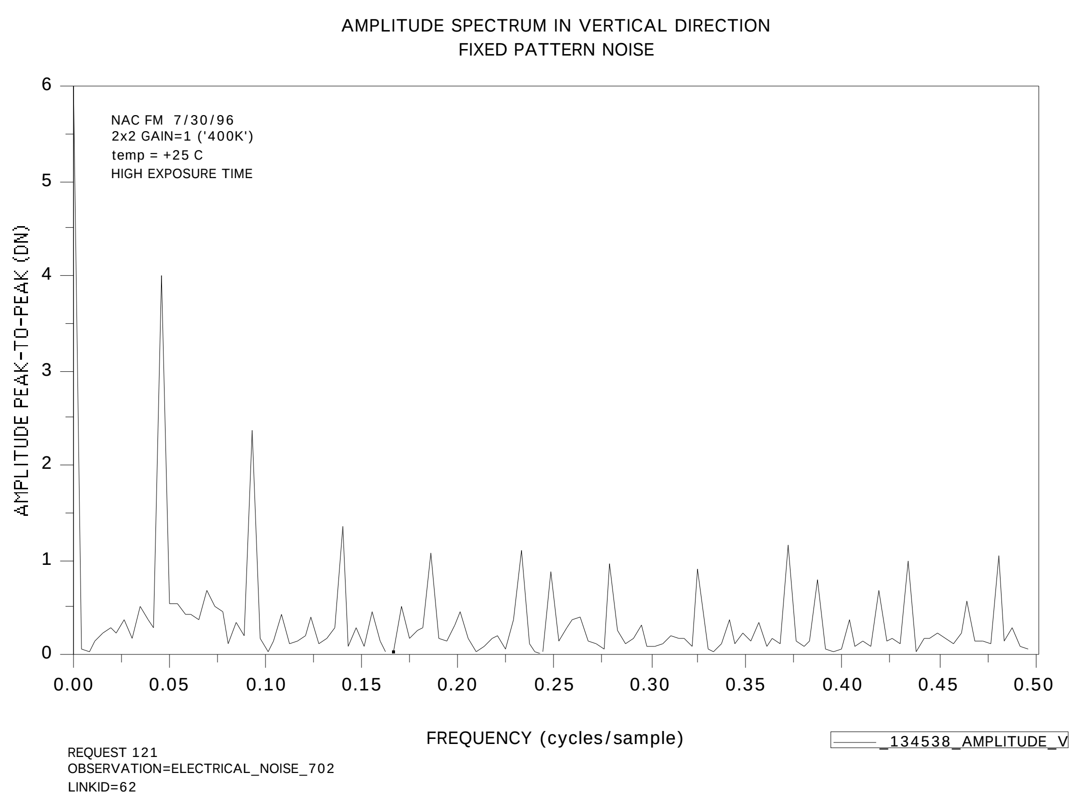
The following plots show the effect of Antiblooming on the spectrum.

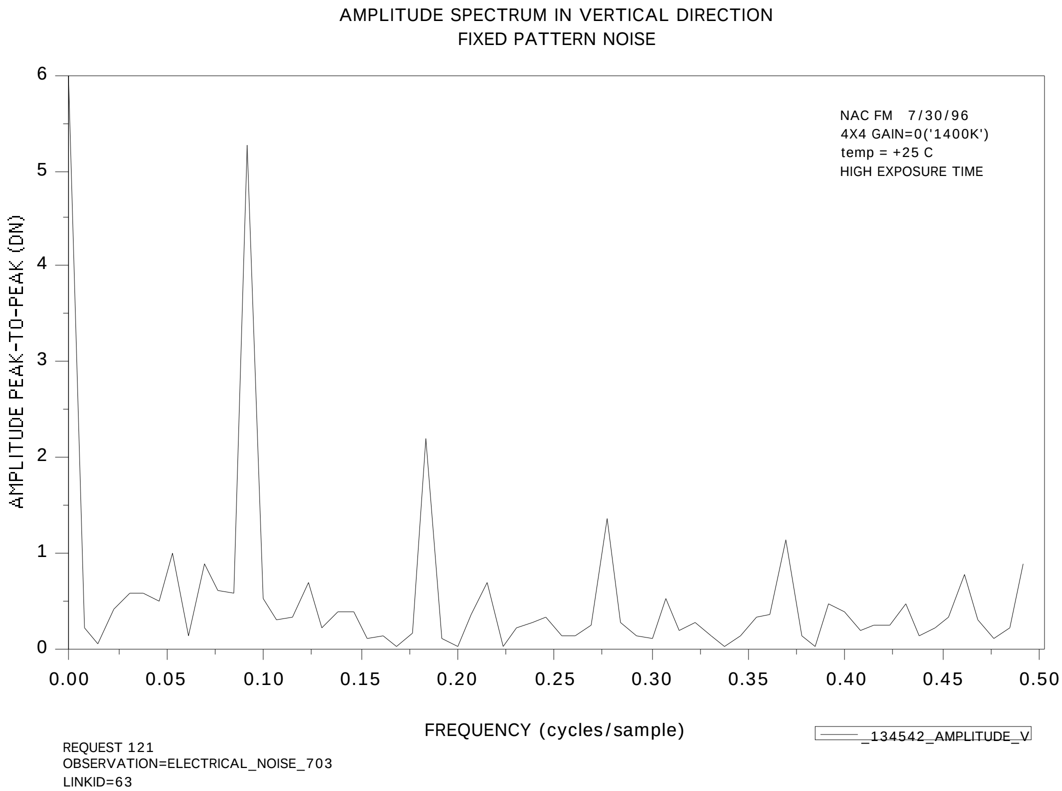




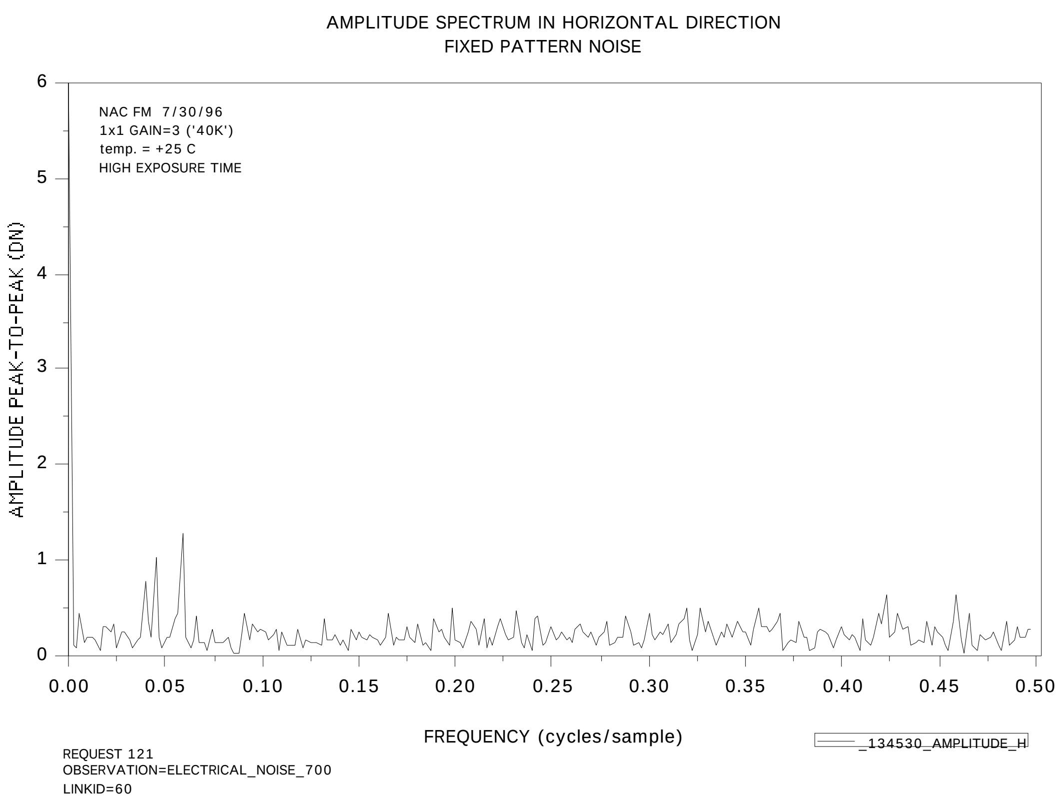
The following three plots show the vertical fixed pattern noise in each summation mode. This comes from the vertical component of the 'step-and-repeat' signature.

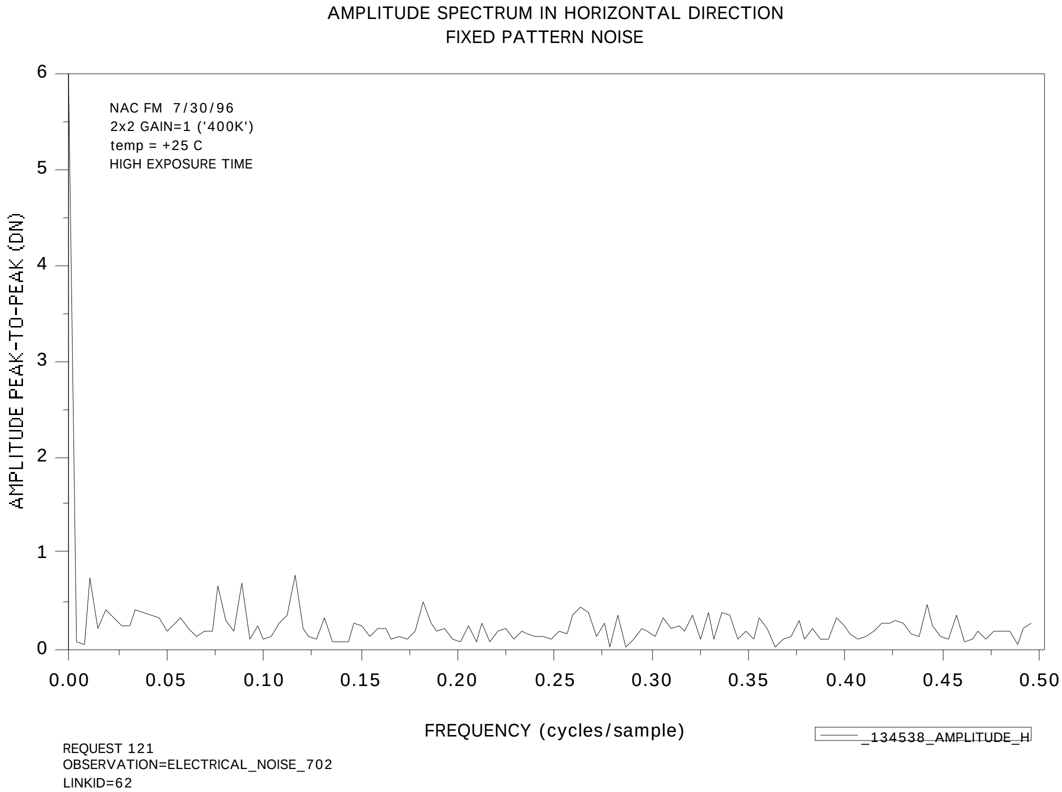






The following three plots show the horizontal fixed pattern noise in each summation mode. This comes from the horizontal component of the 'step-and-repeat' signature.




AMPLITUDE SPECTRUM IN HORIZONTAL DIRECTION
FIXED PATTERN NOISE
NAC FM 7/30/96
2x2 GAIN=1 ('400K')
temp = +25 C
HIGH EXPOSURE TIME
AMPLITUDE PEAK-TO-PEAK (DN)
0
1
2
3
4
5
6
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50
FREQUENCY (cycles/sample)
_134538_AMPLITUDE_H
REQUEST 121
OBSERVATION=ELECTRICAL_NOISE_702
LINKID=62

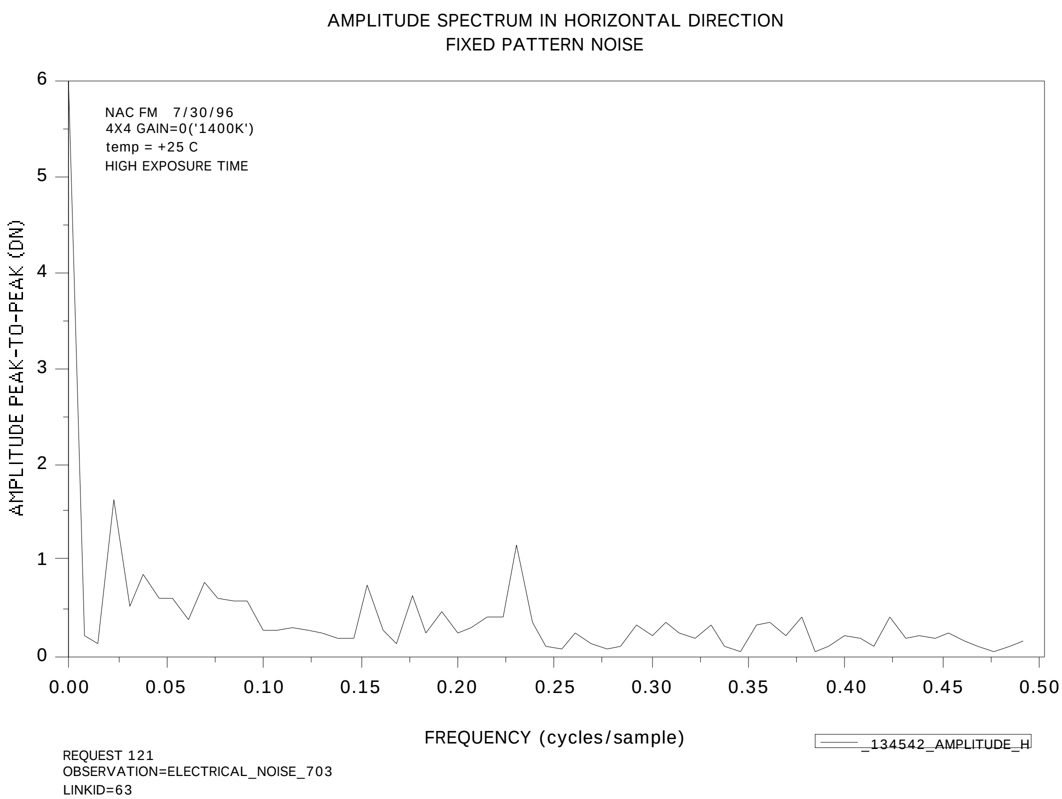

AMPLITUDE SPECTRUM IN HORIZONTAL DIRECTION
FIXED PATTERN NOISE
NAC FM 7/30/96
4X4 GAIN=0('1400K')
temp = +25 C
HIGH EXPOSURE TIME
AMPLITUDE PEAK-TO-PEAK (DN)
0
1
2
3
4
5
6
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50
FREQUENCY (cycles/sample)
_134542_AMPLITUDE_H
REQUEST 121
OBSERVATION=ELECTRICAL_NOISE_703
LINKID=63

image	day	eventtime	observation	gain	mode	expos	ablm
+25C NOT COMPRESSED							
134527	212	21:2:29.0	ELECTRICAL_NOISE_700	3 ('40K')	FULL	0	OFF
134528	212	21:3:58.0	ELECTRICAL_NOISE_700	3 ('40K')	FULL	70	OFF
134529	212	21:5:27.0	ELECTRICAL_NOISE_700	3 ('40K')	FULL	150	OFF
134530	212	21:6:57.0	ELECTRICAL_NOISE_700	3 ('40K')	FULL	220	OFF
134531	212	21:8:5.0	ELECTRICAL_NOISE_701	2 ('100K')	FULL	0	OFF
134532	212	21:9:34.0	ELECTRICAL_NOISE_701	2 ('100K')	FULL	150	OFF
134533	212	21:11:3.0	ELECTRICAL_NOISE_701	2 ('100K')	FULL	320	OFF
134534	212	21:12:33.0	ELECTRICAL_NOISE_701	2 ('100K')	FULL	460	OFF
134559	212	21:45:39.0	ELECTRICAL_NOISE_701	2 ('100K')	FULL	320	OFF
134535	212	21:13:40.0	ELECTRICAL_NOISE_702	1 ('400K')	SUM2	0	OFF
134536	212	21:14:44.0	ELECTRICAL_NOISE_702	1 ('400K')	SUM2	120	OFF
134537	212	21:15:48.0	ELECTRICAL_NOISE_702	1 ('400K')	SUM2	260	OFF
134538	212	21:16:52.0	ELECTRICAL_NOISE_702	1 ('400K')	SUM2	380	OFF
134539	212	21:17:35.0	ELECTRICAL_NOISE_703	0 ('1400K')	SUM4	0	OFF
134540	212	21:18:26.0	ELECTRICAL_NOISE_703	0 ('1400K')	SUM4	80	OFF
134541	212	21:19:17.0	ELECTRICAL_NOISE_703	0 ('1400K')	SUM4	150	OFF
134542	212	21:20:8.0	ELECTRICAL_NOISE_703	0 ('1400K')	SUM4	220	OFF
+25C LOSSLESS COMPRESSION							
134543	212	21:20:43.0	ELECTRICAL_NOISE_704	3 ('40K')	FULL	0	ON
134544	212	21:22:12.0	ELECTRICAL_NOISE_704	3 ('40K')	FULL	70	ON
134545	212	21:23:41.0	ELECTRICAL_NOISE_704	3 ('40K')	FULL	150	ON
134546	212	21:25:11.0	ELECTRICAL_NOISE_704	3 ('40K')	FULL	220	ON
134547	212	21:26:18.0	ELECTRICAL_NOISE_705	2 ('100K')	FULL	0	ON
134548	212	21:27:47.0	ELECTRICAL_NOISE_705	2 ('100K')	FULL	150	ON
134549	212	21:29:16.0	ELECTRICAL_NOISE_705	2 ('100K')	FULL	320	ON
134550	212	21:30:46.0	ELECTRICAL_NOISE_705	2 ('100K')	FULL	460	ON
134551	212	21:31:53.0	ELECTRICAL_NOISE_706	1 ('400K')	SUM2	0	ON
134552	212	21:32:57.0	ELECTRICAL_NOISE_706	1 ('400K')	SUM2	120	ON
134553	212	21:34:1.0	ELECTRICAL_NOISE_706	1 ('400K')	SUM2	260	ON
134554	212	21:35:5.0	ELECTRICAL_NOISE_706	1 ('400K')	SUM2	380	ON
134555	212	21:35:48.0	ELECTRICAL_NOISE_707	0 ('1400K')	SUM4	0	ON
134556	212	21:36:39.0	ELECTRICAL_NOISE_707	0 ('1400K')	SUM4	80	ON
134557	212	21:37:30.0	ELECTRICAL_NOISE_707	0 ('1400K')	SUM4	150	ON
134558	212	21:38:21.0	ELECTRICAL_NOISE_707	0 ('1400K')	SUM4	220	ON
+25C NOT COMPRESSED							
134561	212	22:9:29.0	ELECTRICAL_NOISE_708	3 ('40K')	FULL	0	OFF
134562	212	22:10:58.0	ELECTRICAL_NOISE_708	3 ('40K')	FULL	70	OFF
134563	212	22:12:28.0	ELECTRICAL_NOISE_708	3 ('40K')	FULL	150	OFF
134564	212	22:13:57.0	ELECTRICAL_NOISE_708	3 ('40K')	FULL	220	OFF
134565	212	22:15:4.0	ELECTRICAL_NOISE_709	2 ('100K')	FULL	0	OFF
134566	212	22:16:33.0	ELECTRICAL_NOISE_709	2 ('100K')	FULL	150	OFF
134567	212	22:18:3.0	ELECTRICAL_NOISE_709	2 ('100K')	FULL	320	OFF
134568	212	22:19:32.0	ELECTRICAL_NOISE_709	2 ('100K')	FULL	460	OFF
134569	212	22:20:39.0	ELECTRICAL_NOISE_710	1 ('400K')	SUM2	0	OFF
134570	212	22:21:43.0	ELECTRICAL_NOISE_710	1 ('400K')	SUM2	120	OFF
134571	212	22:22:47.0	ELECTRICAL_NOISE_710	1 ('400K')	SUM2	260	OFF
134572	212	22:23:51.0	ELECTRICAL_NOISE_710	1 ('400K')	SUM2	380	OFF
134573	212	22:24:34.0	ELECTRICAL_NOISE_711	0 ('1400K')	SUM4	0	OFF
134574	212	22:25:25.0	ELECTRICAL_NOISE_711	0 ('1400K')	SUM4	80	OFF
134575	212	22:26:16.0	ELECTRICAL_NOISE_711	0 ('1400K')	SUM4	150	OFF
134576	212	22:27:7.0	ELECTRICAL_NOISE_711	0 ('1400K')	SUM4	220	OFF
+25C LOSSLESS COMPRESSION							
116660	112	1:15:18.0	ELECTRICAL_NOISE_208	3 ('40K')	FULL	0	ON
116661	112	1:16:48.0	ELECTRICAL_NOISE_208	3 ('40K')	FULL	70	ON
116662	112	1:18:17.0	ELECTRICAL_NOISE_208	3 ('40K')	FULL	150	ON
116663	112	1:19:46.0	ELECTRICAL_NOISE_208	3 ('40K')	FULL	220	ON
116664	112	1:20:53.0	ELECTRICAL_NOISE_209	2 ('100K')	FULL	0	ON
116665	112	1:22:23.0	ELECTRICAL_NOISE_209	2 ('100K')	FULL	150	ON
116666	112	1:23:52.0	ELECTRICAL_NOISE_209	2 ('100K')	FULL	320	ON
116667	112	1:25:21.0	ELECTRICAL_NOISE_209	2 ('100K')	FULL	460	ON
116668	112	1:26:28.0	ELECTRICAL_NOISE_210	1 ('400K')	SUM2	0	ON
116669	112	1:27:32.0	ELECTRICAL_NOISE_210	1 ('400K')	SUM2	120	ON
116670	112	1:28:37.0	ELECTRICAL_NOISE_210	1 ('400K')	SUM2	260	ON
116671	112	1:29:41.0	ELECTRICAL_NOISE_210	1 ('400K')	SUM2	380	ON
116672	112	1:30:23.0	ELECTRICAL_NOISE_211	0 ('1400K')	SUM4	0	ON
116673	112	1:31:14.0	ELECTRICAL_NOISE_211	0 ('1400K')	SUM4	80	ON
116674	112	1:32:6.0	ELECTRICAL_NOISE_211	0 ('1400K')	SUM4	150	ON
116675	112	1:32:57.0	ELECTRICAL_NOISE_211	0 ('1400K')	SUM4	220	ON
+5C NOT COMPRESSED							
120441	140	5:21:50.0	ELECTRICAL_NOISE_224	3 ('40K')	FULL	0	ON
120442	140	5:23:19.0	ELECTRICAL_NOISE_224	3 ('40K')	FULL	70	ON
120443	140	5:24:48.0	ELECTRICAL_NOISE_224	3 ('40K')	FULL	150	ON
120444	140	5:26:17.0	ELECTRICAL_NOISE_224	3 ('40K')	FULL	220	ON
120445	140	5:27:25.0	ELECTRICAL_NOISE_225	2 ('100K')	FULL	0	ON
120446	140	5:28:54.0	ELECTRICAL_NOISE_225	2 ('100K')	FULL	150	ON
120447	140	5:30:23.0	ELECTRICAL_NOISE_225	2 ('100K')	FULL	320	ON
120448	140	5:31:53.0	ELECTRICAL_NOISE_225	2 ('100K')	FULL	460	ON
120449	140	5:33:0.0	ELECTRICAL_NOISE_226	1 ('400K')	SUM2	0	ON
120450	140	5:34:4.0	ELECTRICAL_NOISE_226	1 ('400K')	SUM2	120	ON
120451	140	5:35:8.0	ELECTRICAL_NOISE_226	1 ('400K')	SUM2	260	ON
120452	140	5:36:12.0	ELECTRICAL_NOISE_226	1 ('400K')	SUM2	380	ON
120453	140	5:36:55.0	ELECTRICAL_NOISE_227	0 ('1400K')	SUM4	0	ON
120454	140	5:37:46.0	ELECTRICAL_NOISE_227	0 ('1400K')	SUM4	80	ON
120455	140	5:38:37.0	ELECTRICAL_NOISE_227	0 ('1400K')	SUM4	150	ON
120456	140	5:39:28.0	ELECTRICAL_NOISE_227	0 ('1400K')	SUM4	220	ON

120457	140	5:40:3.0	ELECTRICAL_NOISE_228	3 ('40K')	FULL	0	ON
120458	140	5:41:32.0	ELECTRICAL_NOISE_228	3 ('40K')	FULL	70	OFF
120459	140	5:43:1.0	ELECTRICAL_NOISE_228	3 ('40K')	FULL	150	OFF
120460	140	5:44:30.0	ELECTRICAL_NOISE_228	3 ('40K')	FULL	220	OFF
120461	140	5:45:38.0	ELECTRICAL_NOISE_229	2 ('100K')	FULL	0	OFF
120462	140	5:47:7.0	ELECTRICAL_NOISE_229	2 ('100K')	FULL	150	OFF
120463	140	5:48:36.0	ELECTRICAL_NOISE_229	2 ('100K')	FULL	320	OFF
120464	140	5:50:5.0	ELECTRICAL_NOISE_229	2 ('100K')	FULL	460	OFF
120465	140	5:51:25.0	ELECTRICAL_NOISE_230	1 ('400K')	SUM2	0	OFF
120466	140	5:52:29.0	ELECTRICAL_NOISE_230	1 ('400K')	SUM2	120	OFF
120467	140	5:53:33.0	ELECTRICAL_NOISE_230	1 ('400K')	SUM2	260	OFF
120468	140	5:54:37.0	ELECTRICAL_NOISE_230	1 ('400K')	SUM2	380	OFF
120469	140	5:55:20.0	ELECTRICAL_NOISE_231	0 ('1400K')	SUM4	0	OFF
120470	140	5:56:11.0	ELECTRICAL_NOISE_231	0 ('1400K')	SUM4	80	OFF
120471	140	5:57:2.0	ELECTRICAL_NOISE_231	0 ('1400K')	SUM4	150	OFF
120472	140	5:57:53.0	ELECTRICAL_NOISE_231	0 ('1400K')	SUM4	220	OFF
+5C LOSSLESS COMPRESSION							
120425	140	4:41:42.0	ELECTRICAL_NOISE_232	3 ('40K')	FULL	0	ON
120426	140	4:43:11.0	ELECTRICAL_NOISE_232	3 ('40K')	FULL	70	ON
120427	140	4:44:40.0	ELECTRICAL_NOISE_232	3 ('40K')	FULL	150	ON
120428	140	4:46:10.0	ELECTRICAL_NOISE_232	3 ('40K')	FULL	220	ON
120429	140	4:47:17.0	ELECTRICAL_NOISE_233	2 ('100K')	FULL	0	ON
120430	140	4:48:46.0	ELECTRICAL_NOISE_233	2 ('100K')	FULL	150	ON
120431	140	4:50:15.0	ELECTRICAL_NOISE_233	2 ('100K')	FULL	320	ON
120432	140	4:51:45.0	ELECTRICAL_NOISE_233	2 ('100K')	FULL	460	ON
120433	140	4:52:52.0	ELECTRICAL_NOISE_234	1 ('400K')	SUM2	0	ON
120434	140	4:53:56.0	ELECTRICAL_NOISE_234	1 ('400K')	SUM2	120	ON
120435	140	4:55:0.0	ELECTRICAL_NOISE_234	1 ('400K')	SUM2	260	ON
120436	140	4:56:4.0	ELECTRICAL_NOISE_234	1 ('400K')	SUM2	380	ON
120437	140	4:56:47.0	ELECTRICAL_NOISE_235	0 ('1400K')	SUM4	0	ON
120438	140	4:57:38.0	ELECTRICAL_NOISE_235	0 ('1400K')	SUM4	80	ON
120439	140	4:58:29.0	ELECTRICAL_NOISE_235	0 ('1400K')	SUM4	150	ON
120440	140	4:59:20.0	ELECTRICAL_NOISE_235	0 ('1400K')	SUM4	220	ON
-10C NOT COMPRESSED							
119432	137	19:45:36.0	ELECTRICAL_NOISE_212	3 ('40K')	FULL	0	ON
119396	137	18:46:2.0	ELECTRICAL_NOISE_212	3 ('40K')	FULL	70	ON
119397	137	18:47:31.0	ELECTRICAL_NOISE_212	3 ('40K')	FULL	150	ON
119398	137	18:49:0.0	ELECTRICAL_NOISE_212	3 ('40K')	FULL	220	ON
119399	137	18:50:8.0	ELECTRICAL_NOISE_213	2 ('100K')	FULL	0	ON
119400	137	18:51:37.0	ELECTRICAL_NOISE_213	2 ('100K')	FULL	150	ON
119428	137	19:37:22.0	ELECTRICAL_NOISE_213	2 ('100K')	FULL	320	ON
119429	137	19:38:51.0	ELECTRICAL_NOISE_213	2 ('100K')	FULL	460	ON
119403	137	18:55:54.0	ELECTRICAL_NOISE_214	1 ('400K')	SUM2	0	ON
119404	137	18:56:58.0	ELECTRICAL_NOISE_214	1 ('400K')	SUM2	120	ON
119405	137	18:58:2.0	ELECTRICAL_NOISE_214	1 ('400K')	SUM2	260	ON
119406	137	18:59:6.0	ELECTRICAL_NOISE_214	1 ('400K')	SUM2	380	ON
119407	137	18:59:49.0	ELECTRICAL_NOISE_215	0 ('1400K')	SUM4	0	ON
119408	137	19:0:40.0	ELECTRICAL_NOISE_215	0 ('1400K')	SUM4	80	ON
119409	137	19:1:31.0	ELECTRICAL_NOISE_215	0 ('1400K')	SUM4	150	ON
119410	137	19:2:22.0	ELECTRICAL_NOISE_215	0 ('1400K')	SUM4	220	ON
119430	137	19:40:4.0	ELECTRICAL_NOISE_216	3 ('40K')	FULL	0	ON
119412	137	19:4:26.0	ELECTRICAL_NOISE_216	3 ('40K')	FULL	70	OFF
119413	137	19:5:55.0	ELECTRICAL_NOISE_216	3 ('40K')	FULL	150	OFF
119415	137	19:8:44.0	ELECTRICAL_NOISE_217	2 ('100K')	FULL	0	OFF
119416	137	19:10:13.0	ELECTRICAL_NOISE_217	2 ('100K')	FULL	150	OFF
119417	137	19:11:42.0	ELECTRICAL_NOISE_217	2 ('100K')	FULL	320	OFF
119418	137	19:13:11.0	ELECTRICAL_NOISE_217	2 ('100K')	FULL	460	OFF
119419	137	19:14:19.0	ELECTRICAL_NOISE_218	1 ('400K')	SUM2	0	OFF
119420	137	19:15:23.0	ELECTRICAL_NOISE_218	1 ('400K')	SUM2	120	OFF
119421	137	19:16:27.0	ELECTRICAL_NOISE_218	1 ('400K')	SUM2	260	OFF
119422	137	19:17:31.0	ELECTRICAL_NOISE_218	1 ('400K')	SUM2	380	OFF
119423	137	19:18:14.0	ELECTRICAL_NOISE_219	0 ('1400K')	SUM4	0	OFF
119424	137	19:19:5.0	ELECTRICAL_NOISE_219	0 ('1400K')	SUM4	80	OFF
119425	137	19:19:56.0	ELECTRICAL_NOISE_219	0 ('1400K')	SUM4	150	OFF
119426	137	19:20:47.0	ELECTRICAL_NOISE_219	0 ('1400K')	SUM4	220	OFF
-10C LOSSLESS COMPRESSION							
119369	137	15:57:37.0	ELECTRICAL_NOISE_220	3 ('40K')	FULL	0	ON
119370	137	15:59:6.0	ELECTRICAL_NOISE_220	3 ('40K')	FULL	70	ON
119371	137	16:0:35.0	ELECTRICAL_NOISE_220	3 ('40K')	FULL	150	ON
119372	137	16:2:4.0	ELECTRICAL_NOISE_220	3 ('40K')	FULL	220	ON
119373	137	16:3:12.0	ELECTRICAL_NOISE_221	2 ('100K')	FULL	0	ON
119374	137	16:4:41.0	ELECTRICAL_NOISE_221	2 ('100K')	FULL	150	ON
119375	137	16:6:10.0	ELECTRICAL_NOISE_221	2 ('100K')	FULL	320	ON
119385	137	18:22:7.0	ELECTRICAL_NOISE_221	2 ('100K')	FULL	320	ON
119386	137	18:23:36.0	ELECTRICAL_NOISE_221	2 ('100K')	FULL	460	ON
119387	137	18:24:44.0	ELECTRICAL_NOISE_222	1 ('400K')	SUM2	0	ON
119388	137	18:25:48.0	ELECTRICAL_NOISE_222	1 ('400K')	SUM2	120	ON
119389	137	18:26:52.0	ELECTRICAL_NOISE_222	1 ('400K')	SUM2	260	ON
119390	137	18:27:56.0	ELECTRICAL_NOISE_222	1 ('400K')	SUM2	380	ON
119391	137	18:28:39.0	ELECTRICAL_NOISE_223	0 ('1400K')	SUM4	0	ON
119392	137	18:29:30.0	ELECTRICAL_NOISE_223	0 ('1400K')	SUM4	80	ON
119393	137	18:30:21.0	ELECTRICAL_NOISE_223	0 ('1400K')	SUM4	150	ON
119394	137	18:31:12.0	ELECTRICAL_NOISE_223	0 ('1400K')	SUM4	220	ON