ACOUSTIC ANALYSIS REPORT

alienconcepts incorporated

DESCRIPTION

GENERAL INFO

JOB Conveyor Oven Test
DATES Report - 2/25/1997 Test Date 2/21/1997
PERFORMED BY Paul F Bergetz (President Alienconcepts Incorporated)
Phone 708-686-7285 Email audigo@alienc.com

ANALYSIS

LOCATION/DATE/TIME *The tests were ran from 12:30pm until 4:30pm on Saturday 2/11/1997.The reference room noise test position was centered at Hood1. (southwest corner of lab) This is the same position used on 1/19/97. Without making a complete test of all the "hoods" we can not be sure as to how much noise is being added by each hood into the composite measurement.(Hoods are only on in burner tests)*

TEF20 PROCEDURES *We set the B&K 4007 microphone at a height of 44" (the approximate center between a upper and lower unit) and made a series of tests 20" (estimated normal pass by position from the oven) from the oven centered on the front center and left sides. These settings were duplicated throughout the day. All burner on tests were made with the burners forced on for the accumulated time of 7.5 secs for 11 samples. It should be noted that setting the sampler in accumulate mode is good for collecting all energy from the unit in test over time however, the "db" references do not represent the "ACTUAL" system noise since they are accumulated not stable. Actual system noise can be measured very quickly be making a stable measurement after doing all the other tests. We did this and found the system to produce 75db A weighted at 12" from the front center of the unit in test.(see graph below)*

POST-ANALYSIS

FINDINGS *Several issues were derived from the tests.*

1) The new series of tests included the addition of 1.5" spacer rings behind the cooling fans and a newly designed 8.25" blower cage. Both of these changes have dramatically changed the noise performance of the EWB series.

2) The cooling fans can still be silenced more effectively by replacing the Globe units with the EBM units we tested on 2/21.

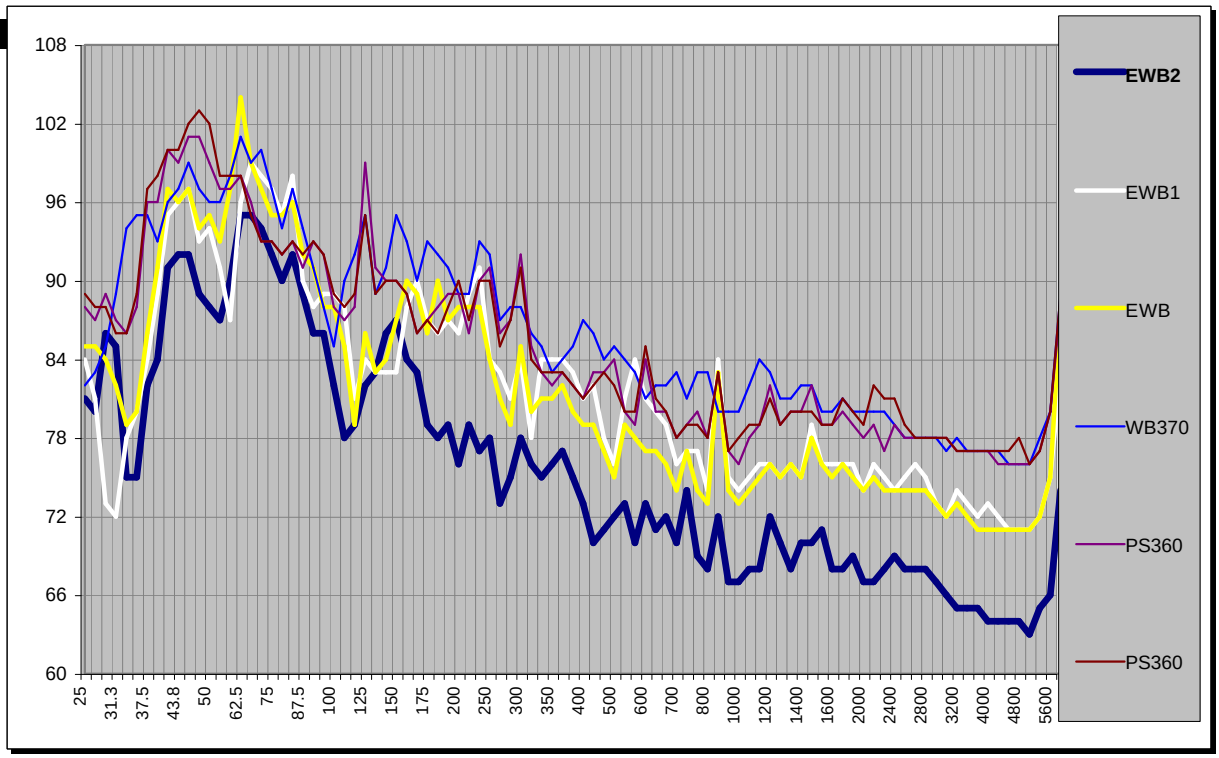
Recommendations:

The next step should be to install the EBM cooling fans in place of the current Globe fans which should gain another 4-6dba in the critical audible ranges that OSHA references with there "A" weighting specifications. After this change the total system noise (with all components running) should have been reduced by 8-10dba from the original EWB design and 12-14dba when compared to the WB370 or PS360.

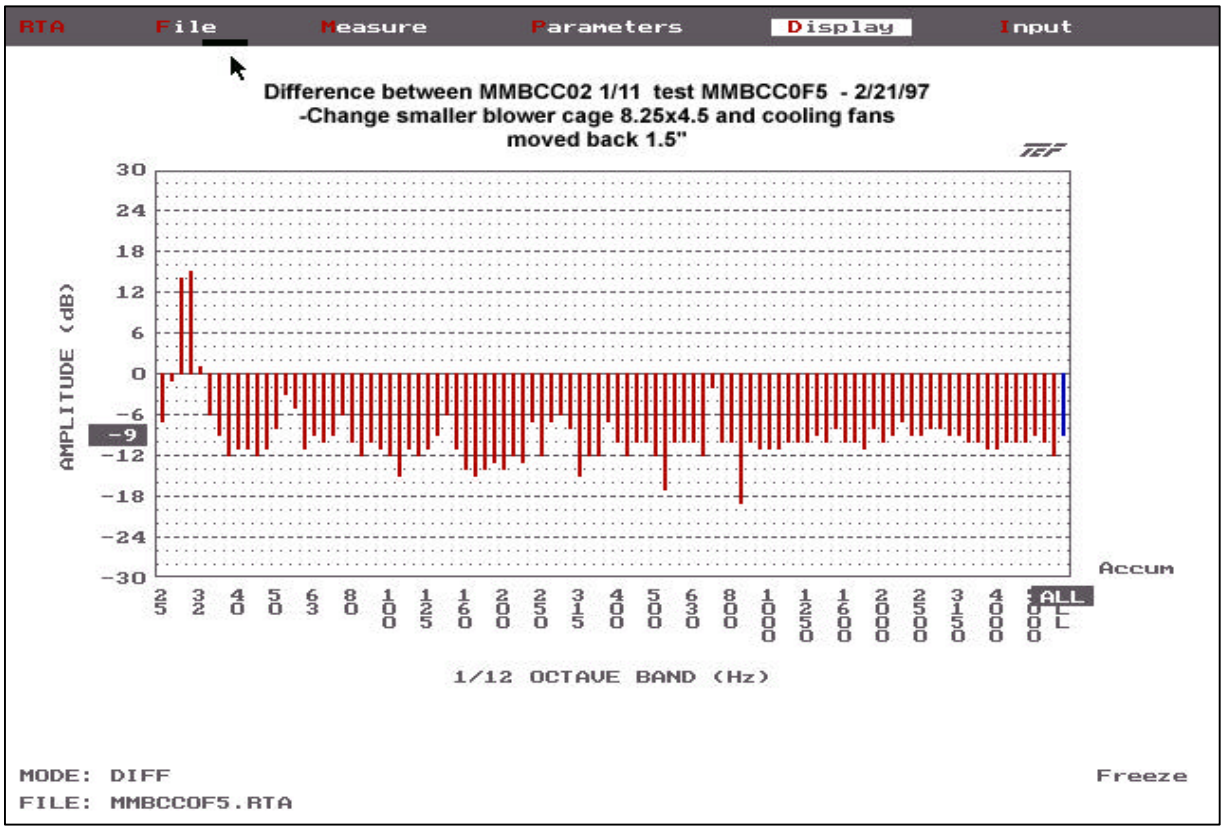
I have attached several pages from "The New Audio Cyclopedia" (1) that explain "A,B &C" weighting, Auditory spectrum and Loudness contours that should be refered to as your design progress.

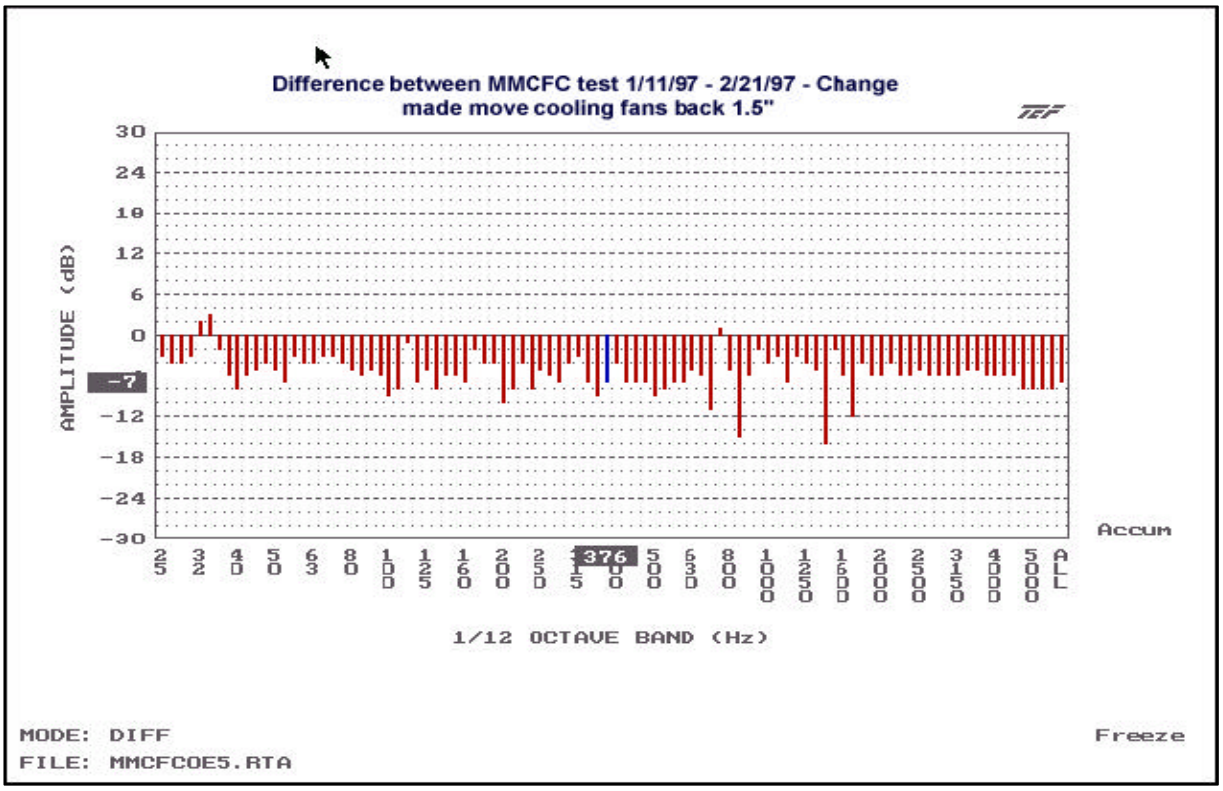
(1) Glen Ballou The New Audio Cyclopedia - Howard w. Sams and Company

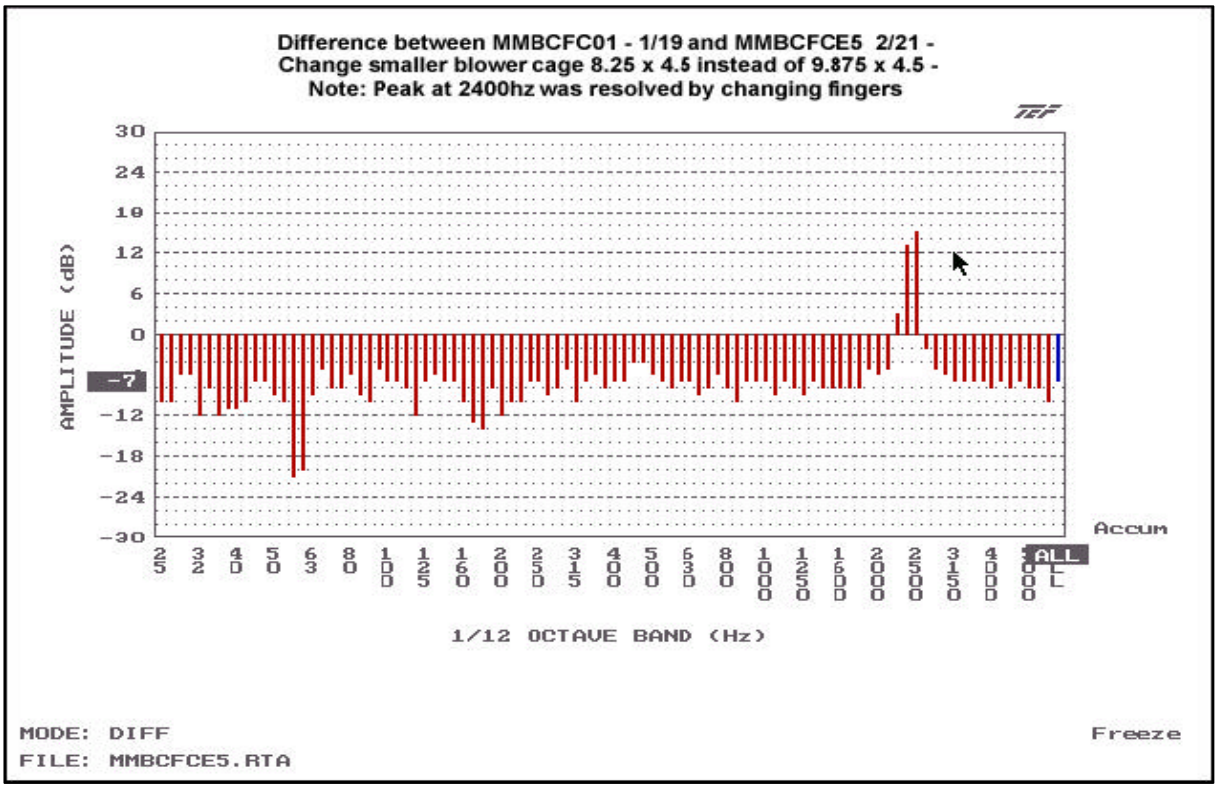
GRAPHS



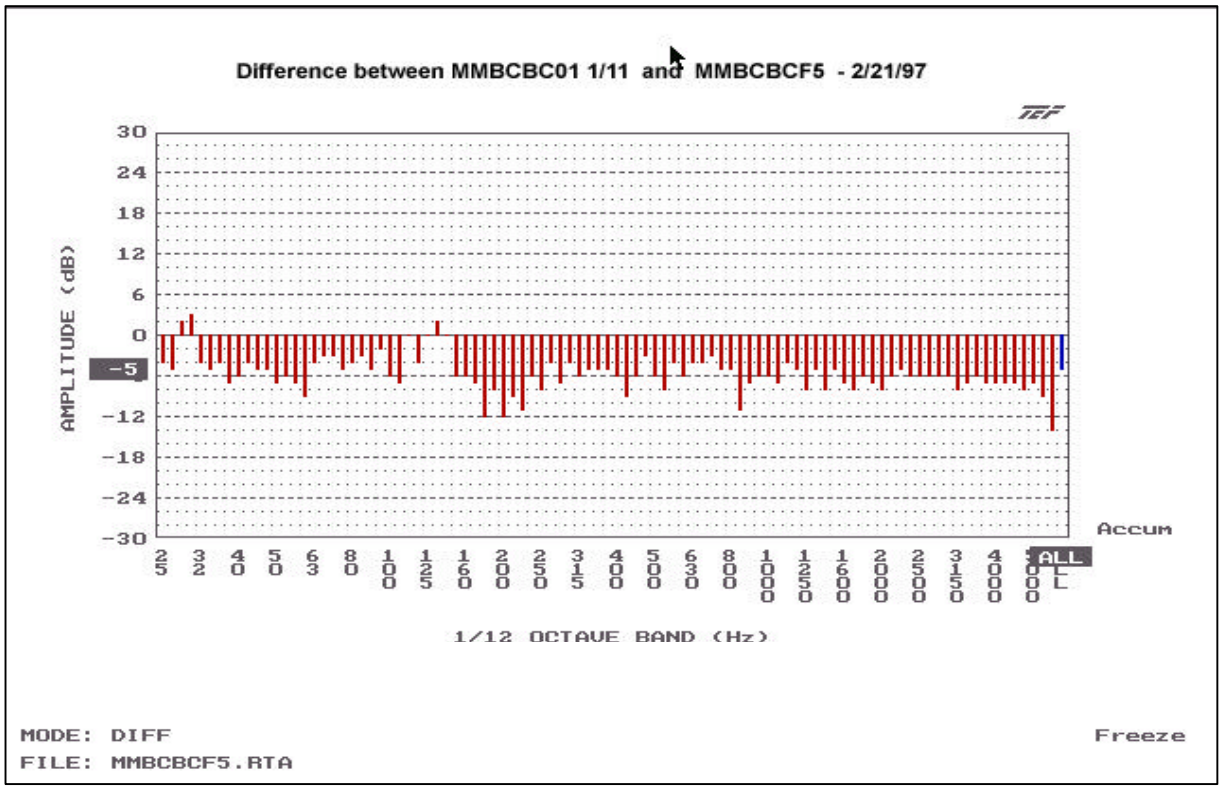
This composite graph shows the change in noise between the five oven models that have been tested since 7/95. The graphs contain the following noise components: Blowers, burners, conveyors and cooling fans on. It can be seen that the new model EWB2 (see Post analysis findings) produces an average of 9db less noise than the prior models.



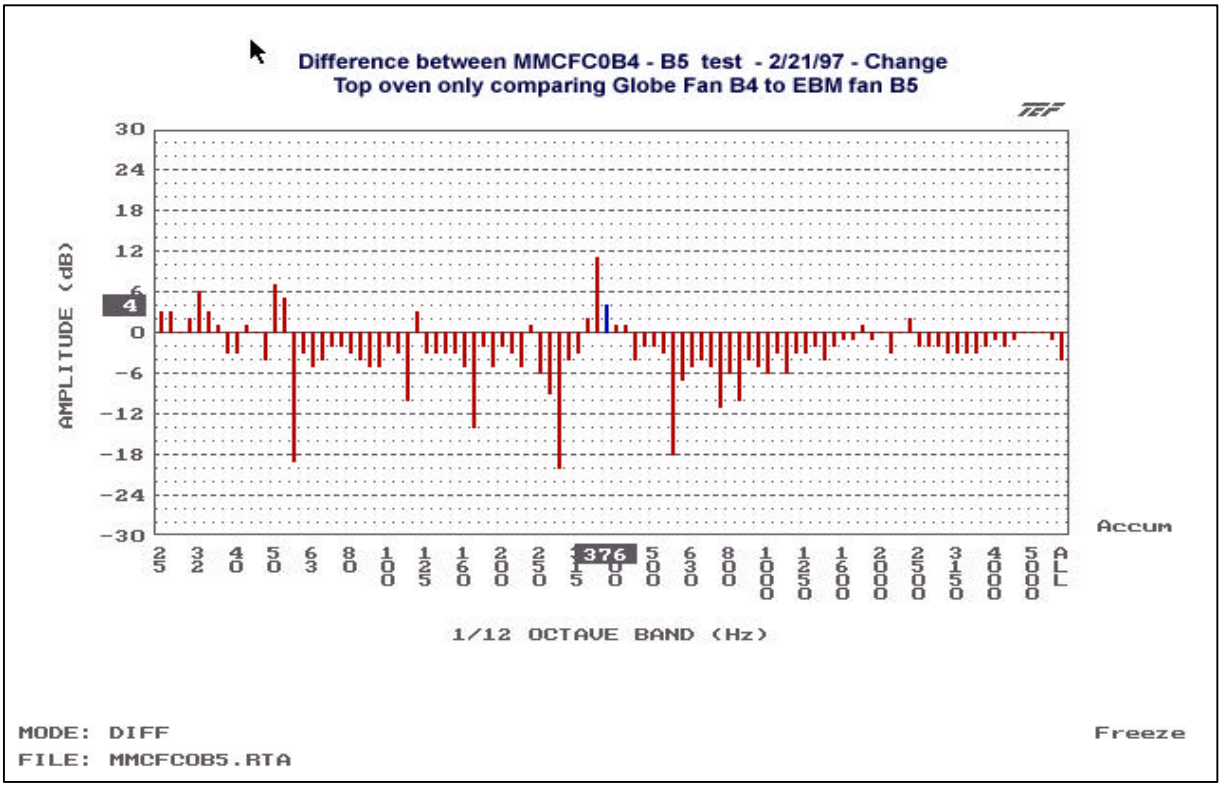




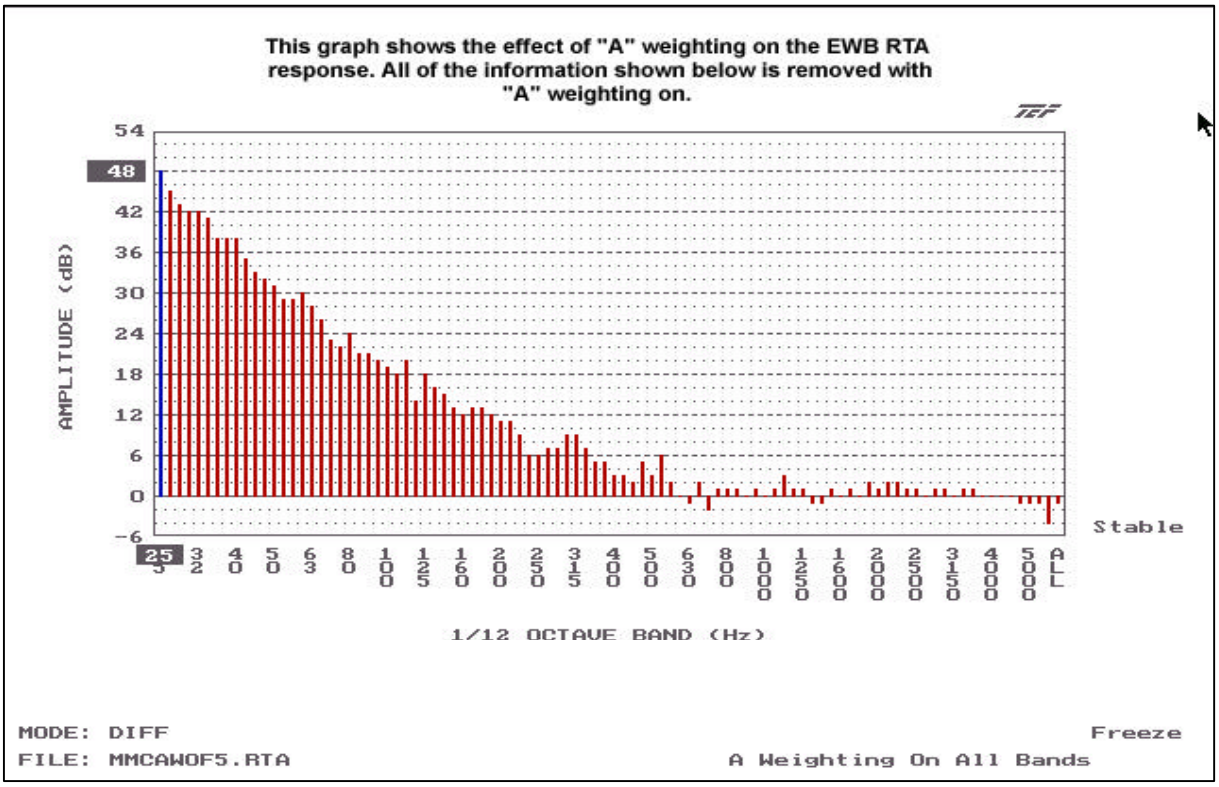
The above 3 graphs represent the areas that were changed and install in the current test model EWB.
These changes neted another 9db in noise reduction from the prior tests taken 1/11. (without burners and hood c

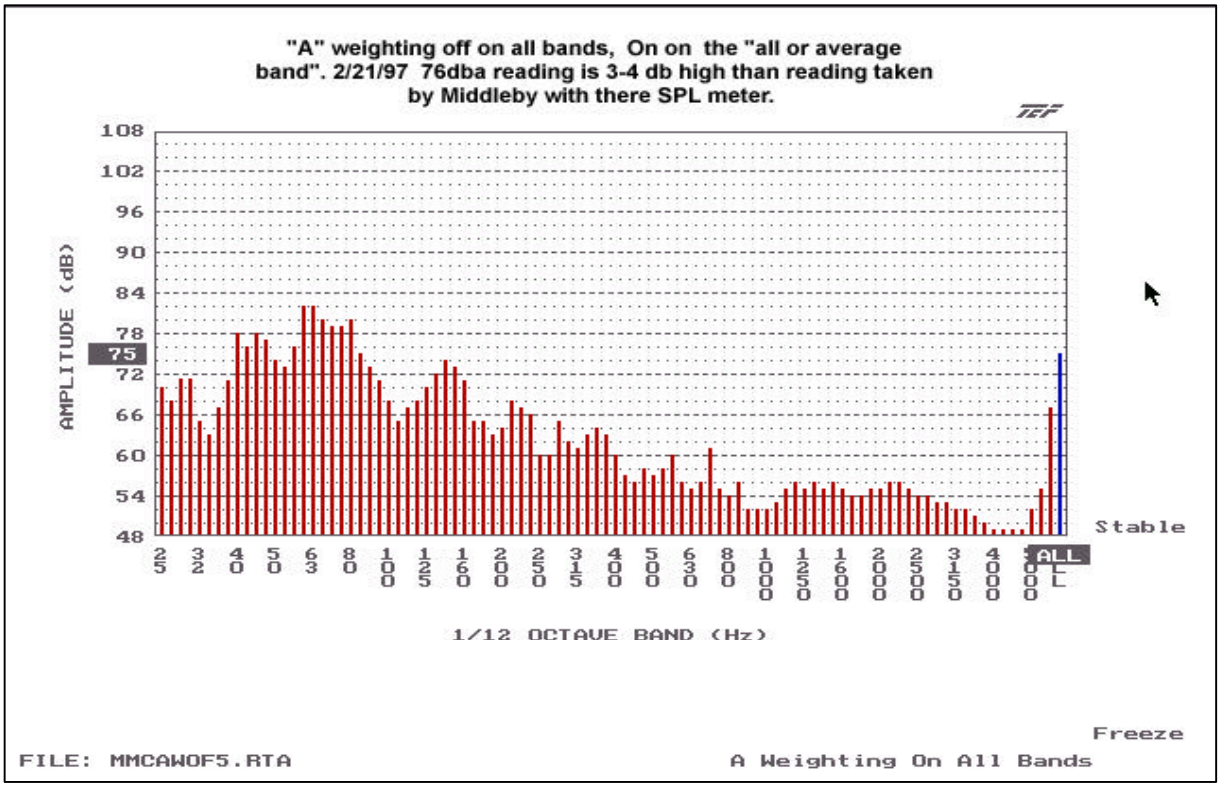


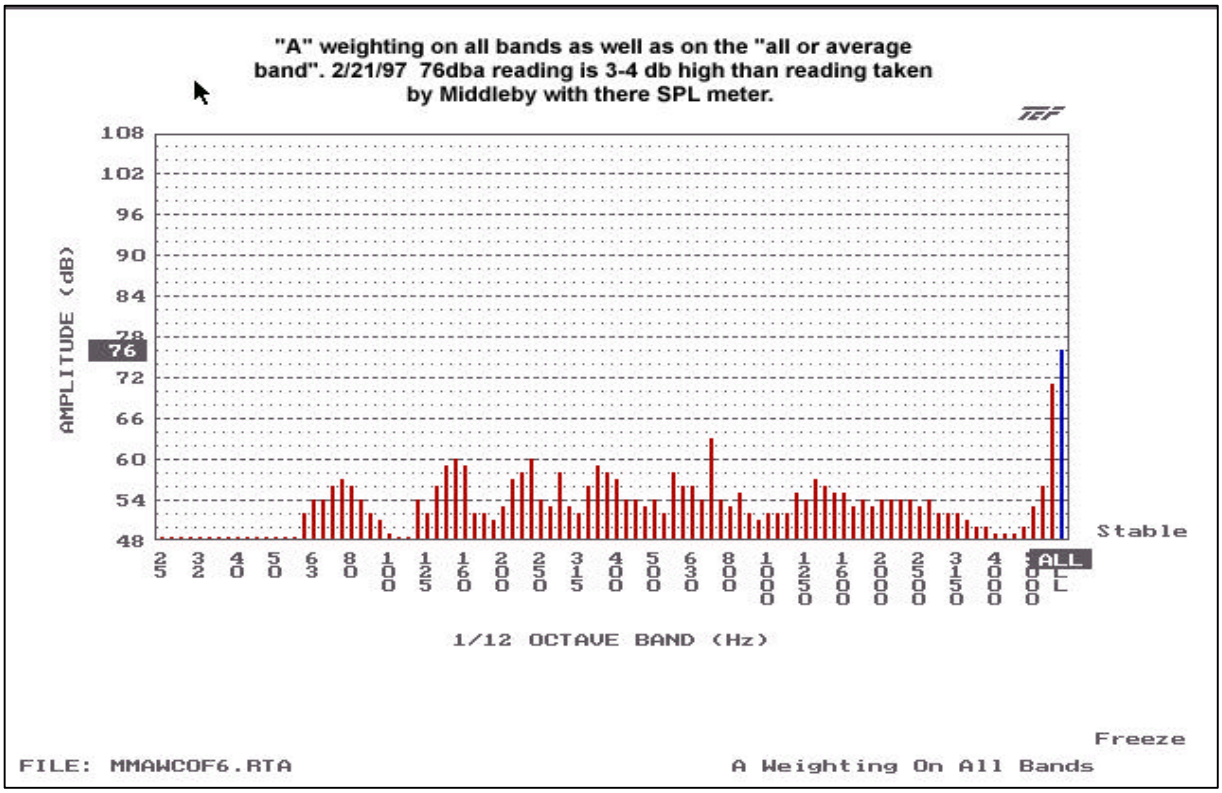
Total system noise *all components running comparing 1/11 to 2/21*



Based on the above information the EBM fans will net an additional 4-5db of noise reduction in the critical areas.


This graph shows the effect of "A" weighting on the EWB RTA response. All of the information shown below is removed with "A" weighting on.
AMPLITUDE (dB)
54
48
42
36
30
24
18
12
6
0
-6
25
32
40
50
63
80
100
125
160
200
250
315
400
500
630
800
1000
1250
1600
2000
2500
3150
4000
5000
ALL
1/12 OCTAVE BAND (Hz)
Stable
MODE: DIFF
FILE: MMCAWOF5.RTA
Freeze
A Weighting On All Bands


"A" weighting off on all bands, On on the "all or average band". 2/21/97 76dba reading is 3-4 db high than reading taken by Middleby with there SPL meter.
AMPLITUDE (dB)
108
102
96
90
84
78
75
72
66
60
54
48
25
32
40
50
63
80
100
125
160
200
250
315
400
500
630
800
1000
1250
1600
2000
2500
3150
4000
5000
ALL
1/12 OCTAVE BAND (Hz)
Stable
FILE: MMCAWOF5.RTA
Freeze
A Weighting On All Bands



FILE NAMES

The following is a guide to what the various tests names indicate. Because of the DOS naming convention of 8 characters it is important to handle this early in an on going series of tests or the test operators will forget what they are referencing to what.

Sample ***MMNCxx01.EXT*** *MM - Job identifier NCxx - Test description 01 - Number*

NC - Noise Criteria all items of in lab except HVAC. This test was taken at front center position 20" from the source at a height of 44". (position at hood 3)

Note the C, R or L at the end of the test description name indications test position.
C - Center R - Right side L - Left side

AW - "A" weighted measurements

BC - Blower conveyor cooling fans on with fingers

BCB - Blower conveyor cooling fans and burners on with fingers

C - Conveyor only

BF - Blower (conveyor out) cooling fans on with fingers

BN - Blower (conveyor out) cooling fans on without fingers

BCF - Blower (conveyor out) without cooling fans with fingers

CF - Cooling Fans only

FD - Frequency Drive only
Frequency drive at specific frequency
A1 = 60hz A2=55hz A3=50hz A4=45hz A5=40hz

DESCRIPTION

GENERAL INFO

JOB Conveyor Oven Test
DATES Report - 1/19/1997 Test Date 1/11/1997
PERFORMED BY Paul F Bergetz (President Alienconcepts Incorporated)
Phone 708-686-7285 Email audigo@alienc.com

ANALYSIS

LOCATION/DATE/TIME *The tests were ran from 12:30pm until 3:30pm on Saturday 1/11/1997.The reference room noise test position was centered at Hood1. (southwest corner of lab) It should be noted that this is the first time that we measured at this location. Without making a complete test of all the "hoods" we can not be sure as to how much noise is being added by each hood into the composite measurement.*

TEF20 PROCEDURES *We set the B&K 4007 microphone at a height of 44" (the approximate center between a upper and lower unit) and made a series of tests 20" (estimated normal pass by position from the oven) from the oven centered on the front center and left sides. These settings were duplicated throughout the day. All burner on tests were made with the burners forced on for the accumulated time of 7.5 secs for 11 samples. It should be noted that setting the sampler in accumulate mode is good for collecting all energy from the unit in test over time however, the "db" references do not represent the "ACTUAL" system noise since they are accumulated not stable. Actual system noise can be measured very quickly be making a stable measurement after doing all the other tests. We did this and found the system to produce 89db flat (no) weighting at 24" from the left end of the unit in test. If you make hand held measurements make sure to note the weighting and response time settings so we can set our system the same for comparison.*

POST-ANALYSIS

FINDINGS *Several issues were derived from the tests.*

1) The new unit EWB (extra wide body) is by far the quietist oven we have tested to date. The unit is around 3db quieter across the measured range. However, we found that when we were making our last measurements (fingers out) that a large amount of foil used for securing sensors during tests was sucked into (and lodged) in the blower vanes. This caused balancing errors at 29hz and 58hz and multiples of these octaves which can be seen in the following composite graph. When the foil was removed the specs improved.

2) The peak at 119hz is now gone since the motors have been remounted to the frame members and new motor mounts are being used.

3) The cooling fans are still a major concern. No improvement has been seen since the last test 8/25/95. These new fans seem extremely noisy as can be seen by the graph. Major 1/12 octave peaks exceeding 10db can be seen at 56hz, 282hz, 562hz, 710hz, 841hz, 1400hz and 1600hz. Some work should be done in this area since the frequency range that these fans operate in 400hz - 4000hz is were the all speech takes place and as a result will make verbal communication difficult.

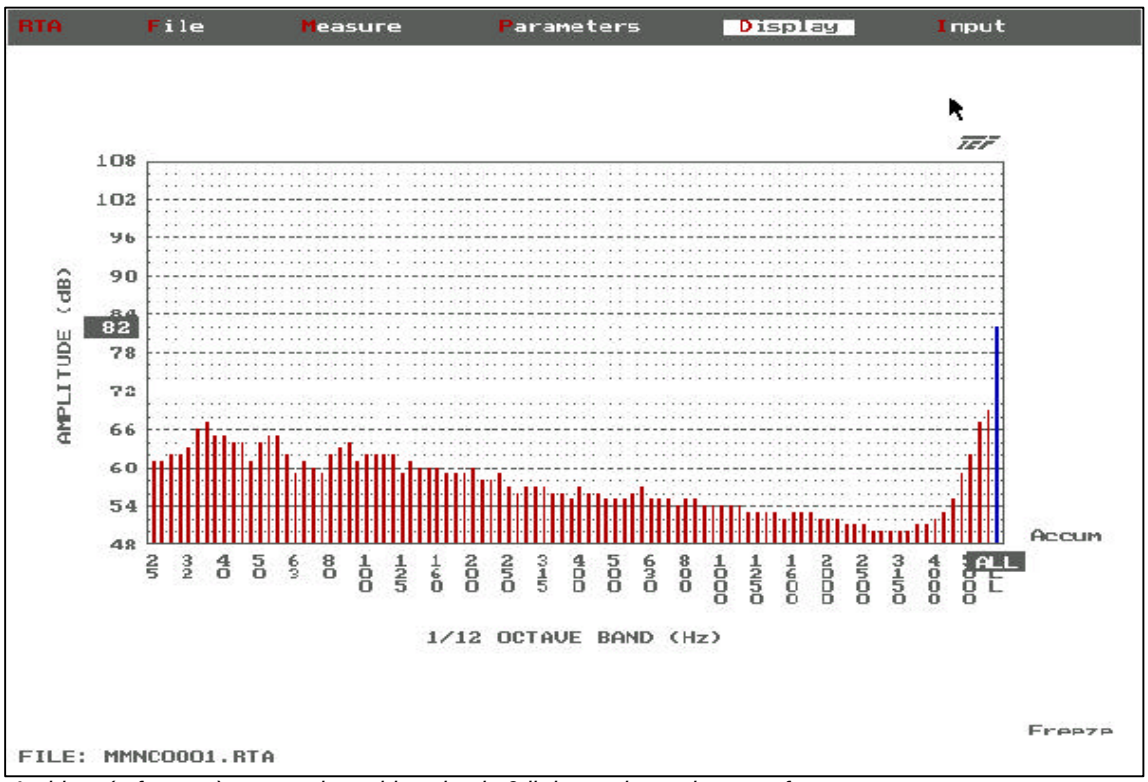
4) The blowers still contribute the majority of the noise to the system. Some research could be done in this area.

Recommendations:

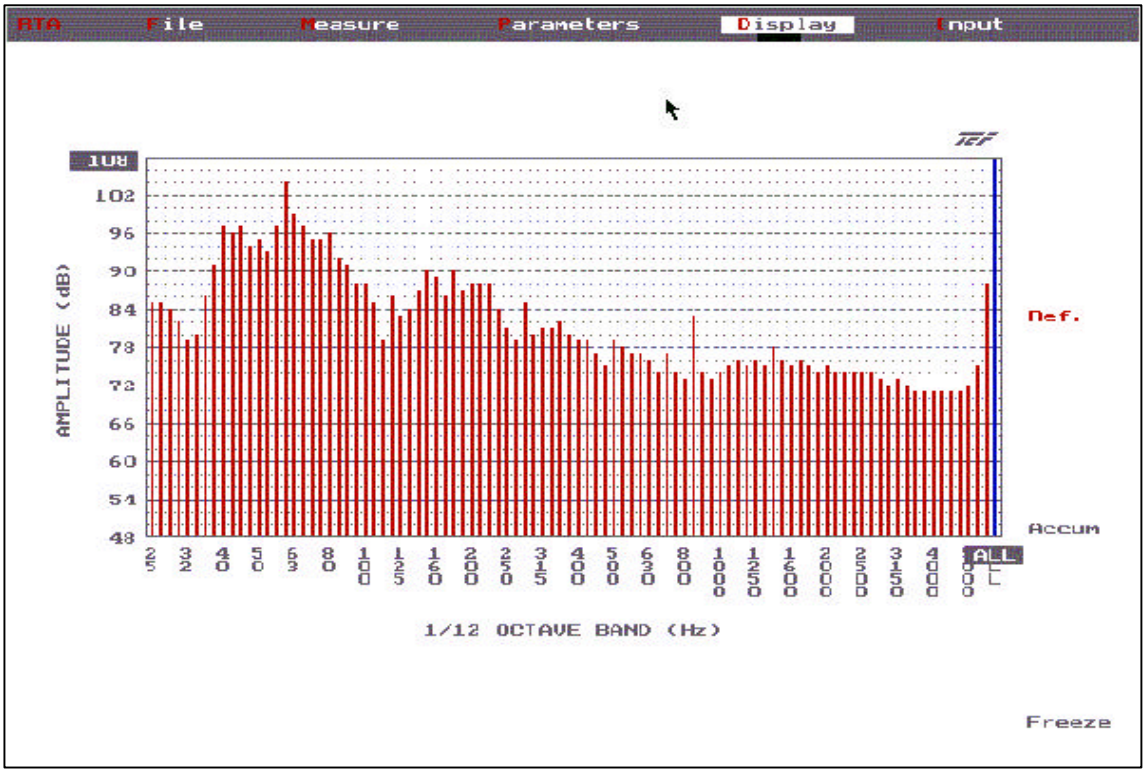
The next step would be to try to re-design the cooling fan system from a standpoint of mounting, material used for guards, and general airflow noise consideration. This should help eliminate the series of peaks that can be seen in the graph on page 5. Can fans be added to the back or bottom of the unit? This would help direct the noise away from the operator.

GRAPHS

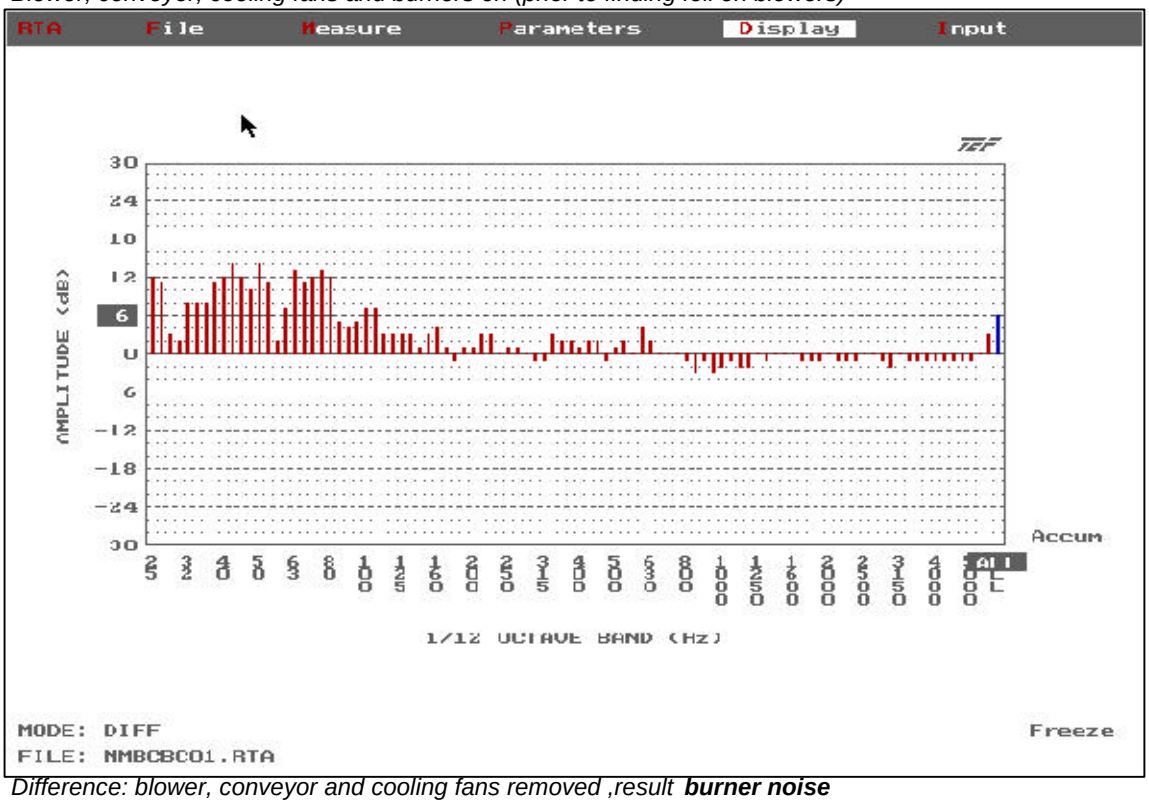
This composite graph shows the change in noise between the four oven models that have been tested since 7/95. The graphs contain the following noise components: Blowers, burners, conveyors and cooling fans on. It can be seen that the new model EWB and EWB1 (see Post analysis findings) produces an average of 3db less noise than the prior models.



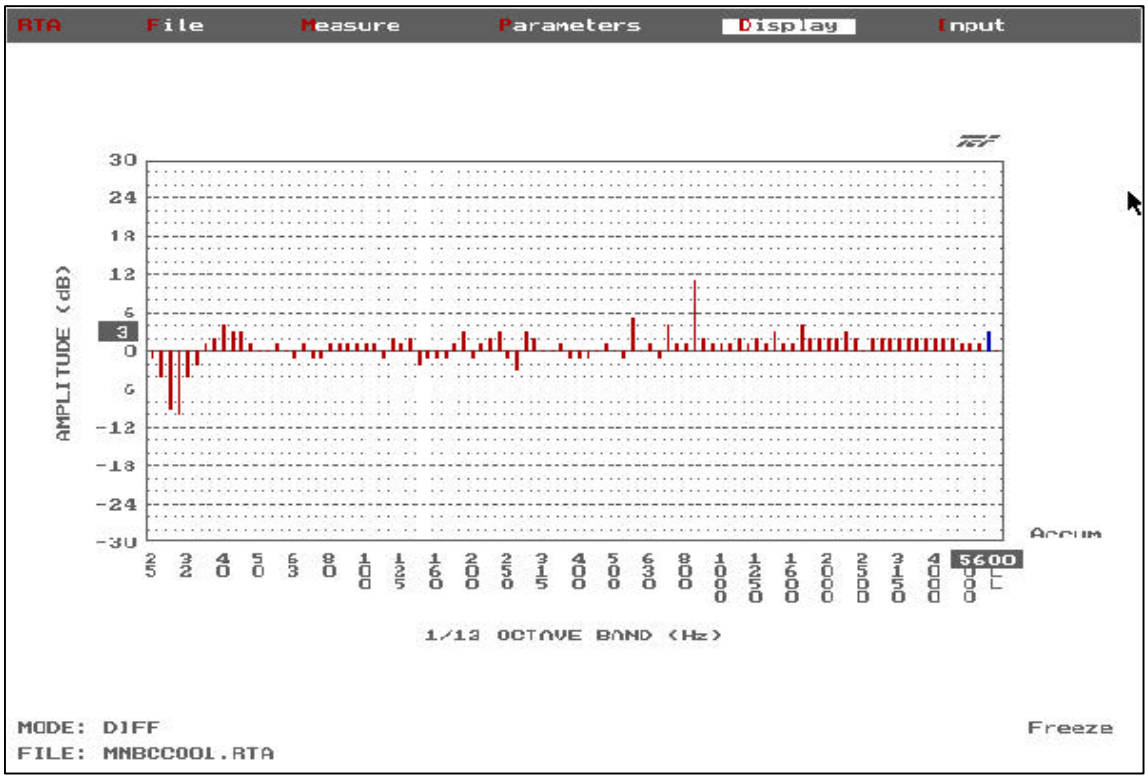
Ambient (reference) room noise - this value is 6db lower than prior tests for some reason.



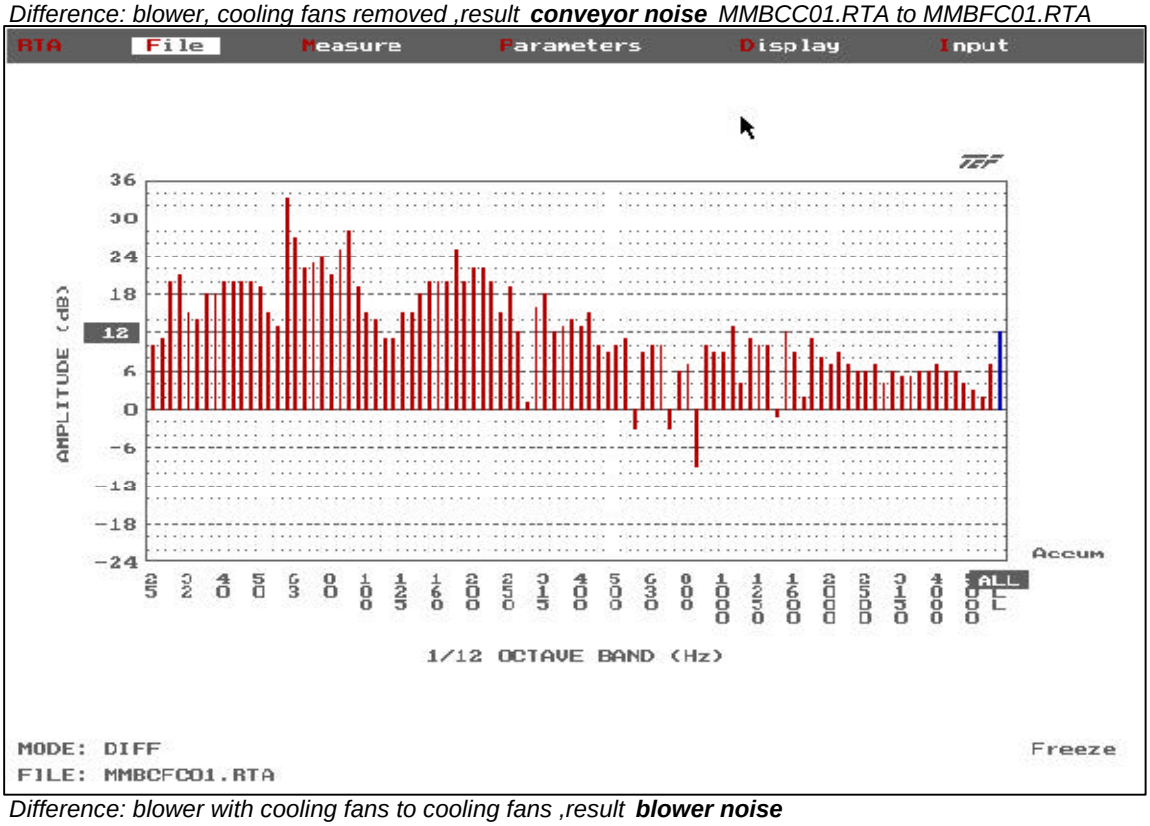
Blower, conveyor, cooling fans and burners on (prior to finding foil on blowers)



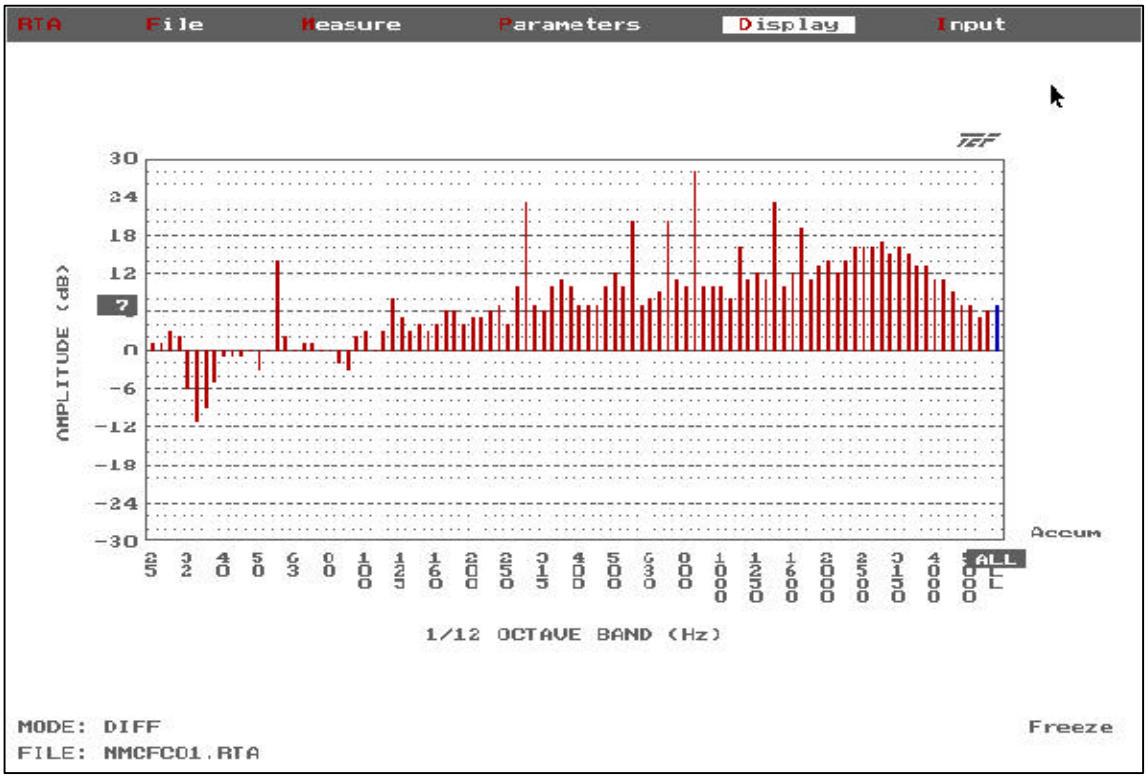
Difference: blower, conveyor and cooling fans removed ,result ***burner noise***
MMBCBC01.RTA to MMBCC01.RTA



Difference: blower, cooling fans removed ,result ***conveyor noise*** *MMBCC01.RTA to MMBFC01.RTA*



Difference: blower with cooling fans to cooling fans ,result ***blower noise***
MMBFC01.RTA to MMCFC01.RTA



Difference: Cooling Fans to room noise result ***cooling fans*** *MMNC001.RTA and MMCFC01.RTA*

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