# The Effect of Hairnets and Tyvek® Hoods on Earmuff Attenuation

**E-A-R 06-33/HP**

**R. W. Kieper, B.S.**
**E. H. Berger, M.S.**

**AEARO Company**
**E•A•RCAL[SM] Laboratory**
**7911 Zionsville Road**
**Indianapolis, IN 46268-1657**
**phone: 317-692-1111**
**fax: 317-692-3116**

**February 26, 2007**

**Version 1.3**

**E•A•RCAL[sm] Laboratory is accredited by the National Institute of Standards and Technology, National Voluntary Laboratory Accreditation Program, for the measurement of attenuation of hearing protection devices re ANSI S3.19-1974 and ANSI S12.6-1997. Laboratory Code 100374-0.**

## INTRODUCTION

Noise-exposed employees must often to wear other safety equipment in addition to their hearing protection devices (HPDs). How the other equipment interfaces with one's HPDs can affect the amount of protection afforded by the HPD. This decrease in protection is especially true when a person wearing earmuffs must also wear safety glasses and in addition a hairnet or hood, as in the food industry. The purpose of this report is to quantify the effects of wearing either a hairnet or a full-head hood on the attenuation of two different earmuffs. The effect of wearing safety glasses and muff is addressed in E•A•R 06-31/HP.

## TEST METHODS

Both series of tests described in this report were performed in the E•A•RCAL test chamber. The earlier testing (Model 1000/Hairnet) was conducted in September 1994 when the lab used the Grason-Stadler/Crown Signal Generation System to produce the test tones. The latter testing with the H9A and hood, was done in August 2006 and utilized the ITA/Norsonic System. The test procedures were the same, utilizing ANSI S3.19-1974 with exception for fitting and testing the devices. The 1994 tests used the seven octave-band center frequencies from 125 to 8000 Hz and 3150 and 6300 Hz for test tones. The 2006 testing did not include 3.15- or 6.3-kHz.

Each of the ten subjects tested each condition three times. The subjects tested the hairnet in a counterbalanced method where the odd-numbered subjects first tested the hairnet/muff combination followed by the muff alone. The even-numbered subjects tested the muff alone followed by the hairnet/muff. In all cases, when preparing for the 2$^{nd}$ test condition, the muff was refit, either alone or with the hairnet, and the subject adjusted the muff while listening to a broadband 'fitting noise,' to obtain the 'best fit' possible.

The muff/hood test was included in a series of tests with the H9A muff and two pairs of safety glasses. An Open condition was measured, followed by the earmuff alone. The muff was removed and the hood donned, and the muff was fit over the hood with the subject again, adjusting the muffs, using the fitting noise, for 'best fit'.

## DEVICES TESTED

One sample of the E•A•R Model 1000 earmuff and ten BC-42 non-woven bouffant-style hairnets (a unique sample for each subject) were tested in the 1994 test series. The hairnet manufacturer's name is unknown.

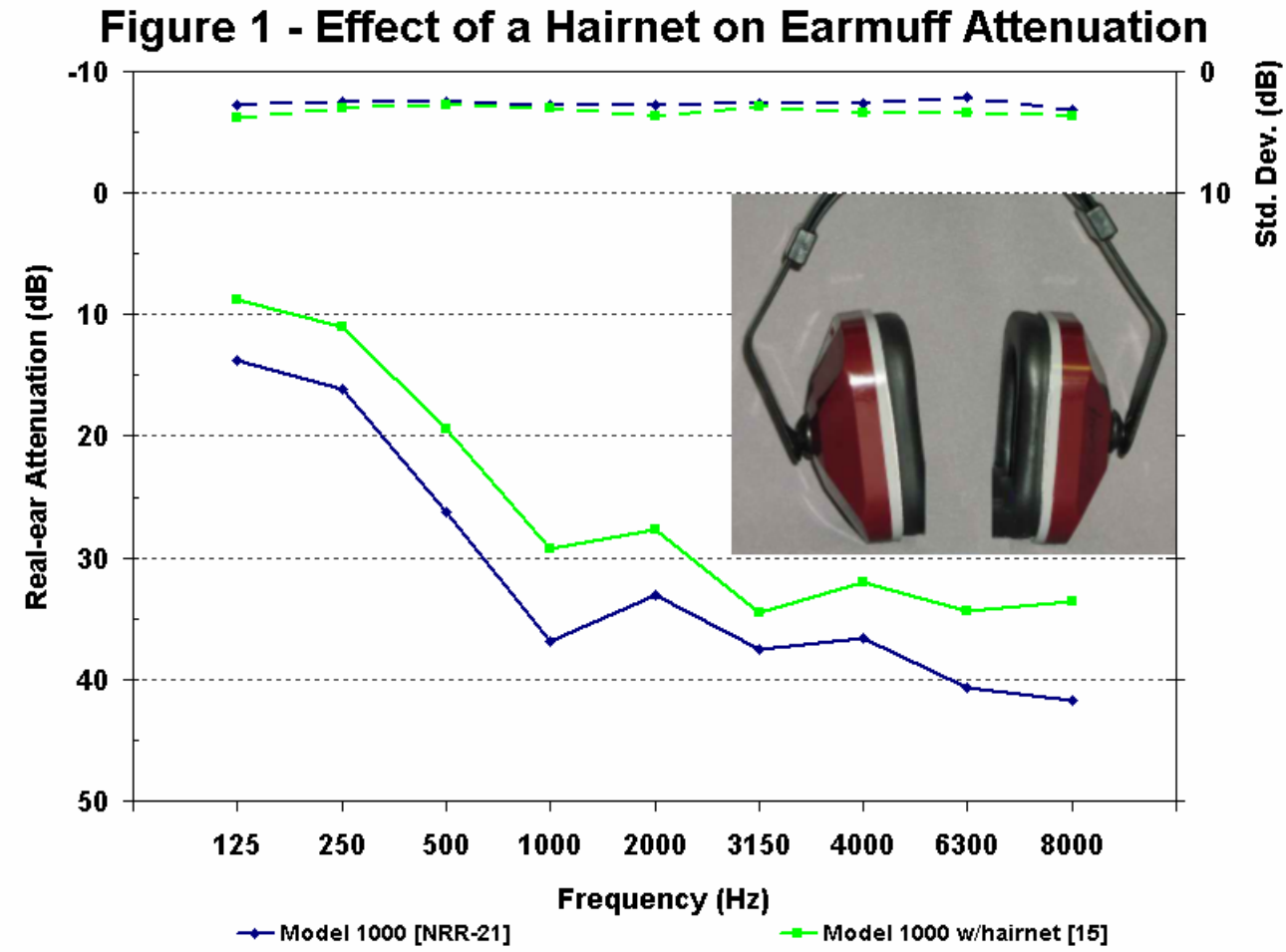
The 2006 tests used two Peltor H9A muffs and ten Dupont Tyvek Hoods. A different hood was worn by each subject. Five of the ten subjects tested each of the two H9As.

## RESULTS

Table 1 lists the devices, the Noise Reduction Ratings (NRRs) achieved and the effect of the hairnet/hood on the muff's attenuation. The individual attenuation values for the ten subjects in each of the four tests are in Appendix I. Figures 1 and 2 are graphical comparisons of the means and standard deviations (SDs) obtained for the earmuffs under each test condition. Images of the Model 1000 muffs and of the H9A muff and hood fit on a KEMAR manikin are also shown.

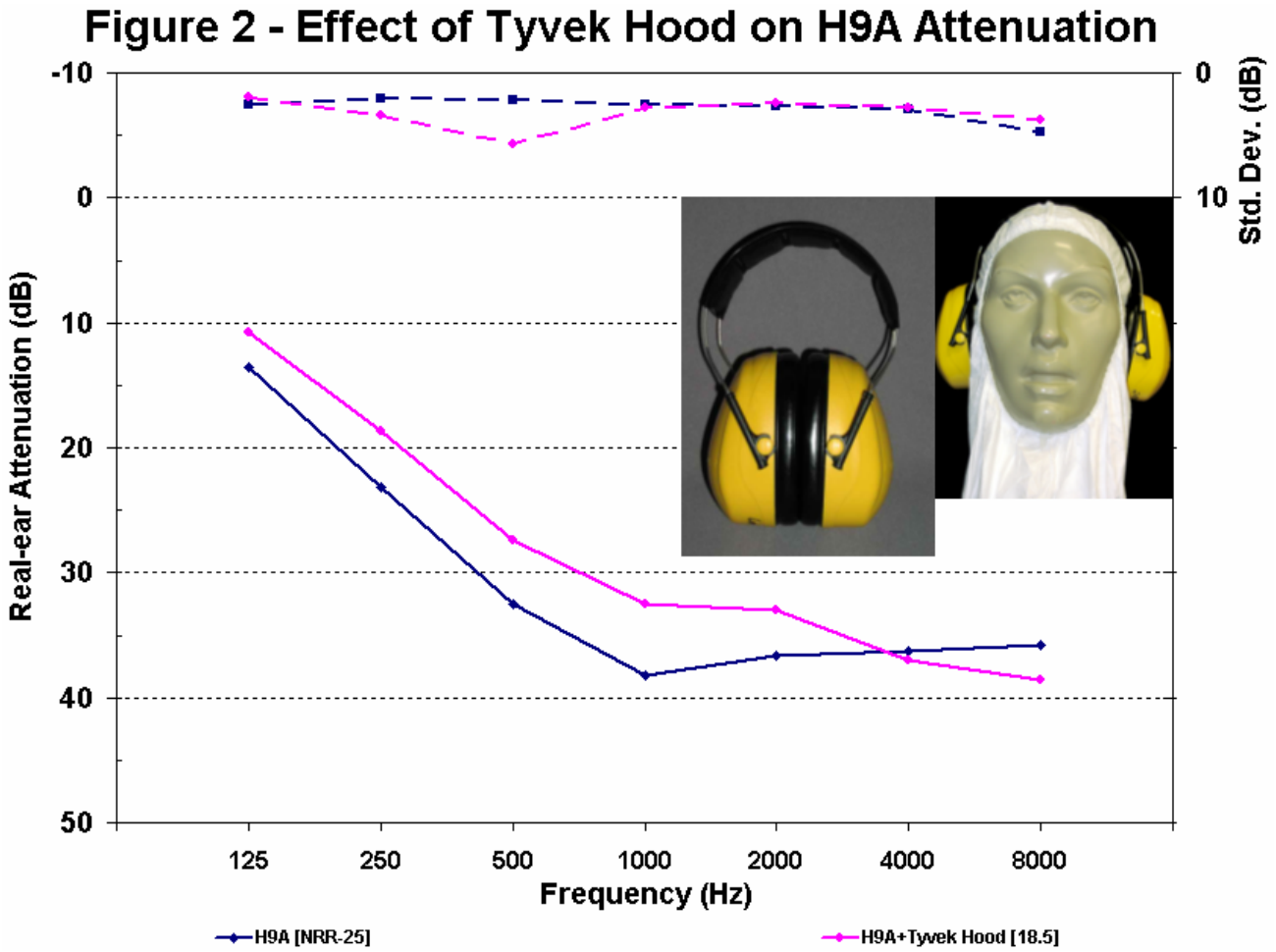
Table 1 – Effect of a Hairnet and a Hood on Earmuff Attenuation

| Device(s) Tested | NRR | Effect of Hairnet (dB) | Device(s) Tested | NRR | Effect of Hood (dB) |
|---|---|---|---|---|---|
| Model 1000 | 21 | ----- | H9A | 25 | ----- |
| Model 1000 + Hairnet | 15 | -6 | H9A + Tyvek Hood | 17 | -8 |




**Effect of Hairnet**

When the hairnet was worn under the Model 1000 muff, the reduced seal of the cushions to the subject's head caused a decrease in the mean attenuation, by frequency, of from 3 to 8 dB. The effect of the hairnet on the computed NRR of the muff by 7 dB when the hairnet was added.




**Effect of Hood**

When the hood was worn under the muffs, the average attenuation decreased by 3 to 6 dB, by frequency and the NRR was 8 dB less. A paired two-sample for means *t*-test was run at all frequencies and demonstrated the differences between the two tests were statistically significant at the $p<0.05$ level for all frequencies, except 4000 Hz. Thus, the interesting effect at 8 kHz, whereby the attenuation of the muff-with-hood exceeds that of the muff alone, is significant, but does not offset the overall degradation in attenuation that the hood creates.

## CONCLUSIONS

In order for earmuffs to block out the most noise, the cushion of an earmuff must make contact with the flesh. Since different earmuffs were used for the two sets of tests in this study, and the tests were

conducted over a decade apart, a direct comparison of the effects of the hairnet vs. the hood is not possible. But it is clear that both of them affect performance negatively at all frequencies from 125 Hz to 2 kHz, with the negative effects of the hairnet extending on upwards to 8 kHz. Surprisingly, the hood appeared to provide some small increase in attenuation at the highest test frequency. In terms of the overall attenuation as measured by the NRR, the reduction from either of these obstructions was in the range of 6 to 8 dB.

# Appendix I

## Individual Subject Data from the Four REAT Tests

Test ID: 152022 Device: CSC Model 1000 Muff

Date: 9/14/94 Samples: 1 Position: NA Comfort: 2.5

Comments: See report #152023 for results of the same earmuff tested over a hairnet.

| | | 1/3 Octave-Band Frequency | | | | | | | | | | | Bitr. | Head | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Subj. | Trial | 125 | 250 | 500 | 1000 | 2000 | 3150 | 4000 | 6300 | 8000 | 125 | Comf. | Breadth | Height | NRR* |
| KJC | 1 | 13 | 13 | 25 | 38 | 28 | 32 | 38 | 38 | 39 | 13 | | 132 | 135 | 21.8 |
| | 2 | 15 | 17 | 27 | 39 | 31 | 38 | 29 | 38 | 35 | 11 | | | | |
| | 3 | 16 | 16 | 28 | 45 | 32 | 39 | 35 | 38 | 36 | 20 | 1 | | | |
| DVF | 1 | 17 | 18 | 28 | 37 | 33 | 38 | 36 | 42 | 44 | 18 | | 136 | 126 | 25.9 |
| | 2 | 13 | 19 | 31 | 39 | 36 | 39 | 35 | 40 | 43 | 15 | | | | |
| | 3 | 17 | 17 | 30 | 38 | 36 | 39 | 35 | 40 | 44 | 17 | 4 | | | |
| GWG | 1 | 13 | 15 | 27 | 37 | 31 | 36 | 35 | 38 | 40 | 11 | | 144 | 132 | 22.9 |
| | 2 | 17 | 16 | 27 | 38 | 35 | 38 | 35 | 37 | 38 | 15 | | | | |
| | 3 | 13 | 20 | 28 | 37 | 37 | 39 | 35 | 40 | 41 | 15 | 1 | | | |
| BAK | 1 | 20 | 21 | 29 | 37 | 31 | 38 | 38 | 42 | 45 | 23 | | 150 | 143 | 23.6 |
| | 2 | 18 | 18 | 28 | 38 | 39 | 42 | 42 | 42 | 45 | 21 | | | | |
| | 3 | 18 | 16 | 26 | 35 | 32 | 37 | 38 | 43 | 44 | 18 | 3 | | | |
| JRM | 1 | 8 | 14 | 24 | 32 | 30 | 37 | 39 | 41 | 40 | 10 | | 141 | 133 | 21.4 |
| | 2 | 12 | 14 | 23 | 35 | 30 | 39 | 39 | 38 | 41 | 10 | | | | |
| | 3 | 14 | 13 | 26 | 38 | 33 | 38 | 38 | 41 | 38 | 13 | 3 | | | |
| DLP | 1 | 10 | 13 | 23 | 32 | 31 | 35 | 38 | 38 | 39 | 9 | | 145 | 149 | 21.6 |
| | 2 | 14 | 16 | 22 | 32 | 32 | 30 | 37 | 42 | 37 | 11 | | | | |
| | 3 | 12 | 15 | 21 | 35 | 31 | 39 | 37 | 44 | 43 | 13 | 5 | | | |
| EAS | 1 | 13 | 15 | 28 | 39 | 35 | 37 | 32 | 39 | 44 | 14 | | 148 | 146 | 22.9 |
| | 2 | 13 | 13 | 26 | 37 | 34 | 36 | 34 | 43 | 46 | 12 | | | | |
| | 3 | 11 | 15 | 24 | 36 | 34 | 38 | 39 | 39 | 41 | 11 | 1 | | | |
| TLS | 1 | 14 | 22 | 24 | 33 | 35 | 32 | 37 | 42 | 40 | 13 | | 132 | 130 | 22.4 |
| | 2 | 12 | 17 | 25 | 36 | 32 | 37 | 39 | 41 | 40 | 14 | | | | |
| | 3 | 10 | 17 | 25 | 37 | 29 | 40 | 38 | 43 | 41 | 11 | 3 | | | |
| KKS | 1 | 16 | 16 | 29 | 37 | 36 | 41 | 40 | 44 | 47 | 14 | | 138 | 135 | 23.3 |
| | 2 | 14 | 18 | 27 | 35 | 30 | 38 | 40 | 44 | 44 | 15 | | | | |
| | 3 | 15 | 14 | 29 | 35 | 34 | 38 | 36 | 43 | 47 | 15 | 3 | | | |
| RSS | 1 | 11 | 11 | 24 | 38 | 32 | 36 | 33 | 40 | 42 | 13 | | 136 | 133 | 19.9 |
| | 2 | 12 | 18 | 25 | 39 | 39 | 40 | 35 | 40 | 45 | 14 | | | | |
| | 3 | 12 | 16 | 29 | 41 | 35 | 40 | 37 | 42 | 42 | 14 | 1 | | | |
| Mean | | 13.8 | 16.1 | 26.3 | 36.8 | 33.1 | 37.5 | 36.6 | 40.7 | 41.7 | 14.1 | 2.5 | 140.2 | 136.2 | 22.6 |
| sd(30) | | 2.7 | 2.5 | 2.5 | 2.7 | 2.8 | 2.6 | 2.7 | 2.1 | 3.2 | 3.3 | ---- | ---- | ---- | ---- |
| sd(10) | | 2.3 | 1.8 | 2.2 | 2.2 | 1.8 | 1.4 | 2.0 | 1.7 | 2.9 | | 1.4 | 6.4 | 7.4 | 1.6 |
| Q-Value | | 24.4 | 19.7 | 24.5 | 31.4 | 26.3 | | 30.8 | | 37.0 | | | Dimensions in mm. | | |

NRR (2sd) = 21.5 (1sd) = 24.1 (0sd) = 26.7

Band Force (N): Before: 12.0; After: 11.1 CSA Class: B NRR* - Individual 2sd NRR

Test ID: 152023 Device: CSC Model 1000 Muff w/ BC-42 Hairnet

Date: 9/14/94 Samples: 1 Position: OTH Comfort: 3.1

Comments: Hairnet worn by Hebrew Nat'l Meatpacking Co. employees. Mfg. not known; bouffant style, non-woven, white.
For test, all of a subject's hair inside hairnet; hairnet worn over both ears, muff cups over hairnet.
See report #152022 for the same earmuff tested w/o hairnet.

| | | 1/3 Octave-Band Frequency | | | | | | | | | | | Bitr. | Head | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Subj. | Trial | 125 | 250 | 500 | 1000 | 2000 | 3150 | 4000 | 6300 | 8000 | 125 | Comf. | Breadth | Height | NRR* |
| KJC | 1 | 5 | 10 | 15 | 32 | 24 | 29 | 33 | 33 | 34 | 6 | | 132 | 135 | 13.6 |
| | 2 | 5 | 5 | 18 | 27 | 23 | 29 | 27 | 30 | 31 | 2 | | | | |
| | 3 | 8 | 10 | 19 | 35 | 28 | 33 | 34 | 37 | 34 | 6 | 1 | | | |
| DVF | 1 | 13 | 10 | 16 | 23 | 31 | 34 | 27 | 33 | 32 | 7 | | 136 | 126 | 14.1 |
| | 2 | 9 | 12 | 20 | 29 | 31 | 36 | 32 | 34 | 30 | 14 | | | | |
| | 3 | 5 | 7 | 16 | 23 | 24 | 36 | 25 | 33 | 32 | 8 | 4 | | | |
| GWG | 1 | 8 | 9 | 18 | 28 | 17 | 34 | 29 | 30 | 30 | 4 | | 144 | 132 | 13.2 |
| | 2 | 12 | 10 | 21 | 30 | 25 | 41 | 35 | 33 | 35 | 7 | | | | |
| | 3 | 6 | 11 | 19 | 26 | 29 | 36 | 28 | 30 | 32 | 8 | 1 | | | |
| BAK | 1 | 16 | 17 | 22 | 31 | 28 | 36 | 31 | 35 | 32 | 13 | | 150 | 143 | 18.2 |
| | 2 | 12 | 11 | 20 | 30 | 30 | 35 | 35 | 35 | 37 | 14 | | | | |
| | 3 | 18 | 14 | 18 | 25 | 31 | 35 | 30 | 37 | 34 | 12 | 3 | | | |
| JRM | 1 | 8 | 14 | 22 | 30 | 25 | 36 | 32 | 35 | 35 | 7 | | 141 | 133 | 15.6 |
| | 2 | 8 | 9 | 17 | 29 | 26 | 38 | 38 | 36 | 37 | 6 | | | | |
| | 3 | 12 | 10 | 25 | 33 | 33 | 37 | 35 | 39 | 40 | 14 | 4 | | | |
| DLP | 1 | 8 | 12 | 20 | 29 | 30 | 35 | 33 | 33 | 31 | 8 | | 145 | 149 | 17.8 |
| | 2 | 6 | 10 | 20 | 27 | 24 | 33 | 31 | 36 | 31 | 3 | | | | |
| | 3 | 9 | 10 | 20 | 33 | 26 | 35 | 35 | 41 | 36 | 8 | 5 | | | |
| EAS | 1 | 4 | 8 | 17 | 26 | 32 | 34 | 27 | 32 | 30 | 8 | | 148 | 146 | 14.9 |
| | 2 | 6 | 13 | 26 | 32 | 33 | 32 | 30 | 36 | 37 | 9 | | | | |
| | 3 | 9 | 10 | 20 | 30 | 31 | 31 | 32 | 34 | 33 | 8 | 0 | | | |
| TLS | 1 | 5 | 16 | 17 | 29 | 25 | 32 | 32 | 33 | 26 | 6 | | 132 | 130 | 16.4 |
| | 2 | 4 | 10 | 18 | 27 | 27 | 32 | 34 | 29 | 29 | 7 | | | | |
| | 3 | 7 | 14 | 17 | 27 | 23 | 31 | 35 | 39 | 35 | 7 | 4 | | | |
| KKS | 1 | 18 | 17 | 23 | 32 | 31 | 40 | 35 | 39 | 43 | 15 | | 138 | 135 | 19.4 |
| | 2 | 10 | 15 | 22 | 32 | 26 | 39 | 37 | 39 | 38 | 10 | | | | |
| | 3 | 11 | 12 | 24 | 34 | 31 | 34 | 37 | 39 | 39 | 39 | 5 | | | |
| RSS | 1 | 9 | 6 | 17 | 30 | 27 | 35 | 32 | 33 | 33 | 11 | | 136 | 133 | 14.6 |
| | 2 | 6 | 8 | 16 | 29 | 28 | 34 | 27 | 26 | 30 | 3 | | | | |
| | 3 | 7 | 11 | 21 | 30 | 31 | 35 | 33 | 34 | 33 | 6 | 4 | | | |
| Mean | | 8.8 | 11.0 | 19.5 | 29.3 | 27.7 | 34.6 | 32.0 | 34.4 | 33.6 | 9.2 | 3.1 | 140.2 | 136.2 | 15.8 |
| sd(30) | | 3.8 | 3.0 | 2.8 | 3.0 | 3.7 | 2.8 | 3.4 | 3.5 | 3.7 | 6.6 | ---- | ---- | ---- | ---- |
| sd(10) | | 3.2 | 2.2 | 2.0 | 2.1 | 2.6 | 2.4 | 2.5 | 2.6 | 3.0 | | 1.8 | 6.4 | 7.4 | 2.1 |
| Q-Value | | 17.3 | 13.7 | 17.1 | 23.3 | 19.1 | | 26.1 | | 28.0 | | | Dimensions in mm. | | |

NRR (2sd) = 14.8 (1sd) = 18.0 (0sd) = 21.2

Band Force (N): Before: 12.0; After: 11.1 CSA Class: B NRR* - Individual 2sd NRR

| Test ID: | 258A14 | | | Device: | H9A | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date: 8/16/06 | | | | Samples: | 2 | | Position: | OTH | | Comfort: | 1.9 | |
| Comments: | Part of 'Effect of glasses on muff attenuation' study. See 258A11, 258A12, 258A13, 258A15, 258A16 and 258A17 for related data. | | | | | | | | | | | |

| | | 1/3 Octave-Band Frequency | | | | | | | | Bitr. | Head | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Subj. | Trial | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | Comf. | Breadt | Height | NRR* |
| CWD | 1 | 16 | 24 | 29 | 38 | 37 | 33 | 32 | | 156 | 132 | 24.4 |
| | 2 | 13 | 22 | 32 | 39 | 36 | 33 | 37 | | | | |
| | 3 | 10 | 19 | 30 | 37 | 35 | 36 | 30 | 2 | | | |
| TJH | 1 | 11 | 21 | 30 | 39 | 35 | 31 | 33 | | 134 | 128 | 23.8 |
| | 2 | 8 | 18 | 29 | 38 | 40 | 32 | 34 | | | | |
| | 3 | 12 | 22 | 28 | 37 | 39 | 34 | 34 | 2 | | | |
| FDJ | 1 | 14 | 22 | 35 | 38 | 35 | 39 | 39 | | 148 | 109 | 25.5 |
| | 2 | 9 | 25 | 32 | 37 | 35 | 38 | 37 | | | | |
| | 3 | 15 | 28 | 37 | 39 | 37 | 39 | 37 | 0 | | | |
| BAK | 1 | 16 | 24 | 34 | 39 | 35 | 41 | 38 | | 150 | 143 | 27.8 |
| | 2 | 14 | 23 | 34 | 36 | 41 | 41 | 37 | | | | |
| | 3 | 19 | 26 | 34 | 44 | 44 | 40 | 41 | 3 | | | |
| BAL | 1 | 16 | 23 | 34 | 38 | 35 | 34 | 34 | | 133 | 112 | 27.0 |
| | 2 | 16 | 23 | 33 | 36 | 34 | 38 | 35 | | | | |
| | 3 | 13 | 21 | 34 | 36 | 36 | 34 | 39 | 1 | | | |
| MSMc | 1 | 15 | 22 | 33 | 39 | 37 | 35 | 25 | | 132 | 126 | 24.8 |
| | 2 | 13 | 23 | 31 | 35 | 36 | 32 | 28 | | | | |
| | 3 | 14 | 21 | 31 | 37 | 39 | 32 | 25 | 4 | | | |
| RTM | 1 | 16 | 24 | 33 | 39 | 35 | 36 | 41 | | 153 | 131 | 27.1 |
| | 2 | 12 | 22 | 32 | 39 | 36 | 38 | 43 | | | | |
| | 3 | 16 | 24 | 37 | 47 | 39 | 38 | 42 | 2 | | | |
| TLS | 1 | 13 | 22 | 32 | 36 | 35 | 38 | 37 | | 132 | 130 | 26.7 |
| | 2 | 13 | 25 | 34 | 42 | 38 | 35 | 32 | | | | |
| | 3 | 16 | 26 | 33 | 37 | 36 | 38 | 35 | 1 | | | |
| KMS | 1 | 16 | 24 | 32 | 35 | 34 | 35 | 40 | | 145 | 122 | 26.3 |
| | 2 | 13 | 23 | 31 | 38 | 30 | 37 | 42 | | | | |
| | 3 | 12 | 26 | 33 | 39 | 34 | 40 | 40 | 2 | | | |
| KJZ | 1 | 9 | 23 | 31 | 37 | 38 | 36 | 33 | | 160 | 142 | 26.1 |
| | 2 | 12 | 23 | 35 | 39 | 39 | 37 | 36 | | | | |
| | 3 | 13 | 25 | 33 | 39 | 39 | 35 | 38 | 2 | | | |
| Mean | | 13.6 | 23.2 | 32.5 | 38.2 | 36.6 | 36.2 | 35.8 | 1.9 | 144.3 | 127.5 | 26.0 |
| sd(30) | | 2.5 | 2.0 | 2.1 | 2.5 | 2.7 | 3.0 | 4.7 | ---- | ---- | ---- | ---- |
| sd(10) | | 1.8 | 1.5 | 1.8 | 1.4 | 2.0 | 2.7 | 4.6 | 1.1 | 10.8 | 11.1 | 1.3 |
| Q-Value | | 24.6 | 27.7 | 31.4 | 33.2 | 30.1 | 29.3 | 27.4 | | | | |

| NRR | (2sd)= | 24.8 | (1sd)= | 27.6 | (0sd)= | 30.2 |
|---|---|---|---|---|---|---|

| Band Force (N): #1 - 11.1, #2 - 10.9 | CSA Class: | A | NRR* - Individual 2sd NRR |
|---|---|---|---|

| Test ID | 258A17 | | | Device: | H9A + Dupont Tyvek Hoods | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date: | 8/16/06 | | | Samples: | 2 | | Position: | OTH | | Comfort: | 3.8 | |
| Comments: | Part of 'Effect of glasses on muff attenuation' study. See 258A14, 258A15 & 258A16 for related data. | | | | | | | | | | | |

| | | | | | 1/3 Octave-Band Frequency | | | | | Bitr. | Head | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Subj. | Trial | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | Comf. | Breadth | Height | NRR* |
| CWD | 1 | 11 | 23 | 37 | 39 | 38 | 42 | 43 | | 156 | 132 | 24.9 |
| | 2 | 10 | 24 | 35 | 40 | 39 | 39 | 39 | | | | |
| | 3 | 10 | 19 | 30 | 33 | 35 | 37 | 42 | 4 | | | |
| TJH | 1 | 10 | 17 | 21 | 37 | 24 | 30 | 35 | | 134 | 128 | 18.2 |
| | 2 | 7 | 13 | 22 | 31 | 29 | 30 | 31 | | | | |
| | 3 | 10 | 17 | 20 | 33 | 33 | 35 | 35 | 5 | | | |
| FDJ | 1 | 13 | 17 | 21 | 27 | 31 | 37 | 43 | | 148 | 109 | 17.3 |
| | 2 | 4 | 20 | 22 | 27 | 29 | 39 | 39 | | | | |
| | 3 | 12 | 18 | 28 | 37 | 34 | 38 | 41 | 9 | | | |
| BAK | 1 | 15 | 22 | 35 | 28 | 32 | 41 | 39 | | 150 | 143 | 22.8 |
| | 2 | 9 | 22 | 36 | 37 | 34 | 38 | 41 | | | | |
| | 3 | 16 | 28 | 35 | 39 | 40 | 40 | 44 | 4 | | | |
| BAL | 1 | 14 | 16 | 22 | 30 | 34 | 36 | 35 | | 133 | 112 | 21.3 |
| | 2 | 13 | 17 | 22 | 30 | 32 | 33 | 35 | | | | |
| | 3 | 12 | 14 | 28 | 28 | 33 | 39 | 39 | 1 | | | |
| MSMc | 1 | 16 | 17 | 22 | 31 | 35 | 36 | 35 | | 132 | 126 | 13.6 |
| | 2 | 4 | 9 | 14 | 25 | 28 | 31 | 33 | | | | |
| | 3 | 10 | 12 | 19 | 31 | 30 | 32 | 31 | 6 | | | |
| RTM | 1 | 11 | 14 | 26 | 30 | 36 | 40 | 40 | | 153 | 131 | 20.5 |
| | 2 | 11 | 24 | 31 | 37 | 33 | 37 | 45 | | | | |
| | 3 | 10 | 17 | 29 | 40 | 32 | 35 | 39 | 3 | | | |
| TLS | 1 | 9 | 17 | 30 | 29 | 33 | 39 | 40 | | 132 | 130 | 22.3 |
| | 2 | 11 | 19 | 26 | 37 | 33 | 39 | 33 | | | | |
| | 3 | 13 | 21 | 27 | 30 | 33 | 39 | 35 | 1 | | | |
| KMS | 1 | 15 | 19 | 25 | 34 | 33 | 37 | 43 | | 145 | 122 | 24.3 |
| | 2 | 14 | 21 | 30 | 32 | 33 | 43 | 45 | | | | |
| | 3 | 11 | 22 | 29 | 31 | 31 | 40 | 45 | 3 | | | |
| KJZ | 1 | 3 | 17 | 34 | 25 | 32 | 34 | 37 | | 160 | 142 | 17.9 |
| | 2 | 12 | 21 | 33 | 35 | 38 | 39 | 39 | | | | |
| | 3 | 7 | 21 | 32 | 31 | 35 | 36 | 37 | 2 | | | |
| Mean | | 10.7 | 18.6 | 27.4 | 32.5 | 33.1 | 37.0 | 38.6 | 3.8 | 144.3 | 127.5 | 20.3 |
| sd(30) | | 3.3 | 4.0 | 6.0 | 4.4 | 3.3 | 3.3 | 4.1 | ---- | ---- | ---- | ---- |
| sd(10) | | 2.0 | 3.4 | 5.7 | 2.8 | 2.5 | 2.8 | 3.8 | 2.4 | 10.8 | 11.1 | 3.6 |
| Q-Value | | 20.1 | 19.1 | 18.7 | 23.7 | 25.2 | 29.4 | 31.5 | | | | |

| NRR | (2sd)= | 18.5 | (1sd)= | 22.8 | (0sd)= | 26.9 |
|---|---|---|---|---|---|---|

| Band Force (N): #1 - 11.1, #2 - 10.9 | CSA Class: | A | NRR* - Individual 2sd NRR |
|---|---|---|---|