AUDITORY SYSTEMS LABORATORY
HEARING PROTECTION DEVICE
ATTENUATION TEST REPORT

AUDITORY SYSTEMS LABORATORY
Dr. John G. Casali, Professor and Director
Office Phone: (540) 231-5073
Facsimile: (540) 231-3322
WWW: http://www.casali.org.vt.edu/audio_lab.pdf

GRADO DEPT. OF INDUSTRIAL & SYSTEMS ENGINEERING
COLLEGE OF ENGINEERING
VIRGINIA POLYTECHNIC INSTITUTE & STATE UNIVERSITY
***Blacksburg, Virginia* 24061**

Test Report Date: **August 6, 2012**

Client: Persona Medical
170 N. Cypress Way
Casselberry, FL 32707

Test Report Number: **VTEA-8/06/12-12HP-P**

The client may not use this report to claim product endorsement by Virginia Polytechnic Institute and State University (Virginia Tech).

This report may be reproduced only in its entirety. It may not be reprinted for use in advertising copy.

VIRGINIA TECH AUDITORY SYSTEMS LABORATORY
HEARING PROTECTOR ATTENUATION TEST REPORT*

HEARING PROTECTOR: earasers
High Fidelity Ear Plugs

PROTECTOR TYPE: earplug

MANUFACTURER: PERSONA MEDICAL

TEST DATE: 07/26/12 - 08/03/12

TEST STANDARD USED: ANSI S3.19 - 1974

FITTING METHOD: Experimenter Fit[5]

NO. OF SAMPLES TESTED: 10 pairs

NO. & SEX OF SUBJECTS TESTED: 5 M, 5 F

SUBJECT AGE RANGE/MEAN: 26 - 43 yrs; 32.4 yrs

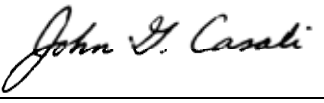
HEADBAND FORCE: N/A

TEST POSITION: N/A

COMMENTS:

1) A new pair of earplugs was fit for each subject. The experimenter selected the appropriate size, from the 2 sizes provided.

2) All subjects met all requirements of the applicable standard.

TESTER:	Kichol Lee		8/06/12
	Name	Signature	Date
APPROVED SIGNATORY:	John G. Casali		8/06/12
	Name	Signature	Date

NOISE-REDUCTION RATING (NRR) (per NIOSH, http://www2a.cdc.gov/hp-devices/useHPDC.html): **-5**
(calculations on page 3)

ATTENUATION MEANS AND STANDARD DEVIATIONS (from 30 trials)

1/3 octave band center (Hz)	125	250	500	1000	2000	3150	4000	6300	8000
mean attenuation (dB)	2.7	3.2	1.2	6.7	14.9	19.2	16.7	14.8	11.0
standard deviation (dB)	3.5	3.1	6.5	4.2	5.3	4.0	3.7	4.8	3.8

*Test report data relate only to those protector units and subject sample tested. The client may not use this report to claim product endorsement by Virginia Tech.

For labeling purposes, only the following statement may be used in regard to testing in the Virginia Tech facility; no other references to the university or to personnel may be used.

"These attenuation data were obtained in accordance with ANSI Standard S3.19-1974 in an independent university testing laboratory at Virginia Tech."

VIRGINIA TECH AUDITORY SYSTEMS LABORATORY
HEARING PROTECTOR ATTENUATION TEST REPORT

PROCEDURES USED

a) Test subjects were randomly selected from a pool of qualified listeners maintained by the Auditory Systems Laboratory. All listeners were empirically qualified as per the requirements of ANSI S3.19-1974[1] or ANSI S12.6-1997(R2002)[3], according to the particular standard specified for testing.

b) Where ANSI S3.19-1974[1] was the test method, experimenter-fit was used, according to section 3.3.3.1 (2) of the standard, as per EPA (1990)[5] requirements. Where ANSI S12.6-1997(R2002)[3] was the test method, Method A (experimenter-supervised fit in section 8 of the standard) or Method B (subject fit in section 9 of the standard) was used, as requested by the client and as indicated on page 1 of this report.

c) Room ambient noise levels were continuously monitored during the tests using a real-time spectrum analyzer to verify that allowable levels of the standards[1,3] were not exceeded during threshold determination.

d) The psychophysical procedure used in the tests was Békésy tracking, presented and scored on-line by computer. The scoring criteria programmed on the computer met the requirements of section 11.2 of ANSI S12.6-1997(R2002)[3]. Detail concerning the implementation of this psychophysical procedure appears in Casali, Robinson and Hankins (2000a, 2000b)[2,4].

e) Where the protector under test was an earmuff or semi-insert device, headband compression force values were obtained from the test samples before attenuation testing commenced. Measurements were arithmetically averaged across the samples and the result (in Newtons, N) reported on page 1 of this report. The measurements were obtained using a Headband Force Rig Model 3.02.B manufactured by INSPEC Laboratories, Ltd, Manchester, England. The force measurements were obtained at a separation of 14.35 cm and a 13.08 cm headband height for tests conducted under S3.19-1974[1] and at a separation of 145 mm and a 130 mm headband height for tests conducted under S12.6-1997(R2002)[3].

REFERENCES CITED

[1]ANSI S3.19-1974. *Method for the measurement of real-ear protection of hearing protectors and physical attenuation of earmuffs*. New York, NY: American National Standards Institute, 1974.

[2]Casali, J. G., Robinson, G. S. and Hankins, S. E. (2000a). *A reverberant computer-controlled facility for hearing protection research and attenuation testing: Verification re ANSI S3.19-1974* (Report No. 20002). Blacksburg, VA: Virginia Tech, Department of Industrial and Systems Engineering.

[3]ANSI S12.6-1997(R2002). *Methods for the measurement of the real-ear attenuation of hearing protectors.* New York, NY: American National Standards Institute, 1997.

[4]Casali, J. G., Robinson, G. S. and Hankins, S. E. (2000b). *A computer-controlled facility for hearing protection research and attenuation testing: Verification re ANSI S12.6-1997* (Report No. 20003). Blacksburg, VA: Virginia Tech, Department of Industrial and Systems Engineering.

[5]Environmental Protection Agency (EPA). Product noise labeling. *Code of Federal Regulations*, 40 CFR Part 211, 128-144, July 1, 1990. (Requires ANSI S3.19-1974 and "Experimenter-Fit" protocol of section 3.3.3.1 (2).)

HEARING PROTECTOR: earasers High Fidelity Ear Plugs

NOISE REDUCTION RATING (NRR) CALCULATION (per EPA,1990)

1/3 octave band center (Hz)	125	250	500	1000	2000	4000	8000		
1. assumed pink noise (dB) †	100.0	100.0	100.0	100.0	100.0	100.0	100.0		
2. C-weighting corrections (dB) †	-0.2	0.0	0.0	0.0	-0.2	-0.8	-3.0		
3. unprotected ear C-weighted level (dB) †	99.8	100.0	100.0	100.0	99.8	99.2	97.0	107.9	Logarithmic Sum (log base 10)
4. A-weighted corrections (dB) †	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1		
5. unprotected ear A-weighted level (dB) (step 1 + step 4) †	83.9	91.4	96.8	100.0	101.2	101.0	98.9		
6. mean attenuation at frequency (dB)*	2.7	3.2	1.2	6.7	14.9	18.0	12.9		
7. standard deviation at frequency (x2) (dB)*	7.0	6.2	13.0	8.4	10.6	7.7	8.6		
8. protected ear A-weighted sound levels (dB) (step 5-step 6+step 7)	88.2	94.4	108.6	101.7	96.9	90.7	94.6	110.0	Logarithmic Sum (log base 10)
9. NRR = (step 3 log sum)-(step 8 log sum)-(3dB correction factor)=							-5.1		

NRR = -5

Fitting Procedure: Experimenter-Fit

† All values/calculations in rows 1-5 are from EPA (1990)

* 4000 Hz values are mean of 3150 Hz and 4000 Hz data.
8000 Hz values are mean of 6300 Hz and 8000 Hz data

FREQUENCY (Hz)	125	250	500	1000	2000	3150	4000	6300	8000
attenuation mean	2.7	3.2	1.2	6.7	14.9	19.2	16.7	14.8	11.0
attenuation std. dev.	3.5	3.1	6.5	4.2	5.3	4.0	3.7	4.8	3.8

HEARING PROTECTOR: earasers High Fidelity Ear Plugs

ATTENUATION DATA (in dB) BY TRIAL BY INDIVIDUAL SUBJECT

		1/3 octave band center (Hz)								
subject	trial	125	250	500	1000	2000	3150	4000	6300	8000
1	1	-0.2	-0.7	2.0	7.2	14.2	22.0	17.1	15.1	10.7
1	2	0.8	2.5	2.1	10.6	15.4	18.5	20.3	16.4	13.0
1	3	0.6	1.5	1.8	9.8	18.5	25.5	17.6	17.3	13.9
2	1	1.3	2.2	7.8	10.2	20.3	20.0	19.6	19.3	11.4
2	2	6.0	2.0	5.6	11.5	20.3	20.8	19.5	20.6	12.9
2	3	6.7	9.1	7.3	10.0	21.7	22.0	18.7	21.0	15.6
3	1	-0.3	0.5	2.5	4.5	12.1	16.3	15.0	11.0	3.5
3	2	3.4	4.8	7.5	7.0	17.5	21.7	19.1	16.0	10.2
3	3	0.4	3.9	2.1	6.5	17.1	20.3	15.2	7.9	6.5
4	1	8.4	5.7	3.8	7.9	21.2	23.8	20.7	20.7	14.0
4	2	5.7	4.5	2.8	5.8	22.2	24.5	20.2	14.3	9.0
4	3	4.9	7.4	2.0	9.6	16.8	24.0	17.0	17.0	11.6
5	1	1.3	0.8	8.3	0.5	8.6	13.3	8.8	11.3	9.8
5	2	0.1	-1.4	5.0	0.1	6.3	14.9	12.8	10.5	5.3
5	3	3.6	0.0	3.2	7.0	13.7	16.6	12.8	9.1	12.0
6	1	3.9	7.4	4.9	9.2	15.8	15.8	13.3	14.2	15.5
6	2	5.0	8.9	2.8	7.9	16.3	17.0	6.9	14.7	12.2
6	3	6.6	5.6	0.8	8.0	11.3	12.0	10.6	13.1	10.4
7	1	-1.0	3.4	2.3	-0.4	11.2	14.2	19.3	7.7	8.8
7	2	-1.8	2.3	-1.9	2.0	14.3	18.6	18.5	8.0	3.8
7	3	0.7	4.2	2.2	6.5	18.8	15.1	17.9	6.1	5.3
8	1	7.0	-1.3	-1.0	10.9	18.2	18.6	20.5	17.2	11.5
8	2	6.1	6.0	4.7	12.2	15.6	25.9	21.8	23.0	14.6
8	3	7.0	4.5	2.7	14.7	14.4	21.4	21.7	22.4	16.1
9	1	-1.2	2.9	-4.7	0.9	5.2	10.5	15.8	13.4	7.0
9	2	-0.3	3.9	3.1	0.1	5.7	16.7	14.7	17.0	10.0
9	3	10.3	7.0	2.5	9.6	11.3	21.2	16.3	12.2	9.5
10	1	-1.8	-2.4	-16.5	1.0	9.1	22.3	16.5	14.4	20.3
10	2	-1.5	-0.4	-20.4	6.6	25.5	22.2	18.4	22.4	13.7
10	3	0.3	1.5	-10.8	2.3	7.4	19.0	13.9	9.9	11.3

attenuation mean	2.7	3.2	1.2	6.7	14.9	19.2	16.7	14.8	11.0
attenuation std. dev.	3.5	3.1	6.5	4.2	5.3	4.0	3.7	4.8	3.8