Audiology Associates

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Sydney Gurschkov
Insta-Mold Products, Inc.
640 Hollow Rd.
P.O. Box 439
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In Re: NRR studies for "INSTA-MOLD *FeatherWEIGHT* INSTANT SILICONES" Customized noise protection ear molds.

Dear Sid,

Attached please find the NRR data for the floating "featherweight" silicone custom ear molds. Information pertinent to the data is as follows:

1. All custom earmolds were fabricated using a cotton dam, syringed material, and double Insta-Seal coating,
2. all earmolds extended beyond the first bend of the ear canal and usually terminated at the second bend,
3. subjects consisted of 5 females and six females from the ages of 21 years to 55 years,
4. all subjects were seated in a head-stable position, and evaluated as per test conditions outlined in applicable ANSI(1974 and 1984) and EPA)1979) standards,
5. while it is not a significant aspect of this study, all subjects had hearing between 125 and 8000 Hz that is within the generally accepted limits of normal,
6. when attenuation data was obviously distant from the group data, the protector was repositioned and the subject was retested,
7. the raw data consisted of 11 subjects and 22 ears,
8. the enclosed raw data was subjected to standard statistical analysis using Microsoft's "Excel" software,
9. the resulting statistical data was entered into the noise reduction formulae as noted on the enclosed data sheets.

The results of the test measurements were subjected to analysis and result in a **Noise Reduction Rating (NRR) of 29.8 dB**.

This NRR is different from the NRR produced by EAR laboratories (27.1 dB). This difference is likely due to the very tight control of attenuation in the low frequencies and the low standard deviations in my data. Interestingly, when I use EAR's raw data (means, standard deviations, and workplace noise levels), I get an NRR of 32.5 dB. Plugging this data into those formulae, the FeatherWeight shows an NRR of 30.5 dB. Evidently, it is "normal" to have a 2-3 dB variation in the data used to calculate the NRR.

I apologize for taking an extra month in accumulating these figure for you. It has been keeping me up at night and I am glad it's finished even though late.

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RAW ATTENUATION DATA -- INSTAMOLD FeatherWEIGHT

a for Eleven

		Frequency (Hz)								
		125	**250**	**500**	**1000**	**2000**	**3000**	**4000**	**6000**	**8000**
s-1-- GM	right	22	28	32	36	32	42	44	46	44
55f	left	26	26	30	34	28	26	46	44	42
s-2 -- BM	right	24	34	34	36	34	42	50	46	44
55m	left	26	32	36	36	32	36	48	44	42
s-3 -- KM	right	24	34	38	34	36	38	42	38	38
21f	left	26	30	36	34	38	42	44	36	40
s-4 -- Sally	right	28	36	38	36	40	42	44	46	40
22f	left	26	36	36	36	38	36	44	46	44
s-5 -- DAC	right	24	30	34	34	36	38	38	42	46
43m	left	24	30	36	34	36	38	36	44	42
s-6 -- Me	right	26	34	38	36	42	44	42	46	44
54m	left	28	36	38	36	42	44	38	46	42
s-7 -- Dan M	right	26	32	34	36	38	40	40	44	43
27m	left	26	32	34	36	42	44	42	42	40
s-8 -- Lance	right	24	28	30	34	38	38	36	36	36
27m	left	24	28	28	32	39	36	36	40	40
s-9 -- Ann	right	22	26	28	30	34	34	36	36	36
53f	left	24	26	27	30	32	32	36	30	36
s-10 -- Gail	right	24	26	34	36	37	40	40	50	44
55f	left	24	26	33	36	34	38	42	47	38
s-11 -- Danny	right	26	28	28	30	32	32	38	36	32
21m	left	28	26	28	30	34	32	35	38	36
Ave. Atten.		25.0909	30.182	33.181818	34.18182	36.0909	37.91	40.773	42	40.4
Std. Dev.		1.71573	3.6467	3.7497475	2.301891	3.7405	4.679	4.2754	5	3.61

Statistical Data for Insta Mold Feather WEIGHT

125 Hz		250 Hz		500 Hz	
Mean	25.0909	**Mean**	30.18182	**Mean**	33.182
Std Error	0.36579	Std Error	0.777487	Std Err	0.7994
Median	25	Median	30	Median	34
Mode	24	Mode	26	Mode	34
Std Dev.	1.71573	**Std Dev.**	3.646738	**Std De**	3.7497
Sample Va	2.94372	Sample Var	13.2987	Sample	14.061
Kurtosis	-0.44038	Kurtosis	-1.31832	Kurtosis	-1.249
Skewness	0.09463	Skewness	0.319206	Skewne	-0.317
Range	6	Range	10	Range	11
Minimum	22	Minimum	26	Minimu	27
Maximum	28	Maximum	36	Maximu	38
Sum	552	Sum	664	Sum	730
Count	22	Count	22	Count	22

1000 Hz		2000 Hz		3000 Hz	
Mean	34.1818	**Mean**	36.09091	**Mean**	37.909
Std Error	0.49076	Std Error	0.797477	Std Err	0.9976
Median	35	Median	36	Median	38
Mode	36	Mode	32	Mode	38
Std Dev.	2.30189	**Std Dev.**	3.7405	**Std De**	4.6793
Sample Va	5.2987	Sample Var	13.99134	Sample	21.896
Kurtosis	-0.39623	Kurtosis	-0.4048	Kurtosis	0.3979
Skewness	-1.01707	Skewness	-0.10824	Skewne	-0.725
Range	6	Range	14	Range	18
Minimum	30	Minimum	28	Minimu	26
Maximum	36	Maximum	42	Maximu	44
Sum	752	Sum	794	Sum	834
Count	22	Count	22	Count	22

4000 Hz		6000 Hz		8000 Hz	
Mean	40.7727	**Mean**	41.95455	**Mean**	40.409
Std Error	0.91152	Std Error	1.065957	Std Err	0.7692
Median	41	Median	44	Median	41
Mode	36	Mode	46	Mode	44
Std Dev.	4.27542	**Std Dev.**	4.999784	**Std De**	3.6077
Sample Va	18.2792	Sample Var	24.99784	Sample	13.015
Kurtosis	-0.62548	Kurtosis	-0.18671	Kurtosis	-0.315
Skewness	0.43364	Skewness	-0.67199	Skewne	-0.587
Range	15	Range	20	Range	14
Minimum	35	Minimum	30	Minimu	32
Maximum	50	Maximum	50	Maximu	46
Sum	897	Sum	923	Sum	889
Count	22	Count	22	Count	22

R = La - 10 Log S

Noise reduction based upon raw data

Where:

R is the amount of estimated noise reduction.
La is the workplace dBA noise level.
S is a calculated factor based upon the measured octave band noise level, the average octave band attenuation and its standard deviation.
These factors are labels L1 through L7, and Q1 through Q7.

La	108	dB(A)

Workplace sound levels

125 Hz	L1	100	dB
250 Hz	L2	100	dB
500 Hz	L3	100	dB
1000 Hz	L4	100	dB
2000 Hz	L5	100	dB
4000 Hz	L6	100	dB
8000 Hz	L7	100	dB

Insta Mold -- FeatherWEIGHT: Attenuation by Octave and Standard Deviations

	Average Attenuation	Standard Deviation
125 Hz	25.091	1.7
250 Hz	30.182	3.6
500 Hz	33.182	3.7
1000 Hz	34.182	2.3
2000 Hz	36.091	3.7
3150 Hz	37.909	4.7
4000 Hz	40.773	4.3
6300 Hz	41.955	5.0
8000 Hz	40.409	3.6

Calculation of the Q factors

Factor Number	Octave Band Center Frequency, Hz	Average Attenuation (dB)	A-weighting factor (dB)	Measurement Uncertainty	=	Q Factor
Q1	125 Hz	25.09	16.10	3.4		37.76
Q2	250 Hz	30.18	8.60	7.3		31.49
Q3	500 Hz	33.18	3.20	7.5		28.88
Q4	1000 Hz	34.18	0.00	4.6		29.58
Q5	2000 Hz	36.09	-1.20	7.5		27.41
Q6	4000 Hz	39.34	-1.00	9.0		29.39
Q7	8000 Hz	41.18	1.10	8.6		33.67

Calculation of S

S = Summation of 10^[.1*(Ln-Qn)]

	2E+06
	7E+06
	1E+07
	1E+07
	2E+07
	1E+07
	4E+06
S =	7E+07

Calculation of R

R = La - 10 Log S

R = h

R = 108 - 78.2 dB(A)

29.8 dB, estimated noise reduction from the HPD, in decibels.