

Hearing Aid Redesign: Test Plans

MECHANICAL TESTING

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Specification Summary:

Spec	Specification	Dir.	Units	Marginal	Ideal	Measured Value	Pass/Fail
S8	Maximum temperature at outside surface of device	min	oF				
S9	Range of adult ear size accommodated	max	percentile	25 th -75 th	10 th -90 th		
S10	Weight of earpiece	min	g	<15	<12		
S14	Percent of surveyed people who identify a picture of the device as something other than a hearing aid.	%	>50	>60	>80		
S15	Percent of surveyed hard of hearing people who prefer the form of the new device to standard behind the ear hearing aids	%	>50		>75		
S16	Percent of surveyed hearing people who would use the device for Bluetooth or music listening	%			>70		
S17	Percent of surveyed people who feel the device is comfortable to wear	%		>60	>80		
S18	Attaches to a standard ear tube and ear mold	yes/no	yes/no	yes	yes		
S19	Manufactured cost (estimated)	min	\$	<2000	<1000		

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ME 1: Device Surface Temperature Test

Date Completed _____

Performed By _____

Specifications Tested

Spec / Customer Need	Description	Ideal	Marginal
S8 / CN11 CN12	Maximum temperature at outside surface of device	98F?	110F

Revision History

Revision	Description	Date
1	Document Created	03/25/13

Equipment

___ Thermocouple

Sections

- Part 1: Surface Temperature Test Outline
- Part 2: Figure 1: Thermocouple placement locations
- Part 3: Table 1: Temperature Results
- Part 4: Summary of Data

Sound Processing Test

Date Completed _____

Performed By _____

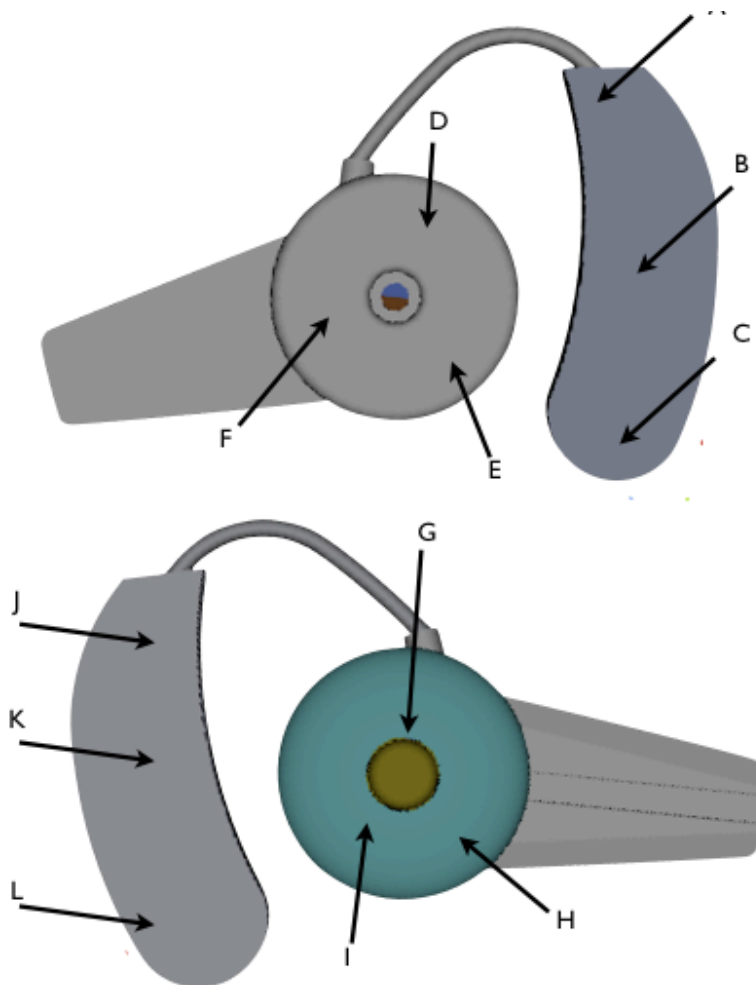
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ME 1: Device Surface Temperature Test

Part 1 – Surface Temperature Test Outline

- ___ 1. Attach a thermocouple to locations A – L (Figure 1)
- ___ 2. Record temperatures at location A-L in the “initial temperature” column of Table 1
- ___ 2. Turn device on and run at maximum power for 30 minutes
- ___ 3. Record temperatures at locations A-L in the “maximum temperature” column of Table 1
- ___ 4. Turn device off and allow to device to cool to room temperature

Part 2 - Figure 1: Thermocouple placement locations



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ME 1: Device Surface Temperature Test

Part 3 - Table 1: Temperatures Results

Location	Initial Temperature (deg. F)	Maximum Temperature (deg. F)	Is the maximum temperature < 100F? (Y/N)
A			
B			
C			
D			
E			
F			
G			
H			
I			
J			
K			
L			

Part 4 - Summary of Data

Are all temperature readings <110F ? Yes _____ No _____

If no, list what locations are out of spec: _____

Testing Part 1 Sign Off _____ Date _____

Hearing Aid Redesign: Test Plans

ME 2: Ergonomic Compatibility Test

Date Completed _____ March 15, 2003 _____

Performed By _Paula Garcia and Marbella Vidals____

Specifications Tested

Spec / Customer Need	Description	Direction	Marginal	Ideal
S7	Connects to standard USB 2.0 computer port	Binary	Yes	Yes
S9	Range of adult ear size accommodated	Max	25 th to 75 th percentile	5 th to 95 th percentile
S15	Percent of hard of hearing people who preferred the form of new device compared to the standard hearing aids.	max	>50%	>75%
S17	Percent of surveyed people who feel the device is comfortable to wear		> 50 %	> 80 %
S18	Attaches to standard ear tube and ear mold	binary	yes	yes

Revision History

Revision	Description	Date
1	Document Created	03/25/13

Equipment

___ Human Subjects (potential users)

___ Prototype

___ Disinfectant wipes

___ Calipers

___ Questionnaire

___ Disposable ear domes

___ Camera and Tripod

Hearing Aid Redesign: Test Plans

Purpose: The intent of this test is to evaluate the design of the beta prototype in order to make any necessary changes and updates to the final prototype design. This test is to be conducted week 2 of MSD2.

Sections

- Part 1: Ergonomic Compatibility Test Outline
- Part 2: Questionnaire
- Part 3: Summary of Data

Date Completed __March 15_____

Performed By __Paula Garcia and Marbella Vidals_____

Part 1 – Ergonomic Compatibility Test

1. Sit user in testing location
2. Present the device to the user without explaining the design intent or features (the purpose of this test is to gauge how intuitive the design is to a new user)
3. Each subject will have their ear dimensions recorded to track ear sizes
4. Data collected from each subject will be kept confidential
5. Conduct one on one interview with each participant for a maximum of 15 minutes
6. Each participant will be asked to wear a prototype and perform a set of tasks such as walking with device, adjusting volume etc.
7. The use of a Likert system will be used to answer each question.
8. Each question will reference a function on the device to evaluate basic usability standards:
 - a. Flexibility and efficiency of use
 - b. Aesthetic and minimalist design
 - c. User Control and freedom

Hearing Aid Redesign: Test Plans

- d. Recognition rather than recall
- 9. Follow the instructions on the attached questionnaire and record answers
- 10. Wipe down device with disinfecting wipes
- 11. Dismiss user and repeat steps 1-3 for the remaining users

Part 2 – Questionnaire

See Appendix A.

Part 3 – Summary of Results

Major Observations:

Description	Comments
Aesthetics/Visibility	Mixed reviews among participants
Overall Comfort	3 out of 6 people were dissatisfied with overall comfort due to long/big ear tube and round module hitting cartilage
Overall Comfort (active)	4 out of 6 people were not able to keep device secured on ear due to long ear tube.
Weight of Device	Mixed reviews among participants, Generally didn't feel uncomfortable due to weight
Ease of Changing Volume	3 out 6 people generally neutral on volume adjustment
Ease of Changing Programs	Generally satisfied/neutral on adjusting program-Some expressed good feedback on multi-function button
Ease of changing/access batteries	Mainly satisfied because of battery
Ease of Recharging	Complete Satisfaction with ability to recharge
Overall Quality	Mixed reviews on overall quality

See appendix B for detailed results.

Testing Part 1 Sign Off _____ Date _____

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Appendix

A. Questionnaire

B. Results

Hearing Aid Redesign: Test Plans

A.

Hearing Aid Design Survey:

Date:

Age:

Time:

Gender:

Please mark how satisfied you are with the hearing aid device for each situation:

#	Question	Very Satisfied	Satisfied	Neutral	Dissatisfied,	Very Dissatisfied	NA
1	Aesthetics/Visibility of device						
2	Overall comfort/fit-Stationary State						
3	Overall comfort/fit-Active State						
4	Weight of Device:						
5	Ease of Adjusting Volume:						
6	Ease of Adjusting Programs:						
7	Ease of changing/accessing batteries:						
8	Ease of recharging device (connection)						
9	Overall Quality of device:						

10. Color Preference:

11. Price range:

\$0-\$20

\$100-\$200

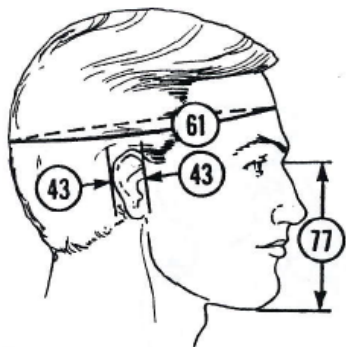
\$20-\$50

Greater than \$200

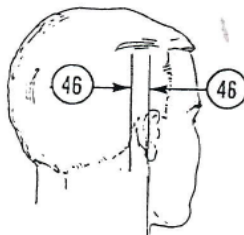
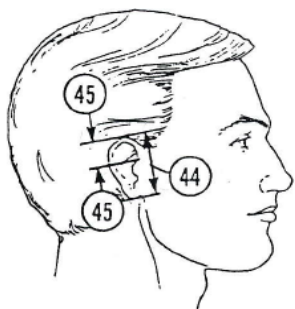
\$50-\$100

Subject's Ear Dimensions:

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Area	Measurements
43	
44	
45	
46	



Additional comments/concerns:

Hearing Aid Redesign: Test Plans

B.

sample size: 6

Results

Question	Description	Satisfied	Neutral	Dissatisfied	NA
1	Aesthetics/Visibility	33%	33%	33%	
2	Overall Comfort	17%	33%	50%	
3	Overall Comfort (active)	17%	17%		67%
4	Weight of Device	33%	17%	50%	
5	Ease of Changing Vol	17%	50%	33%	
6	Ease of Changing Prog.	33%	50%	33%	
7	Ease of changing/access batteries	50%	17%	33%	
8	Ease of Recharging	100%			
9	Overall Quality	33%	33%	33%	

Color Preference				
Blue	Black	Purple	red	silver
3	3	2	2	1
Gender	Female	4		
	Male	2		
Ages	19-25			

Hearing Aid Redesign: Test Plans

ME 3: Weight Test

Date Completed _____

Performed By _____

Specifications Tested

Spec / Customer Need	Description	Marginal	Ideal
S10 / CN 4, 6, 10, 11	Weight of device	<15 grams	< 12 grams

Revision History

Revision	Description	Date
1	Document Created	04/08/13

Equipment

___ Assembled Device

___ Scale

Purpose: The intent of this test is to measure the mass of the assembled device (enclosure and electronics).

Sections

- Part 1: Weight Test Outline
- Part 2: Diagram
- Part 3: Summary of Data

Date Completed _____

Performed By _____

Hearing Aid Redesign: Test Plans

Part 1 – Weight Test

- ___ 1. Zero scale
- ___ 2. Place device on scale (Diagram 1)
- ___ 3. Read and record weight in Part 3

Part 2 – Diagram 1



place device on scale and record value

Part 3 – Summary of Results

Was the device within the specified weight requirement? _____

Comments?

Testing Part 1 Sign Off _____ Date _____

Hearing Aid Redesign: Test Plans

ME4/ISE: Ergonomic Compatibility Test

Part 1 – Ergonomic Compatibility Test

9. Sit user in testing location
10. Present the device to the user without explaining the design intent or features (the purpose of this test is to gauge how intuitive the design is to a new user)
11. Each subject will be given a survey to evaluate the aesthetic design
12. Each question will reference a function on the device to evaluate basic usability standards:
 - a. Flexibility and efficiency of use
 - b. Aesthetic and minimalist design
 - c. User Control and freedom
 - d. Recognition rather than recall
13. Data collected from each subject will be kept confidential
14. Dismiss user and repeat steps 1-5 for the remaining users

Part 2 – Questionnaire

See Appendix A.

Hearing Aid Redesign: Test Plans

ME4/ISE: Ergonomic Compatibility Test

Part 3 – Summary of Results

Major Observations:

Description	Comments
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See appendix B for detailed results.

Testing Part 1 Sign Off _____ Date _____

Hearing Aid Redesign: Test Plans

ME 5: Ear Mold / Dome Compatibility Test

Date Completed _____

Performed By _____

Specifications Tested

Spec / Customer Need	Description	Yes / No	
S18/ CN9	Attaches to a standard ear mold	yes	

Revision History

Revision	Description	Date
1	Document Created	04/08/13

Equipment

___ Assembled Device

___ Ear molds and domes

Purpose: The purpose of this test is to verify that the device will interface with standard ear molds and domes.

Sections

- Part 1: Ear Mold / Dome Test Outline
- Part 2: Diagram
- Part 3: Summary of Data

Date Completed _____

Performed By _____

Hearing Aid Redesign: Test Plans

ME 5: Ear Mold / Dome Compatibility Test

Part 1 – Ear Mold Dome Test Outline

- ___ 1. Attach ear mold / dome to device ear tube
- ___ 2. Visually inspect connection
- ___ 3. Record quantitative analysis of connection

Part 2 – Diagram 1

INSERT PHOTO OF HOW TO ATTACH

Part 3 – Summary of Results

Mold or Dome?	Manufacturer ID	Did the part attach?	Comments / Observations

Testing Part 1 Sign Off _____ Date _____

Hearing Aid Redesign: Test Plans

ME 6: USB Feasibility Test

Date Completed 3/29/13

Performed By Kelly Murosky

Specifications Tested

Spec / Customer Need	Description	Marginal	Ideal
None	None	None	None

Revision History

Revision	Description	Date
1	Document Created	03/25/13
2	Document Populated	04/07/13

Equipment

- 2 C-Clamps (1 large, 1 small)
- Mass Hanger and Weight Set
- Wooden Block
- USB (male)
- USB (female)

Purpose: The intent of this test is to evaluate the feasibility of using a micro USB as the main connection between the transfer module and round enclosure. This test will verify that the micro USB can structurally support the transfer module without harming the round enclosure. This test will also determine if the connection is user friendly – if it will be easy for a user to plug / unplug the micro UCB connector. A mass hanger and weight set is used to determine the maximum force micro USB can support.

Sections

- Part 1: Micro USB Test Outline
- Part 2: Figure
- Part 3: Summary of Data

Date Completed 3/29/13

Performed By Kelly Murosky

Hearing Aid Redesign: Test Plans

ME 6: USB Feasibility Test

Part 1 – Micro USB Feasibility Test

- ___ 1. Solder the micro USB receptacle to the PCB as seen in Figure 1
- ___ 2. Secure the male USB plug in the C-clamp as seen in Figure 2
- ___ 3. Secure the small C-clamp by use of the wooden block then use the larger C-clamp to attach the wooden block to the table as seen in Figure 3
- ___ 4. Plug micro USB receptacle into male USB plug and attach the mass hanger, as seen in Figure 3
- ___ 5. Place a mass disc onto the mass hanger one disc at a time until the micro USB receptacle separates from the micro USB plug.
- ___ 6. Record the maximum mass before separation in Table 1
- ___ 7. Repeat steps 1-6 for a total of ten trials

Part 2 – Test Set Up

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Figure 1

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ME 6: USB Feasibility Test



Figure 2

Hearing Aid Redesign: Test Plans

ME 6: USB Feasibility Test

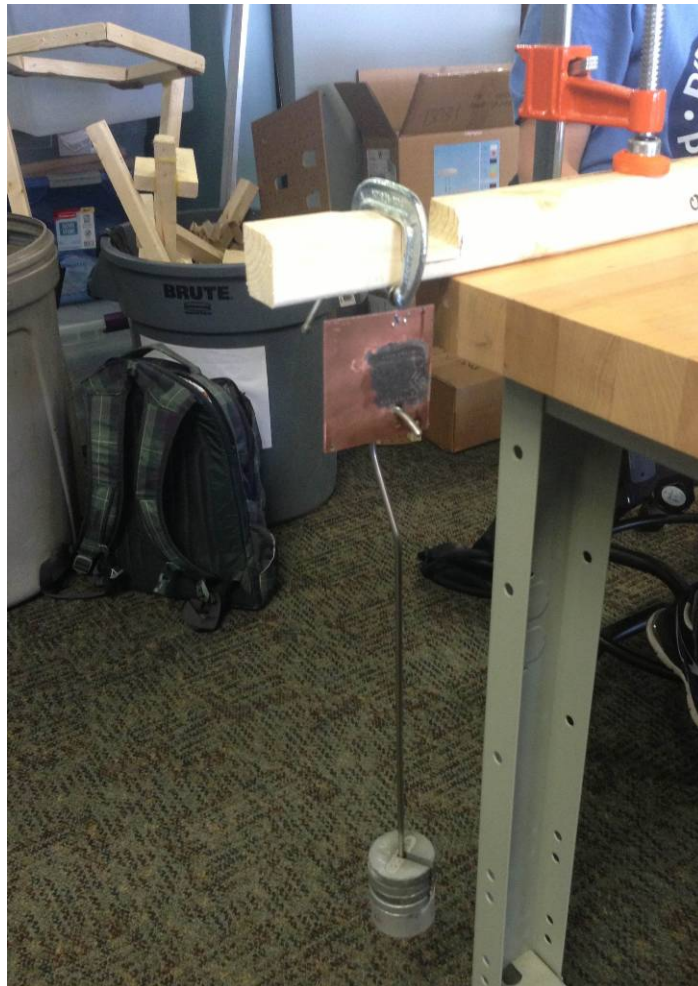


Figure 3

Part 3 – Test Results

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6	Trial 7	Trial 8	Trial 9	Trial 10	Average
Weight Before Failure	1996 g	1796 g	1846 g	1896 g	1896 g	1796 g	1996 g	1896 g	1896 g	1846 g	1886 g or 4.158 lb

Part 4 – Summary of Results

The major take away from this test is that 4.158 lb of force is required to remove the USB plug from the USB receptacle. Also, the transfer module weighs less than this 4 lb pull out force meaning that the own weight of the transfer module will not cause it to dislodge from the main enclosure. The USB connection is strong enough to be the main source of transfer module connection.

Testing Part 1 Sign Off Kelly Murosky Date 3/29/13

Hearing Aid Redesign: Test Plans

Appendix

A. Questionnaire

B. Results

Hearing Aid Redesign: Test Plans

A.

Date:

Age:

Time:

Gender:

Would you use this device is a Bluetooth ? Yes or No

Please mark how satisfied you are with the hearing aid device for each situation:

#	Question	Very Satisfied	Satisfied	Neutral	Dissatisfied,	Very Dissatisfied	NA
1	Texture of device						
2	Shape of device						
3	Color of the device						
4	Weight of Device						
5	Size of Device						
6	Ease of changing/accessing batteries:						
7	Ease of recharging device (connection)						
8	Overall Quality of device:						
9	Cost of device:						

Hearing Aid Redesign: Test Plans

B.

sample size:

Results

Question	Description	Satisfied	Neutral	Dissatisfied	NA
1					
2					
3					
4					
5					
6					
7					
8					
9					

Color Preference				
Blue	Black	Purple	red	silver
Gender	Female			
	Male			
Ages				