

Project Design Specifications (PDS)

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Title: Hearing aid using DSP provided by TI

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Function: A hearing device that will use DSP chips to allow for the shifting or compression of an audio frequency bandwidth in real-time, in order to allow the user to hear frequencies that they can no longer hear due to sensorineural hearing loss.

Client requirements: Apply and use TI DSP chips in a medical instrument.

Design requirements: Build a device that takes the input of the normal human hearing range (20-20,000Hz) and converts (shifts or compresses) the signal (via DSP chip) so that a person with impaired hearing can hear the entire scope of what a normal human can hear. This semester we will concentrate on building the platform (input and output circuitry) and learning to program the DSP chip.

- **Physical and Operational Characteristics**

1. *Performance requirements:* The device should take input from at least the entire normal human speech range range (20-10,000 Hz) and output into the limited range of the individual wearing the device. The device needs to perform real-time calculations.
2. *Safety:* The device should not emit electrical discharge that may harm the the wearer. Method of attachment must not irritate skin. Should be FDA approved
3. *Accuracy and Reliability:* The sound should be true, with no loss of frequency and minimal noise interference.
4. *Life in Service:* With a replaceable battery, the device should have a service life of at least 10 years.
5. *Shelf Life:* Must have a shelf-life of at least 20 years when stored in original packaging.
6. *Operating Environment:* Will be worn on ear for most of the day, but may be taken off at night or other times when unneeded.
7. *Ergonomics:* The device should, in the end, comfortably fit into the ear and not be easily seen or cause discomfort through excessive weight or bad shape.
8. *Size:* Must be smaller than 6 cm x 6 cm x 3 cm.

9. *Weight*: lightweight, not exceeding 50 g, as it needs to be worn on ear.
 10. *Materials*: Outer casing must be fabricated with no materials that irritate or otherwise harm the human skin. Must be soft at contact points to prevent discomfort to the wearer.
 11. *Aesthetics, Appearance, and Finish*: comfortably fit into ear, minimalistic or fashionable (bluetooth hands-free device).
- **Production Characteristics**
 1. *Quantity*: Working prototype.
 2. *Target Product Cost*: under \$200
 - **Miscellaneous**
 1. *Standards and specifications*: FDA approval for standard human use.
 2. *Customer*: People of all ages who suffer from sensorineural hearing loss.
 3. *Patient-related concerns*: Currently no patient-related concerns
 4. *Competition*: Currently there are no frequency changing audio devices that specifically act as hearing aids. Current digital hearing aids have feedback reduction, noise reduction, and speech enhancement capabilities.