Five Band Audio Equalizer

1 Introduction

An equalizer has the ability to adjust the output of different frequency bands within an audio signal. These circuits are widely used in hi-fi systems to achieve superior audio quality throughout all frequency bands. In this challenge, you are tasked to create a 5 band audio equalizer using analog electronic knowledge. After separating the frequency band, the device should be capable of applying a custom gain for each frequency band. The outputs of the 5 bands should be displayed individually using a sound level indicator.

2 Specification

Develop an analog audio processing circuit to adjust the gains of an incoming audio signal.

- Circuit should be capable of adding gains in 5 frequency bands
  - 20-300 Hz
  - 300 - 1 kHz
  - 1kHz - 4 kHz
  - 4kHz - 10kHz
  - 10kHz - 20kHz
- Use of analog electronics for implementation (transistors and operational amplifiers)
- Capable of adjusting the gain individually across 5 frequency bands.
- Mechanisms to avoid signal saturation.
- Mechanism to display the audio level of the processed frequency bands.
- Interface to give input to the device.
- Must consist of an enclosure and good quality.

3 Additional Notes

- Any change of project specification is negotiable only before the mid review
- All circuits must be simulated using software (e.g., Multisim, LTspice,PLECs,...etc.)
- All circuits should be tested on the breadboard and reviewed by the assigned supervisor before moving further
- Circuits must be designed using professional EDA software (e.g., Altium Designer, OrCAD,...etc.)
- Schematics should be verified and evaluated by the assigned supervisor
- Design for manufacturability should be considered when designing the PCB
- Complete set of design and manufacturing documents Schematics, Layout, 3D file Gerber files, Assembly files BoM must be generated and properly documented.
- Students are encouraged to procure components from international component distributors (e.g.,Mouser, DigiKey, Arrow Electronics, LCSC,...etc.)
- Students are encouraged to get the PCBs manufactured from international PCB manufacturers (e.g., JLCPCB, PCBway,...etc.)
- Main functionality of the project must be achieved with basic electronic components such as resistors, capacitors, inductors, diodes, transistors and other analog integrated circuits. Using any other pre-built programmable ICs are prohibited.
- Microcontrollers can be only used for user interface operation.
- Enclosure design must be done using a professional software (e.g., Solidworks) Enclosure and 3D model of the circuit must be assembled and inspected before manufacturing.
- 3D printing, Laser cutting and Sheet metal bending can be used to manufacture the enclosure.
- Students are encouraged to consider the 3D model and PCB co-design (design in parallel by taking their integration into consideration) when designing.
- Final implementation of the project need to done in a PCB.
- Follow provided “General guidelines”.