A9 - Legal and Regulatory Analysis

Year: 2024. Semester: Spring Team: 12 Project: Microphone Interface
Creation Date: March 19, 2024 **Last Modified:** March 21, 2024
Author: Joshua Hom **Email: hom2@purdue.edu**

Assignment Evaluation: See the Rubric in the Brightspace Assignment

1.0 Regulatory Analysis

For our device to be sold on the market, we will need certification from the FCC and the ROHS. For FCC, our project would fall under part 15 which is the unintentional radiator category. This describes a computer with a high-frequency clocking circuit. To be ROHS compliant, our project would have to not contain toxic elements under a certain limit.

We intend for our device to be a *Class B digital device* which is marketed for use in both a commercial and residential environment. FCC defines our device as an unintentional radiator which is any device that operates at radio frequencies being above 9 kHz. For us to verify that our device is in Class B, we would need to measure field strength of the emissions from our device at a certain distance. Since the max clock frequency on our device is 216 MHz the field strength of radiated emissions at 3 meters shall not exceed 150 microvolts per meter[1]. Should our device violate this limit we have ideas to reduce this such as adding metal shielding to our packaging.

We also have reason to believe that our device will also be RoHS compliant. This is supported by checking the material of each component in our device. Our PCB, the majority of our device, is manufactured by JLC which has stated to be RoHS compliant[2]. In addition, we plan to use lead-free solder and most of our discrete components has documentation that explicitly states it is RoHS compliant. One way to verify this is to use an X-ray fluorescence metal analyzer which can screen for the restricted materials[3]. Should violations arise, the capability of our device being RoHS compliant will be based on how replaceable said components are.

2.0 Legal Liability Analysis

2.1 Analysis of Patent 1, US Patent Application US9864569B2:

Patent Title: Adaptable audio devices and systems
Filing Date: 2017-05-23
Patent Holders : Michael J. Pelland, Howard M. Eglowstein

This patent describes an external interface that first receives audio-encoded signal from a source device that converts such signal into one compatible with a sound producing device. The connection between the devices can be some form of wired or wireless connection. The device also has a controller and a DSP aspect. Explicit claims that our device can potentially infringe on is:

1. A sound-producing device, comprising: a housing, an audio transducer disposed within the housing, a digital controller and a signal processor disposed within the housing, the signal processor coupled to the digital controller and having an analog input , a digital input, and an audio output, the audio output, the audio output coupled to the audio transducer, and an audio jack suitable for removable connection to an audio plug, the audio jack disposed proximate an exterior of the housing…
2. A power source configured to provide electrical power to the audio jack.
3. A user interface mounted to the housing and coupled to the digital controller, the user interface adapted to provide status information to the digital controller, or adapted to receive information from the digital controller, or both.

Our device seems to be very similar to the description of this patent. The claims described above is what is included in our design. We will have an audio jack that receives a signal from a device, apply DSP and output through an audio jack. However, some key differences between them are that the patent entails a rechargeable battery inside the device. Our device will be powered by USB connection from a computer or plug. There is no battery. It also entails two audio sources and a switch that can determine which source is chosen. Our design will only receive one audio input. These key differences point out that there is no infringement on this patent.

2.2 Analysis of Patent 2, US Patent Application US20060064186A1:
Patent Title: Audio signal processor with modular user interface and processing functionality
Filing Date: 2004-09-23
Patent Holders : Marcus Ryle, Michel Doidic

This patent describes an audio processing device (APD) and a removable module. The APD includes a digital signal processor that modifies an input audio signal in accordance with a signal processing instruction set. The patent also includes a user interface having at least one control to set a control parameter that is transferred to the DSP to further modify audio processing.
Explicit claims that our device can potentially infringe on is:

1. An audio signal processor to perform an audio processing function upon an input audio signal
2. A method to perform an audio processing function upon an input audio signal comprising: receiving an input audio signal at the audio processing device

The basic design of this patent and our device is similar. They both have audio in and out and apply DSP using a microcontroller and a user interface. However, there are some key differences. For example, the patent seems to be tailored specifically towards a guitar pedal basis, entails a removable module that is coupled to the APD, and composes of a multi-state footswitch. Our device won't have any of these features and will be specifically made for microphones and hand operated therefore, no infringement.

2.3 Analysis of Patent 3, US Patent Application US10237651B2:
Patent Title: Audio signal processing method and electronic device for supporting the same
Filing Date: 2016-08-12

Patent Holders : Beakkwon SON, Gangyoul KIM, Yangsu KIM, Chulmin Choi, Jinwoo Park, Gunhyuk YOON, Namil LEE, Yonghoon Lee, Keunwon Jang, Seungyoon Heo

This patent describes an audio processing method and an electronic device for supporting it. It consists of a processor that has a communication unit, input unit, touchscreen display, and an audio processing unit that will apply DSP. The method describes a flowchart of how it will detect an audio signal and determine how to modify it. Claims that our device can potentially infringe on is:

1. An electronic device, comprising: a memory for storing a first audio signal process and a second audio signal process for processing an audio signal; and a processor functionally connected to the memory,
2. An audio signal processing method, comprising performing a first audio signal process by applying predetermined audio parameters to an audio signal to be output through a speaker in response to a request to play the audio signal.

The hardware aspect of this patent is very similar to our design with the key difference that it has a communication unit and a speaker. On the software side, however, highlights the defining method of processing the audio signal that won't be the same. For instance, their method describes a first audio signal process that aims to enhance it by optimizing at least one parameter value and adjusting the gain. It also describes a second process, that its effects are made unclear, which will process the audio signal should a condition be satisfied through the touchscreen display. We currently don't have it in our design, but it may be a good idea to figure out a way to adjust our incoming audio signal if it isn't sufficient for DSP. However, the second process is like our design through the fact that we will try to implement a touch screen display as an interface. Since we do not share key hardware components and audio signal processing design choices, our device won't infringe upon this patent.

3.0 Sources Cited:

[1] Federal Register. (2014). The Federal Register, [Online]. Available: https://www.ecfr.gov/current/title-47/chapter-I/subchapter-A/part-15#p-15.109(a)

[2] JLC. (2023). RoHS and lead-free compliance, [Online]. Available: https://jlcpcb.com/help/article/28-ROHS-and-Lead-Free-Compliance

[3] Sigmatest. RoHS compliance testing: RoHS compliant, [Online]. Available: https://www.sigmatest.org/rohs-compliance-testing.html#:~:text=RoHS%20compliance%20is%20tested%20with,screening%20of%20the%20restricted%20metals.

[4] Michael J. Pelland, Howard M. Eglowstein, "Adaptable audio devices and systems" U.S. Patent US9864569B2, May 23, 2017

[5] Marcus Ryle, Michel Doidic, "Audio signal processor with modular user interface and processing functionality" U.S. Patent US20060064186A1, September 23, 2004

[6] Beakkwon SON**,** Gangyoul KIM**,** Yangsu KIM**,** Chulmin Choi**,** Jinwoo Park**,** Gunhyuk YOON**,** Namil LEE**,** Yonghoon Lee**,** Keunwon Jang**,** Seungyoon Heo, "Audio signal processing method and electronic device for supporting the same" U.S. Patent US10237651B2, August 12, 2016