

# The Importance of Frequencies in Sound

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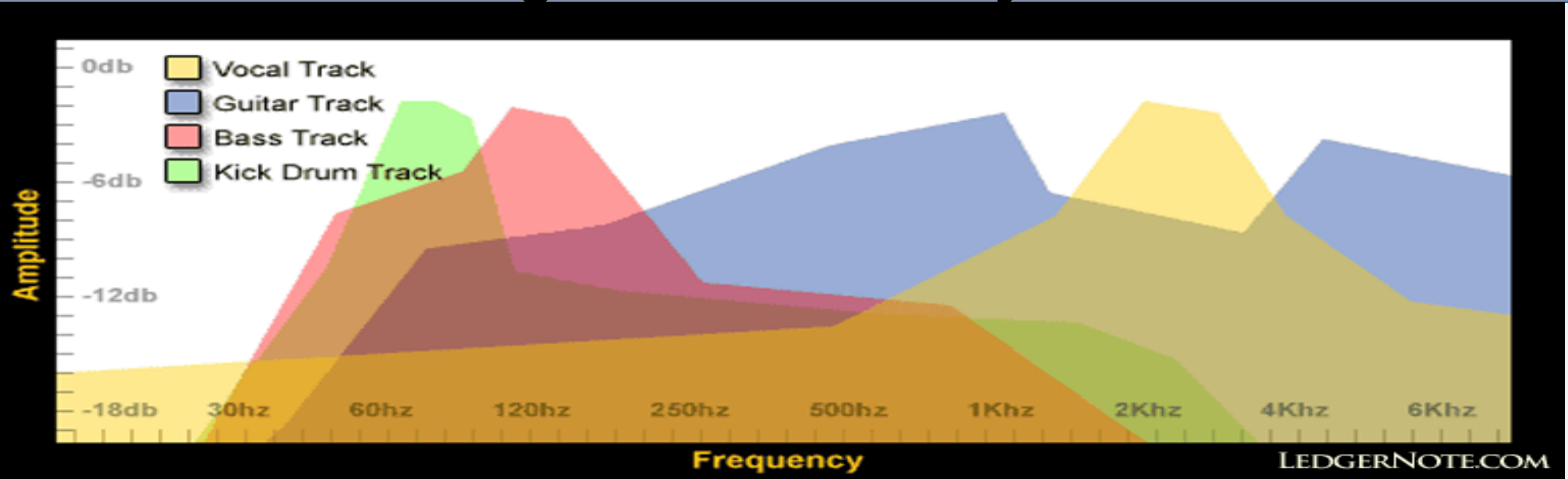
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## Abstract

Sound frequencies are the various types of wavelengths that reach our ear and produce the sound that we hear everywhere. Each instrument and each vocal have a different frequency range that they are in. Knowing these as well as adjusting your sound system to combat the unwanted frequencies can make or break a live concert experience. Equalization is the difference between a clean, crisp sounding concert and one that sounds muddy or is missing a key instrument. This study focuses on equalization in relation to live sound concerts where instruments and vocals are being amplified through a PA system. Of course, sound frequencies also vary given specific environmental factors. These environmental factors include, but are not limited to, size of the space, temperature, and capacity. Understanding all these factors, the overall focus is how to receive the highest quality of sound for the instruments.

## PA System Guide

The sound system is made of various parts. The most basic set up is an output (sending out the sound signal) such as a speaker, a sound board, and some type of input(receiving signal) such as a microphone. Each input is assigned a specific channel which can be manipulated and controlled. An equalizer may be included in a sound board or be a separate unit that is connecting to the sound board. The sound board serves as the main hub for control of all audio aspects such as the decibel(volume) level of all inputs and outputs.



Frequency graph from Ledgernote.com

## Instrument Frequencies

Researching into the various instruments that could make up a live concert displayed their various frequency ranges and what the instrument produces at that specific range as well as how to control them through equalization. I focused on the instruments that would typically make up a rock concert or something of that equivalent. That includes drums(kick, snare, high hats), bass guitar, electric guitar, and vocals.

### **Kick Drum**

- 50-100Hz is where the punch of the kick is
- 150-250Hz can be cut to add more quality to the mix
- 300-600Hz is where it can sound boxy
- 2-4kHz is where the snap is and can be boosted to bring out the kick in the forefront of the mix

### **Snare Drum**

- 150Hz can thicken the sound
- 500Hz rounds the sound out
- 3kHz gives clarity

### **High Hats**

- Anything below 600Hz should be filtered for clarity
- 1kHz-4kHz is where the sharp clang of the hats lie

### **Bass Guitar**

- 40-80Hz most basses bottom end or echo
- 80-200Hz is the focus of the bass frequencies
- 800-1600kHz is where the attack or hit of the bass

### **Electric Guitar**

- 90Hz and below should be filtered for clarity
- 300-1000Hz is where the main parts of an electric live
- 3-8kHz can bring the electric guitar forward in a mix

### **Vocals**

- 100Hz and below should be filtered to reduce rumble created by movement
- 200Hz can create a congested sound
- 800-1000Hz can add clarity
- 3kHz adds some vibrancy to a mix
- 4-8kHz can eliminate sharp hits of ending consonants

## Background Information

Equalization(EQ) can be defined as adjusting different frequencies in a spectrum by adding or subtracting volumes. This is commonly referred to as ”boosting” or “cutting”. At the most basic level the frequencies are divided into frequency ranges of lows(0-100Hz), mids(100Hz-3kHz), and highs(3k+).The Sound Engineer or Audio Engineer (A1) are usually in control of equalizing the space for the show. They are the ones in charge of what is commonly know as the mix of the show. The engineer has various types of equalizers for use in live sound which include, but are not limited to:

- Graphic EQ(Ability to control volume of frequencies)
- Parametric EQ(Ability to control volume, select primary frequencies, and manipulate bandwidth)
- Shelving EQ(Ability to boost or cut in the low or high range of frequencies)

Anything connected to the sound board is available to equalize which includes speakers, groups of channels, and individual channels. Equalization is highly subjective to the preference of the sound engineer or A1.

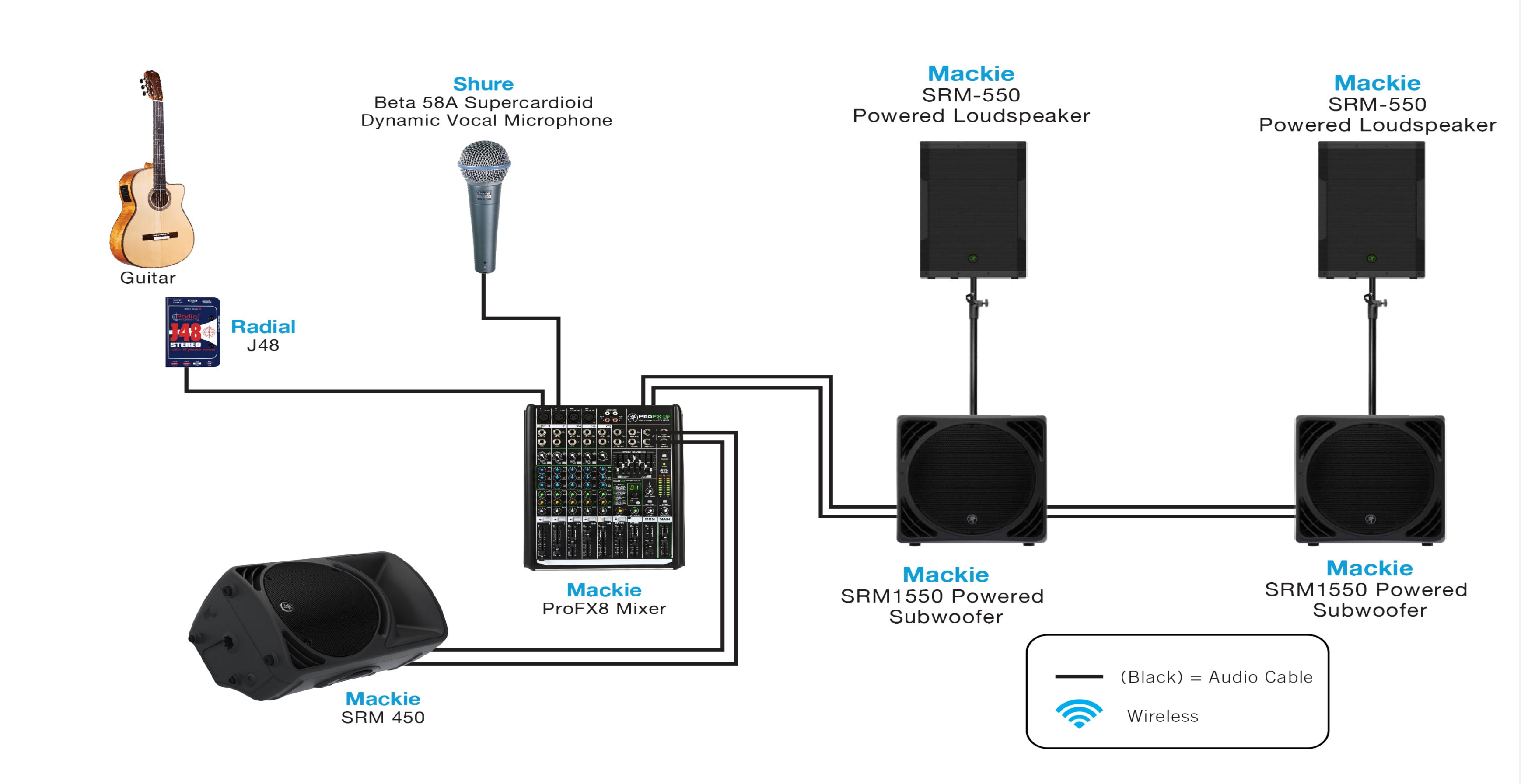
There are also filters that can be added which are extremely useful, the most common in equalizing is the High Pass Filter (HPF). This filters out lower frequencies that may not be needed while still allowing the higher frequencies to pass through. They are usually set around 100 Hertz(Hz) or below.

## Conclusion

Equalizing a sound system for a live concert requires a lot of attention to the various frequencies that these instruments emit. Since the frequencies of the instruments vary quite a bit, I believe the use of the parametric EQ will allow the selection of very precise frequencies and the max amount of control. One may also combine this with the use of an HPF to combat some of the unneeded sound that may come out of the low end. Overall, I think the most important thing to achieve with equalization is to make sure that the instruments do not get lost in the mix and that there is a high level of clarity. Following these basic guidelines is a great base step into fine tuning a concert experience.

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Signal Flow Diagram from NMK Electronics