THE SYSTEMATIC EQUALIZING

FOR REAPER SOFTWARE

(HOME RECORDING)

Course: TECM 2700

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Table of Content

Introduction

The User Manual contains all the essential information for users to work with Reaper software, which is a third party equalizer software for mixing a recorded song. This will allow the user of Reaper or other similar recording software to understand how to go about sound mixing in a music production. This manual is aimed to provide a solution for users who wish to create a low cost yet somewhat professional grade music recording at home. The manual also gives an insight on how to understand and isolate the individual sounds of recorded instruments that are amplified in the speaker. This will ensure that the sound from each instrument and the vocals are "glued" together properly in a recorded song, thus making the recorded music flawless without any unwanted distortion.

The manual will help users understand and perform a clean recording process with minimal effort. This will definitely save music recorders a lot of time and get a handle on the ambiguous procedure of sound mixing. The users will also be able to recognize the bottlenecks in the equalizing process. In addition to this, the manual will help the users understand and identify the frequencies of sounds created by different music instruments. Thus, the users will have a better understanding of the tedious process of listening to recorded music and quickly identify the problem areas and correct them as needed.

In this manual, the proper procedure of recording music will be discussed first, followed by a detailed explanation of the equalizing process with the help of graphics. The manual will provide a better solution to sound mixing and recording because it will provide information about not only the sound recording process but also the common problems that arise in such recording scenarios and how these problems can be eliminated. The manual is focused more on how to solve the problems that surface during recording rather than focusing on how such problems surface.

Chapter 1
REAPER SOFTWARE AT A GLANCE

Chapter 1: Reaper Software at a Glance

This guide describes the reaper software version 3.76 for windows 7/vista/8.
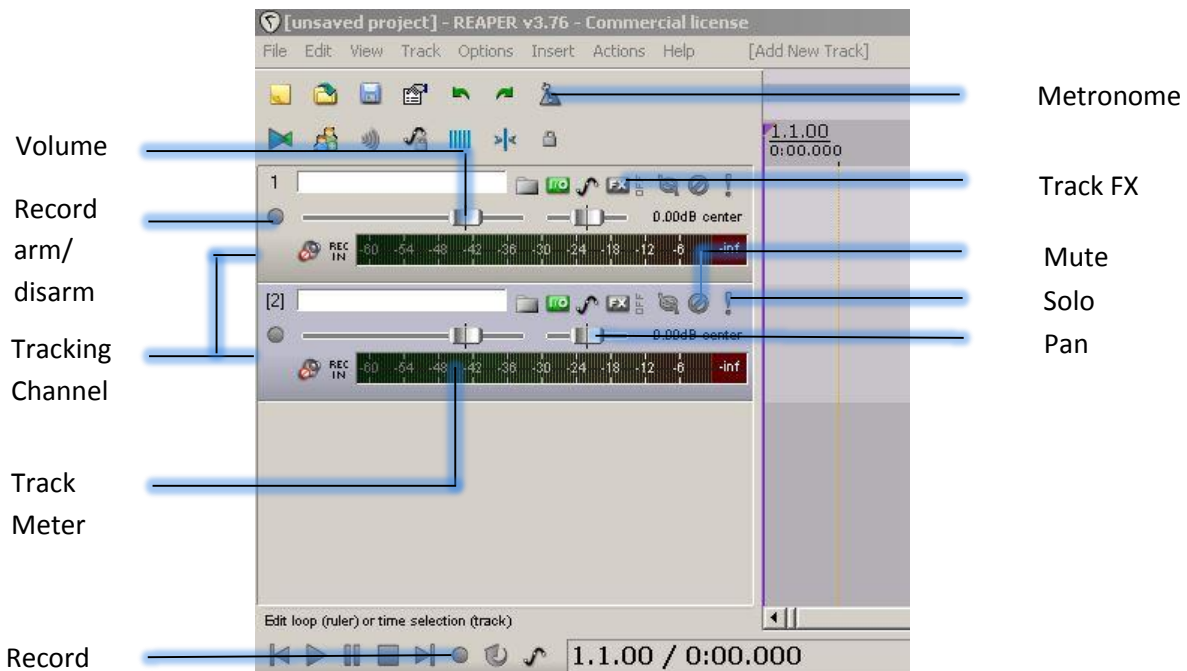
Reaper Overview

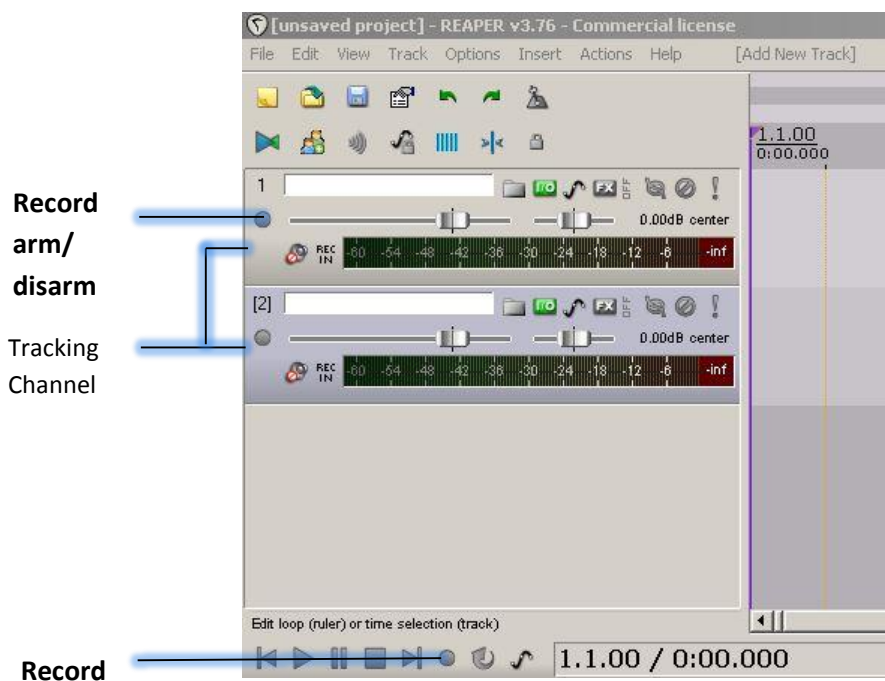
Figure 1 Reaper

USB Recording Interface

The first step will be to purchase an external sound card (**USB recording and modeling interfaces**) such as **Tone port UX-2** along with a **Line-6 Gear box** software. This brings the Line-6 guitar, bass and vocal tone to the world of desktop recording. Gearbox modeling software provides 16 guitar and 5 bass amp/cab models, 24 stomp box and studio effects (up to 10 at once), and 6 models of high end studio microphone preamps. You should attach the USB of your tone port to the computer before starting the **Reaper** software. If you are looking forward to make music using no actual instruments, then you do not have to buy the USB recording interface.

What is Reaper?

The Reaper is a **digital audio workstation** (DAW) that is an electronic system designed for recording, editing and playing back digital audio. This software runs on any computer with audio interface hardware (Tone port UX-2). Press Ctrl-P, after you open the Reaper software. This will take you to the **Device** sub-section under **Audio**. You need to change the audio setting from **Wave Out** to **ASIO**. This will allow you to change the **input** and the **output** device settings as needed.

How to Record?

The guitar should be plugged into the **USB** interface of your computer if you want to record the notes from your guitar. Go to **Insert** and click on **Insert new track**. Click the **Record Arm/Disarm** button. At this point, you should be able to see some gain in the track meter. After you click on **Record**, then it will start recording. It is important to remember that the options Record and the Record Arm are not the same thing. Record Arm allows you to record in that tracking channel. Record allows the guitar (or the instrument attached to the computer) to be recorded.

Figure 2 Record arm, Record in Reaper

Right click on the **All tracking channel** and then go to **Set track time base**. Then click on **Beats** (position, length and rate). This allows you to change the tempo for all the tracks at the same time.

Monitoring

For proper mixing you will need a good environment with proper **monitoring system** condition. You will not be able to mix with accurate details unless you invest in a good monitoring system. It is also recommended that you invest in **acoustic treatment** and a good headphone. Listen to your mixing to other systems to understand the sound mixing better.

The Art of Listening

It is vital that you learn how to listen and separate out the problem and make a solution for it accordingly. Once you are familiar with this, you will be able to use compressor, equalizer, and reverb. In this manual, the information about equalizers will only be discussed.

Home Recording

Professional recording studio can be very expensive just a basic set up. Therefore, home recording presents an affordable alternative solution to such recording set up. Nowadays, it is not even needed to physically purchase any additional musical instruments for the background sound. You can simply use (VSTi) plugins for drums, bass and keyboards. However, at present there are no good (VSTi) plugins for classical instruments and electric guitar. When you are recording any instrument, each instrument should be in separate tracking channel. For example, if a song that you want to make contain guitar, drums and bass pieces, then the guitar needs to be in one track, the bass needs to be in another separate track and the drum needs to be in another separate track. However, it is recommended to have two guitar tracking channels for better guitar rhythms or riffs. One guitar should be panned to the left and the other to the right. You should always record the left and the right channels of guitar separately even if you have identical pieces playing in both of them. You will also need to have separate channels for the lead or solo guitar piece which needs to be panned to the center position. All the **VST** plugins that you use should be in **mono** not **stereo** setting. In the next section, the concept of plugins is discussed further.

Virtual Studio Technology (VST) Plugins

Virtual Studio Technology (VST) Plugin is a software component that adds a specific feature to **DAW** like Reaper which integrates **audio synthesizer** and **effect plugins** with **audio editors**. VSTi Plugin is a **Virtual Studio Technology instrument (VSTi) Plugin**. VSTi allows you to use virtual instruments such as **Superior Drummer** for drums and **Trillian Bass** for Bass. It is vital to always remember that VST and VSTi are not the same thing. VST can be used on sounds that are recorded through audio interface and on VSTi plugins. VSTi works on **midi input**. Although using VSTi can be challenging and somewhat overwhelming, it is important to know how to work with midi notes for proper recording. In this manual, the set up for Superior drummer (VSTi) plugin for drums in the Reaper software will be discussed. You can set up the other VSTi or VST plugins by following the same procedure.

How to Setup Superior Drummer 2.0 in Reaper?

Superior drummer is the virtual drumming software. It can be used in Reaper. The steps shown are only applicable for Windows XP/Vista/7. Before installing the software, make sure that you know the destination folder where the Superior Drummer plugin will get installed. By default, the Super Drummer plugin creates two folders in the program files. One is **Toontrack** and the other is VST plugins. The next step will be to look for superior drummer**.dll** file, which is located in the VST plugins folder. Copy the superior drummer.dll file and go to the Reaper folder. Inside this folder, you will see a **plugin folder** where you need to click again. You will then see FX folder. This is where you will need to paste that .dll file.

Now, click on the Reaper software. Then go to Track to insert a new track. Once you enter the track, you will see the word fx being displayed on the track. When you click it, it will turn blue and an Add Fx to: window will show up. Inside this window, go to VSTi and there you will see the VSTi: Superior Drummer 2.0 (Toontrack). Then click on the Superior Drummer VSTi. A whole heartwarming Ny – avatar drum kit will be displayed. Now if you want to make a beat, select superior drummer track and go to insert and click on new midi item. A blank untitled midi item will appear on the track. Double click the blank item and you will see a **piano roll** where you can make beats with it.

Figure 3: Superior Drummer in Reaper

Quick steps
1. After installing, look for superior drummer.dll in program files
2. Copy paste the .dll in Reaper/plugins/fx
3. Go to reaper software, insert a new track
4. Turn on the fx and select VSTi
5. Click on the superior drummer VSTi
6. Insert new midi item to make beats with piano roll
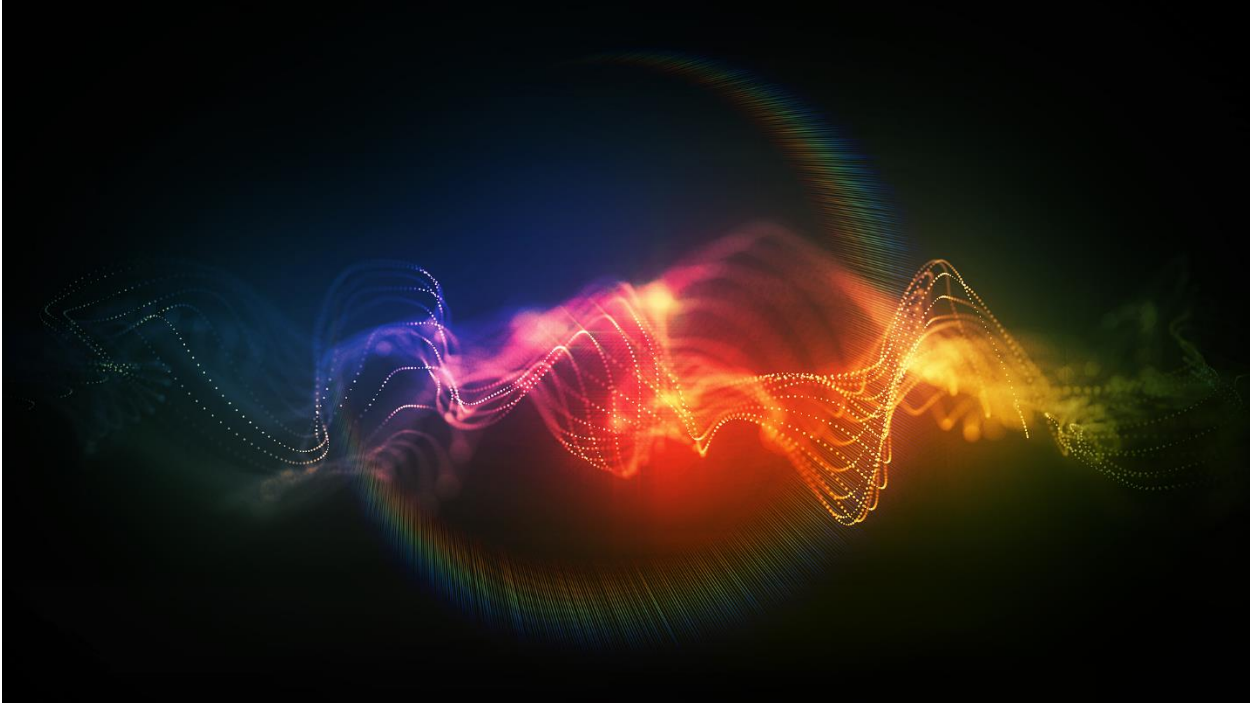
Chapter 2
GETTING STARTED

Chapter 2: Getting Started

Equalization (EQ)

This guide describes the Waves Equalizer (Q10) VST plugin for Windows 7/Vista/8.

When we think of a clean mix, it is actually the idea of equalization. At first, you have to identify where the problem zones are. The problem zones need to be isolated from the **source**. The source is the recorded guitar, drum, piano, vocal or any other instruments that is in a recorded song track. There are some particular **resonances or artifacts** within the **frequency response** of the source where you should be most concerned. Once you find the problem zone cut the **gain** as needed at that frequency. You can also find the problem areas by cutting or boosting and also by altering the center frequency to the right and left. This method is called **surgical method**. Keep repeating this method until the artifact disappears. Once the problem areas are removed, the next step is to boost. If a bit of body is lost in the cut then a bit of boost can be applied to certain frequencies. The EQ process should not be done when all the tracking channels are active. You should do a solo track and then apply the EQ for individual instruments. After the surgical EQ is completed, the goal is to glue all the instruments together.
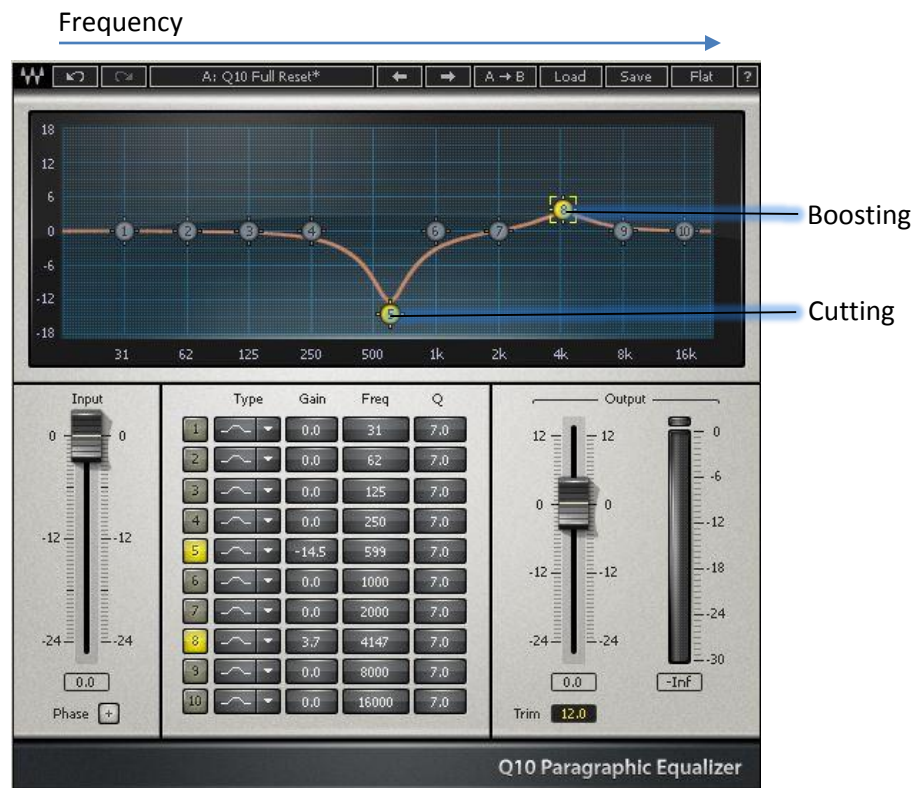

Figure: 4 Equalizer (10 Bands)

Spectrum Legends

The band frequencies will be discussed throughout this manual. These band frequencies are included to avoid any confusion. The **Spectrum Legend** is an approximation of band frequencies.
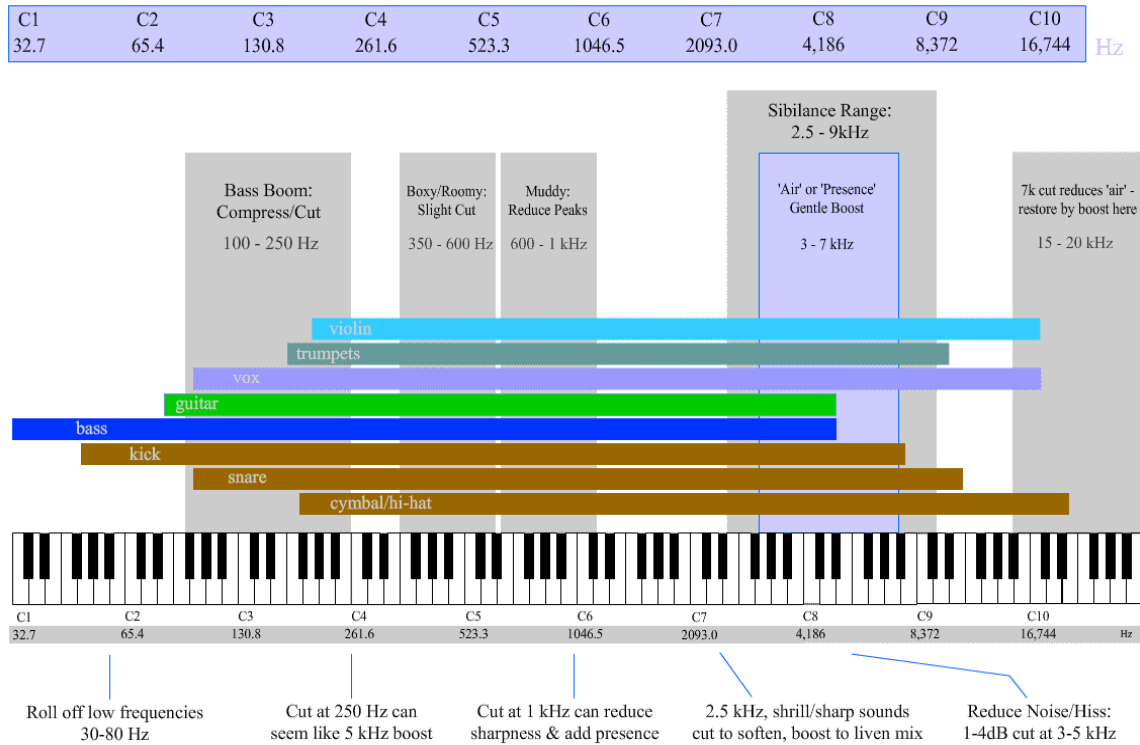
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	
32.7	65.4	130.8	261.6	523.3	1046.5	2093.0	4,186	8,372	16,744	Hz

Sibilance Range: 2.5 - 9kHz

Bass Boom: Compress/Cut 100 - 250 Hz	Boxy/Roomy: Slight Cut 350 - 600 Hz	Muddy: Reduce Peaks 600 - 1 kHz	'Air' or 'Presence' Gentle Boost 3 - 7 kHz	7k cut reduces 'air' - restore by boost here 15 - 20 kHz

violin
trumpets
vox
guitar
bass
kick
snare
cymbal/hi-hat

C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	
32.7	65.4	130.8	261.6	523.3	1046.5	2093.0	4,186	8,372	16,744	Hz

Roll off low frequencies 30-80 Hz

Cut at 250 Hz can seem like 5 kHz boost

Cut at 1 kHz can reduce sharpness & add presence

2.5 kHz, shrill/sharp sounds cut to soften, boost to liven mix

Reduce Noise/Hiss: 1-4dB cut at 3-5 kHz

Figure 5: Equalization Frequency chart

Sub-bass:	60Hz and below
Bass:	60 to 120Hz
Mid-bass:	120 to 250Hz
Low-mid:	250-600Hz
Core-mid:	~1kHz
High-mid:	2kHz to 5kHz
Highs:	5kHz to 10kHz
Super-Highs:	10kHz+

Compression

Compressors are dynamic reduction tool. This allows a greater control for fine sculpting the dynamics of the track mix. The following are some of the key terms used in the compression process:

Threshold: This is the point (gain) where the compressor will start to act.

Attack: This is the amount of time taken by the compressor to reduce the gain when the point reaches above the threshold.

Envelope/Knee: It determines how the compression will be implemented. There are two kinds of envelopes - **Hard Knee** and **Soft Knee**. Hard knee means the compression will act right at the moment when the point reaches above the threshold. Soft Knee means the compression will act gradually before the point reaches above the threshold.

Ratio: This is expressed in the unit decibel *(dB)*. It is the ratio of input *(before compression)* and output *(after compression).*

Release: This is the amount of time taken for the compressor not to act anymore after the point reaches below the threshold.

Output gain: This is a make-up gain control.

Figure 6: Compressor

Reverb

Reverb provides a common ground for the separate tracks. It makes sense to set up your plug-ins so that the same effect can be applied to multiple tracks at the same time. Drum kit usually needs reverb. This reverb is usually added to snare, kick and overheads separately through the **bus channel** because snare needs the most reverb, then kick and then the others need the least.

Effects

The effects units are electronic devices that alter how a musical instrument or other audio source sounds. These effects can be applied using VST. Some of the effects are as follows:

Overdrive/Distortion: Electronic differences are almost the same between a distortion and an overdrive. Distortion exactly distorts and clips the signal at any volume. The amount of distortion stays the same. Overdrives provide not only distortion but also provide the guitar player control of the **clipping** through dynamics.

Wah-wah: This acts as a filter to boost the frequencies of the instrument signal around the moving frequency center. This allows the musician to emphasize on different areas of the frequency spectrum while playing.

Chorus: Chorus splits your guitars signal in two components. After this, the pitch of the signals is delayed or **modulated** in a different pitch and mixed back in with the dry signal.

Delay: A delay VST creates a copy of an incoming sound and slightly delays its time. This creates a slight smooth echo effect.

Figure 7: Guitar Rig Multiple Effect (VST)

Chapter 3
EQUALIZATION FOR DRUMS

Chapter 3: Equalization for Drums

Kick

The key steps in kick equalization are as follows:

- You should filter out most of frequencies below 36Hz when the music is fast paced. This is done by using **high pass frequency filter**.
- Frequency cut around 100 Hz to 200 Hz should be done to make space for instrument bass. It should be done using **band pass filter**.
- Boost around 60 to 80 Hz using band pass filter.
- Boost around 6 kHz to 10 KHz using band pass filter.
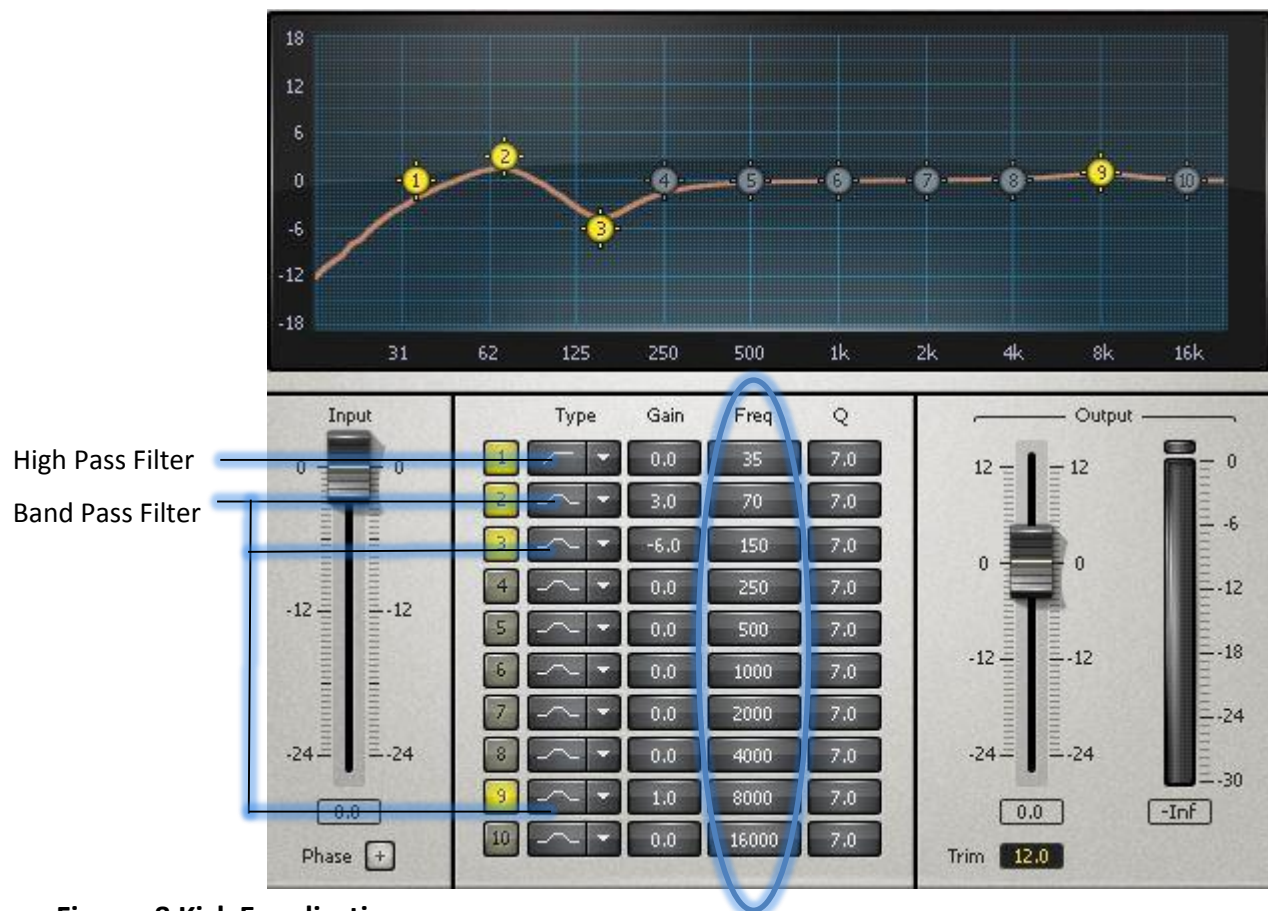
Figure: 8 Kick Equalization

Snare

There are two snares equalization for top snare and bottom snare. Top snare gives the body of the drum and bottom snare gives the crack or sizzle snare wires sound. The steps for snare equalization are as follows:

Top Snare
- Filter out the frequencies below 70Hz using high pass frequency filter.
- Add **low pass filter** at 12 kHz.
- Cut the ringing frequencies nearby low mid-range spectrum around 300 to 900 Hz using band pass filter.
- Try cutting the areas in between (200 to 500) Hz or (500Hz to 1 KHz) depending on the problem areas that you think are present using band pass filter.
- You can use **low shelf** at 100 Hz or you can boost around 100 to 200 Hz using band pass filter.
- Cut around 2 to 4 KHz.
- Boost around 6 KHz to 10 KHz.
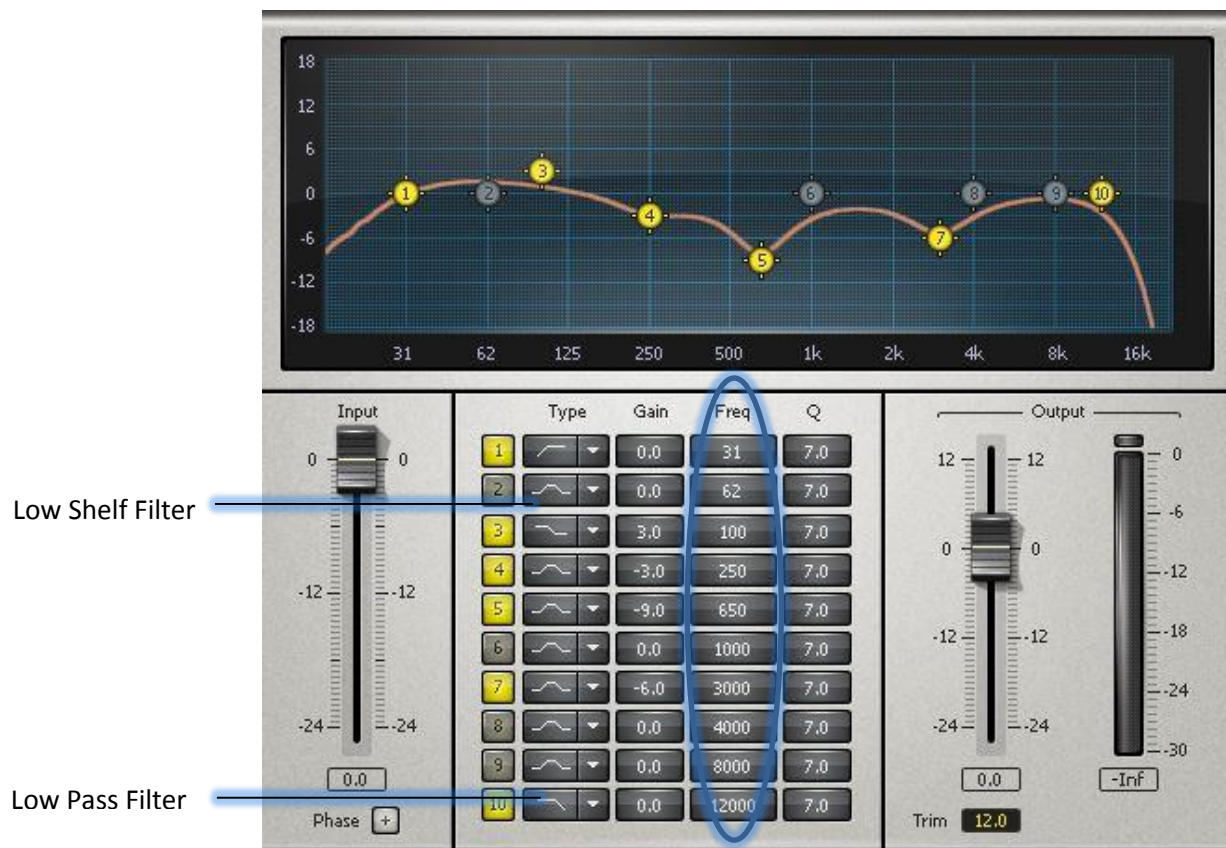
Figure: 9 Top Snare Equalization

Bottom Snare

- Filter out the frequencies below 90Hz using high pass frequency filter.
- Boost around 100 to 200 Hz using band pass filter.
- Boost around 5 KHz.

Figure: 10 Bottom Snare Equalization

Toms

Toms usually have some mud in lower mid and have resonant frequency on mid bass frequencies. As usual, our goal is to cut down the resonant frequency. The steps for tom equalization are as follows:

- You should filter out most of the frequencies between 50 to 90Hz. This is done by using high pass frequency filter.
- Frequency **scoop cut** around 200 Hz to 400 Hz will clear the tone. It should be done using band pass filter. Scoop cut is usually a wider cut which can be done by lowering the value of **Q point**.
- Cut frequency around 600 to 800 Hz using band pass filter.
- Boost around 6 kHz to 8 KHz using band pass filter.
- If the sound still resonates, try cutting the areas between 100 to 200 Hz.
- Boost around 50 to 120 Hz using low shelf.
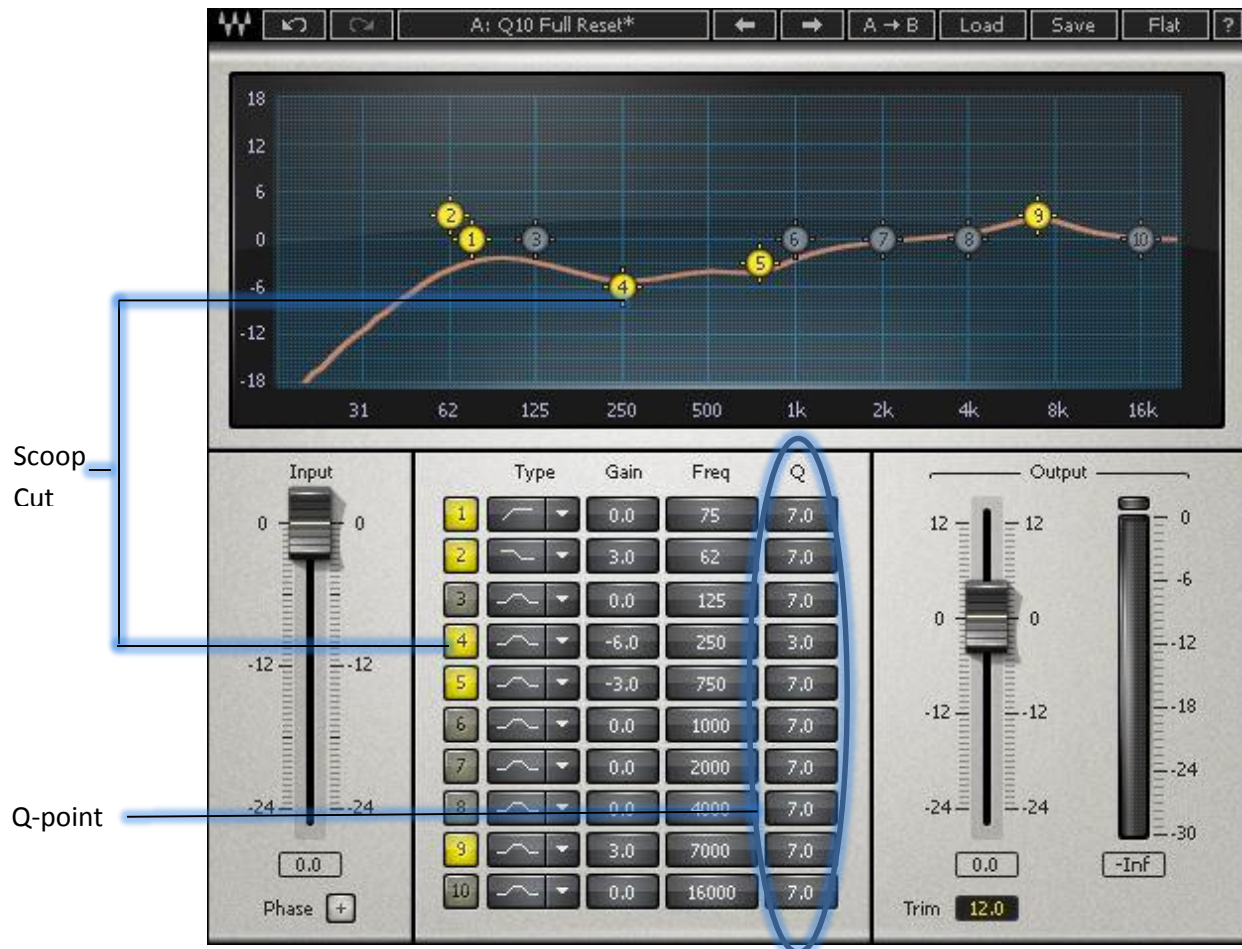
Figure: 11 Tom Equalization

Hi-Hat

The steps for Hi-hat equalization are as follows:

- You should filter out most of the frequencies between 90 to 250Hz. This is done by using high pass frequency filter.
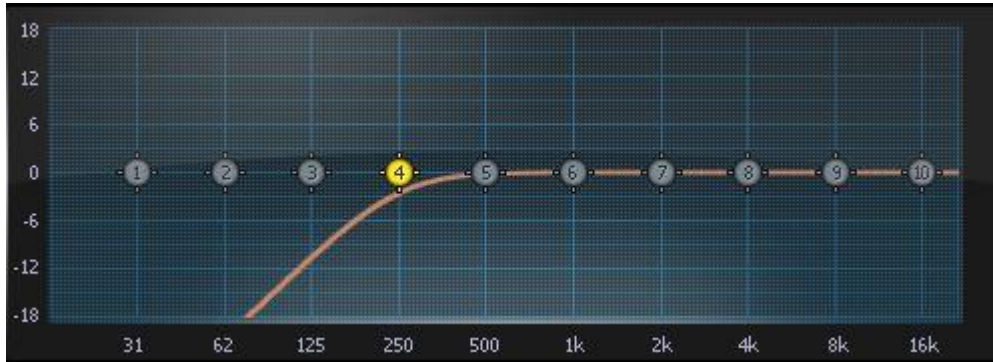
Figure: 12 Hi-Hat Equalization

Overhead

It includes all the crashes and cymbals. The steps for overhead equalization are as follows:

- You should filter out most of the frequencies between 90 to 250Hz. This is done by using high pass frequency filter.
- Do a wide scoop cut frequency between 300 to 700 Hz using high pass filter and lower Q point.
- **High Shelf** boost at around 8 to 10 kHz.
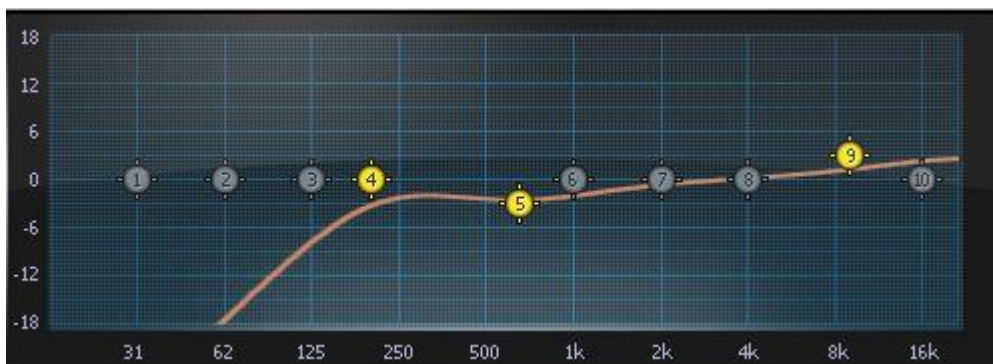
Figure: 13 Overhead Equalization

Frequency Summary Table (Drums)

There is no specific rule for equalization but this guide will make you go through the thinking process.

20 Hz to 70 Hz	**Snare and toms are usually filtered out. Boost of kick is done around 70 Hz**
100 Hz to 200 Hz	**Snare and toms are boosted up**
200 Hz to 400 Hz	**Cutting frequency for kick**
600 Hz to 800 Hz	**Scoop cut in this area brings depth of the drums**
2000Hz/2 KHz	**Boost on this area brings cymbal presence and drum stick attack**
2KHz to 4 KHz	**Boost on kick, snare and toms. Cut for cymbals**
6KHz to 10Khz	**Boost to add clarity**
10Khz and more	**Air**

Table 1: Drums Frequency Summary

Chapter 4
EQUALIZATION FOR BASS

Chapter 4: Equalization for Bass

Surgical Approach

Usually we use two forms of bass – the direct raw bass and the distorted bass in the Reaper. At first, we take the direct raw bass and then equalize it. After this, we take the equalized bass and pass it through another bus channel. Here, we apply the distortion to it and use the equalizer again. These two bass channels (direct raw and distorted) are passed into another channel. The whole process is shown in the flow chart diagram below.
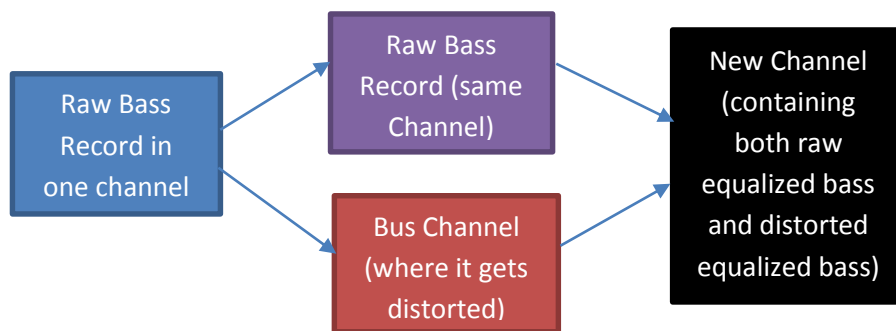
Figure 14: Bass Recording Process

First Equalization involves
- Filter around 200 to 300 Hz using high pass filter.

Second Equalization involves
- Filter around 500 to 700Hz using high pass filter.
- Use low pass filter at 4 KHz
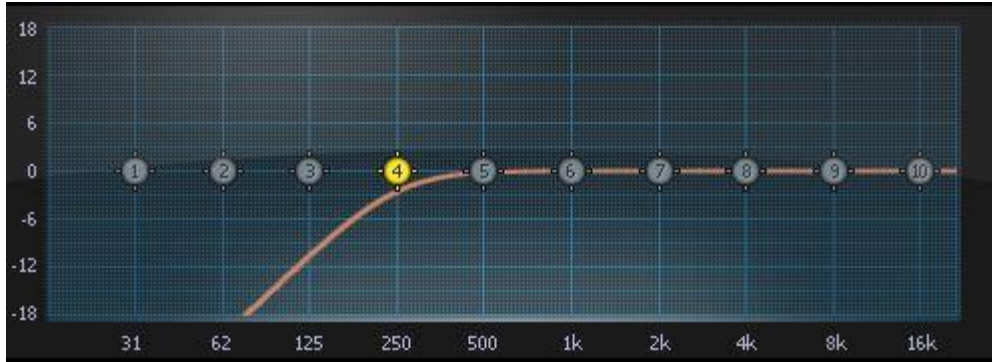
Figure 15: Raw Bass Equalization
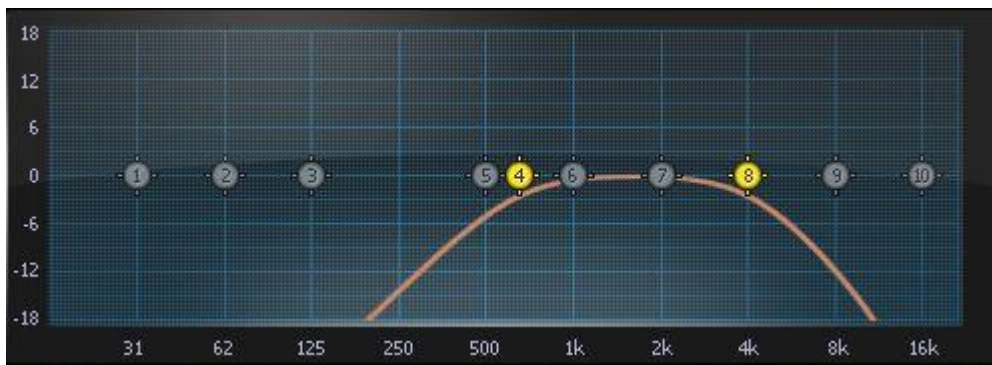
Figure 16: Distorted Bass Equalization

Frequency Spectrum Summary (Bass)

0Hz to 60Hz	**Sub content to add below bass drum**
60Hz to 80Hz	**Usually cutting**
80Hz to 140Hz	**Where most of the bass lies**
500Hz to 900Hz	**Needs cutting**
4Khz and more	**Needs to filter out using low pass filter**

Table 2: Bass Frequency Summary

Chapter 5
EQUALIZATION FOR GUITAR

Chapter 5: Equalization for Guitar

High Gain Guitar

The **dry input** of electric guitar is passed through VST **amp** and VST **cabinet**. Then it is passed through the distortion VST plugins. The modulated gain guitar is also called the high gain guitar. The steps for Hi-Gain guitar equalization are as follows:

- High pass filter between 60Hz to 140Hz.
- Low pass filter between 6 KHz to 10 kHz.
- Frequency cut in between 100Hz to 250Hz depending on the room size.
- Wide scoop cut at around 250Hz to 500Hz.
- A small cut in between 600Hz to 800Hz.
- Balance the equalizer with vocal in between 2 KHz to 4 KHz.(Usually boost for guitar)
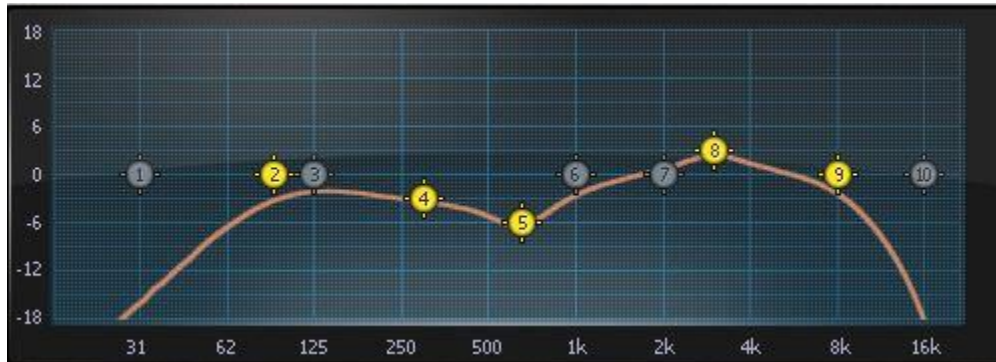
Figure 17: High Gain Guitar Equalization

Lead Guitar

The lead guitar can be in either clean or distorted tone. This manual will provide information about the distorted lead guitar. The lead guitar should always be heard above the rhythm guitar (distortion guitar) piece. The general idea is to use the EQ first and then pass this equalized tone through several effects such as chorus, delays and **saturation**. The steps for lead guitar equalization are as follows:

- High pass filter to 160Hz
- Balance the equalizer with vocals between 2 KHz to 4 KHz.
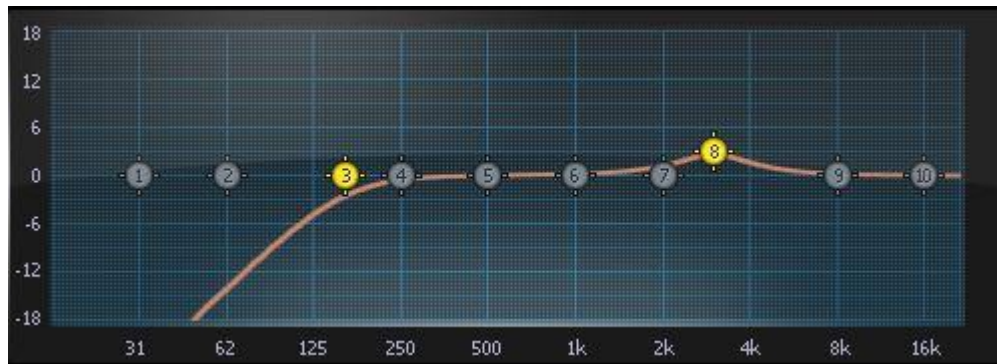
Figure 18: Lead Guitar Equalization

Acoustic Guitar

The steps for acoustic guitar equalization are as follows:

- High pass filter in between 60Hz to 180Hz
- Scoop cut in between 200Hz to 500Hz
- Low shelf boost at 100 Hz
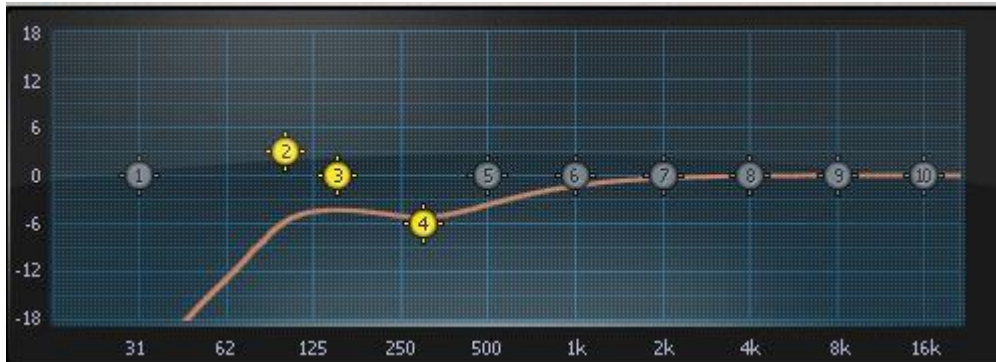
Figure 19: Acoustic Guitar Equalization

Frequency Summary Table (Guitar)

60 Hz	**Usually all guitars are filtered out**
60 Hz to 150 Hz	**Acoustic guitar boosted up to get wood sound, Electric guitar needs cut**
500 Hz to 800Hz	**Usually a cut for all the guitars**
2 KHz to 4 KHz	**Boosted up with balance of vocal**

Table 3: Guitar Frequency Summary

Chapter 6
EQUALIZATION FOR VOCAL

Chapter 6: Equalization for Vocal

Vocal

The steps for Vocal equalization are as follows:

- High pass filter between 60 to 150 Hz
- Cut the frequency a little bit from 300 to 900Hz
- High Shelf in between 8 kHz to 10 kHz
- Boost in between 1 kHz to 2KHz
- Boost in 4 kHz

Back Vocal

All the steps are identical to the vocal equalization except that you need to cut the EQ at 3 kHz to 4 kHz.

Figure 20: Vocal Equalization

Chapter 7
FINAL THOUGHTS

Chapter 7: Final Thoughts...

In this final chapter, I will address the last three features that are important in the sound mixing process when using the Reaper software.

Synthesizer

The equalization for synthesizer varies from tone to tone since the tones do not have the resonance at the same frequency range. For example, when dealing with a synthesizer that has both saw tooth and grand piano effects, you need to fill in the synthesizer by the surgical method. Then at the end, you will need to make some space for the synthesizer to mix and glue your recorded tracks.

Saturation

This is used during the mastering process and mixing in the lead. It helps to create a feel for analog tape recording.

Mastering

Throughout the entire recording process, you need to go through editing, equalizing, compressing and giving reverbs. This process is called **mixing**. After this mixing process is complete, you can go to the final stage - **mastering**. It is important to remember that the mastering helps to further fine tune the mixing. A good mastering **VST plugin** is **Isotope Ozone series**

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Images

Figure 5

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