

Developing Patter Music
from Commercial Sources Using Audacity
Version 1.3

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Introduction

When I moved from vinyl records to computer mp3 files for calling, a whole new world of music became available for patter calls. About half of my patters come from square dance labels and about half from commercial sources. I found that virtually all music from commercial sources had to be edited in some way: tempo, pitch, length, volume level consistency, or removing undanceable sections. This paper focuses on Audacity which has great editing capability, an intuitive user interface, and the right price (free). Although this process seems intimidating when each mouse click is detailed, the whole thing can be done in about 30 minutes for most music after some experience.

Please send me a note if you find errors, procedures which are not understandable, or additional material you feel should be included.

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1.0 Summary

Many steps are required to turn commercial music into music suitable for patter calls. This section describes the purpose of each step. The remainder of this paper details how to do each step using Audacity.

Getting Audacity: Audacity is software for both IOS and Windows as a free download. Search for “Audacity Download” and get the most recent version (3.2 at this time). Previous versions have some bugs that will interfere with the work. Audacity also has a quicker learning curve than many other music editing alternatives. I work with Windows version. Some of the shortcut keys are different in iOS.

Phase 1: Condition the music – Music conditioning activities are those which manipulate the wave form of the music. The step includes the following activities:

- 1.1 Setup a working file for holding work files and audio files as we go through the process.
- 1.2 Reduce or eliminate the vocals while retaining the instrumental parts – Vocals are normally much louder than the instrumentals. This can interfere with the dancers hearing the calls, especially if the vocal is in the same voice range as the caller. I prefer to keep the vocals but to reduce them to the same volume level as the instrumental.
- 1.3 Equalization – Change the volume according to frequency. For example, make the bass louder or softer.
- 1.4 Level the Volume – As callers, we expect the recorded music to have a consistent volume level. Music that suddenly gets much louder or softer is a distraction to the caller who must constantly be adjusting the volume. As a result we want to edit the music so that its volume level is fairly constant. Furthermore, the wave amplitude (volume) should be as big as possible without causing distortion because that gives the cleanest sounding music (maximizes signal to noise).

- 1.5 Adjust the tempo – Generally the tempo is not exactly what you would like, so we adjust the tempo.
- 1.6 Adjust the pitch – The key can usually be moved up or down a couple of steps without ruining the sound of the music.

Phase 2: Package the music – Music packaging breaks the tune into multiple clips and manipulates these clips to get the desired length and content. This step includes the following activities:

- 2.1 Develop a packaging strategy – Generally commercial music is about 3.5 minutes long. As callers we want the patter to be between 5 and 6 minutes. How will we extend the length of the tune? In addition, some sections of the music may not be suitable for dancing due to rhythm or arrangement. We must identify sections of music that must be cut in the packaging process.
- 2.2 Define the clips - Break the music into clips which will become the building blocks for repackaging. Deciding the size of these clips is totally driven by the packaging strategy. For example, we might decide to just loop through the main body of the tune twice to get the desired length. In that case there are three clips: the intro, the loop, and the ending.
- 2.3 Put each new clip in its own track. This makes for much easier clip alignment and editing.
- 2.4 Repackage Using Clips - Copy, delete and sequence the clips to accomplish the packaging strategy. When repackaging we must take care to have rhythm continuity so dancers cannot tell the tune has been edited.
- 2.5 Generate the final mp3 file for use. Then copy it into your patter library.

Directions for doing each of these steps in Audacity are given in the remainder of this paper.

Saving the project file: As we work through the editing phases, I recommend saving the project file as three different names identified by the phase step as a suffix in order restart from a convenient stopping point if the need arises.

- TuneName_NV (meaning No Vocals) to capture the project after reducing the vocals. If you later decided that you need to revisit the mix in that step, you can start here.
- TuneName_P1 (meaning end of Phase 1) to capture the project after all the music condition is complete.
- TuneName_P2 (meaning end of Phase 2) to capture the project with the various clips defined.

Phase 1: Condition the Music

1.1 Setup a working file

I use the following folder structure for working files: Music/Dance Downloads/ (Tune Titles – a folder for each). First create the new folder using the tune title. In this paper the tune is “Let’s Work Together” by Dwight Yoakam. My folder name is LetsWorkTogether. Copy the mp3 from your source (like iTunes or Amazon) into your new folder.

1.2 Reduce or eliminate the vocals – If your tune is an instrumental or the vocals do not need reducing, then skip to section 1.2.8 and continue from there.

1.2.1 The Theory Behind the Magic

The vocals can be reduced only if we start with a stereo tune. When stereo music is produced, some instruments sound like they are on the left side, some sound like they are on the right, and some sound in the center. For example, a guitar might sound like it is on the left because the sound is louder in the left channel than the right channel. The vocals are almost always put in the center, meaning the volume is the same on both channels. The strategy for reducing or eliminating vocals is to invert the wave on one channel so that it will cancel out the same sound on the other channel. The sounds will be cancelled only when the volume is the same on both channels. This is why the vocals are eliminated while the off-center instruments still remain. In reality, it is not uncommon for the drums and bass to also be in the center so they are greatly reduced along with the vocals. Sometimes vocal effects, such as reverb cause the vocals to be a little off-centered, resulting in the vocals being reduced, not eliminated. We don’t know the effect until after we have gone through the process. Frequently we need to add some vocals, bass, or drums back into the mix to get the desired result.

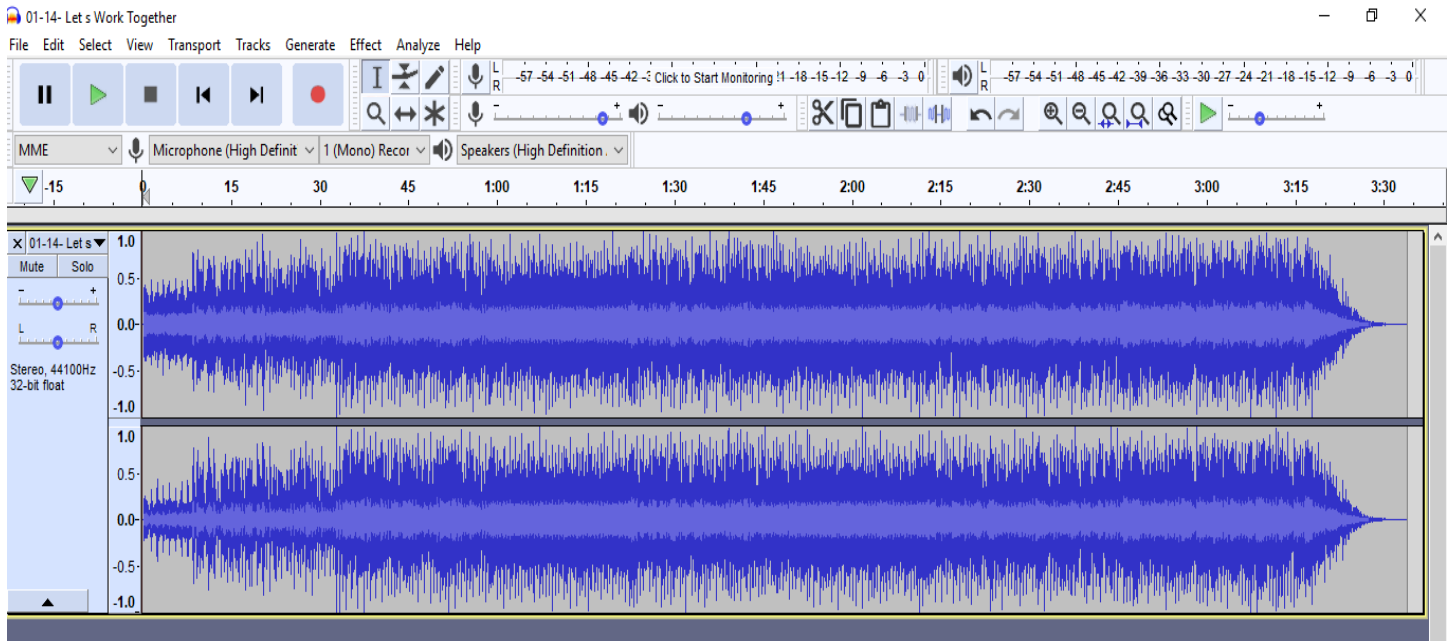
1.2.2 Open the Project in Audacity

- a) Start Audacity
- b) From the menu use File/Open. A popup menu allows us to find and select the tune.

Figure 1 below show the Audacity workspace at this point. Note that we have two tracks and the blue panel to the left of the tracks identifies it as stereo.

- c) Save the project by selecting File/Save Project As. Be careful that the project folder is selected in the popup. My file is named LetsWorkTogether_NV. We attach the suffix NV until we finish Phase 1 Step 2.

Figure 1 shows the workspace after the initial file open.



Basic Transport

YouTube has many Audacity tutorials available on a variety of subjects due to its popularity. Please see those for becoming proficient. Here are just a few basic points needed for our project.

- The upper left has the basic transport buttons common to any audio player. Click the green triangle (play) to start playing and the square to stop. Click the cursor inside one of the tracks to set a start point. Then click play and note that it starts from that point.
- The magnifying glasses on the upper right allows you to zoom in (+) or out (-). Try that.
- Scroll left and right with the scroll bar near the bottom. A scroll bar appears at the right to scroll up and down when the screen gets full.

1.2.3 Duplicate the music for use later.

- The blue box to the left of the tracks is the track properties area. First click in the open area in that box to select the tracks. They turn white.

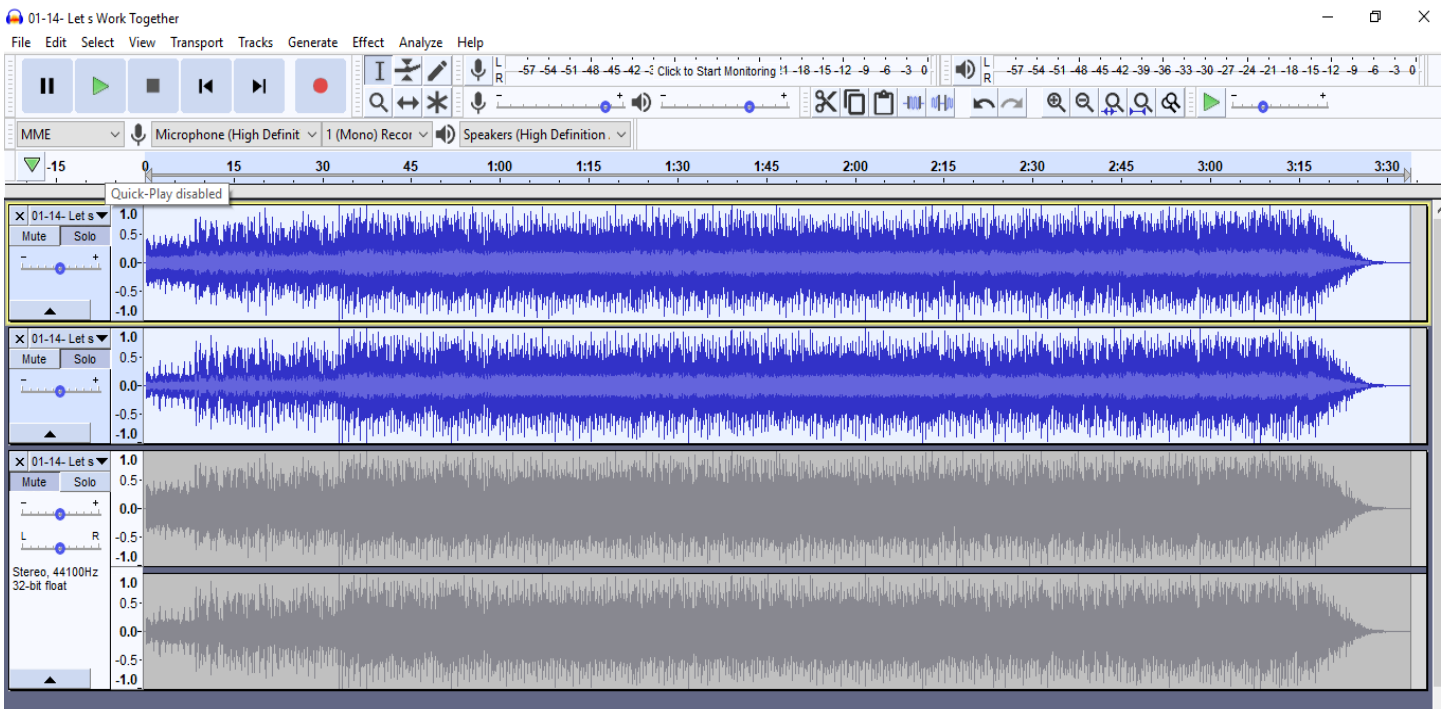
- Use Edit/Duplicate from the top menu and a copy of the stereo tracks are added below.

- Click the “Mute” button in track properties area for the new tracks. They turn grey and do not play when the play button is pressed.

1.2.4 Split the stereo track into two mono tracks. This must be done in order to invert just one of the tracks.

- a) On the top track properties area, click the small triangle in the upper right corner and select “split stereo to mono.”
- b) Select View/Track Size/Fit to Height to see all tracks on the screen.

Figure 2 shows the two mono tracks after the split and the muted duplicate tracks in grey.



Note that each of the top tracks has its own track properties area on the left which now show “Mono” rather than “Stereo.” Play the tune again to hear that no changes have occurred.

1.2.5 Invert the top track

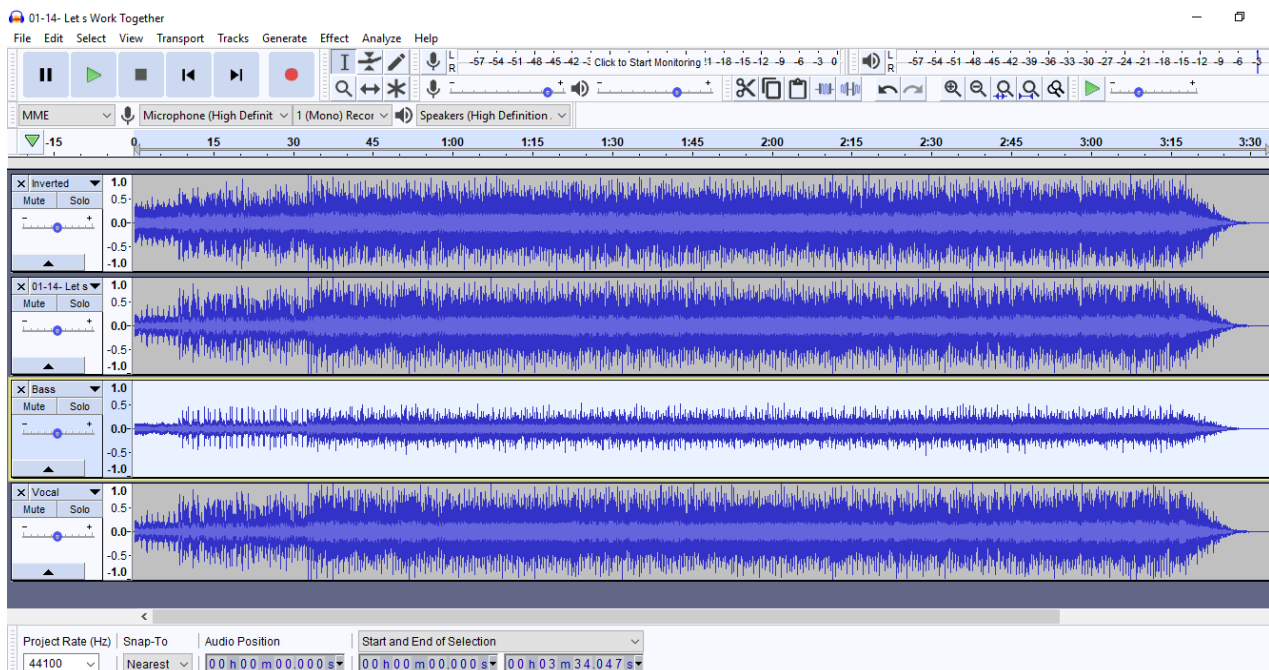
Be aware that any step which makes a change can be reversed by selecting the Edit/Undo from the top menu. Multiple steps working backwards can be reversed in the manner.

- a) Select the top track by clicking in the track properties area.
- b) Use Effect/Invert from the top menu. This inverts the wave on this track.
- c) **Set the name for this track.** Click the small triangle in the track properties box and select “Name.” Name this track “Inverted.”
- d) Play the music (making sure the duplicated bottom stereo track is still muted). On my tune, the vocals are about 98% gone but the bass and drums are still good. Yours may be different.

1.2.6 Setup a vocal track and a bass track for remixing.

- a) Click the “Mute” button again in the bottom duplicated track to unmute it.
- b) Break it into two mono tracks by clicking the small triangle in the track properties area and selecting “split stereo to mono.”
- c) Rename the top new track “Bass” and the bottom track “Vocal” by clicking the small triangle and selecting “Name” for each track.
- d) Select the Bass track by clicking in the track properties area. The music area turns white.
- e) Use Effect/Low Pass Filter from the menu. Scroll down in the drop-down menu until “Low Pass Filter” is visible. Enter 175 into the frequency box and click OK. (See appendix 2 for vocal frequency ranges.) The size of the wave in that track has been reduced but this is not a problem. Now click “Solo” in the track properties area and Play the music. Only this track is now playing. Note that we have bass and drums but very little vocal. Click the “Solo” button again.
- f) Select the Vocals track by clicking in the track properties area. The music area turns white.
- g) Use Effect/High Pass Filter from the menu. Enter 200 into the frequency box and click OK. Now click “Solo” in the track properties area and Play the music. Only this track is now playing. Note that we have clear vocals with little bass and drums. Click the “Solo” button again.
- h) Save the project using File/Save from the main menu.

Figure 3 shows the result of the steps in 1.2.6. Note the track names in the track properties area



1.2.7 Remix to the desired balance

When you play the music, all four tracks are playing. Click the “Mute” button on the Bass track as you play to hear the effect. Then unmute it. Do the same for the Vocal track to hear what that track is doing.

- a) Adjust the volume levels on the Bass and Vocal tracks by moving the slider button in the track properties area until you get the right mix of vocals and bass. Do this step using head phones to get the most accurate sound. When I have done this using the computer speakers, it always comes out wrong.
- b) Save the project using File/Save from the main menu. If you ever need to remix, you can re-open this version.

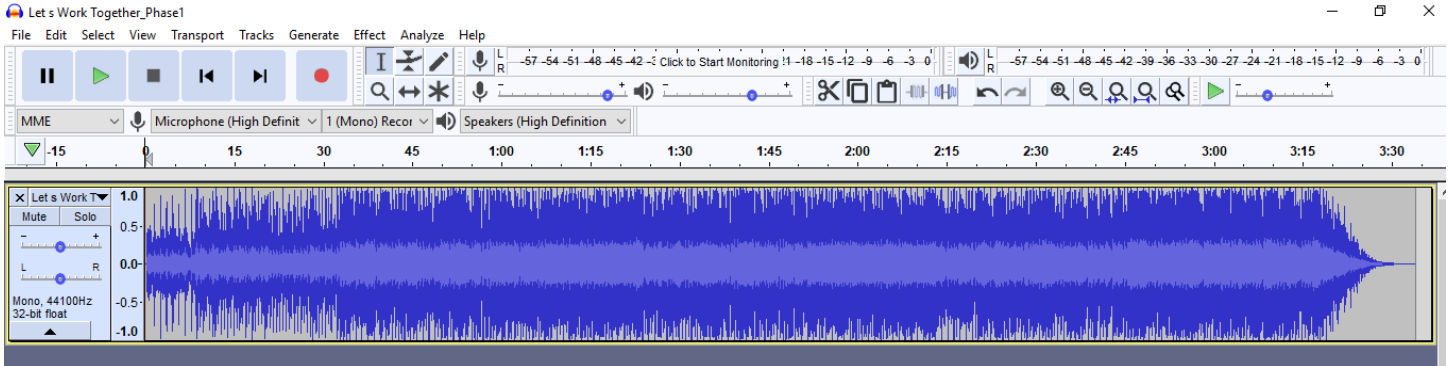
1.2.8 Export the Audio File

- a) From the top menu use File/Export/Export as mp3. An export dialog box appears. Use the following settings.
- b) Make sure the file will be put into your working folder setup for this tune.
- c) Assign a suffix of _NV (No Vocals) to the tune name in the file name box. This will associate it with the project version.
- d) The “channel mode” line at the bottom must have “force to mono” box checked.
- e) Click Save and watch the file exporting.

1.2.9 Check the new audio file

- a) Select File/Close from the Top Menu. You should not need to save as you just did that in the previous step.
- b) Select File/Open and pick the mp3 file which you created in the previous step.
- c) Play the track. If it sounds good, then move to the next step. If not, then close this project, open the most recent version of the project and remix. Then export and overwrite the current mp3 file.

Figure 4 shows the exported audio file.



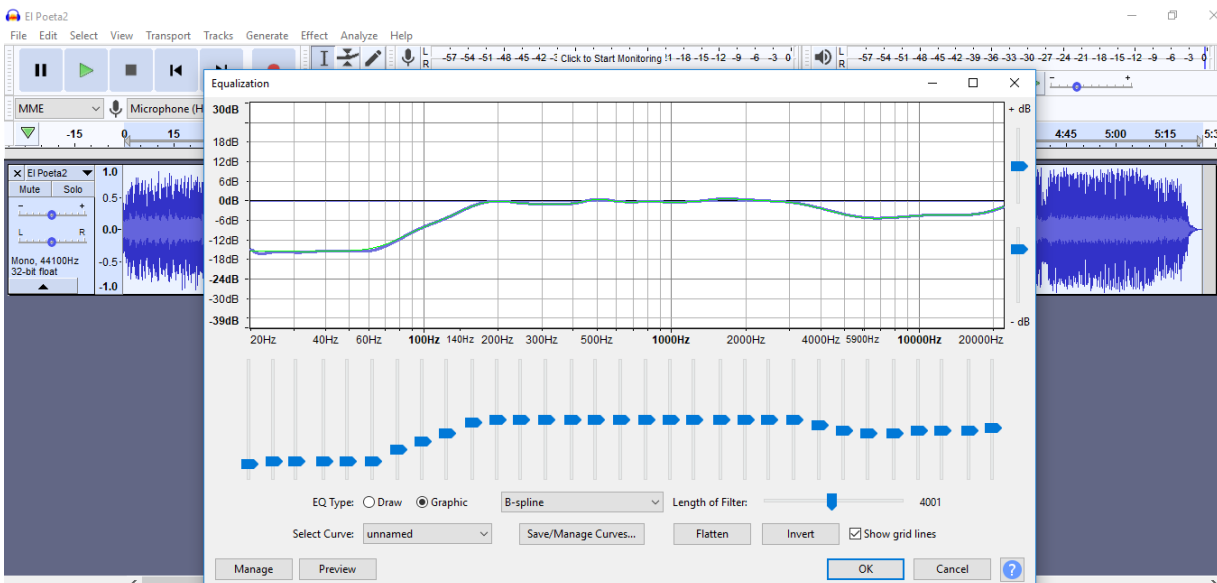
This completes Step 1.2 which focuses on vocal reduction.

1.3 Equalization

Tunes from commercial sources frequently have bass that is too loud, but the individual caller's equipment plays a roll in this decision. Sometime the high frequencies are too shrill and must be reduced. These changes are made with the Equalization effect.

- Use Effects/Equalization from the top menu. Figure 5 shows the equalization parameters screen. Use the blue slider bars on the bottom to change the volume level of each frequency. The curve reflects the slider positions and helps to develop the big picture of changes. Click OK when completed.
- Review the results using head phones to get the most accurate sound. When I have done this using the computer speakers, it always comes out wrong. If you don't like the results, then use Edit/Undo (or Cntl + Z) to reverse the effect.

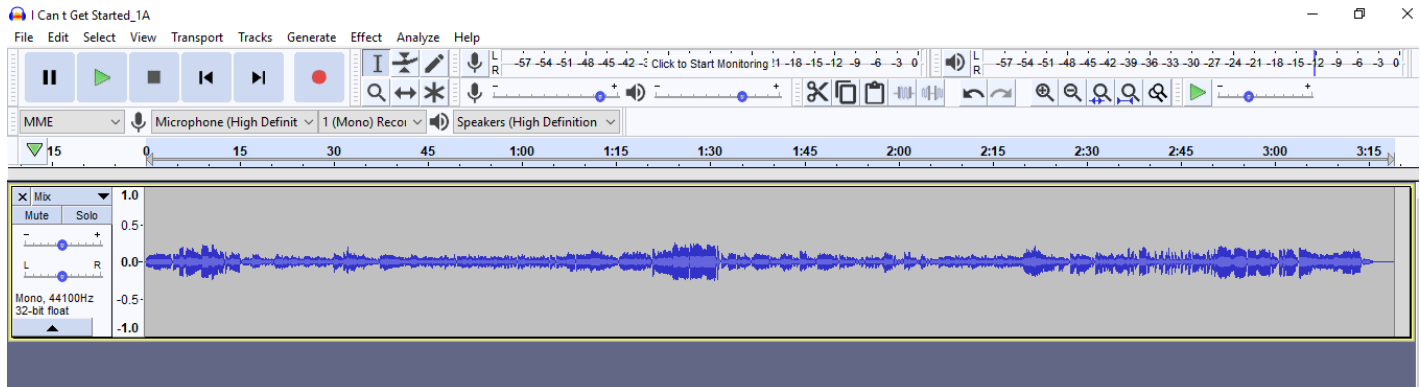
Figure 5 shows the *Equalization* parameter screen.



1.4 Level the Volume

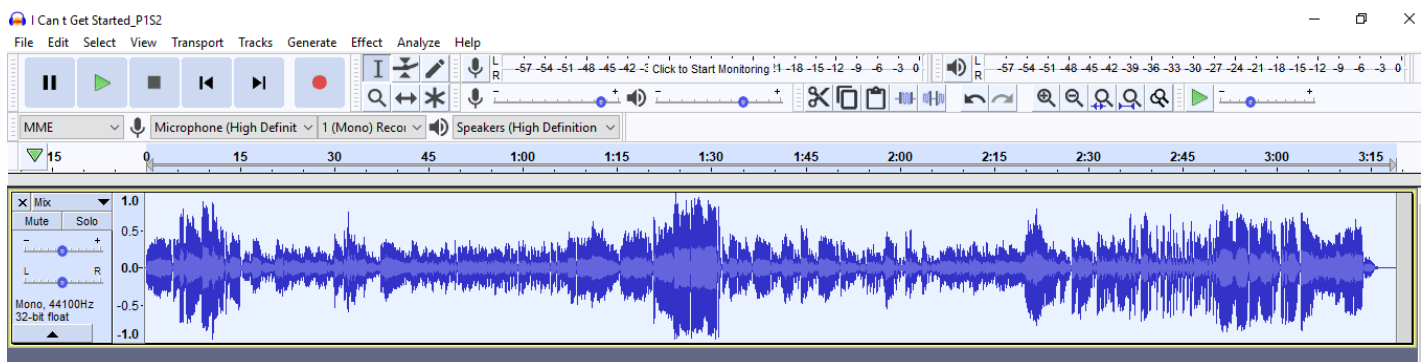
Note from Figure 4 that the full track is filled by the music and that the amplitude is constant throughout. This is exactly how the track should look. If your tracks look like this, then skip section 1.3 and move to section 1.4. I have used a different tune to show a track with some level problems.

Figure 6 shows the tune “I Can’t Get Started With You” after completing step 1.2. Note the small volume (amplitude) and the variation in volume levels.



- Use the Amplify effect to proportionally increase the amplitude (volume).** Click on the track properties box to select the track. Use Effect/Amplify from the top menu. Accept the default parameters and click OK. Figure 7 shows the results.

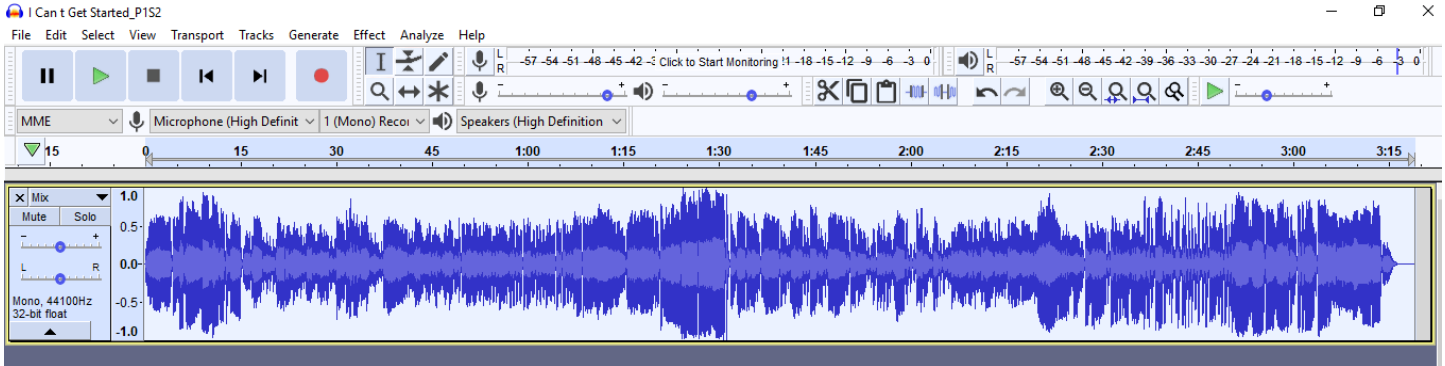
Figure 7 show the results of applying Amplify using default parameters



Now our problem is that the volume varies widely which is really annoying to callers. Audacity provides three tools to level the volume: the Compressor & the Limiter in the Effects menu and the envelope tool on the tool bar. The Compressor uses an algorithm to squeeze the signal, squeezing the high volumes more than the low volumes. This results in a leveling effect.

- Use Effect/Compressor from the top menu. Accept the default parameters and click OK. Figure 8 shows some improvement, but the volume change is still too large.

Figure 8 shows the results of applying the Compressor to the track in Figure 6.



The Limiter effect has a drop down to select Type (Hard Limit or Soft Limit) as shown in Figure 9. A Limiter is a type of compression which is much more aggressive than the Compressor tool in reducing the volume above a set level. The Soft Limit tries to retain the shape while the Hard Limit chops it off. The Limiter is more likely to cause distortion due to its aggressive behavior.

- c) Use Effect/Limiter from the top menu. Select Hard or Soft Limit from the popup box. Click OK to apply the change. Select Edit/Undo if you do not like the results. Results are shown in the figures below.

Figure 9 shows the results of applying the Hard Limit to the track in Figure 6. Note the chopped off peaks.

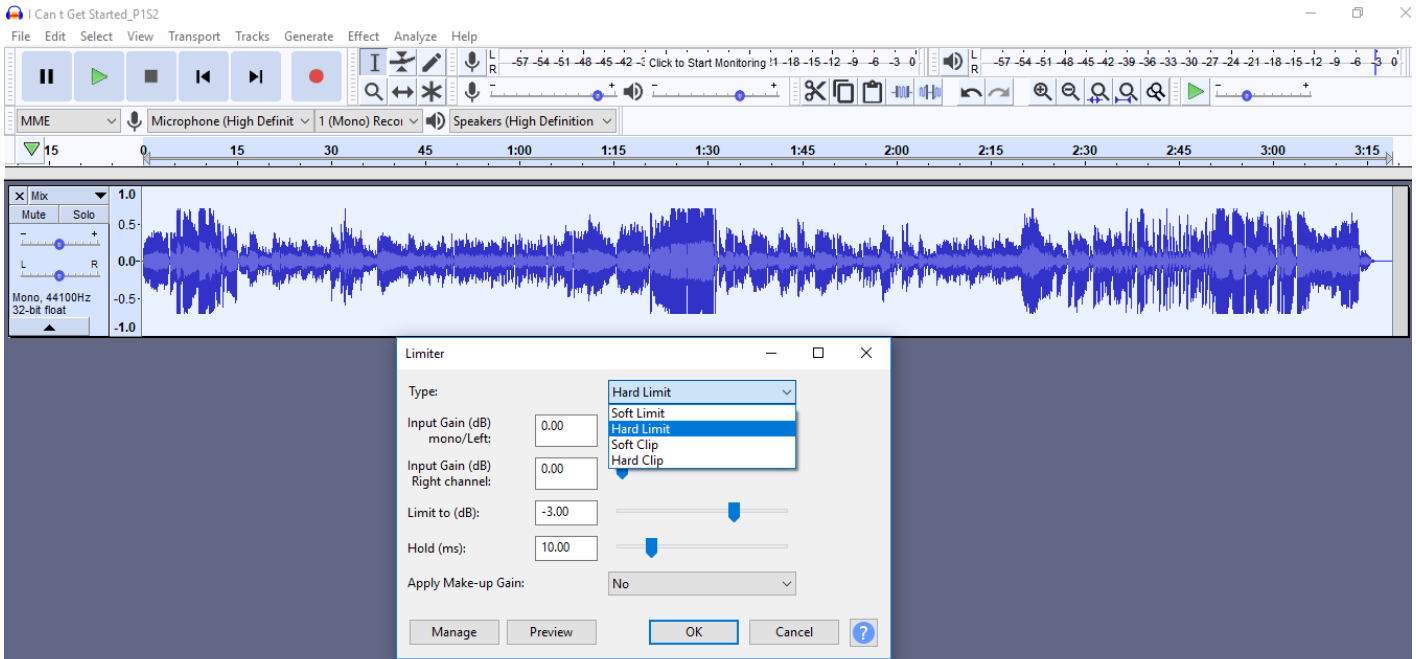
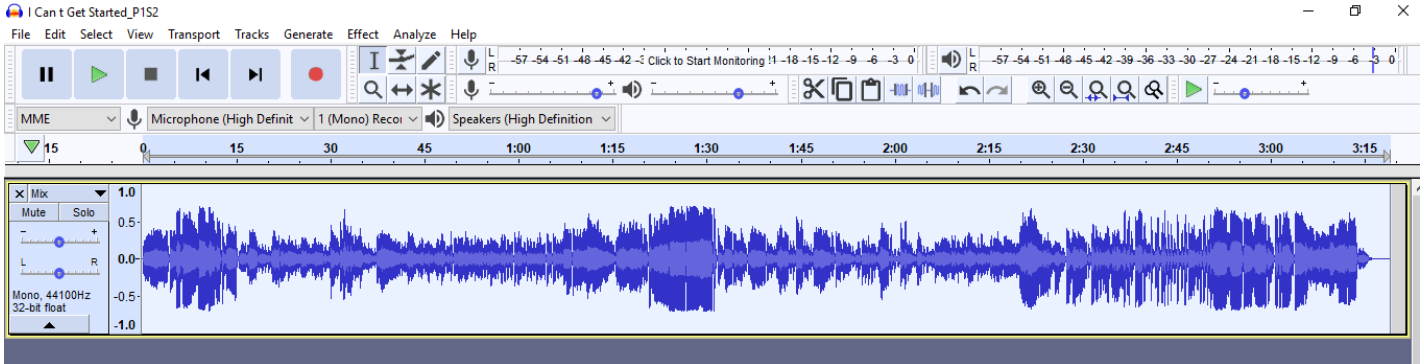


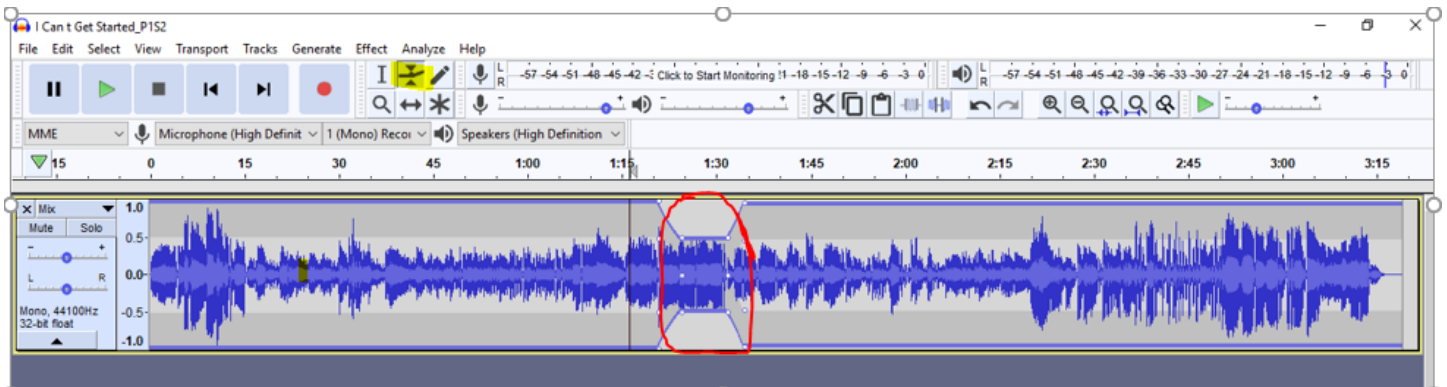
Figure 10 shows the results of applying the Soft Limit to the track in Figure 7. Contrast the peaks to Figure 9.



The Envelope tool allows us to custom fit a compression effect to the track. Figure 11 shows the Envelope tool on the tool bar with a yellow highlight.

- d) Click the Envelope icon on the tool bar. Upper and lower lines are automatically put on the track. Clicking on the track will put small white dots in a vertical line. We can build a custom compression effect by grabbing and moving those dots. Figure 11 has four vertical lines defined. Two of them were used to compress the loud section starting at 1:22 and lasting 10 seconds. The result is shown in the red circle. We could continue to manually compress all of the loud areas. Note that the peaks are compressed, not chopped off. If this explanation is confusing, see an Audacity Envelope tutorial on YouTube.

Figure 11 shows the use of the envelope tool with custom volume level control applied to the track in Figure 6.



We have looked at four ways to level the volume. The order of preference is (1) Compressor, (2) Envelope Tool, (3) Soft Limiter, (4) Hard Limiter as each choice more aggressively affects the wave form. We could also try a combination such as Soft Limiter followed by a Compressor. However, more wave form processing gives a greater chance of distortion.

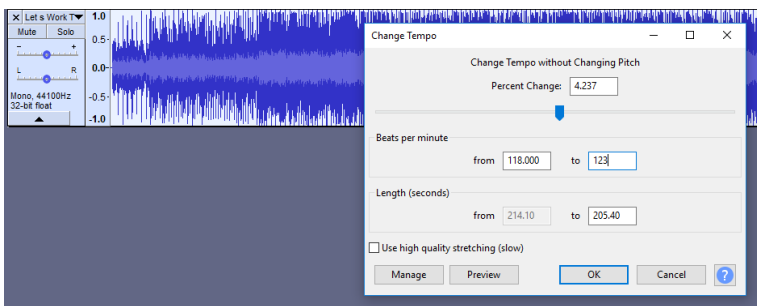
- e) This is a good point to save a new version of the project. Select File/Save Project As and assign a suffix of "_P1" for (Phase 1). We will use this project name through the end of Phase 1.

1.5 Adjust the Tempo

The Effect to change the tempo requires two parameters: the current tempo and the new tempo, both in beats per minute (BPM). I get the current tempo by playing the track and counting the beats in 15 seconds. Then multiply by 4. Obviously, a longer count period results in a more accurate result. In our example of Let's Work Together let's say I have determined the tempo to be 118 BPM.

- a) Select the track by clicking in the Track Properties area. Use Effect/Change Tempo from the top menu. In the dialog box enter the current BPM in the "from" box and the desired BPM in the "to" box (See Figure 12). Then click OK. If you don't like the results, you can always "undo."

Figure 12 shows the Change Tempo dialog box.

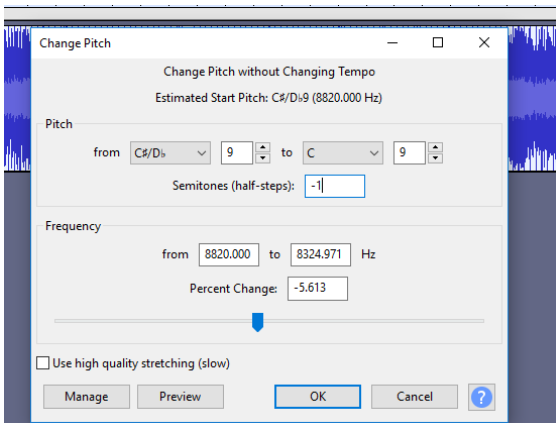


1.6 Adjust the Pitch

The pitch change is specified in the Effects/Pitch Change dialog box shown in Figure 13. We can specify the change in half steps or the current key and the new key. Figure 13 shows a change of 1 half step down (-1).

- a) Select the track by clicking in the Track Properties area. Select Effects/Pitch Change. Enter the change in the dialog box as either half step count or old key/new key. Click OK. Count beats for tempo after the change and adjust tempo again until you are satisfied.

Figure 13 shows the Effects/Change Pitch dialog box.



This complete all Phase 1 work.

- b) **Save the project** using File/Save Project.
- c) **Export a new audio file.** Select File/Export/Export mp3. Put a suffix on the tune name of “_P1” (Phase 1 end). Then click SAVE.

Phase 2: Package the Music

In this phase we package the music into the final form by breaking the music into clips which become the building block for packaging. We accomplish two objectives:

- Delete sections of the music we can't use.
- Build the desired length – usually between 5 and 6 minutes for a patter.

2.1 Develop a Packaging Strategy

a) Listen to the tune all the way through and note the main divisions and the approximate timing of where each starts. Here are the structure notes from “Let’s Work Together.”

Music Section	Start Time	Duration
Intro	0:00	:10
Vocal 1	0:10	:50
Instrumental Break 1	1:00	:25
Vocal 2	1:25	:25
Instrumental Break 2	1:50	:25
Vocal 3	2:15	:45
Ending	3:00	:30
Song Finished	3:30	

If we exclude the intro and ending, the remaining music takes 2:50. If I make a loop of that part and repeat it once, the total length will be 3:30 + 2:50 = 6:20 which works for me. The packaging strategy looks like this

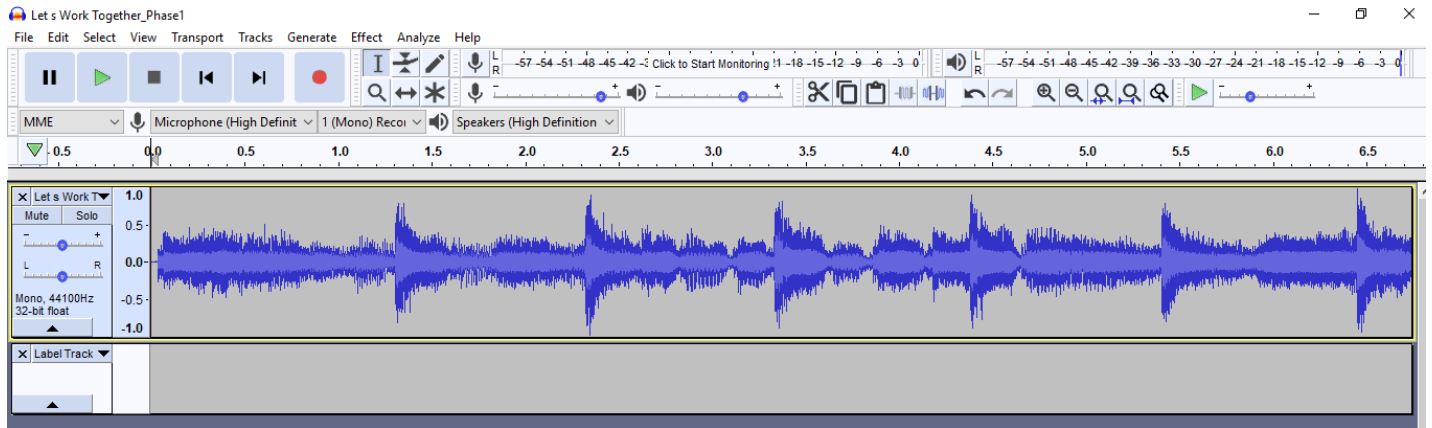
Music Section	Start Time	Duration
Intro	0:00	:10
Loop 1	:10	2:50
Loop 2	3:00	2:50
Ending	5:50	:30
Song Finished	6:20	

This is an easy but common strategy. The important clip is the loop we want to repeat.

2.2 Define the Loop

- a) **Add a label track to mark the clip boundaries.** Select Track/Add New/Label Track from the top menu. The new label track appears.
- b) Zoom in using the + icon in the tool bar until the individual beats can be seen as shown in Figure 14.

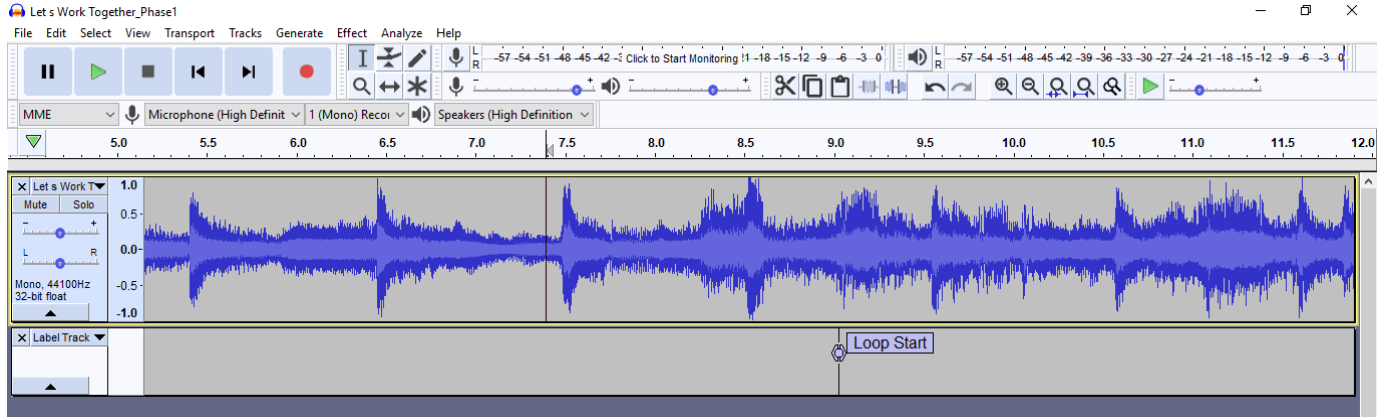
Figure 14 shows the new Label Track and the zoom level high enough to see individual beats. The time labels show half seconds.



This is a good point to learn some shortcut keys. Click in the music track and press “J” to go to the track start and “K” to go to the track end.

- d) **Get rid of dead space.** Press “J” to go to the track start. Delete the dead space at the front by swiping over it with the left mouse key down. Then press the delete key. Remember that the Edit/Undo selection reverses the action if a mistake was made. Press the “K” key and repeat this process for the long dead space at the end.
- e) If an opening section of music needs to be deleted, highlight it and delete it (delete key) first before marking any labels. If sections in the middle need to be deleted, put labels on the start and end of the section using the process described below.
- f) **Label Practice** – Click the cursor under the first beat. Then press Cntl + B on the keyboard to make a label. Type “First Beat” in the text box and press Enter. Click on the small circle in the center of the label. Hold the right mouse button down and drag the label to the left and right. Remove the label by first removing the text in the text box, then press the Delete button or back space to remove the label.
- g) **Insert label for loop start** using the following process. Press Play. While listening to the music use the shortcut Cntl + M on the first beat of the clip to insert a label. In our example, this means the first beat of the vocal after the intro. We have time to enter a short label in the text box: “Loop Start.” The results are shown in Figure 15.

Figure 15 shows the label in the label track which was inserted using Cntl + M while the music was playing.



- h) **Insert label for loop end.** Stop playing and scroll to just short of the loop end and click in the music track to set a start cursor. We know where to put this from the Packaging Strategy work. In our example, this is about the 2:50 mark. Start Play and use Cntl + M to put a label line at the first beat of the ending as in the previous step. Enter “Loop End” in the text box.
 - i) **Align the labels exactly on the beat.** This is critically important for the rebuilt song to play smoothly. There are two ways to do this alignment:
 - If the label is near a clearly defined beat like the one at 7.5 seconds in Figure 15, then drag the label line to the beginning of that beat.
 - Our label is at about the 9 second mark which is not clearly defined. In this case click in the music track about 1.5 seconds before the label as in Figure 15. Then press Play and watch closely to see where beat 1 occurs. Insert a start cursor (mouse click) in the music on beat 1, then drag the label line to that position and repeat the play to verify that the play cursor crosses the label line exactly on beat 1. This may require multiple plays to get it marked correctly. Repeat this process for each label until all labels are exactly on the beat and text is entered in the text box showing the reason for the label. Put labels on both sides of any section to be deleted. (We have none in this example.)
- Slowdown Playback – If the music play cursor is just too fast to find beat 1, try zooming out or try the music slowdown feature. In the upper right corner of the tool bar notice the small green triangle and the sliding scale on its right. Slide the button on the scale slightly to the left to see the percent slowdown in playback. Then press the green play arrow. The music cursor moves more slowly to help find beat 1. Use the normal stop button to stop playing.
- j) **Mark the ending clip so we can move it to the right to make a space for the loop.** Move to the start of the End section (in this case “Loop End”) and put the cursor in the music directly above the label. The best technique is to put the cursor on the loop start line. The cursor shows as a double-headed arrow. Slowly move the cursor up keeping it directly on the line until it changes to a bracket. Then left click to set the cursor line in the music. Use Select/Region/Cursor to Track End (or short cut Cntl + J). The ending section is now highlighted. Press Cntl + B to mark the region in the label track. Fill in the region

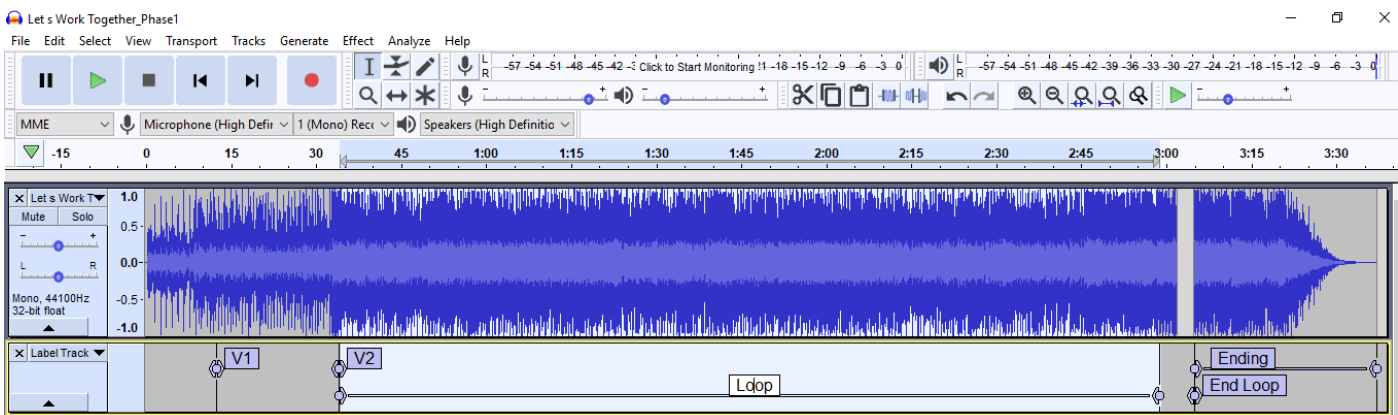
name as “Ending.” Use Edit/Clip Boundaries/Split from the top menu. This splits off the ending as separate clip.

Figure 16 shows how to set a cursor line in the music track directly above the label track line.



- k) **Separate the Ending from Loop1.** Click the Time Shift Tool in the toolbar (double headed arrow in yellow highlight in Figure 16). Then grab the Ending area beyond the loop and drag to the right with the left mouse button down. This provides an opening for Loop2.
- l) **Define the loop as a region in the label track.** Move to the Loop Start label and put a cursor line in the music directly above it. Use Select/Clip Boundaries/Cursor to Next Clip Boundary so select (highlight) the loop. Press Cntl + B to create a region label and name it “Loop” in the text box.
- m) **Change the view to see all the tracks.** Press Cntl + F as the shortcut for the View/Track Size/Fit to Width menu item. Press Cntl + Shift + F as the shortcut for the View/Track Size/Fit to Height menu item. On the label track press the small “up” triangle at the bottom of the track properties area to minimize the label track as we no longer need it. Figure 17 shows the result.
- n) **Save the project as a new version** using File/Save As and a suffix of “_P2”.

Figure 17 shows the loop highlighted, the loop identified in the label track, and Ending separated from the loop.

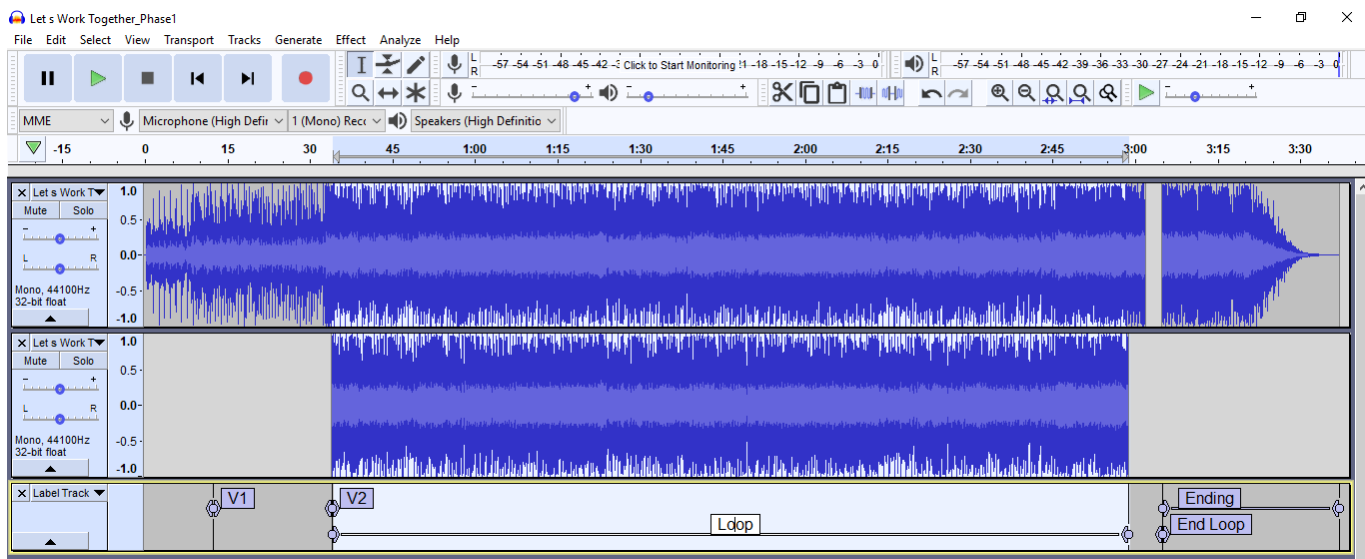


2.3 Copy the Loop into a separate track

This work is driven by the repackaging strategy which is simple in this example. We need to use the duplicated loop to extend the length.

- Click on the Loop label in the label track. This causes the loop in the music track to be selected. Use Edit/Duplicate from the top menu. (Notice that this menu selection has a shortcut combo of Cntl + D.) The loop has been copied to a new track.
- Name the new track.** In the track properties area click the small triangle and select "Name." Type "Loop2" in the name text box and click OK.
- A new label track has also been copied below the Loop2 track. We don't need this so remove it by clicking on the small "X" in the upper left corner of the track properties area. Move the label track to the bottom by clicking on the triangle in the track properties area and select
- Save the project using File/Save.

Figure 18 show the loop copied into a new track.

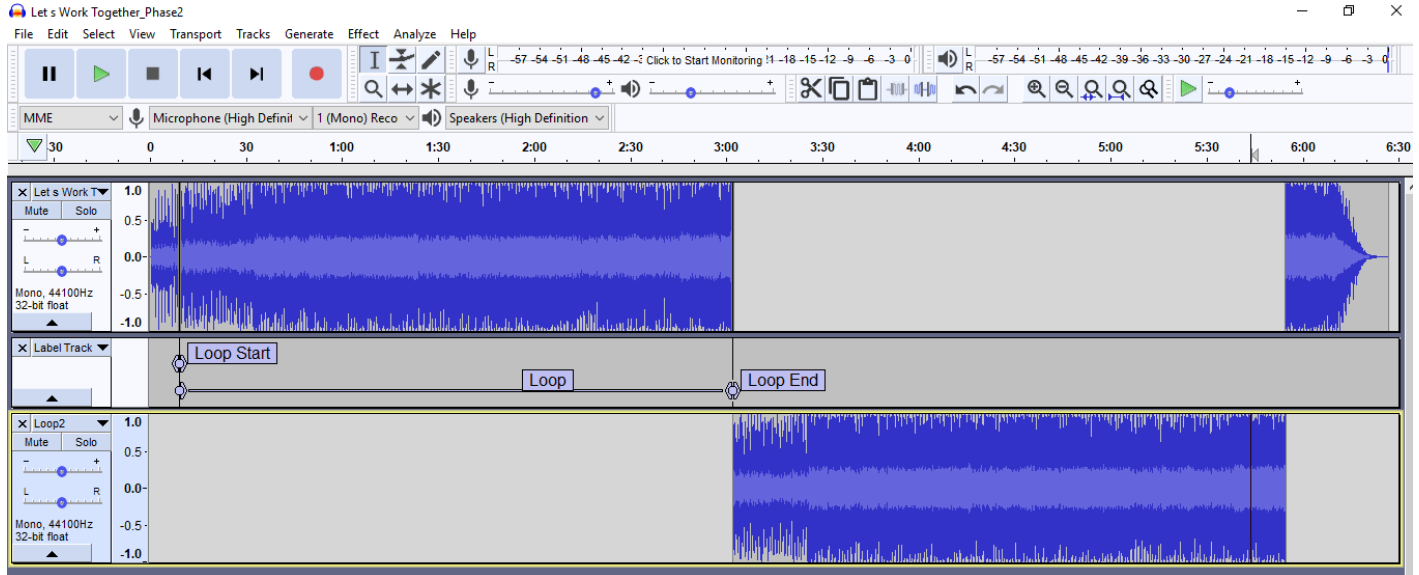


Notice that the loops have automatically lined up when we duplicated it.

2.4 Repackage Using Clips

- Remove clips as needed.** Our example has no clips to remove. If you do, always do your deletes from right to left (end to beginning) since the label track is made inaccurate to the right of any clip deletes.
- Align the clips.** With the Time Shift Tool still selected, drag Loop2 until its start lines up with the end of Loop1. When two tracks are perfectly aligned, a vertical yellow line will appear. Repeat this for the Ending in the top track until it follows Loop2. The tracks are now aligned.

Figure 19 shows Loop2 aligned with Loop1 and the Ending clip. Note the length is about 6:20.



- c) **Verify the transitions.** Click on the selection icon in the toolbar (like an I-Beam). Then click the start cursor near the end of Loop1 and start Play. Notice the smooth transition. Repeat for the transition between Loop2 and the Ending clip. If the transition is not smooth there are two possible causes: (1) the label in 2.2h did not match the first beat of the phrase or (2) the track alignment in step c above did not get a vertical yellow line to show that the tracks were perfectly aligned. If label alignment is the problem, open the project with suffix “_P2” and redo the work from that point. We saved multiple versions of the project exactly for this purpose.

2.5 Export the Final mp3 Audio File

- Select File/Export/Export mp3. Put a suffix on the tune name of “_P2” Then click SAVE.
- Now listen to the final audio file.** Close the project using File/Close. Then open the new audio file and play it.

Finally, rename the audio file according to your practices and copy it to your patter library. Final adjustments to tempo and pitch can be done with your dance music software.

Appendix 1: Summary of Shortcut Keys Used in this Paper

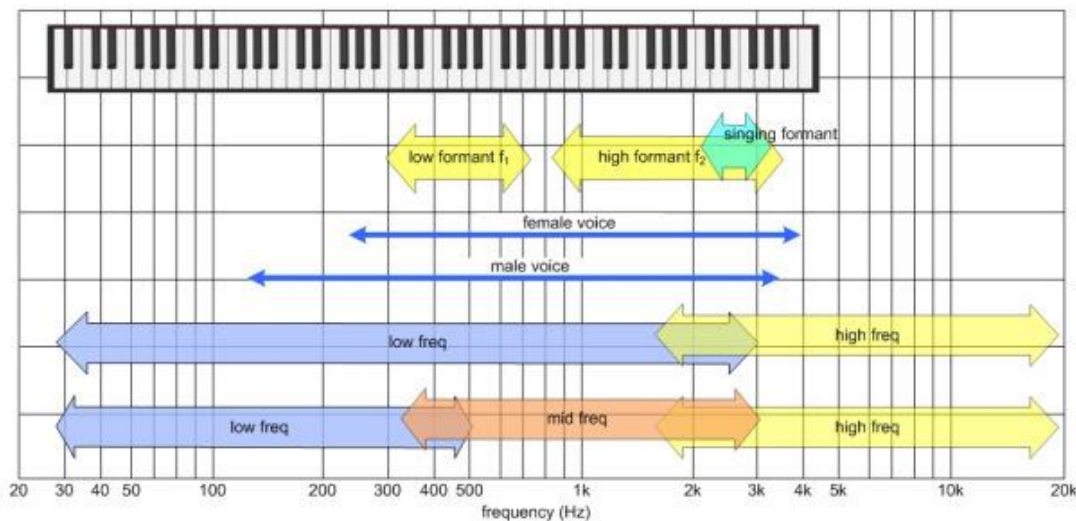
Although letters are shown as caps, the commands are not case sensitive.

Action	Key
In a music track, go to track start/end	J, K
Top Menu: View/Track Size/Fit to Width	Cntl + F
Top Menu: View/Track Size/Fit to Height	Cntl + Shift + F
For highlighted region in track, duplicate to new track	Cntl + D
For highlighted region in track, split into clips to all time movement	Cntl + I
In label track, insert label while music is playing	Cntl + M
In label track, define region corresponding to highlighted music area	Cntl + B
Select a track	Click in Track Properties
Select additional tracks after the first	Cntl + Click
Select all tracks between first to current	Shift + Click
Set start cursor in music track	Click
Select area from start cursor to current position in music track	Shift + Click

Appendix 2: Vocal Frequency Ranges for Audio Editing

On the low pass filter (1.2.6.e) we chose 175 hz as the cutoff which eliminates most vocals.

We then used 200 hz for the high pass filter which included most vocals.



This chart used from PRO/av:

<https://www.google.com/url?sa=i&source=images&cd=&cad=rja&uact=8&ved=2ahUKEwiEruqngungAhWrct8KHVzUDOIQjB16BAgBEAQ&url=http%3A%2F%2Fwww.bnoack.com%2Faudio%2Fspeech-level.html&psig=AOvVaw3hE3jo7BSDd07oAD3ZpcUp&ust=1551807151221913>