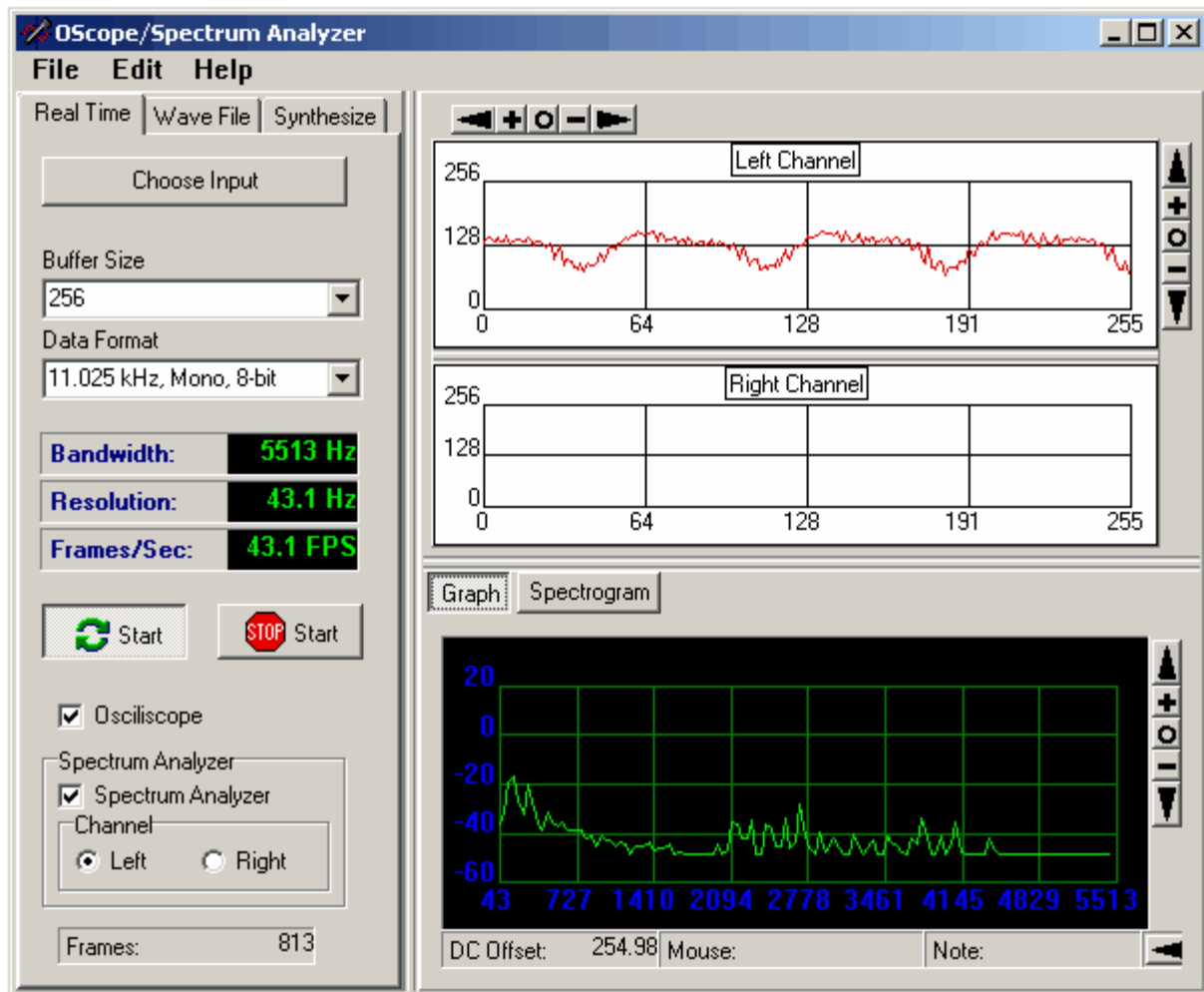


Audio Spectrum Analyzer Help



Audio Spectrum Analyzer Help

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Part



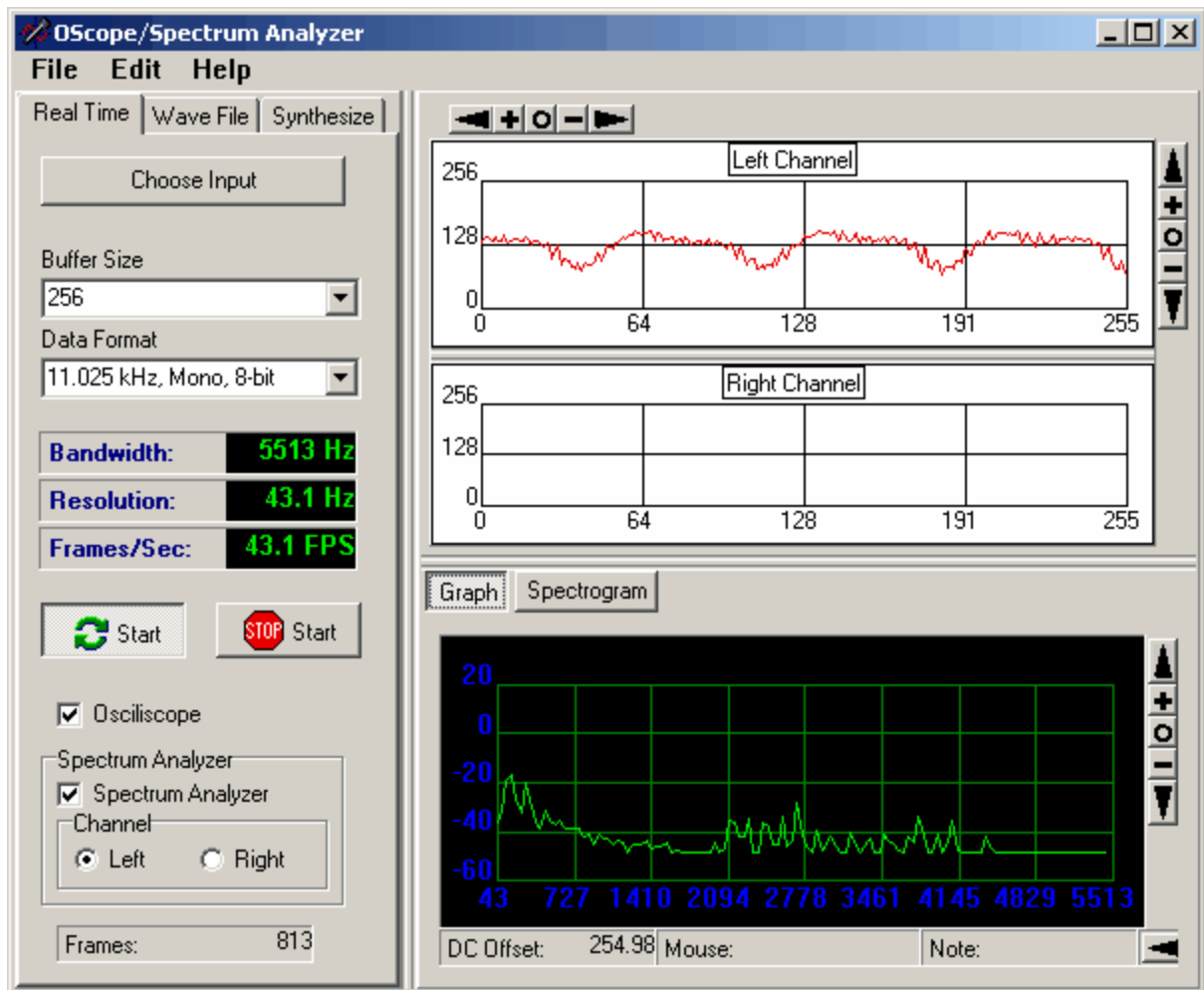
1 Index

Spectraciser allows you to do audio signal analysis using your computer's sound card. It can do real-time analysis of a "live" signal fed to your computer. It can also do static analysis of an Audio Wave file. Depending on the Sample Rate and sample size, it can do bandwidths of 5.5 to 22Khz. It can have a frequency resolution of between 43Hz and 0.3Hz. It also displays oscilloscope signals of the incoming waveform.

Topics

Overview - Spectrum Analysis
 Real-Time Analysis
 Audio File Analysis
 Synthetic Wave Analysis

Oscilloscope Display
 Spectrum Display
 Spectrogram Display

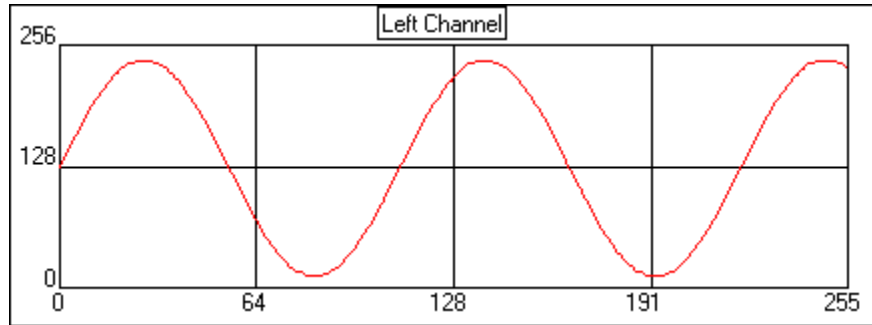


1.1 Spectrum Analysis

What Is Spectrum

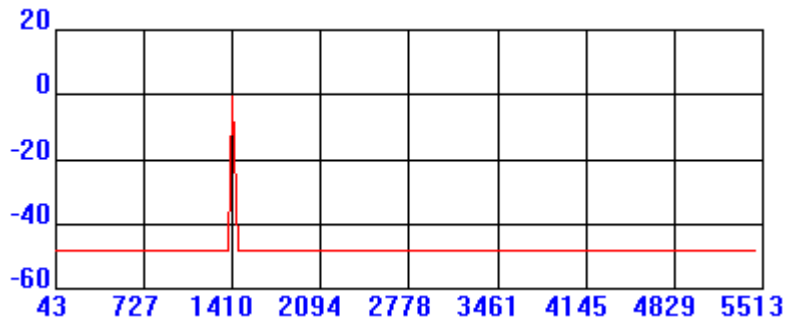
Analysis? When you look at a signal on an oscilloscope, you are essentially looking at graph that shows amplitude and time. If the signal is simple, you will be able to see the peaks and troughs of the wave and determine the frequency by measuring time between peaks.

However, if the signal is complex, containing more than one frequency, it will be virtually impossible to tell accurately measure the frequencies.

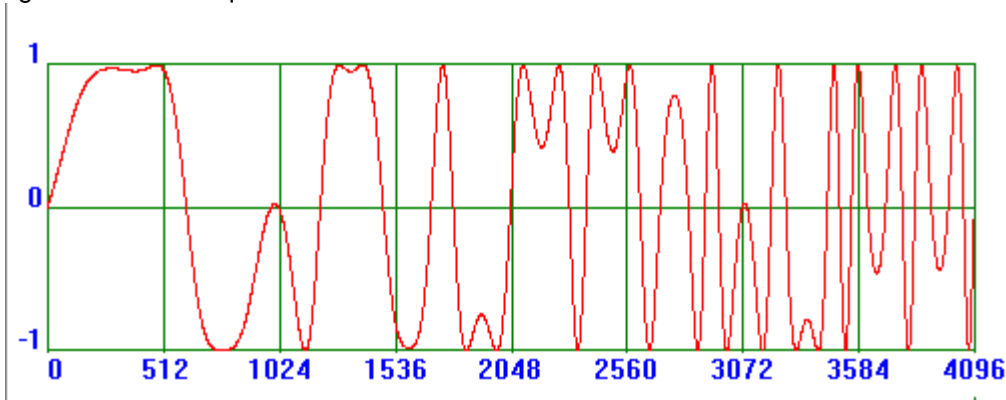


A spectrum analyzer works by generating a graph that displays amplitude and frequency. Thus each peak on the graph represents the amplitude and frequency individual components of the signal. In this way, it is possible to dissect very complex signals into the individual frequencies that compose them.

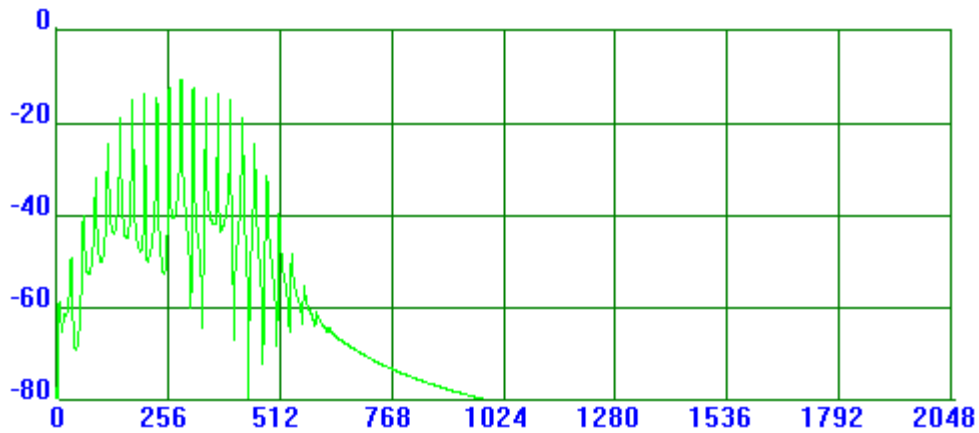
The graph to the right shows the spectrum of a 1410 Hz sine wave. As you can see, there is a spike right on the 1410 line. The height of the spike indicates the amplitude of the signal.



More complex wave forms can very difficult to analyze visually. For example it would very difficult to figure out what frequencies are contained within the wave form below:



However, a spectrum analyzer can dissect the signal and break it up into its component parts. The image below show the spectrum of a very complex wave form.



1.2 Analysis

Spectraciser Does Three Types of Analysis:

- Real Time Analysis
- Audio File Analysis
- Synthetic Wave Form Analysis.

1.2.1 Real-Time Analysis

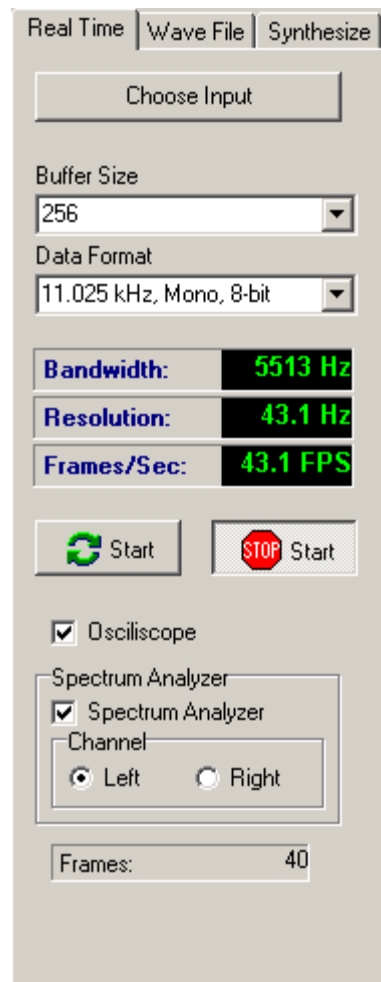
The Real-Time Analysis option allows you to analyze a signal in real-time while it is happening. To perform Real Time analysis, select the "Real Time" option from the left-hand Tool Panel.

1. Select Audio Input. To analyze a signal, you must bring it into the sound card on your computer. To configure and select a sound input channel, press the "Choose Input" button at the top of the page. Here are detailed instructions on setting up inputs and configuring your sound card.

2. Set Analysis Parameters. Before you begin analyzing a signal, you need set the analysis parameters. Click here for detailed description of the analysis parameters.

3. Bandwidth, Resolution, and Frame Rates. Choosing different parameters controls the Bandwidth, Resolution and Frame Rate of the spectrum display.

3. Start Sampling. Once you have set all the options, press the "Start" button. Depending on how you have configured the program, it will begin displaying data. If the oscilloscope option is enabled, the program will display amplitude and time in the Oscilloscope Graphs. If the Spectrum Analyzer option is enabled, the program will display frequency and amplitude.



1.2.1.1 Sound Input

Sound can be analyzed from several different sources. For example, you can plug a cable into your sound card from an external source such as a microphone. You may also be able to analyze sounds from internal devices such as CD players and DVD drives. This depends on the type of sound card, computer you have, and how Windows is configured.

There are two steps to the configuration process: Setting Up Inputs and Configuring the sound card itself:

1. Setting Up Inputs. Click here for instructions on setting up Inputs.
2. The Configuration process is different depending on whether you have Windows XP, Vista or Windows-7. Here are instructions for each one.

Configuring Window XP
Configuring Vista and Windows-7.

1.2.1.1.1 Connecting An Input

The first step to using the Spectrum Analyzer is to connect device to the input of your computer. For example, if you wanted to connect the Spectrum Analyzer to a radio, the radio would need to have an ear-phone jack or some other type of jack so that brings out the audio signal.



You will also need an adapter that will convert from the jack that plugs into the external device to the jacks that connect to the sound card on the back of your computer. Most sound cards will have RCA jacks, but there may be some variation, especially if you are using a laptop, so check your computer before you buy the adapter. Make sure that if your external device is mono, that your adapter converts mono to stereo. The adaptor the right adapts a mono radio signal to stereo.



Most modern sound card can be configured so the jacks on the back perform different functions. The sound cards normally come with a utility that allows you to configure the sound card. You need to configure the sound card so it has a "Line-In" input. The image below show the typical configuration for the RealTech sound card.



1.2.1.1.2 Sound Card Configuration

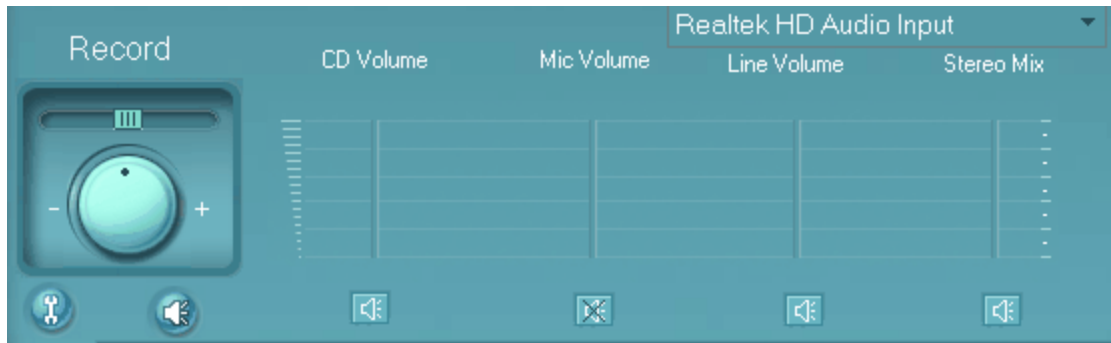
These days, most computers have sophisticated sound cards that come with built-in utilities to configure the advanced features of the cards. In some instances, you may need to directly configure the sound card through one of these utilities to get everything setup the way you want.

The RealTek Audio controller is one of the most common sound cards built into mother boards. For this reason, we'll walk through the configuration process with their configuration utility. Other sound

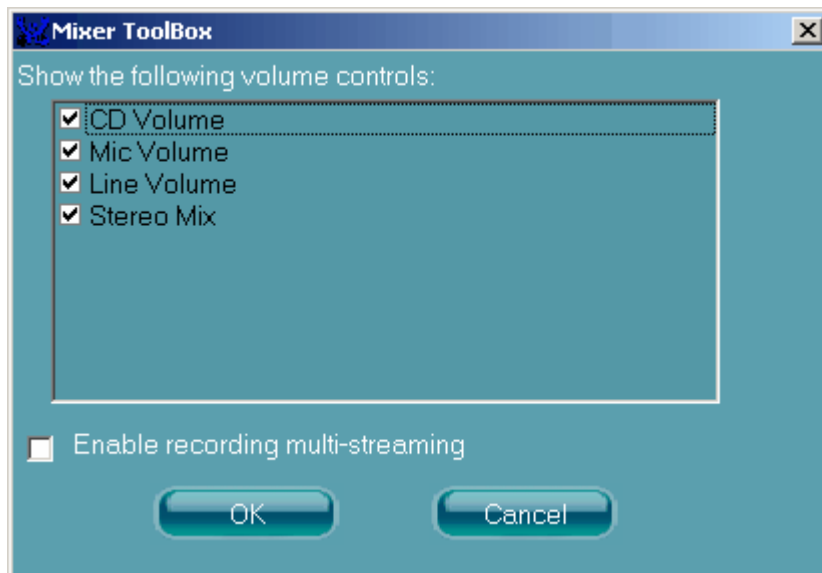
controllers will have similar utilities.

1. Running the Utility. Most sound configuration utilities are displayed in the System Tray, so just double click on the appropriate icon to start the program.

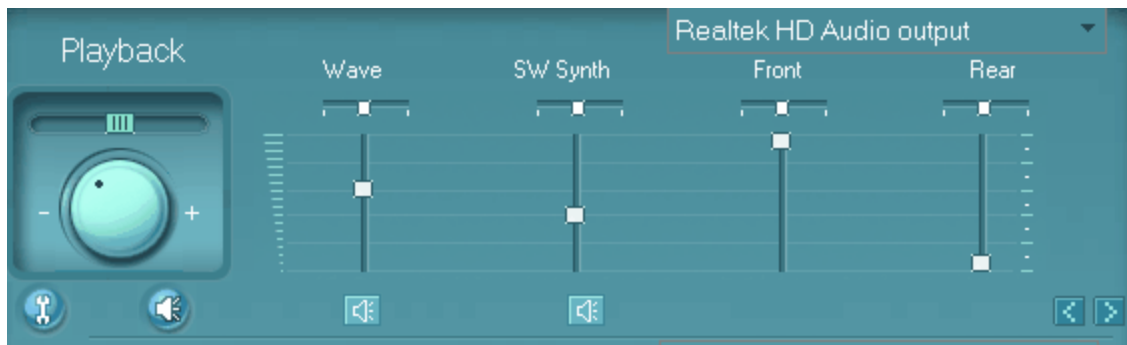
2. Setup Recording. Go to the Mixer Page and check the Line Volume control to be sure it is not muted.



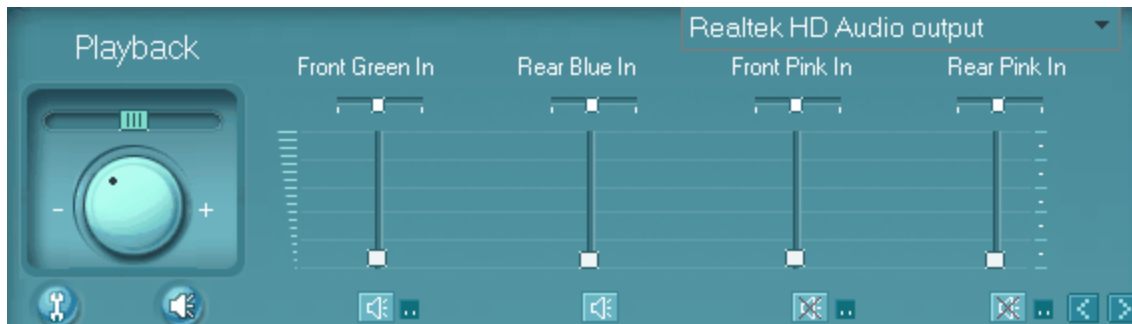
If there is a volume slider, make sure the volume is at least set about half way. If you don't see a line volume option, press the little "Tool" button in that is shown in the lower left corner of the image above. Make sure the Line Volume is enabled.



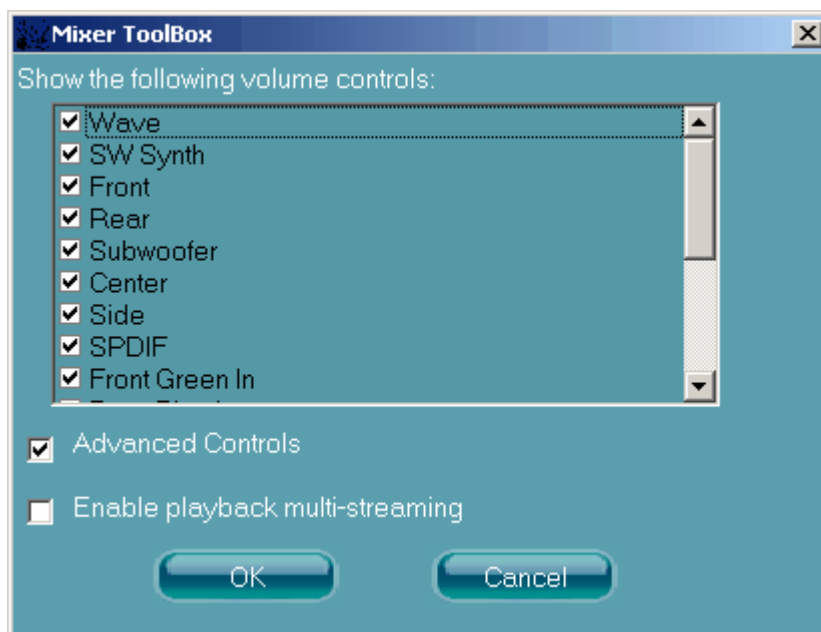
2. Setup Play Back. In Playback section, make sure the Wave option is enabled and the volume control is at least halfway up.



You also need to make sure the Line Input isn't being feed directly to the output. This will cause an echo because you will hear both the delayed and undelayed sound. RealTek software doesn't identify the Line Input as "Line Input," it identifies it by the color of the plug on the rear of the computer. When we setup the rear plugs, the "Line Input" was on the Blue Plug. So scroll the display to the right using the arrow button (in the lower right-hand corner above,) until you get to the "Rear Blue In" option. Make sure it is mute or the volume is all the way down.



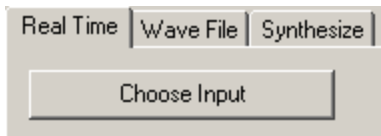
If you cannot find the "Rear Blue In," option, click on the little "tool" button, (in the lower left corner of the image above,) and see if the option is available. If it is, enable it and then mute or turn down the volume.



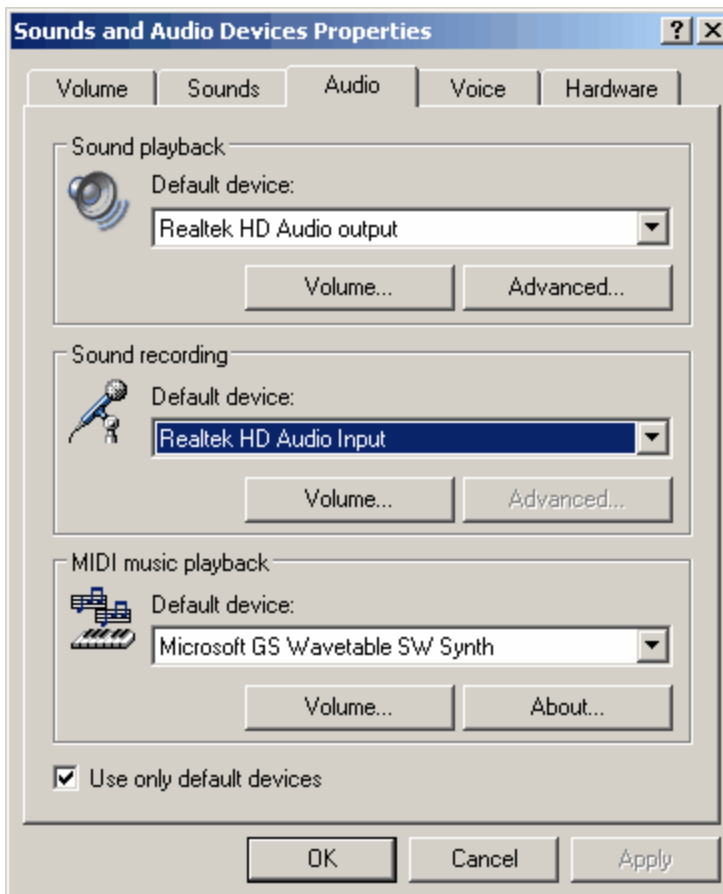
1.2.1.1.3 Configuring XP

Setting Up Inputs. The following section gives detailed instructions for setting up inputs for Windows XP inputs:

1. Press the "Choose Input" button at the top of Real-Time tool page.

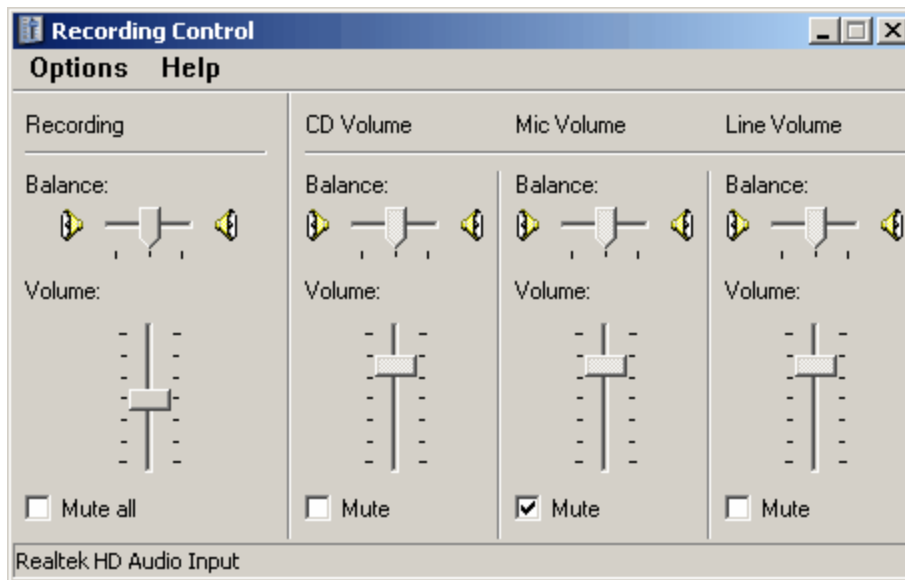


2. This will take you to the "Sounds and Audio Devices Properties" dialog. Choose the "Audio" page from the tabs along the top.



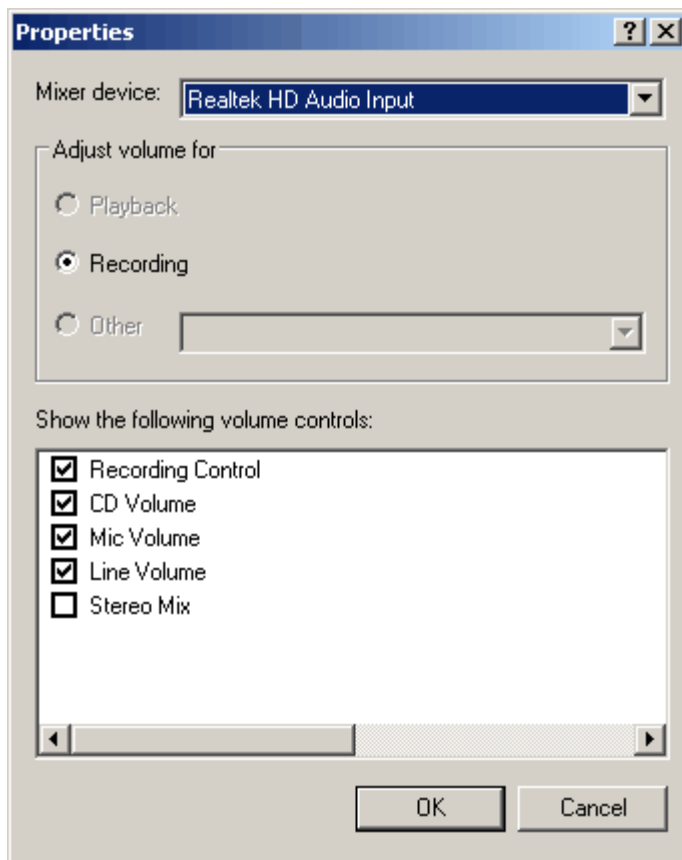
3. In "Sound Recording" section, choose a default device from the list. This will normally be your sound card. In some instances, like the example above, it doesn't describe the option as a sound card so you may have to refer to your computer documentation to know which device is your sound card.

4. Next press the "Volume" button in the Sound Recording section. This will take you to the "Recording Control."



Look at the "Line Volume" option. This option controls the input volume from your radio. Make sure it is not muted and the volume is up at least about half way. You can adjust the volume later if it is too high or low.

If you are missing the line volume option, select the "Options -> Properties" item from the menu bar. This will bring up the Properties window.

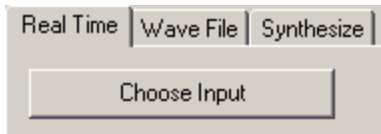


Make sure the Line Volume option is checked and press OK. If you still don't have access to the controls you need, you may have to set things up in the Sound Card Configuration utility that came with your sound card. Click here for general information about Sound Card Configuration Utilities.

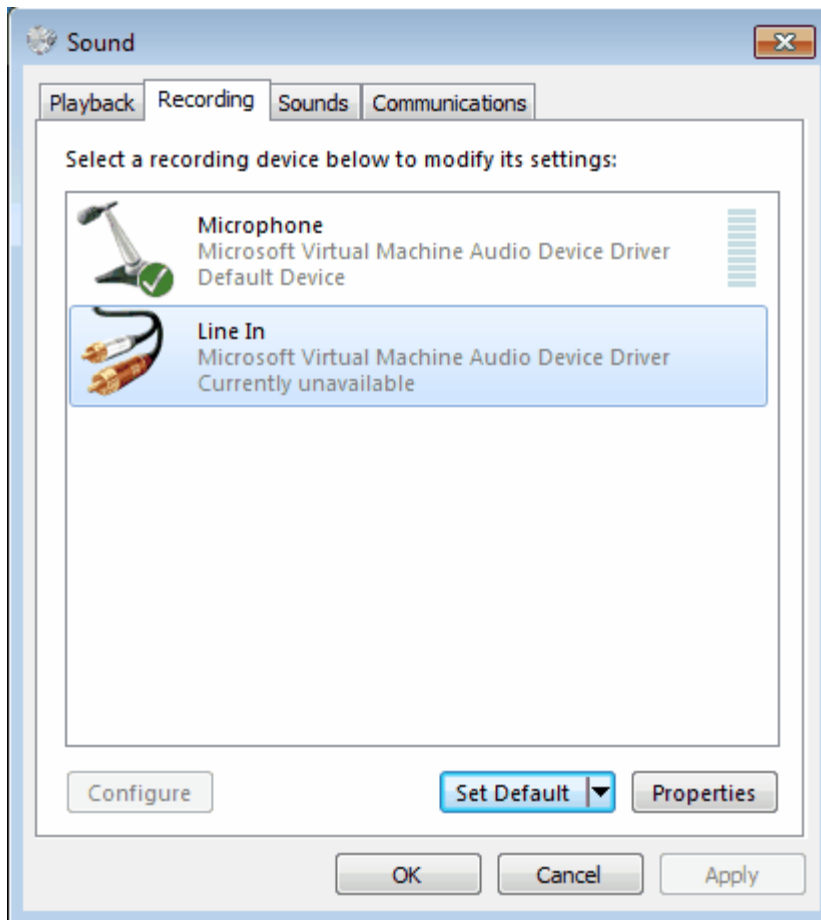
1.2.1.1.4 Configuring Vista and Windows 7

Setting Up Inputs. The following section gives detailed instructions for setting up inputs for Vista or Windows-7 inputs:

1. Press the "Choose Input" button at the top of Real-Time tool page.

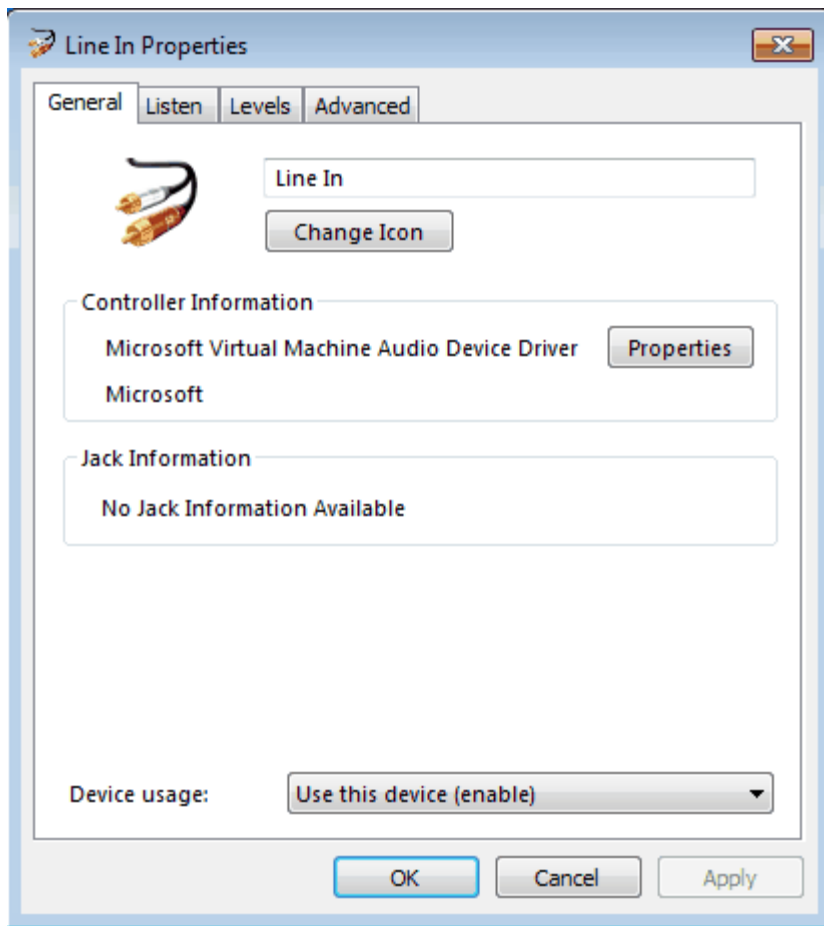


2. This will take you to the "Sound" dialog. Select the "Recording" tab at the top of the window.



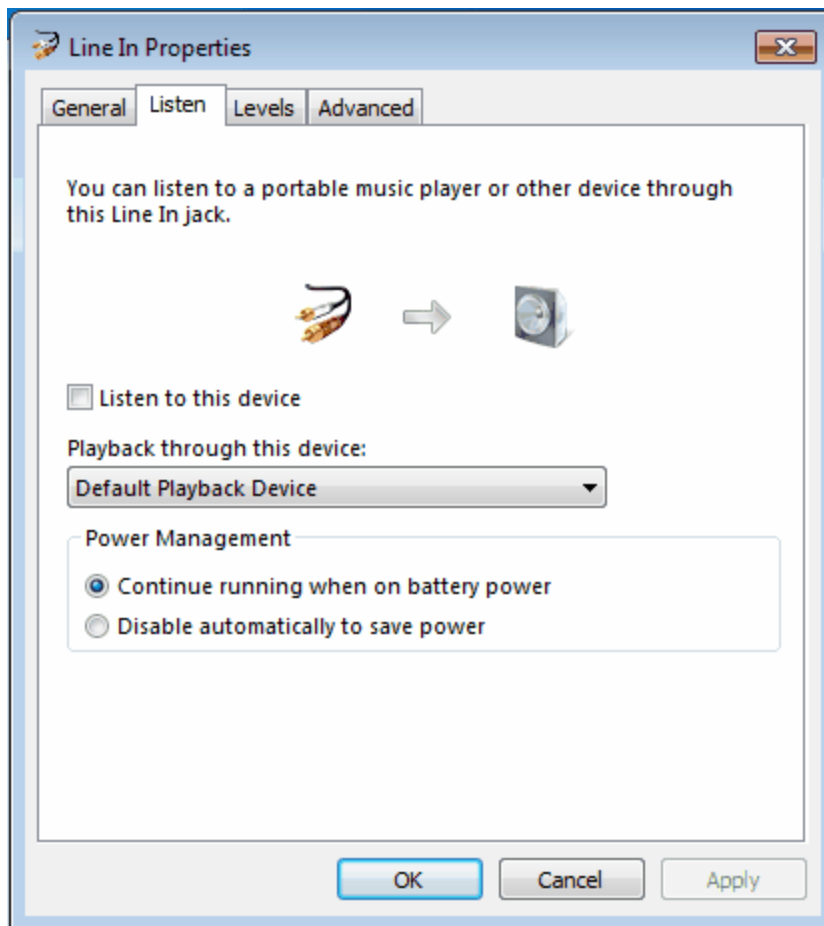
Select the "Line In" option. Next, press the "Default" button. This will cause a check mark to appear indicating that the option has been selected.

3. Press the "Properties" button. This will display the "Line In Properties" dialog. Select the "General" page.



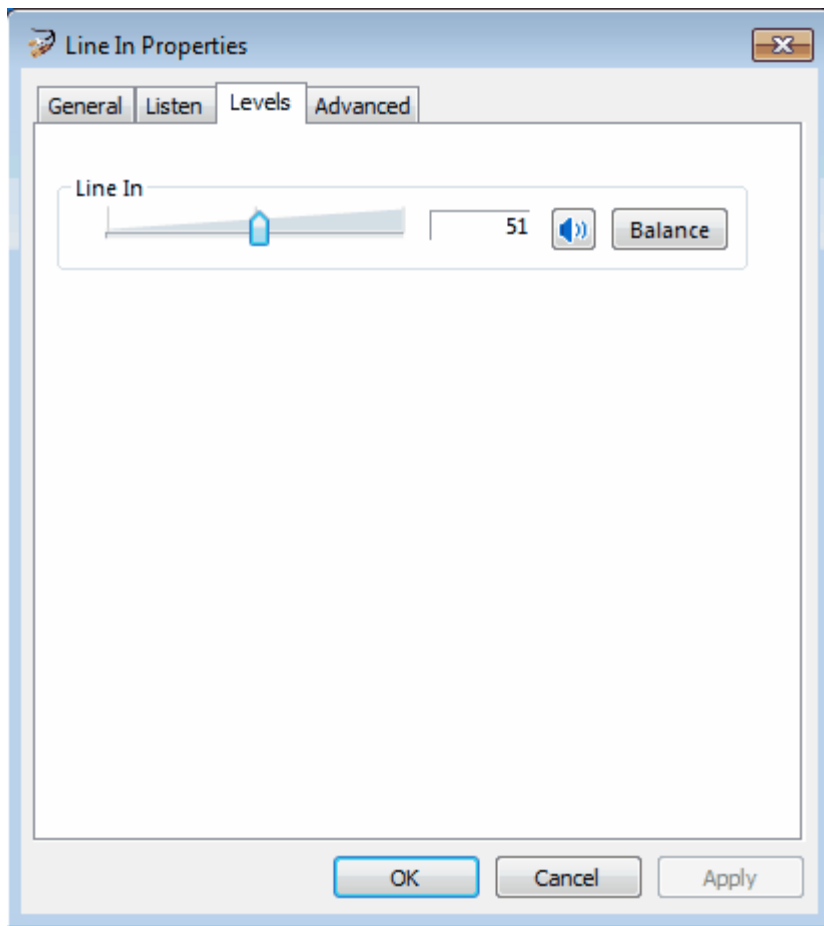
Make sure the "Device Usage" option at the bottom of the page is set for "Use this device (enable)."

4. Now choose the "Listen" page.



If you want to listen to the sounds while you analyze the, make sure "Listen to this device" option is enabled, otherwise there will be an echo in the playback.

5. Switch to the Levels page.



Adjust the levels to about 50%. If necessary, you can return to this dialog and adjust them later.

When you have completed all the steps, press OK twice to exit back to the Spectraciser program.

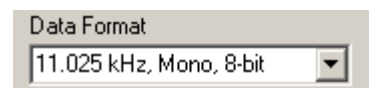
1.2.1.2 Real-Time Options

You have several options that control the way the program analyzes the incoming signal. These options appear in the upper left-hand side of the program window. Here are detailed descriptions of the options:

1. Buffer Size. This option controls how much information the program reads to perform the analysis. Larger buffer sizes give more resolution. More resolution gives sharper peaks in the graph and makes it easier to pick out details. On the other hand, larger buffers take in more information and so small, rapidly changing details in the signal may be lost in clutter.



2. Data Format. A typical PC audio card can sample the data in different formats. Spectraciser inventories all the capabilities of your audio card and displays them in Data Format box. By changing these formats, you can control different aspects of the analysis process. Here is a detailed description of all



the parameters:

a. Sample Rate. This option controls how often a sample will be read. A typical Sample Rate would be 11.025 kHz. This means that data would be sampled 11,025 times per second.

The Frame Rate controls the maximum frequency that can be analyzed. The maximum frequency that can be analyzed is always half the sampling rate. If the sampling rate is 11.025kHz, the maximum frequency that can be analyzed is 5,012kHz. The typical audio card can sample at 44kHz, so the maximum frequency that could be analyzed is 22kHz.

b. Bits. The Bits parameter controls the size of each sample. For example, most audio cards will allow you to sample 8 or 16-bits at a time.

The larger the sample size, the more dynamic range the data will have. Dynamic Range is the difference between the largest and the smallest signal that can be analyzed. With 8-bit samples you have a dynamic range of about 48db, where as with 16-bit samples the dynamic range is 96db.

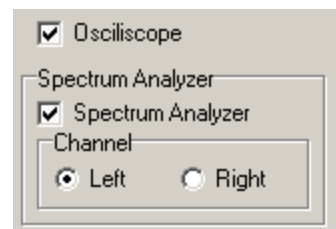
Larger dynamic range allows you to see more low-level details, such as noise in your signal. On the other hand, the extra sensitivity to noise may make the signal more difficult to see.

c. Mono/Stereo. Most audio card can sample data in mono or stereo modes. In stereo mode, you have a choice of left and right channels. This can be useful with recorded music where the different instruments and performers may be recorded in different channels.

3. Start/Stop Buttons. These two buttons start and stop the sampling and the process of analysis.



4. Oscilloscope. This option enables the two oscilloscope displays at the top of the screen. They display the amplitude and time incoming signals. Disabling the oscilloscope displays may speed up processing on a slow computer.



5. Spectrum Analyzer. This option enable spectrum analyzer display at the bottom of the window.

6. Right/Left. This option chooses which channel the spectrum analyzer displays if you are working in stereo mode. This allows you to focus on the data in one specific channel.

1.2.1.3 Bandwidth, Resolution Sample Rate

Setting different Sample Rates, Sample Sizes and Buffer Sizes changes the Bandwidth, Resolution and Frame Rates of the analysis. When you change these values the program displays the resulting Bandwidth, Resolution and Frame Rate. Here is a detailed description of each parameter:

1. Bandwidth. This value indicates the highest frequency the Spectraciser can analyze. It is governed by the Sample Rate. The bandwidth is always half the sample rate. For example, selecting a sample rate of 11,025 Hz results in a bandwidth of half that value or 5,513 Hz.

Bandwidth:	5513 Hz
Resolution:	43.1 Hz
Frames/Sec:	43.1 FPS

2. Resolution. This value indicates the smallest difference in frequency the program can detect. For example, if the program has a resolution of 43 Hz, it will not be able to distinguish between two signals that are less than 43 Hz. If you feed a combine 100 Hz signal and 120 Hz signal to the program, they would appear as a single frequency spike.

Resolution is controlled by the Buffer Size. The larger the buffer size, the more resolution the program will have. The trade off is that larger buffers take longer to fill and so the display is slow to respond to changes in the spectrum. Also, large buffers mean that more sounds are captured and analyzed. This can make it difficult to focus on individual, short lived sounds.

3. Frames Per Second. This value indicates how fast the display is updated. This is controlled by the Buffer Size and the Sample Rate. The larger the Buffer, the slower the frame rate. Likewise, the higher the Sample Rate, the faster the Frame Rate.

4. Frames Count. This display shows the number of samples that have been read since you started sampling

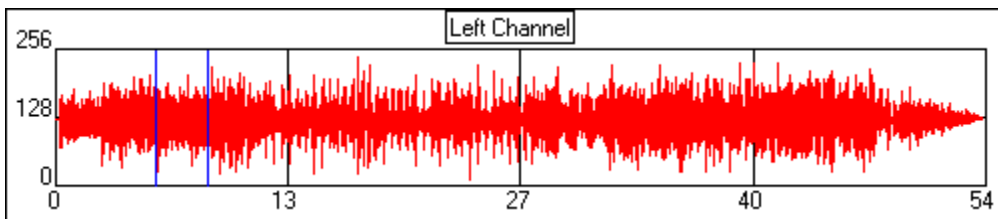
Frames: 174

1.2.2 Audio File Analysis

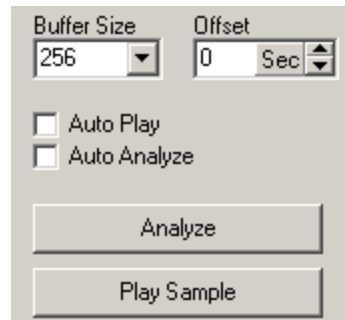
The Audio File Analysis Option allows you dissect an Windows AVI file and examine the spectrum of the sounds in the file. This can be useful for analyzing musical passages to determine the notes being played. Any sound that can be recorded can be analyzed in this way.

1. Loading An AVI File. To begin analyzing an audio file, select the "File -> Open Wave File" option from the menu bar. This will bring up the normal Windows files opening dialog. Just select the file you wish to analyze and click the OK button.

2. Analyzing the File. To begin analyzing the file, select the Wave File page from the left-hand tool panel. The main section contains information about the file just loaded. Click here for a detailed description of these items.



3. Selecting a Sample. When the file is loaded, the Left Channel display will show a graph of the sound data. Before you can analyze the file, you need to select a small sample to test. You can do this by clicking on the graph. A pair of blue, vertical lines will appear. These two lines show the start and end of the sample. (If the sound sample is large, the two lines may appear as a single line.) You can also select a sample setting the "Offset" value shown to the right. This number defines the beginning of the sample as an offset in seconds from the beginning of the file.



You can set the sample size using the "Buffer Size" option. This value determines the spacing between the two lines.

4. Analyzing the Sample. Pressing the "Analyze" button causes the sampled to be analyzed and the spectrum to be displayed. You can also play the sound through your computer's speaker by pressing the "Play Sample" button. Usually this will be short "blip-like" sound, but it gives a sense of where you might be in the file. For example, if you are trying to analyze a particular musical passage, pressing the "Play Button" can give you a sense where you are in the song.

Auto Play. When the Auto Play option is enabled, it allows you to hear the sound anytime you make a change to the sample position or size. This is useful for zeroing in on a section of a sound. For example, incrementing the offset with Auto Play on will allow you to hear the sound as you move to a particular point in the data.

Auto Analyze. When the Auto Analyze option is enabled, every time you do something to change the sample, the program analyzes the current sound sample.

1.2.2.1 File Statistics

The File Statics section gives you basic information about the sound data contained in the file. Here is summary:

Channels. This is the number of audio channel. One channel indicates a monaural recording. Two channels indicates stereo.

Hz. This is sample rate in samples per second.

Bytes/Sec. This is the number bytes per second. It is the number of bytes per sample times the sample rate.

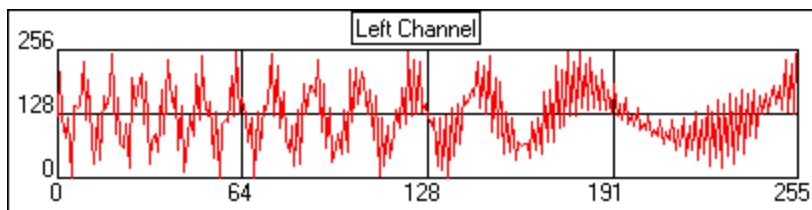
Block Align. This is the alignment of the data blocks.

Bits. This is the number of bits per sample. It determines the dynamic range of the sound.

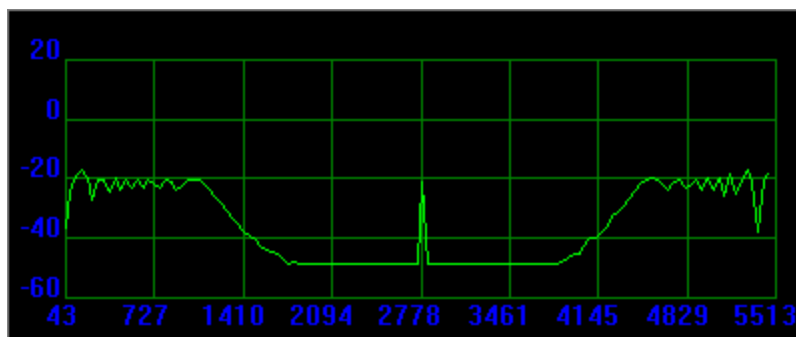
Samples. These are the number of sample in the entire sound file

1.2.3 Synthetic Wave Form Analysis

The Synthetic Wave Form section allows you to generate and analyze arbitrary, software generated wave forms. The image to the below shows a complex wave from generated with a combination of frequency sweeping and modulation.



Here is the result spectrum of the wave form:



To access this option, select the Synthesize Tab on the left Tool-Panel. The Synthesize page allows you to enter parameters that can define a variety of wave forms. Each time you make a change to

the wave form, a new wave form is displayed in the Oscilloscope display and the new wave form is Analyzed in the Spectrum display. Here is complete description of each parameter.

I. Base Wave. The Base Wave section defines a base wave form that can be modulated by the parameter in the Modulated Wave section.

A. Type. This controls whether the Base Wave Form is a sine or square wave.

B. Frequency. This controls the frequency of the base wave form.

C. Sweep. When this option is enabled, the frequency of the Base Wave form is swept between the Base Frequency and the End Frequency described below.

D. End Frequency. This is the end frequency for the sweep option described above.

E. Amplitude. This is the amplitude of the Base Wave form. Increasing this value increases the height of the peaks of the wave form

F. DC Bias. A typical symmetrical wave form will have an average value of zero This option allows you to change the average value. This has the effect of moving the whole wave form up or down. In electronics, it is called the DC Bias..

The screenshot shows a control panel with three tabs: 'Real Time', 'Wave File', and 'Synthesize'. The 'Synthesize' tab is active. It contains two main sections: 'Base Wave' and 'Modulate Wave'.
 The 'Base Wave' section includes:
 - 'Type': Radio buttons for 'Sine' (selected) and 'Square'.
 - 'Frequency': A numeric input field set to 500.
 - 'Sweep': An unchecked checkbox.
 - 'End Freq': A numeric input field set to 1000.
 - 'Amplitude': A numeric input field set to 1.
 - 'DC Bias': A numeric input field set to 0.
 The 'Modulate Wave' section includes:
 - An unchecked checkbox for 'Modulate Wave'.
 - 'Type': Radio buttons for 'Add' (selected), 'Mult', and 'FM'.
 - 'Frequency': A numeric input field set to 2.
 - 'Amplitude': A numeric input field set to 1.
 Below these sections is a checked checkbox for 'Play Sound' and a button labeled 'Display Test Signal'.

II Modulate Wave. When the Modulate option is enabled, the Base Wave form is modulated by the wave form generated in the modulate sections.

A. Type. Program can modulate the Base Wave form in several different ways:

1. Add. The Modulate Wave form is added to Base Wave Form

2. Mult. The Modulate Wave form is multiplied by Base Wave Form.

3. FM. In this mode, the frequency of the Base Wave form is shifted according to the amplitude of the Modulate Wave form. (Note: this option only takes the frequency of the Base Wave form. It doesn't modify that actual Base Wave form. In other words, you cannot FM modulate a square wave or swept wave form, only a sine wave.)

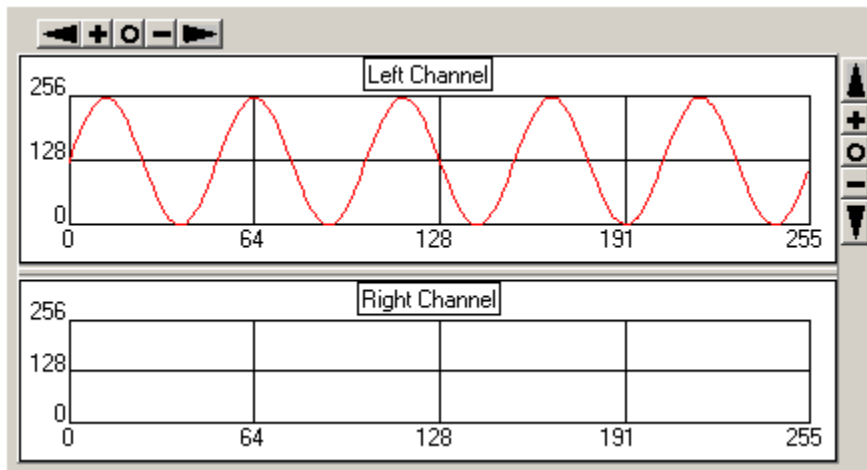
III. Play Sound. When this check box is checked, the wave form is played as a sound every time the wave changes or the signal is redisplayed.

IV. Display Test Signal. Pressing this button displays or redisplay the current wave form. If the "Play Sound" option is enable, the wave form will be played as a sound.

V. Buffer Size, Bits Per Sample and Sample Rate. The buffer size, the bits per sample and the sample rate are controlled by the settings on the First Page. For example, selecting a larger buffer size will increase the length of the sound played.

1.3 Oscilloscope Display

The Oscilloscope Graphs are display in the top right right section of the program. The Oscilloscope Graphs the amplitude of a signal versus time.

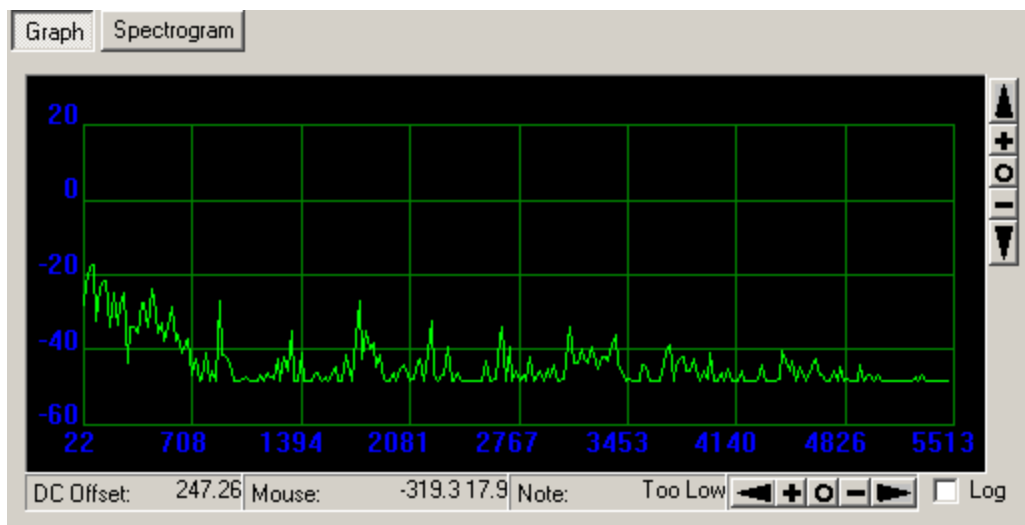


If the you are operating in Real Time mode and oscilloscope option is enabled, these two displays show the incoming signals in real-time. If the signal is monaural or the you are sampling in mono mode, only the Left channel will display data. Signals are also displayed if you are analyzing a audio file or generating synthetic wave forms.

You can zoom and pan the display in both the X and Y-Axes using the buttons along the top and sides of the graphs. Pressing the plus "+" sign zooms in and pressing the minus "-" sign zooms out. The arrow buttons pan the displays right, left, up or down depending on which set of buttons you are using. The "o" button resets all the pans and zooms.

1.4 Spectrum Display

The spectrum display shows a graph of the amplitude of each frequency in the incoming signal. By examining the peaks in the graph, you can tell what frequencies are contained within the signal.



Here is a description of all the options that appear in the graph:

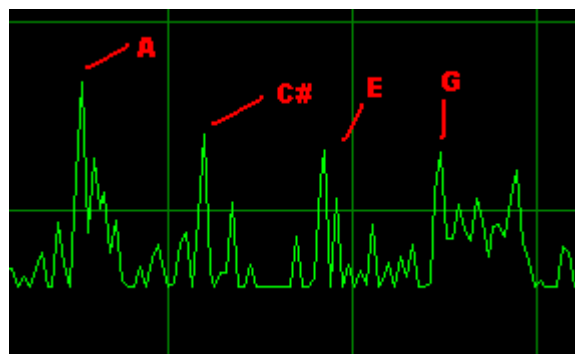
Amplitude. The amplitude is displayed in decibels. Since the input signal is not specified in volts, power or any other unit, the decibel values are calculated as a ratio to the maximum possible input value. The actual meaning of the values depends on the gain setting in the Volume control and the number of bits per sample.

Frequency. Frequency is displayed along the bottom of the graph. The maximum frequency is controlled by the sample rate.

Zoom/Pan Buttons. You can zoom and pan the display in both the X and Y-Axes using the buttons along the top and sides of the graphs. Pressing the plus "+" sign zooms in and pressing the minus "-" sign zooms out. The arrow buttons pan the displays right, left, up or down depending on which set of buttons you are using. The "o" button resets all the pans and zooms.

Note Display. This item displays closest musical note to the frequency represented by the mouse cursor. The first value is the letter value of the note. For example, A#, C, etc. The second value is the octave number, with respect to low C at 16.352hz. This allows you to analyze musical performances and find the exact notes in a composition.

The image to the right shows a typical situation analyzing the chord structure one section of a song. By looking at the obvious peaks, you can pick out the notes being played at that instant in the song. In this example, the notes forming the four obvious peaks are A, C#, E and G. This is a standard A7 chord. Other peaks represent overtones or places where the musician slid between adjacent notes.

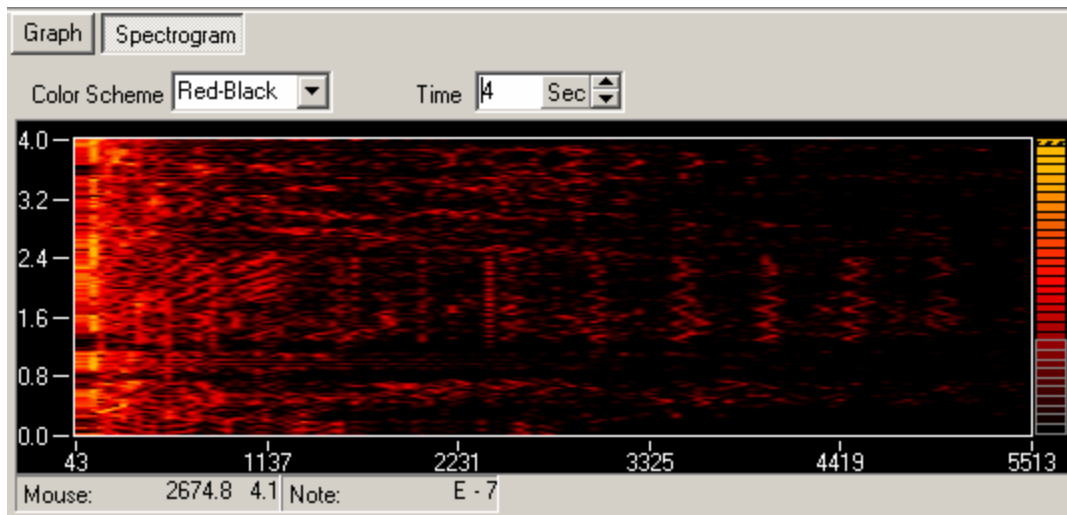


DC Offset. This item displays the amount of DC Offset there is in the signal. Since the input signal is not specified in volts, power or any other unit, the decibel values are calculated as a ratio to the maximum possible input value. The actual meaning of the values depends on the gain setting in the Volume control and the number of bits per sample.

Mouse Display. This item displays the amplitude and frequency represented by the mouse cursor when it is over the Spectrum Graph. It allows you to do precise measurements of amplitude and frequency. If you move the mouse cursor across the Spectrum Graph, the values will change, showing you the exact amplitude and frequency at the point where the mouse cursor is displayed. (Note: you can increase the resolution of the graph by expanding the program window to full size.)

1.5 Spectrogram Display

The Spectrogram displays multiple spectrums over a period of time. Whereas the main spectrum display allows you to see the composition of a signal at just one instant in time, the Spectrogram allows you to see the spectrum of an period of time ranging from one second to 10 minutes.



To access the Spectrogram Display, press the Spectrogram Button at the top of the lower right-hand panel.

The Graph. The Spectrogram displays Amplitude, Time and Frequency.

1. Amplitude. The amplitude is signified by the the color at a point on the screen. Depending on the color scheme, brighter colors usually indicate a higher amplitude.

a. The Color Bar. The Color Bar on the right side of the graph indicates the relative values of each color. The color and thickness of each bar can be adjusted and you can created custom color schemes. Click here for detailed information on setting up custom color schemes.

b. Color Schemes. Two basic standard colors schemes are available: Red Black and Rainbow. You can select either scheme by accessing the Color Scheme box at the top of the display.

2. Time. Time is displayed along the left side of the graph. As newer samples are analyzed, a new row of frequency information is inserted at the bottom and the whole display is scrolled up by one line, so the newest data is always displayed at the bottom and older signals at the top.

Setting Time. You can control the number of seconds of data that are displayed by changing the Time Control just above the graph. The time can range for one second to 10 minutes. Short time frames are useful for rapidly changing sounds. Long time frames for slowly changing signals.

Music is best analyzed with signals in the range of 5 to 10 seconds.

3. Frequency. Frequency is displayed along the bottom of the graph. If you see a colored spot toward the left side of the display, it is low frequency sound. Color spots to the right side are higher frequencies. The maximum frequency is controlled by the sample rate.

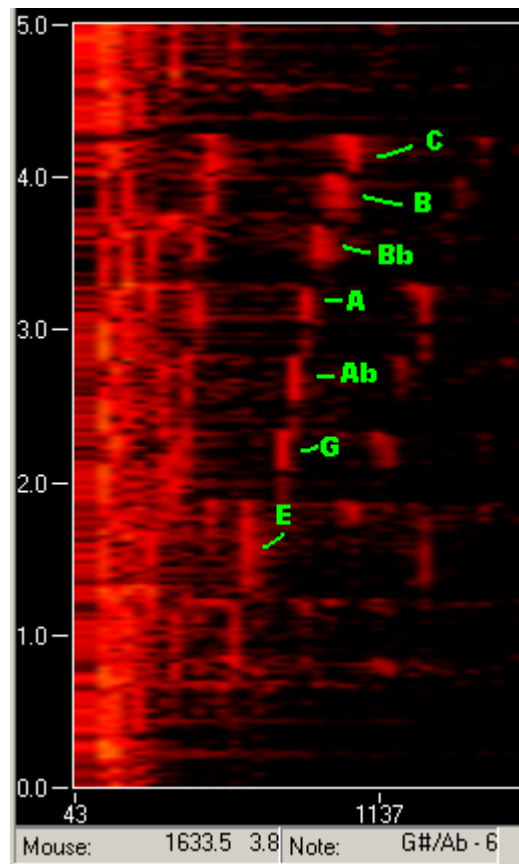
A. Mouse Display. You can precisely measure the frequency and time of a sound feature in the spectrogram using the mouse. As you move the mouse over the graph, the frequency and time displayed in the lower left, below the spectrogram. (Note: you can increase the resolution of the graph by expanding the program window to full size.

B. Note Display. The musical note that corresponds to the mouse cursor position is also displayed below the graph. The note is displayed in two pieces. The first value is the letter value of the note. For example, A#, C, etc. The second value is the octave number, with respect to low C at 16.352hz. This allows you to analyze musical performances and find the exact notes in a composition.

The image to the right shows a typical situation analyzing the a series of notes in one section of a song. By looking at the obvious peaks, you can pick out the notes being played at that instant in the song. In this example, the notes indicate a descending run through C, B, Bb, A, Ab, G and E.

Other peaks represent notes and chords played by other instruments in the song. They can also represent overtones of other notes.

Because the Spectrogram separates out each frequency, it is possible to separate the all the different instruments and vocal notes in a song. This allows you analyze in detail the notes, chords and timing of a song. You can even see wavering sound such as a singer's vibrato or the tremolo effects on a guitar or an organ.



1.5.1 Custom Color Schemes.

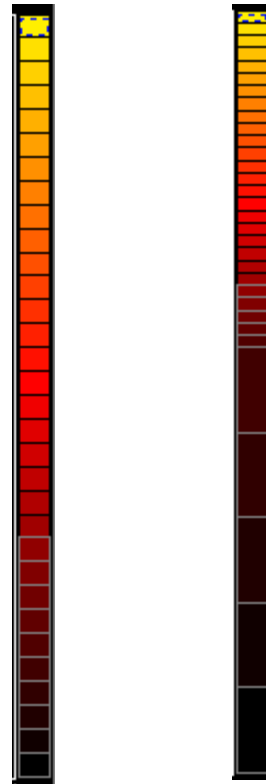
You can adjust the color scheme of the Spectrogram Display or even create custom Color Schemes. To edit the color scheme, select the "Setting -> Setup Spectrogram" display from the Menu bar. You can also access the Color Scheme Editor by right clicking on the Spectrogram and selecting the "Setup Spectrogram" option.

The Color Bar. The color bar sits on the right side of the Spectrogram. The colors in each band represent the colors of different amplitudes of the signal. In the case of the bar show to the right, higher amplitudes would be yellow, middle amplitudes would be orange and red, and lower amplitudes would be fade into black.

Spacing. The width and space of the bands can be changed by dragging the bars between the bands. If you hold down the **Control-Key** while your are dragging, the program will cause the bars below and above to be evenly spaced. This allows you to sift the positions of all the bars in a smooth spacing.

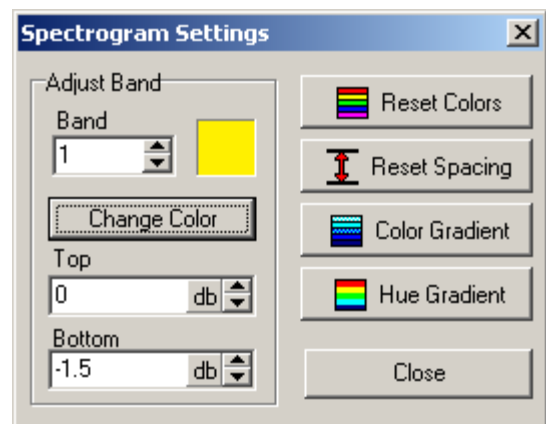
The bands in the color bar to the far right have been adjusted so the spacing is shifted. The majority of the bars has been shifted upward so that low level signals will be less visible in the display.

Resetting Spacing. You can reset the spacing of the color bands by right clicking on the Spectrogram and selecting the "Reset Spacing" option from the menu.



Adjusting Bands. You can precisely control the individual bands in the color bar. To do this select the "Settings -> Setup Spectrogram" option from the menu bar. This will bring up the "Spectrogram Settings" dialog. You can also access the dialog by right clicking on the spectrogram and selecting the "Setup Bands" option from the menu.

Spectrogram Settings. The Spectrogram Settings dialog has controls that give you precise control over the individual bands in the color bar. Here is a detailed description of each control:



1. Adjust Band. The Adjust Band options allow you to control the color and height of each color band.

- a. Band.** The Band option allows you to select a color band by its number. The lowest numbered band is the top band and the highest numbered band is the bottom band.
- b. Change Color.** When you select a band number, the color of the band is displayed to the right. To change the color, press the "Change Color" Button.
- c. Top.** This value is the position of the top of the band. Adjusting this value changes the width of this band and the width of any adjacent band.
- d. Bottom.** This value is the position of the bottom of the band. Adjusting this value changes the width of this band and the width of any adjacent band.

- 1. Reset Colors.** Pressing the Reset Controls button resets the colors to the last color scheme that you selected. It does not change the widths of the bands.
 - 2. Reset Spacing.** Pressing the Reset Spacing button resets the space of each band so they all have the exact same spacing.
 - 3. Color Gradient.** Pressing the Color Gradient button creates a color gradient between the bottom color band and the top color band. The color gradient is determined by linearly interpolating the Red, Green and Blue values.
 - 4. Hue Gradient.** Pressing the Hue Gradient button creates a color gradient between the bottom color band and the top color band. The color gradient is determined by linearly interpolating the Hue of the bottom and top colors. Hue gradients produce a rainbow type color gradient.
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