HOW TO RECORD WAV FILES FOR CONVERSION TO CSW

Recording good CSW files involves using a hi-fi cassette player and an amplifier.

An ideal setup:

ASCERTAIN YOUR CASSETTE PLAYER PRODUCES EVEN WAVE AMPLITUDES

This should not be a problem with a hi-fi cassette player so you only need to read this if you are using a cheap cassette player. Some cassette players produce more amplitude on negative pulses than positive pulses or vice versa. You need to identify whether you have one of these cassette players and if you have one I recommend getting a hi-fi cassette player. To discover if yours is one, connect your cassette player straight to the line in jack socket with a 3.5mm stereo jack plug to 3.5mm stereo/mono jack plug cable. <u>Use only stereo jack plugs with stereo sockets or you will damage something.</u> Alternatively a cable from a DIN socket could be used.

You will need to record some samples from computer cassettes and look close up to see whether the waves have an even amplitude on both sides of the zero line and that the waves have a sine wave or inverted sine wave shape. Players that don't make good waves like this are typically awful with computers, and as I said, one will have to be changed for a player that produces good waves. The graph showing +180 degrees, a few pages forward, is suitable for comparing recordings.
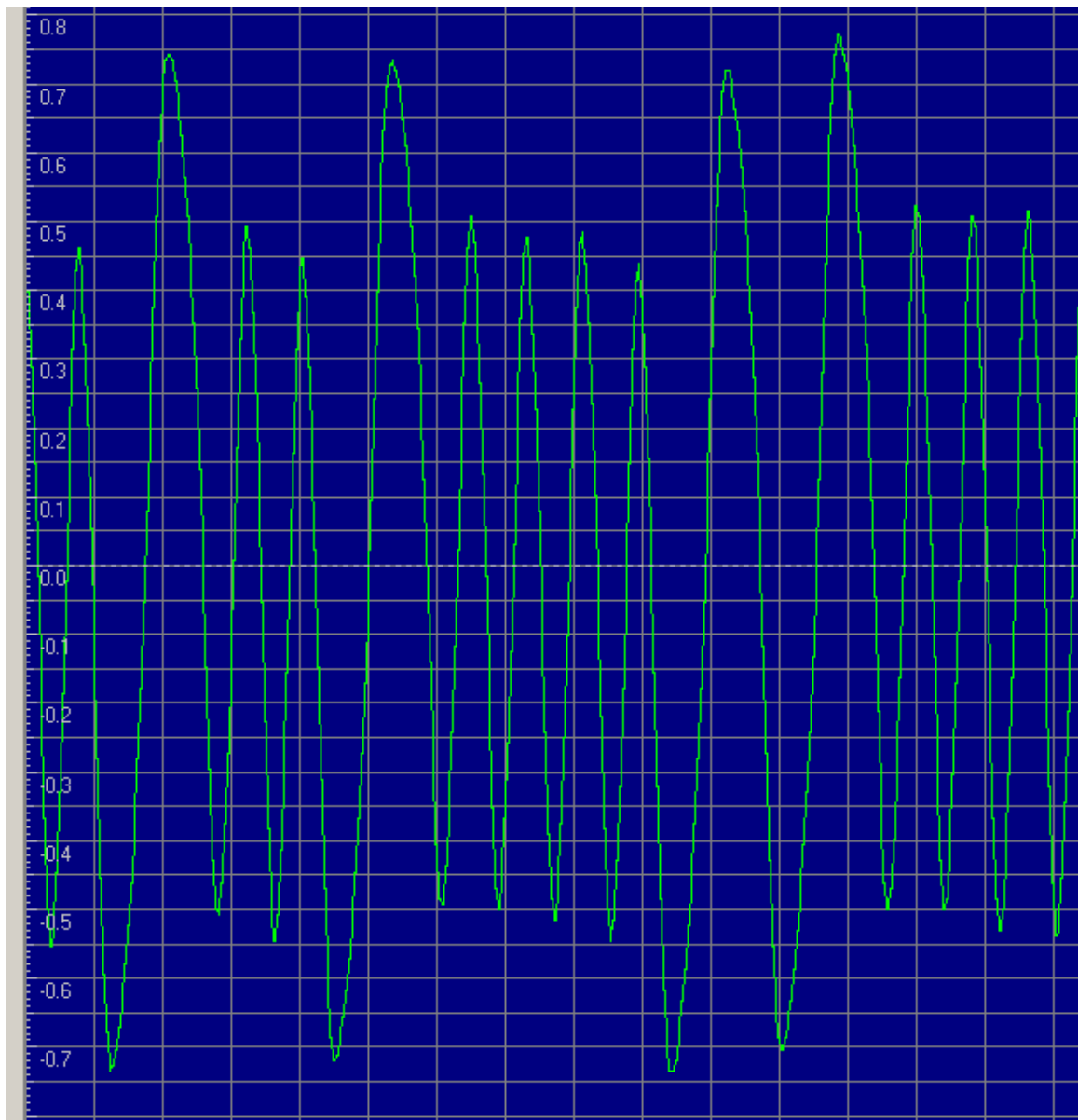
ASCERTAIN WHETHER YOUR AMPLIFIER IS A PHASE SHIFTING ONE

This is not likely to be a problem for many people. Amplifiers that do phase shifting are likely to be ones with digital IC components. When you have ascertained that you have a cassette player that produces even amplitude waves you can then ascertain whether your amplifier applies a phase shift. Some amplifiers apply a +90 degree phase shift along a sine wave to waves when not using tone bypassing.
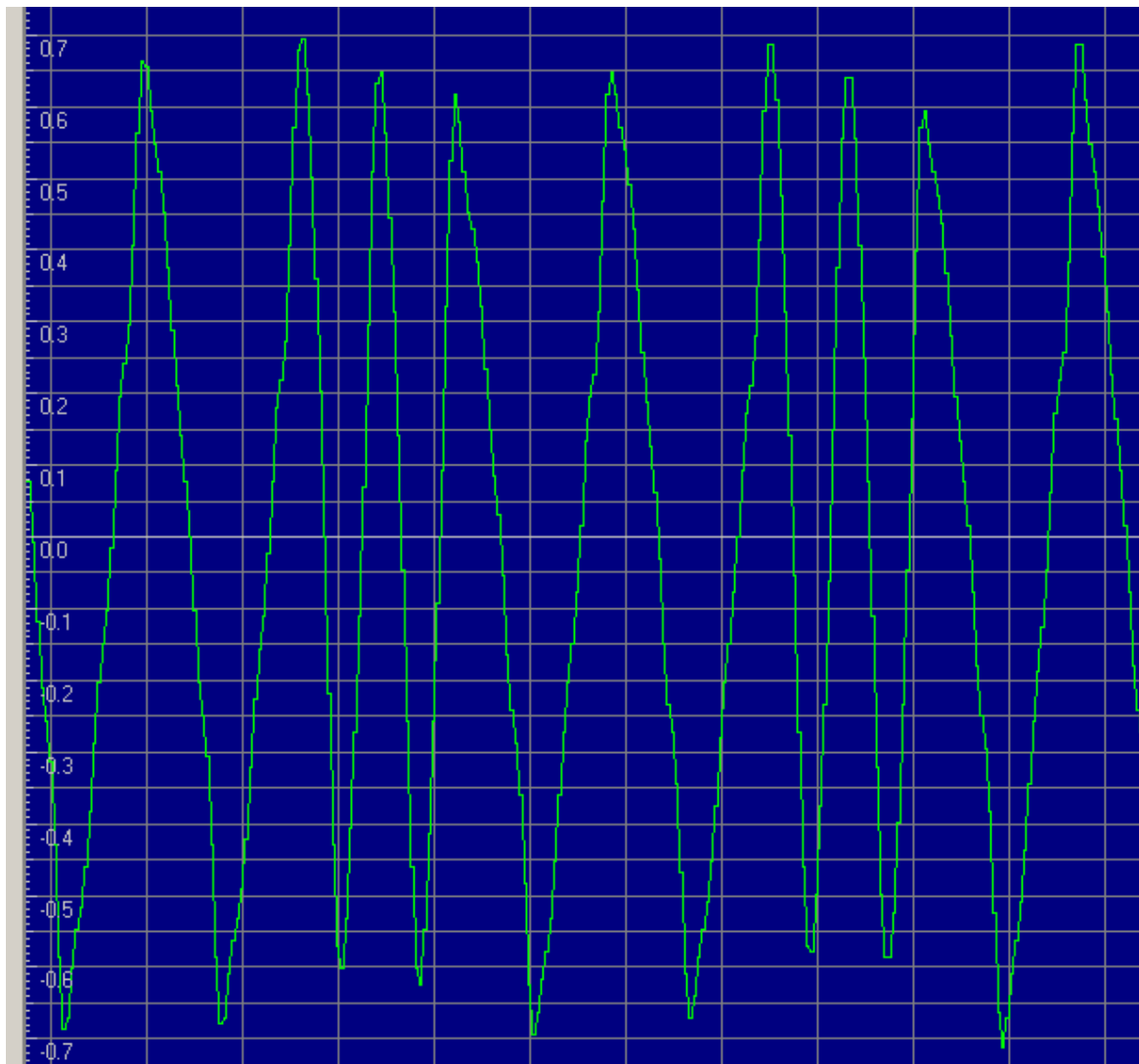
Set the amplifiers volume at a listening level. Turn all tone controls off while recording a sample. Have a look at recordings from a few cassettes to ascertain whether you have a phase shifting amplifier.

Following is a couple of pictures of recordings from different amplifiers.

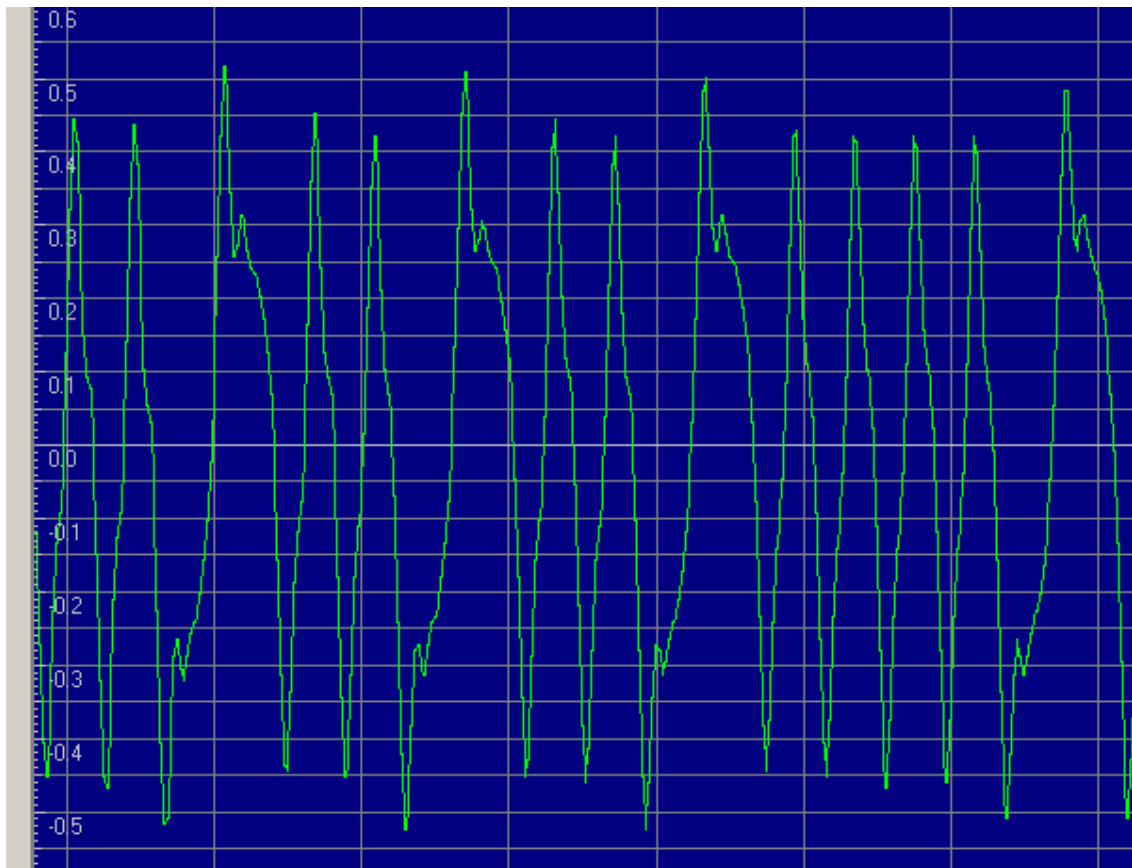**+180 degrees, This amplifier will be easier to use:**

-90 degrees, This amplifier will make extra work for you:

I don't recommend using a phase shifting amplifier. To help CSW Viewer remove the phase shift a filter has to be ran with a sound editor. This is explained in the 'Filtering' section. It is necessary to smooth gaps between files after the whole file filter has been used. See the section entitled 'Smoothing noisy gaps'.

When a cassette has large hiss waves on the data waves it will not be possible to make the cassettes into a CSW file correctly with a phase shifting amplifier. An example of one of these cassettes is BBC Mastermind Quizmaster for the BBC micro.

Large hiss waves on data waves (from BBC Mastermind Quizmaster):

CONNECTING

A Hi-Fi cassette player should be connected the usual way to an amplifier with a pair of phono plug cables. I would avoid using really cheap cables.

Connect the headphone jack socket of the amplifier to the line in jack socket on your sound card. This connection is easily done with a 3.5mm stereo jack plug to ¼ inch stereo jack plug cable with a single shielded wire. Wire the tip and ring together at the ¼ inch plug. At the other plug connect the signal wire to the tip only. The shield of the wire is connected to the sleeve of the plugs.

It is necessary to make a sound cable because you can't buy one of its type.
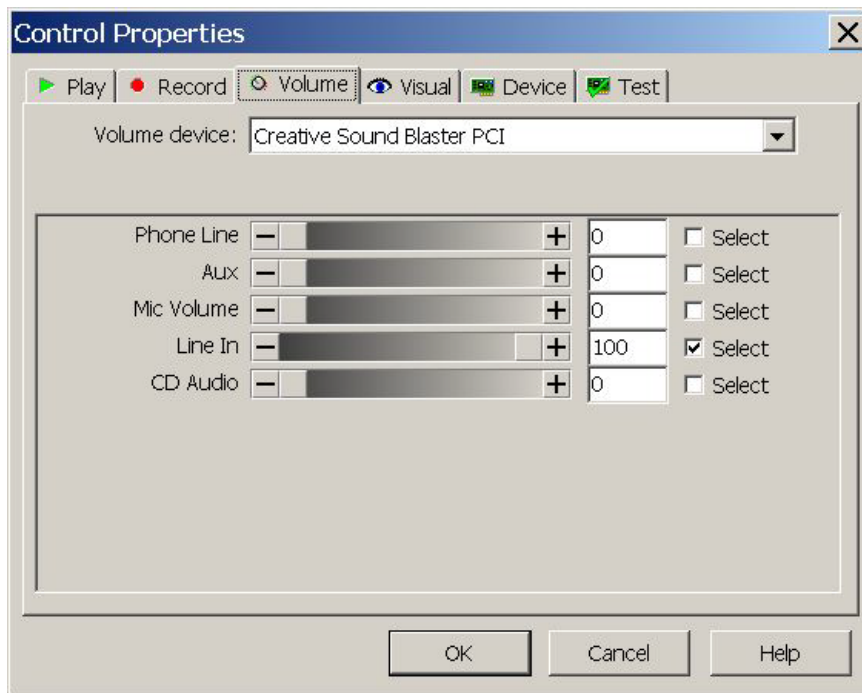
Sound cable:

SOFTWARE

Use a sound recording program such as Gold Wave, Cool Edit 2000 or Sound Forge Studio to record a mono 8bit WAV file from the cassette. The sound is only recorded from the left channel for a mono recording.

If you use Cool Edit 2000 turn off the option Settings, Data, "Smooth all edit boundaries by crossfading." Other programs may also have an option like that.

Gold Wave has the following dialog box for selecting the input device or devices by percentages. You would want to have it set as shown.

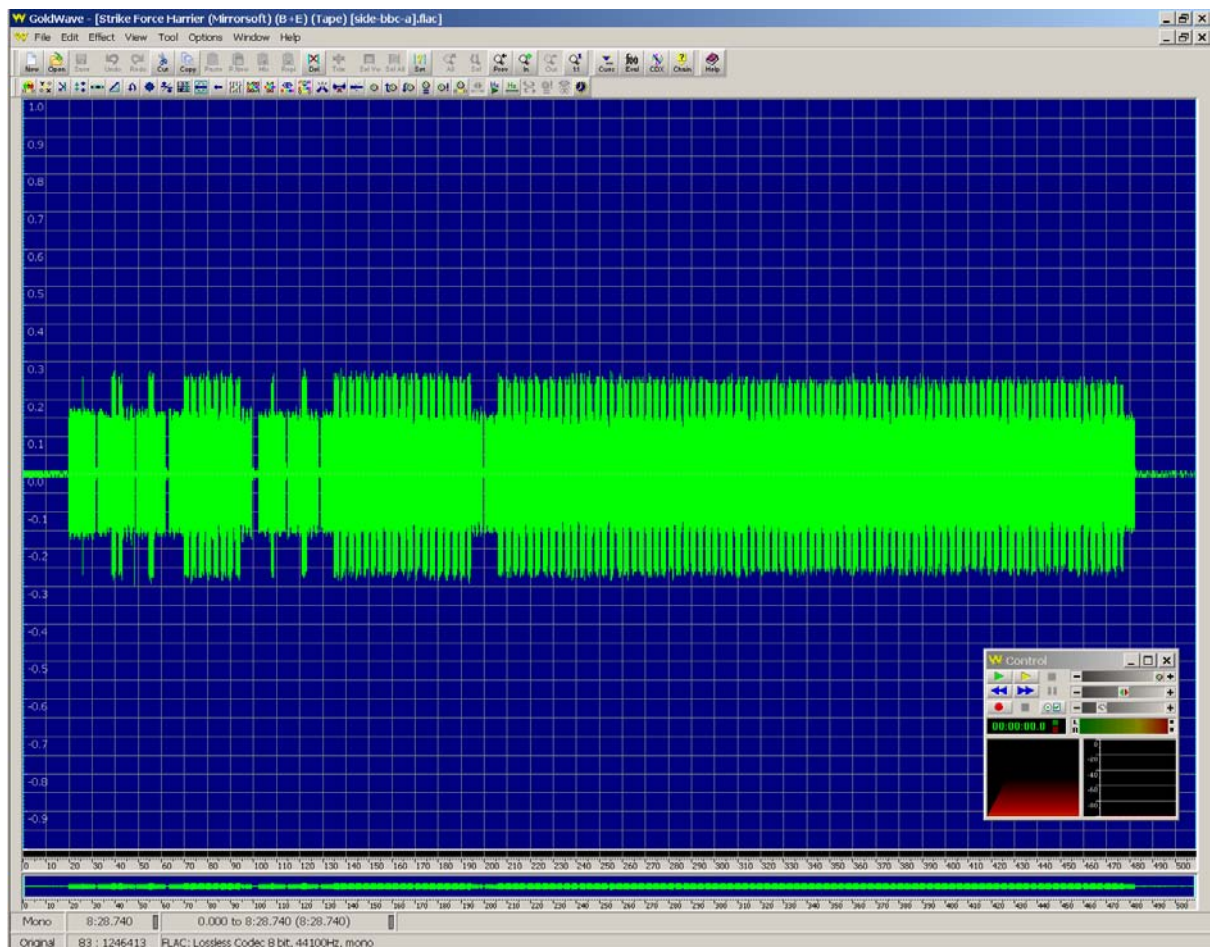Remember to use "Save Selection As …" and not "Save as…".

SETTING THE VOLUME AND TONE

It is best to record with a volume that makes the waves cover no more than a third of the available amplitude range. Too high a volume could damage your sound card. Too much volume also amplifies the hiss at gaps making you more work. You might want to stick with a certain volume that works for all of your cassettes. If less than half of the available amplitude range is used there will only be a small reduction in the quality of the recording.

Switch off Dolby noise reduction if it is available on your cassette player.

Don't use loudness buttons on amplifiers because these usually apply far too much bass.

A complete recording:

It is important with 0/180 degree starting waves to see greater amplitude with the longer waves, to make a good CSW file. Use the bass control to make the long waves have greater amplitude than the short waves. The treble control can also be used but I would try the bass alone first. Try setting bass to 50% turned up initially.

If you use a phase shifting amplifier it is important to have even amplitude with all waves. Use the bass control to make the waves have even amplitude. The treble control can also be used but I would try the bass alone first.
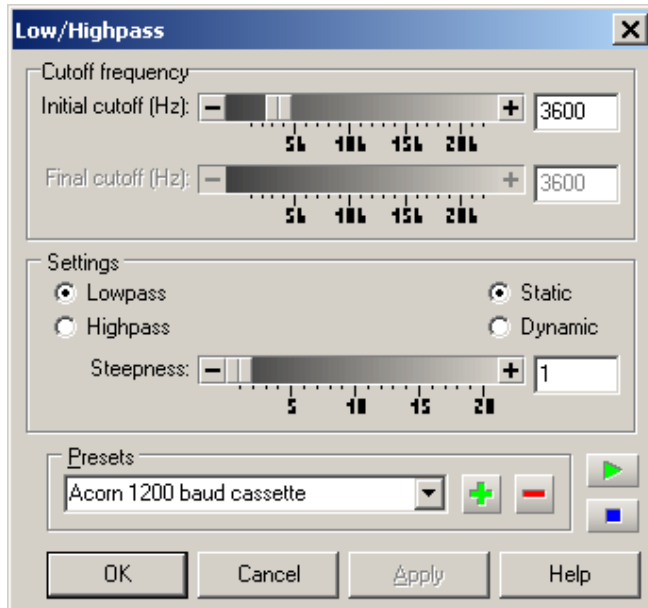
Normally you would not want to move the balance from the centre. If you see that a cassette has been recorded with only the left or right channel you could set the balance to only one channel to avoid noise from the other. It is possible that some of the cassette might be different.

FILTERING

On occasions you have to run a low-pass filter over the whole recording to remove unwanted small waves that are being interpreted as data waves. There is no harm in doing this to all recordings. If you save the recording in a lossless format such as FLAC the size will be greatly reduced.

A static low-pass filter with 3600Hz and a steepness of 1 could be done with Gold Wave. The frequency you use depends on the highest frequency of the cassettes waves. 3600Hz is suitable for Acorn cassettes. It should be greater than the highest frequency used on the cassette. The whole recording should be selected before applying the filter. Saving a preset makes it easier to use.
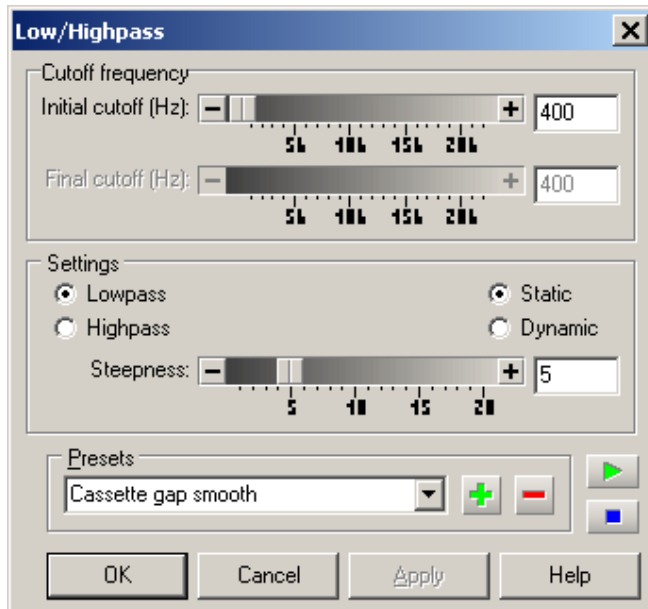
Gold Wave's low-pass filter dialog box:

SMOOTHING NOISY GAPS

It is necessary to smooth gaps between files if noise is being seen as some kind of readable waves. A static low-pass filter with 400Hz and a steepness of 5 could be done with Gold Wave. The gap should be selected before applying the filter. Start and finish the selection at crossing points of the zero line. Saving a preset makes it easier to use.

Gold Wave's low-pass filter dialog box:

Entirely silencing the gap works badly with many programs including MakeUEF, which expects to see at least a few pulses at a gap. It is necessary to have a few waves in gaps so that the surrounding readable pulses are left ok don't become merged into the long gap pulses. With extremely short gaps the gap is usually made into only 2 pulses. Nothing complicated is being done. The computer readable frequency waves are being smoothed down to lower frequencies.

If you use a low volume you can sometimes avoid recording any hiss at gaps.

GENERAL GUIDELINES

Hi-Fi cassette players give a signal much more close to what was recorded. Also DC offsets are not as bad with them. They are basically much better than simple cassette players. They usually require more bass than simple cassette players.

A cassette players heads have to be regularly cleaned with head cleaning fluid and a cotton wool bud. Use one end to clean and the other to wipe the heads dry.

Playing a tape through helps when it hasn't been used for years and also fast winding it. The cassette player heads may need cleaning after.

If a cassette makes high pitched squeaks warm it for a while near a heater and play it through before recording.

I recommend often running a demagnetising cassette. These are only to be played on one side and not rewound by the cassette player.

Demagnetiser:

Using a UPS instead of mains power with a cassette player and amplifier makes a small improvement by not having a minor 50Hz signal from the AC power source.

If the volume decreases as you are recording you probably have dirt on the cassette players head.

Don't use any other programs while recording because sections of the cassette may become missing in the recording and you may not even notice it.

Use your cassette players pause button to start a cassette playing to avoid an unwanted noise at the start.

FLAC is a lossless format that is a good alternative to WAV.

MORE GUIDELINES FOR ACORN CASSETTES

If you are making any files for www.acornpreservation.org enter your name, cassette player model and "Created for www.acornpreservation.org." in the creators signature edit box in CSW Viewer.
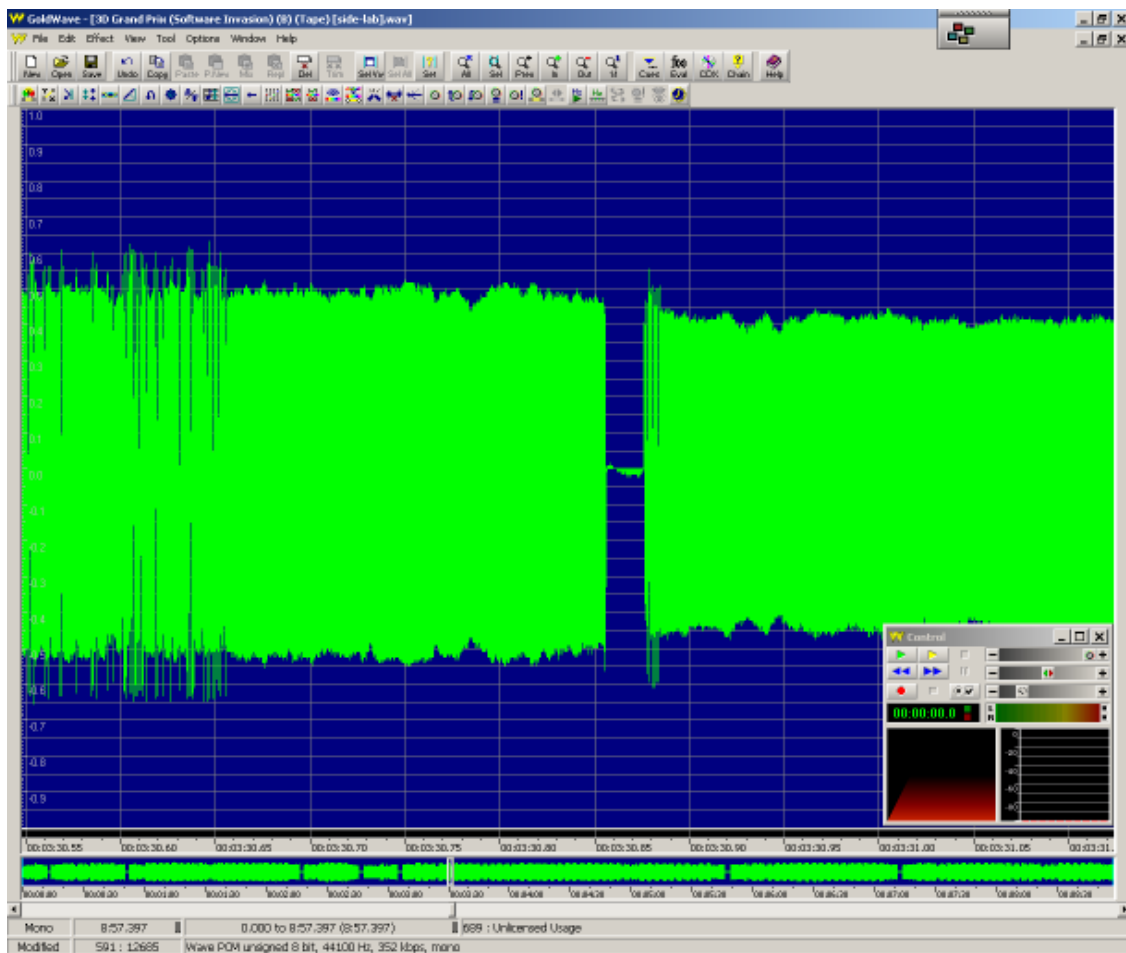
Start and stop the recording to catch the whole tape. You can know when the end of the cassette is coming by winding it to the end, then press the counter reset button, and then rewind. The cassette will end at 000.

Listen or look for dropouts, which are often on the trailing tone of the last block of a file. Don't do tapes with dropouts.

The MakeUEF manual has some information on recording when there is hiss, hum or dropouts in the 'Limitations' section.

Extremely short gaps should be examined with a sound editor for hiss and hum. Firebird's game Estra would have hum turned into security waves by MakeUEF without making the hum unreadable. Some cassettes have small gaps between data blocks. E.g. Software Invasion's game 3D Grand Prix.
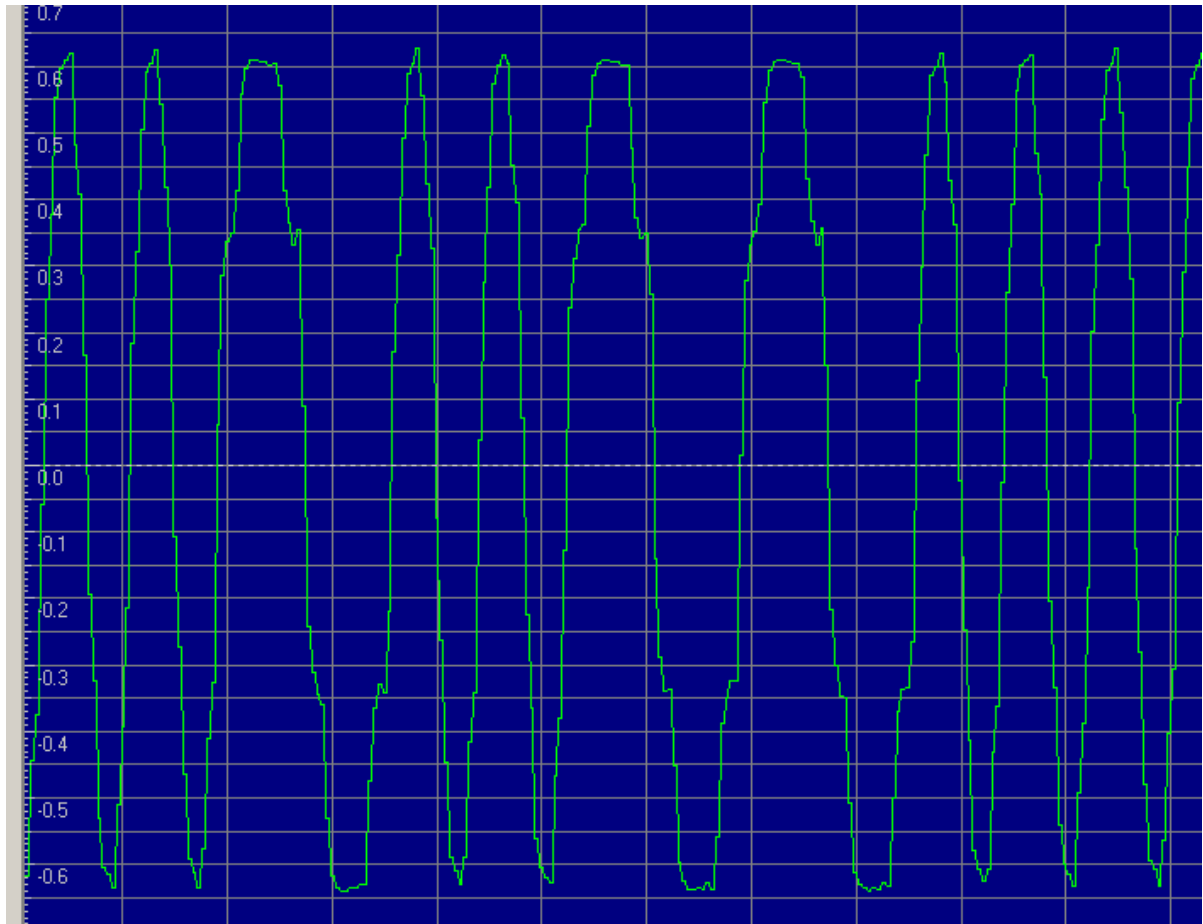
Ideal view for searching for small gaps:

Save the selected recording in the WAV format preferably using the file naming conventions used at www.acornpreservation.org. Remember to use "Save Selection As …" and not "Save as…".
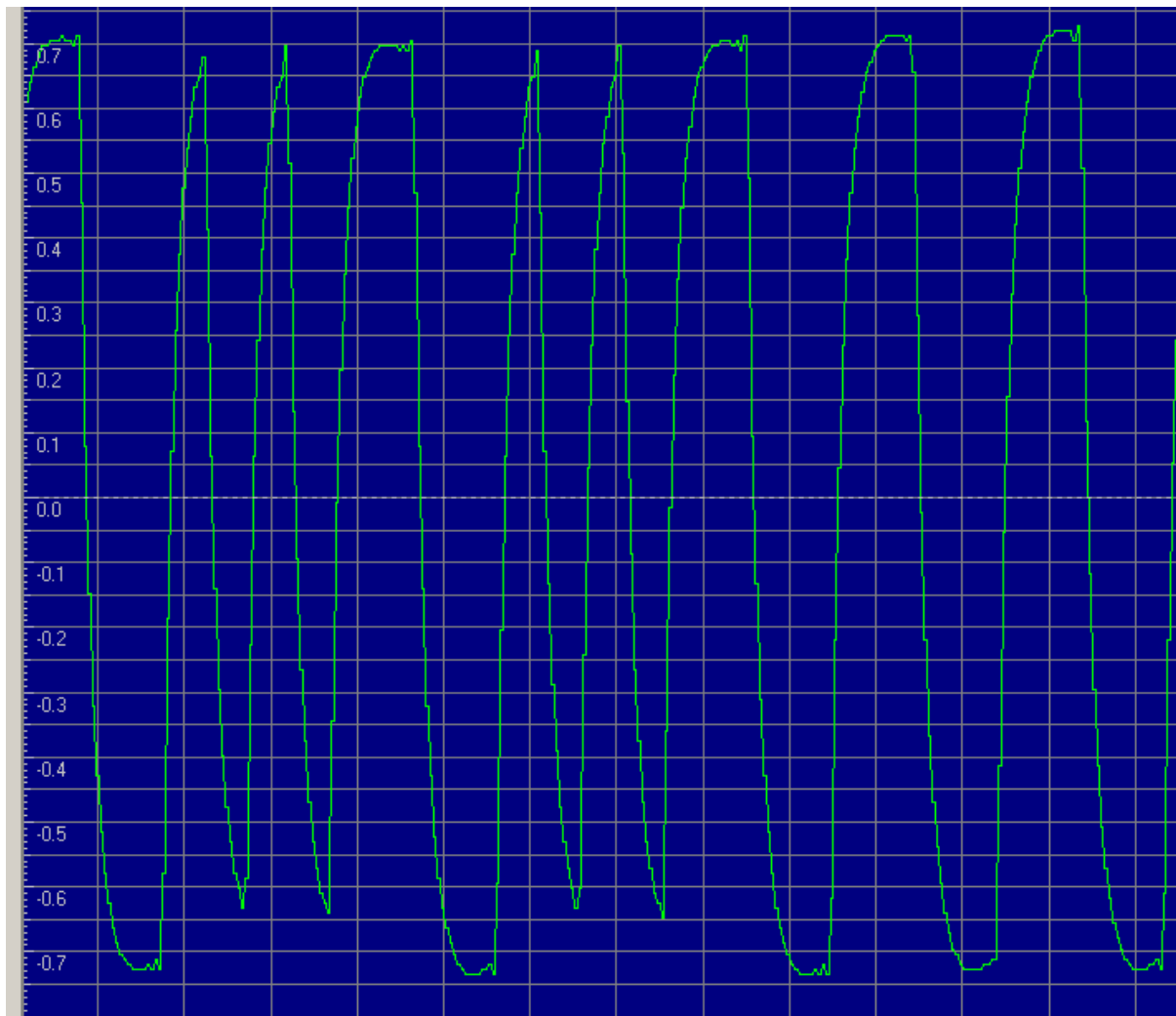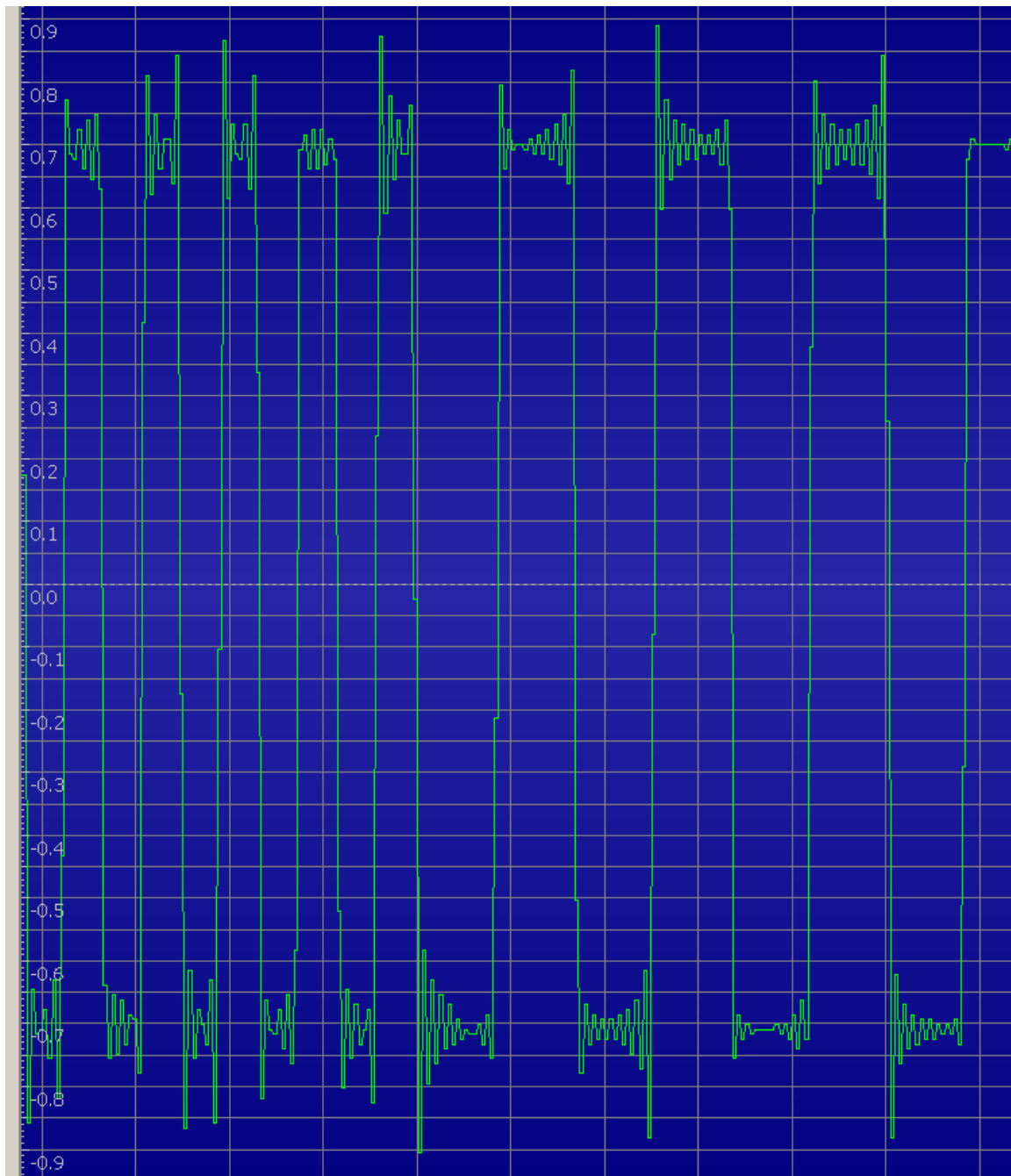
Acorn Electron:

The waves start positive. The amplitude levels of waves are even. There is a rough sine wave shape to the waves.

Spectrum +2A:

The waves start positive. The amplitude levels are noticeably weak with negative short pulses. The waves show the signal is lowered faster than it is raised resulting in lob-sided waves. The signal fades towards 0 after being raised although it is barely noticeable.

Acorn Atom:

The waves start negative. The amplitude levels are even. There is a square shape to the waves. There is a high frequency tone embedded throughout, noticeable at the peaks and troughs.