

# WaveSpectra English help (translated from Japanese)

## Table of contents

---

Introduction .....	3
Install / Uninstall .....	4
Example of operation .....	5
Usage .....	8
Playlist .....	14
Read-out .....	18
Analysis position fine designation function .....	20
Multichannel Format .....	24
Measurement mode .....	25
Measurement of frequency characteristics .....	30
Measuring distortion ratio .....	40
Setting dialog .....	57
Wave .....	58
Spectrum .....	63
FFT .....	70
Play / record .....	72
Other .....	81
WaveFile information window .....	88
Operation with keyboard .....	112
Tips .....	113
Other .....	118
History .....	121

## Introduction

---

High Speed Real Time Spectrum Analyzer

## WaveSpectra Help

---

V1.51 (2012/08/15)

Please see the [history](#) for changes from the previous version.

---

### Introduction

This WaveSpectra is a tool to display its frequency components (spectra) in real time by FFT (Fast Fourier Transform) of sound signals that are input to sound devices and Wave files.

Since it was made to operate at high speed, you can use the personal computer as a spectrum analyzer of the audio band.

(Originally developed at around 100 MHz clock of the PC, it can be used enough even for several generations ago)

\* If you can obtain speeds of several tens of frames per second, you can see almost change in input in real time.

\* Supports 8, 16, 24, 32 bit (including floating point) Wave format (linear PCM only) and 384 kHz sampling (10 MHz on scale).

\* BWF (Broadcast Wave Format) format, RF64 format (4GB or more), Multichannel Wave file up to 8 channels (WAVEFORMATEXTENSIBLE Format).

\* MME, DirectSound, ASIO, WASAPI (exclusive mode Windows Vista SP1, Windows 7 only) Driver support.

#### [ [Measurement Mode](#) ]

As measurement functions, peak hold waveform, average waveform, lead out, overlay (load, save, Export to Excel etc.), THD (+ N), S / N, RMS Others, Spectrum 3D display, Wave Lissajous (X - Y) display, level meter display are also available.

(The display screen can be copied to the clipboard at an arbitrary timing.)

Furthermore, when playing Wave files, there is also an analysis / waveform display function that tracks the movement of the position setting track bar knob, and an arbitrary precise position analysis function. (Analysis mode: [Analysis position fine designation function](#) . Even if there is no sound device or a wave file of a format that can not be played back, the analysis position The fine designation function is available)

Also, when inputting from a sound device, you can record while recording to the file at the same time.

Although there are various measurement functions, for the time being Please do not think about the difficult thing, please use it as a player for Wave file performance (with [playlist](#)

function) or as a recording machine.  
Just watching the change in the spectrum of music is quite fun.

## Operating environment

- Windows XP or later  
(**NOTE:**V1.50 to 95/98 / Me, it does not work, it can not be moved even in 2000.  
However, because it requires special procedures, it is excluded. Please contact if you absolutely need me.)  
CPU clock: If it is over 500 MHz, there is usually no problem. (It may affect graphics performance more than that)
- Since the measurement accuracy depends on the performance of the sound device, we recommend that you use as high performance as possible.  
(Observable / measurable with considerable accuracy up to about 100 kHz by using a high performance device such as 192 kHz / 24 bit)

**\*MME, DirectSound, ASIO, WASAPI (exclusive use only)driver Correspondence.**  
(Accurate input / output is possible with ASIO and WASAPI)

[ASIO Interface Technology by Steinberg Media Technologies GmbH]



---

Created with the Personal Edition of HelpNDoc: [Create iPhone web-based documentation](#)

---

## Install / Uninstall

---

### Installation

Create an appropriate folder and use WS.EXE and WX01DLL.DLL (And the help file WS.CHM).

However, be sure to set **an ordinary folder on the local disk in the PC C: \WS or D: \WS\_TEST etc).**

And if you make a suitable shortcut etc for starting, that is it.

Moreover, since it does not write at all in the Windows system folder and registry even during use, you can use it only with a sense of security with ease.

However, it is necessary to save the window position, display condition and others and reproduce it at the next startup Create the WS.INI file in the same folder as the started WS.EXE.

(It will be made automatically at the end, you do not need to be at the beginning)

If you want to use under different conditions, please make folders separately and put them in.

\*Up to two WS.EXE can be activated.

Two can be used independently with different settings. (For recording, for reproduction etc.)

Second, WaveSpectra: 2 appears in the title bar.  
Also, the second INI file is WS\_2.INI .

It is now possible to operate two from V1.50 synchronously. ( [WaveSpectra: 2 sync](#) )  
By doing this, by playing the same file on the same device with two WaveSpectra (going gradually misunderstood if it is a different device) or recording, for the time being The spectrum can be displayed simultaneously with 2 ch of L, R.

## Uninstallation

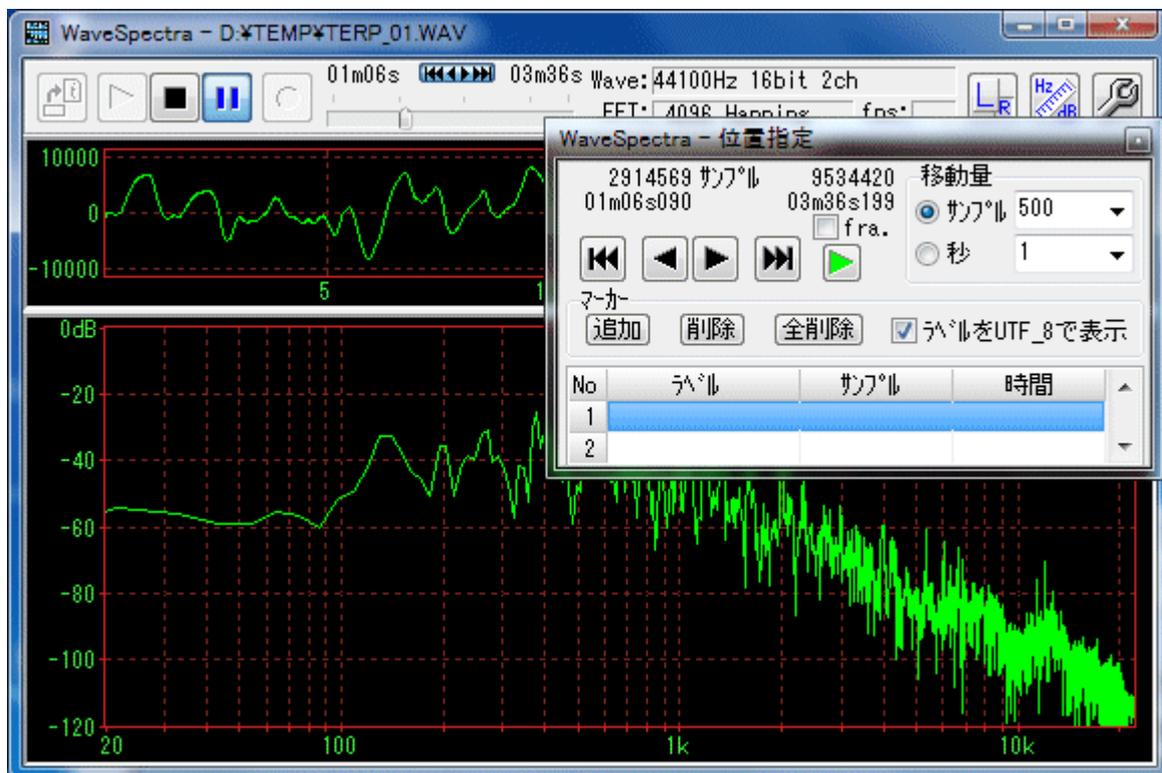
Just erase all the files for each folder and it is the end.

Created with the Personal Edition of HelpNDoc: [Full-featured multi-format Help generator](#)

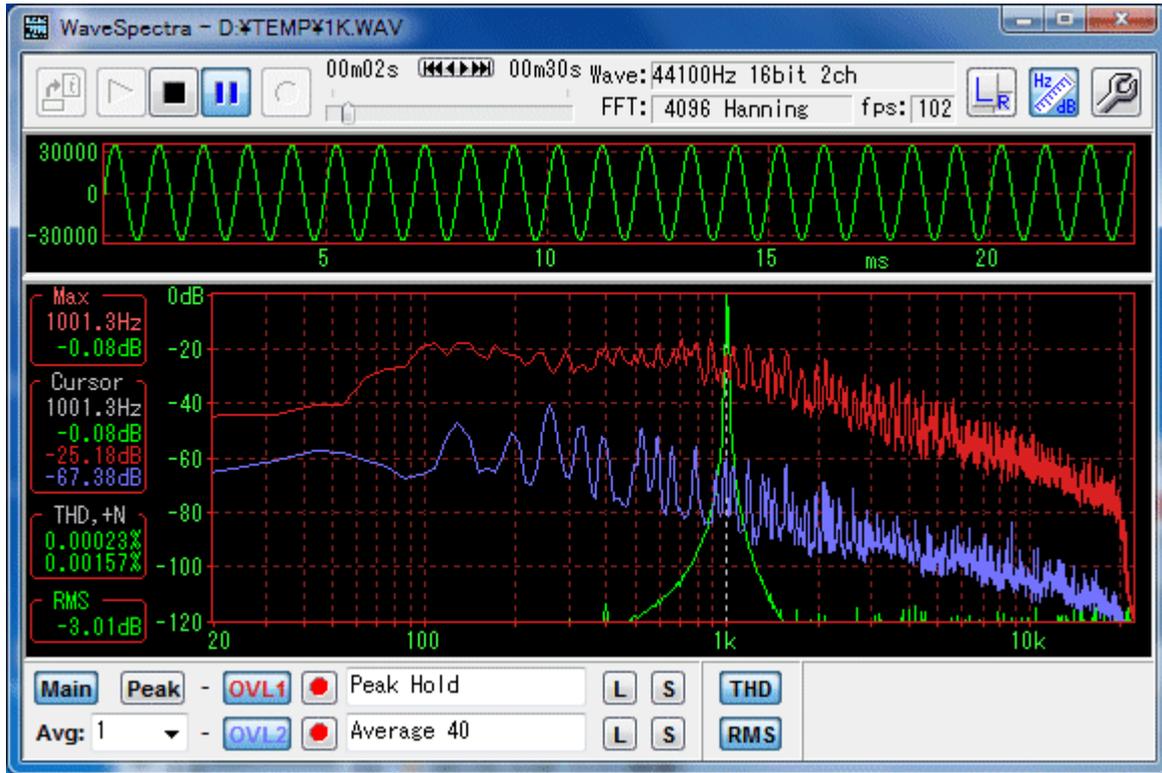
## Example of operation

### Operation example

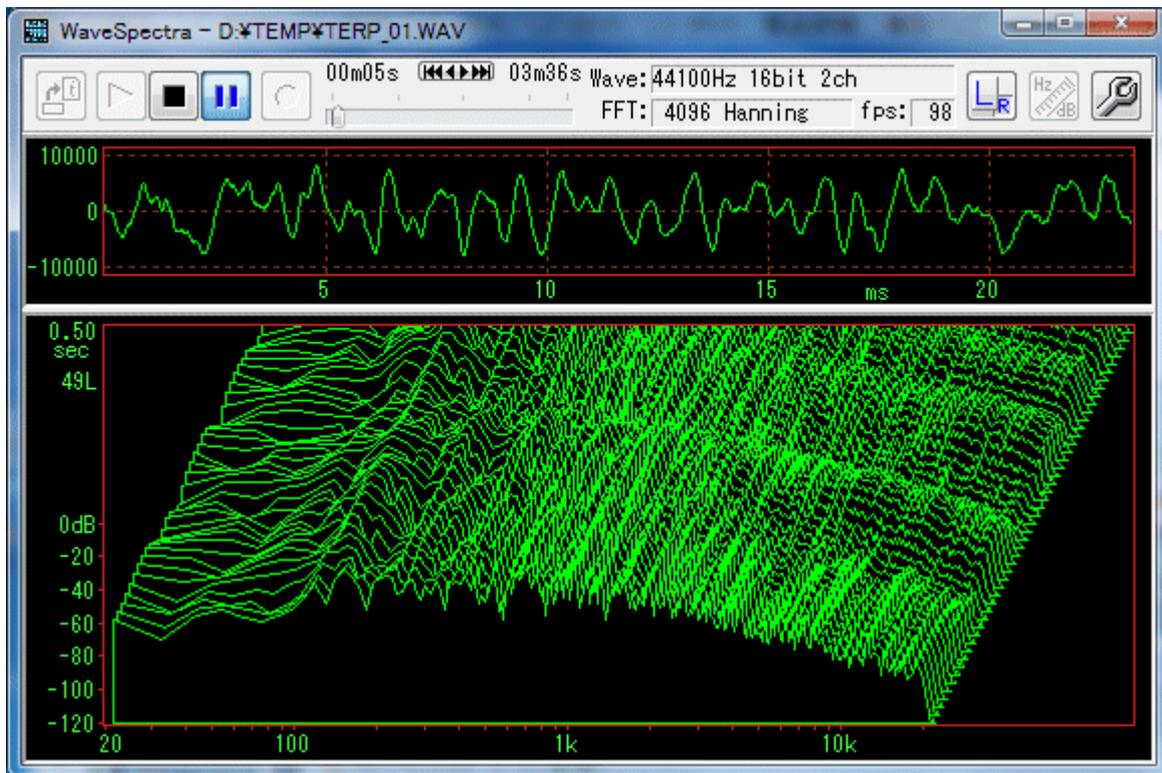
#### Analysis position fine designation function(analysis mode)



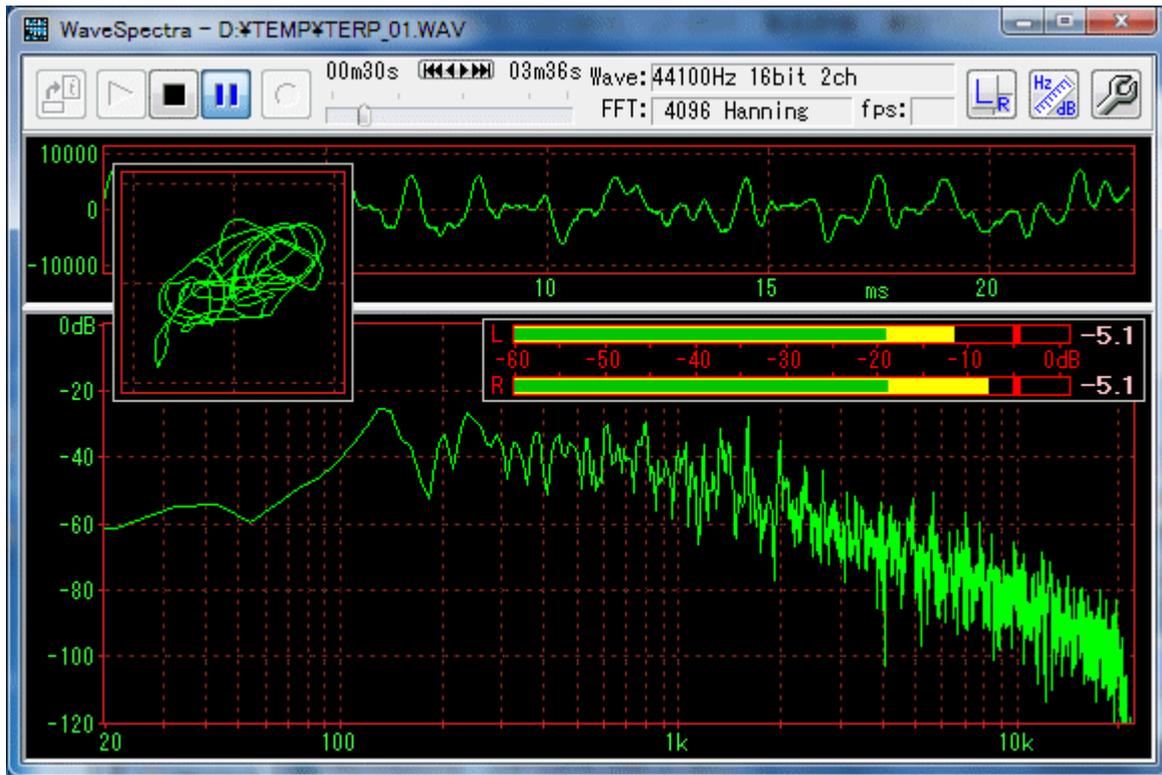
#### Measurement mode



### 3D display



### Lissajous window and level meter



**Synchronized operation with two activated (Lch, Rch when playing the same file in both)**



Created with the Personal Edition of HelpNDoc: [Free Web Help generator](#)

## Usage

### How to use

It is the main window right after startup.

**\* If you click the position of a button, a combo box, etc. in the figure below, it jumps to the explanation of that part.**



## Wave File Performance

-  **Wave File Open Button**

When using Wave file as input signal, press this button to open the file.

\*You can also open files by dragging and dropping files from Explorer etc. to the main window.

\*You can also open a file by dragging and dropping it from the explorer etc. to the shortcut icon.

\***Hold down the shift key and press [play List](#)** window opens, you can play multiple Wave files consecutively.

The playlist window will also open when dragging and dropping multiple files in bulk from the Explorer etc. to the main window or icon.

\*Since it corresponds also to the command line argument, shortcut By placing a space after the link destination of the property of the icon (right click), write the file name directly, you can play directly with double click.

\*When you perform file association (right button - Open from program - Select prescribed program) with explorer etc., just double click on Wave file It will be able to open in WaveSpectra.

-  **play button**

Play the opened file.

\***Shift key pressed** Pressing this button will start in paused state.  
See the section on the bottom pose.

-  **stop button**  
Stop playback / recording.
-  **pause button**  
Pause it.

\*You can read out (read values) by moving the mouse cursor to each display window of Wave / Spectrum during pause.  
(See the [Lead-out](#) section)

While pausing, the function to specify the position accurately You can also use it.  
(Please refer to the section [Analysis position fine designation function](#) )

### Fast forward / rewind

-  **track bar**  
While playing Wave file, you can click on the left and right parts of the knob or drag the knob to any position " fast forward / rewind "

During playing, the elapsed time is displayed on the upper left side of the track bar, and the total playing time of the data on the right side is displayed.



\*During pause, Wave / Spectrum display Also follow.

In addition, there is a function to specify an arbitrary position exactly by the number of samples and elapsed time.

(Please refer to the section [Analysis position fine designation function](#) )

\*If the length of the Wave file is short and the analysis position You can start from the beginning in a pause state by pressing the play button while holding down the shift key for the case where you can not make it in time for the play & pause button action to use the fine designation function.

While inputting from the sound device, go to the upper left of the track bar "Rec. In." Will be displayed with " red ".

(Continue input / display until you press stop button)



While recording while writing to a Wave file, go to the upper left of the track bar " Red " with elapsed time, on the right side, writeable writable " remaining time " is displayed.

(Maximum remaining time display is 999 minutes 59 seconds)



### Input / recording from a sound device

-  **input / record button from the sound device**  
If you press this button, you can use the input of the sound device directly as input signal.  
Also, if you set to record to a file at [setting dialog - Play / Record Tab - Recording - Recording to file](#) , You can create a wave file by simultaneous recording.

**Note:**

In the initial state, the size of one Wave file is the upper limit of Wave file 2 GB (32 GB maximum is 4 GB, but there are play / edit software which does not support) , It will be split every 2 GB.

For example, if the file named ABC.WAV exceeds 2 GB,  
ABC - 01. WAV

A file with \_01, \_ 02 etc. added to the file name is created as shown in Fig.  
(maximum 99)

You can also press **Ctrl + D key to Forcibly split** (Divide) files.  
It is convenient when you want to divide it at breaks of songs.

\*If you do not want to split with 2 GB, you can record in RF 64 format which can also create files of 4 GB or more.

Please refer to the [RF64](#) section of the setting dialog.

(Please note that you can not forcibly divide by Ctrl + D key while recording in RF 64 format.)

**[Technical]**

The division unit 2 GB can be changed as follows.

WS.INI and WS\_2.INI

In the [Conditions] section anywhere is good so

RecFileDivideBytes = 0x7FF00000

If you add a line like this, it will be split if the file size becomes more than this number (bytes).

The above 0x0x7FF00000 (2047MB) is the default.

**Lch / Rch switching**

- Lch / Rch switching button  You can switch the waveform display channel for stereo signals.

 if it is pressed  Lch, Rch.

(The unevenness of the button may be difficult to see depending on the theme setting on the screen, but the channel with the larger L or R character of the button is currently enabled)

It becomes invalid with a monaural signal.

Also, in the multi-channel format of 3 to 8 ch, the L / R button is placed in the combo box

like  You can change the channel number to be displayed.

\*At this time, the Lissajous display (if it is displayed) corresponds to the Lch signal when the signal of the selected channel is 2 ch, the signal of the next channel corresponds to It is displayed to correspond to the signal of Rch.

(When the selected channel is the last channel, the next channel is It returns to 1)

**Measurement mode**

-  **Measurement mode button**  
The measurement mode is entered.  
(See the [Measurement Mode](#) section)

## setting

-  **setting button**  
 You can change various settings.  
 (See the [Settings Dialog](#) section)

## Wave file format

- Wave: 44100Hz 16bit 2ch Displays the format of the currently open Wave file or information on the recording format.  
 Sampling frequency, number of bits, number of channels, and When in the BWF (Broadcast Wave Format) format 'B' Also, '64' when using RF 64 format The character is added.

\*Right clicking on this area opens the [Wave file information window](#) and displays detailed internal data information (chunk structure) I can.

## FFT information

- FFT: 4096 Hanning The sample data number of the FFT and the name of the window function are displayed.  
 You can set FFT by [FFT tab](#) in the setting dialog.

## fps

- fps: 102 Displays the number of updates of the waveform display per second during playback / recording operation. (Frame per sec)

In addition, to reduce the CPU load, you can set the waveform display method so that it draws as fast as possible.

Please refer to [Drawing method - Automatic setting](#) in the setting dialog.

## Wave display area

- Wave waveform is displayed.

You can change the display magnification of the vertical and horizontal axes.  
 ( [preferences dialog - Wave - vertical axis \(Amplitude\)](#) , [Horizontal axis \(Time\)](#) ) )

You can [lead out](#) numeric values ??while pausing.

Sometimes asked, the unit of the left scale is an integer value corresponding to the 16 bit PCM signal, 32767 It is ~ -32768.

When it is 24bit, 32bit, 32bit floating point data, it will be confusing if the maximum value changes, so that the integer part becomes It is shifted by adding decimal part so that it becomes 16 bit. (Internal operation is 64 bit floating point)



- Wave waveform display during FFT operation shows the same as do the oscilloscope's trigger action in order to stop the waveform flow as much as possible and make it easy to see.

(Trigger level: 0 Slope: +)

- However, there is no trigger action when stopped in pause Display Wave data as it is.  
Therefore, the Wave data itself FFTed at that time is displayed from the beginning.

\*In particular, if the magnification of [Wave - horizontal axis \(Time\)](#) is set to x1, it is FFTed It means that all the samples of the wave data being displayed are displayed.

- Waveform display is simply connecting the sample points of the PCM signal with a straight line for convenience.  
Therefore, it is different from the analog waveform actually output from the D / A converter.  
For example, in the case of a sine wave with a high frequency, there are few sample points, so it looks like a jaggy waveform, but the analog waveform actually output from the D / A converter is interpolated into a smooth sine wave.  
In order to reproduce an actual analog waveform, it suffices to interpolate the waveform between sample points and draw it, but for now it does not support it.

### Spectrum display area

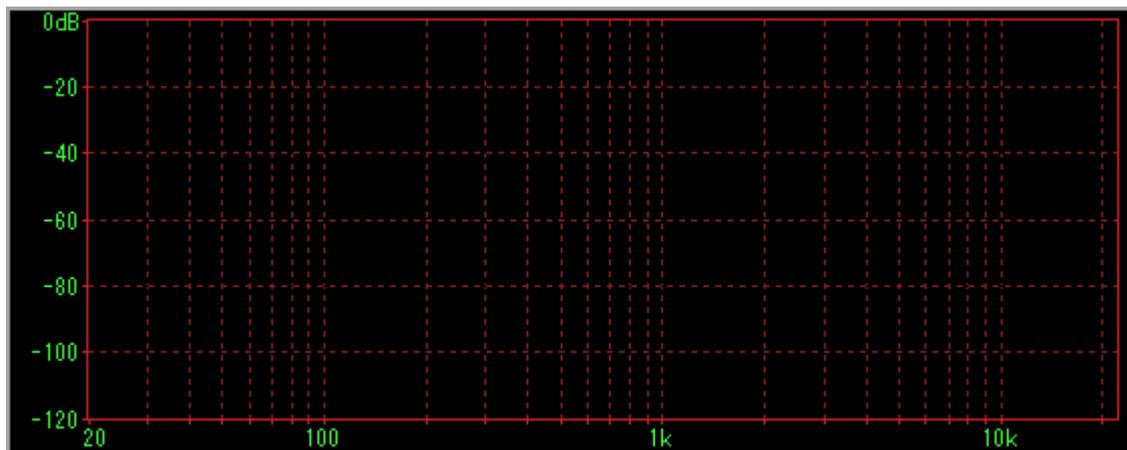
- Spectrum is displayed.

In addition to dB / Log display as shown below, it is also possible to change the vertical and horizontal axes to linear display.

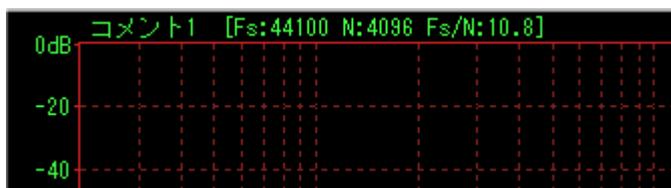
( [preferences dialog - Spectrum - vertical axis \(Amplitude\)](#) , [Horizontal axis \(Frequency\)](#) ) )

You can [lead out](#) numeric values ??while pausing.

The display changes in measurement mode.  
(See the [Measurement Mode](#) section)



- \*screen You can also add a comment so that it is handy when copying and pasting.  
Settings dialog Spectrum tab - [See and edit comment lines](#) .



## End

- Termination, especially because there is no dedicated button, either the upper left system menu button or the upper right **Close button**  .

Created with the Personal Edition of HelpNDoc: [Benefits of a Help Authoring Tool](#)

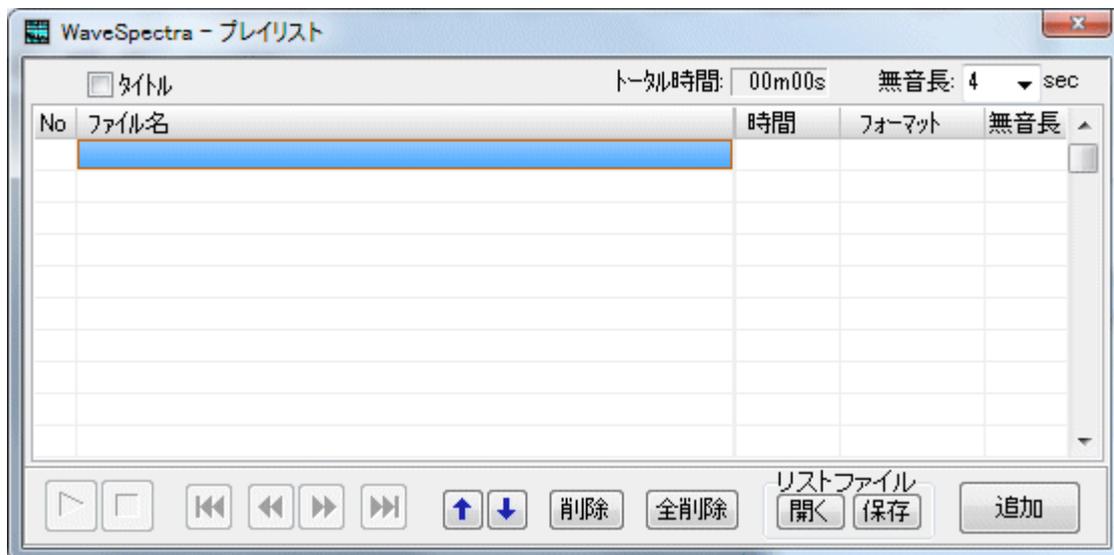
## Playlist

### Playlist

**Holding the shift key and clicking the Open Wave File**  opens the playlist window.  
\*Playlist window also opens when dragging and dropping multiple files in bulk from the explorer etc. to the main window.

**Note: As with the main window, you can only play Wave (linear PCM) files.**

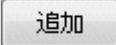
**\* If you click the position of a button, a combo box, etc. in the figure below, it jumps to the explanation of that part.**



To close the playlist window, at the top right **Close button**  .

### Add a file (list)



- You can add (register) files with
- Add button at the bottom right  .
- You can also select multiple files in the
- Add File dialog and add them all at once.
- You can also add files by dragging and dropping (multiple) files from Explorer etc. to this window.

(Up to 99 files can be registered in the list.)

### Playing the list

- Immediately after adding the
- file, press the lower-left play button  from the beginning (No.1) of the list Start playing in order.
- If you want to play from any file, select the file name (highlighted) and press the play button.  
\*You can also play from there by double-clicking the location of an arbitrary file name.
- Stop button  to stop.  
\*You can press the stop button on the main window side.

### Note:

Playlists can only be played from the Playlist window.  
You can not play the playlist with the play button on the main window side.  
However, once you start playing from the playlist side, you can also control the performance with each button on the main window side.  
(Play button, Stop button, Pause button, Track bar)

- Previous button  Press once to return to the beginning of the current performance. Pressing it twice in succession like double click will return to the previous song (No.1 At times other than).

- Next button  will move to the next song.
- Rewind / Fast forward button   moves the performance position respectively. Repeat as long as you press and hold, and keep holding it for a long time will increase the rate of movement.

### Change order

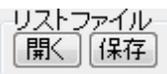
- Up / down arrow button   , you can change the order of the performance.

### Delete list

- Delete button  , you can delete the selected list.
- Delete All button  to delete all lists.

\*Even if you say deletion, registration to the list is only deleted.  
Actual Wave files are not deleted.

### Reading and saving playlist files

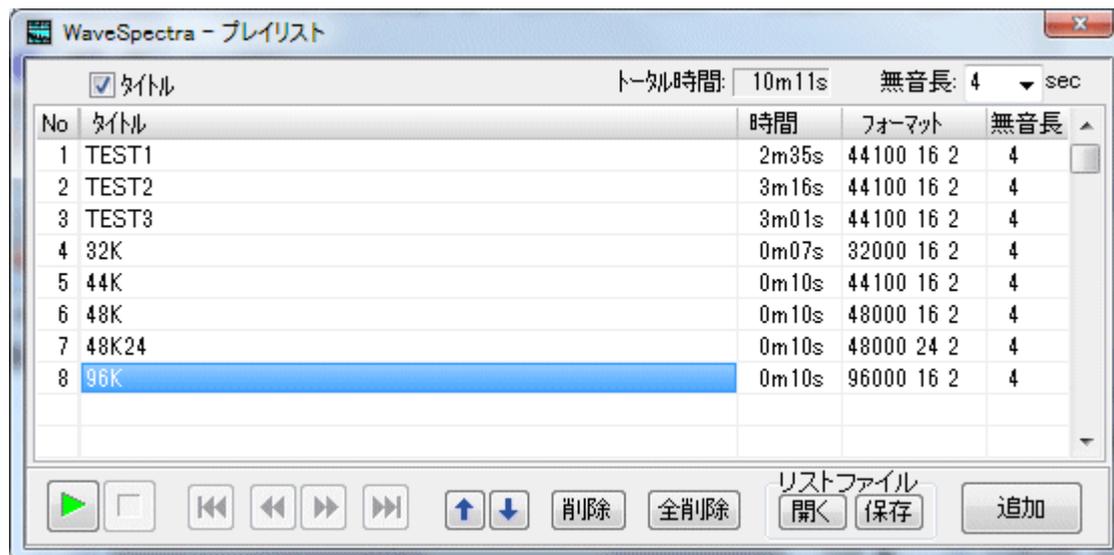
-  List file button
- You can read the playlist file with the open button.
- Save button can save as playlist file.

\*The format of the playlist file is general It is in \* .m3u format.

### titlecheck box

- When checked, the file name column will change to the title display.

\*title is the same as the file name immediately after adding the list, but you can edit it freely by selecting with the mouse.



### Total time

- Displays the total playing time of the list. Under The length of silent length is also

included.

### Silence Length Combo Box

- Sets the number of seconds of silence between the next song.  
When adding a file, this value is registered in the list as an initial value.

\*Total time display is all the performance time including this silent length.

- To change the registered value, set the combo box to the desired numerical value, and then double-click the silence length field of the line you want to change.  
**Please note that it is slightly different from Windows basic editing method.**



- To change multiple lines at once, first select the silence length column of the first line you want to change, then double-click the last column while holding down the Shift key.



- If you set the silence length to 0 as above, it will be connected to the next song and played.  
(So-called gapless reproduction)

\*However, it will only happen if there are consecutive files of the same format.

In the case of the above example, if the format is different like No.3 - & gt; No.4, it takes time to change the format of the sound device itself.

Created with the Personal Edition of HelpNDoc: [Full-featured Documentation generator](#)

## Read-out

### Read-out

Mouse cursor during pause Wave / Spectrum When you move to the display window, the mouse cursor changes to a cross shape, and you can read the value of the waveform indicated by the center.  
(Small display window moves with cursor)

**Note:** You can not read out in Spectrum 3D display.



\*The position of the mouse cursor at this time is only related to reading in the horizontal direction (time axis / frequency axis).  
The vertical position of the mouse itself is irrelevant to the displayed value, as the value of the vertical axis of the graph with respect to that position is only read.

\*Wave Pressing the shift key during the readout will only You can switch between decimal and hexadecimal display.  
You can usually set which to do with [numeric display \(read out\)](#) in the setting dialog.

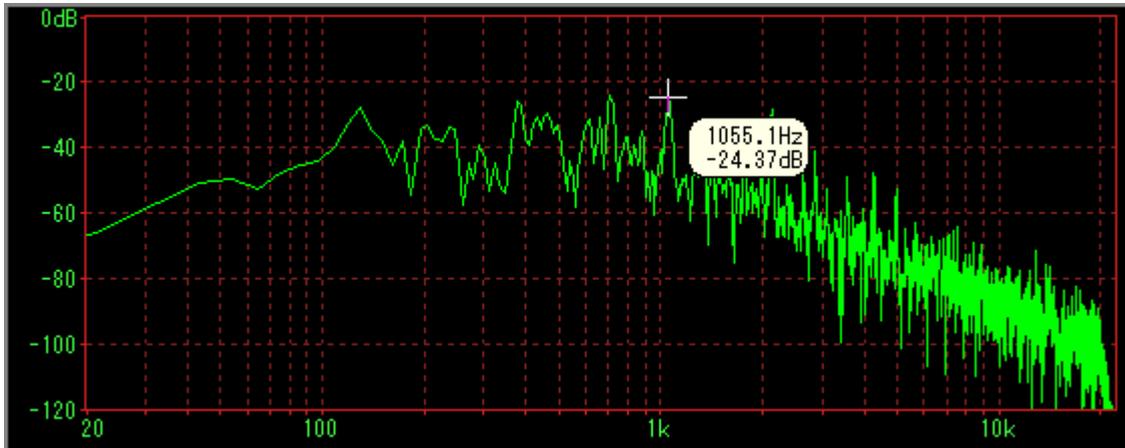


\*When the display density of the graph is high and multiple data actually correspond to one dot on the screen (Spectrum horizontal axis is High frequency part of Log display etc), you can not decide which one of them should be displayed by just hovering over it as above, so you can only read discrete data.  
In such a case, the next " automatic peak detection function " It is useful.

### automatic peak detection function

Move the mouse cursor closer to the peak (apex) or dip (valley) of the waveform you want to read, click the left mouse button, it will automatically be pulled into that part and the value of that part will be displayed.  
It is convenient because it is not necessary to accurately align the mouse cursor.

In addition, since the position of the peak or dip of the data itself in the vicinity is automatically obtained and the cursor is moved to the display position of the corresponding graph again, automatically, the graph is overlapped and it is difficult to read. Even the parts can be read accurately.



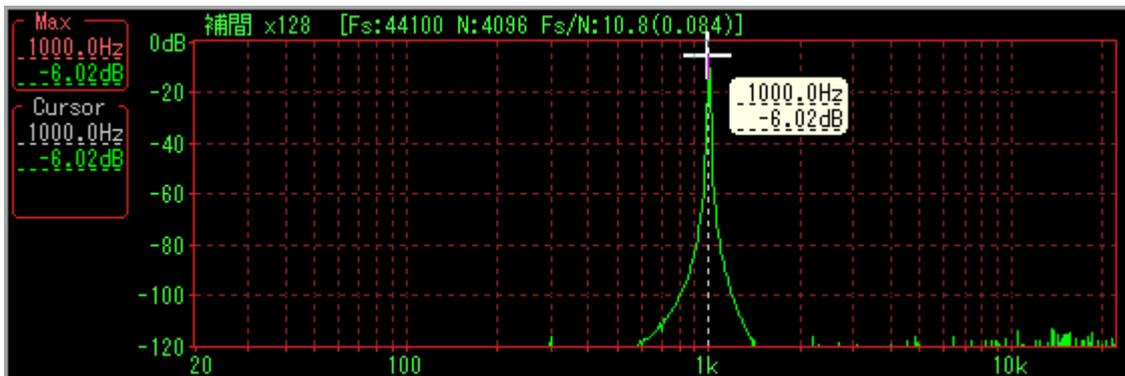
\*If you want to read the part of the peak, slightly above it, when you want to read the part of dip, By placing the mouse cursor and clicking the left button, you can almost certainly go to the target position You can " draw "

\*If the display density of the graph is very high, it will deviate from the actual peak or dip when you release the left button. In this case, please hold down the left button during the readout.

**Note:** [Spectrum display type](#) , " draw only peak " When checking, of course, only the peak part will be detected.

### Read-out at improved accuracy

[Spectrum Tab of Setting Dialog - Numeric Display \(Max, read out\)](#) to improve accuracy by interpolation x 16 in combo box Or x 128 is set, the dotted underline is also displayed in the numeric value of the read-out window to indicate that it is interpolated numerical value.



\*In this case as well, you need to hold down the left button during the readout.

---

Created with the Personal Edition of HelpNDoc: [Write EPub books for the iPad](#)

---

## Analysis position fine designation function

### Analysis position fine designation function (analysis mode)

Only in the case of Wave file performance, since it operates so that the Wave / Spectrum display also follows the change of the position of the track bar during pause, Wave waveform and Spectrum can be observed.

Furthermore, only in that case an elongated button appearing on the track bar By pressing  the " position specification window " , You can specify exactly any position represented by the number of samples or elapsed time.

\*The track bar in the main window and the movement operation in the position designation window are linked with each other, so change the position You do not mind. You can also resume playing Wave files from that position.

**Close button** \* or close  button again I can.

(It temporarily closes when resuming the performance of the wave file or stopping it)

#### Position selection window

At the far left, the current wave position is displayed in terms of the number of samples and the number of seconds since the beginning of the file, and to the right of it the last position of the file (all file sizes) is displayed as well.



- **Position move button**

Two buttons  move back and forward   , button to the end - with  you can move the current position.

\*The left and right arrow buttons repeat as long as you press and hold.

\*When pressing the Shift key, the left and right arrow button temporarily moves the amount of movement It can be multiplied by 10.

**Note:**

Move to the end button Please be aware that " end " is actually all zeros beyond the end of the file.

From there, only the portion returned by the left arrow button is analyzed from the left to the analysis window " will come back "

For example, after moving to the end, if only one sample is returned, only the last sample data of the original file is FFTed as the leftmost head data (all other zeros are all zeros) Become.

- **movement amount**

Set the amount of movement when pressing left and right arrow buttons.

"Number of samples", or "seconds" You can specify with the combo box the amount of each movement.

\*By writing not only the values ??in the list in the combo box but also the direct value **arbitrary value**.

- **Short play button**

 When you press the button, you can play the sound of the current position for about 0.1 seconds.

Every time you press it, the On / Off state repeats, each time a sound comes out.

Press and hold it to repeat.

If you leave it pressed while it is on, you will hear the sound at that position even when you press the position move button to move.

With the  fra. checked, the sound of the length of the current FFT sample data (one frame) is played at will.

**Note:** However, this is a function only when the driver is MME.

**[Tips]**

If you think that the way the sound is repeated when repeating is not smooth, improving the resolution of timer / pause may improve it.

(See the [Settings Dialog - Other Tab - Timer / Hibernation Resolution](#))

**Note:** When using some devices with ASIO 4ALL, it can take quite some time (about 0.3 seconds? There is.

- **marker**

You can store any position as a marker up to 100 locations and you can move there anytime.



[1] Pressing the **Add** button remembers the current position as a marker and adds it to the list with sample value and time.

The label will automatically be Marker 1, 2 ....

[2] By selecting a marker on the list and **double clicking** you can move to the position of the stored marker.

[3] Select a marker in the list and press **Delete** button to delete that marker.

Pressing the **Delete** button while holding down the shift key will delete all markers.

[4] You can change the name (label) of the marker by pressing the **Rename** button.

[5] If you made any changes, you can write the marker information to a file by pressing the **Write** button.

If there is [cue chunk](#) in the original file, if there is not, add cue chunk to the end of the file and write it.

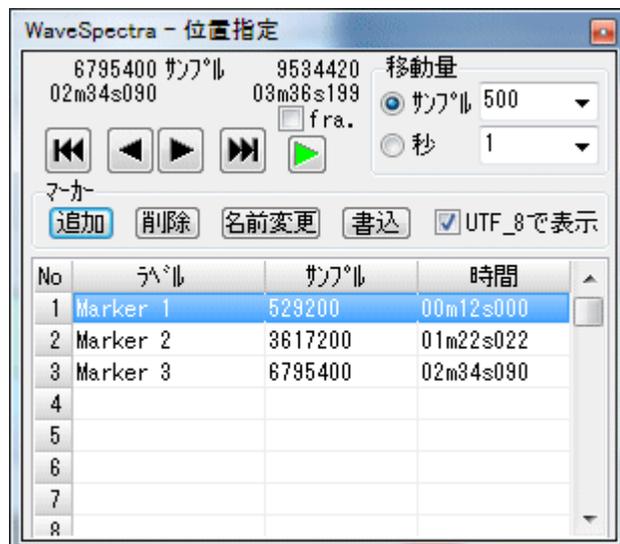
Please understand that the file is changed directly.

(Of course, other original data such as waveform data is not changed.)

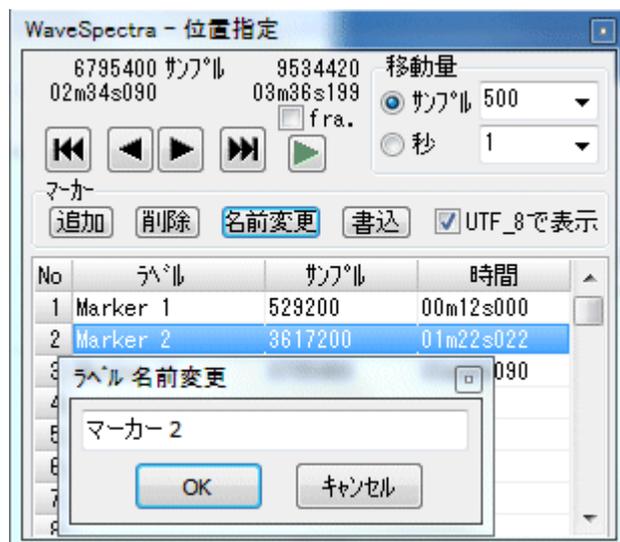
**Note:**

Even after making some changes, the list is reset without any warning whether or not to write to another file at the time of opening another file.

Please write it in a file if necessary.



\* You can display many ranges in the list part by expanding the window in the vertical direction.



When the name change button is pressed



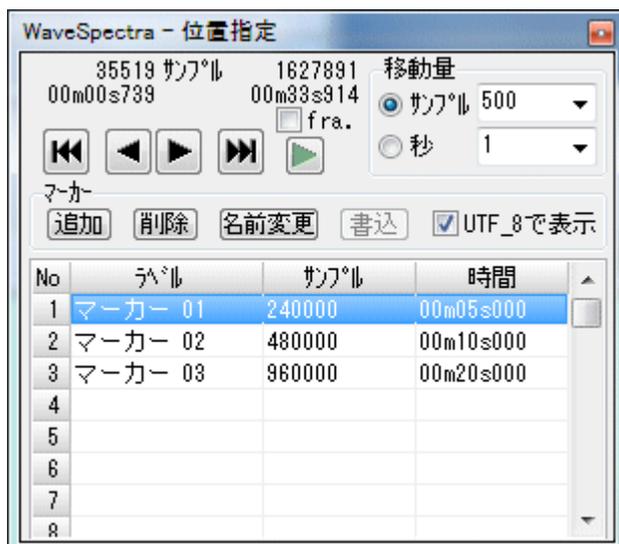
- **Display function of cue chunk contents of Wave file**

When the Wave file contains [cue chunk](#) , its contents are displayed in the list as shown below and

It will be available as a marker.

If it also contains [LIST adtl chunk](#) , it will also display a label (labl).

If the label display garbled, try unchecking "Show " in UTF\_8 ". (Indicated by SHIFT-JIS)



**\* Tip 1**

If you want to move to a fixed time position such as the second from the beginning of the file, once you move it to the top with the button to the top, enter the time (or number of samples) there in the movement amount combo box By pressing the right arrow move button, it is possible.

**\* Hint 2**

In Spectrum 3D display, each time the position is changed, one by one The graph of Spectrum increases as it shifts.

Therefore, if you use this function well, you can use multiple You can display Spectrum together in 3D.

If you want to erase the entire 3D display, you can erase it by changing the size of the

window from the 3D display to the normal display once and then returning to the 3D display again, or keeping the 3D display. (It's a little troublesome (^ ^ ;;)  
You can move the window frame only a few times.

\*Even when the format of the Wave file is an unsupported format of the playback device, or when there is no sound device at all from the beginning, Analysis position You can analyze using the fine designation function.  
(Analysis mode)

In this case, if you press the play button after opening the file, you can not play it for those reasons A message box with a message saying "It will be displayed every time.

If this is troublesome, when you press the play button, if you start from the beginning in the pause state by pressing the play button while holding down the Shift key, the message box above is not displayed .

---

Created with the Personal Edition of HelpNDoc: [Easily create EBooks](#)

---

## Multichannel Format

### Multi Channel Format

---

Multichannel Wave format (WAVE\_FORMAT\_EXTENSIBLE Format) playback / recording is supported.

However, with a maximum of 8 channels, the channel order is as follows.

- Front Left - FL
- Front Right - FR
- Front Center - FC
- Low Frequency - LF
- Back Left - BL
- Back Right - BR
- Front Left of Center - FLC
- Front Right of Center - FRC

For details

<http://msdn.microsoft.com/en-us/windows/hardware /gg463006.aspx>

Please refer to.

#### [Play]

- When you open a file of 3 to 8 ch, the main window, ff the Lch / Rch switching button and the displayed the level meter display changes.

Ch:

1

LG / Rch switching button  It changes to a combo box like and you can select the channel number to display the waveform.

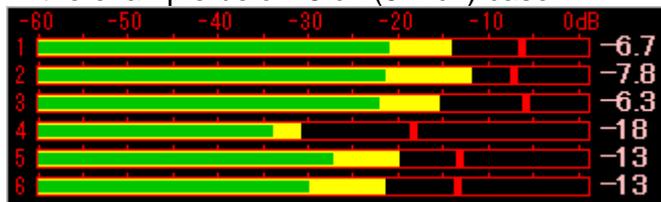
\*Note that the Lissajous display at this time (if it is displayed) indicates that the signal of the selected channel is This signal corresponds to the Lch signal in the case of 2 ch and the signal of the next channel corresponds to It is displayed to correspond to the signal of Rch. (When the selected channel is the last channel, Rch The next channel corresponding to the signal will return to 1)

Level meter, from such a display up to 2 ch,



The display height (width in the case of portrait display) increases by the number of channels.

In the example below 6 ch (5.1 ch) case.



## [RECORD]

- Select 3 to 8 ch in the recording format and (2 ch As in the case of (1)) temporarily pushing the recording button temporarily to change to the recording mode, the main window The display of the Lch / Rch switching button and the level meter (if it is displayed) changes.

How to select channel number and level meter The display is the same as for the above playback.

Other than this, there is no change, especially up to 2ch recording.

---

Created with the Personal Edition of HelpNDoc: [Create help files for the Qt Help Framework](#)

---

## Measurement mode

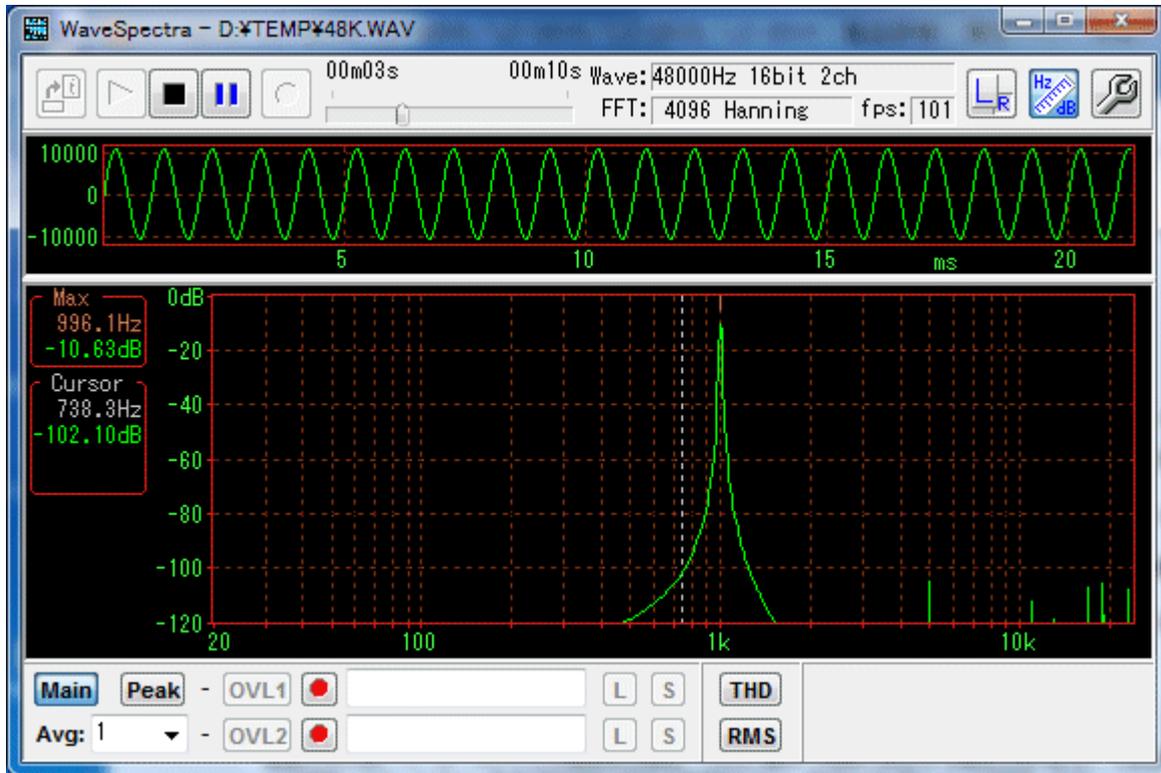
### Measurement mode

Measurement mode button in the main window  Press to enter the measurement mode.

An operation button appears at the bottom, the part displaying various measurement results is taken to the left of the Spectrum display window, and the graph display window is slightly reduced to the right.

**Note:**Spectrum 3D is not displayed in measurement mode. (Similarly, during measurement mode Spectrum 3D display is not possible)

**\* If you click the position of a button, a combo box, etc. in the figure below, it jumps to the explanation of that part.**



### Real-time maximum value display function

- At the top of the measured value display area on the left, the maximum of the measurement Spectrum Frequency and amplitude are always displayed.

\*At this time, a short marker indicating the frequency position is displayed below the upper horizontal axis of the graph display window.

\*You can improve the accuracy of the numerical values ??here.

[Setting dialog Spectrum tab - numerical display \(Max, lead out\) - interpolate to improve accuracy .](#)

### Lead-out function

- In the measurement mode, always clicking the mouse cursor at an arbitrary place in the Spectrum display window always displays the lead-out cursor (vertical dotted line) and can read the value of the waveform at that part. The value is displayed below the maximum value of the measured value display area on the left.

\*You can improve the accuracy of the numerical values ??here.

[Setting dialog Spectrum tab - numerical display \(Max, lead out\) - interpolate to improve accuracy .](#)

\*You can erase the lead-out cursor by clicking the mouse again at the same position

as currently displayed.

\*The lead-out cursor searches for the peak value of the nearest neighbor in the high display density portion of the graph " Retracted "

**Note 1:**

Therefore, even if you click the mouse at the same position while trying to erase the lead-out cursor during the measurement, the same position may not be specified due to the change in the uneven state of the graph.

In such a case, once you move the cursor to another position (such as a fixed peak, a low frequency part of Log display with a low graph display density, etc.), you can erase it by clicking again there.

**Note 2:**

Only during pause, as with normal mode, it leads out with a small display window. At this time, not only the above peak detection but also automatic dip detection function works in the same way.

**various buttons at the bottom**

- **Main** button

You can display or erase the main spectrum (normal real-time measurement waveform).

\*Hereinafter, when simply referring to the measured waveform, this main spectrum will be indicated.

- **Peak** button

As long as this button is pressed, the waveform that holds only the peak of the measured waveform is always loaded into the buffer of overlay 1 (see below).

At this time, the display of the overlay 1 (OVL 1 button) is simultaneously performed. As it is turned on, the measured waveform and the peak-held waveform will be displayed at the same time unless intentionally turned off.

\* **While the** button is not pressed, the peak is not updated.

\*Peak reset is possible by pressing this button again.

(Each time the button is pressed down, the buffer is reset and peak hold operation is started.)

\*ON / OFF of display of peak-held waveform only To do this, please use the OVL 1 button.

- **Avg:**  (Average)

If this combo box is set to a number other than " 1 ", the average waveform of the measurement waveform for that number is loaded into the buffer of overlay 2 (see below).

At this time, the display of the overlay 2 (OVL 2 button) is simultaneously performed. As it is turned on, the measured waveform and the average waveform will be displayed simultaneously unless intentionally turned off.

\*By writing not only the values ??in the list in the combo box but also the direct value **arbitrary value**.

\*The average waveform is a simple average of the specified number of times for each point.

\*In order to stop the average operation, "" 0 " Please also set).

\*To turn ON / OFF only for the average waveform display, set OVL 2 Please use the button.

## Overlay

For storing and superimposing measurement results of spectrum, 1 There are two of two.

- OVL1 and  OVL2 button

On / Off display of overlay 1 or 2 Specify.

\* **While** is being displayed, the readout cursor can be used to read the value in the same way as the measured waveform.

\* [Spectrum display type](#) in the setting dialog< Settings are also valid for overlays.

- (Capture button)

Measurement waveform data at the moment when this button is pressed is overlaid 1 Or you can import it into the buffer of 2.

At this time, the display of the corresponding overlay (OVL 1 Or OVL 2 button) will also be turned on at the same time, so explicitly Unless it is set to Off, the measured waveform and the captured waveform will be displayed at the same time.

\*In capture, generally peak hold, or The average operation must be stopped. However, intentionally capturing itself during each operation is not particularly disadvantageous.

- (for comment edit boxes OVL1, OVL2)

Here you can write a brief description of the overlay data.

This comment is also saved when saving the overlay data described later, and it will be displayed again on later reading.

- L (Load) button

Read the saved overlay data file.

\*The currently set FFT data length, sampling frequency It can not be read unless it is an overlay data file saved with the same settings as the above.

- S (Save) button

Save the data in the buffer of the overlay to a file.

\*Overlay data is saved with \*. WSO extension, but the actual content is in text format, It is in CSV format.

Therefore, it can also be loaded into other applications such as Excel.

### [Detailed format of overlay data (example)]

" WaveSpectra Overlay ", 1.10 First line Title and version  
" Comment ", " Overlay Test 1 "Line 2 comment  
" Sampling Frequency ", 44100 sampling frequency & It; BR & " FFT Samples ",  
4096 & It; Number of FFT samples & It; BR & " Amplitude ", 2049 & It; Below  
amplitude data, 2049 continuation  
1.0397973969882, 0.99449218972777, 0.858296426766904, .....

Thereafter, 2049 pieces of amplitude data (in order from direct current component to one row Repeat with 8 pieces each)

\*The number of data is  $(\text{FFT Samples}) / 2 + 1$

\*The frequency interval is  $(\text{Sampling Frequency}) / (\text{FFT Samples})$

\*The data is the absolute value of the FFT result itself. (Max. 32768)

DB processing etc. are not done.

In other words, it is irrelevant to the screen display setting etc. at the time of output.

### Note 1:

Note that the results of Peak (peak hold) and Avg (average) are also stored in this overlay buffer.

That is, as with each of the other overlay data, each result also includes Load / Save Etc. are possible.

### Note 2:

Supplement for lead-out, pause, automatic peak / dip detection function.

When the waveform display is overlay only (main waveform is Off), the target of the automatic peak detection function of the lead-out cursor changes to an overlay.

At this time, overlay 1 takes precedence over 2.

That is, if both overlays 1 and 2 are displayed, the peak detection is overlay 1 I work on.

## Other measurement functions

- **THD** button

Total Harmonic Distortion, and THD + N (Noise) or S / N (Signal to Noise Ratio) is measured and displayed.

\*Since THD + N and S / N are only the difference in display (dB in reciprocal), THD Every time you press the button, the combination with THD is switched.

\*If the lead-out cursor is being displayed, the frequency of the position indicated by it, the lead-out cursor is erased In case, it will be the frequency of the automatically detected maximum value.

(Therefore, it is usually more convenient to delete the lead-out cursor)

\*Distortion measurements vary considerably depending on the window function used, etc. (I get an error)

Since we summarized notes on distortion measurement etc., please refer to [About distortion measurement](#) .

**Note:**About the measurement target

When the waveform display is overlay only (main waveform is Off), the target of

measurement changes to an overlay.

At this time, overlay 1 takes precedence over 2.

That is, if both overlays 1 and 2 are displayed, the measurement is overlay 1 I work on.

- **RMS** button

The effective value (Root Mean Square value) of the Wave waveform is converted into a square wave with the maximum amplitude It displays in dB as a ratio to that of Sin wave.

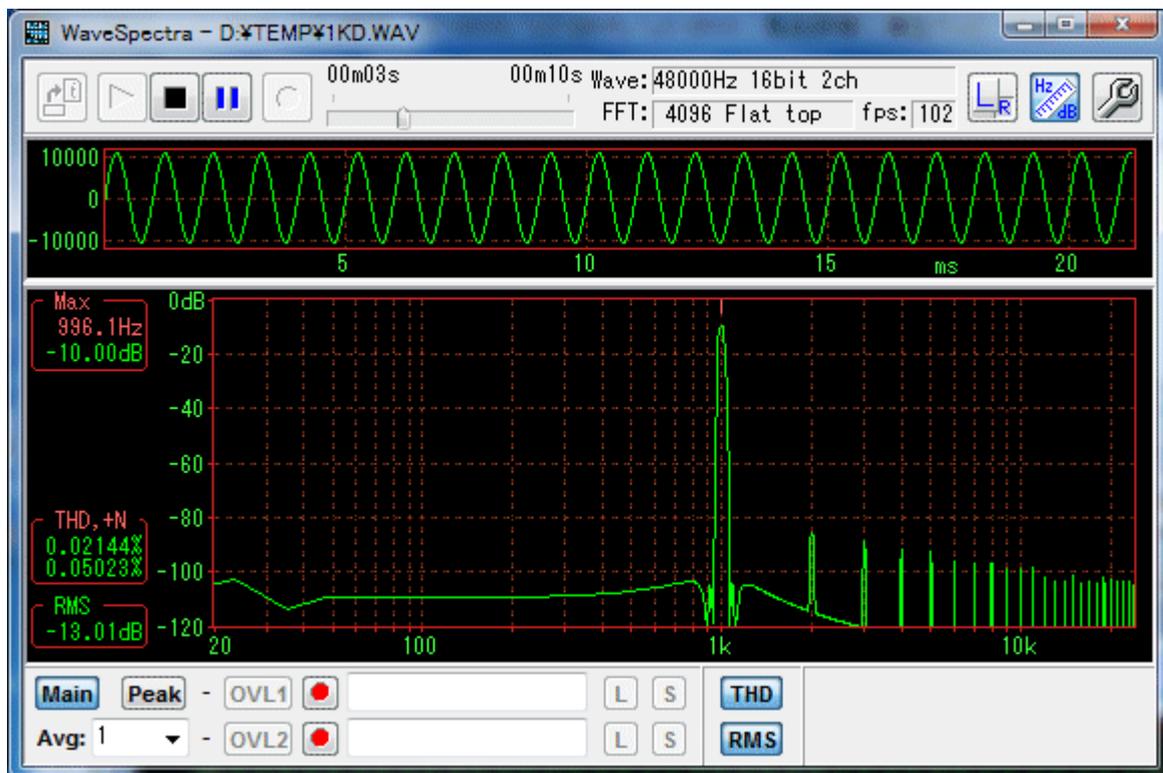
You can set which to do with [Settings dialog Wave tab RMS value](#) .

\*Only this, the measurement target directly uses the original Wave data that was cut out.

Therefore, it is not affected by the kind of window function etc.

### Note:

Both THD and RMS are displayed at about 1 second intervals during operation.



Created with the Personal Edition of HelpNDoc: [Full-featured Documentation generator](#)

## Measurement of frequency characteristics

### On measurement of frequency characteristics

We summarized points to be noted when measuring frequency characteristics by combining

WaveSpectra (WS) and sister software WaveGene (hereinafter referred to as WG).

The method of measuring frequency characteristics with WS + WG is as follows.

- (1) A method that uses a cyclic sweep with a user waveform of WG (V1.40).
- (2) A method using a direct WG sweep signal. (Method using WS peak hold function)

Normally, the method of (1) is recommended because it is easy to obtain accurate frequency characteristics in a short time.

This method can be used in most cases, such as characteristics when the sound device itself is loop connected, external circuit such as an amplifier connected to the sound device, simple measurement of the speaker via the amplifier / microphone, etc. (When direct response can be obtained in real time)

For details, please refer to the help of WG.

(1) can not be used, for example, when the response is not returned in real time, such as the recording / playback characteristics of the sound recording device, the method using the peak hold function of (2) general sweep signal + WS will be used .

However, in this case, there are points to note such as setting on the WG side.

---

### (1) Setting sweep signal of WG

When using the sweep signal in combination with WG to measure the frequency response using the peak hold function of WS, pay attention to the sweep speed.

Originally, in order to obtain the correct value by FFT, it is necessary that the signal is constant and does not change for the time corresponding to the number of sample data. In the case that it is changing, the real value is not obtained.

In the case of Log sweep, the higher the frequency, the greater the rate of change, so it will be measured with the characteristic degraded as you go to the higher range. (We sometimes see measured data posted on the web, magazines, etc. (^ ^;))

In order to eliminate this lowering of the high frequency,

**Linear Sweep** instead of Log Sweep **Note 1:** Please use it.

Although it decreases, it can be reduced to a certain level over the entire frequency range.

Even with the Log sweep, if the number of sample data is decreased or the sweep time is made sufficiently long due to the influence of the window function, there may be cases where the lowering of the high frequency is almost eliminated, but it is not originally a correct measurement.

It is recommended that you grasp the extent of degradation by directly playing back the wave file of the original sweep signal before passing through the measurement object.

Next is the sweep speed, but for accurate measurement it is necessary to change at a sufficiently slow speed.

Let's seek rough estimates of how fast to sweep.

If we decide to render with the original resolution of FFT, for example, **4000 <4800 Hz**, the number of FFT sample data  $N =$ , the frequency resolution is  $48000/4096 = 11.72$  Hz.

When analyzing to 20 to 20000 Hz with this resolution, the analysis time of FFT is the reciprocal of the frequency resolution 0.0853 seconds,

Therefore, assuming that it is almost good if you move at intervals of 11.72 Hz every 0.0853 seconds,

$$(20000-20) / 11.72 * 0.0853 = \mathbf{145 \text{ seconds}}$$

To summarize the expression,

**Note 2:** sweep time = sweep frequency width \*  $N^2 / F_s / F_s$

In this case, it takes about two and a half minutes to 20 kHz, and so on.

In the case of FFT sample data number **8096**, **about four times if** required.

In the case of FFT sample data number **16384**, **many more times** required.

Actually, since the resolution of the window function is several times the FFT resolution, it can only be plotted with the widened width, so it can not be analyzed with the resolution above even if it takes much time.

It will take quite a lot of time, but how is it?

(In addition, if you do not need such a resolution, you can shorten it by knowing that original resolution can not be obtained.)

Below, an actual example of the change in resolution by sweep speed is shown.

---

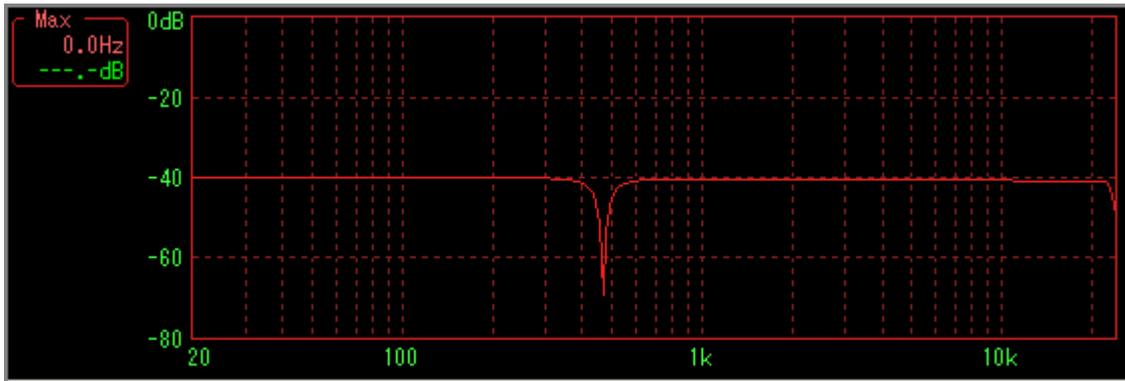
## **(2) Resolution at peak hold of WS due to difference in speed of WG sweep signal**

I inserted a Twin-T notch filter circuit between the input and output of the sound device and examined to what extent the dip can be detected correctly.

WG Linear sweep- & gt; Sound output- & gt; Notch filter- & gt; Sound input- & gt; WS peak hold

It shows the original frequency characteristics of the filter. (By cyclic sweep)

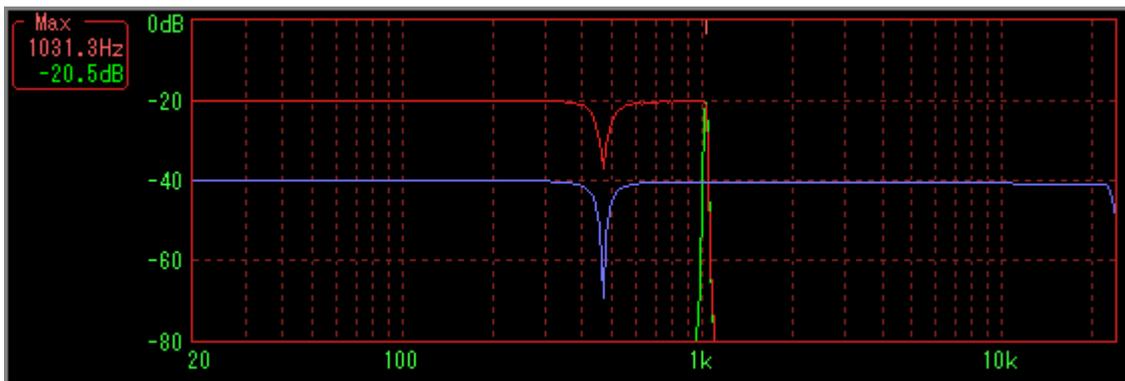
It is a dip of about -30 dB.



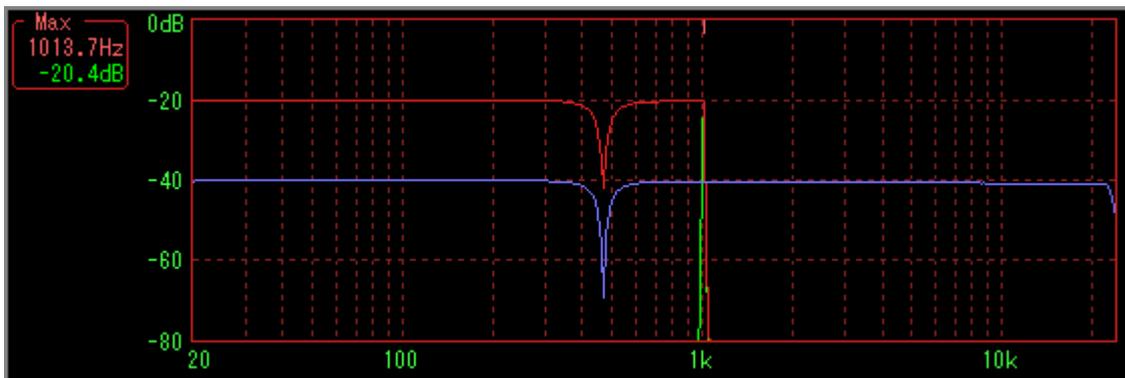
**[When FFT sample data number and sweep time are changed]**

Sweep time is the optimum time according to the formula in (1)? It is.  
(The blue line is the correct characteristic for comparison, it has been paused at about 1 kHz daringly)

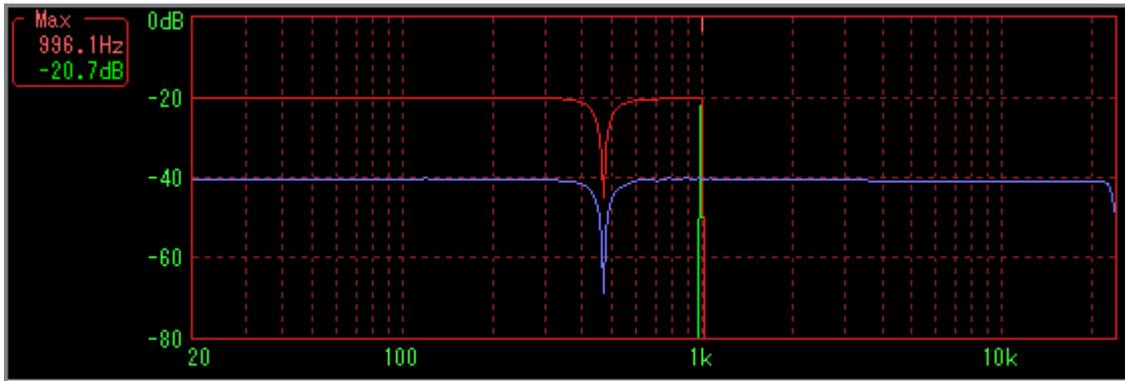
Sample data number 4096, Hanning window, sweep time is 10 to 2000 Hz for 15 seconds (44 fps)



Number of sampled data 8192, Hanning window, sweep time is 10 to 2000 Hz 58 seconds (38 fps)



Number of sample data 16384, Hanning window, sweep time is 10 to 2000 Hz for 230 seconds (30 fps)

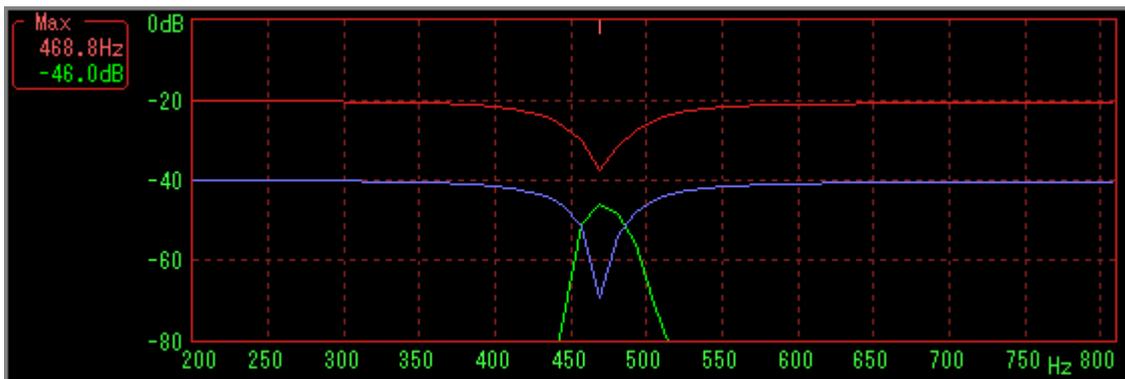


Again, the larger the number of sample data (and sweep time), the better the result.

**[Enlarged near the dip to make it easy to see]**

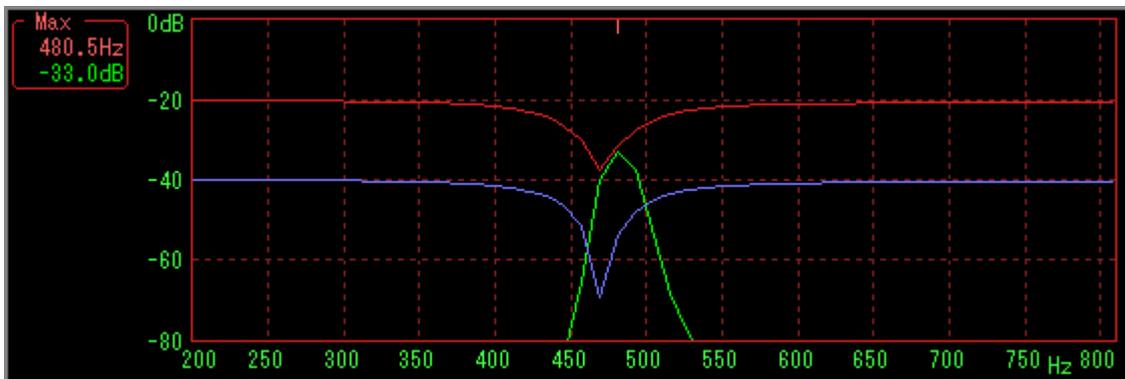
In addition to the sweep speed, the resolution also decreases depending on the characteristics of the window function. It shows the difference.

Sample data number 4096, Hanning window, sweep time is 10 to 2000 Hz for 15 seconds (44 fps)



Green line is the spectrum when pausing in accordance with the dipped position in the middle of sweep.

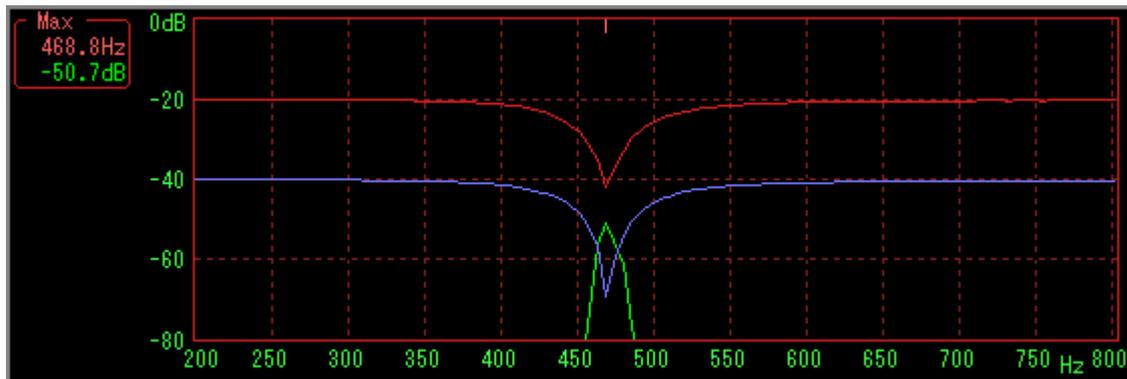
It seems that a nearly correct dip is detected as seen from the level.



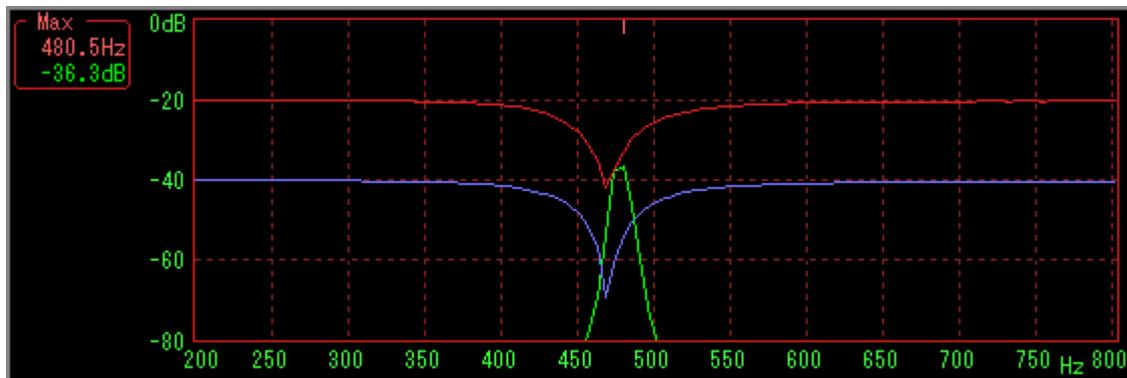
However, you can see that the dips are filled and disappear by filling the base of the window function at the rising and falling parts on both sides.

Likewise,

Sample data number 8192, Hanning window, sweep time is 10 to 2000 Hz 58 seconds (38 fps)



Green line is the spectrum when pausing in accordance with the dipped position in the middle of sweep.



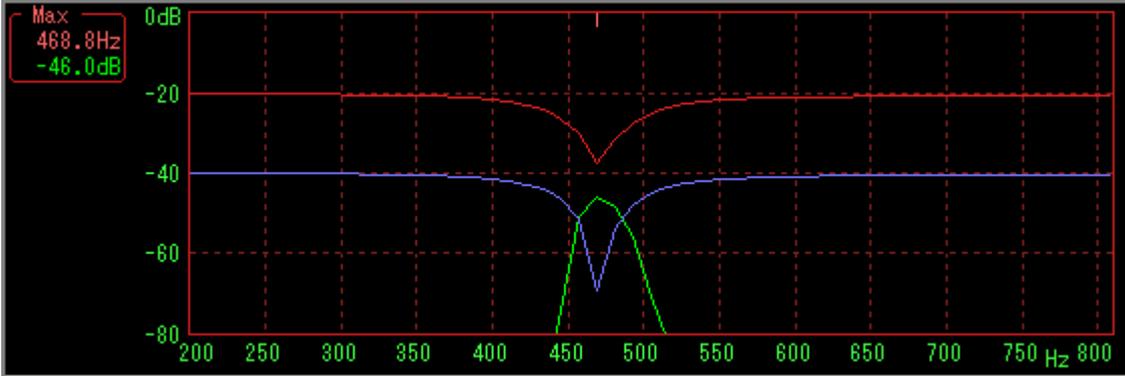
Likewise, you can see that the dips are filled and lost on both sides.

### [Difference by window function]

Difference in the degree of dip filling depending on the type of window function. [See](#)

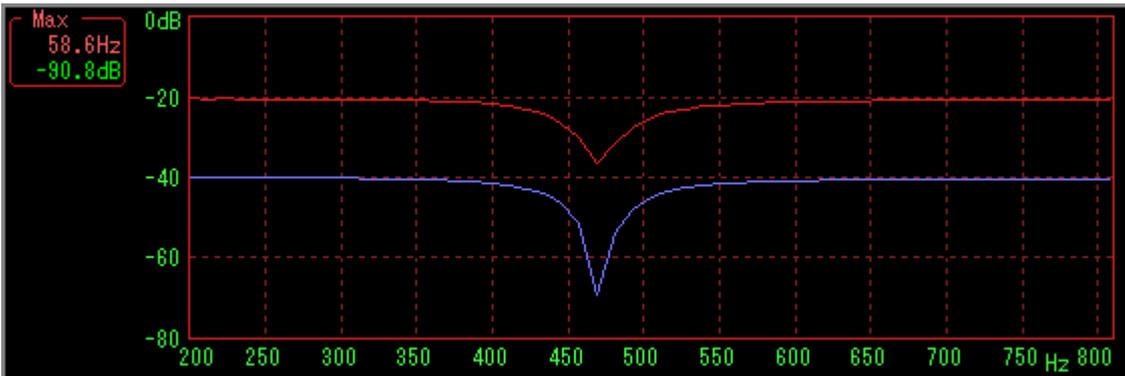
Window function	Number of sampled data 4096, sweep time is from 10 to 2000 Hz 15 seconds	width of main lobe
-----------------	--	--------------------

Hanning



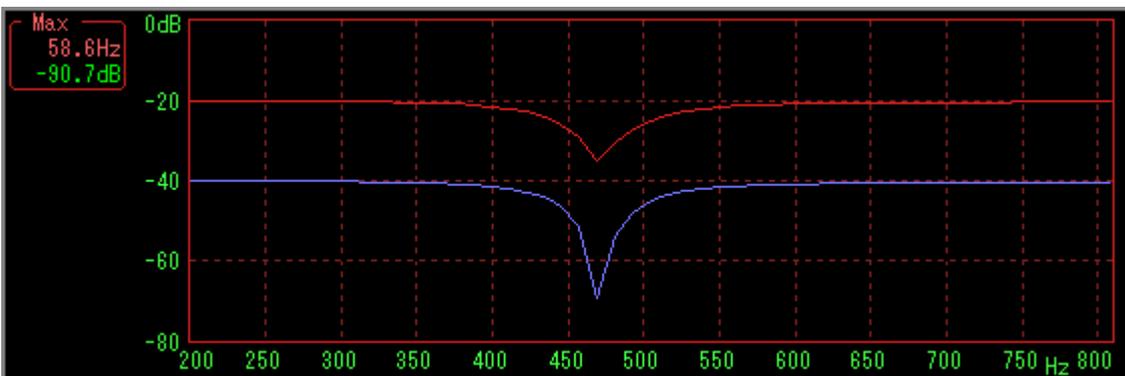
Double the rectangular window

Blackman



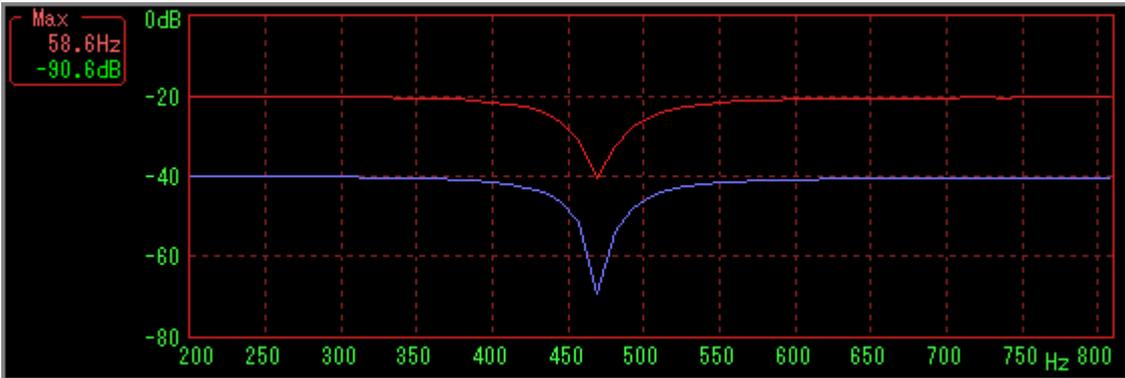
3 times rectangular window

Blackman-Harris



4 times rectangular window

None (Rectangle)



w  
b  
y  
f  
i  
l  
l  
i  
n  
g  
D  
i  
p  
d  
i  
s  
a  
p  
p  
e  
a  
r  
a  
n  
c  
e  
L  
a  
r  
g  
e  
T  
h  
i  
s  
d  
e  
g  
r  
e  
e  
o  
f  
d  
i  
p  
J  
u  
s  
t  
b  
y  
d  
e  
t  
e  
c  
t  
i  
n  
g  
H  
i  
g  
h  
r  
e

s  
o  
l  
u  
t  
i  
o  
n  
R  
e  
c  
t  
a  
n  
g  
u  
l  
a  
r  
w  
i  
n  
d  
o  
w  
e  
x  
c  
e  
l  
l  
e  
n  
t  
B  
u  
t  
s  
i  
d  
e  
l  
o  
b  
e  
B  
e  
c  
a  
u  
s  
e  
i  
t  
s  
p  
r  
e  
a  
d  
s  
w  
i  
d  
e  
l  
y  
i  
d

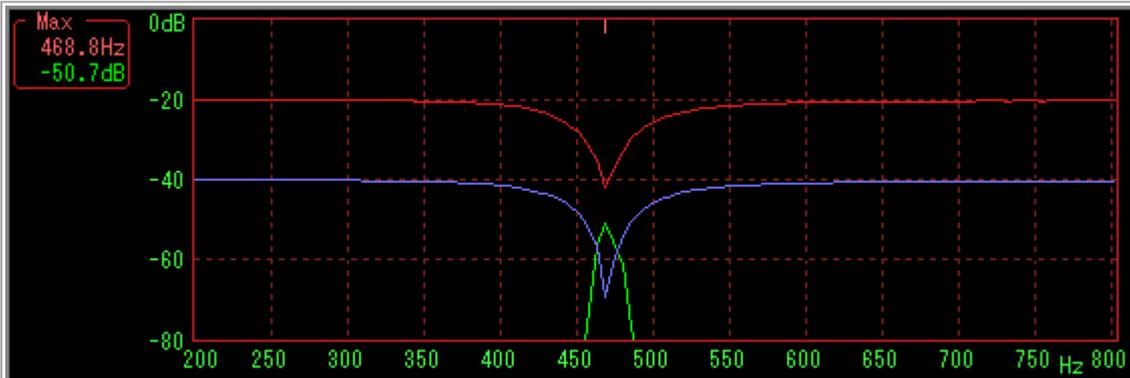
o  
n  
o  
r  
m  
a  
l  
l  
y  
u  
s  
e

Likewise, in the case of sample data number 8192

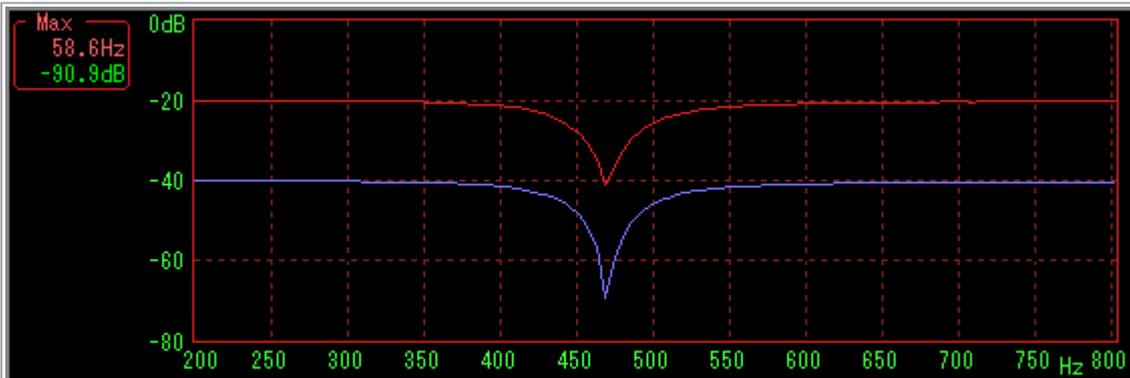
Wi  
nd  
ow  
fun  
cti  
on

Number of sample data 8192, sweep time is from 10 to 2000 Hz 58 seconds

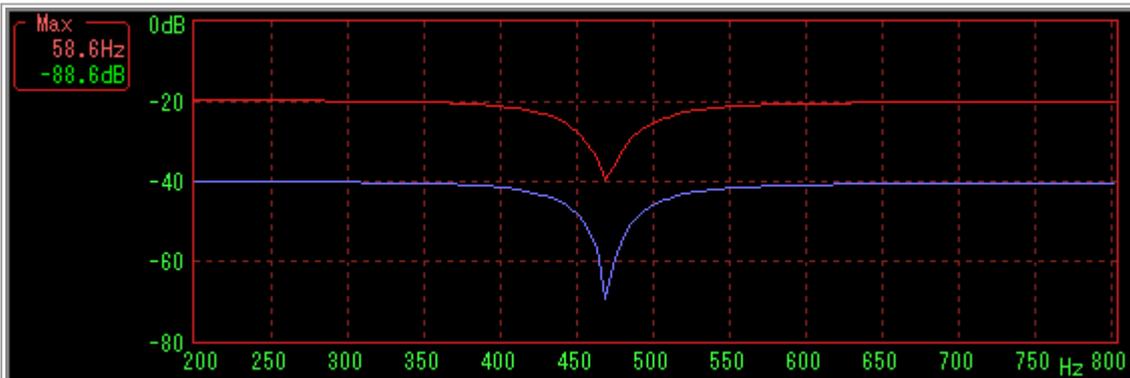
Ha  
nni  
ng

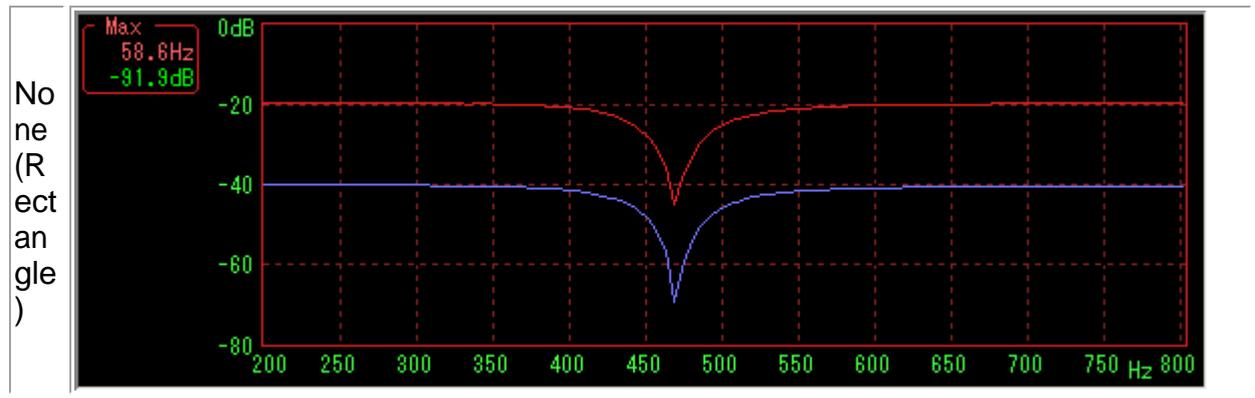


Bla  
ck  
ma  
n



Bla  
ck  
ma  
n  
-  
Ha  
rris





Hanning window seems to be the best for the time being.

Created with the Personal Edition of HelpNDoc: [Free EPub producer](#)

## Measuring distortion ratio

### About measurement of distortion rate

We summarized restrictions and cautions in measuring distortion ratio (THD, THD + N) by combining WaveSpectra (WS), sister software WaveGene (WG) and external oscillator.

(If you are in a hurry skip the explanation and see [summary](#))

WS, I think that if you measure the distortion factor very normally, it will be almost as follows.

- (1) THD is measured to be smaller than the original value.
- (2) For THD + N, it is measured to be larger than the original value.

There are two possible causes of these measurement errors.

The influence of the window function and the frequency resolution at the time of FFT.

I will examine it with the signal created by WG.

\* Because Wave file created by WG is calculated directly with WS as input signal, performance of the sound device itself is irrelevant even when playing with a sound device at that time.

(This is not the case when measuring by inputting an external signal to the sound device.)

#### (1) THD case

We will create the following two Wave files at 48000 Hz, 16 bit which is common with WG. (Wave file length is appropriate)

The first one is

Wave 1: 1000 Hz sine wave, -3 dB

Wave 2: 2000 Hz sine wave, -63 dB

Mixed.

And the second one is

Wave 1: 1000 Hz sine wave, -3 dB

Wave 3: 3000 Hz sine wave, -63 dB

Mixed.

Two are the second harmonic and the distortion factor having only the third harmonic, respectively It should be a 0.1% 1 kHz signal.

We will look at the distortion ratio (THD) by playing the created signal with WS.

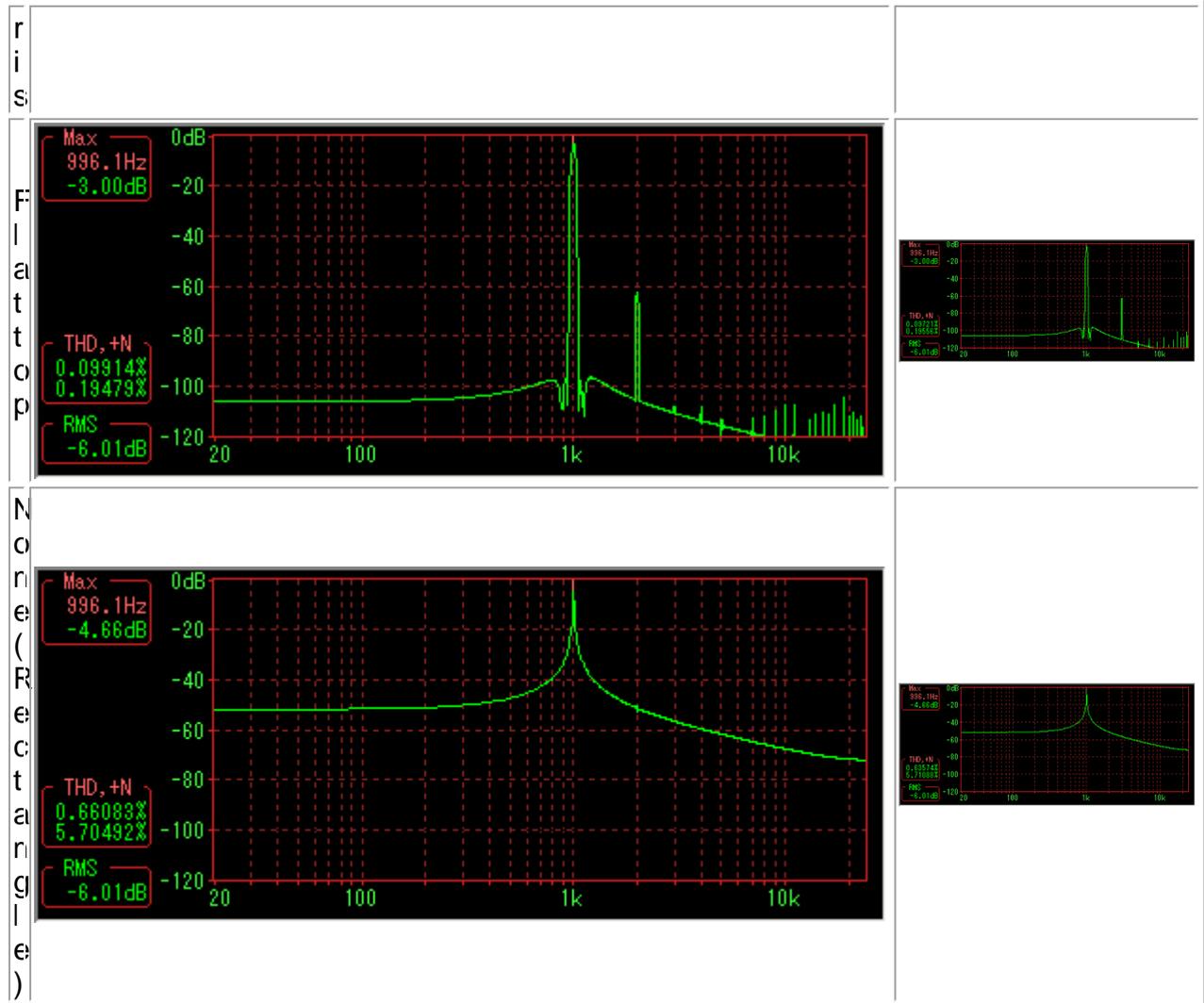
☐ Set WS to measurement mode and press the THD, RMS button Leave it on.

**(Also, the number of FFT sample data of WS is set in the setting dialog I will keep it at 4096)**

THD is the upper numerical value of the display part of THD, + N.

Table 1

W i n d o w f u n c t i o n	1 kHz + 2 kHz	1 kHz + 3 kHz
H a r m i n g		
E l a c t r i c a r		



You can see that there are differences depending on the window function. (Especially it is supposed to be terrible though window function without rectangle window (rectangular window))

Furthermore, we can see that there is also a difference between 1 kHz + 2 kHz and 1 kHz + 3 kHz.

Measurement of THD of WS is quite common, the ratio of the component of the fundamental wave (the largest component when not specifying otherwise) and the component of the integer multiples of the frequency to obtain the ratio of the RMS value We are displaying.

Except in the case of a rectangular window which will calculate many distortion components different from original due to the influence of the frequency response of the window function, 1 kHz At + 2 kHz, both values ??are around 0.08%, the original value It is less than 0.1%.

At 1 kHz + 3 kHz it is even smaller, but of course the original value is It is 0.1%.

However, the result close to the original value is obtained in the Flat top window.

In addition to the influence of the window function, these are more fundamental for the following reasons.

The dB value of the maximum value Max in each figure (excluding the Flat top window) It is

not -3 dB, and it is subtly different depending on the window function and the frequency is As you can imagine since it is 996.1 Hz instead of 1000 Hz, the frequency resolution in FFT is affected.

In the above case, since it is 48000 Hz sampling and 4096 point FFT, the frequency resolution is It becomes  $48000/4096 = 11.71875$  Hz.

Therefore, when 1000 Hz signal counts direct current as 0 th, 85 th The frequency component of  $11.71875 * 85 = 996.09375$  Hz is the maximum value.

(The next 86 th 1007.8125 Hz is also close to 1000 Hz, but 996.09375 Hz is closer to 1000 Hz, the 85th is the maximum value)

In other words, it means that frequency components in the low part separated from the original 1000 Hz by about 4 Hz are being displayed, and considering that the value of the frequency component is the amount passed through the band pass filter having the width corresponding to the resolution, each of the upper You can also see that the dB value of Max in the figure depends on the window function.

(Negative) error due to the difference in shape of the frequency response near the center of the window function has come out.

Further, for the harmonic component, 996.09375 Hz By collecting the components at integral multiples of, we can see that the (negative) error further increases.

For example,

At twice the 2000 Hz,  $85 * \text{the second } 11.71875 * 170 = 1992.1875$  Hz (deviation of about 8 Hz)

Three times 3000 Hz,  $85 * \text{Third } 11.71875 * 255 = 2988.28125$  Hz (deviation of about 12 Hz)

As a matter of course, the deviation from 2000 Hz and 3000 Hz gradually expands as higher harmonics.

In other words, **THD is measured to be smaller than the original value** will be.

(For this reason it is measured lower than the original value as far as higher harmonics are available.)

By the way, in the case above, twice the ingredients, in fact  $85 * 171$ , not 170th, 2003.

90625 Hz It becomes maximum with 3 times the ingredients of  $85 * 3$  Just 3000 Hz at 256th instead of 255 It becomes maximum with.

In other words, the center that becomes maximum deviates from the integral multiple of the fundamental wave.

In the meantime, the frequency response near the center is flat Flat top windows reduce the drop, but in order to obtain accurate values ??it is easiest to measure in combination with WG as follows.

---

From the above, conversely, if the measurement frequency matches an integer multiple of the resolution of the FFT (centered), it can be measured accurately.

In other words, from the beginning it is only necessary to measure at a frequency that matches an integer multiple of the resolution.

In other words, the sample length of the FFT is exactly equal to the integral multiple of the period of the measurement signal.

In this case, the waveforms are connected at the beginning and the end of the cutout part,

and no matter where you cut it, the error for that part disappears.  
 (It is the case that the best result is obtained when there is no window function (rectangular window))

With

WG, create a wave file as follows.

For these reasons, WG makes it easy to set the frequency Function to make it an integral multiple of the resolution of FFT, "Optimized for FFT" I use this because it has a function.

(Please see the help of WG for details)

The first one is

Wave 1: 996.09375 Hz sine wave, -3 dB

Wave 2: 1992.1875 Hz sine wave, -63 dB

Mixed.

The second one is

Wave 1: 996.09375 Hz sine wave, -3 dB

Wave 3: 2988.28125 Hz sine wave, -63 dB

Mixed.

As for the first two, the distortion rate having only the second harmonic and the third harmonic respectively It should be a 0.1% 1 kHz signal.

Wave 1: 996.09375 Hz The sine wave is first Wave 1 Set the frequency setting combo box of 1000 to 1000, right click on the mouse on it, and select "Optimize for FFT" (F) " If you select, it will be converted automatically.

Always, right click "FFT sample number (T)" in the same way " I chose 4096 by. (Match the FFT length in WS)

\* Wave 2: 1992.1875 Hz The sine wave is obtained by right-clicking the mouse on the frequency setting combo box of Wave 2 and selecting "Wave 1 multiples (W)" & If you select " x 2 ", it will be converted automatically.

\* Wave 3: 2988.28125 Hz The sine wave is obtained by right-clicking the mouse on the frequency setting combo box of Wave 3 and setting "Wave 1 multiples (W)" & If you select " x 3 & quot ;, it will be converted automatically.

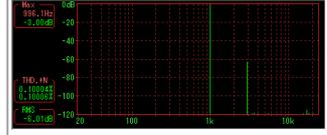
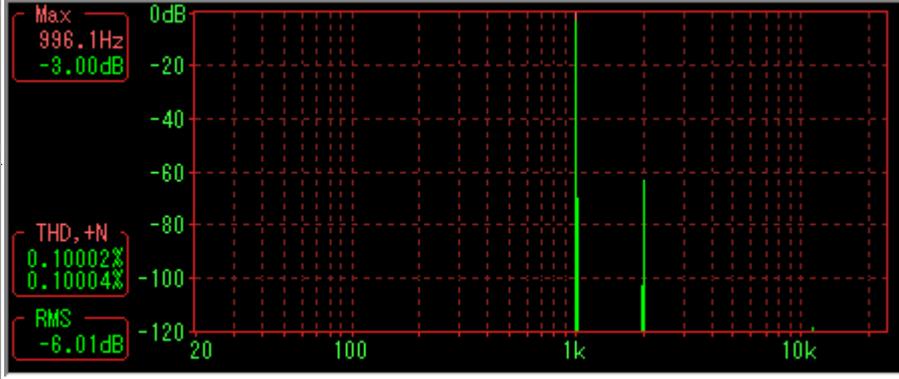
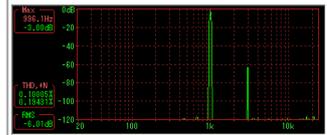
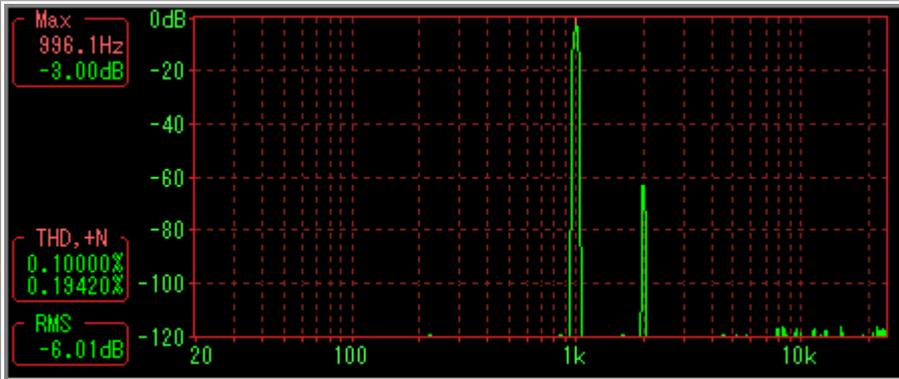
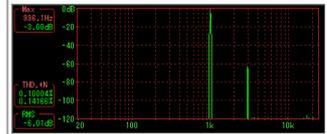
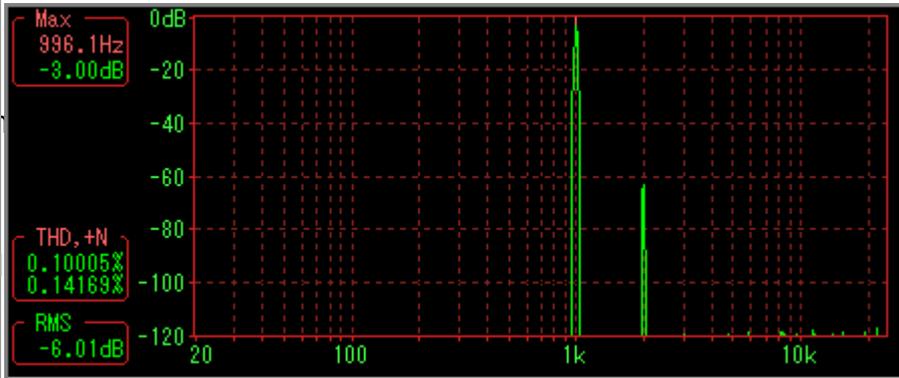
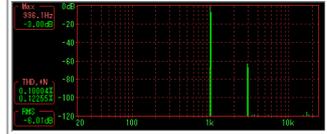
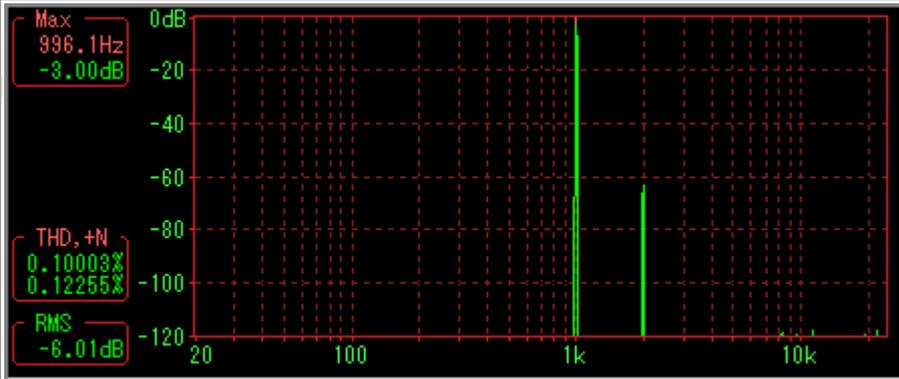
Since these are not automatically linked, Wave 1 When changing the frequency of Wave 2 and 3, it is necessary to repeat the setting of Wave 2 and 3 again.

Play back the created signal with WS and look at the distortion factor.

Table 2

W i n d o w f u n c t i	996.09375 Hz + 1992.1875 kHz	996.09375 Hz + 2988.28125 Hz
--	------------------------------	---------------------------------

On  
H  
a  
n  
n  
i  
n  
g  
B  
l  
a  
c  
k  
r  
m  
a  
n  
-  
H  
a  
r  
r  
i  
s  
F  
l  
a  
t  
t  
o  
p  
N  
o  
n  
e  
(  
R  
e  
c  
t  
a  
n  
g  
l



e )

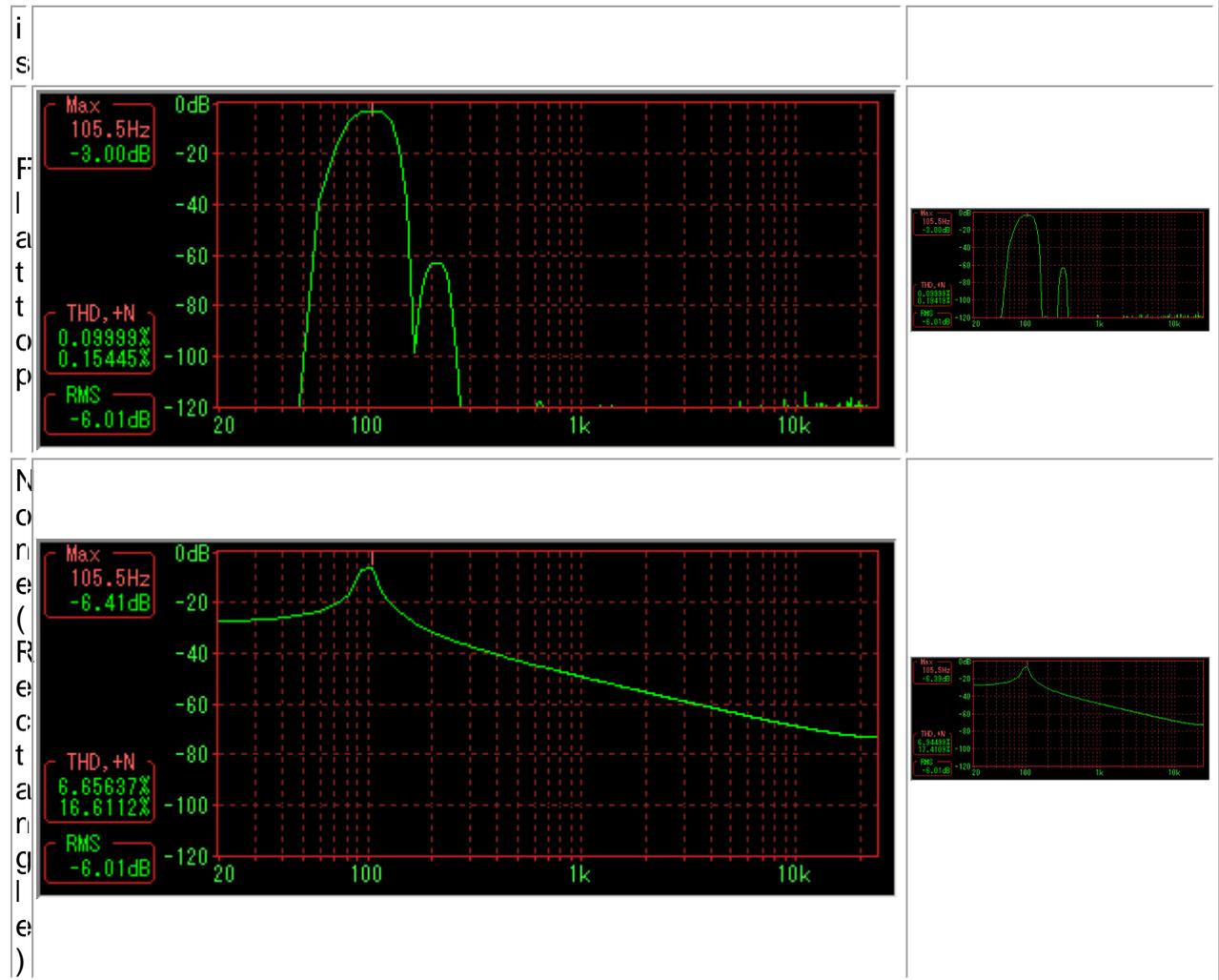
Now you can see that it is the correct value.

(This time "Optimized for FFT", the sample length of FFT is exactly equal to the integral multiple of the period of the measurement signal, so there is no influence of data clipping and originally Correct measurement will be done when " No window function " Only one spectrum of each component becomes)

Let's also look at when the fundamental frequency is lower.  
It is similarly examined for the case of 100 Hz.

Table 3

Window function	100 Hz + 200 Hz	100 Hz + 300 Hz
Harmonic		
Blackman-Harris		

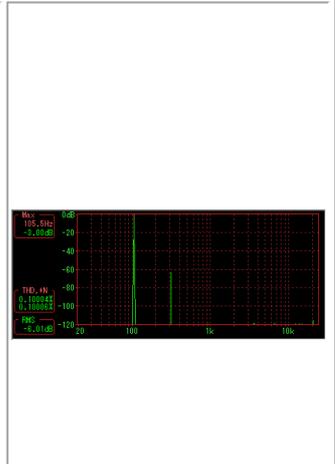
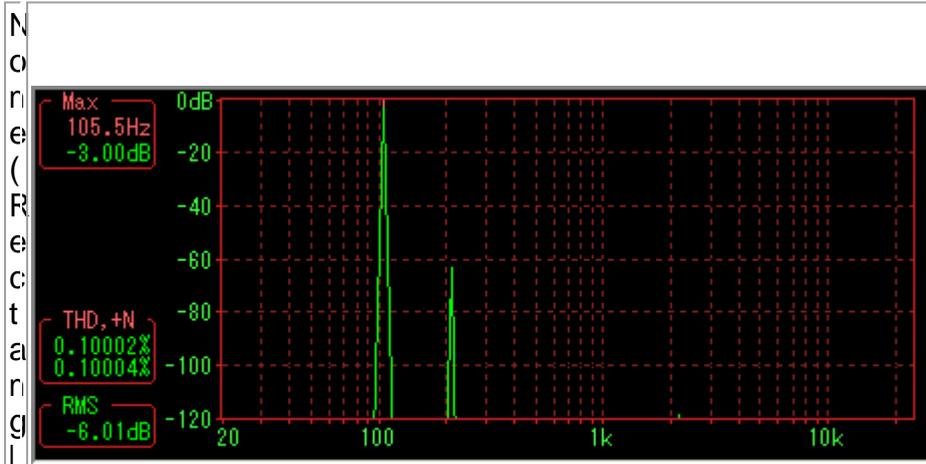
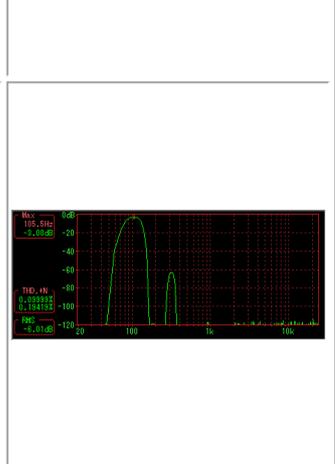
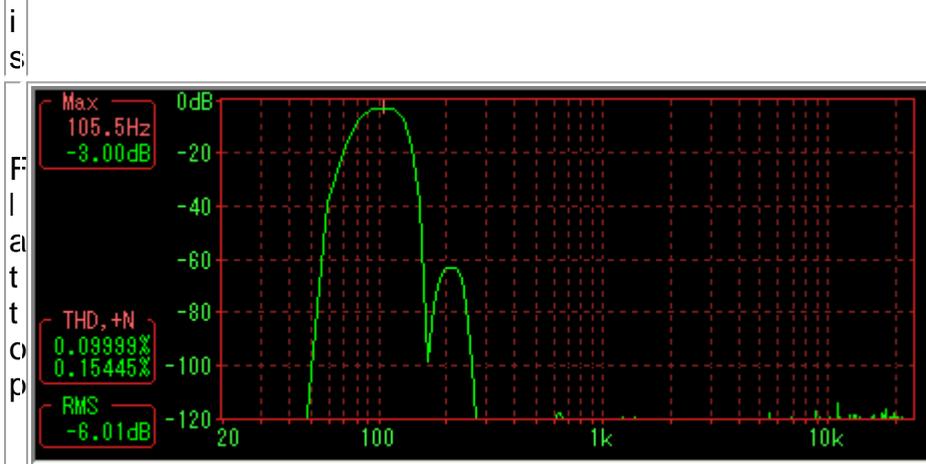
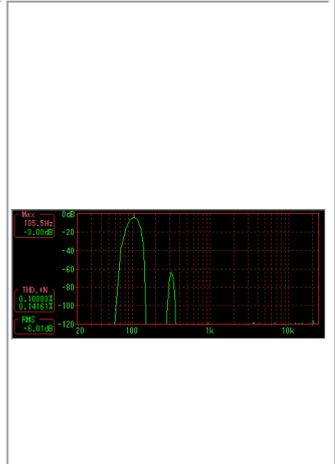
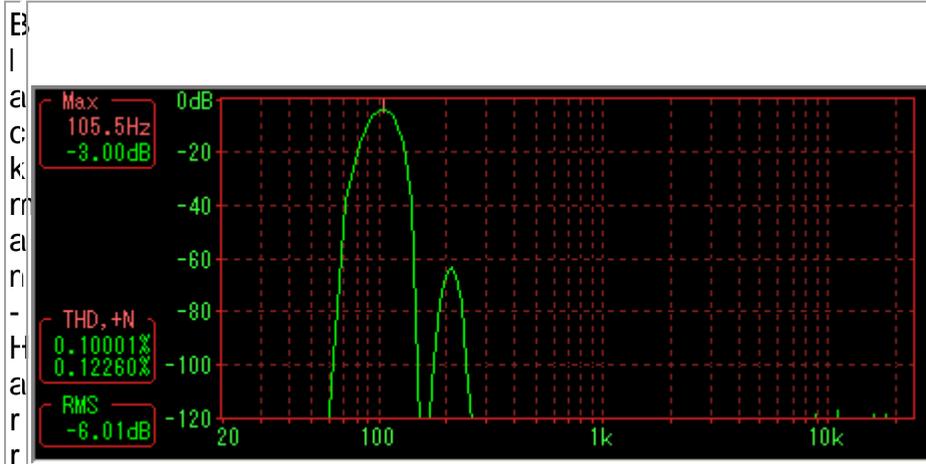
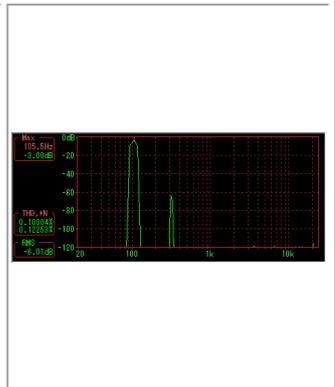
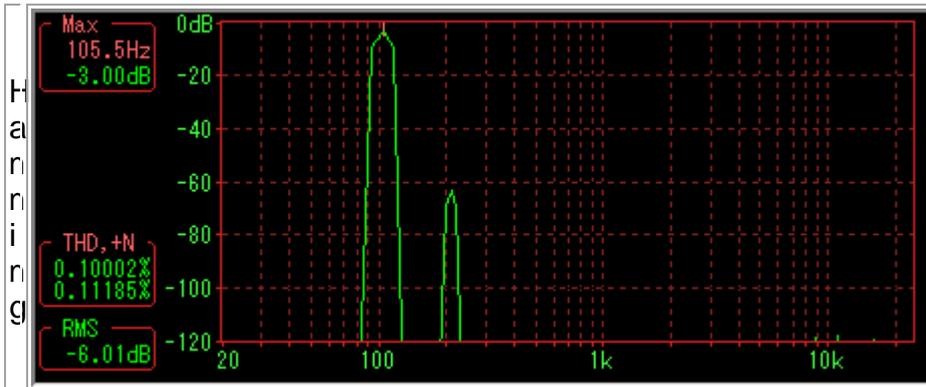


You can see that the difference by the window function is larger than at 1 kHz.  
It seems that results close to the original value are obtained in the Flat top window.

We will also look at the case of optimizing " FFT & quot ;.

Table 4

W i n d o w f u n c t i o n	100 Hz + 200 Hz	100 Hz + 300 Hz
--	-----------------	-----------------



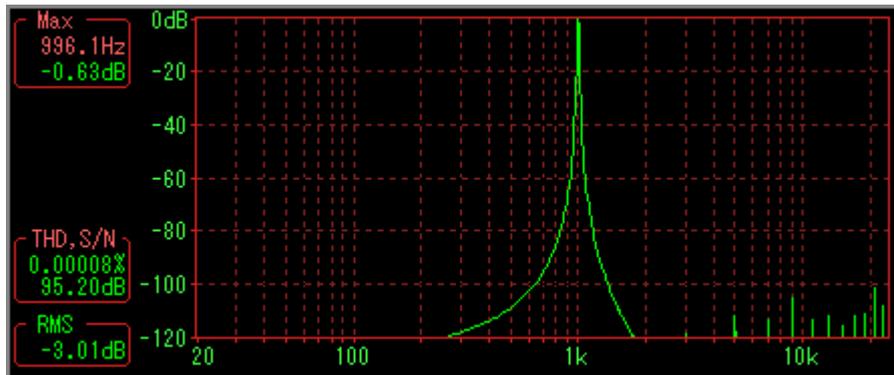
You can see that it is correct value.

## (2) In the case of THD + N

In the case of

THD + N it should be more easily understood that the window function has a big influence.

First of all, please see the figure below.



Although this is a spectrum of 1 kHz 0 dB signal when hanning window is applied (4096 points FFT as before), you can see that the base of the window function is expanding.

In determining THD + N from now on, the fundamental wave can take only one frequency component at the position of the maximum value, but it is not a matter of how much from where to collect as a part other than the noise component, that is, the fundamental wave It will be understood that it becomes.

If you include all of the footings, you can imagine that it will naturally be much larger than originally. (It is true.)

This is because it is an apparent component of the cut-out portion of the FFT sample and the window function, which is not present in the signal itself.

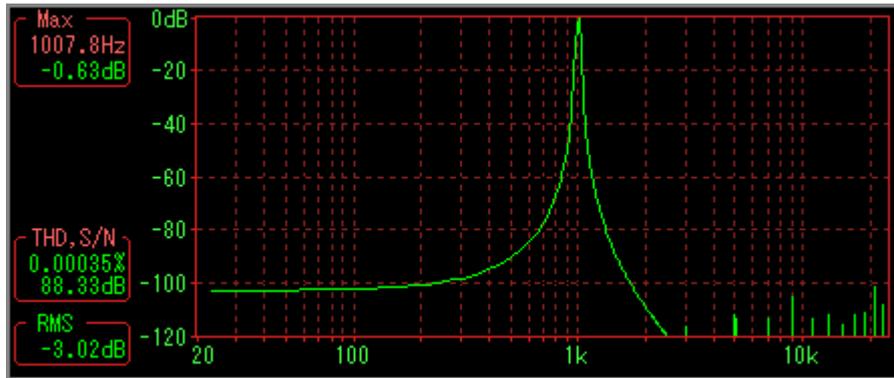
For the sake of clarity, in the figure above it is not the display of THD + N Since it is displayed by S / N, it is good if it is about 96 dB.

As you can see, it is around 95 dB and it is nearly the correct value, so it might seem like that, on the contrary.

However, this is because it is excluded so as not to include a part (both sides) of the base part close to the fundamental wave as a noise component so as to be almost correct.

(How much range to exclude is adjusted by experiments)

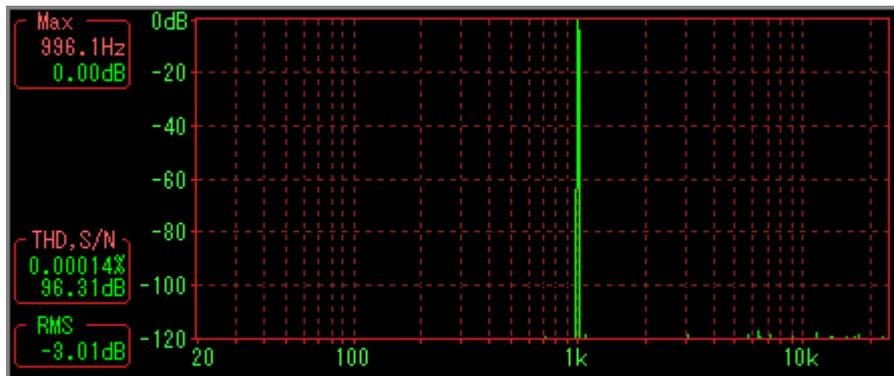
Try to make the same signal extend more base When it is displayed with 2048 point FFT, it becomes as follows, it is about 88 dB and it is also increasing, and it is understood that the influence of the window function has come out. (It can not be ruled out because the foot spreads more, you can see that it also spreads to 2 kHz.)



If it is set to the number of samples of 4096 points or more, there is not much difference in influence due to exclusion.

By the way, it is not 1000 Hz, and "Optimized for FFT" " It is 996.09375 Hz, and it is imagined that good results will be obtained if we eliminate the influence of the foot of the window function, but that is the figure below.

As you can imagine it is about 96 dB. (4096 point FFT Hanning window)



Next, when we return to THD + N and pay attention to the harmonic component (and noise) when using the window function, similarly, since there is a broadening of the base by the window function for each harmonic If you collect all the noise as it is, it becomes larger than the original value for the same reason as above.

As for harmonics, since excluding near the center is not done like the fundamental wave, the components of all the skirts are added and it becomes a large value.

In Table 2 of (1), THD + N is larger than THD for the same reason.

Only one, each spectrum does not spread at the base with only one spectrum In the case of " no window function & quot ;, both are almost the same You will see that it is 0.1% correct value.

So, if **THD + N, it will be measured larger than the original value** .

(Furthermore, the greater the value of the distortion component, the more the number of such distortions, the greater the increase due to the footsteps will be found)

Finally confirm with sine wave + noise signal.

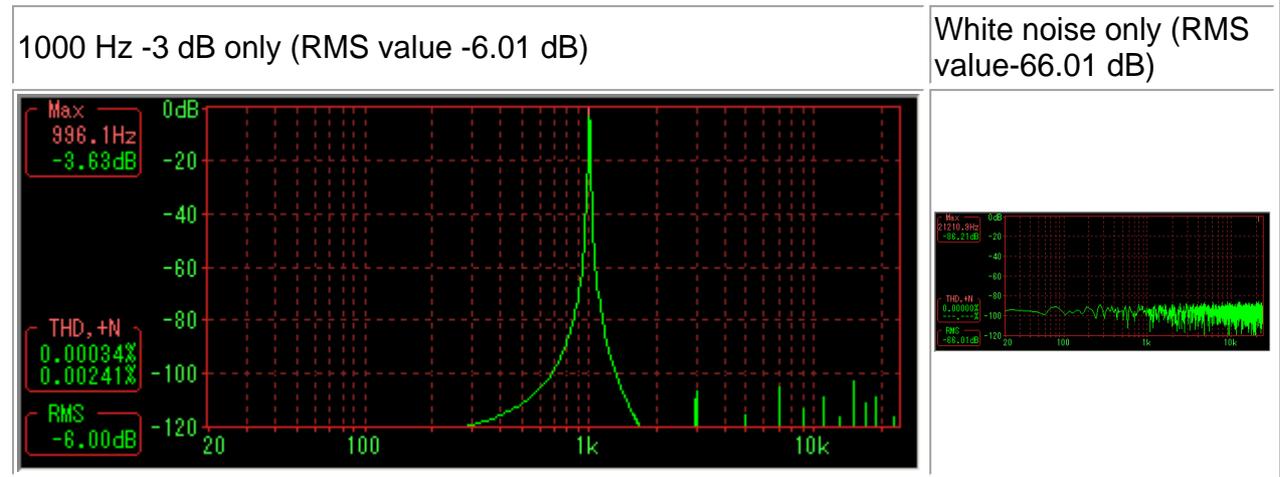
With the WG, create a wave file as follows.

Wave 1: 1000 Hz sine wave, -3 dB

Wave 2: White noise, -55.1 dB

With this, it should be a signal of approximately 0.1% when measured with THD + N.

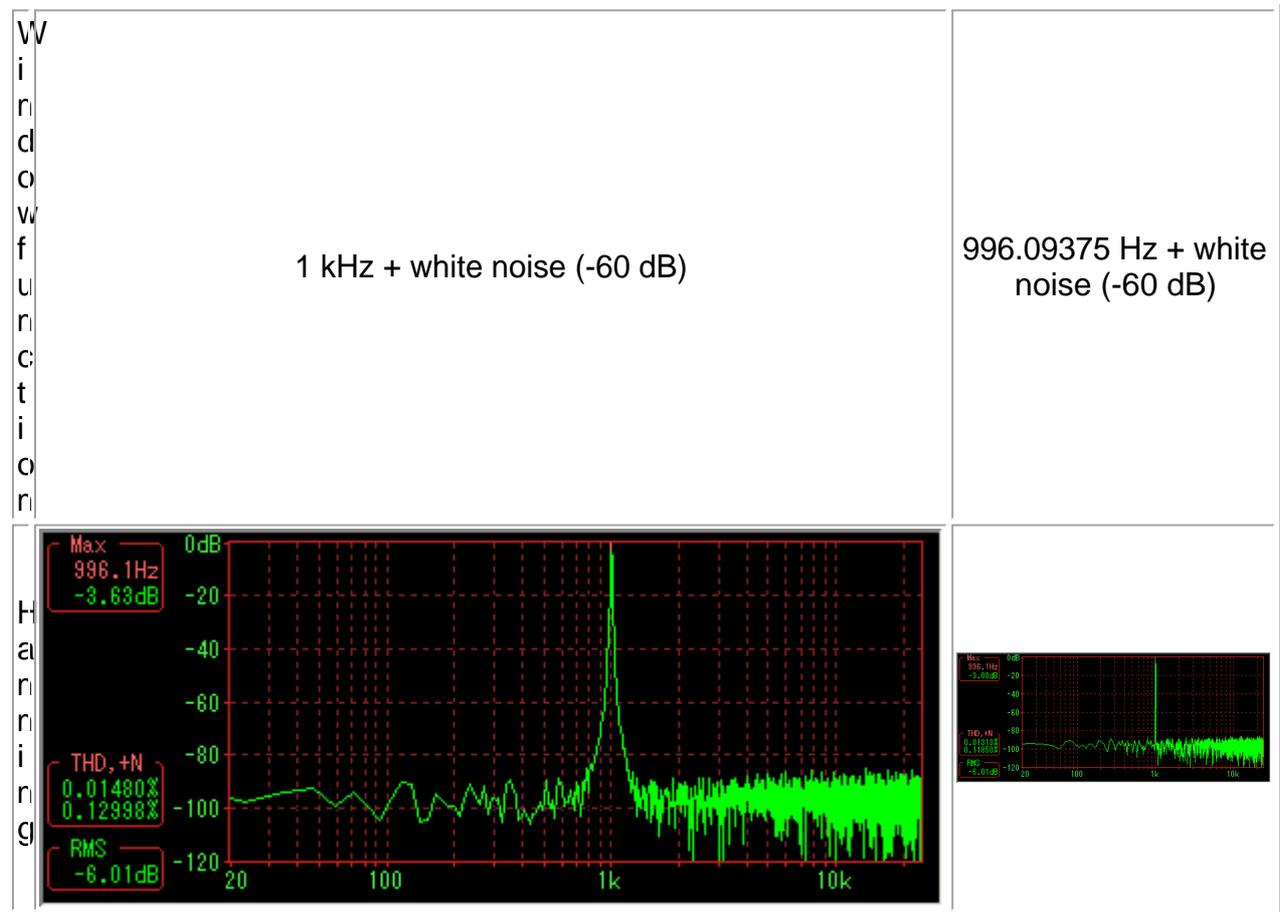
(As shown below, looking at the FFT of the two components separately, the ratio of RMS values 60 dB, that is, THD + N becomes 0.1%)

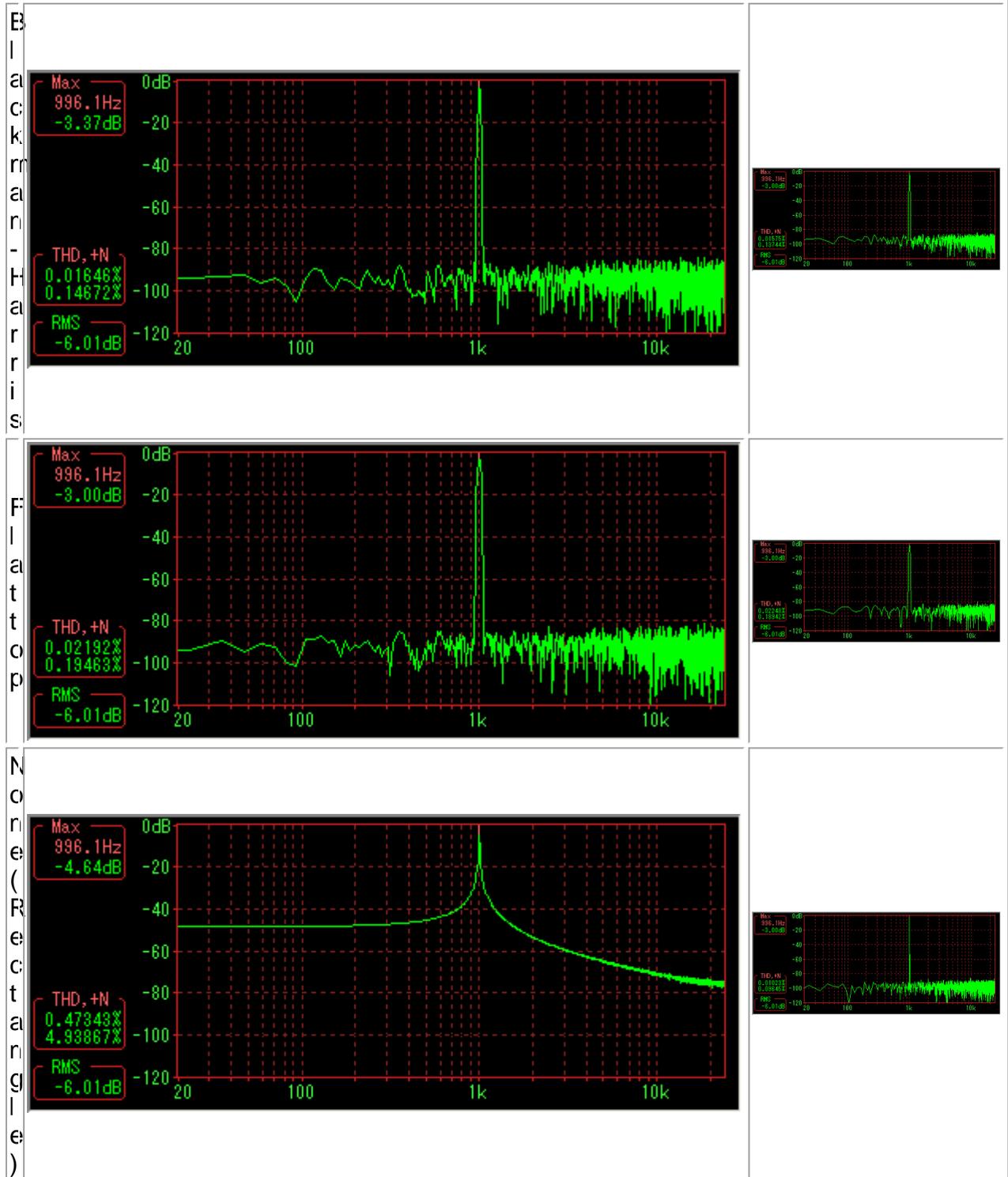


For further comparison, optimize 1000 Hz to "FFT" " It added the signal of 996.09375 Hz - 3 dB and added THD + N I tried to measure.

THD + N is the number below the display of THD, + N.

Table 5





\* In a general case where the measurement frequency is not optimized for "FFT" in general, none of the original THD + N is greater than 0.1%. (Hanning window has the smallest error?)

\* Optimizing the measurement frequency to " FFT & quot ;, there is no difference that it is larger than the original value, but everything is improved and errors are reduced.

In this case, in fact, if you do not have a window function you should be able to do the correct measurement, but about 0.096% It is smaller than the original value of 0.1%. This is because, as explained a little above, a part of the vicinity of the fundamental wave is

excluded from the noise component, so the noise component is reduced by that much. In the case of "without optimization" for FFT, when there is no window function, since there is no origin at the base (spectrum is only one), it is excluded although it is not necessary to exclude it.

In the future, we may not exclude this in case of no window function.

(In the case of no window function, optimize measurement frequency "FFT" " Only the measured frequency is synchronized with the window and other noise components are not synchronized, so there should be an error for cutting out with a rectangular window.

However, in the general case where the noise component is not so large, it is considered to be of no particular problem.)

### (3) Number of FFT sample data

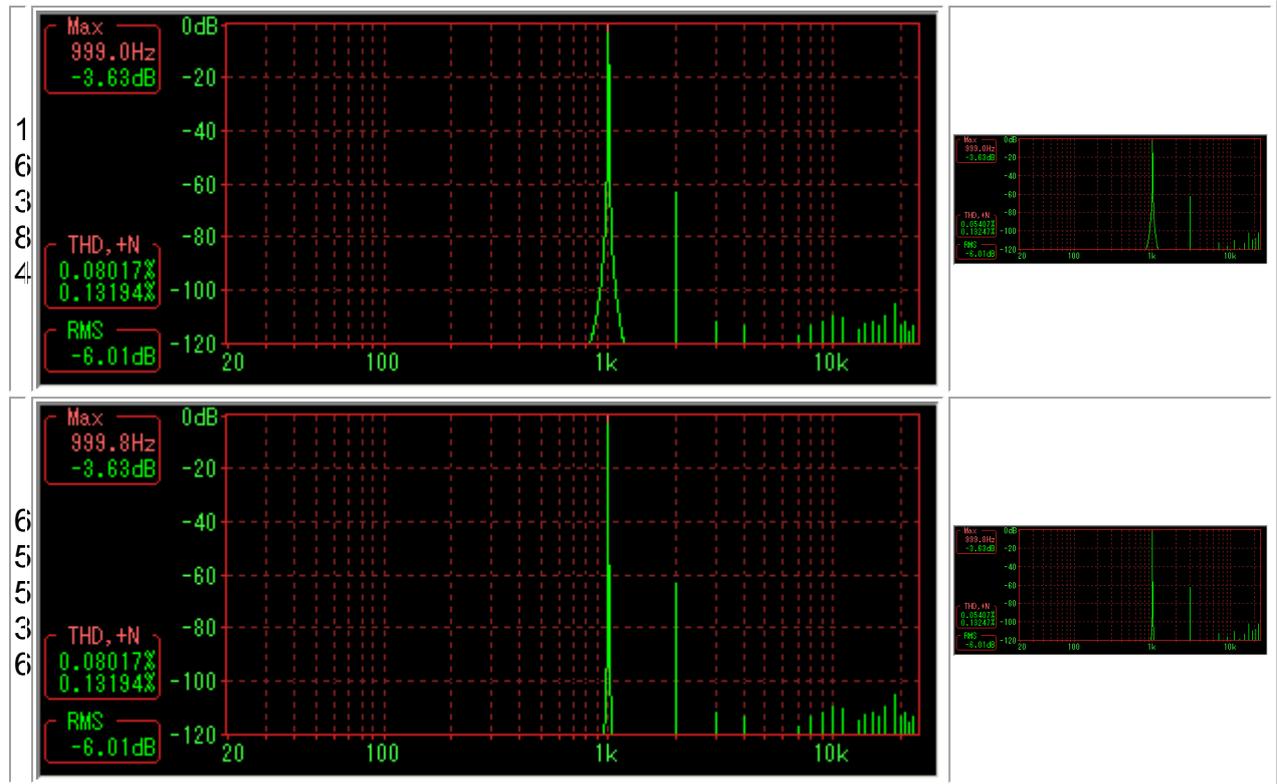
I summarized the difference depending on the number of FFT sample data.

As before, when the fundamental frequency is 1 kHz, there is almost no difference as follows.

The window function is a Hanning window. THD 0.1% is the correct value.

Table 6

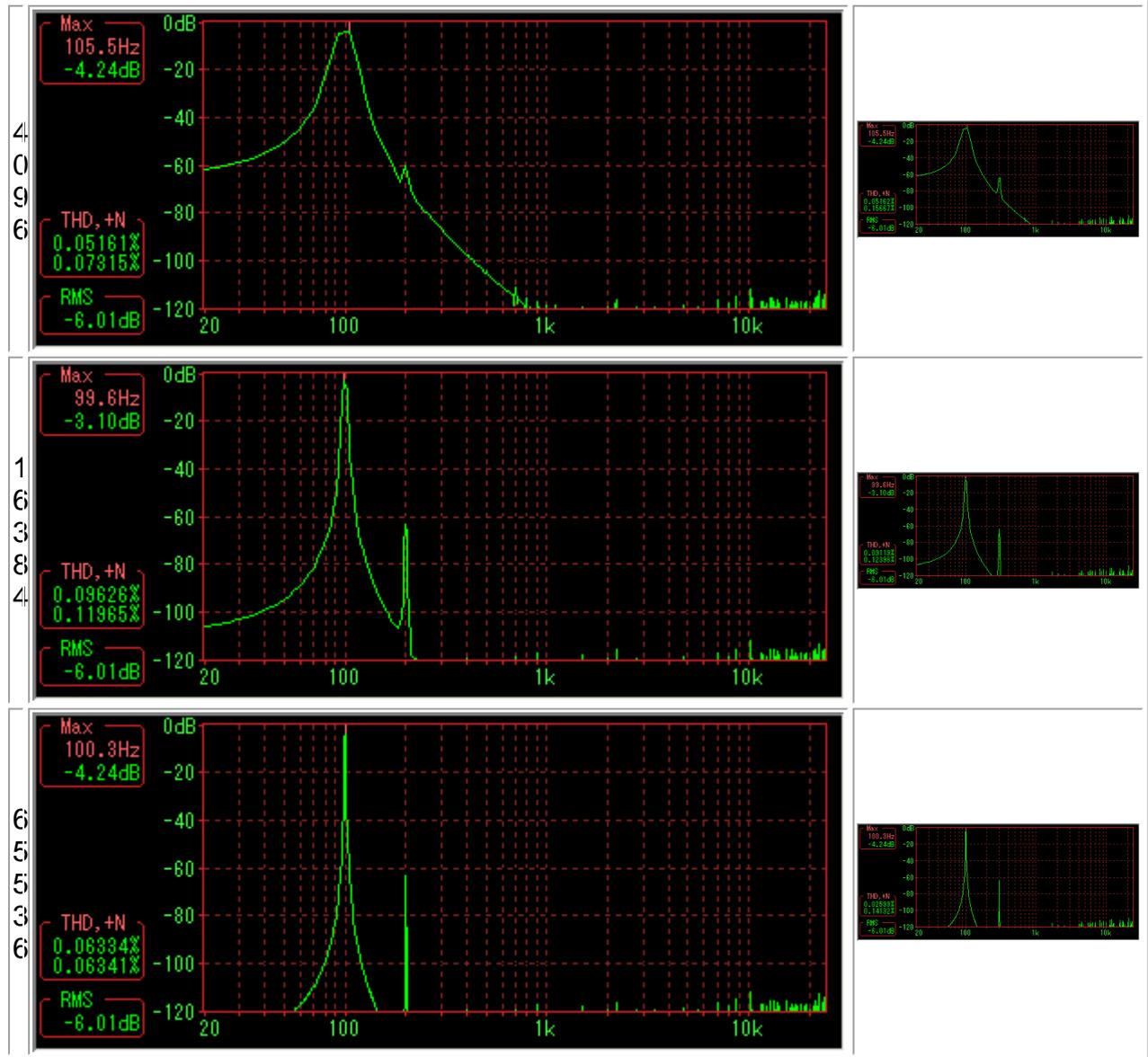
N u m b e r o f s a m p l e s	1kHz + 2kHz	1kHz + 3kHz
4 0 9 6		



However, caution is necessary as the basic frequency will be different if it is lower. Below is the same as for the case of 100 Hz. You can see that harmonics can not be separated unless the number of sample data is increased. However, even if you increase it, you can also see that THD's value is not that right for reason (1). (THD 0.1% is the correct value)

Table 7

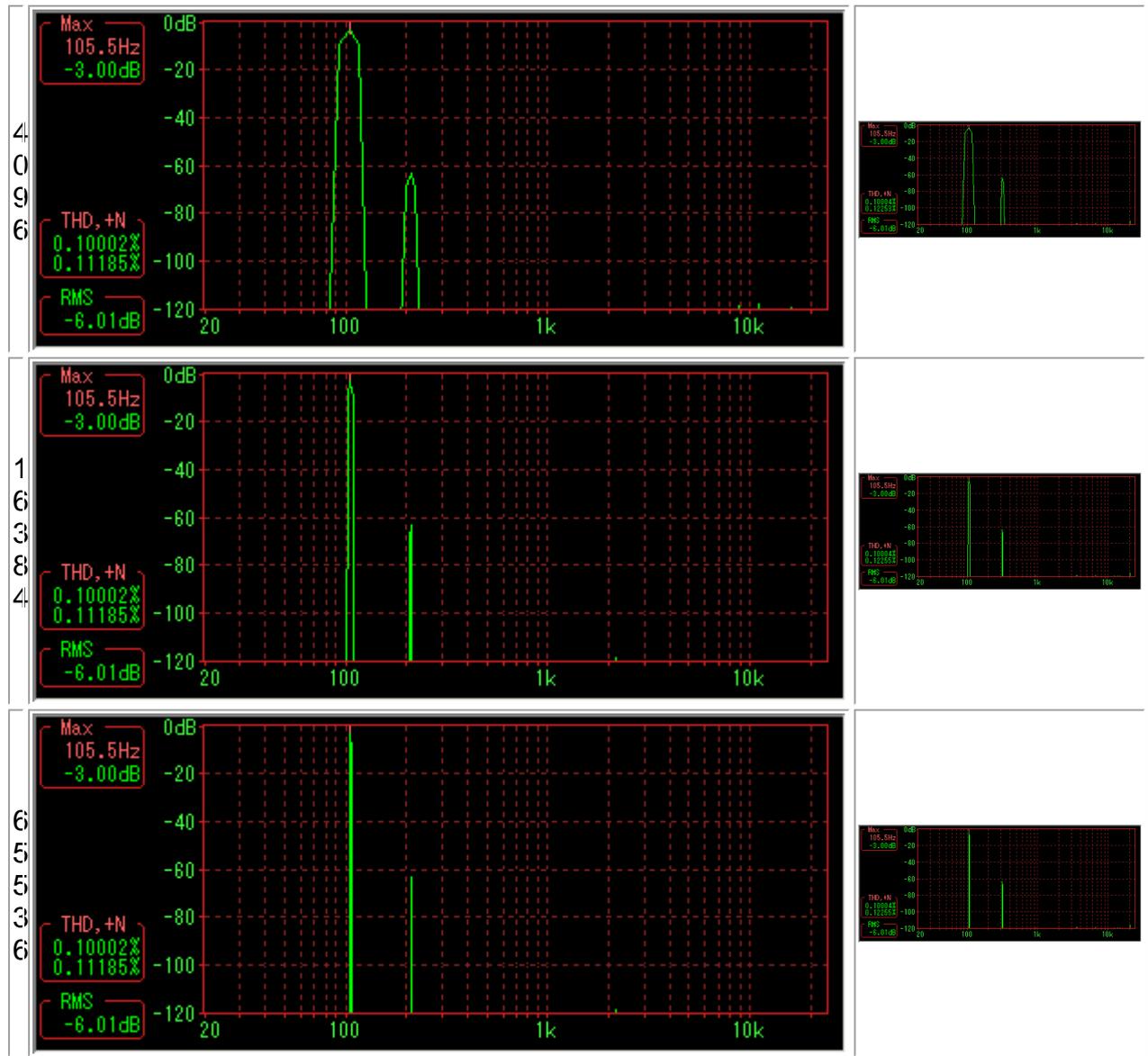
N u m b e r o f s a m p l e s	100 Hz + 200 Hz	100 Hz + 300 Hz
---	-----------------	-----------------



When optimized " to FFT, 4096 points are correct.

Table 8

Number of samples	105.46875 Hz + 210.9375 Hz	105.46875 Hz + 316.40625 Hz
-------------------	----------------------------	-----------------------------



## Summary

I summarized what you think is better to watch out for distortion measurement in WS.

1. Pay attention to the measurement frequency setting.

Specifically, it is preferable to use WG as a signal source instead of an external oscillator as much as possible, adjust the frequency of the measurement signal to the FFT sample data length of WS on the WG side Optimize " FFT " so that the frequency matches an integer multiple of the resolution of the FFT. This will reduce the measurement error.

2. Also note the window function used.

In the case of only THD, it is optimized for "FFT" as in 1. " If you do, it will not change very much with any window function, but originally No window function (rectangular window) should be good.

In the case of not optimizing " FFT " (when it can not be optimized, such as when

using an external oscillator) It is better to use the Flat top window.  
Also, it seems better to use the Flat top window even when the fundamental frequency is low.

In the case of THD + N, similarly " Optimized for FFT " Hanning window or no window function (rectangular window).

Note that in the case of Hanning window, there are slightly more eyes, and in the case of no window function (rectangular window), it becomes slightly smaller eye value at present.

3. Also note the number of FFT sample data.

Optimized for " FFT " does not affect much, but it is optimized for " FFT " If it is not done (when it can not be optimized, such as when using an external oscillator, etc.), make the data length so that second harmonic can be reliably separated.  
If you do too much indefinitely, the error will increase for reason (1).

4. Sound devices that operate WG and WS use objects that can record and reproduce simultaneously (full duplex operation is possible).

When using a separate sound device, such as when using another PC dedicated to playback / recording, the clocks of the two parties are not perfectly synchronized, so 1 Even if you optimize " " to FFT it can not be measured accurately.

(Even if it is a crystal oscillator, even if there is a slight difference in such an application.)

When you try it you understand, but the width of the spectrum will fluctuate.)

5. Check the distortion characteristics of the sound device itself thoroughly with your own loop connection etc. in advance.

Naturally, the measurement accuracy depends on the performance of the sound device to be used.

Since the measurement result becomes the distortion and noise of the device itself, please understand beforehand what type of distortion and noise characteristics the device is.

Depending on the device, be careful as there is a need to restrict the input to -2 to 3 dB, suddenly distorting when inputting near 0 dB. (Such as part of sound blaster card)

---

Created with the Personal Edition of HelpNDoc: [Free CHM Help documentation generator](#)

---

## Setting dialog

### Setting dialog

---

Setting button  is displayed.

**\* Note that each setting here can be changed in real time even during operation,**

**with some exceptions.**

Also, when closing the setting dialog box, When you press the [Cancel] button and close it, all settings up to that point will return to the state when the dialog box was opened. Therefore, you can temporarily make another setting.

All settings of the main window, including settings in the setting dialog, are all set in the setting file It is saved in **WS.INI (WS\_2.INI)** for the second instance **WaveSpectra: 2)** and reproduced on the next start .

**[Wave]** tab

**[Spectrum]** tab

**[FFT]** tab

**[PLAY / RECORD]** tab

**[Miscellaneous]** tab

Created with the Personal Edition of HelpNDoc: [Easily create HTML Help documents](#)

**Wave**

**[Wave]** tab

Wave Configure settings related to waveform display.

**\* If you click the position of a button, a combo box, etc. in the figure below, it jumps to the explanation of that part.**



### === Display Type ===

#### normal

- It is a normal waveform display.

#### Lissajous (X - Y)

- This is the Lissajous (X - Y) display in Stereo Lch / Rch.  
It is useful for phase checking during recording, microphone arrangement check and so on.

Lch is set to Y axis, Rch is set to X axis.  
The display window at this time is always square.

\*For multi-channel format [here](#) .

- **Draw with Bezier curve**  
When checked, draw the Lissajous waveform with a Bezier curve.  
Normally, being connected by a straight line may become connected a little smoothly.  
(It will be late, though slightly)
- **Center**  
When checked, it is always displayed in the middle of the window.
- **Display in new window**  
If checked, it will be displayed in a separate, independent floating window.  
If this is already checked during lissajous display, the wave display window will change to the normal waveform display.

\*You can of course change the position and size of the floating window.

Move: Drag anywhere in the window.

Resize: Drag the lower right corner of the window (here only).

(Please be careful as it can be changed only to a square)

Also, by setting the floating window with the [Move with the main window](#)  
along the [Others] tab - Maintain the relative position when moving the main window.  
You can move at the same time.

### === Vertical axis (Amplitude) ===

#### magnification

- Wave Sets the display magnification of the amplitude data of the waveform. When x1, all data up to the maximum amplitude are displayed.

### === Horizontal axis (Time) ===

#### magnification

- Wave Sets the display magnification of the waveform's time axis. When x1, all of the sample data number being FFTed is displayed.

### === Level meter ===

#### Not displayed, display (horizontal), display (vertical)

- In the display (horizontal) and display (vertical), they are displayed in separate horizontal and vertical directions, respectively, in separate independent floating windows.

\*You can of course change the position and size of the floating window.

Move: Drag anywhere in the window.

Resize: Drag each corner of each side like an ordinary window.

(However, there is a limit on the size of the shorter side for both horizontal and vertical display, it can not be larger than that)

Also, by setting the floating window with the [Move with the main window](#)

along the [Others] tab - Maintain the relative position when moving the main window.

You can move at the same time.



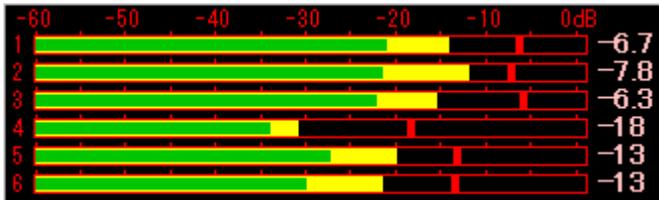
- \*In addition to the normal peak meter, the level meter shows the power inside it The RMS value (effective value) bar is also displayed. This is what I meant to be a substitute for the so-called VU meter. Since the real VU meter has different mechanisms, the movement is not the same, but it is a guideline, but the displayed value itself is an accurate RMS value. (In fact, it is displayed with a slightly multiplied mean value filter)  
\* See the RMS value below

#### Margin mode

- When checked, the normal peak value display mode changes to the margin display mode. The margin value is retained until you press the Reset button.



- In case of multi channel with more than 3 channels, the display height (width in vertical display) increases by the number of channels. Although the number of channels is displayed for both playback and recording, the number of channels of the level meter immediately after startup is the number of channels set as the recording format.



### === Wave file information window ===

#### display

- Pressing the display button indicates the chunk structure and contents of the wave file. The [Wave file information window](#) opens.

### === Numeric display (lead-out) ===

#### Display in hexadecimal

- If checked, the value of the waveform at the time of the lead-out is It will be displayed in hexadecimal.

\*Pressing the Shift key during the leadout will display the setting opposite to this setting only during that time.

In short, you can switch between decimal and hexadecimal displays.

### === RMS value ===

#### Set the value of full scale sine wave to 0 dB

- Switches the RMS value of 0 dB between the case of a full-scale rectangular wave

and the case of a sine wave.

If checked, the value of the full scale sine wave is set to 0 dB will do.

The setting here affects the RMS value of the measurement mode and the inner RMS bar of the level meter.

\*For RMS value of full scale rectangular wave (half scale DC) and RMS value of full scale sin wave, Sin is Since it is smaller by 3.01 dB, if you check here, the display value is reversed It increases by 3.01 dB.

When not checking is the original RMS value, but by measuring only the sine wave, shift of spectrum display If it is set to Auto mode, it may be more convenient to check this if it is the same as the lead-out display of the spectrum.

### === Drawing method ===

- The following six types of drawing methods can be selected.  
Select the fastest drawing method (the least CPU utilization) in your environment.  
(Depending on the display card, there may be little change, but on the contrary it may be very different so please try.)

Screen: Direct drawing on screen

Image 1: Drawing in the image in the memory and transferring to the screen

Image 2: Transfer the image drawn only to the screen to the screen, draw only the line directly

DDraw 1: DirectDraw version of Image 1 method

DDraw 2: DirectDraw version of Image 2 method

DDraw 3: Transfer after synthesizing to another image instead of screen by DDraw 2 method

Depending on the window size and number of colors, One of the drawing methods in which V. Blank is effective should be the fastest.

(Independent floating window for Lissaoujou display, even if it is set to 3 types of DDraw, Image2 It becomes the drawing method of)

### === V.Blank ===

- When the drawing method is Screen, Image 2, DDraw 2, the screen flickers.  
In that case, if you check here and make it effective, you will draw after waiting for the vertical retrace period, so flicker disappears.

However, in the case of a large window size or a slow CPU, flickering may be left behind without being written during the flyback period, and since it will wait until then, Please note that the utilization rate may become 100%.

Also, depending on the display driver, there seem to be software emulation, in that case, there is no effect.

\*This function is originally a function for CRT display set at a high refresh rate.  
Liquid crystal display, it seems to be 60 fps in general, so it may just be late.

### === automatic setting ===

- By pushing this button, the setting window opens and you can automatically set the combination of drawing methods that will be the fastest.  
If you do not understand the combination, it is convenient to set it automatically with this button.  
Even if you press this button (Wave tab) Both Wave and Spectrum are set at the same time.

\*If there is a drawback in the drawing due to a bug in the driver etc. with the combination set by automatic setting, try changing the setting manually.

**\* Refer to the same section of the [\[Spectrum\]](#) tab.**

**=== Display Interval ===**

**=== display color ===**

See [\[Miscellaneous\]](#) tab.

\*All display setting functions can be changed in real time even during calculation & display.

~~~~~

When closing the setting dialog box, When you press the [Cancel] button and close it, all settings up to that point will return to the state when the dialog box was opened. Therefore, you can temporarily make another setting.

All settings of the main window, including settings in the setting dialog, are all set in the setting file It is stored in **WS.INI** (**WS - 2. INI** for **WaveSpectra: 2** for the second) and reproduced at the next start It will be.

---

Created with the Personal Edition of HelpNDoc: [Full-featured Kindle eBooks generator](#)

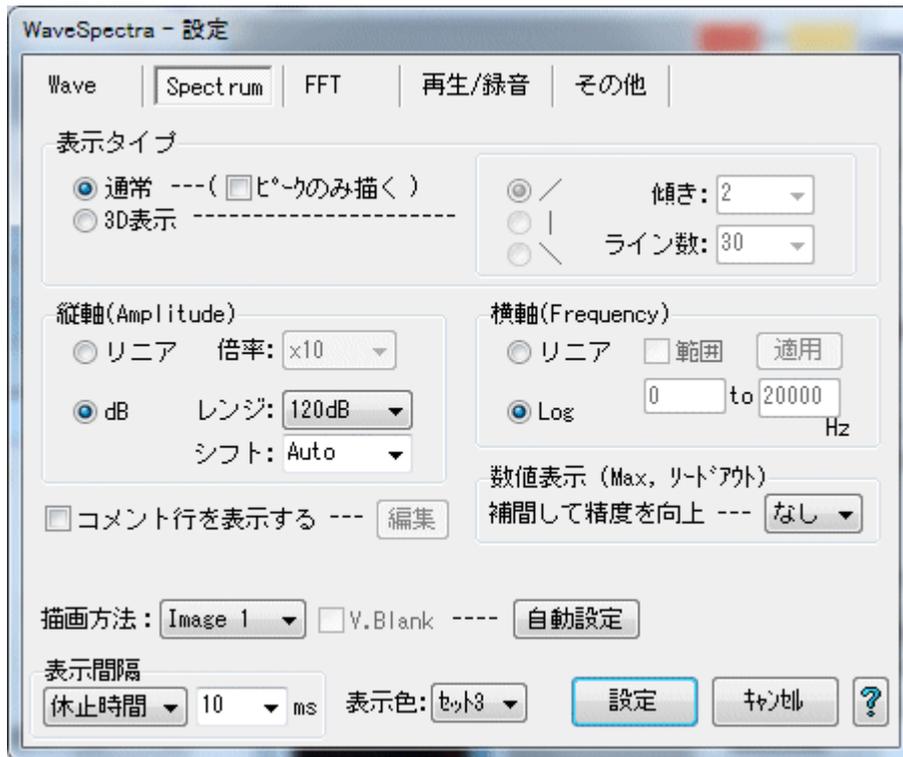
---

## **Spectrum**

**[Spectrum]** tab

Spectrum Configure settings related to waveform display.

**\* If you click the position of a button, a combo box, etc. in the figure below, it jumps to the explanation of that part.**



### === Display type ===

#### normal

- This is a normal Spectrum display.
- **Draw only peaks**  
When checked, only the peak of Spectrum is connected and the waveform is displayed.  
If the display density of the graph is high and multiple data actually correspond to one dot on the screen (for example, where the horizontal axis is the part where the frequency of Log display is high), the graphs will not overlap, which makes it easier to see.  
(The display is also slight, but it gets faster.)  
  
\*However, because the number of display data decreases, there will be a part that will display slightly different from original.

#### 3D display

- Multiple 3D display of Spectrum in 3 different directions.
- **Direction(/, |, \)**  
Specify from the upper right, upper, upper left, the direction of extension of the graph of 3D display.
- **slope**  
Specify the horizontal deviation of each adjacent graph in dot units.  
The larger the value, the larger the angle.  
  
\*Since the end of the graph is drawn to pass through the corner at the top, the larger

the slope, the more horizontal The length of the direction will become shorter.  
(However, since it is designed not to be less than half of the size of the display window, if it becomes more inclined, it does not pass through the upper corner.)

- **Number of lines**

Specify how many graphs to draw in the vertical direction.

However, since it is necessary to set the actual graph drawing intervals at equal intervals (integral), depending on the display window size, the specified graph drawing intervals are set as follows.\* It may not be the number of lines.

The actual number of lines is "31 L" on the upper left of the 3D display, And it will be displayed.

Also, at the same time, the seconds of how many lines it corresponds is also displayed.

\*If you change the window size due to limitations of the drawing method, be careful Please.

(It is the same while stopping)

**Note 1:**

In 3D display, in order to make it easy to see, in normal mode The graph is drawn only in the same way as when checked, regardless of whether "" draw only peak " is checked or not.

Also, whichever type of drawing method is checked, it will always be drawn only by the method of Image 1, so depending on the graphics environment, drawing is very slow if it is enlarged by maximizing the window etc. You may.

**Note 2:**

You can not move to measurement mode during 3D display.

**=== Vertical axis (Amplitude) ===**

**Linear**

- Select this when you want to display the amplitude data of the Spectrum waveform as it is.

- **Magnification**

Spectrum Sets the display magnification of the amplitude data of the waveform.

**dB**

- Spectrum Select when you want to display the amplitude data of the waveform in dB.

- **Range**

DB Select the display range.

A range of 10 to 180 dB, and +1 dB, + - 3 dB, + - 10 dB You can select.

+ - 1 dB, + - 3 dB, + - 10 dB is used for enlarging and displaying near 0 dB in combination with the lower shift.

- **Shift**

Select the value to shift the display waveform.

Auto, 0 dB, 6 to 18 dB, Norm, Norm 100, Norm 1 k, Norm 10 k You can select, but by

inputting from the keyboard you can choose any dB value You can set 0 to 200 (real number).

**\*Auto mode**

Even if any window function is used, it is automatically corrected so that the value of the maximum amplitude Sin wave becomes 0 dB.

Normally it should be Auto.

**\*Normalize mode**

Norm: The maximum value of the spectrum is always fixed to 0 dB.

Norm 100: Fixes the spectrum of 100 Hz (frequency closest to) to 0 dB at all times.

Norm 1k: Fixes the spectrum of 1 kHz (frequency closest to) always to 0 dB.

Norm 10k: The spectrum of 10 kHz (frequency closest to) is always fixed to 0 dB.

It is convenient when you want to display relative values only, such as when measuring frequency characteristics such as impulse response, in an easy-to-understand manner. It is convenient to use in combination with +1 dB, + - 3 dB, + - 10 dB etc. of the upper range.

**=== Horizontal axis (Frequency) ===**

**Linear**

- Select this when you want to display the frequency axis of the Spectrum waveform as it is.

**\*Although the lower limit is 20 Hz in Log below, You can display up to DC components.**

When it is necessary to display below 20 Hz, this Please be linear.

- **Range**

If not checked, all frequency components are displayed.

When checked, frequency components in an arbitrary range can be displayed.

Set the range with two edit boxes, then click the Apply button Press it and it will be displayed in that range.

**\*Input box 0 in the edit box becomes the direct current component.**

**\*The specified range is an integer multiple of the frequency resolution at that time and is displayed to include that range.**

That is, the points at the left and right ends of the graph always match a certain point of the frequency sample.

**Log**

- Select to logarithmically display the frequency axis of the Spectrum waveform.

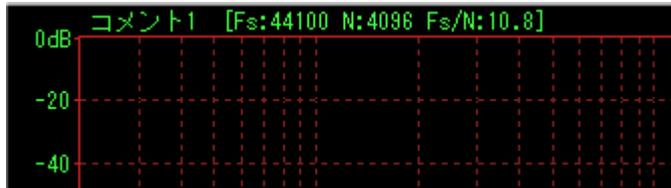
**\*When displaying logarithm, always set the sampling frequency 2(??) is the upper limit, and 20 Hz is the lower limit frequency.**

When you want to display

20 Hz or less, please make linear display.

**=== Display comment lines, Edit ===**

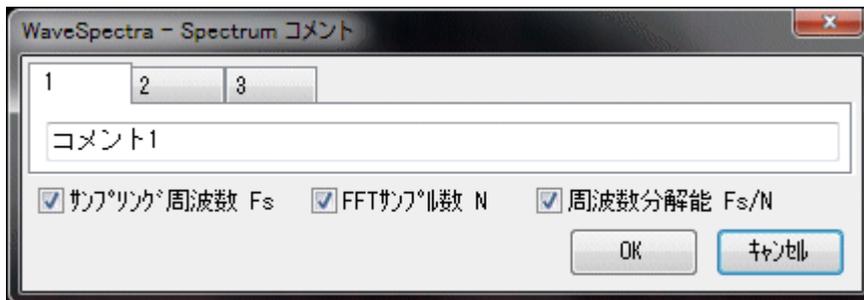
- If you check here, the Spectrum display area will be slightly lowered and comment lines will be displayed at the top.  
After the comment, the current sampling frequency ( $F_s$ ), the number of FFT data samples ( $N$ ), the frequency resolution ( $F_s / N$  Hz) is also displayed.



- When displaying the comment line, the edit button becomes effective, so pressing it will open the comment edit window and you can edit the contents of the comment.

Up to three comment lines can be stored.

Also, sampling frequency, number of FFT sample data, frequency resolution You can also choose whether or not to show.



- You can also open the comment edit window by right-clicking not only the edit button but also the comment display itself of the Spectrum display area.

**=== Number display (Max, lead out) ===****Interpolation to improve accuracy**

- Max display in measurement mode and lead out , The accuracy of the display of frequency and amplitude is improved from the frequency resolution determined by the current sampling frequency and the number of FFT sample data.

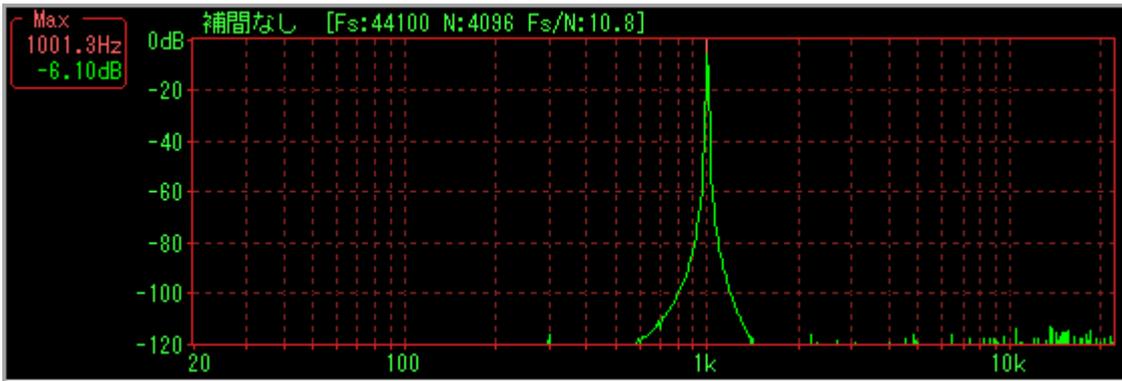
By interpolation calculation, the precision increases by 16 times for x16, 128 times for x128, and so on.

(Since the FFT calculation of 128 points at x16 and 1024 points at x 128 is added, the CPU load increases by that amount.)

Also, interpolation calculation hidden between frequency resolution? Since it is only to find the original peak, it does not mean that the spectrum itself becomes sharp and displayed as it is when you increase the number of FFT sample data.

Note that when interpolated, Max and lead out The underline of the dotted line is displayed for the numerical value part of. (Lower figure)

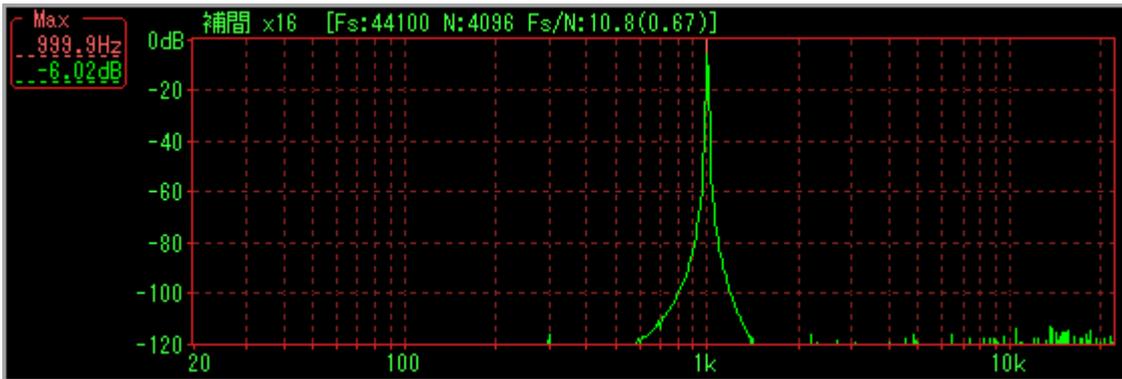
\*sampling frequency 44,100 Hz, number of FFT data samples 4096, frequency resolution 10.8 Hz  
Of the signal of amplitude 16384 (-6.02 dB) with no interpolation and presence.



**No interpolation**

1000 Hz - 6.02 dB  
It should be

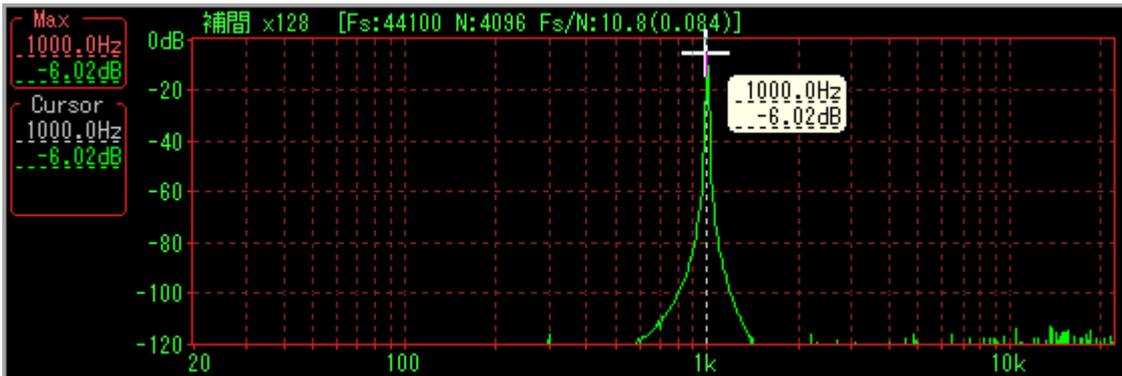
with a resolution  
Therefore, its 93  
1001.3 Hz, and  
The amplitude is  
dB and  
It is displayed sm



**interpolation x**

999.9 Hz - 6.02 dB  
And close to its c  
value

End of comment  
(0.67 Hz) is 16 ti  
Resolution (10.8



**interpolation x**

1000.0 Hz - 6.02 dB  
It is the original v

End of comment  
(0.084 Hz) is 128  
Resolution (10.8

\*If the lead out and display of the cursor position are also interpolated, it will be underlined with a dot

### === Drawing method ===

- The following six types of drawing methods can be selected.  
Select the fastest drawing method (the least CPU utilization) in your environment.  
(Depending on the display card, there may be little change, but on the contrary it may be very different so please try.)

Screen: Direct drawing on screen

Image 1: Drawing in the image in the memory and transferring to the screen

Image 2: Transfer the image drawn only to the screen to the screen, draw only the line directly

DDraw 1: DirectDraw version of Image 1 method

DDraw 2: DirectDraw version of Image 2 method

DDraw 3: Transfer after synthesizing to another image instead of screen by DDraw 2 method

Depending on the window size and number of colors, One of the drawing methods in

which V. Blank is effective should be the fastest.

(Independent floating window for Lissaoujou display is drawing method of Image 2 even if it is set to 3 types of DDraw)

**=== V.Blank ===**

- When the drawing method is Screen, Image 2, DDraw 2, the screen flickers. In that case, if you check here and make it effective, you will draw after waiting for the vertical retrace period, so flicker disappears.

However, in the case of a large window size or a slow CPU, flickering may be left behind without being written during the flyback period, and since it will wait until then, Please note that the utilization rate may become 100%.

Also, depending on the display driver, there seem to be software emulation, in that case, there is no effect.

\*This function is originally a function for CRT display set at a high refresh rate. Liquid crystal display, it seems to be 60 fps in general, so it may just be late.

**=== automatic setting ===**

- By pushing this button, the setting window opens and you can automatically set the combination of drawing methods that will be the fastest. If you do not understand the combination, it is convenient to set it automatically with this button. Even if you press this button (Spectrum tab) Both Wave and Spectrum are set at the same time.

\*If there is a drawback in the drawing due to a bug in the driver etc. with the combination set by automatic setting, try changing the setting manually.

**\* Please refer to the same section of the [\[Wave\] tab](#) .**

**=== Display Interval ===**

**=== display color ===**

See [\[Miscellaneous\]](#) tab.

\*All display setting functions can be changed in real time even during calculation & display.

~~~~~  
~~~~~

When closing the setting dialog box, When you press the [Cancel] button and close it, all settings up to that point will return to the state when the dialog box was opened. Therefore, you can temporarily make another setting.

All settings of the main window, including settings in the setting dialog, are all set in the setting file It is stored in **WS.INI** (**WS - 2. INI** for **WaveSpectra: 2** for the second) and reproduced at the next start It will be.

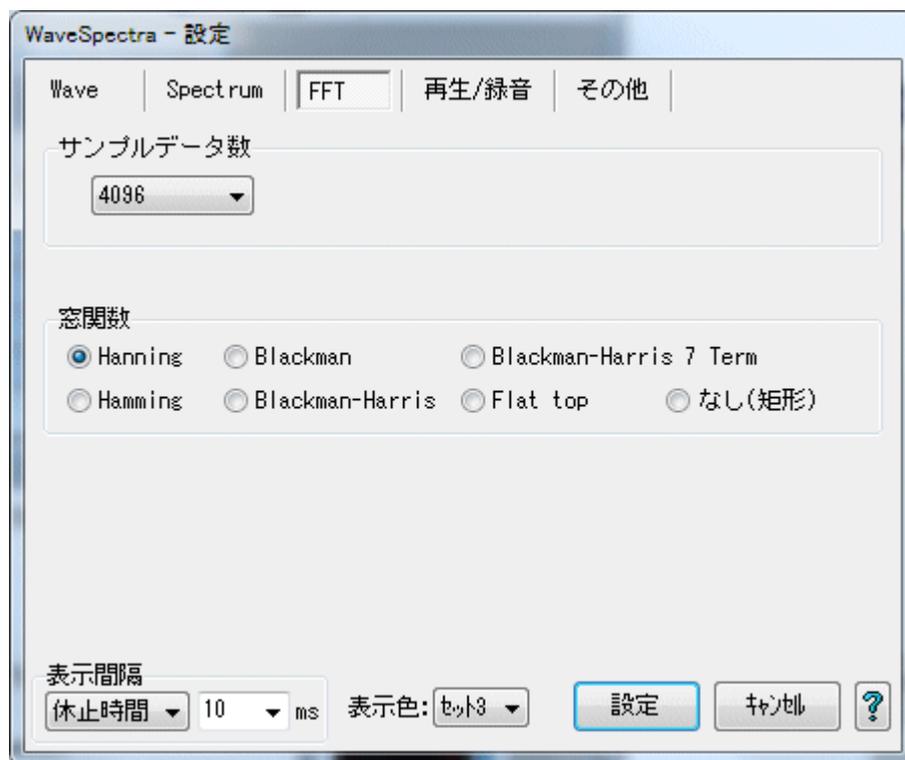
Created with the Personal Edition of HelpNDoc: [Free EBook and documentation generator](#)

## FFT

### [FFT]

Configure the FFT.

**\* If you click the position of a button, a combo box, etc. in the figure below, it jumps to the explanation of that part.**



### === Number of sample data ===

- Data length of FFT. (128 to 131072)  
Naturally more frequency resolution will increase but calculation time will take more. Conversely, if the data length is short, the frequency resolution will be reduced, but you can observe the time change of spectrum such as music finely.  
(Originally, in order to obtain correct results, it is necessary that the data does not fluctuate during the data length.) In the case of the ever-changing signal such as music, if the data length is long, we can not see small changes)

\*The minimum frequency resolution is the sampling frequency  $\div$  sample data number.  
(Example) 44100 samples / sec 4096 points For FFT, 10.77 Hz  
This value can be displayed at the same time by displaying Spectrum's comment line.

[Settings dialog - Spectrum tab - See Editing](#) for comment lines.

**Note:**

To raise the resolution, we tend to increase the number of sample data freely, but with caution about this.

For details,

[About the number of sample data of FFT of hint collection](#)

Please refer to.

\*You can not change the number of sample data while calculating & It can be changed only while stopped.

**=== window function ===**

- Select the window function for FFT.  
The following seven types can be selected.

Hanning  
Hamming  
Blackman  
Blackman-Harris  
Blackman-Harris 7 Term  
Flat top  
None (Rectangle)

**\*Window function (Window Function)**

Originally it is a function to multiply waveform data by FFT which assumes that the signal is periodic and continuous, as preprocessing to reduce errors due to cutting out part.

(Please refer to the related specialty book for details.)

Normally, observation of music waveforms, etc., the balance between the display of close-up spectra and separation characteristics is relatively good Hanning window is good.

In the THD measurement and the like, there is almost no decrease in the peak value You can use the Flat top window.

For details, please see [About distortion measurement](#) .

\*Window functions can be changed in real time even during calculation & display.

~~~~~

When closing the setting dialog box, When you press the [Cancel] button and close it, all settings up to that point will return to the state when the dialog box was opened. Therefore, you can temporarily make another setting.

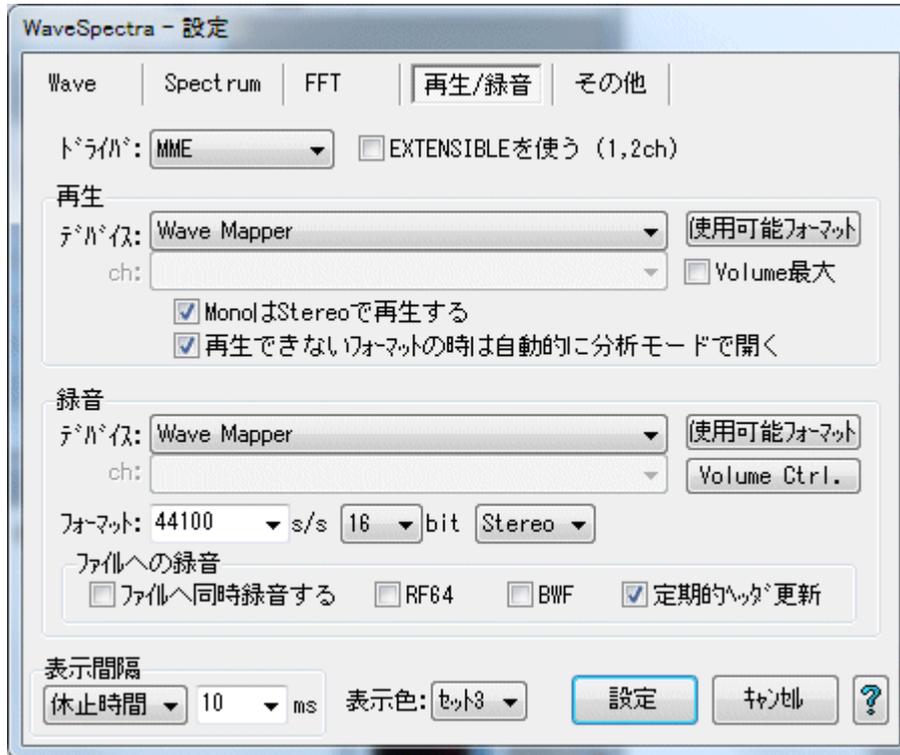
All the settings of the main window, including the setting in the setting dialog, It is stored in **WS.INI** (**WS - 2. INI** for **WaveSpectra: 2** for the second) and reproduced at the next start It will be.

## Play / record

### [Play / record] tab

Perform various settings when using a sound device for playback / recording.

**\* If you click the position of a button, a combo box, etc. in the figure below, it jumps to the explanation of that part.**



### ASIO time



### WASAPI time



### === Driver ===

- MME (Multimedia Extensions [standard WaveIn, WaveOut API])  
DirectSound  
ASIO (Steinberg Audio Stream I / O)  
WASAPI (Windows Audio Session API) exclusive use only

Choose from four.

\*WASAPI is supported only on Windows Vista SP1, Windows 7 or later.  
Otherwise it will not be displayed in the list.

### Use EXTENSIBLE (1,2ch)

- It becomes effective in case of MME, DirectSound.  
If checked, it is an extended format corresponding to multi-channel multi-bit length  
Open the device in the WAVE\_FORMAT\_EXTENSIBLE format.

\*If the driver is WDM (Windows Driver Model), if it is compatible 24 bit, 32 bit length will be available.

(However, please note that the driver may be simply converting and not actually supported bit length)

Currently there may be little meaning.

As mentioned in (1, 2 ch), Mono, Stereo It is effective only in case of.  
In the case of multi-channel of 3 channels or more, originally  
WAVE\_FORMAT\_EXTENSIBLE It is a format.

### event drive mode

- It becomes effective in case of WASAPI.  
Also in WASAPI exclusive mode event driven mode And a timer drive mode, and  
When this check box is checked It operates in event driven mode.

In the event drive mode, buffer read / write is performed by periodic events (interrupts), but in timer mode, timing is measured with a timer.  
Event driven may be more accurate, but in principle there will be no data missing if you are working with both.

Normally you should put it in the event drive mode, but depending on the device there are formats that are only valid in the timer mode, so if you can not use the desired format, remove this check Please check with timer mode to see if the format is valid.



### Latency

- It becomes effective in case of WASAPI.  
Set the latency (buffer length) of WASAPI.  
It will be delay time for playback / recording, but if it is too short it skips the sound and if it is too long you may get trouble.  
[Info. Button](#) (described later) allows you to check the settable range and operation mode of latency.

### === Playback ===

#### device

- Select the device to use for playback.  
  
\*Wave Mapper when the driver is MME Primary sound driver at DirectSound If you select, the device set in Windows will be used.

#### Mono plays in Stereo

- If you check here, you can download 1ch Mono file Play it with 2 ch as Stereo.  
If you do not check it will play with 1ch as it is in Mono.

However, even when not checking it seems that when the driver is MME, DirectSound it will always be played in Stereo.

#### Open automatically in analysis mode when format can not be played

- If this is checked, if it can not be played, such as when there is no supported format or no playback device, it will automatically be followed by an error message to that

effect Open in [analysis mode \(analysis position fine designation mode\)](#) .

If you do not like to open it in this mode each time, unchecking here will end with error message only.

Even in that case, while holding down the shift key, play button You can open it in direct analysis mode by pressing.

### usable format

- Pressing this button will display a list of formats (sampling frequency, bit length, number of valid channels) that can be used with the currently selected playback device.



- Number indicates the number of supported channels. As shown above, "12" indicates that 1ch (Mono), 2ch (Stereo), are supported. " - " indicates an unusable format.

- The part of the format currently set is highlighted.

- F32 of the top bit length represents 32 bit floating point format.
- In order to judge whether it can be used, the device is actually opened once in each format. Depending on the driver, it may take quite a while.

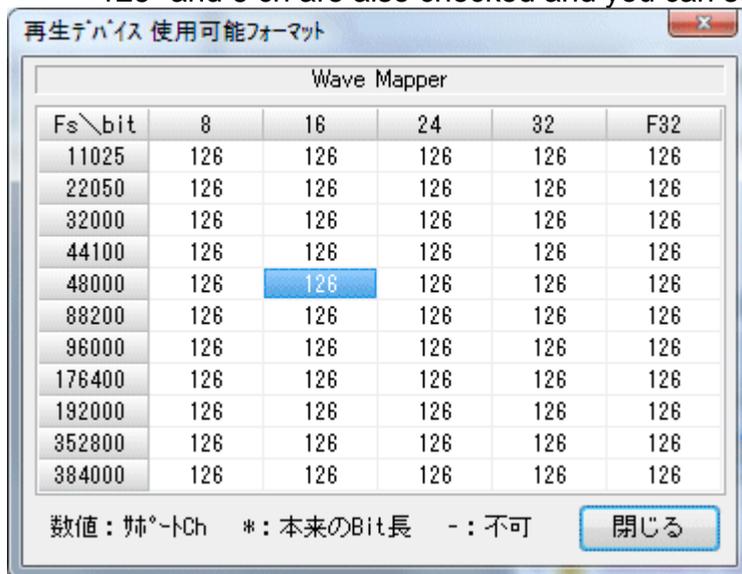
Although it seems to be able to understand the process of scanning, it takes time, so when you want to stop Please press **stop button**.

Note that while holding down the Shift key, By pushing the button, you can change to just the operation by querying with WAVE\_FORMAT\_QUERY, time will be shortened, but some drivers report lies occasionally, so it is definitely better to actually open.

- Depending on the driver, even if it is displayed here as usable, it may not actually operate normally.
- Normally, checking is limited to 2 channels to save time, but if multichannel data is open, that number of channels will also be checked.

The figure below shows 6 ch (5.1 ch) data open and available format It is when you press the button.

"126" and 6 ch are also checked and you can see that it is valid.



- Hold Ctrl key and use available format If you press the button, you forcefully check all channels.

Even if you are not opening a multi-channel file, all channels are checked, so it is effective when you want to check all the channels.

However, it will take a lot of time.

Currently, the number of channels supported is 8 Until.



- When the driver is ASIO or WASAPI, it becomes a special display. For ASIO and WASAPI, the operation bit length is fixed, and the application will convert the data accordingly. The point where it is the original operation bit length is "\* 12" It is distinguished with an asterisk (\*).

A place without \* indicates that data is being converted.

\*However, conversion to the direction in which the data length becomes shorter is not performed, so if there is validity, there is no loss of data.

In the figure below, since it is originally processed at 32 bits, we can see that all other bit length data is converted to 32 bits and output.

Here \* is one place in 32 bit, but of course it may be attached to more than one place.

Fs \ bit	8	16	24	32	F32
11025	-	-	-	-	-
22050	-	-	-	-	-
32000	-	-	-	-	-
44100	12	12	12	*12	12
48000	12	12	12	*12	12
88200	12	12	12	*12	12
96000	12	12	12	*12	12
176400	-	-	-	-	-
192000	-	-	-	-	-
352800	-	-	-	-	-
384000	-	-	-	-	-

数値：\* - 1ch    \*: 本来のBit長    -: 不可    閉じる

## Volume Maximum

- It becomes valid when the driver is MME, DirectSound.  
If checked, it will play with full volume.  
(Some drivers do not become effective)
- Depending on the driver, it is sometimes configured to output at about -6 dB by default, especially with digital output, it can not output with the correct original value.  
In that case, if you check here, you may be able to output with the correct value.
- In DirectSound, it may not be effective unless you set it on the MME side, so please set it up first in MME. (Play once)

## ch (ASIO playback channel)

- It becomes valid when the driver is ASIO.  
Select the channel to use for playback.  
The specified channel will be on the Lch side of the stereo.
- When multiple channels are available, normally 0 or 2 (channels are When it starts from 0), even-numbered channels are specified, but there is no distinction in the channel itself, so odd-numbered channels may be specified.  
In that case, when considering 2 ch as a normal stereo pair, the original pair of a pair It will be output on the Rch side and on the Lch side of the next pair.

For example, when there are 4 channels in total including AnalogOut 1, AnalogOut2, DigitalOut 1, DigitalOut2 When ch is set to AnalogOut 2, AnalogOut 2 Data of Rch will be output to Lch, DigitalOut1.

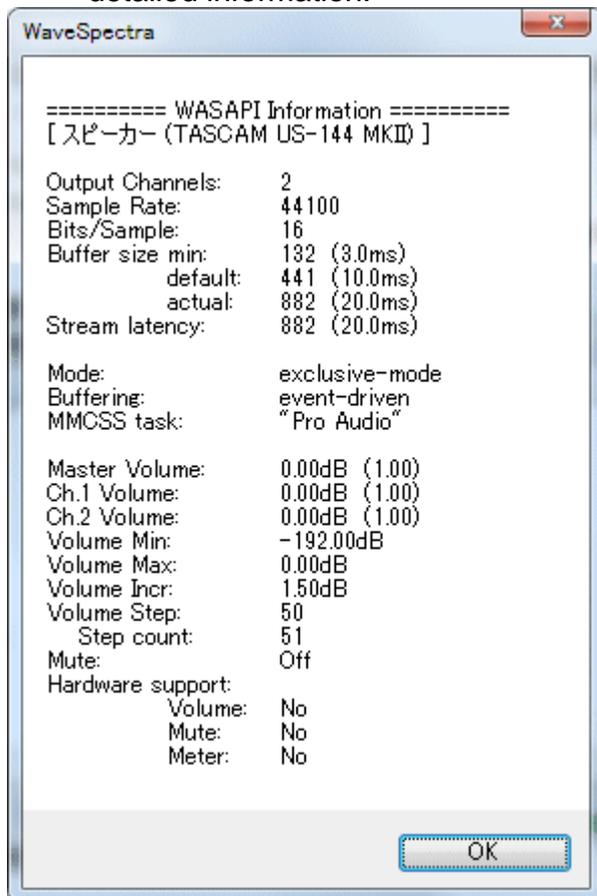
Note that in the case of monaural file playback, it is output to only one channel.



### Info.

- This button is enabled when the driver is ASIO and WASAPI.  
If you push this button normally, the current ASIO WASAPI driver setting information is displayed, you can check the number of channels, sample rate, bit length, latency, etc.

\*For WASAPI, pressing this button while holding down the shift key displays more detailed information.



### Panel

- This button is enabled when the driver is ASIO and WASAPI.  
When this button is pushed, in case of ASIO, ASIO Control You can open Panel.  
(Nothing happens with unsupported drivers)

In the case of WASAPI, open the sound control panel (playback).

\*The above can not be changed during playback operation.

=== recording ===

device

- Select the device to use for input / recording.

\*Wave Mapper when the driver is MME Primary sound capture when DirectSound If you select a driver, the device set in Windows will be used.

### usable format

- Pressing this button will display a list of formats (sampling frequency, bit length, number of valid channels) that can be used with the currently selected recording device.

"12", "-", "etc." Are the same as in the case of playback.

- The part of the currently set format is displayed enclosed by a dotted frame.

Make one of the available formats with the mouse By clicking " double click ", you can set the input format just like you set in the next section.

(However, only the sampling frequency and the bit length can be set. Please set Stereo / Mono or multichannel in the next section)

- When the driver is ASIO or WASAPI, it becomes a special display as in the case of playback. (See playback section)

Likewise, since the conversion in the direction in which the original number of bits decreases is not supported, it is not recorded with lowering the precision of the data.

- When the operation bit length is 32 bits, the data length from the actual ADC (in the future as well?) It is 24 bits so it can be handled as 24 bit data.  
(Allow 24-bit and F32 bit file formats)

### Volume Control

- It becomes effective when the driver is MME, DirectSound.  
Pressing this button opens the volume control on the recording side.

### ch (ASIO recording ch)

- It becomes valid when the driver is ASIO.  
Select the channel to use for recording.  
It is the same as for playback.

### Info.

- This button is enabled when the driver is ASIO and WASAPI.  
It is the same as for playback.

### Panel

- This button is enabled when the driver is ASIO and WASAPI.  
When this button is pushed, in case of ASIO, ASIO Control You can open Panel.  
(Nothing happens with unsupported drivers)

In the case of WASAPI, open the sound control panel (recording).

### Direct Monitor

- It becomes valid when the driver is ASIO. (Only when recording is stopped)  
If checked, turn on the ASIO Direct Monitor function.  
(If the driver does not support it, a message will be displayed.)

- Even if there is no Direct Monitor function, it seems to be able to check.  
(Driver bug?)  
Of course nothing happens in this case.
- It is set to output all input channels in order from the first output channel.

#### format

- Sets the format of sound device input.

**\* Please set based on the list of available formats on.**

**\* This is exactly the same as setting by double click on the list of available formats on.** Both sides are linked.

#### Note 1:

Please note that not all formats that can be selected are supported by sound devices.  
(Sampling frequency conversion may be done by software)

In addition, please write the sampling frequency directly to the combo box, if it is supported in reverse but not in the list.

(Example: 8 ks / s etc.)

**\*By writing not only the values ??in the list in the combo box but also the direct value arbitrary value.**

#### Note 2:

Next, the input / record button  is pressed when changing the format here Please note that it will only take effect when the recording operation is actually done.

Therefore, if you want to confirm the change, please press the input / record button once.

(Each display on the main window also changes at that time.)

#### == Recording to file ==

##### Simultaneously record to file

- If not checked here, calculate & as direct input from the sound device as data.

If checked, calculate & display while recording to file.

In this case, each time you press the input / record button, you can specify the name of the file to output A dialog box opens.

**\*Pressing the input / record button while holding down the shift key temporarily starts in the opposite mode to the current setting I can do it.**

Normally it is convenient to use the shift key without checking here if you like only input monitor, sometimes recording to file.

#### RF64

- If you do not check this, it will be recorded as an ordinary wave file.  
If the maximum Wave file size exceeds 2 GB, the file is automatically split every time it exceeds.  
(Although there is also Wave editing software that can handle up to 4GB of 32 bits, it is limited to 2GB so that it has more versatility.This division unit 2GB You can also change it. [See here](#) )

For example, when you start recording with the filename ABC.WAV, and when it exceeds 2 GB,  
ABC - 01.WAV, ABC - 02.WAV will be made next. Best \_99)

If you check here, you can create files of 4 GB or more Record in RF 64 format.  
However, since the internal structure of the RF64 file can be handled as an ordinary wave file up to 4 GB, 4 GB Until the truth, it is not in RF 64 format.  
(A dummy area called JUNK chunk was created, and when it exceeded 4 GB It will change to a storage location of 64 bit data size)

**Note:**

If you record in the RF64 format, you can not read with Wave file editing software etc. which can not handle RF64 file.

Please make sure that your software can handle RF64 file.

Also, as a matter of course, the save destination disk must be NTFS.

**[Tip]**

If you do not check (when dividing by 2 GB), pressing Ctrl + D during recording will force you to split the file at that point.

It is convenient when you want to divide it at breaks of songs.

**BWF**

- If checked here, BWF (Broadcast Wave Format) format.  
Even so, BWF's extended information chunk 'bext' Chunks are only added.  
Here, the file recording start time, format and recording software name (WaveSpectra) It is recorded.

**Periodic header update**

- If checked here, it will be recorded periodically (Prescribed value 5 seconds), update the file by writing the header information of the file.  
Even if you can not finish the recording properly, such as hanging up with some accident, it is a function to save the file up to that point.

If not checked, data of header information such as data size will be written at the end of recording so file size will remain at zero when abnormal termination.

If there is no problem in particular, you can usually keep checking, but if the storage destination disk is an SSD with the initial random write slower, there may be times when the update can not be completed in time and the sound skips Hmm.  
In that case please remove the check.

**[Technical]**

You can change the update interval (5 seconds) as follows.

In the [Conditions] section of WS.INI,

[Conditions]

RecUpdateHeaderPeriod = 10

You can change it by describing it. (In the above example 10 seconds)

\*The above can not be changed during recording operation.

When closing the setting dialog box, When you press the [Cancel] button and close it, all settings up to that point will return to the state when the dialog box was opened. Therefore, you can temporarily make another setting.

All the settings of the main window, including the setting in the setting dialog, It is stored in **WS.INI** (**WS - 2. INI** for **WaveSpectra: 2** for the second) and reproduced at the next start It will be.

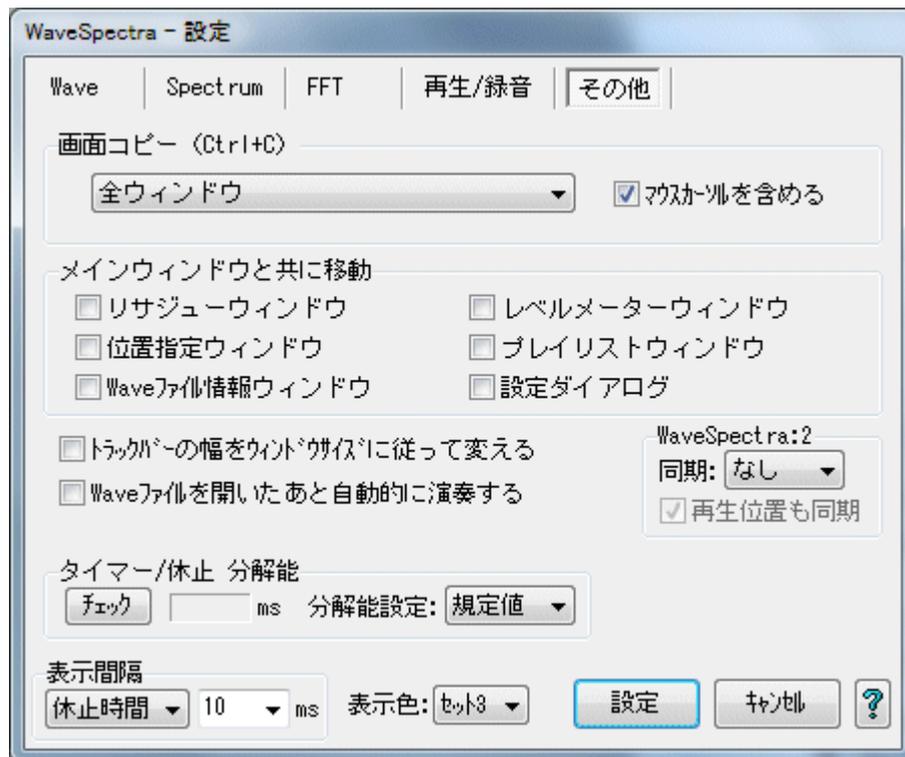
Created with the Personal Edition of HelpNDoc: [Easy CHM and documentation editor](#)

## Other

### [Miscellaneous] tab

Make other settings.

**\* If you click the position of a button, a combo box, etc. in the figure below, it jumps to the explanation of that part.**



### === screen copy (Ctrl + C) ===

- Select the range of the screen to be copied to the clipboard when you press Ctrl + C.

All windows: WaveSpectra as a whole (Alt + PrtScrn Same as key)

Wave + Spectrum: Wave and Spectrum (so-called client area as a whole)

Wave only: Wave only

Spectrum only: Spectrum only (not including bottom panel of measurement mode)

Spectrum + measurement mode panel: Spectrum only (Including lower panel of measurement mode)

**Note:**

WaveSpectra itself has no printing function.

Actual printing, etc., to other applications (WordPad etc.) It will be done by " Pasting "

- **Include mouse cursor**

If checked, you can copy the screen including the mouse cursor.

It will be useful for lead-out.

**=== Move with the main window ===**

- Sets whether to move each subwindow at the same time when moving the main window.

The checked window moves while keeping the relative position.

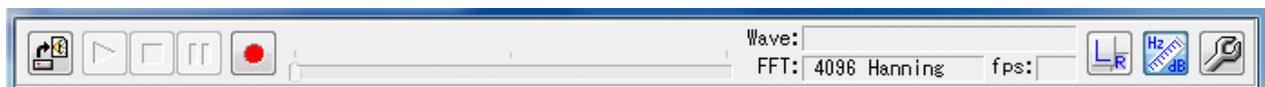
**=== Change the width of the track bar according to window size ===**

- If checked, if you change the width of the window, the width of the track bar will also follow and change.

When not checking



When checked



**=== Autoplay after opening the Wave file ===**

- If checked, including the case with drag & drop, after you open the Wave file you will automatically play without pressing the play button.

\*The above can be changed in real time even during operation.

~~~~~

**=== WaveSpectra: 2 ===**

- You can control the playback and recording of the second activated WaveSpectra: 2 (second instance) from the first and operate simultaneously.

By doing this, it is possible to reproduce both the recording and the same file in both, and to display the two channels of Lch and Rch simultaneously at the same time.

( [example of action](#) )

\* Recording / playback is performed with the same device. As a matter of course, it will be shifting gradually as it is a different device.

(Since you can not use the same device at the same time with ASIO and WASAPI which are not multi-client compatible, MME and DirectSound Please use it.

Below, we denote the first WaveSpectra as WS: 1, the second WaveSpectra: 2 as WS: 2.

- If you set **Sync: Play**, WS: 2 will be played regardless of WS: 1 playback or recording.  
If you set **Sync: Recording**, WS: 2 will be recorded regardless of WS: 1 playback or recording.  
(Of course nothing happens when WaveSpectra: 2 does not exist.)

In addition, WS: 2 moves as well as WS: 1 for pause and stop.

WS: 2 will be a slave of WS: 1, but if you do some operation with WS: 2 it will move normally.

However, since it is only sending an instruction to simply press each button from WS: 1, for example, when releasing the pose of WS: 2 only after canceling the pause of WS: 2 during both pauses, WS: 2 On the contrary, it returns to the pause state.

- Furthermore, if you check the **Play position as well as the sync** checkbox that is enabled at playback, the position stopped at the pause and the position in the position designation window during pause Movement of the position in the track bar and movement of the position (even while stopped) WS: 1 - & gt; WS: 2, and the position is synchronized (aligned).

\* Pause synchronization is only during playback. When recording, it will not be synchronized with pause, restart.

However, since this function does not work completely unless the [position specification window](#) that is displayed when pausing is displayed,  Please be sure to display it by pressing the button.

If it is not displayed, the restart from the pause will not start synchronously. (They will be played back off each other)

The position designation window related to the synchronization at the restart is only for WS: 1, and the position designation window for WS: 2 is irrelevant, so it may not be displayed if it is unnecessary.

Even if the position designation window of WS: 1 is displayed even once even during pause, only the restart of pause release immediately after that will be synchronized. (If you leave closed as is, of course you will not be synchronized at the next pose & restart)

If you do not check it, you will not synchronize the position at all, so you can play back different places, but as you can repeat it over and over it is obvious that each other's position gradually shifts.

\* Even if not checked, if the position designation window is displayed, restart at the time of cancellation of pause will start in synchronization.

\* At the start of the first playback from the stop, it always starts synchronizing regardless of this check or display of the position designation window.

This check can be turned on / off even during playback operation, so it is possible to combine free positioning with or without synchronizing.

- **[Technical]**

Both playback starts are synchronized and synchronized with the resolution of the internal timer (refer to the section under Timer / Pause Resolution), but Windows It is not possible to synchronize accurately because of the mechanism. Furthermore, although it seems that it can not be synchronized with Single Core CPU, multiple Core is more advantageous. Also, it depends on OS. (See below [1])

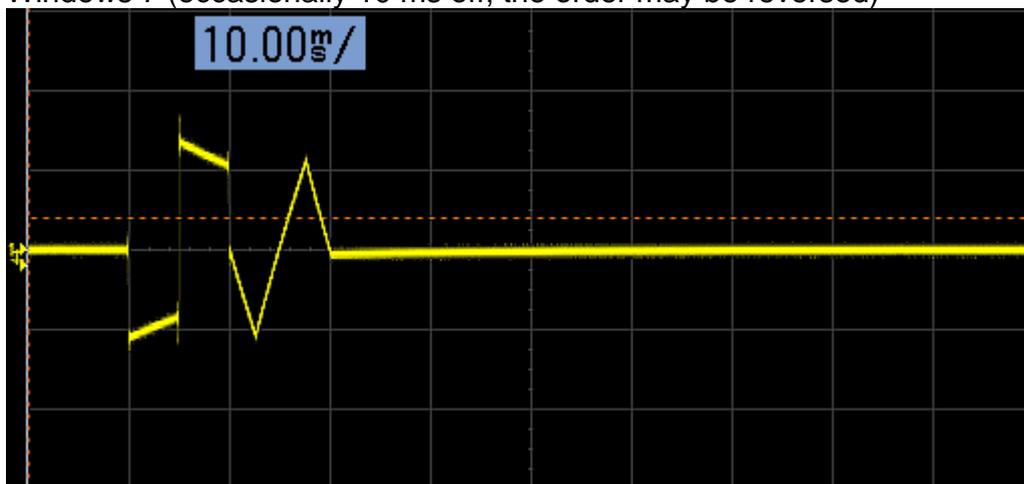
Make actual synchronization precision (deviation) by tone burst of square wave and triangle wave (100 Hz 1 wave on / 9 waves Off) and use Windows on Dual Core 7 / Vista and Windows XP, output to the same sound device, check with the oscilloscope, Windows 7 / Vista It was 10 ms in XP and 30 ms in XP. (Pretty accurate)

On Windows 7 / Vista it is most likely to be completely synchronized (no deviation), and occasionally it may be off by 10 ms. XP seemed to be misaligned by almost 30 ms. Although it is obvious in terms of the mechanism, when it shifts, it is not decided which side WS: 1, WS: 2 will be the first.

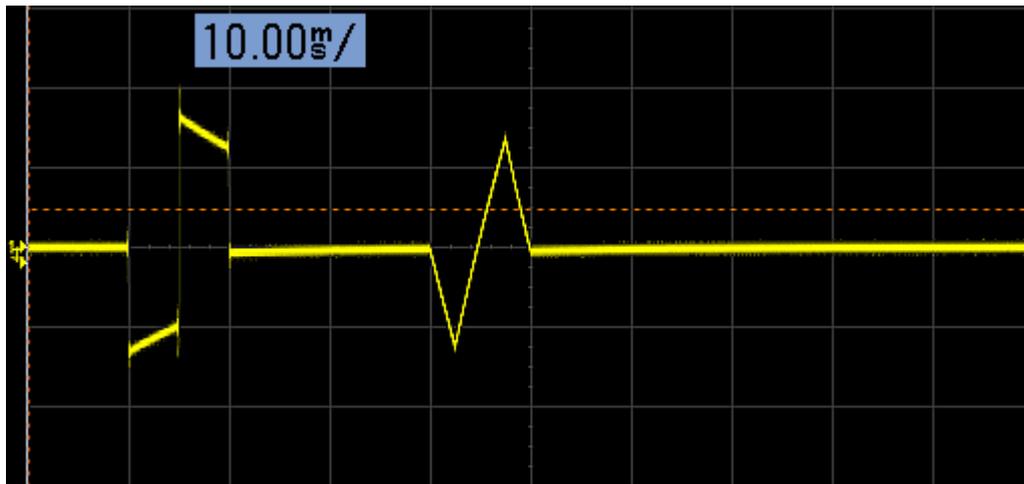
Windows 7 (in most cases, fully synchronized)



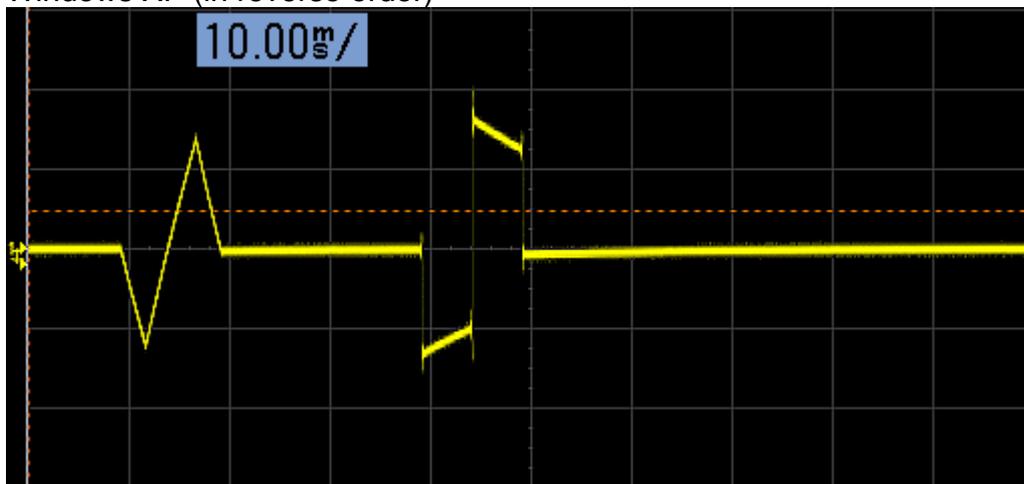
Windows 7 (occasionally 10 ms off, the order may be reversed)



Windows XP (in most cases it will be 30 ms off, sometimes completely synchronized extremely)



Windows XP (in reverse order)



(These are the effects of the low-frequency characteristics of the device that the rectangular wave is not straight)

As reputed? Windows 7 / Vista seems to be getting better performance of multitasking. Also, it seemed unrelated to the setting of the timer resolution.

I tested the PC with Dual Core / Single Core, so I tested it on Single Core, but it gave almost the same results.

(Contrary to expectation, Windows 7 / Vista almost completely synchronized.)

I did the same test on other PCs, but the same result was obtained.

It should be noted that synchronization is not always completely synchronized.

Also, when outputting to two different devices, the sampling frequencies of both are not exactly the same, so even if the start is synchronized, there is a possibility that it will deviate over time.

The first gap due to latency may be absorbed as follows.

WS.INI and WS\_2.INI

In the [Conditions] section anywhere is good so

PlaySyncDelay = 30

If you add a line like this, you can start playing later than this number (ms) after synchronization.

(But this also depends on the resolution of the timer)

Similarly,

RecSyncDelay = 30

If you add a line like this, you can start recording further later than this number (ms) after synchronization.

Writing on the WS.INI side writes WS: 1, WS - 2. INI side, WS: 2 playback / recording start will be delayed, so it may be usable for absorbing the latency of different devices.

(Delay can be confirmed as it can be set up to 1000 ms.)

### === Timer / Pause Resolution ===

- You can check and set the resolution of the timer used for internal timing and delay. The resolution of the timer is determined by the hardware and OS of the PC and it is not the same in all environments, so it will be helpful to know the resolution of your environment in various ways.

If the resolution is low (numerical value is high), smooth operation may not be performed in some cases.

If it does not work smoothly, it may be improved if you change the setting here.

#### check

- Pressing this button displays the resolution of the current timer in the right-hand column. (Play / record It is also possible to run)

The setting of the resolution setting combo box in the next section When pressed at the specified value, the original resolution is displayed.

It depends on the hardware, OS, and other environments such as other software under operation, so it is about 1 ms, about 2 ms, about 4 ms Or 10 ms, or about 16 ms.

For example, even if you set the setting of the display interval below this to be less than this resolution, it means that it actually does not fall below the display value here. (It is only an integer multiple of the number)

#### Resolution setting

- If you change this to a value other than the specified value, the resolution is set to that value. However, even here, the minimum resolution that can be set differs depending on the environment, so it may not always be the same as it was set. It may be about 2 ms even if it is set to 1 ms. By pressing the check button again after setting, you can check the resolution actually set.

Setting it to a smaller value will make it smoother, but if it is made smaller Since CPU load may increase, Task Manager (Ctrl + Shift + Del or Shift + Ctrl + Please check whether the CPU usage rate does not increase too much with the performance of Esc).

- **[Hint]**

On Windows Vista and Windows 7, it seems that the resolution of the timer will change automatically so that the resolution increases (the value decreases) during multimedia playback.

Wave and mp3 play also will change, but it seems that it may become a small value especially during playback of Internet streaming etc. (Windows Media Player etc)

Therefore, first check with the prescribed value as it is, Even if it is a large value like 10 ms or 16 ms, you can try playing / recording properly as it is and then Check the resolution by pressing the check button, 2 ms If it is a small value of 3 ms or 3 ms, It may be set to the specified value.

However, please be aware that if you close other software that is running, you may return to the original large value.

---

### === Display Interval ===

- Adjust the display time interval of the waveform.  
Depending on the difference in operation, the pause time and the timer You can select.
- **pause time**  
In case of FFT calculation & display, after a specified period of time, I will repeat this. Therefore, the repetition period is calculated & display time + Set pause time  
.

- **Timer**

, FFT calculation & display is performed at specified time intervals.  
Therefore, the repetition period is set to the set time interval  
.

(When the set time interval is shorter than the actual calculation & display time, it is naturally limited there.)

In other words, you can set a more accurate interval than in the case of pause time.

However, when a timer is selected, the pause time CPU usage rate will be higher than in case of. (It is the characteristic of Windows)

Please be aware that the CPU usage rate may increase abruptly especially when the set time interval is less than 10 ms.

- **About the value of time (ms) to set**

When the pause time is 0 or the setting interval for the timer is the actual calculation & display time For shorter time, FFT calculation & display at full speed.

(In this case, in the case of single CPU, the CPU usage rate is It will be 100%)

Is it time to be in trouble if it is too fast? Or when you want to lower the CPU usage rate for other software, please set an appropriate value (ms).

\*By writing not only the values ??in the list in the combo box but also the direct value **arbitrary value** can be set.

**Note:**

In particular, when using it simultaneously with the sister software WaveGene, WaveSpectra If the CPU usage rate is 100% only with WaveGene, the output from

WaveGene may be interrupted or the display may be jerky. In that case, try setting the appropriate value and lowering the CPU usage rate .

Please also try to activate which window has a relationship.

\*At the top of the main window (left of the L / R button) Since fps is displayed, please refer to it. 

If several tens of frames / second is appearing, it will almost follow the input and follow up in real time.

\*You can set the pause time / timer setting in ms, but in reality it is usually more It works only at large intervals.

It seems that there are many about 10 ms, but it seems that it may be about 16 ms in some cases. It may be shorter.

If screen rendering does not seem to change smoothly, try increasing the resolution of the timer.

**For details, refer to the above timer / pause resolution section.**

### === display color ===

- Display color set can be selected from 3 types.
  1. Ordinary Windows-like display
  2. Display suitable for screen printing, with white background
  3. Oscilloscope CRT-like display (default)

When closing the setting dialog box, When you press the [Cancel] button and close it, all settings up to that point will return to the state when the dialog box was opened. Therefore, you can temporarily make another setting.

All the settings of the main window, including the setting in the setting dialog, It is stored in **WS.INI** (**WS - 2. INI** for **WaveSpectra: 2** for the second) and reproduced at the next start It will be.

---

Created with the Personal Edition of HelpNDoc: [Generate Kindle eBooks with ease](#)

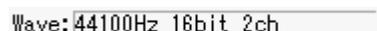
---

## WaveFile information window

### Wave file information window

---

Setting dialog - [Wave tab - Wave file information window - Press the display button](#) or [Wave file format display area](#) in the main window



It is the detailed information window of the file that is displayed when right clicking.

Displays the internal data information (chunk structure) of the currently open Wave file and the file created while recording to the file.

\*You can open different files and move to recording while keeping this window open. It will change to new contents.

**Currently, chunks that support content explanation are as follows.**

[fmt](#)

[data](#)

[ds64](#)

[JUNK](#) (only for the first chunk for ds64)

[bext](#)

Fact

DISP

[cue](#)

Plst

[LIST INFO](#)

[LIST adtl](#)

[PMX](#)

**=== at playback ===**(=== Here is an example when recording [here](#) ===)

### **[Example 1]**

Wave file with the most ordinary and simplest structure (RIFF Resource Interchange File Format file) It is time to open.

The structure of the chunk contained on the left side is displayed in the tree.

In the figure below you can see that there are fmt and data chunks.

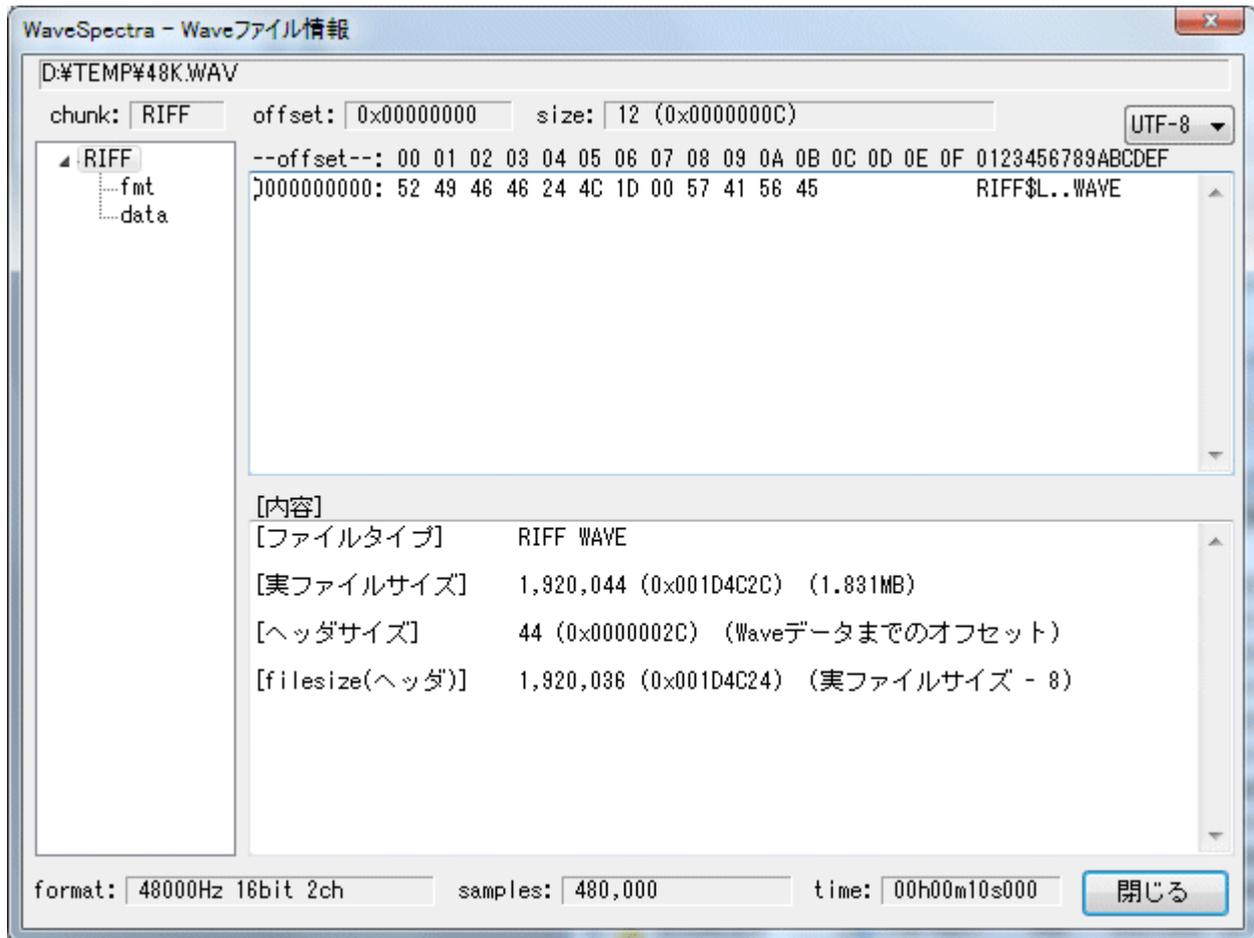
On the right side, the upper side is a hexadecimal binary dump of chunk's data and the lower side is explanation of the contents making numerical values ??etc. easy to understand.

\*You can copy the contents of these two display parts.

Please select normally and copy it with the right mouse button menu.

\*You can select the character code used for character display in the combo box on the right end.

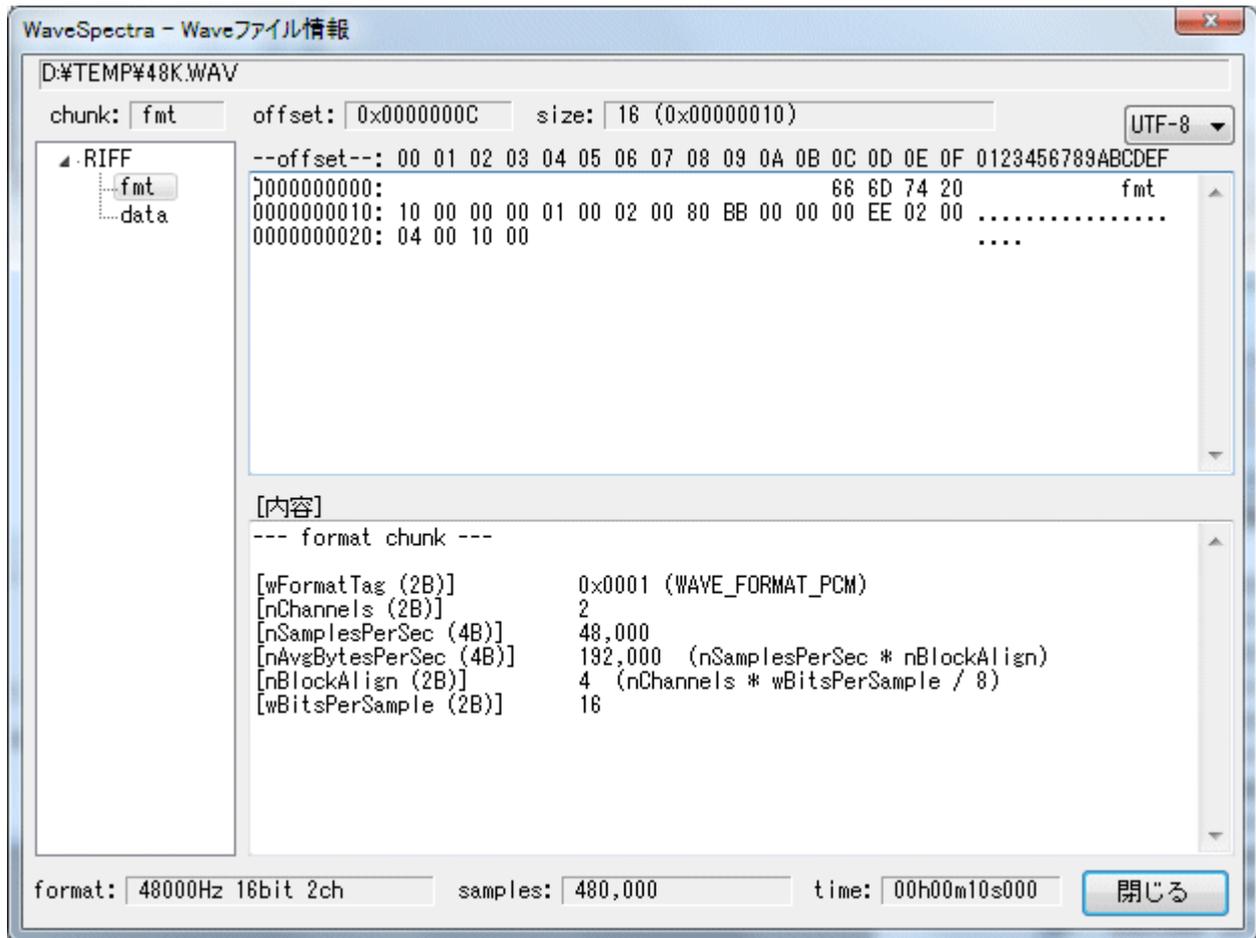
Below, if it is obvious that it is garbled though it is a character part, please change it.



When you select each item in the chunk tree list, the contents of that chunk are displayed.

**fmt**chunk .

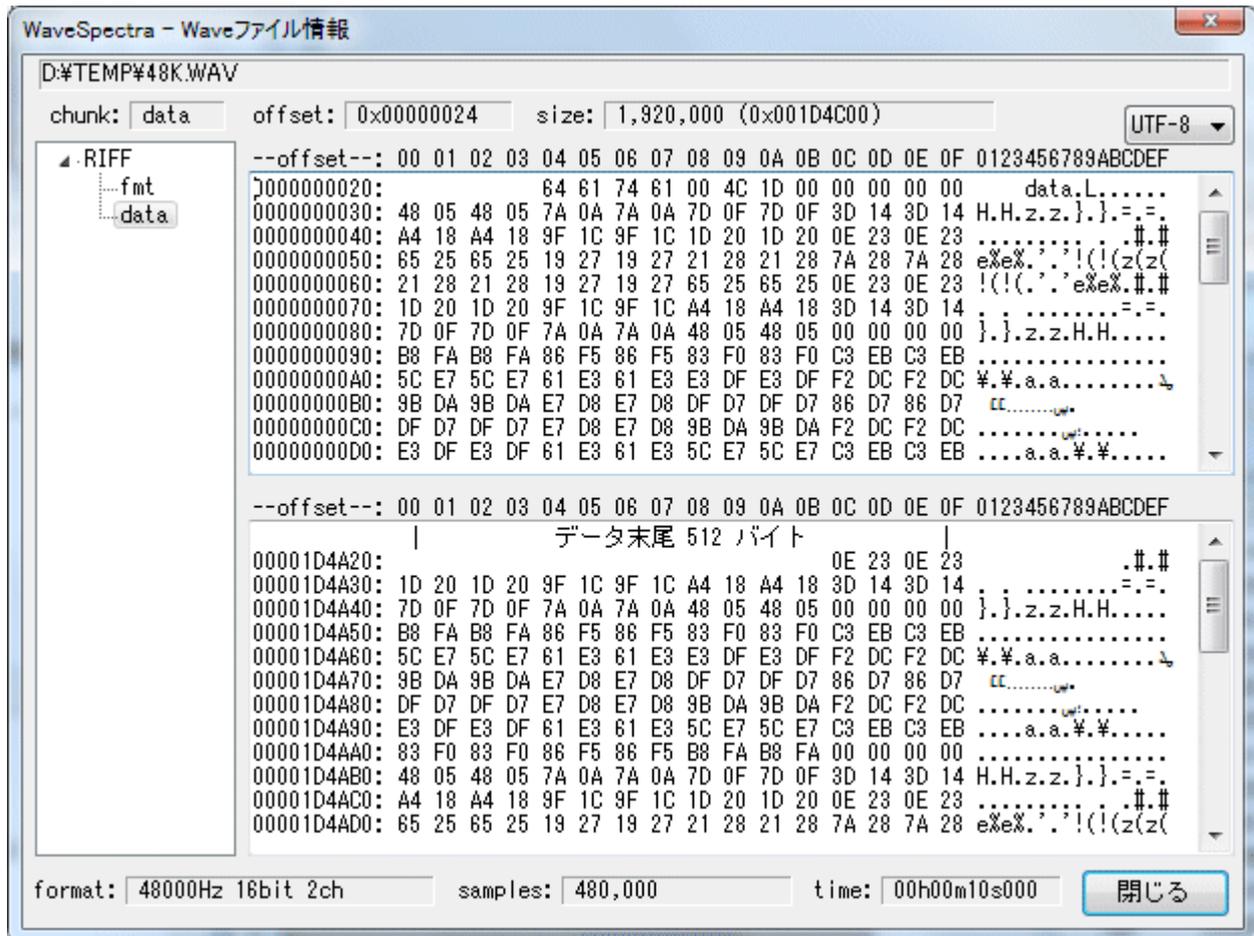
Data is written in the format.

**datachunk .**

It is a part of Wave data, but here the display part on the right side is a binary dump list both up and down.

Displaying all the data generally leads to a large length, so only the leading and trailing parts are displayed, that is, only 512 bytes of data at the top and 512 bytes of data at the bottom are displayed.

(You can scroll with the scroll wheel just by moving the mouse to the display area.)



### [Technical]

You can change the number of display bytes at the beginning and end of the data as follows.

In the [WaveInfoWindow] section of WS.INI,

[WaveInfoWindow]

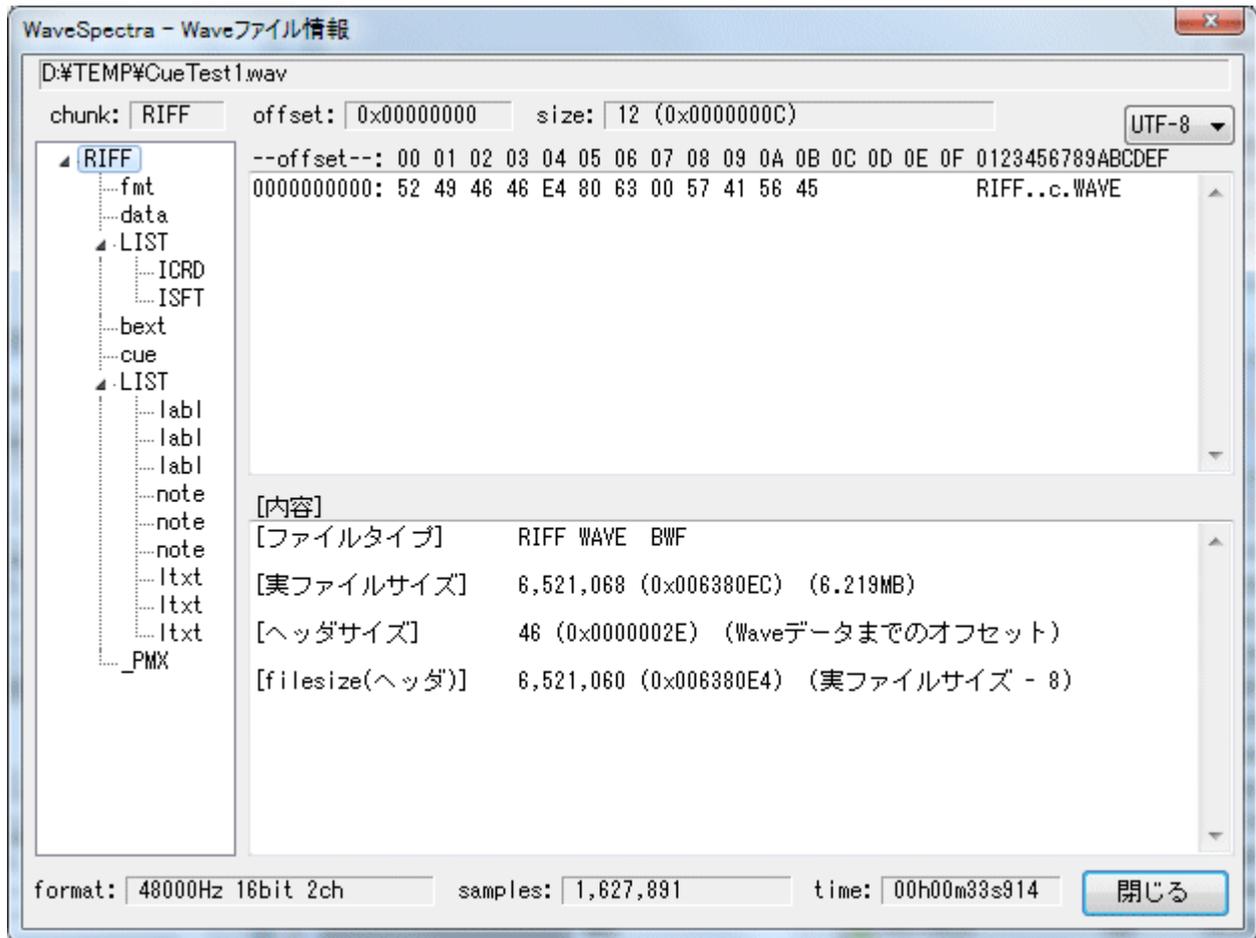
DataSaveBytes = 4096

You can change it by describing it. (4096 bytes in the above example)

(Because data is displayed after converting it all at once, setting it too large will take time to display)

### [Example 2]

Here is an example of a wave file containing many chunks.



If there is **LIST** chunk, data has further entered below It becomes a " nested " structure. Here **INFO** list of various information is included.



WaveSpectra - Waveファイル情報

D:\TEMP\CueTest1.wav

chunk:  offset:  size:

| RIFF | offset      | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 0A | 0B | 0C | 0D | 0E | 0F | 0123456789ABCDEF |
|------|-------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|------------------|
| fmt  | 0000635C60: |    |    |    |    |    |    |    |    | 62 | 65 | 78 | 74 | 5A | 02 | 00 | 00 | bextZ...         |
| data | 0000635C70: | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | .....            |
| LIST | 0000635C80: | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | .....            |
| ICRD | 0000635C90: | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | .....            |
| ISFT | 0000635CA0: | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | .....            |
| bext | 0000635CC0: | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | .....            |
| cue  | 0000635CD0: | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | .....            |
| LIST | 0000635CE0: | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | .....            |
| labl | 0000635CF0: | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | .....            |
| labl | 0000635D00: | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | .....            |
| labl | 0000635D10: | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | .....            |

[内容]

--- BWF (Broadcast Wave Format) Broadcast Audio Extension ---

[Description (256B)]

[Originator (32B)]

[OriginatorReference (32B)]

[OriginationDate (10B)]      2011-07-26

[OriginationTime (8B)]        04:21:00

[TimeReference (4+4B)]        0 (0x0000000000000000)

format:  samples:  time:

**cue**chunk .

It contains a cue list (sampled value of the position of the marker).

WaveSpectra - Waveファイル情報

D:\TEMP\CueTest1.wav

chunk: cue    offset: 0x00635ECA    size: 76 (0x0000004C)    UTF-8

| Offset     | Hex                                             | ASCII          |
|------------|-------------------------------------------------|----------------|
| 0000635EC0 | 63 75 65 20 4C 00                               | cue L.         |
| 0000635ED0 | 00 00 03 00 00 00 01 00 00 00 80 A9 03 00 64 61 | .....da        |
| 0000635EE0 | 74 61 00 00 00 00 00 00 00 00 80 A9 03 00 02 00 | ta.....        |
| 0000635EF0 | 00 00 00 53 07 00 64 61 74 61 00 00 00 00 00    | ...S..data.... |
| 0000635F00 | 00 00 00 53 07 00 03 00 00 00 00 A6 0E 00 64 61 | ...S.....da    |
| 0000635F10 | 74 61 00 00 00 00 00 00 00 00 00 A6 0E 00       | ta.....        |

[内容]

--- cue (Cue points) chunk ---

[dwCuePoints (4B)]        3

[dwName (4B)]            0x00000001

[dwPosition (4B)]        240,000 (0x0003A980)

[fccChunk (4B)]         'data'

[dwChunkStart (4B)]     0

[dwBlockStart (4B)]     0 (0x00000000)

[dwSampleOffset (4B)]   240,000 (0x0003A980)

[dwName (4B)]            0x00000002

[dwPosition (4B)]        480,000 (0x00075300)

format: 48000Hz 16bit 2ch    samples: 1,627,891    time: 00h00m33s914    閉じる

Another **LIST** chunk .

**adtl**(Associated Data) list is included.

It contains labels (**labl**) etc. corresponding to the data of the above **cue** chunk.

WaveSpectra - Waveファイル情報

D:\TEMP\CueTest1.wav

chunk: LIST    offset: 0x00635F1E    size: 214 (0x000000D6)    UTF-8

| Chunk | Offset     | Content                                                         |
|-------|------------|-----------------------------------------------------------------|
| RIFF  | 0000635F10 | 4C 49 LI                                                        |
| fmt   | 0000635F20 | 53 54 D6 00 00 00 81 64 74 6C 6C 61 62 6C 14 00 ST...adt1labl.. |
| data  | 0000635F30 | 00 00 01 00 00 00 E3 83 9E E3 83 BC E3 82 AB E3 .....マーカー       |
| LIST  | 0000635F40 | 83 BC 20 30 31 00 6C 61 62 6C 14 00 00 00 02 00 01.labl.....    |
| ICRD  | 0000635F50 | 00 00 E3 83 9E E3 83 BC E3 82 AB E3 83 BC 20 30 ..マーカー 0        |
| ISFT  | 0000635F60 | 32 00 6C 61 62 6C 14 00 00 00 03 00 00 00 E3 83 2.labl.....マ    |
| bext  | 0000635F70 | 9E E3 83 BC E3 82 AB E3 83 BC 20 30 33 00 6E 6F マーカー 03.no      |
| cue   | 0000635F80 | 74 65 05 00 00 00 01 00 00 00 00 00 6E 6F 74 65 te.....note     |
| LIST  | 0000635F90 | 05 00 00 00 02 00 00 00 00 00 6E 6F 74 65 05 00 .....note..     |
| labl  | 0000635FA0 | 00 00 03 00 00 00 00 00 6C 74 78 74 14 00 00 00 .....ltxt....   |
| labl  | 0000635FB0 | 01 00 00 00 00 00 00 00 72 67 6E 20 00 00 00 00 .....rgn ....   |
| labl  | 0000635FC0 | 00 00 00 00 6C 74 78 74 14 00 00 00 02 00 00 00 .....ltxt.....  |

[内容]

--- adtl (Associated Data) list ---

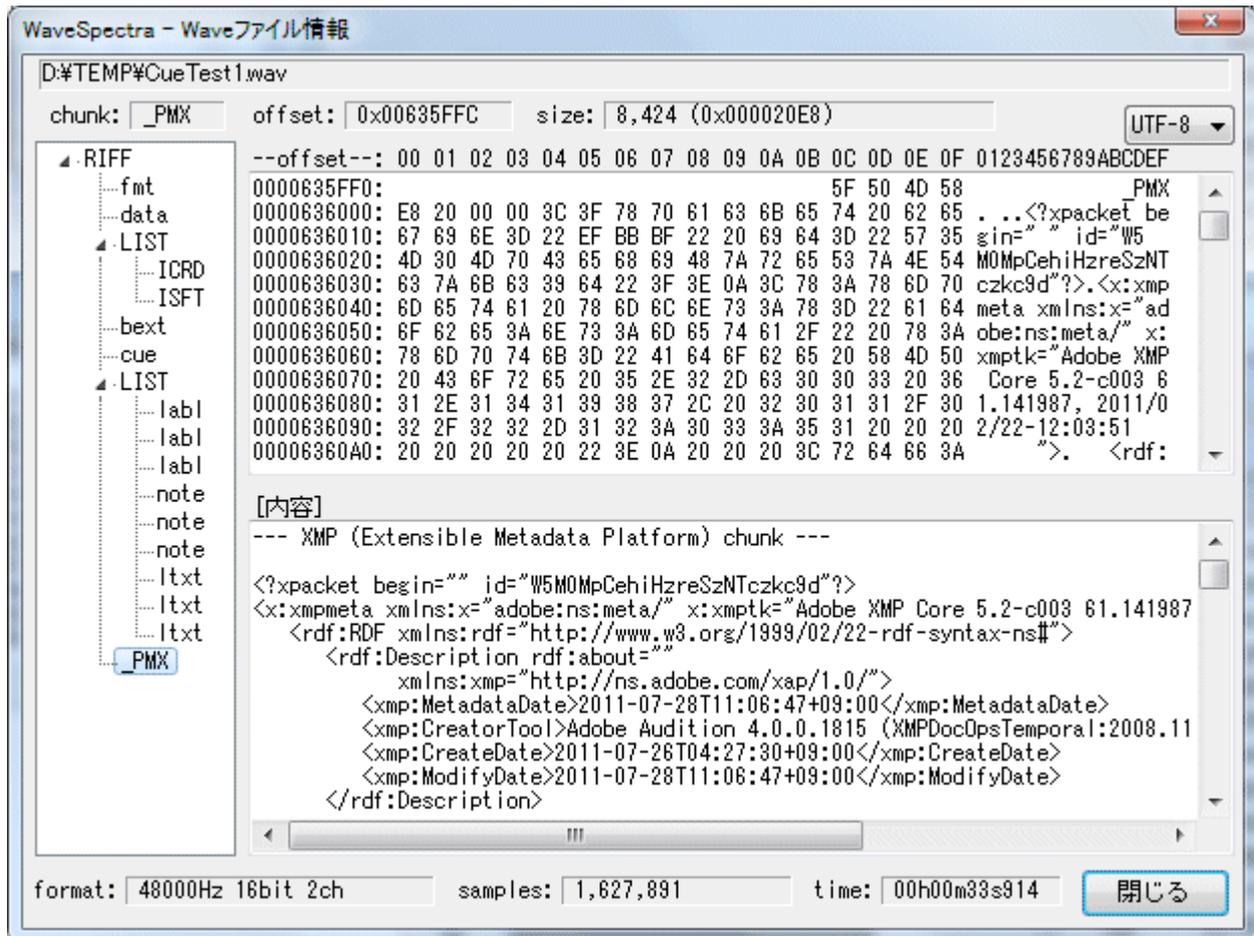
|         |               |            |
|---------|---------------|------------|
| [labl]  | [dwName (4B)] | 0x00000001 |
| マーカー 01 |               |            |
| [labl]  | [dwName (4B)] | 0x00000002 |
| マーカー 02 |               |            |
| [labl]  | [dwName (4B)] | 0x00000003 |
| マーカー 03 |               |            |

format: 48000Hz 16bit 2ch    samples: 1,627,891    time: 00h00m33s914    閉じる

**\_PMX** chunk.

XMP (Extensible Metadata Platform) is included.

(\* It is attached with Adobe editing software)



### [Example 3]

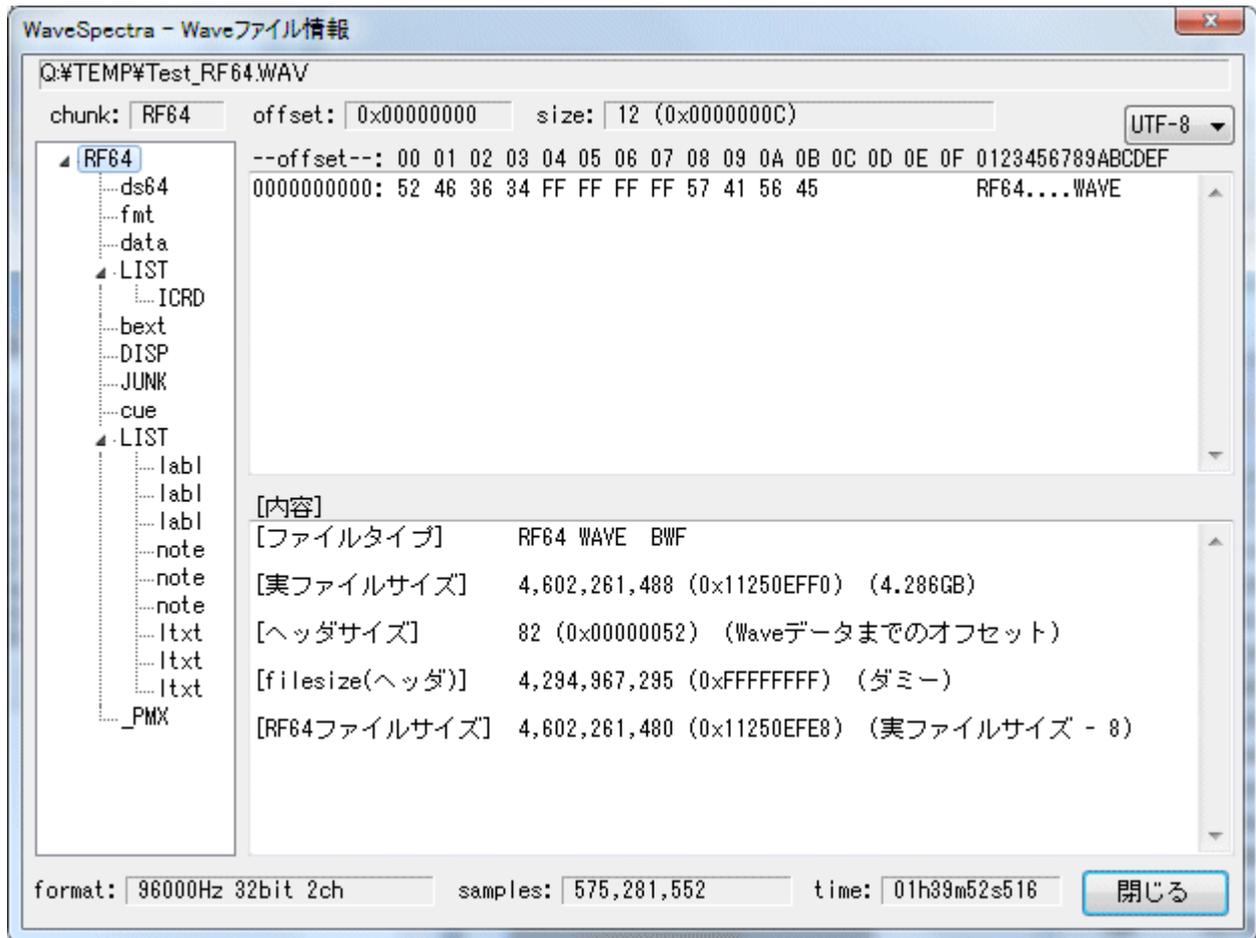
RF 64 which supports file size exceeding 4 GB Here is an example of a formatted wave file.

The first is instead **RF64**.

For details

<http://tech.ebu.ch/docs/tech/tech3306-2009.pdf>

Please refer to.

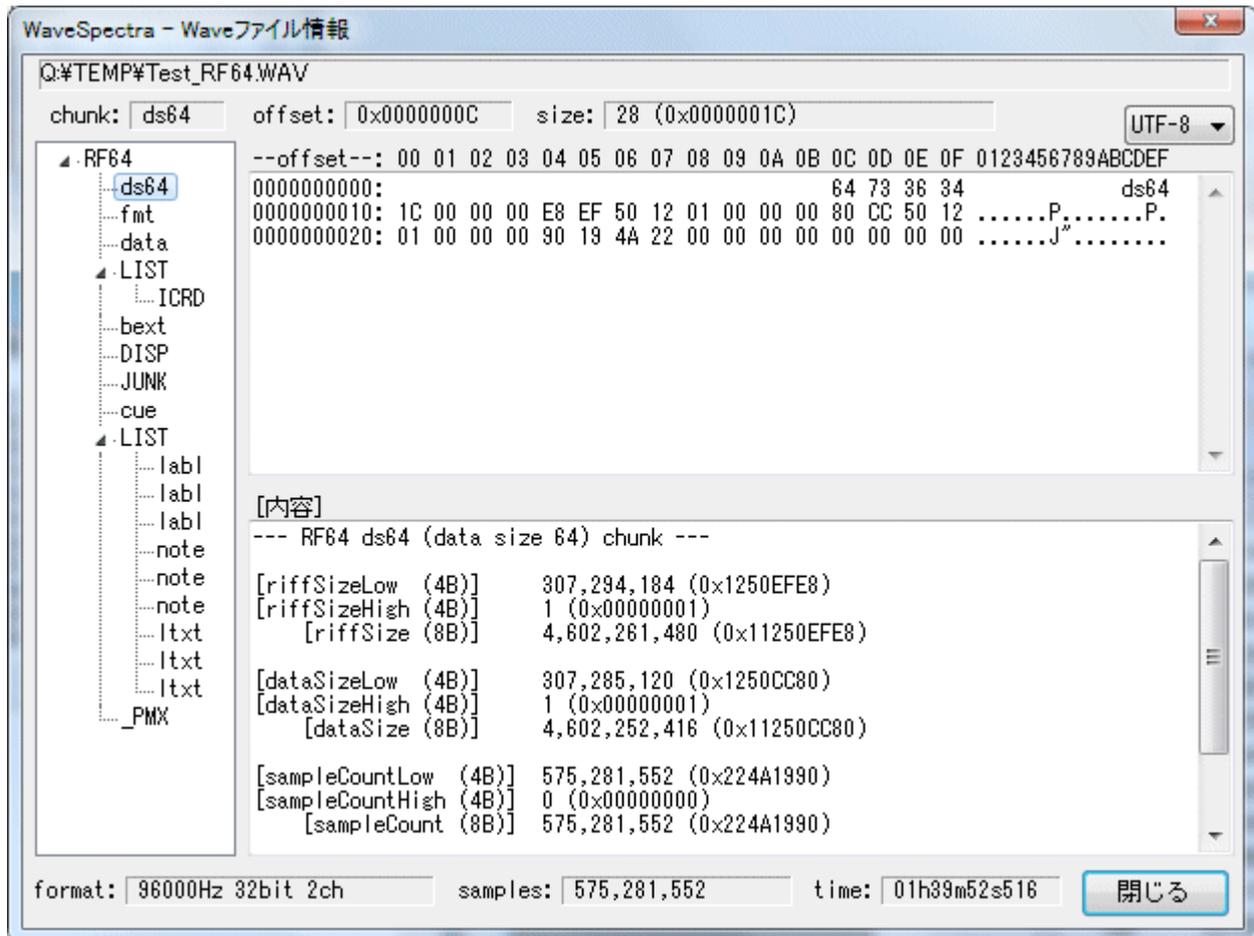


### ds64chunk .

The first chunk of the file of the RF 64 format is It is decided as ds64 chunk,

Here the data size is stored with 64 bits.

The data size of 32 bits written in the header of the ordinary Wave file or the data chunk is not used as dummy (0xFFFFFFFF).



\*Note that until recording reaches 4 GB, this ds 64 The chunk is a dummy chunk named JUNK chunk, and the file structure is normal RIFF It is a Wave file. If it exceeds 4 GB, change the name from JUNK to ds 64, re-insert the 64-bit data size there It becomes a file of RF 64 format.

#### [Example 4]

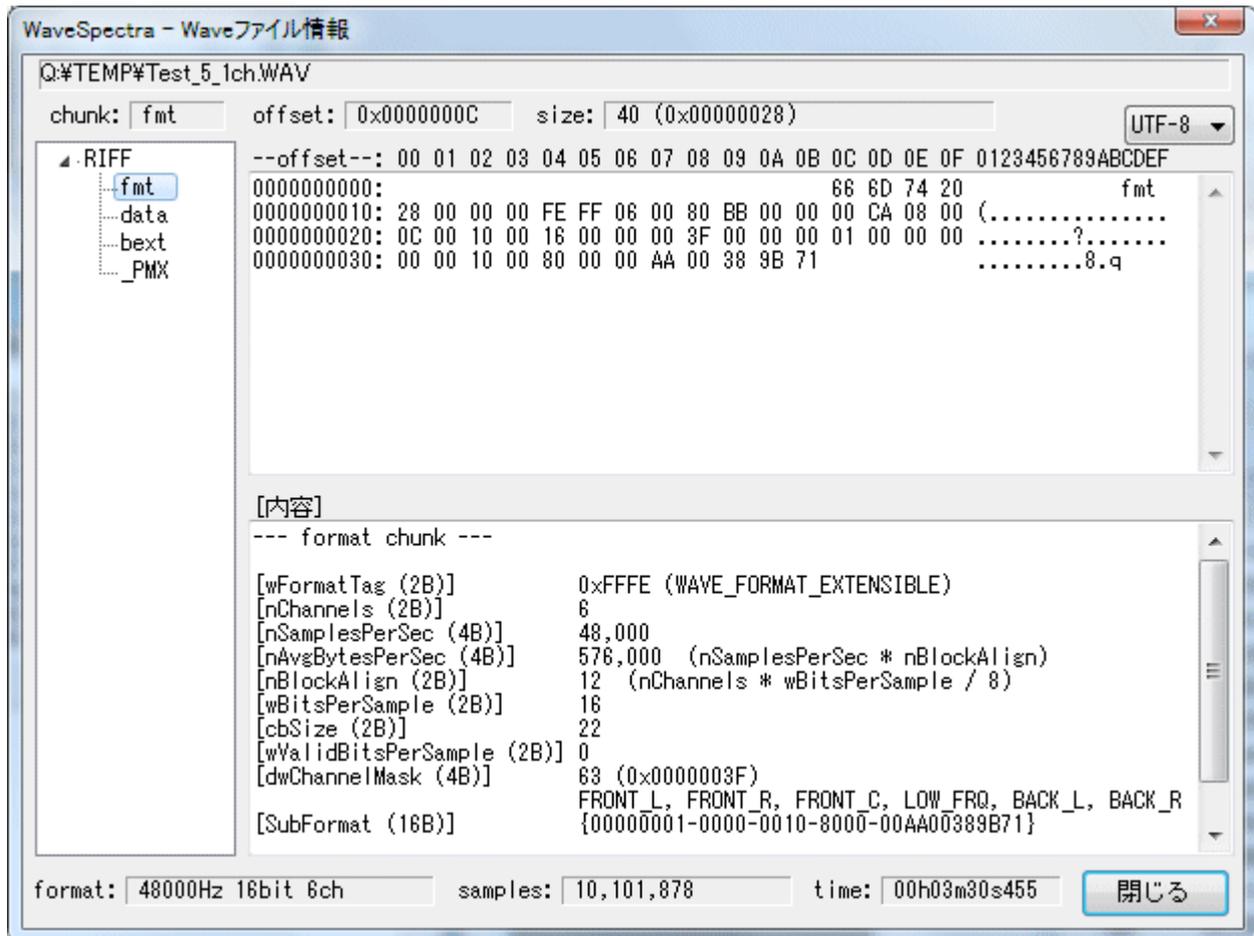
Multichannel of 6ch (5.1ch) (WAVE\_FORMAT\_EXTENSIBLE An example of a wave file of the format).

You can see that the fmt chunk is in WAVE\_FORMAT\_EXTENSIBLE format.

For details

<http://msdn.microsoft.com/en-us/windows/hardware/gg463006.aspx>

Please refer to.



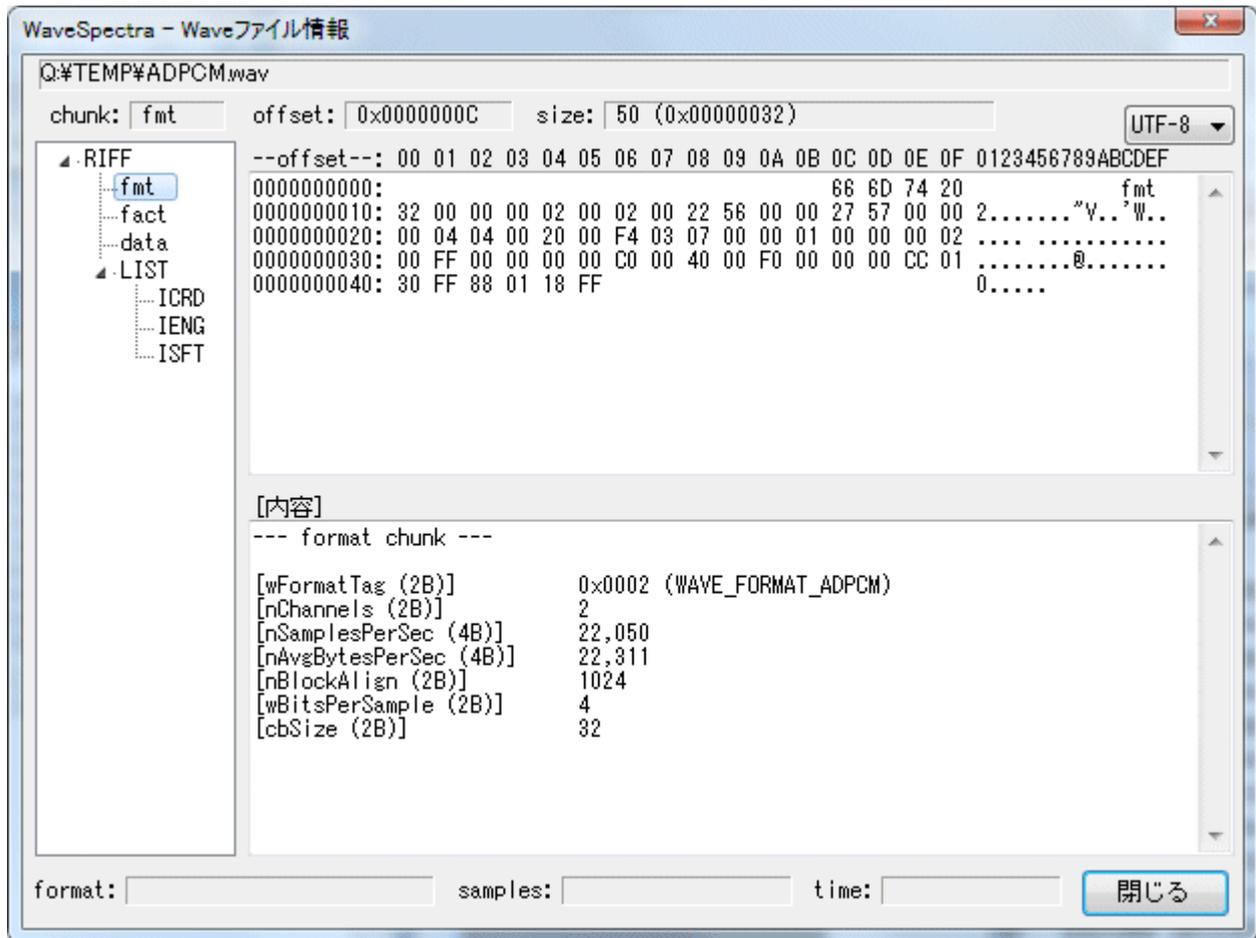
## [Extra applied version]

### Part 1

This window is for chunk display of PCF format Wave file, but PCM Even if it is not in the format, if it is a RIFF file you can display the structure of the chunk.

This is an example of a wave file of the **ADPCM** format.

**Note:** However, because content analysis is not supported, the description is incorrect. (Also, when opening it "This file is not a valid PCM file" I see a message saying, but opening will be held. Of course you can not play)

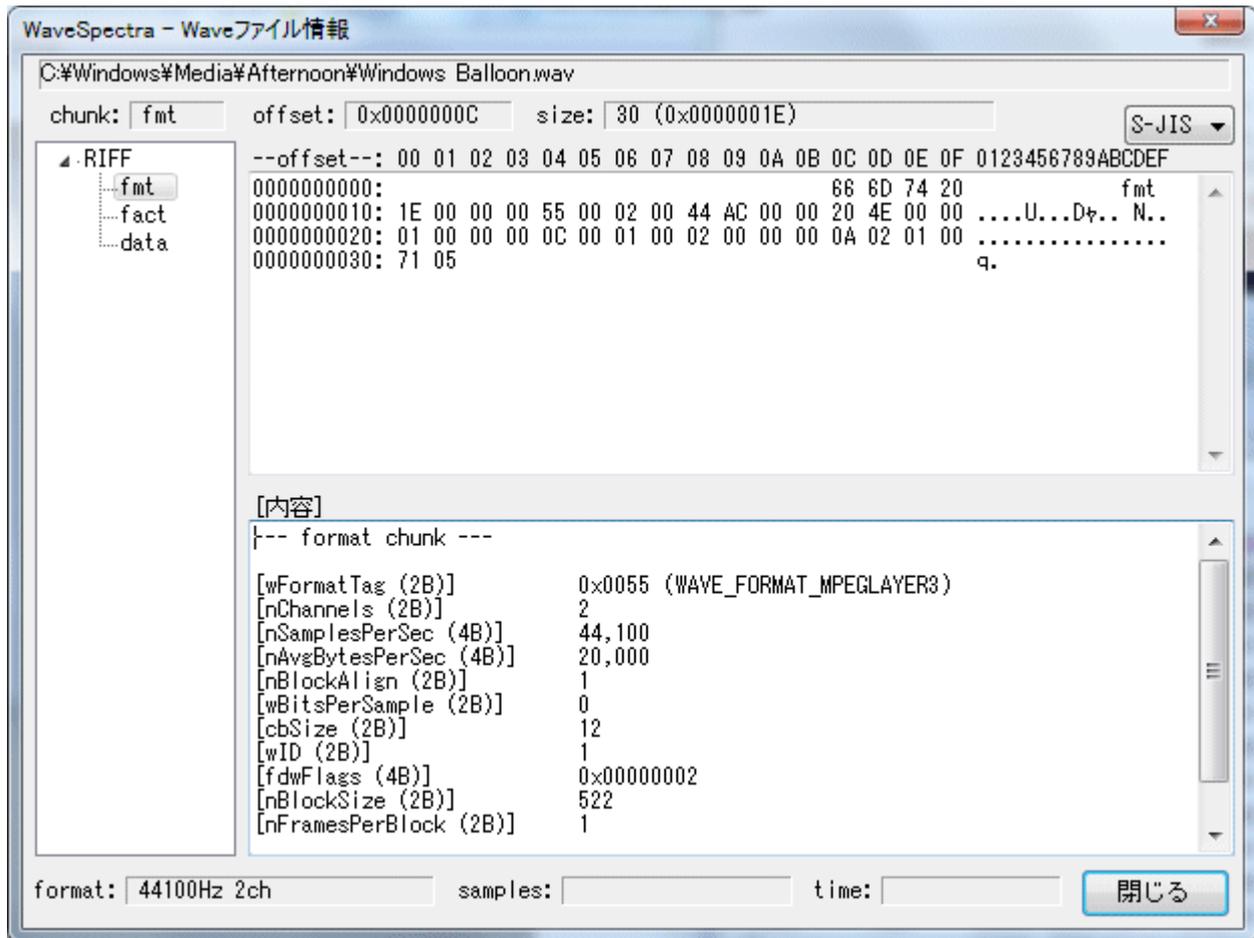


## Part 2

In the Windows Media folder, the extension is Even if it is wav, the data of contents is mp3  
There is a wave file.

For example.

**Note:** However, because content analysis is not supported, the description is incorrect.



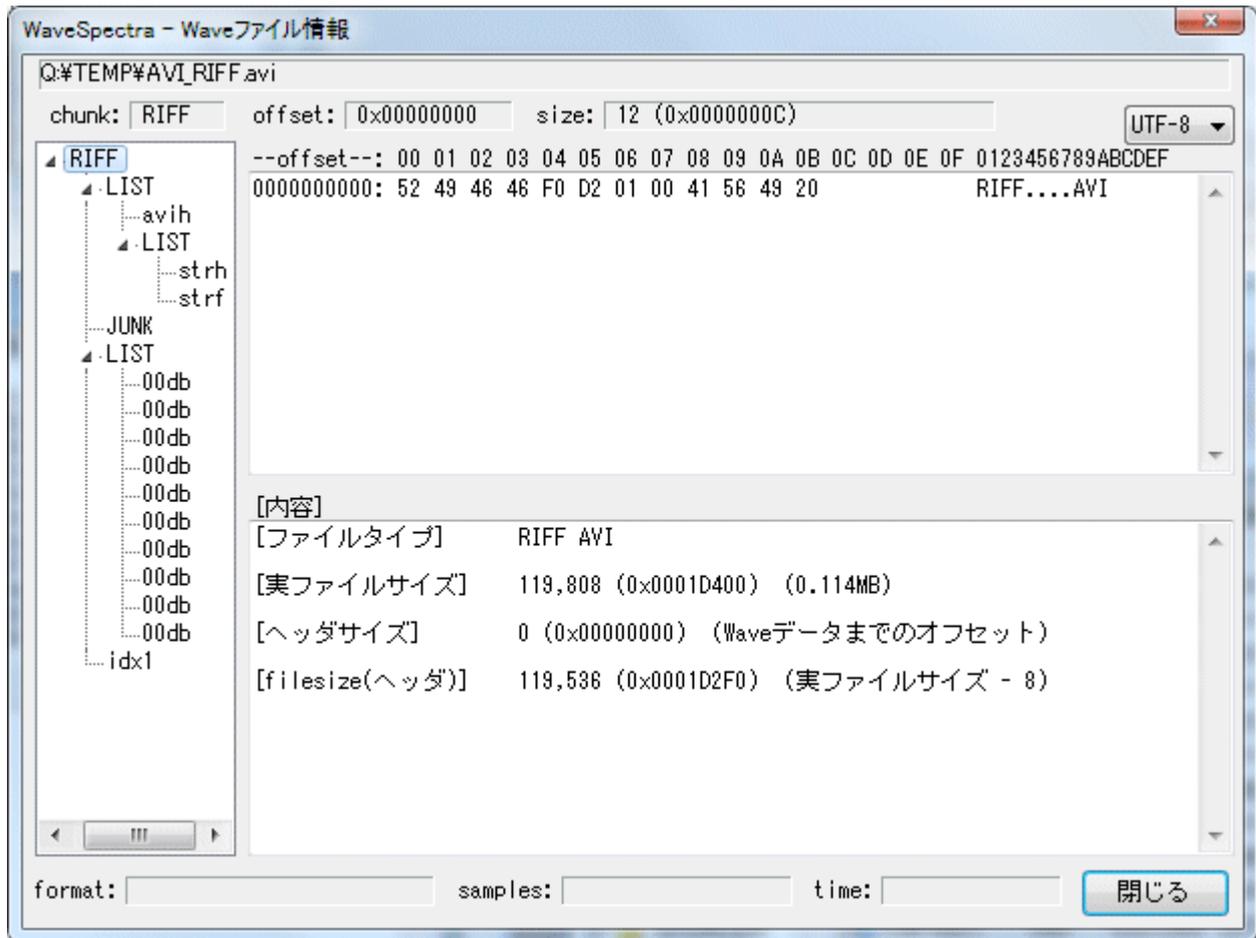
### Part 3

Even if it is not a Wave file, if it is even a RIFF file it can be forcibly opened to check the chunk structure.

Below is an example of the **avifile**.

If you try to open as it is, you can not open the file " Or Drag & Drop "Extension is not WAV" Although it is refused, opening it while holding down the Ctrl key "This file is not a valid PCM file" I get a message saying that you can force it open and you can see the contents of the chunk.

**Note:** However, because content analysis is not supported, the description is incorrect.



### === During recording ===

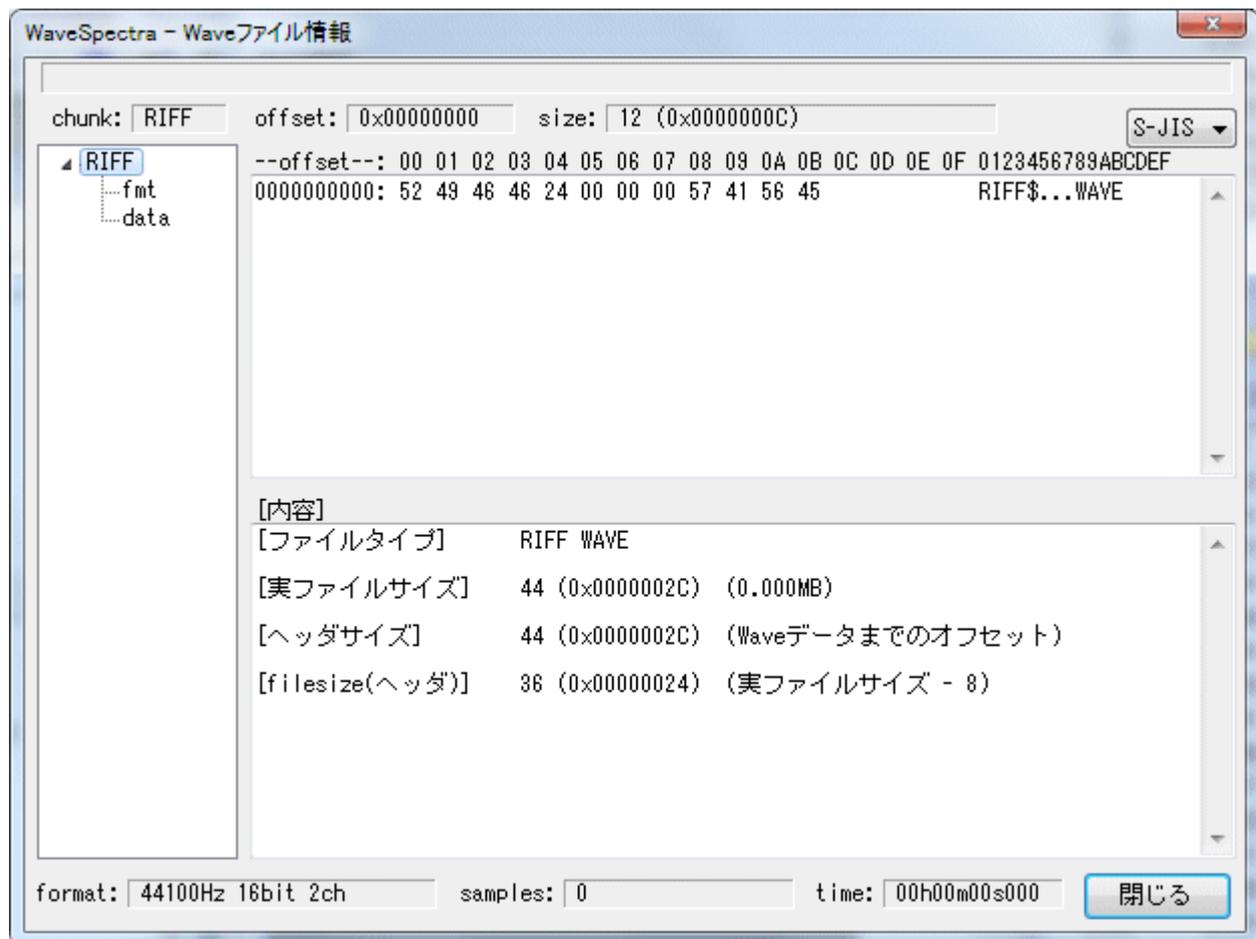
Even during recording, during recording, the data is definitely not fixed yet, so it will be a temporary value, but in the case of recording to a file, the content of the created file is displayed at the end of recording.

#### [Example 1]

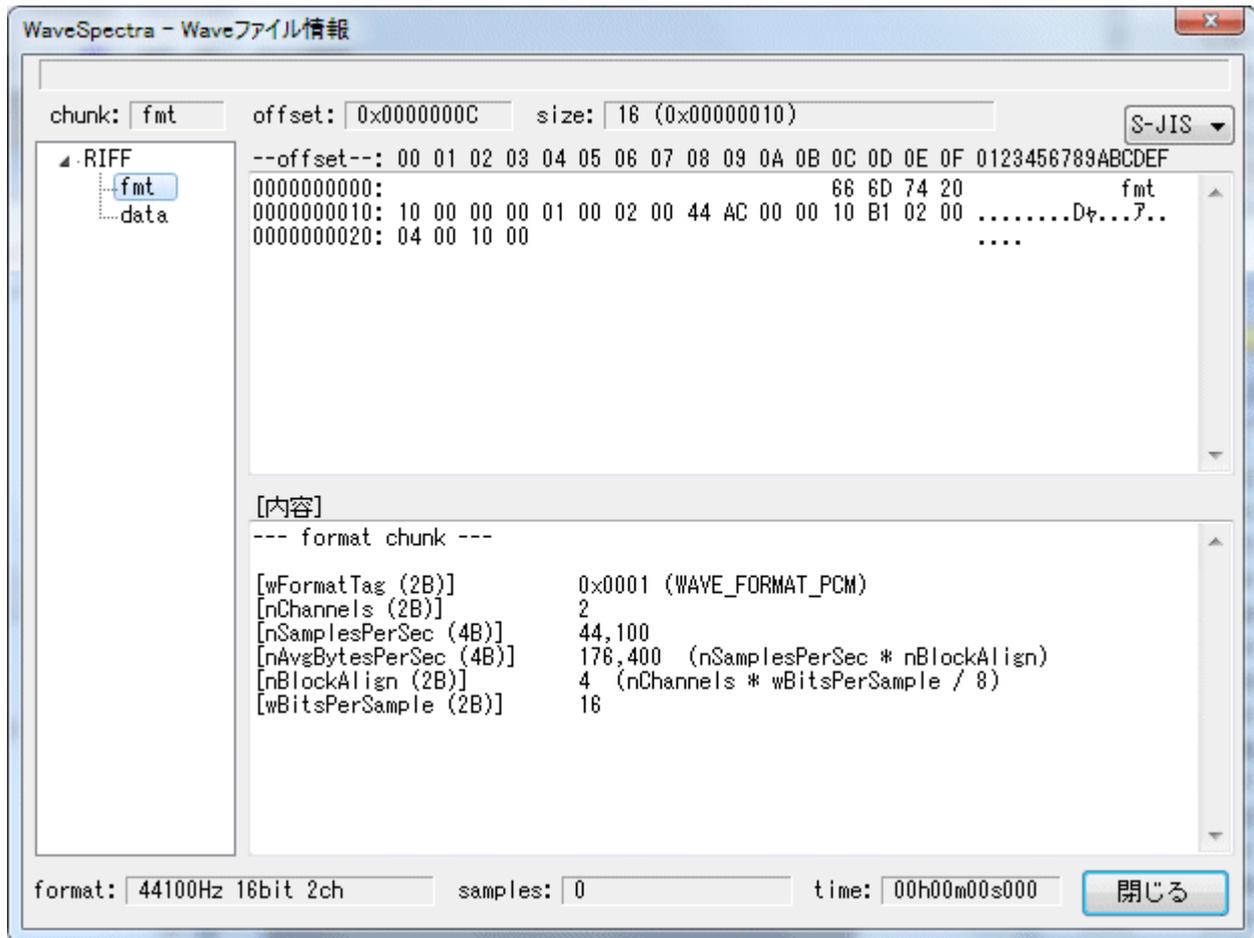
It is time to start the recording operation just by pressing the record button on 44100/16/2 ch.

Since it does not actually make the file, it becomes all temporary value, and there is not much meaning.

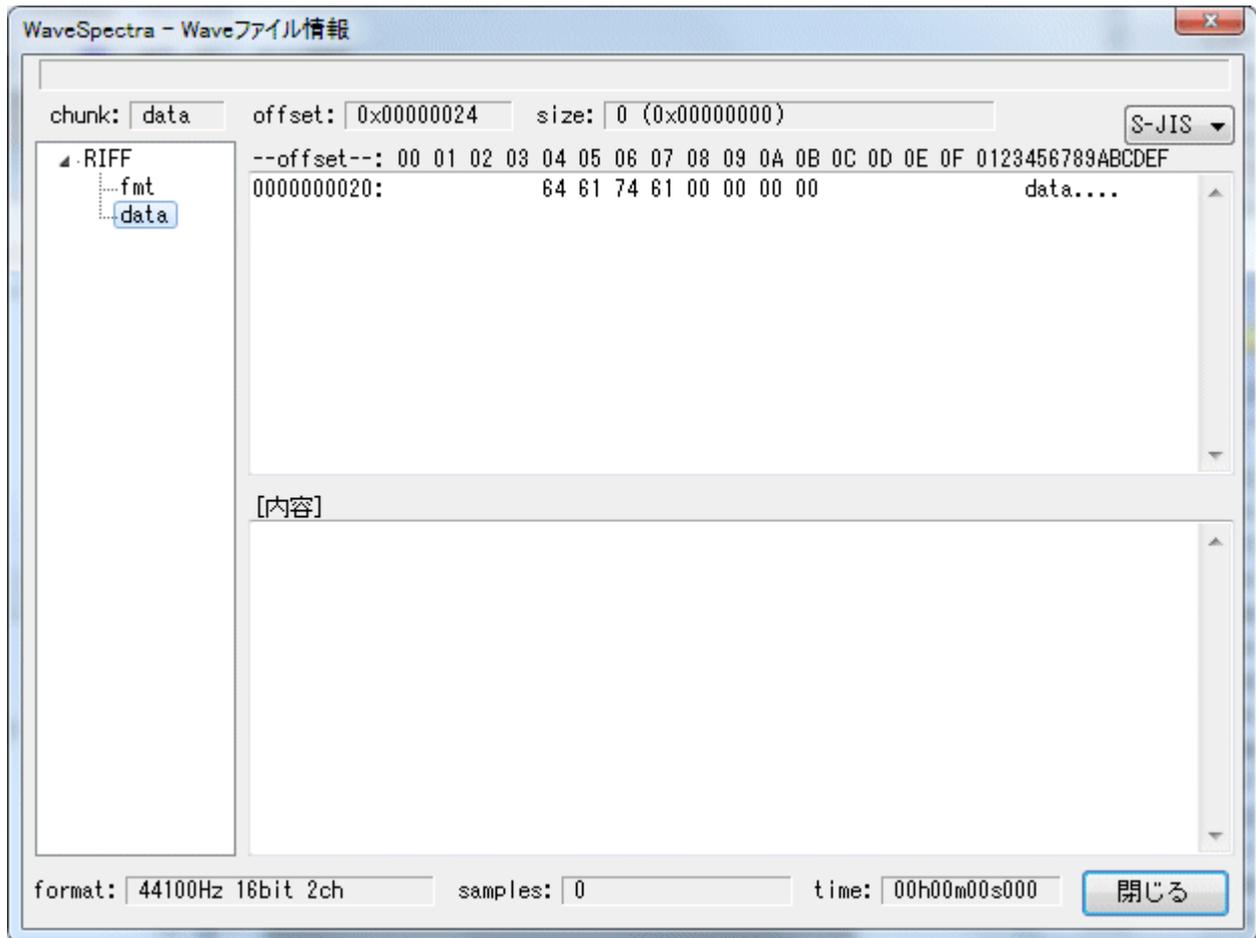
Size etc is for the time being the value of the header part.



The **fmt** chunk is the actual value.



**data** Since chunks also have no actual data here, they are only at the beginning.

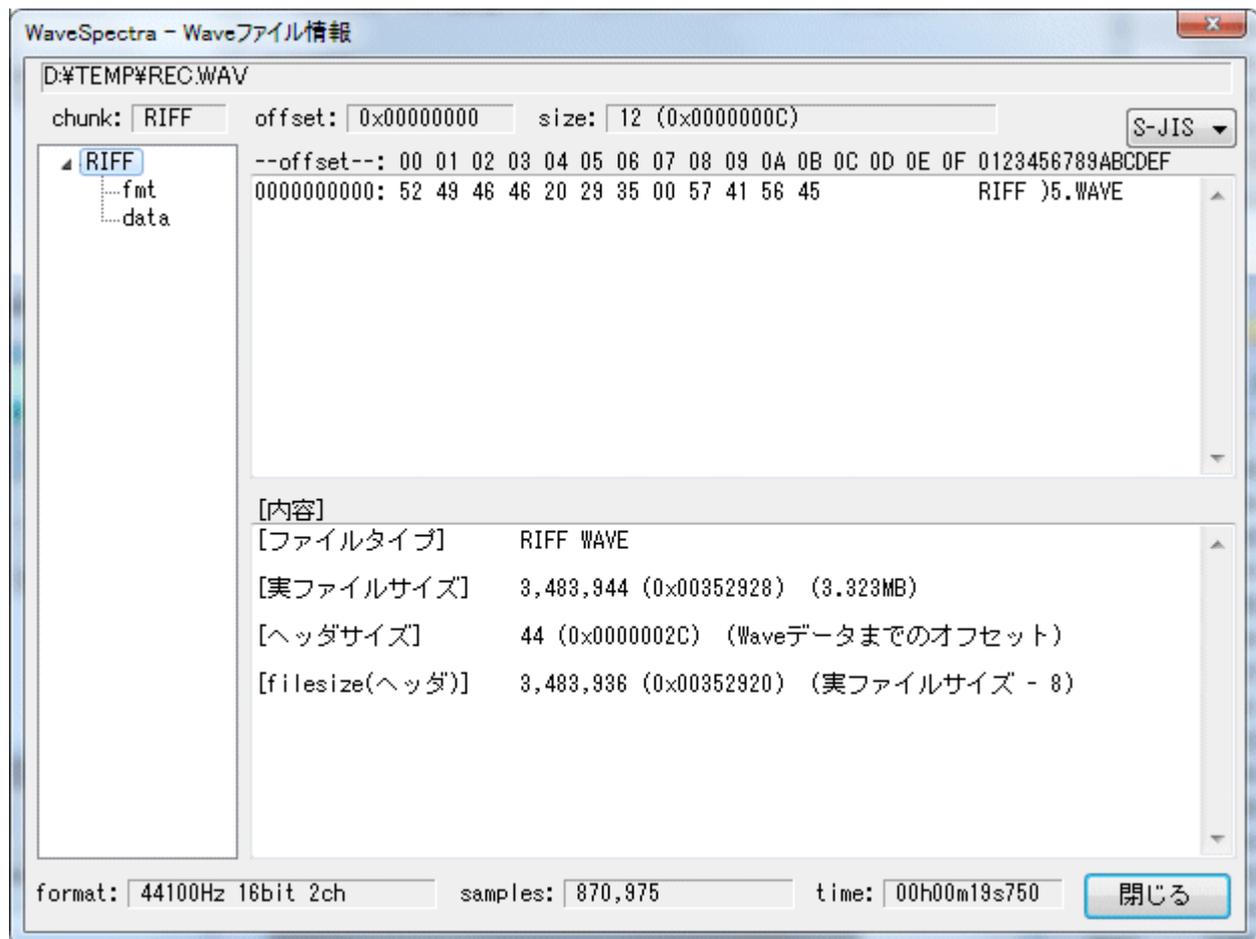


### [Example 2]

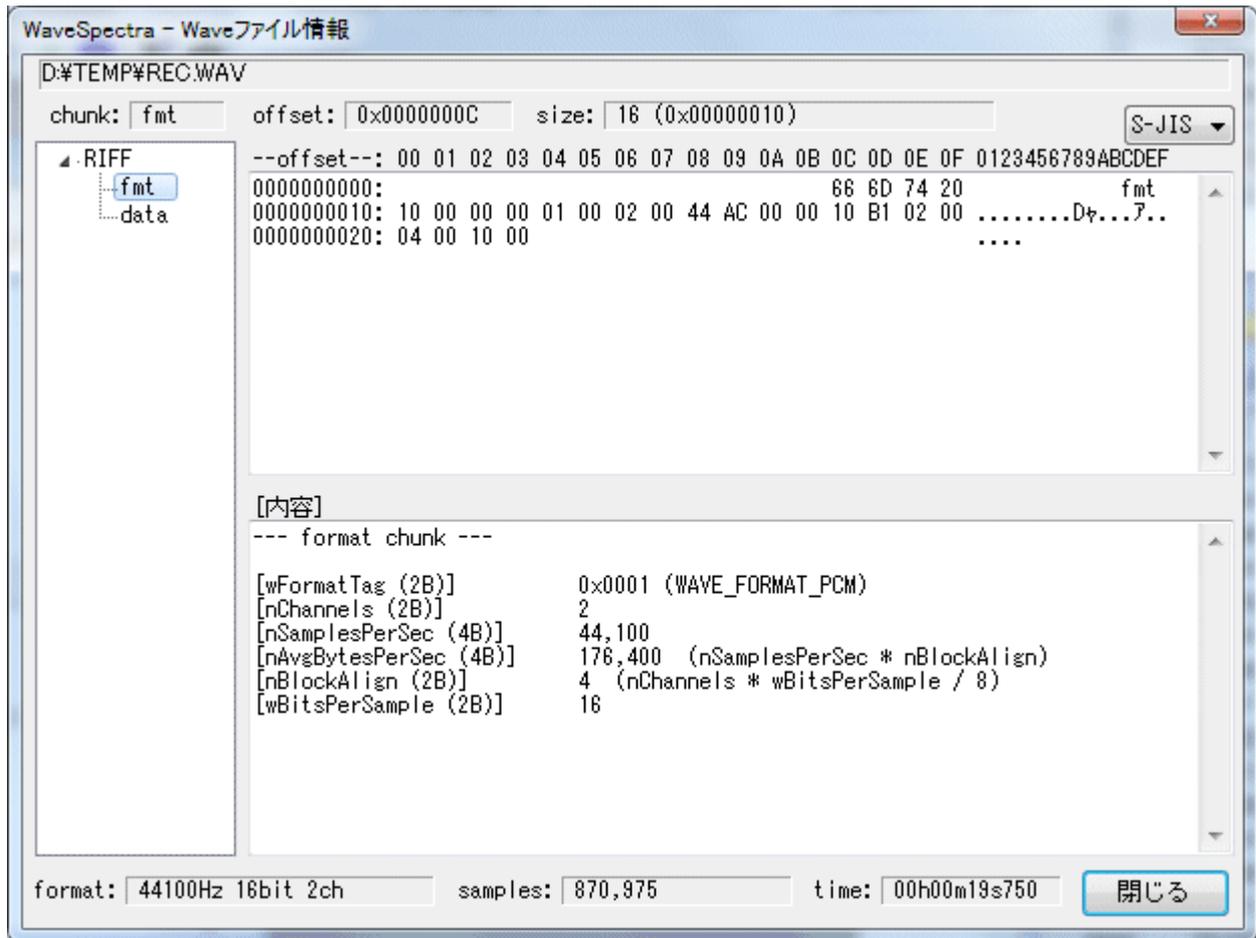
It is 44100/16/2 ch same as in Example 1, and this time it is when actually recording to a file.

While recording, it is exactly the same as Example 1, but when you stop recording by pressing the stop button, the information of the file created now is displayed.

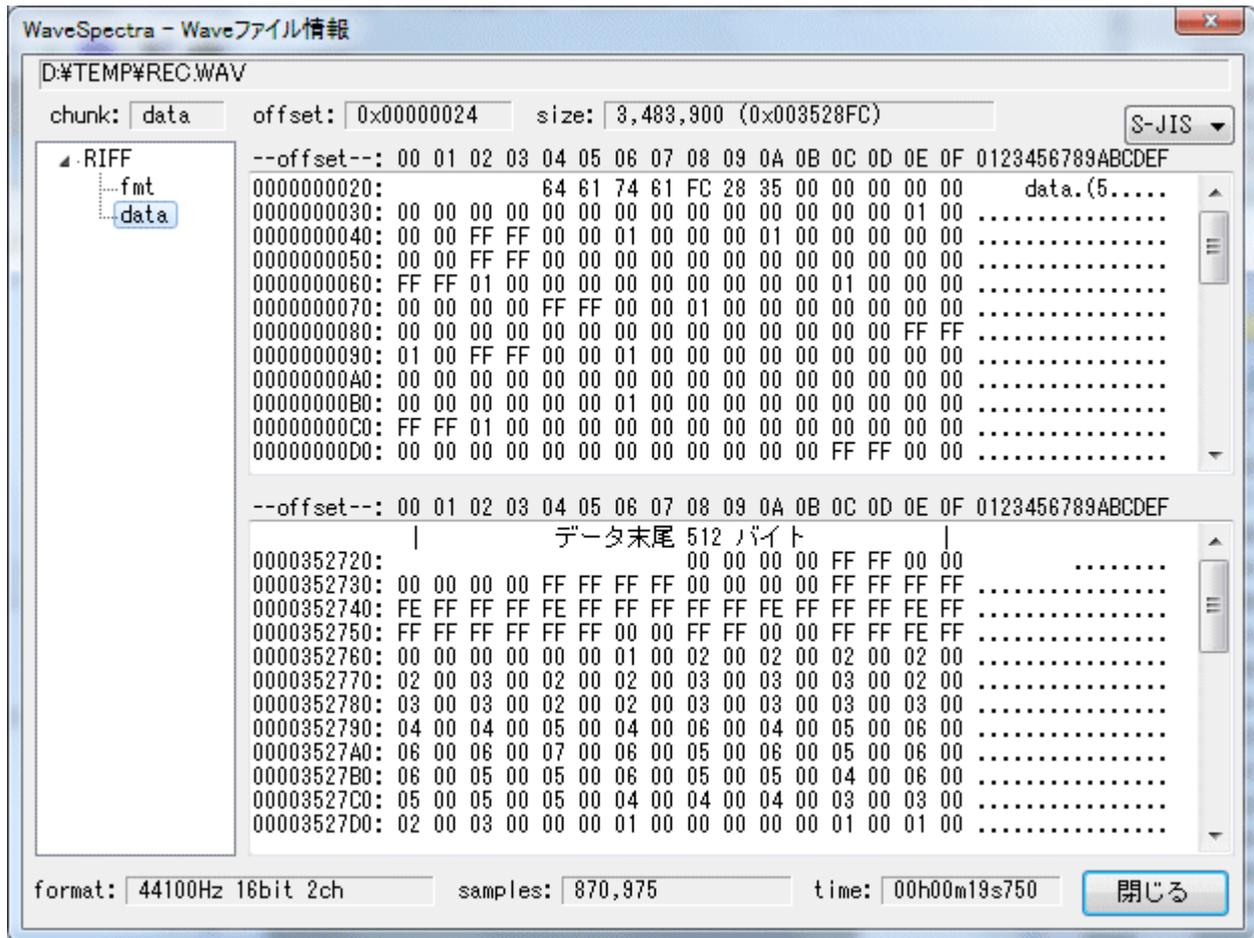
The data size etc. are also the value of the created file.



**fmt**chunk.

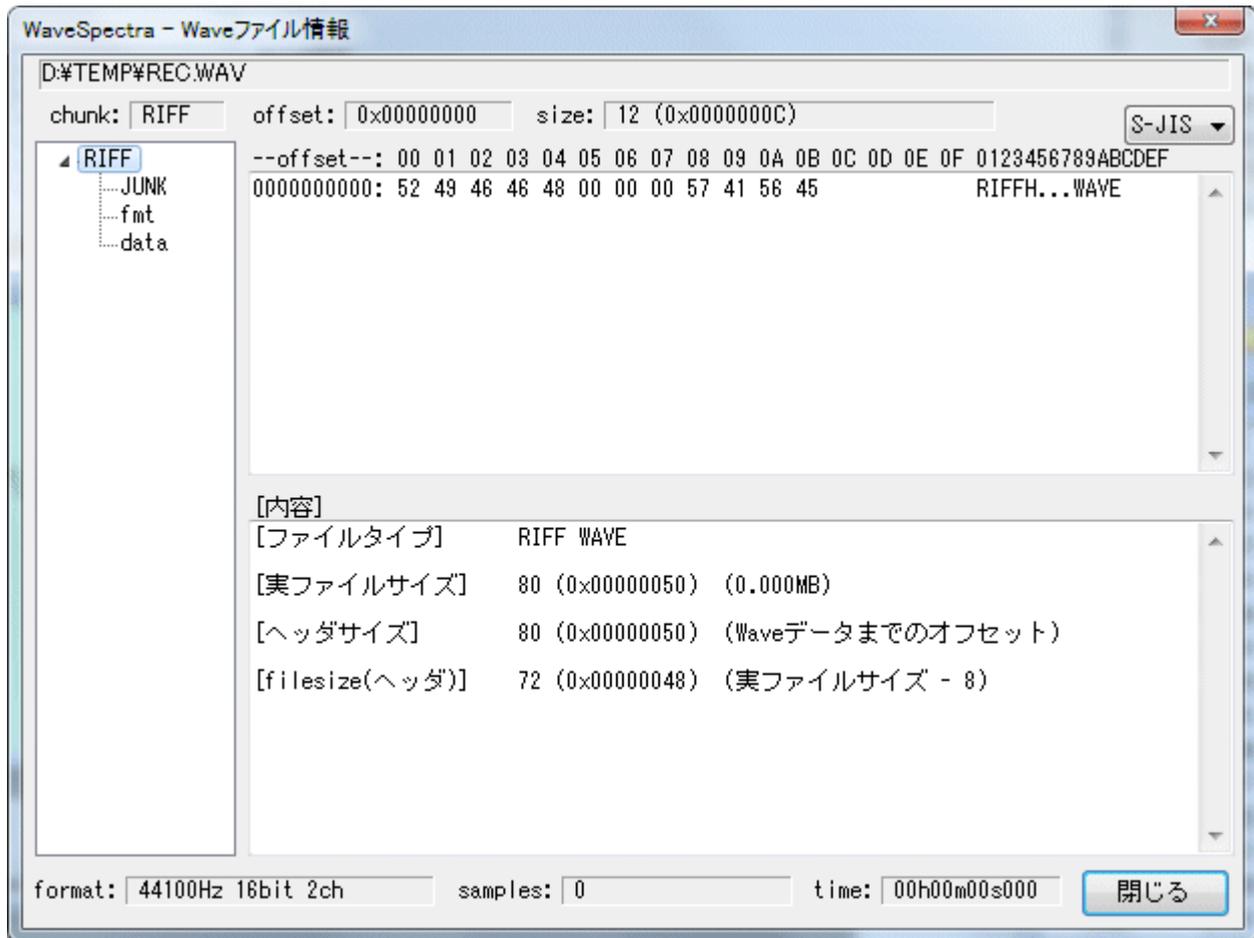


**data**The chunk is also the value of the created file.

**[Example 3]**

Next is the actual recording in the file in the RF 64 format.

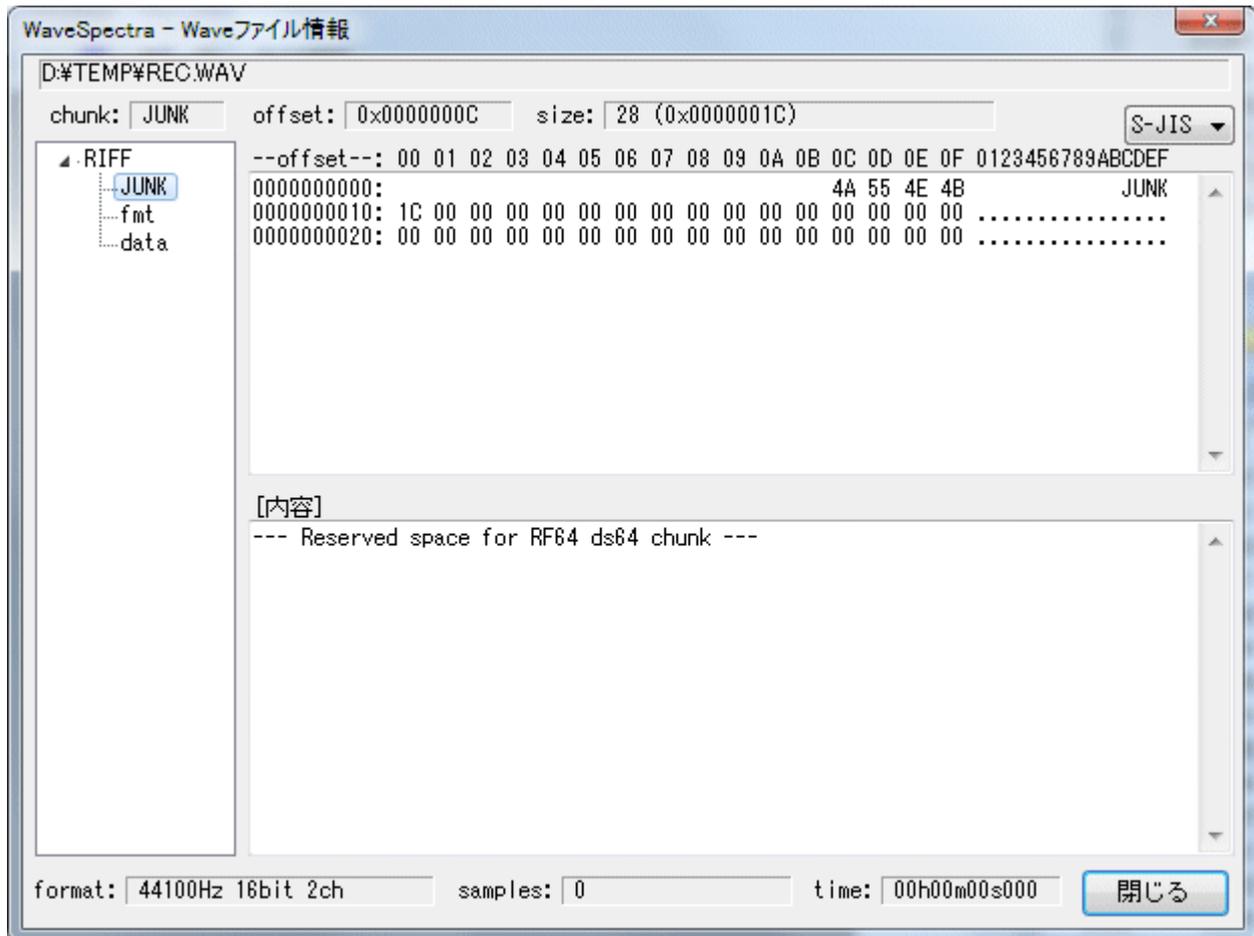
Now, during recording, a dummy JUNK chunk is created at the beginning in addition to the state of [Example 2].



**JUNK**chunk . At first it is a dummy so there is no content.

If the size exceeds 4 GB, the name will be changed at that point and it will be **ds64**chunk.

\*At the moment when it is changed to ds64 chunk, the display here also changes at the same time.



As in [Example 2], the information of the file created at the end of recording is displayed. For actual data of the file created at the end of recording, see Example 3 at playback.

Created with the Personal Edition of HelpNDoc: [Free help authoring tool](#)

## Operation with keyboard

### Operation with keyboard

Each button can also be operated with a keyboard.

#### Main window

- Ctrl + O (O): Open Wave file
- Shift + O (O): Open playlist
- Ctrl + P: Play (During pause of Wave file playback Open the position specification window)
- Ctrl + S or ESC: Stop
- Ctrl + R: Input / recording from a sound device
- Ctrl + U: pose
- Ctrl + L: Lch / Rch switching
- Ctrl + M: Measurement mode On / Off

- Ctrl + T: Open the setting dialog
- Ctrl + D: During recording to a file, forcibly split the file at the time of pressing it (Divide)  
(Only file split mode up to 2 GB. It does not work in RF64 mode)
- Ctrl + C: Copy the display screen when pressed to the clipboard  
(Please refer to the [setting dialog - \[other\] - screen copy](#) for the range of copying)
- space: When the Wave file is loaded, alternately Same as play & It; - & gt; pose.  
When the wave file is not loaded, alternately Input / Recording from Sound Device & It; - & gt; Same as pose.
- Alt + F4: End

### **Main window (in measurement mode)**

- Shift + M: same as Main button
- Shift + P: same as Peak button
- Shift + A: same as Avg button
- Shift + 1: Same as the OVL 1 button
- Shift + 2: same as OVL 2 button
- Shift + C: same as capture button of OVL 1
- Shift + L: same as L button on OVL 1
- Shift + S: same as S button on OVL 1
- Shift + T: same as THD button
- Shift + R: same as RMS button

### **Position selection window**

- Home: to the top
- Page Up: Move left position (same as left arrow button)
- PageDown: Move right position (same as right arrow button)
- End: to the end
- space: same as short play button

---

Created with the Personal Edition of HelpNDoc: [Free Qt Help documentation generator](#)

---

## **Tips**

---

### **Hints collection**

---

#### **About WASAPI**

- WASAPI (Windows Audio Session API) will be available on Windows 7 from Windows Vista SP1 or later. (It is displayed in the list of drivers)

As with ASIO you can expect input and output of the correct data, but it seems that the load is slightly lighter than ASIO in general because it is the function of the OS itself, especially USB It may be good for the device.

However, please be aware that there are quite a few drivers with bugs in practice, as the driver side is still dealing with the same problem, and the corresponding format tends to be small.

For example, even if you pause, you will notice that the sound continues to be output (repeated buffers for the buffer at the stopped position), all formats can not be used unless it is in the timer drive mode, or once it is initialized As long as you do not play or record, do not do anything and close it There are various kinds of Windows death and so on.

Some things could be avoided by some means, but unfortunately those that could not be avoided (those that do not do the first pose etc) are left unchanged.

If the same phenomenon appears in other WASAPI compatible software, it will be a driver bug.

### Speeding up display

- Increasing the speed of the
- display means that even if you set down the display interval to lower the CPU usage rate and use it, the CPU usage rate will be lower, so it has its own meaning.

In particular, when using it simultaneously with the sister software WaveGene, we recommend that you lower the CPU usage sufficiently to prevent sound skipping etc.

- Since the CPU has recently become faster, there is not much problem, but in order to speed up the calculation itself, there will be only about a decrease in the number of FFT sample data.

However, the display may be considerably faster depending on the setting as below.

1. Change to a high-speed display card if desktop type.

(There seems to be some slow on integrated graphics of integrated chipset.)

2. Decrease the display size of WaveSpectra.

3. Take patience of somewhat flickering and select flickering drawing method.

\* Draw "peak only" in Spectrum display " Check it, it may be good as the apparent flicker decreases ...

It seems that it may be affected by the use environment of Windows memory.

(The speed may be different immediately after startup and after using various applications.)

Depending on the display card, it seems that WaveSpectra itself is affected by the difference in display position on the screen even though the window size is the same.

\* In fact, a considerable part of the display update time is taken at the time of the screen display rather than the FFT calculation, and the display capability of the display card is working well.

(It seems that the lowering of the drawing speed when making it on a large screen such as full screen display is quite different depending on the display card. It may not decrease much)

### Tip:

If you press the Shift key and the Ctrl key at the same time during operation, drawing of the waveform stops during that time, and only FFT and internal processing will be done.

Therefore, by comparing the value of fps at that time with fps at the time of normal drawing, it is possible to estimate the time used for drawing.

The value of fps at this time is very large depending on high speed PC and conditions, and may exceed 999.

In that case, if the uppermost digit is 9 or more, A, B, C, D .... It becomes alphabetic display like hexadecimal.

For example, if it is A23, decimal number is 1023, if D45 If it is 1345 ...., Z 67 it is 3567.

(Actually it will be Z or more in ASCII code order)

- **Specific drawing method setting method**

Once you set the pause time of the display interval to 0 (CPU utilization will be 100% on a single CPU), set the time to maximize fps display and restore the pause period. Since it has an automatic setting function, it will be convenient to use this function.

[Wave - Drawing method and Auto setting](#)

[Spectrum - Drawing Method and Auto Configuration](#) [Other - display interval](#) and [Timer / Hibernation Resolution](#)

### About split bar

- By dragging the split bar in the center of the Wave / Spectrum display area you can change the ratio of the two areas.  
You can also eliminate one display area.

\*Although we did not explain so far in particular, the size of the main window can be freely changed (^ ^;

### About sampling frequency

- The sampling frequency corresponds to 100 Hz to 10 MHz.  
Internally there is no particular limitation, so it is a limitation only on the display of the scale of the graph.

When playing, it corresponds to an arbitrary frequency.

Outside the range that can be reproduced is simply for analysis.

Even if the sound device does not support it, normal playback is not possible, but you can analyze it using analysis mode [analysis position fine designation function](#).

Even during recording, you can freely set it by writing the numerical value directly, in addition to the frequency set in the setting list box.

However, depending on the device / driver of course whether or not it can be actually recorded.

- From time to time, what is the maximum value of the spectrum display 0 dB or the scale of the waveform display? I am asked the question, but this is the numerical value of PCM Wave format data.

Since the standard CD format is 44.1 kHz sampling 16 bits, the sample data is an integer value of 16 bits-32768 to 32767 It is a value in the range of.

Wave waveform display scales 10000, 15000, 30000 etc. are the values ?? themselves.

For the spectrum 0 dB, its maximum value 32768 is 0 dB.

Therefore, since normally recorded sound is usually smaller than this, all the data will be negative like - XX dB.

For formats other than 16 bit please refer to the bottom.

### About 8 bit data

- When the data is 8 bit, calculate & display by treating the value of -128 ~ 127 by 256, treat it like 16 bit data.  
Therefore, the display of amplitude of Wave is also displayed as it is with 256 times multiplied display, so the display of scale etc. Please note that it is not 128 maximum.

In addition, Spectrum is shifted up by 256 times (about 48 dB) and displayed.

### About 24 bit, 32 bit Wave format

- Supported formats are the following three types.
  1. 24 bit int (3 bytes / sample)
  2. 32 bit int (4 bytes / sample)
  3. 32 bit normalized float (absolute value less than or equal to 1.0) IEEE\_FLOAT (4 bytes / sample)

Also at this time, Wave on the main window: A character 'F' is added before the bit number, and "F 32 bit" It will be displayed.)

Also, for internal compatibility and readability, all internal processing is done after conversion to floating-point values ??of integer part 16 bits (-32768 to 32767) and fraction part 8 bits (or 16 bits).

Therefore, decimal part is added for waveform leadout etc.

### About internal calculation accuracy

- All real arithmetic operations such as FFT are double (64 bit floating point) I am doing it.  
However, the parts that can be done with integers are each optimal integer.

### Setting dialog

- If the setting dialog is already open and it is hidden under the other window (maximizing the main window etc), set button , the dialog will appear in the front.

### About customizing display color set

- Customization by dialog etc. can not be done, but still it is You can customize WS.INI to an arbitrary display color by directly editing it with an editor.  
Windows color notation (hexadecimal), but I think that you can understand because you added a comment easily.

### About speed in Lissajous display

- In order to display Lissajous's display smoothly, you need 30 to 40 fps Although it seems to need the display speed above, it seems that even when it is too fast it sometimes disappears with indications becoming ugly.

In such a case, if you set the display interval appropriately and slow down the speed, it will be displayed cleanly.

Therefore, in order to prevent the FFT calculation from being canceled too fast, such as when minimizing the Spectrum window, the display pause time is automatically set internally (5) automatically .

### About the number of sample data of FFT (and attention when measuring with

## sweep signal)

- Although it tends to increase the number of sample data easily and freely in order to raise the frequency resolution, a little caution is needed about this.

In order to obtain the correct value by FFT, it is necessary that the signal is constant and does not change for the time corresponding to the number of sample data. For example, in the case of 44,100 Hz sampling 65,536 points FFT, the resolution is It is 0.67 Hz at  $44100/65536$ , but at that time, its reciprocal It is necessary that the signal is constant and does not change for  $65536/44100 = 1.49$  seconds.

If it is a changing signal, it is generally measured less than its original value. Therefore, in the case of a changing signal such as music, this time also needs to be considered.

In this software, the initial value of the number of sample data is set to 4096 because it is okay if it can see change of about 0.1 second in the CD format.  
 $4096/44100 = 93$  ms

- When using frequency sweep signal in conjunction with the sister software WaveGene to measure the frequency response by peak hold, please pay attention to the sweep speed.

From WaveGene V 1.40, it is now possible to easily measure accurate frequency characteristics using a cyclic sweep, so we recommend using this.

For details, please refer to [measurement of frequency characteristics](#).

## Frequency resolution of FFT

- Sometimes I think that when comparing the noise floor with a spectrum graph, it is necessary to match the frequency resolution in FFT.

The frequency resolution of the FFT is the sampling frequency / Number of FFT samples, for example  
For 48000 Hz sampling 4096 points FFT, the resolution is It becomes  $48000/4096 = 11.71875$  Hz.  
(Frequency resolution can be checked easily by keeping Spectrum's [comment line](#))

If this is not adjusted, the position of the noise floor will change, so you need to be careful in the comparison.

For example, if you change from 48000 Hz to 96000 Hz sampling, the same conditions as above (the noise floor will not be displayed at the same position) will have to be made unless the number of FFT samples is also changed from 4096 to 8192.

Generally, when the frequency width of the resolution is expanded twice, the noise floor rises by 3 dB, and when it becomes half, it decreases by 3 dB, so 48000 Hz sampling 4096 points FFT If you change to the 65536 point FFT, the noise floor will drop by about 12 dB.  
(4096 - & gt; 8192 - & gt; 16384 - & gt; 32768 - & gt; 65536 & 12 dB in 4 steps)

\* Even with the same signal, if you increase the number of FFT samples, the noise

floor will appear to be lowered so it seems that it seems to be high performance at first glance? (^ ^;

### About multi-client support of ASIO driver

- If you use [two programs synchronize](#), use this software for recording and playback, or when you use it together with the sister software WaveGene When you use it, if you use both ASIO drivers of the same device, it is necessary for the driver to support multi-client (and multi stream?).

If it is not compatible, one may become grayed out so that it can not be selected, but even if it can be selected with both, it seems to be usable once it hangs up or ends at a blue screen It seems there are times when you do, please be careful.

### About error when using MME driver

- Depending on the embedded audio codec, Wave There seems to be a case that it hangs up with an error when format listing is done with Mapper.

In that case, try not to use that CODEC, or if you can not do that, WS.INI In the [Conditions] section of the "Notepad" " For example,  
Use\_WF\_DIRECT=1

After adding the line of and starting up, WAVE\_FORMAT\_DIRECT You will be opening a device with a flag, so you may be able to avoid errors, so please try.

~~(Note that MME can not be used on Windows Me, 98/95, please note that~~ this time it does not work on 95/98 / Me)

### About the Wave file information window

- In the [Wave file information window](#), you can see the internal chunk structure if it is a RIFF file in addition to the wave file (PCM) I will. (Chunk viewer function)

However, if you try to open it as is, "If you can not open the file" or Drag & Drop "Extension is not WAV" Although it is rejected, if you hold down the Ctrl key and open it will display a message "This file is not a valid PCM file" but you can force it open and you can see the contents of the chunk.

**Note:** However, because content analysis is not supported, the description is incorrect.

For details, please refer to [Extra applied](#).

---

Created with the Personal Edition of HelpNDoc: [Easily create iPhone documentation](#)

---

## Other

---

### Other

---

\* This program is compatible with Borland C ++ Builder It is created with MS VC ++ (DLL).

\* It will operate on Windows XP or later.

---

[Acknowledgment]

To create this html help, UNA 's free software I am using " Help Tell ".  
Thank you for the wonderful software.

Frogs

<http://homepage3.nifty.com/KaeruMachine/>

[Acknowledgment]

Thanks to Mr. Ross Bencina

IASIOThiscallResolver (calliasio - thiscall Adapter for the IASIO interface) (public Domain / open source)

<http://www.rossbencina.com/code/iasio-thiscall-resolver>

---

\*Disclaimer\*

The author is not responsible for any damage caused by using this program.

---

\* This program is freeware.

Copyright is in efu.

\* For non-profit or educational purposes, you can use it freely.

Also please feel free to post the measurement results (screen copy) in this program.

(Of course I am glad if you can let me know (^ ^;)

You can use it in companies, etc, please contact us first. Please do not use without permission.

\* If you can post to magazines etc., please be sure to contact us by e-mail beforehand.

Please do not publish without permission.

\* Donation welcome

Thankfully, we may occasionally receive an offer to donate, so we had a window for you once.

Thank you for your support and I would like to appreciate it for purchasing the hardware / software for development / verification. Thank you.

Although freeware originally there is no use restriction, please do by money transfer service by shareware treatment as **Vector share registration**.

The share registration number is **SR 272800**.

Money transfer page

[http://shop.vector.co.jp/service/servlet/NCart.Add?ITEM\\_NO=SR272800](http://shop.vector.co.jp/service/servlet/NCart.Add?ITEM_NO=SR272800)

The price is **630 yen**(500 yen + 5% consumption tax + fee 105 yen).

I wanted to make it a low price, but please understand that the above price is the setting lower limit of Vector share registration.

In addition, because the information of remitter can not be told to us at all according to the

terms of the share registration service, even if remittance is received, we can not contact you etc for gratitude without knowing your name.  
Thank you for your understanding regarding this matter.

---

#### \*Contact Information\*

Report of disability, impressions, hope, other, thank you here.  
E-Mail: [efu@efu.jp.net](mailto:efu@efu.jp.net) (changed on 8/01/2014)

However, please be aware that HTML mails, e-mails with attachments are automatically deleted and can not be received at all.

**\*Especially when you use Outlook (Express), please note that it is often HTML mail settings.  
In "Sending" tab of "Tools" "Options", please set "Mail transmission format" to "Text format".  
Please also pay attention to the setting in the case of Web mail. (Do not use HTML mail)**

Also, please be sure to add the software name (WaveSpectra) to the subject of the mail. Otherwise, if it is a simple subject, it may be deleted with the spam filter.

**\*Even if it is several days after a few days, even if the reply does not return, there is a possibility that it has not arrived, please check the setting again just in case.**

When reporting a problem, in addition to the operation procedure, please be sure to include as much detailed operating environment as possible including OS and sound device type.  
If possible, copy and paste the contents of WS.INI or WS\_2.INI to the body of the e-mail (please do not attach).  
Since failure can not be reproduced it can not be handled, so please.

The latest version is  
<http://efu.jp.net/> (changed on August 1, 1414)  
It is in

#### Sister software

- Multifunctional, high precision test signal generation software ----- & gt; WaveGene
  - Wave file exclusive comparison software with auto cueing function ---->WaveCompare
  - High precision de-emphasis software for wave file ----- & gt; DE.EXE
  - Software for DAT playback / recording by DDS drive ----- & gt; WaveDAT (Shareware)
- 

2012/08/15 efu (2014/08/01 URL / change mail address only)

## History

---

### History

---

V1.51 (2012/08/15)

#### [Bug Fix & Improve]

- A nested state chunk (labl) in the [LIST adtl chunk](#) attached to the cue chunk with the marker recorded , Note, ltxt) Fixed a problem that a file with a large number of errors could not be read. (Corresponding to the number of markers of 100 +)
- In order to display and display up to 100 [marker function](#) in the position specification window of the fine position designation function (analysis mode) increased.
- [Playback of the sound at the beginning of the current position](#) of the fine position designation function, simultaneously press the right mouse button while repeating Fixed that it became unstable or hung.

V1.50 (11/11/2011)

- Corresponds to [WAS API \(Windows Audio Session API\)](#). (Windows Vista SP1, Windows 7 only)  
Exclusive mode exclusive (event drive mode, timer drive mode Both
- 64 bit file addressing, 2GB or more Wave file, 4GB or more Corresponds to [RF64 format](#). In addition to splitting every 2 GB (change to 99) as usual when recording to a file to file, add mode that automatically becomes RF 64 format when exceeding 4 GB.
- Corresponds to files of [BWF \(Broadcast Wave Format\) format](#). (Reproduction / recording)
- [multi-channel Wave file \(WAVEFORMATEXTENSIBLE Format\)](#). (Up to 8 channels of playback / recording)
- Change the display window when pressing the [usable format button](#) on the recording / playback tab of the
- setting dialog. The window is displayed first and the currently checked place is displayed in real time.  
Also, from the display of S, M etc., it changed to display with the number of the supported channel number.
- On the recording / playback tab of the setting dialog, expand the usable format to 384 kHz. (Internally up to 10 MHz is possible) On the recording / playback tab of the
- setting dialog, [Info / Panel button](#) was separated into each. (ASIO, WASAPI)
- Mono files have always been played in Stereo, Mono Changed to play as it is.  
In the recording / playback tab - play in the setting dialog, if you check the "[Mono play in Stereo](#)" Become.  
(Even in the setting without check, it seems that it will always be played in Stereo when MME, DirectSound)
- So far, in the format which can not be reproduced, it was always possible to select so that it was designed to open in analysis mode (fine position designation mode).  
In the recording / playback tab - Play in the settings dialog, "[Open automatically in analysis mode when format is unplayable](#)" When checked, as usual.
- Recording / playback tab in setting dialog "Recording to file" "

- Enabled on / off of "[periodic header update](#)". [Added automatic setting of drawing method](#) button on WI and Spectrum tab of setting dialog.  
(I made the setting window open automatically on the first boot)
- Wave tab of setting dialog - [Display Wave file information window](#) button to display the [It opens a window](#) that displays detailed information (contents of chunk).
- Added "[Timer / pause resolution](#)" [checking function and setting function](#) on the other tab of the setting dialog.
- "[WaveSpectra: 2](#)" [synchronization function](#) was added on the other tab of the setting dialog.
- It is now possible to control the operation of the second WaveSpectra: 2 from the first and to do it at the same time. Simply set the spectrum of both Lch and Rch to [Observation at the same time](#) as well.
- Changed to instantly write profile when pressing setting button in setting dialog.
- [It is possible to display the level meter in the vertical direction](#) as well. It became possible to display up to 8 channels in both length and width.
- Measurement mode Spectrum Max, and lead out At the time of, add a function to make "[interpolate to improve accuracy](#)".  
Spectrum tab of setting dialog - Numeric display (Max, lead out), it can be set to x16, x128. On the
- scale, sampling frequency Fs 100 to 10 MHz, FFT sample data number 128 to 131072 corresponded.
- Main Window [Wave: Change the display of the field](#).  
In the case of the BWF format, the display of B is added at the end, and in the case of the RF 64 format Added display of 64.  
Wave: Right-clicking on the column displays [detailed information on the file](#).  
(Wave tab of setting dialog Wave file information window The same function as display button of)
- Changing playing position to playlist window [Previous \(Prev\), Next \(Next\), Rewind \(REW\), Fast Forward \(FF\) Add](#) button.  
(Rewind and fast forward are accelerated when kept pressed)
- All the drivers, not only MME, made it to be in the fine position designation function (analysis mode).
- [sound at the beginning of the current position can be played](#) when using the fine position designation function. (Approximately 0.1 seconds)  
Waveform playback can be done for the length of the number of FFT sample data only at MME.
- Change the [marker function](#) in the position designation window of the fine position designation function (analysis mode) so that you can record up to 30 add to.  
When there is [cue chunk](#) in the Wave file, it can be used as a marker by reading the Cue list.  
It is also possible to edit the marker list and write it as a Cue list to the original file.
- [Added a function to make the part of TrackBar expandable / contractable in response to changes in window horizontal size](#).
- [Show comment line in Spectrum display area](#). (Store up to 3 types)
- Corresponds to file performance from the command line. Multiple files are also OK.  
Automatic playing regardless of AutoPlay if only one file is played.  
(Drag & amp; Drop to icon, Corresponds to command line performance with association)
- Display the maximum time when recording to a file to 999 m 59 s Expansion to. [Ctrl + D forcibly split files](#) when recording to file.  
(Only in 2 GB division mode, it does not work in RF64 mode)

### Improvement

- Sharing internal processing of playback and recording.
- Partially separated as an external DLL. (Speeding up)
- Improved that it was in the sound skipping state when load was given by holding the window title (the same in Level Meter and Lissajous window as well in WS) with mouse with the mouse when recording. (Buffer size change)
- Speed ??up response when changing position with TrackBar.
- Improved Wave / Spectrum scale display.
- Improve the time axis display accuracy of Wave lead-out.
- Improvement method of level meter drawing.
- Improved file name display of title bar. (CompactPath)
- Change the image of [L / R button](#) slightly. (Corresponds to unevenness being difficult to see depending on the theme of the screen)
- Improved the recording method of Window size to WS.INI. (Client size)
- We recorded the version number in WS.INI and displayed the initial message + help when the version changed.  
Also, when executing for the first time, [automatic setting of drawing method](#) window is executed.
- I made my appearance a little alive. (Theme)

### [Bug fix]

- Fixed that the scale does not change even if Fs changes in playlist.
- In the performance of playlist, silence length 0 and ASIO When " Unable to create ASIO Buffer " Fixed an error.
- Playlist file to main window Fixed an error when Drag & Drop.
- Drag & Drop Fixed that playing did not stop.
- XP bug, when recording on MME, time indication 05 m 49 s (192 k / 32 bit) 07 m 46 s (192 k / 24 bit)  
11 m 39 s (192 k / 16 bit) 11 m 39 s (96 k / 32 bit) Fix to stop at 46 m 36 s (48 k / 16 bit).

### The following is a summary of the parts changed from beta version V1.49b1 (2011/09/03).

- Added ["WaveSpectra: 2" synchronization function](#) on the other tab of the setting dialog.  
It is now possible to control the operation of the second WaveSpectra: 2 at the same time by controlling it from the first and it is now possible to simply observe the spectrum of both Lch and Rch at the same time.
- In the fine position designation function (analysis mode), it becomes possible to edit the marker list and write it as a Cue list to the original file.
- Improved the sound skipping state when loading by holding the window title (the same in Level meter and Lissajous window as well in WS) with mouse with recording, etc. at the time of recording. (Buffer size change)
- Speed ??up response when changing position with TrackBar.
- Change the image of [L / R button](#) slightly. (Corresponds to unevenness being difficult to see depending on theme on screen)
- Fixed command line argument not working properly.

When associating files with WAV and double clicking on .WAV, the first time it starts up by loading the file, it fixes that it did not load the file even if double clicking after starting.

- Fixed that it could not be activated due to memory access violation in the next execution when the process was terminated with the Peak button (PeakHold) pressed in measurement mode.  
In this regard, it fixes that the settings of Peak button and Avg combo box were not reproduced at the next execution despite the setting in the INI file.
- Fixed that deadlock occurred at the time of switching setting of drawing method between measurement thread and spectral display thread in drawing method automatic setting window and hang up.
- Fixed that the waveform display shifted at the start when some devices were used with ASIO 4 ALL. (Improved playback position detector when it takes time to start) With the same cause, there was a case that the sound [the beginning part of the current position played for about 0.1 seconds](#) did not come out in the position specification window Fix.
- Fixed memory access error part in various places.

#### V1.40 (Dec. 15, 2007)

- Added playlist function. (Gapless playback support)
- Added 131072 to the number of FFT sample data.
- Blackman - Harris 7 Term, Flat top added to the window function.
- Changed display of THD, RMS every about 1 second even during operation.
- Wave Improved triggering of waveform display to take lower frequency and many waveforms.  
When the magnification is x2, the waveform of one period stops. (Up to 8192 points, up to 23 Hz at 192 ks / s)
- Changed to show Spectrum lead-out up to 0.01 dB.
- Spectrum + - 10, + - 3, + - 1 dB was added to the range of the vertical axis dB.
- Spectrum Add Norm 100, Norm 1 k, Norm 10 k to the shift of the vertical axis dB. Added setting function of arbitrary value (0 - 200 dB).
- Spectrum vertical axis Add x2, x5 to linear magnification. When recording to the file, when exceeding 2 GB, it is possible to record for a long time by separating it into separate files every 2 GB.  
We also closed regularly and made it difficult to lose the file even in case of an accident.
- Assigned keys to measurement mode buttons. Change display to measurement mode Ave - & gt; Avg.
- Through the calculation of THD + N, it excluded that it was included up to the DC component.
- Display and lead out of Spectrum doubled other than direct current. (There is no apparent change other than the DC component in the vertical axis dB display)
- Fixed a bug where the display range was only changed for the first time when opening the setting dialog, although the & amp; save range was restored in the range of horizontal axis of Spectrum, after designation, it was reproduced.
- Fixed not opening even if Drag & Drop of file during recording / playing.
- Fixed that there was sometimes noise in the waveform when playing with DirectSound.
- When recording at 192 ks / s, noise was added to the waveform, it was fixed.
- Fixed that the character display of the scale was misaligned until it was operated

when changing the number of FFT sample data and horizontal scale display magnification depending on the drawing mode in Wave waveform display.

- Fixed that dust was displayed when changing the number of FFT sample data in Lissajous waveform display.
- Fixed display data being distorted when changing the window function when paused with F32 format.
- Fix that the part outside the frame of the scale of the Spectrum graph disappeared (from V 1.30).
- Fixed that the state of the window when maximized and finished was not saved correctly.
- Changed Help to HTML Help.
- Changed the archive file to \* .ZIP.

#### V1.31 (February 22, 2004)

- Added mode to display margin on level meter.  
We also improved the display precision at a minute level.
- Added a function to simultaneously move each subwindow while keeping the relative position when moving the main window.
- Fixed a bug that could not be used at all when Windows ME / 98/95 driver is MME.  
(I made WAVE\_FORMAT\_DIRECT possible to turn on / off with WS.INI)
- Fixed a bug that the free space became zero and writing was impossible when directly specifying the network drive at the time of file writing.
- Fixed a bug where the background could not be changed properly depending on the combination of drawing methods in the Lissajous window.
- Changing how to set recording playback buffer slightly. (Improvement of more than 96 ks / s)

#### V1.30 (2003/10/04)

- ASIO, DirectSound, and WAVE\_FORMAT\_EXTENSIBLE (Only 2ch) recording / playback, IEEE\_FLOAT (32 bit floating point) It corresponds to recording in the format. (Significant remodeling of recording / playback section)
- Supports 192 kHz sampling recording. (Addition of frequency choice)  
(Playback is traditionally supported)
- Conventional (at MME), WAVE\_FORMAT\_QUERY when displaying supported format list Changed to actually open once you were inquiring with.  
(For drivers reporting lies?)
- Level meter (Peak + RMS) added.
- I made it possible to display Lissajous in a separate window.
- Wave It is possible to display even in hexadecimal when reading out.
- 0 dB of the RMS value can be switched between the case of a full scale rectangular wave and the case of a sine wave. (Conventionally only for Sin wave)
- Spectrum frequency display range can be set arbitrarily.  
(when the horizontal axis is linear display)
- Add 3 types of DirectDraw to the drawing method.
- In addition to the pause time so far, the display interval can be set with a timer.  
Also, change the initial value of pause time from 0 ms to 10 ms (about 100 fps).  
(especially since the CPU usage rate of 100% in recent high-speed CPU is useless)
- It was made possible to start up to two independently. (One in the past)
- Changed to clear the waveform at the time of normal display (when not in Spectrum 3D display or measurement mode), at the time of recording / reproduction stop.

- Added 10 dB, 20 dB, 180 dB to the dB display range of Spectrum.
- Fixed a bug that displayed threads were sometimes left.
- Fixed a bug where setting of rectangular window of window function is not saved.
- Spectrum in the setting window - Display type - 3D display Fixed a bug where it was not possible to set an arbitrary value with the slope and number of lines. Fixed a bug where the negative maximum value in the display of Wave becomes the maximum positive value.
- Depending on the environment, avoiding occurrence of zero divide error when selecting wave mapper is avoided.
- Other, minor modifications and changes.

#### V1.20 (2000/01/25)

- Supports 24 bit, 32 bit Wave format.  
Change the composition of the buffer accordingly.
- Extends the number of FFT samples to 65536.
- Blackman-Harris (4 Term) was added to the window function.
- Expands Spectrum Amplitude range to 40 to 160 dB.  
(However, the step is 20 dB interval)
- screen copy (Ctrl + C) function added.
- Added a function to automatically play without pressing the play button after opening or dragging and dropping a file.
- Added the function to specify the playback / recording device and display function of the usable format. (Change of setting dialog tab for that)
- Even if it is not in the usable format at the time of playback, or when there is no playback device, it works only in position fine designation mode. (Offline mode)
- Fixed that the FFT operation ended when setting the position setting window to be displayed in the pause during playback, and sometimes did not resume when pause was canceled.
- Fixed that there was a case that response of Spectrum display to Wave afterward was delayed a little more than before when releasing pause during recording.
- Fixed a bug that once device open error occurred in playback / recording, it was not reset unless restarted after that.
- Fixed a bug that caused general protection error in Wave file with large dummy chunk before data.
- Other, minor modifications and changes.

#### V1.11 (1999/06/19)

- WAVE file When pausing while playing, with respect to position change by track bar, Spectrum It is made to follow even in 3D display.  
(Analysis position fine designation function)
- When pushing the play button of the WAVE file with the shift key, it started from the pause state.  
(Analysis position of short file that does not make play & pause in time) Because of the fine designation function)
- Allow the position fineness setting button to remain on, and when pausing the position setting window that disappeared at the time of releasing the pause I let it always be left out.
- When pushing the record button with the shift key, temporarily set it to the mode opposite to the current recording mode.
- Other, minor modifications and changes.

### V1.10 (June 13, 1999)

- Spectrum 3D display addition added.
- Wave Added Lissajou display.
- Added measurement mode.  
Peak hold waveform, average waveform, lead out, overlay (with load, save), THD (+ N), S / N, RMS
- Configuration change of the setting dialog.  
Change / extension of input method of input / recording.  
Also change the fps display so that it is always displayed in the main window.
- Wave / Spectrum display was also tracked for position change by track bar at pause during WAVE file performance.  
In addition, the addition of a function that specifies an arbitrary position precisely by sample number and elapsed time. (2 markers are also available)
- Acceleration of FFT calculation. (FFT part is about twice)  
(Stereo was used for simultaneous display properly for Mono)
- Improve the accuracy of graph display.
- Added mode for displaying peak only when Spectrum graph is displayed.
- Spectrum dB Added Normalize mode that always sets the maximum value to 0 dB for display shift.
- Spectrum amplitude Change the interval of the range of dB display to 10 dB interval.
- Save the window ratio of Wave and Spectrum. Press the
- key to move the space key during play / recording Change to pause function.  
Stop, in addition to the conventional Ctrl + S, ESC key Also added.
- Changed the color set default to set 3 (oscilloscope style).
- Corresponds to WAVE file of illegal header which some software makes.
- Other, minor modifications and changes.

### V 1.02 (Dec. 9, 1998)

- Display speed is increased by up to 20%.
- 20 added to the enlargement ratio of Wave display.
- Auto mode added to automatically correct degradation due to window function when Spectrum dB is displayed.
- Fixed that it was not possible to start up with NT.
- Every time I repeat starting / ending on NT, it is written in WS.INI Fix that comment lines of ColorSet 1 are increasing more and more.
- Fixed that 16-bit WAVE format could not be displayed properly depending on sound card.
- Fixed that once you moved the track bar, you can no longer enter the key.
- Fixed bug of display of Spectrum lead-out less than 1 dB.
- Other, minor modifications and changes.

### V 1.01 (Nov 11, 1998)

- Renamed WaveSpectra because of software of the same name.  
(Wave series, maybe rather good (^ \_ ^))
- I made it possible to lead out (value reading). (Pausing)
- Use of DirectDraw (V.Blank check), Wave, Spectrum It was divided into both.  
Change the name of
- " display delay " to " display pause time "
- Name change in WS.INI with the above two.

- Fixed the case where the main window was closed and an access violation occasionally occurred before the calculation display thread completely stopped when forced terminating during calculation display.
- Fixed that it was canceled that it was supposed that you were pressing the setting button when you exit with the setting dialog open.
- I forgot the version / copyright indication (^ ^;
- Other, minor modifications and changes.

V1.00 (1998/10/30) WinSpectra

---

---

Created with the Personal Edition of HelpNDoc: [Full-featured Help generator](#)

---