

Filter Hose

User Guide v 1.4.2



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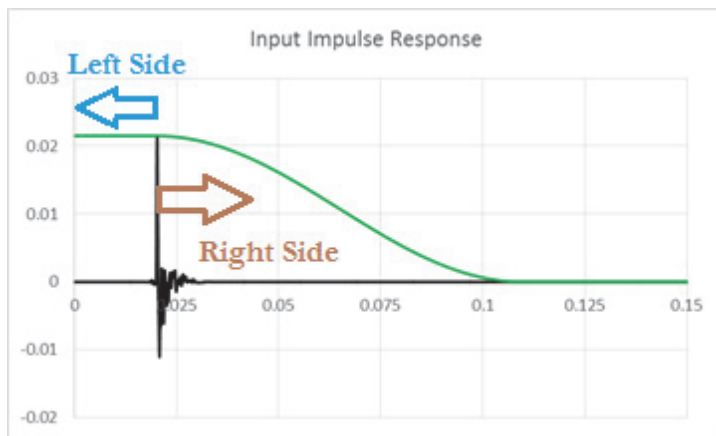
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Feature

- ✓ Easy and quick to create FIR filter based on measurement
- ✓ Create asymmetric FIR, linear-phase FIR and minimum-phase FIR
- ✓ Multi-Zone Time Windows (MZTW) to clean input impulse response (IR)
- ✓ Compatible with EASERA, Systune, ARTA, Room EQ Wizard and Smart ASCII file format
- ✓ Five filter target presets: flat magnitude only (linear or minimum phase), flat phase only (phase = 0), flat magnitude & flat phase (phase = 0), and minimum phase (phase = min.)
- ✓ Export filter coefficient in *.csv, *.wav, MiniDSP text file
- ✓ Numerical data format converter
- ✓ Manual frequency domain data input [RTA data, log-spaced frequency domain data, sample rate conversion]

Notes

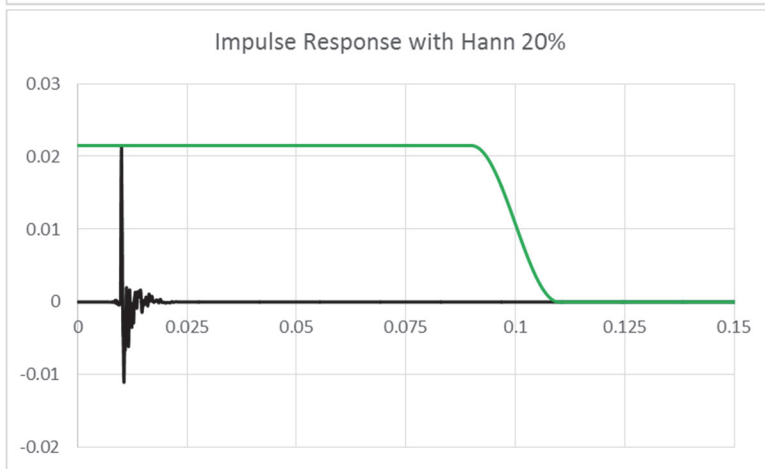
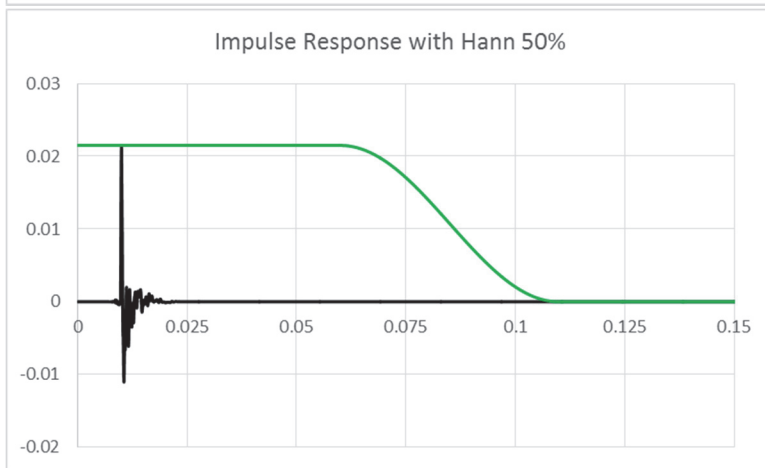
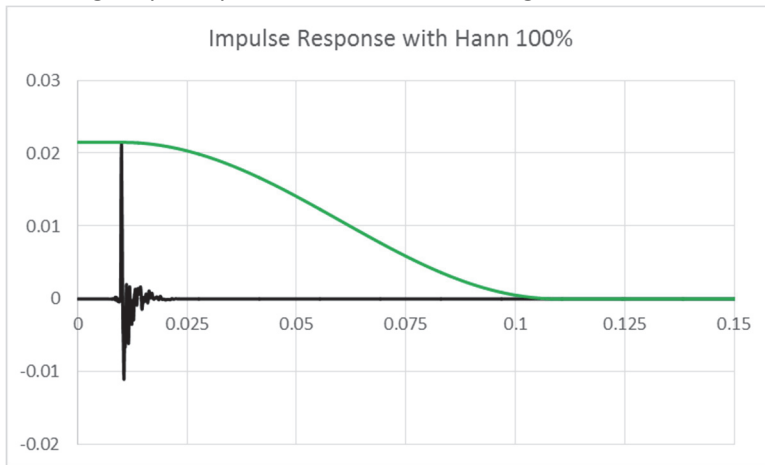
- ✓ Output and filter sample rate depends on the input sample rate. Sample rate conversion can be done from manual input data (under advance menu).
- ✓ Windowing for input IR (including multi-zone time windows) is performed at the right half side only, with IR peak auto detected.



- MZTW starts at 0.5ms [short] and 1ms [medium & long] after the IR peak.
- Hann 50% window always start at the IR peak.
- The left half side of the window is rectangular.
- ✓ MZTW suggested application:
 - Long: Fits perfectly to clean up a ground plane measurement in a very large room or outdoor area. For venue tuning application, this allows early reflections to be included in the IR.
 - Medium: For general use.
 - Short: For creating loudspeaker correction where good measurement is not possible due to limited room size.
 - Room: For creating room compensation EQ, where the minimum length of the window at high frequency is 20ms (>5000Hz), and wider at lower frequencies. This window will include early reflections.
- ✓ Maximum filter tap depends on the input IR length (N) unless the filter is loaded from step 2.
- ✓ Wave file export is fixed @ 8, 16 and 24 bit and float @ 32 and 64 bit. *Filter gain may change due to normalization.*

Notes cont'd

- ✓ Windowing percentage illustration and comparison
Hanning, impulse peak = 10ms, window length = 100ms



Compatibility and Known Issues

Windows XP, vista, 7 and 8

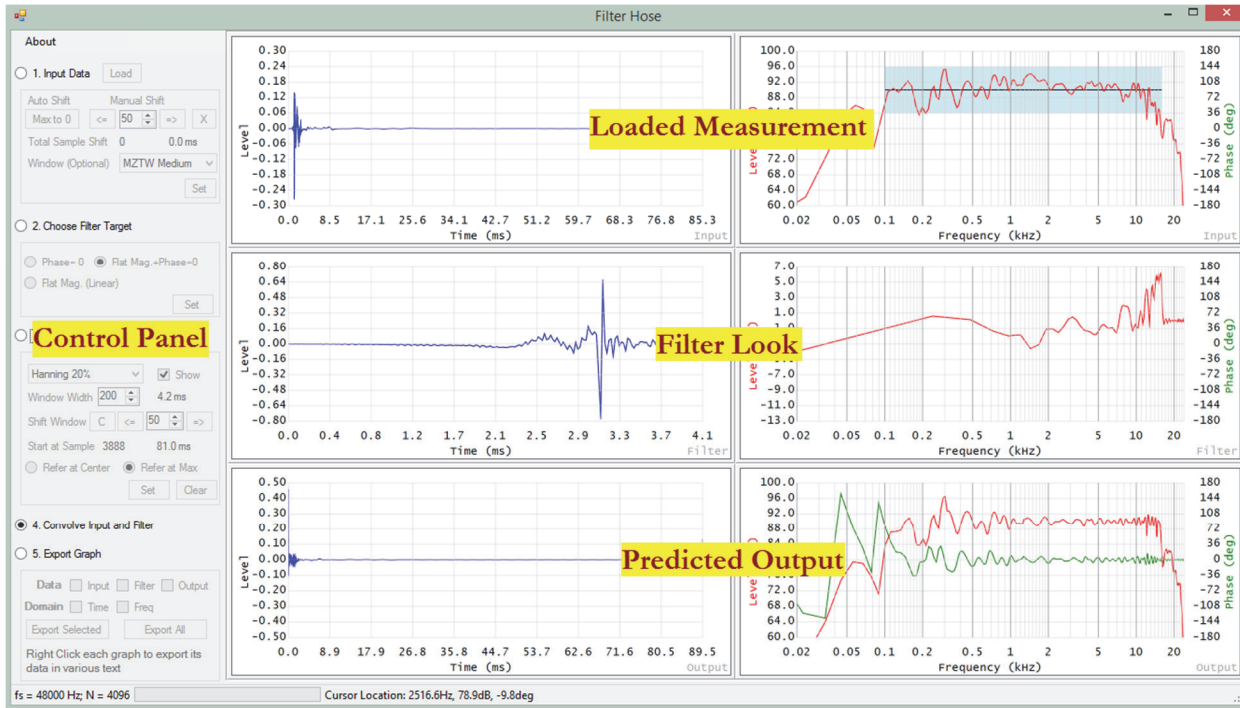
Region and Language of the Operating System: English (USA)

Requires Framework 4.0 Client

Recommended display resolution: 1280 x 800 or higher

Navigation

Understanding Filter Hose User Interface



The Five-Step Control Panel

About Advance

1. Input Data 1

Auto Shift Manual Shift

5

Total Sample Shift -911 -19.0 ms

Window (Optional)

2. Choose Filter Target 2

3. Set Filter Window 3

Show

Tap Length 512

Shift Tap 24

Start at Sample 16113 335.7 ms

Refer at Center Refer at Max

Smooth Filter FR

4. Convolve Input and Filter 4

Max to 0

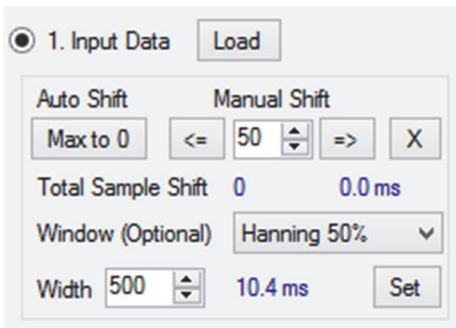
5. Export Graph 5

Data Input Filter Output

Domain Time Freq

Right Click each graph to export its data in various text formats

1. Input Data
Direct load measurement data and provide basic editing such as windowing and cyclic shift. Manual data input can be done via Advance menu – Manual Input.
2. Choose Filter Target
Choose from five filter target presets, or load a csv file.
3. Set Filter Window
Define the FIR tap and provide basic time domain editing.
4. Convolve Input and Filter
Calculate the convolution of input IR and filter.
5. Export Graph
Group export graphs in Filter Hose user interface.



Click **Load** button to load measurement file.

Max to 0 button will cyclic shift the IR so its peak is at 0ms. Please note that the impulse should not be cut off at 0ms. Use Manual Shift to make sure the whole IR is located after 0ms.

Manual Shift will cyclic shift the IR based on the selected interval (in sample). If the IR is cut off at 0ms, it needs to be shifted to the right. The **X** button will clear all shift performed by Filter Hose.

Window (Optional) drop down list contains four different windows to clean up the input IR. Please see the Notes section of the user guide (page 2) for more information. If Hanning 50% is chosen, user is able to define the total window width, relative to the IR peak. The **Width** input value is in sample.

Please click **Set** button to apply the window.

Filter Hose provides five filter target presets:

Phase = 0 will flatten the phase response of the input data close to 0 degree. Ideally, the magnitude is unchanged, but depending on the property of the filter, it may be affected.

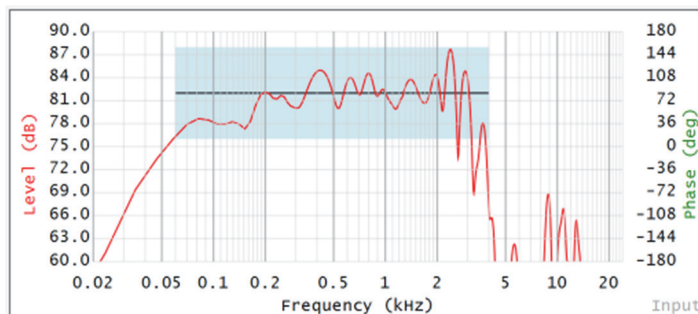
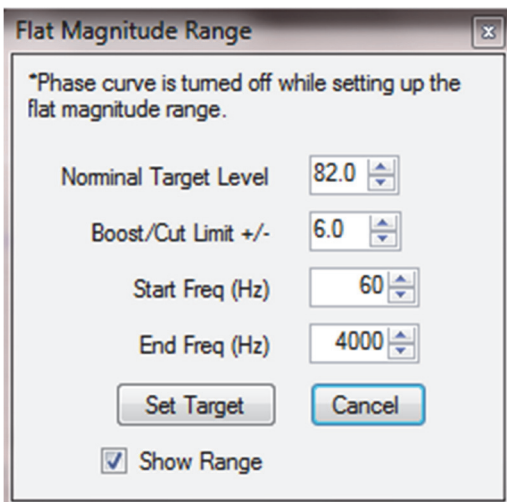
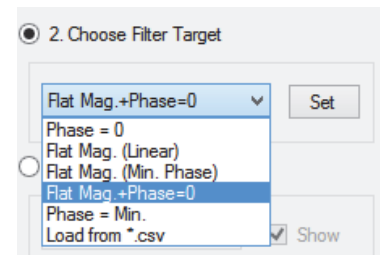
Flat Mag. + Phase = 0 will flatten the magnitude and phase of the input data close to a flat line and 0 degree respectively. The actual result depends on the property of the filter.

Flat Mag. (Linear) will flatten the magnitude of the input data. Ideally, the phase is unchanged, but depending on the property of the filter, it may be affected.

Phase = Min. will create minimum phase from the input data based on its magnitude. Ideally, the magnitude is unchanged, but depending on the property of the filter, it may be affected.

Flat Mag. (Min. Phase) will flatten the magnitude of the input data. The filter is a minimum-phase FIR filter.

Load from *.csv allows user to load a .csv filter file.

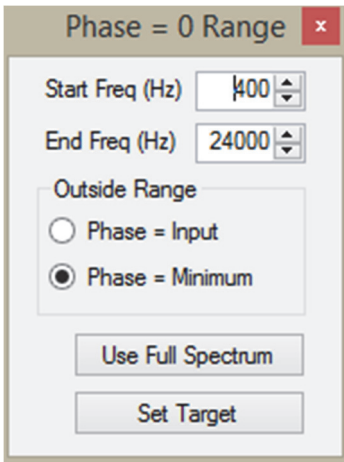


If **Flat Mag. + Phase = 0**, or **Flat Mag. (Linear)**, or **Flat Mag. (Min. Phase)** is selected as filter target, **Flat Magnitude Range** window will pop-up.

Magnitude response will be flattened to the **Nominal Target Level** as long as it is within the **Boost/Cut limit**. Please make sure the light blue rectangle covers your desired magnitude range before clicking **Set Target**. If the Y-axis is in dBFS, most likely user needs to input a negative value.

Start Freq and **End Freq** determine the frequency range to flatten.

All parameters are visualized as a black line and a light-blue rectangular, overlapping the magnitude response curve.

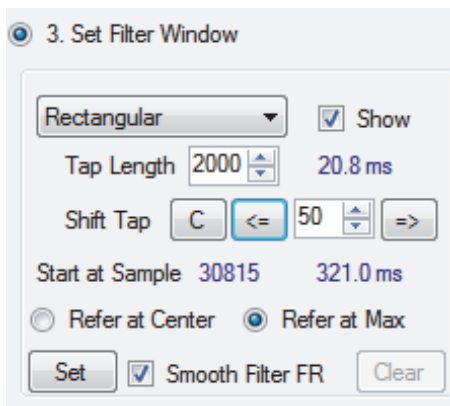


If **Flat Mag. + Phase = 0**, or **Phase = 0** is selected as filter target, **Phase = 0 Range** window will pop-up.

Start Freq and **End Freq** determine the frequency range for the target phase = 0.

Outside Range determines the target phase for the extreme low (0 Hz – start freq) and extreme high (end freq – fs/2). User is able to choose minimum phase (**Phase = Minimum**) or original phase (**Phase = Input**).

Use Full Spectrum will input the lowest and fs/2 frequency in the start/end freq range. This option will ignore **outside range** phase target since the whole spectrum target phase will be 0 deg. Note: Prior to v1.3, Filter Hose always calculate the whole spectrum for Phase = 0 target.



The **Window** drop down list contains several window presets to taper the filter's tails.

Show check button will toggle the tap area display on and off.

Tap Length determines the filter tap length. The input value is in sample.

Shift Tap will cyclic shift the filter tap location. The input value is in sample.

C button will center the tap selection to the peak of the impulse.

Note: Selecting appropriate tap location is the most important step of creating FIR filter. Failure to do so will result in a bad FIR filter.

Select **Refer at Center** to use the center of the tap area as the left and right window dividing point.

Select **Refer at Max** (default) to use the peak sample of the tap area as the left and right window dividing point. This is the recommended choice for general use.

Check **Smooth Filter FR** to lengthen the filter's N so that the frequency response display is smoother (finer frequency domain resolution curve).

Set button will apply the window and tap selection to finalize the FIR filter. Click **Clear** button if the user wishes to experiment other window or tap settings.

4. Convolve Input and Filter

Max to 0 Fast Calculation

This step convolves the input IR and the filter IR in time domain. Then, frequency response is calculated using DFT/FFT, based on the new calculated IR. **Note: DFT requires significantly longer process time if input IR and/or filter has N larger than 8192.**

To use FFT, please select **Fast Calculation** (by default). To use DFT, please unselect **Fast Calculation** (more accurate result). FFT or DFT choice only affects the frequency domain data.

If **Max to 0** checkbox is selected, the peak of IR will automatically cyclic shifted to 0ms (by default).

5. Export Graph

Data Input Filter Output

Domain Time Freq

Export Selected

Export All

Right Click each graph to export its data in various text formats

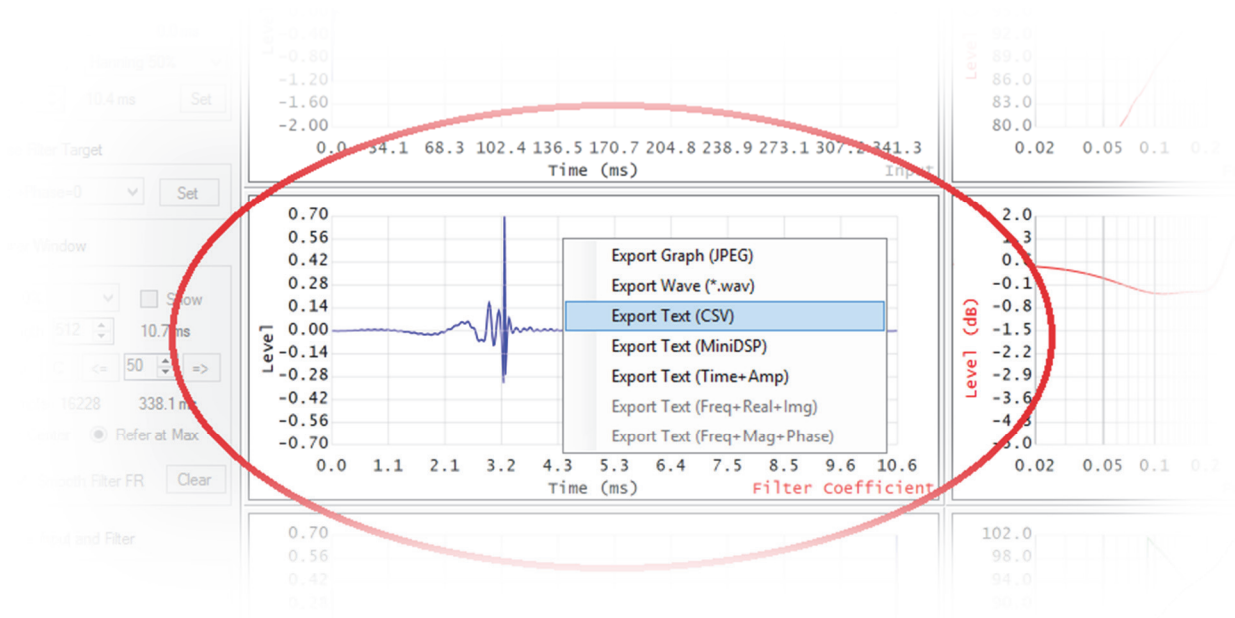
This step allows user to group export the six graphs shown in Filter Hose. Right click each graph to export its data in various text formats.

Mouse Navigation on Each Graph

- ✓ **Right-Click:**
Show the export menu
- ✓ **Control Right-Click:**
Pop up the property window
- ✓ **Control Left-Click + drag:**
Horizontal zoom in
- ✓ **Double Left-Click:**
100% zoom out

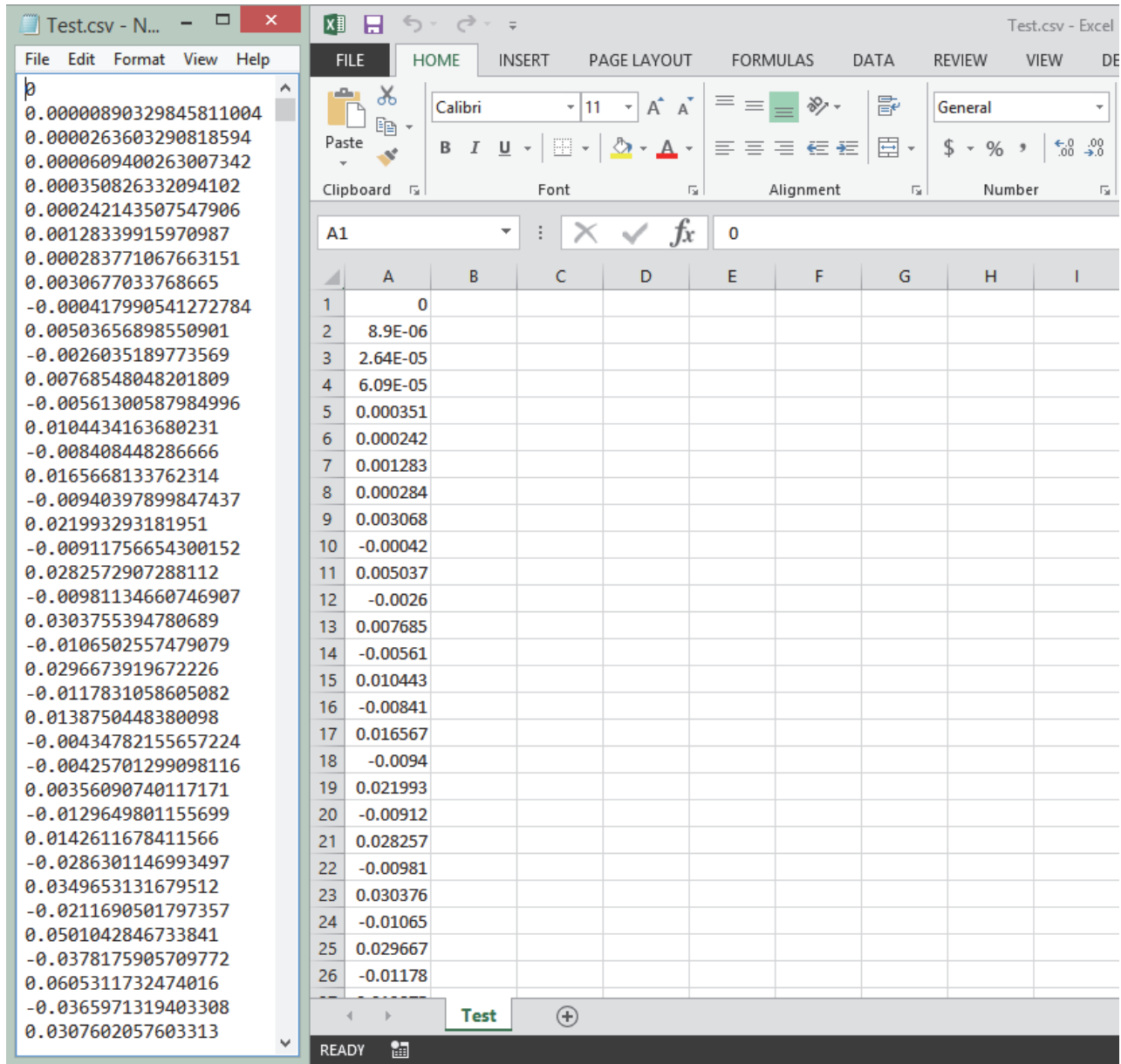
Exporting FIR values

Right-click on the time-domain filter graph ('middle left graph' - as shown below)



.csv File Format

The .csv file format that Filter Hose recognizes follows the following screenshot.



Note:

1. Comma is not used as separator.
2. For countries that use comma for expressing a decimal, please change to the English region and language setting in the operating system.

Advance Menu

In Filter Hose v1.2 and newer, advance menu is introduced.

Send Filter to Input

When a filter is already generated, this function enables user to send the filter (time domain) to the data input. This is useful when creating a mixed phase FIR filter. A similar way can be done by saving the filter as a .csv file and loading it to the data input. Please see the section on Importing a Filter Transfer Function in this user guide.

Half Input N

This function shorten the data input N by eliminating the last half and the function works for $N > 1024$. Please make sure the impulse is not chopped incorrectly by shifting the peak to near beginning.

Tips on shortening Input N

Several software (such as room EQ wizard) collects long impulse response and may cause Filter Hose “not responding”. To shorten the data input, please follow the steps below

1. Load a data (assuming $N > 64k$).
2. Click on Max to 0
3. Cyclic move the impulse at least 50 samples to the right (to avoid the impulse getting chopped).
4. Use Advance – Half Input N function about two or three times to shorten the impulse length.

It is recommended to work with impulse response with $N \leq 32k$ to avoid slow response of the program.

Smooth Input

This function will smooth the input data to approximate the 1/3 octave smoothing.

Filter Gain

User is able to set gain compensation for the FIR filter. This gain will be included after the Set button in step 3 is clicked. If a FIR is already created but a gain compensation is required, please set the desired gain, click Clear in step 3 and click Set in step 3.

Manual Input Data

Clicking this function will pop-up a new window as shown on the left. This window enables user to:

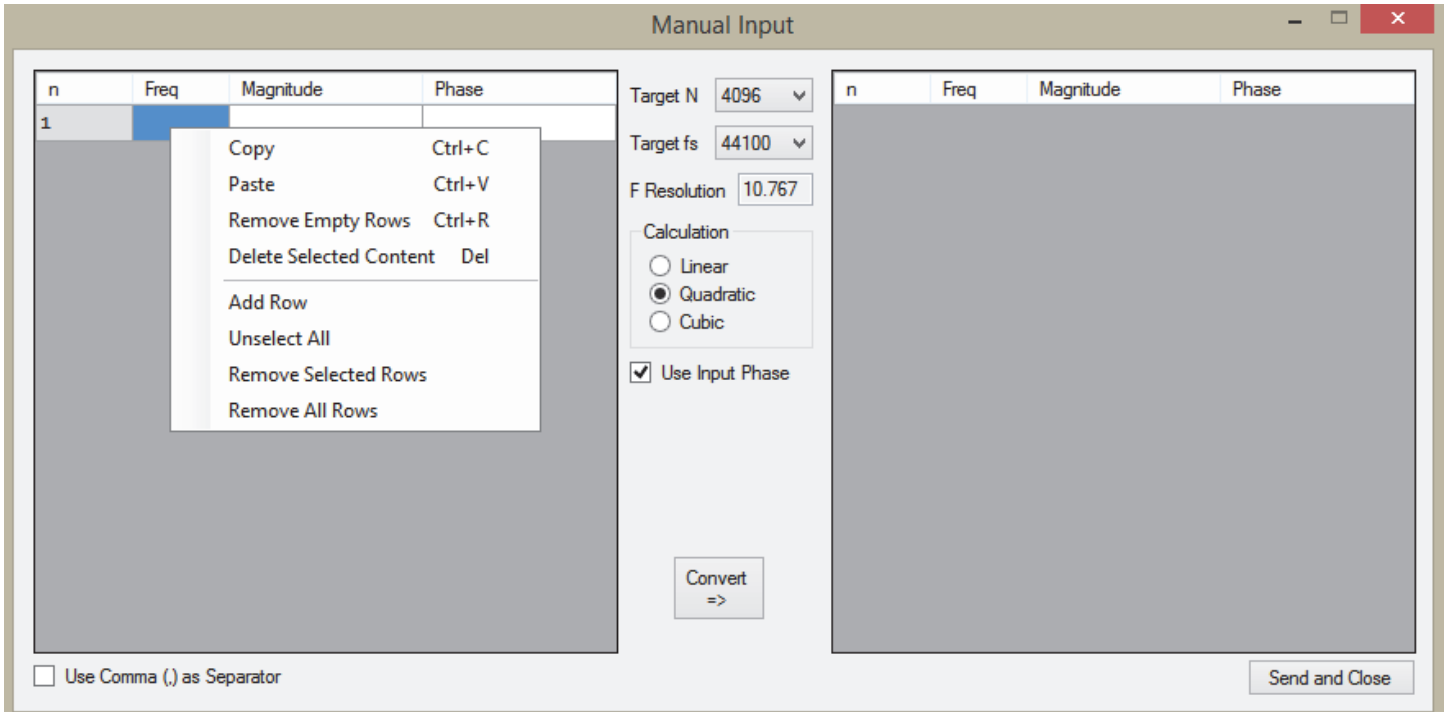
- ✓ Load RTA data
- ✓ Load log-spaced frequency domain data
- ✓ Do a sample rate conversion

The user input is located on the left table. User is able to copy-paste text/ASCII data from notepad or Excel or other similar software. It accepts log or linear frequency domain data.

By unchecking **Use Input Phase**, Filter Hose offers two options on how the phase will be calculated: minimum phase (calculated from the magnitude data) or phase = 0 deg. This is required to create a phase curve from RTA data, or if user wish to overwrite the current measured phase data.

Please define the target sample rate (fs) and N before clicking **Convert**. The new data set will be transferred to the main Filter Hose window by clicking **Send and Close**.

The pasted data on the left table may contain rows that are not acceptable to Filter Hose. Please use right click on the row to perform editing. Several editing options can be seen below.



Note:

1. **Target N** refers to time domain data N , therefore the right table data will contain half of the selected target N value.
2. **Manual input** always perform interpolation to create a new (linear frequency) data set. Direct load (from Step 1) imports the data without any changes.

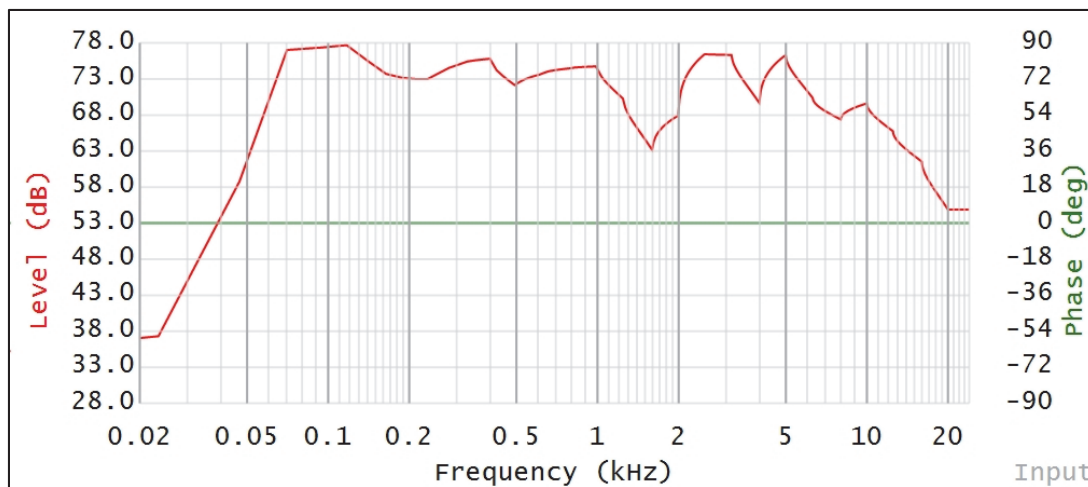
Manual Input Example – Loading RTA data

The screenshot shows the Filter Hose software interface. A 'Manual Input' dialog box is open, allowing for manual entry of RTA data. The dialog contains two tables of data:

n	Freq	Magnitude	Phase
1	16.0000	32.1721	0.000
2	20.0000	33.3393	0.000
3	25.0000	37.9616	0.000
4	31.5000	46.5420	0.000
5	40.0000	49.3801	0.000
6	50.0000	59.9069	0.000
7	63.0000	71.9964	0.000
8	80.0000	78.8461	0.000
9	100.000	77.0346	0.000
10	125.000	70.2007	0.000
11	160.000	74.0281	0.000
12	200.000	73.0163	0.000
13	250.000	73.0276	0.000
14	315.000	75.1697	0.000
15	400.000	75.8267	0.000

The dialog also shows settings for Target N (2048), Target fs (48000), and F Resolution (23.438). The 'Calculation' section is set to 'Quadratic' and 'Phase=0'. A 'Convert' button is visible at the bottom of the dialog.

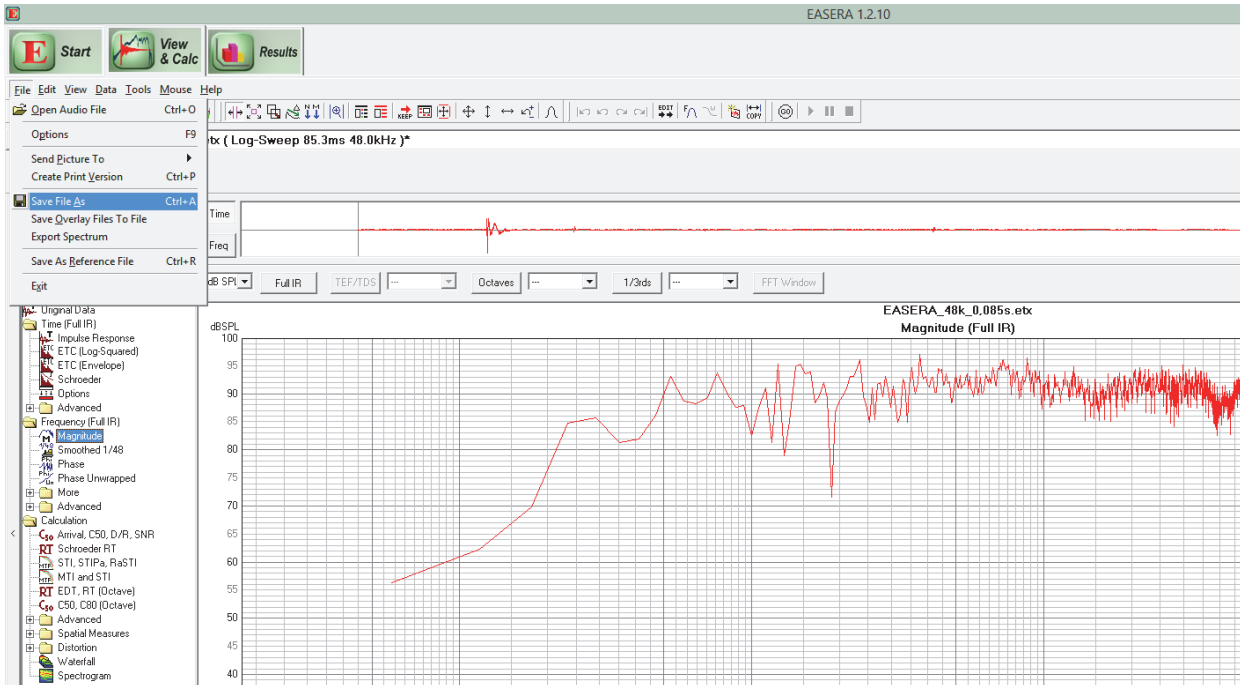
An RTA data is copy pasted from notepad. The data is transferred without phase information, and filter hose is inputting phase = 0. To do this, please unclick **Use Input Phase** and select the desired option. The input result can be seen below (48kHz sample rate, N=2048).



Direct Import ASCII Measurement File

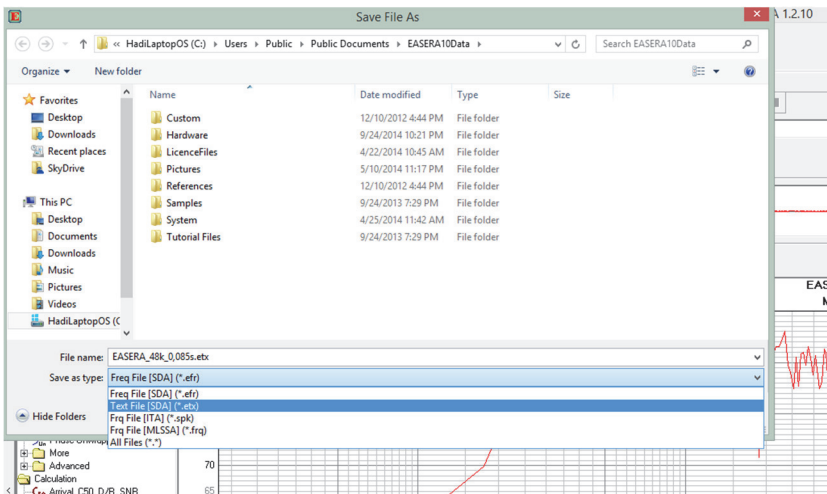
EASERA .etx file

Filter Hose is able to load time and frequency domain EASERA .etx files. The example below is in frequency domain.



Click **Magnitude** on the left panel

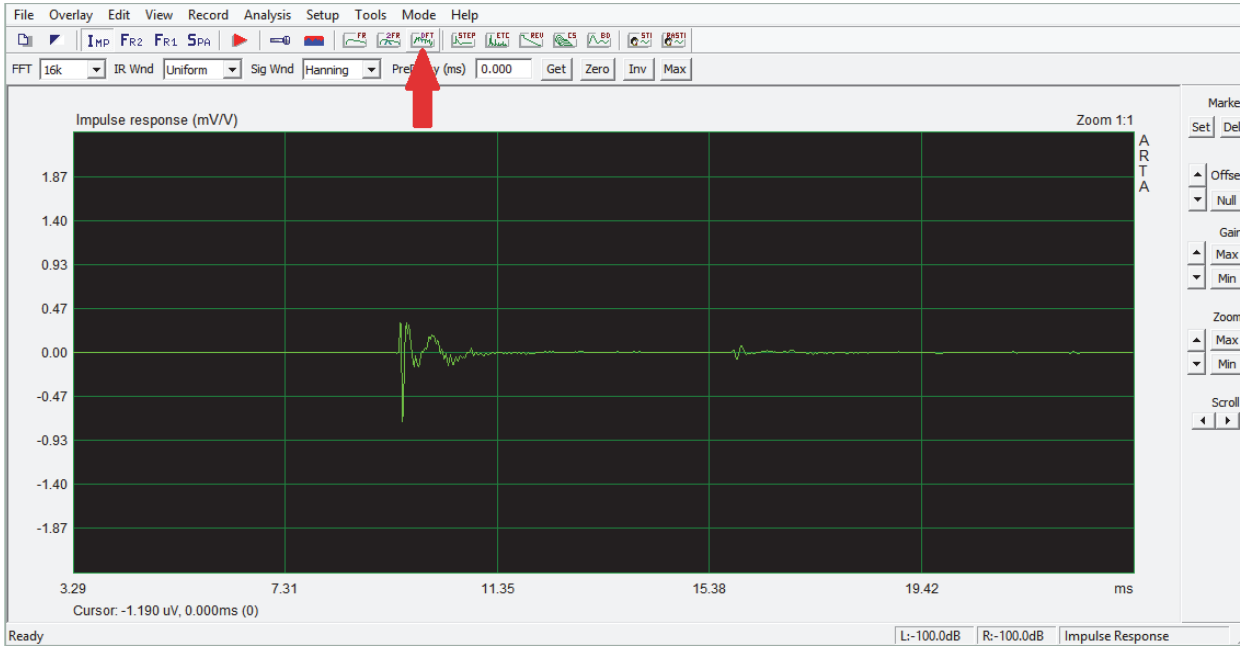
Click **File – Save File As**



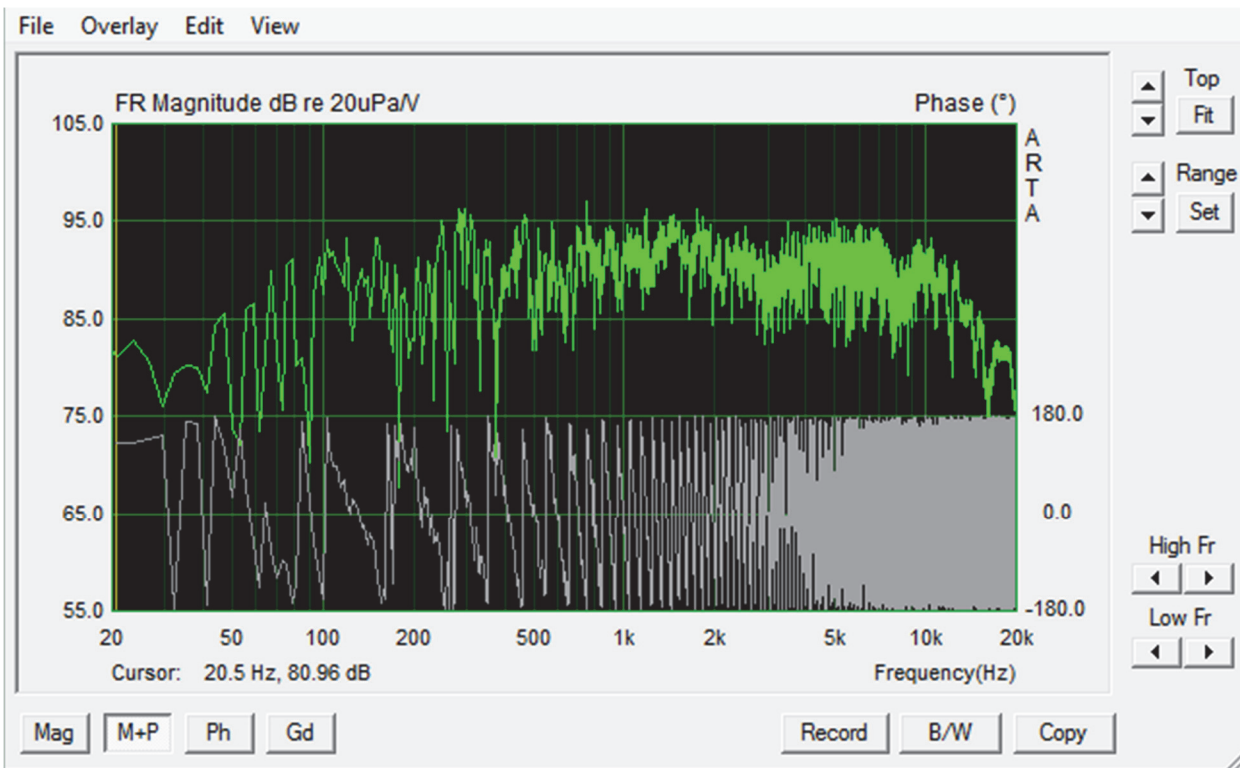
Select Text File *.etx from the drop down menu

ARTA .txt file

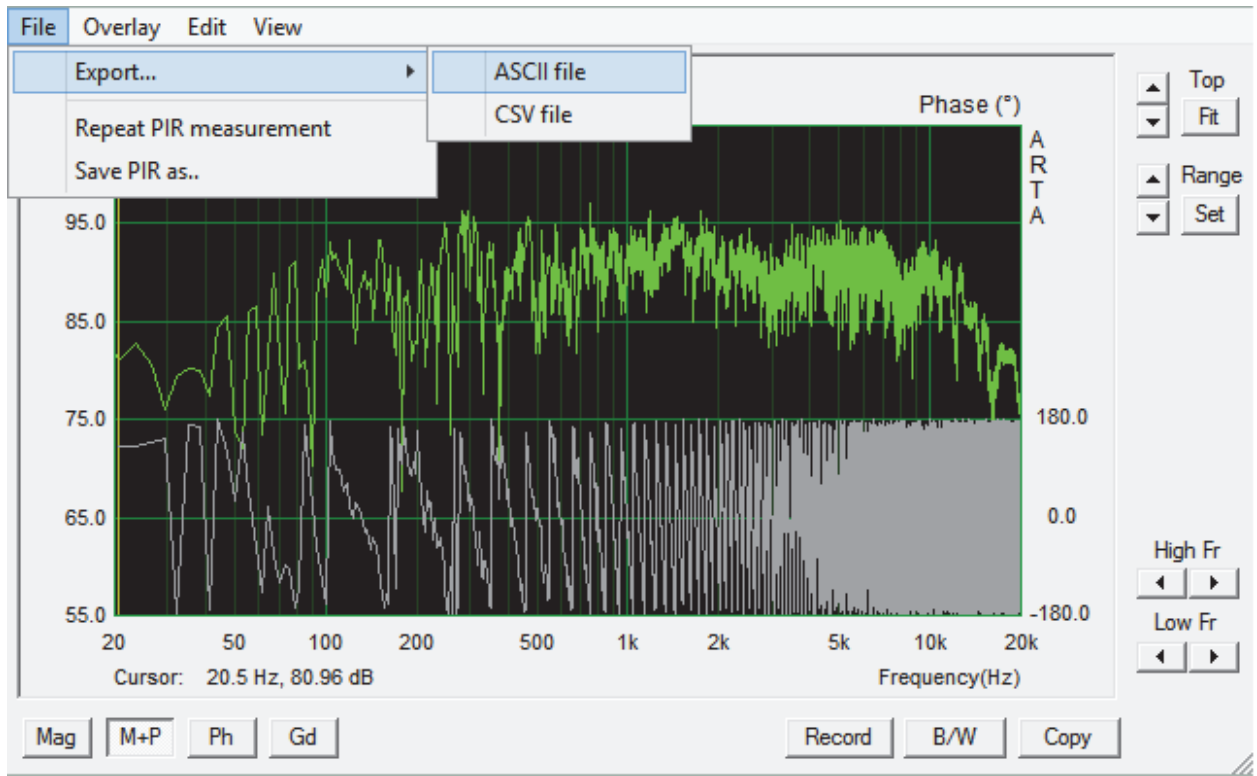
Click **DFT** (unsmoothed FR)



Make sure magnitude and phase are both shown by clicking **M+P** button

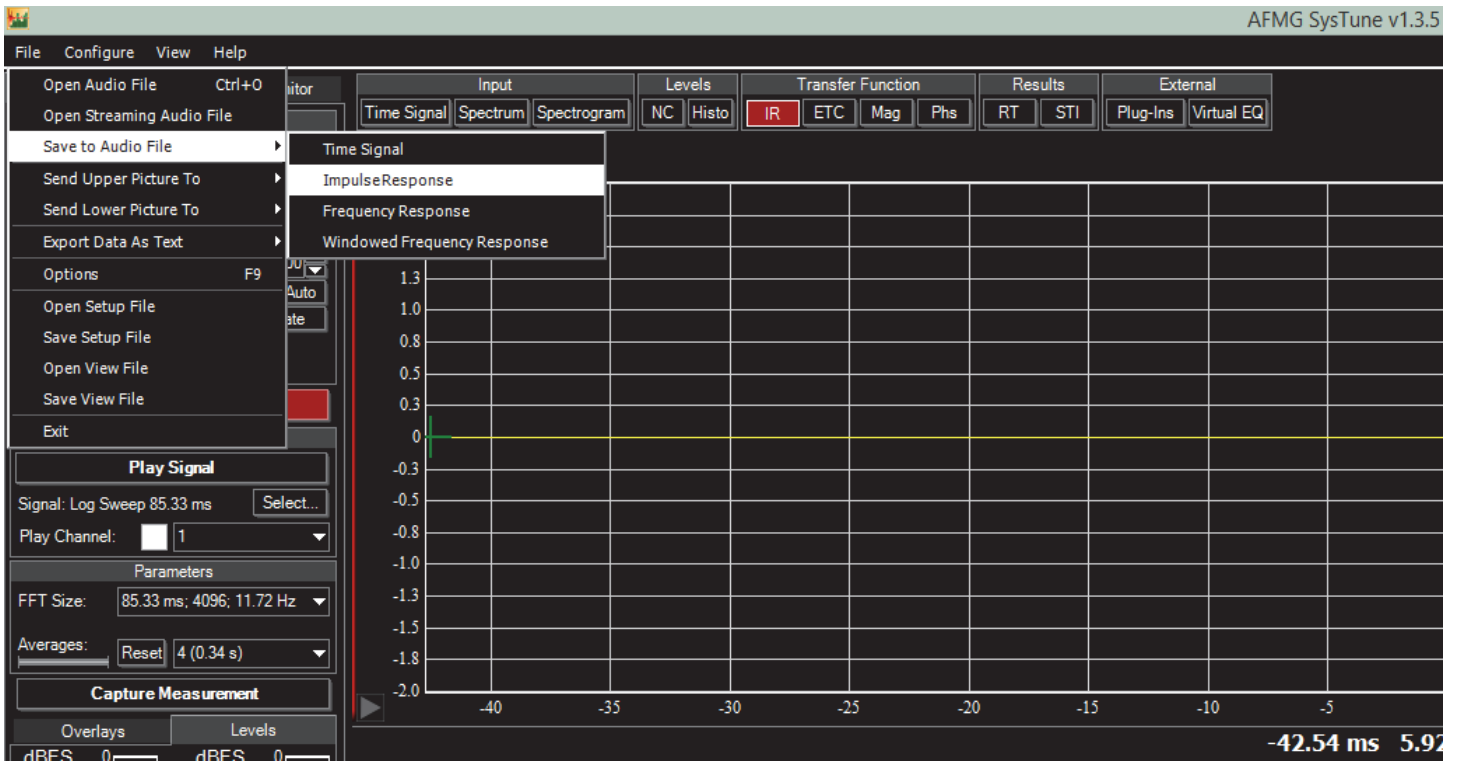


Click **File – Export – ASCII file**

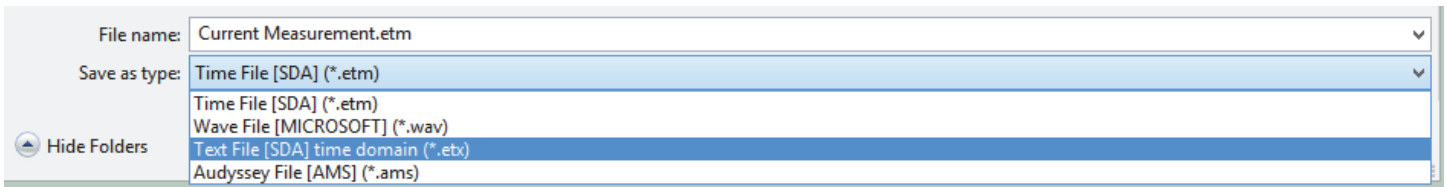


Systune .etx file

Click **File – Save Audio As – Impulse Response** to create an .etx file from Systune. We recommend using Systune’s time domain etx data format.



From the file dialog, select *.etx.



In Filter Hose, please use EASERA *.etx file type to import the file.

Smart 7 .txt file

Click **Measurement Config** and switch the MTW to a FFT size.

The screenshot shows the Smart software interface. The 'Options' menu is open, and 'Measurement Config...' is selected. The main window displays a frequency response plot with Magnitude on the y-axis (ranging from -36 to 6) and frequency on the x-axis (logarithmic scale from 30 to 10k). The right-hand panel shows the 'UR44 Input 1' level at 0.0 dB SPL Slow, with various measurement controls like 'Spectrum', 'Transfer', and 'Impulse'.

The screenshot shows the Smart software interface with the 'Measurement Config' dialog box open. The dialog box has a tree view on the left showing 'All Groups' with 'Spectrum', 'Transfer Function', and 'Default TF' expanded. The 'Default TF' section contains a table with the following data:

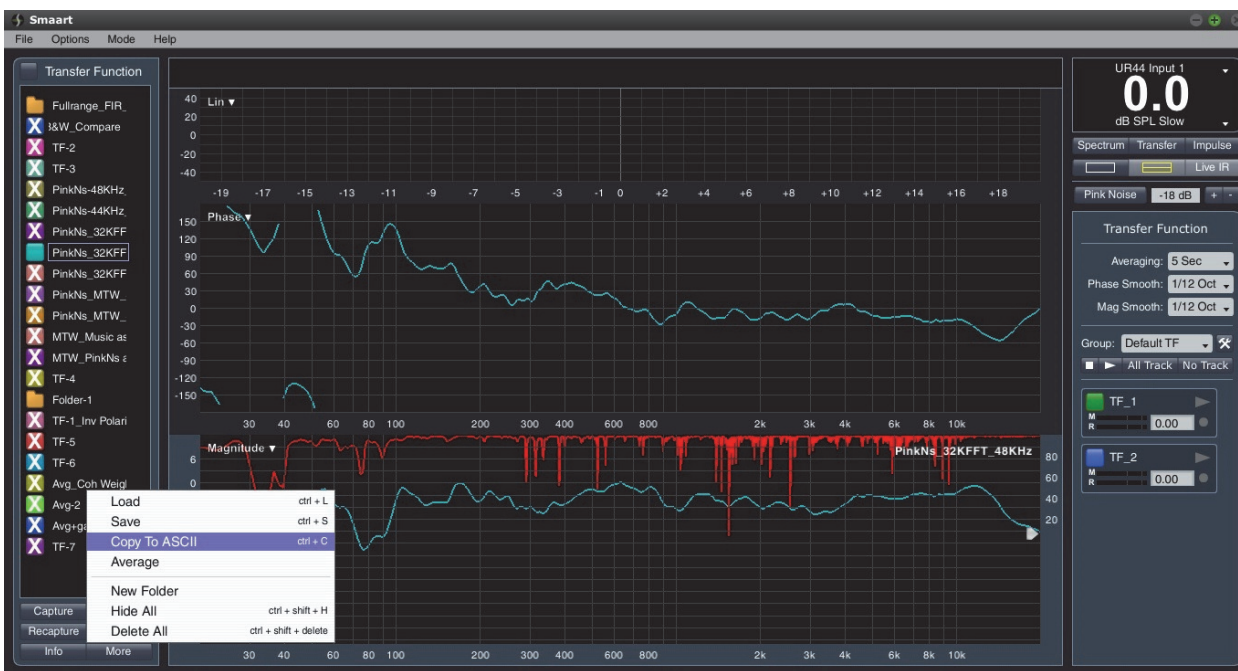
Group	Avg	Type	Color	dB +/-	Name	Delay	Mea Ch	Ref Ch
TF_1	Pair		Green	0	TF_1	0.00	UR44 Input 1	UR44 Input 4
TF_2	Pair		Blue	0	TF_2	0.00	UR44 Input 1	UR44 Input 2

Below the table are buttons for 'Delete', 'New TF Measurement', 'New Average', and 'Clear All dB Offsets'. The 'Global TF Settings' section includes: FFT: MTW (selected), Phase Smoothing: 1/12 Oct, Mag Threshold: -70 dB, Averaging: checked, Mag Smoothing: 1/12 Oct, Blanking Threshold: 5%, Mag Avg Type: 32k, and Weighting: None. The 'OK' button is at the bottom right.

Another way to open **Measurement Config** is to press the tool button as shown below:



Click **More – Copy to ASCII**

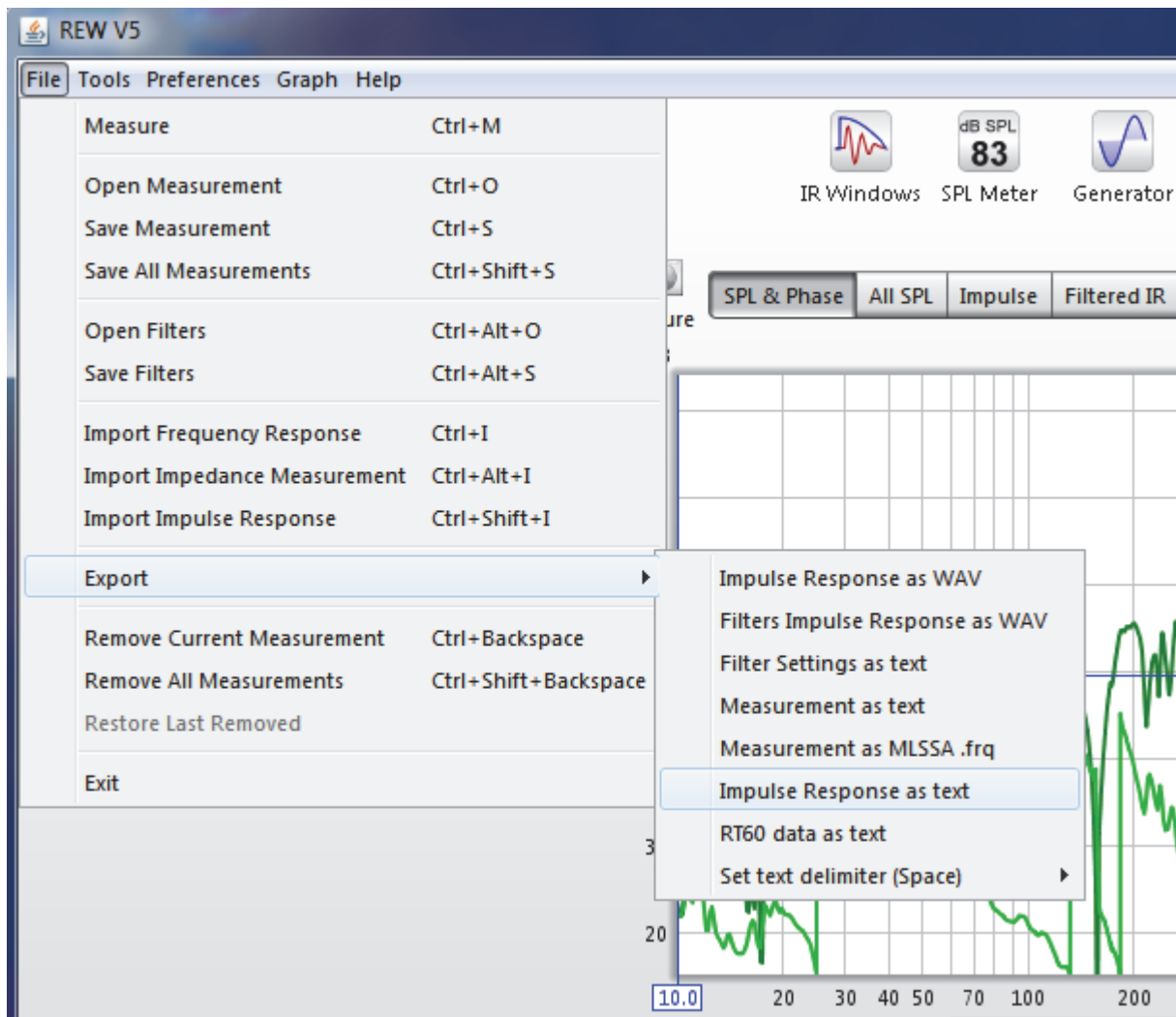


The values are stored in the clipboard. Open Notepad to paste in the values, and save as a new text file (*.txt).

Room EQ Wizard (REW) v5.00 .txt file

Click **File – Export – Impulse Response as text** to create a compatible txt file for Filter Hose use.

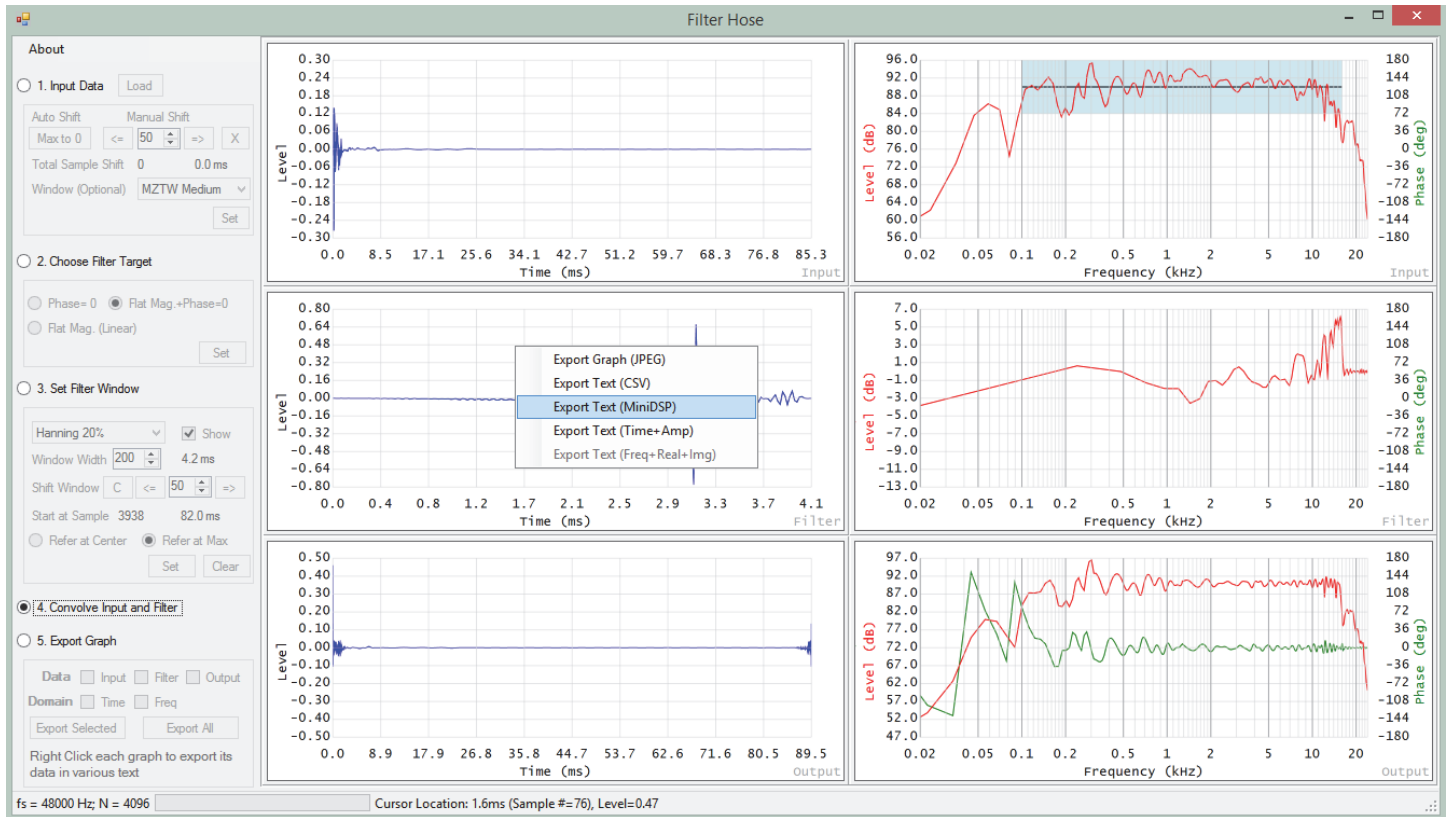
Please note that REW impulse length is default to $N > 64k$. Upon loading the txt file to Filter Hose, it is recommended to use **Advance – Half Input N** to shorten the impulse length at least to $N \leq 32k$. Please see “Tips on Shortening Input N” section in the user guide.



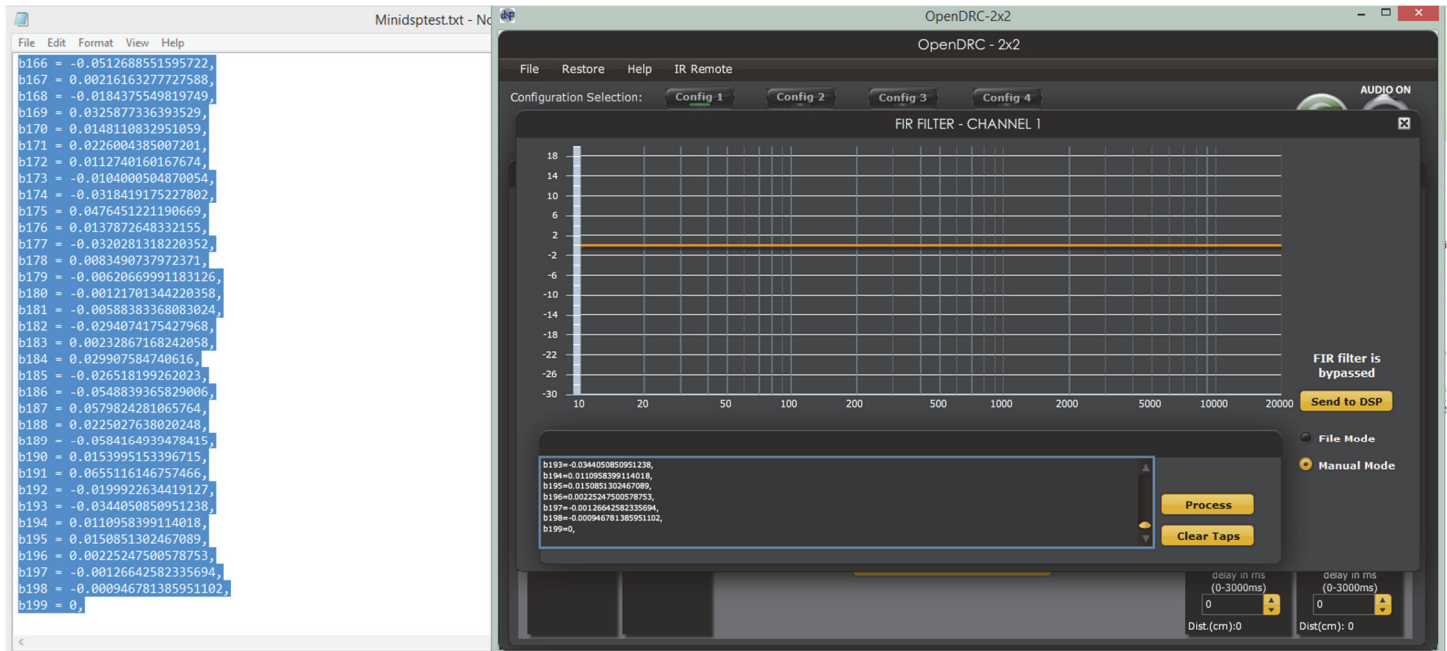
Export to MiniDSP

Filter Hose is able to export coefficient to MiniDSP OpenDRC plugin.

Right-click on the time-domain filter graph and select **Export Text (MiniDSP)**.



Open the text file in Notepad; copy all text to MiniDSP input. Please make sure that MiniDSP is in manual mode and its previous filter taps are cleared (click **Clear Taps** button).



Click Process

The screenshot shows the OpenDRC-2x2 software interface. At the top, there is a menu bar with 'File', 'Restore', 'Help', and 'IR Remote'. Below the menu bar, there are configuration selection buttons for 'Config 1', 'Config 2', 'Config 3', and 'Config 4'. The main window title is 'OpenDRC - 2x2'. The central part of the interface is a graph titled 'FIR FILTER - CHANNEL 1'. The graph has a logarithmic x-axis representing frequency from 10 to 20,000 Hz and a linear y-axis representing magnitude from -30 to 18 dB. An orange line shows the filter's response, which is relatively flat around -10 dB until about 100 Hz, then rises to a peak of about 2 dB between 200 Hz and 500 Hz, and then fluctuates between -2 dB and 6 dB up to 20,000 Hz. To the right of the graph, there is a status indicator 'FIR filter is bypassed' and a yellow 'Send to DSP' button. Below the graph, there is a text area containing the following coefficients:

```
b193 = -0.0344050850951238,  
b194 = 0.0110958399114018,  
b195 = 0.0150851302467089,  
b196 = 0.00225247500578753,  
b197 = -0.00126642582335694,  
b198 = -0.000946781385951102,  
b199 = 0.0,  
b200 = 0,
```

Next to the text area is a vertical slider and two yellow buttons: 'Process' and 'Clear Taps'. At the bottom right, there are two delay controls, each with a dropdown menu set to '0' and a 'Dist.(cm):0' label. The interface also includes a volume knob and 'AUDIO ON' indicator at the top right, and a 'File Mode' / 'Manual Mode' selector on the right side.

Importing a Filter Transfer Function

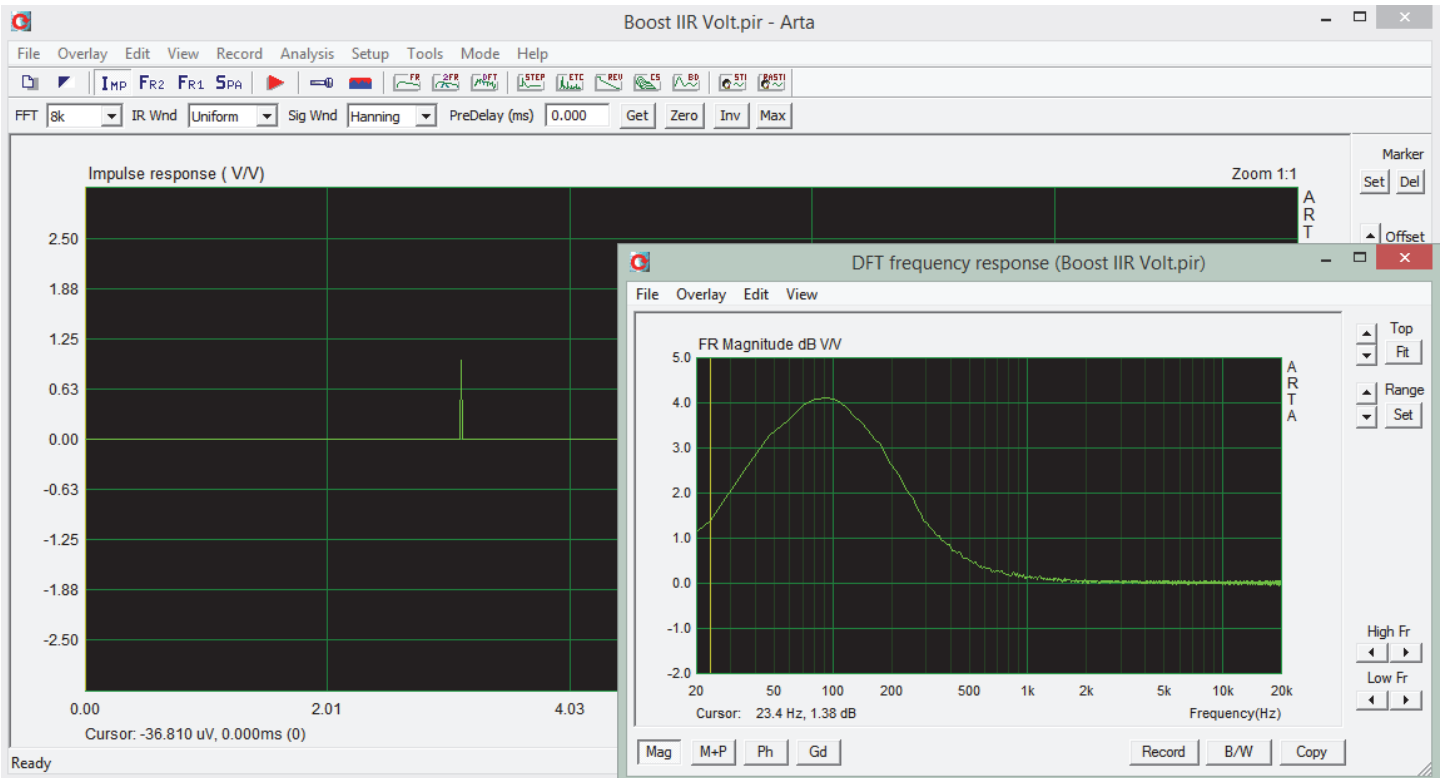
General Information

In Filter Hose v1.2 and higher, it is possible to import a .csv file in step one or step two. Step one will import .csv file and will extend the length to the next 2ⁿ value or more. Sample rate will be asked when a .csv file is loaded. Step two will import .csv as is, assuming the sample rate matches the loaded measurement (step one).

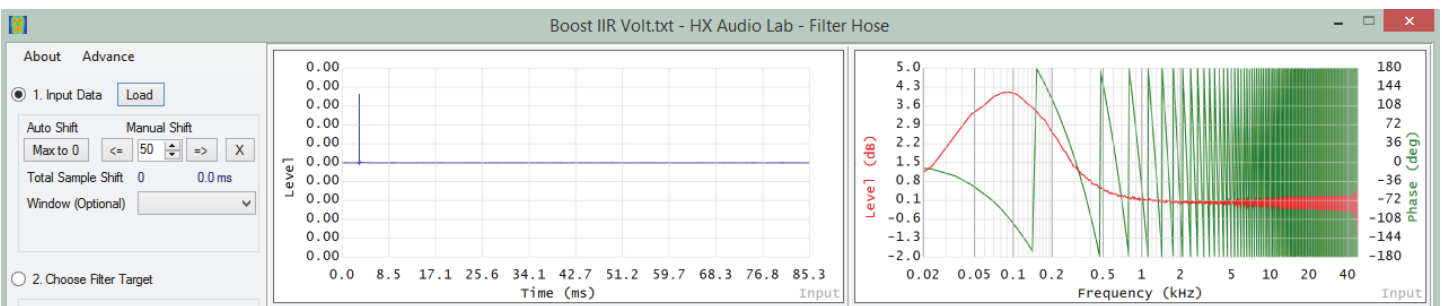
Loading a Filter Transfer Function Measurement

To load a filter transfer function measurement to Filter Hose, it is recommended to use a time domain data. Please follow the example below.

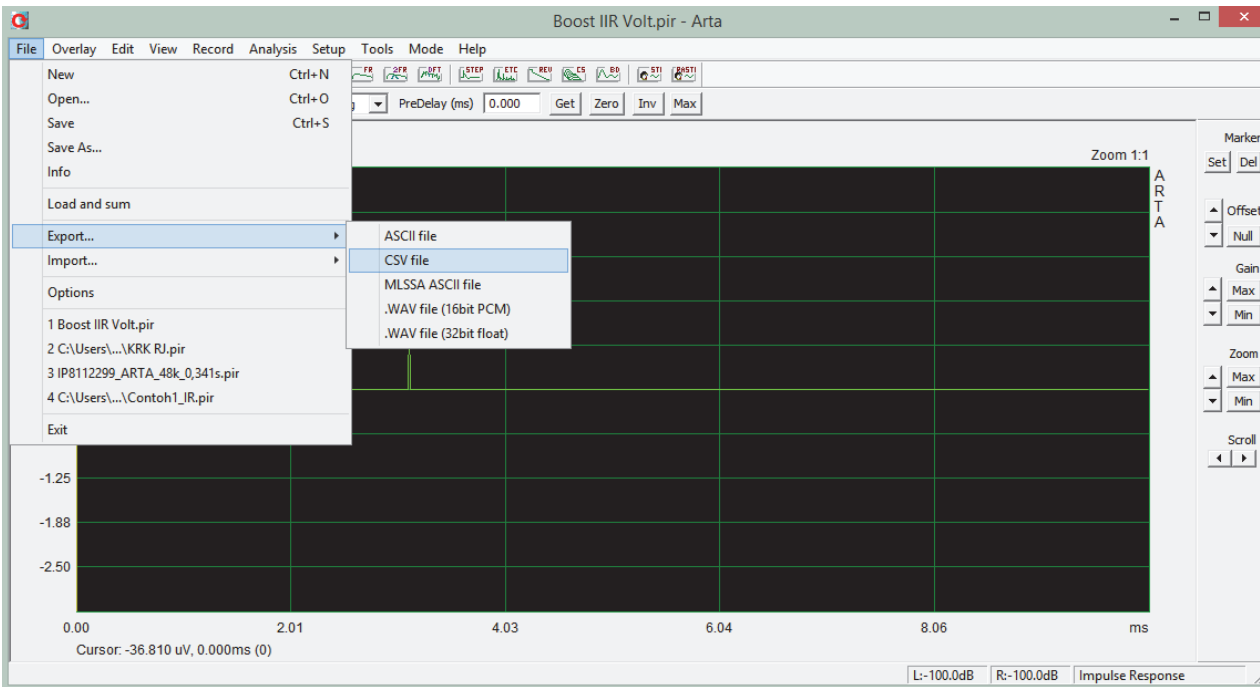
1. ARTA is used to measure a transfer function of a digital loudspeaker management system. The transfer function contains only low frequency boost centered at 90Hz as shown below.



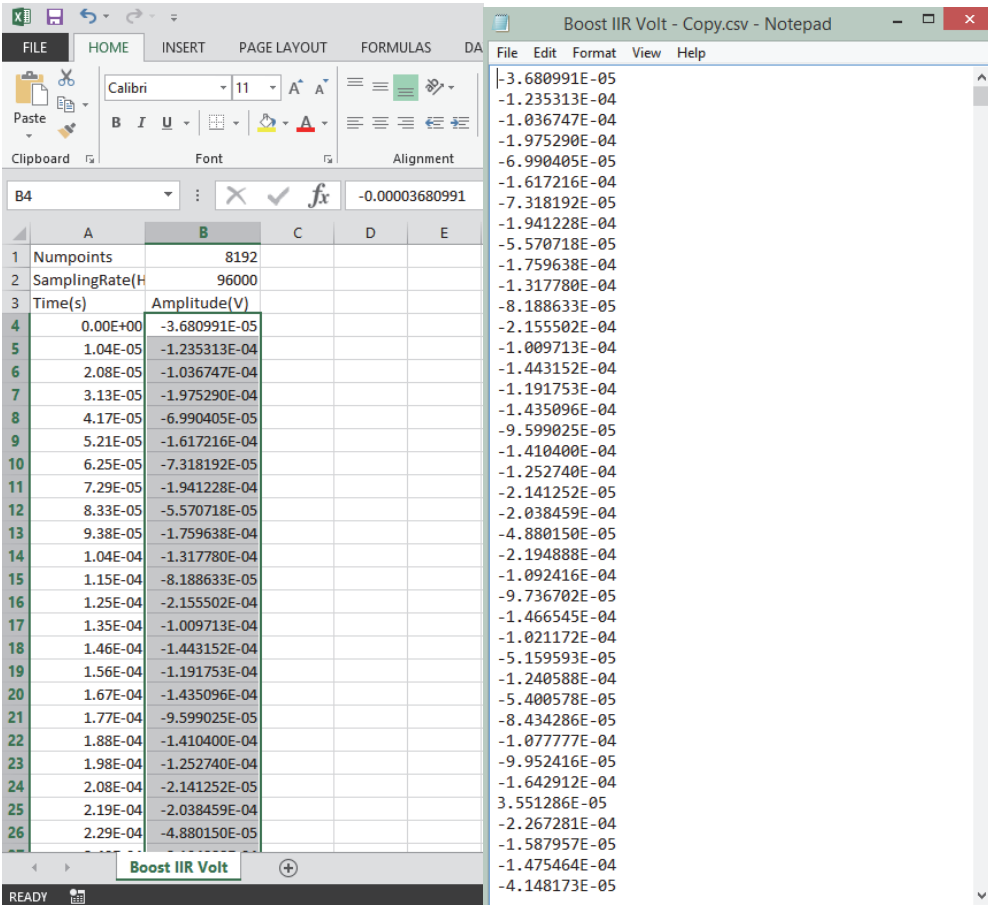
2. When the filter is exported from ARTA, the ARTA .txt file contains frequency domain data. If it is loaded to Filter Hose under ARTA (.txt), it will result incorrect time domain data. Note the Y-axis is all 0.



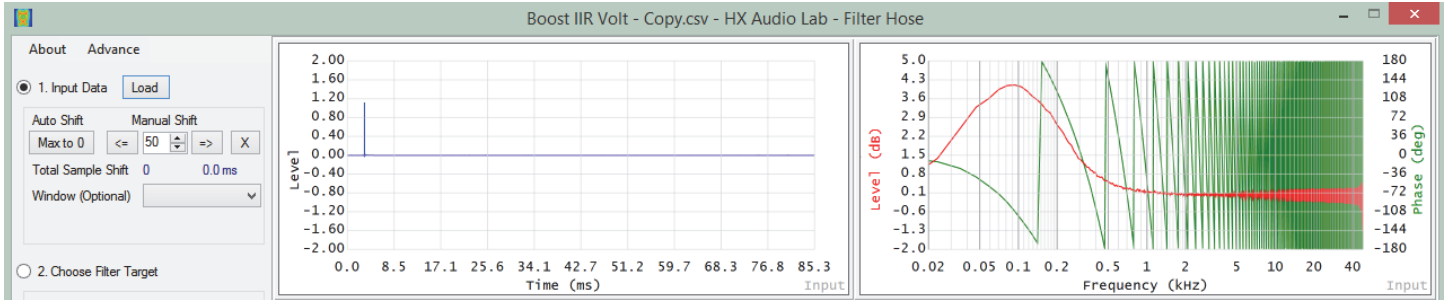
3. To do this correctly, it is recommended to export the time domain data from ARTA as shown below.



4. Open the exported ARTA .csv file (time domain) and select the amplitude column only. Copy paste the value to a new .txt file (such as using Notepad) and then rename the .txt to .csv as shown below. Note: .csv is basically a .txt file format.



5. Use Load Filter (.csv) option from Filter Hose to open the filter, choose the appropriate sample rate and desired extended N. The graph below matches the graph shown under step 1 of this tutorial.



In version 1.3 and newer, manual frequency domain data input is introduced. User is able to use this function to perform the above procedure using frequency domain data.