

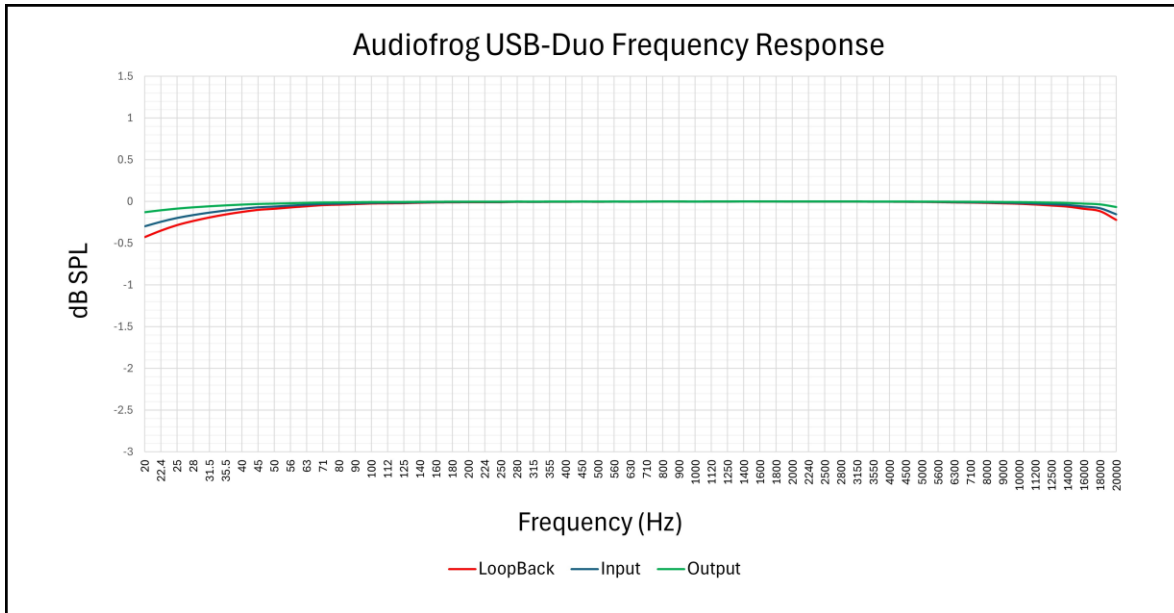
Setting Up Audiofrog USB-Duo and UMI-1 for Making Impulse Response Measurements with Room EQ Wizard



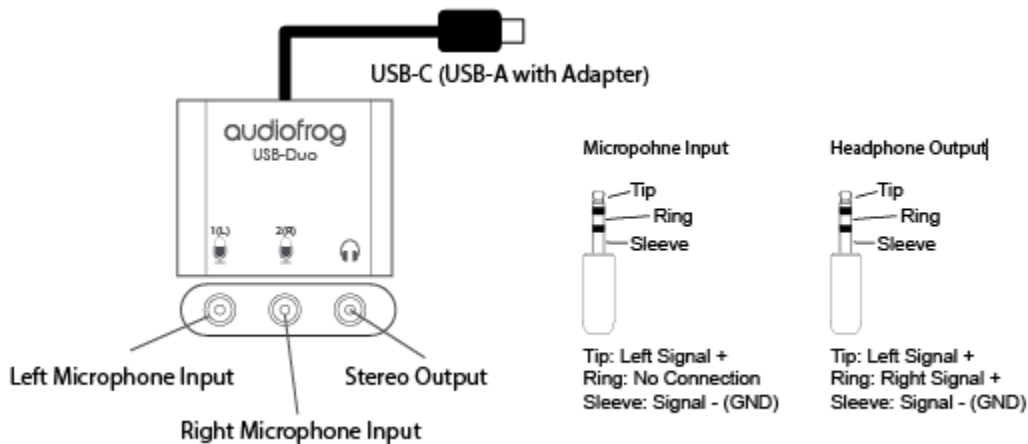
About Audiofrog USB-Duo

USB-Duo has been designed to provide a compact, high quality and high-performance interface for recording sounds and measuring the acoustic performance of audio systems using Audiofrog's UMI-1 microphone kit or any microphone that includes a pre-polarized condenser microphone (electret).

Unlike many other compact USB soundcards, USB-Duo has nearly flat frequency response on its input and its output. Typical frequency response is 20Hz-20kHz, +0, -0.5dB. While this is certainly sufficient for recording and measuring even without calibration, we will include the method for calibrating the card in this guide.



USB-Duo includes two separate microphone inputs on a pair of 3.5mm TRS jacks and one stereo output on a single 3.5mm TRS jack. Connection to the PC can be made using the USB-C plug or with the USB-C to USB-A adapter.



Connecting USB-Duo to the UMI-1 Microphone

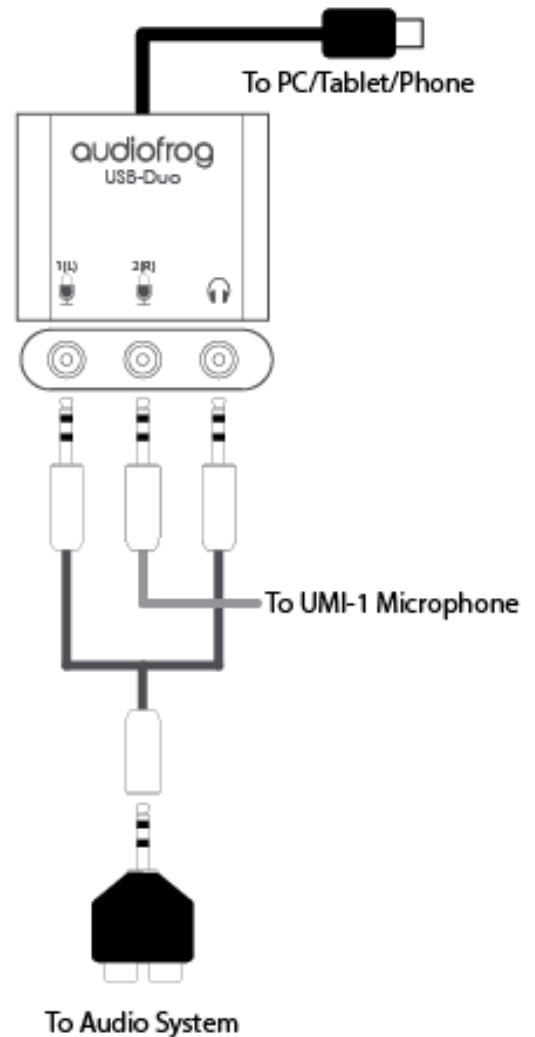
1. Plug the USB-Duo into any USB or USB-C port on your PC.
2. Plug one male end of the Y adapter into the 1(L) microphone input connector.
3. Plug the other male end of the Y adapter into the headphone output connector. This is your “loopback” connection and will provide a path for the reference signal REW will use as a baseline.
4. Plug the UMI-1 microphone into the UMI-1 micstand and plug the micstand into the 2(R) microphone input connector. This will be your measurement signal.
5. Finally, plug the female end of the Y adapter into the Auxiliary input of your head unit using a 3.5mm stereo cable. Alternately, use the 3.5mm to RCA adapter included with UMI-1 and an RCA patch cable to plug USB-Duo’s stereo output into your DSP.

Notes:

The measurement signal will be present on both the left and the right outputs of the Y adapter and the RCA adapter.

REW will use the left input as the reference signal and the right input as the measurement signal. When used this way, REW will compare the reference input to the measurement input to determine the difference between them. The reference input will contain the stimulus signal only. The measurement signal will contain the stimulus signal plus any modifications in time or frequency attributable to the audio system and the acoustic space into which it is installed. The difference between them will be displayed as the frequency, impulse and phase response of the system.

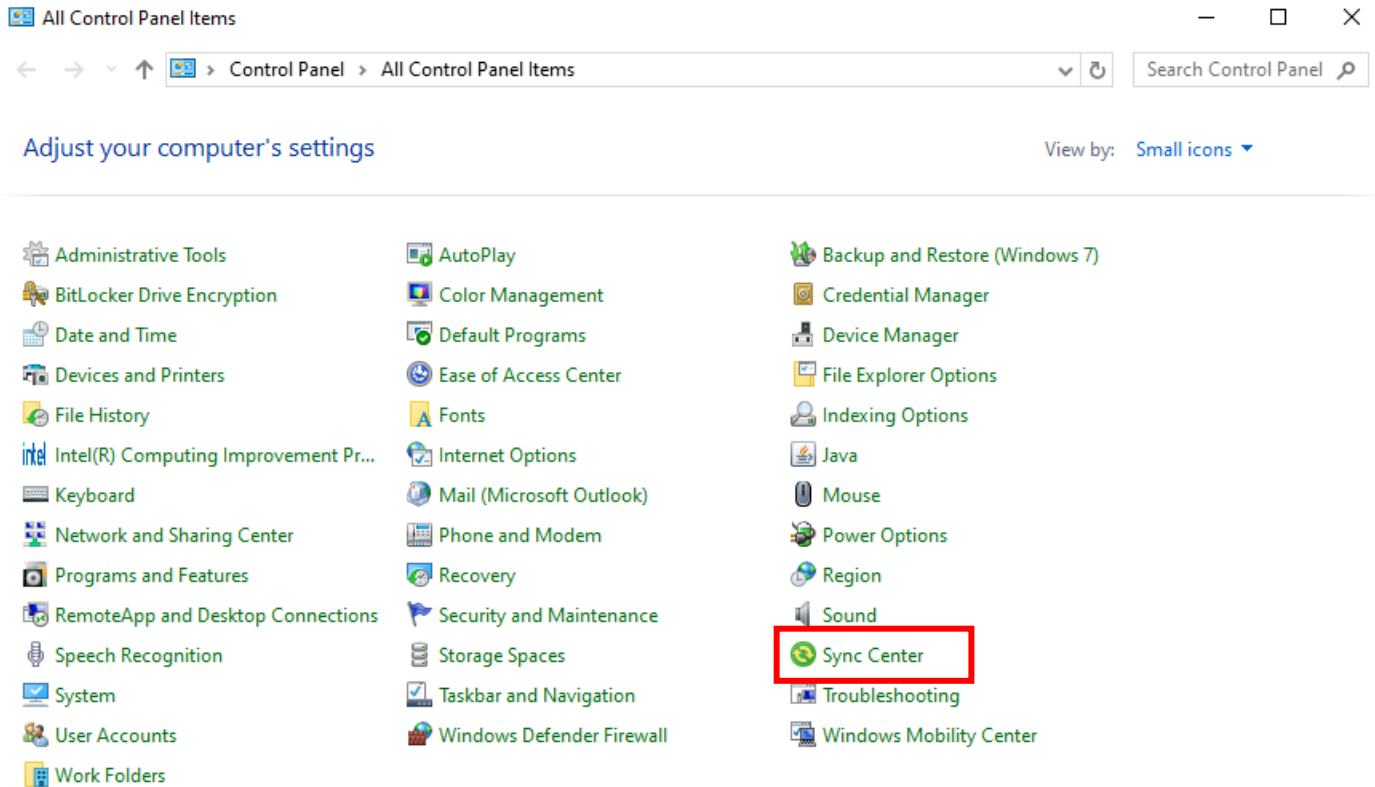
The reference signal gives the analyzer its “zero” in time and in level.



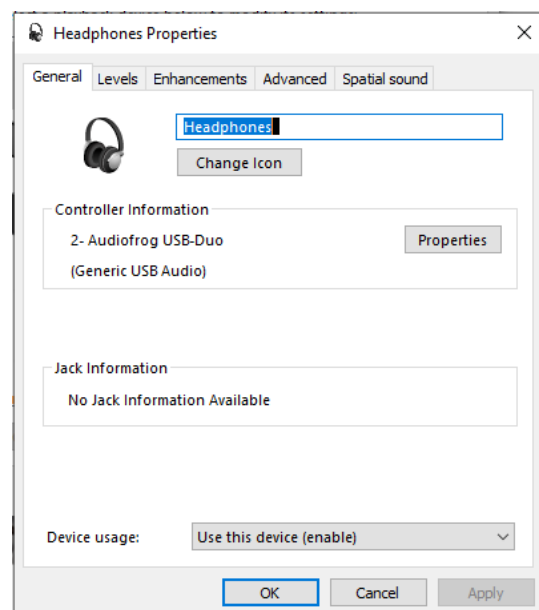
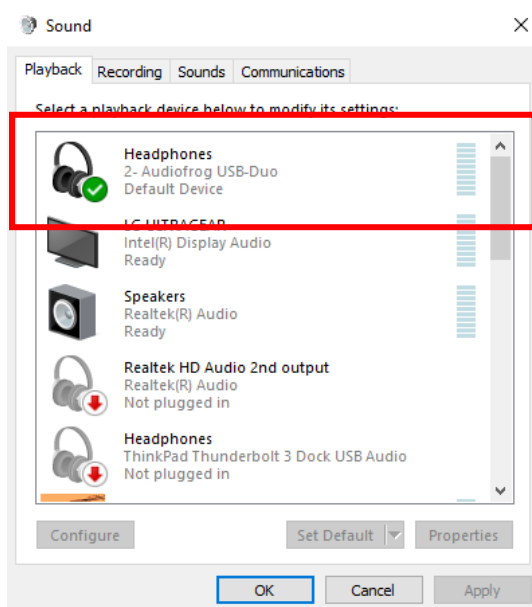
Windows Audio Settings

Once you have plugged in USB-Duo, in the windows search bar (at the bottom left or the bottom center of your screen) type “Control Panel”.

When the prompt opens, choose the “Control Panel” app and click to open it.

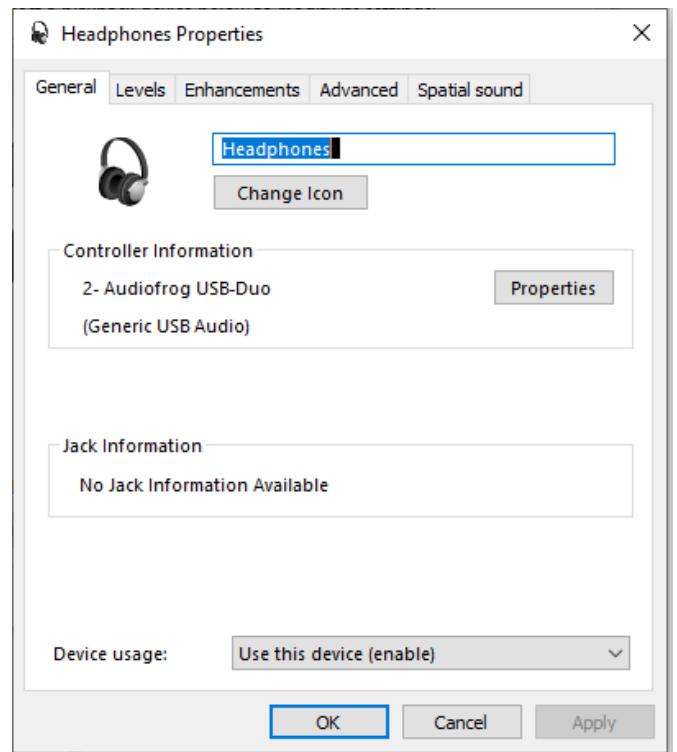


Next, click on “Sound” to open the Sound controls. Sound will open to the “Playback” tab. Look in the list of audio devices for Audiofrog USB-Duo (Headphones). If it is not highlighted initially, click on it to highlight it. Then, double-click on it to open the Properties panel.



In Properties, be sure that “Use this device (enable)” is selected.

Then, click on “Levels” at the top.



Move the slider to set the input level to 30.

Make sure the output is activated. There should be no red circle next to the speaker icon.

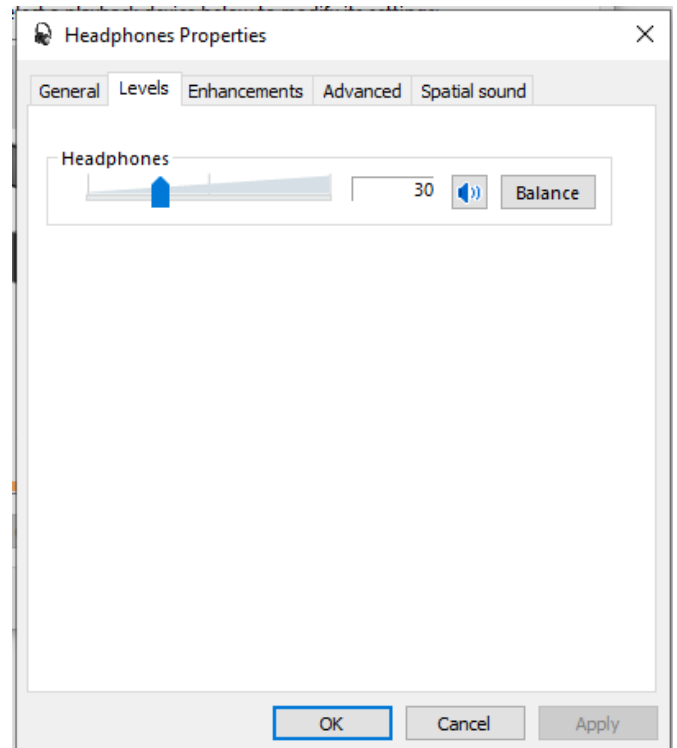


Not like this

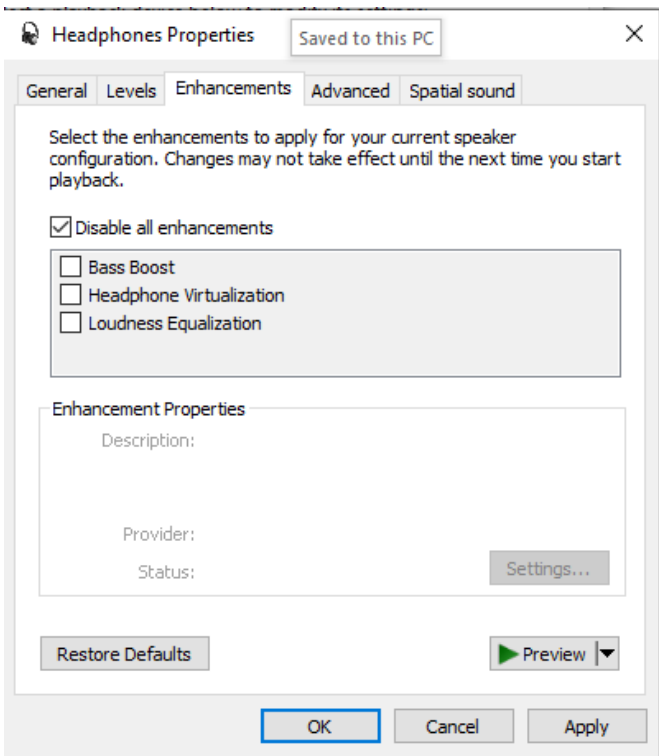


Like this

Next, Click on “Enhancements”

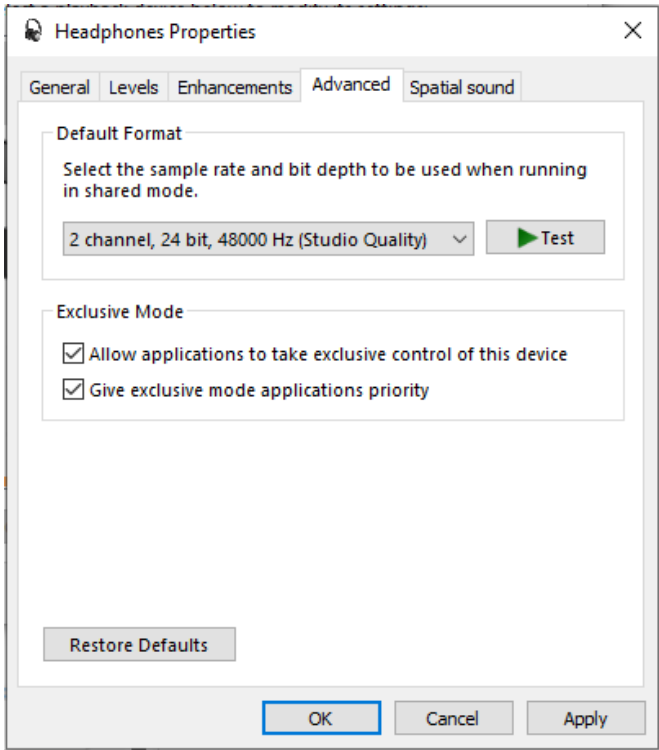


In the Enhancements window, click to check the box marked “Disable all enhancements”



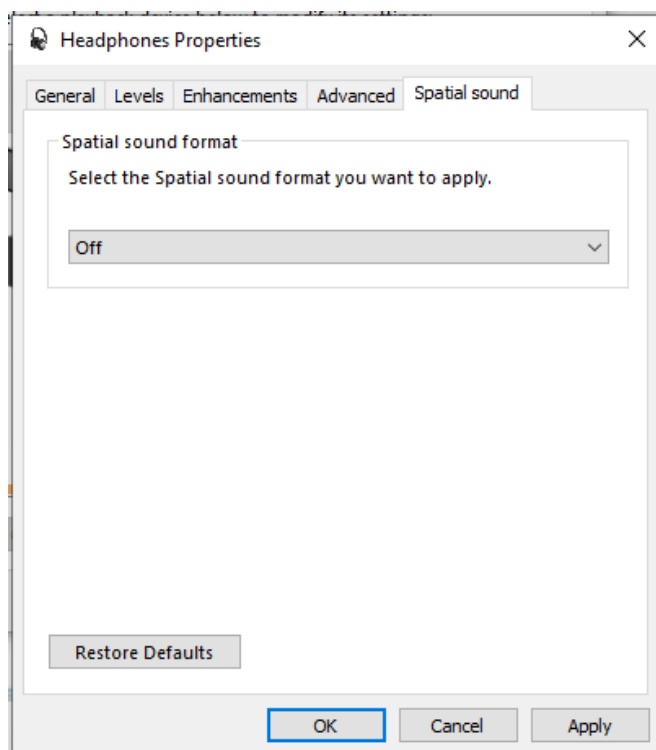
Then, click on “Advanced”

In the Advanced window, select 2-channel, 24 bit, 48000 (Studio Quality) in the drop-down menu.
Check both boxes under “Exclusive Mode”



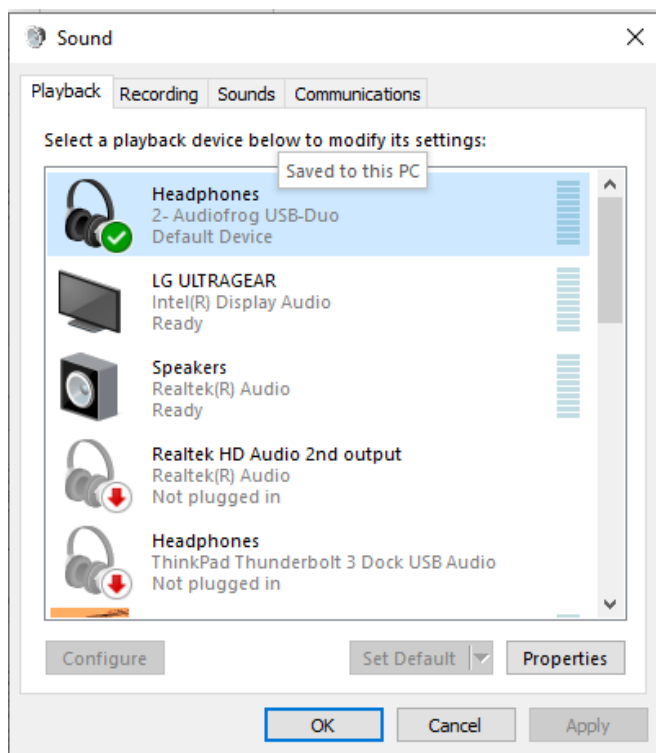
Then, click on “Spatial Sound”

In Spatial Sound, select “Off” in the drop-down menu.



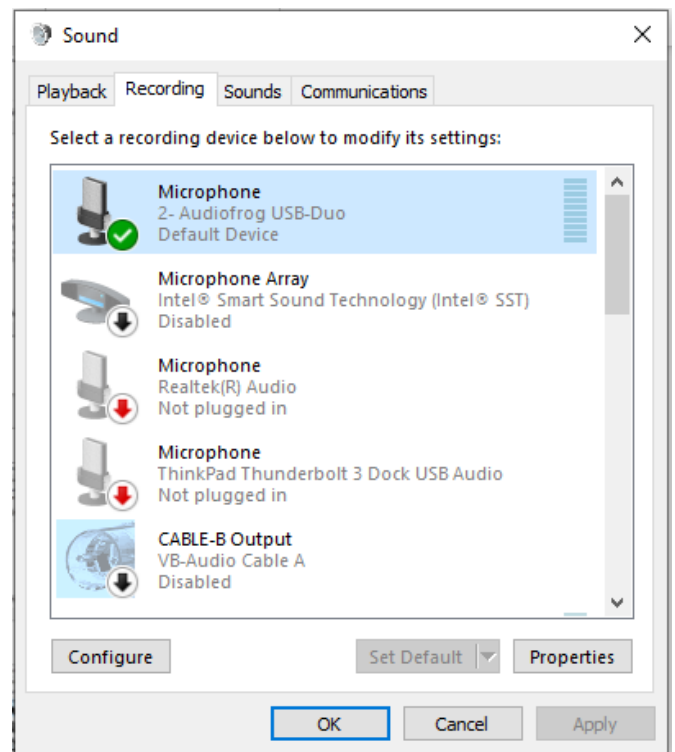
Click “Apply.” And then click “OK.” The window will close and the previous menu will reappear.

Next, click on the “Recording” tab at the top.

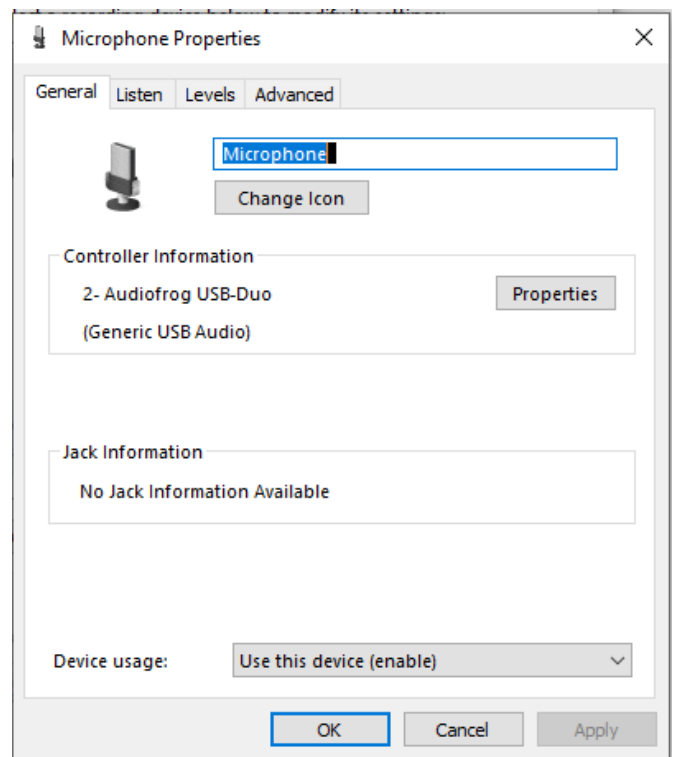


Find the Microphone tab for Audiofrog USB-Duo and click to highlight it.

Then, double click to open it.



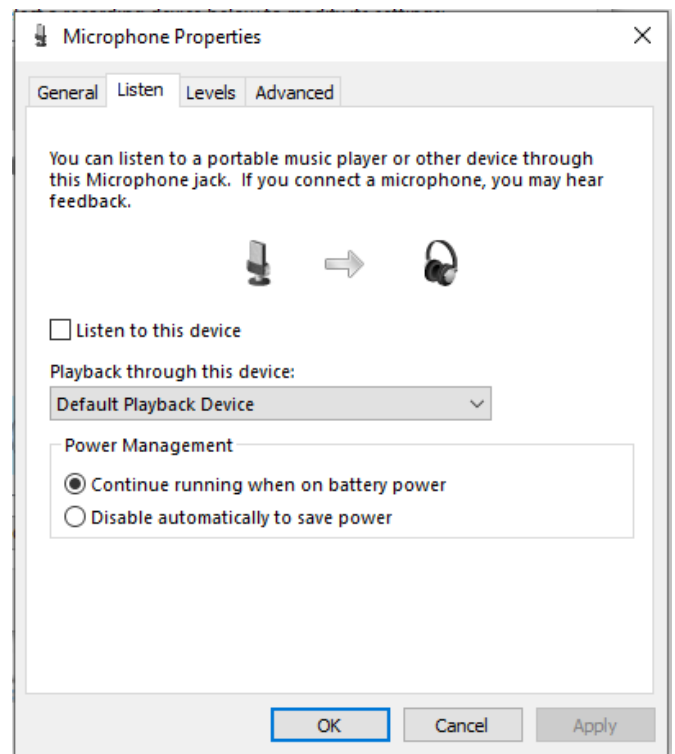
The “General” tab will open. There is nothing to set here. Then, click on “Listen”



In the “Listen” tab, uncheck the box next to “Listen to this device”.

Click to select “Continue running when on battery power”

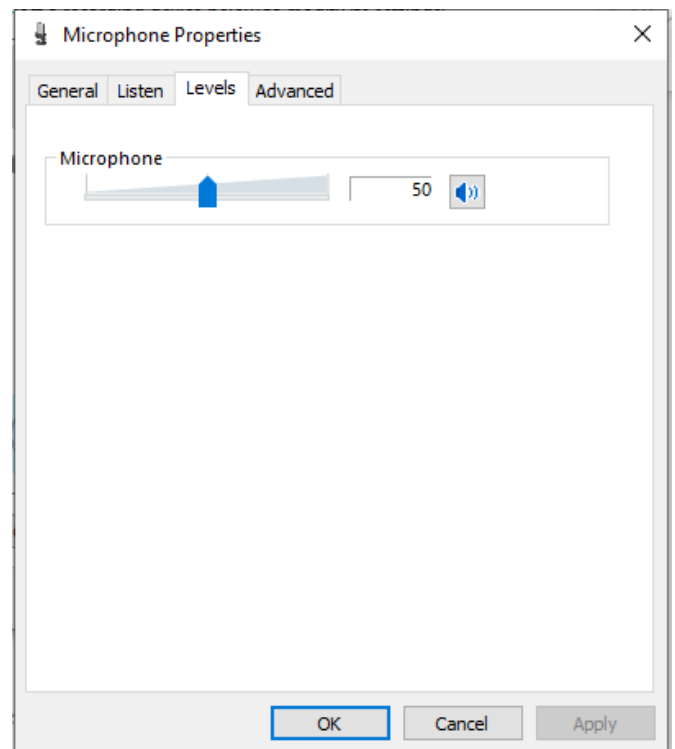
Then, click on “Levels” at the top.



Move the slider to set the microphone level to 50.

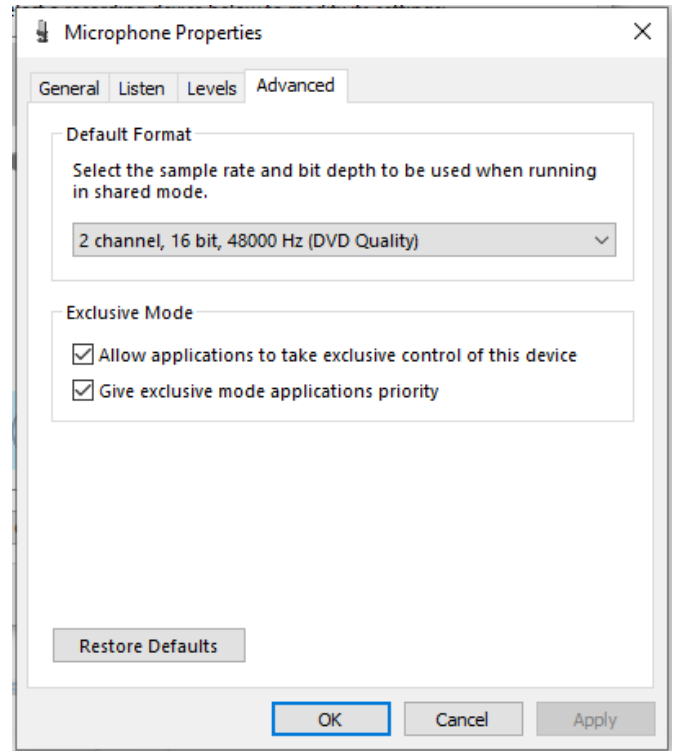
Just as before, make sure there is no red circle next to the speaker icon. The red circle indicates that the microphone input is not muted.

Then, click on “Advanced”



Choose 2 channel, 16 bit, 48000 HZ (DVD Quality) in the drop-down menu.

Then, click “OK”.

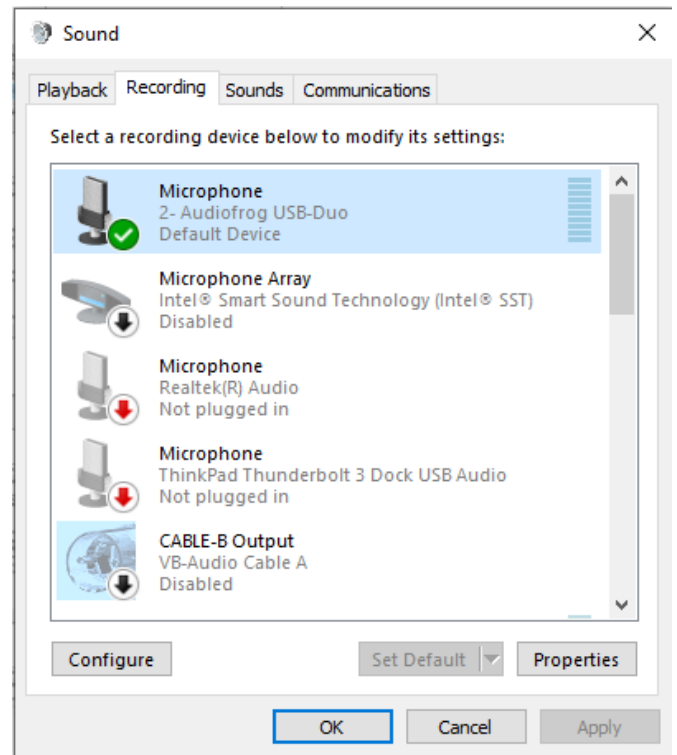


The previous menu will appear. Click “OK.”

This will save your settings for USB-Duo.

Note:

If you update your computer, use a different sound card or change these settings for Audiofrog USB-Duo, you may need to perform this procedure again. If you experience trouble in the future, check these settings first!

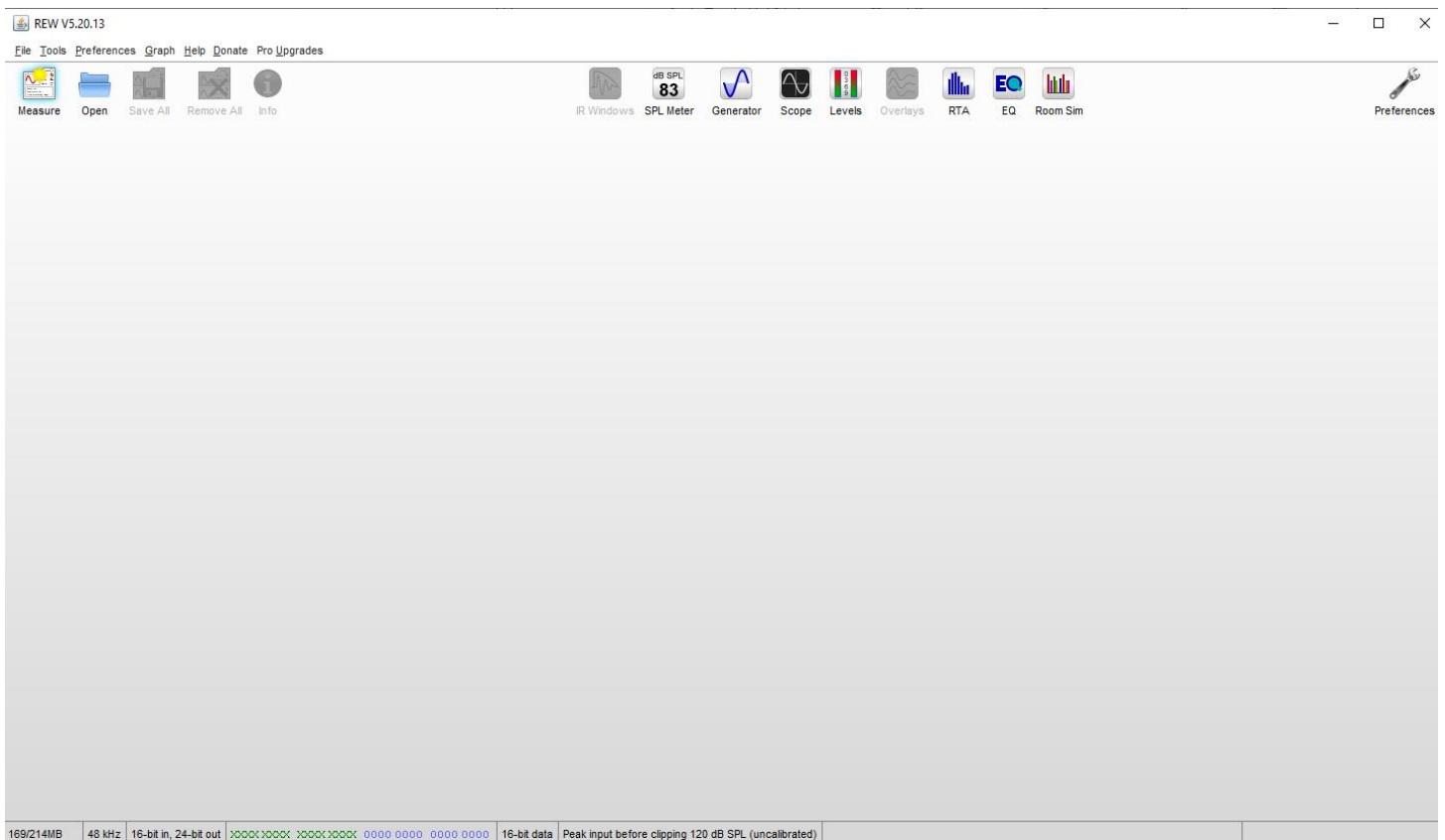


Installing Room EQ Wizard

If you haven't already, go to www.roomEQWizard.com . Download and install the program following the prompts. Open the program. Please note that your version may be a more recent one than the one used below in the examples. For the purposes of setup, this shouldn't matter.

Please note that REW is a free program not associated with Audiofrog, Inc. For specific questions about versions and operation of the program not included here, please use the Help file included with the program. It's GREAT!

Once you have installed and opened the program and clicked through all of the initial prompts, you should arrive at a screen that looks like the one below.



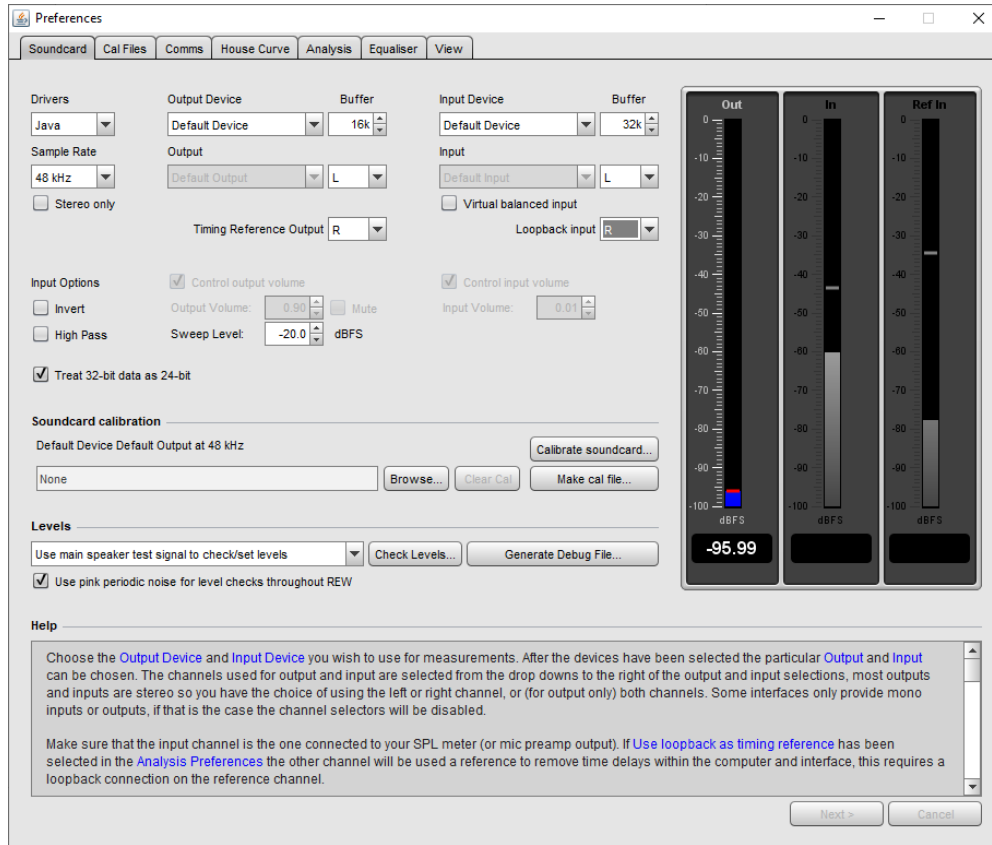
Navigating in REW

“Preferences” will bring up a screen in which you will choose various settings to use in making measurements, where you can check levels and choose and configure your audio device—in this case, your Audiofrog USB-Duo.

The “Measure” window below the menu is where you will make these measurements. If you have heretofore been using only the RTA function, this will be a change in process.

The “Overlays” option to the right is where you will be able to look at several measurements simultaneously.

Click on “Preferences” and you should see this screen. If you see a different screen, click on the “Soundcard” tab at the top.:



About “Preferences”:

The “Soundcard” tab is where you will set up your audio hardware and measurement signal levels.

The “Cal Files” tab is where you will select calibration files for the soundcard (if you choose to calibrate it) and for your microphone.

It’s unlikely you’ll need the “Coms” tab since car audio equalizers don’t include MIDI functionality. You can ignore this one.

The “House Curve” tab is where you might enter a target curve for use with REW’s auto EQ.

The “Analysis “ tab is where you can choose parameters for analysis, including the resolution of the measurements.

The “Equalizer” tab is where you can enter parameters for REW’s auto EQ.

The “View” tab is where you can enter parameters for the display of graphs and the operation of the program.

REW and most PC based analyzers offer a calibration routine that will remove any frequency response nonlinearities inherent in your soundcard from your measurements. The frequency response of USB-Duo is flat enough that this isn't absolutely necessary. The process does provide a good functionality check, so we are going to include it here.

If the Soundcard tab isn't already open, click to open it.

Use the screenshot below to set up your preferences as they are indicated below.

For input and output devices, use the down arrow next to the selection to open the list of available devices and choose "Headphone (2-Audiofrog USB-Duo)" for the output device, Choose Microphone (2-Audiofrog USB-Duo) for the input device.

Set up the rest of the Preferences panel as indicated below.

Confirm that the loopback connector is plugged into the headphone output and the 1(L) input of USB-Duo

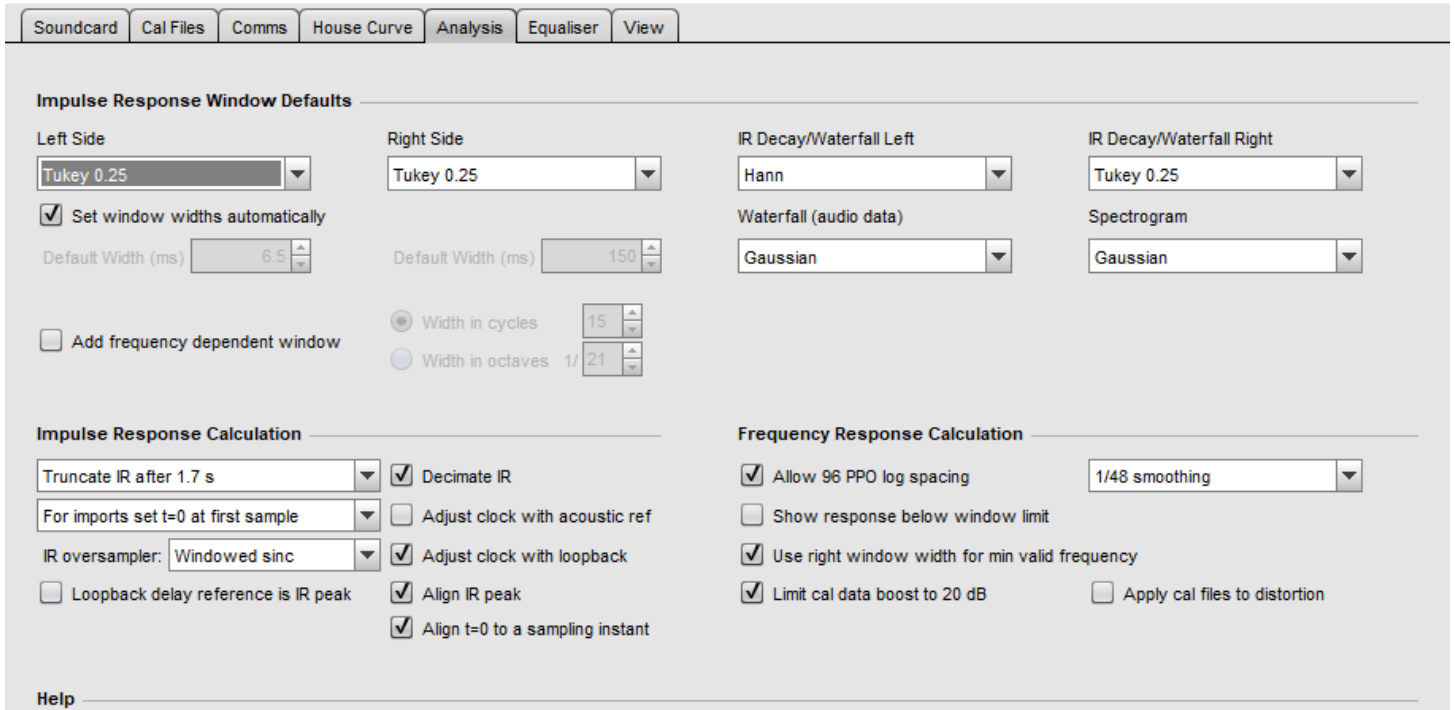
The screenshot shows the REW software interface with the Soundcard preferences panel open. The panel is divided into several sections:

- Drivers:** Java
- Output Device:** Headphones (2-Audiofrog USB-Duo)
- Buffer:** 16k
- Input Device:** Microphone (2-Audiofrog USB-Duo)
- Buffer:** 32k
- Sample Rate:** 48 kHz
- Output:** HEADPHONE
- Input:** MICROPHONE (Master ...)
- Timing Reference Output:** R
- Input Options:** Control output volume, Control input volume, Output Volume: 0.50, Input Volume: 0.60, Sweep Level: -20.0 dBFS
- Soundcard calibration:** Headphones (2-Audiofrog USB-Duo) HEADPHONE at 48 kHz
- Levels:** Use main speaker test signal to check/set levels

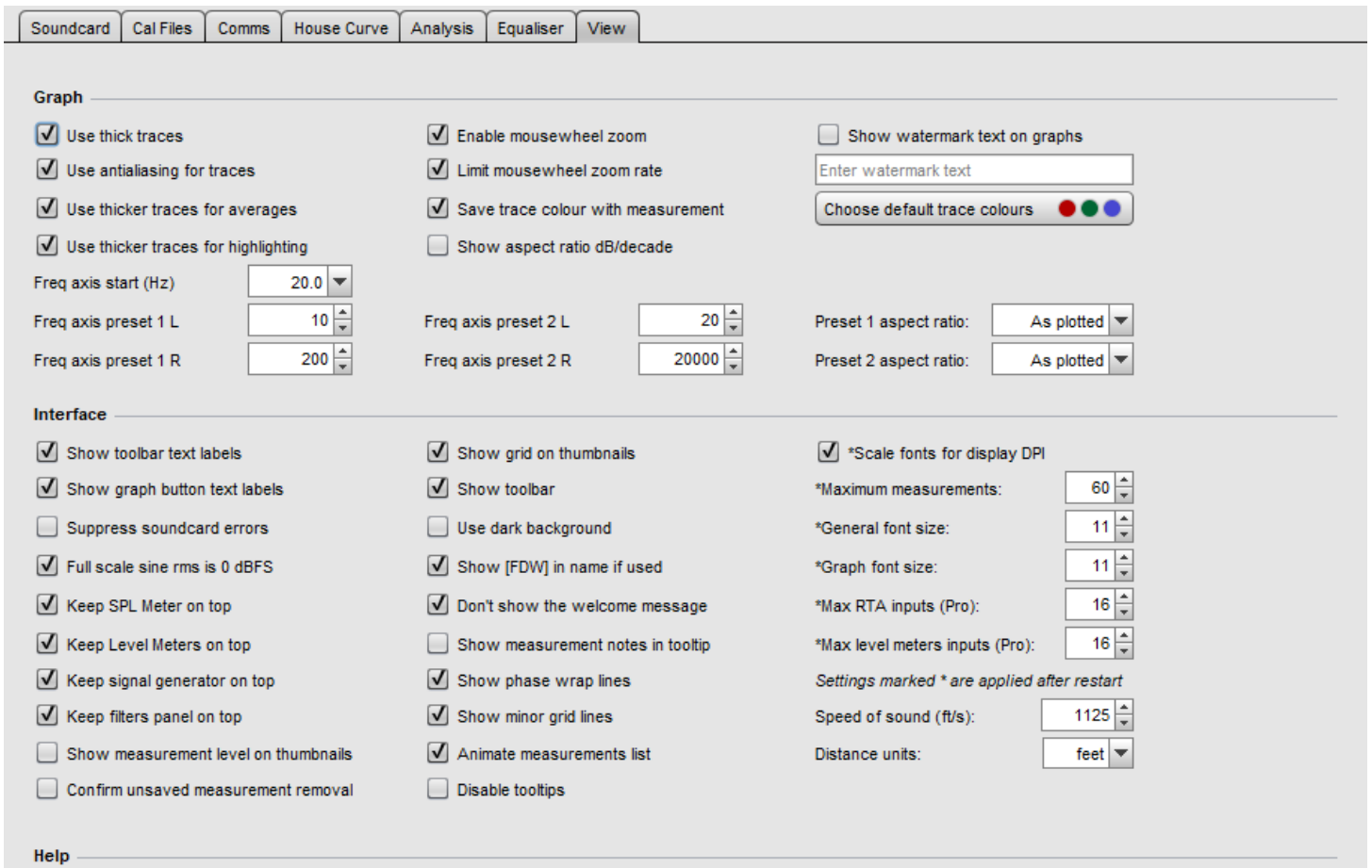
On the right side of the panel, there are three level meters:

- Out:** -95.99 dBFS
- In:** -40 dBFS
- Ref In:** -50 dBFS

Next, click on the Analysis tab and set all the parameters there as in the screenshot below:



Next, click to open the View tab and set those parameters as in the screenshot below.



Now, click on the Soundcard tab again to open it.

Then, click on Calibrate Soundcard

Then, click on Next in the bottom right.

Soundcard Cal Files Comms House Curve Analysis Equaliser View

Drivers: Java
Output Device: Headphones (2- Audio) 16k
Buffer: 16k
Input Device: Microphone (2- Audio) 32k
Buffer: 32k

Sample Rate: 48 kHz
Output: HEADPHONE L
Input: MICROPHONE (Master) L
Timing Reference Output: R
Loopback input: R

Input Options:
 Invert
 High Pass
 Control output volume
Output Volume: 0.50
 Mute
Sweep Level: -20.0 dBFS
 Control input volume
Input Volume: 0.60

Treat 32-bit data as 24-bit

Soundcard calibration
Headphones (2- Audiofrog USB-Duo) HEADPHONE at 48 kHz
None
Calibrate soundcard
Browse... Clear Cal Make cal file...

Levels
Use main speaker test signal to check/set levels
Check Levels... Generate Debug File...
 Use pink periodic noise for level checks throughout REW

Help
The first stage is to use a 1kHz tone to set the levels of the measurement signal and the interface input volume. The tone is generated at the current Sweep Level setting, it is best to use a fairly high level for interface measurement, between -12 and -6 dBFS. Set this level now using the Sweep Level control above, the original level will be restored at the end.
If the REW volume controls are available and enabled the Output Volume should be around 0.5 if it affects the signal level. If REW volume controls are not available or not being used set the levels via the controls in your interface's mixer or your OS audio control panel.
Press Next when the Sweep Level and Output Volume have been set or Cancel to quit.

Next > Cancel

Then, click on Next again. The level indicators should appear and the Out and In levels should be similar. If they are not, adjust the value next to "Input Volume" until the input level is within about 1dB out the output level.

Soundcard Cal Files Comms House Curve Analysis Equaliser View

Drivers: Java
Output Device: Headphones (2- Audio) 16k
Buffer: 16k
Input Device: Microphone (2- Audio) 32k
Buffer: 32k

Sample Rate: 48 kHz
Output: HEADPHONE L
Input: MICROPHONE (Master) L
Timing Reference Output: R
Loopback input: R

Input Options:
 Invert
 High Pass
 Control output volume
Output Volume: 0.50
 Mute
Sweep Level: -20.0 dBFS
 Control input volume
Input Volume: 0.60

Treat 32-bit data as 24-bit

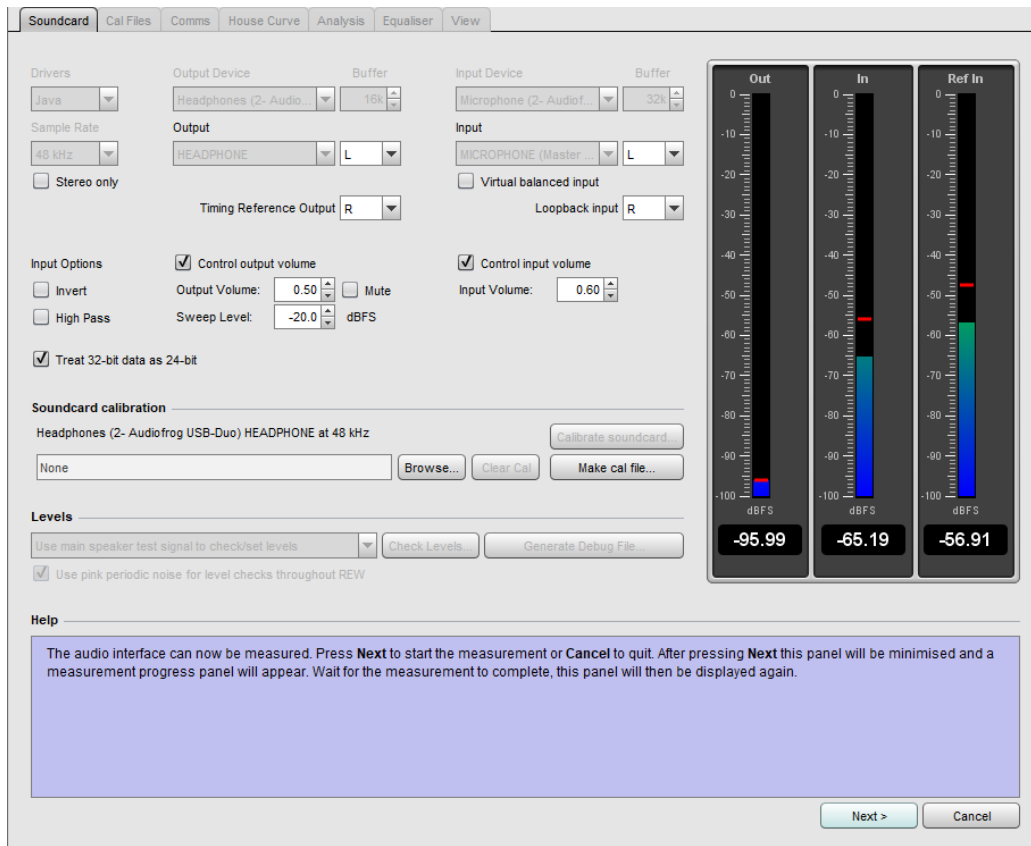
Soundcard calibration
Headphones (2- Audiofrog USB-Duo) HEADPHONE at 48 kHz
None
Calibrate soundcard
Browse... Clear Cal Make cal file...

Levels
Use main speaker test signal to check/set levels
Check Levels... Generate Debug File...
 Use pink periodic noise for level checks throughout REW

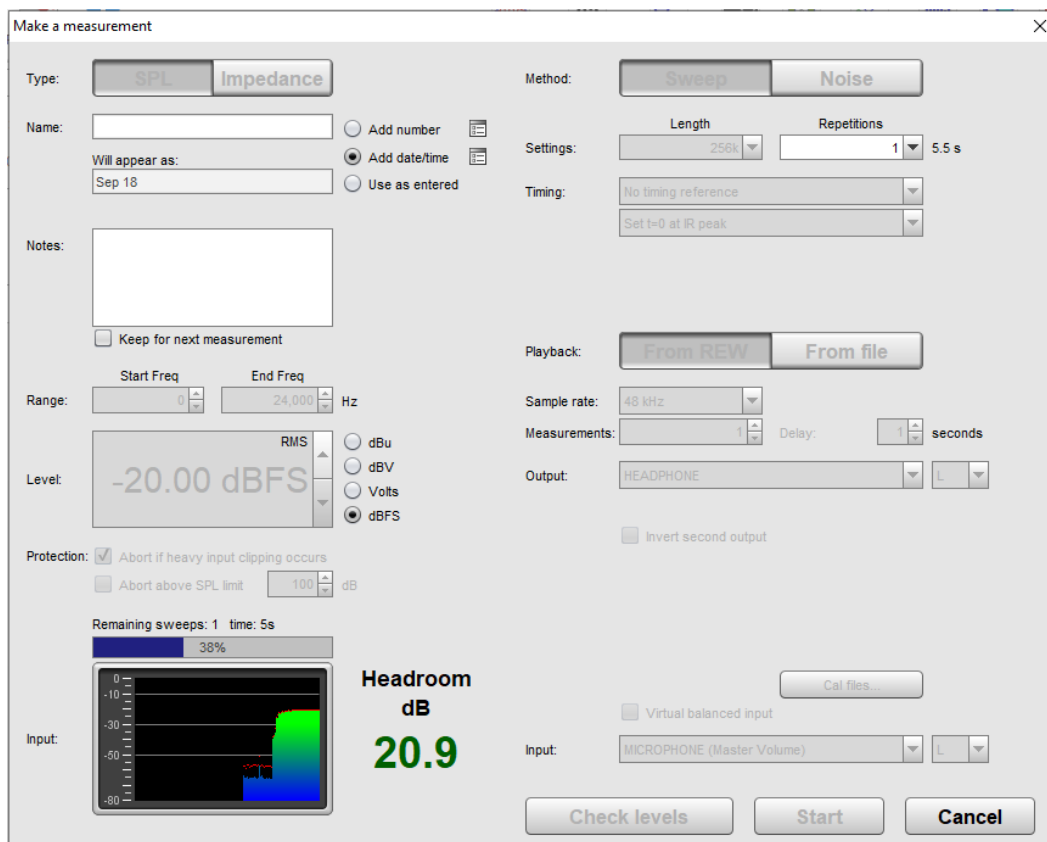
Help
The 1kHz tone is now playing. Adjust the Input Volume using the REW control (if enabled and available) or your interface's mixer or your OS audio level controls so that the input level is close to the output level, ideally within 6dB, and the peak level (the red line on the bar) is lower than -1dB.
If the input level control is at its maximum but the input level is still more than 6dB below the output level try increasing the Output Volume using the REW control (if enabled and available) or your interface's mixer or your OS audio level controls.
Press Next when the input volume has been set or Cancel to quit.

Next > Cancel

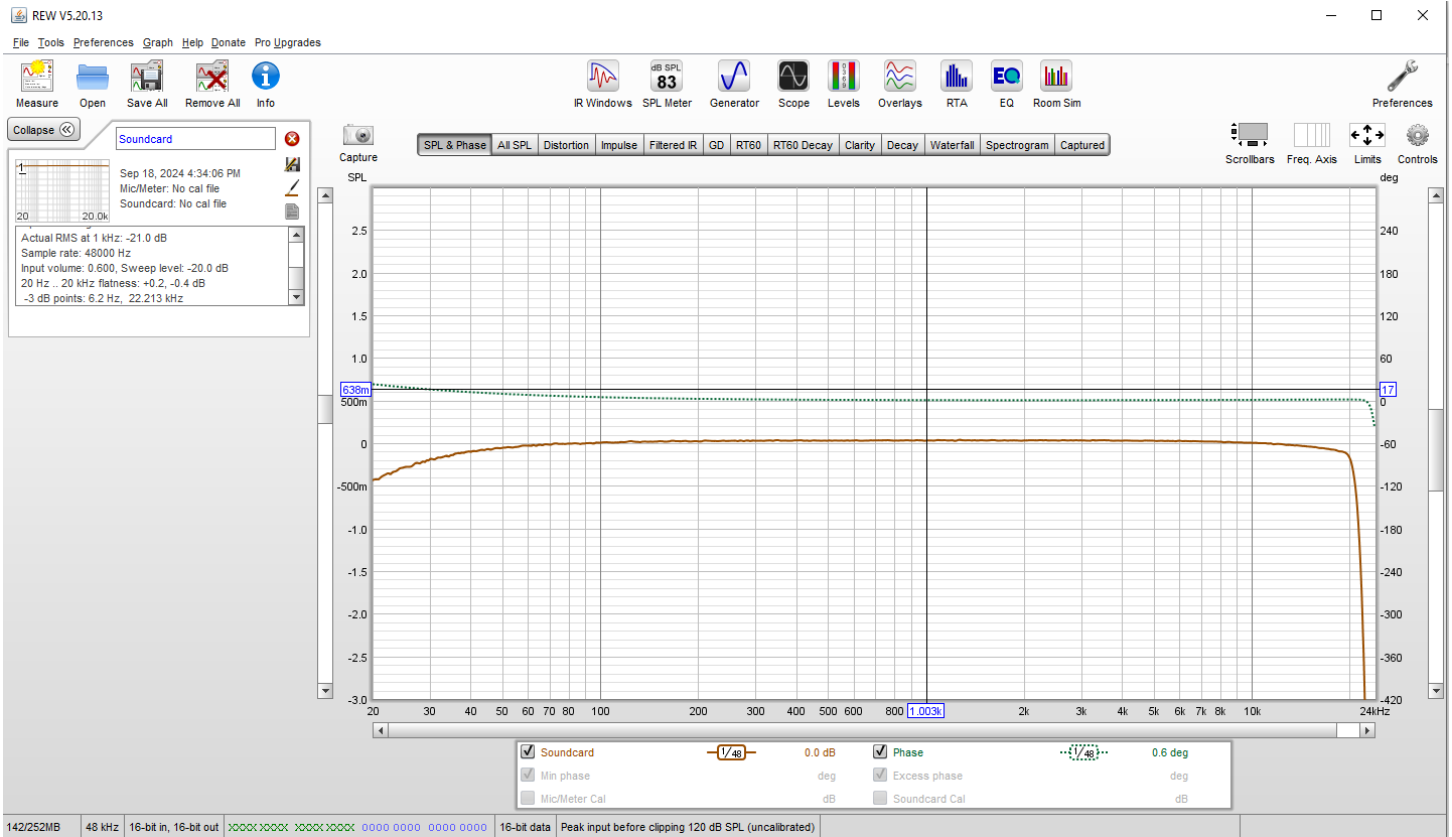
Once the Out and In level meters read about the same, click Next again.



And then click Next one more time. The measurement window will open and the soundcard will be measured.



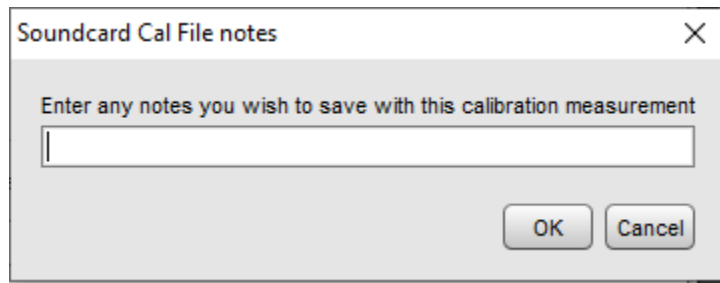
After the measurement is complete, the window will close. Go to REW's main screen to view the measurement of the soundcard. It should look something like the screen below.



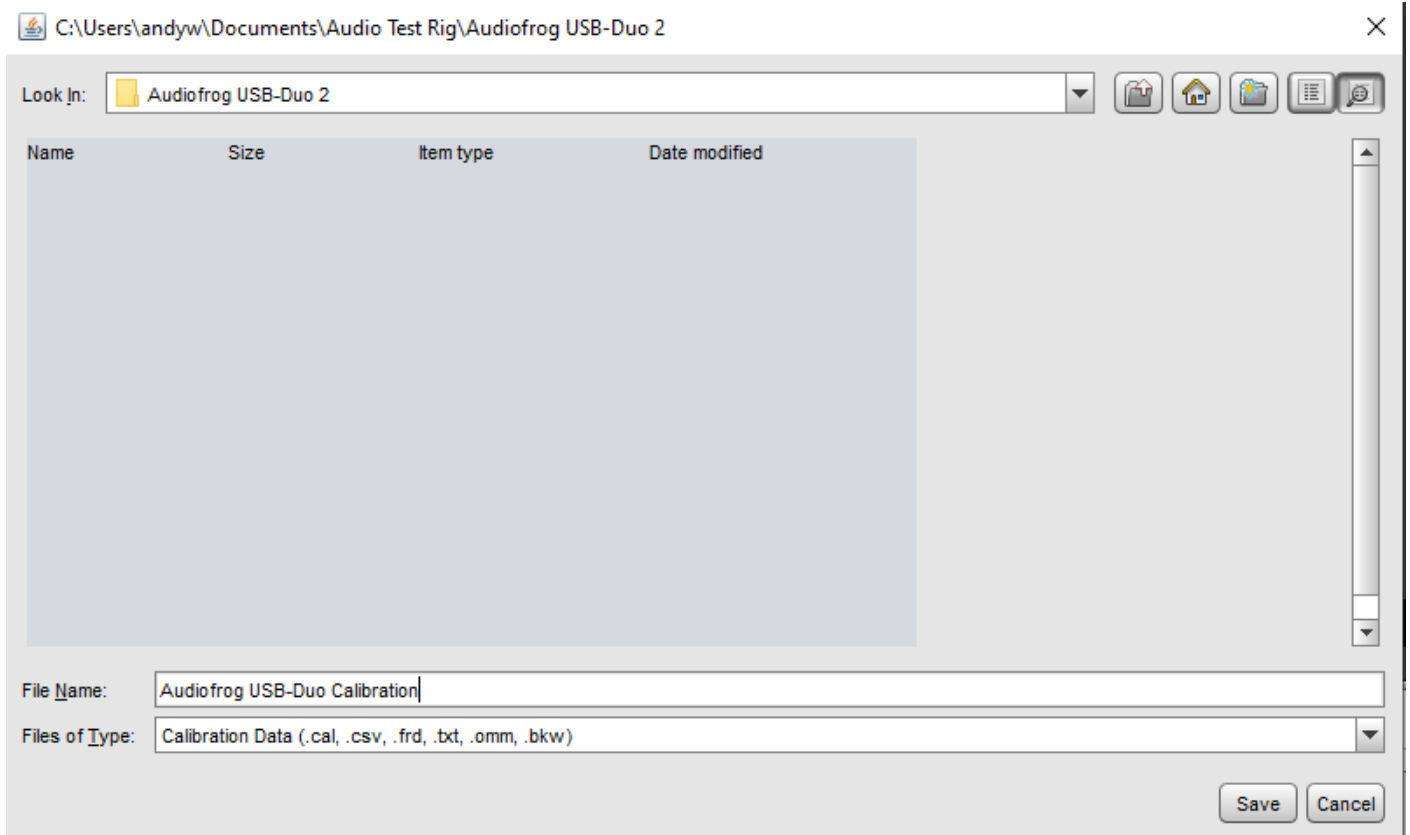
Go back to the Soundcard panel in Preferences. And click “Make Cal File”

The screenshot shows the REW Soundcard panel in Preferences. The panel is divided into several sections: Drivers, Output Device, Input Device, and Soundcard calibration. The Soundcard calibration section includes a text field for the device name, a 'Browse...' button, a 'Clear Cal' button, and a 'Make cal file...' button. A red arrow points to the 'Make cal file...' button. The panel also includes a 'Levels' section with a 'Check Levels...' button and a 'Generate Debug File...' button. On the right side, there are three vertical level meters labeled 'Out', 'In', and 'Ref In', with a value of -95.99 dBFS displayed at the bottom.

Enter a description for the calibration file if you wish and then click OK.



Name the calibration file and save it to a convenient folder on your computer.



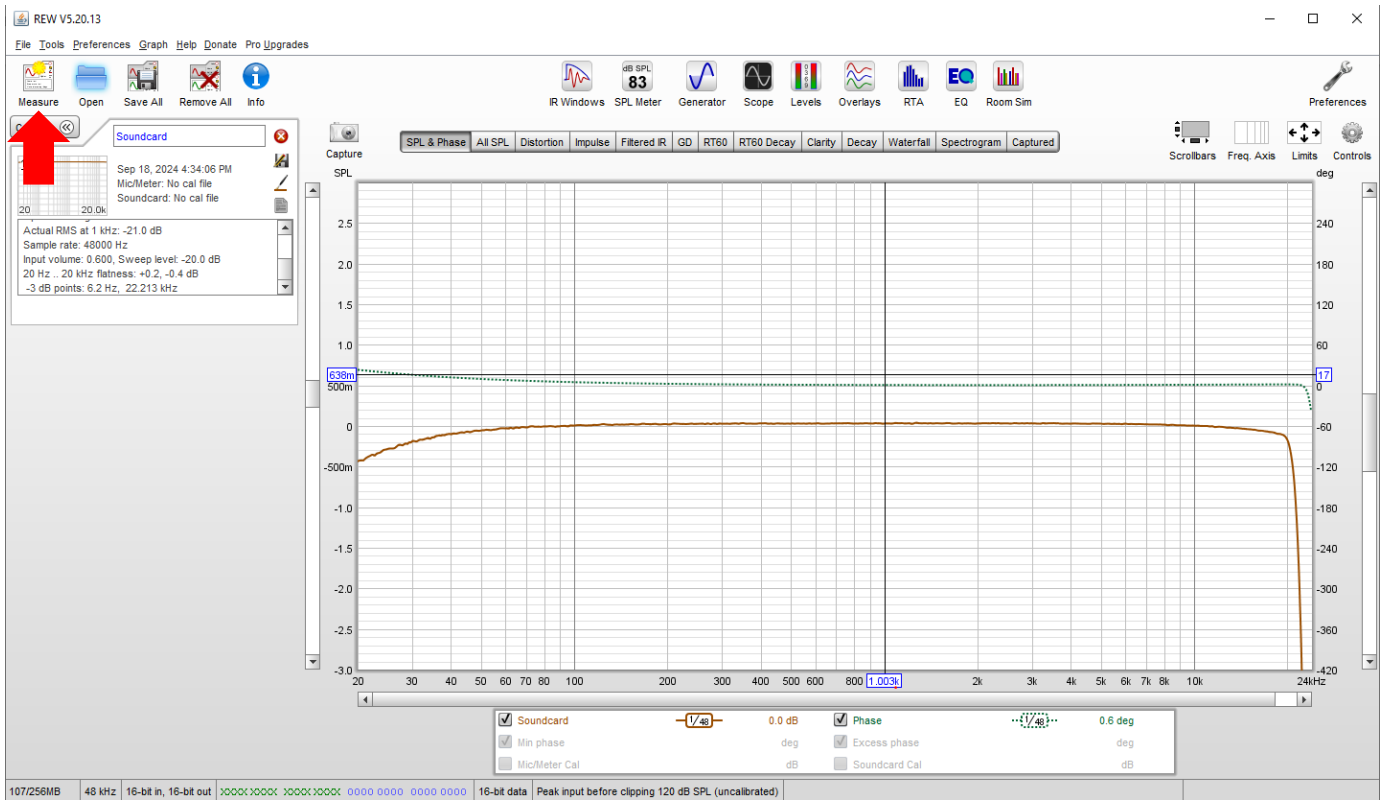
Now the calibration file will be loaded into the Soundcard panel in REW. This will invert the frequency response of the soundcard and apply that correction filter to every measurement you make.

The screenshot shows the 'Soundcard' panel in REW. The 'Soundcard calibration' section is highlighted with a red arrow pointing to the 'Audiofrog USB-Duo Calibration.cal' file. The 'Levels' section shows 'Use main speaker test signal to check/set levels' selected. On the right, three level meters are visible: 'Out' at -95.99 dBFS, 'In' at approximately -55 dBFS, and 'Ref In' at approximately -55 dBFS.

Go back to REW's main screen.

The screenshot shows the REW main screen with a frequency response graph. The graph displays a flat response from 20 Hz to 20 kHz, with a sharp drop-off at 24 kHz. The y-axis is labeled 'SPL' and ranges from -3.0 to 2.5. The x-axis is labeled 'Hz' and ranges from 20 to 24k. The status bar at the bottom indicates '107256MB 48 kHz 16-bit in, 16-bit out' and 'Peak input before clipping 120 dB SPL (uncalibrated)'. The 'Soundcard' and 'Phase' sections are visible at the bottom, showing '0.0 dB' and '0.6 deg' respectively.

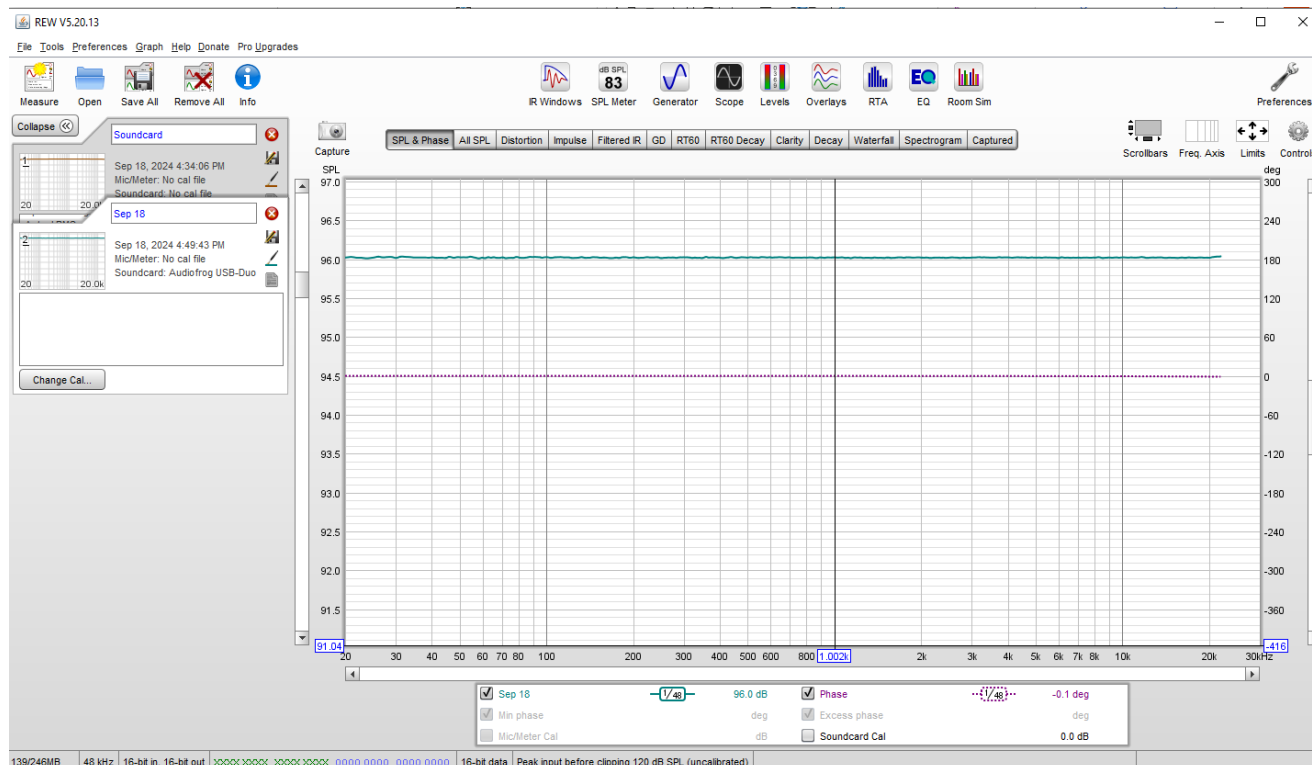
To confirm that the calibration file works, Click on Measure in the top left



Click on Start at the bottom and in a few seconds, the measurement will be completed.

The screenshot shows the 'Make a measurement' dialog box. The 'Type' is set to 'SPL' and 'Impedance'. The 'Method' is 'Sweep'. The 'Range' is set to '10' to '22,000' Hz. The 'Level' is set to '-20.00 dBFS'. The 'Output' is 'HEADPHONE'. The 'Input' is 'MICROPHONE (Master Volume)'. A red arrow points to the 'Start' button at the bottom. The 'Ready to measure...' progress bar shows 0%.

When the measurement completes, you should see a second measurement in REW's main screen on the left below the soundcard calibration measurement. The new measurement will fill the display. The new measurement should be flat with the small amount of attenuation at low frequencies and at high frequencies removed.



Next, go back to the Soundcard panel in Preferences and change the input and output channels and the timing reference channels so that the Left channel is the timing reference and the right channel is the input and output channel.

The screenshot shows the 'Soundcard' panel in the REW Preferences dialog. The 'Output Device' is set to 'Headphones (2- Audiof...' and the 'Input Device' is set to 'Microphone (2- Audiof...'. The 'Output' channel is set to 'R' and the 'Input' channel is set to 'R'. The 'Timing Reference Output' is set to 'L'. The 'Loopback input' is set to 'L'. The 'Output Volume' is 0.50 and the 'Input Volume' is 0.60. The 'Sweep Level' is -20.0 dBFS. The 'Soundcard calibration' section shows 'Headphones (2- Audiofrog USB-Duo) HEADPHONE at 48 kHz' and a 'Calibrate soundcard...' button. The 'Levels' section has 'Use main speaker test signal to check/set levels' selected and a 'Check Levels...' button. The 'Out', 'In', and 'Ref In' meters are visible on the right, with the 'Out' meter showing -95.99 dBFS.

Now you're ready to make impulse measurements!

Connect the output of the sound card (the female end of the Y adapter) to your head unit or your DSP. Be sure your microphone is plugged into USB-Duo's 2(R) input.

Click Measure in the upper left of REW's main screen. When the measurement window opens, be sure that "Use loopback as timing reference" is selected.

Click "Check Levels" and set the head unit's volume control or the input level of your DSP so the stimulus noise is at a low to moderate level. You don't need to make these measurements loudly and doing so may put your speakers in danger!

Then, click Start.

Make a measurement

Type: **SPL** Impedance

Method: **Sweep** Noise

Name: Add number Add date/time Use as entered

Will appear as:

Notes:

Keep for next measurement

Range: Start Freq: End Freq: Hz

Level: RMS dBU dBV Volts dBFS

Protection: Abort if heavy input clipping occurs Abort above SPL limit dB

Ready to measure...

Input:

Settings: Length: Repetitions: 5.5 s

Timing: Timing offset: ms

Playback: **From REW** From file

Sample rate:

Measurements: Delay: seconds

Output:

Invert second output

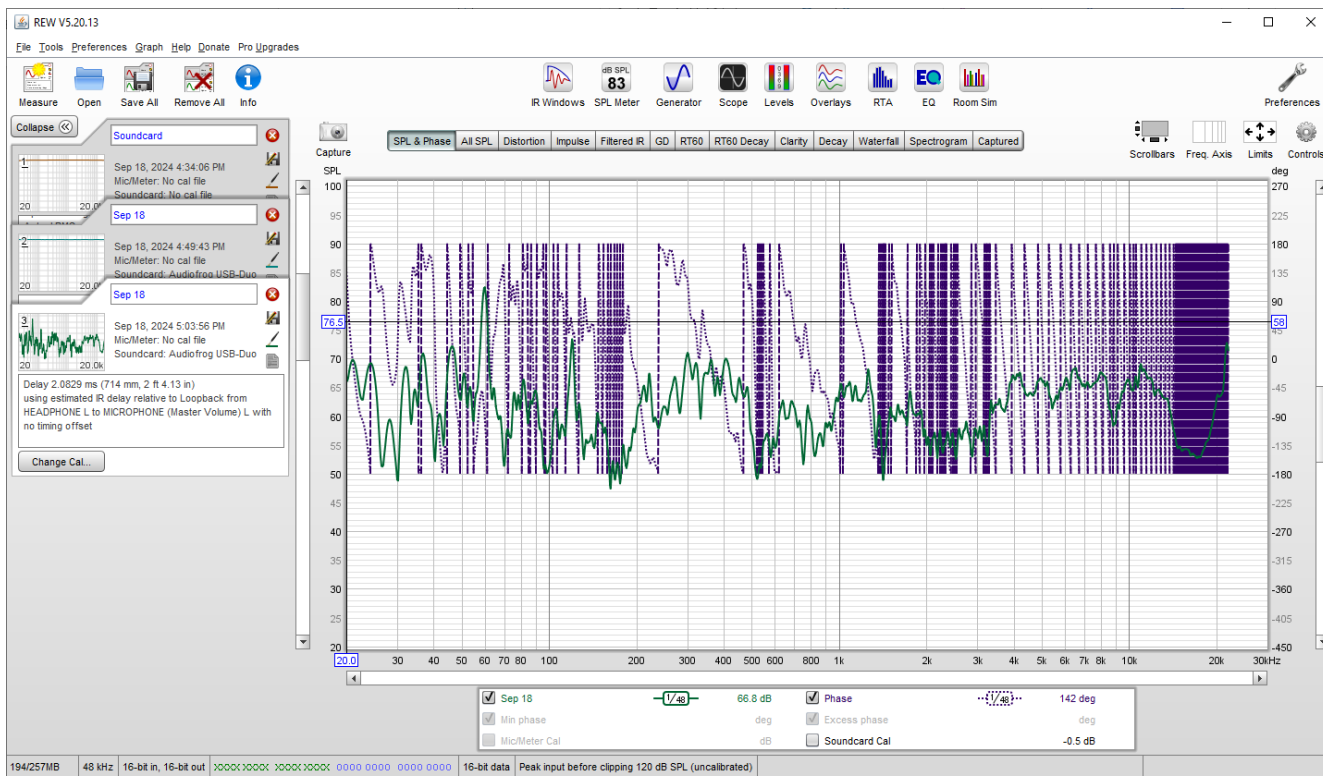
Ref output:

Ref input:

Virtual balanced input

Input:

When the measurement completes, you should see another measurement in the list of measurements to the left in REW's main screen and the new measurement should fill the display. You can turn the phase and frequency response graphs on and off using the check box below the display.



Click on Impulse in the horizontal list of options just above the display. The impulse response measurement will appear in the display.

