

REW
Measurement Guide



Focus Fidelity

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Revisions

Revision	Date	Description
1.0	21 March 2021	Initial Issue
1.1	31 July 2021	Added REW Ref alignment instructions, updated export settings.

Contact

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Introduction

This document is a step-by-step guide for performing impulse response measurements suitable for use with Focus Fidelity's filter design software. The measurement software and microphone used here is Room EQ Wizard (REW) with a USB connected measurement microphone

Measurements at 6 to 10 positions of both the left and right channels are required, the measured impulses should be more than 2 seconds in length and be exported from REW as *.wav files. This guide provides a walk-through of this process.

Technical Support

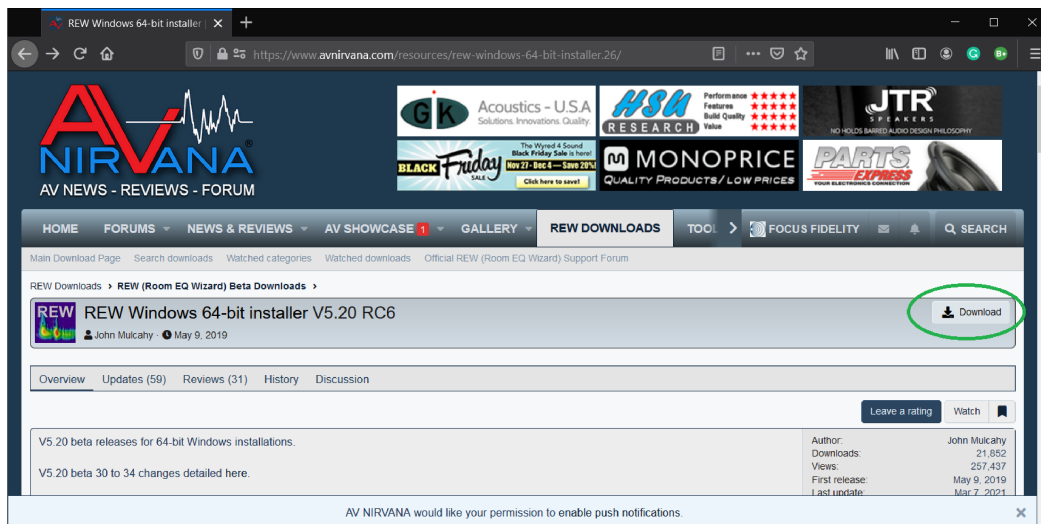
For support please e-mail support@focusfidelity.com and include your REW mdat file or Focus Fidelity project file.

Room EQ Wizard

Room EQ Wizard (REW) is a widely used freeware application for performing acoustic measurements, the official website is <https://www.roomeqwizard.com/>

This guide was written using version 5.20 RC6.

The latest beta release is available here <https://www.avnirvana.com/resources/categories/rew-room-eq-wizard-beta-downloads.1/>



Measurement Microphones

The MiniDSP UMIK-1 is a very widely used measurement microphone, the UMIK-2 is a newer model and is the model used here.

More information and purchase options can be found on the product pages on MiniDSP's website,

<https://www.minidsp.com/products/acoustic-measurement/UMIK-1>

<https://www.minidsp.com/products/acoustic-measurement/UMIK-2>

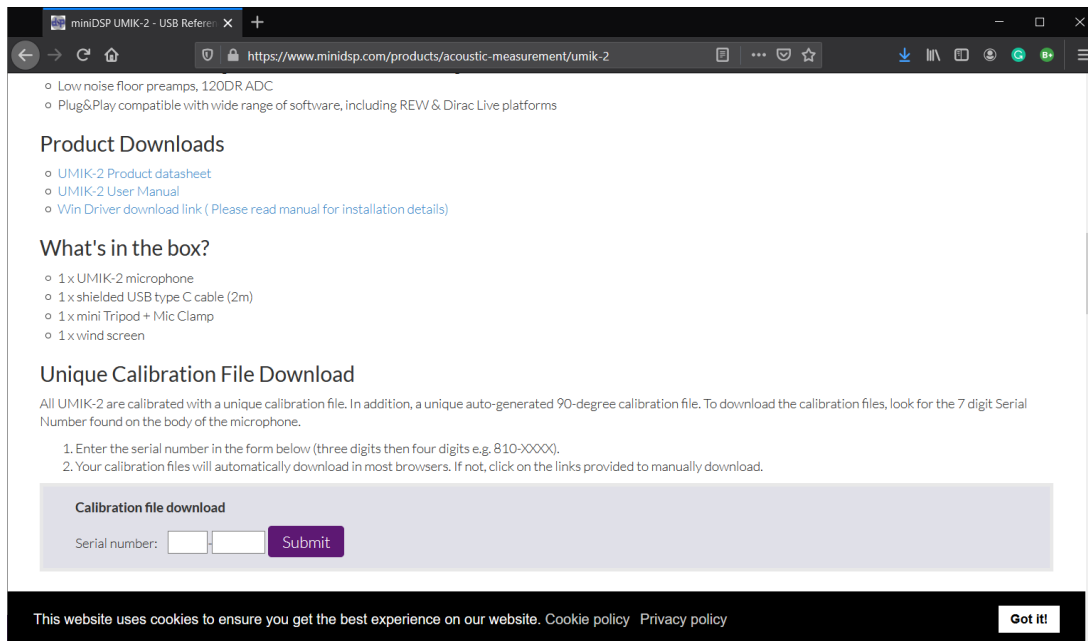
A floor standing microphone stand is highly recommended to allow for easily moving the microphone to different positions,



Microphone Setup

If you are using the UMIK-2 install the windows device drivers if you have not done so already. The UMIK-1 does not require a driver to be installed.

Download the microphone calibration files from the MiniDSP website, these are available from the UMIK-1 & UMIK-2 product pages,

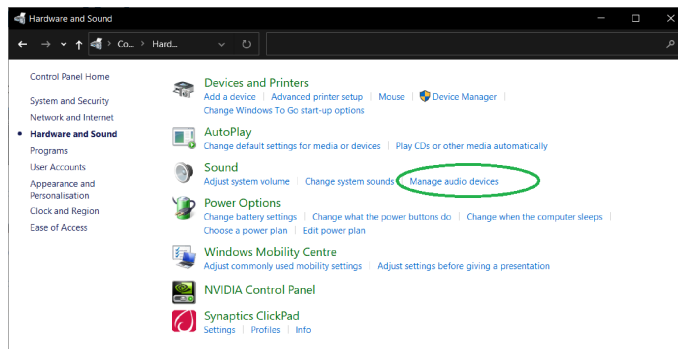


Turn the volume control on your amplifier down.

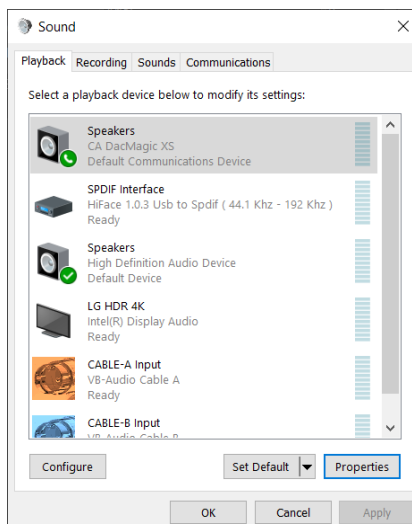
Connect your UMIK-1 or UMIK-2 to your PC. Connect your Hi-Fi system to your PC, this guide assumes you have a DAC, amplifier or speakers with USB or HDMI audio input from your PC.

It is important to configure Microsoft Windows to the same sample rate which will be used in REW, this avoids Windows introducing a sample rate conversion stage.

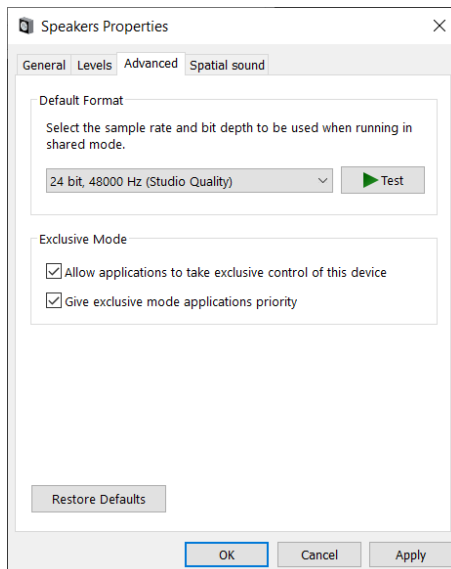
Open windows control panel and select manage audio devices,



Select your playback device,

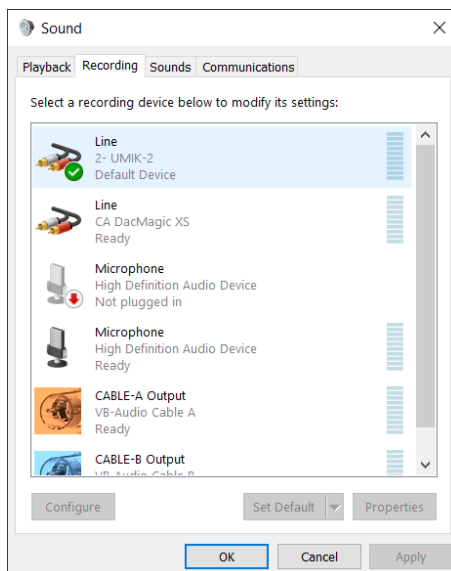


Click Properties, select the advanced tab,

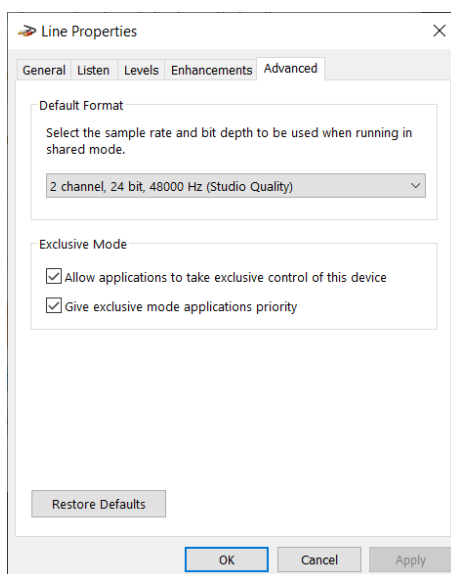


Select 24 bit, 48000Hz. Click OK.

Select the recording tab,



Select UMIK-2 (or UMIK-1) and click Properties, select the advanced tab,

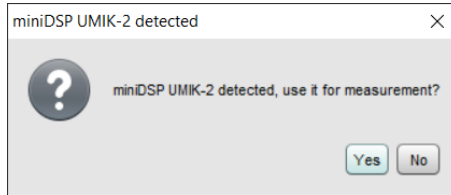


Select 24 bit & 48000Hz. Click OK.

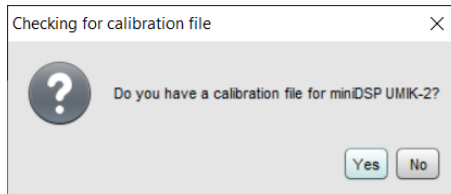
Click OK to close the sound dialogue.

REW Setup

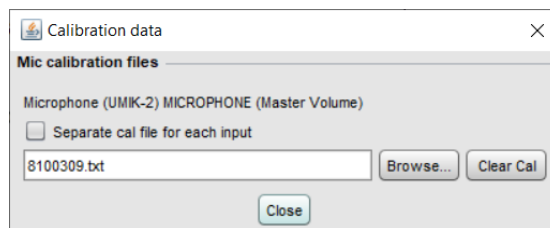
Start REW. On start-up REW should recognise the microphone,



Click Yes. REW will prompt you for the microphone's calibration file,



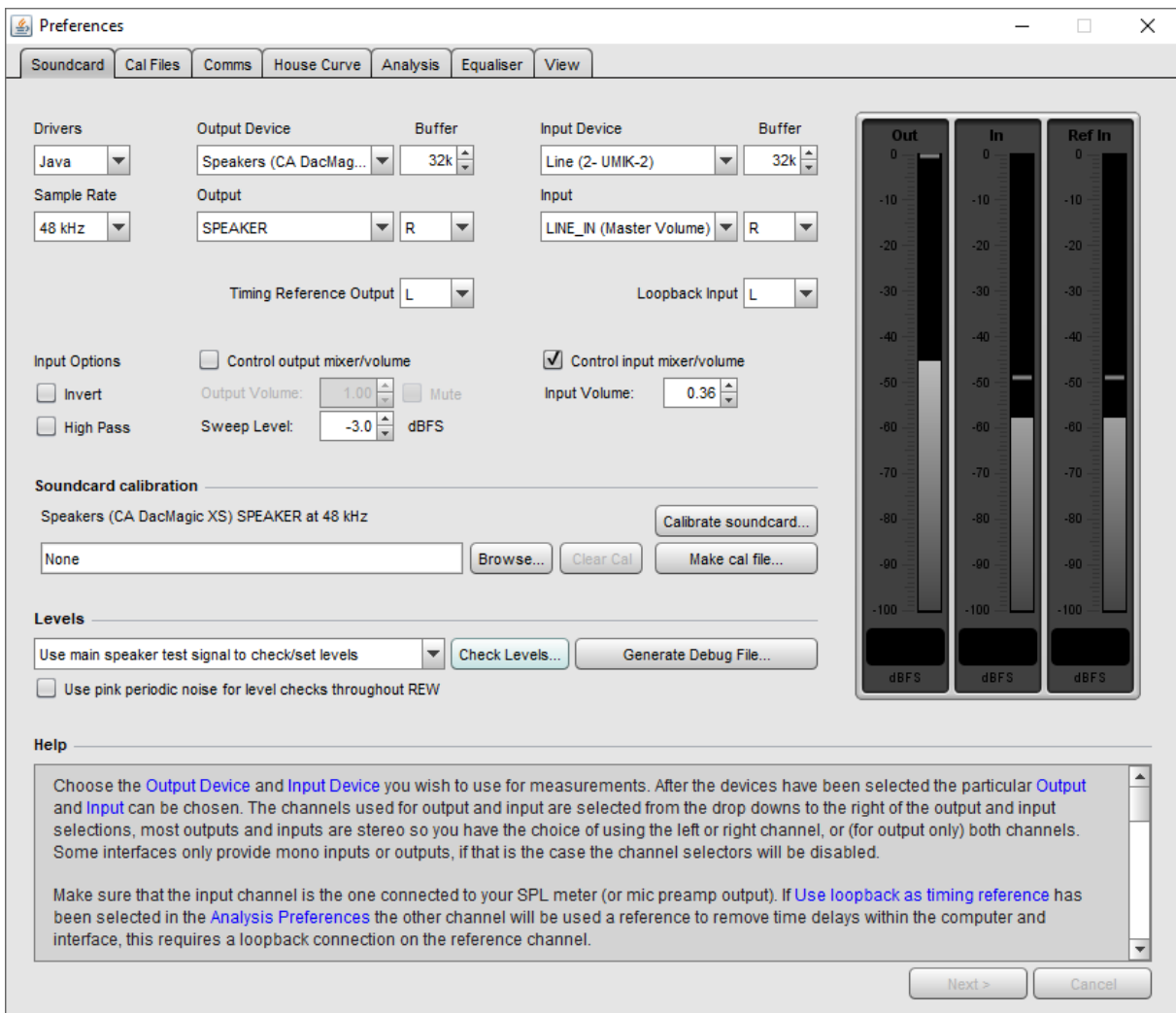
Click Yes.



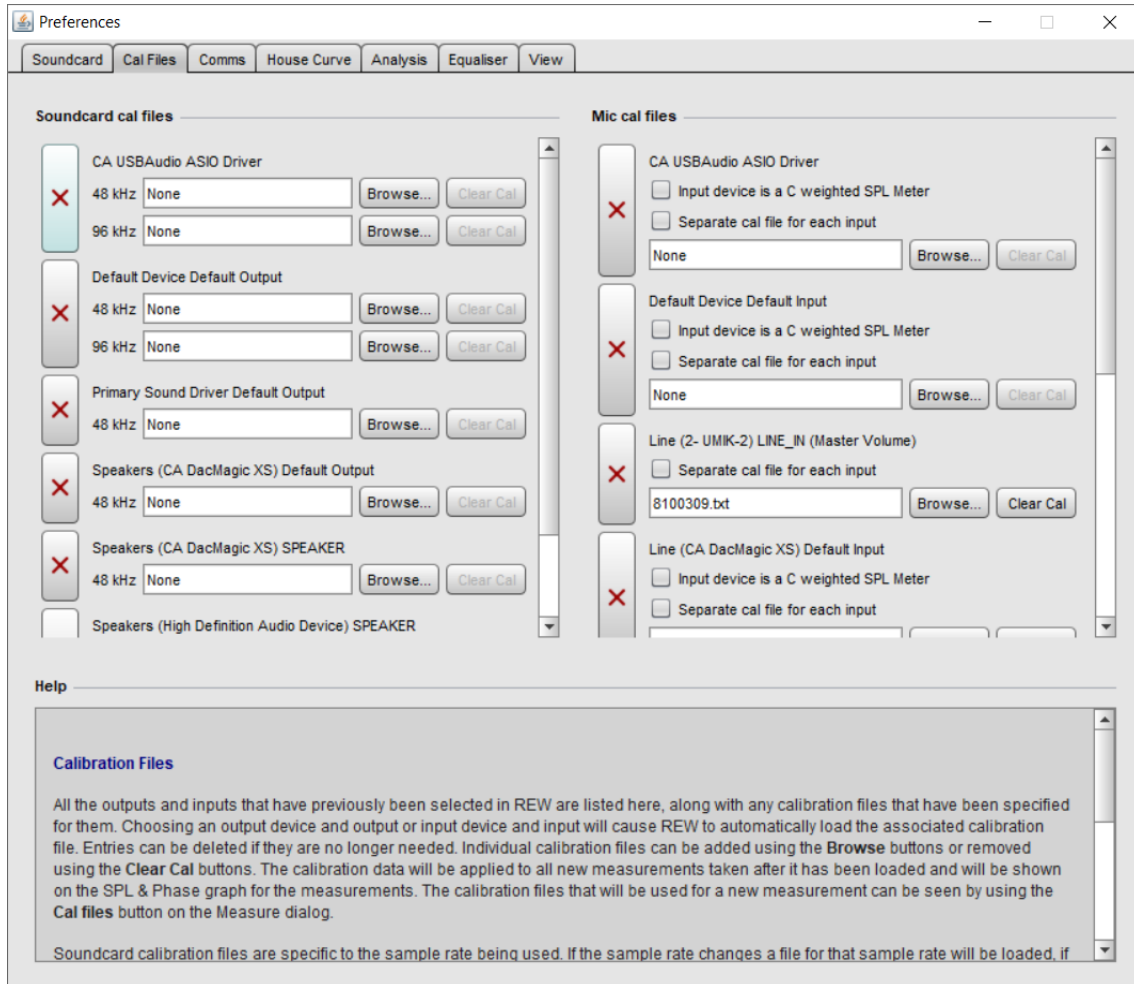
Browse to your calibration file, select the on axis calibration file (the one without _90deg in the filename). Click Close.

From the preferences menu select preferences.

Ensure the setup is as shown below. Sample Rate must be set to 48 kHz, sweep level -3.0 dBFS.



Click the Cal Files Tab,



Ensure that the calibration file is loaded for all entries of your UMIK in the Mic cal files list.

Sound card calibration is not required.

REW does not apply the microphone calibration to the impulse response measurements which will be exported as described later. **For this reason your microphone calibration should also be applied in the Focus Fidelity Filter Designer.** This described in the filter designer user guide.

Performing Measurements

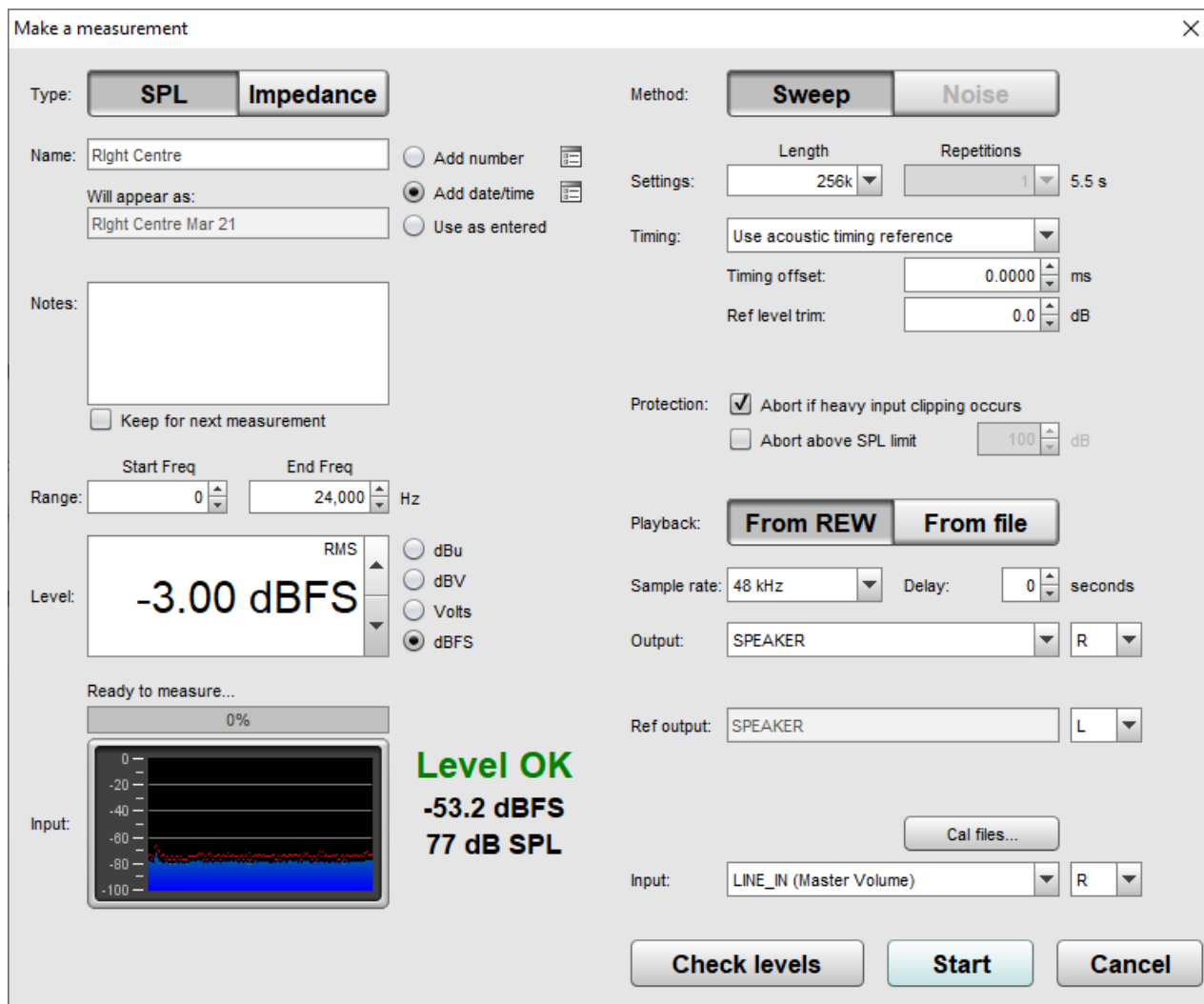
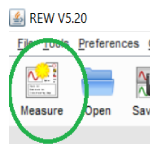
Microphone Positioning

Position the microphone in your primary listening position, point the microphone at the mid point between the speakers.

Five to nine further measurements should be taken around this primary position, vary the position of the microphone in all three dimensions.

Measurements in REW

In REW click the new measurement button,



Starting with the right hand loudspeaker and the microphone in the central listening position name the measurement Right Centre.

Ensure the rest of the settings are as shown above,

Start Freq = 0, End Freq = 24000, Level = -3.00 dBFS, Length 256k, Use acoustic timing reference, sample rate = 48 kHz.

Turn the volume on your amplifier down.

Click the check levels button, REW will play a white noise signal through the right hand loudspeaker for a few seconds.

At the end of the test noise REW will indicate if the volume level was loud enough.

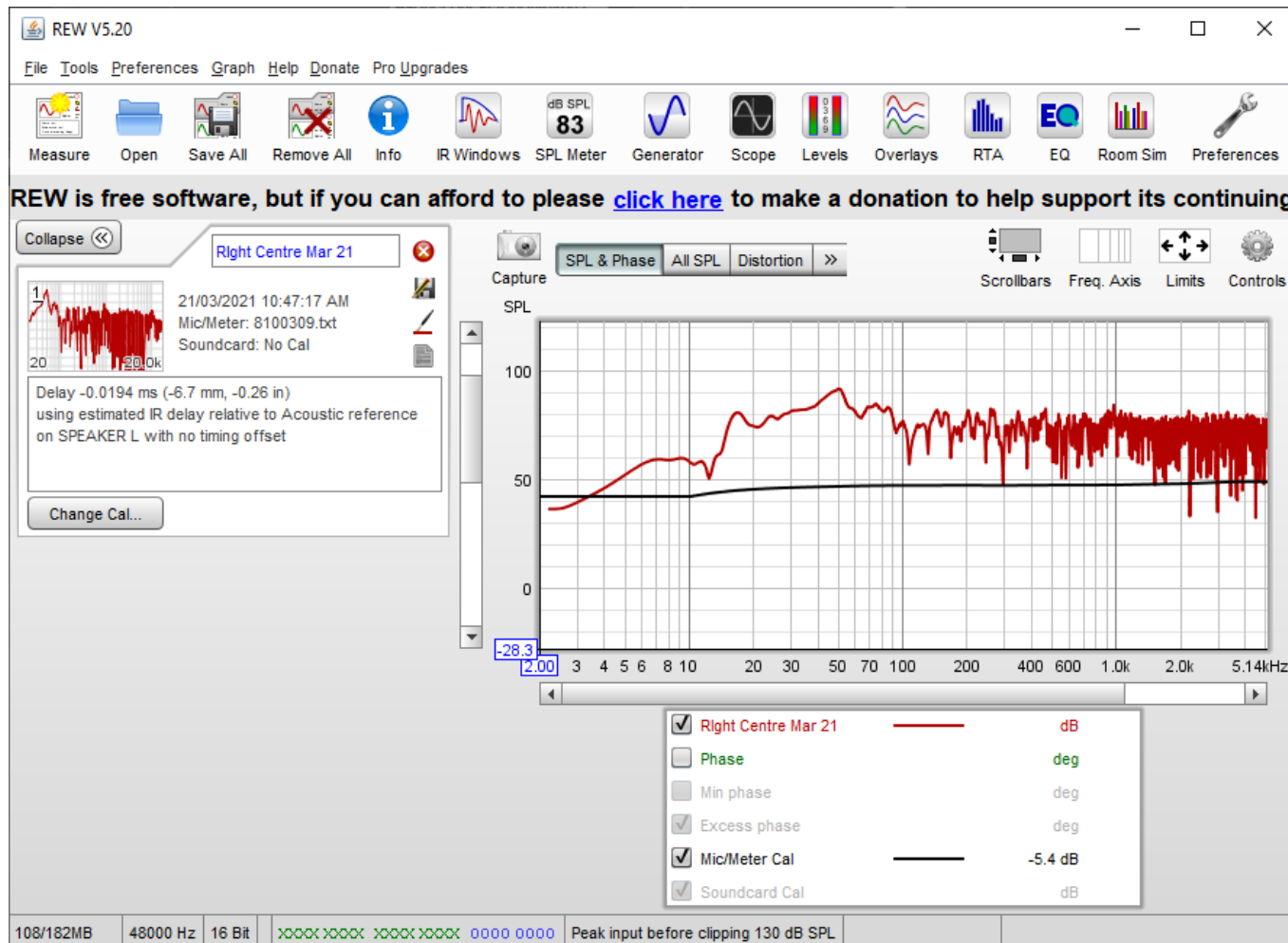
Increase the volume setting and repeat until REW indicates Level OK. **Keep the amplifier volume at this setting for all further measurements.**

Click start to perform the measurement.

A high frequency chirp should be emitted from the left hand speaker followed by the main sweep signal from the right hand speaker.

The chirp from the left hand speaker is the acoustic timing reference.

Your REW screen should show the new measurement,



Click the new measurement button again,

The 'Make a measurement' dialog box is shown with the following settings:

- Type: **SPL** / Impedance
- Method: **Sweep** / Noise
- Name: Left Centre
- Will appear as: Left Centre Mar 21
- Notes: (Empty)
- Keep for next measurement:
- Range: Start Freq 0 Hz, End Freq 24,000 Hz
- Level: -3.00 dBFS (RMS)
- Units: dBu, dBV, Volts, **dBFS**
- Ready to measure...: 0%
- Input: (Graph showing frequency response)
- Settings: Length 256k, Repetitions 1, 5.5 s
- Timing: Use acoustic timing reference
- Timing offset: 0.0000 ms
- Ref level trim: 0.0 dB
- Protection: Abort if heavy input clipping occurs, Abort above SPL limit 100 dB
- Playback: **From REW** / From file
- Sample rate: 48 kHz, Delay: 0 seconds
- Output: **SPEAKER**, **L** (indicated by a green arrow)
- Ref output: SPEAKER, L
- Cal files... (Button)
- Input: LINE_IN (Master Volume), R
- Buttons: **Check levels**, **Start**, Cancel

Name the measurement Left Centre and swap the output to the left output indicated by green arrow above.

Leave all other settings and amplifier volume the same as before.

Click Start. The sweep signal will will run. Once complete your REW screen should look like,

The REW V5.20 software interface displays the following information:

- File Tools Preferences Graph Help Donate Pro Upgrades
- Measure Open Save All Remove All Info IR Windows SPL Meter Generator Scope Levels Overlays RTA EQ Room Sim Preferences
- REW is free software, but if you can afford to please [click here](#) to make a donation to help support its continuing
- Measurement list:
 - 1. Right Centre Mar 21 (21/03/2021 10:47:17 AM, Mic/Meter: 8100309.txt, Soundcard: No Cal)
 - 2. **Left Centre Mar 21** (21/03/2021 10:55:05 AM, Mic/Meter: 8100309.txt, Soundcard: No Cal)
- Delay: -0.0233 ms (-8.0 mm, -0.31 in) using estimated IR delay relative to Acoustic reference on SPEAKER L with no timing offset
- Change Cal... (Button)
- Main Graph: SPL vs Frequency (3 to 5.14 kHz). Peak at 2.00 kHz, -28.3 dB.
- Legend:
 - Left Centre Mar 21 (Green line, dB)
 - Phase (Grey line, deg)
 - Min phase (Grey line, deg)
 - Excess phase (Grey line, deg)
 - Mic/Meter Cal (Black line, -5.4 dB)
 - Soundcard Cal (Grey line, dB)
- Status Bar: 84/172MB, 48000 Hz, 16 Bit, Peak input before clipping 130 dB SPL

Move the microphone to a new position, click the new measurement button,

Make a measurement

Type: **SPL** Impedance

Method: **Sweep** Noise

Name: Right Pos 1 Add number Add date/time Use as entered

Will appear as: Right Pos 1 Mar 21

Notes:

Keep for next measurement

Range: Start Freq: 0 End Freq: 24,000 Hz

Level: -3.00 dBFS RMS dBu dBV Volts dBFS

Ready to measure... 0%

Input:

Settings: Length: 256k Repetitions: 1 5.5 s

Timing: Use acoustic timing reference

Timing offset: 0.0000 ms

Ref level trim: 0.0 dB

Protection: Abort if heavy input clipping occurs Abort above SPL limit 100 dB

Playback: **From REW** From file

Sample rate: 48 kHz Delay: 0 seconds

Output: SPEAKER R

Ref output: SPEAKER L

Cal files...

Input: LINE_IN (Master Volume) R

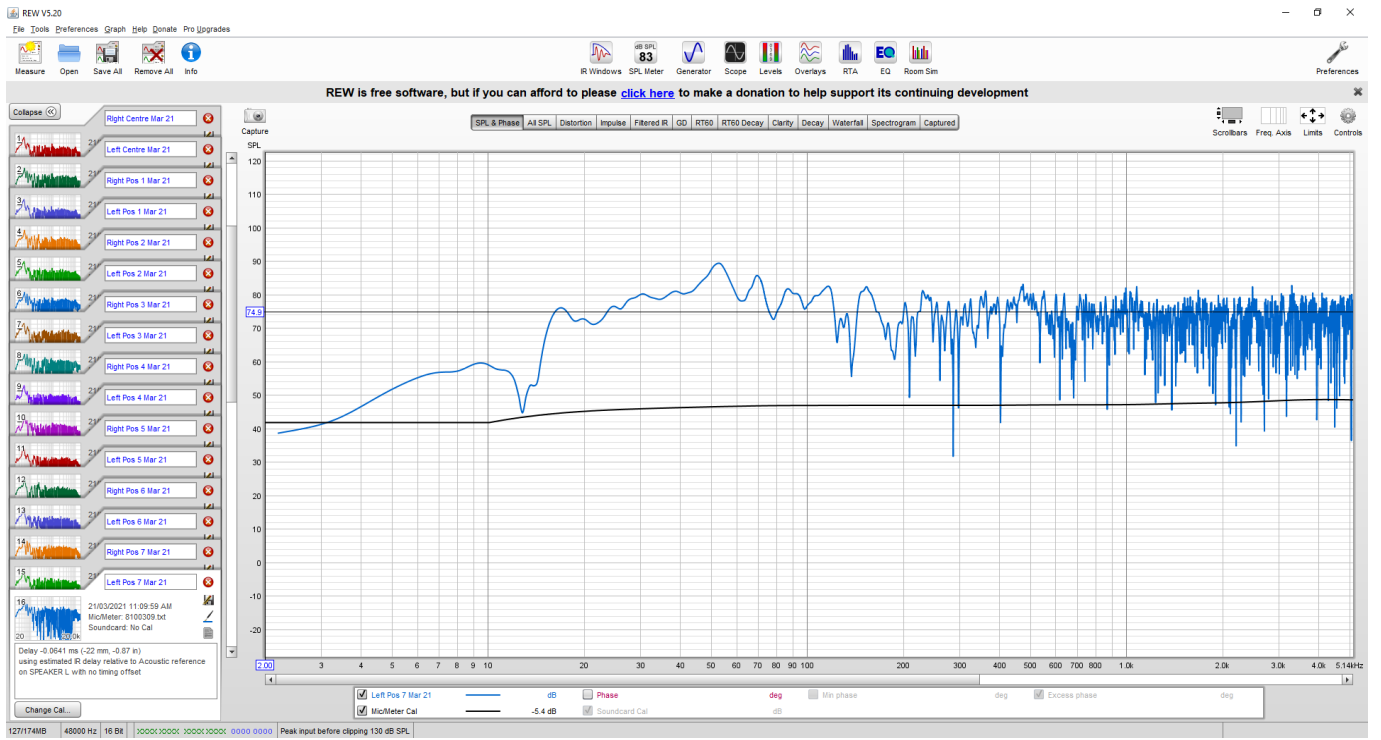
Check levels Start Cancel

Switch the output back to the right channel, name the measurement Right Pos 1. Click Start.

Repeat for the left hand channel, name the measurement Left Pos 1.

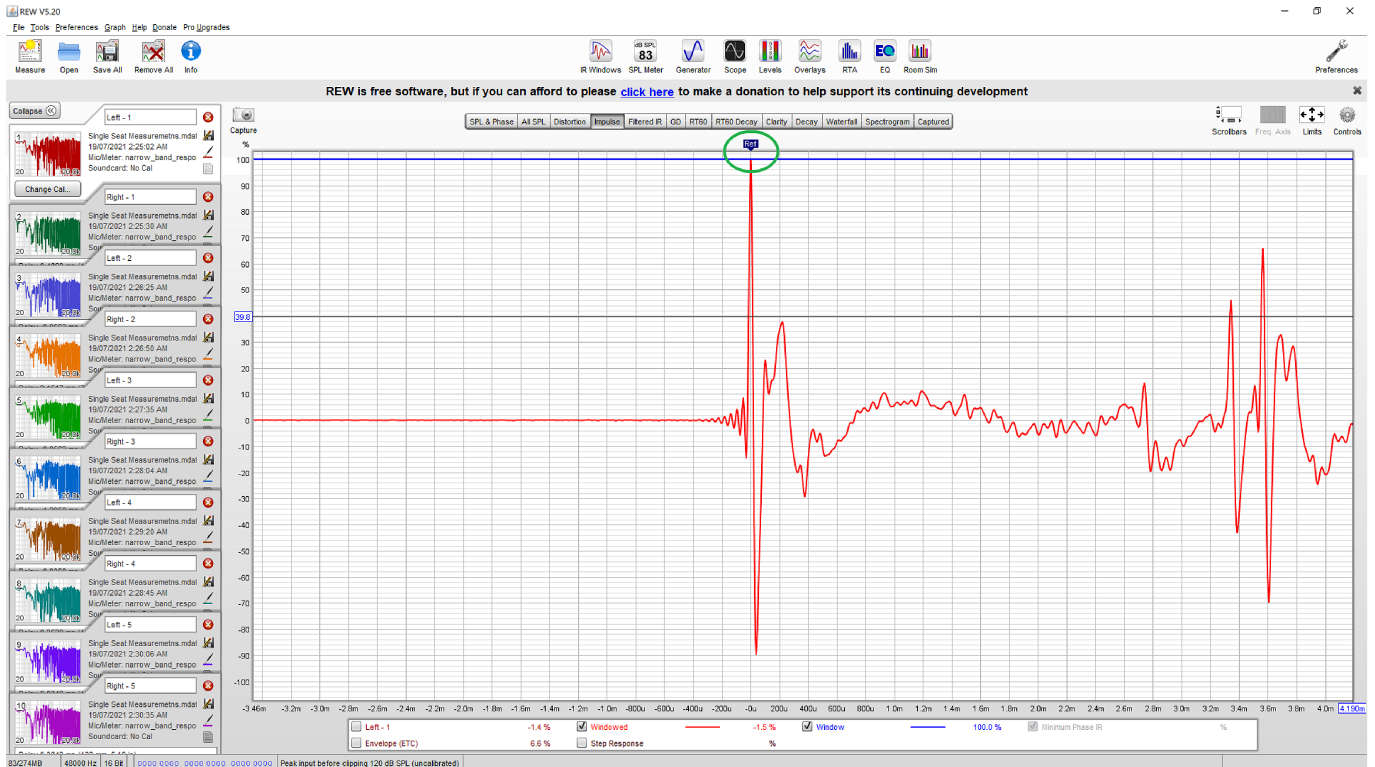
Repeat for a further 4 to 8 measurement positions.

You should have a complete set of measurements in REW,



Impulse Reference Alignment

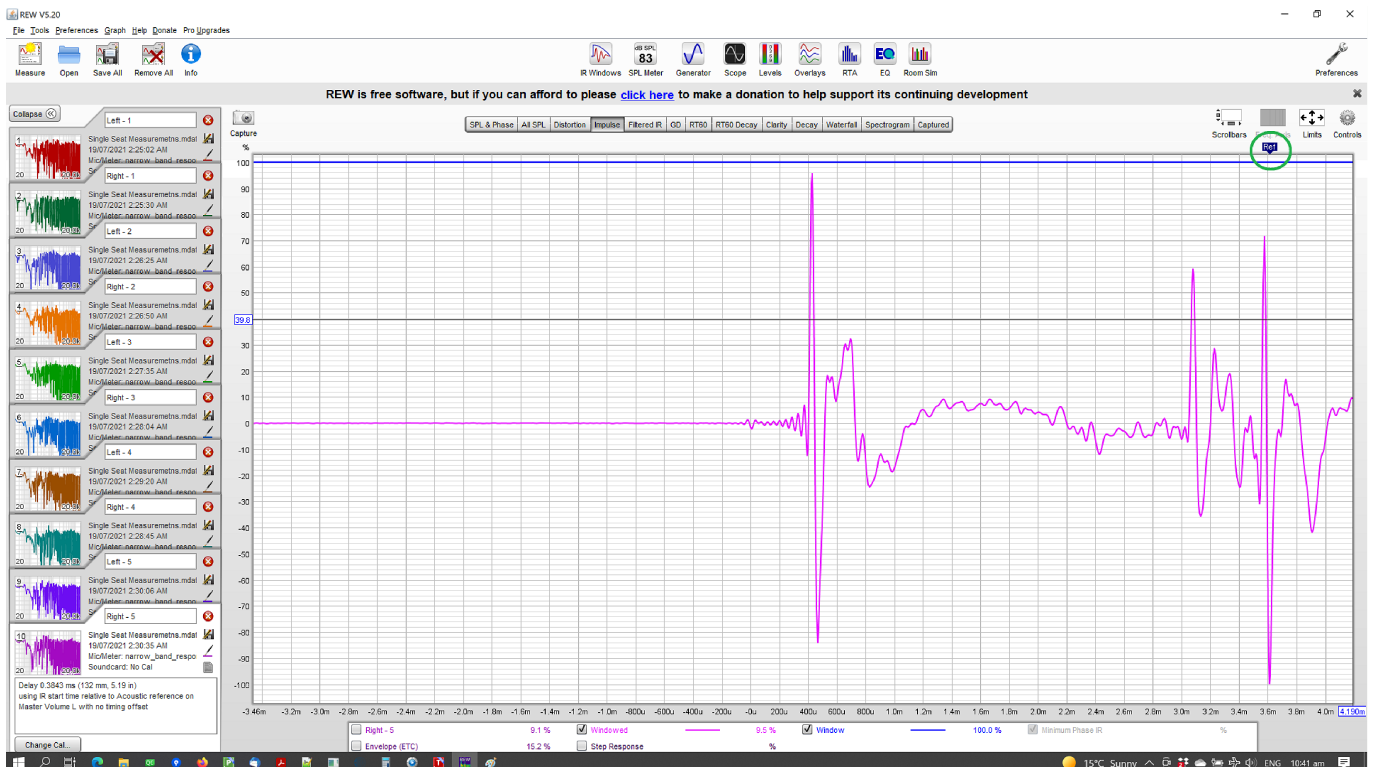
Select the first measurement at the top of the list on the left hand side. Click the impulse button above the graph,



The Ref marker above the graph (circled in green in image above) should be aligned with the direct sound impulse. It can be aligned with the positive or negative peak but must be aligned with the same peak for all measurements.

The Ref marker can be dragged left or right to adjust the alignment.

In the example below REW has automatically (and incorrectly) placed the Ref marker (circled in green) on a reflection instead of the direct sound.

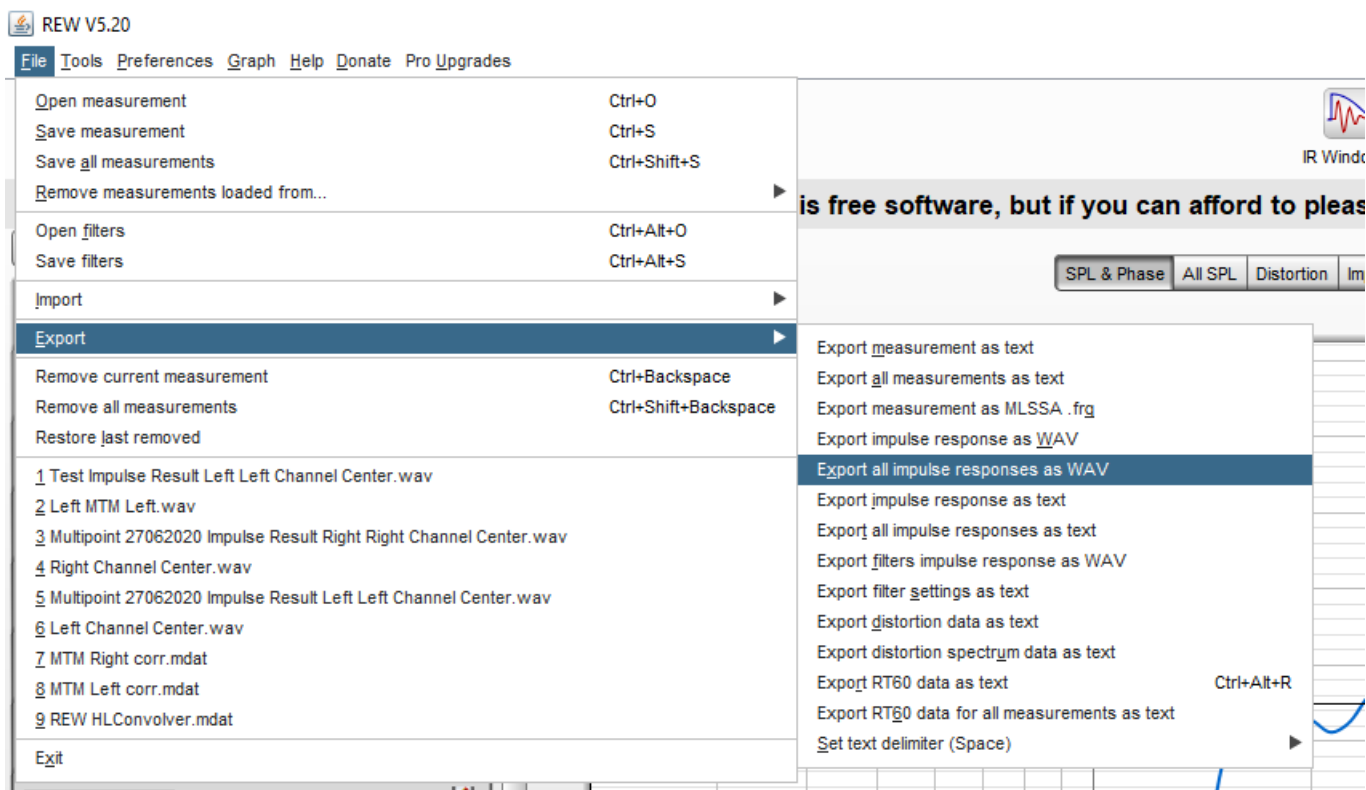


The ref marker should in this case be dragged to the left to align it with the positive peak of the direct sound.

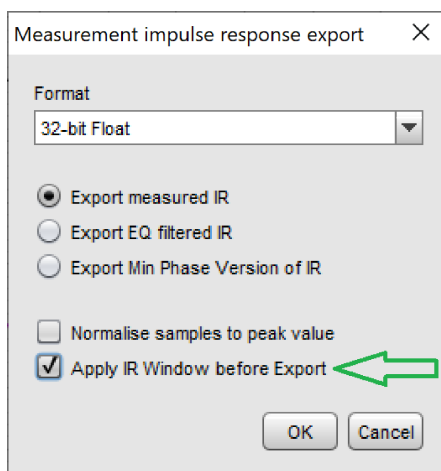
Repeat the alignment check and adjustment (if required) for all measurements.

Measurements Export

Go to the file menu and select Export -> Export all impulse responses as WAV,



Choose the options shown below and click OK



Ensure the "Apply IR Window before Export" is selected.

Select a directory and save the measurements.