



(<http://www.minidsp.com/>)

Auto-EQ tuning with REW

Welcome to the world of system tuning and DSP!

There isn't much to argue on the fact that speaker building is an art requiring time and understanding of acoustic theories. While some simulation software may help for the design of your enclosure, audio measurements are the basis for any evaluation of your system. No matter how pretty your box is or the choice of high specs drivers, your "system" (i.e. enclosure + speakers + crossover) may very well have poor specifications if it isn't properly tuned (equalization/time alignment).

Thanks to the partnership between the miniDSP platforms and the well known freeware Room Eq Wizard (REW), miniDSP is much more than a digital audio processor. By providing a complete measurement + system tuning solution fitting in the palm of your hand, the miniDSP product line innovates once again, yet keeping our price very competitive.

What's needed?

You will need:

- A miniDSP plugin (</products/plugins>) that supports the "REW integration" feature. (Suitable examples includes the Advanced 2-way, Advanced 2.1, Advanced 4-way, and the 2x8, 4x8, 4x10 and 10x10 Crossovers.)
- The miniDSP hardware that runs the plugin - see the "Supported platforms" row on the plugin page linked above.
- Room EQ Wizard (<http://www.hometheatershack.com/roomeq/>) (REW), which is a free download from Home Theater Shack.
- A measurement microphone, such as the UMIK-1 (</products/acoustic-measurement/umik-1>).

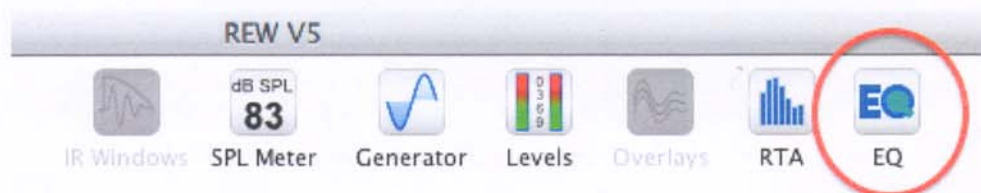
1. Make the initial measurement

In the miniDSP interface, disable all equalization and crossover filters on your subwoofer. Turn off all amps except the subwoofer amp(s), or disable the other outputs in the miniDSP interface. This is so you can measure the "raw" subwoofer response.

Then, in REW, run a measurement sweep from 10 Hz to 300 Hz. Ensure that your SPL is adequate to get a clean measurement.

2. Calculate the correction filters in REW

From the REW main screen, open the "EQ" tab.

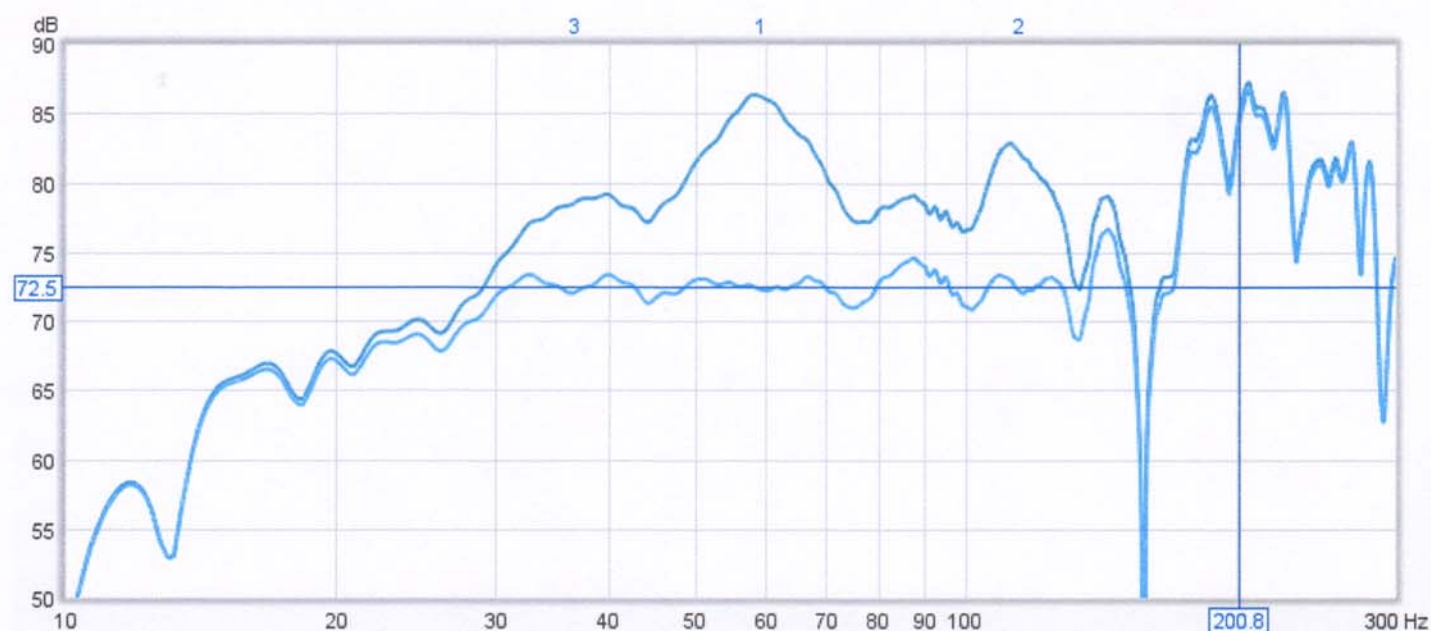


Set the parameters as shown in the following screenshot. Note that in the Equaliser section you will need to select "MiniDSP" for plugins running at 48 kHz, and "MiniDSP-96k" for plugins running at 96 kHz.

The screenshot shows the "Equaliser: MiniDSP" settings window. It is divided into three main sections: "Equaliser: MiniDSP", "Target Settings", and "Filter Tasks".
Equaliser: MiniDSP section contains a list of radio buttons for selecting an equaliser plugin: TMREQ, DSP1124P, FBQ2496, DCX2496, SMS-1, R-DES, DSP-30, USM 810, MiniDSP (selected), MiniDSP-96k, ADA PEQ, and Generic.
Target Settings section includes fields for Speaker Type (set to None), Crossover, Cutoff (Hz), LF Slope, LF Cutoff (Hz), and Target Level (dB) (set to 72.5). There is a "Set Target Level" button.
Filter Tasks section includes fields for Match Range (10 to 120 Hz), Individual Max Boost (6 dB), Overall Max Boost (3 dB), and Flatness Target (3 dB). Below these fields is a "Match Response to Target" button. At the bottom, there are three buttons: "Manual Optimisation Controls", "Optimise Gains", "Optimise Gains and Qs", "Optimise Gains, Qs and Frequencies", "Retrieve Filter Settings from Equaliser", "Send Filter Settings to Equaliser", and "Reset Filters for Current Measurement".

Next, click on "Set Target Level" to set the target level to REW's recommendation. (You can manually change it later.)

Then click on "Match Response to Target." REW will generate filters to optimize the response and display the predicted response (response after correction). Here is an example with the measured response in dark blue and the predicted response in light blue:



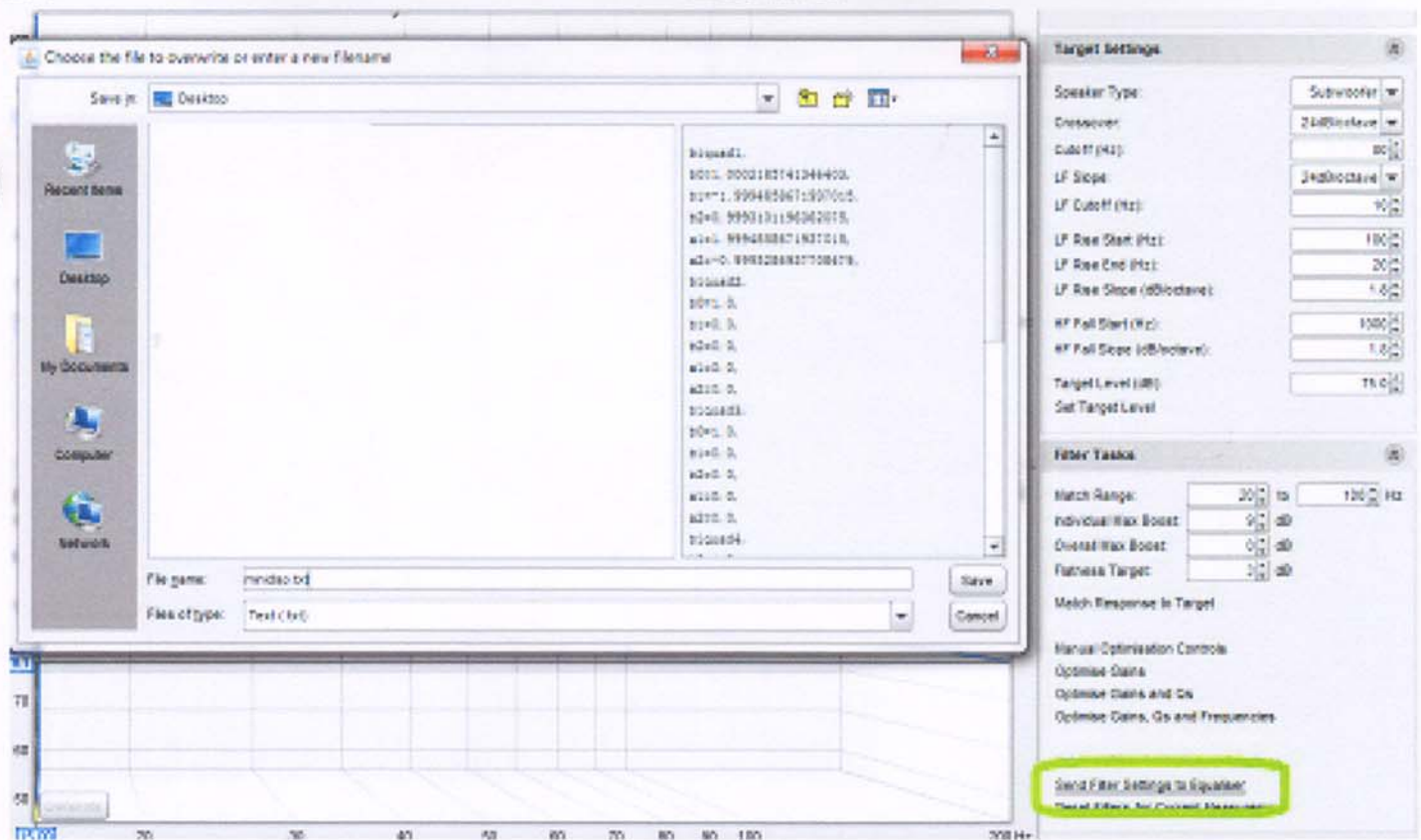
You can see the filter settings calculated by REW by clicking on the "EQ Filters" button near the top of the screen:

No EQ						
<div> <div>Sort Ascending</div> <div>by Fre</div> </div>						
MiniDSP	Control	Type	Frequency	Gain	Q	
<input checked="" type="checkbox"/> 1	Auto	PK	59.00	-13.5	2.49	
<input checked="" type="checkbox"/> 2	Auto	PK	114.0	-8.7	4.71	
<input checked="" type="checkbox"/> 3	Auto	PK	36.65	-4.0	4.48	
<input checked="" type="checkbox"/> 4	Auto	None				
<input checked="" type="checkbox"/> 5	Auto	None				
<input checked="" type="checkbox"/> 6	Auto	None				

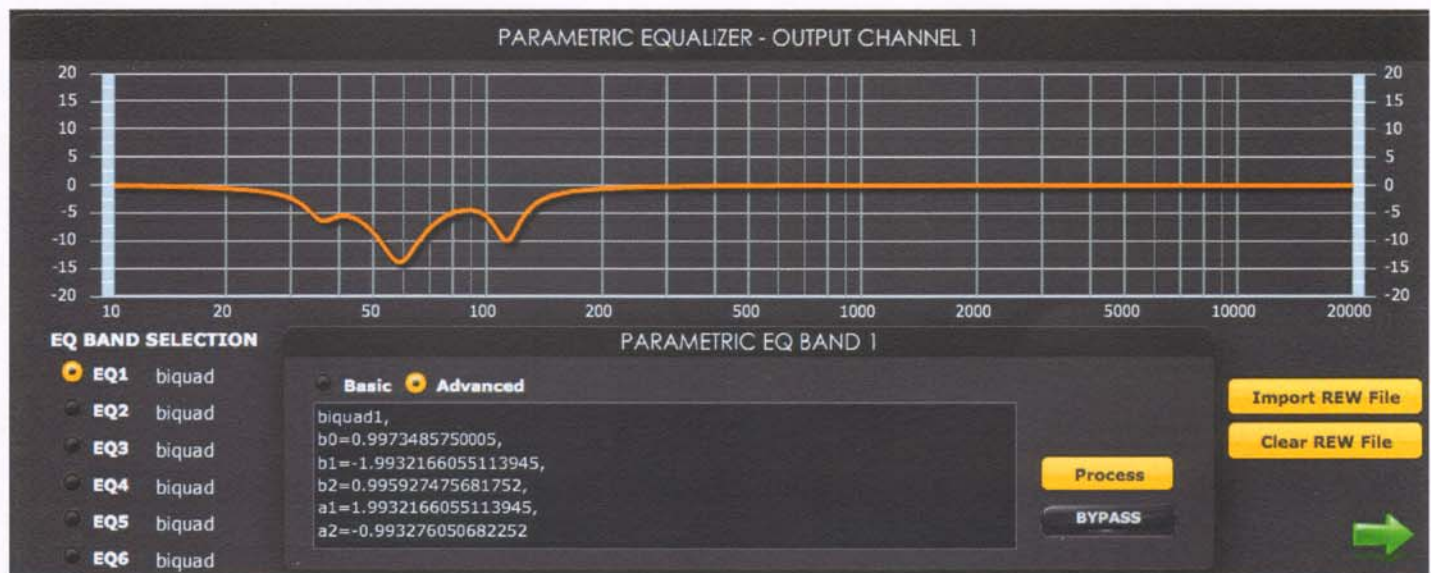
In this example, only three filters were needed. If REW uses a lot of filters or uses filters with very high Q (> 20), experiment with the target level setting to try and get a smoother correction curve. You can also experiment with the flatness target and the max boost settings to get the best predicted response.

3. Load the correction filters into the miniDSP

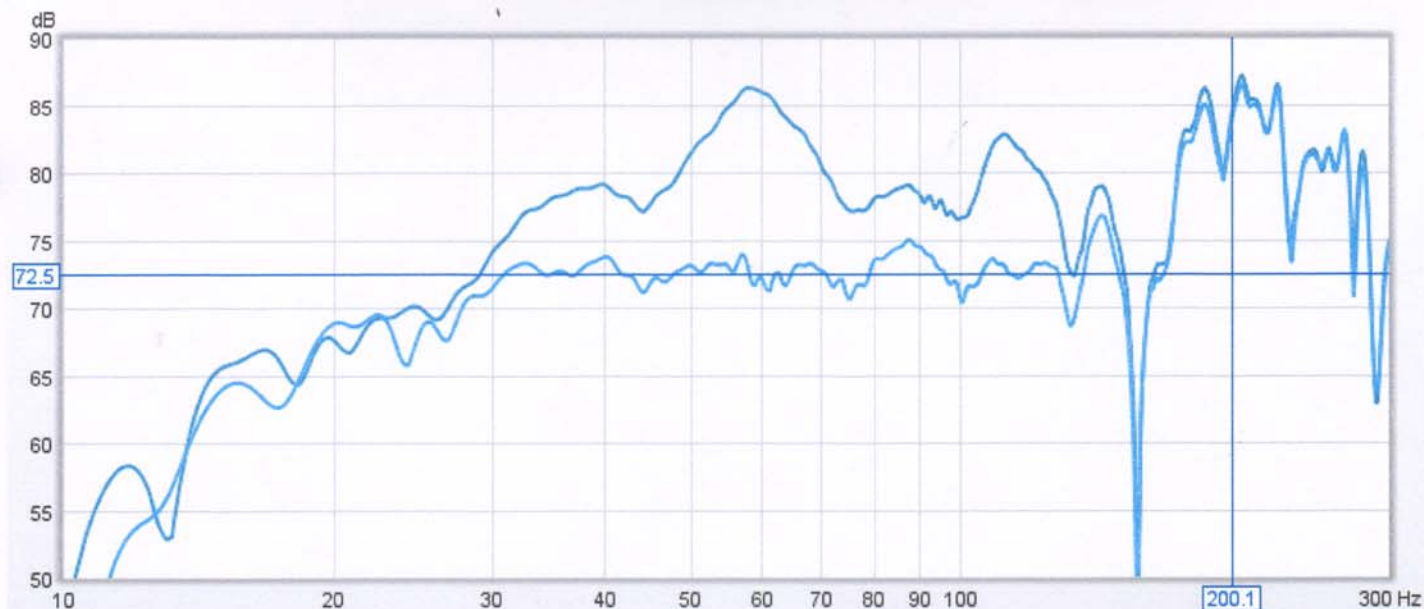
Once the predicted response is satisfactory, click on "Send Filter Settings to Equaliser" and save the settings as a file.



Then, in the miniDSP plugin, navigate to the Parametric EQ block that will be equalizing the subwoofer. Set it to "Advanced" mode and click on "Import REW File." Select the file that you just saved, and the plugin will then display the correction filter:



Confirm your result by running your measurement sweep again - it should be much smoother than before! Here in light blue is the new measurement, compared to the original measurement in dark blue - as you can see, the measured result is almost identical to REW's prediction:



4. Integrate the subwoofer

In the crossover block in the miniDSP interface, re-enable the subwoofer's low pass filter. If you have a ported sub, you may wish to also add a high pass filter to protect the sub from over-exursion at high levels and low frequencies.

Then enable the other outputs (main speakers or drivers) and run full-range measurement sweeps. If there is a bump or dip at the crossover point, try adjusting the crossover settings (frequency, slope, phase) and the time delay of the subwoofer to flatten it out.

Next steps

Once you have mastered the above procedure, you can improve your system even further:

- Try different subwoofer locations to find the one with the smoothest response. The smoother the response without equalization, the better the result will be with equalization!
- Make several measurements around the listening area, and in the REW All SPL tab, click on "Average the Responses." Then use that average for the EQ calculation.
- If you have a sealed sub, apply a Linkwitz Transform (</linkwitz-transform/linkwitz-transform.html>). You will now have the smoothest bass response you could imagine! Don't forget to ask on the miniDSP forum if you have questions.



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