

Using MiniDSP 2x4 to Time-Align Multiple Subs on One Channel before Room Correction

(Last updated March 10, 2017)

The screenshot displays the MiniDSP-4wayAdv software interface. At the top, the title bar reads "MiniDSP-4wayAdv" and the window title is "MINI DSP - 4 WAY CROSSOVER ADV". Below the title bar are navigation tabs: "Audio Settings", "System Settings", "Biquad Calculator", and "miniDSP.com". On the right side of the top bar, there are icons for "AUDIO ON" (a green circular arrow) and "HELP" (a red lifebuoy).

The main interface is divided into several sections. On the left, there are three yellow boxes representing processing stages: "Input Gain", "Parametric EQ", and "4 wayCrossover". To the right of these boxes are four yellow boxes labeled "Parametric EQ - Ouput 1", "Parametric EQ - Ouput 2", "Parametric EQ - Ouput 3", and "Parametric EQ - Ouput 4". Further right are two larger yellow boxes: "Delay/ Gain/ RMS - Outputs 1 & 2" and "Delay/ Gain/ RMS - Outputs 3 & 4".

Below this main section is a section titled "OUTPUTS 1 and 2". It contains two columns, "OUTPUT CHANNEL 1" and "OUTPUT CHANNEL 2". Each column has a vertical gain slider on the left, ranging from 0 to -70 dB, with a "MUTE" button below it. To the right of the slider is a "Parametric EQ" color bar. Further right is a "Delay" control section with a dropdown menu showing "0" and a "Polarity" section with an "INVERT" button. Below the delay control, it says "Distance: 0 meters". A green arrow points to the right at the bottom right of the interface.

Using MiniDSP 2x4 to Time-Align Multiple Subs On One Channel before Room Correction

(Rev 1.6, March 10, 2017)

Contents

Contents.....	2
Overview	3
The Procedure.....	4
Step 1: Gain-matching the subwoofers.	4
Step 2: Deciding which MiniDSP 2x4 is appropriate for your setup.	5
Step 3: Insert the MiniDSP into the signal path.....	5
Step 4: Set up the MiniDSP.	6
Step 5: Optimizing sub placement.	13
Step 6: Set Output Delays.	13
Alternate Method of Determining Delays Using Audyssey.	17
Checking Sub Polarity.....	17
Step 7: Determining the Gain Structure.	21
Step 8: Applying DSP Filters Using REW's EQ Tool (Optional).	23
Step 9: Running Automated Room Calibration.....	30
a: Audyssey Calibration.....	30
b: Dirac Live Calibration (using the miniDSP DDRC-88A).	34
Revision History	37
Credits	37

Using MiniDSP 2x4 to Time-Align Multiple Subs On One Channel before Room Correction

(Rev 1.6, March 10, 2017)

Overview

The purpose of this procedure is to outline the approach to use the MiniDSP 2x4 to time-align multiple subwoofers when using an AVR with automated room correction systems (e.g. Audyssey and Dirac Live).

The benefits of using the MiniDSP are:

1. Allows time-alignment of multiple subs for AVR's with Audyssey MultEQ or MultEQ XT, which do not have two sub channels with unique level and delay settings, or with the miniDSP DDRC-88A, which has only one sub channel.
2. Allows more control for time-aligning more than two subs.
3. Allows experimentation with EQ'ing the sub channel prior to running room correction, potentially improving the final frequency response.

Assumptions:

1. The reader has a measurement system such as REW or OmniMic and knows how to configure the systems and take basic room measurements. (REW is used in this guide)
2. The reader will have conducted the necessary subwoofer placement steps to ensure that the sub locations are optimized prior to running this procedure. (Note: since the MiniDSP allows for up to four unique sub delay settings, it is not necessary to restrict sub placements to symmetrical, equidistant placements).
3. Multiple identical subs are being time-aligned. Time-aligning disparate subs is much more of a challenge, and results may or may not be acceptable.

Requirements:

1. AVR or Pre-pro with a subwoofer output channel.
2. MiniDSP 2x4 hardware, available for on-line purchase [here](#). There are two versions of the MiniDSP 2x4, an un-balanced and a balanced version. The balanced version is used in this guide. See subsequent discussion with respect to which 2x4 model will be best for you.
3. A laptop, which is used both to configure the MiniDSP plug-in software, to measure levels, and to conduct before/after audio performance measurements. (A Windows laptop is recommended, and is used in this procedure).
4. A microphone for use with the measurement software (a USB mic is recommended for use with REW. Download the [REW Guide here](#) for more information regarding selecting the appropriate microphone.)
5. Appropriate cables to connect the AVR with the MiniDSP, appropriate cables to connect the subs to the MiniDSP, and a USB cable to connect the laptop to the MiniDSP (a short one is included with the MiniDSP, although cables up to 5m can be used).
6. A voltmeter (digital multi-meter) (available from a hardware store for a reasonable price).

Using MiniDSP 2x4 to Time-Align Multiple Subs On One Channel before Room Correction

(Rev 1.6, March 10, 2017)

The Procedure

Step 1: Gain-matching the subwoofers.

Overview: The multiple subwoofers we are time-aligning will produce a combined output level at the MLP which is a sum of each subwoofer's output level (e.g. a higher level, but how much higher depends on sub placement, room effects, etc.). Before proceeding, we need to establish the proper gain for each sub. There are two approaches to this, one is called "Level-matching" and one is called "Gain-Matching".

Level-matching is accomplished by placing a SPL device at the MLP (at ear-height), and adjusting each sub's gain so that each sub is measuring the same output level. Since the automated room correction software is expecting the combined sub channel output level to measure close to 75dB, obtaining a combined output level of 75dB may require several attempts of gain adjustments before finding the right settings. The issue with level-setting, which makes it much less desirable than gain-matching, is that the room will have an effect on each sub's output level. For example, a sub in the corner will reach the same output level at a lower gain setting than a sub placed at the mid-point along a wall. Level-matching will ultimately result in different gain settings on each sub, depending on where the sub is placed. This can result in the sub with the higher gain setting "hitting the wall" at high output levels before the other subs have reached their maximum levels. This means that one sub can define maximum output levels in your system, which is not desirable.

Gain-matching, on the other hand, avoids the problem described above. To gain-match the subs, the SPL meter is placed "near field", i.e. several inches in front of the subwoofer's cone driver (best practices recommend that the tip of the mic be placed at 11% of the sub's membrane radius to effectively remove the room's impact on the measurements). This close placement all but eliminates the room's effect on the subwoofer, and after gain-matching each sub, you will see that the gain controls on each sub are very close to being the same. As with level-matching, you may need to go through several iterations before arriving at gain settings that result in a combined output of ~75dB at the MLP. Important note: Gain-matching is most effective for multiple identical subs. Results for disparate subs can vary.

Gain-matching procedure:

1. Make sure your sub's settings are correct. Crossover should be off, and phase/polarity setting should be zero.
2. Place the SPL or mic close to the sub's cone (the guideline is 11% of the cone's diameter, which for a 15 inch sub is slightly less than 2 inches).
3. In the AVR, set the subwoofer trim to zero.
4. Output the sub channel level-setting test tone.

Using MiniDSP 2x4 to Time-Align Multiple Subs On One Channel before Room Correction

(Rev 1.6, March 10, 2017)

5. Adjust the sub plate amp's gain setting until the output level reaches the desired level. The "desired level" is a target we need to determine, and may require several iterations of the gain-matching procedure to accomplish the objective. For now, we want a gain setting that results in a combined sub output of ~75dB at the MLP (for Audyssey). As an example, for the four matched subs used in this procedure, each sub's gain, measured near field, was 92dB.
6. Repeat the gain-setting for each sub.
7. Measure the combined sub output at the MLP. If not ~75dB, repeat the process, raising or lowering each sub's gain, carefully maintaining the same level for each sub.
8. Once ~75dB at the MLP is measured, gain-matching is completed.

Step 2: Deciding which MiniDSP 2x4 is appropriate for your setup.

The 2x4 comes in both balanced and unbalanced versions. Please go to the MiniDSP web site to obtain the latest product datasheets for the current revision specifications, as there have been recent product updates. Other than the connection types, the significant difference between the two models is the gain structure, i.e. the input and output voltages, summarized in the table below:

Balanced /Unbalanced	Input	Output	Notes
Balanced	Selectable .9V or 2.0V	Fixed 2.0V	
Balanced	Selectable 1.8V or 4.0V	Selectable 2.0V or 4.0V	PCB 1.7 or higher
Unbalanced	Fixed .9V	Fixed .9V	PCB Rev A
Unbalanced	Selectable .9V or 2.0V	Fixed .9V	PCB Rev B

Carefully research the input voltage requirements of your power amps and select the 2x4 version that will drive your amps to their rated levels, yet not over-drive them. A good read is "[Why You Should Think Twice About Buying an Unbalanced miniDSP 2x4](#)", authored by Andyc56.

Even if your equipment (AVR and power amps) only has unbalanced connections, the balanced 2x4 can be used if you select the appropriate RCA-to-XLR converter cables. An example of such cables can be found [here](#).

Step 3: Insert the MiniDSP into the signal path.

1. Unplug your subs from the AVR.
2. Connect a single output cable from the AVR's Sub1 output to the "Input 1" connection on the MiniDSP. If you are using the balanced 2x4, you will need to build a balanced cable that connects to the 2x4's Phoenix connector. A step-by-step guide on how to build the cable can be found [here](#). **Note:** While the 4-Way Advanced Plug-In is used in this document, if you have the

Using MiniDSP 2x4 to Time-Align Multiple Subs On One Channel before Room Correction

(Rev 1.6, March 10, 2017)

Two-Way Advanced Plug-In, simply use a Y-Cable to input the single subwoofer signal to both sides of the 2x4. Results should be the same.

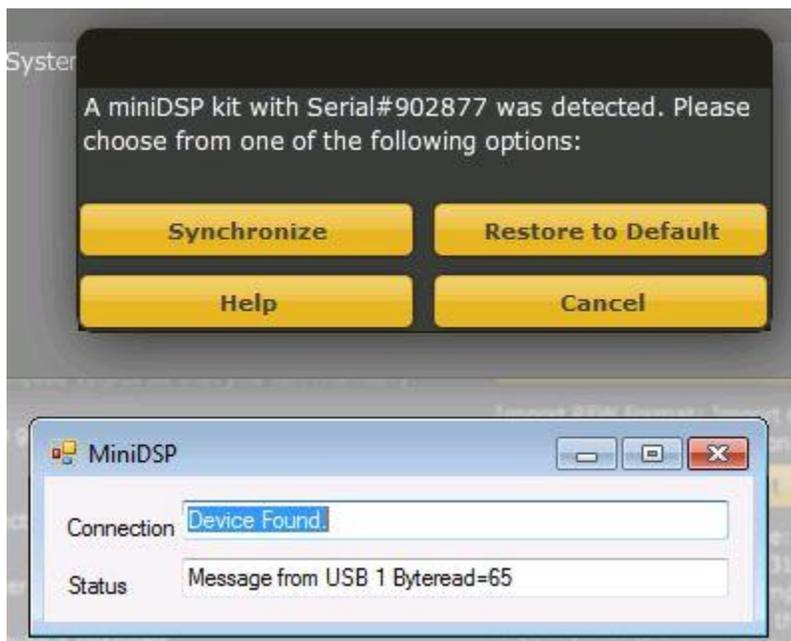
3. Connect each of your subs to the output connections on the MiniDSP. If you have less than four subs, it does not matter which of the outputs the subs are connected to. If you have more than four subs, then you will need to use a Y-cable to connect two subs together, and then plug the Y-cable into the MiniDSP. (Subs paired using a Y-cable should be located equidistant from the MLP, since only one delay setting will be available.)

Step 4: Set up the MiniDSP.

1. Connect the MiniDSP to your laptop using a USB cable.
2. Download and install the MiniDSP 4-Way Advanced Plug-In software from the [MiniDSP web site](#).
3. Start up the 4-Way Advanced Plug-In software.
4. Click the Synchronize button at the top of the screen to synchronize the plug-in with the hardware.



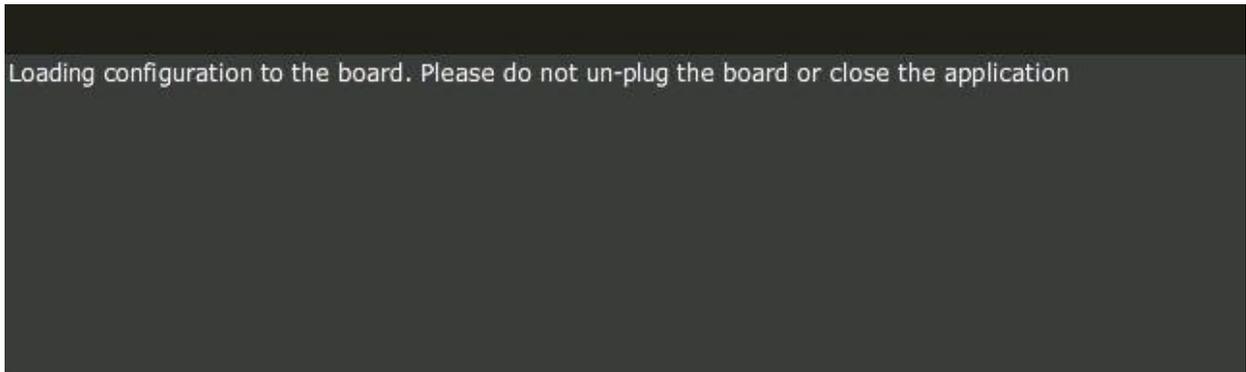
5. The plug-in should recognize the hardware:



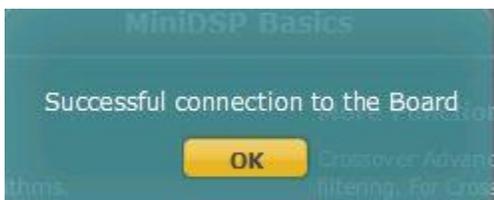
Using MiniDSP 2x4 to Time-Align Multiple Subs On One Channel before Room Correction

(Rev 1.6, March 10, 2017)

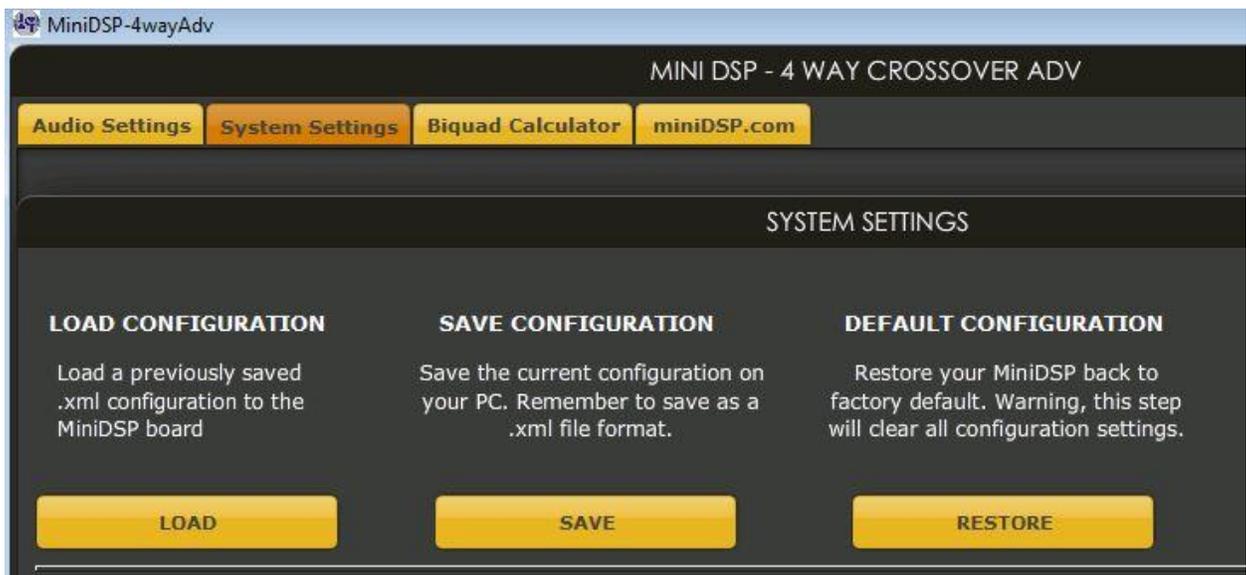
6. Click "Synchronize". The plug-in will communicate with the board.



7. When the connection has completed, click OK.



8. Click the System Settings tab at the top of the plug-in screen, and then click the button to restore the Default Configuration (this ensures you are starting from scratch, in case the MiniDSP was used previously).



Using MiniDSP 2x4 to Time-Align Multiple Subs On One Channel before Room Correction

(Rev 1.6, March 10, 2017)

- 9. When the factory defaults have been successfully loaded, click OK.



- 10. Click the Audio Settings tab.



- 11. On the Input Gain screen, set the Input Gain slider to unity (zero).

Using MiniDSP 2x4 to Time-Align Multiple Subs On One Channel before Room Correction

(Rev 1.6, March 10, 2017)

12. On the Parametric EQ screen, the EQ line should be flat, indicating no EQ is being applied.



Using MiniDSP 2x4 to Time-Align Multiple Subs On One Channel before Room Correction

(Rev 1.6, March 10, 2017)

- 13. On the Four-Way Crossover screen, you will see that the default settings include a number of bandpass filters.



Using MiniDSP 2x4 to Time-Align Multiple Subs On One Channel before Room Correction

(Rev 1.6, March 10, 2017)

14. This guide will not discuss the use of bandpass filters, which the reader can research on his own. Selecting each “Bandpass Filter Outx” tab in turn (1 through 4), click the “Bypass” button to disable the crossovers. When completed, the screen should show a flat line, with no bandpass filters enabled.



Using MiniDSP 2x4 to Time-Align Multiple Subs On One Channel before Room Correction

(Rev 1.6, March 10, 2017)

15. Select each “Parametric EQ – Output x” screen in turn (1 through 4) and make sure no EQ is being applied (i.e. the line is flat).



16. And finally, select each “Delay/Gain/RMS Output” screen (1 and 2), and make sure that the output for each channel is set to unity (zero), that the output delay is also zero, and that the Polarity switch is not engaged.
17. The MiniDSP is now ready for customization.

Using MiniDSP 2x4 to Time-Align Multiple Subs On One Channel before Room Correction

(Rev 1.6, March 10, 2017)

Step 5: Optimizing sub placement.

1. Using common subwoofer placement guidelines, experiment with various placements to find what produces the best (flattest) low frequency response.
2. Using your measurement system, take a series of “before” measurements that will allow you to compare the “after” results once the MiniDSP has been implemented. Take these measurements with room correction turned off, since room correction is altered if the sub is moved. The best response before room correction is run should produce the best response after room correction is run as well.

Step 6: Set Output Delays.

Once you have decided where to place your subwoofers, it is critical that the subs be time-aligned. This will optimize the combined sub response prior to running room correction. This step should not be confused with the so-called “Subwoofer distance tweak”, which time-aligns the combined sub response with the main speakers, and is performed **after** room correction has been completed.

1. Carefully measure the actual physical distance of each sub to the MLP. The measured distance should be from the center of the sub’s cone to exactly where your ears would be if you were sitting in the MLP.
2. We will now calculate the required delay, based on the speed of sound, 1,126 feet/second, or 13,512 inches/second. An example of calculating the delays is shown below:

Using MiniDSP 2x4 to Time-Align Multiple Subs On One Channel before Room Correction

(Rev 1.6, March 10, 2017)

Speed of sound	13512	In/Sec			
	Dist	Dist (in)	Diff (In)	Delay (ms)	MiniDSP Output Channel
Front Right Sub	11' 2"	134		0.0	1
Front Left Sub	11' 2"	134		0.0	2
Rear Left Sub	3' 7 1/2"	43.5	90.5	6.7	3
Rear Right Sub	3' 3 1/2"	39.5	94.5	7.0	4

3. Note the distance of each subwoofer. Convert the distance to inches. Pick the subwoofer that is the **furthest from the MLP**. Now calculate how much closer each additional sub is. In the example above, the sub(s) at 134" are the furthest from the MLP. The other two subs are 94.5" and 90.5" closer to the MLP than the furthest sub, noted in the "Diff" column. To correctly time-align the two closer subs with the two furthest subs, a delay must be added. Calculate the delay by dividing the "Diff" value by the speed of sound, and multiplying the result by 1,000 (to convert seconds to milliseconds). The resulting delay values are shown in the "Delay" column.
4. On the "Delay/Gain/RMS Output" screen, select the screen associated with the sub connection requiring the delay (in the example above, both subs requiring a delay would be in the Output Channels 3&4 screen).

Using MiniDSP 2x4 to Time-Align Multiple Subs On One Channel before Room Correction

(Rev 1.6, March 10, 2017)

- 5. Input the delay values calculated above.

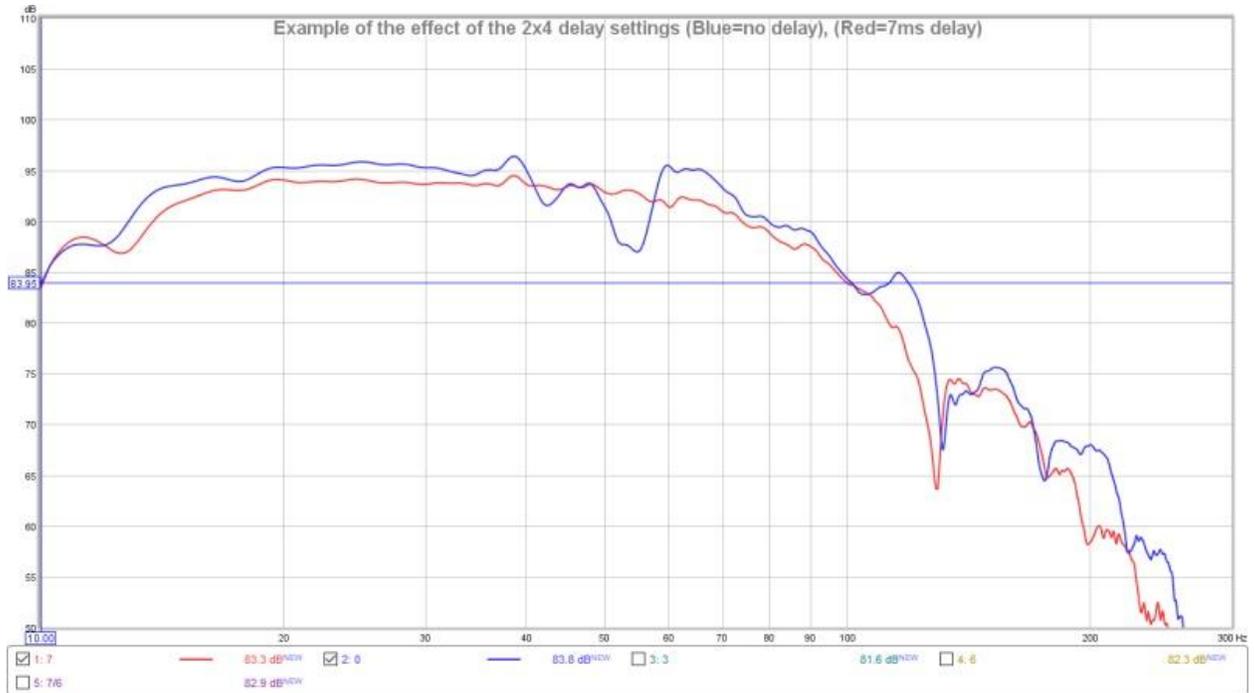


- 6. The subs are now time-aligned.

Using MiniDSP 2x4 to Time-Align Multiple Subs On One Channel before Room Correction

(Rev 1.6, March 10, 2017)

- 7. Here is an example of the effect of the delay setting, showing the significant improvement with the proper delay setting:



Using MiniDSP 2x4 to Time-Align Multiple Subs On One Channel before Room Correction

(Rev 1.6, March 10, 2017)

Alternate Method of Determining Delays Using Audyssey.

Rather than measuring actual physical distance from the MLP to the subs, you can use Audyssey to measure the distances by following this procedure:

1. If you are using any outboard processing (e.g. Dirac Live in the MiniDSP 88A), make sure the process is defeated, i.e. in bypass mode.
2. Using the 2x4 mute buttons, mute all but one sub.
3. Place the Audyssey mic at ear level in the MLP and run a quick one-position calibration.
4. When the measurement sweeps conclude, click the "Calculate" button and then observe the Audyssey-calculated subwoofer distance.
5. Mute the first sub, un-mute the second sub, and proceed with a second one-position calibration, observing the Audyssey-calculated distance for the second sub.
6. Continue this process until you have Audyssey-calculated distances for all subs.
7. Using the procedure described earlier in this section, calculate the delay setting for each of the subs and input it into the 2x4.
8. Just to make sure everything has turned out correctly, repeat steps 2-6 a second time, this time using the calculated delays. You should see the same distance for each sub now, which means that your calculated delays are correct.

Checking Sub Polarity

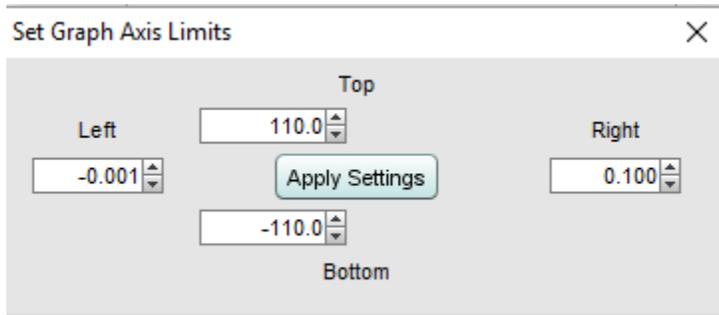
Before proceeding, it is a good idea to check the polarity of the subs. Use the procedure listed below. For this example, a setup using four subs was tested. Two subs were in the front of the room, equidistant from the MLP, and two subs were at the rear of the room, also equidistant from the MLP. The test was to see if the two sub pairs were in phase with each other.

1. With room correction turned off, measure each sub pair 15-300Hz.
2. Select the Impulse tab for one of the two measurements.
3. Configure the Impulse graph as follows:
 - a. In the upper left corner, configure the Impulse to display "% FS", not "dB FS".

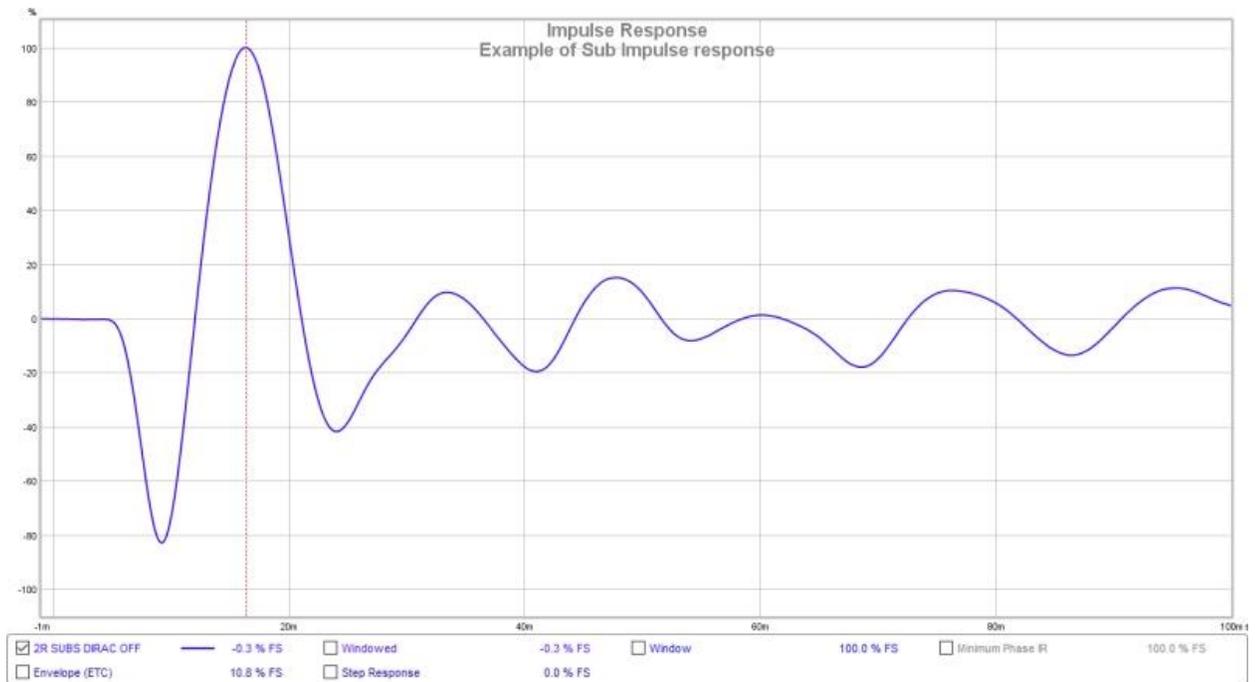
Using MiniDSP 2x4 to Time-Align Multiple Subs On One Channel before Room Correction

(Rev 1.6, March 10, 2017)

b. Configure the limits:



c. The Impulse graph should now look like this:

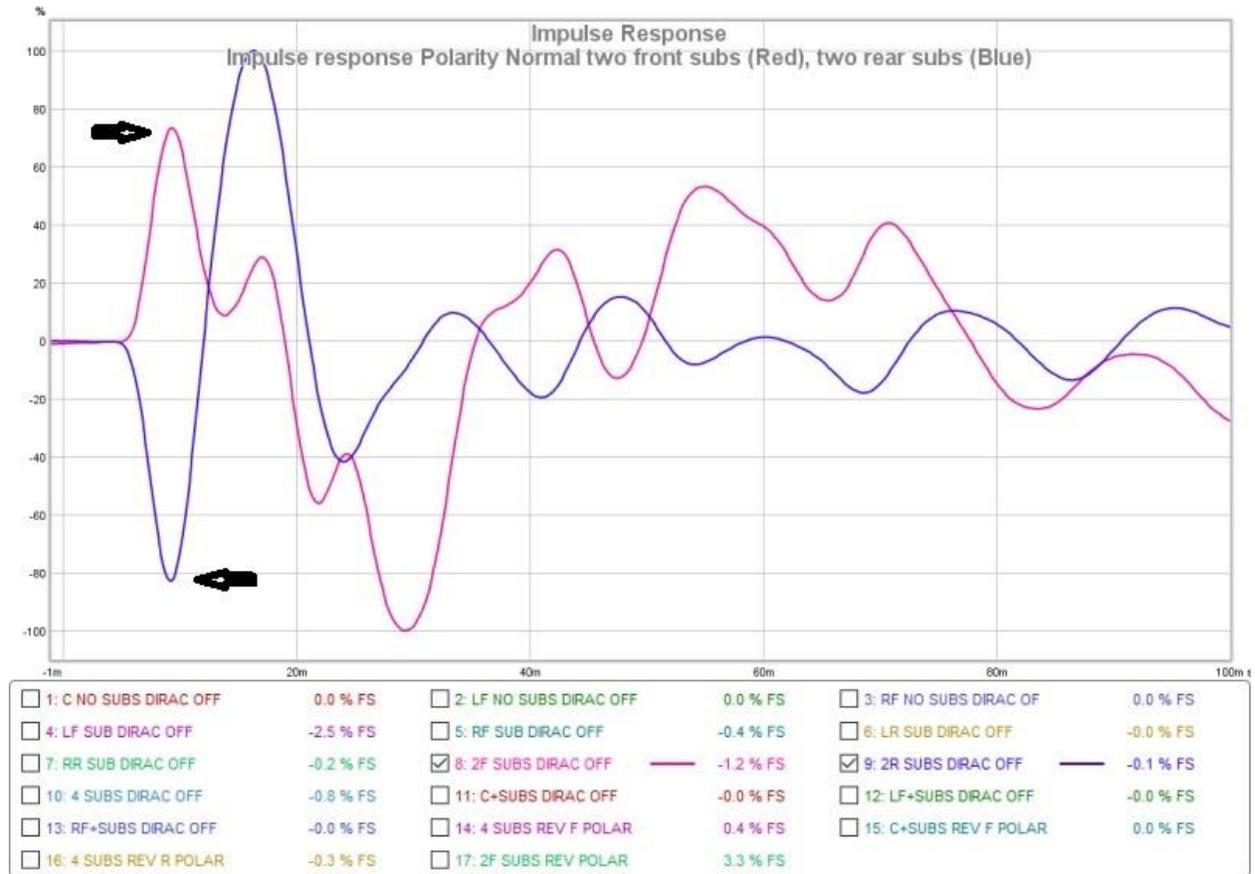


4. In the REW toolbar, click "Overlays".
5. For the overlays, select the two sub measurements you created in Step 1.

Using MiniDSP 2x4 to Time-Align Multiple Subs On One Channel before Room Correction

(Rev 1.6, March 10, 2017)

6. For each sub measurement, look at the first “swing” in the measurement. Example:

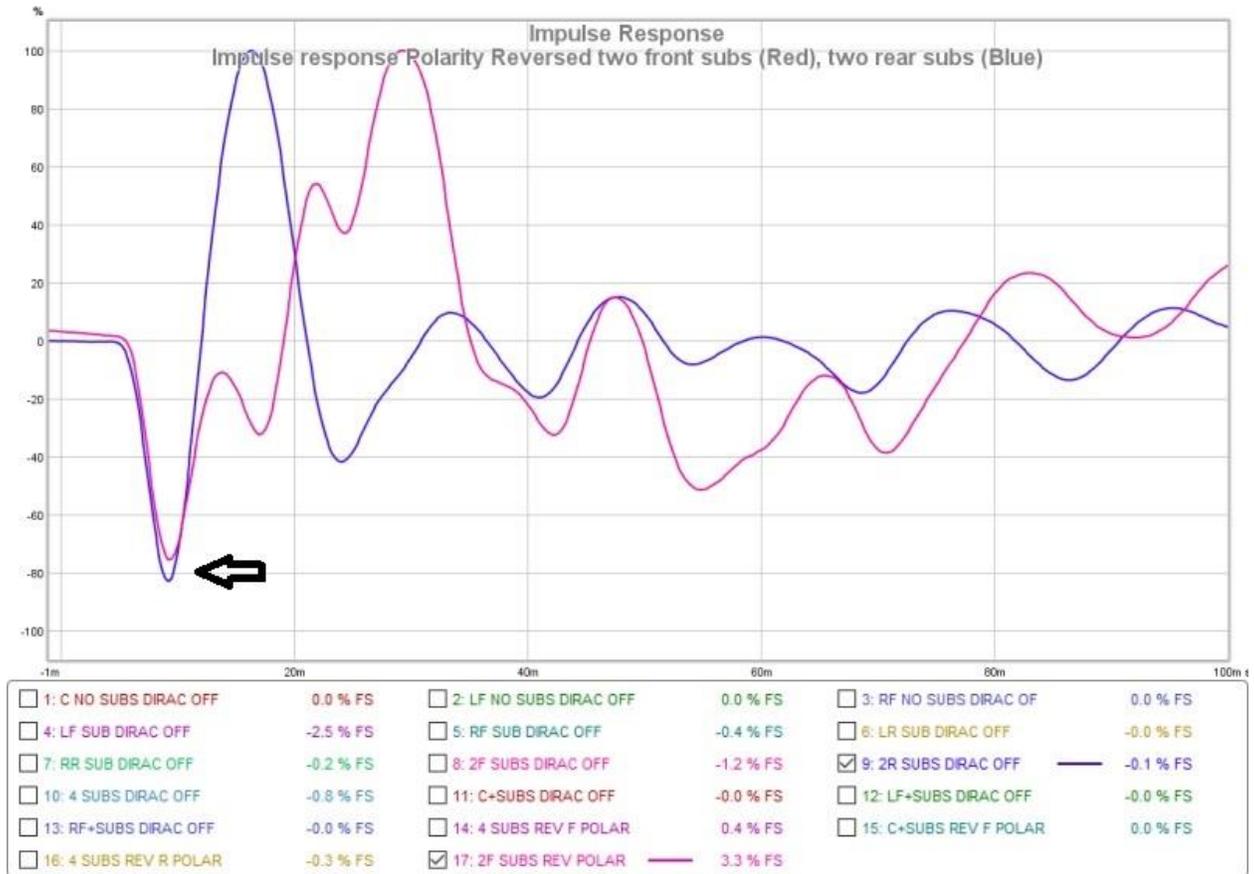


7. In the example above, the front sub pair and the rear sub pair have impulse responses that show opposite polarity.

Using MiniDSP 2x4 to Time-Align Multiple Subs On One Channel before Room Correction

(Rev 1.6, March 10, 2017)

8. Here is a similar example, but using a measurement for the front sub pair with Polarity=180.



9. Now it is clear that the two sub pairs have matched polarity. Leaving the front sub pair with Polarity=180 is the correct setting.

Using MiniDSP 2x4 to Time-Align Multiple Subs On One Channel before Room Correction

(Rev 1.6, March 10, 2017)

Step 7: Determining the Gain Structure.

Overview: The **unbalanced MiniDSP 2x4** has a maximum input voltage. MiniDSP “Rev A” has a maximum input voltage of .9VRMS. MiniDSP “Rev B” has a switchable maximum input voltage of either .9VRMS or 2.0VRMS. It is extremely important that the maximum input voltage threshold not be exceeded when the AVR is delivering a maximum signal on the subwoofer output channel. If the voltage threshold is exceeded, distortion will be the result. This procedure was written for a MiniDSP with a maximum input voltage of .9VRMS, although the procedure can be modified for the 2.0VRMS “Rev B” (or newer 4.0VRMS version) device as appropriate.

Note: If you are using the **balanced 2x4**, the procedure for checking the input voltage is the same as with the unbalanced 2x4, except the voltages are different. (See Step 2 for a summary of various input voltage options.)

Procedure:

1. Set up REW and your AVR so that you can output a REW test signal to the sub channel only.
Various ways to do this:
 - a. Set AVR to stereo mode, with speakers set to “small”. Disconnect left and right speaker cables (or turn off power amp to those channels).
 - b. If using REW with HDMI support, output the test signal to HDMI3 and disconnect the center channel speaker cable9 (or turn off the power amp for that channel).
 - c. If using REW with HDMI support, output the test signal to HDMI4 (the LFE channel).
Note that the test signal using HDMI4 is 10dB louder than the first to methods.
2. Set the AVR master volume to reference (typically MV=0), make sure the sub channel trim is set to zero, and turn off any processing in the AVR (e.g. Audyssey).
3. Disconnect the audio cable from the AVR to the MiniDSP at the MiniDSP end.
4. Using the REW tone generator, output a 60Hz tone at a -3dBFS level (this is REW’s maximum output level).

Using MiniDSP 2x4 to Time-Align Multiple Subs On One Channel before Room Correction

(Rev 1.6, March 10, 2017)

- Using the Voltmeter set to measure AC voltage, touch the leads across the audio cable coming from the AVR (one lead touching the center signal pin, and the second lead touching the outer grounding ring). It doesn't matter which lead touches which part of the cable—if the leads are reversed, the voltage will read negative. Whether you measure $-.9\text{VRMS}$ or $.9\text{VRMS}$, the result is the same. Here is a typical Voltmeter showing the setting to use. Inset the black lead into the black "Common" hole, and the red lead into the red "Volt-Ohm-milliAmp" hole.



- Measure the voltage. On the AVR used in this test, the output level measured 1.8VRMS , which is too high for the MiniDSP input.
- While the 60Hz tone is still running, go to the subwoofer channel trim settings screen, and gradually lower the trim setting, observing the voltage reading on the Voltmeter.
- At some trim setting, the voltage will measure $.9\text{VRMS}$ (or slightly lower). Make a note of this trim setting. For the AVR used in this test, $.9\text{VRMS}$ was achieved with a trim setting of -4.5 .
- We have now accomplished the objective: with a sub channel trim setting of -4.5 (in this example), we can be assured that the MiniDSP input voltage threshold will not be exceeded.

Using MiniDSP 2x4 to Time-Align Multiple Subs On One Channel before Room Correction

(Rev 1.6, March 10, 2017)

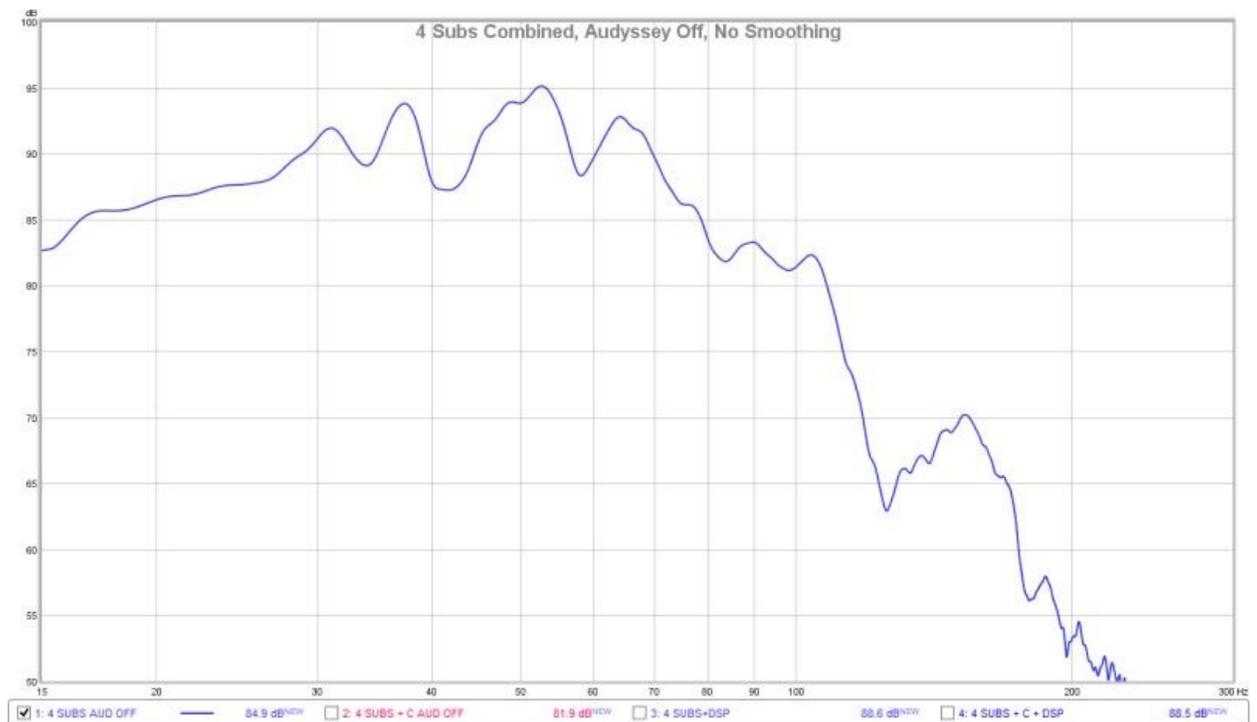
Step 8: Applying DSP Filters Using REW's EQ Tool (Optional).

Overview: By measuring the combined subwoofer output **with room correction turned off**, and then applying REW's EQ Tool, we can generate downloadable EQ filters that can be loaded into the MiniDSP prior to running room correction. In theory, this should present a flatter response to room correction, resulting in an even better calibration. In practice, the results can vary. However, it certainly is worth a try because, other than the time to do it, applying EQ filters can cause no harm. Of course, this step applies only to those who are using REW as the measurement tool. Applying EQ is not without risk, especially if the EQ is providing boost. Please refer to the MiniDSP and/or the REW Home Theater Shack forums for more detailed guidance on applying EQ.

Note: Audyssey room correction (or Dirac Live) should provide the same frequency adjustments as the REW EQ filters (in other words, room correction should be as effective as REW), so that is why this section is optional. If you have the initiative, experiment with both approaches and pick the one with the best results.

Procedure:

1. After completing all the steps to prepare the subs and the MiniDSP, including gain-setting and establishing delays, make sure no processing is running on the AVR (e.g. Audyssey).
2. Use REW to measure the combined sub response, 15Hz to 300Hz.

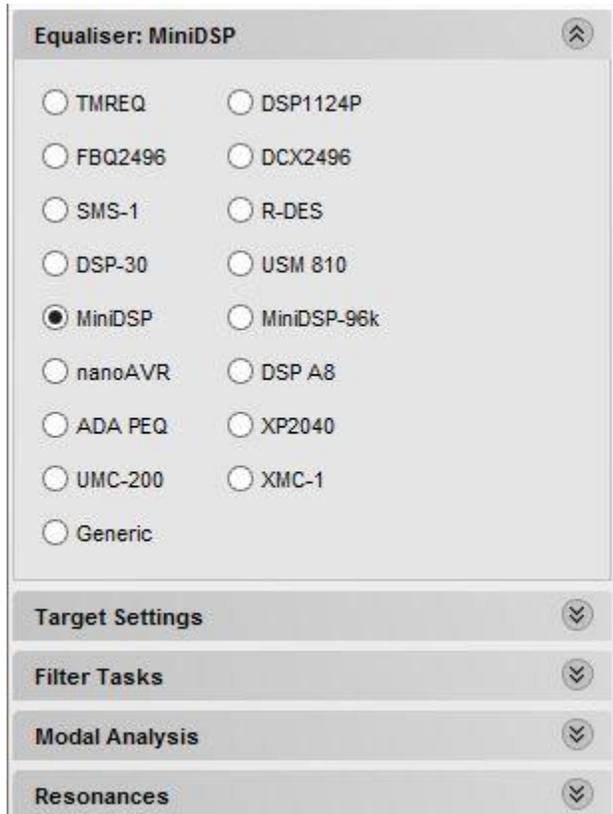


Using MiniDSP 2x4 to Time-Align Multiple Subs On One Channel before Room Correction

(Rev 1.6, March 10, 2017)

Select the sub measurement, and launch the REW EQ Tool.

3. On the right side of the tool, open the drop-down list of equalizers and select the MiniDSP.



Using MiniDSP 2x4 to Time-Align Multiple Subs On One Channel before Room Correction

(Rev 1.6, March 10, 2017)

4. Open the Target Settings drop-down and click the “Set Target Level” link, which fills in the “Target Level” box with the maximum level that was reached during the measurement sweep.

Target Settings

Speaker Type: Subwoofer

Crossover: 24dB/octave

Cutoff (Hz): 80

LF Slope: 24dB/octave

LF Cutoff (Hz): 10

LF Rise Start (Hz): 100

LF Rise End (Hz): 20

LF Rise Slope (dB/octave): 1.8

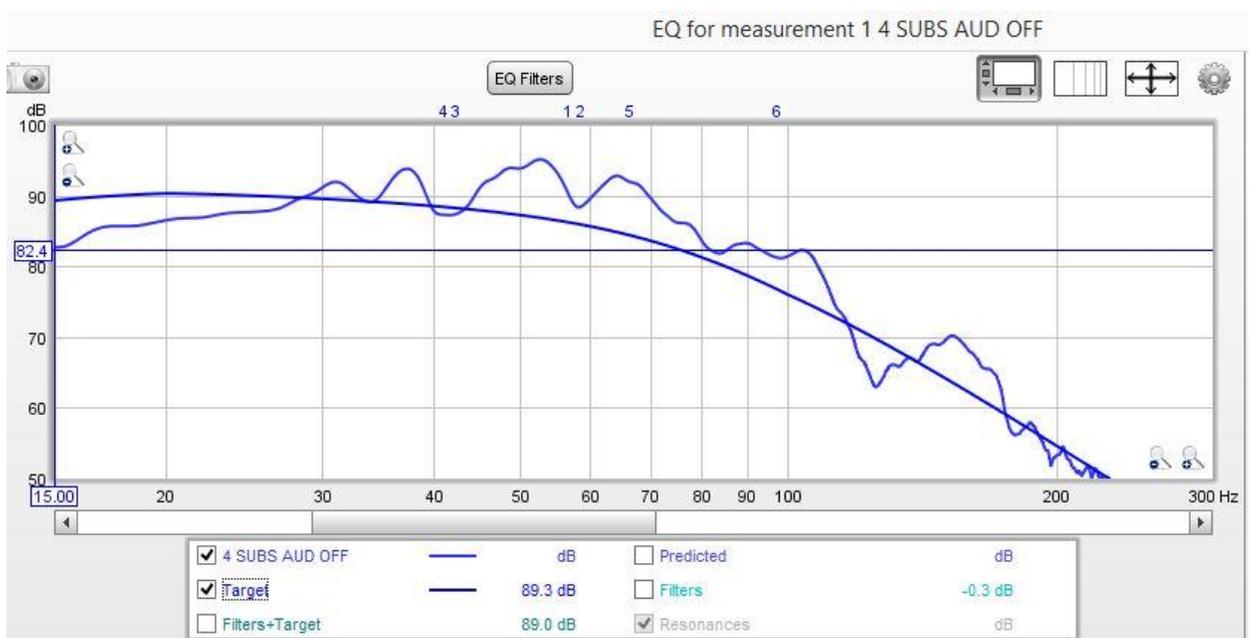
HF Fall Start (Hz): 1000

HF Fall Slope (dB/octave): 1.8

Target Level (dB): 86.7

[Set Target Level](#)

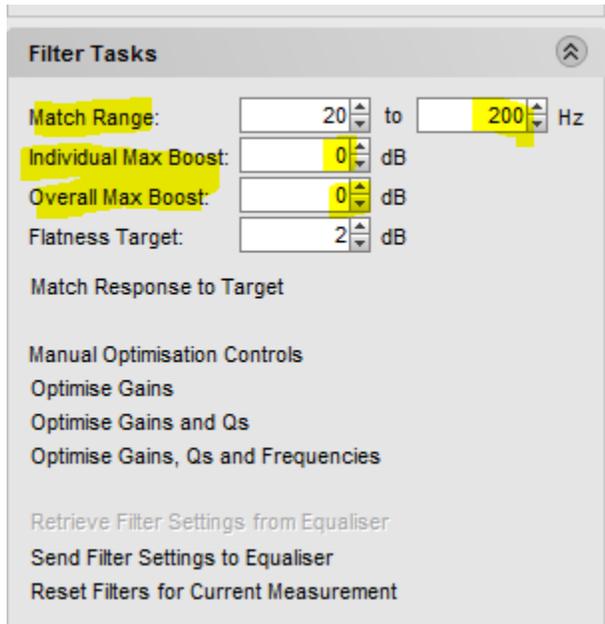
5. The default target settings can be displayed in the measurement window by clicking the “Target” button in the legend. You can experiment with the shape of the target setting, but for this document, the default values will be used.



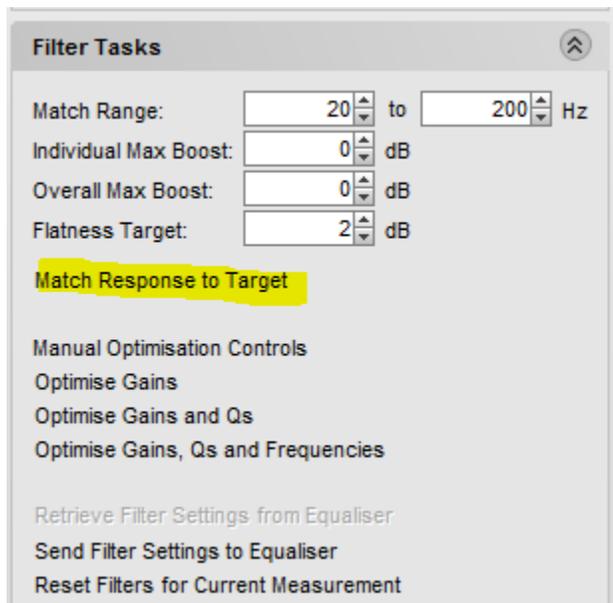
Using MiniDSP 2x4 to Time-Align Multiple Subs On One Channel before Room Correction

(Rev 1.6, March 10, 2017)

6. Back on the right side, open the Filter Tasks drop-down. Adjust “Max Boost” values to zero (you don’t want the MiniDSP and REW both to be providing boost. Adjust “Max Range” upper limit to 200Hz to improve the splice between sub and mains.



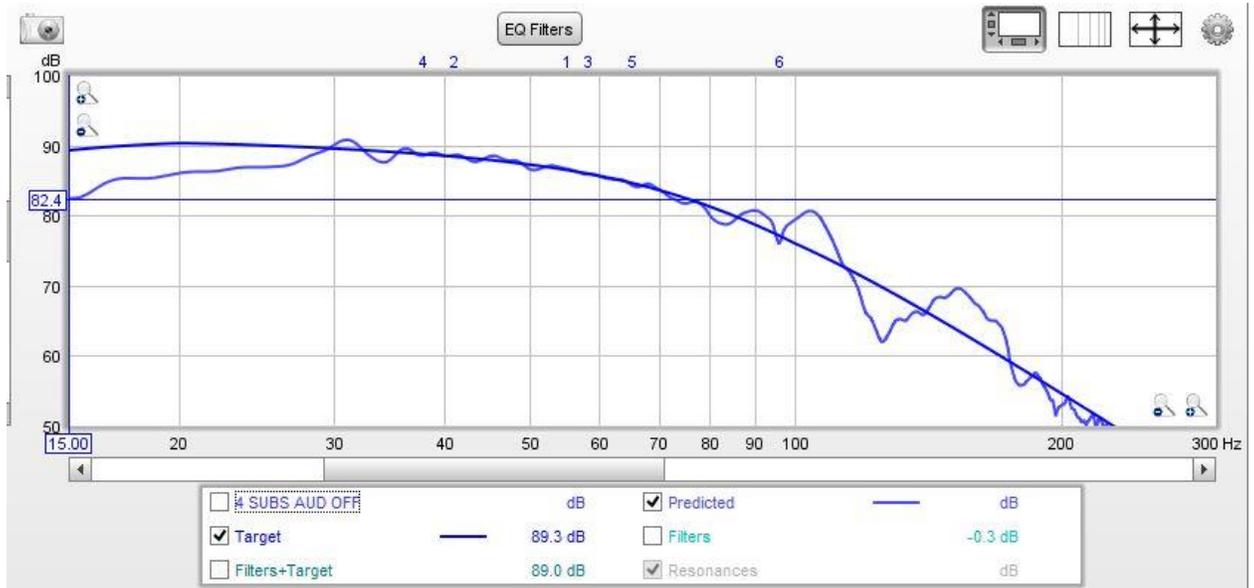
7. Now click the “Match Response to Target” link.



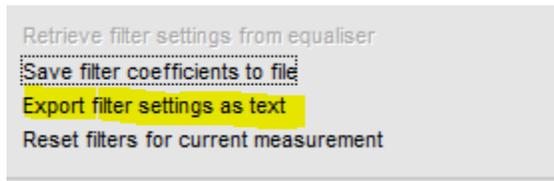
Using MiniDSP 2x4 to Time-Align Multiple Subs On One Channel before Room Correction

(Rev 1.6, March 10, 2017)

- 8. REW analyzes the sub response curve against the target curve, generates filters, and fills in a “Predicted Curve”. This is how the subs “should” measure once the EQ filters are applied.



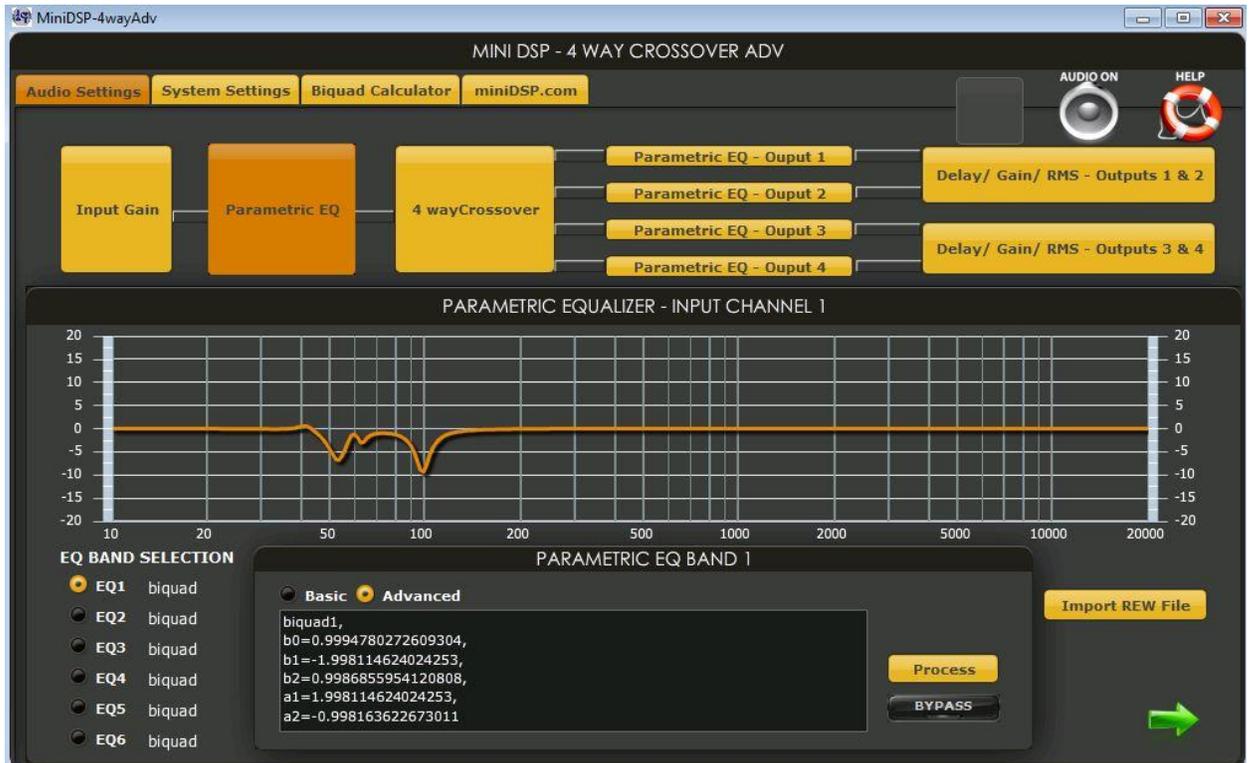
- 9. Now click the “Export Filter Settings as Text” link, give the filter settings file a name, and save it to the laptop drive.



Using MiniDSP 2x4 to Time-Align Multiple Subs On One Channel before Room Correction

(Rev 1.6, March 10, 2017)

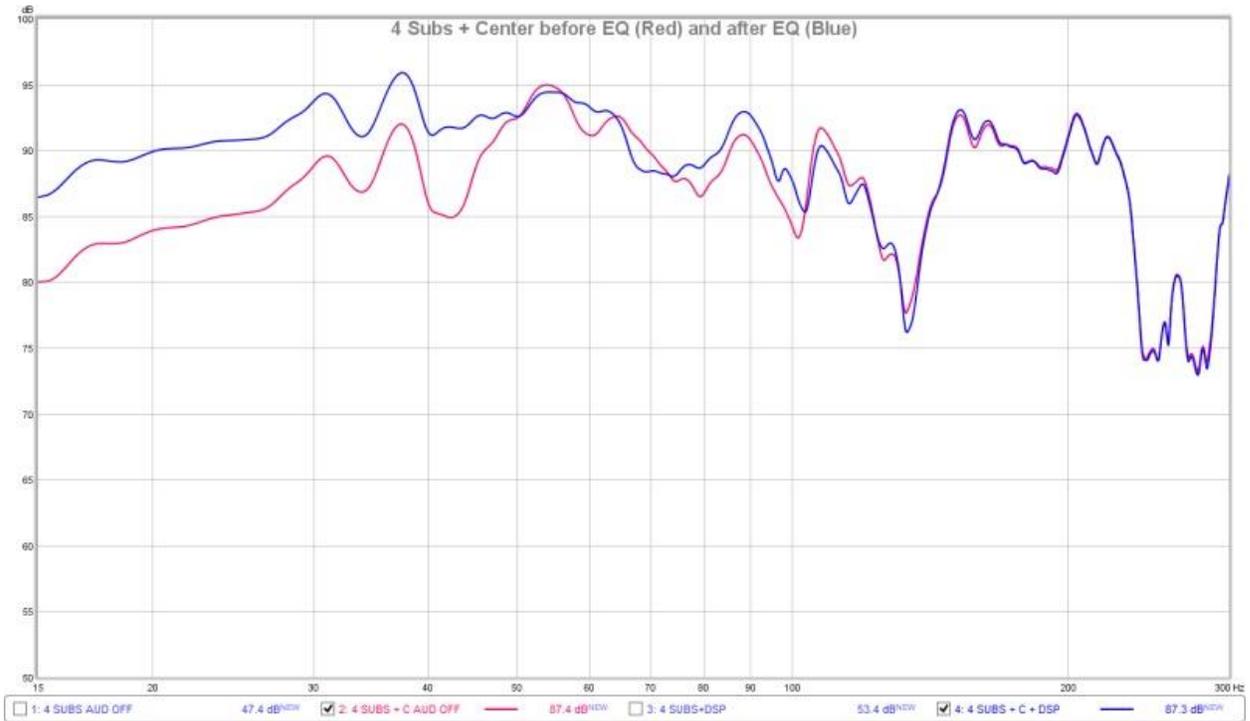
10. Back on the MiniDSP 4-Way Advanced Plug-In screen, go to the Parametric EQ screen, click the button "Import REW File" on the bottom right, and select the file you saved in the previous step. You will now see an EQ curve being applied.



Using MiniDSP 2x4 to Time-Align Multiple Subs On One Channel before Room Correction

(Rev 1.6, March 10, 2017)

- 11. For completeness, run a REW measurement with the EQ filters in place, and observe the differences the EQ filters accomplish. In the example below, the actual in-room measurement is not quite as good as the REW “predicted” response, but it still has some improvement that will likely benefit the Audyssey calibration.



Using MiniDSP 2x4 to Time-Align Multiple Subs On One Channel before Room Correction

(Rev 1.6, March 10, 2017)

Step 9: Running Automated Room Calibration.

a: Audyssey Calibration.

Overview. When the Audyssey calibration is run, Audyssey will set a trim for the sub channel. Based on our work in Step 7, we know that if the sub trim is greater than -4.5, then we run the risk of sending a signal higher than .9VRMS to the MiniDSP. So, the following procedure once again involves some trial and error to zero in on an Audyssey calibration that results in the “optimal” sub trim setting.

Procedure:

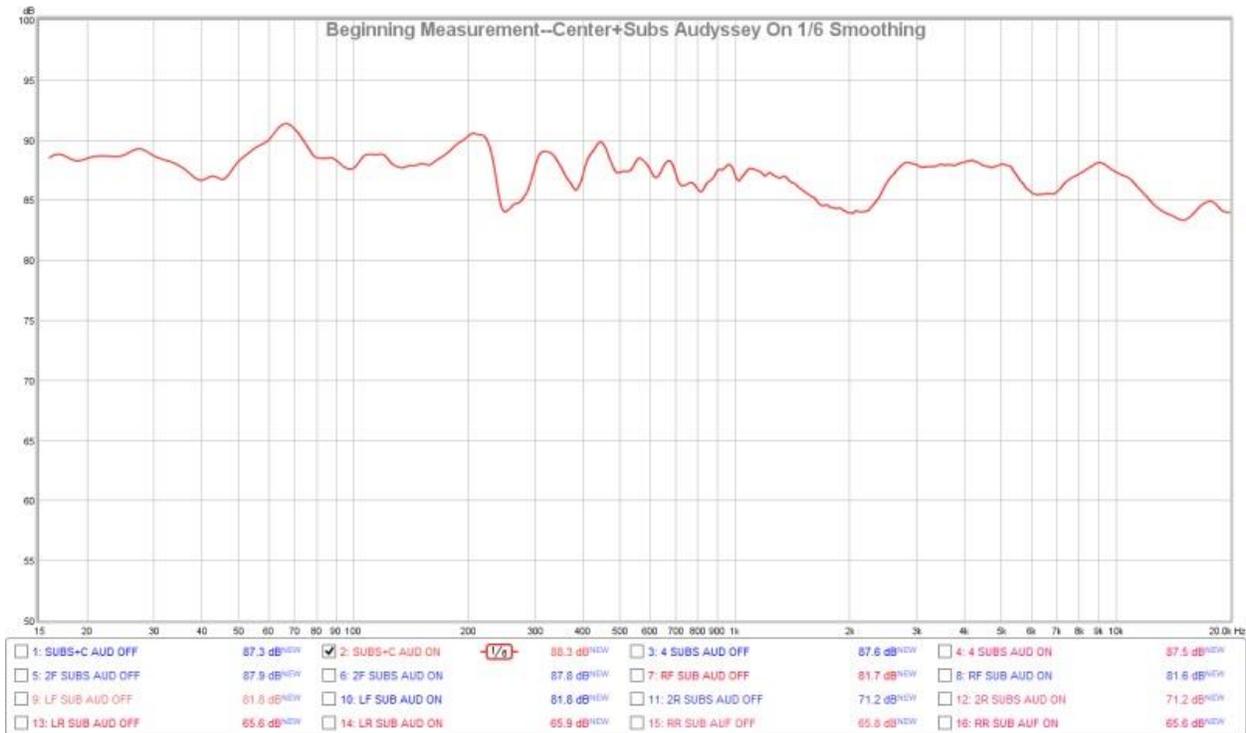
1. Set up the Audyssey calibration mic at the MLP.
2. Start the Audyssey calibration.
3. If you are using a version of Audyssey lower than XT32, skip forward to Step 6 below.
4. Proceed to the subwoofer level measurement screen.
5. Output the sub level-setting tone and observe the level Audyssey measures. Normally, this should be close to 75dB because of the work done in the level-setting step. Note the value, and click the button to proceed with the calibration.
6. Complete the first set of measurements.
7. At the end of the first measurement set, click “Calculate” to observe the results.
8. When Audyssey displays the results, click on “Levels” and observe the trim for the sub channel.
9. If the trim exceeds the target trim that you established in “Step 7: Determining the Gain Structure”, or if the sub trim is significantly lower than the target trim, then you need to make adjustments and start the calibration step over again. Note: In the example we used earlier, -4.5 was established as the target trim. If Audyssey were to set a trim of -4 or higher, adjustments need to be made. If the trim is lower than -5.5 (i.e. more than 1dB variance), adjustments should be made.
10. By “adjustments”, here is what needs to be done:
 - a. Return to the sub gain matching step.
 - b. Re-adjust the sub gains up or down, depending on whether the Audyssey trim is lower or higher than the target.
 - c. Re-measure the combined sub output, verifying that the new combined level is lower or higher by the amount you want to change the Audyssey trim.
 - d. Go back to Step 2 in this section and re-run a 1-point Audyssey calibration, calculate the results, and examine the sub trim again. If you are within the target, you are OK. If not, run everything another time.
11. Once your 1-point Audyssey calibration achieves the desired trim setting for the sub channel, you should run a full Audyssey calibration.

Using MiniDSP 2x4 to Time-Align Multiple Subs On One Channel before Room Correction

(Rev 1.6, March 10, 2017)

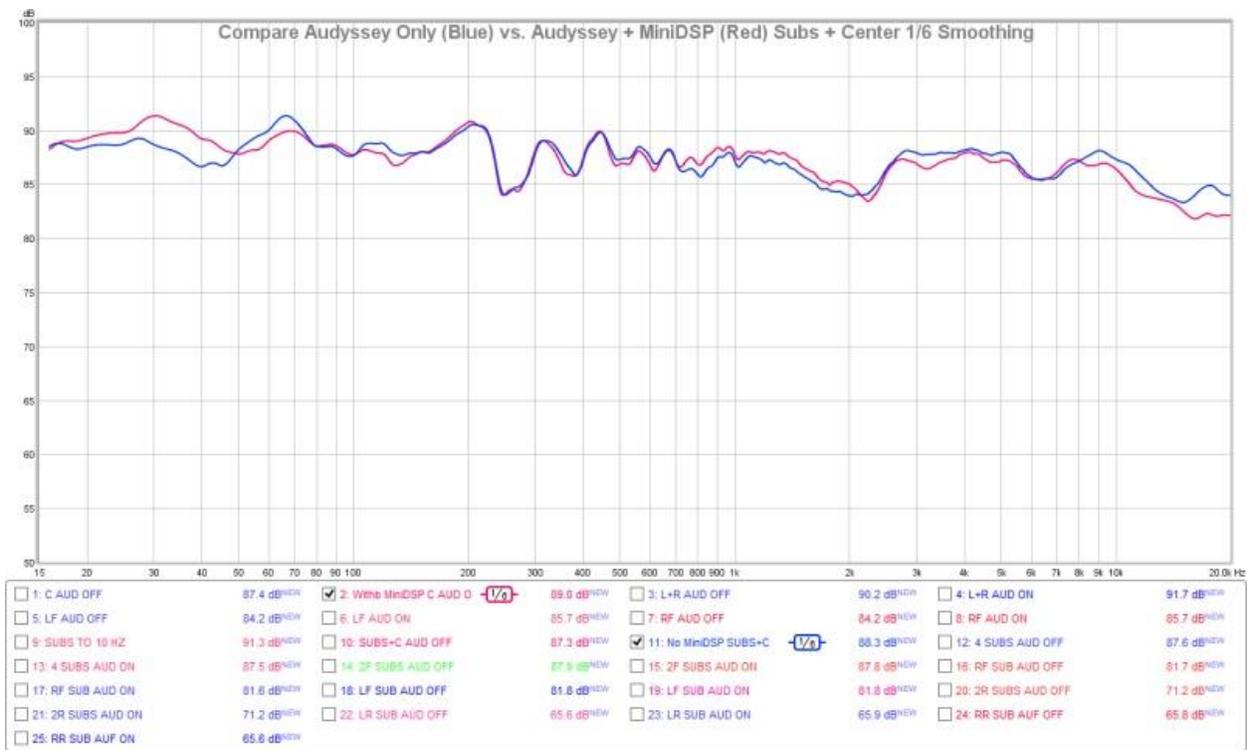
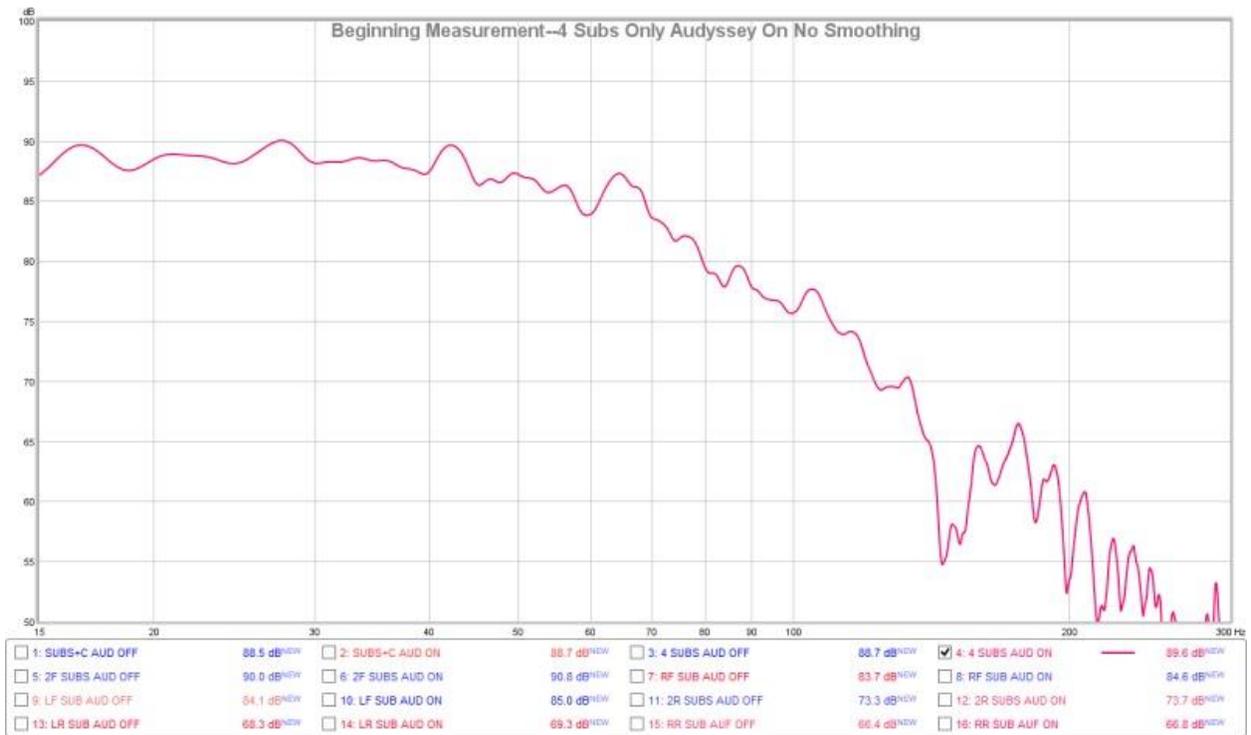
12. Once the final Audyssey calibration is completed, use your measurement system to run a full set of “after” measurements similar to the “before” measurements you took way back in Step 1.
13. Compare results.

Example Results (Audyssey):



Using MiniDSP 2x4 to Time-Align Multiple Subs On One Channel before Room Correction

(Rev 1.6, March 10, 2017)



Using MiniDSP 2x4 to Time-Align Multiple Subs On One Channel before Room Correction

(Rev 1.6, March 10, 2017)



Comments: In the real-world example shown above, the before and after graphs are actually quite similar, which is a “successful” result. It means we can consolidate multiple subs onto one channel and still get acceptable, if not excellent, results. Listening tests confirm that the sound of the MiniDSP solution is excellent.

Using MiniDSP 2x4 to Time-Align Multiple Subs On One Channel before Room Correction

(Rev 1.6, March 10, 2017)

b: Dirac Live Calibration (using the miniDSP DDRC-88A).

Overview: Unlike the Audyssey calibration, Dirac never reveals the resulting sub channel trim level, so we cannot use the single-point technique to set the sub level as we did with Audyssey. However, getting the right sub level before we run a Dirac calibration is equally important, if not more so.

Procedure:

1. The subs should be gain-matched as per the procedure outlined in Step 1.
2. All trims and delays in the AVR should be set to zero. Set speakers to “Small”, set the correct crossovers, and make sure all room correction in the AVR is turned off. Note: the AVR actually plays no role in the Dirac calibration. The reason we are setting up the AVR now is so that it is ready once the Dirac calibration completes.
3. Launch the Dirac Live Calibration Tool (DLCT).
4. Select “Custom Config”. (Note: Selecting either the 5.1 or 7.1 config adds a 10dB boost to the LFE channel which we will assume for the purpose of this procedure is not wanted.)
5. Select the number of channels, e.g. eight for a 7.1 system, and click Next.
6. Make sure the mic is selected, and the proper calibration file is in use. Then click Next.
7. On the level-setting screen, adjust the microphone gain slider to the right so that you have at least -12dB of headroom (headroom higher than -12dB is perfectly acceptable, so don't worry if you can't get to -12dB).
8. Now click the button to output the test tone to the left channel.
9. While the left channel test tone is playing, gradually adjust the output volume slider until the output indicator reaches the center of the “green area”, i.e. -12dB. The mic gain slider should not be changed during this step.
10. Turn off the left channel test tone and output the test tone for the sub channel (which should be channel 3).
11. Without touching or adjusting either the output volume or input gain adjustment, observe where the output indicator for the sub channel registers in the “green area”. **It is critical** that the sub output be exactly the same as the left channel output, i.e. exactly at -12dB.
12. If the sub channel output level is either higher or lower than -12dB, you **must** correct this before proceeding with the Dirac calibration.
13. To correct the sub output level:
 - a. Exit the DLCT.
 - b. Re-run the sub gain-matching procedure outlined in Step 1, adjusting the combined sub output lower or higher as needed.
 - c. Re-do the DLCT channel level tests until the combined sub output reaches the -12dB level in the green area. Note: this may take some trial and error effort, so don't give up until you get it right!
14. Once the sub channel level is correct, proceed with the Dirac Live calibration.

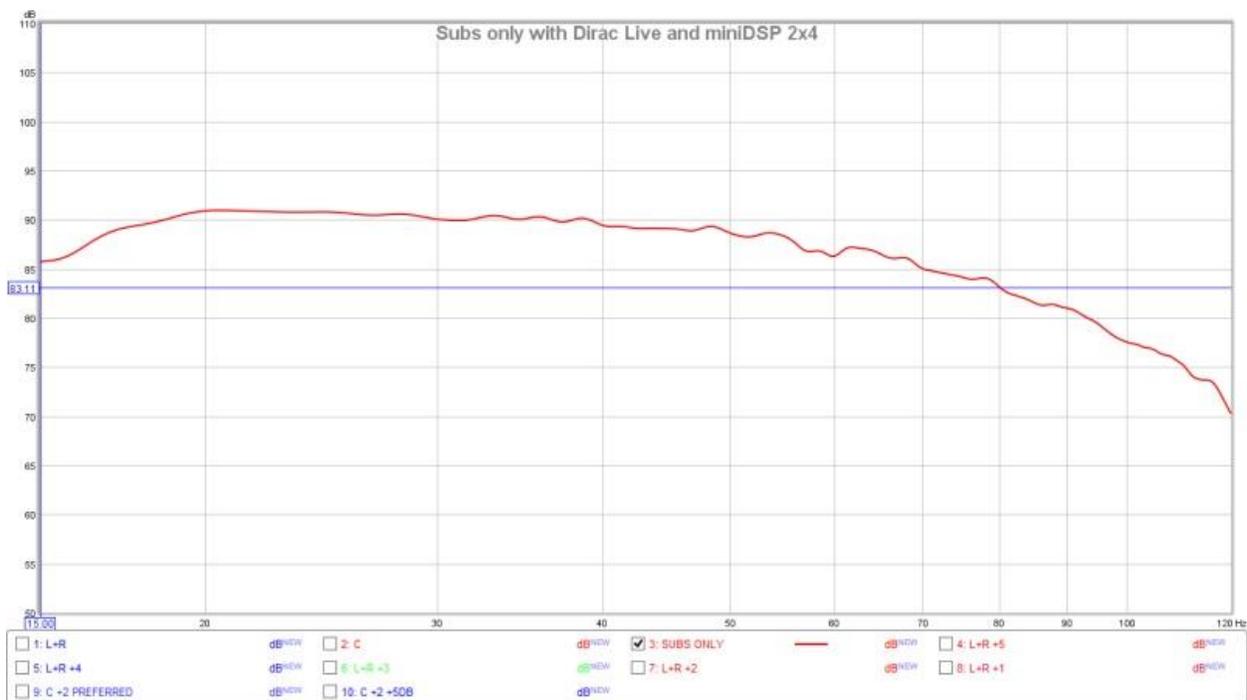
Using MiniDSP 2x4 to Time-Align Multiple Subs On One Channel before Room Correction

(Rev 1.6, March 10, 2017)

- 15. When the calibration has completed, measure the output levels of all channels using the AVR speaker-level test tones. The levels should be very close to 75dB (+/- 1dB).
- 16. You may use the [“Sub Distance Tweak”](#) procedure to ensure the smoothest splice between the subs and the mains at the crossover (thanks to KBarnes701 for this excellent write-up).
- 17. You may adjust the sub channel trim at this time to suit your preferences.

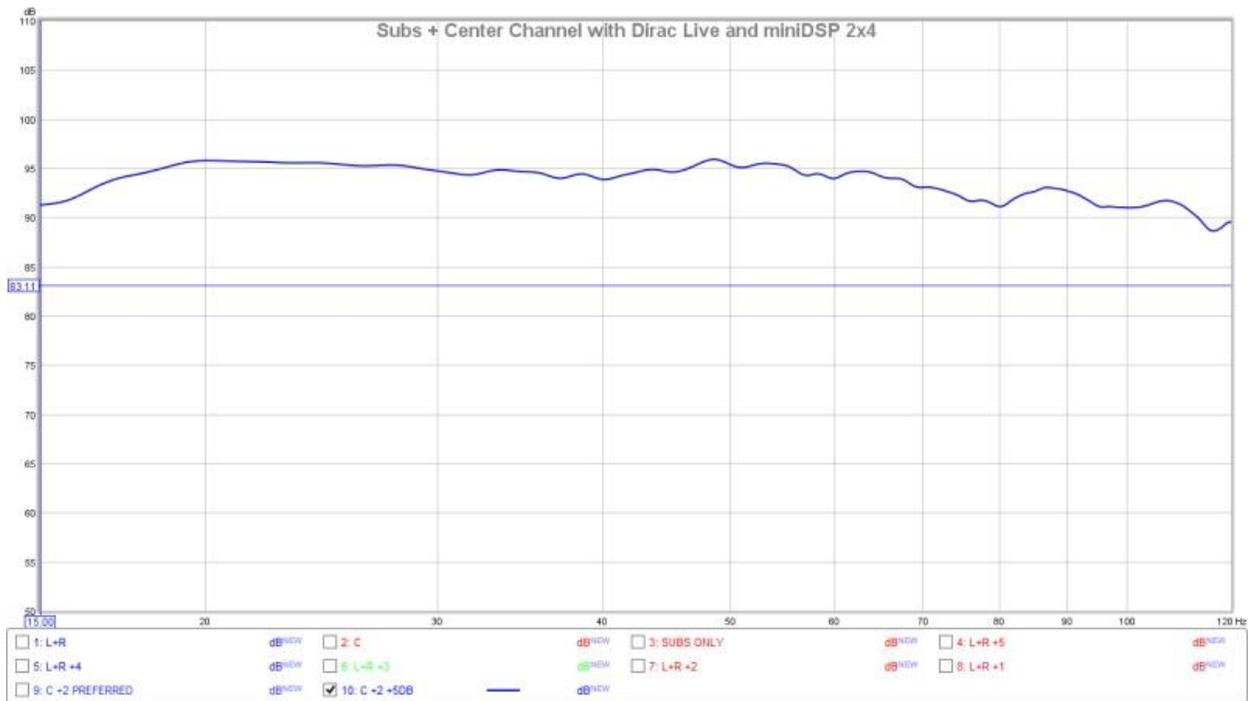
Note on gain structure: If you are concerned about over-driving the miniDSP with the output from the 88A, use a voltmeter to measure the output, similar to the procedure outlined in Step 6.

Example Results (Dirac Live):



Using MiniDSP 2x4 to Time-Align Multiple Subs On One Channel before Room Correction

(Rev 1.6, March 10, 2017)



Using MiniDSP 2x4 to Time-Align Multiple Subs On One Channel before Room Correction

(Rev 1.6, March 10, 2017)

Revision History

Version	Date	Change Description
1.0	Jan 10, 2015	First "official" release.
1.1	July 9, 2015	Added a section for Dirac Live calibration, making the document less "Audyssey-centric".
1.2	September 24, 2015	Major overhaul based on six months of experience. Added description of how to configure the balanced 2x4. Tweaked other sections as appropriate.
1.3	January 5, 2016	Added a section titled "Alternate Method of Determining Delays Using Audyssey".
1.4	February 2, 2016	Updated input sensitivity and output level settings based on new PCB Rev 1.7 (first manufactured in Jan 2016), in Step 2.
1.5	August 25, 2016	Added a Sub Polarity Test in Step 6.
1.6	March 10, 2017	Revised Step 5, noting that measurements to optimize sub placement should be taken with room correction off.

Credits

Thanks to the contributors in the [AVS MiniDSP thread](#), especially **Audionut11**, **3ll3d00d**, and **Markus767** for their detailed guidance. And a special thanks to **Kbarnes701** for relentlessly encouraging me to develop this guide, which I hope is useful to others as well, and for providing feedback during the document's draft stages.

Corrections and suggestions for improvement should be directed to user AustinJerry on <http://avsforum.com>.