



Using Key Measurements to Verify Basic System Setup

Making and interpreting measurements to build the foundation for a proper sounding system

There are several key concepts for the proper design, layout and execution of miniDSP-based audio systems. The first step is to make sure all the elements of your system are set up correctly and efficiently by performing a number of verification measurements.

In this blog, we will outline the process of making and interpreting key measurements to verify all basic system functions:

1. Component Settings
2. Cabling Integrity
3. Speaker Driver Operation
4. Speaker Polarity
5. Relative Speaker Level Settings
6. Crossover Function
7. Speaker Room Positions

Completing the verification process using these steps will give you a proper sounding system. This, in turn, will provide the basis to successfully apply Room EQ Wizard (REW) filters or Dirac Live room correction to your audio system.

1. Component Settings

Before beginning the verification process, you will need to install REW and connect your UMIK-1 microphone and miniDSP 2x4 HD, Flex or SHD to your computer. Be sure that you have adequate USB cable lengths to position the computer in the listening area and have the ability to move the microphone around the seating area.

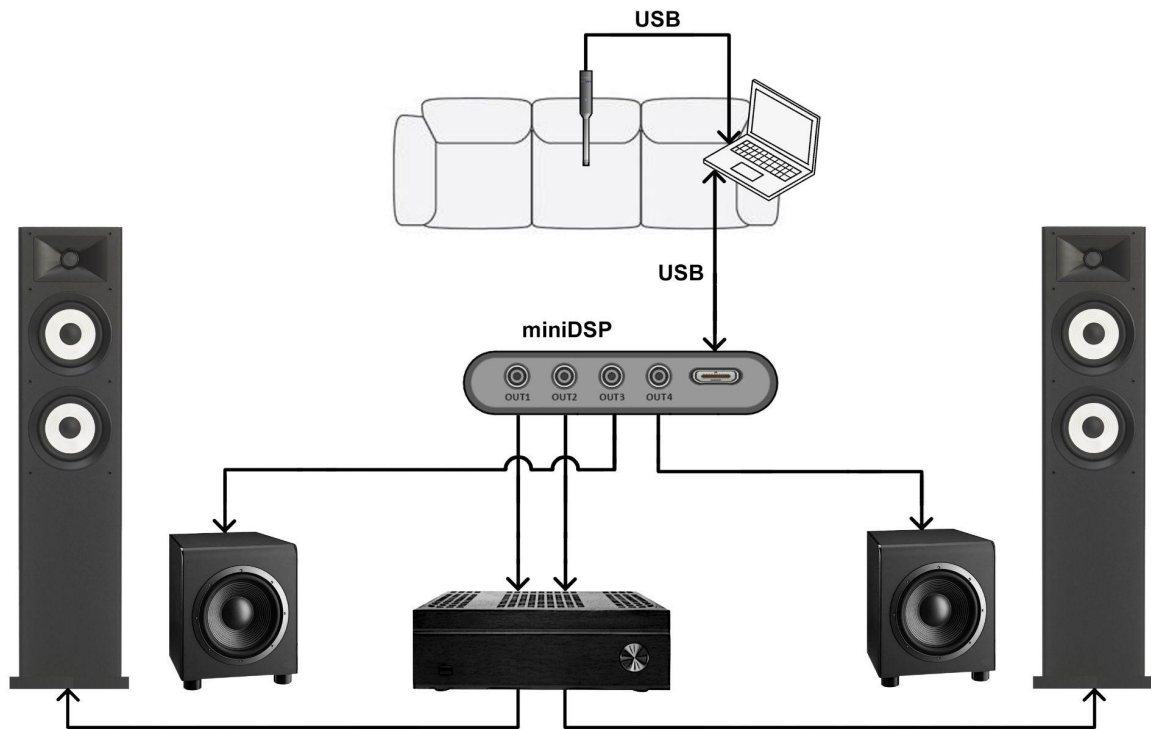


Diagram 1. Positioning for microphone and computer.

First check each component's hardware and/or software settings to make sure they are all in the proper configuration or nominal position. To perform basic measurements, use REW software. Depending on your specific system components, examples may include:

- Amplifier mono versus stereo switch and gain settings
- Speaker tone gain control knobs
- Bi-wiring connections
- Subwoofer(s) level, phase, inversion and tone settings
- Preamplifier and power amplifier level trim knobs
- miniDSP restore all to default
- miniDSP select USB input

IMPORTANT: If applicable, set any / all of the above settings that apply to your specific components to nominal.

2. Cabling Integrity

Before beginning a system tuning project, all of your system components need to be operating in proper working condition. To confirm cabling integrity, use REW or a noise generator and listen to each speaker and subwoofer individually to confirm the connections listed below.

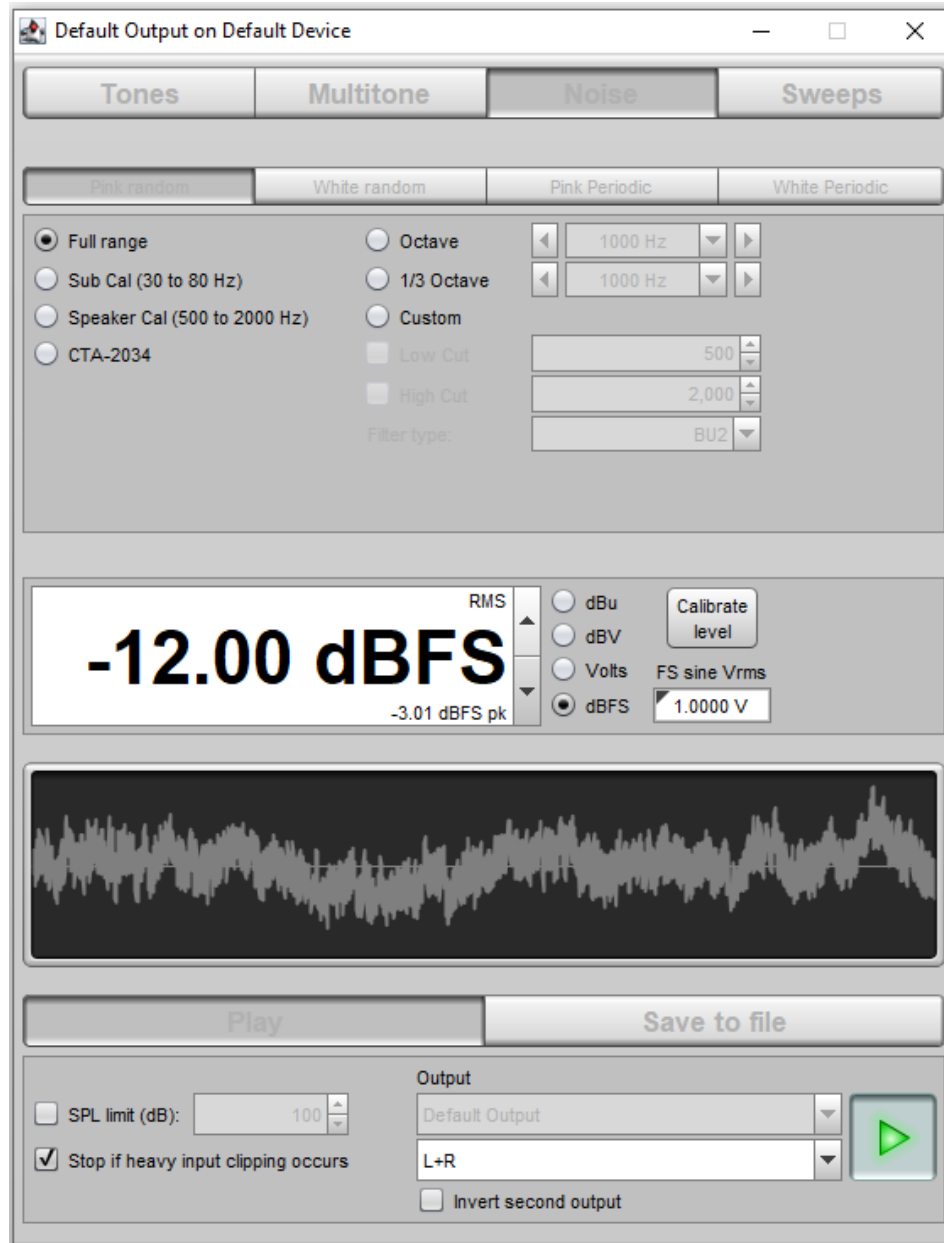


Diagram 2. Example of the REW noise generator.

- All cables are connected correctly and securely
- Left and right main speakers sound the same and match the subwoofer(s) levels
- No drivers are damaged or misconnected
- Left is left and right is right for all speakers
- No speaker cable connections are inverted

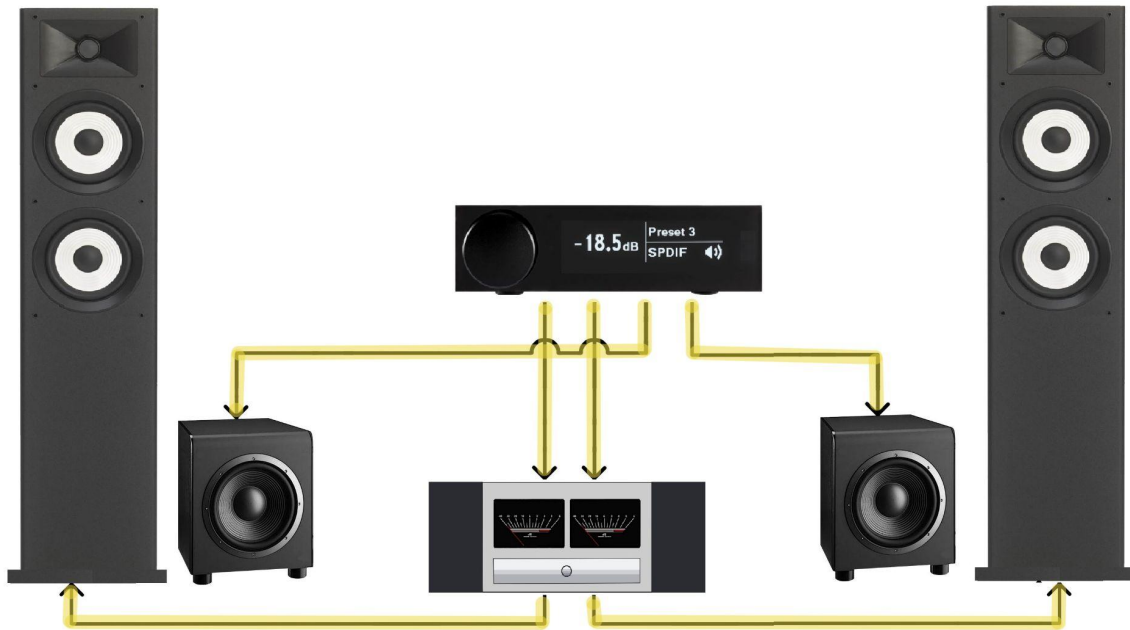


Diagram 3. Cables and connections need to be verified throughout the system.

This process is performed using the output page on the miniDSP plug-in. With the plug-in you can selectively mute, unmute, invert, etc. each of the connected speakers and subwoofer(s). This process will confirm the proper operation of your system elements.

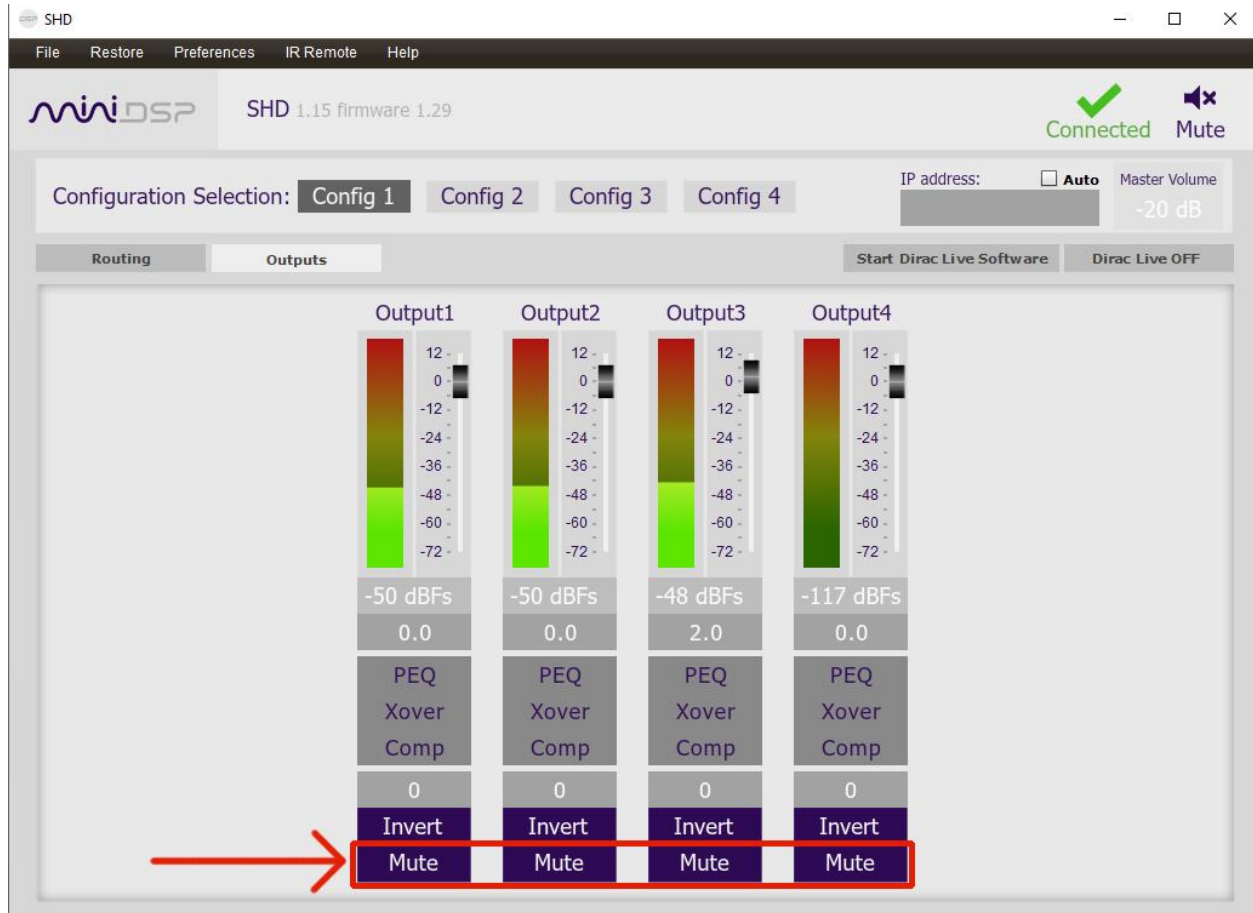


Diagram 4. miniDSP output page used for system measurements and verification.

3. Speaker Driver Operation

It's important to make sure that each of the individual drivers, tweeters, mid-ranges and woofers are functioning properly. This is accomplished by using REW to measure the frequency response of each of the speakers separately and combined to validate performance.

In this step we want to make sure there are no burned out drivers, buzzes or rattles. You also can listen for and correct any excessive room vibrations. Room vibrations can include rattling pictures, light fixtures, cabinet doors, etc.

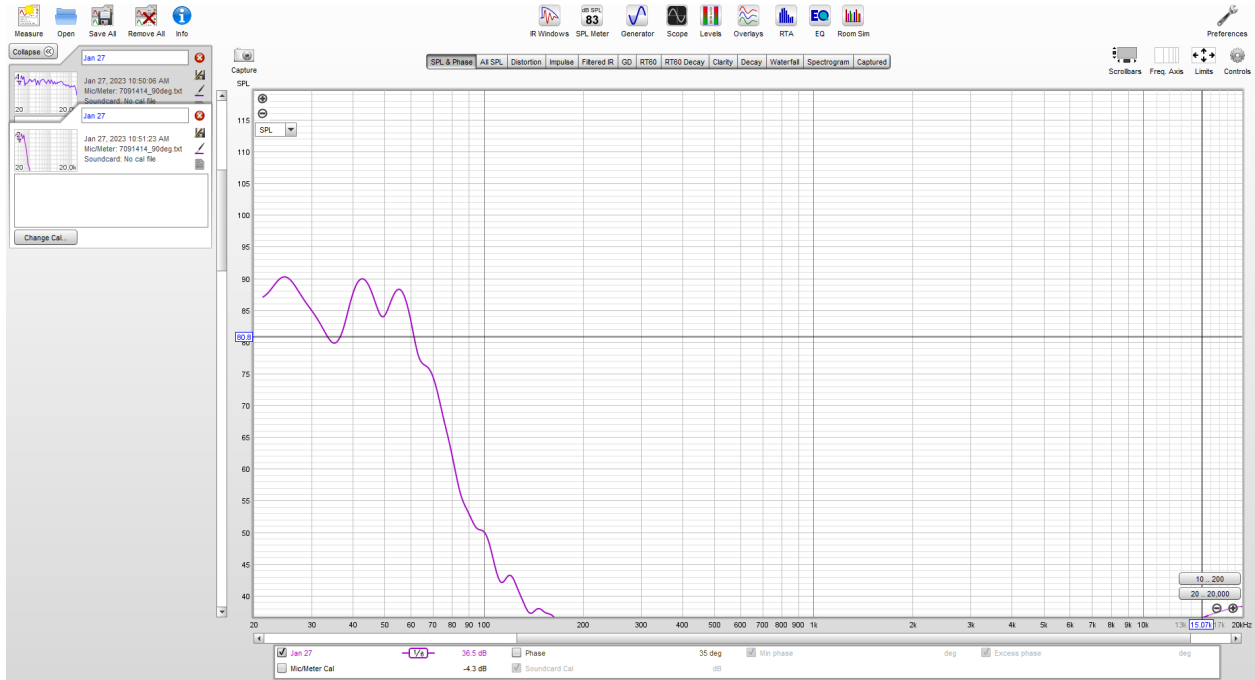


Diagram 5. The subwoofer sweep measurement verifies the unit, but also helps identify physical room vibrations.

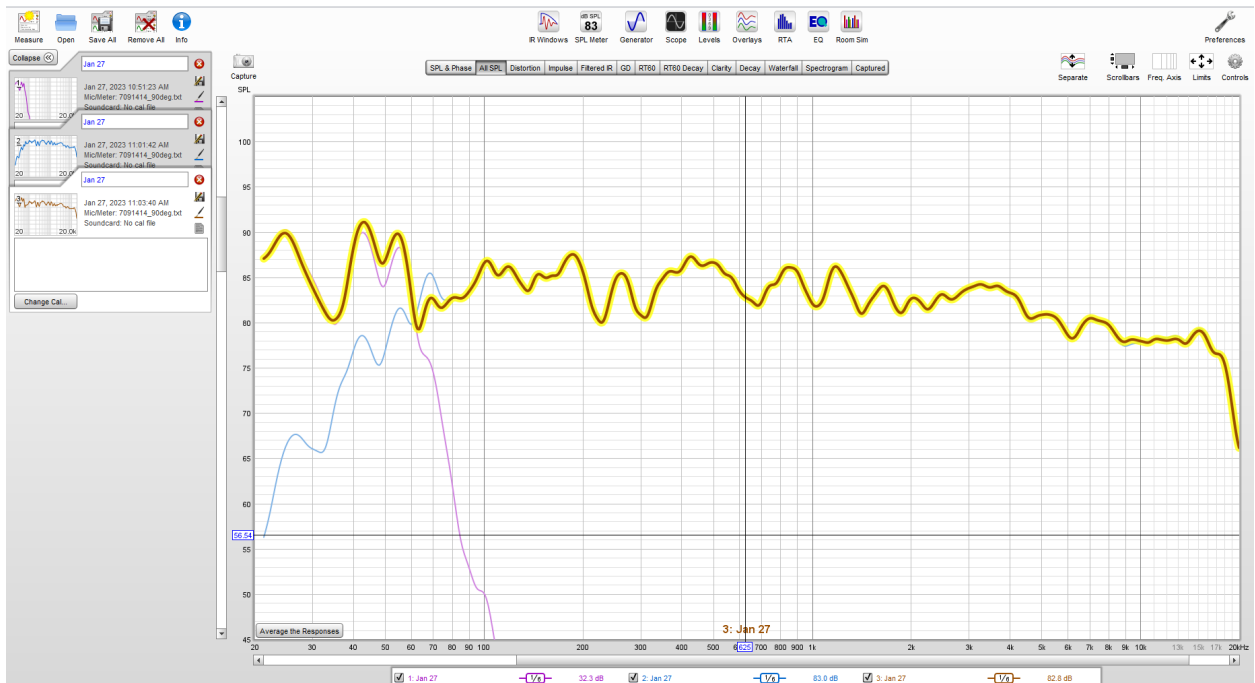


Diagram 6. A system composite sweep with main speaker and subwoofer should be additive in the crossover region. This also will show the formation of the classic Harmon tilt.

4. Speaker Polarity

After confirming the integrity of all connections and speaker driver operation, the next step is to independently measure each of your channels, main speakers and subwoofer(s). First, view them on the All SPL screen of REW.

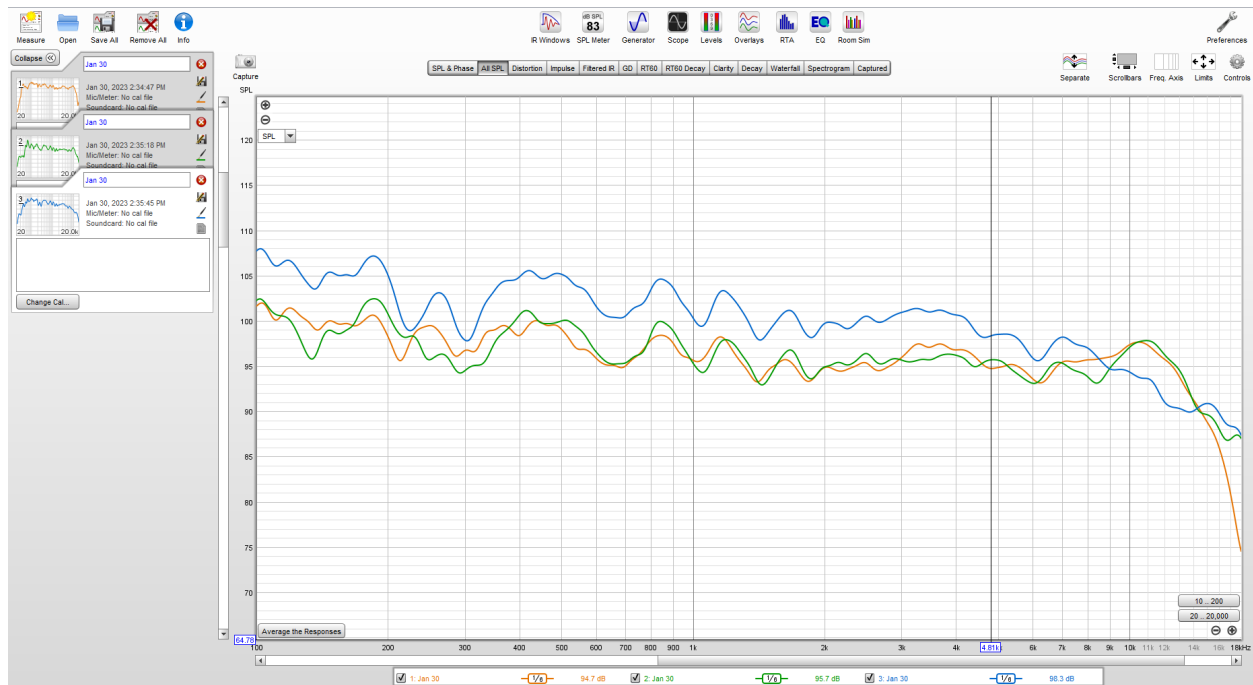


Diagram 7. In this graph, green and orange represent left and right main speakers only; blue is the sum of both left and right. You can see in this example they add by 6 dB, meaning they are in phase.

Next, we can verify the subwoofers are non-inverted from the main speakers. If you have an inverted phase situation, the level will subtract in the crossover region of the drivers. The goal is to end up with all of the speakers being additive in power level.

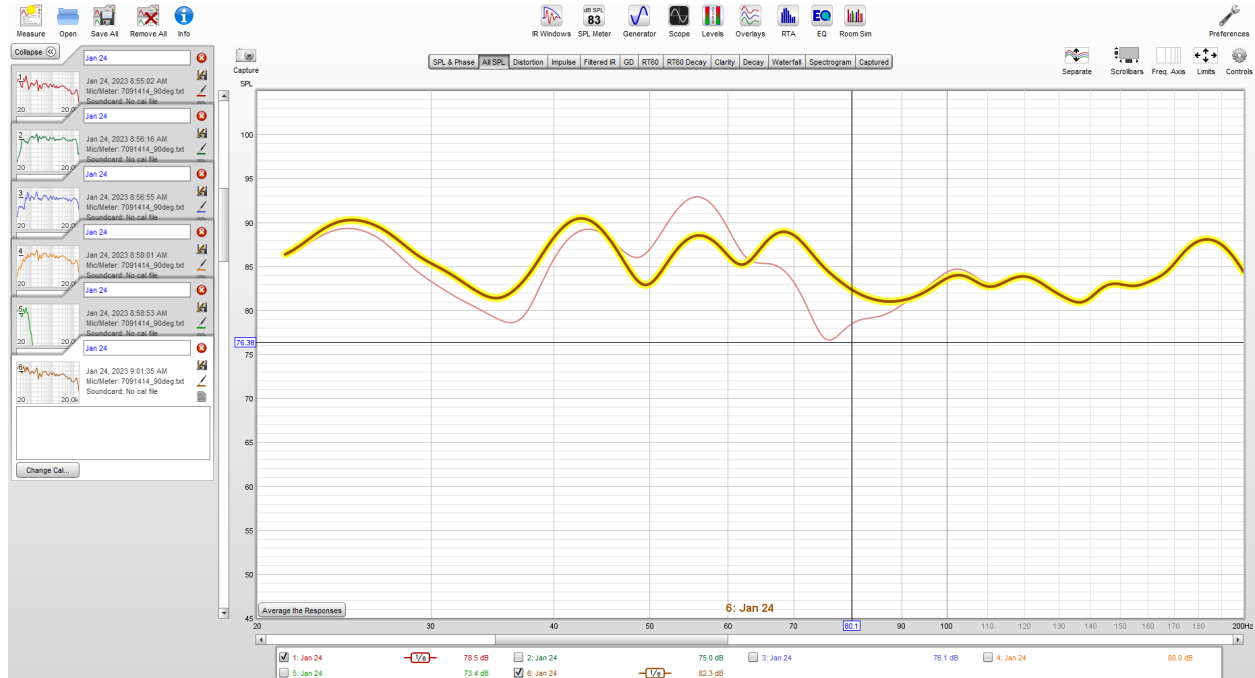


Diagram 8. The highlighted curve shows the flattest frequency response.

5. Relative Speaker Level Settings

The next step is to set all the levels to be approximately equivalent using the All SPL screen in REW. What should be notable here is that all of the relative speaker levels are close and sloping downward, exhibiting a Harmon tilt. By this point you should have made significant improvements, resulting in a nice sounding system.

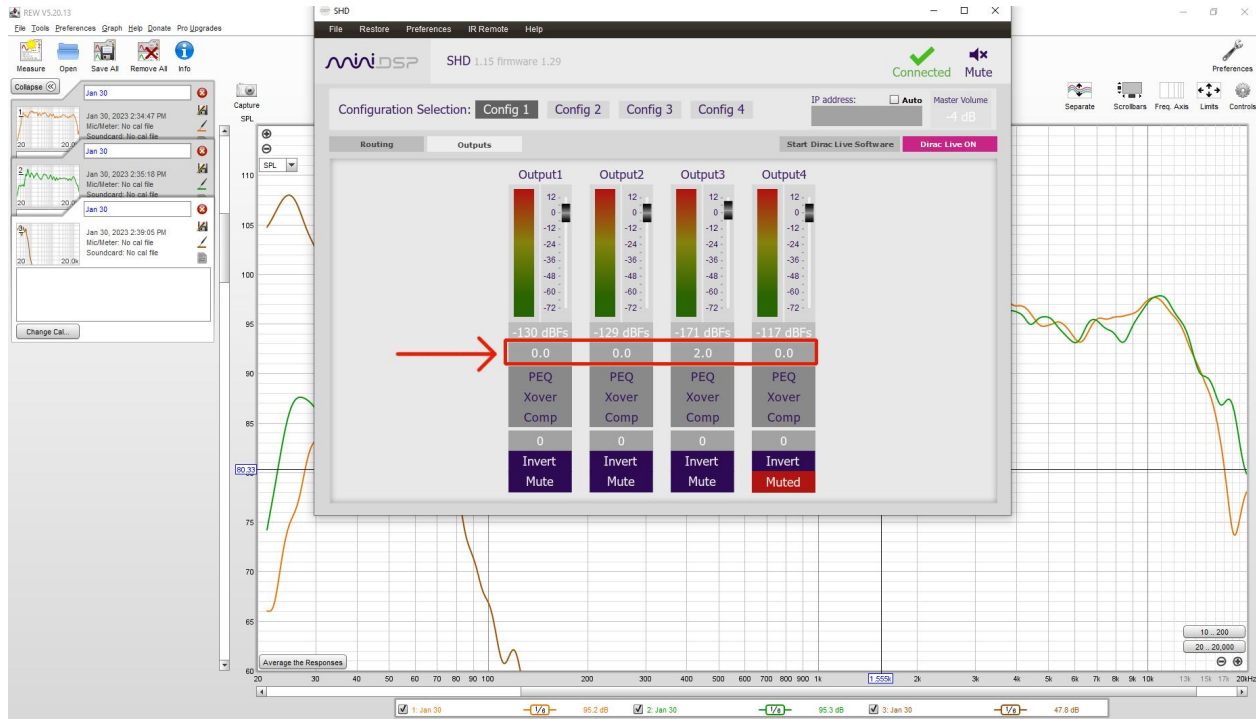


Diagram 9: Here we use the miniDSP output page to adjust the output amplitude values

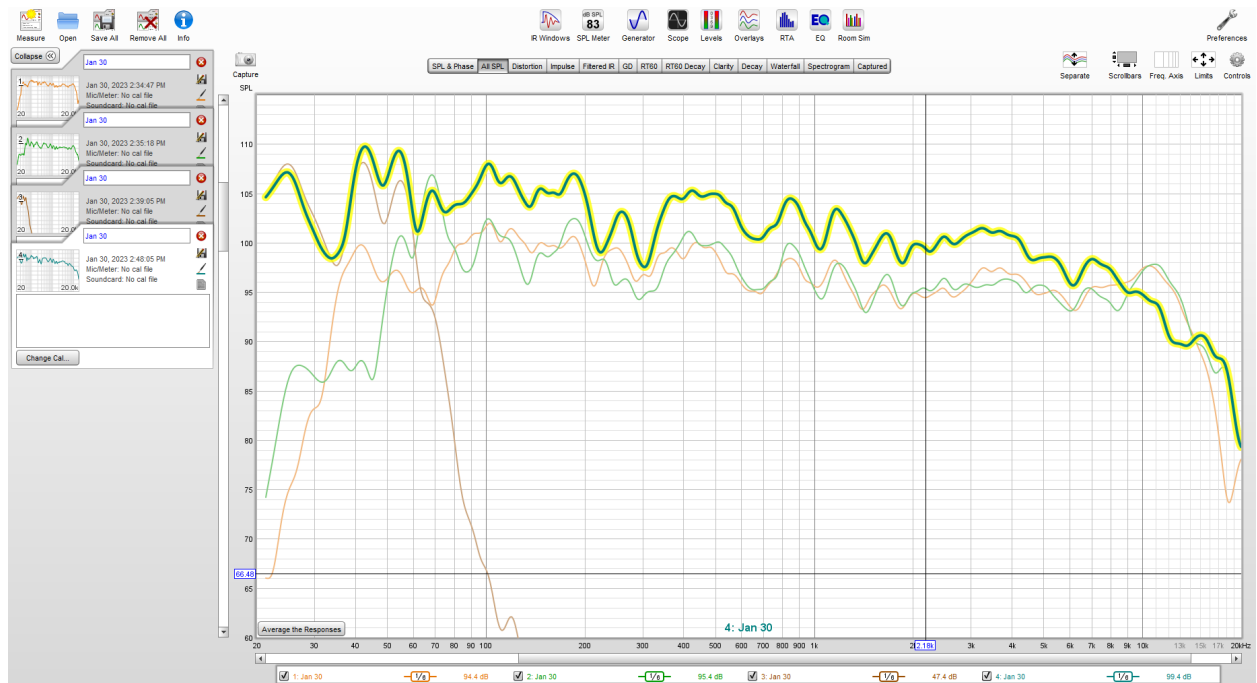


Diagram 10. This image shows traces overlaid with the left main, right main and subwoofer levels measured individually. The additive sum of speakers and subwoofer is highlighted. Notice the Harmon tilt reflected in the composite measurement.

6. Crossover Function

One of miniDSP's most powerful tools is the ability to create a very precise and neutral sounding main speaker plus subwoofer(s) system. This is an area where critical listening combined with measurements allows you to determine the best sounding setup. The goal is to have a neutral sounding system with no boominess that still allows you to feel the last octave in your chest.

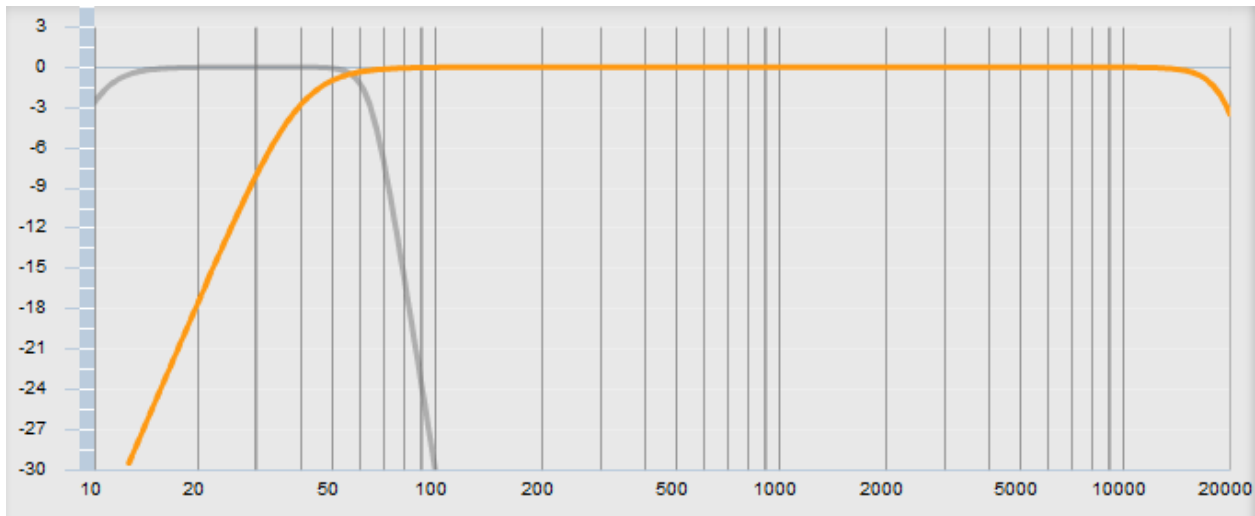


Diagram 11. This graph represents the crossover used for the examples in this blog, including slopes, types and frequency.

This topic is further explored in our Tech Blog: [Simplifying the Science of Subwoofer Integration](#)

7. Speaker Room Positions

At any time in the process you can reconfirm that there are no significant issues with room placement of your speakers, especially the subwoofer(s).

For example, if you don't see the expected performance out of a subwoofer you may wish to move it to a corner or some other location. Then you can use REW to verify that you have improved your system's frequency performance.

Deer Creek Audio Tech Series:

Key Concepts for Creating a High-Fidelity Audio System

We offer a series of Tech Blogs to guide you through the key concepts for the proper design, layout and execution of miniDSP-based audio systems. The guides can be read sequentially with each concept building on the previous one, or individually as in-depth discussions of specific topics.

Please watch for future Tech Blogs about:

- Initial System Verification
- Delay Settings
- Crossover Settings
- Relative Amplitude Settings
- Filters for Room Correction Using REW
- Frequency and Time Domain Room Correction Using Dirac Live
- Tuning to Taste

If you have questions or would like to discuss in more depth, feel free to give us a call or drop a line.