

## What is Room EQ Wizard (aka REW)?

REW is room acoustics analysis software for measuring and analyzing room and loudspeaker responses, and is very handy for measuring the sub response in your room. It is free and downloadable from <http://www.roomeqwizard.com> or <http://www.hometheatershack.com/forums/downloads-area/>. There are PC and Mac versions. You will also need Java Runtime Environment: <http://www.java.com/>.

The REW software, along with a calibrated microphone and HDMI cable (or USB sound card and RCA cable), will allow you to measure the frequency response of your subwoofer in your room so that you can see the frequency response curve you are hearing. Once you get REW downloaded, take a few minutes to look around the program and be sure to check out the HELP files included with the program. They are very useful in understanding how REW works and helpful in getting it setup, although for the purpose of measuring your subwoofer, it is fairly simple. Once you get the hang of it, you will be glad you learned how to use it.

## How does seeing the response of my subwoofer help me?

You may ask why anyone would want to see the frequency response of their subwoofer. Every room is different, and placement of your subwoofer will have a significant impact on how well it will perform. It is not uncommon for most people to think that you can simply place a subwoofer anywhere in the room and it will sound the same. This is definitely not the case, because the subwoofer will excite what are called *room modes*, which are dependent on the room size, shape, openings into other rooms, and furniture in the room. Once these room modes are excited, they can cause standing waves in certain areas of the room. If you play bass music through a subwoofer and walk around the room, you will notice some areas will sound louder than others, perhaps some areas sound weak, some sound boomy, muddy, etc., while others seem to sound okay. This is all due to room modes creating standing waves in various positions based on the configuration of the room. Every room is different. What you are hearing are variances in the subwoofer's frequency response due to the room. If you were to mark one of the good spots and one of the bad spots, then move the subwoofer six feet in one direction or another, the sound in those spots will most likely change, in some cases drastically. The frequency response you are hearing from the subwoofer changes with each location due to room modes and standing waves. Some times it can be as little as six inches to a foot of movement.

The most common problems you will encounter are peaks or nulls at the main listening position that causes the subwoofer to not sound the way you think it should sound. In some cases it might actually be the correct sound, it may be accurate sound, but you have previously been listening to inaccurate bass and it doesn't sound like what you have been accustomed to hearing. Sometimes accurate bass can seem like it doesn't sound right, but after you realize that it is accurate and listen to it for a while, it will grow on you and you will like it, although for movies it is not unusual to want to turn the subwoofer volume up, depending on your taste. Later we will look at some examples of inaccurate bass response versus accurate bass response.

You want to find out where these problems exist... and what frequencies are being affected. REW will show you the frequencies where you have peaks and nulls at your main listening position. You will be able to move the subwoofer around the room and measure the frequency response to determine the best placement to eliminate as many peaks and nulls as possible. In some cases it could be as simple as firing (aiming) the front of the subwoofer in a different direction, or moving it a foot or two. Some subwoofers will even include parametric equalizer filters to help tame the imperfections in the response. If you really want to understand why your subwoofer sounds the way it does, REW is a very handy resource.

## **What will I need to get REW setup?**

You will need a laptop (or desktop computer in the room with the subwoofer) preferably with a USB input and an HDMI output, as these make for the easiest connections. The USB input is used for the calibrated microphone to measure the frequency sweep that REW sends to your processor or receiver via the HDMI output of your laptop. A good calibrated microphone to consider is the miniDSP UMIK-1 available directly from miniDSP: <http://www.minidsp.com/products/acoustic-measurement/umik-1> located in Hong Kong, or if you prefer you can order one from Cross-Spectrum Labs: [http://cross-spectrum.com/measurement/calibrated\\_umik.html](http://cross-spectrum.com/measurement/calibrated_umik.html) in the United States. You will receive a calibration file for the microphone, usually by email, which you will save on your laptop. HDMI cables can be found at various online and local stores. Make sure you get one long enough to go from your laptop to your processor or receiver. If your computer does not have HDMI outputs, you can still get the sweep sent to your processor or receiver via an external USB sound card and an RCA cable. You can pickup a USB sound card at Amazon... search for the Behringer UCA202 and it will work just fine.

Note: There is a convenience in using the UMIK-1 microphone. The calibration file includes the sensitivity measurement of the microphone. This will eliminate having to calibrate the microphone to the SPL meter within REW. If at all possible, get the UMIK-1 and it will make things easier.

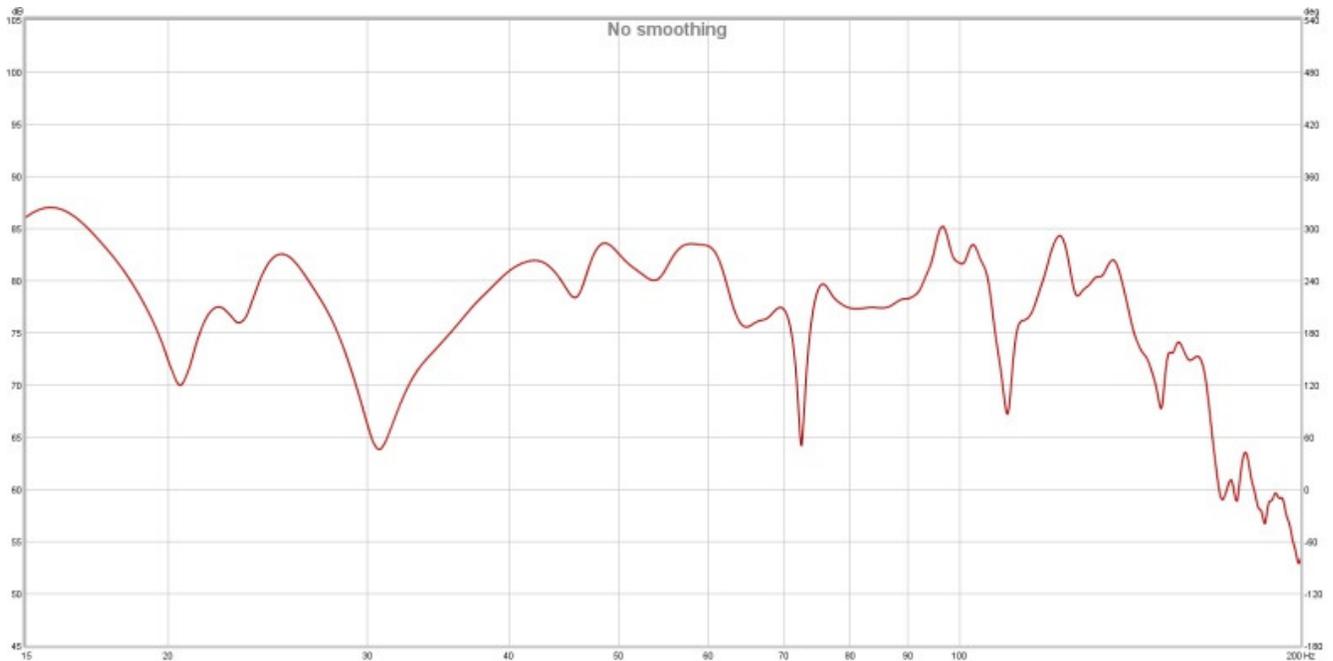
Once you get REW downloaded and installed on your computer, you will plug in the USB microphone to your laptop and place the microphone in your primary listening position, centered at about where your head will be when listening. You will run the HDMI cable from your laptop's HDMI output to the AUX input on the front of your AVR, or to one of the HDMI inputs on the rear (or the RCA cable from the USB sound card to a spare RCA input) and then select that input on your processor or receiver so that you can hear the sweep that REW will generate. After you have the connections made, start up REW and it will recognize that you have the UMIK-1 installed. It will ask you if you want to load the UMIK-1 calibration file and you will point it to where you saved it on your laptop. At that point your UMIK-1 microphone is calibrated and ready to be used as a measurement microphone and an SPL meter via the REW software program. Next, if you use an HDMI cable, you will need to setup the ASIO driver so that you can select the speaker you wish to measure, in this case the subwoofer. You will need to download the ASIO4ALL driver: <http://www.asio4all.com/>. Once you get it downloaded, follow the instructions that miniDSP has created for using the ASIO driver and the HDMI cable with your computer and REW. There are very detailed and documented instructions that can be found here: <http://www.minidsp.com/applications/acoustic-measurements/umik-1-hdmi-on-windows>.

Next you need to set the level of your processor or receiver. See the Check Levels section of the REW Help Files to see the complete details of setting your measurement levels. Setting the signal level REW uses during measurement involves generating a pink noise calibration signal (this is built-in to REW – again, see Check Levels in the REW Help Files) and adjusting the processor or receiver volume control so that your SPL meter (if using the UMIK-1 microphone, it will be your SPL meter) at the main listening position shows a level of around 75dB.

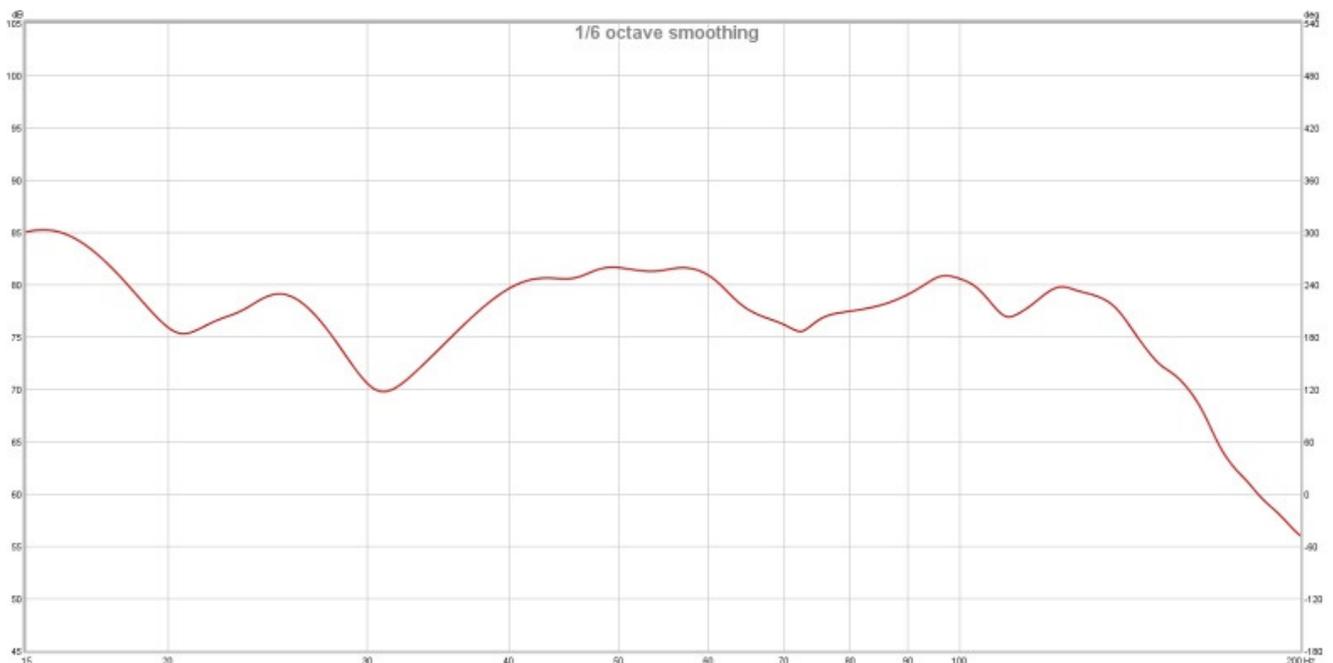
## **Measuring with REW.**

After you get the ASIO setup finished so that you understand how to get the measurement sweep from your computer to your subwoofer, and you have set your measurement level, you are now ready to measure the frequency response of your subwoofer.

You will want to set the measurement microphone at ear level of your main listening position. Click the Measure icon in the upper left corner of the REW program, then click Start Measuring, at which time you will hear a low frequency sweep through your subwoofer. Remember that this is all covered in the REW Help Files, so if you have questions or can't figure it out, check out the Help Files and/or ask a question in the REW Forum at <http://www.hometheatershack.com/forums/rew-forum/>. After you get the measurement sweep run, the result will look similar to graph below.



You can click on the Graph dropdown menu in the upper left corner of the program and change the smoothing to 1/6 octave to make it look better and easier to work with. The graph below is what you would see after smoothing the graph above.

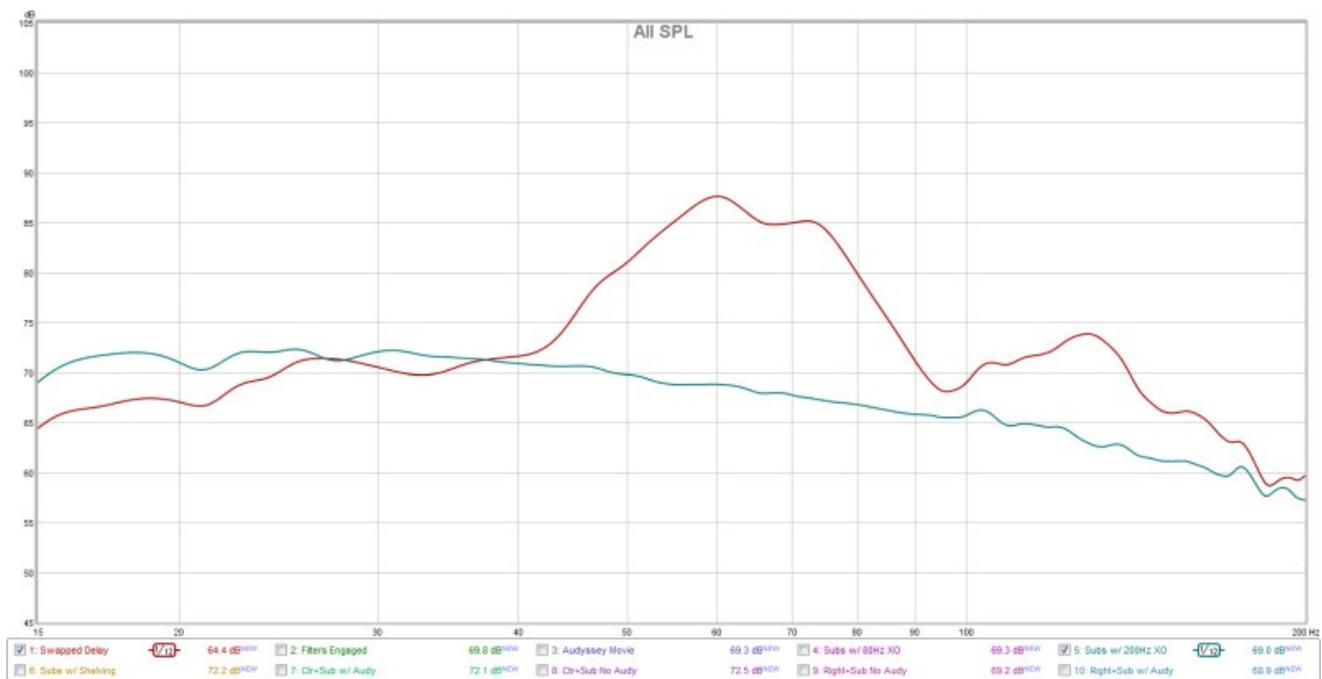


## Understanding the graphs after measuring with REW.

The narrower variances are not something to be all that concerned with and the smoothing will get rid of those so you can focus on the wider (broader) issues. What we would like to see with this graph is the line being fairly close to 75dB across the entire frequency range, which is why we set the measurement level to 75dB when we were checking the levels. We would hope to be able to move the subwoofer around and/or angle the firing of it in different directions to see if we can get rid of the nulls (dips) and or peaks. After we have found the best position with the least amount of variances, then we run our auto-EQ program... or perhaps our subwoofer has a couple of parametric EQ bands that we can use to filter some of the issues. One of the more common and very good subwoofer auto-equalization programs is Audyssey XT32, which is built-in to several of the Onkyo, Denon and Marantz processors and receivers. It is highly recommended because it does such a good job of equalizing the subwoofer. Several of the other auto setup programs fail to equalize the bass, although it is probably the most important area to equalize.

## I have run my auto setup program and my bass does not seem very loud, what is going on?

Looking at another measurement graph below, there is a very large 15dB peak centered at around 60Hz after working on placement issues. The subwoofer will sound loud, but you would not be hearing accurate bass... and you might also think the subwoofer does not extend very low. The goal will be to get rid of that peak and attempt to get a response like you see with the blue line.



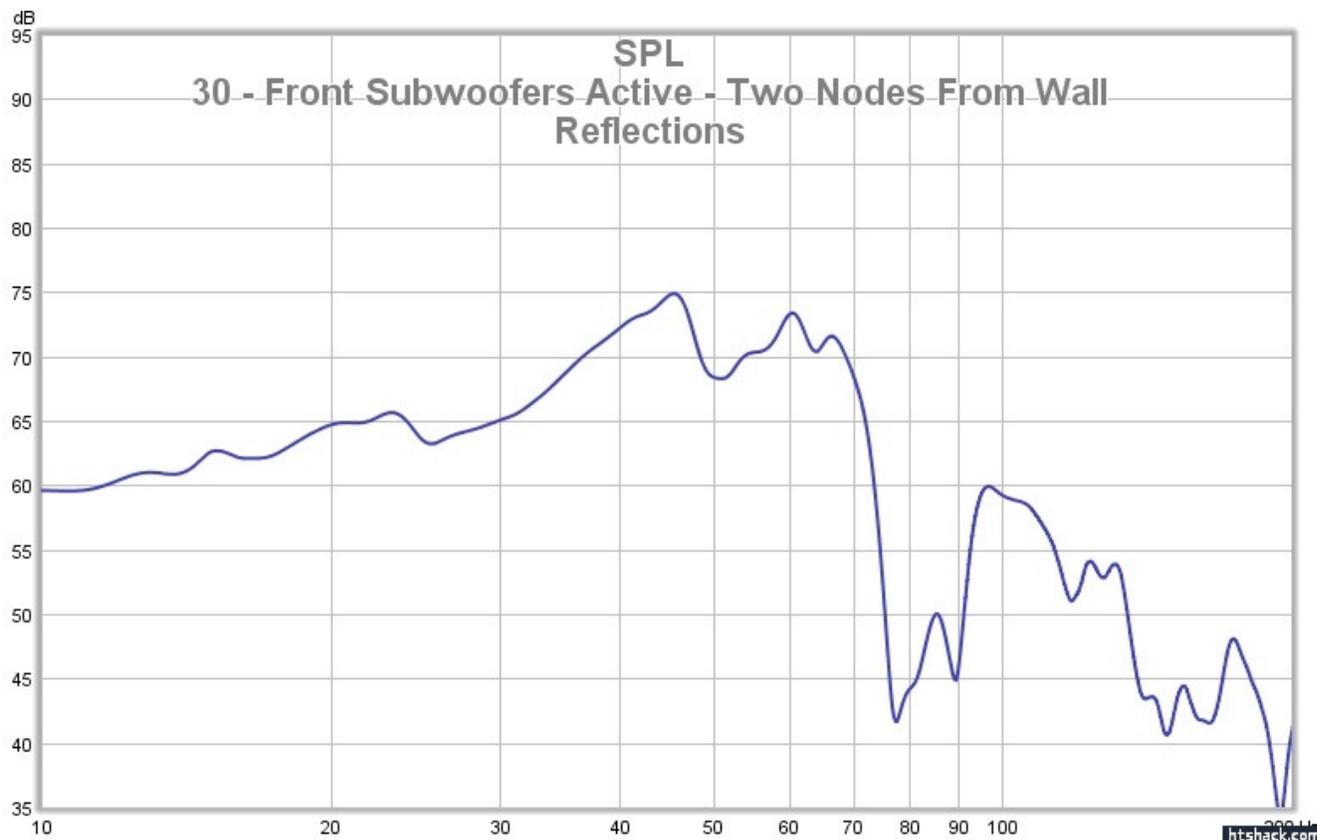
After you get rid of the peak, the blue line will be a classic example of those thinking the bass doesn't sound as good as it did with the peak. Why? Because it is 15db lower in volume... and that large bump at 60-70Hz can have an affect of making the bass sound good to some people, so much that when it is gone, it doesn't seem to sound right. They are left scratching their head and wondering what is going on. What is going on is accurate bass... however; the overall bass level has dropped, so in this case the overall subwoofer level probably needs to be raised. This is an actual measurement from a room and the subwoofer volume was ultimately increased by about 6-8dB to compensate for the reduced peak and to please this particular person.

Remember that in many cases after you have run your auto setup program, whether it equalizes your bass or not, the bass level may be too low. In these cases it is okay to raise the volume of your subwoofer, but it is recommended to do so at the subwoofer, not in the processor or receiver. In most cases it is better to keep the subwoofer level in the processor or receiver at zero or less, even a -2 to -8 level is okay. Increase the volume at the subwoofer if it is not loud enough.

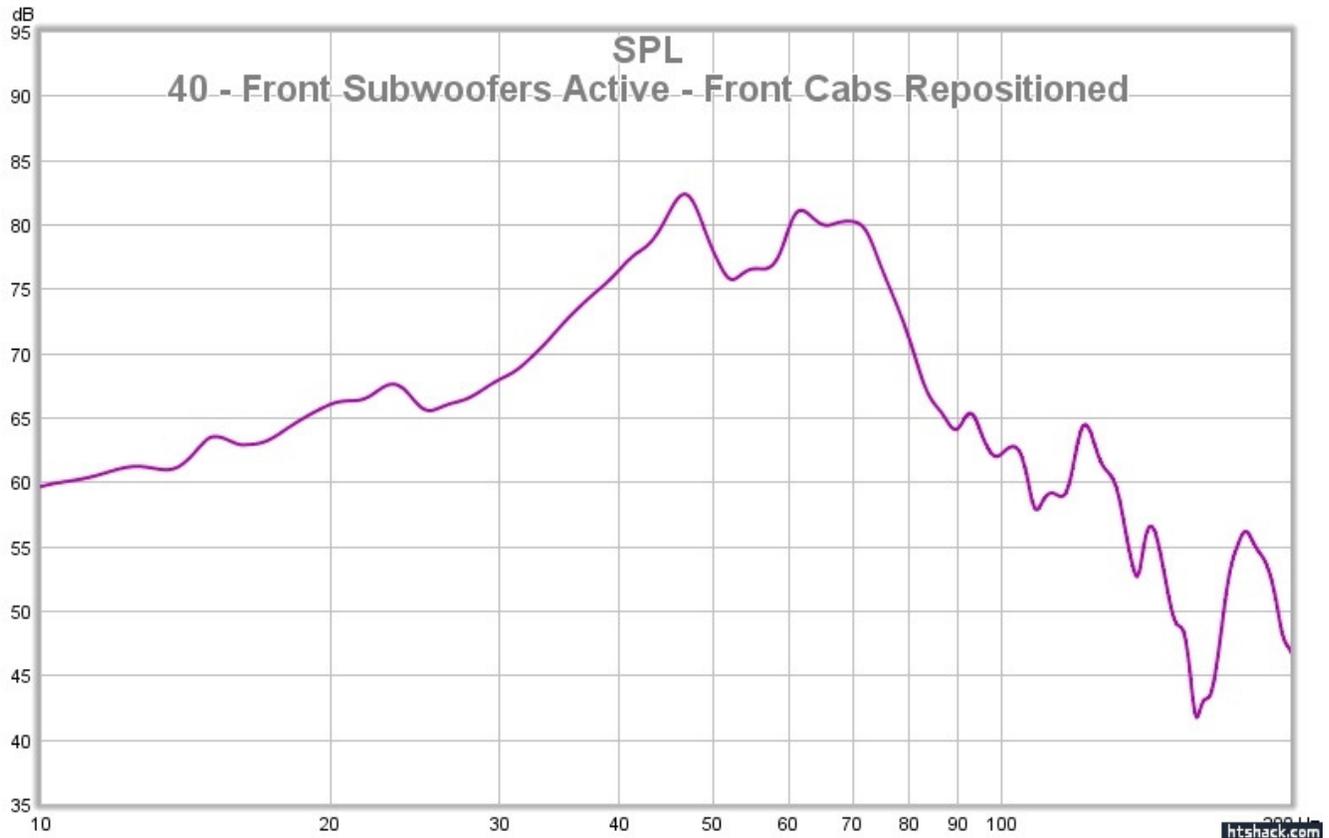
Another reason the bass may not seem as loud or may not seem like it is extending very low is because the auto setup program that does not equalize the bass is setting the bass level based on the loudest peak. For example, look again at the graph above and that large 15dB peak at 60-70Hz. It's actually about 17-18dB. The auto setup program that does not have subwoofer equalization reads the subwoofer output level as being 87-88dB and wants to reduce the overall subwoofer level to 75dB. Therefore it has to lower the overall subwoofer level by 12-13dB. Now the level from 20-40Hz is very low and the subwoofer is sounding extremely weak. This is why it is important to get a processor or receiver that has a good subwoofer equalization program, and one reason Audyssey XT32 is so popular... as it focuses heavily on smoothing out the response of the subwoofer.

### Does it matter which way my subwoofer is pointed?

It was mentioned earlier that orientation of the subwoofer (firing or aiming it one direction or another) could have an affect on the frequency response. It will not always make a drastic difference, but in some cases it may. Experimentation is the best way to find out. Here is a graph of the frequency response of two front corner placed subwoofers firing out into the room.



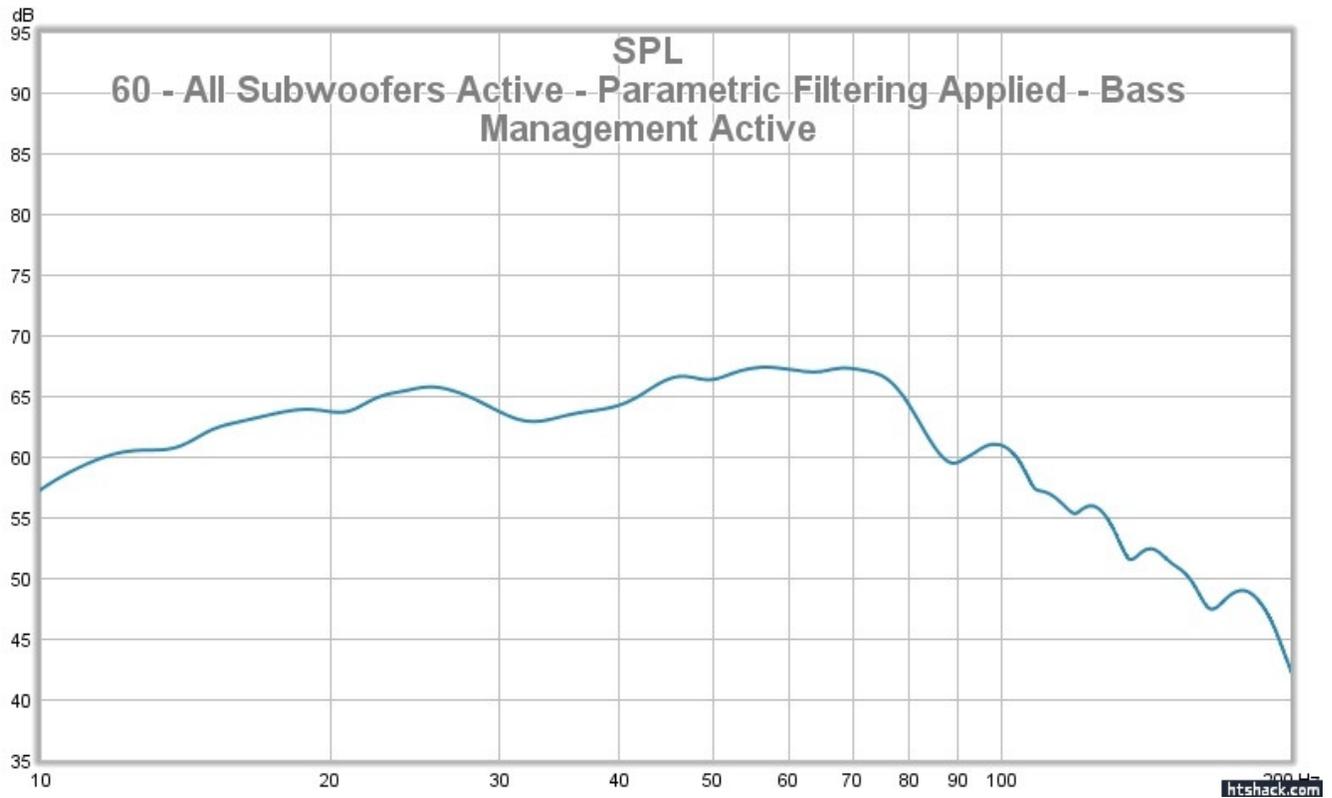
Notice the ugly roll-off at 70Hz. This is where you will get a lot of kick impact from movies and music (think gunshots and bass kick drums). This is not good because you will be missing something in movies and music. The fix was rather simple, although it took quite a bit of experimenting before figuring it out. The subwoofers had to be turned around and fired straight into the corners (45 degree angle); actually about 4 inches away from a corner bass trap (which only affects frequencies above about 120Hz). Look at the very next REW graph measurement of the subwoofer response after firing them into the corners.



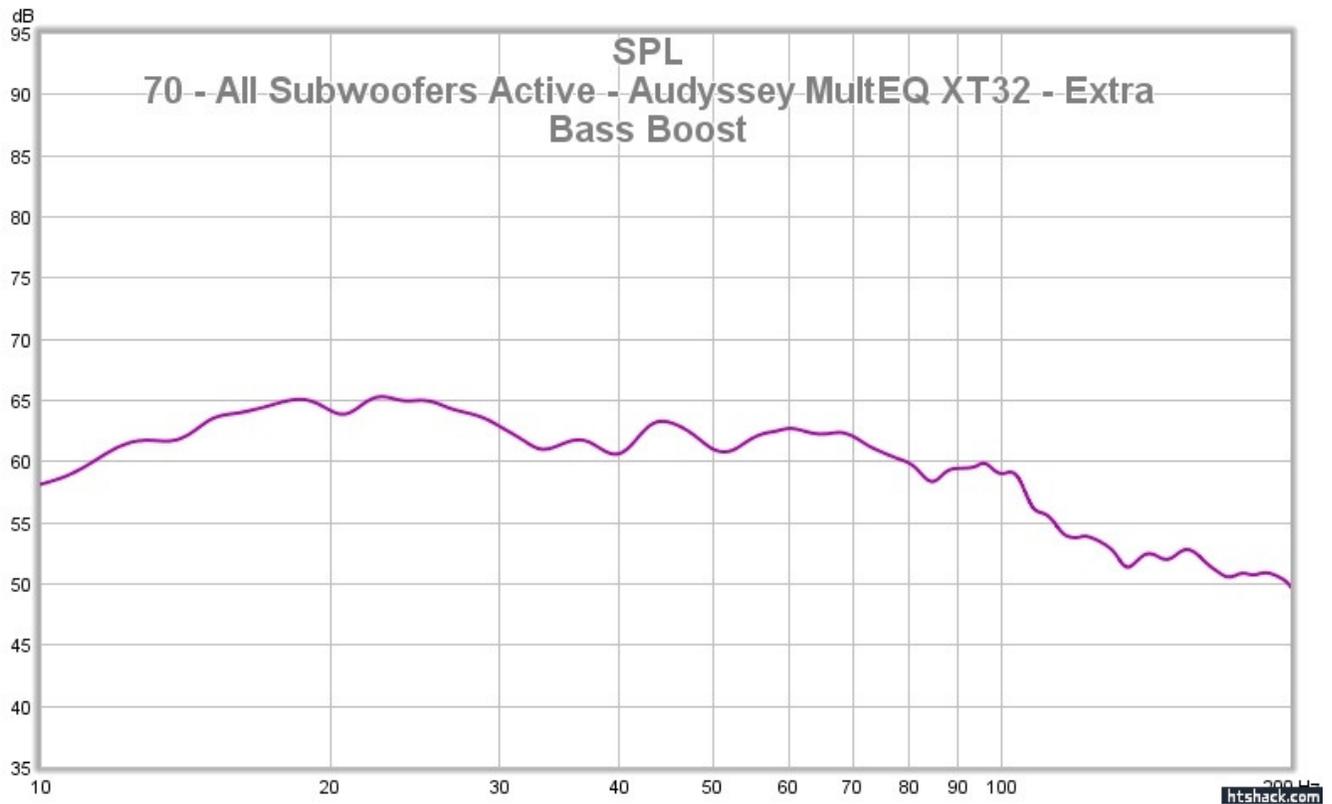
The null is gone, but there is still a pretty nasty peak to deal with, which is much easier to deal with than a null. Again, there are some who would probably like the sound of this response simply because they have not experienced accurate bass and have always relied on their “ears” for what they thought was the best sound.

Seeing and understanding what your frequency response of your subwoofer is in your room has its advantages. While not always necessary, it is certainly helpful; especially if you want to make sure you have accurate bass response.

The next graph shows an example of two parametric filters from a parametric equalizer (PEQ) setup and applied to tame that big peak you see in the graph above. Notice the smoothed results. This is not perfect, but it makes it very simple for Audyssey to do the rest. You don’t have to have a parametric EQ, but it does help. In most cases Audyssey can take care of the response pretty well, but remember that you may have to turn the subwoofer volume up after running Audyssey. Also remember that some other auto setup software programs do not have subwoofer equalization. REW will confirm this for you.



Audyssey XT32 is then run from the receiver to achieve an even smoother response.



Now this is a good looking and good sounding subwoofer frequency response, although the overall subwoofer volume may need to be increased to your preference. Turn it up and enjoy!