The Rives Audio Test CD is a unique and inexpensive way to determine room and speaker response. There are 2 sets of test tones. The first set is a flat response. The second set (tracks 32 through 62) is not linear and is designed to compensate for the non-linearity of the Radio Shack analog SPL meter. This meter is inexpensive and very reproducible. Together with the Rives Audio Test CD you can achieve good quality measurements. The following instructions are specific for the Radio Shack meter.

Placement of the meter:
The meter should initially be placed as close to the position of the primary listeners head in a normal listening position as possible. The opening of the meter should face forward, although the meter is omni directional, and therefore the direction is not critical. It is best if you have a tripod to mount the SPL meter on the tripod and position the tripod so that the SPL meter is in the normal listening position. If you do not have a tripod, use other materials to get the SPL meter into proper placement. You do not want to hold the meter by hand as this can affect the measurements. You also do not want any objects close to the opening of the meter.

Setting up the meter:
Use the C weighting position. Set the meter to "slow" sample. Check and be sure the battery is okay (there is a setting on the dB dial for battery check). Set the dB level to 80. You can use other levels 70 or 90, but 80 is a good compromise between being too loud and not being sensitive enough. 90 dB will give you slightly better measurements, but it can be fatiguing to listen to and may damage equipment. Be sure that you can be in location behind the meter to read the results.

Now play a test tone around 1000 Hz. If this is a cross-over point for your speakers, don't use this point and pick one slightly higher. Play the test tone and adjust the volume on your pre-amplifier (or receiver) until the meter reads approximately 0 dB. Once you've found this setting you should check one other point and insure that it is reasonably close to 0 dB, such as 4000 Hz. What you are looking for is a good mid point. All other measurements will be relative to this midpoint.

Playing and Recording Test Tones:

If you are using the Radio Shack SPL meter use tracks 32 through 62 for your measurement. These tracks are corrected for the non-linearity of the Radio Shack SPL meter. Record the results on a graph or spreadsheet. A spreadsheet is available on the Rives Audio Web Site. Go to the Test CD on the website and download either the black and white or color version of the "Frequency Chart".

Evaluating the Response:

Now that you have an accurate graph; you will likely see some peaks and valleys on your plot. The larger ones will be the problem areas that need to be further evaluated. If you have troughs at cross-over frequencies, this should not be too alarming. In most cases the human ear integrates between these troughs and does not perceive them as a loss. In addition to this, there is little that can be done about these troughs.

The peaks are generally the biggest concern. They will create an imbalance of the whole system, so it's important to tame them. In many cases the peak may not be perceived as the problem, but they frequently are. A good example is where someone says their midrange is unclear and muddy. It turns out the midrange has a flat response, but the bass has a large peak at 125Hz. This peak, caused by a room mode, has a slow decay time and is muddying up everything. It is perceived as a midrange problem, but in actuality it was a bass problem. Having a flat frequency response throughout the spectrum is the single most important factor in having a good sounding system.

Finding Pressure Zones in the Room:

Rives Audio made this CD with individual tracks. This is a particular advantage when trying to find the pressure zones. Now that you know where the peaks are, set your CD player to repeat on the track that closest represents the largest peak. Now take the SPL meter in hand, and while the CD player is repeating this tone, walk around the room. Look where the SPL meter peaks. It is likely you will have to turn down the dB setting one notch. If you turn down the dB setting make a note of this—it means the peak you find is actually 10 dB higher than what you will record. Find the "hot spots", or areas that have the highest pressure. Write down there location on a map of your room and write down how high the peak was (this is where you need to add the 10dB if you changed the setting on the SPL meter).

You will need to repeat this exercise for each of the prominent peaks you have in your room. Prominent is generally defined as being greater than 6 dB from the norm. There are two ways to do this. One is to make more maps or layouts of your room, or one is to record each peak with a different pen color. That way it is clear which frequency has high pressure zones in what parts of the room.

Congratulations. You're done and know where the problems exist. If you have this information evaluated by a well trained acoustic engineer, they can tell you what needs to be done to tame the problems in the room. If you are more of a DIY type, then you need to use material that will tame the frequencies measured at the highest pressure points. This is not the easiest task, but without good measurements it's basically impossible.

Correcting the Room—a Few Caveats:

There are a few words of caution that need to be exercised here. First, there are in general four different basic types of acoustical devices that can be used to treat a room:

1. Acoustical Treatments that absorb. These should generally be located in the high pressure areas and should be appropriate for the frequencies that require being absorbed. It is difficult to achieve practical absorbers below about 150 Hz.
2. Acoustical Treatments that resonate. These are typically Helmhotz resonators. They should be placed at the highest velocity points for the frequencies that they are tuned for. There is no limit as to the frequency they can operate on, but they are not absorbers. They re-radiate energy and while solving one set of problems can frequently create another set of problems. They are also frequently difficult to build and it is usually best to have them professionally designed for the task.
3. Acoustical Treatments that diffuse. These frequently absorb and diffuse, but in general can be designed to break up a particular band of frequencies (usually used in the mid frequencies, but can be made to tune any band of frequencies). These are very effective for “slap echo”, when a particular mid band is reflecting off a surface and it is not desirable to reduce the high frequency response, but rather to diffract (or diffuse) the mid frequency. These are typically not practical for low frequencies as they become too large to be effective for the longer wavelengths.
4. Active electrical means of correction. The most flexible and easiest to use, but also the least desirable. It is best to attack the room problem first, and when nothing else is practical then move on to active equalization. This is generally only necessary in the low (150 Hz and below) frequencies, as there are not good absorbers and resonators are very impractical. Even if you do have to use active equalization to tame bass modes within a room, it is still best to try to minimize it with room treatment first.

The measurements found from an SPL meter measure pressure only. You do not have velocity points and we would recommend professional assistance in designing an appropriate resonator. If the high pressure areas are above 150 to 200 Hz, then treating them with absorbing panels, diffusors, and bass traps will work very well. There are a variety of sources for these types of products.

If the problem exists below 150 Hz, then there are two possibilities. One is to consult an acoustical engineering service and consider either room modifications or building appropriate resonators (which is not always advised as they can create some other problems). The other is to consider the active equalization. Rives Audio manufactures such equalization as a very simple 3 band per channel notch filter. It is completely analog and designed to have a minimal effect on the signal with the exception of the frequencies that need to be attenuated. For more information, please visit the Rives Audio Web Site.

Rives Audio Inc.
The ATI Group, Ste A-1
8301 Patuxent Range Road
Jessup, MD 20794
800-959-6553
www.rivesaudio.com

Appendix A:

Radio Shack SPL meter correction. Add the correction numbers at the frequencies given to get a linear result from the Radio Shack SPL meter on C weighting and slow response.

Hz	Correction
10	20.5
12.5	16.5
16	11.5
20	7.5
25	5
31.5	3
40	2.5
50	1.5
63	1.5
80	1.5
100	2
125	0.5
160	-0.5
200	-0.5
250	0.5
315	-0.5
400	0
500	-0.5
630	0
800	0
1000	0
1250	0
1600	-0.5
2000	-1.5
2500	-1.5
3150	-1.5
4000	-2
5000	-2
6300	-2
8000	-2
10000	-1
12500	0.5
16000	0
20000	1