

Home Theater Room Treatment

Abstract:

The basics of treating a room for a better home theater experience include room dimensions, placement, absorbers, diffusers, and bass traps.

Introduction:

The ideal home theater sound system needs to produce the exact sound that the producer (the person who made the audio) intended their audience to hear. The most common mistake when setting up a home theater sound system is not treating the room it is in. The room is the most important part of setting up a home theater system because sound waves interact with the room before hitting the listener's ear. These interactions with the room change the sound away from the ideal.

Room Dimensions:

The first thing to consider is the room dimensions. The goal is to avoid dimensions that allow common frequencies to become stationary.

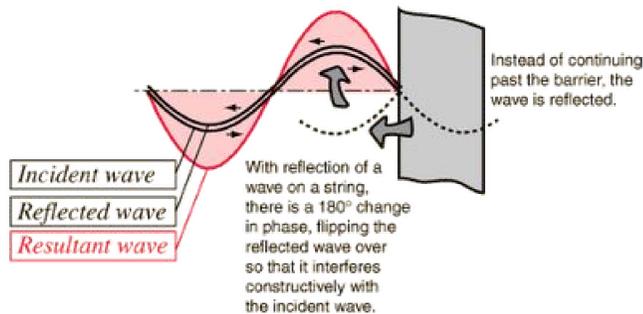


Figure 1: Diagram of a standing wave.

Standing waves will occur at any frequency proportional to twice the length of the room. So to avoid having one frequency get amplified, one must choose a room that does not have a length, width, and height that are multiples of each other.

Some golden ratios for room dimensions calculated by experts include:

- Sepmeyer: 1.0 : 1.28 : 1.54
- Louden: 1.0 : 1.4 : 1.9
- Volkmann: 1.0 : 1.5 : 2.5
- Boner: 1.0 : 1.26 : 1.59

Placement of Speakers:

For a standard 7.1 channel surround sound system, the placement of the speakers is as follows:

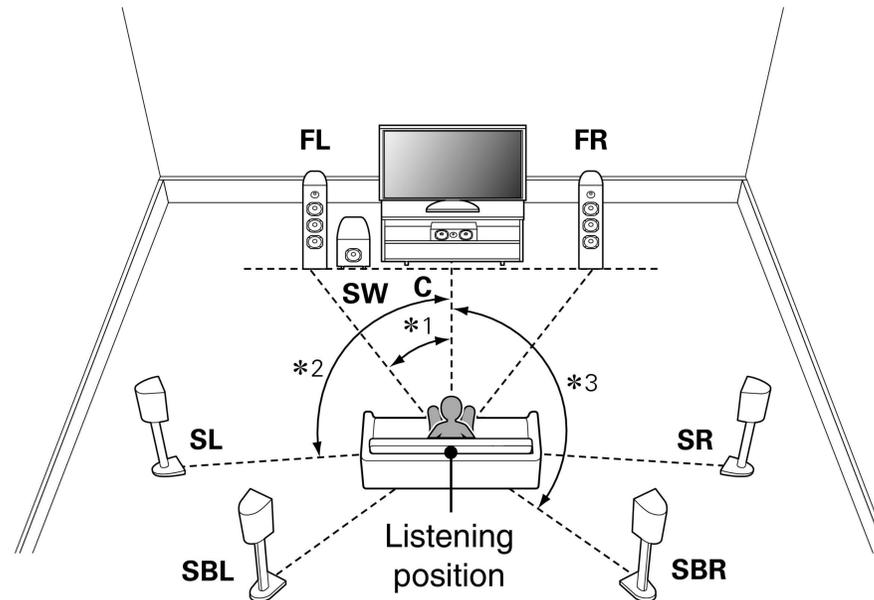


Figure 2: Layout of a standard 7.1 channel surround sound system. The angle values are as follows: Angle 1 = 22° to 30°, Angle 2 = 90° to 110°, Angle 3 = 135° to 150°.

A common technique to placing the subwoofer is called the *subwoofer crawl* where the listener places the subwoofer in the listening position and crawls around until they hear the best sound. That spot is where the subwoofer should be placed for the best bass.

Treating Reflections:

Sound will reflect off of surfaces in the room, some more than others. These reflected sound waves take an extra amount of time to hit the listener's ears than normal, thus creating a slight echo. This delay may not be desirable and so to alter how the sound interacts with the wall, the listener can place sound *absorbers* or *diffusers*.



Figure 3: Example of a sound absorbing panel (Left) and a sound diffusing panel (Right). Absorbing and diffusing panels have many variations on how they look. These are just examples.

Bass Traps:

Low frequencies require a special type of absorbing panel called *Bass Traps*. Bass traps are typically placed in the corners of the room because low frequency waves become stationary in the corners.



Figure 4: Bass Trap panel. Notice how it looks like the absorbing panel but has a corner shape.

Treatment Placement:

Below is an example layout of a room with treatment.



Figure 5: Example of room treatment in a home theater system. The white panels on the right and left of the room are sound absorbing panels. The wooden panels with slits in them are also sound absorbers. There are also sound absorbers on the ceiling. There are four bass traps, two per corner.

There are no definitive rules for placing room treatment because in the end it comes down to what sound the listener thinks sounds best. However, generally, absorbing panels should be placed at least on the reflection points on the left and right walls. Bass traps should also be used in all corners. Diffusers are commonly used on the back wall and back ceiling to simulate a surround effect for systems that do not have surround speakers.