White Paper

Hi-End Rooms

Acoustic Treatment Guidelines

V/COUSTIC

INNOVATIVE ACOUSTIC SOLUTIONS

Technology and rigorous in-house testing are the foundations of every Vicoustic Product

The Vicoustic Research Center was designed for technological development that includes training and skill enhancement in specific areas, such as Acoustic Product Engineering and Room Acoustic Design. Vicoustic has dedicated a considerable investment in these facilities. We have been extremely successful producing high performance acoustic products that comply with demanding fire, safety and environmental regulations; all while maintaining competitive cost levels.

Multifunctional Room

Vicoustic Multifunctional Room with magnetic walls allows us to mount and dismount any combination of acoustic products, to study performance, quality, design and aesthetics, instantaneously. This concept is already creating a ripple effect and is being adapted in demo rooms and testing facilities at Vicoustic partners around the globe.

Innovative Acoustic Chamber

Vicoustic Lab Test Facility is an innovative chamber with exclusive features that continues to be unique in the world. The goal was to build an adaptive volume chamber, allowing us to perform acoustic tests in various sized rooms. Thanks to a 4-ton mechanical wall that travels on a set of rails, we can define the exact dimensions of the chamber, and in this way deeply study low frequency room modes solutions. The wall has a bespoke sound insulation solution that is remotely controlled by a hydraulic system, completely blocking sound transmission, from inside and out. In addition, this cutting edge acoustic chamber is convertible from a reverberation chamber into an anechoic chamber, allowing both free field and diffuse field conditions to be achieved giving us the possibility to test our different products. By placing the mechanical wall in different positions it is possible to study any product sample at precise frequencies. The sound behavior is captured using B&K microphones, insuring reliable data for our analyses.

Problem

The Hi-Fi market is launching new powerful sound reproduction and signal processing tools, some of which contain acoustic correction features.

Nevertheless, even with the most effective sound system, if the acoustics of your room are not properly addressed, it is unlikely that you will be able to totally enjoy and take advantage of its full potential. **Ultimately, this will raise doubts regarding the investment made.**

It is well known that simply placing loudspeakers in any convenient location is not sufficient to get full enjoyment of your Hi-Fi system.

Basic Acoustic Treatment Steps

First Reflections Control | Optimizing Reverberation Time (RT) | Controlling Sound Field Anomalies

First Reflections Control

• First Lateral Reflections may influence the stereo image (by shifting or broadening it) and the perception of spaciousness within your Hi-Fi room. This will strongly determine the enjoyment you will have when listening to your Hi-Fi system.

• Different listeners will judge the importance of first lateral reflections differently. While some prefer to have some energy coming from first lateral reflections and in this way increase the sense of spaciousness, others prefer to hear the ambiance and reverb contained in the recordings with minimum room influence.

• These preferences may even change with the type of music one is listening. e.g. For classical music with acoustic instruments and slow rhythmic tempos, it may be more pleasant to have some energy coming from the sides to increase the sense of spaciousness and feel more involved with music. On the other hand, when listening to contemporary popular music with electronic instruments / effects and faster tempos, energy coming from the sides may compromise music definition.

• Taking this into account, this white paper presents two ways to treat first lateral reflections. One where mainly sound absorbers are used and another where mainly sound diffusers are used.

• The good thing is that with the new Vicoustic FlexiFrame system you will easily be able to change from one situation to another and tune your room according to your preferences or to the music you are listening.

Reverberation Time Optimization

• Reverberation Time (RT) is one of the main room acoustic aspects the human ear is able to perceive.

• The perception of reverberation is given by the multiple late reflections that arrive at the listener's ears.

- RT may influence spaciousness and signal perception/definition.

- A Hi-Fi room should neither be very live (with huge reverberation) nor too dead (with lack of reverberation).

- Optimum RT for Hi-Fi rooms should be within 0,3 s to 0,6 s.

- In addition, RT should maintain steady and continuous in the frequency range between 250 Hz and 4 kHz, avoiding compromising spectral content of the original music signal.

- RT optimisation can use both Vicoustic sound absorption and diffusing panels.

Sound Field Anomalies

In standard Hi-Fi rooms there are two main sound field anomalies that are likely to occur. Your solutions should deal with: i) Flutter Echoes and ii) Room Modes.

Flutter Echoes

- Flutter Echoes are repeated sound reflections caused by sound waves travelling between parallel reflective surfaces, such as walls, floor and ceiling.

- It should be noted that by treating first reflections and reverberation time one is already dealing with flutter echoes issues.

Room Modes

- Small rooms such as Hi-Fi rooms normally have poor acoustic response at low frequencies due to room modes.

- Low frequency response of your Hi-Fi room may be enhanced by including Vicoustic's Bass Trap solutions in the corners of your rooms where high sound pressure fluctuations are located.

- In this White Paper we are using VicTotem as a Variable Bass Trap, allowing you to control low frequencies from as low 80 Hz to 200 Hz, by simply rotating your VicTotem from the wood side to the fabric side.

- By including bass trap solutions one will have much more definition and clarity when listening to music with low frequency contents.

Solution

Based on the Basic Acoustic Treatment Steps presented before, this White Paper presents two acoustic treatment solutions depending on your budget: Economical and Premium Solutions, that will help you to achieve proper acoustic conditions within your Hi-Fi room and maximize the enjoyment of your Hi-Fi system.

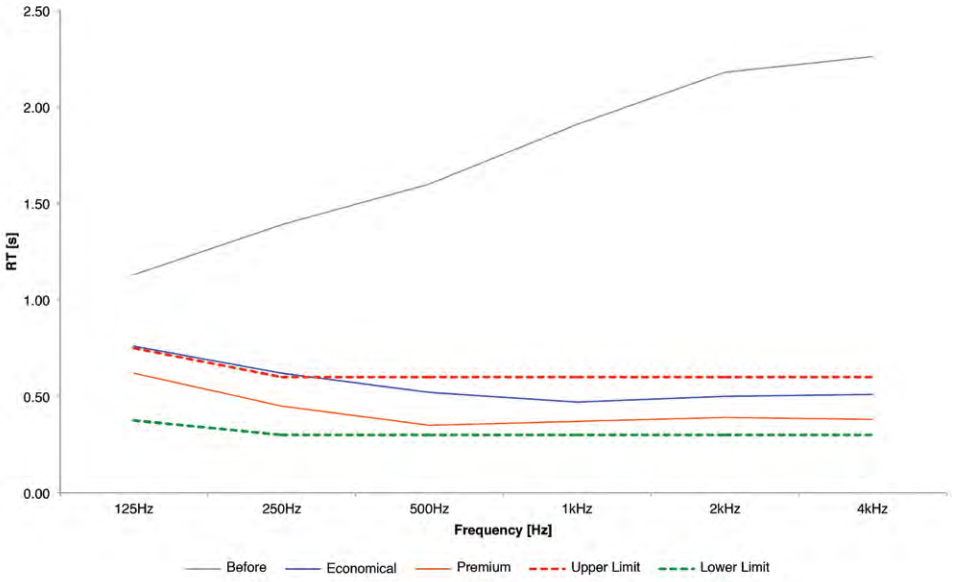
These solutions are meant for standard Hi-Fi rooms (Rectangular Rooms between 10m ^{2} to 20m^2 and height between 2,4m and 3m*).

	Economical	**Premium**
First Reflections	★★★	★★★
Reverberation Time	★★	★★★
Back Wall	★★★	★★★
Low Frequencies	★★	★★★

* If your room is not within this range of dimensions, you can always adapt the different solutions proposed in this document to your room.

Reverberation Time Predictions

The image below presents the calculated RT* for both an untreated and a treated room for the two different solutions proposed.



* For the RT calculations, we used a room with 4 m (W) x 5 m (L) x 3 m (H) dimensions. Regarding room finishes, we considered walls and ceiling made of plasterboard and floor made of parquet.
It should be noted that the RT is likely to have lower values than the ones presented in the image if smaller rooms are considered. If different finishes are considered the RT may increase or decrease, depending on the finishes. These predicted values are meant to be used as guidance to understand the benefit of the acoustic treatment that is being proposed.

Economical Solution

1 Box Flat Panel VMT

2 Boxes of Cinema Round Premium

4 Boxes of Multifuser DC2

2 VicTotem

In this Economical Solution a complete acoustic treatment solution is being proposed for your Hi-Fi room.

First Reflections, from the Side, Back, Front Walls and Ceiling are being treated with a mix of sound absorbers and diffusers (Flat Panel VMT, Cinema Round Premium and Multifuser DC2).

By treating all room surfaces potential strong specular reflections and flutter echoes are being controlled. This will improve sound definition in your Hi-Fi room.

Low Frequency issues are also being addressed by using two VicTotem as Bass Trap located in the corners.

Predicted RTs for this room show that the RT is likely to be within target RTs for Hi-Fi rooms.

In this Economical Solution the following Vicoustic Products are being used:

Flat Panel VMT: These panels are designed to perform primarily in the medium and high frequencies and come in 12 standard collections with 4 different patterns each., Flat Panels VMT can simulate concrete, marble and other premium materials achieving an amazing and realistic look.

Cinema Round Premium: Cinema Round Premium has a flat absorption performance between 250Hz and 5kHz maintaining, in this way, the spectral content of the original music signal.

Multifuser DC2: Despite being an economical Diffuser, the Multifuser DC2 has a great performance. It recently won the Best Accessory Award in the HI-FI+ Magazine Awards 2017.

VicTotem: This product is a variable bass trap allowing you to tune it according to your needs. You can vary its low frequency performance from as low 80 Hz to 200 Hz by changing the side facing the room from the wood side to the fabric side or having any intermediate situation.

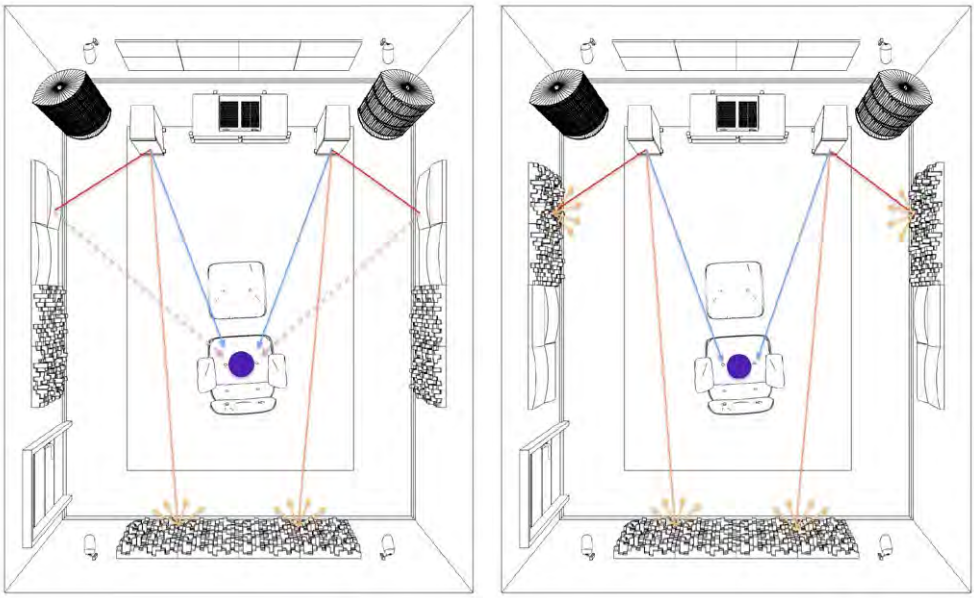
By using Vicoustic Flexi Frame system, one will be able to choose if first reflections are treated with Absorption Panels (Option A) or with Diffusing Panels (Option B), based on the listener´s preferences.

Option A

Absorption Panels in first reflections

Option B

Diffusing Panels in first reflections



Front Wall view
Option A - Absorption Panels in first reflections

Front Wall view
Option B - Diffusing Panels in first reflections

Back Wall view
Option A - Absorption Panels in first reflections

Back Wall view
Option B - Diffusing Panels in first reflections

Premium Solution

1 Box Flat Panel VMT	2 Boxes Cinema Round Premium	2 Boxes Wave Wood
8 Boxes Multifuser Wood	1 Box Multifuser DC2	4 VicTotem

In this Premium Solution a complete acoustic treatment solution is being proposed for your Hi-Fi room.

First Reflections, from the Side, Back, Front Walls and Ceiling are being treated with a mix of sound absorbers and diffusers (Flat Panel VMT,Cinema Round Premium, Wavewood and Multifuser DC2).

By treating all room surfaces potential strong specular reflections and flutter echoes are being controlled. This will improve sound definition in your Hi-Fi room.

This Premium Solution is better with Low Frequency issues than the Economical one by using four VicTotem as Bass Trap located in the corners.

In addition, by including extra acoustic treatment elements in the Hi-Fi room, the RT is more within the target RTs for Hi-Fi rooms than the Economical one.

In this Premium Solution the following Vicoustic Products are being used:

Flat Panel VMT: These panels are designed to perform primarily in the medium and high frequencies and come in 12 standard collections with 4 different patterns each., Flat Panels VMT can simulate concrete, marble and other premium materials achieving an amazing and realistic look.

Cinema Round Premium: Cinema Round Premium has a flat absorption performance between 250Hz and 5kHz maintaining, in this way, the spectral content of the original music signal.

Wavewood: Vicoustic's flagship acoustic panel has been specifically developed to treat acoustic problems without destroying the room's ambience, or over-deadening the sound.

Multifuser Wood 64: Multifuser Wood 64 is one of Vicoustic's Premium diffusers. Made of natural wood, it is a perfect QRD diffuser for your Hi-Fi room with both great performance and great design.

VicTotem: This product is a variable bass trap allowing you to tune it according to your needs. You can vary its low frequency performance from as low 80 Hz to 200 Hz by changing the side facing the room from the wood side to the fabric side or having any intermediate situation.

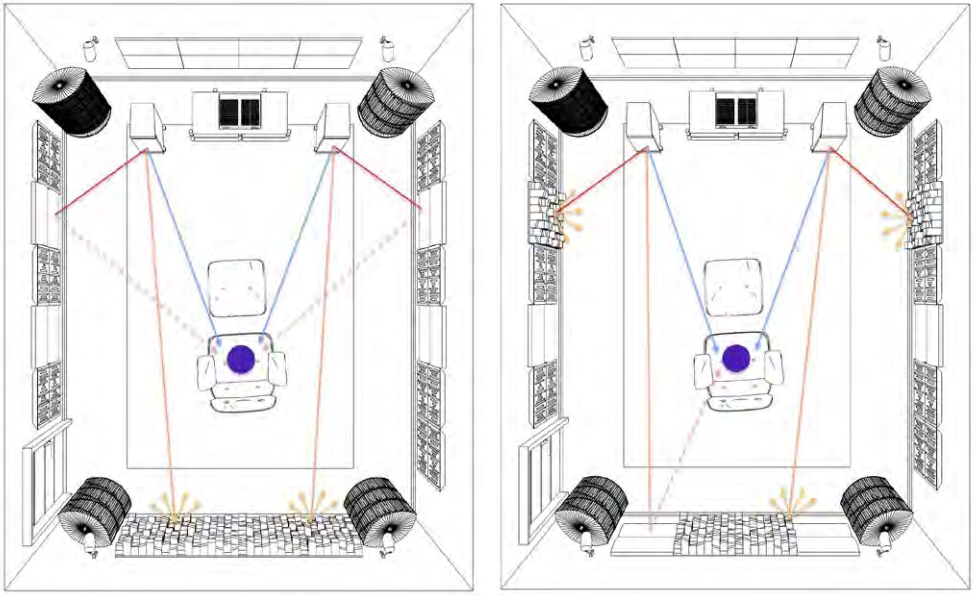
By using Vicoustic Flexi Frame system, one will be able to choose if first reflections are treated with Absorption Panels (Option A) or with Diffusing Panels (Option B), based on the listener´s preferences.

Option A

Absorption Panels on first reflections

Option B

Diffusing Panels on first reflections



Front Wall view
Option A - Absorption Panels in first reflections

Front Wall view
Option B - Diffusing Panels in first reflections

Back Wall view
Option A - Absorption Panels in first reflections

Back Wall view
Option B - Diffusing Panels in first reflections

List of Materials Needed

• Flat Panel VMT // Economical (1Box) - Premium (1Box)

Acoustic Properties

Mid and High Freq.
Absorption

Raw Materials

VicPet Wool

Dimensions

595 x 595 x 20
595 x 1190 x 20

12 collection, each one with 4 different patterns available

• Cinema Round Premium // Economical (2Boxes) - Premium (2 Boxes)

Acoustic Properties

Mid and High Freq.
Absorption

Raw Materials

Foam (M1)
and Fabric

Dimensions

600 x 600 x 75

Available Fabric Colors

• Wave Wood // Premium (2Boxes)

Acoustic Properties

Mid and High Freq.
Absorption

Raw Materials

Wood (MDF)
and Foam (M1)

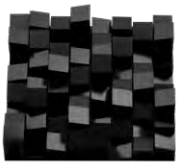
Dimensions

595 x 595 x 60

Available Wood Colors

List of Materials Needed

- Multifuser Wood 64 // Premium (8Boxes)



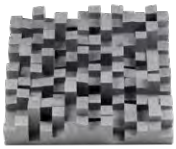
Acoustic Properties
Broadband Diffusion

Raw Materials
Wood

Dimensions
595 x 595 x 75

Available Wood Colors

- Multifuser DC2 // Economical (4Boxes) - Premium (1Box)



Acoustic Properties
Mid and high freq.
Diffusion

Raw Materials
100% EPS

Dimensions
590 x 590 x 147

Available EPS Colors

- VicTotem // Economical (2) - Premium (4)

Acoustic Properties
Broadband Absorption

Raw Materials
Wood, Foam,
VicPet Wool
and Fabric

Dimensions
1845 x 595 x 366

Available Wood Colors

Available Fabric Colors

Glossary

dB (decibel) – The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the root-mean-square pressure of the sound field and reference pressure ($2x10^{5}$ Pa).

Direct Sound – Sound that arrives at the listener's position directly from the sound source, i.e. without being reflected from any objects or surface.

First Reflections – Normally defined as the sound reflections that reach the listening position up to approximately 20ms after the direct sound.

Flutter Echoes – Repeated sound reflections caused by sound waves travelling between parallel reflective surfaces such as walls.

Reverberation – An acoustical phenomenon that occurs in enclosed spaces, when sound persists in that space as a result of repeated reflection or scattering from surfaces enclosing the space or objects within it.

Reverberation Time (s) – A measure of the degree of reverberation in a space. It is equal to the time required for the level of a steady sound to decay by 60 dB after it has been turned off.

Room Modes – At specific frequencies, called room resonance frequencies, standing waves are created within rooms. These frequencies depend on the dimensions and shape of the room. This group of resonance frequencies are normally referred to as room modes. When a sound source generates sound with frequencies equal or close to the room resonance frequencies, the room response will be enhanced and patterns of maximum pressure levels and minimum pressure levels will be produced. The shape of these patterns differs with the room resonance frequency.

Sound Absorption – The portion of the sound energy that is absorbed and not returned when a sound wave hits a surface.

Sound Diffusion – Sound diffusion occurs when a sound wave hits a complex surface such as a diffuser and its energy is distributed in many directions.

Sound Reflection – The portion of the sound energy that is returned when a sound wave hits a surface.

Standing Waves – A standing wave is originated from the interaction of two sound waves with equal frequency and amplitude but travelling in opposite directions. Unlike the travelling waves, the standing waves do not cause a net transport of energy, since the two waves that form it are carrying equal energy in opposite directions. The resulting standing wave alternates between maximum and zero amplitude.

Vicoustic Project Assistance

If you need further assistance, the Vicoustic Team is here to help.

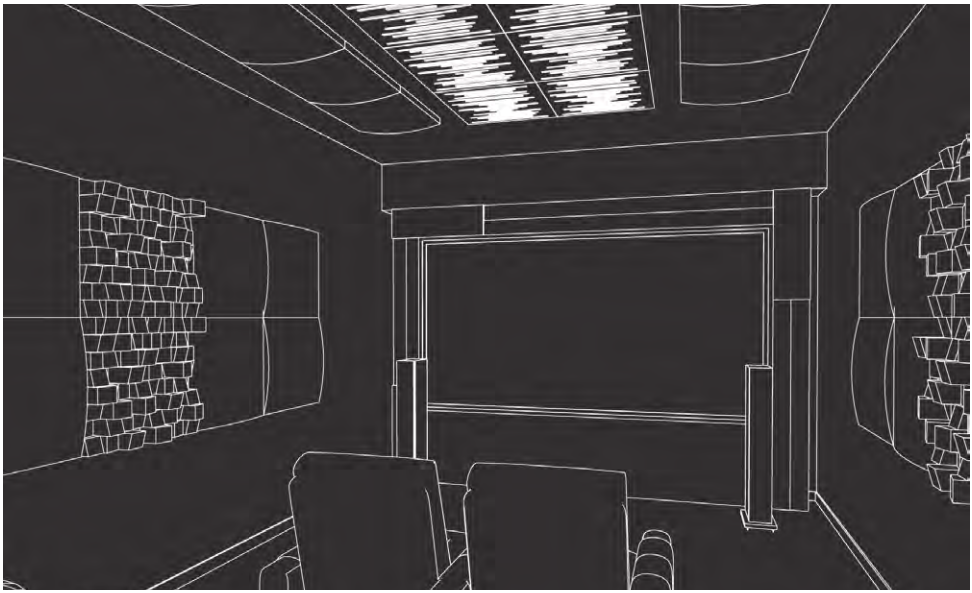
Our designers and acousticians can help you develop the design you like with the best acoustics possible.

Our research department is also available to develop customized products to satisfy your needs.

Our sales and marketing team are able to inform you about prices, new products and provide you all necessary product documentation and implementation details.

Together, we have proven that we can provide high levels of value add with reliable and effective recomendations, products and support services throughout your whole project process from conception through to completion.

This ability has provided us with a large base of clients in a relatively short period of time. We are proud that our customer list includes Sony, BBC, ITV, Facebook and Microsoft, along with many other satisfied users.



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UNIÃO EUROPEIA
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