Vicoustic
Innovative Acoustic Solutions

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Acoustic Treatment Proposal

Hi Fi Room // Audiophile Style
19/10/2018

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Contents

Vicoustic Approach to Projects

Standard acoustic design technics tend to result in standard acoustic solutions. As our trademark states, Vicoustic aims for **Innovative Acoustic Solutions** and therefore we do not consider standard solutions good enough.

We take pride in challenging standard technics and this is well reflected in our innovative acoustic products and in our innovative acoustic facilities.

We take this same approach every-time we start a new project, so that we can deliver really exciting and efficient rooms that provide a great environment for people to work, relax or simply enjoy.

The project process starts by collecting all information regarding client aspirations, client requirements, room use, room dimensions, etc. This is done via our web form and by liaising directly with the client.

Then, based on: i) the information collected; ii) best practice guidance; iii) layout constraints and iv) all Vicoustic experience gained in the last 10 years of business, bespoke acoustic design criteria are well defined to make your space function at the very best from small rooms to stadiums and auditoriums.

Our Project Team has a group of audio professionals with a decade-long experience. We can help you getting the best performance of your audio system, with a project that tells you what and where to install every acoustic panels, side by side with our own professional acousticians.

We choose to present design solutions through graphical form since we find it more helpful and inspirational. Therefore, each project contains several 3D photorealistic models, giving a realistic sense of how the room will look like.

Solutions proposed are always balanced against other requirements, i.e. Vicoustic always aims for both innovative and value engineering solutions.

We have proven in recent years that we can provide this level of value adding, innovative, effective and value engineering solutions to several acoustic projects. This ability has provided us a large base of Clients in a relatively short period of time. We are proud in having between our Clients companies such as Sony, BBC, ITV, Facebook, Microsoft and many others.

Introduction

A Listening Room should provide proper acoustic conditions to allow the enjoyment of listening to music. For this, simply placing loudspeakers in any convenient location will not be enough, i.e. the acoustics of the room must be well controlled.

These rooms should generally try to produce a similar sound field of a domestic environment and at the same time, naturally, keep some acoustic properties under control.

To achieve this, there are three main areas where acoustic treatment should act on:

1. Reverberation Time (RT);
2. Early Reflections;
3. Sound Field Anomalies (room modes, flutter echoes, etc.).

Acoustic terms, definitions and symbols used in this project are presented at the end of this report.

Reverberation Time Several authors agree that the average RT for a Listening Room should be within 0.3 s to 0.6 s in the frequency range from 250 Hz to 4 kHz.

The RT study conducted by Vicoustic involves: i) defining optimum RT values for the room; ii) defining the type, number and location of acoustic panels to be used; iii) presenting the proposed location for the acoustic panels; iv) presenting the expected RT values before and after the application of the proposed acoustic treatment.

Early Reflections The listener should be able to feel the ambiance and reverb contained in many recordings, therefore, early reflections from the Listening Room should be controlled in order to avoid masking those ambiance and reverb.

Vicoustic has proposed the following solutions in order to control early reflections: i) sound absorbing panels, which will control early reflections by taking energy from them (this is being done by Vicoustic's Cinema Round Premium panel), and ii) sound diffusing panels, which will control the reflections by spreading the energy evenly by the room, enlarging the listening position and creating a sense of spaciousness inside (this is being done by Vicoustic's Multifuser DC2, a QRD 2D diffuser).

In order to prevent the room from becoming too "dead" and control late reflections, sound diffusing panels are being proposed for the back part of the room, which will control late reflections by spreading the energy evenly by the room, creating a sense of spaciousness inside (this is being done by Vicoustic's Multifuser DC2, a QRD 2D diffuser).

Sound Field Anomalies In small rooms such as Listening Rooms one of the major sound field anomalies is related with room modes. Room modes are set-up in small rooms due to the relationship between low frequency wavelengths and room dimensions.

These modes can cause audible effects in the Listening Room's sound field at low frequencies, by originating areas with minimum pressure levels and areas with maximum pressure levels that can vary as much as 15 dB. Naturally, this will affect the listener's correct perception of sound at low frequencies.

Based on room modes study (presented later in this report), Vicoustic has recommended the use of Super Bass Extreme Premium. Preferably, the bass traps should be located where the maximum pressure levels occur within the room, i.e. in the corners of the room (this is shown in the 3D drawings presented later in this report).

It should be noted that other acoustic anomalies such as flutter echoes are already being controlled by the solutions previously proposed for RT and early reflections control.

3D Drawings

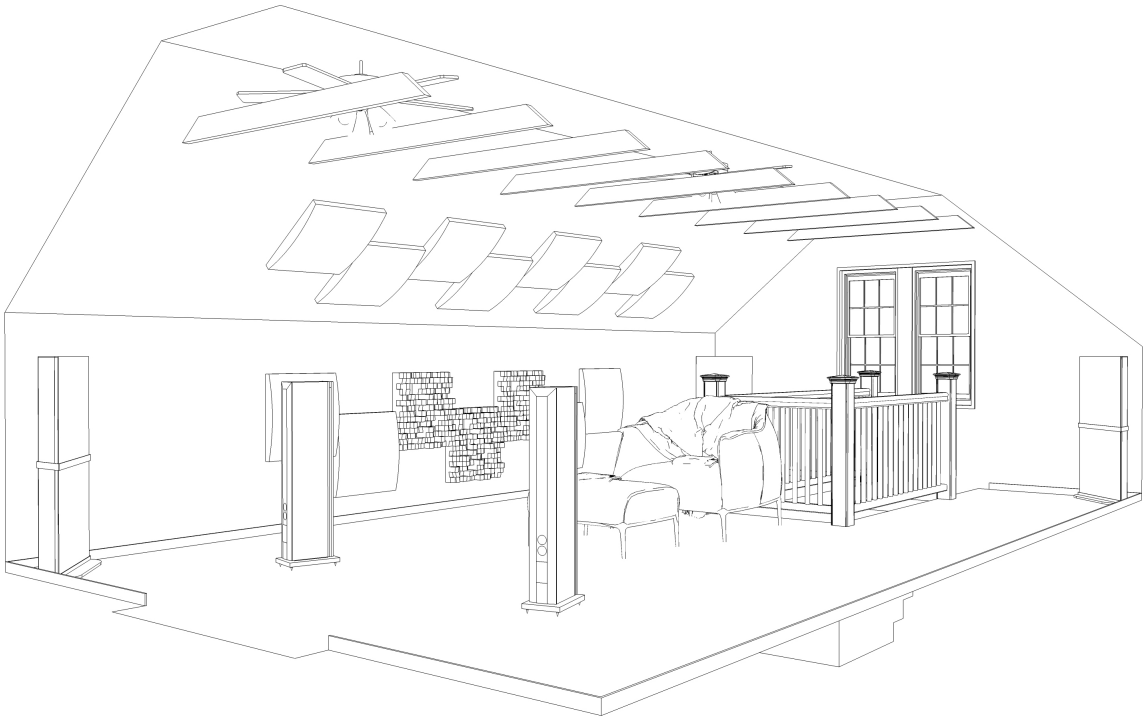
i) Renders

Picture 1 Render A

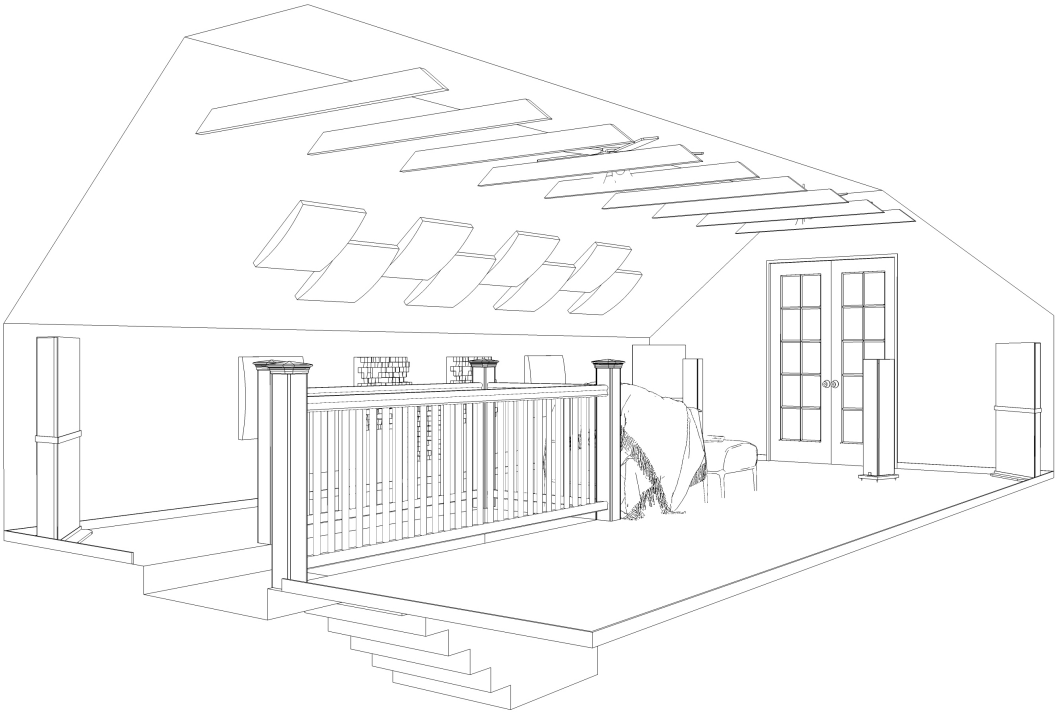
Picture 2 Render B

3D Drawings

ii) Perspectives



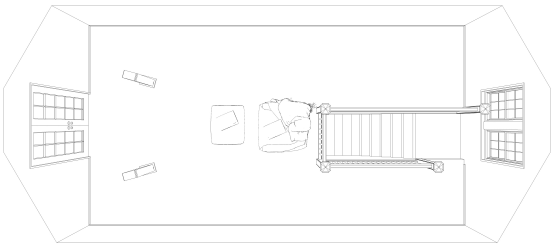
Picture 3 Perspective A



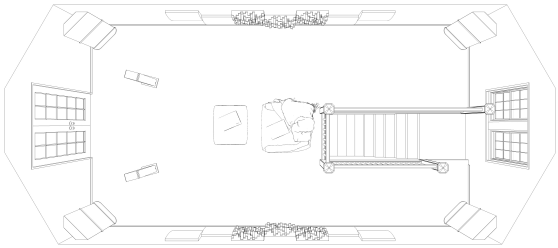
Picture 4 Perspective B

Acoustic Study

i) Reverberation Time



Before Acoustic Treatment



After Acoustic Treatment

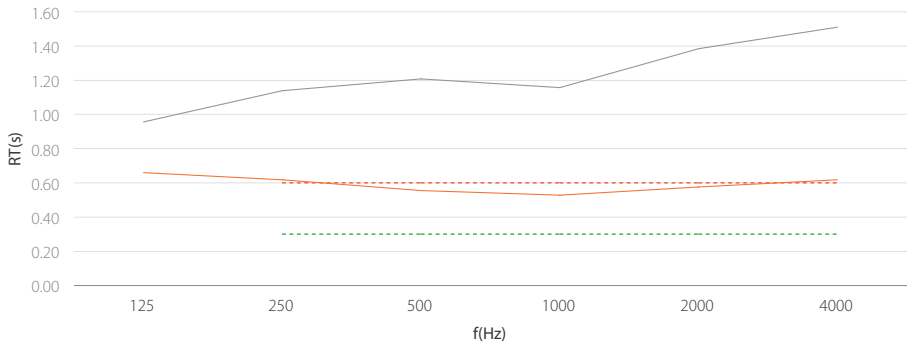
Room Data

Floor area (m²)	Volume (m³)
33	72

Proposed Solution - Min. RT Reduction

Low Freq.	Med Freq.	High Freq.
31%	54%	58%

Reverberation Time
RT Prediction Before and After Acoustic Treatment vs Recommended values



Recommended RT Upper Limit — Recommended RT Lower Limit — RT Before — RT After

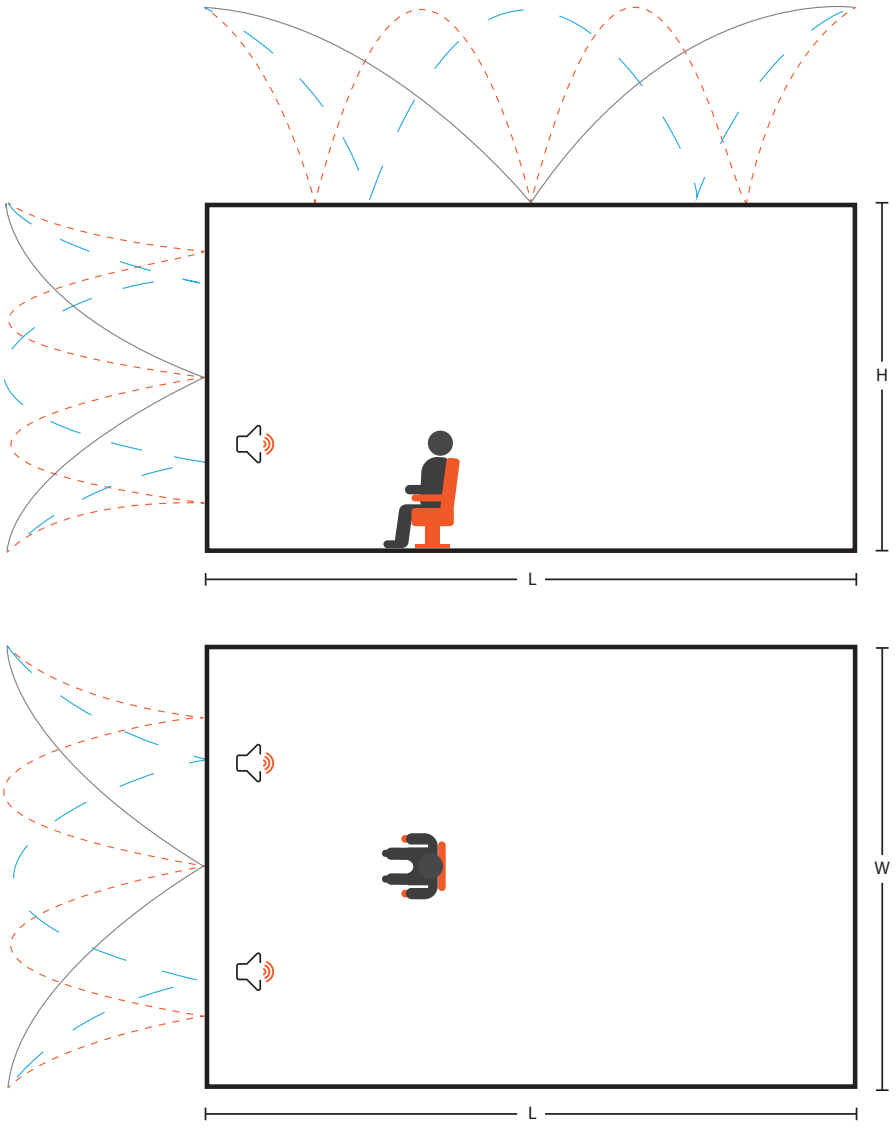
RT Prediction (s)

	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	Tm(f)*
Before	0,96	1,14	1,21	1,16	1,38	1,51	1,25
After	0,66	0,62	0,56	0,53	0,58	0,62	0,55

* Tm(f) - Averaged reverberation time over the 500 Hz, 1000 Hz and the 2000 Hz octave bands

Acoustic Study

ii) Room Modes



		L (m)	W (m)	H (m)
		7.82	**4.17**	**2.74**
———	1st Room Mode (Hz)	21.7	40.8	62
- - - - - -	2nd Room Mode (Hz)	43.5	81.5	124.1
- - - - - -	3rd Room Mode (Hz)	65.2	122.3	186.1

Picture 5 Room Modes

Recommended Products

Vicoustic Products			
Description	**Quantity**	**Reference**	**Fixation System**
Cinema Round Premium Ref. 87A (White)	24 un	B00548	*Flexi Glue Ultra*
Multifuser DC2 White	6 un	B00004	*Flexi Glue Ultra*
Super Bass Extreme Premium Ref. 82A (Beige)	8 un	B00627	*Stacker*
SBE Stacker Level White	4 un	U00022	
SBE Stacker Base White	4 un	U00017	
Flexi Glue Ultra (310ml)	4 un	U03528	

Product's Specifications

i) Cinema Round Premium

Design
15 Fabric Colors

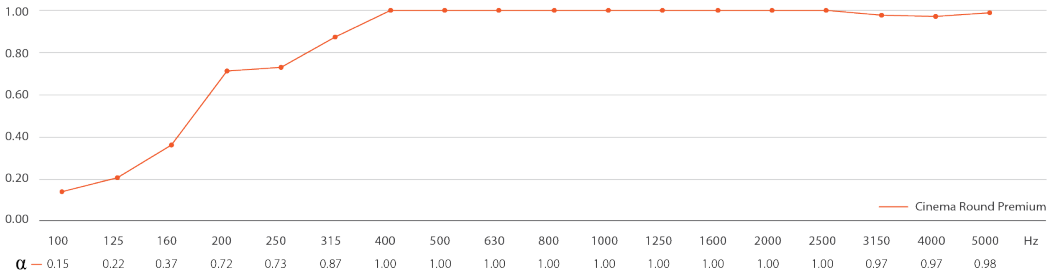
Materials
Foam (M1)
Fabric

Fixation
Flexi Glue Ultra
VicFix Frame
VicFix

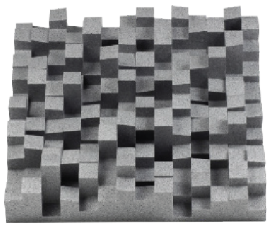
Function
Absorption

Fire Rating
Euroclass F

Dimensions
600 x 600 x 75 mm
23.6" x 23.6" x 2.9"



ii) Multifuser DC2



Design
3 EPS Colors

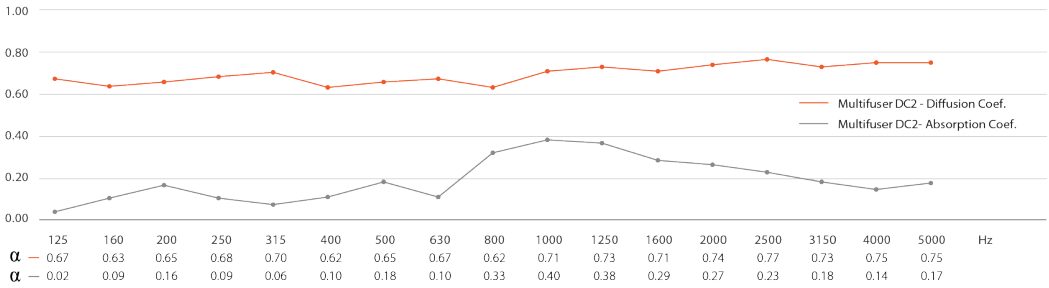
Materials
100% EPS

Fixation
Flexi Glue Ultra
VicFix Magnetic

Function
Diffusion

Fire Rating
Euroclass E

Dimensions
590 x 590 x 147 mm
23.2" x 23.2" x 5.7"



Product's Specifications

iii) Super Bass Extreme Premium

Design
15 Fabric Colors

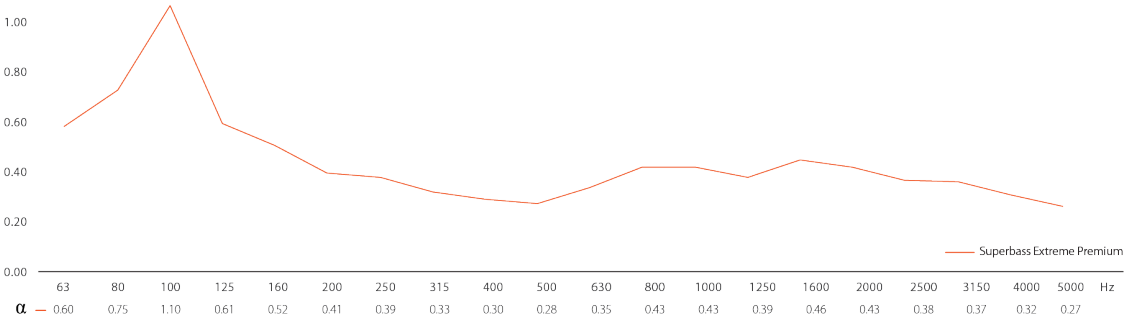
Materials
Wood (MDF)
Foam (M1)
Fabric

Fixation
For Ceilings:
SBE Ceiling Accessory

Function
Bass Trap

Fire Rating
N/A

Dimensions
595 x 595 x 155
23.4" x 23.4" x 6.29"



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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 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.

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