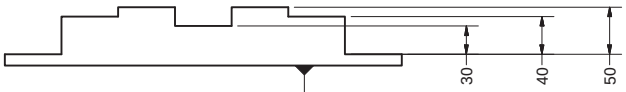
DIY ACOUSTIC DIFFUSER DESIGNS

Fabrication Drawings for Optimized Stepped Diffuser A1-LF

(The Leanfuser™)

ARQEN SONIC
A DIVISION OF WESTRIVER INDUSTRIAL INC.
2012-2013
Prepared by: Tim Perry

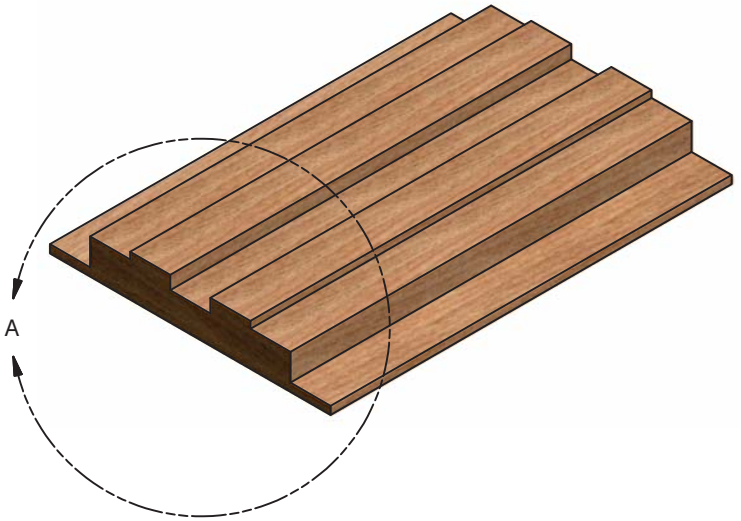
The latest version of these drawings can be downloaded for free at
http://Arqen.com/acoustics/

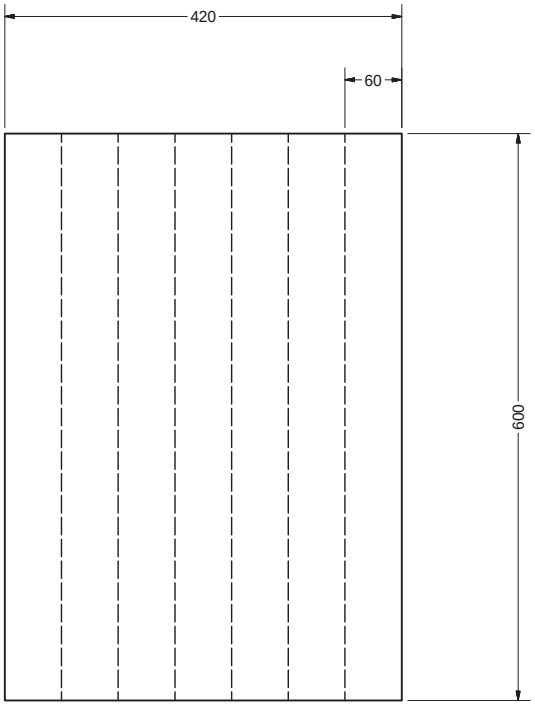


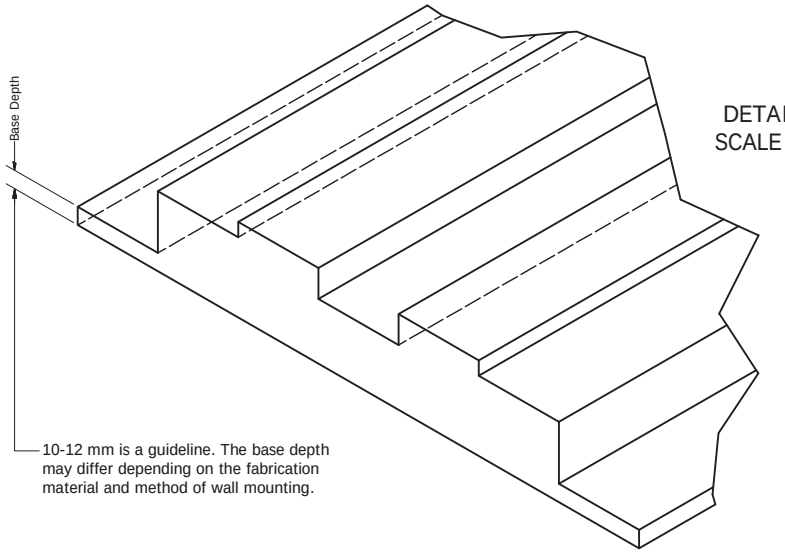
Seven 60 mm wide strips, or "steps".

Step heights measured from the top of the base are {0, 40, 50, 30, 50, 40, 0} mm.

Fabricate from acoustically reflective material such as wood or bamboo



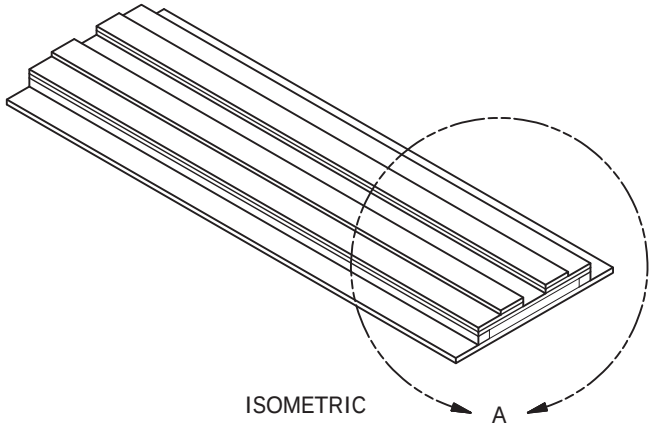




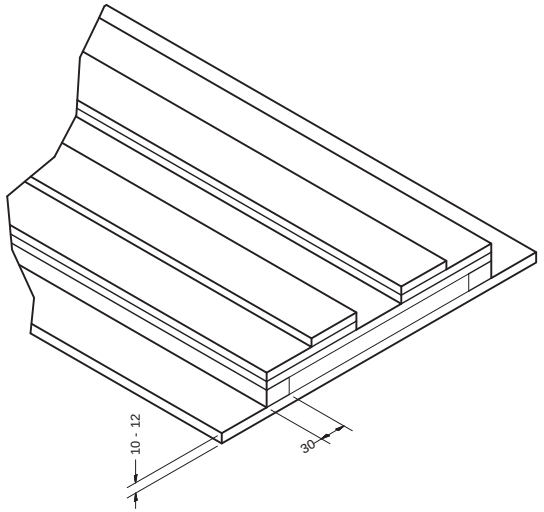
DETAIL A
SCALE 1 / 2

10-12 mm is a guideline. The base depth may differ depending on the fabrication material and method of wall mounting.

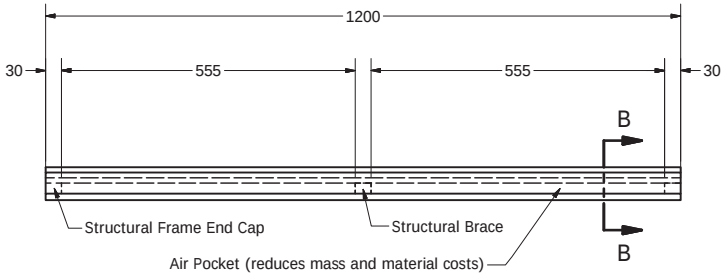
DRAWN Tim Perry	31/03/2012	Arqen		
CHECKED		TITLE Lean Optimized Acoustic Diffuser Module A1-LF		
QA				
MFG				
APPROVED				
		SIZE C	DWG NO DiffuserA1-LF-Fab	REV
		SCALE	SHEET 1 OF 1	



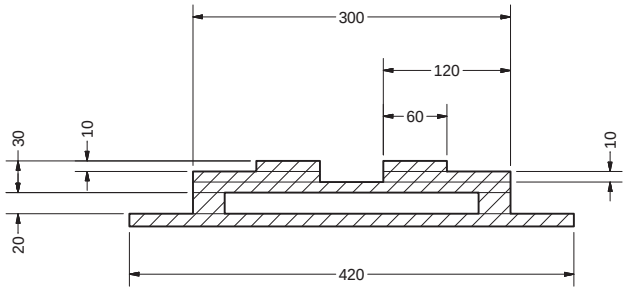
ISOMETRIC



DETAIL A
SCALE 0.28 : 1

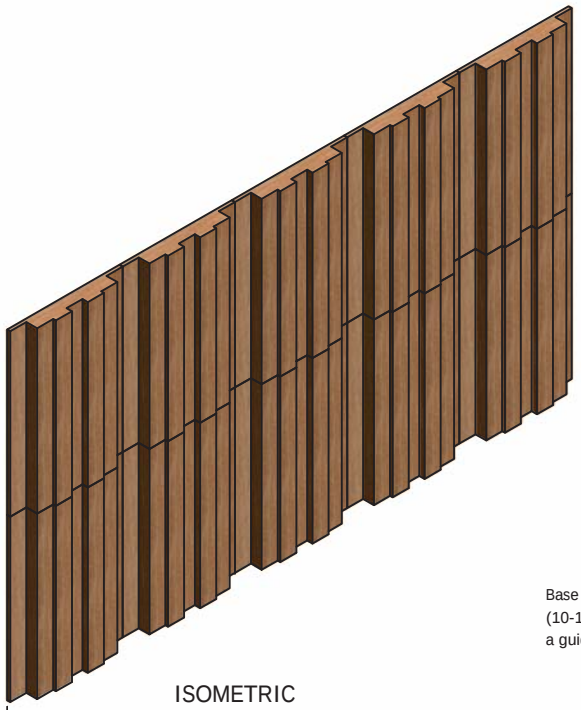


SIDE



SECTION B-B
SCALE 0.28:1

DRAWN Tim Perry	02/09/2012	Arqen			
CHECKED		TITLE Optimized Acoustic Diffuser Module A1-LF Assembly (full height module)			
QA					
MFG					
APPROVED					
		SIZE C		DWG NO DiffuserA1-LF-Fab-2-Tall	REV
		SCALE		SHEET 1 OF 1	



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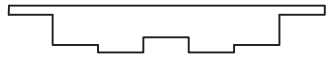
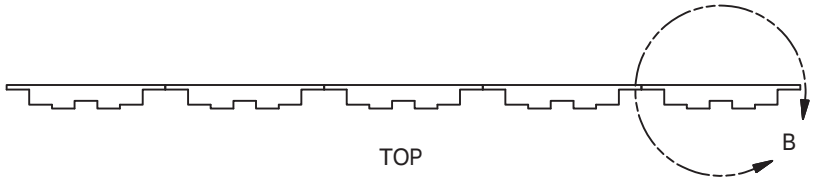
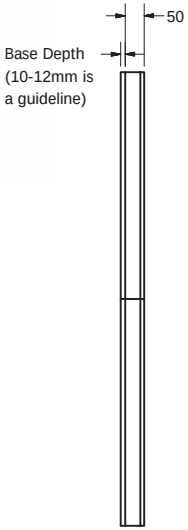


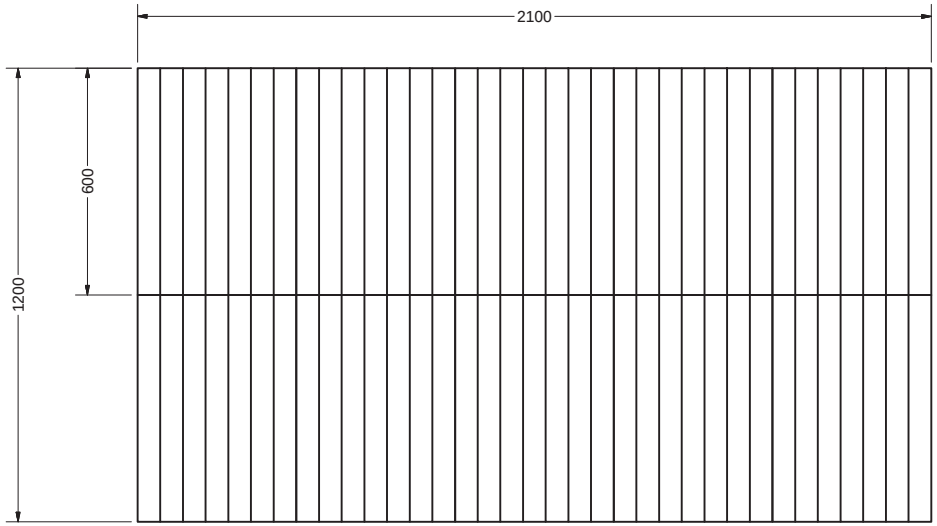
DETAIL B
SCALE 1 / 5



TOP



SIDE



FRONT

WALL-MOUNTING NOTES

Array assembly may vary depending on the height of each module*.

Modules may be heavy, depending on the construction material. Mount appropriately to support the weight of each module (Use a stud finder to choose locations for drilling into the wall).

To mount the array on a wall, attach modules to the wall one at a time. The simplest way to mount each unit is to pre-drill at the wall anchor points, then attach using wood screws.

If wall stud spacing does not allow convenient mounting, attach a mount board to the wall studs (large enough to support the entire array). Then, attach the modules to the mount board.

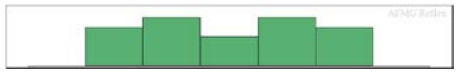
***ARRAY ASSEMBLY OPTION 1:**
Create array by assembling 5 full-height diffuser modules.
Each module is 1200 mm (4') high.

***ARRAY ASSEMBLY OPTION 2 (Shown):**
Create array by assembling 10 half-height diffuser modules.
Each module is 600 mm (2') high.

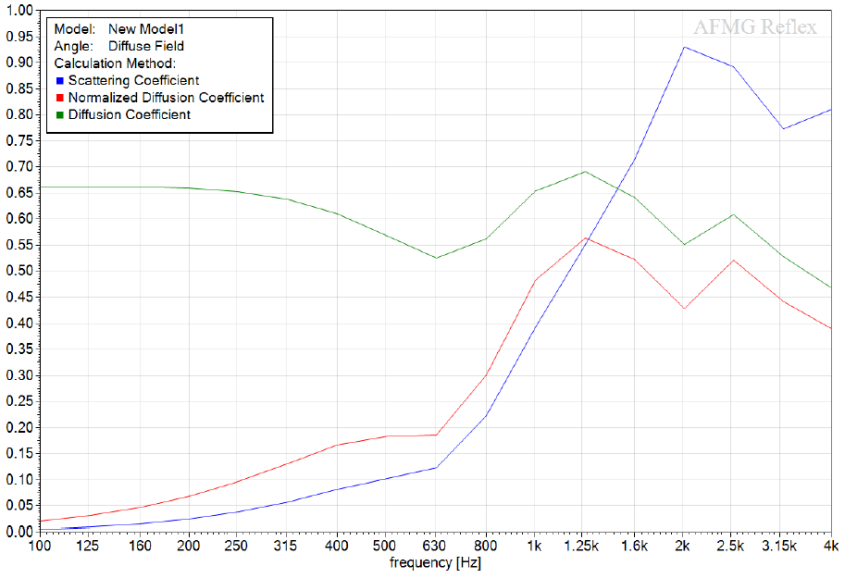
DRAWN Tim Perry	30/08/2012	Arqen		
CHECKED		TITLE Modular Stepped Diffuser A1-LF Assembly (Array of Modules)		
QA				
MFG				
APPROVED				
		SIZE C	DWG NO DiffuserA1-LF-Fab-Array	REV
		SCALE	SHEET 1 OF 1	

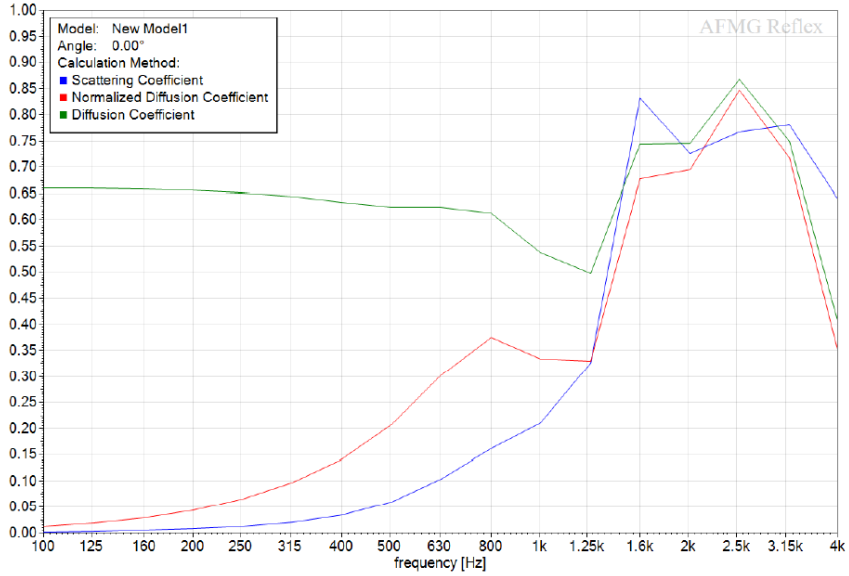
Performance Coefficients for Single Module

Depth Profile of Diffuser Module (Simulation View in AFMG Reflex)



Performance Coefficients for Diffuser Module





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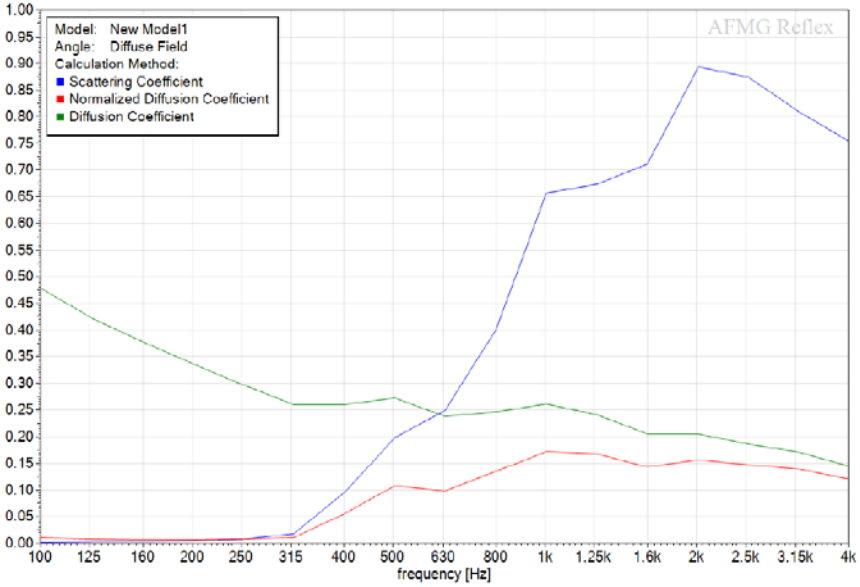
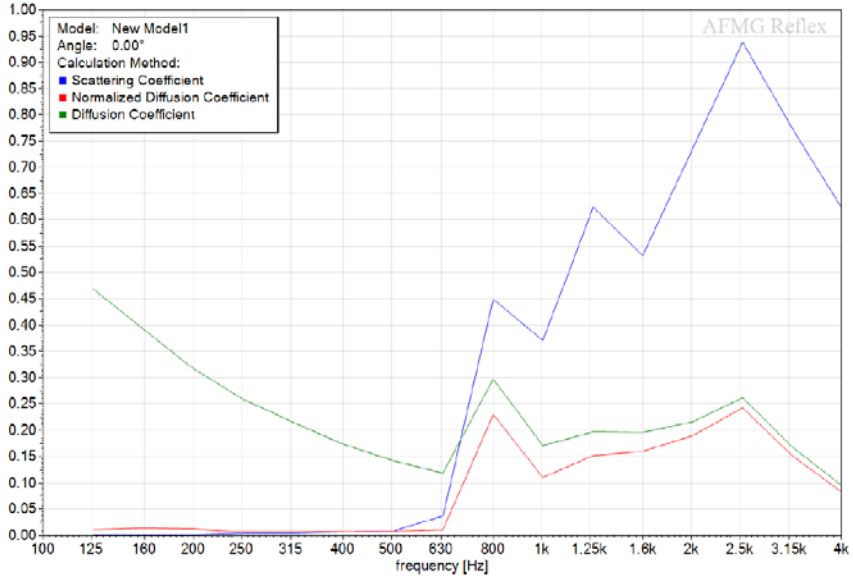
Performance Coefficients for Periodic Array of 5 Modules

Depth Profile of Diffuser Array with No Profiled Modulation 1 (Simulation View in AFMG Reflex)

Performance Coefficients for Periodic Array of 5 Modules



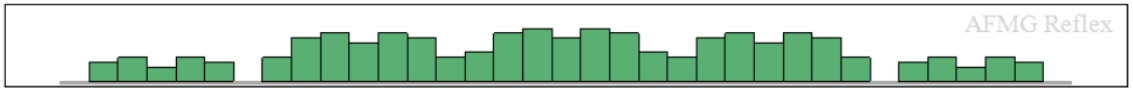


Profiled Modulation 1: Mounting Modules to Prevent Periodicity

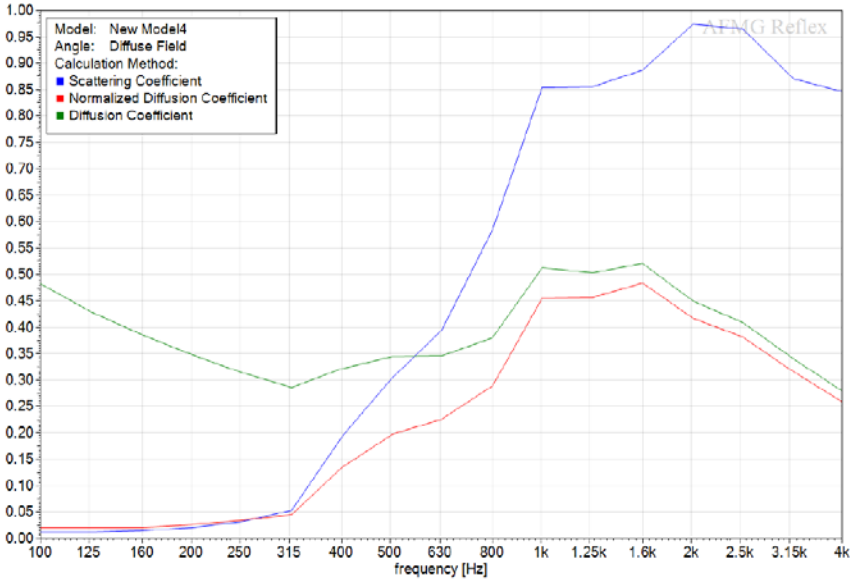
To reduce the effects of periodicity in the array, mount modules with varying depths as follows:

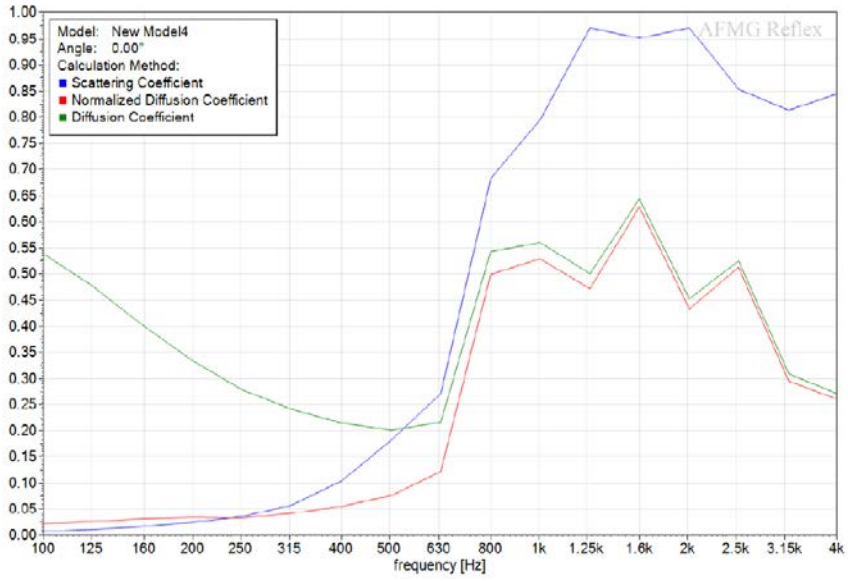
[0 cm, 5 cm, 6 cm, 5 cm, 0 cm]

Depth Profile of Diffuser Array with Profiled Modulation 1 (Simulation View in AFMG Reflex)



Performance Coefficients for Profiled Modulation 1





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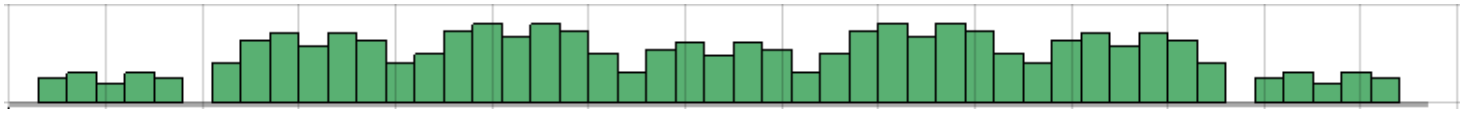
Profiled Modulation 2: Mounting 7 Modules to Prevent Periodicity (*Fractal Modulation*)

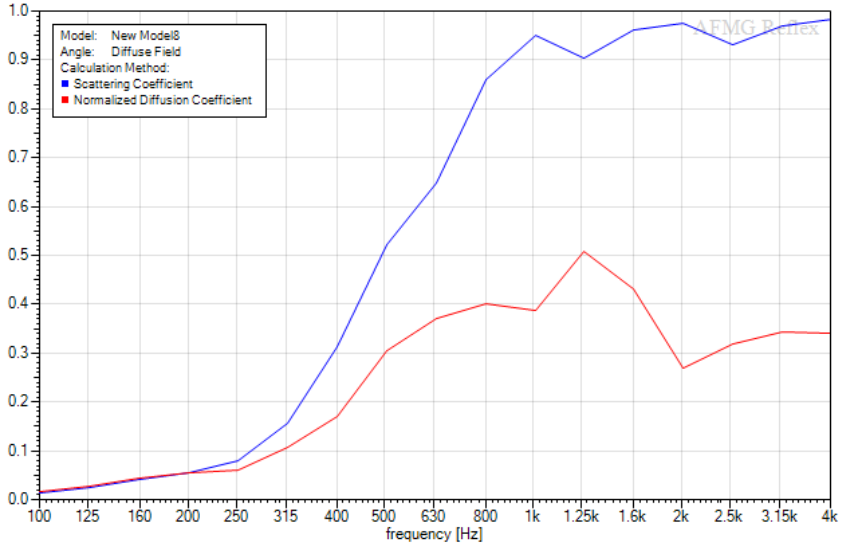
To reduce the effects of periodicity in the array, mount 7 modules with varying depths as follows:

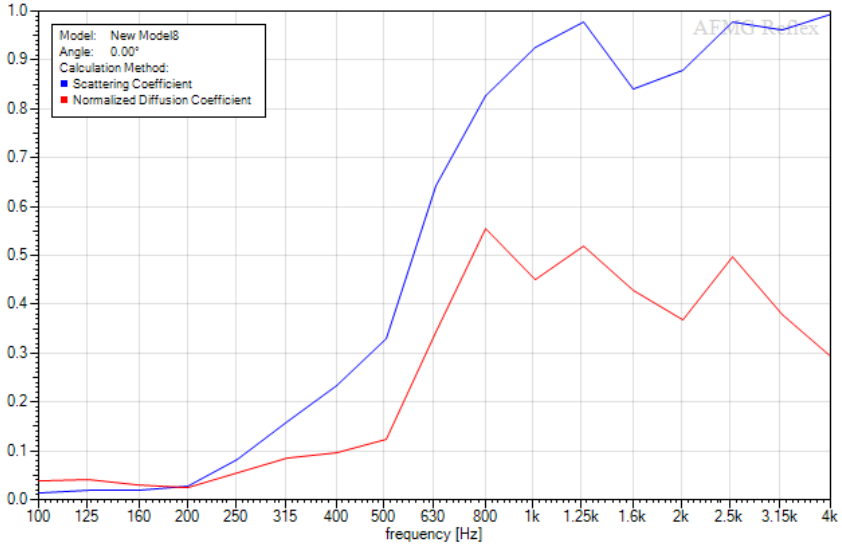
[0 cm, 8 cm, 10 cm, 6 cm, 10 cm, 8 cm, 0 cm]

Depth Profile of Diffuser Array with Profiled Modulation 2 (Simulation View in AFMG Reflex)



Performance Coefficients for Profiled Modulation 2





Visit http://Argen.com/acoustics/ for updates.

More about Fractal Modulations

Profiled Modulation 2

Profiled Modulation 2 uses seven A1-LF (Leanfuser™) modules mounted at different depths based on fractal self-symmetry. The seven mounting depths are derived from the depth sequence of the Leanfuser™. The resulting diffuser has basic fractal geometry; therefore, you can call this a *fractal modulation*. And if you applied this modulation to A1-frac (the fractal version of the A1-LF module, which is detailed in Chapter 8 of the diffuser design thesis), you'd have a 3rd order nested fractal!

The mounting sequence [0, 8, 10, 6, 10, 8, 0] cm is based on the depth sequence of the Leanfuser™ multiplied by 2:

$$2x[0, 4, 5, 3, 5, 4, 0] \text{ cm} = [0, 8, 10, 6, 10, 8, 0] \text{ cm}$$

I chose the scaling factor of 2 because it creates a shallow profiled diffuser that offers good performance with minimal depth. The scaling factor was determined experimentally by simulating various profiled modulations using AMFG Reflex.

Feel free to test the performance of your own fractal design variations by choosing a scaling factor, applying it to the Leanfuser™ depth sequence, and simulating the resulting modulation using AMFG reflex. If you find a design that performs well that you want to share, please email me (tim@arqen.com), or better yet, share it with the community in the DIY diffusers forum thread.

Deep Fractal Modulation

If you don't mind a thick diffuser, you could take the fractal self-symmetry concept more literally. For example, you could create a low frequency fractal stage with the proportions equal to the stepped diffuser proportions (I.e., keeping the same width:depth ratio). For the Leanfuser™, the width:depth ratio = 42 cm / 5 cm = 8.4. Therefore, for an array of 7 diffuser modules (294 cm wide), the deepest step of the profiled modulation would be 294 cm / 8.4 = 35 cm. Since the deepest step of the Leanfuser™ is 5 cm, you would scale all the depths by 35 cm / 5 cm = 7.

This would give you a profiled modulation of 7x[0, 4, 5, 3, 5, 4, 0] cm = [0, 28, 35, 21, 35, 28, 0] cm. The resulting diffuser would have an operational depth of 40 cm, which is a much deeper design than the one we started with!