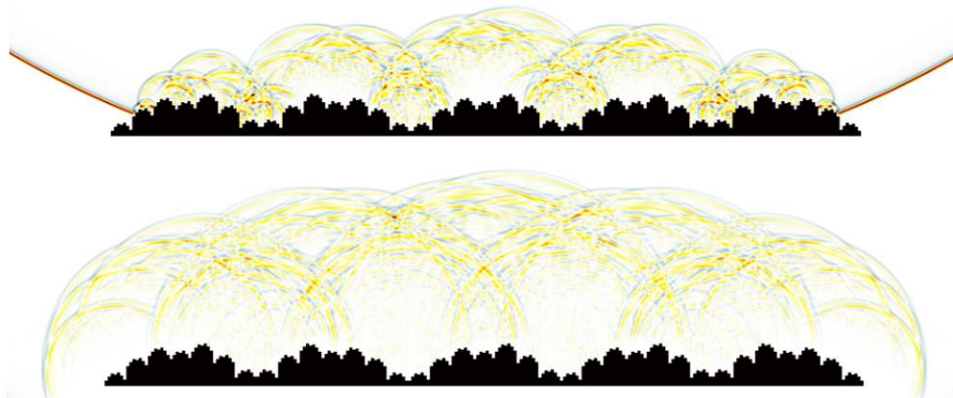




DIY Acoustic Diffuser Designs

Specifications for Fractal Diffuser B2-Frac: The Stepfractal™

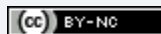


ARQEN SONIC

A DIVISION OF WESTRIVER INDUSTRIAL INC.

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Stepped Diffuser Designs in Chapters 7.3 and 8 of “The Lean Optimization of Acoustic Diffusers” by [Tim Perry](#) are licensed under a [Creative Commons Attribution-NonCommercial-ShareAlike 3.0 Unported License](#). Consult [RPG Diffusor Systems Inc.](#) for further restrictions on fractal diffusers. Background research draws from the works of [Trevor Cox, University of Salford](#); [Peter D’Antonio, RPG Diffusor Systems Inc.](#)

The latest version of these specifications can be downloaded for free at
<http://Arqen.com/sound-diffusers/>

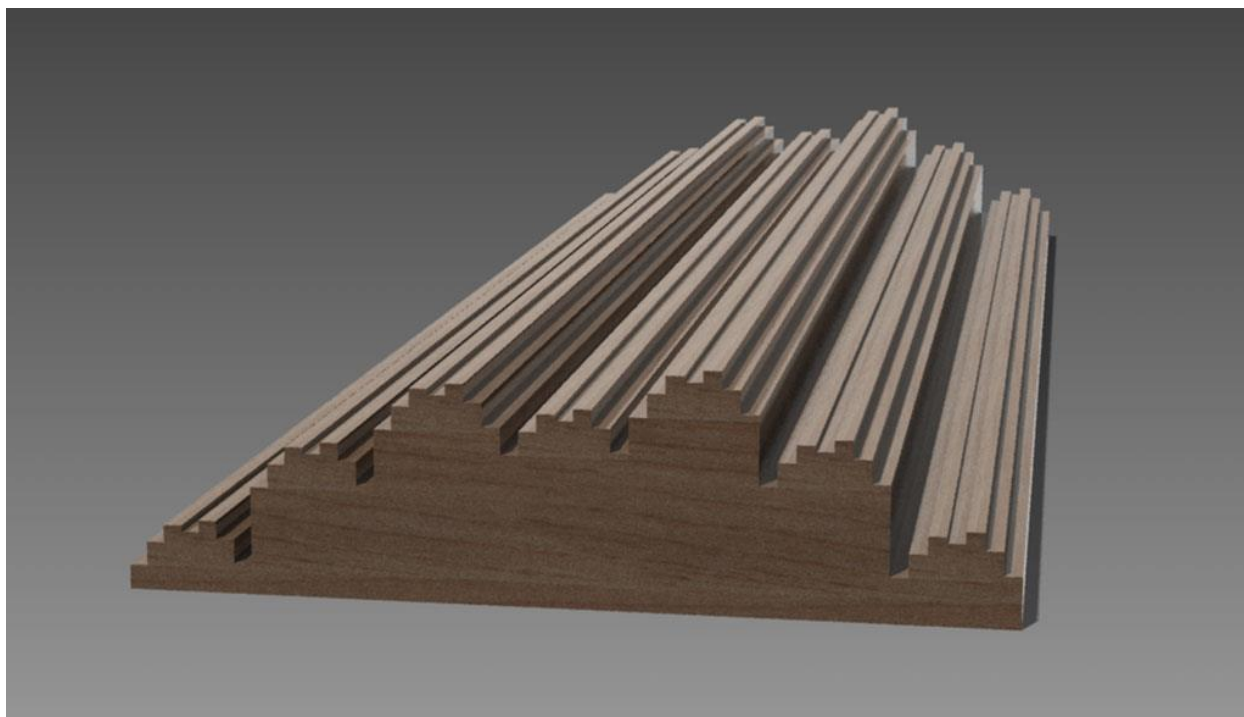


Figure 1 Single module of fractal sound diffuser B2-Frac.

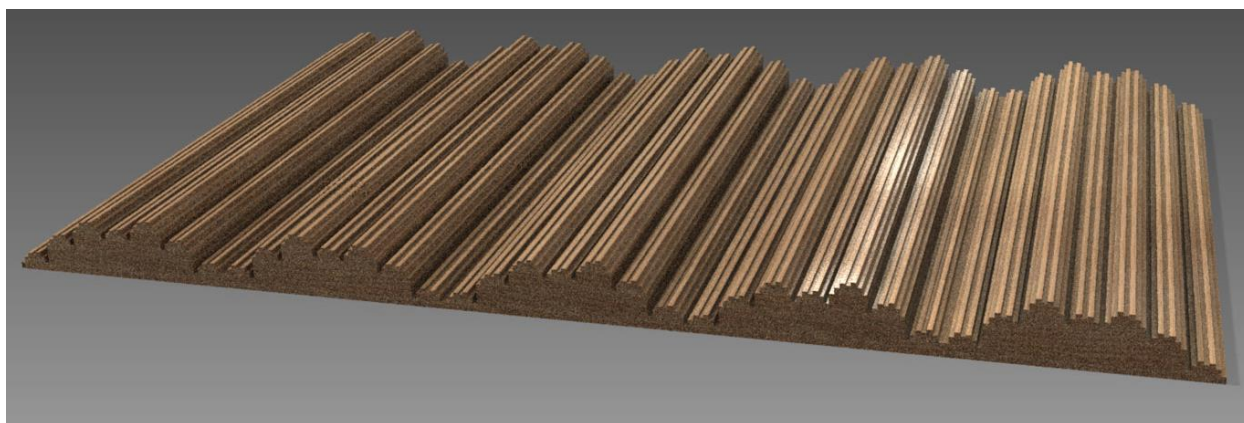


Figure 2 Fractal sound diffuser B2-Frac (array of five modules). Modules are arranged with aperiodic modulation {1 0 1 1 0}.

Geometric Specifications

B2 Fractal Module “Step Depths” or Well Depths¹ (rounded to nearest mm)

0	11	20	17	23	14	3
40	51	60	57	63	54	43
70	81	90	87	93	84	73
60	71	80	77	83	74	63
80	91	100	97	103	94	83
50	61	70	67	73	64	53
10	21	30	27	33	24	13

B2 Fractal Module Step Depths (mm)

0	11.40	19.95	17.10	22.80	14.25	2.85
40.00	51.40	59.95	57.10	62.80	54.25	42.85
70.00	81.40	89.95	87.10	92.80	84.25	72.85
60.00	71.40	79.95	77.10	82.80	74.25	62.85
80.00	91.40	99.95	97.10	102.80	94.25	82.85
50.00	61.40	69.95	67.10	72.80	64.25	52.85
10.00	21.40	29.95	27.10	32.80	24.25	12.85

Mirrored B2 Fractal Module Step Depths (mm)

12.85	24.25	32.80	27.10	29.95	21.40	10.00
52.85	64.25	72.80	67.10	69.95	61.40	50.00
82.85	94.25	102.80	97.10	99.95	91.40	80.00
62.85	74.25	82.80	77.10	79.95	71.40	60.00
72.85	84.25	92.80	87.10	89.95	81.40	70.00
42.85	54.25	62.80	57.10	59.95	51.40	40.00
2.85	14.25	22.80	17.10	19.95	11.40	0

¹ Step depths (called “Well Depths” in AFMG Reflex Software) are used to define a profiled surface called a “stepped diffuser”. The depths are the distances from the base of the diffuser to the tip of each protruding “step”.

Table 1 Framework Used for Designing Fractal Stepped Diffusers (Table 5 from the Thesis).

Type of geometry	No. wells	Well width (mm)	Round to grid step (mm)	Max. freq. (Hz)	Module width (mm)
Base Shape	7	60	10	2867	420
2 nd Stage of Fractal	7	8.57	2.85	20067	60

- **Step Width (Well Width):** The fractal diffuser B2-Frac is based on the N = 7 stepped diffuser B2-LF. The underlying stepped diffuser module consists of 7 steps, each **60 mm wide**. On each of these steps, a fractal cell is mounted. Each fractal cell consists of 7 steps, each **8.57 mm wide** (ideally).
- **Step Depth Sequence for Underlying Stepped Diffuser Module:** *[0 40 70 60 80 50 10] mm*
- **Step Depth Sequence for each Fractal Cell:** *[0 11.40 19.95 17.10 22.80 14.25 2.82] mm*
- **Module Height and Material Selection:** If a lightweight construction material is used, make five full-height modules, each **1200 mm (4')** high. Alternatively, make ten half-height modules, **600 mm (2')** high. If the construction material is heavy (e.g. fiberboard), half-height modules are recommended.
- **Base Depth:** each module should be constructed on a base, or mount board (a flat backboard used to mount the diffuser to the wall). The recommended depth of this board is **at least 10mm**.
- For optimal performance, arrange five full height modules in an array with aperiodic modulation {1 0 1 1 0}. The five numbers in the expression {1 0 1 1 0} represent an array of five diffuser modules. Each “1” represents a module placed with regular orientation (like the module in Figure 1). Each “0” is a module with mirrored orientation. See Figure 3 for a visual guide.

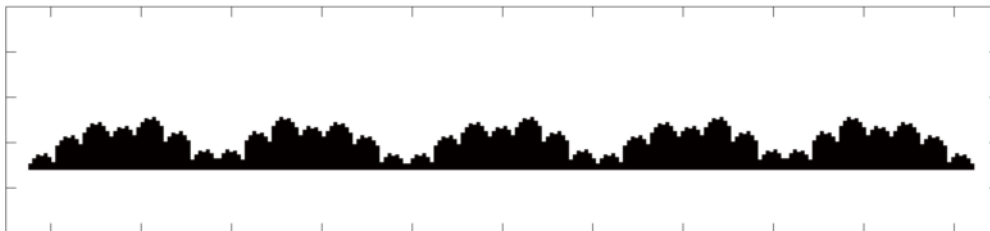


Figure 3 Fractal sound diffuser B2-Frac (array of five modules, arranged with aperiodic modulation {1 0 1 1 0}).

- Even better performance may be achieved by mounting the modules at different depths (so that certain modules stick out from the wall further than others). For example, you can mount five modules with varying depths as follows: *[0 50 60 50 0] mm*.
- You can test the performance of various mounting schemes using AFMG Reflex software, available at <http://reflex.afmg.eu/>.

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

Wall Mounting and Array Assembly



Figure 4 Fractal sound diffuser B2-Frac mounted on a wall (array of five modules).

- 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, and 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.

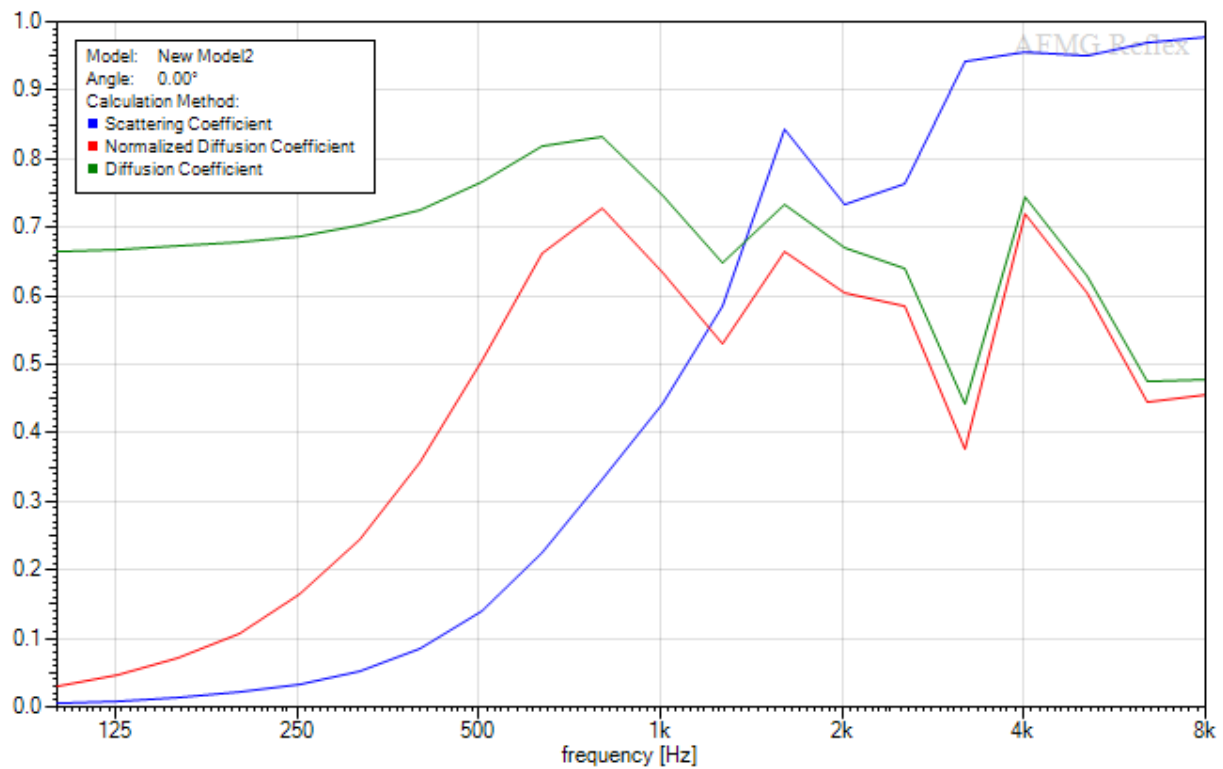
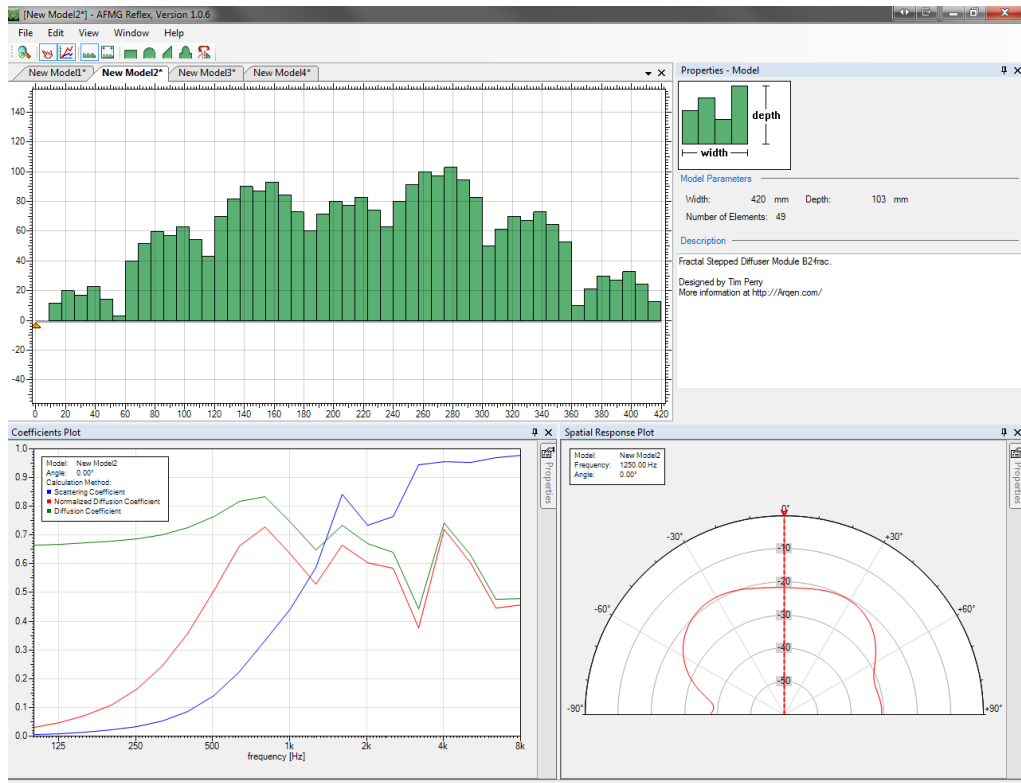
ARRAY ASSEMBLY OPTION 1:

Create array by assembling 5 full-height diffuser modules.
Each module is 1200 mm (4') high.

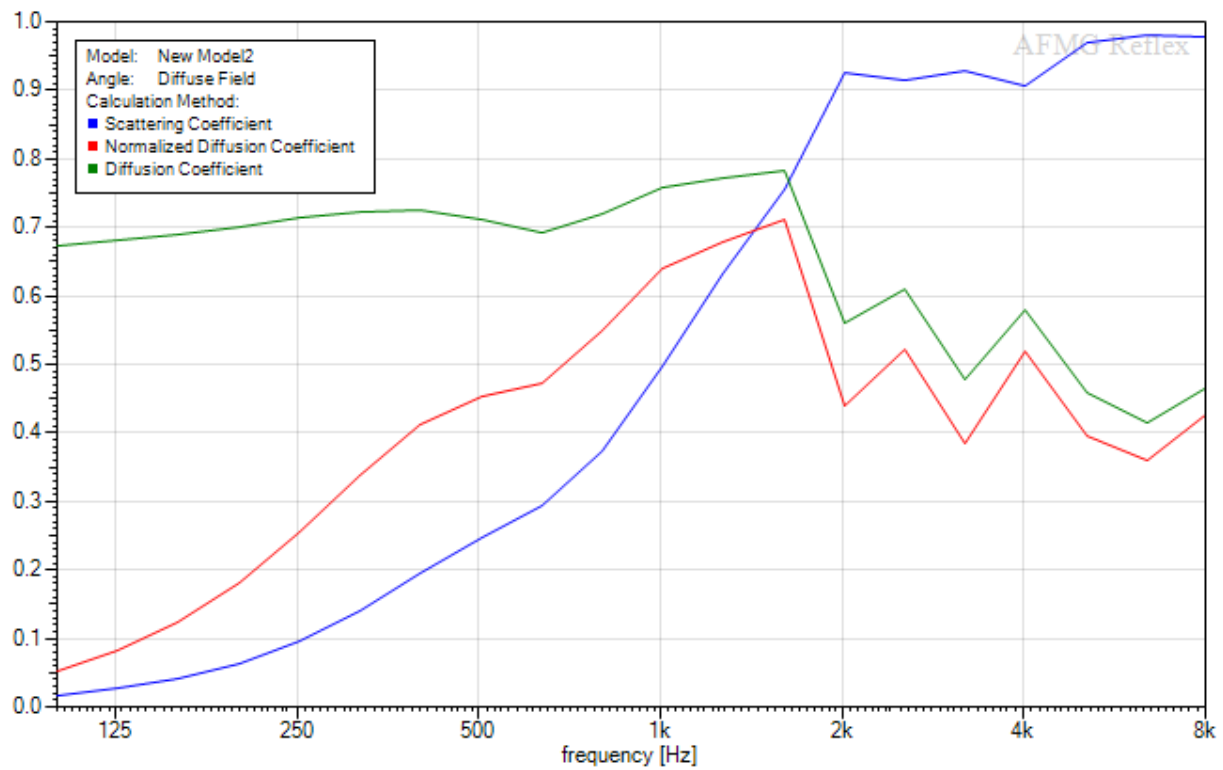
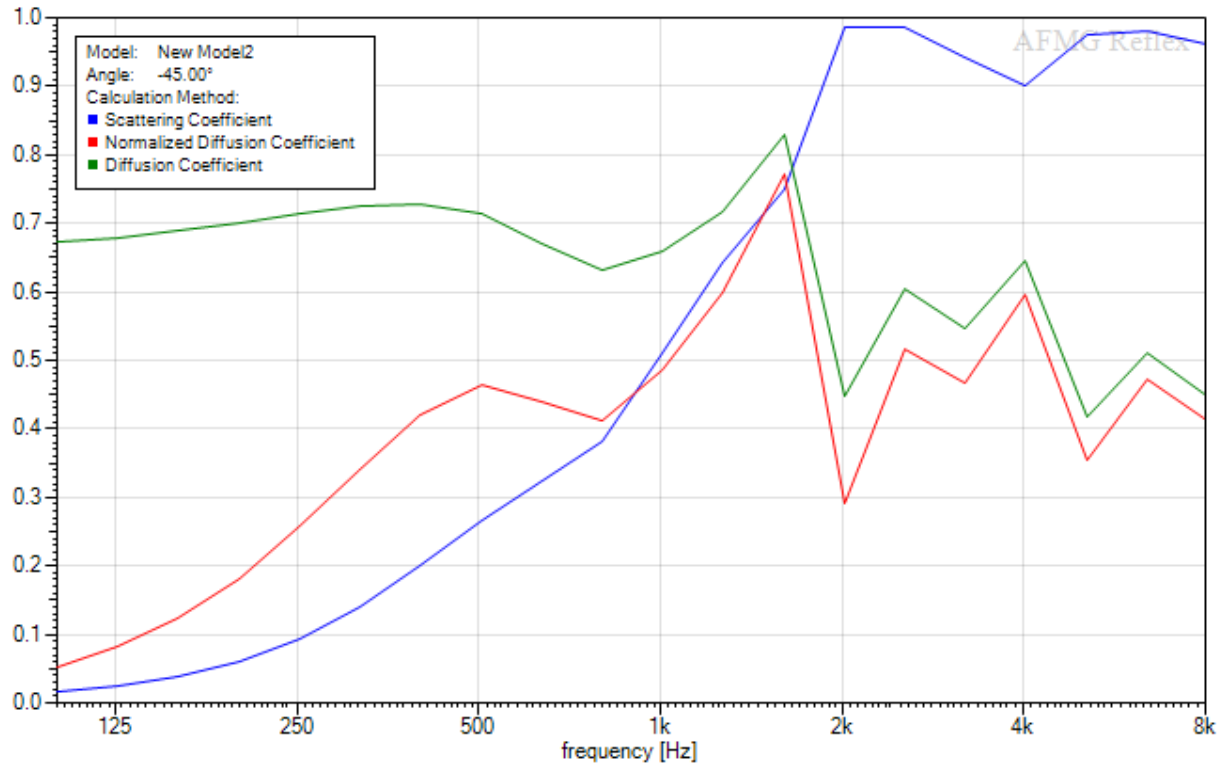
ARRAY ASSEMBLY OPTION 2:

Create array by assembling 10 half-height diffuser modules.
Each module is 600 mm (2') high.

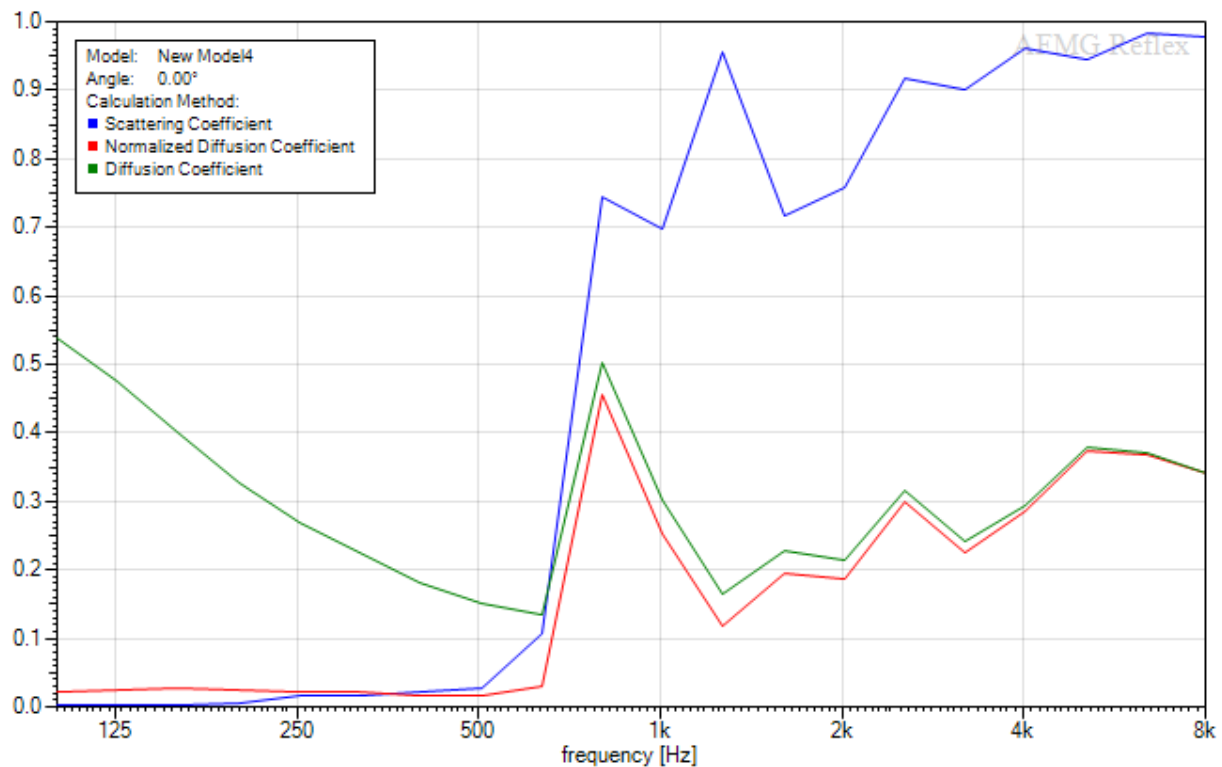
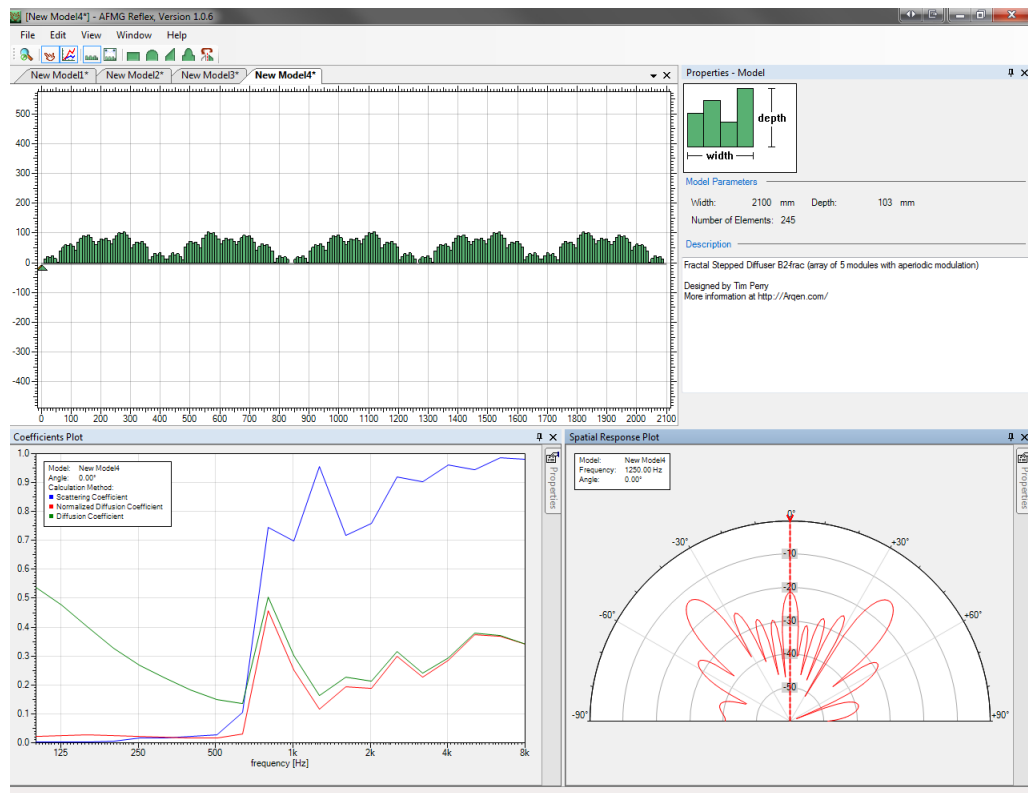
Performance Coefficients for Single Module



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



Performance Coefficients for Aperiodic Array of 5 Modules



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

