

Waveform

Bicubic™

2D Diffusion



Overhead canopy arrays are used in auditoriums and worship spaces to blend the direct and early reflected sound, increasing speech intelligibility and enhancing musical clarity and intimacy. Traditionally, non-optimized, periodic flat panels and arcs have been used. These arrays can give rise to non-uniform coverage, due to array gaps, non-optimal shaping, and periodicity effects. RPG has developed an optimization algorithm called the Shape Optimizer, to provide optimal shaping and tilting, offering omnidirectional scattering. RPG's patent pending aperiodic modulation of a single asymmetric base shape minimizes periodicity arraying effects and provides uniform coverage. Aperiodic modulation of a single asymmetric base shape allows infinite tiling. Unlimited shapes are possible with different tiling patterns. Waveform Bicubic represents the next generation in acoustical canopy design. No other system provides the aesthetic and performance possibilities. Several depths are available in Class A Glass Reinforced Gypsum.

*Optimized Compound Curvature GRG Canopies
From The Acoustical Industry's Leading Innovator*



The Sound of Innovation™

Problem and Solution

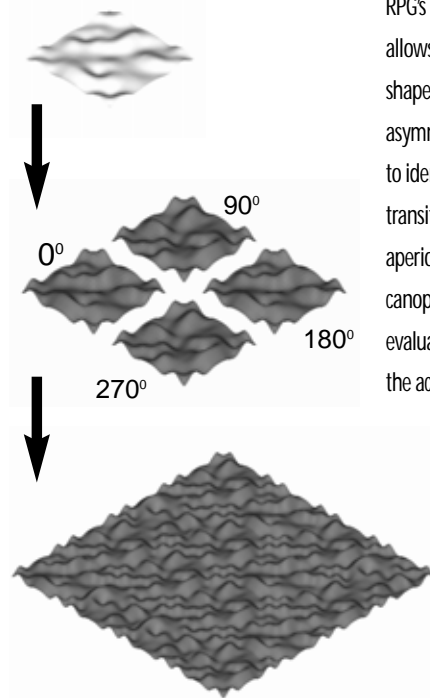
Problem

When multiple spaced canopy panels are used in an array, the scattering response or coverage is the combination of the response of a single panel and the periodic arrangement. Periodicity results in scattering in preferred directions, which depend on the array configuration. The sound level in these preferred diffraction directions depends on the uniform scattering capability of each individual panel. As a result, coverage is often compromised unless optimization is utilized.

Solution

To solve this problem, RPG developed the first Shape Optimization program, which automatically determines the best shape, tilt, and arraying to insure uniform coverage. The Shape Optimizer combines the power of the boundary element and multi-dimensional optimization techniques, incorporating the diffusion coefficient as the metric of optimal performance. Therefore, optimal shape provides uniform coverage. Periodicity effects are minimized by modulating the asymmetric base shape, thus allowing the canopy array to perform as one of the individual optimized canopy elements. The Waveform Biscubic offers a level of performance and aesthetics formerly not available in commercial canopies.

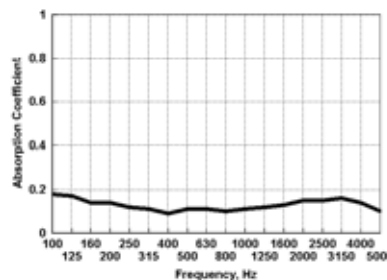
Performance Specifications



Aperiodic Modulation of an Asymmetric Base Shape

Aperiodic Modulation of a Single Asymmetric Base Shape

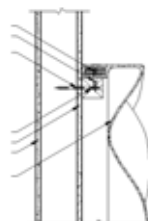
RPG's patented Aperiodic Modulation of a Single Asymmetric Base Shape allows the creation of wide area coverage with a single asymmetric base shape (top), thus minimizing periodicity effects. This is possible, because the asymmetric central shape, determined by the architect or acoustician, morphs to identical sides, which have a zero gradient, allowing adjacent tiles to transition without discontinuity in any orientation (middle) forming a larger aperiodic array (bottom 4x4 array). Thus, with an optimized aperiodic array, canopy performance can finally be mathematically determined and evaluated. The performance of the aperiodic array is similar to that of one of the acoustically optimized canopy elements.



Absorption Coefficient

Installation

The Waveform Biscubic can be used as an overhead canopy and also in a wall mounting, using a wood cleat as shown. Overhead mounting is accomplished by bolting adjacent modules (shown in sidebar) together and suspending from integral hairpin hanging loops (photo) with supplied engineered cables. Wall mounting is accomplished by attaching through the sides into cleats mounted to the substrate.



FEATURES

- Optimized shape
- Optimized arraying and positioning
- Single asymmetric base shape
- Asymmetric shape capable of unlimited, wide area, aperiodic, modulation patterns
- Seamless tiling for wide area coverage
- Integrated mounting hardware
- Glass Reinforced Gypsum (GRG) fabrication
- Non-diaphragmatic
- Penetrations can be provided
- Field or factory finished

BENEFITS

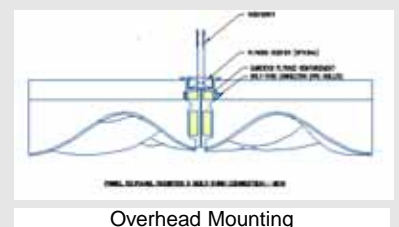
- Optimized shape ensures uniform coverage
- RPG provides optimal arraying and tilting to ensure uniform coverage and eliminate guess work in the field
- RPG's patent pending aperiodic modulation of a single asymmetric base shape allows modulation to minimize periodicity effects
- Adjacent panels tile in either direction for wide area coverage simulating a single canopy element
- GRG is non-combustible and hence can be used in all applications requiring a Class A rated material
- Non-diaphragmatic rigid construction does not absorb low frequency sound, maintaining low frequency reverberance
- Speaker, lighting and sprinkler openings can be specified
- Installation is quick and easy, using integral metal hairpin hanging loops and supplied cables.

APPLICATIONS

Auditoriums, Rehearsal rooms, Performance and Worship Spaces, Studios and Control Rooms.

SPECIFICATIONS

- Panels 4' x 4' x 8" deep
- 8" panels weigh on average 135 lbs.
- Thickness: 1/4" GRG
- Finish: Unfinished or factory finish available



Overhead Mounting