Application Guide

Venue™ and Sound Power™ Multiple Loudspeaker System Array Configurations

Synopsis:
This applications guide is compiled to assist optimally arraying selected JBL Sound Power™ and Venue™ Series loudspeaker systems for increased horizontal and/or vertical coverage, while reliably maintaining qualities of wide frequency range, high output and low distortion for which these products have become known.

Introduction

JBL Sound Power and Venue Series loudspeakers use the finest transducers available in professional loudspeaker systems to deliver high performance and exceptional sound quality for fixed, permanent installations.

Each recommended array is illustrated as a line drawing, with appropriate cabinet-to-cabinet allowance for suspension hardware and rigging attachments. Typical applications for each array are listed, along with specifications. Performance specifications for the arrays include frequency range, nominal horizontal and vertical coverage, power capacity, maximum SPL capability, dimensions and weight. Subwoofer options are shown, where appropriate.

Choosing an appropriate loudspeaker array begins by selecting the array that meets the desired SPL and coverage requirements for the application or project. The physical requirements of the array should then be evaluated, and a final determination made on the basis of these and budgetary considerations.

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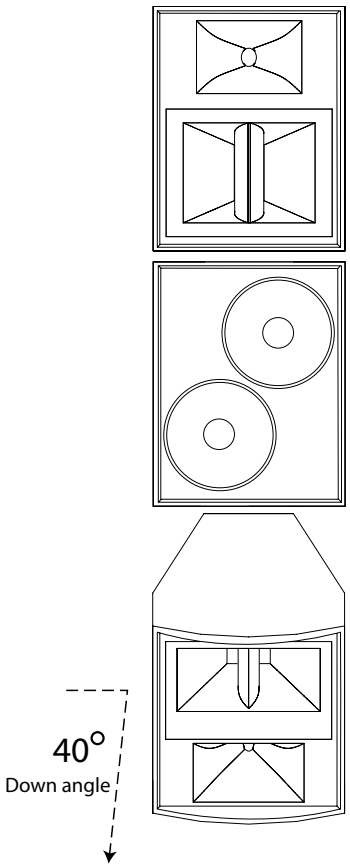


Wide Vertical, High SPL Array

One VS2210-6 For Long Throw
One VS2210-9 For Short Throw
One CVS124 Low Frequency

System Description:

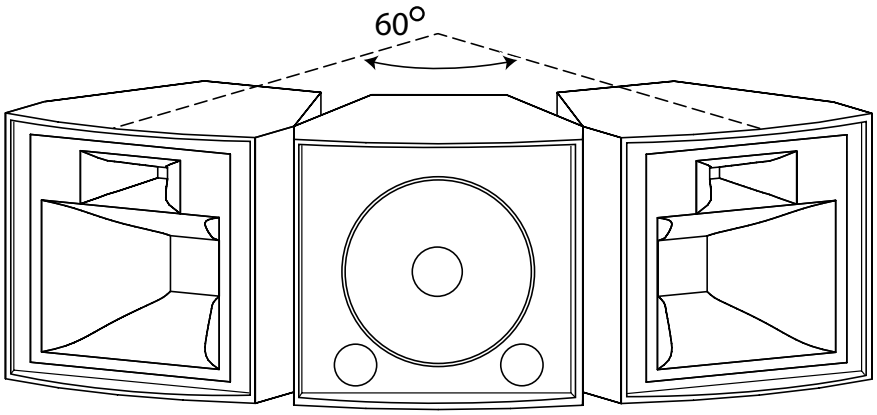
- Excellent for use in exploded L/C/R clusters in fan shape audience areas
- Also for voice address in small to medium size indoor sporting venues
- Delay applied to the lower box (in relation to top box) is suggested for optimal performance
- Two DSP channels required – (1) Tri-amp, (1) Bi-amp

Select Specifications:

Coverage[1] (H x V):	Near Coverage: 90° x 50° Far Coverage: 60° x 50°
Maximum SPL[2]:	130 dB
Frequency Range:	60 Hz to 16 kHz
Power Capacity[3]:	LF: 1,200 W MF: 2 x 250 W HF: 2 x 75 W
Dimensions (HWD):	273 x 102 x 2590 mm (102 x 23 x 41 in)
Weight:	123.9 kg (273 lbs)

Wide Horizontal, Moderate SPL Array

Two VS2110 Mid/High
VS115SC Low Frequency



System Description:

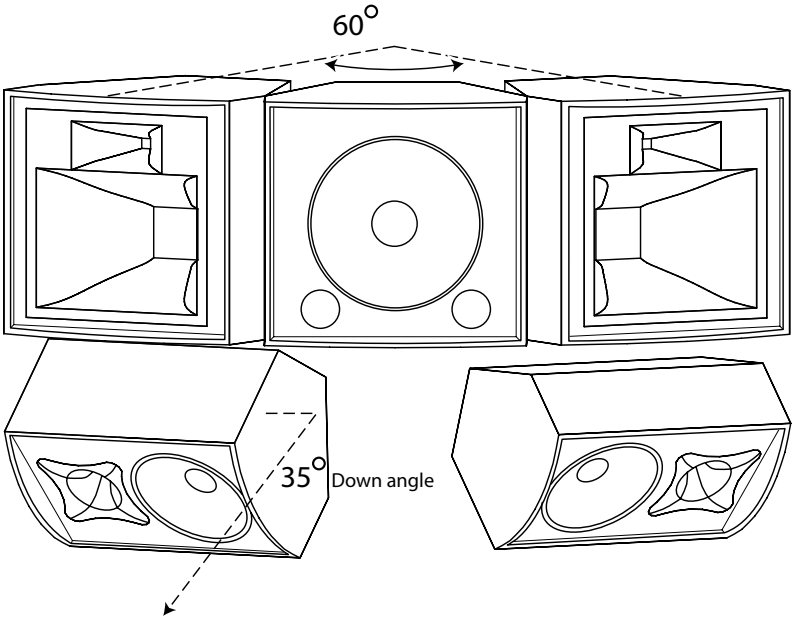
- Ideal as center voice/music module in small to medium auditoriums and Houses of Worship
- Can be used with the 3115 speakers in passive mode for additional system cost reduction, utilizing only one bi-amp DSP channel
- One Tri-amp DSP channel required if run three-way

Select Specifications:

Coverage[1] (H x V):	120° x 80°
Maximum SPL[2]:	125 dB
Frequency Range:	65 Hz to 16 kHz
Power Capacity[3]:	LF: 600 W MF: 2 x 150 W HF: 2 x 50 W
Dimensions (HWD):	535 x 1716 x 733 mm (21 x 68 x 29 in)
Weight:	87 kg (192 lbs)

Wide Horizontal, Wide Vertical, Moderate SPL Array

Two VS2110 Mid/High
Two MS112 Full Range Downfill
One CVS115SC Low Frequency



System Description:

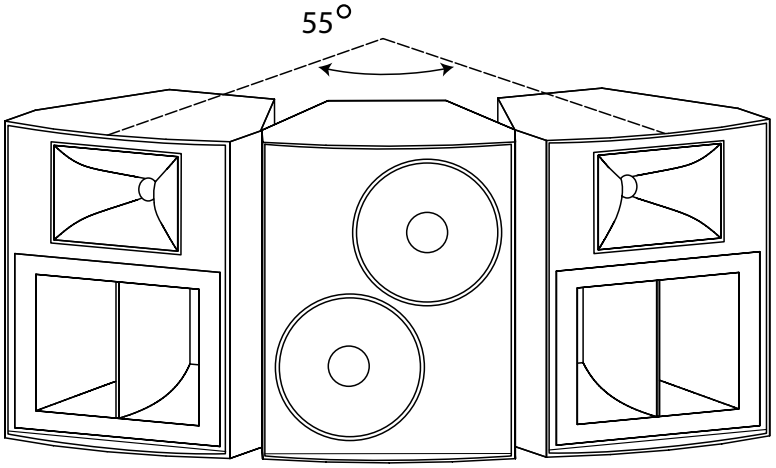
- Ideal as a center voice/music module in small to medium size auditoriums and Houses of Worship where additional vertical coverage is required
- Delay applied to the down-fill boxes (in relation to top box) is suggested for optimal performance
- Three minimum DSP channels required – One each for Full-range, LF, HF/MF

Select Specifications:

Coverage[1] (H x V):	120° x 110°
Frequency Range:	65 Hz to 16 kHz
Maximum SPL[2]:	123 dB
Power Capacity[3]:	LF: 600 W; MF: 2 x 150 W
	HF: 2 x 50 W;
	Near Coverage: 2 x 300 W
Dimensions (HWD):	1019 x 1714 x 760 mm
	(40 x 68 x 30 in)
Weight:	132.4 kg (292 lbs)

Wide Horizontal, High SPL Array

Two VS2210-6 Mid/High
One CVS124 Low Frequency



System Description:

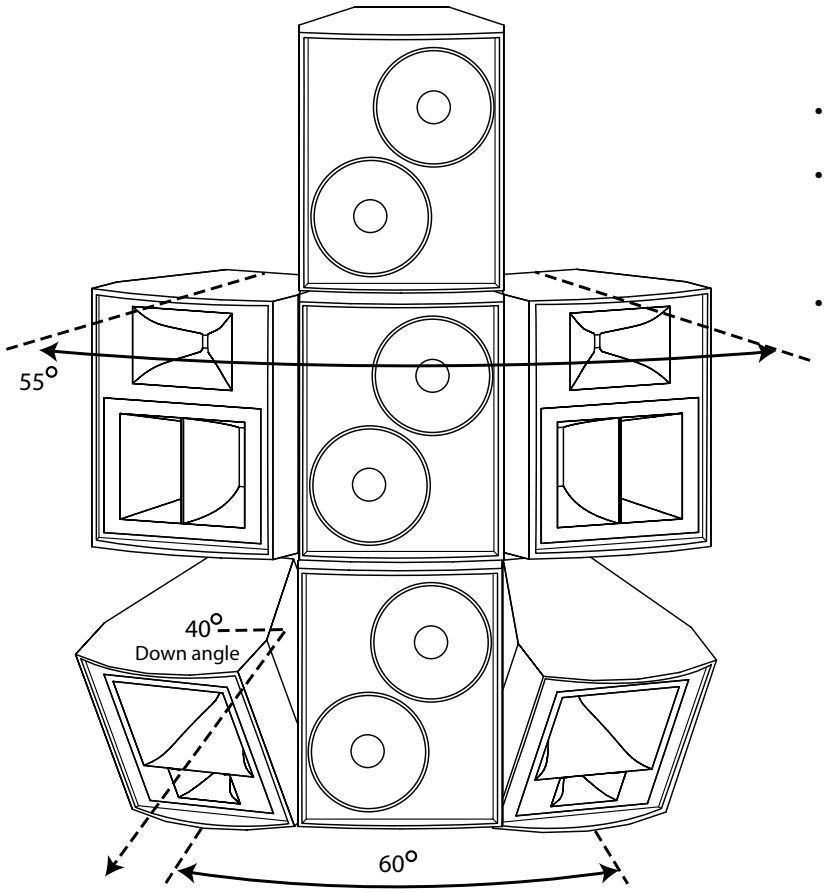
- Excellent as center voice/music module in medium size auditoriums and Houses of Worship
- Also for a left/right module in fan-shaped rooms
- One Tri-amp DSP channel required

Select Specifications:

Coverage[1] (H x V):	120° x 60°
Maximum SPL[2]:	130 dB
Frequency Range:	65 Hz to 16 kHz
Power Capacity[3]:	LF: 1,200 W; MF: 2 x 250 W
	HF: 2 x 75 W
Dimensions (HWD):	730 x 1730 x 724 mm
	(29 x 69 x 29 in)
Weight:	123.9 kg (273 lbs)

Wide Horizontal, Wide Vertical, High SPL, Extended LF Array

Two VS2110-6 Mid/High
Two VS2110 Mid/High Downfill
Three CVS124 Low Frequency



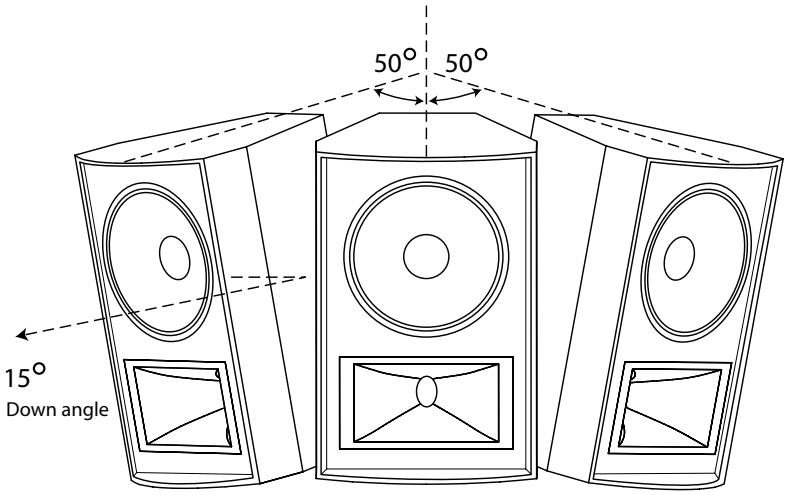
System Description:

- Ideal as center voice/music module in medium to large size auditoriums and Houses of Worship where additional vertical coverage is required
- For higher trim heights switch down-fill boxes to VS2210-6/9 for greater output
- Two DSP channels required – One Tri-Amp, One Bi-Amp for down fills. Additional DSP outputs required if LF Steering of CVS 124s is desired
- Below-cluster control to 100 Hz. Additional pattern control can be achieved through beam steering techniques utilizing additional DSP and amplifier channels

Select Specifications:

Coverage[1] (H x V):	120° x 100°
Maximum SPL[2]:	127 dB
Frequency Range:	30 Hz to 16 kHz
Power Capacity[3]:	LF: 3 x 1,200 W
	Near Coverage MF: 2 x 150 W
	Near Coverage HF: 2 x 50 W
	Far Coverage MF: 2 x 250 W
	Far Coverage HF: 2 x 75 W
Dimensions (HWD):	2300 x 1790 x 962 mm
	(91 x 71 x 38 in)
Weight:	264.5 kg (583 lbs)

Very Wide Horizontal, Moderate SPL Array
Three SP212-6 Full Range



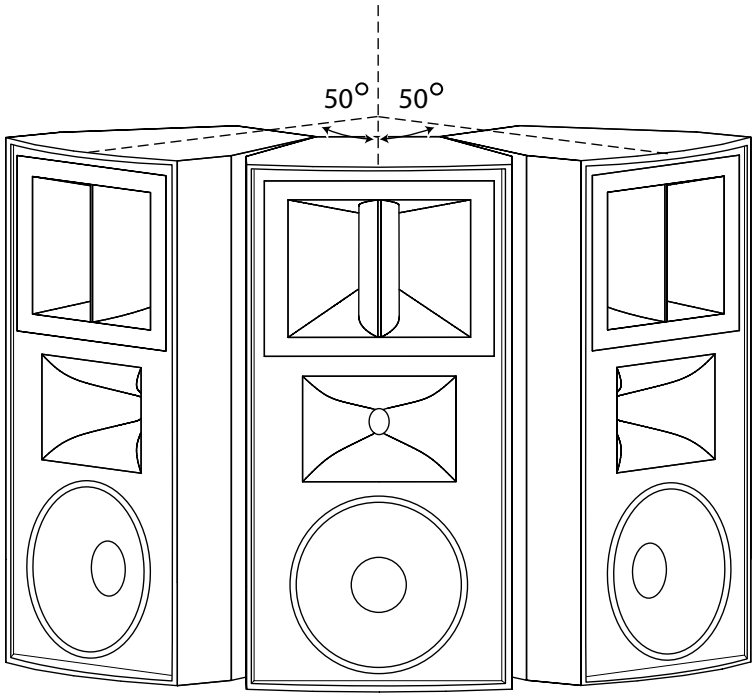
System Description:

- Great for school auditoriums and multi-purpose rooms
- Delay applied to the outer boxes (in relation to the center box) is suggested for optimal performance
- Four DSP channels required: outside low; outside high; inside low; inside high

Select Specifications:

Coverage[1] (H x V):	160° x 50°
Maximum SPL[2]:	130 dB
Frequency Range:	70 Hz to 16 kHz
Power Capacity[3]:	LF: 3 x 600 W
	HF: 3 x 75 W
Dimensions (HWD):	677 x 1241 x 667 mm
	(27 x 49 x 27 in)
Weight:	95.4 kg (210 lbs)

Very Wide Horizontal, High SPL Array
Three VS3215-6 Full Range



System Description:

- Excellent system for a center voice/music module in medium to large size auditoriums and Houses of Worship
- Delay applied to the outer boxes (in relation to the center box) is suggested for optimal performance
- Six DSP channels required

Select Specifications:

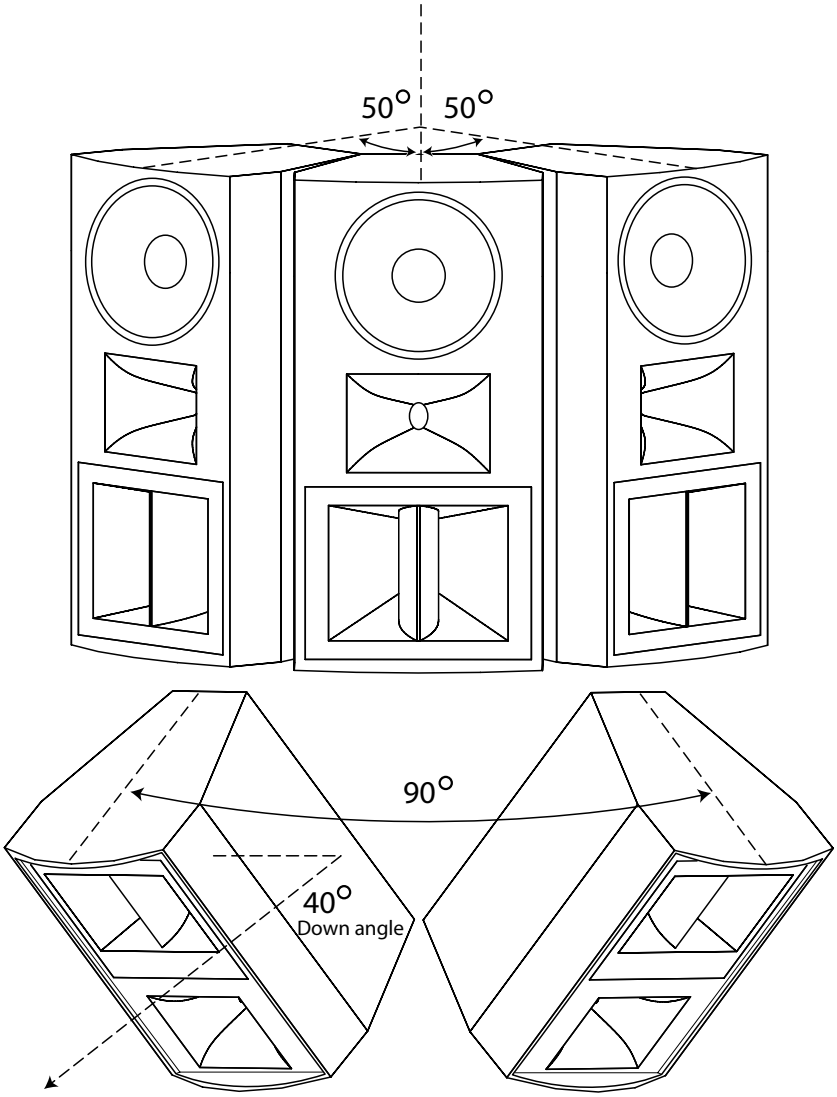
Coverage[1] (H x V):	160°x 60°
Maximum SPL[2]:	132 dB
Frequency Range:	60 Hz to 16 kHz
Power Capacity[3]:	LF: 3 x 600 W
	MF: 3 x 250 W
	HF: 3 x 75 W
Dimensions (HWD):	1140 x 1604 x 776 mm
	(45 x 64 x 31 in)
Weight:	223.2 kg (492 lbs)

Very Wide Horizontal, Wide Vertical, High SPL Array

Three VS3215-6 Full Range
Two VS2210-9 Mid/High Downfill

System Description:

- Ideal as a center voice/music module in medium to large size auditoriums and Houses of Worship where additional vertical coverage is required
- Delay applied to the outer top boxes and to the down-fill boxes (in relation to top center box) is suggested for optimal performance
- Eight DSP channels required – Six for Tri-amp, Two for Bi-amp



Select Specifications:

Coverage[1] (H x V):	160° x 110°
Maximum SPL[2]:	132 dB
Frequency Range:	60 Hz to 16 kHz
Power Capacity[3]:	LF: 3 x 600 W
	Near Coverage MF: 2 x 250 W
	Near Coverage HF: 2 x 75 W
	Far Coverage MF: 3 x 250 W
	Far Coverage HF: 3 x 75 W
Dimensions (HWD):	2190 x 1892 x 1162 mm
	(87 x 75 x 46 in)
Weight:	305.8 kg (674 lbs)

Application Tips

ACHIEVING LOW FREQUENCY PATTERN CONTROL

- **LF Array Orientation** – When using multiple low frequency cabinets, it is usually preferable to place multiple low frequency cabinets vertically in relation to each other rather than horizontally. Horizontal LF arrays tend to result in wide vertical and narrow horizontal projection, whereas vertical LF arrays tend to result in wide horizontal and narrow vertical coverage, which is usually more appropriate for evenly covering the seating plane in most rooms.

- **Boundary Spacing** – When using a single low frequency cabinet, or a compact cluster of cabinets, low frequency energy projection downward can be reduced by installing the low frequency system a specified distance from the ceiling. Choose the frequency band you want to minimize and install the low frequency cabinet 1/4 of the center frequency's wavelength from the ceiling. Since low frequencies project omnidirectionally — regardless what direction the LF cabinet faces — there will be radiation upward. That upward radiation reflects off the ceiling, reaching the LF cabinet at 1/2 wavelength (out of phase), canceling much of the sound that would have otherwise projected downward.

- **Gradient Array** – A Gradient Array is a simple method for providing greater than 10 dB under-cluster attenuation with control of the null location by adding a "steering element" to the array. Gradient Arrays are described in JBL's Application Note "Loudspeaker Array Low-Frequency Pattern Control Using Filtered Array Technology" and an example is given.

- **Bandpass Array** – A Bandpass Array involves orienting multiple low frequency elements in a line (typically a vertical line to control vertical dispersion), and using delays and frequency shading to create interference to control coverage. JBL's Application Note "Loudspeaker Array Low-Frequency Pattern Control Using Filtered Array Technology" describes the theory behind bandpass arrays and provides examples, with signal processing parameters for a 3 element and a 4 element bandpass array.

BOUNDARY EFFECTS

- **Boundaries Behind Array** – Be careful of boundaries around any array – you can end up with unintended reflections and cancellations. Placing an array close to a back wall cancels projection into the audience area for a band of frequencies centered around the frequency that is 4 times the distance between the array and the wall. Here is an example: With an array placed 3 feet (approx 1m) from the back wall, the reflection of frequencies around 80 Hz (12 foot wavelength) off the back wall (6 foot path length) are out of phase, canceling out much of the sound projection of the 80Hz frequency band forward into the audience area.

- **Very Close Boundaries** – Boundaries that are very close to the array can cause early reflections and midrange cancellations as well as multi-path radiation which smears the time coherency of the signal, ultimately degrading the intelligibility of the system.

RIGID ARRAY FRAMES

- **Down-Tilting of Rigid Frames** – There is a difference between tilting down a rigid horizontal array and individually aiming each cabinet of the array. They end up with different aiming axes. When you construct a horizontal array, for example using rigid truss bars, the speakers are splayed outward (horizontally) at a certain angle resulting in an arc to the array. By tilting down that rigid arced horizontal array, the speakers not only tilt downward, but the rigid arc makes the splayed speakers tilt farther outward. This can result in projecting more sound onto the sidewalls than what was intended.

SIGNAL PROCESSING

- **Number of DSP Channels** – Be sure to provide enough DSP channels to be able to control array components separately when needed.

- **3-Wide Systems** – On any 3-wide system of all the same model speaker, the side boxes need to be controlled separately from the center cabinet to allow different delay and filter settings. For example, it is often worthwhile to delay the side boxes relative to the center for the audience seated in the side box's coverage area. This is usually in the range between 0.5 and 2.0 mS, depending on the distance between the boxes. It is also often beneficial to EQ and level shade the center box separately from the side boxes.

- **Down-Fills** – For downfill cabinets, consider delaying the down-firing horns to maintain time coherency with the top cabinets for the audience seated in the downfill's coverage area. It is also often desirable to high-pass downfill horns at a higher frequency than the long-throw horns, to compensate for the horns' natural widening of coverage at lower frequencies.

- **Verification and Adjustment** – Verifying and adjusting device arrival times from multi-element arrays, as well as confirming the appropriateness of the array angles for that room, requires the use of modern measurement equipment such as Smaart Pro or Smaart Live.

Footnotes:

[1] Nominal included angle in degrees between –6 dB points, +/- 10%. All stated specifications for "Coverage" are typical at 1 kHz, 2 kHz, 4 kHz.

[2] Calculated one meter SPL based upon (lowest system) sensitivity and continuous power capacity. Power compression is not considered. "Maximum Peak SPL" is 6 dB higher than the stated Maximum SPL figure.

[3] Continuous. See individual product catalog sheet.

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VS/SP ARRAY
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