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From: DE Carlson
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Subject: X-Array Subwoofer SPL Ratings

cc: M. O'Neill

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We have been informed of an Engineering Data Sheet issue that, on occasion, presents problems with comparisons with competitors' subwoofers – in particular with the X-Array subwoofers. On the data sheets for subwoofer systems, we typically indicate the sensitivity as an SPL for 1 watt at 1 meter in an *anechoic* environment (otherwise known as *full-space*). Our competitors often rate their systems for *half-space* radiation, which results in numbers higher than ours. In the future, we will be changing the data sheet specifications to indicate the SPL for 1 watt at 1 meter for both full-space and half space. The half-space SPL number will be 3 dB higher than the full-space SPL number. For your immediate sales-comparison needs, a summary of the X-Array sensitivity ratings is shown below for both full-space and half-space radiation. Below that is an explanation of the half-space/full-space rating difference for your reference.

X-Array Touring and X-Array Install Subwoofer SPL Ratings:

Most of the questions that we have received recently concerning SPL ratings have been for the X-Array models. Listed below are both the full-space and half-space SPL ratings for those speakers.

<u>System</u>	<u>Full-Space Sensitivity</u> (SPL 1w@1m)	<u>Half-Space Sensitivity</u> (SPL 1w@1m)
Xds	100.0 dB	103.0 dB
Xb	98.5 dB	101.5 dB
Xcb	95.0 dB	98.0 dB
Xi-1191	94.0 dB	97.0 dB

Explanation of Full-Space and Half-Space SPL Ratings:

Subwoofers are operated at very-low frequencies where the where the polar pattern is omni-directional (meaning that the beamwidth is 360°). In an anechoic environment (i.e., full-space), the sound goes in all directions for a full spherical radiation pattern. A half-space environment is one where it is assumed that the loudspeaker is setting on a floor of infinite size, and the sound can only radiate above the floor and not below – resulting in a hemispherical pattern. Thus, in the case of subwoofers, the name full-space indicates that the sound is radiating with a full spherical pattern, while half-space indicates that the sound is radiating with a hemispherical pattern. In a half-space environment, the sound energy is confined to radiate into only half that of a full-space environment – therefore, the power density for half-space is

doubled compared to that for full-space – which results in the SPL being 3 dB higher. (The same would hold true if the loudspeaker system was setting next to a wall instead of on a floor.)

Note that this 3-dB increase is only true for loudspeakers with an omni-directional radiation pattern (i.e., subwoofers) and is not true for full-range systems. To illustrate this, consider the case of a $90^\circ \times 40^\circ$ high-frequency horn. The on-axis SPL from the horn would not be increased by adding a wall behind the horn because, at $90^\circ \times 40^\circ$, the sound from the horn is already confined to a coverage pattern less than the $180^\circ \times 180^\circ$ half-space environment.