



# TECH-NOTE

## TN-1002

**Tech Note No:** TN1002

**Date:** May 27, 2014

**Subject:** Rear Panel Radiation on James Loudspeaker 63SA-7 models

**Introduction:** When Loudspeakers are placed within an environment it is necessary to minimize the sound radiation through the rear panel. Sound transmission through the back of loudspeakers can cause noise carryover to adjoining rooms or other locations. By maximizing the dampening of sound through the rear panel these effects can be attenuated and sound isolation can be improved, allowing less sound pollution in nearby areas.

**Measurements:** Measurements were taken of a James loudspeaker 63SA-7 in ceiling speaker by placing first the front and then the back of the speaker against a baffle consisting of a rubber mat and the floor, and subsequently measuring the SPL produced in either circumstance. Microphones were placed at an 18 inch distance in the on axis direction from the front and the rear enclosure for each measurement respectively. Sensitivity at 18 inches is 98dB and when referenced to standard 1meter distance (39.37 inches) sensitivity is about 91dB.

Figure 1 shows both measurements on a SPL verses frequency plot. A measurement of noise was also taken to establish a noise floor as an anechoic chamber was not available. Notice that the rear transmission SPL at frequencies above 1kHz are below the noise floor indicating sound radiation through the rear panel of the enclosure is extremely low and will require little to no additional attenuation.

**Attenuation of Signal Through Rear Panel:** In order to demonstrate the difference between the on axis response and the rear panel radiation, the curves were normalized to the on axis response as shown in Figure 2. The 0dB line represents the on axis response while the red line shows the rear radiation output level. Notice that the rear output is given in negative dB values showing that there is attenuation of sound through the rear panel relative to the 0dB on axis response. Additionally, at frequencies above 1kHz, the rear radiation is equivalent to the noise floor (shown in purple) so frequencies above 1kHz can be assumed to be attenuated to negligible levels. Additionally, any peaks above that frequency can be attributed to room anomalies rather than significant sound radiation through the rear panel of the enclosure. Across low frequencies, the curve indicates an average of -20dB difference between the on axis response and the rear panel radiation; although, at 150 to 250Hz, there is a deviation giving only a -15dB transmission. This peak is to be expected in aluminum as can be seen in figure 3. In the mid range frequency band, there is an average of -25dB difference between on axis measurement and rear enclosure radiation. A 25dB sound transmission loss is roughly equivalent to the STL through a layer of drywall. In the high frequency range, SPL levels are attenuated in a range from -30dB to -40dB and coincide with the noise floor, indicating the possibility of even greater attenuation.

**Relevance of Attenuation Values of Rear Panel Radiation:** Figure 3 shows the STL of standard construction materials including drywall. The signals at the low end of the frequency spectrum are not as strongly attenuated by drywall as they are through the rear panel of the

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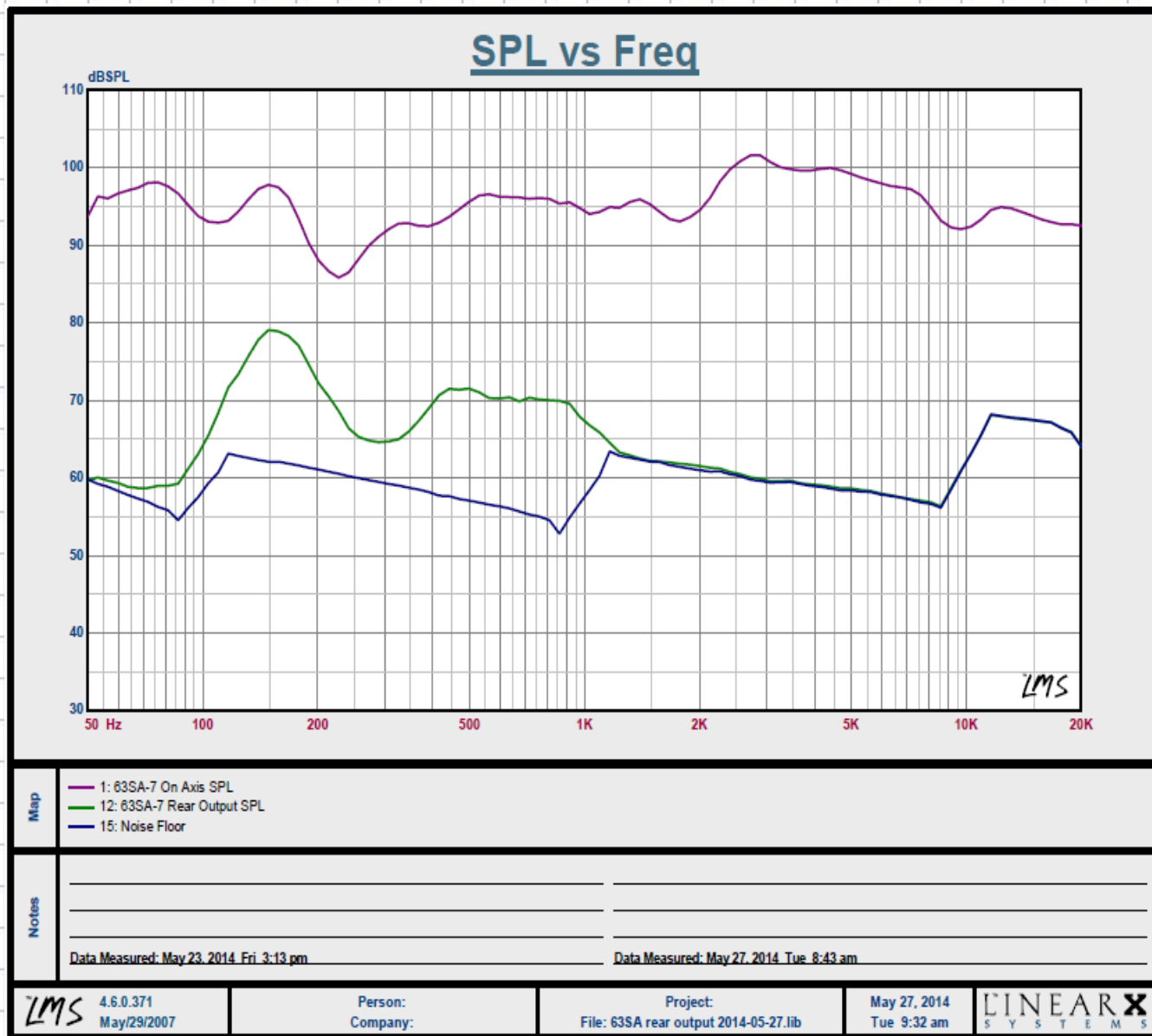
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63SA-7. In the mid to high frequency bands, signals are attenuated equivalently or better than drywall as well. The addition of dynamat to the rear panel as well as polyfill within the enclosure gives an additional boost to the STL giving the 63SA-7 an even stronger attenuation of unwanted rear panel sound radiation. The aluminum panel with the addition of the dynamat and polyfill gives a cumulative attenuation of rear panel radiation which is better than a single layer of drywall, especially in the low frequency signal range. However, additional insulation is advised between zones where sound isolation is desired. As a reference, figure 4 shows the STC rating of a typical wall with a layer of gypsum board on either side of an air gap which gives a STC of around 38-40dB and the same wall with the addition of a single layer of insulation which produces a STC of around 43-44dB. This is significantly better than a single aluminum panel which is shown in figure 3.

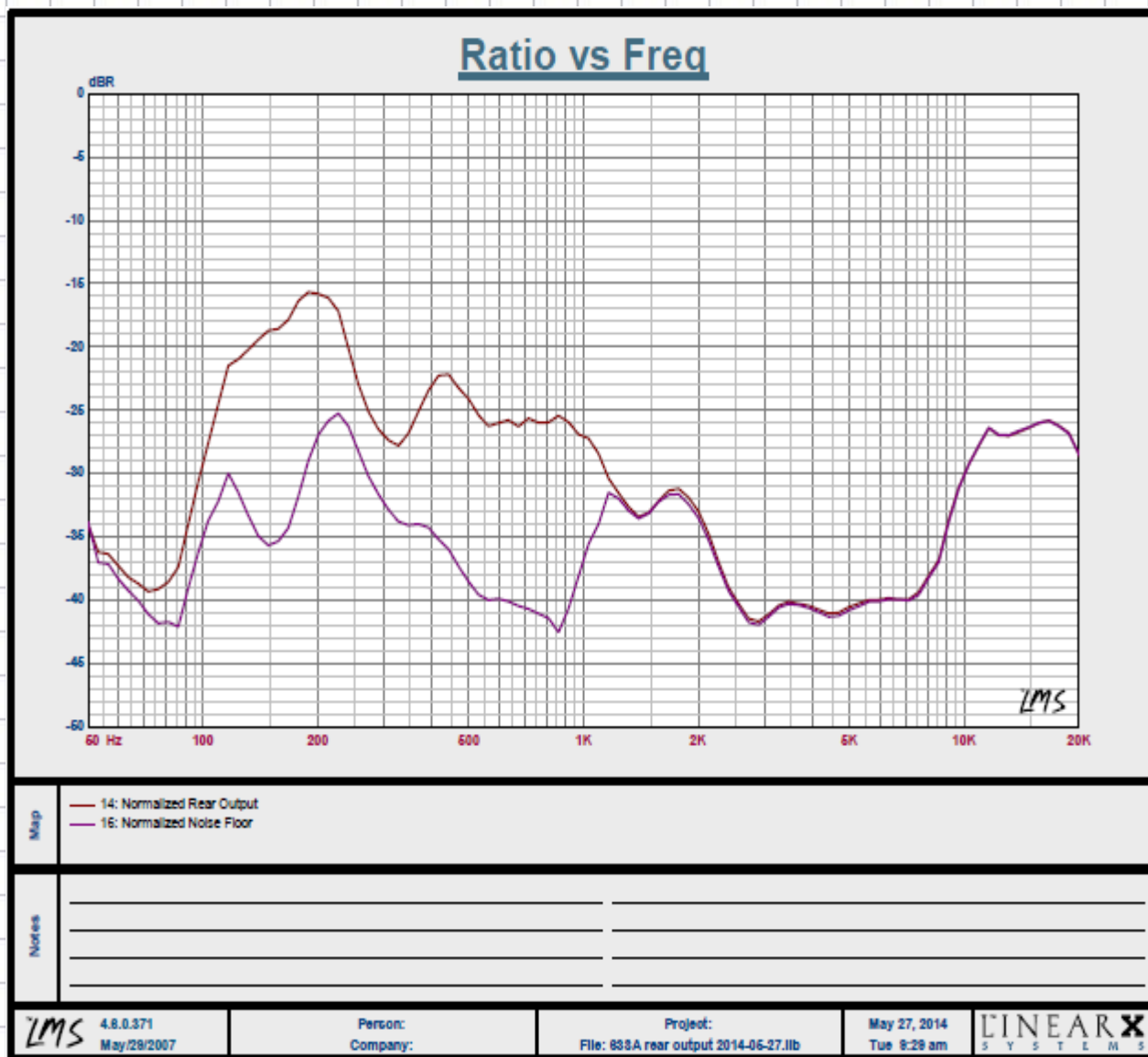
**Other Sources of Noise Pollution:** The biggest problem with sound isolation is not the insulation between two areas but rather the available flanking paths which sound can leak through. If sound is allowed to pass around insulating materials through means of some other path, the expected isolation of sound can be deteriorated. The most common paths that this unwanted noise can take include air vents, outlet plates, switch plates, light canisters, exhaust fans, pipes in the walls, doors, windows, and other vibration carrying structural components. To eliminate sound allowed through these flanking paths insulation and damping materials can be used such as special mounts which prevent vibration from transferring between structural components. By using rubber or spring loaded mounts to attach components ranging from pipes to the speakers themselves, much of the noise pollution caused by structural vibration can be eliminated.

When considering the installation of an in ceiling speaker such as the 63SA-7 it is important to consider all the methods with which sound may travel to nearby areas. Insulating the gap between the speaker and the floor above addresses only one source of possible sound pollution. Sound can also travel through the walls and bleed out through the walls of other units if proper measures are not taken to ensure that an easy path is not provided for noise to travel. This is easily addressed by adding insulation to walls in a similar manner as in the ceiling to prevent sound transmission. Sound may also transfer through structural vibration such as ceiling boards carrying vibration into the rest of the building structure causing vibration and noise pollution in other areas. This can be addressed in a number of ways. First, mounts can be used to suspend the speaker and isolate the vibrations of the box from carrying to the ceiling and thus to other structural components. Rubber mounts as well as spring loaded mounts are available for this purpose and examples are shown in figure 5. Secondly the ceiling itself can be isolated from the rest of the structure by suspending it with similar spring loaded mounts. These springs effectively dampen the vibration caused by the speakers and prevent vibrations from carrying into the structure causing noise pollution.

**Summary:** A James loudspeaker 63SA-7 gives attenuation of rear panel radiation of about 20dB in the low end of the frequency spectrum, while in the midrange frequencies one can expect a 25dB attenuation, and in the high frequency range (above 1 kHz) attenuation through the rear panel of the enclosure gives a radiation equivalent to or less than the SPL caused by environmental noise. The rear panel of the 63SA-7 offers an attenuation which is slightly better than a single layer of drywall which significantly reduces SPL levels; however, additional insulation is suggested to isolate and reduce transmission to acceptable levels.

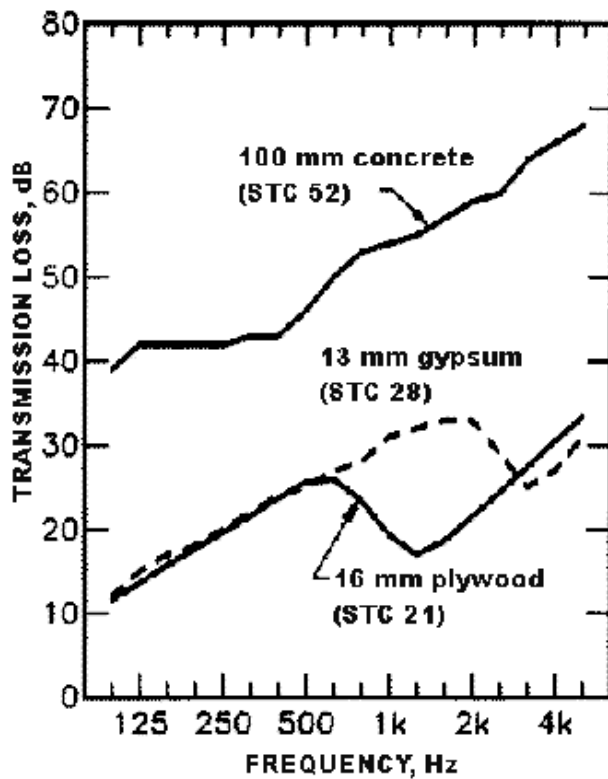


**Figure 1:** Front (on axis SPL/response measurement) Back (rear output SPL measurement) and Floor (measurement of nose floor) indicated on this graph.

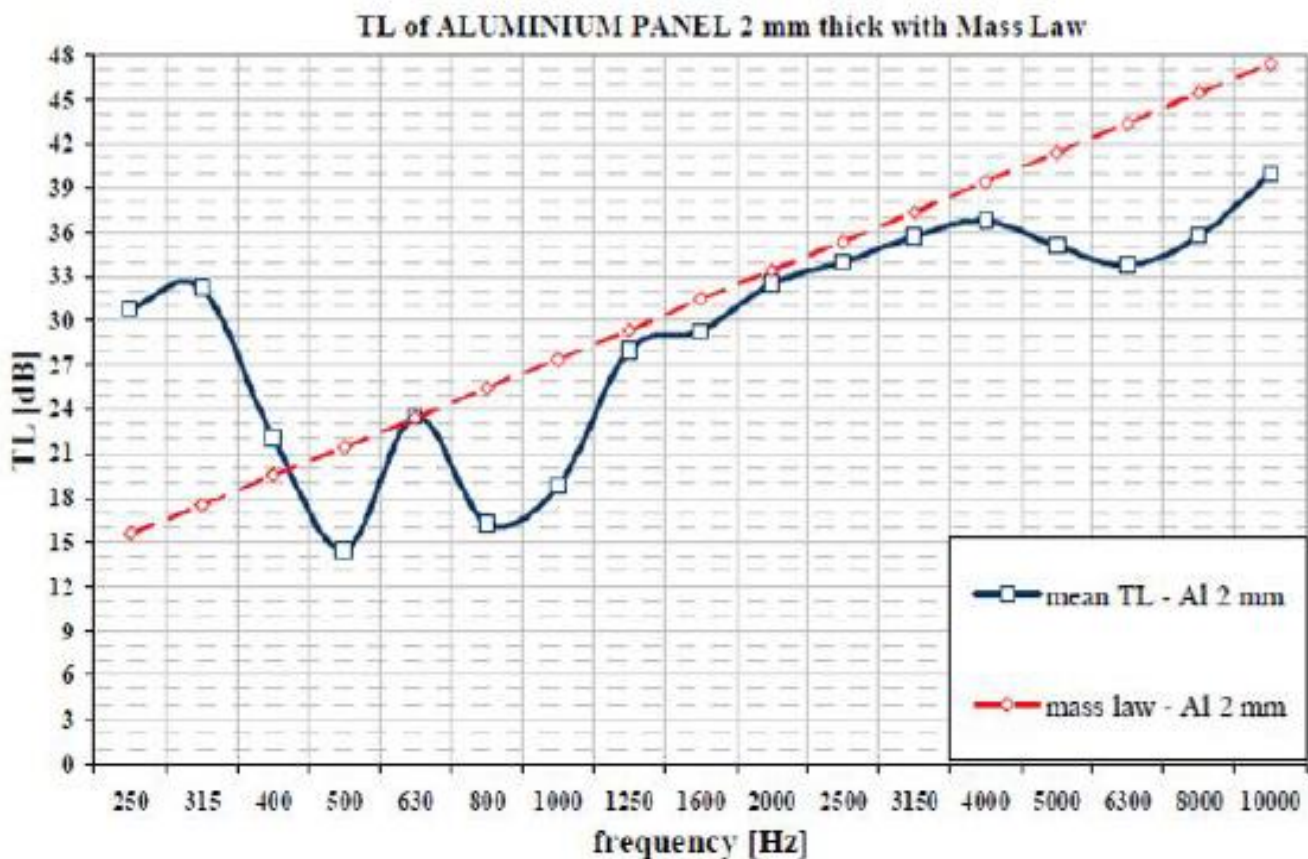



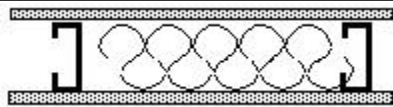
**Figure 2:** Normalized curves. 0dB line indicates normalized on axis response, the red line indicates the normalized rear output showing STL. Noise floor measurement is also normalized to on axis response and given in purple. Frequencies above 1 kHz coincide with room noise, as indicated by noise floor measurement.





**Figure 3:** Measurements of STL through various materials commonly used for wall construction. Notice STL levels are not given in -dB but are normalized. Values of STL given in figure 3 and figure 2 should be compared as mirror images of one another. Aluminum panels are shown in graphs below, drywall shown in graph to the left. Notice that aluminum in this circumstance is given at 2mm, and James Loudspeaker 63SA-7 rear panel is ¼ inch thick which is 6.35mm.



Description	Estimated STC Rating	Wall Assembly
3 5/8" metal studs, 5/8" gyp (2 layers total), No insulation	38 - 40	
3 5/8" metal studs, 5/8" gyp (2 layers total), Batt insulation	43 - 44	

**Figure 4:** STC rating of common walls using metal studs. Use of wooden studs reduces STC rating by about 5dB. Data taken from <http://www.stcratings.com/assemblies.html>.

**Figure 5:** Examples of rubber and spring loaded mounts used to isolate vibrations cause by speakers from transferring to structural components. 1 and 2 are rubber mounts. 3-5 are spring loaded mounts.

1.



2.



3.



4.



5.

