The ARP-101 anti-reflection panel is designed to improve the performance of any microphone when used in an acoustically compromised environment. When room reflections exist in the recording environment they can adversely affect the quality of your recording. Unwanted effects such as frequency colorations, "muddy" vocals, and time delay anomalies can occur in non-acoustically treated environments. The anti-reflection panel works to reduce or eliminate these effects in non-acoustically treated environments at a fraction of the cost of acoustically treating a room, and can provide additional isolation when needed in acoustically treated environments as well.

Assembling the ARP-101

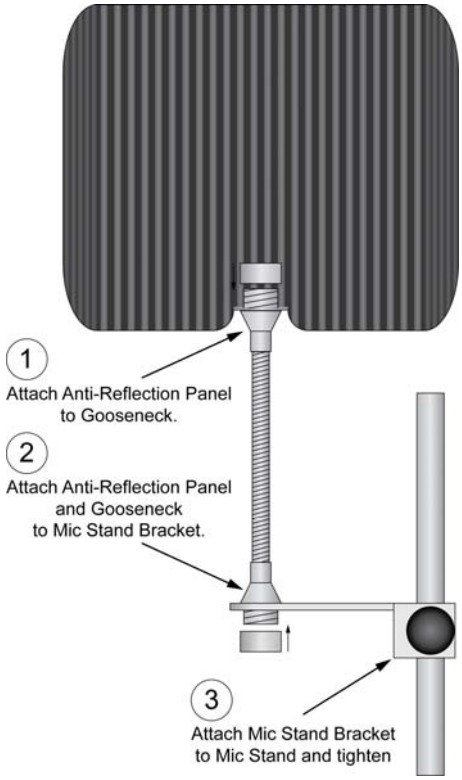

Figure 1

The difference between "live" and "dead" sounding rooms

To better understand how sound works in a room we first need to understand what makes a room sound "live" or "dead". A room is called a "live" room when it has a bright sound, one that accentuates the audible frequency ranges of the voice or instruments. A bright sounding room can also have a reverberation or "echo" as well. This brightness and reverberation is caused by reflections from hard surfaces in the room such as glass windows, wood paneling, wall board, and tile or other hard flooring materials. Since most rooms have walls, floors and ceilings that are parallel surfaces to each other, these reflections bounce around the room between hard surfaces accentuating different frequencies and creating natural reverberation. These reflections can arrive at the microphone at different time intervals which will affect the intelligibility of the spoken word and can also change the sound of instruments. A "dead" room of course is the opposite of a "live" room; it is a room with more sound absorption than reflection.

Rooms with lots of soft surfaces such as deep shag carpet, soft furniture, soft wall materials or theatrical drapery, even lots of clothes in a well packed closet will absorb sound at different frequencies and in extreme cases can sound very unnatural. In these kinds of rooms there seems to be a lack of high frequencies, but actually mid and low frequencies can also be absorbed depending upon the size of the room and the extent of the soft or absorptive materials. An additional effect of extreme sound absorption is the lack of perception of boundaries due to our ears natural tendency to perceive slight differences in time arrival as evidence of a wall or room boundary. Ideally the goal is to have a good balance of absorption, reflection, and non-parallel surfaces in your room to make the best recordings, which is often not possible to achieve without drastic changes in room construction. This is why an Anti-Reflection Panel is such a good tool; it will help significantly reduce the effects of an acoustically unbalanced room by isolating the microphone from the effects of room reflection and absorption problems.

Directional and Non-Directional (Omni) Microphones

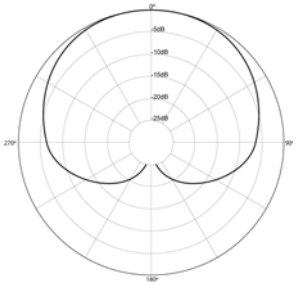

Figure 2 – Cardioid

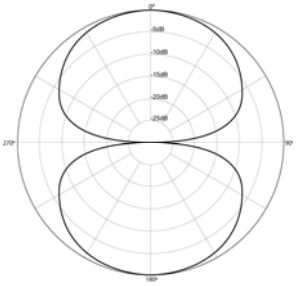

Figure 3 – Figure 8 Pattern

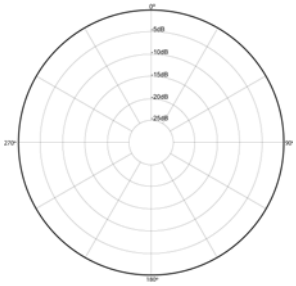

Figure 4 - Omni

Microphones are designed with specific pick-up patterns, but they all fall into essentially two types, directional and omni-directional. Directional microphones have a defined pattern field, some are cardioid shaped rejecting sound from behind (figure 2), some are "figure 8" shaped rejecting sound from the sides to benefit the front and rear pick-up pattern (figure 3) and there are others that are variations of these shapes, while omni-directional microphones as the name implies are designed to pick-up sounds from all directions at the same time (figure 4). Directional microphones are useful in that they can naturally reject sounds from the rear or the sides which can be useful for live sound applications and for specific recording situations, while omni-directional microphones usually have a more open and true sound in both instrument and live recordings, but also are very sensitive to other sounds (such as other instruments) that may make them more difficult to use in some situations. The choice of what kind and type of microphone to use is based on both artistic and specific applications and will not be discussed here, but we will show that the ARP device can be used for either type of microphone in many different applications.

Vocal Microphone use with Anti-Reflection Panel

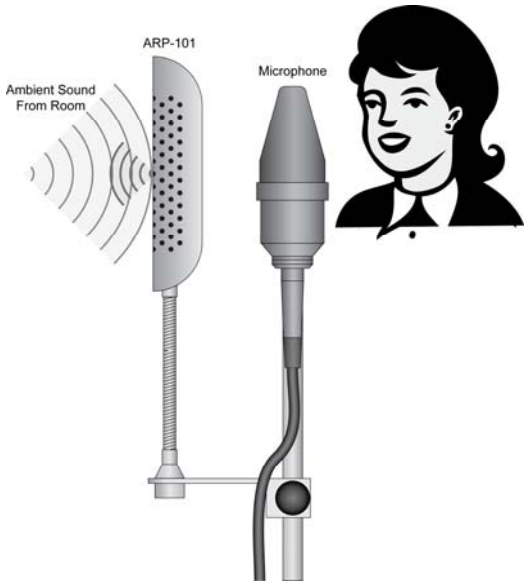

Figure 5 - Vocal Position with ARP behind the Microphone

As seen in figure 5 (this figure looks like clip art, I think a side view of a head with sound waves emminating toward the microphone would be a better graphic), this is a typical set up position for use of a microphone in a vocal recording position. By placing the ARP behind with the soft side facing the microphone in the direction of the source of the voice, the microphone is shielded from room reflections that might be picked up from the back and rear sides. This position is particularly useful when the vocalist is close to a wall because the ARP will block the reflections incident on the microphone from the shortest distance away (the wall surface) which are likely to be the loudest and thereby the most offending. In general when working in a small room it is best to keep the wall that is the longest distance away from the microphone behind the vocalist because reflections from that wall will be the lowest in volume and therefore not as likely to interfere with the direct field level of the singer.

If desired, multiple ARPs may be used both above and below or side to side (see figure 6) to further isolate the microphone from reflections in particularly difficult rooms.

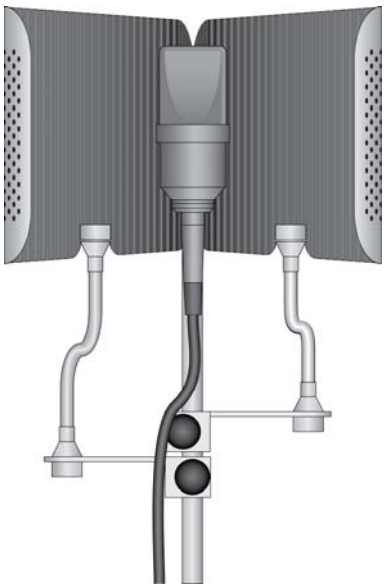

Figure 6 – Side by Side ARP-101's (This drawing should show the two panels at a 45 degree angle to the mic to demonstrate the ability to absorb reflections from the sides and back with two units. This drawing shows them in a parallel position. It would be nice to add another drawing that shows the ARP with a longer gooseneck to move it above and below (vertical) the mic to show how that would look.

Instrument Microphone use with Anti-Reflection Panel

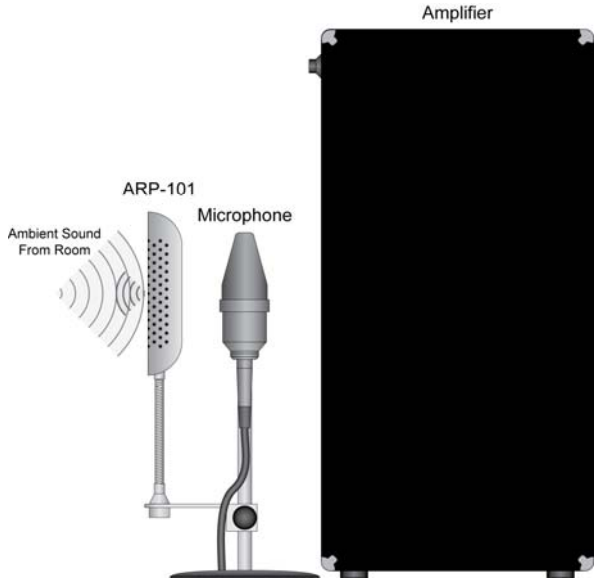

Figure 7 – Instrument Microphone

Musical instruments are subject to the same room acoustic anomalies as the voice, but often due to proximity of sound sources such as drum kits or in sheer volume as with a guitar amplifier there can be more extreme acoustical reflections at play; along with extreme levels of sound leakage, especially with multiple microphones in a live recording

set-up. An ARP configured with a microphone for recording an amplifier is depicted in figure 7. Used in similar fashion to the vocal position, the ARPs soft side is aimed at the source of the sound (the amplifier) in close proximity to the microphone. This position isolates the sound source incident on the microphone coming from the amplifier and reduces reflections from the rear of the microphone. This position also helps to diminish extreme sound levels that might be emanating from other amplifiers in the room should this be a live recording situation. This position is also good for acoustic stringed instruments, brass, and woodwinds. Drums and drum kits pose the largest problem when it comes to microphone isolation. Since it is common to use multiple microphones when recording a drum kit, it is inevitable that each microphone will pick up the sounds of adjacent drums and cymbals as well as the intended target. Use of an ARP for drum microphones will help to reduce this interference. A typical set up for recording a drum kit is shown in figure 8 (this is OK, but shows only one position for a generic drum. It would be nice to show a complete kit with mics on cymbals, hi-hat, etc. all using the ARP for isolation. I think it would be a better presentation, and a variation showing an ARP on the top and bottom of the mic would show a better option for more complete isolation.

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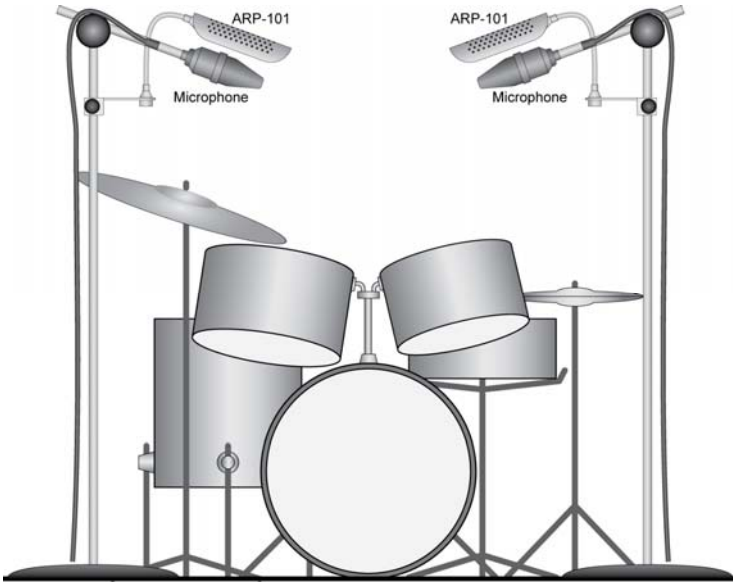


Figure 8 – Recording a Drum Kit – Two Overhead Microphones

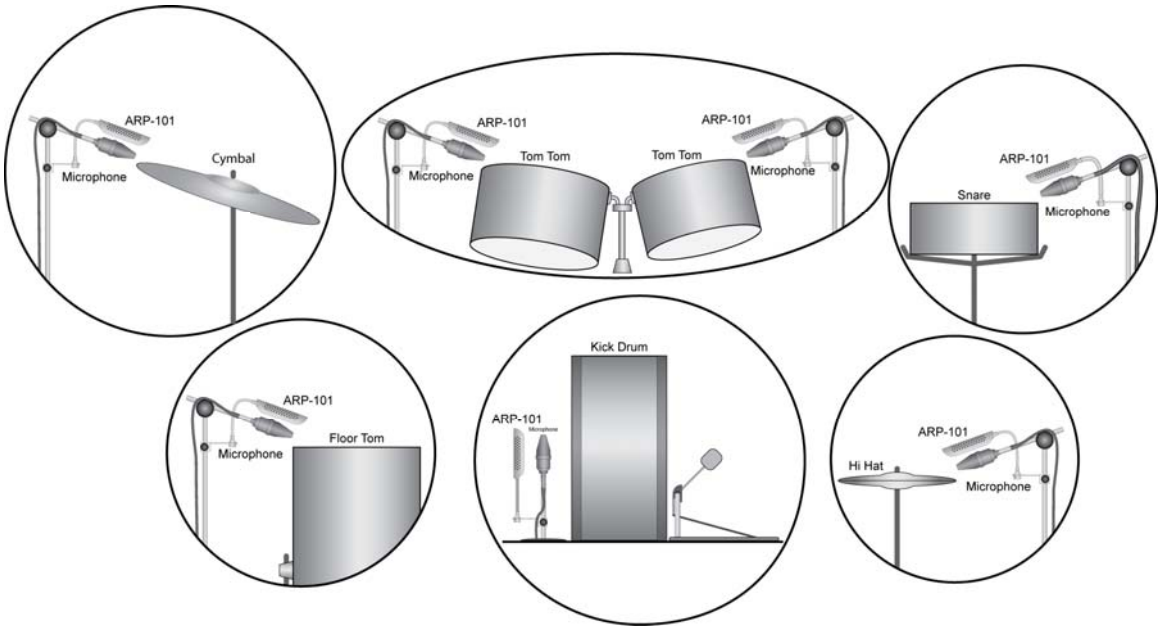


Figure 9 – Recording a Drum Kit – Dedicated Microphones

Live Recording Applications with the Anti-Reflection Panel

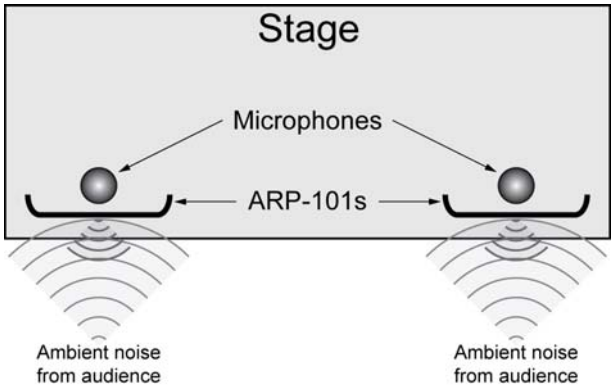


Figure 10 – Shielding Audience Noise in Live Recording

Sometimes it is desirable to make a live recording of a practice session or a performance using microphones in a fixed position. Often in these situations there are limited locations to place microphones, but one of the most common is in the audience on stands close to front of the venue. Using the ARP as in the example shown in figure 10 is particularly effective with omni-directional microphones since they are preferred for recording applications but often pick up too much noise from the live audience. When using the ARP with this kind of microphone set-up sound blocked by the ARP to the rear of the pick-up pattern reducing the crowd noise and enhancing the sound in the direction

from where the music is coming from. The ARP also reduces reflections from the rear of the room that can adversely affect sound quality.

Test Recording Trial and Error

There are many different and creative applications for using the ARP in the recording process, we have outlined some of the most common here, but as with most situations where recording hardware intersects with artistic expression, we encourage creative use of the ARP in the recording process. Without testing and listening back to recordings it would be hard to determine what is the best position of the ARP relative to the sound you are looking for, sometimes even small changes in position can make large changes in sound quality, so we encourage lots of experimentation along with these guidelines.

Noise Reduction Coefficient (NRC) testing:

A fully enclosed room is set up with a speaker (at voice microphone position) and a test microphone. A signal sent to the speaker produces sound at 250 Hertz, 500 Hertz, 1000 Hertz, and 2000 Hertz, which represent the range of the human voice. Distance between the test microphone and the speaker are setup to represent typical use with the ARP-101 diffuser in-between.

To get a baseline level, a microphone captures the level of sound at these frequencies in a reverberant room without a sound absorption product, like the ARP-101 Acoustic Panel. (Fig. A)

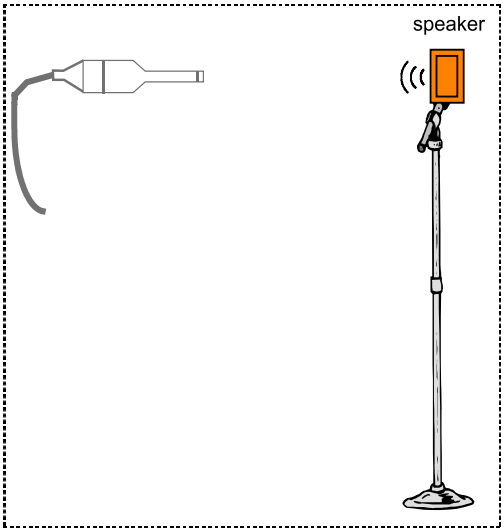


Fig. A

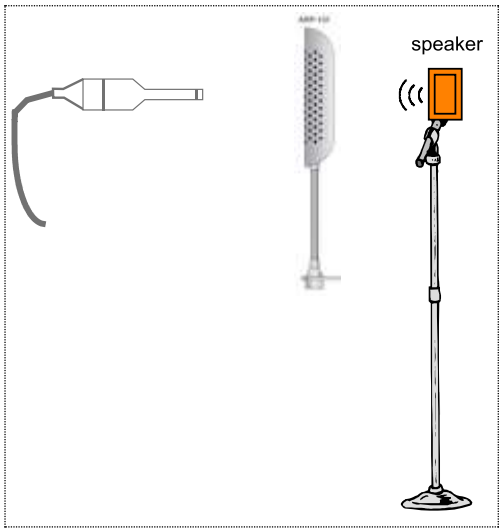


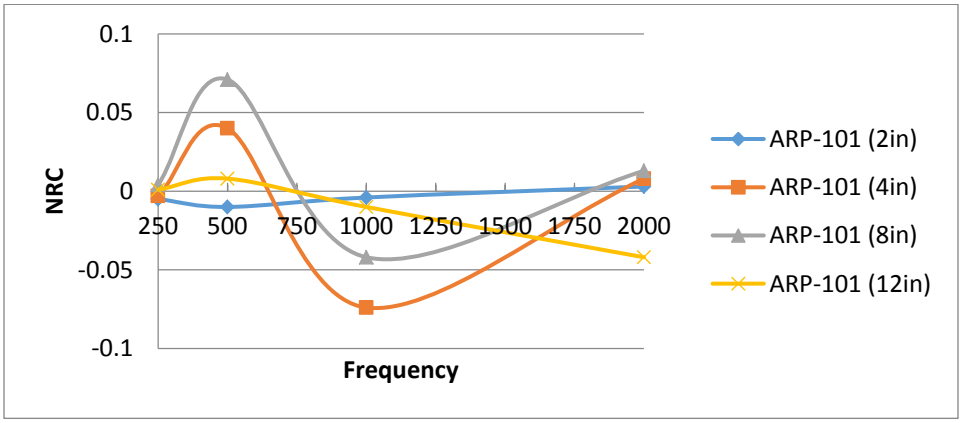
Fig. B

After the baseline readings are measured, the ARP-101 panel placed between the speaker and the microphone represents its use in a typical application (Fig. B), and the test repeated.

NRC calculated values for each frequency figure the amount the ARP-101 reduces the amount of sound in the room. Frequencies are tested, and averaged to the nearest .05. This test did not produce any unusually data for considering the thickness of the ARP-101 material. The test also indicates that the ARP-101 panel does not alter considerably the reflections in the room, but helps to average them out or in some ranges enhance them as shown by the positive values. Very little reduction occurs and less than 1 percent.

NRC for the ARP-101:

Frequency	250	500	1K	2K	Total
Reduction in level - panel 2 inches from source	-0.005	-0.010	-0.004	0.003	- 0.004
Reduction in level - panel 4 inches from source	-0.003	0.040	-0.071	0.01	-0.01
Reduction in level - panel 8 inches from source	0.004	0.071	-0.042	0.013	-0.01
Reduction in level - panel 12 inches from source	0.001	0.008	-0.010	-0.042	-0.01

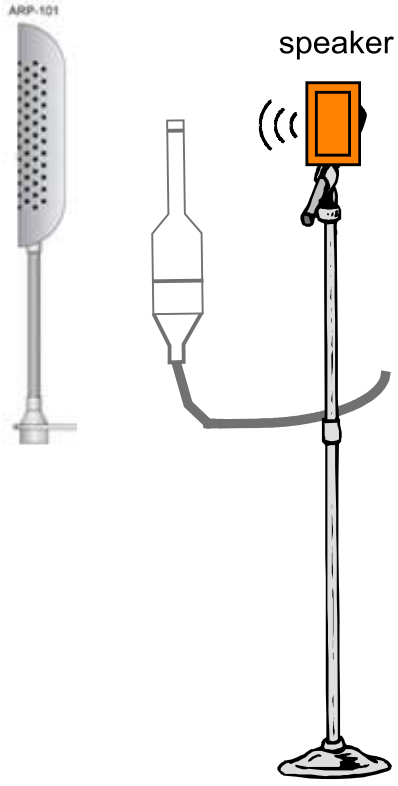


Data showing the NRC values indicates that a panel distance of 2-4 inches attenuates reflections in the 750Hz – 1500Hz range the best. Zero represents no attenuation, and one is full attenuation. Zero line is reference level. In some areas, the energy actually increases, such as in the 500Hz region. Reduction levels are not substantial based on this data, given the thickness of the panel; this is not surprising, compared to acoustical dampening foam, which is much thicker.

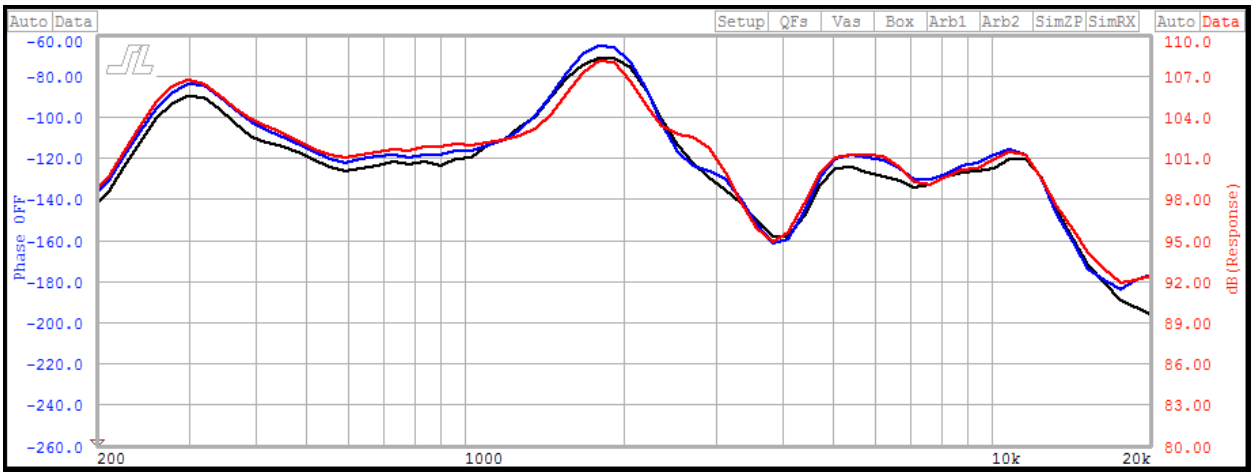
The real value of the ARP-101 panel shows up in the unsmoothed frequency response curves, which shows response slightly attenuated in the upper frequency response range. The ARP-101 panel provides some attenuation and smoothing of frequencies, depending on placement from the source speaker (vocal microphone position). The ARP-101 panel also reduces or filters reflections that would normally bounce back into the source microphone area, without a the ARP-101 panel in place.

Typical attenuation of ARP-101 panel, unsmoothed data, panel 2 inches from source. Similar results measured with panel at 4, 8, 10 and 12 inches.

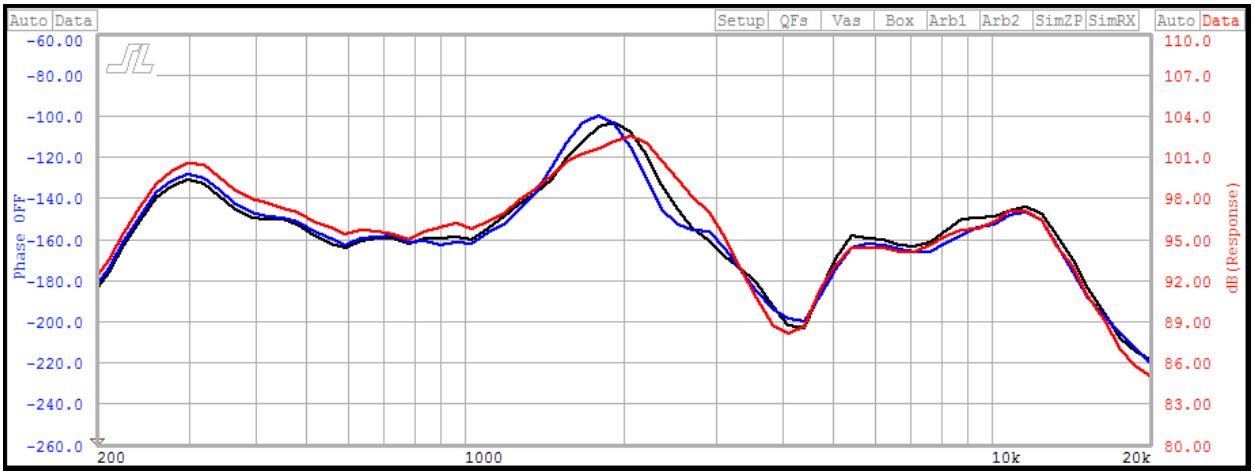
Measurements of the microphone in front of the panel:



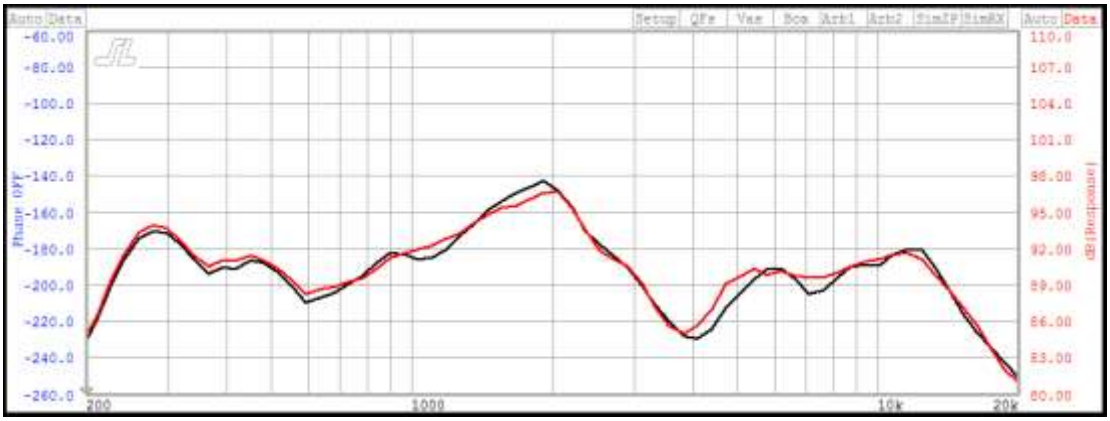
This result, which represents typical, use conditions of the ARP-101 panel, indicates that the ARP-101 panel enhances the frequency response level in various ranges depending on the distance the panel is behind the microphone and the distance the sound source is from the microphone. This increase in energy is from a focusing effect, which appears to be the result of the shape of the metal panel and the curved ends.



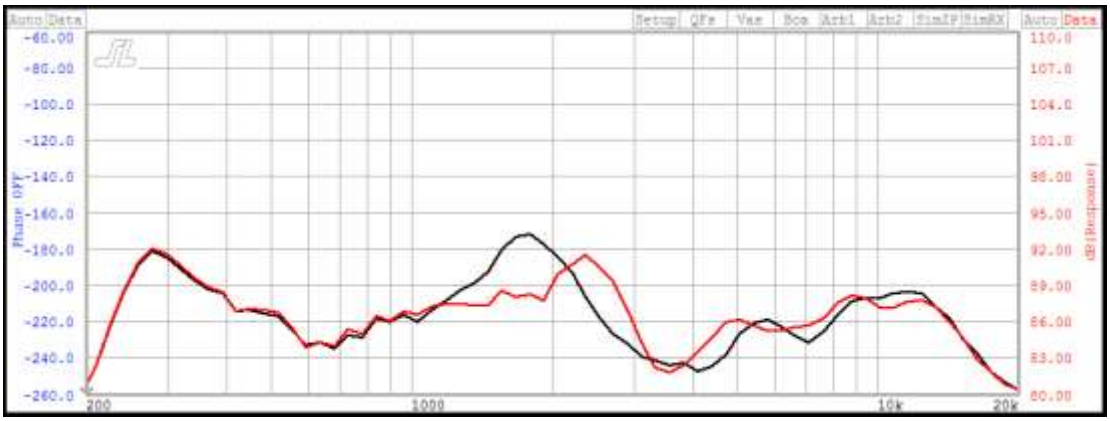
ARP-101 test with microphone 2 inches from reference speaker (normal vocal microphone position) = Black curve, Red curve= ARP-101 panel 2 inches behind test microphone, Blue curve =ARP-101 panel 4 inches behind test microphone.



ARP-101 test with microphone 4 inches from reference speaker (normal vocal microphone position) = Black curve, Red curve= ARP-101 panel 2 inches behind test microphone, Blue curve =ARP-101 panel 4 inches behind test microphone.



ARP-101 test with microphone 8 inches from reference speaker (normal vocal microphone position) = Black curve, Red curve= ARP-101 panel 6 inches behind test microphone.



ARP-101 test with microphone 12 inches from reference speaker (normal vocal microphone position) = Black curve, Red curve= ARP-101 panel 2 inches behind test microphone. Some frequency shifting as panel distance is further away from sound source position.

Summary:

Even with the ARP-101 placed at a distance of 2 to 6 inches from the back of the microphone, the ARP-101 panel enhances energy in various vocal frequency ranges, improving clarity and sonic definition. The metal grille helps filter rear reflections while the foam material on the front absorbs or passes through direct energy. The NRC test indicate the ARP-101 panel has very little absorption properties to block out sound at low frequencies, but the test also showed smoothing and level uniform attenuation of various high frequencies. This will provide a less harsh and smoother articulation quality to vocals and music sources.

NRC test setup

typical use setup

Reference setup

ARP-101