

Effect of Mic Placement on Banjo Tone

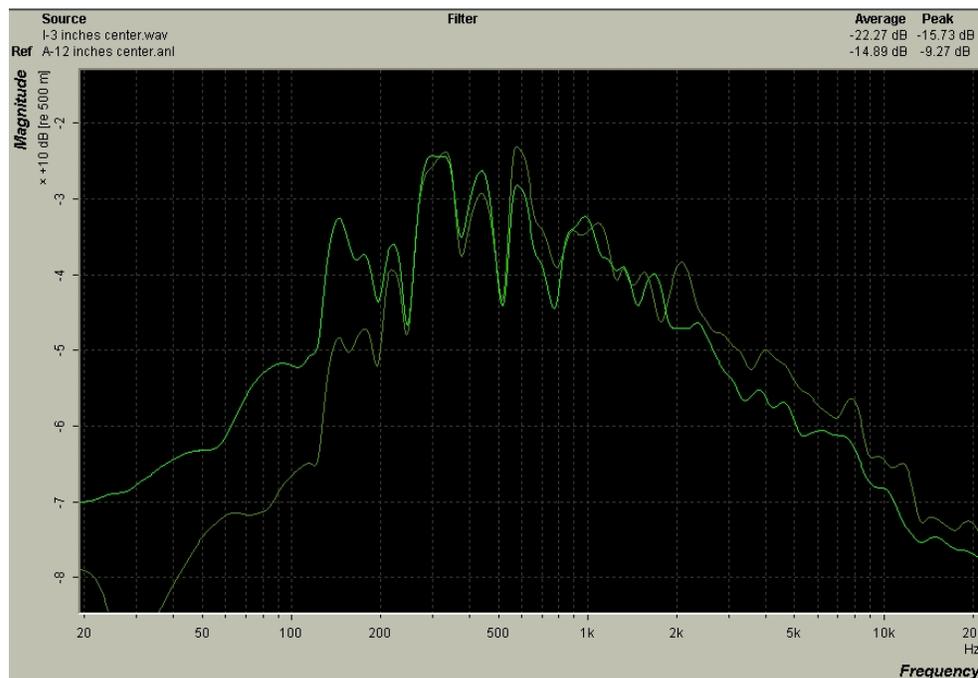
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I wanted to find out how the location of a microphone near a banjo affects the tone quality you hear. To make these tests scientific as well as subjective, I measured the spectrum of the banjo in several different mic locations.

The spectrum of a musical instrument is its output vs. frequency. It affects the tonal balance or timbre. It is the relative levels of the fundamental frequencies and harmonics, and can be measured with a real-time analyzer.

As an experiment, I measured the spectrum of a Chuck Lee open-back banjo in several different mic locations to find out what the differences were. I also compared the sound by recording the mic signals and listening to the playbacks at equal listening volumes.

For example, the screen capture below shows a banjo spectrum picked up at 1 foot (red) and at 3 inches (yellow). The 3-inch placement sounds bassy (more low frequencies than the reference) and dark (less high frequencies than the reference):



Red curve: Spectrum measured 1 foot from the center of the banjo.

Yellow curve: Spectrum measured 3 inches from the center of the banjo.

I placed a flat-response omni measurement mic 1 foot from the center of the banjo head as a reference. Compared to the reference, the spectra of other mic positions had these differences:

6 inches from the center: Warmer or thumpier than the reference. +8 dB from 100-180 Hz.

Comment: The closer the mic is to the banjo head, the more warmth or bass you get. That's not due to microphone proximity effect in this case, because I used only an omnidirectional mic, which does not have proximity effect. Instead, the

banjo's bass is weak at a distance because the low frequencies from the front of the head are partially out of phase with the low frequencies from the back of the head, so they partly cancel out at a distance. (The same thing happens with an open-back guitar cabinet).

3 inches from the center: Bassy and dark. The hand gets between the strings and the mic, so the highs are diminished about -4 dB from 2kHz to 10 kHz. Lows are boosted +14 dB from 100-200 Hz compared to the reference mic position.

6 inches away, halfway between the bridge and lower rim: Good match with the reference, but a little warmer due to a +6 to +9 dB rise from 100-180 Hz. A nice, natural sounding mic location (just my opinion).

6 inches from the lower rim: Thin, due to an 8 dB loss from 160-360 Hz compared to the reference mic location.

6 inches from where the neck meets the pot: Similar to the reference, but a little warmer due to a +7 dB boost from 100-200 Hz. This is another natural-sounding location, but is not as loud as halfway between the bridge and lower rim.

3 inches away, halfway between the bridge and lower rim: +10 dB at 400 Hz, -5 dB above 3 kHz, +10 to +12 dB from 100 to 180 Hz. In musical terms, bassy and dark.

3 inches from the lower rim: Midrangey -- thin and dark. -4 dB from 180 to 250 Hz, -4 dB above 4 kHz.

3 inches from where the neck meets the pot: Similar to the reference but +6 dB from 100-140 Hz.

The purpose of these measurements is not to tell you how to mike your banjo -- that depends on your instrument and your personal taste in tonal balance. Each instrument is different, too. But hopefully these tests may shed some light on how mic placement affects the reproduced timbre of an open-back banjo.

Here's a quick summary:

- Mic 12" from the center of the head: A little thin or weak in the bass. (But a cardioid mic with proximity effect might not sound thin here).
- A "natural" sound is available halfway between the bridge and lower rim, or where the neck meets the pot.
- Miking near the rim sounds thin.
- Close miking sounds bassier than distant miking but provides more gain before feedback and more isolation from floor monitors and other instruments.

There are lots of other mic placements to try. Sometime I hope to round up a closed-back resonator banjo and run these experiments again.

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