

## Open Or Closed Back Speaker Cabinets?

**This is a question that is commonly asked, but no one can explain why there's a difference in tone. Well, we'd better put that right!**

All speakers have what is known as a *Free Air Resonance* (Fs) and is measured in Hz. It is the frequency that the speaker's cone will naturally resonate at with greatest acoustic output and with the least input power, when the speaker is *not* mounted in a speaker cabinet... just sitting on a bench connected to a signal source. The frequency is different for each speaker type in a maker's range, but is often around the 75 to 110Hz range for a typical 12" guitar speaker.

When that same speaker is mounted in an open back cabinet, it will still exhibit high acoustic output at around those same frequencies. But, let's suppose that a speaker naturally resonates at 80Hz... which is almost the same frequency as open E on the 6th string of a guitar (82Hz). So, playing that note sets off the speaker and gives a very high output at that frequency. That's why many amps can sound quite boomy around that note and is more noticeable with tube amplifiers and also modern transistor amplifiers that employ constant current drive... like Marshall's FDD - *Frequency Dependent Damping* - used in many of their tranny amps.

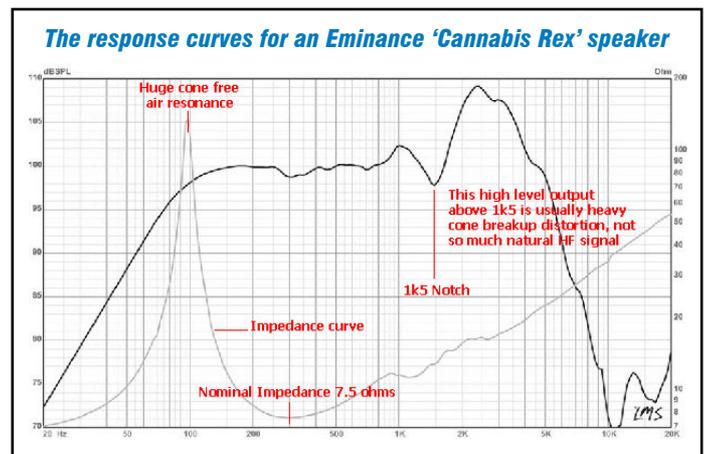
Are you with me so far? Good. So, now let's fit a closed back on that same speaker and cabinet. What happens now, is that the sealed cabinet puts an increased load on the speaker. By this, I mean that the air is trapped inside the cabinet, so the speaker has to compress and stretch it... causing more opposite tension on the speaker's cone. So the cone becomes stiffer and raises the speaker's resonant frequency, usually by two and a half notes up to open A on the 5th string (110Hz). This resonance rise is pretty much the same amount for any size cabinet, but air temperature seems to make it vary a small amount. Many speaker cabinets have half backs with an extra half that you can screw onto the back to make it totally closed, providing the option of both types.

Tonally, both have their place. Closed backs seem best suited to rock music, where open backs seem nicer for all other genres. The trouble I find with closed backs, is that they sound boxy and the higher resonance seems to get in the way for me. But then I'm more of a swing jazz/blues/country player, so not surprising really.

Some find that even the lower resonance of open back cabinets can be too much, so they fit speakers with a low resonant frequency, well below open E (82Hz) at around 55Hz. This has the affect of making the tone rather flat or cold in tonality, but for some styles it works well. Larry Carlton had a Mesa Boogie fitted with an EVM12L (Fs: 55Hz) when he was with The Crusaders and sounds great with his Gibson ES335. The Celestion G12H30 Heritage model was brought back into production for this reason a

few years back. It's plain paper edge has a resonance of 55Hz too and was designed originally as a bass guitar speaker. It has a regular guitar cone, but without the plasticised surround to stiffen up it's suspension. Hence the low Fs. A more supple edge lowers the FS... that's why most hifi bass speakers have very supple rubberised edges to the cone, and can reproduce very low frequencies... but this is not required for 6 string guitar!

I have included the plots of a typical guitar speaker. On the plot there are two traces. One shows the frequency response and the other shows the impedance curve of the speaker. Looking at the low frequency end of the impedance curve, you might notice a huge peak around 95Hz. This is the speaker's resonant frequency. It is also worth pointing out that the speaker's impedance changes with frequency, hence the term *nominal impedance* used by all speaker manufacturers. Therefore, it's not necessary to worry about *exact* speaker impedances, as many musicians do.



Porting small guitar speaker cabinets that have speakers with plastic reinforced cone edges fitted to enhance the bass is not a good practise. It puts a big strain on the cone edge. Best stick with open back or sealed back *infinite baffle* designs.

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