

The length of the capacitor and its construction determine the capacitor's self-inductance and thus its resonant frequency. The lead length to the capacitor's external circuit load influences the in-circuit performance, usually in a quite different manner from that which was calculated based upon ideal (i.e., no inductance) conditions. The following figure shows the effect of lead length increased from 3/8" to 3", a typical length when you add the circuitboard trace length or circuit wiring to the capacitor's lead length. Note that the useful upper frequency limit has gone from 490 kHz to about 290 kHz. The reduction is about 33 kHz per inch for this particular capacitor! For a dielectric loss angle of 10 degrees ($\tan \delta = .176$) in the audio pass-band (a common occurrence with larger capacitor values, inductance, and ESR) there is an even more pronounced effect. Here, the corresponding frequencies for 1/4" and 3" lead lengths are 260 kHz and 141 kHz.

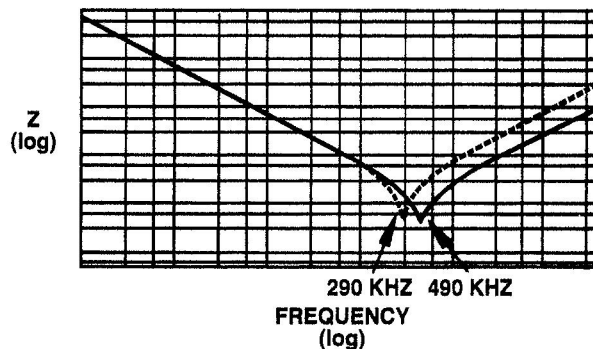


FIGURE 6

Lead length alters a capacitor's range of operating frequency. Here, a 2 μ fd capacitor's self resonance decreased from 490 kHz to 290 kHz when its leads were lengthened from 3/8" to 3". In other words, the capacitor's usable operating range is reduced by almost one half!
