



Tip #40 What is Frequency Response?

There's just no getting around this. If you're going to understand anything about audio—how speakers work, the effect of room acoustics, how to set your subwoofer's level, the concept of bass management/low-pass filters, anything about audio—you have to understand frequency response. This is the cornerstone of everything in audio. It all starts and stops with frequency response. Amplifiers, receivers, speakers, CD and DVD players, they all have to have as close to perfect frequency response as possible, or else they just won't sound right. Nothing else matters if the frequency response is no good. Can't make it any clearer than that.

Let's start of with the basics: Sound waves in the air that we perceive as music or speech or noise are measured in cycles per second, usually abbreviated as Hertz or Hz. Humans can hear from approximately 20 Hz in the bass to about 20,000 Hz (20 kHz) in the treble. (Well, women and young children can hear that high; a middle-aged man is lucky to make it much past 13-14 kHz. You're grandfather needs his hearing aid because his ears are toast by 3 kHz. That's why he's always saying, "Huh?")

Why Frequency Response is important: An audio device with good frequency response is able to play all the low, middle, and high tones correctly—and in the proper proportion to each other—and that's what tells our ears whether or

not this is a high-fidelity unit with rich, vibrant sound.

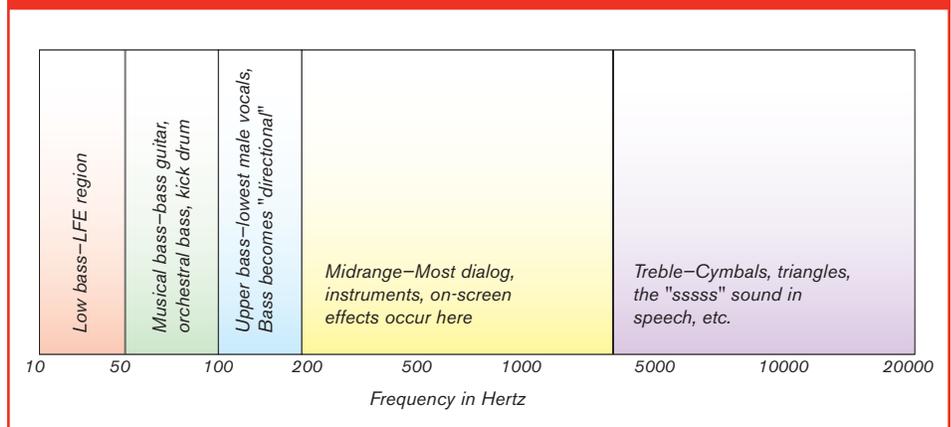
To understand frequency response, remember this: the loudness of sound is expressed in a unit of measure called the decibel, or dB. (See TT 24.) Then we say how by many decibels (dB) the equipment varies from perfect, over a specified range of frequencies. For example, a speaker may be said to have a frequency response of 40 Hz–20 kHz (that's the range), $\pm 3\text{dB}$ (that's the variation).

Now it's time for another hard part: Frequency responses are almost always shown as a graph. This graph is known as the "Frequency Response Graph." (Clever, no?) You have to know how to read a graph, no excuses. If you paid attention in Mr. Kelleher's 6th grade class, great. If not, you'll be sorry now.

Look at Figure 1. This chart tells you what frequencies correspond to bass, midrange, and treble sounds.

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Figure 1 Audible Frequency Range



Other Tech Tips:

- Tip 36: IWTS IP vs. non-IP versions
- Tip 37: That's a Gross Distortion
- Tip 38: Why no Back Box for 28 SUB?
- Tip 39: Receiver setup for the FS-7.0

Figure 2 Speaker frequency responses: Good and bad

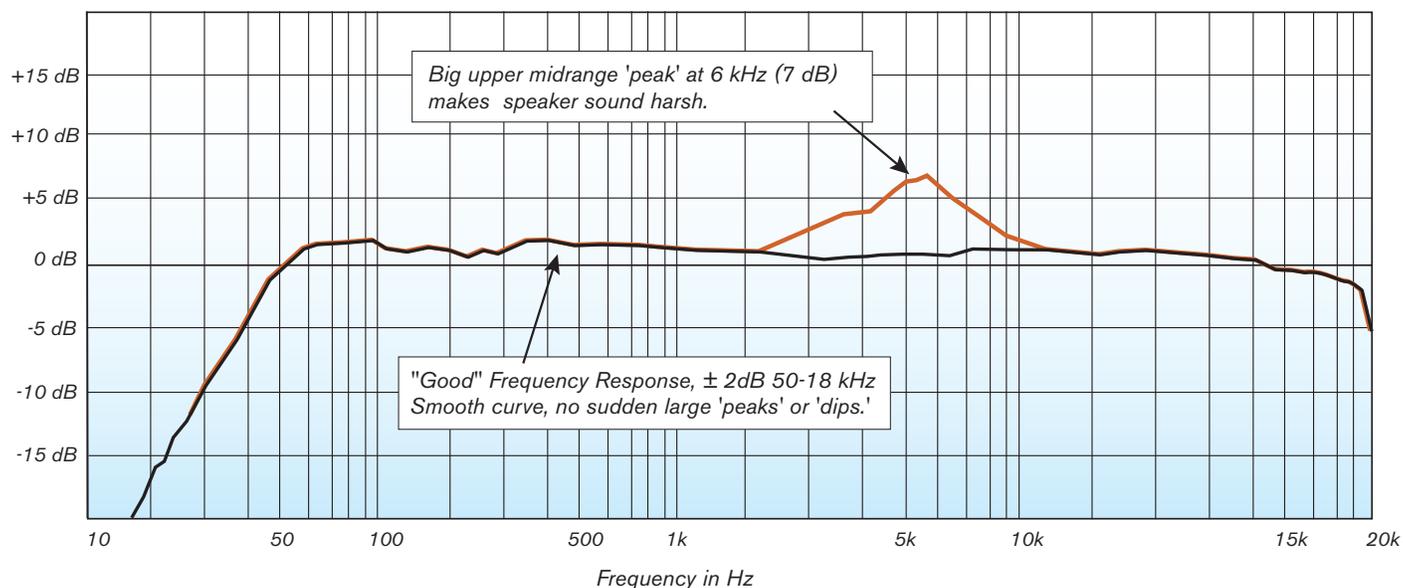
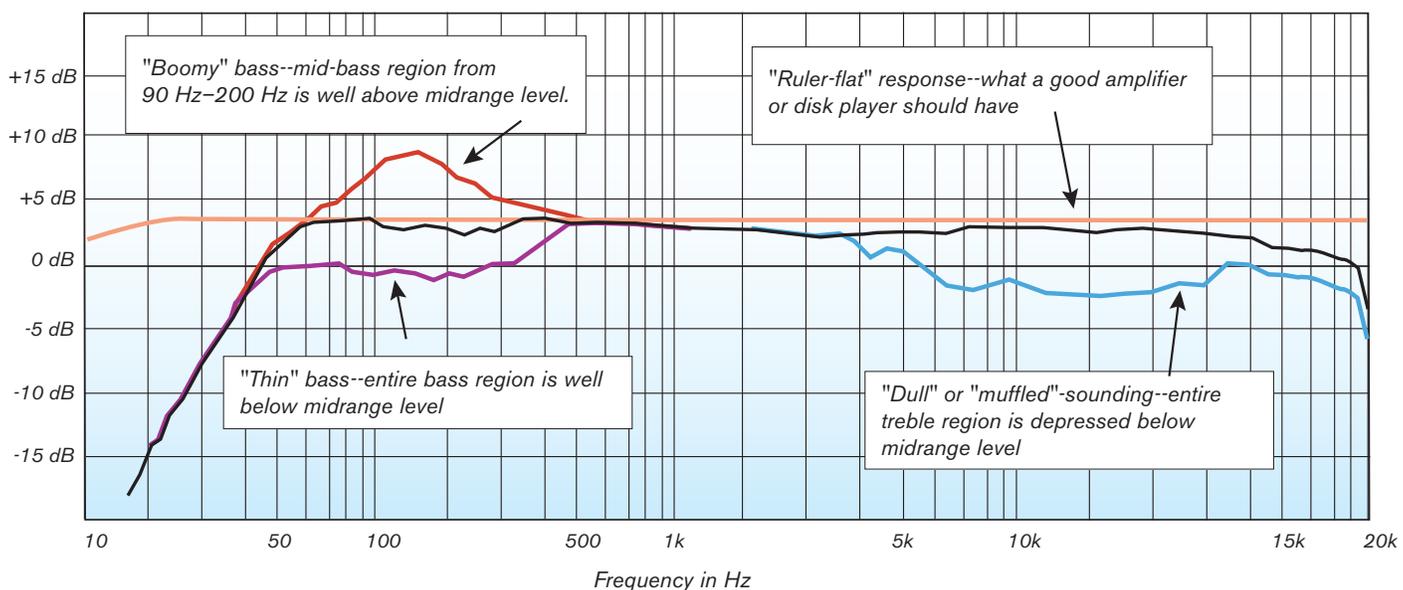


Figure 3 Audio terms shown as frequency responses



Now look at Figure 2. The black line is a speaker with excellent frequency response. The frequency response curve (so-called because a speaker's frequency response curves, or drops off, in the low bass and high treble) is pretty flat ("flat" is good, because it means the device is accurate), with no serious peaks or dips. For speakers, ± 2 or 3 dB is considered very good.

By contrast, the red line in Figure 2 shows a speaker's frequency response with a big 7 dB peak (so-called because the graph looks like a mountain's peak) in the upper midrange around 6 kHz, which will make it sound harsh and irritating.

Figure 3 shows what response curves look like that correspond to various subjective descriptions.

Learn these terms and learn how they look as frequency response graphs, and you'll be on your way to a meaningful understanding of audio.