Subject: Energy along frequency spectrum
Posted by GarMan on Thu, 27 May 2004 17:47:19 GMT
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Can someone provide me with some rule-of-thumb regarding the division of energy along the frequency spectrum. For example, 50% of energy is typically found below 250Hz?How is this information translated into amplification power requirment? For example, if a 2-way is crossed and bi-amped at 1.5KHz, and only 25% of energy goes to HF, does this mean the HF can can be 1/3 the power of the LF amp?Gar.

Subject: Re: Energy along frequency spectrum
Posted by Wayne Parham on Thu, 27 May 2004 22:52:31 GMT
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Most energy is required in the midrange, followed by midbass and bass. There's less power requirement for the HF amp in a bi-amped system because there's generally less signal content. Also, because the HF signal isn't riding on top of a LF signal, removing the LF component makes less of a peak-to-peak voltage requirement too.Rod Elliot has written a pretty good article that describes some of the issues. Check it out:
Benefits of Bi-Amping

Subject: Re: Energy along frequency spectrum
Posted by Bill Fitzmaurice on Fri, 28 May 2004 10:35:10 GMT
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Another way to look at this question is vis a vis excursion; for equal power output excursion increases at 6dB (factor of 4) per halving of octave, so it takes roughly 4 times the power at 1kHz than at 2kHz for equal output. Similarly, pink noise, which reasonably duplicates audio program material, decreases in power at a 6dB/octave rate as frequency rises. Power requirements tend to level out below 80 Hz and above 8kHz, as natural signal sources (instruments) also level out in power requirements at the ends of the spectrum, though artificial sound sources (electronic instruments) can have higher first and last octave content. Generally speaking a rule of thumb is that 75% of power requirement is in the band up to 500 Hz, 20% from 500 to 5kHz, and 5% from 5kHz on up for music program.

Subject: Re: Energy along frequency spectrum
Posted by Wayne Parham on Fri, 28 May 2004 14:35:25 GMT

This isn't exactly on topic, but it's related.I define the midrange band as 100Hz to 500Hz, whereas I think many consider it to start much higher, like 500Hz. Not that this is right or wrong, it's just a definition, a label used to communicate an idea. But I consider a driver used above 500Hz or 1000Hz to be a tweeter more than a midrange.Middle C is 260Hz. To me, that's squarely centered in the midrange. One octave below (130Hz) is the start of midrange, where it transitions to midbass and bass. 60Hz to 130Hz is midbass, and 60Hz down is bass. Below 20Hz is infrasonic, certainly felt but not heard.One octave above middle C (520Hz) marks the start of the overtone region. Sopranoes hit notes an octave higher and more, so the overtone region and the fundamental vocal range overlap between 500Hz and 1500Hz. The overtone range for voice overlaps with the overtone range for many instruments too, so a definition of this region is fuzzy because overtones vary so much in content and distribution. But I tend to mentally think of a artificial boundary, an end of the overtone region of about 5kHz.That leaves the last two octaves, the treble region 5kHz to 10kHz and the top octave above 10kHz. This is where cymbals, chimes and brushes live. It's the splash and the air and where the leading edge of transients are represented. Above 20kHz is the ultrasonic range. It can be shown that humans cannot identify sounds much above 20kHz, but there is some debate as the whether or not energy above 20kHz can be sensed in some way, perhaps by artifacts caused by interaction with audible frequency components.Seems like Elliot estimated that 1/2 power is generally required below Middle C or so, and 1/2 above. That puts half the power in the midrange, midbass and bass and the other half in the upper midrange, overtone and treble range. It also means that half power is used in the first third of the audible range. You can break the range into three decades, marked by 10x frequency divisions each, for a total of 1000-fold frequency range. The first 10x range carries half power, and the next 100x range carries the other half.

Subject: Re: Energy along frequency spectrum
Posted by Bill Fitzmaurice on Fri, 28 May 2004 19:05:47 GMT

I'd say that 1/2 power above and below 260 odd Hz is about right. Definition wise I'm a bit more retro as to what's where, so if you take a 'traditional' 3 way system crossed over at 500 Hz and 5kHz then that's where I'd delineate the bass, midrange and treble. On the other hand, my own modern home system crosses over at 100 Hz and 6 kHz, so it gets harder to define what is a woofer and what's a midrange driver or tweeter.Another way to look at it is fundamentals versus harmonics and overtones; taking the electric guitar as an example the fundamentals run up to about 1280 Hz (the highest E note with 24 fret scale), though a 1280 Hz fundamental is also a 2nd harmonic of 640 Hz and fourth harmonic of 320 Hz and so forth. In any event there's no question that it takes a lot more energy to push the bottom end than it does the top, and a good, if rarely used combination, would be a robust SS amp for the bottom end and a pristine 3 watt SET for the highs.

Subject: Re: Energy along frequency spectrum
Posted by Wayne Parham on Fri, 28 May 2004 19:32:24 GMT
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I agree with you Bill, and I think it's an important and fair statement. A three-way loudspeaker has a woofer, midrange and tweeter. So whatever frequencies the midrange driver covers, it's midway between the woofer and tweeter, hence the name "midrange."I just wanted to point out where the vocal range was, and to illustrate it by mentioning the frequency of middle C.