www.burwenbobcat.com  www.burwenaudio.com

FREQUENCY RESPONSE IS MOST IMPORTANT

Dick Burwen

SUMMARY OF 1ST RECORDING

The first recording in this series on HOW TO ACHIEVE HIGH FIDELITY SOUND was on how to make MP3s sound better than the original CDs from which they were recorded. It described two types of frequency response curves. One is the general trend or smooth frequency response, and the other has many resonant peaks and valleys produced by high-frequency reverberation. The combination of the two curves can make your music more natural, smoother, and more musical.

Even in my first hi-fi audio system back in 1945 I found that frequency response was the most important characteristic. I used equalization (EQ) to extend the frequency range of my loudspeakers downward and to balance the tone on different types of records so everything sounded a lot more pleasing than the original recordings. I carried this theme throughout my life and many different sound systems. Believe me, frequency response is really what makes the sound system. You can get a lot more out of your speakers if they are equalized for the optimum frequency response.

YOU HEAR TENTHS OF A DECIBEL

Many people think you can equalize by measurement. There is a lot of development going on and many products on the market use automatic measurements and digital signal processing (DSP) for frequency response compensation via one or several microphones. The problem is you don't know exactly where to put the microphones to get the best sound, and while they help, these systems cannot equalize close enough to optimum.

I found that your ear is very sensitive to the trend of the frequency response curve. When remastering music recordings, once the sound has been nearly perfectly balanced, as little as 0.1 decibels (dB) tilt in the frequency response curve becomes important. If your tonal balance is way off, as much as 2 dB may be barely detectable, but when the tonal balance is nearly perfect, as little as 1/10th of a dB can become important.

For readers not familiar with decibels, here is the idea: dB = 20 x log (voltage/voltage refererence) = 10 x log (power/reference watts) It gives you a logarithmic scaling that roughly corresponds to how you perceive sound and the ability to carry out multiplication of ratios by simple addition and subtraction. Specifically:

0.1 dB = 1.0116 x voltage (1.16 % more) = 1.0233 x power
3.01 dB = 1.414 x voltage = 2 x power
20 dB = 10 x voltage = 100 x power

40 dB = 100 x voltage = 10,000 x power
60 dB = 1000 x voltage = 1,000,000 x power

EXTENDING THE FREQUENCY RANGE

EXTENDING the frequency range and achieving near-perfect tonal balance is not something that's easy to do. It takes time and you have to acquire some skill to do a really good job. Any loudspeaker can be very noticeably improved by tweaking the system frequency response. The difference you make in frequency response may be only tenths of a dB or it may be several dB. Those last tenths of a dB prove to be very important when your speaker system is in good balance.

Audiophiles tend to be purists and many do not believe in using equalization. What they don't realize is they really do place frequency response first and they mix-and-match pieces of equipment to obtain most pleasing overall frequency response. For example, audiophiles match amplifiers with speakers to find a combination that sounds good. A fortunate combination of a moderate-feedback vacuum tube amplifier and speaker system may boost the mid-bass a bit to produce pleasing warmth. This occurs because the effective internal resistance of the amplifier makes a voltage divider with the speaker load, and the loss in output is smaller at the resonant frequency of the speaker where the load is lighter.

What an audiophile really should use is a high-feedback semiconductor amplifier that has a near-zero internal output impedance and and acts like a perfect voltage source. Like AC power available from your wall, the output voltage hardly drops at all when you connect a load. Then changing the frequency response with an equalizer or tone control system can produce more solid, better-damped bass that more accurately represents the recorded sound or a pleasing boosted bass. A professional semiconductor amplifier designed for sound reinforcement is likely to deliver many times the undistorted power of vacuum tubes. It won’t wear out like tubes, it will likely cost a lot less over its lifetime, and will produce less heat. It just won’t glow in the dark.

EQUALIZED SUBWOOFER

While audiophiles tend to reject EQ, many accept active subwoofers, not realizing they are accepting extreme EQ. This is a prime example of how extreme equalization can work. For example, Sunfire makes a 10 inch subwoofer in a closed box that contains only one cubic foot. A box that small and a speaker, even with a heavy cone, is bound to roll off the low-frequencies below a resonant corner frequency of perhaps 70 Hz. Inside the box, there is a 1000 W switching power amplifier and equalizer that is able to flatten the frequency response of the speaker to below 20 Hz while removing the fundamental resonance. It delivers plenty of power to drive the long-throw speaker cone and move a lot of air. You don't have to worry about whether you have enough power available.

EQUALIZE YOUR SPEAKER SYSTEM

If you just want your sound system to accurately reproduce whatever is in a recording, good or bad, then you want a system which is accurate on what you consider to be reference program material. That may be a tall order, but let's assume you have picked out one or more recordings that you consider to be reference material. No matter how much you pay for a

loudspeaker, it won't be perfect on that material. But if you spent a lot of money, it may be pretty good. However if you add some equalization you may be able to make it much more accurate in your own estimation. The change in frequency response may be 15 dB. Or it may be only tenths of a dB, at least in the frequency range from 200 to 4,000 Hz. Therefore you need an equalizer that has resolution in steps of only 1/10th of a dB in order to do the best equalization job.

If you own an inexpensive speaker system it may need a lot of compensation. An inexpensive equalizer or a free one like that which comes with the Windows Media Player may do a lot of good. Generally what is needed to compensate your speaker system at low frequencies is an equalizer capable of boosting the bass at 12 to 18 DB per octave, depending upon how fast the speaker cuts off the low frequencies. At the lowest corner frequency before the bass falls off, the frequency response may peak. So your equalizer may need a capability for canceling the resonant peak at the corner frequency. Choosing a high-feedback semiconductor amplifier will likely damp the the corner peak and the result can be quite good without cancellation. Once you have such an equalizer you will find it really does extend the bass lower in your particular room.

ROOM ACOUSTICS

Every room needs some acoustic sound absorption. I personally like a fairly live room. The optimum amount of sound absorption for each room is different and greatly dependent upon its size and shape. A perfectly rectangular room has a lot of strong resonances due to parallel surfaces and needs more absorbing material than a room that has nonparallel surfaces. Both the shape of the room and the sound absorbing materials control the strongest resonances. Furniture and rugs contribute much of the needed absorbtion. Once you have a room nearly optimized you will find that people and their clothing affect the sound by blocking and absorbing it.

What you like to hear is a lot of room resonances distributed fairly evenly over the audio range with no one resonance standing out like a sore thumb. So to get good sound, you have to control the strongest resonances, and the general trend of the frequency response curve has to be just right to suit your ears.

PROGRAM MATERIAL VARIATIONS

If the shape and sound absorbtion of your room are near optimum and your speaker system is well equalized, you now have a system that sounds very good on your reference recordings. When you play ordinary recordings, you will hear them the way they were released with all their imperfections.

My favorite country singer is Merle Haggard. When I hear some of his older recordings, I can't stand listening to them the way they were recorded. If I could not further equalize them, I would never listen to them at all. His voice is so screechy, it just grates on my ears. Yet, when Merle’s voice is equalized, it is beautiful and very musical. This is one big reason why I spent so much of my life developing tone control systems and my dynamic equalizer, NO SCREECH.

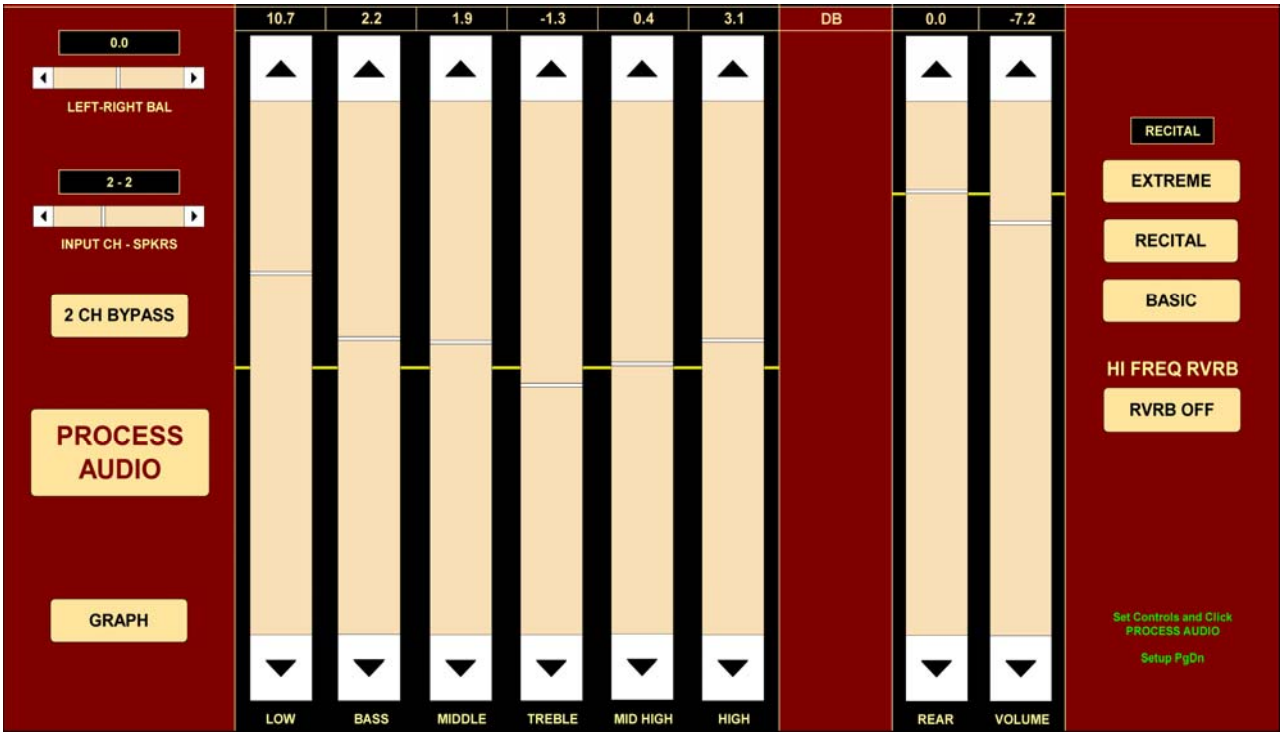
Variations in the sound quality of CDs are huge. In my own collection of about 3000 CDs, I don't think I have a single recording that doesn't require us some degree of equalization. For 30 years I recorded live classical concerts, even using some EQ built into a mixer I designed. I used to think these recordings were really high fidelity. Now my standards are higher and I have started remastering them with added EQ. My recordings were generally made via two omnidirectional microphones and I am now converting them to 5 channels by adding ambiance into the rear and front channels using my high frequency reverberation. To make completely remastered recordings I use my professional AUDIO SPLENDOR PC software, described at www.burwenaudio.com, which provides a huge range of EQ in fine steps of only 0.1 dB. This system has the power of a more than 310 slider studio console with 357 buttons.

If you don't want to equalize for the program material but just want to tweak the sound of your speaker system to near perfect on what you consider to be a reference recording that is your right. Then you will hear ordinary CDs just as they were recorded with all their problems. Some audiophile purists think it is a crime to improve the sound of any recording because you are tinkering with someone else's art. I personally get satisfaction from making recordings enjoyable by removing the injustice done to the artist's talent in the recording studio.

BURWEN BOBCAT TONE BALANCER

Whether you just want to improve the sound of your speaker system or get beautiful 2-channel or 5-channel sound from your CDs and music downloads, BURWEN BOBCAT TONE BALANCER (BBTB) is the easy-to-use tool for the job. This software has 6 tone controls, LOW, BASS, MIDDLE, TREBLE, MID HIGH, and HIGH. Each control boosts or attenuates over a 20 dB or 30 dB range in steps of only 0.1 dB. All the controls are completely independent from one another and their decibel settings add up – to as much as +/- 70 dB at 15 Hz and 20 kHz. This program sends new sounds to BURWEN BOBCAT TR (BBTR) which is included, and it plugs into the Windows Media Player. BBTR was introduced in my first recording. It is capable of adding my unique high frequency reverberation together with slight equalization to make music files that sound better than original CDs. Both BBTR and BBTB are directly derived from AUDIO SPLENDOR and utilize the same 1,400,000 mathematical formulas.

Each program is covered in full at www.burwenbobcat.com, including detailed operating instructions, and is demonstrated. They will become the subject of one or more talks available in MP3 and PDF formats.



BURWEN BOBCAT TONE BALANCER