Audio Frequency Response Tests

Rick Campbell 11/27/07

Abstract: This paper describes a basic procedure for measuring the frequency response of audio systems, and measurements of the electronic path of an acoustic music amplification system. A reference noise source is first obtained and recorded. The recorded reference noise source is then used with a Laptop-based 2 channel FFT analyzer to compare a direct reference path with the path through the audio system.

The first requirement is a set of reference noise recordings. Pseudo random noise generators can provide a reference signal, but the randomness is always subject to some suspicion. Our lab has the capability of amplifying, frequency converting, and band limiting the thermal noise in a resistor. The block diagram of the system is shown in Figure 1. The Racal 5760/gm reference receiver has 5 selectable flat-topped bandpass filters that may be placed anywhere in the audio frequency range.

An assortment of reference noise recordings have been made at various bandwidths and center frequencies throughout the audio range. Since the primary interest for these measurements is the range from about 10 Hz to 8 kHz, an 8 kHz bandwidth noise reference was used for all of the measurements reported here. The same noise source is recorded on the right and left channels of the stereo wave file, which is then transferred to CD and then the Ipod using standard software.

Figure 2 is the measurement system block diagram. This set of measurements was designed to study the response of a Schertler David audio amplifier with its tone controls empirically adjusted to provide good sound quality in a coffee house venue with a DPA 4060 microphone element on an instrument mount 1 cm above the sound board of a 1921 Gibson H-4 Mandola. Figure 3 shows the Instrument mounted microphone element.

Note that the measurements illustrated in figure 2 includes only the electronic path through the amplifier, and not the acoustic signal from the microphone. Once this preliminary study has been completed, a more extensive study including comparison of the spectrum of the instrument mounted DPA 4060 microphone element with a reference DPA 4006 microphone at various distances from the mandola sound board will be conducted. These future measurements will provide more insight into the frequency response of the instrument mounted microphone system and should help in our understanding of the subjective adjustments of the Schertler David amplifier. Note that the doctor K direct box is in the system for both the reference noise recordings and the Schertler David tests. An independent measurement of the doctor K box needs to be made.
Figure 2 Frequency Response Measurements
Marshall
Standard Preamp Tone Control

Americanized Baxendall circuit from National Semiconductor Audio/Radio Handbook p 2-53