

FIGURE 10-3 Noise density plots (volt/Hertz<sup>1/2</sup>).

You will notice that we have selected the output of the equalization as our noise output and the signal generator of the phono-cartridge as our reference input. We have selected a frequency response analysis with a range of 20 Hertz to 20,000 Hertz to cover the entire audio range. This is the range over which the noise calculations will be made. After running PSpice, we may graph the noise results directly. But first, let's look at the transfer function of the equalizer, so you will understand some of the noise calculations we try later. The transfer function is displayed in Figure 10-2.

With 1,000 Hertz as the unity gain reference frequency, you can see that the lower frequencies get quite a boost. Let us see how this changes the noise from our pre-amplifier. As shown in Figure 10-3, the boost in the equalization circuitry amplifies the noise from the phono-cartridge and input load. Fortunately, the human ear is not as distracted by noise at lower frequencies as those in the mid-range (where the noise has already approached its lowest value).

## 10.5 CALCULATING TOTAL NOISE AND S/N

Using the phono-cartridge example from the previous section, we will use Probe to directly calculate noise totals. Total noise is the overall variance of the combined noise fluctuations at each frequency. This is the RMS calculation we discussed earlier. In Probe, so long as the frequency range for the calculation has been simulated, we can directly calculate total noise as shown.

The plot in Figure 10-4 is the running total of the noise contributions at each frequency, so that the right-most point on the graph is the total for the entire range of frequencies. The cursors are used, in Probe, to measure the total RMS noise