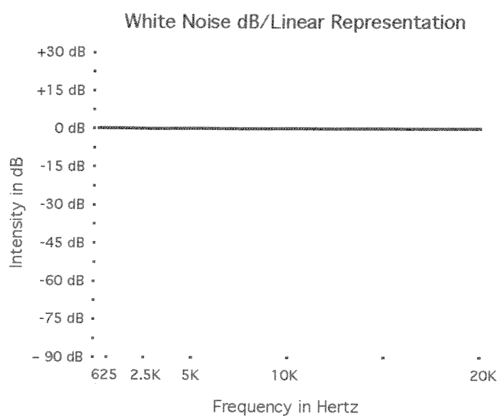
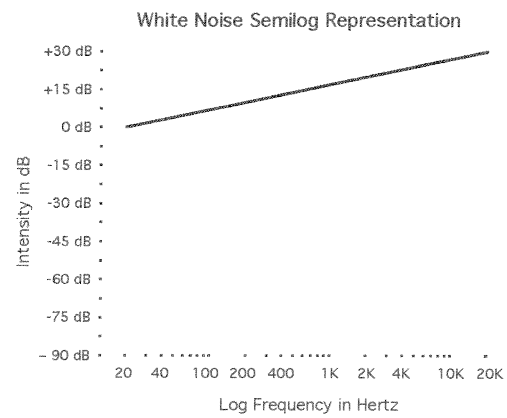
Noise

Noise is a *random* signal, one that is totally without repetition or pattern of any kind. Noise is therefore an *aperiodic* signal. The typical Noise spectrum features many partials that are *not* harmonically related to each other. Typically, each partial in a Noise spectrum is not depicted individually, but the "frequency response" of the spectrum is summarized with a single line.

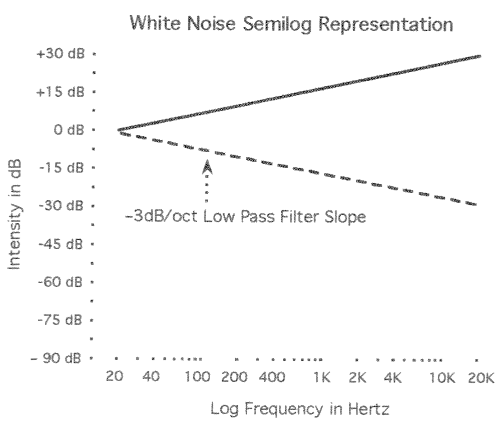
White light contains all visible frequencies. *White Noise* has all *audible* frequencies, with equal power per *frequency unit*. The amplitude and phase of each frequency in White Noise fluctuate randomly. The *average* power of *any two* discrete frequencies is the *same* in White Noise, and the *average* power of any two *groups* of frequencies of similar size (e.g. 5-10 KHz and 10-15 KHz) is the same. When White Noise is depicted on a dB/linear graph (below left), its "spectral envelope," or "frequency response" (more properly, *amplitude* response) will appear as a "flat" line. The many partials in White Noise are shown in a *linear* representation by a single horizontal line, indicating *equal* power per frequency unit.

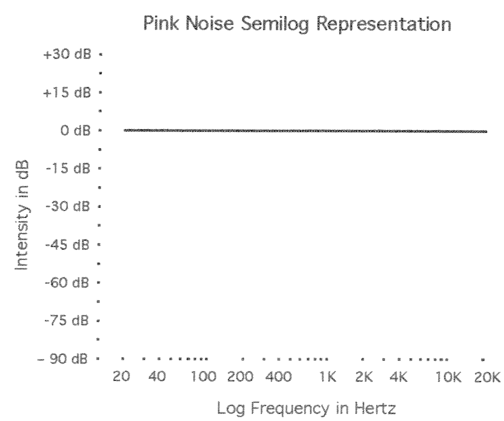
As the dB/linear graph shows, each successively *higher* octave has *twice* the number of frequencies. (Compare 5-10 KHz and 10-20 KHz). This is a doubling, or 3 dB increase in power per octave (+30 dB for the 10 octave audio frequency span). That White Noise is more powerful in the *treble* is obvious in the semilog representation (adjacent right). The many partials in White Noise are shown in a *semilog* representation by a single *slanting* line, indicating *increasing* power per *ascending* interval bandwidth.

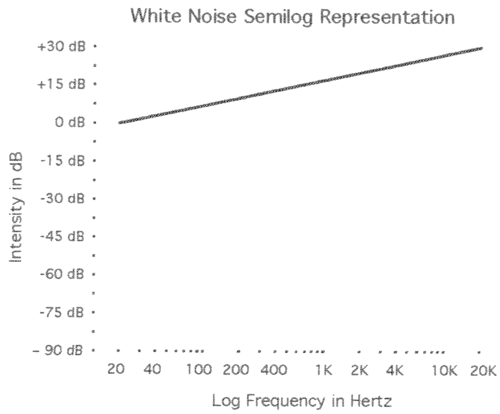


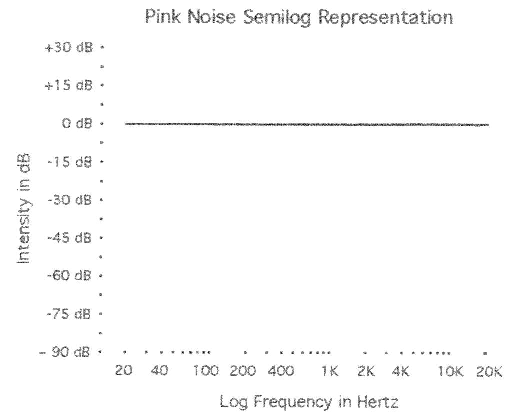


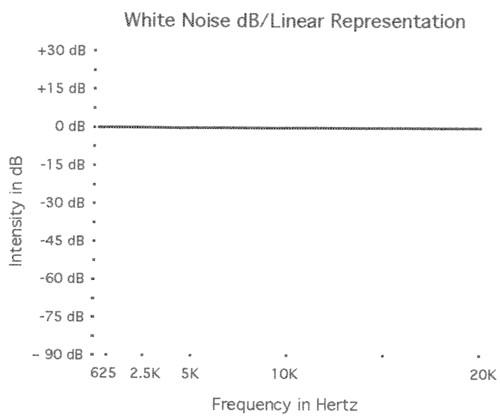
Pink Noise has equal power per *interval* bandwidth, e.g. per octave. Pink Noise is useful in many audio tests. For instance, the frequency response of a room can be determined using a Real Time Analyzer while monitoring high level Pink Noise. As the semilog White Noise representation (below left) shows, White Noise filtered by a Low Pass filter with a –3 dB/octave slope will yield Pink Noise, as shown in the Pink Noise semilog representation (below right). The many partials in Pink Noise are shown in a *semilog* representation with a single horizontal line, indicating a "flat" response per interval bandwidth, i.e. any musical interval. Note that filtering causes an "insertion loss," giving Pink Noise a lower level.

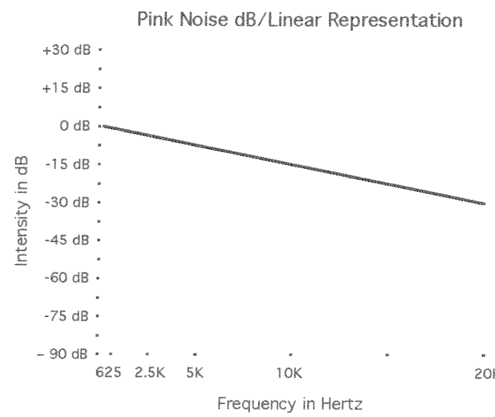






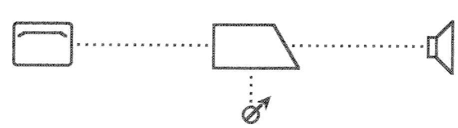






The graphics above summarize the relationships among linear and semilog representations of White Noise and Pink Noise. Note (bottom right) that a *linear* representation of Pink Noise graphically depicts the filter slope used to process White Noise in order to produce Pink Noise. Although linear and semilog representations of the same thing contain the same data, each has respective utility in how data are interpreted. In particular, the "flat" representations of *both* White Noise and Pink Noise portray the difference between whether *frequency unit* or *frequency interval* is portrayed as the unit of measure.

To hear the *spectrum* of Noise, connect the patch to route Noise through a sharply resonant (high Q) Low Pass filter or a very narrow Band Pass filter, and monitor. Move filter *cutoff frequency* throughout the audible frequency range. Noise has no discernible harmonics such as geometric waveforms (sawtooth, etc.) Alter resonance (or bandwidth), and repeat the procedure. Since Noise contains "all" frequencies, narrow noise bands will produce a semblance of pitch.



To demonstrate the *waveshape* of Noise, connect the patch to route noise through a Low Pass filter. Adjust resonance to *minimum.* Use this signal as a *control* signal by connecting it to the FM input of a VCO, and monitor VCO output. Lower the *cutoff frequency* and listen for "slow, random modulation" of oscillator frequency. Apply this signal to other control inputs.