Loudspeaker Power Rating – Is it Just a Number?

Have you ever burned out a loudspeaker? If so, you've learned the hard way that the manufacturer's loudspeaker power rating-sometimes called power handling or power capacity-is important. This rating, which appears in the loudspeaker's specification sheet, is often understood to answer the question, "How far can I turn it up before I burn it out?" But this is only one of the possible uses of a power rating. Power ratings are essential for creating a sound system that both sounds good and is reliable in the intended application - whether that be for ultrasound devices in medical settings or for professional sound systems in concert halls and arenas.

Power ratings, often expressed in watts (from 0.1W for small speakers to 1000W for large speakers), refer to how much power the speaker is designed to safely receive from an amplifier. A power rating can also define the power level that when exceeded will cause the speaker to exhibit:

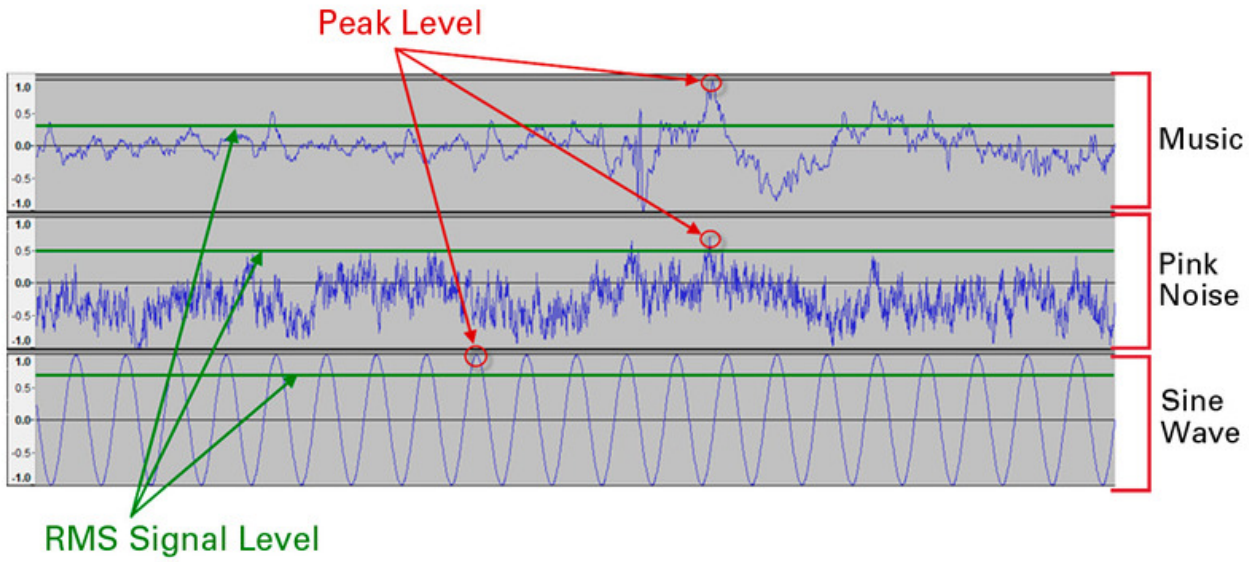
- excessive distortion
- mechanical "bottoming" (i.e., soft parts hitting hard parts)
- power compression (more power in does not create more sound out)
- voice-coil wire breakage (commonly known as "blown speaker"

$$Watts = Volts\ x\ Amps = \frac{Volts^2}{Ohms} \quad \Big| \quad Watts\ Peak = Volts_{Max}\ x\ Amps_{Max} = \frac{(Volts_{Max})^2}{Ohms}$$

Equations for Calculating Power in Watts and Watts Peak

In addition to confusion over what a power rating means, there is also a wide variation in power-rating standards for loudspeakers, which are technical standards set by industry organizations. For example, you may see ratings that look like AES2-1984 (from the Audio Engineering Society) or EIA-426B (from the Electronic Industries Alliance) or IEC 60027 (from the International Electrotechnical Commission). Ratings from different standards bodies are developed using different test conditions, signal types, and levels, making it difficult for consumers to compare ratings from different standards systems. Furthermore, most manufacturers use terms like "maximum," "peak," "average," or "program" power handling. While providing guidance, these terms are not tied to published technical standards and are therefore open to interpretation, which can also be confusing.

But perhaps most significantly, loudspeaker ratings do not take the user's specific needs into account-where and how the speakers will be used and with what input signal (e.g., music, pink noise, sine wave, voice, etc.). A military alarm speaker may operate at one frequency (like a sine wave) at very high power for a very long time in a harsh outdoor environment. Its power-handling requirements will be different than that of a full range speaker in a home hi-fi system that produces a wide range of frequencies (e.g., music) at moderate power levels in a controlled indoor environment. An example of different signal types and how they differ in peak and RMS levels is shown on next page.



Example of Different Audio Signals Peak and RMS Signal Level

The frustrating truth is that the loudspeaker industry is diverse and disaggregated and serves many markets. For that reason, it would be wise to think of power ratings as guides or reference points. Have a discussion with your loudspeaker manufacturer about your specific audio requirements and application-the input signal, the speaker enclosure, the duty cycle, and whether the rating will be related to durability/reliability or to distortion and power compression. They can help you determine your individual power-handling needs.