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Chapter 4

Can An Amp Put Out More Power Than a 'Wall Socket' Can Deliver?

by
Hartley Peavey

Can an amp put out more power than a "wall socket" can deliver? I have encountered this discussion numerous times. It is a fairly complex issue that even some fairly decent technicians don't understand. The simple FACT is that you cannot get more power out of an amplifier (CONTINUOUSLY) than the wall socket can provide! No power amp is 100% efficient, but the situation with peak and/or music power is quite a bit different than average power or what most people refer to as RMS (root mean square) power.

First of all, Watt's Law dictates that the total power (P) may be obtained by multiplying voltage (E) times current (I), i.e. P = I X E… (20 amps X 120 volts equals approximately 2,400 watts). This is assuming that you a have a well regulated 120 volt supply and a 20 amp breaker… The fact is, 20 amp breakers can rarely supply 20 amps CONTINUOUSLY, and even at that, the VOLTAGE usually DROPS considerably from the nominal 120 volts when you are pulling that much current. Given the 120-volts/20 amps scenario, you are pretty much stuck with an AVERAGE maximum of 2,400 watts.

Most people do the math on this and ASSUME that 2,400 watts is all you can get out of a wall socket… At first glance, this is true, but then the amplifier itself has the ability to STORE energy in its INTERNAL power supply CAPACITORS. If we are talking about purely RMS (average power), we are talking about SINEWAVES and if the discussion is limited to the amount of sinewave power, then the argument about the amount of available power out of the wall socket has some validity.

In the real world, we usually do not encounter "sinewaves" but in fact, some kind of "musical waveform" that is anything but a "sinewave." There are "peaks and valleys" in the signal that contribute to the complexity of this issue. Since our products are designed to reproduce music, the additional headroom afforded by our amplifiers is indeed considerably in excess (on peaks) of what is available from the wall socket on a continuous average (RMS) basis.

A simple listening test will quickly illustrate the superiority of a higher-powered amplifier than the supposed 2,400-watt theoretical maximum power. It is true however, that for long term (continuous) average power you cannot exceed the power available at the wall socket. There is a huge "differential" in musical peaks and zero power especially considering the "time domain" of musical waveforms. It is indeed possible to instantaneously deliver considerably in excess of the theoretical power available from the wall socket by virtue of the stored energy in the amplifier's power supply capacitors.

Simply put, it is possible to deliver more power on "peaks" because of the time constants involved and because of the ability of the power supply to store considerable energy. What we are talking about here is enough power (headroom) to handle musical peaks without clipping. And while it is "technically correct" that you can't get more (continuously) out of the amp than is available at the wall socket, the additional headroom afforded by high-powered amplifiers is readily recognizable and audible… Otherwise, no one would ever buy (or produce) an amplifier having power rating greater than 2,400 watts. Obviously, Peavey, Crest, and many other companies offer amplifiers far in excess of what is "theoretically" available from the wall socket. It would seem rather apparent that users of these high powered amplifiers have long recognized the utility in having the peak power available in order to reproduce musical transients cleanly.

DOWN THE TUBES

I have a somewhat "gross" analogy that I have found quite effective over the years… Here goes… When you flush a toilet, you can instantaneously achieve a short term "massive flow" of water… FAR MORE in fact, than the small water supply pipe feeding the toilet could deliver on a CONSTANT (continuous) basis… Why? The toilet's water tank stores up a considerable quantity of water and releases it on demand… Obviously, it takes some time for the tank to "recover" given its small water supply pipe, but the toilet's ability to deliver a large quantity of water PERIODICALLY is quite similar to the power amp's internal power supply capacitors being able

to store up “energy” and deliver it instantaneously when required… The toilet (and high-powered amplifiers) can not deliver this volume of water (energy) CONTINUOUSLY, but absolutely CAN do it PERIODICALLY, and very reliably!

The “2,400 watt argument” is “half right and half wrong.” It is correct that you can’t get more (continuous) power out of the amplifier than the wall socket can deliver… The salient point here is that this is ONLY true for a CONTINUOUS average (RMS) power basis… It is NOT true that the “theoretical limit” represents the MAXIMUM power that can be delivered MOMENTARILY from the amplifier (i.e. by the P = I X R formula). Some modern “power factor corrected” power amp power supplies modify this generalized assumption somewhat. This is a very complex topic that most engineers understand only marginally.

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Peavey Electronics Corporation • 5022 Hartley Peavey Drive • Meridian, MS 39305
Phone: (601) 483-5365 • Fax: (601) 486-1278 • www.peavey.com • **80307343**