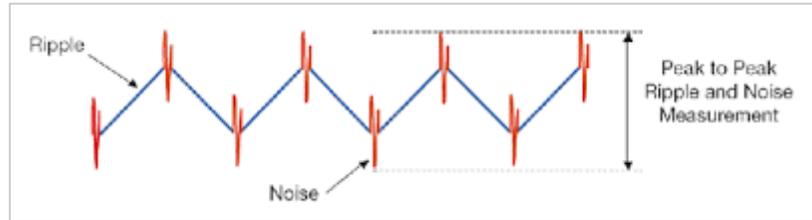


Friday, November 21, 2008

Ripple & Noise Specs and Measurements

AC-DC power supply and DC-DC converter datasheets should always include output "Ripple & Noise" specifications. The Ripple & Noise spec is sometimes referred to as Periodic And Random Disturbances or PARD. The following drawing shows how ripple and noise may look when viewed on an oscilloscope that is attached to the output of a typical switchmode power supply.



The output "Ripple" frequency is primarily determined by the switching frequency of the power supply. The higher frequency "Noise" spikes are generated by the fast rise and fall times of the pulses associated with the switching and rectification components of the power supply. Typical ripple and noise specs are defined as peak-to-peak measurements in mV units.

Ripple & Noise Measurements

Unfortunately, there is no universally accepted method for measuring ripple and noise. It seems that each manufacture, and sometimes different products from the same manufacturer, may have varying methods for these measurements. In some cases the bandwidth of the test oscilloscope is defined as 20MHz or 100MHz. In addition, added components such as capacitors, resistors, twisted wires, and/or coax are sometimes required in the test set-ups that are defined by the manufacturer. In order to meet the power product's specified ripple and noise specs, care must be taken to follow the manufacture's defined test set-up. There are a few standardized methods for ripple and noise measurements; one of which is the JEITA-RC9131A standard.

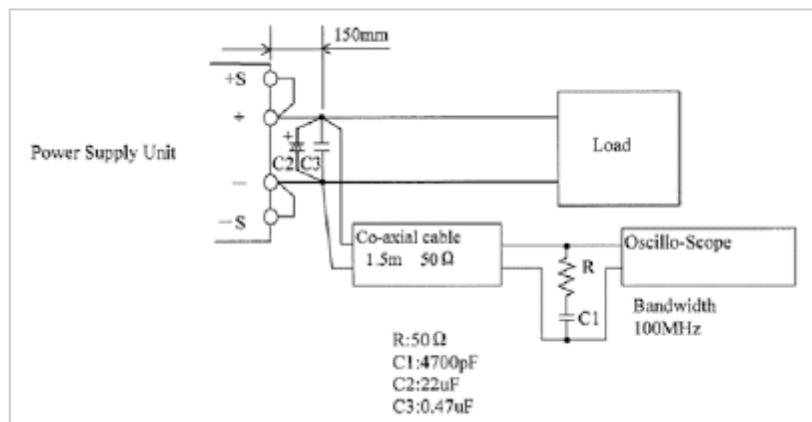


Fig 1: JEITA-RC9131A Ripple & Noise Test Set-Up

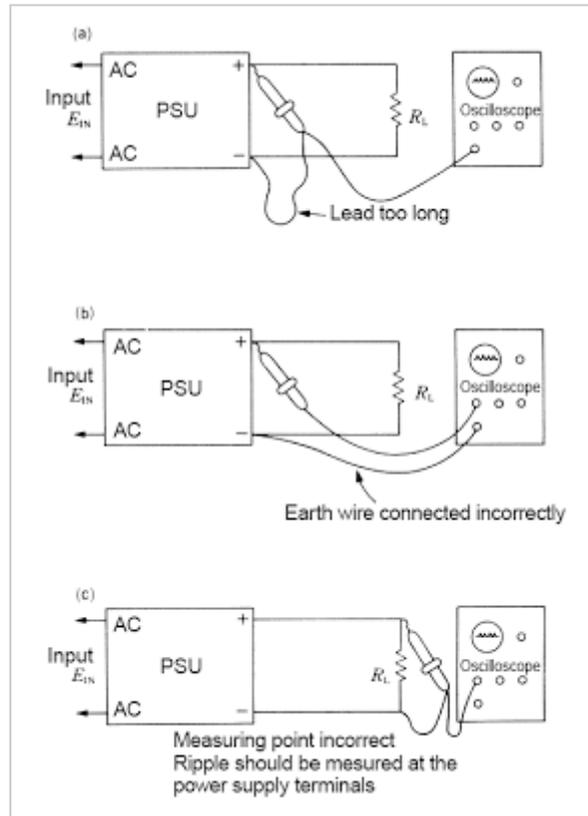
The above drawing (Fig 1) shows the test set-up per JEITA-RC9131A. This standard defines a custom oscilloscope connection comprised of a length of 50 ohm coax that is connected to the output of the power supply with the other end terminated at the scope with a 50 ohm resistor in series with a 4700pF capacitor. Notice that the coax is attached to the output of the power supply within 150mm or 6 inches of the output terminals and has two added capacitors (22uF electrolytic and 0.47uF film type) soldered across those points. The 50 ohm coax should not exceed 1.5M or 5 feet in length. All coax pigtailed and added component's lead lengths should be kept to a minimum to prevent pick-up of radiated noise.

Other Measurement Precautions

Some ripple and noise measurements can be made with the use of a standard oscilloscope scope probe that has been modified by removing the plastic tip cover and ground clip wire and replacing the ground connection with a short length of bare copper wire that is wound around the probe's ground ring. In this

way the probe's tip and ground connections are kept to a minimum length, thereby reducing the chance of the ground lead acting as an antenna and picking up radiated noise signals, which can result in out-of-spec measurements.

Figures (a), (b), and (c) below show incorrect set-ups for ripple and noise measurements.



When making ripple and noise measurements a standard load should be used. This precaution is to prevent any noise from the power supply's normal system load, which may contain noisy digital or RF circuits, from feeding noise back to the output of the supply, which again can result in out-of-spec test measurements. In some cases, to reduce ground loops, it may be necessary to isolate or float the oscilloscope from the AC source by plugging it into an isolation transformer.

Unless otherwise stated, the ripple and noise specifications are usually based on measurements taken while operating the power supply with its nominal input voltage, at the rated output voltage and current load, and at or near room temperature (typically 72°F to 77°F).

Posted by [Power Guy](#)