Output Noise of LDC500/501 Current Source

Rev B. Revised Oct 2012

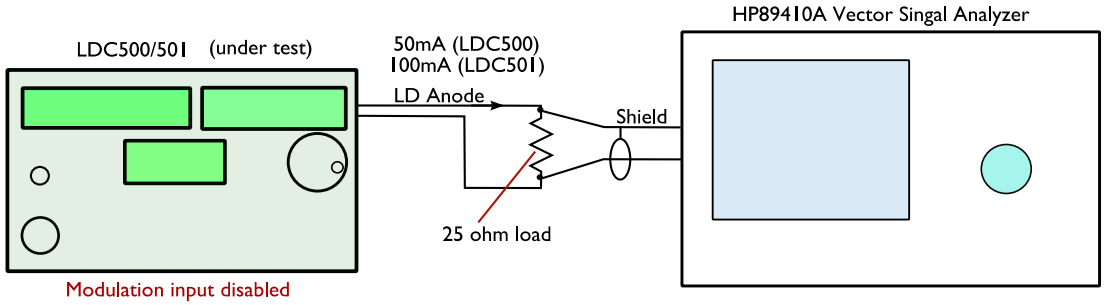

Figure 1 Laser driver noise spectrum measurement setup

LDC500 and LDC501 are equipped with an ultra low noise current source for laser diodes. The noise in the output current is a combination result of thermal noise (Johnson Noise) in resistors, shot noise in semiconductors, flicker noise (1/f noise) , and electromagnetic interference (EMI) inside or outside of the instrument. The noise in the output current could be regarded as an addition to the setting current.

We measure the output noise through a 25Ω resistor which converts the output current noise into a voltage noise which is then AC coupled to HP89410A signal analyzer. Figure 1 shows the measurement setup. Figure 2 shows the measurement result. The output current was set at 50mA for LDC500 and 100mA for LDC501.

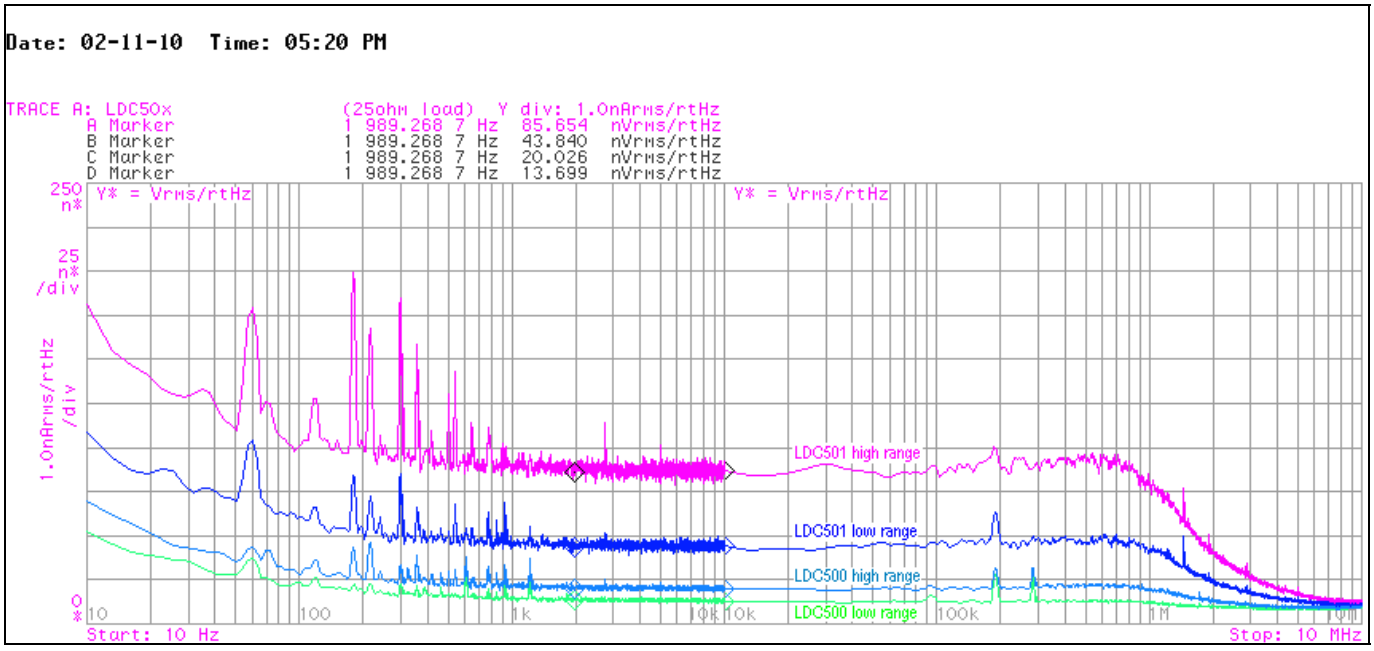

Figure 2 Voltage noise and current noise measured across a 25Ωload driven by LDC500/LDC501

In order to see details in the noise spectrum, the measurement was divided into two bands: 10Hz~10kHz and 10kHz~10MHz. Captured screens from HP89410A are cascaded at 10kHz as shown in Figure 2. During test, the LDC500 modulation input was disabled to reduce internal cable pickup. The voltage noise is read close to 2kHz (Marker A, B, C and D) and the output current noise is calculated using the formula: **(Voltage noise)/25Ω.**

Table 1 LDC500 and LDC501 Current Source Output Noise measurement Result

Model and Range	Measurement result (within 1kHz~1MHz)	
	Voltage noise on 25Ω resistor (nV/√Hz)	Calculated output current noise (nA/√Hz)
LDC501 500mA range	85.7	3.43
LDC501 250mA range	43.8	1.75
LDC500 100mA range	20.0 (18.0*)	0.80 (0.72*)
LDC500 50mA range	13.7 (10.0*)	0.55 (0.40*)

*A gain block of ×100 is used before HP89410A.

Table 1 shows the noise level between 1kHz and 1MHz (the number is read at 2kHz). Because of the measurement limit of HP89410A, we added a gain block of ×100 before HP89410A and the measured noise density is shown in the parenthesis.

A comparative test was also done with a competitor's controller, and the result is plotted in Figure 3. Both instruments are set at 500mA range and 100mA output. Although the competitor's laser driver has a bandwidth of DC~200kHz, its noise level goes up after 7MHz. At 60Hz, the competitor's current noise is 5.1755uV/√Hz, which is 30 times bigger than that of the LDC501.

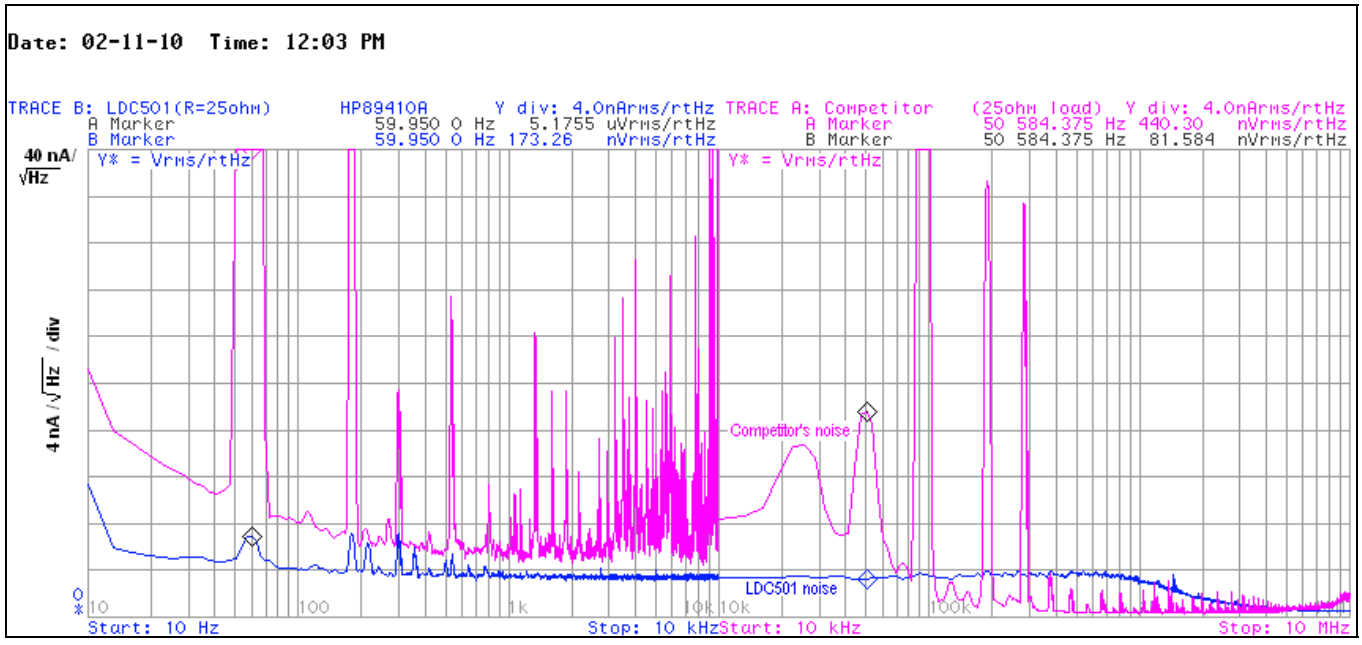

Figure 3 Comparison between LDC501 and competitor's laser driver