Broadband Noise Measurements for Laser Diode Current Sources

TECH NOTE

This technical note describes the measurement of broadband noise found in laser diode current sources. A description of the test setup is presented with the results shown in graphical form for a simple battery source, an ILX Lightwave LDC-3724 Laser Diode Controller and a competitor's Laser Diode Current Source.

OVERVIEW

Noise may be defined as any signal which does not convey useful information. It is introduced in measurement and control systems externally by mechanical coupling and coupling from electromagnetic fields. Noise can also be internally introduced within a system by noise sources such as the power supply and digital circuitry, as well as component level noise such as Johnson noise and shot noise.

Noise measurements in laser diode current sources are typically specified as an rms current over a specified bandwidth. This can be measured by driving a resistive load with the current source and measuring the resulting rms voltage across the load resistor with an rms voltmeter. Noise can also be measured by driving a laser diode with the current source, coupling the output light into a photodetector, and measuring the fluctuations on the output of the detector with an rms voltmeter. Noise can also be characterized in the frequency domain using a spectrum analyzer. In that case an indication of noise component amplitude in dBm over a desired frequency spectrum is attained.

MEASUREMENT SETUP

The test setup was configured as shown in Figure 1. An HP® Spectrum Analyzer, model 71100C, was used to gather the spectral data over the frequency range of 100 kHz to 120 MHz. The output from a New Focus® 125 MHz photodetector was AC-coupled to the input of the spectrum analyzer. A Sharp® laser diode, LT023MC0, was used as the light source. Three current sources were used to drive the laser diode, a simple battery source, an ILX LDC-3724 Laser Diode Controller and a competitor's laser diode controller. The battery source was used to show the noise floor of the laser, detector and RF measurement system.

The current sources were set at 60 mA in high bandwidth constant current mode.

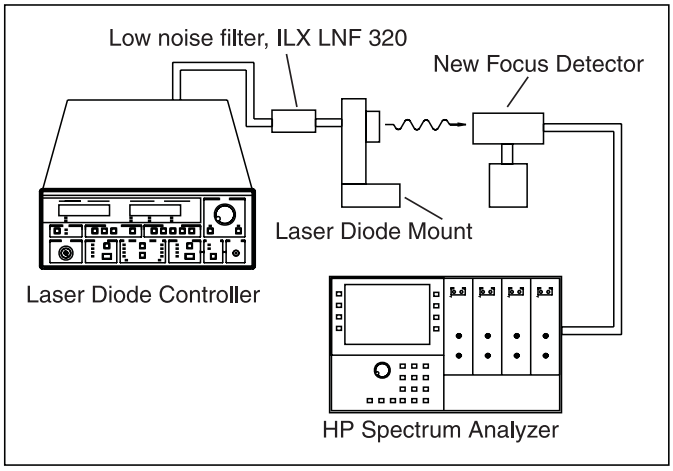

Figure 1. Broadband Noise Measurement setup.

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RESULTS

The spectral noise data was recorded for each current source and plotted as shown in the graphs below.