TECH NOTE

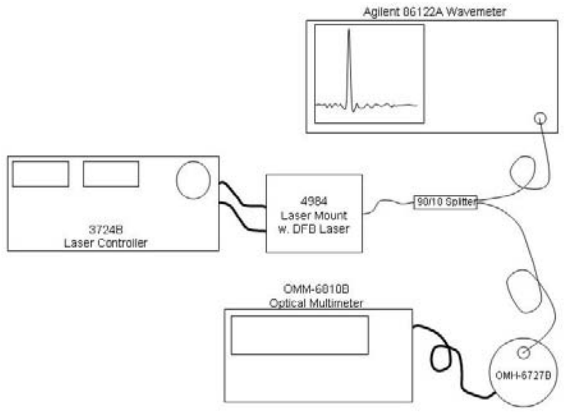

Figure 2: Laser Load Test Setup

Monitoring the output of a laser is an accurate way to measure the stability of the laser controller because the light output is directly proportional to the laser drive current (above threshold) and the wavelength is very sensitive to laser temperature. In fact, the laser's output wavelength can be shown to change ~0.11nm/°C or roughly 100 pm/°C. Because of this property, millidegree changes in temperature can be measured with an appropriate wavemeter.

In both tests, the test loads were monitored over a minimum of 18 hours with a computer collecting data via GPIB.

TEST RESULTS

Figures 3 - 6 show the results of both tests. It can be seen in Figure 3 that the laser drive current maintained <40 ppm stability, excluding the first hour after turn-on, over the entire test.

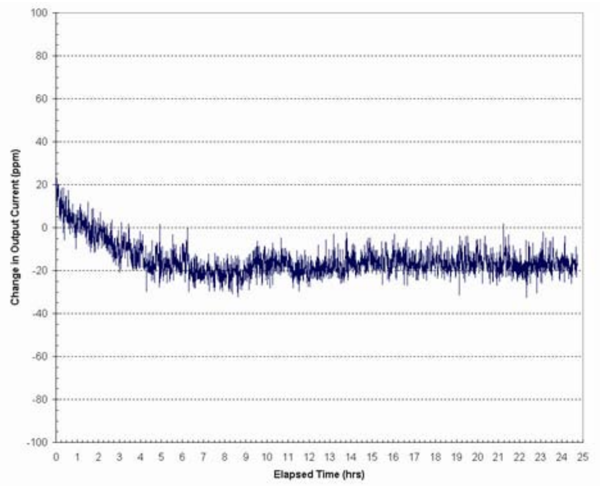

Figure 3: Laser Current Stability with 1Ω Load

Figure 4 shows the results of the TEC output section controlling the coldplate in an LDM-4412. Again, excluding the first hour of warm-up, the maximum temperature variations, either short-term or long-term, are significantly less than ±4 millidegrees, the short-term (1 hour) stability specification, and well under the long-term (24 hour) stability specification of ±10 millidegrees.

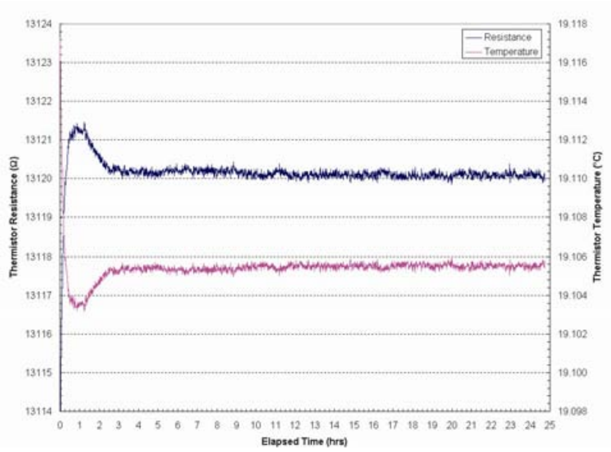

Figure 4: Temperature Stability

Figure 5 illustrates laser drive current stability in terms of optical power output. Long term power stability remains < ±0.01dB. Figure 6 shows how the laser output wavelength will vary over the course of several hours and how the measured temperature varies in the same time span.

During this test, the absolute maximum wavelength variation was 0.3pm. This wavelength shift roughly corresponds to a temperature shift of 0.003°C. This laser, typical among butterfly-packaged DFB lasers in the 1550nm telecom wavelength range, has a thermistor embedded within the package. The resistance measurement of the internal thermistor is graphed in Figure 6 as well. As can be seen, the 3724 measured no more than 1 Ω variation (the measurement resolution limit) during the entire run. Using typical thermistor constants, this 1 Ω variation corresponds to a temperature variation of 0.002°C - within a factor of 2 agreement with the value obtained due to wavelength shift.

SUMMARY

Figures 3 - 6 show the results In summary, the data presented displays the typical laser and TEC control stability of a current production ILX Lightwave LDC-3724B Laser Diode Controller. The data is presented in two sets. The first set uses passive test loads as was done when originally designed to show compliance to published specifications. The data from this test shows that the laser current source remains stable to $\leq$ 20 ppm over the course of a single hour and within 40 ppm over a 24 hour period. The temperature controller maintains setpoint temperature to within ±0.004°C over any hour interval and ±0.01°C over 24 hours when the ambient is held to 25°C ± 0.5°C.

The second set involves connecting the 3724 to a typical 20mW DFB laser using the same output settings as the first test to create a correlation between the two methods. The laser output is measured with an optical power meter and a sub-picometer-accuracy wavemeter. The data shows that long term stability of the instrument is within specification and will allow the optical output to remain stable to within 0.01dB and 0.3pm of its center wavelength.

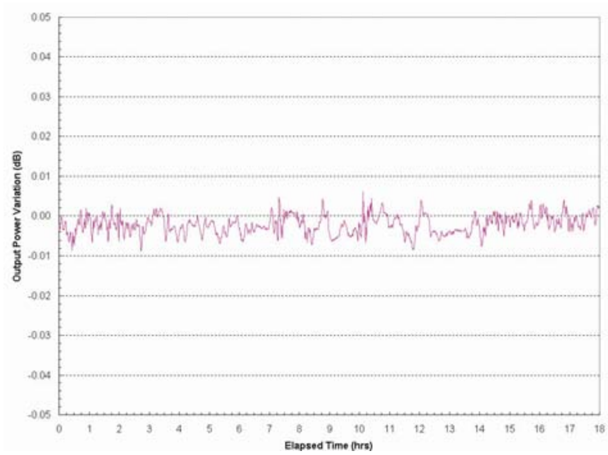

Figure 5: Optical Power Stability

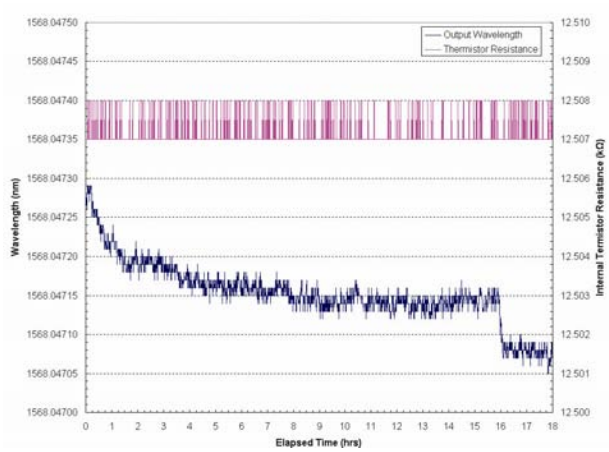

Figure 6: Wavelength Stability

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