Evaluation of YY labs' Mini-MBC-1B bias controllers for MZMs

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Summary

Using the bias controllers, the intrinsic DC ER of the MZM (44.2dB ER) was achieved for both CW and pulsed operation. The leakage fluctuation under low pulse repetition rate down to ~1kHz was significantly reduced to negligible level.

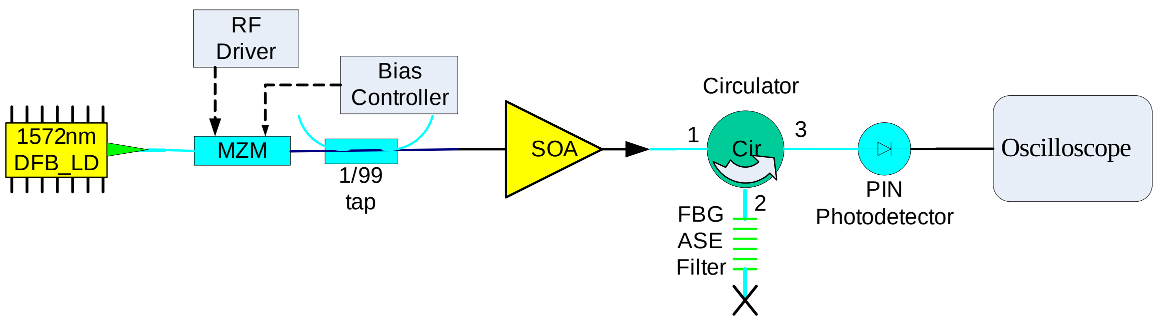

Figure 1. Measurement setup.

As shown in fig. 1, the bias cards (YY labs' Mini-MBC-1B) were tested with a 30mW 1572nm DFB laser diode (DFB-LD) modulated by a Photline Mach-Zehnder intensity Modulator (MZM). Under CW operation (without RF modulation), the optical power after the MZM (through the 99% tap port) was measured to be 10.17dBm or -34.05dBm, when the MZM was manually biased at peak or null point, respectively. This corresponds to a DC ER of 44.2dB. Under pulsed modulation, the peak optical output power of the MZM was found to be the same as the CW case. We then turned to compare the leakage power between pluses with the CW leakage power. To do this, the MZM output is amplified by a semiconductor optical amplifier (SOA) and then filtered with a 1nm band optical filer (circulator +FBG). The filtered signal is passed to a PIN detector and the detector signal is measured with an oscilloscope. Next, we show screenshots of the oscilloscope where the voltage is proportional to the detected optical power.

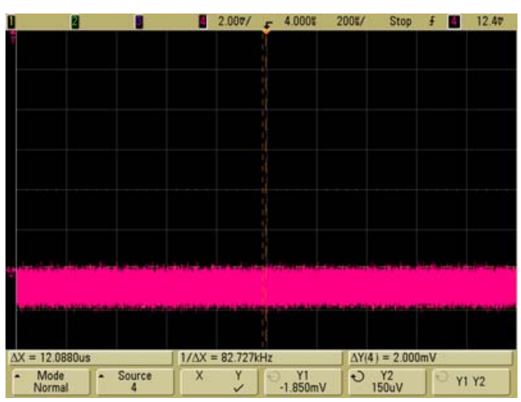

Figure 2. Detector noise floor without optical signal (Vmin= -1.85mV, Vmax =0.15mV, Vpeak_ peak = 2.0mV, Vaverage = -0.85mV).

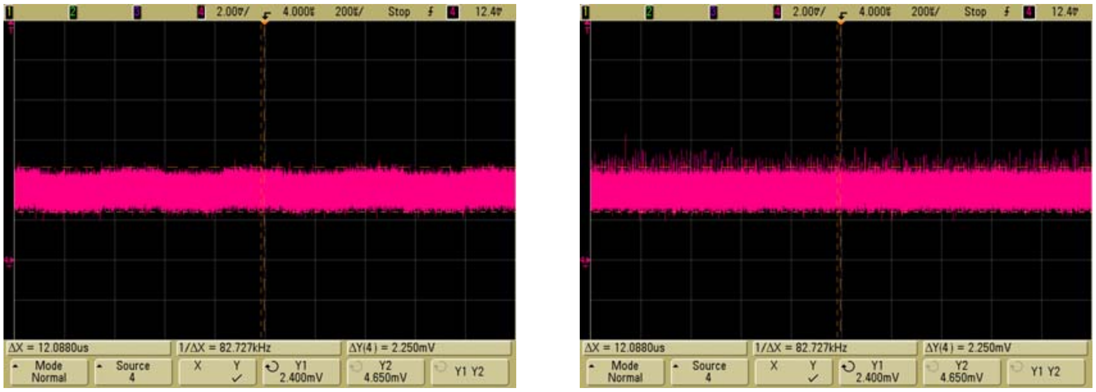

Figure 3. Screen shot of the leakage power when biased at a null point under CW operation with laser on and SOA on (I =500mA): (*left)* using the bias card; (*right*) biased manually.

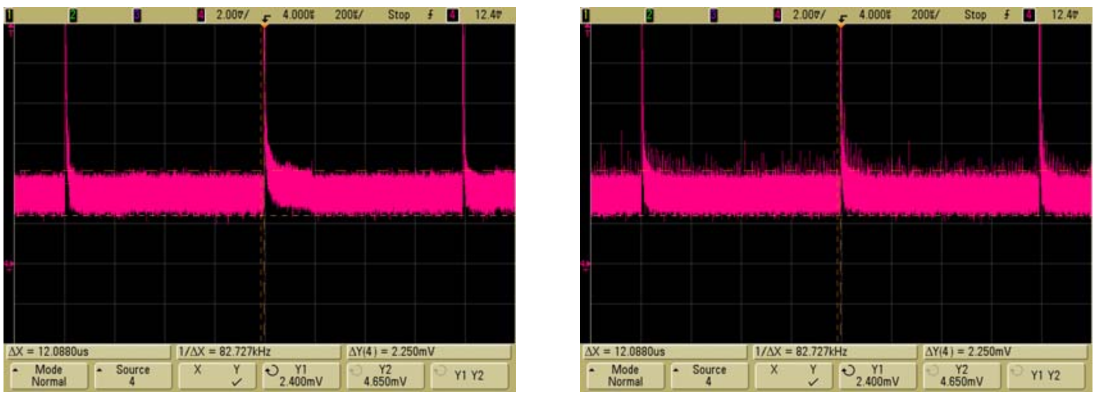

Figure 4. Screen shot of the leakage power under 1.25kHz pulsed operation (PW=0.96us, Period =887us) when biased at a null point with laser on and SOA on (I =500mA): (*left)* using the bias card; (*right*) biased manually. For both cases, the leakage is the same as the CW operation.

As seen in figs 2 and 3, the leakage level is the same for manual and auto bias cases in CW and pulsed operation mode: Vmin = 2.4mV, Vmax = 4.65mV, Vpeak_peak = 2.25mV, Vaverage = 3.53mV. The leakage voltage is Vleak = 3.53mV – (-10.85mV) = 4.4mV.

As seen in fig. 4 (left), the dithering fluctuation becomes more pronounced at the trails of the pulses. This extra leakage due to dithering is <0.6mV, corresponding to an ER penalty of 0.6/4.4 = 14% or 0.6dB, which is negligible.