OPTICAL COMMUNICATION COMPONENTS
Laboratory Experiments

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Setup 1

We measure the transmitted power by inserting an optical power meter between the laser and the multiplexer.
In Table 1 are reported the power measures.

λ [nm]	Power [dBm]	Power [mW]
1550	-2.97	0.5
1310	-6.60	0.22

Table 1: Power measures.

Setup 2

The maximum laser output power of the optical power meter is 10 dBm. To avoid link damage we apply an attenuation of 6 dB, so the effective output power is 4 dBm.

Method 1

The laser wavelength is $\lambda = 1552.52$ nm. We first compute the attenuation due to the connectors, the insertion loss, connecting only the pigtails fibers, obtaining a received power of:

$$P_{rx} = 2.61\ dBm$$

from this value is trivial to compute the insertion loss:

$$\alpha_{ins} = 4 - 2.61 = 1.39\ dB$$

Then we connect the link A and we measure the received power:

$$P_{rx_{link}} = -1.3\ dBm$$

the total attenuation is:

$$\alpha_{tot} = 4 - (-1.3) = 5.3\ dB$$

subtracting to it the insertion loss we obtain the attenuation of our link:

$$\alpha_{link} = 5.3 - 1.39 = 3.91\ dB$$

Method 2

In this case our input is the Node A instead of the laser of the power meter as in the previous case. For this measurement we have inserted optical coupler of

$70\% - 30\%$ power divider. The measured power at the receiver, for the 1550 nm link, is:

$$P = -19.67\ dBm$$

Note that we measure only the 30% of the total power.
We first convert the measured values in linear scale, then we compute the total transmitted and received power:

$$P_{tx} = 0.50 \cdot \frac{100}{30} = 1.67\ mW$$

$$P_{rx} = 0.011 \cdot \frac{100}{30} = 0.37\ mW$$

that in logarithmic scale are:

$$P_{tx_{dBm}} = 2.23\ dBm$$

$$P_{rx_{dBm}} = -4.32\ dBm$$

We can now compute again the total attenuation:

$$\alpha_{tot} = 2.23 - (-4.32) = 6.55\ dB$$

finally, subtracting the insertion loss computed earlier, we obtain the following link attenuation value:

$$\alpha_{link} = 6.55 - 1.39 = 5.16\ dB$$

The difference between the values of the two methods is due to the different number of connectors, that modify the insertion losses, and to the uncertainty of the measurements.

Setup 3

We measure the throughput of the 1310 nm link as a function of the attenuation. In the Figure 1 are reported the measured values: we observe that the throughput is almost constant until an attenuation of 9 dB, then it immediately falls.

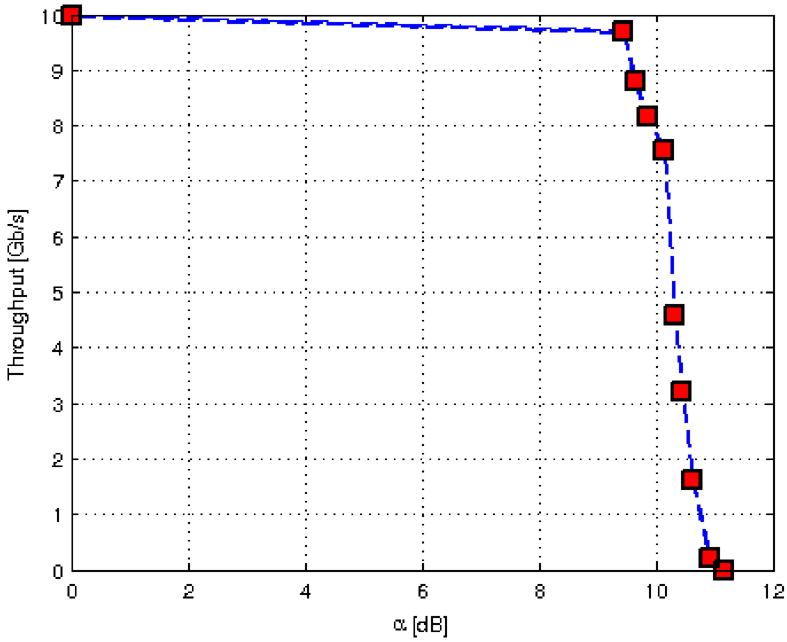

Figure 1: Throughput versus attenuation.