OPTICAL COMMUNICATION COMPONENTS
Lab 1

Nicola Simoni, Tadewos Somano

University of Brescia, Faculty of Engineering
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Question 1

The difference between the two scope traces resides in the power. In fact both signals have the same waveform but the power of the positive pulse of the first signal is about 5 mW, while the one of the second is about 5 μW, that is three order of magnitude smaller.

Question 2

The electrical received signal is severely distorted because of the photo-detector. In fact, even if the optical signal is undistorted, the photo-detector introduces thermal noise. Moreover, smaller the power received, more severe is the effect of the noise.

Question 3

In Figure 1 is shown the curve that represents the bit error rate (BER) as a function of the distance. The red dots on the plot represent the values computed at given distances, while the blue line is the linear interpolation of the points. The BER axis is in logarithmic (base 10) scale, while the distance axis is in linear scale. Assuming that the maximum acceptable BER is 10^{-9} (which logarithm is -9), the corresponding distance is nearly 144 Km. So, to have acceptable BER, the maximum length of the link has to be lower or equal than this value. In Figure 2 is shown the limit point, indicated by the black arrow.
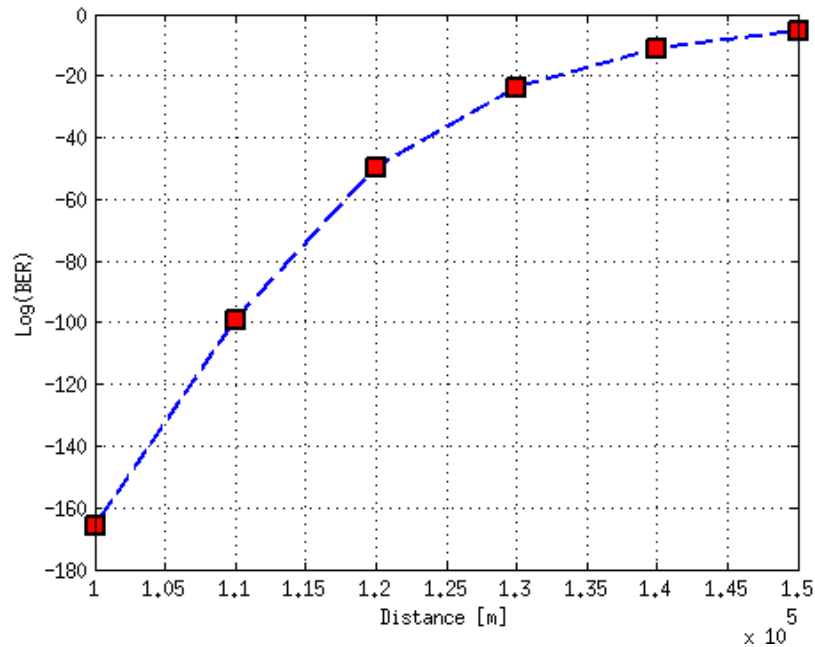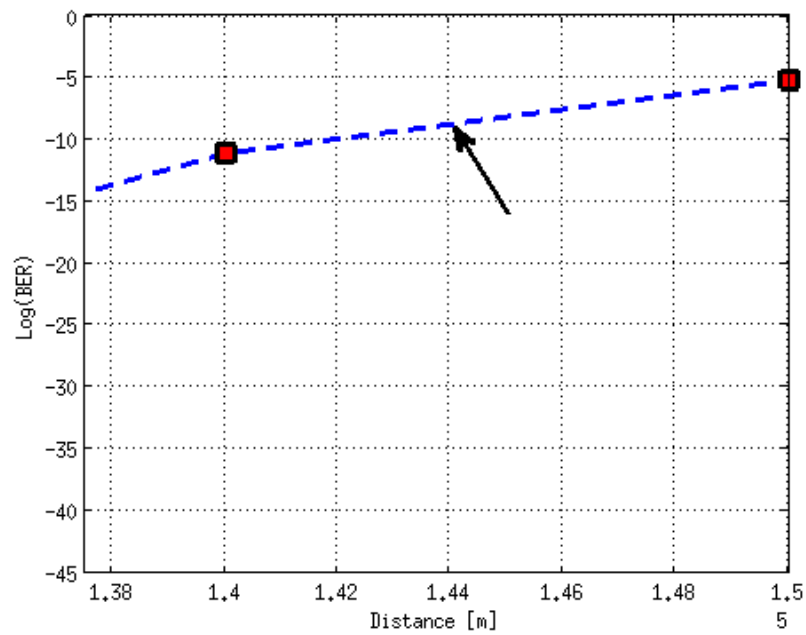

Figure 1: BER versus distance.

Figure 2: Limit point.

Question 4

To overcome loss limit is not possible to increase the power arbitrarily. In fact we have to take into account dispersion, that is a linear effect that causes the spreading of the signals transmitted and doesn't depend on the power.