Optical Communication Experiment 2

Attenuation measurement of an optical fiber link

1. OBJECTIVES

☑ To measure the optical power loss using insertion loss method

☑ To determine the loss and attenuation coefficient of the optical fiber.

2. MATERIALS NEEDED

☑ Attenuator box
☑ FC connector
☑ Optical fiber patch (2 pcs),
☑ Optical power meter
☑ Laser source

3. INTRODUCTION

Attenuation is the major source of signal degradation in optical fiber communication systems. It impose limits on the maximum link length of the optical communication system. Attenuation in optical communication system is mainly caused by the optical signal loss in the fiber and the connectors.

Insertion loss is the loss in transmitted light power when an optical device is inserted in the light path. The insertion loss measurement technique will be used to estimate the attenuation of an optical fiber and connector in an optical link. An optical fiber loss is measured as the optical power loss in dB at any point along the fiber length relative to the input power.

Attenuation of optical fiber or attenuator box is given by: **Attenuation (dB) = $10\log_{10}(P_1 / P_2)$**
P_1 is power measured with the optical fiber patch or reference fiber patch.
P_2 is power measured with the attenuator box or the Fiber under Test (FUT).

The attenuation for a given link length, L, of an optical fiber is then simply αL (dB).

Attenuation (dB) = $\alpha L = 10\log_{10}(P_1 / P_2)$

α is the **Attenuation coefficient of the fiber (dB/km), $\alpha = [10\log_{10}(P_1 / P_2)] / L$**

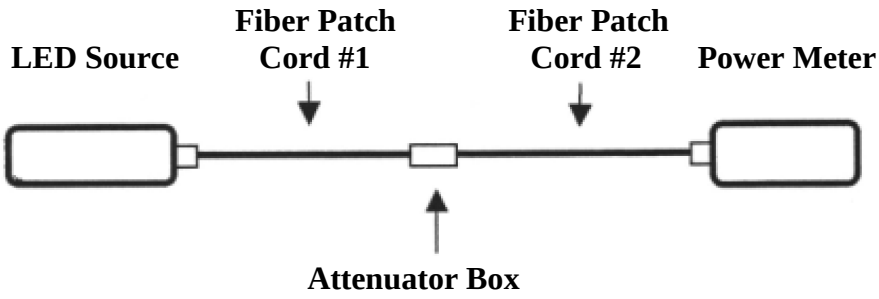
4. PROCEDURES & RESULTS

Part 1: Attenuation box loss measurement by insertion loss method

1. Connect the LED source to the optical power meter (ChA) using short fiber patch cord #1 and short fiber patch cord #2.

2. Record down the power meter readings using 1550nm and 1310nm sources.

3. Insert the **Attenuator Box** between the two fiber patch cords.



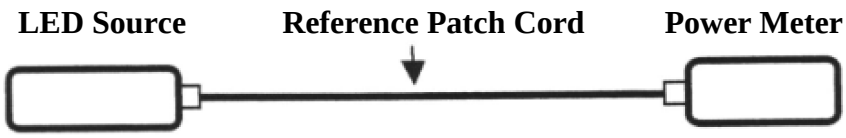
4. Record down the power meter readings using 1550nm and 1310nm sources.

LED Source	Power measured using two fiber patch cords (μW)	Power measured using two fiber patch cords and Attenuator Box (μW)
1310 nm		
1550 nm		

5. Determine the optical power loss (attenuation) of the attenuator box at 1550nm and 1310nm wavelengths using the above measured data.

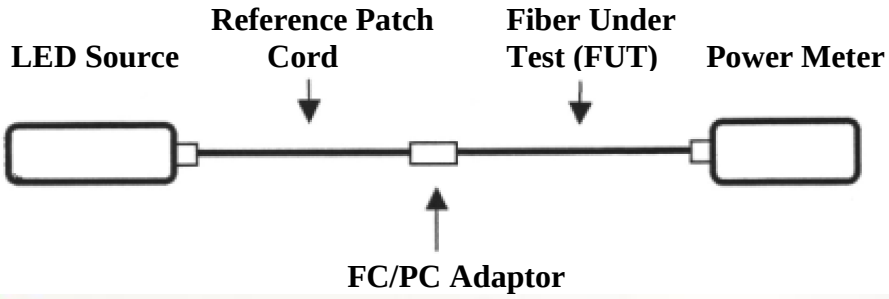
Part 2: Optical fiber Loss Measurements by insertion loss method

1. Connect the LED source to the optical power meter (ChB) using short fiber patch cord #1 (Reference Fiber).



2. Record down the power meter readings using 850nm and 1310nm sources.

3. Insert the Fiber Under Test (FUT) between the fiber patch cord #1 (Reference Fiber) and the optical power meter.



4. Record down the power meter readings using 850nm and 1300nm sources.

LED Source	Power measured using Reference Fiber (μW)	Power measured using FUT and Reference Fiber (μW)
850 nm		
1300 nm		

5. If the length of the optical fiber (FUT) is 250m, determine the optical loss (attenuation) and the fiber attenuation coefficient (α) of the optical fiber at 850nm and 1300nm wavelengths using the above measured data.

6. Complete the following summary table and answer the following questions.

	Attenuation (dB)	Attenuation coefficient (dB/km)
850 nm		
1300 nm		

5. DISCUSSIONS

1. Compare the Attenuator Box loss using 1550nm and 1310nm LED source. Are they the same? Comment on the results**.**

2. Compare the optical fiber loss at 850nm and 1300nm. Are they the same? If not the same, give reasons to explain the difference in values.

3. Comment on the accuracy of the insertion loss measurement technique.

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