To Study for the Different Dimensions of Measurement of the Bending and Connecter Losses in Optical Fiber

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I. Introduction

Communication has always dreamt of higher information bandwidth for wires and coaxial lines with frequency available for transmission extends from $10^3$ to $10^9$ Hz. But modulated light transmission frequency about $10^{10}$ Hz range, thus here increase in several orders of magnitude in potential bandwidth is possible. The main drawback these communication systems using the light signal is unguided and it is transmitted through atmosphere where it is subject to attenuation and distortion. Therefore, a better light wave communication system would certainly need a light guide to help preserve the signal and increase the reliability and distance of transmission.

However, it was not until like a practical wave guide unvisaged. This guide was a solid cylinder capable of guiding a wide range of electromagnetic waves including the upper limits of visible light. Another light guide developed during that consist of a hollow tube with a highly reflective metal coating with its inner surface. Thus light injected into one end of either guide bounced back and forth along the length to exit at the other end. These devices had high signal loss and hence, were not much practical use. With some success therein by 1950’s these glass fiber bundles were used as light conducts reader for this time the core with its high refractive index and surrounded by that had a lower refractive index.

II. Theory

When the light propagated from one end to the other end in single mode or multimode fibre is known called attenuation. Thus attenuation is ratio of optical output power $P_{out}$ from a fibre of length $L$ to the input power $P_{in}$.

The power loss is given by

$$L_{loss} = -10 \log \left( \frac{P_{out}}{P_{in}} \right) \quad \text{in dB}$$

$$L = L_0 - A L$$

$$A = 10 \log \left( \frac{P_{in}}{P_{out}} \right)$$

$$L_{in} = 10/A \times 10 \log \left( \frac{P_{in}}{P_{out}} \right)$$

Where $P_{in}$ and $P_{out}$ watts, $L$ is in km.

Absorption losses

Impurities absorb the light and it convert to heat. These are constitutes few factors. By atomic defect, impurity atoms basic constituent atoms.

Altraviolet absorption is light ionizes the valency electrons in to conduction. This ionization contributes to the transmission losses. And infrared is photons of light are absorbed but the core molecules these are converted in to random mechanical vibrations. Then ion resonance is caused by OH-ions in the material.

Scattering losses

It due to impurity particle scattering occurs in core or cladding. The particle will scatter another direction this effect is total internal reflecton at the boundary of core-clading. This will create loss in the amount of light.

Bending losses

Reduction in optical power due to fibre bending known as bending losses. This is caused by macroscopic and microscopic mechanisms. Macrascopic is a large scale bend, When a fibre is bent through a large angle know strain is placed along the regions it causes the change in refractive index and in critical angle, as a result losses occur, but it minimum loss. Then micro bends are repetitive small scale, fluctuation in the radius of the optical axis. To prevent by losses extruding a common possible jarket over the fibre. Thus jarket will be deformed but the fibre will tend to stay relatively straight. When optical energy travels along.
a fibre due to intra and intermodal. It creates distraction for both digital and analog transmission. To avoid it the digital bit rate must be less than the reciprocal of the broadening pulse duration

**Intermodal Dispersion**

Pulse spreading within a single mode arise from finite spectral emission width of the optical source. Since it depends on wavelength and effect on signle distraction increse with spectral width. Then propagation delay difference between different modes.

**Intramodal Dispersion**

It take place due to the fact that optical sources do not emit a single frequency but a bend of frequencies. This kind of pulse broadening in almost every type of optical fibre. When the dispersive characteristics of the waveguide material responsible for the delay differences known as material dispersion. Propogation chararaistics are effectted by several factors including transmittance properies the quality of reflecting interface, residul light leakage through the coating various end losses. These losses in transmission could be divided into lines losses.

III. Procedure

[1] **Bending losses.**

- Connect the power supply cable at the power in connector.
- Connect 1 meter optical cable is connect to the TX- OPTO and other end of the fibre cable loop it around one bend connect to the RX-OPTO connector.
- Put the switch SW2 in the meter position.
- Then switch on the power supply.
- Adjust the intensity knob till the meter reading till -2.0dB.
- Swith off the power supply without disturbing the knob position.
- Take the posion of the fibre and loop it around first bend.
- Note down the meter reading in power –dB. Then fiber loop it around two bends then connect again, note down again meter reading in- dB.
To Study For The Different Dimensions Of Measurement Of The Bending And Connector Losses In...

Connecter loss.
• Priminary adjustments similar previous steps,
• Now connect one end fiber cable about 2 meter length to TX-OPTO other end to connecter, connect one end of 1meter cable to RX-OPTO and other end to the connecter.
• The connecter the two cables must be placed in properly the ends without any gap. Then connecter loss can be calculated.

<table>
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<th>Size of the fiber</th>
<th>Length of the fiber</th>
<th>Meter Readings</th>
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<tr>
<td></td>
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<tr>
<td>1</td>
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<td>1meter</td>
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<tr>
<td>1.5” diameter</td>
<td>1meter</td>
<td>-6.0 dB</td>
<td>-3.4dB</td>
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<td>1meter</td>
<td>-6.0 dB</td>
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<tr>
<td>2</td>
<td>1” diameter</td>
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<tr>
<td>1.5” diameter</td>
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<td>-6.0 dB</td>
<td>-3.5dB</td>
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<tr>
<td>2.0 “Diameter</td>
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<tr>
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IV. Conclusions
The attenuation coefficient is the function of angle of incient, wavelength and type of fiber. The angle of incident increases both the path and number of reflection increase. Therefore attenuation get increaed. This causes the reduction in the effective numerical aperture with the length of the fiber. The coupling light sources to fiber for the trasmission signals, it is necessary to be able to couple. This is the importance where fiber cable have to be joined to fiber. Loss to be fiber coupling depends on types of joint, size, refractive index, eccentricity of the core, and numerical apertures mechanical misaligmenst, longitudinal, lateral and angular misalignment of the fibers. Then connecter loss can be calculated.

Reference
[3]. Technical staff of CSELT, optical fibre communication.centro studio laboratory Telecomunicazioni.Torino,1980