OPTIMIZATION OF DISTANCE ON THE TRANSMISSION OF LONG HAUL WDM SYSTEM

This thesis is presented in partial fulfillment for the award of the
Bachelor of Engineering (Hons) Electronics (Communication)
UNIVERSITI TEKNOLOGI MARA

MOHD HAZIM BIN MOHAMED HARITH
Faculty of Electrical Engineering
UNIVERSITI TEKNOLOGI MARA
40450 SHAH ALAM, SELANGOR

JULY 2012

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

In fiber-optic communications, wavelength-division multiplexing (WDM) is a technology which multiplexes a number of optical carrier signals onto a single optical fiber by using different wavelengths (i.e. colours) of laser light. This technique enables bidirectional communications over one strand of fiber, as well as multiplication of capacity. The term wavelength-division multiplexing is commonly applied to an optical carrier (which is typically described by its wavelength), whereas frequency-division multiplexing typically applies to a radio carrier (which is more often described by frequency). Since wavelength and frequency are tied together through a simple directly inverse relationship, the two terms actually describe the same concept [1].

1.2 WDM SYSTEM

Early optical networking systems used a single wavelength of light on one optical fiber. However, the bandwidth capacity of optical fiber cable is much greater than the amount of data that can be encoded onto a single wavelength. In order to take advantage of this extra

capacity and maximize the use of early optical systems, the technology of wavelength division multiplexing (WDM) has been developed and is being used around the world to improve the existing Internet infrastructures. A WDM is basically a fiber optical transmission technique, which multiplexes many signals of different wavelength and is capable of providing data capacity in excess of hundreds of gigabit per second over thousands of kilometers in a single mode fiber. At the present, most countries in the world have implemented Internet infrastructure by means of WDM systems to provide high bandwidth and a high-speed internet service. A WDM system is needed to support Internet infrastructure, which currently transmits more than data rate of 40Gb/s per wavelength channel on a single mode fiber over a long distance. No other Internet infrastructure systems apart from WDM system can support these scalable high speeds and huge bandwidth over a longer distance. The WDM system use optical fibers for data transmission, which is more secure compared with other data transmission systems, e.g., satellite, from tapping (as light does not radiate from the fiber, it is nearly impossible to tap into it secretly without detection) and is also immune to interference and crosstalk. The possibility of using existing optical fibers from the early optical systems more efficiently makes the WDM system a very attractive commercial proposition, thus it can be considered to be the right choice for constructing an Internet infrastructure everywhere in the world [2].

1.3 OPERATION IN WDM SYSTEM

In WDM system, data are converted into electrical signals and coded to the non-return-to-zero (NRZ) modulation format, then converted into light signals, and assigned a wavelength channel for transmission by means of a transmitter. The transmitter consists of tunable laser along with an external modulator. The signals from the different wavelengths channels are combined into a standard single mode fiber by optical multiplexer and amplified using erbium-doped fiber amplifiers (EDFAs), which are spaced 120 km along the link. A post amplifier is used to increase the output power; a line amplifier is used typically in the middle of the link to compensate for link loss, which is normally about 0.2