

**ANALYSIS AND MEASUREMENT OF FIBER TO THE HOME (FTTH) AS AN  
ACCESS TECHNOLOGY IN FIBER-OPTIC COMMUNICATION LINK**

**LOH MUN YEE**

**This report is submitted in partial fulfillment of the requirements for the award of  
Bachelor of Electronic Engineering (Telecommunication) With Honours**

**Faculty of Electronic and Computer Engineering  
Universiti Teknikal Malaysia Melaka**

**May 2011**



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**  
**FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER**

**BORANG PENGESAHAN STATUS LAPORAN**  
**PROJEK SARJANA MUDA II**

**Tajuk Projek** : ANALYSIS AND MEASUREMENT OF FIBER TO THE HOME (FTTH) AS AN ACCESS TECHNOLOGY IN FIBER-OPTIC COMMUNICATION LINK

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Date : .....

## **DEDICATION**

To my beloved mother and father

## ACKNOWLEDGEMENT

I would like to express my deepest gratitude to my supervisor, En. Chairulsyah bin Abdul Wasli for his knowledge, valuable guidance, and encouragement that have influenced this project to a success.

Apart of that, I would like to express my warm and sincere thanks to my parent for their supports throughout this project. I would like to warmly thank my friends for valuable advice and friendly helps. A special dedication to Mr. Bernard from Kumpulan Abex Sdn. Bhd who has shares his knowledge and experience in completing this project.

Also, I would like to give earnest thank you to Mr. Rodisham from Significant Technology Sdn. Bhd who provides equipments in measurement for completing this project.

## ABSTRACT

This project proposes the design, analysis and measurement of Fiber to the Home (FTTH) then compare the result of calculation, simulation and measurement. The basic principle to design FTTH is Passive Optical Network (PON). The design is deploying an entirely passive point-to-multipoint (P2MP) FTTH design which consists of optical line terminal (OLT) and optical network unit (ONU) with a fixed distance. The project is mainly focus on the difference of FTTH's parameter between calculation, simulation and measurement. The project outcome is to overcome the lack of knowledge about FTTH in UTeM.

Keyword: Fiber to the Home; Passive Optical Network; passive point-to-multipoint; optical line terminal; optical network unit

## ABSTRAK

Projek ini mencadangkan reka, analisis dan pengukuran tentang Fiber to the Home (FTTH) dan kemudiannya membandingkan hasil perhitungan, simulasi dan pengukuran. Prinsip rekaan FTTH ini adalah berdasarkan Passive Optical Network (PON). Rekaan ini melibatkan passive point-to-multipoint (P2MP) FTTH sepenuhnya dan rekaan ini terdiri daripada optical line terminal (OLT) dan optical network unit (ONU) dengan jarak yang ditetapkan. Terutamanya, projek ini adalah fokus pada perbezaan parameter FTTH di antara perhitungan, simulasi dan pengukuran. Keputusan projek untuk mengatasi kurangnya pengetahuan tentang FTTH di UTeM.

Kata Kunci: Fiber to the Home; Passive Optical Network; passive point-to-multipoint; optical line terminal; optical network unit



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## LIST OF ABBREVIATIONS AND SYMBOLS

$\theta_i$	-	Incident angle
$\theta_r$	-	Reflection angle
ADS	-	Additional digital services
ATM	-	Asynchronous transfer mode
APC	-	Angled physical contact/ angled polished connector
APD	-	Avalanche photodiode - type of optical detector
APON	-	ATM-based passive optical network
ARPU	-	Average Revenues per User
BBGP	-	Broadband to the General Population
BER	-	Bit error rate
BPON	-	Broadband passive optical network
CAPEX	-	Capital Expenditures
CATV	-	Cable Television
CO	-	Central Office
dB	-	Decibel
DLC	-	Digital loop carrier
DSL	-	Digital Subscriber Line
DSLAM	-	DSL Access Multiplexer
EDFA	-	Erbium Doped Fiber Amplifier
EMI	-	Electromagnetic Interference
ETTH	-	Ethernet-to-the-Home
EPON	-	Ethernet based passive optical network
Gbps	-	Gigabit per second
GDP	-	Gross Domestic Product
GPON	-	Gigabit passive optical network

HDTV	-	High Definition Television
IEC	-	International Electrotechnical Commission
IEEE	-	Institute of Electrical and Electronic Engineers ( <a href="http://www.ieee.org">www.ieee.org</a> )
IP	-	Internet Protocol
IPTA	-	Institut Pengajian Tinggi Awam
IPTS	-	Institut Pengajian Tinggi Swasta
IPTV	-	Internet Protocol Television
ITU	-	International Telecommunication Union ( <a href="http://www.itu.int">www.itu.int</a> )
ITU-T	-	ITU- Telecommunication standardization sector
ISO	-	International Standards Organization
Kbps	-	Kilobits per second
LED	-	Light Emitting Diode
FBT	-	Fused-biconic taper
FDH	-	Fiber distribution hubs
FDI	-	Feeder Distribution Interface
FTB	-	Fiber Termination Box
FTTB	-	Fiber to the Building
FTTC	-	Fiber to the Curb
FTTCab	-	Fiber to the Cabinet
FTTH	-	Fiber-to-the-Home or Fiber-to-the-House
FTTN	-	Fiber to the Node
FTTP	-	Fiber to the Premises
FTTx	-	Fiber-to-the-x
FWS	-	Fiber Wall Socker
HSBB	-	High Speed Broadband
Hz	-	Hertz
MAC	-	Media access control
Mbit/s or Mbps	-	Megabit per second
MDU	-	Multidwelling units
MSM	-	Metal-Semiconductor-Metal
n1	-	Refractive index of cladding
n2	-	Refractive index of core
ODN	-	Optical distribution network
ODF	-	Optical Distribution Frame

OLT	-	Optical Line Terminal
ONT	-	Optical Network Terminal
ONU	-	Optical Network Unit
OSP	-	OutSide Plant
P2P	-	Point-to-Point
P2MP	-	Point-to-Multipoint
PIN	-	Positive-insulator-negative- type of optical detector
PLOAM	-	Physical layer operations administration and maintenance
PON	-	Passive Optical Network
PSTN	-	Public switched telephone network
Q-Factor	-	Quality factor
QoS	-	Quality of Service
OPEX	-	Operating Expense
RBOC	-	Regional Bell Operating Company
RFI	-	Radio frequency Interference
Rx	-	Receiver
SC	-	Subscription channel
SDH	-	Synchronous digital hierarchy
SONET	-	Synchronous optical network
SOP	-	Standard operating procedure
SMP	-	Significant market power
TIA	-	Telecommunications Industries Association
TDM	-	Time-division Multiplexing
Tx	-	Transmitter
TM	-	Telekom Malaysia
TV	-	Television
VoD	-	Video on Demand
VSDL2	-	Very High Speed Digital Subscriber Line 2
W	-	Watt
WDM	-	Wavelength-division multiplexing

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# CHAPTER 1

## INTRODUCTION

### 1.0 INTRODUCTION

Generally, the Fiber-Optic cable is recognized as an excellent transmission medium in telecommunication especially in connection between exchanges. Nowadays, the access links still use copper cable where this hybrid technology would not give optimum performance especially in bit rate. The Fiber to the House (FTTH) is a new technology that covers Fiber-Optic cable from exchanger to user home. With this method, it will give many advantages to the user and provider. This project will analyze the FTTH from the theoretical, design, and measurement aspect. Also, including the analysis of area that is suitable for development of FTTH. The measurements presents including power loss, Bit-rate, and other parameter that play a main role in this project. The measurement will be taken in SIGTECH Sdn. Bhd. Also, advantage and disadvantage will be discovered. The task is study literature of FTTH, design consideration of FTTH, animation of FTTH, simulation and measurement of FTTH.

## **1.1 OBJECTIVE**

1. To gain more knowledge about FTTH through animation, calculation, design, simulation and measurement.
2. Able to design FTTH network for specific area given.
3. Able to make comparison between calculation, simulation, and measurement parameter as well as analyze it.

## **1.2 SCOPE OF WORKS**

1. Animation is being made to demonstrate FTTH in order to explain the FTTH as an access Technology in Fiber-Optic Communication Link.
2. Design a FTTH with an area specify to parameter by calculation.
3. Simulation of FTTH using OptiSystem software.
4. Measure the performance of FTTH at Sigtech Sdn. Bhd.

## **1.3 PROBLEMS STATEMENT**

1. In Malaysia, nowadays, optical fiber is not fully developed in the communication link. Still, copper cable is being used between the central office and subscribers.
2. In UTeM, there is not much knowledge of FTTH.

## 1.4 METHODOLOGY

Below is the project work flow of my final year project:

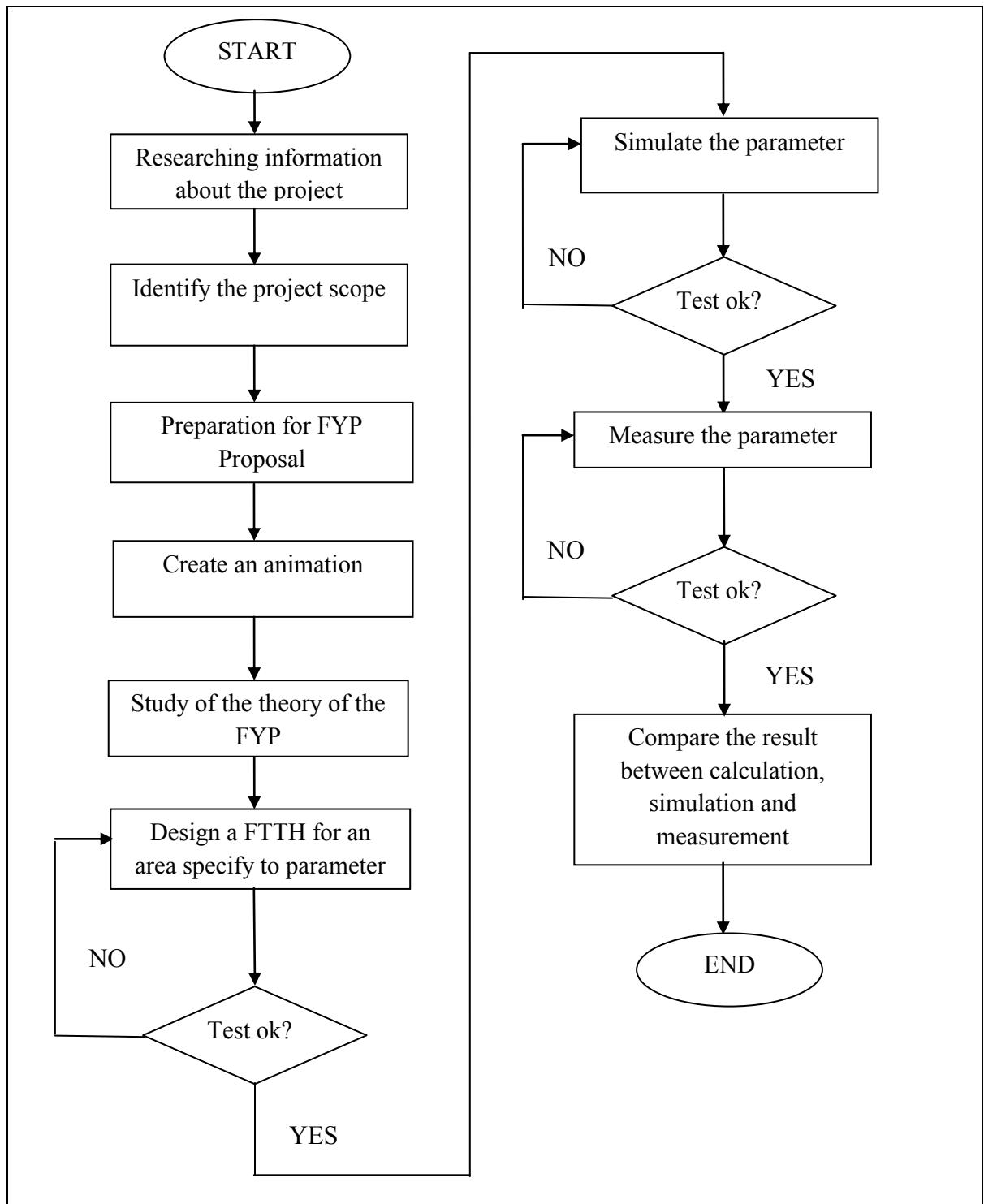


Figure 1 - 1: Overall project work flow

## **1.5 THESIS OUTLINE**

1. An attractive animation is created.
2. A model of FTTH is designed.
3. The SOP and SMP of FTTH are analyzed.
4. Conference technical paper is created.