Course ID
GPONB

Course Title
GPON Backhaul for LTE/5G Networks

Course Duration
5 days

Related Courses

- DWDM Introduction (DWDM101, 2 days)
- DWDM Advanced (DWDM, 3 days)
- Fiber Optics (LightMASTER) Training (LIGHTMST, 3 days)
- LTE Network Planning (LTE-NPC, 5 days)
- LTE/SAE Fundamentals (LTE-FUND, 2 days)
- 5G Wireless Technology (5G-TUTE, 3 days)

Aimed At

Optical network engineers, optical technology technicians, optical backhaul planners, transmission engineers, radio network capacity planners, fixed line engineers/technicians, 5G engineers/planners, LTE engineers/planners, and others interested in the GPON optical backhaul and networking technology for LTE and 5G network infrastructure. The course will also help the 5G system engineers acquire a unified view of the Gigabit Ethernet optical transmission backhaul, as specified in 3GPP and 5G PPP.

Prerequisites

Some preliminary knowledge of transmission network principles, mobile backhaul, LTE/5G networks and general telecom networking.

Course in a Nutshell

This course provides a comprehensive coverage of the GPON technology including the basics of optical transmission, GPON architecture and components, GPON ITU-T standards, GPON functionality, GPON link budgets, and other important topics. The course also discusses the integration of GPON backhaul into LTE (indoor/outdoor) and 5G network architectures, including the key points underlying GPON backhaul capacity for LTE-A and 5G wireless.

Course Outline

Fiber Communications Overview

- Fiber Optical Transmission Principles
  - Physical optical beam principles
  - Optical transmission windows
  - Losses and materials
- Types of Fibers
  - Multimode fiber
  - Single mode fiber
  - Dark fiber
  - Polymer (Plastic) Optical Fiber - POF
- Optical Transmission Principles
  - Material dispersion
  - Chromatic dispersion
  - Time dispersion
  - Mode dispersion

- Optical Transmission Losses
  - Material losses
  - Bending losses
  - Wavelength losses
  - Optical insertion losses
  - Optical aperture losses
  - Splicing losses
- Exercises using MS Excel

Introduction to Optical Networking

- Optical LAN
  - IP/Ethernet over fiber
  - Requirements/restrictions
- Optical Network Spanning
  - Estimate link loss
  - Estimate fiber length
  - Optical repeating
- WDM
  - WDM principles
  - DWDM principles
  - WDM design
- Exercises using MS Excel

GPON Access Technology

- What is PON?
- Differences between passive and active optical networks
- Generic PON architecture
- PON components
- Connectors and fiber accessories for PON technology
- BPON architecture and components
- BPON and EPON
- What is GPON?
- GPON advantages and features
- GPON requirements and restrictions
- GPON security overview
- Background history
- Access network infrastructures: FTTx architectures (FTTC, FTTN, FTTD, FTTP, FTTH)

GPON Standards

- GPON ITU-T G.984.1
- GPON ITU-T G.984.2

- Physical Media Dependent (PMD)
- GPON ITU-T G.984.3
- Transmission convergence
- GPON ITU-T G.984.4
- GPON ITU-T- G.984.5 enhancement band
- GPON ITU-T G.984.6
- Optical reach extension (G.984.re)
- XG-PON ITU-T G.987.1
- 10 Gigabit Passive Optical Network XG-PON
- XG-PON2
- 40Gbps GPON network elements
- Optical Line Termination (OLT), Optical Network Unit (ONU), SFU, SBU, MDU, and MTU
- GPON fiber termination
- Fiber connectors, splice trays, fiber cassette trays and enclosures
- Optical splitter, Optical Distributions Frame (ODF)

GPON System Architecture

- GTC layer system
- TC concepts in GPON
- GPON frame format
- PLOAM field
- OMT method B activation
- GPON ranging and spanning
- OMCI protocol
- GPON Dynamic Bandwidth Assignment (DBA)
- Introduction to Transmission Containers (T-CONT)

GPON Power Budget Calculations

- GPON optical transmitter
- GPON optical receivers
- GPON receiver sensitivity
- Optical receiver detection and estimation principles
    - Exercises on Tx/RX using MS Excel
- In-Building wiring & GPON multiplexing
- GPON Physical Layer Dependency (PMD)
- Channel insertion loss
- GPON dispersion calculation
- Optical power budget
    - Exercises on optical link budget principles using MS Excel

- Optical Distribution Network (ODN)
- XGPON power budgets
  - Exercises on optical link budget principles using MS Excel

GPON Backhaul for LTE/LTE-A

- LTE-A network overview
- GPON as mobile indoor backhaul technology
- GPON indoor with POF and LiFi technologies
- GPON as mobile outdoor backhaul technologies
- GPON mobile backhaul capacity principles
  - Estimate LTE RAN capacity
  - Estimate IP/Ethernet overheads
  - Estimating GPON overheads
  - Exercises on LTE-A IP/Ethernet backhaul estimations using MS Excel

GPON Backhaul for 5G

- 5G technology overview
- 5G network architecture
- GPON as 5G mobile backhaul technology
- GPON 5G mobile backhaul capacity principles
  - Estimate 5G RAN capacity
  - Estimate IPv4 IPv6/Ethernet overheads
  - Estimating GPON overheads
- Exercises on 5G IP/Ethernet backhaul estimations using MS Excel
- GPON and IoT expectations
  - Exercises on GPON to IoT traffic backhaul estimations using MS Excel

Course Recap, Discussion, and Course Evaluation