Digital Microwave Radio Training Course Outline

Welcome to the digital microwave radio training course featured by Telecom Training Center. This course provides classroom training in microwave transmission concepts.

Course Objectives:

This three day course is intended for microwave support technicians, project managers, system installation and test personal and path design engineers. The overview covers key technical areas which are required to design, test, installation and isolate troubles in high availability microwave backhaul systems. Upon completion of this course, you will be able to understand:

- ANSI Digital Signal Hierarchy for customer payload signal types and the relationship to microwave radio interfaces
- Signal flow through a radio terminal
- Transmission line basics and the passive components used in typical radio terminal designs
- Customer traffic loss protection – hardware vs. propagation failures
- ANSI RF channel sizes in frequency bands, link capacity and the tradeoffs of each modulation type
- Radio link budget basics, signal propagation basics, and technologies used in radio to increase availability
- High level radio link commissioning / testing of PDH, SONET and Ethernet traffic
- Troubleshooting techniques

Prerequisites:

- Basic understanding of radio frequency transmission theory
- Basic understanding of radio hardware, such as power amplifiers, frequency up/down conversion, modulators and demodulators.
- Basic understanding of digital telecommunication systems

Course Structure:

Day 1

Digital Signal Hierarchy

- PDH (Asynchronous) basics
- SONET (Synchronous) basics
- Ethernet over PDH, over SONET and native mapping to the radio frame, L1/L2

Digital Radio Signal Flow

- Radio building blocks – IDU, ODU, Integrated radios
- Breakdown of each section in a typical radio
- Nodal radios vs. single ended

Microwave Components in a Transmission System

- Transmission line introduction
- Passive Components – band pass, band stop, hi/low pass filters, circulators, directional couplers, attenuators, termination, splitting couplers
- Branching Networks – key components, channel addition and segregation, circulator bounce, CPR flanges, CMR flanges, E bend, H bend etc.

Traffic Loss Prevention

- Protection methods – hardware failure vs. propagation protection
- MHSB transmitter – basics – what to watch out for. Trade-offs between the two methods used in the industry
- MHSB receiver – basics – coupler choices, errorless vs. hitless switching
- 1:N multi channel design

RF Channel Capacity and Relationship to Gain and Modulation

- Digital modulation types overview
- Canadian RF channel sizes vs. frequency bands
- Modulation density required to encode the given traffic into a specific channel size
- Impacts of modulation density to system gain
- Performance reduction from distortion

Day 2

Basic Microwave Link Budgets Concepts - System Gain

- Transmitter Output
- Connector & Feeder Losses
- Antenna gain and ERP
- Free Space Loss
- Receiver threshold and fade margin

Propagation, Fading, and Interference

- Propagation Basics
- Line of sight, earth bulge, required clearance
- Fading, flat, dispersive fading
- Rain impacts
- Interference sources
- Availability Basics

Countermeasures and Availability Objectives

- Antenna considerations, self vs. external interference. F/B ratio, discrimination, XPD impact
- Radio Adaptive Technologies
    - Adaptive Modulation vs. Fixed, relationship to traffic QOS
    - ATDE and Slope Equalizers
    - ATPC Transmitter power control
- Space and Frequency Diversity, IF Combining vs. BB switching
- FEC – Forward Error Correction

Day 3

Commissioning Radio Systems

- Basic site check list
- Remote Antenna vs. Integrated Antenna Considerations
- Antenna System Testing
    - Waveguide & Feed horn testing - basics
    - Antennal Alignment Concepts – Azimuth and Elevation, side lobes
    - Polarization Optimization
    - 2A-B Testing
- Signal Measurement with Power Meter vs. Spectrum Analyzer
- Confirming Expected System Gain
- Confirm NE visibility to monitoring system
- Site master introduction
- Concept of mW, dBm and dB
- Radio specifications comparison

Over the Air Traffic Tests, PDH, Ethernet, SONET

- PDH BER tests – confirm line coding, line build out, test parameter basics
- Ethernet RFC 2544 Tests – throughput, latency etc
- Radio as a Ethernet pipe, QOS enabled, prioritization and adaptive modulation
- SONET testing

Troubleshooting Techniques

- Customer releases
- Hard failure isolation, resolution – breakdown of steps to take
- Intermittent failures, traffic hits – hardware based
- MHSB terminal testing
- Propagation issues – collecting information, basic understanding of event correlations

Price: $3,280 CAD per person per session, tax included

Included:

- 3 day Microwave radio theory training course, text books and Certificate;
- 3 day and night accommodation, single occupancy in Nav Canada Training and Conference Center for each session;
- Daily breakfast, lunch and dinner on site;
- Continuous refreshment, coffee, tea, soft drink and snack service on site;
- Fully equipped classroom and facilities on site;
- Free WiFi internet access;
- Indoor swimming pool and fitness room on site.

Location: NAV CANADA Training and Conference Centre, 1950 Montreal Road, Cornwall (Ontario) K6H 6L2, Canada. http://conference.navcanada.ca/