

# Microwave Radio System Fundamentals

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## Course Length

Three Days – with equipment

## Prerequisites

A general understanding of telecommunication networks and technical math will be useful for students taking this course. *This course is NOT vendor specific.*

## Course Objectives

This course covers core competencies and supporting technologies for employees who maintain microwave based and cellular radio systems. Each module includes student exercises and applicable testing applications (when available) designed to strengthen job skills. Modules include an overview of radio service as a transmission media, how transmitters and receivers work, modulation schemes used in microwave and cellular services, an overview of wave propagation and radio antenna system testing.

## Suggested Equipment

Suggested test and network equipment includes:

- RF Spectrum Analyzer with Tracking Generator
- Digital Volt Meter
- RF Power meter (capable of measuring microwave)
- T1/DS3 Test Set

Network Equipment should include

- At least two microwave radios, any variety
- Antenna cables & adaptor including minimum 60dB pad.
- Power Supplies - capable of supporting load
- Plug Strips

## Field Labs

Field Labs and hands-on exercises are dependent on available equipment. It is very important to have T1/DS3 test sets available.

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*For more information or a custom quote*

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## COURSE OUTLINE

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### **DAY # 1 – Classroom**

#### **Introduction to Radio Transmission**

- Why Radio
- Radio Vs Fiber Vs Cable
- Student Exercise
- Broadband Vs Narrowband
- Bandwidth Defined
- Attenuation and Noise
- Radio Regulation in the US

#### **Traffic & Modulation**

- Review of Carrier Modulation
  - CW & QPSK
  - QAM
- Network Testing - optional
  - Network Testing -T1
  - Network Testing- DS3

### **Day #2**

#### **Understanding Radio Equipment (Classroom & Field)**

- Radio Transmitters
  - Block and Level
  - Traffic Interfaces
  - Student Exercises
  - Testing RF
  - Power & Freq.
- Radio Receivers
  - Block & Level
  - Selectivity and Sensitivity
  - Data and Timing Recovery
  - Eye Patterns
  - Network Testing – RX tests
  - RSL curves

### **Day #3 - Classroom**

#### **Radio Wave Propagation**

- Maxwell & Waves
- Wave Attenuation
  - Free Space Loss & Absorption
  - Reflections & Multi-Paths
- Radio Horizons
- Creating Site Foot Prints
- Student Exercises

#### **Antenna Coupling and Filters**

- Antenna Coupling in Radios
- ACU Components – Isolators, Circulators, Switches
- Antenna Combiners and Filters
- Student exercises
- Sweeping filters
- Measuring ACU Loss
- SMA cables

#### **How Antennas Work**

- Isotropic Unity Gain
- Gain and EIRP
- Licensing Requirements
- Antenna Types
- Waveguides & Transmission Lines
- Grounding Overview
- Antenna Testing
- Student Exercises

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*For more information or a custom quote*