

# Fundamentals of RF Communications

Covers: HF, VHF, UHF and Microwave Communications Systems



## Overview

This course is designed to provide the participant with the knowledge to understand the different ways that we can use radio frequencies for communication purposes.

## You will be able to

- Explain the fundamentals of RF communications systems
- Describe the electromagnetic spectrum band usage & licencing
- Understand the principles of analog & digital modulation
- Explain the operation of an antenna
- Understand the structure of an RF transmitter & receiver
- Perform test & measurement on RF systems
- Provide examples of typical RF systems for HF, VHF, UHF and microwave

## Who can benefit

Electrical/electronic technicians, test engineers, any personnel entering a career involving working with RF communications systems.

## Pre requisite knowledge

None.

## Teaching Methodology

This is an instructor led hands-on program that uses many practical exercises, demonstrations & examples.

## Outline

### Fundamentals of RF & Microwave

- RF propagation
- Frequency & wavelength
- Analog & digital
- The electromagnetic spectrum & band usage
- Regulation & standards bodies
- Simplex, half duplex & full duplex
- HF /VHF/UHF communication systems
- Microwave communication systems
- Direct waves, ground waves & sky waves
- Atmospheric & weather effects
- Reflection, refraction, diffraction and scattering
- Loss, noise & interference

### Modulation

- Principles of modulation
- Amplitude modulation
- Single sideband
- Frequency modulation
- Phase modulation
- Bits vs baud
- Digital modulation techniques

### Antennas

- What is an antenna?

- Antenna gain
- Vertical & horizontal polarization
- Antenna radiation patterns
- Isotropic and dipole antennas
- Effective radiated power
- Practical antenna examples

### RF Transmitters & Receivers

- The radio communications system
- Architecture of a transmitter & receiver
- The Super heterodyne technique
- Receiver sensitivity & noise
- Features of a modern transceiver
- Synchronization
- Frequency management

### RF/Microwave Parameters & Measurements

- Power measurements
- Watts, dB and dBm
- System gain
- Voltage standing wave ratio (VSWR)
- Signal to noise ratio
- Microwave passive & active circuits & components
- Filters
- Transmission lines
- Microwave analysis
- Spectrum analysis
- Bit & block error ratio
- Forward error correction

### RF & Microwave System Test & Measurement

- Using a spectrum analyser & signal generator
- Making power measurements
- RF system component analysis
- Using a network analyser
- Systems performance and optimization

### Example RF Systems

- HF radio communications system
- HF automatic link establishment
- VHF/UHF two way radio system
- Secure radio communications
- GSM mobile radio network
- Point to point microwave links

### Practical Assessment

DURATION 5 days  
MAXIMUM CLASS SIZE 12