Introduction to Radio Concepts

Course Description

In this course the basic concepts of radio principles are introduced starting with an overview of the electromagnetic spectrum, with a primary focus on the area of radio communications. The course will progress and provide some basic radio communication terms and concepts before providing a focus on antennas used within radio communication systems. It will then finish off with an overview of the techniques utilised in modulation, duplexing and multiplexing.

This course has no prerequisites.
This course will contain the following sections:

1. Introduction to Radio Concepts

**Topic areas covered include:**

- The Electromagnetic Spectrum.
  - Frequencies of RF Communication:
    - Licensed and Unlicensed.
    - mmWave.
  - Regulations:
    - Interference and Power.

- RF Fundamentals:
  - Waveform Fundamentals.
  - The Fundamentals of Propagation.
  - Frequency, Wavelength and Velocity.

- Decibel Basics:
  - dB Variants (dBi, dBm).
  - Link Budget Calculation.

- Antennas – Part 1:
  - Antenna types, gains and radiation patterns:
    - Dipole.
    - Yagi.
    - Patch.
    - Parabolic Reflector.

- Antennas – Part 2:
  - Microwave.
  - MIMO.
  - Adaptive Antennas and Beamforming.
  - Massive MIMO.

- Modulation Techniques:
  - AM, FM, Phase.
  - QPSK, 16QAM, 64QAM, 256QAM.

- Duplexing and Multiplexing Techniques:
  - Simplex, half duplex and full duplex.
  - FDD and TDD.
  - FDMA, TDMA, CDMA.
  - OFDMA.
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