RF Training – Advanced

RF Training Advanced by Example, Project-Based, Hands-on

Advanced RF training course provides a multidimensional overview for professionals involved in the specification, procurement, design, testing, operations and optimization of next-generation wireless and communications systems.

This RF training course, Radio Frequency Advanced, is an interactive hands-on program intended for anyone working in the area of radio frequency communications who requires a technical level of advanced RF principals applied to various communication technologies such as Microwave, SATCOM, VSAT, GSM, GPRS/EDGE, CDMA, UMTS, HSPA+, LTE, LTE-Advanced, WiFi, Bluetooth, Zigbee, RFID, NFC and more.

Learn about Advanced RF Topics such as:

- RF Planning
- RF Propagation Models
- Transmission Lines
- Link Budget
- Transmission Line
- Antenna Theory
- RF Measurements
- Transmission Measurements
- Noise
- RF System design and ENgineering Principles
- RF Systems Simulation and Behavioral Modeling
- Practical RF System Design Guidelines
- RF transmitters/receivers
- Evaluate system specifications
- EM Shielding
- EMC Engineering

BASIC AND ADVANCED RF TRAINING COURSES

COURSE NAME	LENGTH
Antenna Engineering Training Boot Camp	4 days
Antenna Training – Engineering, Theory, Analysis and Design	3 days
Cellular Networks Performance Workshop Training	3 days
DAS Training – Distributed Antenna System	3 days
RF Engineering Training Boot Camp	4 days
RF Fundamentals – RF Training	2 days
RF Optimization Training	2 days
RF Safety – Radio Frequency Safety Training	2 days
RF Theory & Technical Training	2 days
RF Training – Advanced	2 days

Who Should Attend

Technical personnel involved with RF system design/operations, Engineers and managers engaged or expect to be engaged in the specification, procurement, design and development, testing, and operation of current and future RF systems.

Objectives

After completing this course, students will be able to:

- Learn critical details of major RF systems analysis and design advances
- Learn the structure of RF systems and associated issues
- Learn about critical RF design and engineering procedures and principals
- Learn how to work with specifications, procurement, design and development, testing, and operation of current and future RF systems
- Assess RF system design/operations
- Assess effects of RF system advances on communications technique effectiveness
- Examine and evaluate RF systems performance and optimization processes
- Analyze RF system components
- Step through a practical process for analyzing, optimizing and managing advanced RF networks

Outline

RF System design and Engineering Principles

- Overview of RF Systems
- HF, VHF, and UHF Radio Systems, including Analog, Digital, and Trunk
- RF System Design & Integration
- Capturing RF System Requirements
- RF System Requirements Analysis and Design
- Transceiver and Receiver Architecture
- High-Speed PC Board Layout and Design
- Software Defined Radio and Next Generation Hardware
- Modulation Techniques
- DSP Digital Signal Processing
- RF Testing and Measurement

RF Systems Simulation and Behavioral Modeling

- RF Modeling
- EM Shielding/EMC Engineering
- Shannon and Nyquist Theorems
- Modulation, Demodulation and Multiple Access Techniques
- Spectral efficiency vs. Power Efficiency
- Antenna Types
- RF system Performance based on C/N and Eb/No
- Link Budget Calculations
- Power Settings for a Balanced Path
- Modeling RF Path Loss
- Noise Figure
- Eb/No vs. SNR
- Receiver Sensitivity
- Dynamic Range
- Intermodulation Distortion
- Power Output
- Spectral Efficiency and System Limitations
- RF Performance Engineering
- Traffic Engineering applied to RF Systems
- System Noise Management
- Scattering Parameter Analysis
- RF Regulatory and Safety Considerations

Practical RF System Design Guidelines

- Basic Building Blocks in Radio and Microwave Design
- Tradeoffs in designing wireless systems
- Design Trade-off between Modulation Scheme, Data Rate, RF Bandwidth, Channel Filter, Power, Noise, Phase Noise, and Bit-Error Rate
- RF Impairments
- Noise and Distortion
- Transistor Oscillators and Frequency Synthesizers
- Receiver Design
- Eb/No vs. SNR, BER vs. noise, Bandwidth Limitations
- Low Noise Amplifiers and Mixers Design
- Oscillator, Frequency Synthesizers and Filter Design
- Oscillators/Phase Noise
- Basic Concepts of Oscillator Design
- Phase Noise in Oscillators
- Calculating the Allowable Phase Noise from the System Specifications
- Power Amplifier Design
- Design Tradeoffs between Linearity, Power, and Efficiency
- Phase-Locked Oscillators
- Modulators
- Power Amplifiers
- Antennas
- Low Noise Receivers
- Mixers
- Overall Receiver Performance
- System Design
- System Operating Margin (SOM)
- Block diagram
- Baseband signaling
- Forward error correction
- Modulation/demodulation

RF Transmitters/receivers

- Circuit and system level Design
- Circuit and system level in radio transceivers and other RF systems
- Typical Radio Architectures
- Exploring the Design Tradeoffs
- RF Systems Engineering, Integration, and Installation

- RF System Design Principals
- Evaluation, Design and Implementation Management of Reliable, cost-effective RF Systems
- Fundamentals of Digital RF Communication
- Circuit Level RF Design
- RF System Components
- RF Circuit Design
- System Level RF Design Considerations
- RF Surveys
- Measure Signal level, Walking or Driving
- Coverage Analysis
- Examine Terrain-based Coverage, including urban, suburban, rural, tunnels, bridges, campus, and in-building
- Antenna Design Considerations
- Electromagnetic Modeling and Simulation
- Define Antenna Types and Locations to fit Application
- Interference Analysis and Resolution
- Perform intermodulation and Collocation Analysis, Filter Definition

Evaluate system specifications and performance

- RF Optimization Principles
- RF coverage and service performance measurements
- Propagation in Urban Environments, from Simple to Extremely Dense
- Propagation Inside Buildings
- Design, analysis and optimization of wireless networks
- Site Acquisition
- Verification of network deployments for wireless networks
- Network planning resources
- Link budgets, scheduling and resource allocation
- Preparation and Report generation
- Real-time coverage maps
- True-up RF modeling software
- System Setting Parameters
- Initial optimization testing of installed networks
- Antenna and Transmission Line Considerations
- System field-testing and parameter optimization
- Functional testing and optimization for implemented sites
- Test plan development
- System drive test and data analysis

- System parameter settings and interference control
- Key RF Performance Indicators
- FER, Mobile Receive Power, Ec/Io, Mobile Transmit Power
- System accessibility analysis
- Available radio resources and network trunking issues
- System parameter optimization
- Regression analysis to measure benefits
- Self-generated system interference
- Cell site integration
- Construction coordination
- Equipment installation/antenna system verification
- Radio testing
- Initial drive testing
- Performance monitoring
- Site migration planning and testing
- ERP changes
- Orientation changes

EM Shielding/EMC Engineering

- Understand Shielding Mechanisms and Problems
- EMC/Shielding/Grounding Techniques for Chip & PCB Layout
- EMC Design, Bench Top Measurements and Troubleshooting Techniques
- Successful Shielding Strategies
- EMC and Signal Integrity Design Strategies
- Signal Integrity from the Ground Up
- Shielding Enclosures and Cables for Wired and Wireless Products and Systems
- Cost Effective and Optimal Shielding System Engineering and Integration
- Shielding Evaluation