

RF Optimization Training

Why should I choose RF Optimization Training?

RF Optimization Training Course provides a thorough overview of the principles behind RF optimization applied to GSM, EDGE, CDMA/CDMA2000, WCDMA/UMTS, LTE, Microwaves, SATCOM, VSAT and Wireless LANs/Hot Spots. This four-day course builds competence in the principles and present-day practices used to improve the operating performance of modern wireless systems. Core performance indicators are thoroughly explored and desirable healthy operating conditions are identified. Both system-side and mobile-side performance-monitoring tools are introduced. The main operating parameters are identified along with the considerations necessary to properly set them in real systems.

Signatures of specific problems (including several deadly but innocent-appearing failure mechanisms) are identified, along with their common solutions. Real-life captured drive-test examples are studied and solved by the class. Special attention is given to multiple-carrier and intersystem handoff issues, system determination algorithms commonly used by mobiles, and data communication, and a glimpse of future issues. At conclusion, participants will be able to evaluate their own systems' performance, armed with the knowledge and confidence necessary to identify and solve most common problems, defining KPIs and more.

Applicability: Wireless LANs, Microwave Systems, Satellite Communications, VSAT, CDMA/CDMA2000 1x, 1xEV-DO, GERAN, UMTS (R99, HSPA/HSPA+), LTE and LTE Advance and any other RF systems.



Who Should Attend

This course is designed for individuals and anyone needing a solid foundation for understanding the principles of RF optimization. Engineers, technicians and managers who are new to RF and require applicable skills in RF design, planning and engineering. Engineers and Technicians responsible for designing, maintaining, monitoring, and/or optimizing performance of wireless systems

Objectives

Upon completing the course, the participant will be able to:

- Understand RF optimization principles and procedures
- Understand the basic RF operations and the configurable parameters that control them
- Select key network performance counters
- Examine RF optimization KPIs (Key Performance Indicators)
- Describe RF measurements and testing types
- Explain why the various measurements must be made
- Perform uncertainty analysis on the measurements and determine how to improve accuracy

- Review Performance-monitoring tools available from the System and the mobile side
- Review Performance-monitoring tool
- Explore Real-Life Drive-Text Example Cases to be solved in class
- Discuss Real-World Optimization Issues and Solutions

Outline

RF Optimization Principles

- Design, analysis and optimization of wireless networks
- Verification of network deployments for 2G, 2.5G and 3G wireless networks
- RF engineering principals
- Ensure good quality network and services
- Optimize the use of your network planning resources
- Expand the coverage more quickly
- Link budgets, scheduling and resource allocation to support Site Acquisition.
- Preparation and Report generation
- Detect and correct adjacent and co-channel interference
- Determine actual uplink coverage
- Produce real-time coverage maps
- True-up RF modeling software

Propagation Analysis

- Propagation models
- Free space, Okamura/HATA, Okamura with Knife Edge Diffraction, Longley-Rice, and the proprietary BIBY-C
- Propagation analysis as a complex process
- Many variables to model the proposed or existing system accurately
- Propagation Channel Considerations
- RF path loss
- Reflection
- Multipath and fading
- Noise and interference
- Polarization distortion
- Diversity implementation

Role of Antenna in rf optimization

- Antenna properties
- Impedance, directivity, radiation patterns, polarization
- Types of Antennas

- Resonant antennas
- Traveling wave antennas
- Frequency Independent antennas
- Aperture antennas
- Phased arrays
- Electrically small antennas
- Circularly polarized antennas
- Elementary Antenna Elements
- The monopole
- The dipole
- The loop
- The folded dipole
- The slot
- Omnidirectional Antennas
- Monopole configurations
- Feed considerations
- Dipole configurations
- Ground plane considerations
- The impact of the surrounding environment on antenna performance
- Bandwidth improvement techniques
- Microstrip Antennas
- Element types
- Microstrip element design
- Design trade-offs
- Circularly Polarized Antennas
- Achieving circular polarization
- The helix antenna
- The crossed dipole antenna
- The microstrip patch
- The quadrifilar heli
- Aperture Antennas
- Broadband and Frequency Independent Antennas
- Antenna Arrays
- Electrically Small Antennas
- Fractal Antennas
- Ultra Wideband (UWB) Antennas
- Low Profile Antennas

Network parameters testing

- Evaluate call-processing operations
- Perform selected call processing functions
- Measure and report the amplitude of the received base station signal
- Measure and report the signal quality of the received base station signal
- Read and report the neighbor cell list from the broadcast messages
- Report the amplitude of neighbor list base stations
- View and log protocol messages in decoded form for easy interpretation

System Optimization

- RF coverage and service performance measurements for 2G/2.5G/3G network optimization
- System Setting
- 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 Performance Indicators

- Call quality analysis, using customer complaints, statistical data, and drive test data
- Determine the exact causes of dropped calls, high BER/FER, and missed hand-offs
- FER, Mobile Receive Power, E_c/I_o , Mobile Transmit Power
- System accessibility analysis
- Available radio resources and network trunking issues
- System parameter optimization
- Regression analysis to measure benefits
- Frequency/PN offset planning
- Self-generated system interference
- Cell site integration
- Construction coordination
- Equipment installation/antenna system verification
- RF parameter datafills
- Radio testing
- Initial drive testing
- Performance monitoring

- Neighbor site re-designs
- Cell site migration planning and testing
- Unburden overloaded switches by migrating cell sites to new or existing switches
- Ensuring consistent cell site performance
- Switch performance statistics and drive test analysis to recommend antenna pattern changes
- ERP changes
- Orientation changes
- TMA
- Investigating and resolving customer complaints
- Ranges, normal values, what they mean, and what to do about it

Performance Signatures

- For a good call
- For a lost call in bad coverage
- Link interference
- A Death Scenario

Survey of Performance-monitoring tools available

- What's available, what does it mean? Identifying the key indicators to watch
- Tracking and Benchmarking for problem detection and growth management

Survey of Performance-monitoring tool available from the mobile side

- Maintenance Mode features of handsets, a useful tool that's always with you!
- Commercially-available handset-based drive-test data collection tools
- Commercial PN scanners and their special capabilities: powerful allies
- Post-Processing tools: how to find the important facts buried in all that data

Real-Life Drive-Text Example Cases to be solved in class

- A normal call
- Dropped Call, Poor Coverage
- Dropped Call, Link Interference
- Capacity and Loading dynamic example
- Specific neighbor list, search window, and resource congestion cases

Real-World Optimization Issues and Solutions

- Managing excessive soft handoff: root causes and solutions
- Achieving higher cell capacity: tips, tricks, and real expectations
- Managing search windows for speed

Special topics

- Multi-carrier Operation and Optimization: principles and tips
- Intercarrier and Intersystem Handoff mechanisms and troubleshooting
- Data transmission on today's CDMA and GSM systems: early optimization considerations
- Looking toward the future: 3G systems and their operating implications
- Optimization techniques, package interconnect modeling, parameter extraction, RF components modeling
- RF antenna design-optimization for electromagnetic applications
- RF Circuits Design for Wireless and Satellite Communication systems
- RF Filters and Multiplexers Design and Analysis

WORKSHOPS

Class Projects: Optimizing GSM/GPRS/EDGE Networks

- Performance analysis
- Optimization process
- BCCH parameter optimization
- Cell selection and reselection
- Attach and routing area update process
- PDP context activation process
- TBF Setup and Retransmission
- Uplink and downlink TBF establishment
- TBF flow throughput
- Impact of retransmissions on throughput
- Impact of the Gs interface
- Impact of packet control channels
- Impact of GPRS uplink power control

Class Projects: Optimizing CDMA/CDMA2000 1xEV-DO and 1xEV-DV Networks

- Performance analysis
- Dropped Call, Poor Coverage
- Dropped Call, Forward Link Interference
- Dropped Call, Reverse Link Interference
- Capacity and Loading dynamic example
- Specific neighbor list, search window, and resource congestion case
- Managing excessive soft handoff: root causes and solutions
- Achieving higher cell capacity: tips, tricks, and real expectations
- Managing search windows and neighbor lists for speed
- Special topics
- Multi-carrier Operation and Optimization: principles and tips

- Intercarrier and Intersystem Handoff mechanisms and troubleshooting
- Data transmission on today's CDMA systems: early optimization considerations