

Hands-On

# Advanced Wi-Fi Installation, Testing & Troubleshooting



## Course Description

The Advanced Hands-On course is an expansion of the Residential Wi-Fi Best Practices course, and includes comprehensive coverage of past, current and emerging wireless technologies. It includes an in-depth look at Radio Frequency (RF) propagation and Wireless LANs.

The course is designed for those who want a better understanding of Wi-Fi networks, including those seeking certification, or who need to find and mitigate challenging wireless problems.

The course covers various aspects of a WLAN design, such as access point placement, multi-node mesh networks, wired and wireless links, and system testing. The latest Wi-Fi Alliance and IEEE 802.11ax standards are discussed, as well as security options including WPA3 and covers the business and enterprise WLAN installation and troubleshooting.



Our instructors have actual field experience and have faced the same obstacles as your team. Our Real World Experience allows us to provide the participants with the answers and the skills to overcome their daily challenges.

## Students Will Learn

- **Networking Fundamentals Refresher**
- **OSI Model components in a Wi-Fi network**
- **Radio Frequency (RF) Propagation Issues**
- **IEEE 802.11 Wireless standards**
- **Modulation Coding Schemes**
- **MU-MIMO Antennas & Beamforming**
- **Interference Mitigation on 2.4G & 5G bands**
- **Wi-Fi6E Extended Band Plan**
- **Wireless Access Point Configuration incl. SSIDs, Security, Ports**
- **Client Device Configuration**
- **Test & Measurement (Viavi & phone apps)**
- **Troubleshooting by previous examples**
- **And much more**

## Target Audience

Wireless and network Installation Techs, IT Technical staff & management, network support personnel in NOC/SCC, or others seeking advanced Wi-Fi installation and troubleshooting skills.

## Prerequisites

A general understanding of wireless networks, personal computers, and network connections to the CPE is recommended. Previous experience with wireless test equipment may be helpful.

## Course Outline

### Module 1 : Networking Overview

OSI Layers & Components

Layer 1 Media

- Hubs, Copper, Fiber, Radio
- Collision Domains, CSMA/CD

Layer 2 Switching

- Switches, MAC Address, LANs

- Wireless LANs, CSMA/CA

#### Layer 3 Routing

- Routers, IPv4, IPv6, NAT
- Subnets, masks
- DHCP, DNS

#### Layer 4 Ports

- Port Forwarding, PAT

### **Module 2 : Radio Frequency Propagation**

#### What Are Radio Signals?

#### Antennas & Propagation

#### Networks

- Point-to-Point/Ad Hoc, WAP, Mesh
- Links and Backhaul
- Extenders

#### IEEE 802.11 Standards

- Channels - 2.4G, 5G
- UNII/ISM Bands & DFS
- Channel Bonding
- 802.11a thru ax, Wi-Fi4 thru Wi-Fi6E (incl. 7.5GHz)
- Wi-Fi6 Propagation Techniques

#### Types of Interference

- Adjacent (overlap) & Co-Channel
- Commercial Users, non-radio equipment

Wi-Fi Antennas incl. MIMO types, MU-MIMO, beamforming

### **Module 3 : Wireless Access Points & Routers**

#### System Set-Up

- Telco default & custom parameters

#### Single vs. Mesh

- Device Placement guidelines
- Environmental factors
- Pre-Testing

#### Primary Node & Satellites

- Uplinks - wired & wireless
- Channel Selection
- Default Passwords

#### Examples

- Calix, Ubiquiti, Linksys, and/or customer equipment

#### Testing

- Wi-Fi Network Analyzers
- Viavi WFED series
- Smartphone apps - Net Analyzer, WiFiMan, Fing, Viavi, Linksys

### **Module 4 : Wireless Security**

#### Security Types

- WEP, WPA2 PSK & ENT, TKIP/AES, WPA3

#### Security Techniques

- Wireless Frames & Interception
- Default Passwords
- SSID - multiple, guest, hidden
- MAC filtering/device detection
- Firewalls

#### WAP/Router Logs

## Module 5 : Troubleshooting

### Typical Wi-Fi Problems

- Slow Speeds, Causes
- Signal Strength, RSSI, S/N Ratio
- Interference Sources, Mitigation
- High Channel Utilization
- Antenna/Coverage Optimization
- Legacy wireless devices

### Windows/Shell commands

- ping, netstat, arp, ipconfig/ifconfig, traceroute/tracert

### Troubleshooting Techniques

- Verifying the fault/fix
- Separating SSIDs/Legacy devices
- Minimal-config Testing
- Disabling radios/channels
- Wireless signal & SSID maps
- Reviewing Logs
- Firmware updates
- Public vs. Private network access
- Sporadic Interference: Microwave, video camera, computer, congestion, etc.

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## Notes

Our courses focus on understanding the values presented by the various test meters and analysis software used to troubleshoot Wi-Fi networks it is not the Buttonology training that is provided by the manufacturer reps and equipment manufacturers. Our goal is for the attendees to understand what the analysis is telling them and to understand why a circuit or the access point may not work even though the Auto Test functions states that all tests pass.

Featured Equipment  
PC Based Wi-Fi Analysis Software  
Discussion of Greenlee Airscout  
Various Wi-Fi Scanners and Analyzers  
Incorporate your own Test Meters and Software

## Delivery Method

Instructor led with numerous Hands-On labs and exercises.

## Equipment Requirements

**(This apply's to our hands-on courses only)**

This course can be combined with other courses such as the Residential Wi-Fi Best Practices for a customized curriculum.

BTS always provides equipment to have a very successful Hands-On course. BTS also encourages all attendees to bring their own equipment to the course. This will provide attendees the opportunity to incorporate their own gear into the labs and gain valuable training using their specific equipment.

## Course Length

3 Days