

# CWTS™ Exam Objectives (Exam PW0-070)

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## Introduction

The Certified Wireless Technology Specialist (CWTS) certification, covering the current objectives, will certify that successful candidates know the fundamentals of RF behavior, can explain basic technologies and operations of WLANs, describe the functions and proper implementation of wireless components, and have the skills needed to perform basic installation and configuration wireless network hardware components. A typical candidate should have a basic understanding of data networking concepts.

The skills and knowledge measured by this examination are derived from a survey of wireless networking experts and professionals. The results of this survey were used in weighing the subject areas and ensuring that the weighting is representative of the relative importance of the content.

The following chart provides the breakdown of the CWTS exam as to the weight of each section of the exam.

Subject Area	% of Exam
Wi-Fi Technology, Standards, and Certifications	25% 45%
Hardware and Software	20% 25%
Radio Frequency (RF) Fundamentals	20%
Site Surveying and Installation	10%
Applications, Support, and Troubleshooting	15%
Security & Compliance Monitoring	10% 45%
<b>Total</b>	<b>100%</b>

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## Wireless Technologies, Standards, and Certifications

1.1 Define the roles of the following organizations in providing direction and accountability within the wireless networking industry

- IEEE
- Wi-Fi Alliance
- Local regulatory authorities

1.2 Define basic characteristics of and concepts relating to Wi-Fi technology

- Range, coverage, and capacity
- Frequencies/channels used
- Channel reuse and co-location
- Infrastructure and ad hoc modes
- BSSID, SSID, BSS, ESS, BSA, IBSS
- Network discovery via active and passive scanning
- 802.11 authentication and association
- Data rates and throughput
- The distribution system and roaming
- Protection Mechanisms
- Power saving operation
- Dynamic rate switching

1.3 Summarize the basic attributes of the following WLAN standards, amendments, and product certifications

- 802.11a
- 802.11b
- 802.11g
- 802.11n
- Wi-Fi Multimedia (WMM) certification
- WMM Power Save (WMM-PS) certification
- Wi-Fi Protected Access (WPA/WPA2) certification
  - Enterprise
  - Personal

1.4 Explain the role of Wi-Fi as a wireless network access technology

- WPAN, WLAN, WMAN, WWAN
- The OSI reference model

## Hardware and Software

2.1 Identify the purpose, features, and functions of the following wireless network components. Choose the appropriate implementation or configuration steps in a given scenario.

- Access Points
  - Controller-based
  - Autonomous
  - Cooperative
- Mesh
- Wireless LAN routers
- Wireless Bridges
- Wireless Repeaters

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- WLAN Controller
    - Distributed and centralized data forwarding
  - Power over Ethernet (PoE) Devices
    - 802.3af and 802.3at
    - Midspan
    - Endpoint
- 2.2 Identify the purpose, features, and functions of the following client device types. Choose the appropriate installation or configuration steps in a given scenario.
- PC Cards (ExpressCard, CardBus, and PCMCIA)
  - USB2, CF, and SD Devices
  - PCI, Mini-PCI, and Mini-PCIE, and Half Mini PCIE cards
  - Workgroup Bridges
  - Client utility software and drivers
- 2.3 Identify the purpose, features, and proper implementation of the following types of antennas.
- Omni-directional / dipole
  - Semi-directional
  - Highly-directional
- 2.4 Describe the proper locations and methods for installing RF antennas
- Internal and external (to the AP) antennas
  - Pole/mast mount
  - Ceiling mount
  - Wall mount

## Radio Frequency (RF) Fundamentals

- 3.1 Define the basic concepts and units of RF measurements, identify when they are used, and perform basic unit conversion.
- Watt (W) and milliwatt (mW)
  - Decibel (dB)
  - dBm
  - dBi
  - RSSI
  - SNR
- 3.2 Identify and explain RF signal characteristics
- Frequency
  - Wavelength
  - Amplitude
  - Phase
- 3.3 Identify factors which affect the range and rate of RF transmissions
- Line-of-sight requirements
  - Interference (Baby monitors, spread spectrum phones, microwave ovens Wi-Fi and non-Wi-Fi)
  - Environmental factors, including building materials
  - Free space path loss

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3.4 Define and differentiate between the following physical layer wireless technologies

- 802.11b HR/DSSS
- 802.11g ERP
- 802.11a OFDM
- 802.11n HT

3.5 Define concepts which make up the functionality of RF spread spectrum communication

- OFDM & HR/DSSS 802.11 channels
- Co-location of HR/DSSS and OFDM 802.11a/b/g/n systems
- Adjacent-channel and co-channel interference
- ~~WLAN/WPAN co-existence~~
- CSMA/CA operation
- Half duplex communications

3.6 Understand and apply basic RF antenna concepts

- Passive Gain
- Beamwidth
- Simple diversity
- Polarization

3.7 Identify the use of the following WLAN accessories and explain how to select and install them for optimal performance and regulatory domain compliance

- RF cables
- RF connectors
- Lightning Arrestors and grounding rods

## Site Surveying and Installation

4.1 Understand and describe the requirements to gather information prior to the site survey and do reporting after the site survey

- Gathering business requirements
- Interviewing stakeholders
- ~~Defining physical and data security requirements~~
- Gathering site-specific documentation including existing network characteristics
- Identifying infrastructure connectivity and power requirements
- Understanding RF coverage requirements
- Understanding application requirements
- ~~Client connectivity requirements~~
- ~~Antenna use considerations~~

4.2 Define and differentiate between the following WLAN system architectures and understand site survey concepts related to each architecture. Identify and explain best practices for access point placement and density.

- Multiple Channel Architecture (MCA)
- Single Channel Architecture (SCA)

4.3 Describe the basic purpose and methodology of manual and predictive site surveys

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4.4 Define the need for and the use of a manual site survey tool and differentiate between the following manual site survey types

- Active surveys
- Passive surveys

4.5 Differentiate between manual and predictive site surveys

- Advantages and disadvantages of each site survey methodology

4.6 Define the need for and use of **site survey software** or a protocol analyzer in a manual site survey as it relates to identifying, locating, and assessing nearby WLANs

~~4.7 Differentiate between site survey involving networks with and without a mesh access layer~~

~~4.8 Differentiate between site survey methods for indoor and outdoor wireless service~~

4.9 Define the need for and use of a spectrum analyzer in a site survey

- Identification and location of interference sources
- Differentiation of Wi-Fi and non-Wi-Fi interference sources

~~4.10 Identify limitations on hardware placement~~

- ~~▪ Areas where APs or antennas cannot be placed~~
- ~~▪ Areas beyond Ethernet distance limitations~~

4.11 Understand industry best practices for optimal use of directional and omni-directional antennas in site surveys

## Applications, Support, and Troubleshooting

5.1 Identify deployment scenarios for common WLAN network types and suggest best practices for these scenarios.

- Small Office / Home Office (SOHO)
- Extension of existing networks into remote locations
- Building-to-building connectivity
- Public wireless hotspots
- Carpeted office, education, industrial, and healthcare
- ~~▪ Municipal and law enforcement connectivity~~
- ~~▪ Corporate data access and end-user mobility~~
- Last-mile data delivery – Wireless ISP
- High density environments
- ~~▪ Transportation networks (trains, planes, automobiles)~~

5.2 Recognize common problems associated with wireless networks and their symptoms, and identify steps to isolate and troubleshoot the problem. Given a problem situation, interpret the symptoms and the most likely cause.

- Throughput problems
- Connectivity problems
- RF coverage or capacity problems
- Interference from Wi-Fi or non-Wi-Fi sources
- **Application performance problems**

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- RF performance problems, such as multipath and hidden nodes
- ~~Device upgrades~~

5.3 Identify procedures to optimize wireless networks.

- Infrastructure hardware selection and placement
- Identifying, locating, and removing sources of interference
- Client load-balancing and infrastructure redundancy
- Analyzing infrastructure capacity and utilization
- ~~Multipath and hidden nodes~~

## Security & Monitoring

6.1 Identify and describe the following legacy WLAN security technologies.

- SSID Hiding
- WEP
- MAC Filtering

6.2 Understand the basic operation of and implementation best practices for the following WLAN security technologies.

- WPA- and WPA2-Personal
- WPA- and WPA-2 Enterprise
- 802.1X/EAP
- AAA and RADIUS
- Encryption – TKIP/CCMP

6.3 Understand the basic functions and implementation best practices for the following WLAN security technologies.

- Role Based Access Control (RBAC)
- Virtual Private Networking (VPN)
- Wireless Intrusion Prevention Systems (WIPS)
- Captive Portals
- Network management and monitoring systems