INSTALLATION AND CONFIGURATION GUIDE

15   AVOIDING HAZARDS

Use simple precautions to protect staff and equipment. Hazards include exposure to RF waves, lightning strikes, and power surges. This section specifically recommends actions to abate these hazards.

15.1   PREVENTING OVEREXPOSURE TO RF ENERGY

To protect from overexposure to RF energy, install Canopy radios so as to provide and maintain the minimum separation distances from all persons shown in Table 40.

Table 40: Exposure separation distances

Canopy module	Minimum separation distance from all persons	
Antenna of 900-MHz AP or SM	60 cm	24 in
2.4-, 5.2-, 5.4-, or 5.7-GHz radio with no reflector	20 cm	8 in
2.4-, 5.4-, or 5.7-GHz radio with a reflector	1.5 m	60 in (5 ft)
Antenna of connectorized 5.7 GHz AP	20 cm	8 in

At these and greater separation distances, the power density from the RF field is below generally accepted limits for the general population.

> **NOTE:**
> These are conservative distances that include compliance margins. In the case of the reflector, the distance is even more conservative because the equation used models the reflector as a point source and ignores its physical dimensions.

15.1.1   Details of Calculations for Separation Distances and Power Compliance Margins

Limits and guidelines for RF exposure come from:

- US FCC limits for the general population. See the FCC web site at http://www.fcc.gov, and the policies, guidelines, and requirements in Part 1 of Title 47 of the Code of Federal Regulations, as well as the guidelines and suggestions for evaluating compliance in FCC OET Bulletin 65.
- Health Canada limits for the general population. See the Health Canada web site at http://www.hc-sc.gc.ca/rpb and Safety Code 6.
- ICNIRP (International Commission on Non-Ionizing Radiation Protection) guidelines for the general public. See the ICNIRP web site at http://www.icnirp.de/ and Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields.

The applicable power density exposure limits from the documents referenced above are

- ◦ 6 W/m^2 for RF energy in the 900-MHz frequency band in the US and Canada.

- ◦ 10 W/m^2 for RF energy in the 2.4-, 5.2-, 5.4-, and 5.7-GHz frequency bands.

Peak power density in the far field of a radio frequency point source is calculated as follows:

$$S = \frac{P \cdot G}{4 \pi d^{2}}$$

where
S = power density in W/m^2
P = RMS transmit power capability of the radio, in W
G = total Tx gain as a factor, converted from dB
d = distance from point source, in m

Rearranging terms to solve for distance yields

$$d = \sqrt{\frac{P \cdot G}{4 p S}}$$

Calculated Distances and Power Compliance Margins

Table 41 shows calculated minimum separation distances d, recommended distances and resulting power compliance margins for each frequency band and antenna combination.

Table 41: Calculated distances and power compliance margins

Frequency Band	Antenna	Variable			d (Calcu-lated)	Recom-mended Distance	Power Compliance Margin
		P	*G*	*S*			
900 MHz	external	0.4 W (26 dBm)	10.0 (10 dB)	6 W/m^2	0.23 m	60 cm (24 in)	7
2.4 GHz	internal	0.34 W (25 dBm)	6.3 (8 dB)	10 W/m^2	0.13 m	20 cm (8 in)	2.3
	internal plus reflector	0.34 W (25 dBm)	79.4 (19 dB)	10 W/m^2	0.46 m	1.5 m (5 ft)	10
5.2 GHz	internal	0.2 W (23 dBm)	5.0 (7 dB)	10 W/m^2	0.09 m	20 cm (8 in)	5
	internal plus reflector	0.0032 W (5 dBm)	316 (25 dB)	10 W/m^2	0.09 m	1.5 m (5 ft)	280
5.4 GHz	internal	0.2 W (23 dBm)	5.0 (7 dB)	10 W/m^2	0.09 m	20 cm (8 in)	5
	internal plus reflector	0.0032 W (5 dBm)	316 (25 dB)	10 W/m^2	0.09 m	1.5 m (5 ft)	280

Frequency Band	Antenna	Variable			*d* (Calcu-lated)	Recom-mended Distance	Power Compliance Margin
		P	*G*	S			
5.7 GHz	internal	0.2 W (23 dBm)	5.0 (7 dB)	10 W/m^2	0.09 m	20 cm (8 in)	5
	internal plus reflector	0.2 W (23 dBm)	316 (25 dB)	10 W/m^2	0.71 m	1.5 m (5 ft)	4.5
	external	0.125 W (21 dBm)	31.6 (15 dB)	10 W/m^2	0.18 m	20 cm (8 in)	1.27

15.2   GROUNDING CANOPY EQUIPMENT

Effective lightning protection diverts lightning current safely to ground, Protective Earth (PE) ⏚. It neither attracts nor prevents lightning strikes.

> ### *WARNING!*
> Lightning damage *is not* covered under the Canopy warranty. The recommendations in Canopy guides give the installer the knowledge to protect the installation from the harmful effects of ESD and lightning. These recommendation must be thoroughly and correctly performed. However, complete protection is neither implied or possible.

15.2.1   Grounding Infrastructure Equipment

To protect both your staff and your infrastructure equipment, implement lightning protection as follows:

- ◦ Observe all local and national codes that apply to grounding for lightning protection.
- ◦ Before you install your Canopy modules, perform the following steps:
  - – Engage a grounding professional if you need to do so.
  - – Install lightning arrestors to transport lightning strikes away from equipment. For example, install a lightning rod on a tower leg other than the leg to which you mount your module.
  - – Connect your lightning rod to ground.
  - – Use a Canopy 300SS Surge Suppressor (or Transtector ALPU-ORTs for OFDM BH installations) on the Ethernet cable where the cable enters any structure. (Instructions for installing a Canopy 300SS Surge Suppressor are provided in Procedure 28 on Page 346.)
- ◦ Install your modules at least 2 feet (0.6 meters) below the tallest point on the tower, pole, or roof.

15.2.2   Grounding Canopy 30/60- and 150/300-Mbps Backhaul Modules

For grounding the Canopy OFDM series backhaul modules, see the details, caveats, and wiring schemes provided in the following documents:

- ◦ *Canopy 30 Mbps 60 Mbps Backhaul User Guide*
- ◦ *Lightning Arrestor Alert Notice*
- ◦ *Canopy 30/60 & 150/300 Mbps OFDM Backhaul Lightning Arrestor Guide*.

15.2.3   Grounding SMs

This section provides lightning protection guidelines for SMs to satisfy the National Electrical Code (NEC) of the United States. The requirements of the NEC focus on the safety aspects of electrical shock to personnel and on minimizing the risk of fire at a dwelling. The NEC does not address the survivability of electronic products that are exposed to lightning surges.

The statistical incidence of current levels from lightning strikes is summarized in Table 42.

Table 42: Statistical incidence of current from lightning strikes

Percentage of all strikes	Peak Current (amps)
<2	>140,000
25	>35,000
>50	>20,000
>80	>8,500

At peak, more than one-half of all surges due to direct lightning strikes exceed 20,000 amps. However, only one-quarter exceed 35,000 amps, and less than two percent exceed 140,000 amps. Thus, the recommended Surge Suppressor (300SS) provides a degree of lightning protection to electronic devices inside a dwelling.

Summary of Grounding Recommendations

Motorola recommends that you ground each SM as follows:

- ◦ Extend the SM mounting bracket extend to the top of the SM or higher.
- ◦ Ground the SM mounting bracket via a 10-AWG (6 mm^2) copper wire connected by the most direct path either to an eight foot-deep ground rod or to the ground bonding point of the AC power service utility entry. This provides the best assurance that
  - – lightning takes the ground wire route
  - – the ground wire does not fuse open
  - – your grounding system complies with NEC 810-15.
- ◦ Ground the Canopy Surge Suppressor 300SS ground lug to the same ground bonding point as above, using at least a 10-AWG (6 mm^2) copper wire. This provides the best assurance that your grounding system complies with NEC 810-21.

Grounding Scheme

The proper overall antenna grounding scheme per the NEC is illustrated in Figure 134 on Page 347. In most television antenna or dish installations, a coaxial cable connects the outdoor electronics with the indoor electronics. To meet NEC 810-20, one typically uses a coaxial cable feed-through block that connects the outdoor coax to the indoor coax and also has a screw for attaching a ground wire. This effectively grounds the outer shield of the coax. The block should be mounted on the outside of the building near the AC main panel such that the ground wire of the block can be bonded to the primary grounding electrode system of the structure.

For residential installs, in most cases an outdoor rated *un*shielded twisted pair (UTP) cable is sufficient. To comply with the NEC, Motorola provides the antenna discharge unit, 300SS, for each conductor of the cable. This 300SS must be

- positioned
    – outside the building.
    – as near as practicable to the power service entry panel of the building and attached to the AC main power ground electrode, or attached to a grounded water pipe.[6]
    – far from combustible material.
- grounded in accordance with NEC 810-21, with the grounding wire attached to the screw terminal.

The metal structural elements of the antenna mast also require a separate grounding conductor. Section 810-15 of the NEC states:

> *Masts and metal structures supporting antennas shall be grounded in accordance with Section 810-21.*

As shown in Figure 134 on Page 347, the Motorola recommendation for grounding the metal structural element of the Canopy mounting bracket (SMMB1) is to route the grounding wire from the SMMB1 down to the same ground attachment point as is used for the 300SS discharge unit.

Use 10-AWG (6 mm^2) Copper Grounding Wire

According to NEC 810-21 3(h), either a 16-AWG copper clad steel wire or a 10-AWG copper wire may be used. This specification appears to be based on mechanical strength considerations and *not* on lightning current handling capabilities.

For example, analysis shows that the two wire types are not equivalent when carrying a lightning surge that has a 1-microsecond rise by 65-microsecond fall:

- The 16-AWG copper clad steel wire has a peak fusing current of 35,000 amps and can carry 21,000 amps peak, at a temperature just below the ignition point for paper (454° F or 234° C).
- The 10-AWG copper wire has a peak fusing current of 220,000 amps and can carry 133,000 amps peak, at the same temperature.

---

[6] It is *insufficient* to merely use the green wire ground in a duplex electrical outlet box for grounding of the antenna discharge unit.

Based on the electrical/thermal analysis of these wires, Motorola recommends 10-AWG copper wire for *all* grounding conductors. Although roughly double the cost of 16-AWG copper clad steel wire, 10-AWG copper wire handles six times the surge current from lightning.

Shielding is not Grounding

In part, NEC 810-21 states:

> *A lightning arrester is not required if the lead-in conductors are enclosed in a continuous metal shield, such as rigid or intermediate metal conduit, electrical metallic tubing, or any metal raceway or metal-shielded cable that is effectively grounded. A lightning discharge will take the path of lower impedance and jump from the lead-in conductors to the metal raceway or shield rather than take the path through the antenna coil of the receiver.*

However, Motorola does not recommend relying on shielded twisted pair cable for lightning protection for the following reasons:

- ◦ Braid-shielded 10Base-T cable is uncommon, if existent, and may be unsuitable anyway.
- ◦ At a cost of about two-thirds more than 10-AWG copper UTP, CAT 5 100Base-TX foil-shielded twisted pair (FTP) cable provides a 24-AWG drain wire. If this wire melts open during a lightning surge, then the current may follow the twisted pair into the building.

  More than 80 percent of all direct lightning strikes have current that exceeds 8,500 amps (see Table 42 on Page 172). A 24-AWG copper wire melts open at 8,500 amps from a surge that has a 1-microsecond by 70-microsecond waveform. Hence, reliance on 24-AWG drain wire to comply with the intent of NEC 810-21 is questionable.

Shielded twisted pair cable may be useful for mitigation of interference in some circumstances, but installing surge suppressors and implementing the ground recommendations constitute the most effective mitigation against lightning damage.

NEC Reference

NEC Article 810, *Radio and Television Equipment*, and associated documents and discussions are available from http://www.neccode.com/index.php?id=homegeneral, http://www.constructionbook.com/xq/ASP/national-electrical-code-2005/id.370/subID.746/qx/default2.htm, and other sources.

15.3   CONFORMING TO REGULATIONS

For all electrical purposes, ensure that your network conforms to applicable country and local codes, such as the NEC (National Electrical Code) in the U.S.A. If you are uncertain of code requirements, engage the services of a licensed electrician.

15.4   PROTECTING CABLES AND CONNECTIONS

Cables that move in the wind can be damaged, impart vibrations to the connected device, or both. At installation time, prevent these problems by securing all cables with cable ties, cleats, or PVC tape.

Over time, moisture can cause a cable connector to fail. You can prevent this problem by

- ◦ using cables that are filled with a dielectric gel or grease.
- ◦ including a drip loop where the cable approach to the module (typically a CMM2 or CMMmicro) is from above.
- ◦ wrapping the cable with weather-resistant tape.

On a module with an external antenna, use accepted industry practices to wrap the connector to prevent water ingress. Although the male and female N-type connectors form a gas-tight seal with each other, the point where the cable enters each connector can allow water ingress and eventual corrosion. Wrapping and sealing is critical to long-term reliability of the connection.

Possible sources of material to seal that point include

- ◦ the antenna manufacturer (material may have been provided in the package with the antenna).
- ◦ Universal Electronics (whose web site is http://www.coaxseal.com), who markets a weather-tight wrap named Coax-Seal.

Perform the following steps to wrap the cable.

Procedure 4: Wrapping the cable

1. Start the wrap on the cable 0.5 to 2 inches (about 1.5 to 5 cm) from the connection.
2. Wrap the cable to a point 0.5 to 2 inches (about 1.5 to 5 cm) above the connection.
3. Squeeze the wrap to compress and remove any trapped air.
4. Wrap premium vinyl electrical tape over the first wrap where desired for abrasion resistance or appearance.
5. Tie the cable to minimize sway from wind.

========================== **end of procedure** ======================

16   TESTING THE COMPONENTS

Before you install any component into your Canopy network, allow yourself the opportunity to discover that the component is defective. If you always follow the preliminary steps in this section, you will save

- installation and removal costs for a component that will not function.
- time in the process of replacing the defective component.

The best practice is to connect all the components—BHs, APs, GPS antenna, and CMM2 or CMMmicro—in a test setting and initially configure and verify them before deploying them to an installation. However, circumstances or local practice may require a different practice. In this case, appropriately modify the following procedures.

16.1   UNPACKING COMPONENTS

When you receive Canopy products, carefully inspect all shipping boxes for signs of damage. If you find damage, immediately notify the transportation company.

As you unpack the equipment, verify that all the components that you ordered have arrived. Save all the packing materials to use later, as you transport the equipment to and from installation sites.

16.2   CONFIGURING FOR TEST

You can use either of two methods to configure an AP or BHM:

- Use the Quick Start feature of the product. For more information on Quick Start, see Quick Start Page of the AP on Page 185.
- Manually set each parameter.

After you change any configuration parameter, to put the change into effect, you must do both of the following:

1. Click the **Save** button to temporarily save the change(s).
2. Click the **Reboot** button to reboot the module and implement the change(s).

16.2.1   Configuring the Computing Device for Test

If your computer is configured for Dynamic Host Configuration Protocol (DHCP), disconnect the computer from the network. If your computer is instead configured for static IP addressing

- set the static address in the 169.254 network
- set the subnet mask to 255.255.0.0.

16.2.2   Default Module Configuration

From the factory, the Canopy AP, SM, and BH are all configured to *not transmit* on any frequency. This configuration ensures that you do not accidentally turn on an unsynchronized module. Site synchronization of modules is required because

- ◦ Canopy modules
  - – cannot transmit and receive signals at the same time.
  - – use TDD (Time Division Duplexing) to distribute signal access of the downlink and uplink frames.
- ◦ when one module transmits while an unintended module nearby receives signal, the transmitting module may interfere with or desense the receiving module. In this context, interference is self-interference (within the same Canopy network).

16.2.3   Component Layout

As shown in Figure 52, the base cover of the module snaps off when you depress a lever on the back of the base cover. This exposes the Ethernet and GPS sync connectors and diagnostic LEDs.
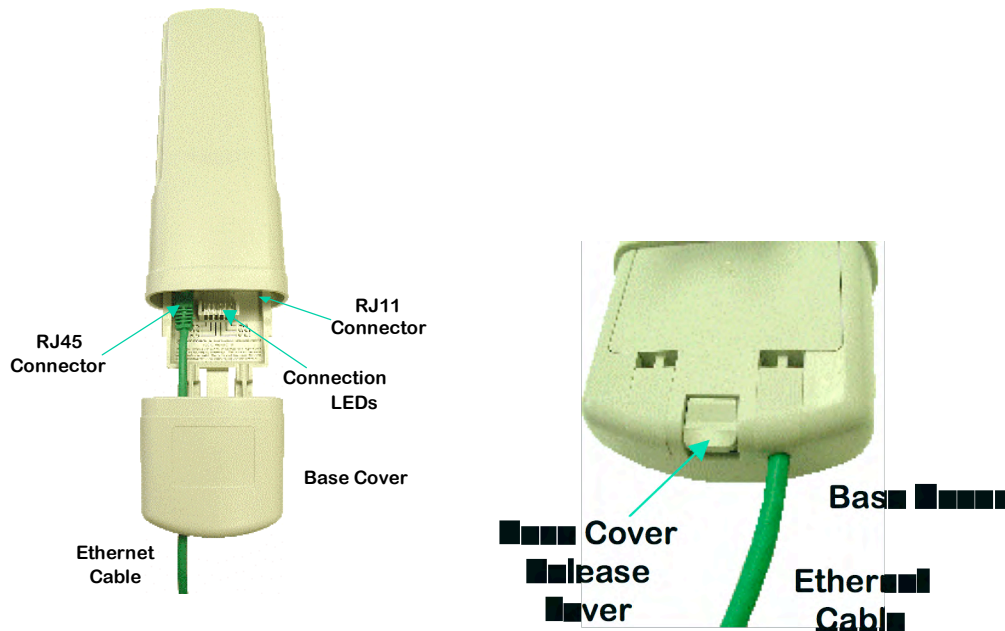
Figure 52: Canopy base cover, attached and detached

16.2.4   Diagnostic LEDs

The diagnostic LEDs report the following information about the status of the module. Table 43 and Table 44 identify the LEDs in order of their left-to-right position as the cable connections face downward.

> *NOTE:*
> The LED color helps you distinguish position of the LED. The LED color *does not* indicate any status.

Table 43: LEDs in AP and BHM

Label	Color when Active	Status Information Provided	Notes
LNK/5	green	Ethernet link	Continuously lit when link is present.
ACT/4	orange	Presence of data activity on the Ethernet link	Flashes during data transfer. Frequency of flash is not a diagnostic indication.
GPS/3	red	Pulse of sync	Continuously lit as pulse as AP receives pulse.
SES/2	green	*Unused on the AP*	SES is the session indicator on the CMM.
SYN/1	orange	Presence of sync	Always lit on the AP.
PWR	red	DC power	Always lit when power is correctly supplied.

Table 44: LEDs in SM and BHS

Label	Color when Active	Status if Registered	Notes	
			Operating Mode	Aiming Mode
LNK/5	green	Ethernet link	Continuously lit when link is present.	These five LEDs act as a bar graph to indicate the relative quality of alignment. As power level and jitter improve during alignment, more of these LEDs are lit.
ACT/4	orange	Presence of data activity on the Ethernet link	Flashes during data transfer. Frequency of flash is not a diagnostic indication.	
GPS/3	red	*Unused*	If this module is not registered to another, then these three LEDs cycle on and off from left to right.	
SES/2	green	*Unused*		
SYN/1	orange	Presence of sync		
PWR	red	DC power	Always lit when power is correctly supplied.	Always lit when power is correctly supplied.

16.2.5   CMM2 Component Layout

As shown in Figure 131 on Page 341, the CMM2 comprises four assemblies:

- ◦   Ethernet switch
- ◦   Power transformer
- ◦   Interconnect board
- ◦   GPS receiver.

Some CMM2s that were sold earlier had four openings in the bottom plate, as shown in Figure 53. Currently available CMM2s have two *additional* Ethernet cable and GPS sync cable openings to allow use of thicker, shielded cables.
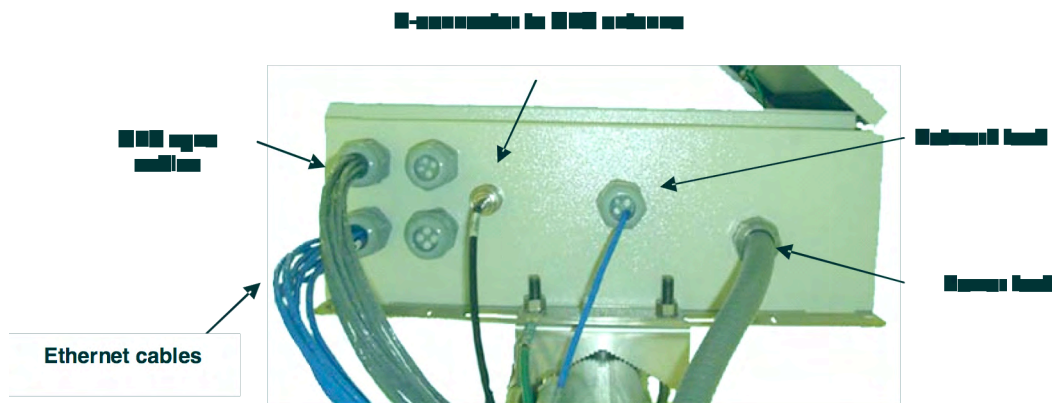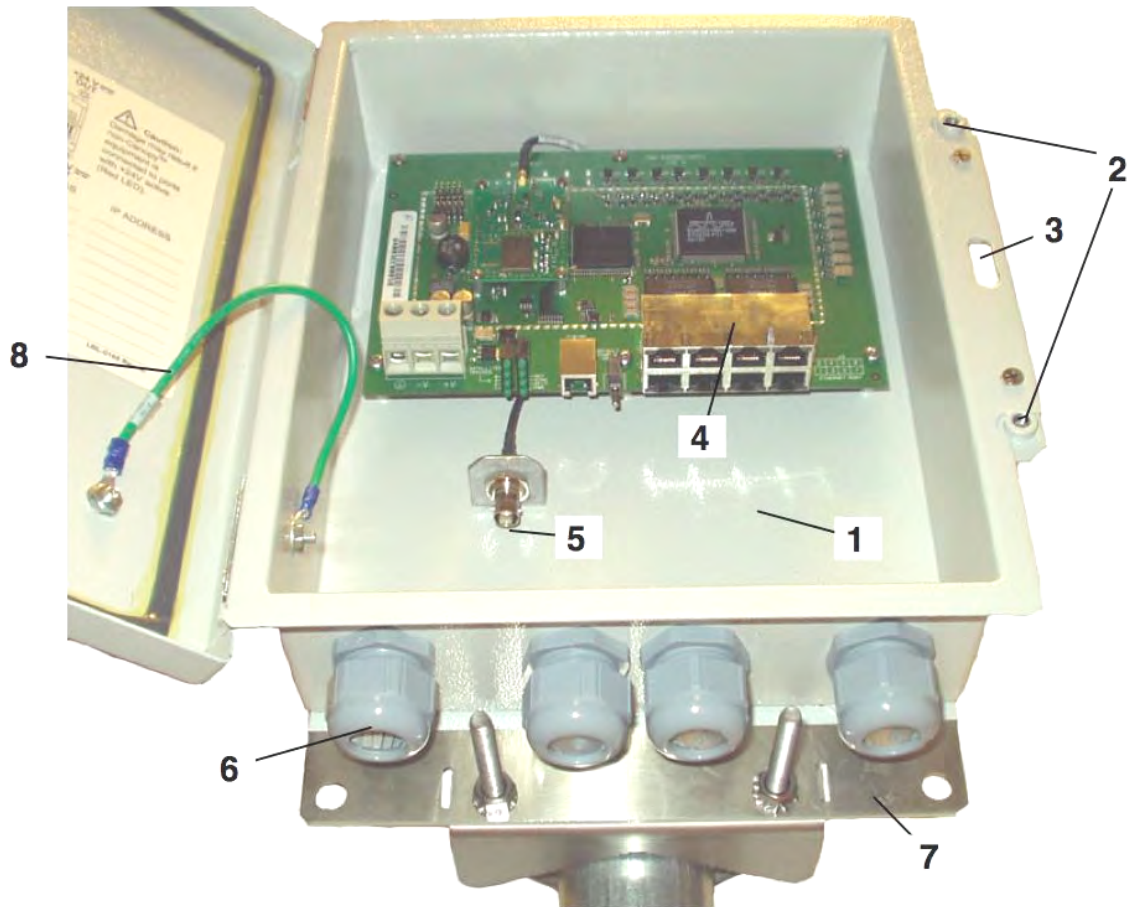

Figure 53: Canopy CMM2, bottom view

16.2.6   CMMmicro Component Layout

The layout of the CMMmicro is shown in Figure 54.

LEGEND

1. Weatherized enclosure
2. Thumb-screw/slot-screwdriver door fasteners
3. Punch-out for padlock
4. Ethernet switch and power module
5. Female BNC connector
6. Water-tight bulkhead connectors
7. Flange for attachment (stainless steel for grounding to tower or building) using U bolts (provided) or other hardware such as screws, lag bolts, or attachment straps (not provided)

8. Ground strap (for grounding door to enclosure)
9. 100-W 115/230-V AC to 24-V DC power converter, with 10 ft (3 m) of DC power cable (not shown)
10. 6-ft (1.8-m) AC power cord for 24 V power converter (not shown)

Figure 54: Cluster Management Module micro

16.2.7   Standards for Wiring

Canopy modules automatically sense whether the Ethernet cable in a connection is wired as straight-through or crossover. You may use either straight-through or crossover cable to connect a network interface card (NIC), hub, router, or switch to these modules. For a straight-through cable, use the EIA/TIA-568B wire color-code standard on both ends. For a crossover cable, use the EIA/TIA-568B wire color-code standard on one end, and the EIA/TIA-568A wire color-code standard on the other end.

Where you use the Canopy AC wall adapter

- the power supply output is +24 VDC.
- the power input to the SM is +11.5 VDC to +30 VDC.
- the maximum Ethernet cable run is 328 feet (100 meters).

16.2.8   Best Practices for Cabling

The following practices are essential to the reliability and longevity of cabled connections:

- Use only shielded cables to resist interference.
- For vertical runs, provide cable support and strain relief.
- Include a 2-ft (0.6-m) service loop on each end of the cable to allow for thermal expansion and contraction and to facilitate terminating the cable again when needed.
- Include a drip loop to shed water so that most of the water does not reach the connector at the device.
- Properly crimp all connectors.
- Use dielectric grease on all connectors to resist corrosion.
- Use only shielded connectors to resist interference and corrosion.

16.2.9   Recommended Tools for Wiring Connectors

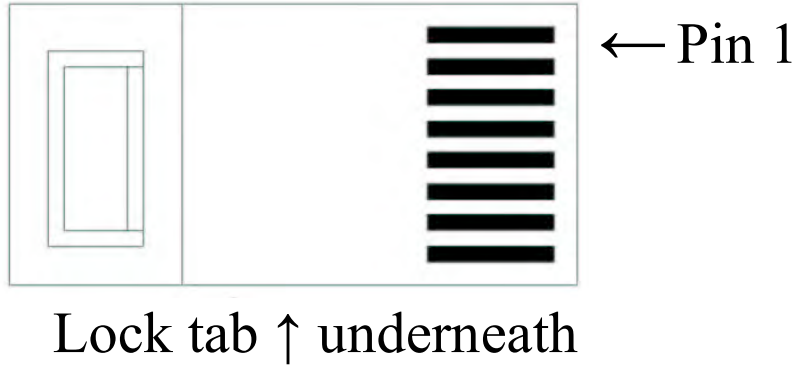The following tools may be needed for cabling the AP:

- RJ-11 crimping tool
- RJ-45 crimping tool
- electrician scissors
- wire cutters
- cable testing device.

16.2.10   Wiring Connectors

The following diagrams correlate pins to wire colors and illustrate crossovers where applicable.

Location of Pin 1

Pin 1, relative to the lock tab on the connector of a straight-through cable is located as shown below.

← Pin 1

Lock tab ↑ underneath

RJ-45 Pinout for Straight-through Ethernet Cable

Pin 1 →	white / orange	← Pin 1
Pin 2 →	orange	← Pin 2
Pin 3 →	white / green	← Pin 3
Pin 4 →	blue	← Pin 4
Pin 5 →	white / blue	← Pin 5
Pin 6 →	green	← Pin 6
Pin 7 →	white / brown	← Pin 7
Pin 8 →	brown	← Pin 8

Pins 7 and 8 carry power to the modules.

Pin	RJ-45 Straight-thru	Pin
TX+ 1		1 RX+
TX- 2		2 RX-
RX+ 3		3 TX-
+V return 4 / 5		4 / 5 +V return
RX- 6		6 TX-
+V 7 / 8		7 / 8 +V

Figure 55: RJ-45 pinout for straight-through Ethernet cable

RJ-45 Pinout for Crossover Ethernet Cable

Pin 1 →	white / orange	← Pin 3
Pin 2 →	orange	← Pin 6
Pin 3 →	white / green	← Pin 1
Pin 4 →	blue	← Pin 4
Pin 5 →	white / blue	← Pin 5
Pin 6 →	green	← Pin 2
Pin 7 →	white / brown	← Pin 7
Pin 8 →	brown	← Pin 8

Pins 7 and 8 carry power to the modules.

Pin	RJ-45 Crossover	Pin
TX+ 1		3 RX+
TX- 2		6 RX-
RX+ 3		1 TX+
+V return 4 / 5		4 / 5 +V return
RX- 6		2 TX-
+V 7 / 8		7 / 8 +V

Figure 56: RJ-45 pinout for crossover Ethernet cable

RJ-11 Pinout for Straight-through Sync Cable

The Canopy system uses a utility cable with RJ-11 connectors between the AP or BH and synchronization pulse. Presuming CAT 5 cable and 6-pin RJ-11 connectors, the following diagram shows the wiring of the cable for sync.
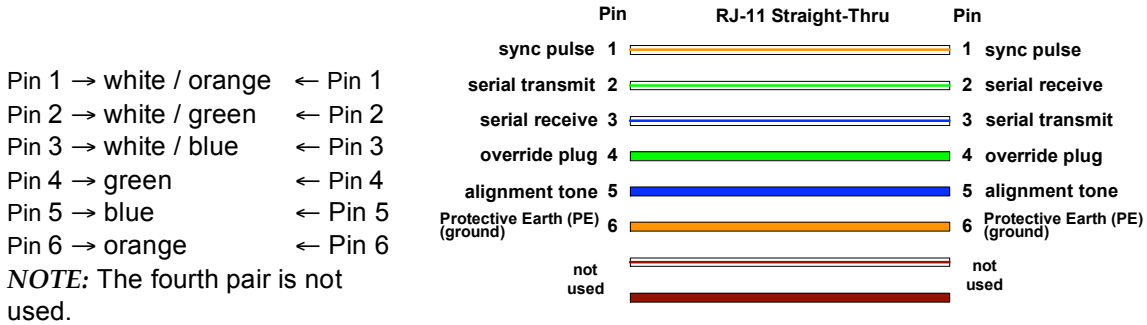
Pin 1 → white / orange   ← Pin 1
Pin 2 → white / green   ← Pin 2
Pin 3 → white / blue   ← Pin 3
Pin 4 → green   ← Pin 4
Pin 5 → blue   ← Pin 5
Pin 6 → orange   ← Pin 6

NOTE: The fourth pair is not used.

	Pin	RJ-11 Straight-Thru	Pin	
sync pulse	1		1	sync pulse
serial transmit	2		2	serial receive
serial receive	3		3	serial transmit
override plug	4		4	override plug
alignment tone	5		5	alignment tone
Protective Earth (PE) (ground)	6		6	Protective Earth (PE) (ground)
not used				not used

Figure 57: RJ-11 pinout for straight-through sync cable

16.2.11 Alignment Tone—Technical Details

The alignment tone output from a Canopy module is available on Pin 5 of the RJ-11 connector, and ground is available on Pin 6. Thus the load at the listening device should be between Pins 5 and 6. The listening device may be a headset, earpiece, or battery-powered speaker.

16.3   CONFIGURING A POINT-TO-MULTIPOINT LINK FOR TEST

Perform the following steps to begin the test setup.

Procedure 5: Setting up the AP for Quick Start

1. In one hand, securely hold the top (larger shell) of the AP. With the other hand, depress the lever in the back of the base cover (smaller shell). Remove the base cover.

2. Plug one end of a CAT 5 Ethernet cable into the AP.

3. Plug the Ethernet cable connector labeled To Radio into the jack in the pig tail that hangs from the power supply.

> **WARNING!**
> From this point until you remove power from the AP, stay at least as far from the AP as the minimum separation distance specified under Preventing Overexposure to RF on Page 169.

4. Plug the other connector of the pig tail (this connector labeled To Computer) into the Ethernet jack of the computing device.

5. Plug the power supply into an electrical outlet.

6. Power up the computing device.

7. Start the browser in the computing device.

========================= **end of procedure** =========================

The Canopy AP interface provides a series of web pages to configure and monitor the unit. You can access the web-based interface through a computing device that is either directly connected or connected through a network to the AP. If the computing device is not connected to a network when you are configuring the module in your test environment, and if the computer has used a proxy server address and port to configure a Canopy module, then you may need to first disable the proxy setting in the computer.

Perform the following procedure to toggle the computer to *not* use the proxy setting.

Procedure 6: Bypassing proxy settings to access module web pages

1. Launch Microsoft Internet Explorer.

2. Select **Tools→Internet Options→Connections→LAN Settings**.

3. Uncheck the **Use a proxy server…** box.
    NOTE: If you use an alternate web browser, the menu selections differ from the above.

========================== **end of procedure** ==========================

In the address bar of your browser, enter the IP address of the AP. (For example, enter `http://169.254.1.1` to access the AP through its default IP address). The AP responds by opening the General Status tab of its Home page.

16.3.1   Quick Start Page of the AP

To proceed with the test setup, click the **Quick Start** button on the left side of the General Status tab. The AP responds by opening the Quick Start page. The Quick Start tab of that page is displayed in Figure 58.

NOTE:
If you cannot find the IP address of the AP, see Override Plug on Page 60.
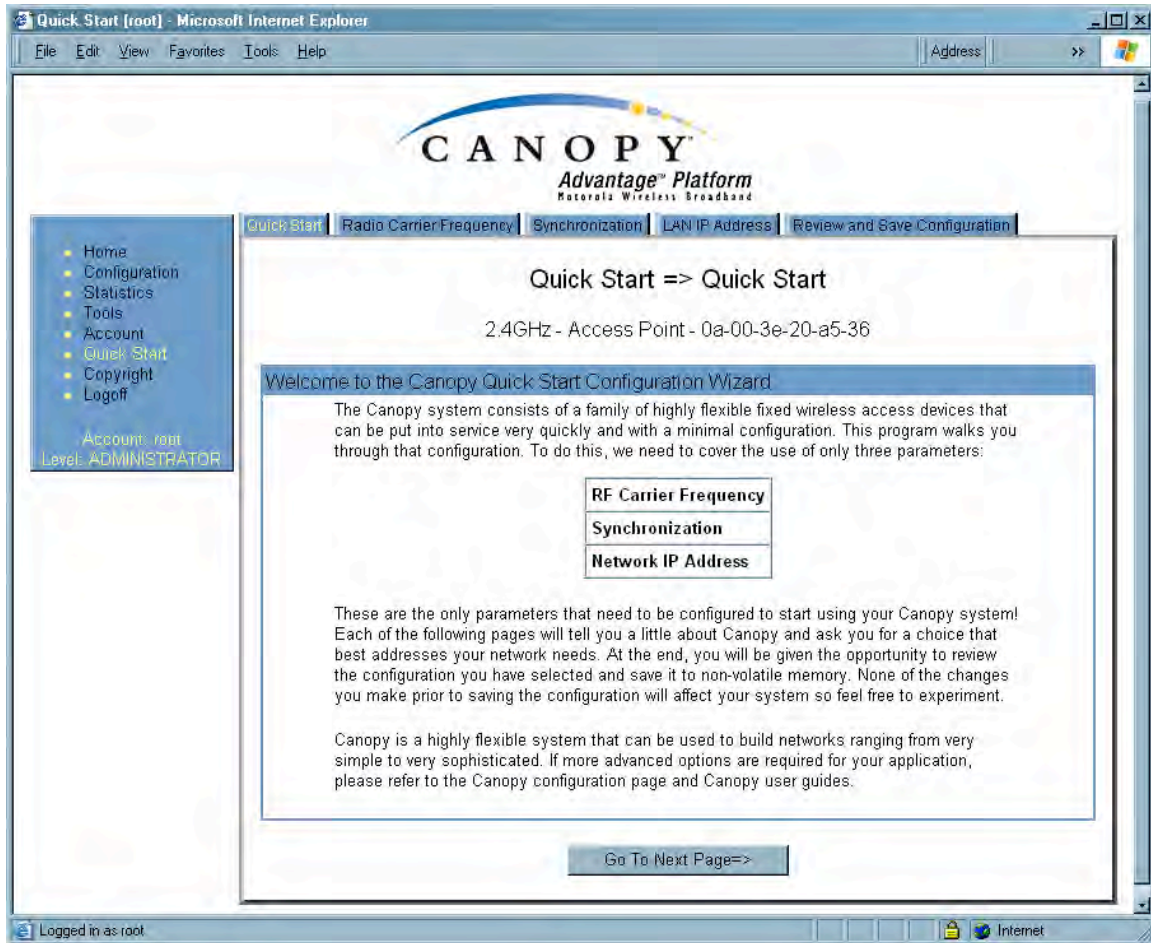
Figure 58: Quick Start tab of AP, example

Quick Start is a wizard that helps you to perform a basic configuration that places an AP into service. Only the following parameters must be configured:

- **RF Carrier Frequency**
- **Synchronization**
- **Network IP Address**

In each Quick Start tab, you can

- specify the settings to satisfy the requirements of the network.
- review the configuration selected.
- save the configuration to non-volatile memory.

Proceed with the test setup as follows.

Procedure 7: Using Quick Start to configure a standalone AP for test

1. At the bottom of the Quick Start tab, click the **Go To Next Page =>** button.
    RESULT: The AP responds by opening the RF Carrier Frequency tab.
    An example of this tab is shown in Figure 59.

Figure 59: Radio Frequency Carrier tab of AP, example

2. From the pull-down menu in the lower left corner of this tab, select a frequency for the test.

3. Click the **Go To Next Page =>** button.
    RESULT: The AP responds by opening the Synchronization tab. An example of this tab is shown in Figure 60.
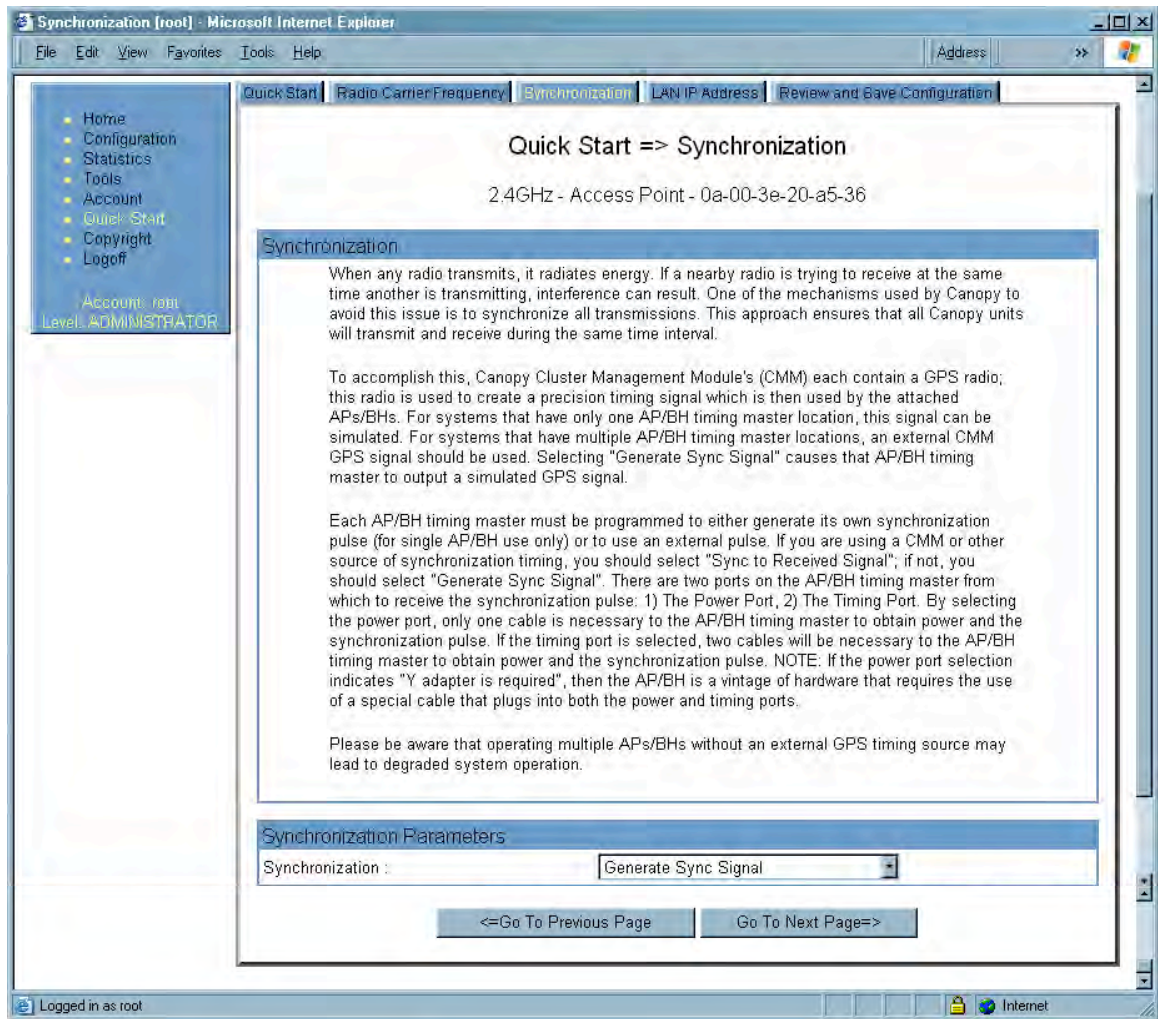
Figure 60: Synchronization tab of AP, example

4. At the bottom of this tab, select **Generate Sync Signal**.
5. Click the **Go To Next Page =>** button.
   RESULT: The AP responds by opening the LAN IP Address tab. An example of this tab is shown in Figure 61.
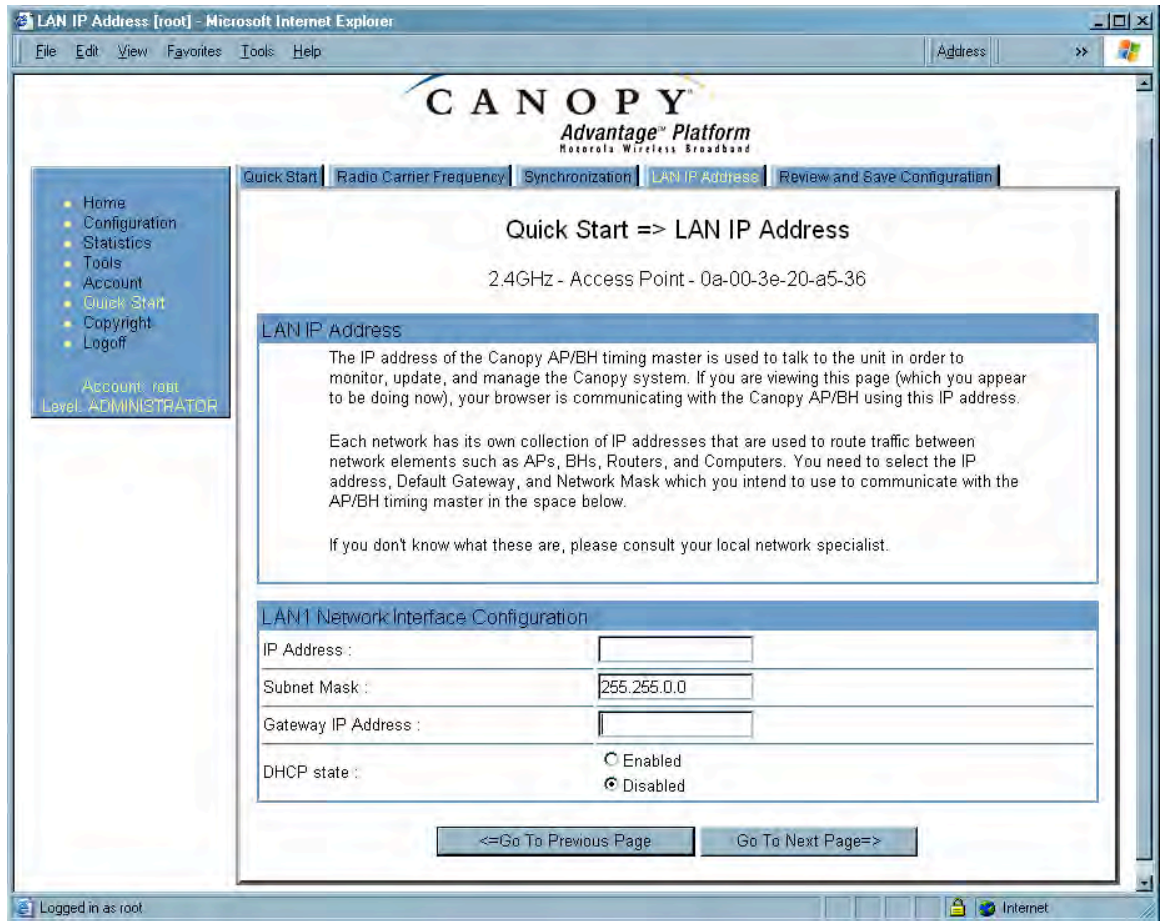
Figure 61: LAN IP Address tab of AP, example

6. At the bottom of this tab, either

    ◦ specify an **IP Address**, a **Subnet Mask**, and a **Gateway IP Address** for management of the AP and leave the **DHCP state** set to **Disabled**.

    ◦ set the **DHCP state** to **Enabled** to have the IP address, subnet mask, and gateway IP address automatically configured by a domain name server (DNS).

7. Click the **Go To Next Page =>** button.
    RESULT: The AP responds by opening the Review and Save Configuration tab. An example of this tab is shown in Figure 62.
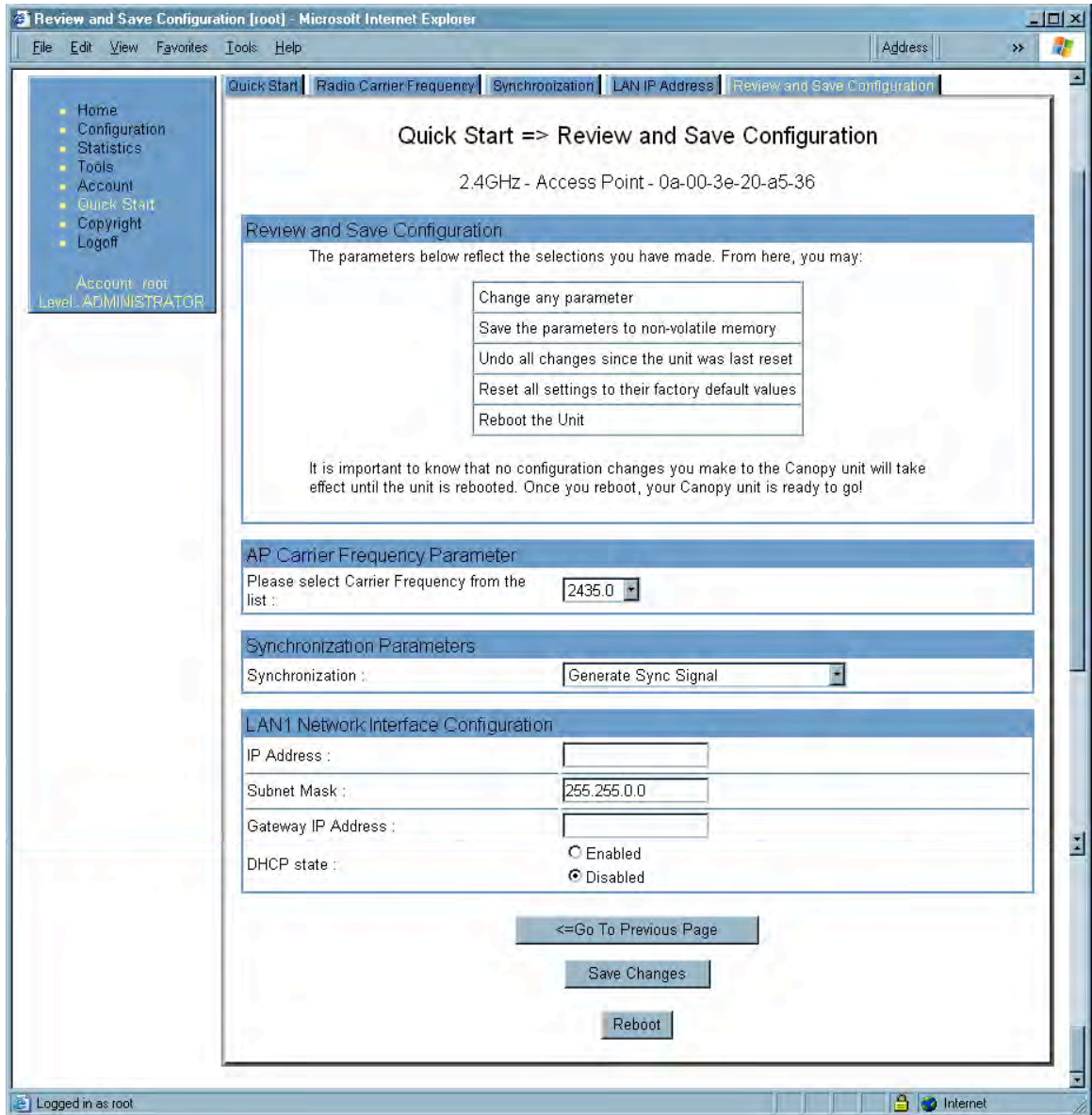
Figure 62: Review and Save Configuration tab of AP, example

8. Ensure that the initial parameters for the AP are set as you intended.

9. Click the **Save Changes** button.

10. Click the **Reboot** button.
    RESULT: The AP responds with the message **Reboot Has Been Initiated…**

11. Wait until the indicator LEDs are not red.

12. Trigger your browser to refresh the page until the AP redisplays the General Status tab.

13. Wait until the red indicator LEDs are not lit.

========================= **end of procedure** =========================

Canopy encourages you to experiment with the interface. Unless you save a configuration and reboot the AP after you save the configuration, none of the changes are effected.

16.3.2   Time Tab of the AP

To proceed with the test setup, click the **Configuration** link on the left side of the General Status tab. When the AP responds by opening the Configuration page to the General tab, click the Time tab. An example of this tab is displayed in Figure 63.
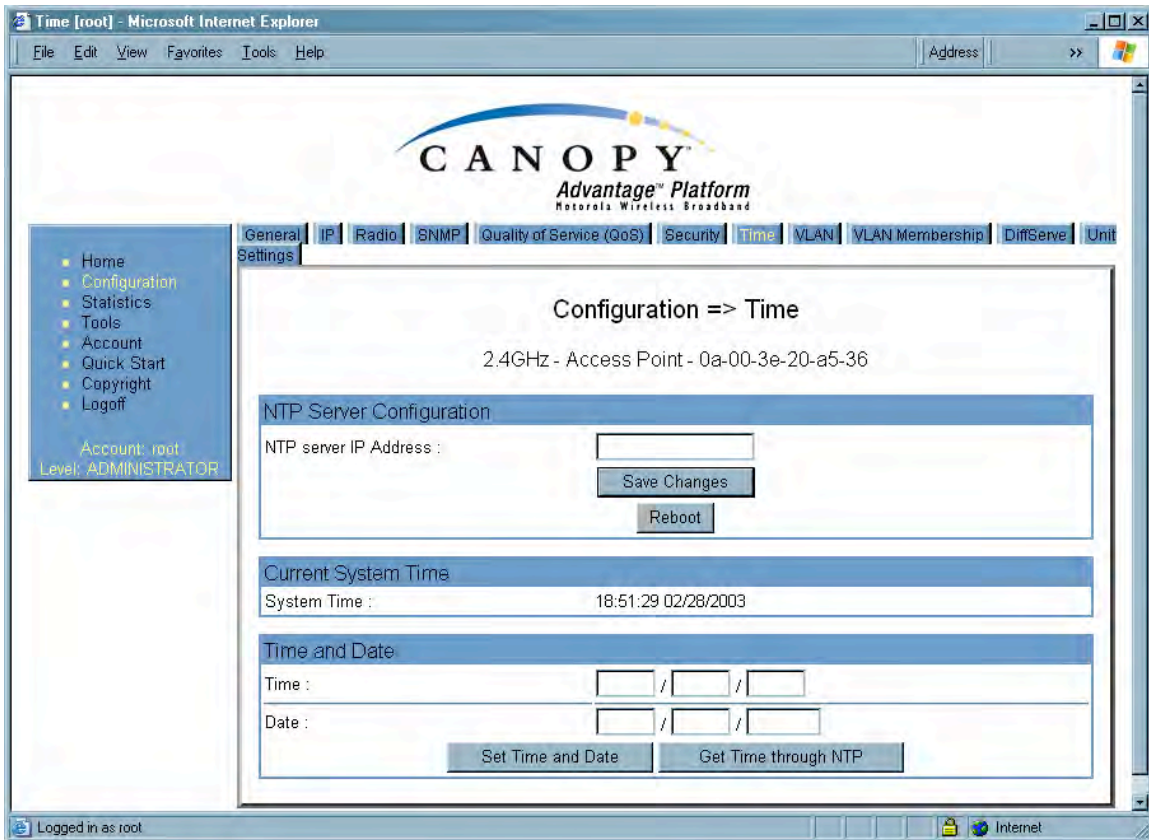

Figure 63: Time tab of AP, example

To have each log in the AP correlated to a meaningful time and date, either a reliable network element must pass time and date to the AP or you must set the time and date whenever a power cycle of the AP has occurred. A network element passes time and date in any of the following scenarios:

- ◦ A connected CMM2 passes time and date (GPS time and date, if received).
- ◦ A connected CMMmicro passes the time and date (GPS time and date, if received), but only if both the CMMmicro is operating on CMMmicro Release 2.1 or later release. (These releases include an NTP server functionality.)
- ◦ A separate NTP server is addressable from the AP.

If the AP should obtain time and date from either a CMMmicro or a separate NTP server, enter the IP address of the CMMmicro or NTP server on this tab. To force the AP to

obtain time and date before the first (or next) 15-minute interval query of the NTP server, click **Get Time through NTP**.

If you enter a time and date, the format for entry is

Time :	**hh**	/	**mm**	/	**ss**
Date :	**MM**	/	**dd**	/	**yyyy**

where

hh	represents the two-digit hour in the range 00 to 24
mm	represents the two-digit minute
ss	represents the two-digit second
MM	represents the two-digit month
dd	represents the two-digit day
yyyy	represents the four-digit year

Proceed with the test setup as follows.

- ◦ Enter the appropriate information in the format shown above.
- ◦ Then click the **Set Time and Date** button.
  NOTE: The time displayed at the top of this page is static unless your browser is set to automatically refresh.

Procedure 8: Setting up the SM for test

1. In one hand, securely hold the top (larger shell) of the SM. With the other hand, depress the lever in the back of the base cover (smaller shell). Remove the base cover.

2. Plug one end of a CAT 5 Ethernet cable into the SM RJ-45 jack.

3. Plug the other end of the Ethernet cable into the jack in the pig tail that hangs from the power supply.

4. Roughly aim the SM toward the AP.

> **WARNING!**
> From this point until you remove power from the SM, stay at least as far from the SM as the minimum separation distance specified under Preventing Overexposure to RF on Page 169.

5. Plug the power supply into an electrical outlet.

6. Repeat the foregoing steps for each SM that you wish to include in the test.

7. Back at the computing device, on the left side of the Time & Date tab, click **Home**.

8. Click the Session Status tab.

========================= **end of procedure** =========================

16.3.3   Session Status Tab of the AP

An example of the AP Session Status tab is displayed in Figure 64.
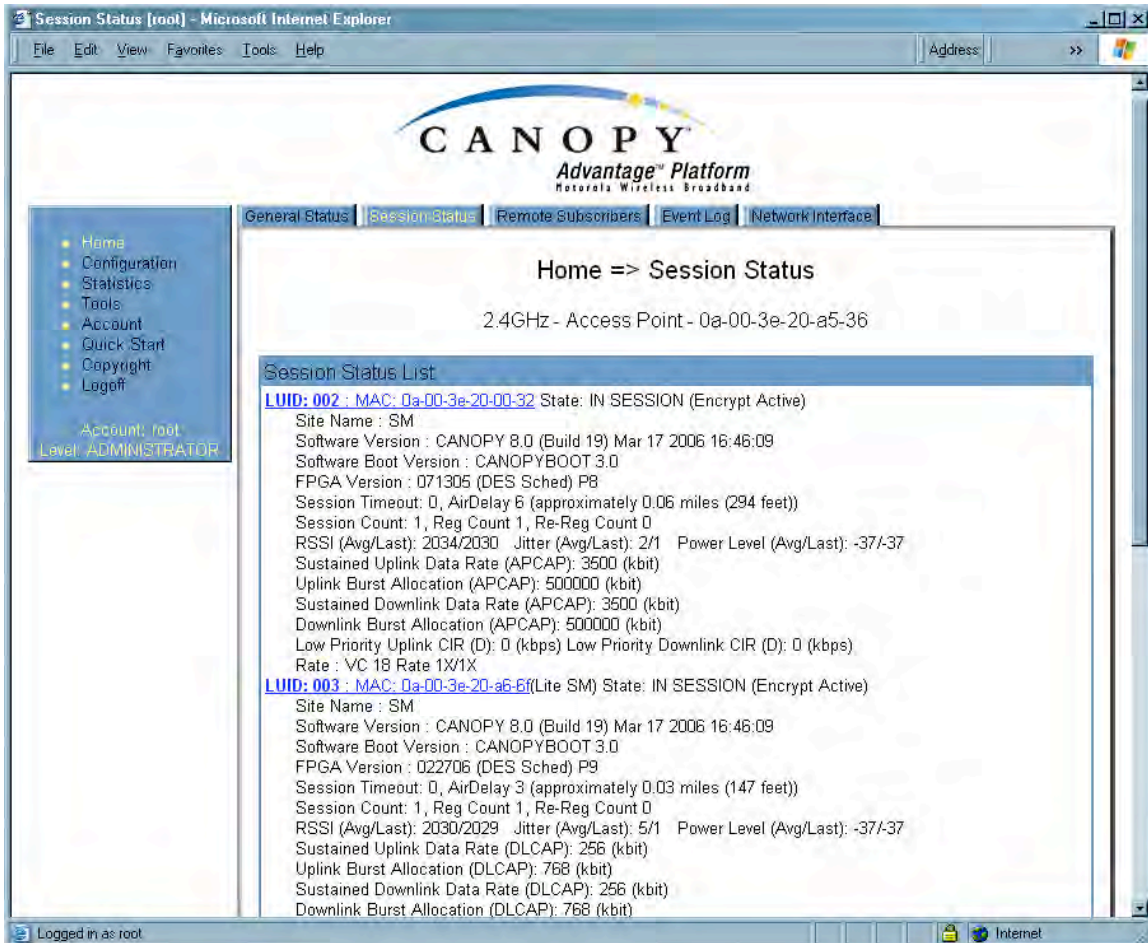

Figure 64: Session Status tab data from AP, example

If no SMs are registered to this AP, then the Session Status tab displays the simple message **No sessions**. In this case, try the following steps.

Procedure 9: Retrying to establish a point-to-multipoint link

1. More finely aim the SM or SMs toward the AP.

2. Recheck the Session Status tab of the AP for the presence of LUIDs.

3. If still no LUIDs are reported on the Session Status tab, click the **Configuration** button on the left side of the Home page.
   RESULT: The AP responds by opening the AP Configuration page.

4. Click the Radio tab.

5. Find the **Color Code** parameter and note the setting.

6. In the same sequence as you did for the AP directly under Configuring a Point-to-Multipoint Link for Test on Page 184, connect the SM to a computing device and to power.

7. On the left side of the SM Home page, click the **Configuration** button.
   RESULT: The Configuration page of the SM opens.

8. Click the Radio tab.

9. If the transmit frequency of the AP is not selected in the **Custom Radio Frequency Scan Selection List** parameter, select the frequency that matches.

10. If the **Color Code** parameter on this page is not identical to the **Color Code** parameter you noted from the AP, change one of them so that they match.

11. At the bottom of the Radio tab for the SM, click the **Save Changes** button.

12. Click the **Reboot** button.

13. Allow several minutes for the SM to reboot and register to the AP.

14. Return to the computing device that is connected to the AP.

15. Recheck the Session Status tab of the AP for the presence of LUIDs.

========================= **end of procedure** =============================

The Session Status tab provides information about each SM that has registered to the AP. This information is useful for managing and troubleshooting a Canopy system. All information that you have entered in the **Site Name** field of the SM displays in the Session Status tab of the linked AP.

The Session Status tab also includes the current active values on each SM (LUID) for MIR, CIR, and VLAN, as well as the source of these values (representing the SM itself, BAM, or the AP and cap, if any—for example, APCAP as shown in Figure 64 above). L indicates a Canopy Lite SM, and D indicates from the device. As an SM registers to the AP, the configuration source that this page displays for the associated LUID may change. After registration, however, the displayed source is stable and can be trusted.

The Session Status tab of the AP provides the following parameters.

LUID

This field displays the LUID (logical unit ID) of the SM. As each SM registers to the AP, the system assigns an LUID of 2 or a higher unique number to the SM. If an SM loses registration with the AP and then regains registration, the SM will retain the same LUID.

> *NOTE:*
> The LUID association is lost when a power cycle of the AP occurs.

MAC

This field displays the MAC address (or electronic serial number) of the SM.

State

This field displays the current status of the SM as either

- **IN SESSION** to indicate that the SM is currently registered to the AP.

- **IDLE** to indicate that the SM was registered to the AP at one time, but now is not.

This field also indicates whether the encryption scheme in the module is enabled.

Site Name

This field indicates the name of the SM. You can assign or change this name on the Configuration web page of the SM. This information is also set into the *sysName* SNMP MIB-II object and can be polled by an SNMP management server.

Software Version

This field displays the software release that operates on the SM, the release date and time of the software.

Software Boot Version

This field indicates the CANOPYBOOT version number.

FPGA Version

This field displays the version of FPGA that runs on the SM.

Session Timeout

This field displays the timeout in seconds for management sessions via HTTP, telnet, or ftp access to the SM. 0 indicates that no limit is imposed.

AirDelay

This field displays the distance of the SM from the AP. To derive the distance in meters, multiply the displayed number by 0.3048. At close distances, the value in this field is unreliable.

Session Count

This field displays how many sessions the SM has had with the AP. Typically, this is the sum of Reg Count and Re-Reg Count. However, the result of internal calculation may display here as a value that slightly differs from the sum.

If the number of sessions is significantly greater than the number for other SMs, then this may indicate a link problem or an interference problem.

Reg Count

When an SM makes a registration request, the AP checks its local data to see whether it considers the SM to be already registered. If the AP concludes that the SM is not, then the request increments the value of this field.

Re-Reg Count

When an SM makes a registration request, the AP checks its local data to see whether it considers the SM to be already registered. If the AP concludes that the SM is not, then the request increments the value of this field. Typically, a Re-Reg is the case where both

- ◦ an SM attempts to reregister for having lost communication with the AP.
- ◦ the AP has not yet observed the link to the SM as being down.

A high number in this field is often an indication of link instability or interference problems.

RSSI, Jitter, and Power Level (Avg/Last)

The Session Status tab shows the received **Power Level** in dBm and **Jitter**. Proper alignment maximizes **Power Level** and minimizes **Jitter**. As you refine alignment, you should favor lower jitter over higher dBm. For example, if coarse alignment gives an SM a power level of −75 dBm and a jitter measurement of 5, and further refining

the alignment drops the power level to −78 dBm and the jitter to 2 or 3, use the refined alignment, with the following caveats:

- ◦ When the receiving link is operating at 1X, the **Jitter** scale is 0 to 15 with desired jitter between 0 and 4.
- ◦ When the receiving link is operating at 2X, the **Jitter** scale is 0 to 15 with desired jitter between 0 and 9.

For historical relevance, the Session Status tab also shows the **RSSI**, the unitless measure of power. Use **Power Level** and ignore **RSSI**. **RSSI** implies more accuracy and precision than is inherent in its measurement.

Sustained Uplink Data Rate

This field displays the value that is currently in effect for the SM, with the source of that value in parentheses. This is the specified rate at which each SM registered to this AP is replenished with credits for transmission. The configuration source of the value is indicated in parentheses. See

- ◦ Maximum Information Rate (MIR) Parameters on Page 86
- ◦ Interaction of Burst Allocation and Sustained Data Rate Settings on Page 88
- ◦ Setting the Configuration Source on Page 292.

Uplink Burst Allocation

This field displays the value that is currently in effect for the SM, with the source of that value in parentheses. This is the specified maximum amount of data that each SM is allowed to transmit before being recharged at the **Sustained Uplink Data Rate** with credits to transmit more. The configuration source of the value is indicated in parentheses. See

- ◦ Maximum Information Rate (MIR) Parameters on Page 86
- ◦ Interaction of Burst Allocation and Sustained Data Rate Settings on Page 88
- ◦ Setting the Configuration Source on Page 292.

Sustained Downlink Data Rate

This field displays the value that is currently in effect for the SM, with the source of that value in parentheses. This is the specified the rate at which the AP should be replenished with credits (tokens) for transmission to each of the SMs in its sector. The configuration source of the value is indicated in parentheses. See

- ◦ Maximum Information Rate (MIR) Parameters on Page 86
- ◦ Interaction of Burst Allocation and Sustained Data Rate Settings on Page 88
- ◦ Setting the Configuration Source on Page 292.

Downlink Burst Allocation

This field displays the value that is currently in effect for the SM, with the source of that value in parentheses. This is the maximum amount of data to allow the AP to transmit to any registered SM before the AP is replenished with transmission credits at the **Sustained Downlink Data Rate**. The configuration source of the value is indicated in parentheses. See

- ◦ Maximum Information Rate (MIR) Parameters on Page 86
- ◦ Interaction of Burst Allocation and Sustained Data Rate Settings on Page 88

○   Setting the Configuration Source on Page 292.

Low Priority Uplink CIR

This field displays the value that is currently in effect for the SM, with the source of that value in parentheses. The configuration source of the value is indicated in parentheses. See

○   Committed Information Rate on Page 88

○   Setting the Configuration Source on Page 292.

Low Priority Downlink CIR

This field displays the value that is currently in effect for the SM, with the source of that value in parentheses. The configuration source of the value is indicated in parentheses. See

○   Committed Information Rate on Page 88

○   Setting the Configuration Source on Page 292.

Rate

This field displays whether the high-priority channel is enabled in the SM and the status of 1X or 2X operation in the SM. See Checking the Status of 2X Operation on Page 93.

16.3.4   Beginning the Test of Point-to-Multipoint Links

To begin the test of links, perform the following steps:

1. In the Session Status tab of the AP, note the LUID associated with the MAC address of any SM you wish to involve in the test.

2. Click the Remote Subscribers tab.

16.3.5   Remote Subscribers Tab of the AP

An example of a Remote Subscribers tab is displayed in Figure 65.

Figure 65: Remote Subscribers tab of AP, example

This tab allows you to view the web pages of registered SMs over the RF link. To view the pages for a selected SM, click its link. The General Status tab of the SM opens.

16.3.6   General Status Tab of the SM

An example of the General Status tab of an SM is displayed in Figure 66.
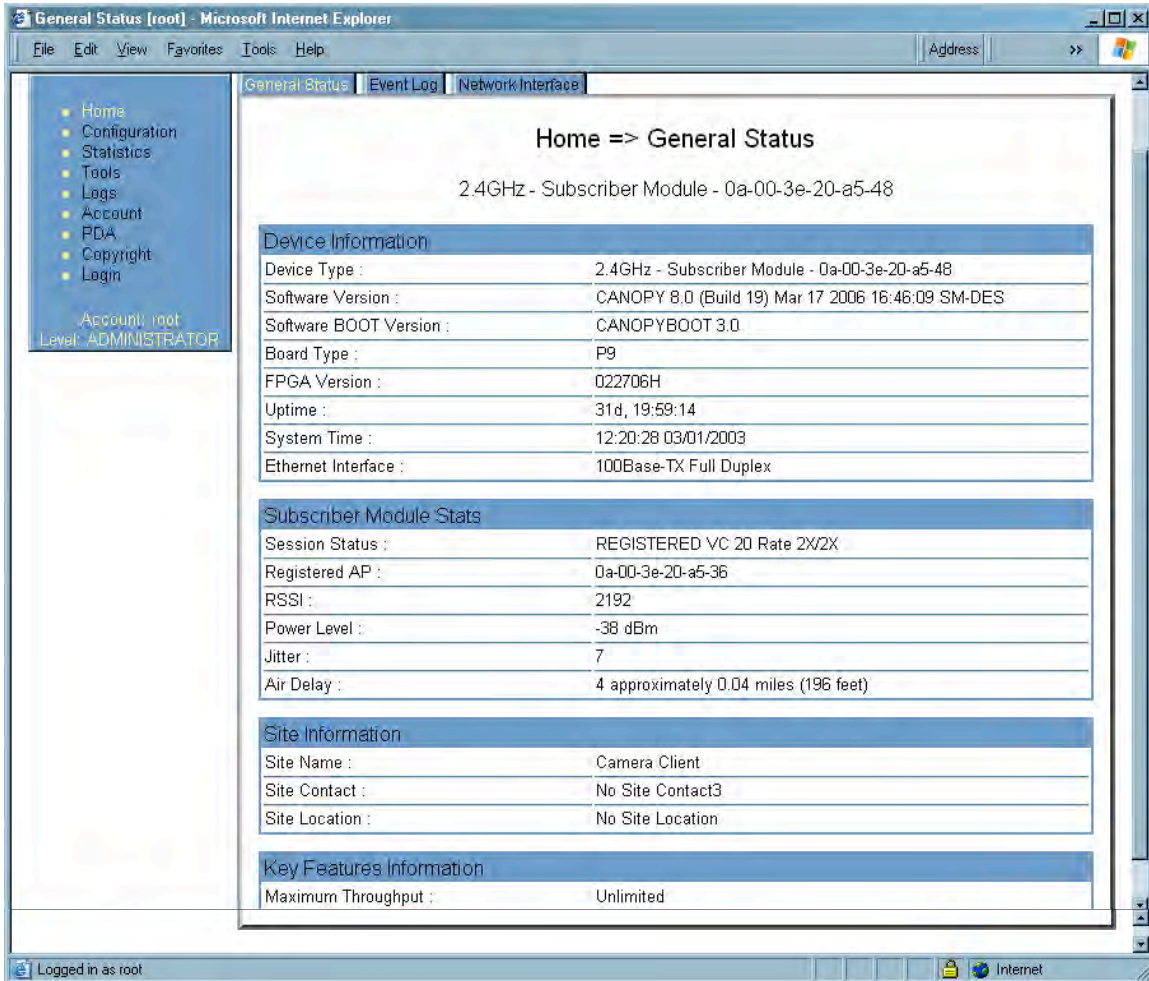

Figure 66: General Status tab of SM, example

The General Status tab provides information on the operation of this SM. This is the tab that opens by default when you access the GUI of the SM. The General Status tab provides the following read-only fields.

Device Type

This field indicates the type of the Canopy module. Values include the frequency band of the SM, its module type, and its MAC address.

Software Version

This field indicates the Canopy system release, the time and date of the release, and whether communications involving the module are secured by DES or AES encryption (see Encrypting Canopy Radio Transmissions on Page 371). If you request technical support, provide the information from this field.

Software BOOT Version

This field indicates the version of the CANOPYBOOT file. If you request technical support, provide the information from this field.

Board Type

This field indicates the series of hardware. See Designations for Hardware in Radios on Page 367.

FPGA Version

This field indicates the version of the field-programmable gate array (FPGA) on the module. When you request technical support, provide the information from this field.

Uptime

This field indicates how long the module has operated since power was applied.

System Time

This field provides the current time. Any SM that registers to an AP inherits the system time, which is displayed in this field as GMT (Greenwich Mean Time).

Ethernet Interface

This field indicates the speed and duplex state of the Ethernet interface to the SM.

Session Status

This field displays the following information about the current session:

- **Scanning** indicates that this SM currently cycles through the radio frequencies that are selected in the Radio tab of the Configuration page.

- **Syncing** indicates that this SM currently attempts to receive sync.

- **Registering** indicates that this SM has sent a registration request message to the AP and has not yet received a response.

- **Registered** indicates that this SM is both

  - registered to an AP.

  - ready to transmit and receive data packets.

- **Alignment** indicates that this SM is in an aiming mode. See Table 44 on Page 179.

Registered AP

This field displays the MAC address of the AP to which this SM is registered.

RSSI, Power Level, and Jitter

The General Status tab shows the received **Power Level** in dBm and **Jitter**. Proper alignment maximizes **Power Level** and minimizes **Jitter**. As you refine alignment, you should favor lower jitter over higher dBm. For example, if coarse alignment gives an SM a power level of −75 dBm and a jitter measurement of 5, and further refining the alignment drops the power level to −78 dBm and the jitter to 2 or 3, use the refined alignment, with the following caveats:

- When the receiving link is operating at 1X, the **Jitter** scale is 0 to 15 with desired jitter between 0 and 4.

◦ When the receiving link is operating at 2X, the **Jitter** scale is 0 to 15 with desired jitter between 0 and 9.

For historical relevance, the General Status tab also shows the **RSSI**, the unitless measure of power. Use **Power Level** and ignore **RSSI**. **RSSI** implies more accuracy and precision than is inherent in its measurement.

> *NOTE:*
> Unless the page is set to auto-refresh, the values displayed are from the instant the General Status tab was selected. To keep a current view of the values, refresh the browser screen or set to auto-refresh.

Air Delay

This field displays the distance in feet between this SM and the AP. To derive the distance in meters, multiply the value of this parameter by 0.3048. Distances reported as less than 200 feet (61 meters) are unreliable.

Site Name

This field indicates the name of the physical module. You can assign or change this name in the SNMP tab of the SM Configuration page. This information is also set into the *sysName* SNMP MIB-II object and can be polled by an SNMP management server.

Site Contact

This field indicates contact information for the physical module. You can provide or change this information in the SNMP tab of the SM Configuration page. This information is also set into the *sysName* SNMP MIB-II object and can be polled by an SNMP management server.

Site Location

This field indicates site information for the physical module. You can provide or change this information in the SNMP tab of the SM Configuration page.

Maximum Throughput

This field indicates the limit of aggregate throughput for the SM and is based on the default (factory) limit of the SM and any floating license that is currently assigned to it.

16.3.7 Continuing the Test of Point-to-Multipoint Links

To resume the test of links, perform the following steps.

Procedure 10: Verifying and recording information from SMs

1. Verify that the **Session Status** field of the General Status tab in the SM indicates **REGISTERED**.

2. While you view the General Status tab in the SM, note (or print) the values of the following fields:

   ◦ **Device type**

   ◦ **Software Version**

   ◦ **Software BOOT Version**

◦   **Board Type**

◦   **FPGA Version**

3.   Systematically ensure that you can retrieve this data (from a database, for example) when you later prepare to deploy the SM to subscriber premises.

4.   Return you to the Remote Subscribers tab of the AP.

5.   Click the link of the next SM that you wish to test.

6.   Repeat the test procedure from that point. When you have tested all of the SMs that you intend to test, return your browser to the General Status tab of the AP.

========================== **end of procedure** ==========================

16.3.8   General Status Tab of the AP

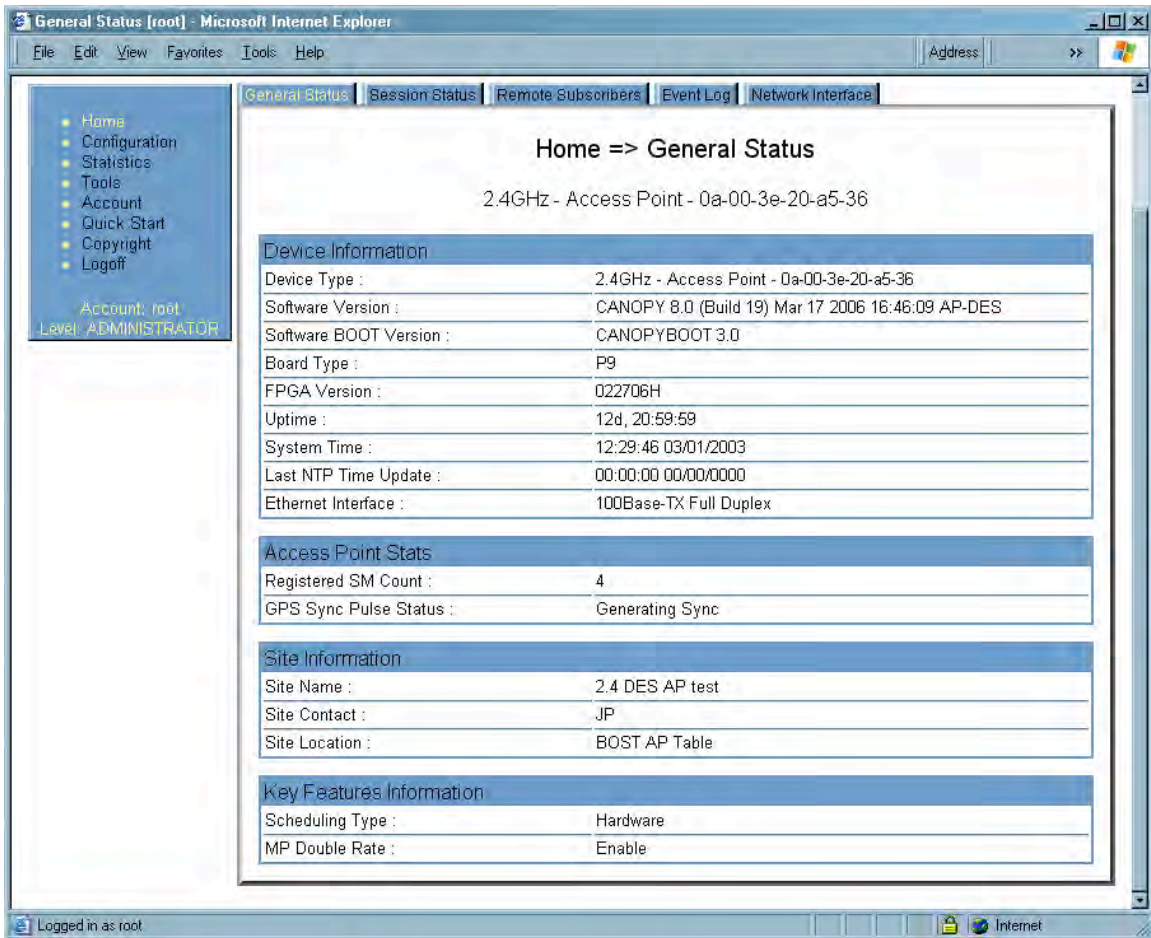An example of an AP General Status tab is displayed in Figure 67.

Figure 67: General Status tab of AP, example

The General Status tab provides information on the operation of this AP. This is the tab that opens by default when you access the GUI of the AP. The General Status tab provides the following read-only fields.

Device Type

This field indicates the type of the Canopy module. Values include the frequency band of the AP, its module type, and its MAC address.

Software Version

This field indicates the Canopy system release, the time and date of the release, and whether communications involving the module are secured by DES or AES encryption (see Encrypting Canopy Radio Transmissions on Page 371). If you request technical support, provide the information from this field.

Software BOOT Version

This field indicates the version of the CANOPYBOOT file. If you request technical support, provide the information from this field.

Board Type

This field indicates the series of hardware. See Designations for Hardware in Radios on Page 367.

FPGA Version

This field indicates the version of the field-programmable gate array (FPGA) on the module. When you request technical support, provide the information from this field.

Uptime

This field indicates how long the module has operated since power was applied.

System Time

This field provides the current time. If the AP is connected to a CMM, then this field provides GMT (Greenwich Mean Time). Any SM that registers to the AP inherits the system time.

Last NTP Time Update

This field displays when the AP last used time sent from an NTP server. If the AP has not been configured in the Time tab of the Configuration page to request time from an NTP server, then this field is populated by 00:00:00 00/00/00.

Ethernet Interface

This field indicates the speed and duplex state of the Ethernet interface to the AP.

Registered SM Count

This field indicates how many SMs are registered to the AP.

GPS Sync Pulse Status

This field indicates the status of synchronization as follows:

- **Generating sync** indicates that the module is set to *generate* the sync pulse.
- **Receiving Sync** indicates that the module is set to *receive* a sync pulse from an outside source and is receiving the pulse.
- **ERROR: No Sync Pulse** indicates that the module is set to *receive* a sync pulse from an outside source and is not receiving the pulse.

> **NOTE:**
> When this message is displayed, the AP transmitter is turned off to avoid self-interference within the Canopy system.

Site Name

This field indicates the name of the physical module. You can assign or change this name in the SNMP tab of the AP Configuration page. This information is also set into the *sysName* SNMP MIB-II object and can be polled by an SNMP management server.

Site Contact

This field indicates contact information for the physical module. You can provide or change this information in the SNMP tab of the AP Configuration page. This information is also set into the *sysName* SNMP MIB-II object and can be polled by an SNMP management server.

Site Location

This field indicates site information for the physical module. You can provide or change this information in the SNMP tab of the AP Configuration page.

Scheduling Type

This field indicates the type of frame scheduler that is active in the AP.

MP Double Rate

This field indicates whether 2X modulation rate is enabled for the sector.

16.3.9   Concluding the Test of Point-to-Multipoint Links

To conclude the test, perform the following steps.

Procedure 11: Verifying and recording information from the AP

1. Confirm that the **GPS Sync Pulse Status** field indicates **Generating Sync**.
    NOTE: This indication confirms that the AP is properly functional.

2. While your browser is directed to this General Status tab, note (or print) the values of the following fields:
    ◦   **Device type**
    ◦   **Software Version**
    ◦   **Software BOOT Version**
    ◦   **Board Type**
    ◦   **FPGA Version**

3. Systematically ensure that you can retrieve this data when you prepare to deploy the AP.

========================= **end of procedure** =======================

16.4   CONFIGURING A POINT-TO-POINT LINK FOR TEST

> *NOTE:*
> This section supports the Canopy 10- and 20-Mbps Backhaul Modules. To find setup and configuration guides that support the OFDM Series Backhaul Modules, refer to Products Not Covered by This User Guide on Page 34.

Perform the following steps to begin the test setup.

Procedure 12: Setting up the BH for Quick Start

1. In one hand, securely hold the top (larger shell) of the BH that you intend to deploy as a timing master. With the other hand, depress the lever in the back of the base cover (smaller shell). Remove the base cover.

2. Plug one end of a CAT 5 Ethernet cable into the timing master.

3. Plug the other end of the Ethernet cable into the jack in the pig tail that hangs from the power supply.

4. Plug the other connector of the pig tail into the Ethernet jack of the computing device.

> *WARNING!*
> From this point until you remove power from the BH, stay at least as far from the BH as the minimum separation distance specified under Preventing Overexposure to RF on Page 169.

5. Plug the power supply into an electrical outlet.

6. Power up the computing device.

7. Start the browser in the computing device.

========================= **end of procedure** =============================

The Canopy BH interface provides a series of web pages to configure and monitor the unit. These screens are subject to change by subsequent software releases.

You can access the web-based interface through only a computing device that is either directly connected or connected through a network to the BH. If the computing device is not connected to a network when you are configuring the module in your test environment, and if the computer has used a proxy server address and port to configure a Canopy module, then you may need to first disable the proxy setting in the computer.

To toggle the computer to *not* use the proxy setting, perform Procedure 6 on Page 185.

In the address bar of your browser, enter the IP address of the BHM (default is 169.254.1.1). The BHM responds by opening the General Status tab of its Home page.

16.4.1 Quick Start Page of the BHM

To proceed with the test setup, click the **Quick Start** button on the left side of the General Status tab. The BHM responds by opening the Quick Start tab of the Quick Start page. An example of this tab is displayed in Figure 68.
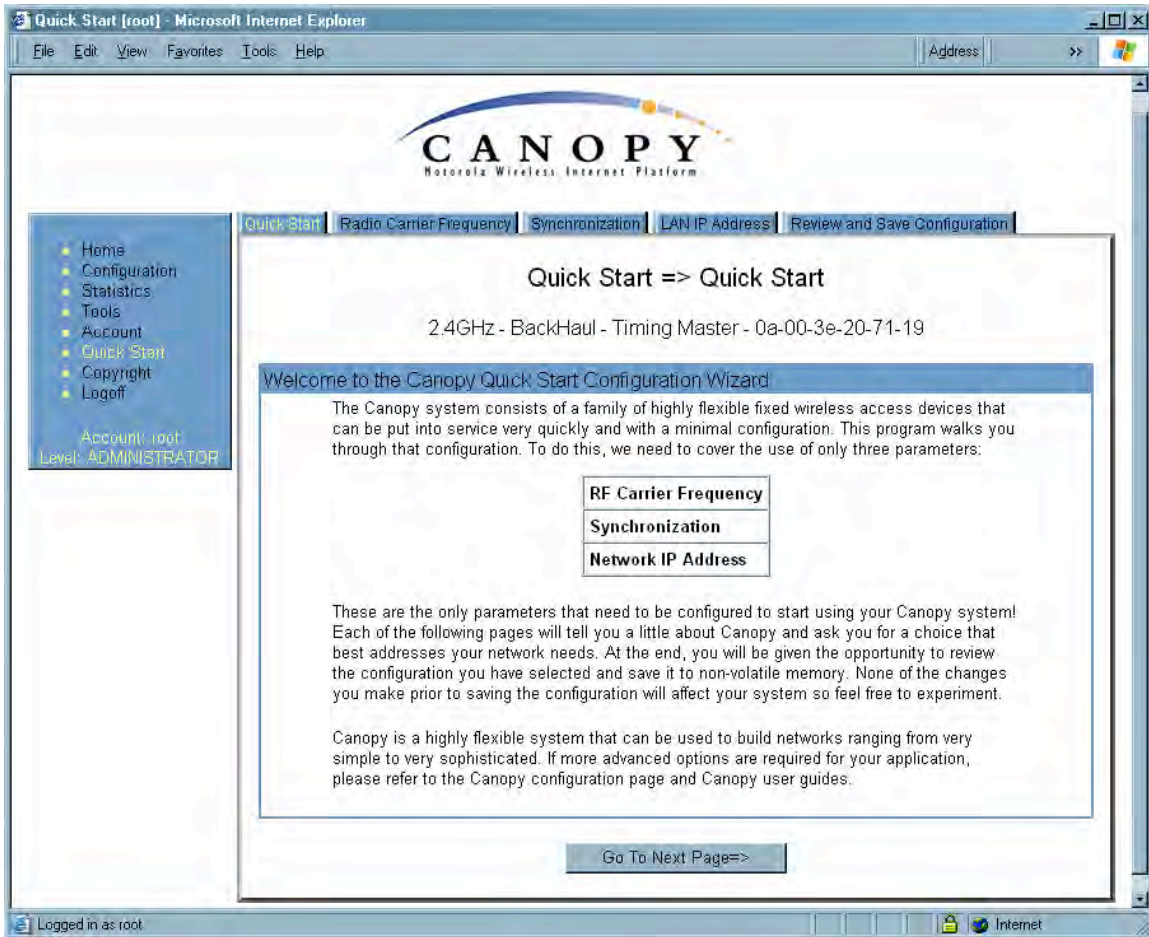

Figure 68: Quick Start tab of BHM, example

Quick Start is a wizard that helps you to perform a basic configuration that places a BHM into service. Only the following variables must be configured:

- ◦ **RF Carrier Frequency**
- ◦ **Synchronization**
- ◦ **Network IP Address**

In each page under Quick Start, you can

- ◦ specify the settings to satisfy the requirements of the network.
- ◦ review the configuration selected.
- ◦ save the configuration to non-volatile memory.

Proceed with the test setup as follows.

Procedure 13: Using Quick Start to configure the BHs for test

1. At the bottom of the Quick Start tab, click the **Go To Next Page =>** button.
   RESULT: The BHM responds by opening the RF Carrier Frequency tab.

2. From the pull-down menu in the lower left corner of this page, select a frequency for the test.

3. Click the **Go To Next Page =>** button.
   RESULT: The BHM responds by opening the Synchronization tab.

4. At the bottom of this page, select **Generate Sync Signal**.

5. Click the **Go To Next Page =>** button.
   RESULT: The BHM responds by opening the LAN IP Address tab.

6. At the bottom of this tab, either

   ◦ specify an **IP Address**, **Subnet Mask**, and **Gateway IP Address** for management of the BHM and leave the **DHCP State** set to **Disabled**.

   ◦ set the **DHCP State** to **Enabled** to have the IP address, subnet mask, and gateway IP address automatically configured by a domain name server (DNS).

7. Click the **Go To Next Page =>** button.
   RESULT: The BHM responds by opening the Review and Save Configuration tab.

8. Ensure that the initial parameters for the BHM are set as you intended.

9. Click the **Save Changes** button.

10. On the left side of the tab, click the **Configuration** button.
    RESULT: The BH responds by opening the General tab of its Configuration page.

11. In the **Timing Mode** parameter, select **Timing Master**.

12. Click the **Save Changes** button.

13. Click the **Reboot** button.
    RESULT: The BHM responds with the message **Reboot Has Been Initiated…**. This BH is now forced to provide sync for the link and has a distinct set of web interface pages, tabs, and parameters for the role of BHM.

14. Wait until the indicator LEDs are not red.

15. Trigger your browser to refresh the page until the BHM redisplays the General Status tab of its Home page.

16. Repeat these steps to configure the other BH in the pair to be a BHS, selecting **Timing Slave** in Step 11.

========================= **end of procedure** =========================

Canopy encourages you to experiment with the interface. Unless you save a configuration and reboot the BHM after you save the configuration, none of the changes are effected.

16.4.2   Time Tab of the BHM

To proceed with the test setup, in the BHM, click the **Configuration** button on the left side of the General Status tab. The BHM responds by opening its Configuration page to the General tab. Click the Time tab. An example of this tab is displayed in Figure 69.
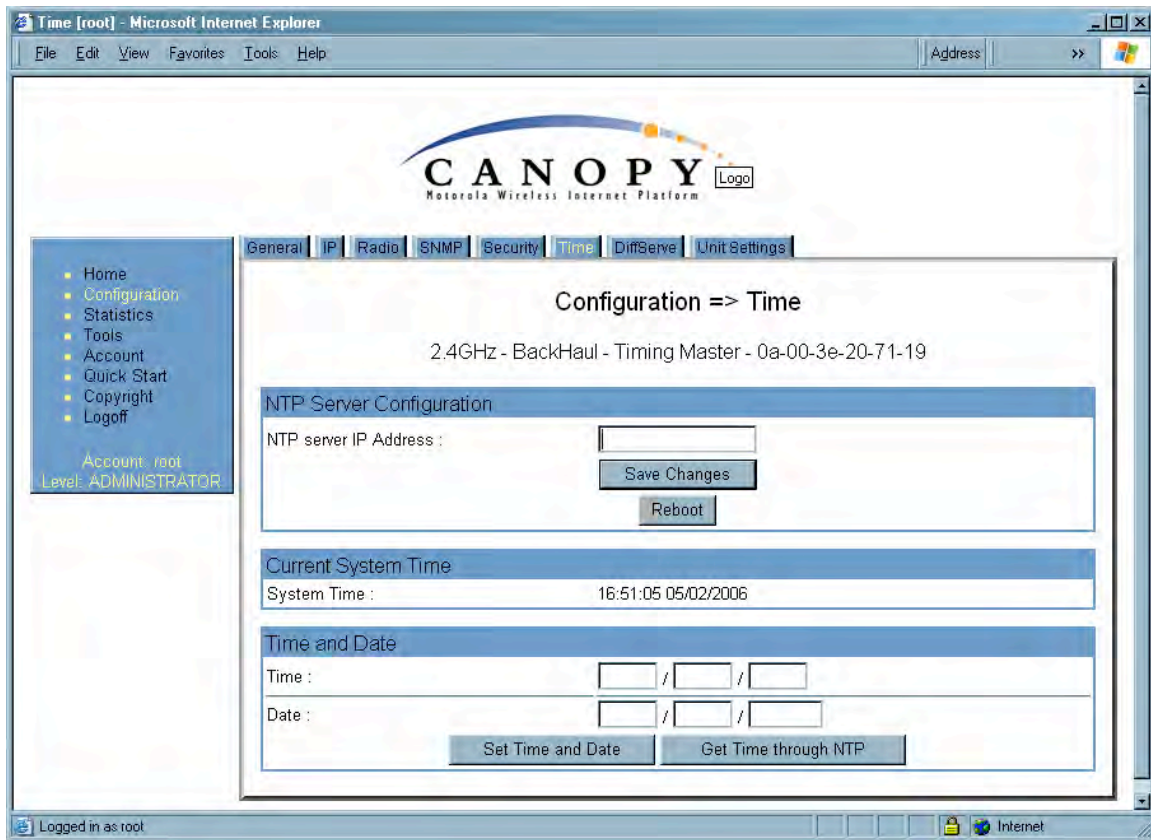
Figure 69: Time tab of BHM, example

To have each log in the BHM correlated to a meaningful time and date, either a reliable network element must pass time and date to the BHM or you must set the time and date whenever a power cycle of the BHM has occurred. A network element passes time and date in any of the following scenarios:

- A connected CMM2 passes time and date (GPS time and date, if received).
- A connected CMMmicro passes the time and date (GPS time and date, if received), but only if the CMMmicro is operating on CMMmicro Release 2.1 or later release. (These releases include an NTP server functionality.)
- A separate NTP server is addressable from the BHM.

If the BHM should derive time and date from either a CMMmicro or a separate NTP server, enter the IP address of the CMMmicro or NTP server on this tab. To force the BHM to derive time and date before the first (or next) 15-minute interval query of the NTP server, click **Get Time through NTP**.

If you enter a time and date, the format for entry is

Time : | **hh** | / | **mm** | / | **ss** |

Date : | **MM** | / | **dd** | / | **yyyy** |

where

hh   represents the two-digit hour in the range 00 to 24
mm   represents the two-digit minute
ss   represents the two-digit second
MM   represents the two-digit month
dd   represents the two-digit day
yyyy   represents the four-digit year

Proceed with the test setup as follows.

Procedure 14: Setting up the BHS for test

1. Enter the appropriate information in the format shown above.
2. Click the **Set Time and Date** button.
   NOTE: The time displayed at the top of this page is static unless your browser is set to automatically refresh.
3. In one hand, securely hold the top (larger shell) of the BH that you intend to deploy as a timing slave. With the other hand, depress the lever in the back of the base cover (smaller shell). Remove the base cover.
4. Plug one end of a CAT 5 Ethernet cable into the BHS.
5. Plug the other end of the Ethernet cable into the jack in the pig tail that hangs from the power supply.
6. Roughly aim the BHS toward the BHM.

WARNING!
From this point until you remove power from the BHS, stay at least as far from the BHS as the minimum separation distance specified under Preventing Overexposure to RF on Page 169.

---

7. Plug the power supply into an electrical outlet.
8. Back at the computing device, on the left side of the BHM Time tab, click the **Home** button. When the Home page opens to the General Status tab, click the **Remote Subscribers** tab.
   RESULT: The BHM opens the Remote Subscribers tab. An example of this tab is shown in Figure 70.

========================= **end of procedure** =======================

Figure 70: Remote Subscribers tab of BHM, example

16.4.3   Beginning the Test of Point-to-Point Links

To begin the test of your BH link, in the Remote Subscribers tab of the BHM, click the link to the BHS. The BHS GUI opens to the General Status tab of its Home page.

An example of the BHS General Status tab is displayed in Figure 71.
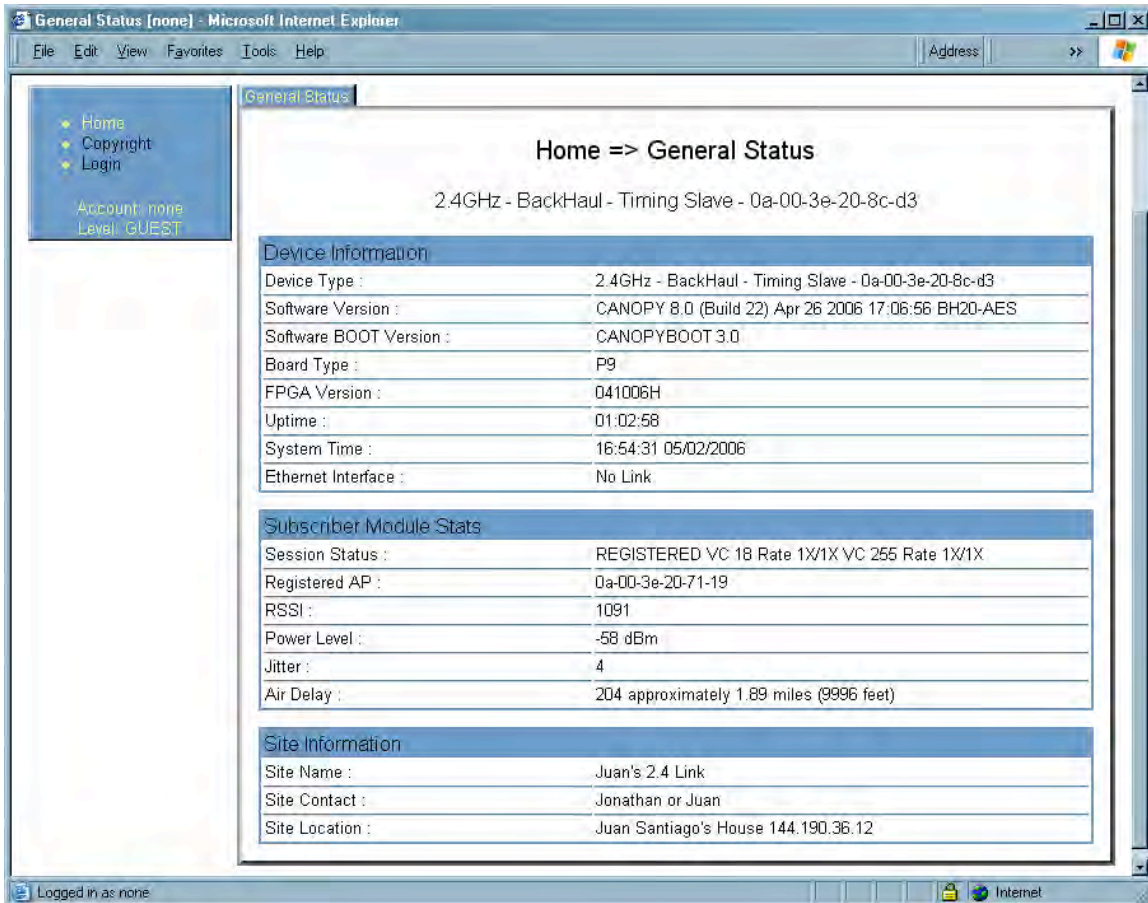

Figure 71: General Status tab of BHS, example

The General Status tab provides information on the operation of this BHS. This is the tab that opens by default when you access the GUI of the BHS. The General Status tab provides the following read-only fields.

Device Type

This field indicates the type of the Canopy module. Values include the frequency band of the BHS, its module type, and its MAC address.

Software Version

This field indicates the Canopy system release, the time and date of the release, the modulation rate, and whether communications involving the module are secured by DES or AES encryption (see Encrypting Canopy Radio Transmissions on Page 371). If you request technical support, provide the information from this field.

Software BOOT Version

This field indicates the version of the CANOPYBOOT file. If you request technical support, provide the information from this field.

Board Type

This field indicates the series of hardware. See Designations for Hardware in Radios on Page 367.

FPGA Version

This field indicates the version of the field-programmable gate array (FPGA) on the module. When you request technical support, provide the information from this field.

Uptime

This field indicates how long the module has operated since power was applied.

System Time

This field provides the current time. When a BHS registers to a BHM, it inherits the system time, which is displayed in this field as GMT (Greenwich Mean Time).

Ethernet Interface

This field indicates the speed and duplex state of the Ethernet interface to the BHS.

Session Status

This field displays the following information about the current session:

- ◦ **Scanning** indicates that this SM currently cycles through the RF frequencies that are selected in the Radio tab of the Configuration page.
- ◦ **Syncing** indicates that this SM currently attempts to receive sync.
- ◦ **Registering** indicates that this SM has sent a registration request message to the AP and has not yet received a response.
- ◦ **Registered** indicates that this SM is both
  - – registered to an AP.
  - – ready to transmit and receive data packets.
- ◦ **Alignment** indicates that this SM is in an aiming mode. See Table 44 on Page 179.

Registered AP

This field displays the MAC address of the BHM to which this BHS is registered.

RSSI, Power Level, and Jitter

The General Status tab shows the received **Power Level** in dBm and **Jitter**. Proper alignment maximizes **Power Level** and minimizes **Jitter**. As you refine alignment, you should favor lower jitter over higher dBm. For example, if coarse alignment gives the BHS a power level of −75 dBm and a jitter measurement of 5, and further refining the alignment drops the power level to −78 dBm and the jitter to 2 or 3, use the refined alignment, with the following caveats:

- ◦ When the receiving link is operating at 1X, the **Jitter** scale is 0 to 15 with desired jitter between 0 and 4.

◦   When the receiving link is operating at 2X, the **Jitter** scale is 0 to 15 with desired jitter between 0 and 9.

For historical relevance, the General Status tab also shows the **RSSI**, the unitless measure of power. Use **Power Level** and ignore **RSSI**. **RSSI** implies more accuracy and precision than is inherent in its measurement.

> *NOTE:*
> Unless the page is set to auto-refresh, the values displayed are from the instant the General Status tab was selected. To keep a current view of the values, refresh the browser screen or set to auto-refresh.

Air Delay

This field displays the distance in feet between the BHS and the BHM. To derive the distance in meters, multiply the value of this parameter by 0.3048. Distances reported as less than 200 feet (61 meters) are unreliable.

Site Name

This field indicates the name of the physical module. You can assign or change this name in the SNMP tab of the BHS Configuration page. This information is also set into the *sysName* SNMP MIB-II object and can be polled by an SNMP management server.

Site Contact

This field indicates contact information for the physical module. You can provide or change this information in the SNMP tab of the BHS Configuration page. This information is also set into the *sysName* SNMP MIB-II object and can be polled by an SNMP management server.

Site Location

This field indicates site information for the physical module. You can provide or change this information in the SNMP tab of the BHS Configuration page.

16.4.4   Continuing the Test of Point-to-Point Links

To resume the test, perform the following steps.

Procedure 15: Verifying and recording information from the BHS

1. Verify that the **Session Status** field of the General Status tab in the BHS indicates **REGISTERED**.
    NOTE: This indication confirms that the BHS is properly functional.

2. While your browser is set to the General Status tab, note (or print) the values of the following fields:

    ◦   **Device type**
    ◦   **Software Version**
    ◦   **Software BOOT Version**
    ◦   **Board Type**
    ◦   **FPGA Version**

3. Systematically ensure that you can retrieve this data when you prepare to deploy the BHS.

4. Return your browser to the General Status tab of the BHM.

=========================== **end of procedure** ========================

16.4.5   General Status Tab of the BHM

An example of a BHM General Status tab is displayed in Figure 72.

Figure 72: General Status tab of BHM, example

The Status page provides information on the operation of the module. This is the default web page for the module. The Status page provides the following fields.

Device Type

This field indicates the type of the Canopy module. Values include the frequency band of the module, the module type, timing mode, and the MAC address of the module.

Software Version

This field indicates the software release that is operated on the module, the release date and time of the software release, the modulation rate capability, and whether the module

is secured by DES or AES encryption (see Encrypting Canopy Radio Transmissions on Page 371). When you request technical support, provide the information from this field.

Software BOOT Version

This field indicates the version of the CANOPYBOOT file. If you request technical support, provide the information from this field.

Board Type

This field indicates the series of hardware. See Designations for Hardware in Radios on Page 367.

FPGA Version

This field indicates the version of the field-programmable gate array (FPGA) on the module. When you request technical support, provide the information from this field.

Uptime

This field indicates how long the module has operated since power was applied.

System Time

This field provides the current time. If the BHM is connected to a CMM, then this field provides GMT (Greenwich Mean Time). The BHS that registers to the BHM inherits the system time.

Last NTP Time Update

If the Time & Date page of the module specifies that time should be received from an NTP server, then this field indicates when the time was last updated by a Network Time Protocol (NTP) server.

Ethernet Interface

This field indicates the speed and duplex state of the Ethernet interface to the module.

Registered SM Count

This field confirms that only one BHS is registered to the BHM.

GPS Sync Pulse Status

This field indicates the status of synchronization as follows:

- **Generating sync** indicates that the module is set to *generate* the sync pulse.
- **Receiving Sync** indicates that the module is set to *receive* a sync pulse from an outside source and is receiving the pulse.
- **ERROR: No Sync Pulse** indicates that the module is set to *receive* a sync pulse from an outside source and is not receiving the pulse.

> *NOTE:*
> When this message is displayed, the BHM transmitter is turned off to avoid self-interference within the Canopy system.

Site Name

This field indicates the name of the physical module. You can assign or change this name in the SNMP tab of the BHM Configuration page. This information is also set into the *sysName* SNMP MIB-II object and can be polled by an SNMP management server.

Site Contact

This field indicates contact information for the physical module. You can provide or change this information in the SNMP tab of the BHM Configuration page. This information is also set into the *sysName* SNMP MIB-II object and can be polled by an SNMP management server.

Site Location

This field indicates site information for the physical module. You can provide or change this information in the SNMP tab of the BHM Configuration page.

Scheduling Type

This field indicates the type of frame scheduler that is active in the BHM.

16.4.6   Concluding the Test of Point-to-Point Links

To conclude the test, perform the following steps.

Procedure 16: Verifying and recording information from the BHM

1. Confirm that the **GPS Sync Pulse Status** field indicates **Generating Sync**.
   NOTE: This indication confirms that the BHM is properly functional.

2. While your browser is set to this BHM Status page, note (or print) the values of the following fields:
   ◦ **Device type**
   ◦ **Software Version**
   ◦ **Software BOOT Version**
   ◦ **Board Type**
   ◦ **FPGA Version**

3. Systematically ensure that you can retrieve this data when you prepare to deploy the BHM.

========================= **end of procedure** =========================

16.4.7   Setting up a CMMmicro

The layout of the CMMmicro is as shown in Figure 73.
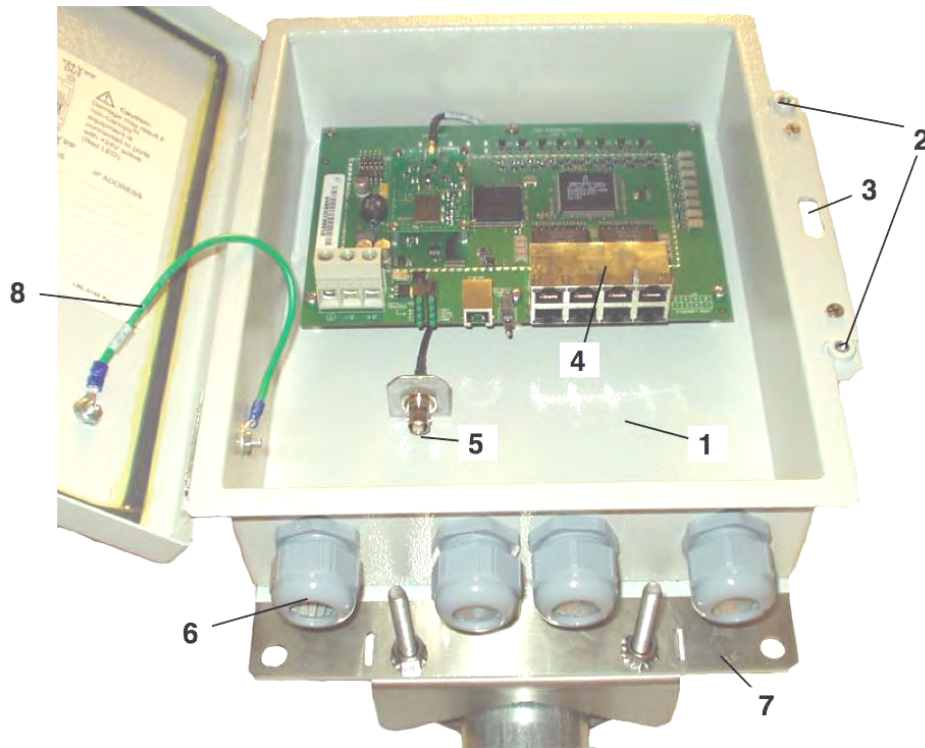
1   **Weatherized enclosure**

2   **Thumb-screw/slot-screwdriver door fasteners**

3   **Punch-out for padlock**

4   **Ethernet switch and power module**

5   **Female BNC connector**

6   **Water-tight bulkhead connectors**

7   **Flange for attachment (stainless steel so it grounds to tower or building) using U bolts (provided) or other hardware such as screws or lag bolts or attachment straps (not provided).**

8   **Ground strap to ground door to enclosure**

Figure 73: CMMmicro layout