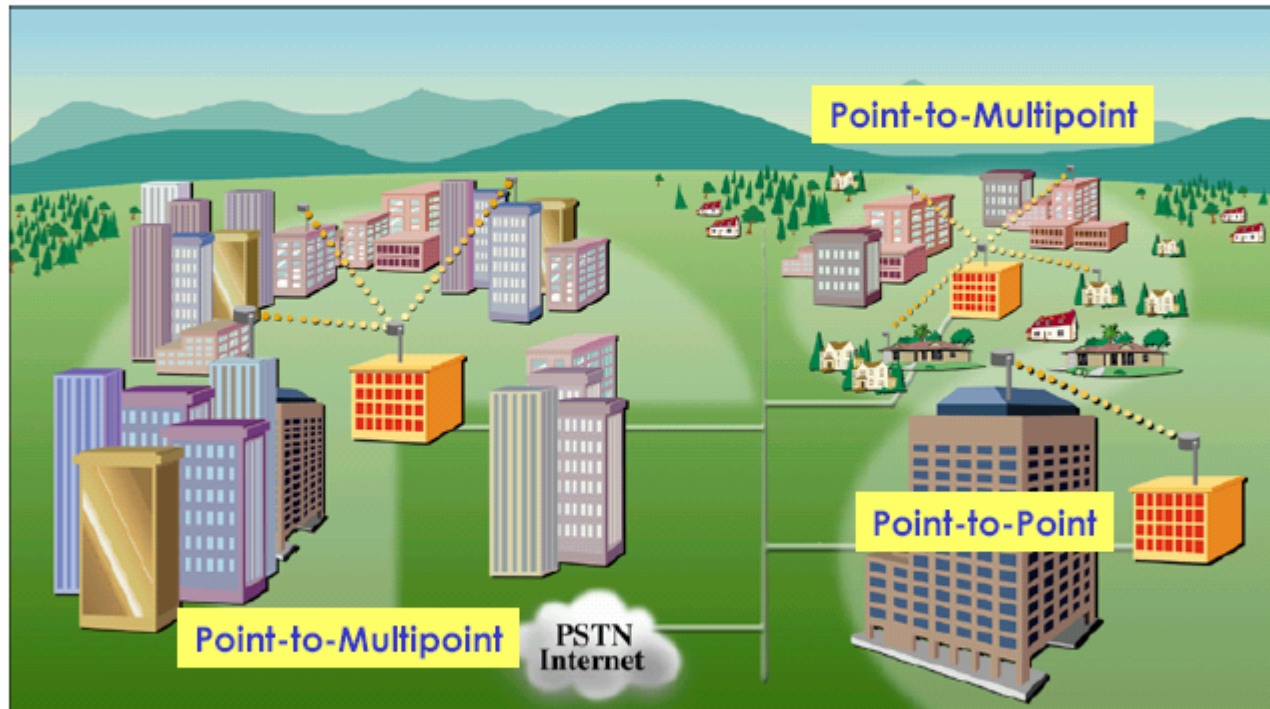


- Canopy Broadband Wireless Platform  
*A Fixed Wireless Access Solution*

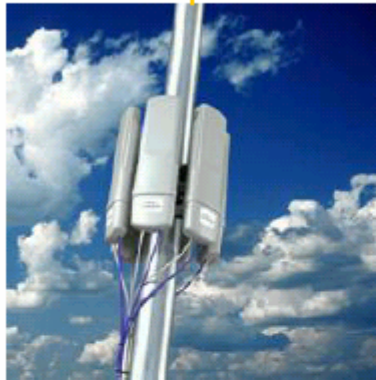


# Canopy Components



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Access Point (AP)



Backhaul Module  
(BH)



Subscriber Module  
(SM)

# Canopy Components

- Canopy Broadband Wireless Components Consist of:
  - Access Point Module (AP)
  - Subscriber Module (SM)
  - Backhaul Module (BH)
  - Cluster Management Module (CMM)
  - 300SS Surge Suppressor
  - Bandwidth and Authentication Manager (BAM)
  - Simple Network Management Protocol (SNMP)
  - Built-In and Third Party Management Mechanisms

# Canopy Features



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# Canopy Performance Characteristics

## Canopy

- Access Points (AP's), Subscriber Modules (SM's) and 10Mb Backhaul Modules (BH) run at a channel rate of 10Mbps.
- 20Mb Backhaul Modules (BH) run at a channel rate of 20Mbps.
- Modules operate in the U-NII and ISM bands.

# Canopy Performance Characteristics

## Canopy

- Modules are available in two configurations:
  - Point-to-Point
    - For dedicated networks or broadband backhaul.
  - Point-to-Multipoint
    - For distribution to Campus, Enterprise and the surrounding community.

# Canopy Radio Characteristics

## Canopy

- Is available in both the 5.2GHz (U-NII) & 5.7GHz (U-NII/ISM) bands.
- Uses 20MHz channels.
- Transmits conforming to United States FCC EIRP requirements for 5.2GHz and 5.7GHz.
- Is designed with an integrated 60 degree beamwidth, vertically polarized directional patch antenna.



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# Canopy Radio Characteristics

## Canopy

- Is designed with an integrated auto-negotiating 10/100base T Ethernet interface.
- Can auto-sense CAT 5 cable configurations - crossover vs. straight-through.

# Canopy Configurations



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*intelligence*  *everywhere™*

# Canopy Configurations

Canopy components are available in several configurations

- 5.2 GHz Multipoint Network (U-NII)
- 5.7 GHz Multipoint Network (U-NII/ISM)
- 5.2 GHz Point-to-Point (Backhaul) (U-NII)
- 5.7 GHz Point-to-Point (Backhaul) (U-NII/ISM)

# Multipoint Network

- A multipoint unit consists of a minimum of one Access Point and one Subscriber Module.
- A multipoint network provides service to multiple users, usually one to two hundred Subscriber Modules.
- Typical Downlink throughput from AP to SM is ~4Mbps.
- Typical Uplink throughput from SM to AP is ~1.5Mbps.

## Point-to-Point (Backhaul) Link

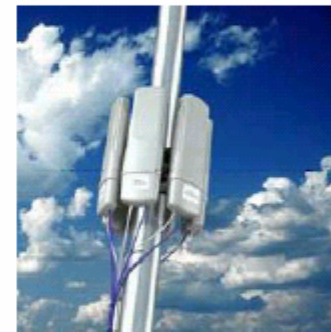
- A basic Point to Point link consists of one Backhaul Master and one Backhaul Slave.
- This link can be 5.2GHz or 5.7GHz depending on the throughput and distance requirements.
- Backhaul links can be combined into multiple hops to extend link distance and to ensure link reliability.
- Backhaul links are generally used to transport large amounts of data between a Network Operations Center (NOC) and an Access Point Cluster or provide a broadband network link to one or more buildings in a campus environment, i.e. extending a LAN.

# Typical Multipoint Cluster Configuration

- The Cluster Management Module Supports:
  - One to Six Access Point Modules (AP's) per cluster (5.2 GHZ or 5.7 GHZ)
  - Up to eight Access Point (AP)/Backhaul Module (BH) combinations (5.2 GHz or 5.7 GHz)
  - One Surge Suppressor

## Typical Access Point Cluster Components

- One to Six Access Points (AP's) per cluster (5.2 GHZ or 5.7 GHz)
- Up to Two Backhaul Modules (BH) (5.2GHz or 5.7 GHz)
- One Surge Suppressor
- One to three, 110 - 240 VAC Single Module Power Supplies (Domestic or International version) or a Cluster Management Module (CMM). A CMM is required when using multiple Access Points (AP's) or Backhaul Modules (BH) in a cluster)



## Access Point Features

Access Point (5.2GHz or 5.7GHz) with Integrated patch antenna:

- >3 km or 2 mile range – Line Of Sight - >16 km or 10 miles at 5.7GHz with Subscriber Module (SM) Reflector Kit.
- >6 Mbps Effective Throughput.
- Integrated vertically polarized 60 degree beamwidth patch antenna.
- Each Access Point (AP) can support up to 200 Subscriber Modules (SM's).
- Up to six Access Points (AP's) can be collocated in a cluster supporting up to 1200 Subscriber Modules.



## Typical Subscriber Module Components

- One 5.2GHz or 5.7GHz Subscriber Module
- One Power Supply (110VAC or 240VAC Domestic or International version)
- One Surge Suppressor
- One Universal Mounting Bracket
- Optional Passive Reflector Kit for 5.7GHz Subscriber Module



Subscriber Module  
(SM)

## Subscriber Module Features

- SM (5.2GHz and 5.7GHz) with Integrated Antenna
  - >3.2 km or 2 mile range – Line Of Sight.
  - 4+ Mbps effective Downlink throughput.
  - ~1.5 Mbps effective Uplink throughput.
- SM (5.7GHz) with Passive Reflector Kit.
  - Up to 16 km or 10 mile range – Line Of Sight.
  - 4+ Mbps effective Downlink throughput.
  - ~1.5 Mbps effective Uplink throughput.

# Canopy Users



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# Canopy Users

- Education
  - Schools
  - Universities
- Government Agencies
  - Local Fire and Police Departments
  - City and County Governments
  - Federal Government
  - Military
- Internet Service Providers



# Canopy Users

- Private Enterprise (Businesses)
  - Banking
  - Engineering
  - Energy Producers
  - Industrial – Private Security
  - Farming - Ranching
  - Health Care
  - Retail
  - Sporting Event Organizers
  - Water Management



# Canopy Users

- Private Sector
  - Hotels
  - MDU's
  - MTU's
  - Resorts
  - Retirement Communities



# Canopy Applications



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## Canopy Broadband Wireless Applications

- LAN Extension
- Internet Service
- High Bandwidth Point to Point Connections
- Multicast Video (Instruction and Training)
- PBX Extension
- Point to Multipoint Backhaul
- Redundant Network Backup
- Video Surveillance
- Voice Over IP (VOIP)

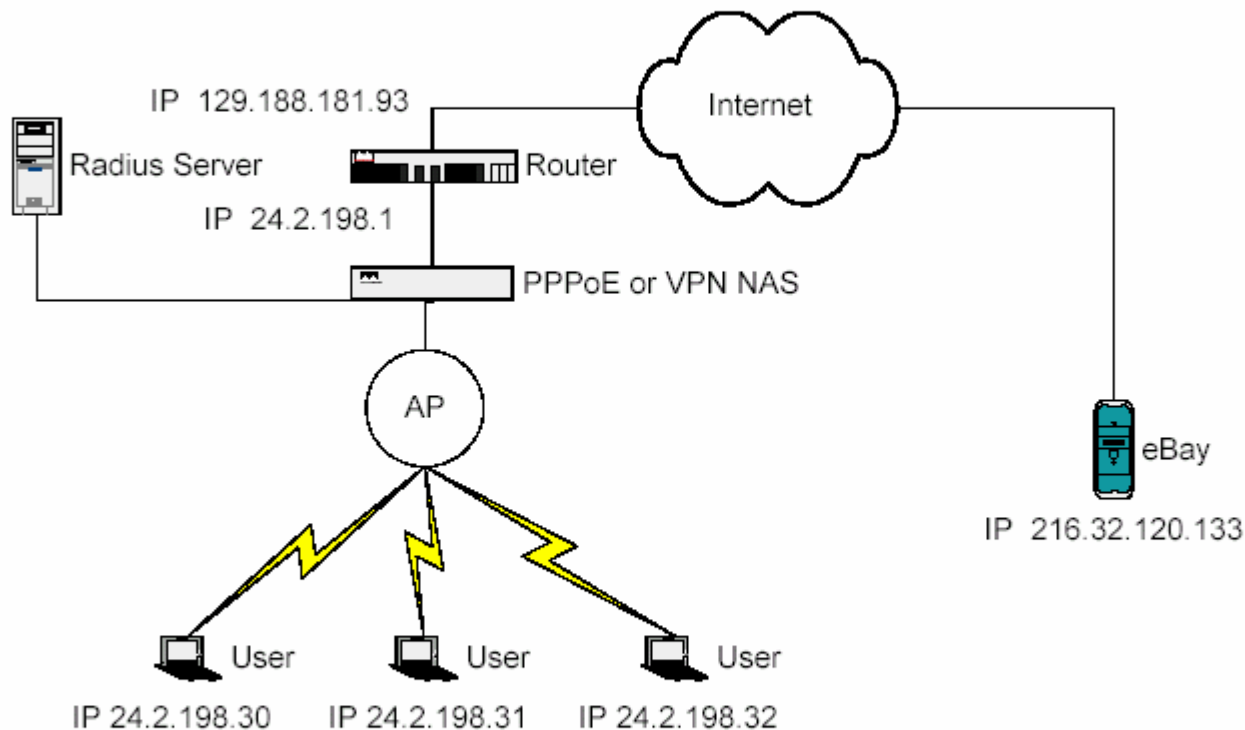


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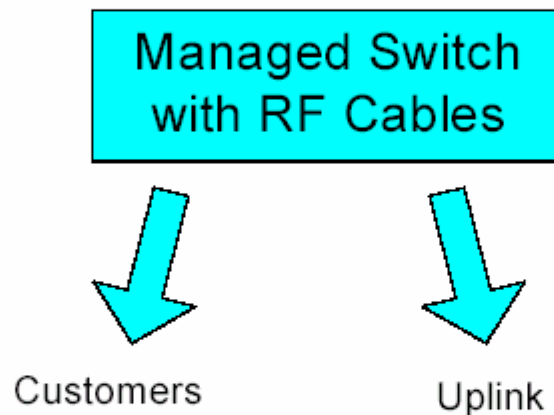




## Why Use Layer 2? – Protocol Independence

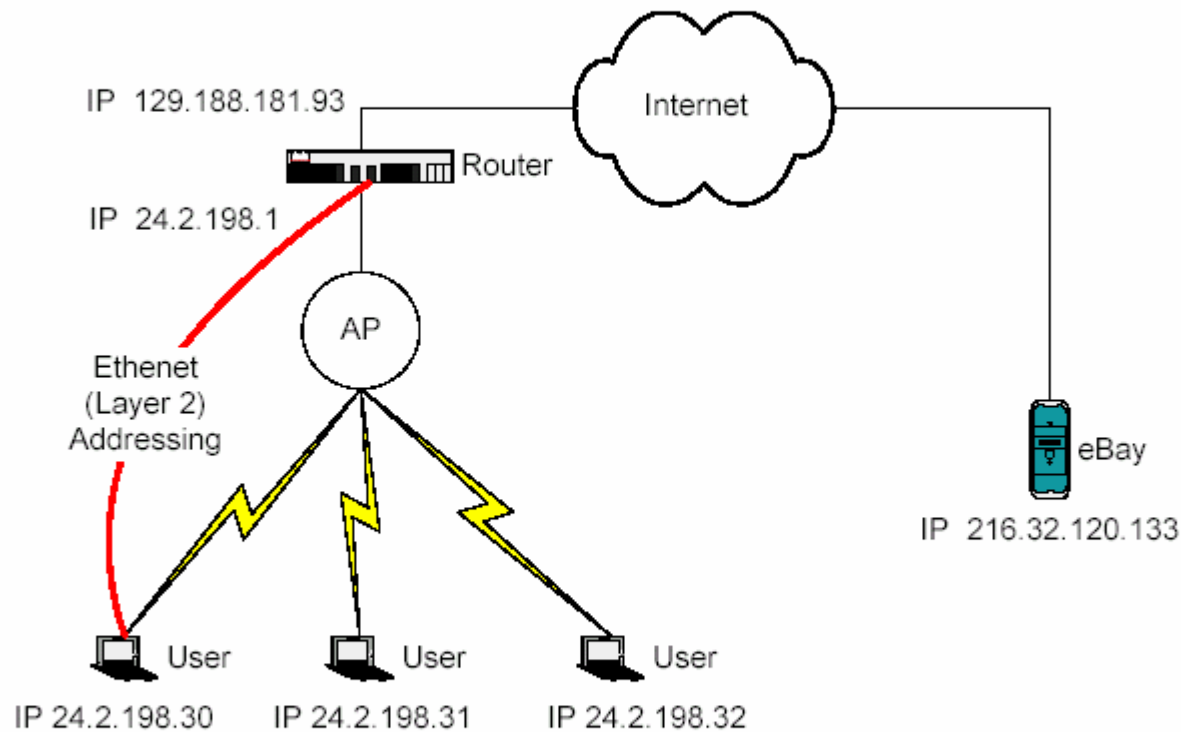


## Canopy is like a Wireless Switching Hub...



- Canopy can be thought of as a managed switch

# Canopy in Place of the Switching Hub



## Canopy Cables - Important Notes

- Cabling is one of the most important components of any communication network.
- Poor quality or poorly constructed cables can create intermittent network problems.
- Properly dressed and labeled cables make identification and troubleshooting easier.
- One of the “Top Ten” Canopy technical support issues involves some type of cable problem.

# Site Selection

- Site selection for Point-to-Point and Multipoint wireless networks use basically the same techniques:
  - At 5GHz most communication is Line of Sight (LOS), If you can't see it you probably can't talk to it!
  - In some cases, a 5GHz signal will pass through trees, reflect off buildings and provide near or non - line of sight communication.

## Site Selection

- The only way to find out if the radio path will work is to try it! It is not good business practice to provide service where the signal is reflected off of objects or passes through trees unless you have control over new construction, trees, repainting of RF reflective surfaces, etc.

## Site Selection

- Tall structures such as buildings, radio towers, water towers and hills or mountain tops are ideal radio sites.
- The site must have some source of power:
  - AC
  - DC
  - Solar
  - Emergency backup power (UPS, generator, batteries)

# Site Selection

- If the site is not being used as a repeater some type of data source must be available:
  - Ethernet Cable
  - Fiber optic cable
  - Modem, Mux
  - Telco line
  - Wireless Backhaul



## Site Selection

- The site must have provisions for grounding and lightning protection.
- If peripheral devices such as hubs, switches or routers are used, proper protection from the elements (weather) is required (weatherproof cabinet, radio room etc.).
- Local regulations must be followed regarding installation and operation of RF devices.
- Site must be accessible for maintenance.

## Site Selection

- Site should be secure from vandalism, animals and the curious.
- Mounting structures should be rigid and capable of supporting radios, mounting hardware and the technician installing the equipment!
- Units with parabolic antennas or reflectors should be mounted on structures designed to withstand, at minimum, the wind load rating of the antenna.

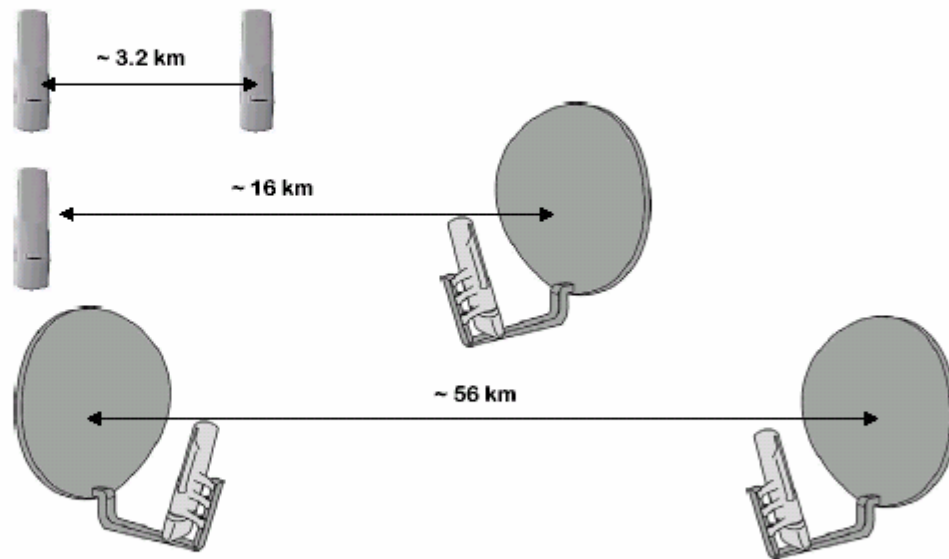
## Site Selection

- Check for sources of potential interference. These may be sources other than radios broadcasting on or around the same carrier frequency as Canopy:
  - High energy sources that could potentially be injected into the CAT 5 POE (Power Over Ethernet) or GPS cables.
- If you suspect interference sweep the area with a spectrum analyzer.

# Canopy Range

Depending on the band and antenna combination, Canopy radios can span distances >56 km or 35 miles

- Patch to Patch
  - 3.2 km or 2 miles
- Patch & reflector
  - 16 km or 10 miles
- 2 reflectors
  - 56 km or 35 miles



# Lightning Protection - Grounding

- **Lightning protection:**

- Cables entering or leaving a building
- Data interface cables
- Masts, Towers
- Radios
- Transmission lines
- Canopy radios should be mounted .609 meters or 2 feet below the top of the tower or mounting structure
- Lightning rods must not be mounted directly to Canopy radios
- Lightning arrestors should be installed at intervals from the top of the mounting structure to the cable and power entrance of the building



# Canopy Specifications

## ACCESS POINT

- Operating Frequency Range U-NII: 5.25 to 5.35 GHz and 5.725 to 5.825 GHz
- Access Method: TDD/TDMA
- Signaling Rate: 10 Mbps
- Modulation Type: High Index BFSK (Optimized for interference rejection)
- Carrier to Interference: (C/I)3dB
- Nominal Receiver Sensitivity: -83dBm 10-4 BER
- Transmitter Power into Antenna: 23dBm
- Transmitter Power: Meets FCC UNII ERP Limit



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# Canopy Specifications

## ACCESS POINT

- Antenna: Integrated Patch Vertically Polarized, 60° x 60° Beamwidth
- Antenna Gain: 7dB
- F/B ratio: 15dB
- Operating Range: Up to 3.2 km or 2 miles with integrated antenna in the 5.2 GHz band. Up to 16 km or 10 miles with passive reflector on the SM in the 5.7 GHz band.
- DC Power: .3A @ 24 VDC (7.2 watts)

# Canopy Specifications

## ACCESS POINT

- Interface 10/100 BaseT, half/full duplex rate auto negotiated (802.3 compliant)
- Protocols Used by CANOPY: IPV4, UDP, TCP, ICMP, Telnet, HTTP, FTP, SNMP, DES
- Protocols Supported by Canopy: Switched Layer 2 Transport with support for all common Ethernet protocols including IPV6, NetBIOS, DHCP, IPX, etc.
- Software Upgrade Path: Remotely downloaded into FLASH via RF link
- Network Management: HTTP, TELNET, FTP, SNMP



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# Canopy Specifications

## ACCESS POINT

- Temperature: -40°C to +55°C (-22o to +131°F)
- Weight: .45 kg or 1 lb.
- Dimensions: 29.9 cm H x 8.6 cm W x 8.6 cm D or 11.75" H x 3.4" W x 3.4" D
- MTBF (Mean Time Between Failure) 40 years
- MTTR (Mean Time to Repair) 15 minutes

# Canopy Specifications

## SUBSCRIBER MODULE

- Operating Frequency Range: U-NII Mid band 5.25 to 5.35 GHz and 5.725 to 5.825 GHz
- Access Method: TDD/TDMA
- Signaling Rate: 10 Mbps
- Modulation Type: High Index BFSK (Optimized for interference rejection)
- Carrier to Interference (C/I) also known as Jitter: 3dB nominal
- Receiver Sensitivity: -83dBm 10-4 BER
- Transmitter Power into Antenna: 23dBm
- Transmitter Power: Meets FCC UNII ERP Limit



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# Canopy Specifications

## SUBSCRIBER MODULE

- Antenna: Integrated Patch Vertically Polarized, 60° x 60° Beamwidth
- F/B ratio: 15dB
- Antenna Gain: 7dB
- Reflector: Vertically Polarized, 6° x 6° Beamwidth
- Reflector Gain: 18dB
- F/B ratio: 30dB
- Operating Range: (All Weather)  
Up to 3.2 km or 2 miles with integrated antenna in the 5.2 GHz band.  
Up to 10 mile with passive reflector in the 5.7 GHz band.
- DC Power: .3A @ 24 VDC (7.2 watts)



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# Canopy Specifications

## SUBSCRIBER MODULE

- Interface: 10/100 BaseT, half/full duplex Rate auto negotiated (802.3 compliant)
- Protocols Used by Canopy: IPV4, UDP, TCP, ICMP, Telnet, HTTP, FTP, SNMPv2c, DES
- Protocols Supported by Canopy: Switched Layer 2 Transport with support for all common Ethernet protocols including IPV6, NetBIOS, DHCP, IPX, etc.
- Software Upgrade Path: Remotely downloaded into FLASH via RF link
- Network Management: HTTP, TELNET, FTP, SNMP



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# Canopy Specifications

## SUBSCRIBER MODULE

- Temperature: -40°C to +55°C (-22°F to +131°F)
- Dimensions: 29.9 cm H x 8.6 cm W x 8.6 cm D or 11.75" H x 3.4" W x 3.4" D Weight: .45 kg or 1 lb.
- MTBF (Mean Time Between Failure) 40 years
- MTTR (Mean Time to Repair) 15 minutes

# Canopy Specifications

## BACKHAUL MODULE

- Operating Frequency Range: U-NII 5.25 to 5.35 GHz and 5.725 to 5.825 GHz
- Access Method: TDD/TDMA
- Signaling Rate: 10 Mbps
- Modulation Type: High Index BFSK (Optimized for interference rejection)
- Carrier to Interference (C/I) (10Mb): 3dB nominal
- Carrier to Interference (C/I) (20Mb): 10dB nominal
- Receiver Sensitivity (10Mb): -83dBm 10<sup>-4</sup> BER
- Receiver Sensitivity (20Mb): -79dBm 10<sup>-4</sup> BER



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# Canopy Specifications

## BACKHAUL MODULE

- Transmitter Power into Antenna: 23dBm
- Antenna: Integrated Patch Vertically Polarized, 60° x 60° Beamwidth
- Antenna Gain: 7dB
- F/B ratio: 18dB
- Reflector: Vertically Polarized, 6° x 6° Beamwidth
- Reflector Gain: 18dB
- F/B ratio: 30dB

# Canopy Specifications

## BACKHAUL MODULE

- Operating Range (All Weather)  
Up to 3.2km or 2 miles with integrated antenna.  
Up to 32 km or 20 miles with installed passive reflectors.
- Transmitter Power: Meets FCC UNII ERP Limit
- DC Power: .3A @ 24 VDC (7.2 watts)
- Interface: 10/100 Base T, half/full duplex Rate auto negotiated (802.3 compliant)
- Protocols Used by Canopy: IPV4, UDP, TCP, ICMP, Telnet, HTTP, FTP, SNMP, DES



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# Canopy Specifications

## BACKHAUL MODULE

- Protocols Supported by Canopy: Switched Layer 2 Transport with support for all common Ethernet protocols including IPV6, NetBIOS, DHCP, IPX, etc.
- Software Upgrade Path: Remotely downloaded into FLASH via RF link
- Network Management: HTTP, TELNET, FTP, SNMP
- Temperature: -30°C to +55°C or -22°F - +131°F

# Canopy Specifications

## BACKHAUL MODULE

- MTBF (Mean Time Between Failure) 40 years
- MTTR (Mean Time to Repair) 15 minutes
- Dimensions: 29.9 cm H x 8.6 cm W x 8.6 cm D or 11.75" H x 3.4" W x 3.4" D
- Weight: .45kg or 1 lb.
- Weight with passive reflector: 3kg or 6.5 lbs.