



**Technical
Frequently Asked Questions**

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ACRONYMS

AP	Access Point
BH.....	Backhaul Module
CAT 5.....	Category 5
CMM.....	Cluster Management Module
FM.....	Frequency Modulation
GPS	Global Positioning System
IP	Internet Protocol
LAN	Local Area Network
LUID	Logical Unit Identification
MAC	Media Access Control
QoS	Quality of Service
RF.....	Radio Frequency
RSSI	Received Signal Strength Indicator
Sector ID.....	Sector Identification
SM.....	Subscriber Module
Synch.....	Synchronization
TOS.....	Type of Service
VPN.....	Virtual Private Network

Notice

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IP ADDRESSING

Q1: *What is the default IP address of the Canopy™ radios?*

A: The default IP address for all Canopy products is 169.254.1.1 with subnet mask 255.255.0.0.

Q2: *Does the Canopy Subscriber Module have an IP address?*

A: Yes, the Canopy Subscriber Modules are preconfigured with the IP address of 169.254.1.1. The service provider may change this address to suit their network architecture.

Q3: *What is the difference between the LAN IP and the Private IP?*

A: The LAN IP is the IP address that is associated with the wired connection on the Canopy module. The Private IP is the IP associated with the wireless (RF) connection on the Canopy module. The Private IP space consists of a flat class C subnet.

Q4: *How do I gain access to the Canopy radio if I forget the IP address or the password?*

A: If you have forgotten your password or the IP address to a Canopy radio, you can easily gain access to the module by applying the following simple steps. First, insert a CAT 5 cable with a 6-pin RJ11 connector into the RJ11 port on the Access Point Module. Second, turn the power on to the Access Point module. Third, short pins 4 and 6 together. Once these steps are completed, the Access Point will come up in the default mode and the unit will be automatically configured with the default IP address and the passwords removed.

CANOPY COMPONENTS

Q1: *How far should the Access Point Modules be physically located from the Cluster Management Module?*

A: There are two generations of the Cluster Management Module. For Generation One, which can be identified with a serial number less than 300, the maximum AP location distance is driven by the maximum allowable length of GPS Synch cable, or 100 feet. For Generation Two, identifiable by a serial number greater than 300, the maximum distance is the maximum allowable length of both the Ethernet cable and the GPS synchronization cable, or 328 feet.

Q2: Does an Access Point Cluster need to be fully populated?

A: No, as few as one Access Point Module can be employed in the Access Point Cluster. This offers tremendous cost benefits to the broadband carrier. Once deployed, the Access Point Cluster can support up to 1,200 subscribers. To grow the system, the only additional investment required by the carrier is the Canopy Subscriber Modules (200 per each AP) necessary to deliver the signals to each customer.

Q3: How many Subscriber Modules can register to a single Access Point Module?

A: Up to 200 Subscriber Modules can register to a single Access Point Module. A single Access Point Cluster (consisting of six Access Points) can support up to 1,200 Subscriber Modules.

Q4: How much power does one Canopy radio dissipate?

A: The Canopy radio dissipates approximately seven watts of power.

Q5: What is the default username when a password is set on a Canopy radio?

A: The Canopy radios do not come preconfigured from the factory with a default username or password.

Q6: How much physical separation is needed between a 5.2 GHz Access Point Cluster and a 5.7 GHz Backhaul Module?

A: In this scenario, there must at least five feet of vertical separation between the Access Point Cluster and the Backhaul Module.

Q7: Is the Canopy radio a router or a bridge?

A: The Canopy system may be thought of as a bridge. (*Question 11 in the Canopy System section of this document provides further information on this question.*)

Q8: Is there a factory default button on the Canopy radios?

A: On the Canopy software release R3, there is a software factory default button that enables the service provider to return to the factory defaults. The Canopy User Guides contain more detailed information on this subject.

Q9: *How long does a Subscriber Module stay in “aiming mode” when it’s powered on and no connection is present at the Ethernet port?*

A: The Subscriber Module will stay in aiming mode for approximately 15 minutes when there is no connection present. After 15 minutes, the Subscriber Module automatically returns to operational mode.

Q10: *Can the Canopy radios lose connectivity with the GPS satellites due to weather?*

A: Typically, weather does not impact connectivity to the GPS satellites. Nearby lightning strikes may, however, disrupt reception.

Q11: *How does GPS control synchronization within the Canopy system?*

A: The GPS ensures that all Access Point Clusters and/or Backhaul Master Modules are transmitting and receiving at the same time.

Q12: *What factors are examined when a Subscriber Module attempts to register to an Access Point?*

A: The SM examines the Received Signal Strength Indicator (RSSI), jitter and number of registered units being serviced by the AP module to decide whether or not to register. If the RSSI is too low (below 700), the Jitter above 9 or the traffic excessive it will reject the AP module and continue its search. *(See Definitions section of Technical FAQs, Questions 1 and 2 for further definition of RSSI and Jitter.)*

Q13: *What is the MAC limit on the Subscriber Module and the Access Point Module?*

A: The AP supports 4,096 MAC addresses.

Q14: *Can users change the bandwidth capacity at the Subscriber Module?*

A: The service provider can control the limits on both the uplink and the downlink capacity for all registered subscriber modules at the Access Point module. This is not, however, a settable parameter at the Subscriber Module. Allowing changes to the bandwidth capacity only at the Access Point Module, gives the service provider the greatest amount of control over the bandwidth of each of its customers.

Q15: *What is the username that is used when accessing a Canopy module that has a password set?*

A: In the Canopy software release Naham (SP3) there is no default username. In the subsequent Motorola Canopy software release R3, the default username when

accessing via the web should be left blank, but when accessing via telnet or ftp the default username is root.

Q16: *Can Logical Unit Identifications (LUIDs) be statically assigned to a Subscriber Module?*

A: No, the AP nominally assigns LUIDs to the Subscriber Modules.

Q17: *What is the difference when an Access Point generates a sync pulse or when it synchronizes to a received pulse?*

A: Autonomous generation of sync pulses by the Access Point can be employed to allow a simple configuration to function. The pulses will not be, however, in synchronization with any other clocking mechanism and will drift relative to the absolute timing provided by a GPS receiver. The use of a GPS sync generator is recommended for almost all applications.

Q18: *What happens when the downlink data rate percentage is changed?*

A: When the downlink parameter is changed, it has the effect of changing both the proportion of time spent in downlinking and that of uplinking, always preserving a sum of the fractions equal to one. (That is, if the downlink is 75%, the uplink becomes 25%). A portion of the frame is occupied with guard bands, the beacon and contention slots so the proportion is nominally between the actual data rates.

CANOPY SYSTEM

Q1: *What is the latency in a Canopy Point-to-Multipoint system?*

A: The latency in a Canopy Point-to-Multipoint system is somewhat dependent upon the data rate and packet length. Typical latency rates are four milliseconds for downlink transmissions and 15 milliseconds in uplink transmissions.

Q2: *What is the latency in the Canopy Point-to-Point system?*

A: The latency in a Canopy Point-to-Point system is typically about 2.5 milliseconds (one frame time) in both the uplink and downlink transmissions.

Q3: *Is the Canopy Point-to-Point system protocol half or full duplex?*

A: The Canopy Point-to-Point system is half-duplex.

Q4: *Does the Canopy system use forward error correction?*

A: No, the Canopy system uses selective retransmission.

Q5: *How does the Canopy system handle Layer 2 broadcasts?*

A: The MAC layer address is comprised of all ones and is reserved for broadcasting. This address will cause a broadcast message to be seen by all hosts. This is configured by setting the high priority uplink percentage parameter and its associated downlink percentage. Additional information is contained in the *Canopy AP Manual Advance Features section*.

Q6: *How can the Canopy system fit into my VoIP network?*

A: The Canopy broadband system solution easily fits with a voice over IP network. The Canopy system has the ability to reserve data slots for a low latency queue. The Canopy software checks the Type of Service (TOS) field of the Ethernet frame and places the data in the appropriate queue.

Q7: *Is a virtual private network (VPN) with some number of Subscriber Modules registered to the same or different Access Point Modules possible?*

A: Yes, the Canopy system functions like a Layer 2 Switch and is transparent to Layer 2 protocols, including VPN.

Q8: *Does the Canopy system support over the air encryption.*

A: The Canopy software supports over the air encryption. Canopy supports single DES encryption for the over the air link and is backward compatible with current Canopy modules. There is no performance degradation to the Canopy system when over the air encryption is engaged.

Q9: *Can the Canopy system be used for conveying surveillance images?*

A: Internet cameras can be used very effectively with the Canopy system. It is recommended that the Canopy system's Point-to-Point framework be used for surveillance in order to take advantage of the five millisecond roundtrip latency.

Q10: *How does the Canopy system compare with 802.11 products?*

A: The 802.11 products (802.11A, B, and G) are all intended to serve as wireless Local Area Networks (LANs) in indoor environments. Characteristics of 802.11 products include modest ranges (measured in hundreds of feet), impressive bandwidths for short distances and significantly reduced bandwidths at maximum range. (*802.11G is still undergoing standardization.*)

The Canopy system is a wireless broadband bridge (not a LAN) between hosts or LANs and the Internet with a Subscriber Module to Access Point range of up to two miles (10,560 feet). Unlike products based on 802.11, the Canopy system's

bandwidth is unaffected by the distance. (Backhaul ranges are much longer - *10 to 35 miles or more* - depending upon implementation.)

Because the 802.11B and G products operate in the 2.4 GHz band, they do not interfere with Canopy systems nor do Canopy systems interfere with them.

802.11A operates in the same spectral territory as the Canopy system, but is not a significant interferer because the Canopy system's FM capture mechanism rejects almost all interfering signals. However, the Canopy system could interfere with 802.11A installations if they were within 100 feet and were operating at the same frequency. Using different frequencies or staying beyond about 100 feet virtually guarantees comfortable coexistence. It would be wise to select 802.11A frequencies at the lowest values and, in any event, as spectrally distant from those used by nearby Canopy installations as possible.

Q11: How does the Canopy system compare with Mesh Network systems?

A: Ideally, mesh network systems provide non-line-of-sight broadband access. When they do not have line-of-sight access to the NAP, they relay through a succession of subscriber units to set up a path around whatever obstruction prevents direct access. The subscriber units are (according to the *Economist Technology Quarterly on Wireless Network Technologies*) typically priced at \$800 at present.

A Comparison of Mesh Networks and Wireless Broadband Bridge (Canopy System)

Mesh Networks

- **High Density Requirements:** Mesh networks require an adequate density of subscribers to constitute a mesh (the low-power, omni-directional subscriber units have a limited reach). Such a density usually requires significant time to be attained and depends upon the density of the potential subscriber base. There are some areas where a useful density may never be reached. Potential customers in outlying areas may not have access to service.
- **High Latency:** Relaying through a number of customer units will add latency because of the delay associated with traversing several units. Such latency can prove excessive.
- **Subscriber Unit Failure:** A subscriber unit failure can affect the performance of a number of neighboring units when it is a key relay element because of its position. Determining which unit is at fault can be difficult and dispatch for repair can be time consuming and expensive.

- **Significant Cost of Entry:** Highly priced subscriber units (approximately \$800 per unit) exclude a significant number of prospective customers.

Wireless Broadband Bridge (Canopy System)

- **Low Density Systems:** Can be installed to serve a sparse customer base, providing each with excellent service from the time that the first is installed.
- **Low Latency:** Offers low latency under all circumstances.
- **Isolation of Subscriber Units:** A subscriber unit failure will have no effect upon other subscribers.
- **Low Cost of Entry:** The current SM price is comfortable to many prospective customers and will continue to decline as product advancements are realized.

CABLES

Q1: What type of cables does the Canopy system require?

A: The cables used for data and power are Category 5 unshielded twisted pair with RJ45 connectors. For GPS timing, Category 5 unshielded, twisted pair with 6-pin RJ11 connector is used. For the GPS antenna, LMR-200 coaxial cable is used.

Q2: What is the maximum length of the CAT 5 cable from the AC wall adapter to the Canopy radio?

A: The Category 5 cable has a nominal length limitation of 328 feet (100 meters).

Q3: Does Motorola have an authorized dealer for cables?

A: Yes, Motorola has designated Best-Tronics Manufacturing, Inc. as an authorized dealer of cables that meet our rigorous specifications. The Canopy system requires UV protected cables for use outdoors in temperature ranges between -30° C to +55° C.

Q4: When do you use a straight-through Ethernet cable and when do you use a crossover Ethernet cable in the Canopy system?

A: A straight-through cable is used when connecting to a computer. A crossover cable is used when connecting to a hub, switch or router.

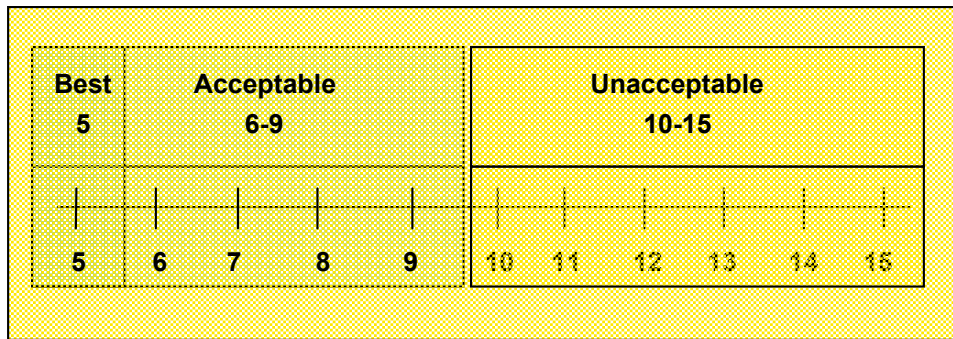
DEFINITIONS & REFERENCES

Q1: *What is RSSI?*

A: RSSI is an acronym for Received Signal Strength Indicator. RSSI is an indication of the power level being received by the antenna. Generally, the higher the RSSI level is the stronger the signal. Overall, a level of 700 or more is considered adequate.

Q2: *What is Jitter?*

A: Jitter is a measure of the variability in temporal position (the variation between the arrival time and the expected time). A consistent level of nine or less is considered acceptable. The scale for Jitter is five to 15 with five being the best (*see illustration*).



Jitter Scale

Q3: *Is Received Signal Strength or RSSI calibrated on the Canopy radios?*

A: No, the RSSI is not calibrated on the Canopy radios.

Q4: *What is the purpose of the Color Code?*

A: Color code is a means to segregate parts of a Canopy network. For example, all business customers may be on one color code and all residential customers may be on a separate color code. Color code can also be used to make specific Subscriber Modules register to only specific Access Point Modules.

Q5: *What is the purpose of the Sector ID?*

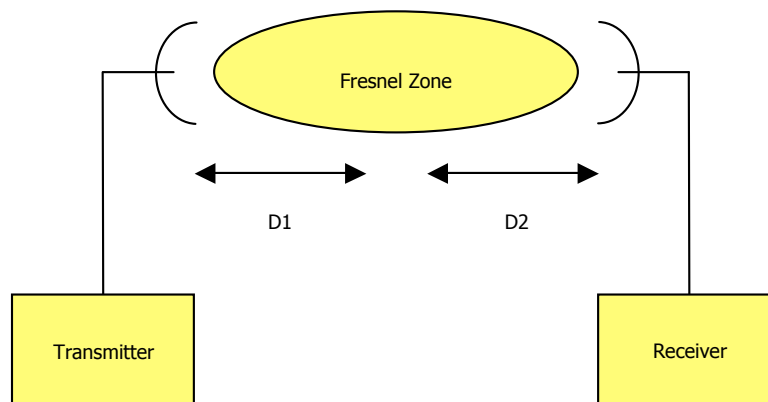
A: The Sector ID is a configurable number that is assigned to each AP module (ideally assigned sequentially) and is conveyed to each registering SM. The purpose of the ID is to serve as a distinguishing label between Access Point sectors.

Q6: What is the purpose of the Max Range?

A: The Max Range sets the longest SM range (distance) allowed to register to an Access Point Module. In an Access Point Cluster all modules must have the same maximum range set. (Note: Do not set the max range to advance much greater than the distance of your farthest subscriber.)

Q7: What is the Fresnel Zone?

A: The Fresnel Zone is a theoretical area around the line-of-sight of an antenna transmission that can affect the signal strength. Objects that penetrate the Fresnel Zone can cause fading of the transmitted signal. This fading is caused by the cancellation of the signal due to out-of-phase reflections. An unobstructed line-of-sight is important, but it is not the only determination of an adequate placement. Even though the path has a clear line of sight, if obstructions (such as terrain, vegetation, metal roofs, cars, etc.) penetrate the Fresnel Zone, there may be signal loss. The following illustrates a Fresnel Zone.



Q8: Where can I find further information on SNMP MIB-II systems and interfaces?

A: General discussions of SNMP and MIBs can be conveniently found on the Internet at <http://www.rad.com/networks/1995/snmp/snmp.htm>. The Canopy system's implementation of SNMP MIB-II is done in accordance with RFC 1213.

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