



PMP 320 Access Network User Guide

Issue 2

November 2009

Notices

See important regulatory, legal, and safety notices in section [6](#) on page [18](#).

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<http://motorola.wirelessbroadbandsupport>

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1.0 Using This User Guide

The audience for this document includes network planners, system operators, network administrators, and equipment installers.

1.1 FINDING THE INFORMATION YOU NEED

1.2 Becoming Familiar with This User Guide

The Table of Contents provides not only a sequential index of topics but also a visual glance at the organization of topics in this guide. A few minutes spent with the Table of Contents in either the paper or the electronic version of this guide can save much more time in finding information now and in the future. The List of Procedures may be especially useful in the paper version of this guide, particularly where you mark those procedures that you wish to frequently see.

In contrast, the List of Figures and List of Tables are most useful for automated searches on key words in the electronic version of this guide. If a match is present, the match is the first instance that the search finds.

Quick Reference

This user guide comprises six sections, as described in [Table 1](#).

Section	Purpose
Guide to This User Guide (this section)	Identifies <ul style="list-style-type: none">❑ products covered by this user guide.❑ products covered by their own separate user guides.❑ how this user guide is organized.❑ where to find module web pages and parameter descriptions.❑ what the various typefaces and admonitions indicate.❑ how to contact Motorola.
Product Description	Provides <ul style="list-style-type: none">❑ references to RF and networking theory.❑ overviews and comparisons of products and how they communicate.❑ descriptions of data handling and synchronization.❑ a review of optional features.❑ resources for developing familiarity and proficiencies
Planning	Provides essential information for <ul style="list-style-type: none">❑ evaluating an area for a network.❑ specifying the IP addresses and frequencies to use.
Configuration	Provides guidance for <ul style="list-style-type: none">❑ expanding network coverage.

	<ul style="list-style-type: none"> ❑ improving the security of wireless links. ❑ distributing bandwidth resources ❑ monitoring and changing variables through SNMP.
Installation	<p>Provides systematic approaches for</p> <ul style="list-style-type: none"> ❑ avoiding hazards from RF and natural causes. ❑ testing, storing, and deploying equipment.
Reference Information	<p>Provides supplemental information such as</p> <ul style="list-style-type: none"> ❑ authorizations, approvals, and notices. ❑ a bibliography of adjunctive information sources. ❑ a history of changes in documentation.
Glossary	Defines terms and concepts that are used in this user guide

1.3 Searching This User Guide

To search this document and the software release notes of supported releases, look in the Table of Contents for the topic and in the Adobe Reader® search capability for keywords that apply.¹ These searches are most effective when you begin the search from the cover page because the first matches may be in titles of sections, figures, tables, or procedures.

1.4 Finding Parameter and Field Definitions for Module Web Pages

Because this user guide is sequentially arranged to support tasks, and various tasks require different settings and readings, parameter and field definitions are scattered according to the tasks that they support.

1.5 NEW PRODUCTS AND FEATURES DESCRIBED IN THIS ISSUE

This section is a placeholder where other new descriptions, as well as clarifications and corrections, will be listed in future issues.

1.6 NEW DESCRIPTIONS AND REVISIONS IN THIS ISSUE

This section is a placeholder where other new descriptions, as well as clarifications and corrections, will be listed in future issues.

1.7 PORTFOLIO OF WIRELESS BROADBAND SOLUTIONS

The Motorola portfolio of wireless broadband solutions provides a range of flexible, interworkable, products

- licensed 802.16e point-to-multipoint solutions (PMP 320)
- unlicensed point-to-multipoint solutions (PMP 100, PMP 400)
- point-to-point solutions
- Enterprise Wireless LAN (WLAN) solutions
- Mesh, including the MOTOMESH series of products
- Wireless Manager, a network manager capable of managing many of these elements

1.8 PRODUCTS COVERED BY THIS USER GUIDE

This user guide describes planning, configuration, installation, and operation of the CAP 320 (the Access Point member of the PMP 320 family) and also includes information to help the operator plan and deploy a PMP 320 access network.

1.9 PRODUCTS NOT COVERED BY THIS USER GUIDE

Related PMP 320 Access Network devices have their own user guides: CSM 320, the Cluster Management Module 4 (CMM4), Network Updater Tool (CNUT), and Wireless Manager (WM).

1.10 CONVENTIONS

This document employs distinctive fonts to indicate the type of information, as described in [Table](#)

Table 3: Admonition types

Admonition Label	General Message
	<p>NOTE:</p> <p>informative content that may</p> <ul style="list-style-type: none"> ◦ defy common or cursory logic. ◦ describe a peculiarity of the implementation. ◦ add a conditional caveat. ◦ provide a reference. ◦ explain the reason for a preceding statement or provide prerequisite background for what immediately follows.
	<p>RECOMMENDATION:</p> <p>suggestion for an easier, quicker, or safer action or practice.</p>
	<p>IMPORTANT!</p> <p>informative content that may</p> <ul style="list-style-type: none"> ◦ identify an indication that you should watch for. ◦ advise that your action can disturb something that you may not want disturbed. ◦ reiterate something that you presumably know but should always remember.
	<p>CAUTION!</p> <p>a notice that the risk of harm to equipment or service exists.</p>
	<p>WARNING!</p> <p>a notice that the risk of harm to person exists.</p>

1.11 TECHNICAL SUPPORT

Here is the escalation path for resolution of a problem:

1. Check this user guide
2. Consider checking the Community Forum and Knowledge Base at <http://motorola.wirelessbroadbandsupport.com/support/community>.
3. Escalate the problem to your supplier or reseller.
4. Escalate the problem to Canopy Technical Support or other designated Tier 3 technical support:

U.S. and Canada Email: technical-support@canopywireless.com

1-866-961-9288

Latin and Central America Email: technical-support@canopywireless.com

Argentina 0800-666-2789

Brazil 0800-891-4360

Columbia 01-800-912-0557

Mexico 001-800-942-7721

Peru 0800-70-086

All other countries +420 533 336 946

Europe, Middle East, Email: essc@motorola.com

and Africa Denmark 043682114

France 0157323434

Germany 06950070204

Italy 0291483230

Lithuania 880 030 828

Netherlands 0202061404

Norway 24159815

Portugal 0217616160

Spain 0912754787

Russia 810 800 228 41044

Saudi Arabia 800 844 5345

South Africa 0800981900

United Kingdom 0203 0277499

Asia Pacific Email: WiBBsupport.apac@motorola.com

+6048503854 (9am - 5pm Malaysia Time)

+420 533 336 946 (outside hours)

When you send e-mail or call, please include, as appropriate, software release on each module, IP addresses, MAC addresses, and features enabled.

1.12 FEEDBACK ON DOCUMENTATION

Is this document accurate, complete, and clear? How can it be improved? Send your feedback on documentation to technical-documentation@canopywireless.com.

Issue

2 Product Description

A PMP 320 Access Network provides a low cost point-to-multipoint broadband infrastructure optimized for fixed outdoor applications. The access point is an 802.16e micro base station with WiMAX CPE interoperability. The system offers an integrated, all-outdoor solution with simple installation for rapid deployment.

Target applications for the PMP 320 Access Network include

- Tier 2/tier 3 carriers, where the PMP 320 system provides a cost-effective, reliable broadband connectivity for residential and business customers
- Government network operators, where the PMP 320 system provides broadband-based infrastructure for administrative networks
- Wireless service providers, with broadband network service for any size operation
- Wireline service providers, with broadband wireless extensions for existing DSL or cable networks.

As shown in [Figure 1](#), a PMP 320 network consists of

- APs – CAP 320 Access Points, usually tower-mounted in a four-sector configuration.
- SMs - CSM 320 Subscriber Modules, Customer Premise Equipment (CPE), usually mounted on a residence or other structure, and powered by a power adapter providing standard 802.3af power over Ethernet.
- CMM4 (Cluster Management Module 4) – a zero-footprint enclosure housing a GPS module connected to a GPS antenna, sync- and power-injection circuitry, surge protection, and a managed switch. The CMM is used to provide custom “sync over power over Ethernet” to the APs as well as offering a networked, managed switch.

High Level Network Diagram

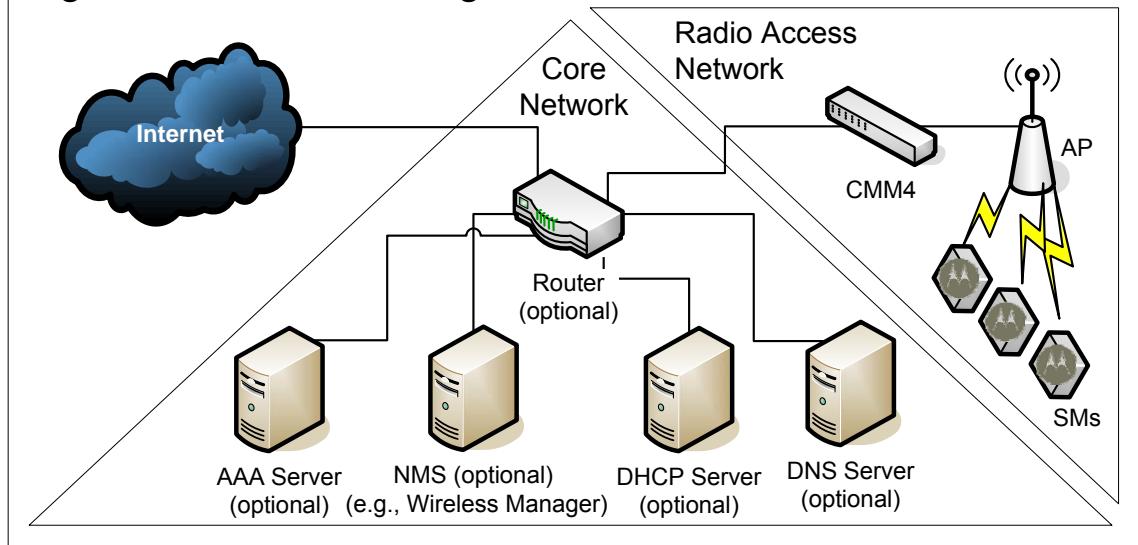


Figure 1: High level network diagram

In addition, a PMP 320 network usually also requires a

- AAA Server – Authentication, Authorization, and Accounting server using the RADIUS (Remote Authentication Dial In User Service) protocol
- EMS – an Element Management System, such the Motorola One Point Wireless Manager
- DHCP Server – Dynamic Host Configuration Protocol server
- DNS Server – Domain Name System server
- CNUT – Network Update Tool for updating device software

Motorola offers PMP 320 equipment that operates in the spectrum ranges as shown in [Table 4](#)

Licensed Spectrum Ranges	System Name	AP Name	SM Name	AP Model Number	SM Model Number	Frequencies Supported
3.3 to 3.4 GHz	PMP 35320	CAP 35320	CSM 35320	3530APC	3530SM	3.3 to 3.6 GHz
3.4 to 3.6 GHz						
3.6 to 3.8 GHz	PMP 36320	CAP 36320	CSM 36320	3630APC	3630SM	3.6 to 3.8 GHz (Includes 3.65 GHz)

2.1 Access Point (AP)

WARNING!



Installing an AP usually involves height, electricity, and exposure to RF (Radio Frequency) energy. To avoid personal injury, follow applicable national and local safety regulations along with industry best practices. Also follow the specific guidelines in this document, including maintaining a sustained exposure separation distance of 50 cm (~20 in) as described in section [6.3](#) on page [21](#).

A PMP 320 Access Point (AP) is an 802.16e micro base station that connects wirelessly to up to 200 PMP 320 Subscriber Modules (SMs) or WiMAX CPEs. The AP consists of a connectorized antenna and radio, as shown in

Figure 2, with the radio shown separately in [Figure 3](#). The standard antenna is a dual-polarity 16.5 dBi antenna typically mounted in a four 90° sector configuration. The AP is manageable by local web interface, as well as SNMP or the Motorola One Point Wireless Manager.



Figure 2: Access Point (AP)



Figure 3: AP, radio only

The PMP 320 AP uses 802.16e for the over-the-air connection to the SMs or CPE and is 802.16e PHY and MAC compliant. It complies with WiMAX Wave2 profile, except for mobility.

The AP uses a custom 56 VDC power system, typically powered by a CMM4. The AP uses less than 25 W per AP, or less than 100 watts for 360° coverage. The AP includes integrated surge suppression that is the equivalent of the 600SS surge suppressor recommended for SM installations.

The AP functions as a router in the network, with routes to the SMs auto-configured. It supports a configurable static routing table and the standard RIPv2 routing protocol. The AP supports ICMP and ARP.

The AP can be configured to either receive its IP address from a network DHCP server, or be manually assigned its IP address.

The AP can be configured to respond to SM DHCP requests either by relaying the requests to a network DHCP server, or function as a DHCP server itself.

The AP can be configured either to use an external AAA (Authentication, Authorization, and Accounting) server, or use a minimal internal AAA server. When configured to use an external AAA server, the AP serves as a relay between SMs and the AAA server for authentication requests, and serves as a RADIUS client communicating with the AAA server for authorization of SM services.

The AP has an embedded web server for configuring using a web browser.

The AP supports SNMP v1 and v2c, and uses standard 802.16e MIBs (Management Information Base) as well as the Motorola 802.16e AP MIB.

Specifications for the CAP 320 are listed in [Table 1](#).

Table 1: CAP 320 Specifications

CAP 320			
FREQUENCY	3.3 – 3.4 GHz (CAP 33320)	3.4 – 3.5 GHz (CAP 35320)	3.6 – 3.8 GHz (CAP 36320)
PERFORMANCE			
Physical Layer	802.16e-2005 (5 MHz channel: 512 FFT; 7/10MHz channel: 1024FFT)		
MAC layer	802.16e-2005		
Maximum Transmission Power	Up to 2 x 25 dBm; <i>Local Regulatory Requirements May Limit Max Transmission Power.</i> <i>See table 5 on page 19 for FCC limits in U.S. applications.</i>		
Maximum EIRP	Integrated: 2 x 41.5 dBm Connectorized: Antenna Dependant <i>Local Regulatory Requirements May Limit Max EIRP.</i> <i>See table 5 on page 19 for FCC limits in U.S. applications</i>		
Maximum Throughput per Sector	Greater than 45Mbps total aggregate per sector		
Packets per Second	65,000		
Maximum LoS Range	Up to 40km with extended range feature		
SPECTRUM			
Frequency Range of Band	3.3 – 3.4 GHz	3.4 – 3.6 GHz	3.6 – 3.8 GHz
Channel Width	Configurable to 5/7/10 MHz		
SECURITY			
Encryption	EAP-TTLS/PKMy2 authentication over RADIUS, AES over-the-air encryption		
LINK BUDGET			
Receive Sensitivity (10 MHz channel); based on MRCT method	CTC-QPSK(1/2): -103 dBm CTC-QPSK (3/4): -102 dBm CTC-16QAM(1/2): -101 dBm CTC-16QAM (3/4): - 97 dBm CTC-64QAM(1/2): - 96 dBm CTC-64QAM (2/3): - 92 dBm CTC-64QAM(3/4): - 91 dBm CTC-64QAM (5/6): - 89 dBm		

ANTENNA			
Antenna Beam Width	16.5 dBi gain Dual Polarity +/- 45 degree 4 sector application (actual 3 dB antenna pattern: 60° horizontal 8° elevation)		
PHYSICAL			
Power Consumption	< 25 Watts		
Temperature	-40° F to +131° F (-40° C to +55° C)		
Wind Survival	118 miles/hr (190 km/hr)		
Dimensions (LxWxD)	Integrated: ~711 x 195 x 240mm Connectorized: ~330 x 195 x 140mm		
Weight	Integrated: 5.5 kg Connectorized: 2.2 kg		
INTERFACE			
Interface	10/100 Base T, half/full duplex. Rate auto negotiated (802.3 compliant)		
Protocols Used	IPv4, UDP, TCP, IP, ICMP, SNMP, HTTP, FTP, RIP, DHCP Relay		
Network Management	Web-Based Interface; SNMPv2c; or Motorola Wireless Manager		
CERTIFICATION S			
FCC ID	n/a	n/a	ABZ89FT7632
Industry Canada Certification Number	n/a	109W-3530APC	109W-3630APC
CE	"CE" marked & compliant to EN300 328. DoCs are available at http://motorola.wirelessbroadbandsupport.com/doc.php		

2.2 Subscriber Module (SM)

Please refer to the CSM35320 User Guide for further information on the Subscriber Module

2.3 INSTALLING THE AP

General communications equipment, infrastructure, and facilities site design should be performed in line with Motorola's "Standards and Guidelines for Communications Sites" (also known as the R56 manual) available from

http://www.motorola-wls.com/Dynamic/Course_Description.asp?number=ANT001-CD&CourseKey=y=125

These procedures are specific to the case of an AP purchased as a kit consisting of a connectorized antenna and a connectorized radio.

A short coaxial cable from the radio terminates in a male N connector. The antenna has a chassis-mounted female N connector. The antenna includes tower mount brackets with adjustable down-tilt.

Installing an AP typically consists of four phases:

1. Configure the AP at an operator's facility or at the installation site using the information and settings defined in the Planning and Configuring sections of this user guide.
2. Assemble the AP (radio, antenna, and brackets) and physically install it using **Procedure 2**. A CMM4 is typically installed at the same time, if not previously installed.
3. Cable the AP to the CMM4 and ground it to Protective Earth – PE using **Procedure 4**. This phase can also include cabling to backhauls, or running terrestrial feeds.
4. Confirm operation, using SMs in the field.
Local practices and choices of installation options will dictate the actual processes. For example, variations on these generalized procedures can be used to install on a building or install multiple APs on a pipe mount before hoisting up a tower for final attachment.



IMPORTANT!

This transmitter must not be collocated within 20 cm (8 in) of, or operated in conjunction with, any other antenna or transmitter.

Procedure 1: Assembling an AP and attaching to tower

1. Perform a parts check to ensure all parts are present.



2. Connect antenna brackets to the antenna. Assemble with the “scissor bracket” pointing up (unlike in the accompanying pictures) to avoid physical interference between the bracket and the radio housing.



3. Connect the radio to the antenna by sliding it into the captive space. Secure the radio to the antenna using the two bolts provided.



4. Connect both coax N-connectors from the radio to the antenna. Connect the cable labeled “main” to the antenna connector labeled “main”, and connect the cable labeled “Diversity” to the antenna connector labeled “Diversity”.



5. Using standard work and safety practices for tower climbing, connect the assembled unit (assembled antenna, brackets, and radio) to a pole, mounting fixture, or the tower. Mount the unit so as to avoid accidental touching by personnel. Typically this means mounting the unit at least 4 m (13 ft) above ground level.

Procedure 2: Cabling and Grounding/Earthing the AP

Standard installation practices apply, including

- use shielded Ethernet cable for all infrastructure cabling
- use drip loops
- provide extra cable (a splice loop) for future use at any termination
- ensure the tower or structure is fully grounded (Protective Earth – PE)

1. Use dielectric grease (which is uniformly non-conducting) on all connections and in all RJ-45 Ethernet connectors. The best practice is to use enough grease to fill the RJ-45 female connector, and then insert the RJ-45 male connector and push the grease further into the unit and around the RJ-45 connector. Excess grease can be wiped over the connector area to provide some resistance to water ingress around the connector.

Run a 10 AWG ground strap from the ground lug on the AP (see **Error! Reference source not found.**) to known good ground (Protective Earth - PE).



The AP has metal-to-metal contact from the tower or support structure, through the antenna, through the coax cable, to the radio. Installing surge suppression at the AP is strongly recommended to provide the best protection from nearby lightning strikes.

Up to four 600SS surge suppressors may be mounted in series on an Ethernet link without degrading the link. The equivalent of a 600SS is built into each of the 8 ports on a CMM4 and counts as one of the four.

As an example, a typical installation might have properly-grounded 600SS units within 3 ft (1 m) of each AP and additional properly-grounded 600SS units on each Ethernet cable mounted outside at the point of cable entry to a telecommunications hut that contains the CMM4.

3 Regulatory, Legal, and Safety Notices

3.1 ***IMPORTANT NOTE ON MODIFICATIONS***

Intentional or unintentional changes or modifications to the equipment must not be made unless under the express consent of the party responsible for compliance. Any such modifications could void the user's authority to operate the equipment and will void the manufacturer's warranty.

3.2 ***NATIONAL AND REGIONAL REGULATORY NOTICES***

3.2.1 ***U.S. Federal Communication Commission (FCC) Notification***

This device complies with Part 15 of the US FCC Rules and Regulations. Operation is subject to the following two conditions:

1. This device may not cause harmful interference and
2. This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the US FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio-frequency energy and, if not installed and used in accordance with these instructions, may cause harmful interference to radio communications. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment on and off, the user is encouraged to correct the interference by one or more of the following measures:

- Increase the separation between the affected equipment and the unit;
- Connect the affected equipment to a power outlet on a different circuit from that which the receiver is connected to;
- Consult the dealer and/or experienced radio/TV technician for help.

FCC IDs and the specific configurations covered are listed in [Table 5](#).

Table 5: US FCC IDs and covered configurations

FCC ID	Operating Freq	Model Number	Antenna Gain	Channel Size	Maximum Transmitter Output Power
ABZ89FT7632	3.650 to 3.675 GHz	3630APC	16.5dBi	10 MHz	22.91 dBm
				7 MHz	21.35 dBm
				5 MHz	19.81 dBm
				3.5 MHz	18.33 dBm

3.2.2 Industry Canada Notification

This device is approved for use in Canada in the licensed frequencies from 3.450 GHz to 3.650 GHz. It is undergoing Industry Canada approval for use in the 3.65 GHz band, and may not be used in that band until Industry Canada approval is granted.

Operation is subject to the following two conditions:

1. This device may not cause harmful interference and
2. This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio-frequency energy and if not installed and used in accordance with these instructions, may cause harmful interference to radio communications. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment on and off, the user is encouraged to correct the interference by one or more of the following measures:

- Increase the separation between the affected equipment and the unit;
- ° Connect the affected equipment to a power outlet on a different circuit from that which the receiver is connected to;
- Consult the dealer and/or experienced radio/TV technician for help.

To reduce potential radio interference to other users, the antenna type and its gain should be chosen so its Equivalent Isotropic Radiated Power (EIRP) is not more than that permitted for successful communication.

Industry Canada Certification Numbers and the specific configuration covered are listed in [Table 6](#).

Table 2: Industry Canada Certification Numbers and covered configurations

ID	Operating Freq	Model Number	Antenna Gain	Channel Size	Maximum allowed EIRP	Maximum Transmitter Output Power
TBD	3.650 to 3.675 GHz	3630APC	16.5 dBi	10 MHz	10 W (40 dBm)	23.5 dBm
				7 MHz	7 W (38.5 dBm)	22 dBm
				5 MHz	5 W (37 dBm)	20.5 dBm
				3.5 MHz	3.5 W (35.4 dBm)	18.9 dBm
109W-3530APC	3.450 to 3.600 GHz	3530APC	16.5 dBi connect orized	any	na	27 dBm (500 mW)
109W-3630APC	3.600 to 3.650 GHz	3630APC	16.5 dBi connect orized	any	na	27 dBm (500 mW)

3.2.3 6.2.3 European Union Notification

The relevant Declaration of Conformity can be found at
<http://motorola.wirelessbroadbandsupport.com/doc.php>.

3.2.4 6.2.4 Equipment Disposal



Waste (Disposal) of Electronic and Electric Equipment

Please do not dispose of Electronic and Electric Equipment or Electronic and Electric Accessories with your household waste. In some countries or regions, collection systems have been set up to handle waste of electrical and electronic equipment. In European Union countries, please contact your local equipment supplier representative or service center for information about the waste collection system in your country.

3.2.5 EU Declaration of Conformity for RoHS Compliance

Motorola hereby, declares that these Motorola products are in compliance with the essential requirements and other relevant provisions of Directive 2002/95/EC, Restriction of the use of certain Hazardous Substances (RoHS) in electrical and electronic equipment.

The relevant Declaration of Conformity can be found at

<http://motorola.wirelessbroadbandsupport.com/doc.php>.

3.2.6 Labeling and Disclosure Table for China

The People's Republic of China requires that Motorola's products comply with China Management Methods (CMM) environmental regulations. (China Management Methods refers to the regulation *Management Methods for Controlling Pollution by Electronic Information Products.*)

Two items are used to demonstrate compliance - the label, and the disclosure table as shown in

Table 7. [Need updated table for this product.]

The label is placed in a customer visible position on the product.

- Logo 1 means that the product contains no substances in excess of the maximum concentration value for materials identified in the China Management Methods regulation.
- Logo 2 means that the product may contain substances in excess of the maximum concentration value for materials identified in the China Management Methods regulation, and has an Environmental Friendly Use Period (EFUP) in years, fifty years in the example shown.



The Environmental Friendly Use Period (EFUP) is the period (in years) during which the Toxic and Hazardous Substances (T&HS) contained in the Electronic Information Product (EIP) will not leak or mutate causing environmental pollution or bodily injury from the use of the EIP. The EFUP indicated by the Logo 2 label applies to a product and all its parts. Certain field-replaceable parts, such as battery modules, can have a different EFUP and are marked separately.

The Disclosure table is intended to communicate compliance with only China requirements; it is not intended to communicate compliance with EU RoHS or any other environmental requirements.

Table 7: Disclosure table

部件名称	有毒有害物质或元素					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr ⁶⁺)	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
金属部件	×	○	×	×	○	○
电路模块	×	○	×	×	○	○
电缆及电缆组件	×	○	×	×	○	○
塑料和聚合物部件	○	○	○	○	○	×

○： 表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T11363-2006 标准规定的限量要求以下。

×： 表示该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T11363-2006 标准规定的限量要求。

3.3 RF EXPOSURE SEPARATION DISTANCES

To protect from overexposure to RF energy, an AP must be installed to provide a separation distance of at least **52 cm (~20 in)** from all persons. In addition, do not collocate within 20 cm (4 in) of any other antenna or transmitter.

The following section and [Table 8](#) provide details and discussion on the separate distance calculations.

3.3.1 Details of Exposure Separation Distances Calculations and PowerCompliance 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 is 10 W/m².

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

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

Table 8 shows calculated minimum separation distances d , recommended distances and resulting power compliance margins for each frequency band and antenna combination.

Table 8. Calculated exposure distance and power compliance margins

Band	Unit	Variable			D (calculated)	Recom- mended Separation Distance	Power Compliance Margin
		P	G	S			
3.3 GHz to 3.8 GHz	AP	0.5 W (27 dBm)	44.7 (16.5 dB)	10 W/m^2	42 cm	52cm (~20 in)	1.5
3.650 to 3.675 GHz (FCC Power Limits)	AP	.195W (22.91 dBm)	44.7 (16.5 dB)	10 W/m^2	26.4 cm	52cm (~20 in)	3.9

These are conservative distances:

- They are along the beam direction (the direction of greatest energy). Exposure to the sides and back of the module is significantly less.
- In the case of collocated APs, they assume all APs are oriented in the same direction, which is a worst-case calculation.
- They meet or exceed sustained exposure limits for the general population (not just short-term occupational exposure limits).
- The calculated compliance distance d is overestimated because the far-field equation models the antenna(s) as a point source and neglects the physical dimension of the antenna(s).

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4 Checking Software Version

4.1 Log into the AP GUI using the following procedure

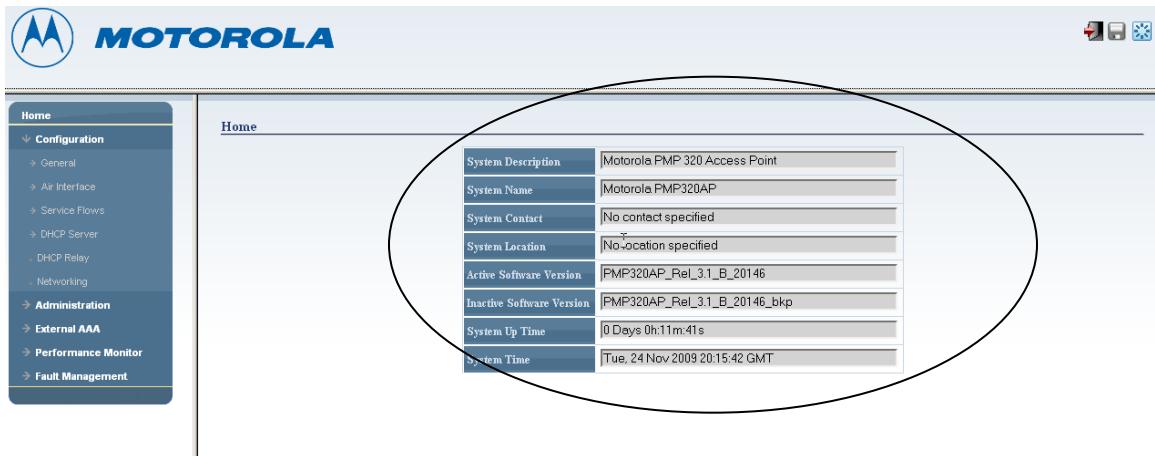
Set your PC's static IP to the same subnet as the AP default IP address of "192.168.2.101"

Connect the PC to the AP and use Internet Explorer version 7 or greater to launch a web GUI. In the URL type <http://192.168.2.101>

4.2 Check the current running version of the AP

Log into the AP using "admin" as log in and "admin" as password

Go to home and take note of the version running per the figure below



The screenshot shows the Motorola AP GUI. On the left is a navigation menu with the following items under 'Home': Configuration (General, Air Interface, Service Flows, DHCP Server, DHCP Relay, Networking), Administration (External AAA, Performance Monitor, Fault Management), and a 'Configuration' section. The main content area is titled 'Home' and displays a table of system information. The table has two columns: 'System Description' and 'Value'. The 'Value' column contains the following data:

System Description	Motorola PMP 320 Access Point
System Name	Motorola PMP320AP
System Contact	No contact specified
System Location	No location specified
Active Software Version	PMP320AP_Rel_3.1_B_20146
Inactive Software Version	PMP320AP_Rel_3.1_B_20146_bkp
System Up Time	0 Days 0h:11m:41s
System Time	Tue, 24 Nov 2009 20:15:42 GMT

4.3 Check the current running version of software on the CPE

Set your PC's static IP to the same subnet as the CPE's default LAN IP address of "10.1.1.254"

Using a web browser, navigate to the CPE's default IP at <http://10.1.1.254>

Login in as "admin", password "admin" and take note of the software version according to the figure below



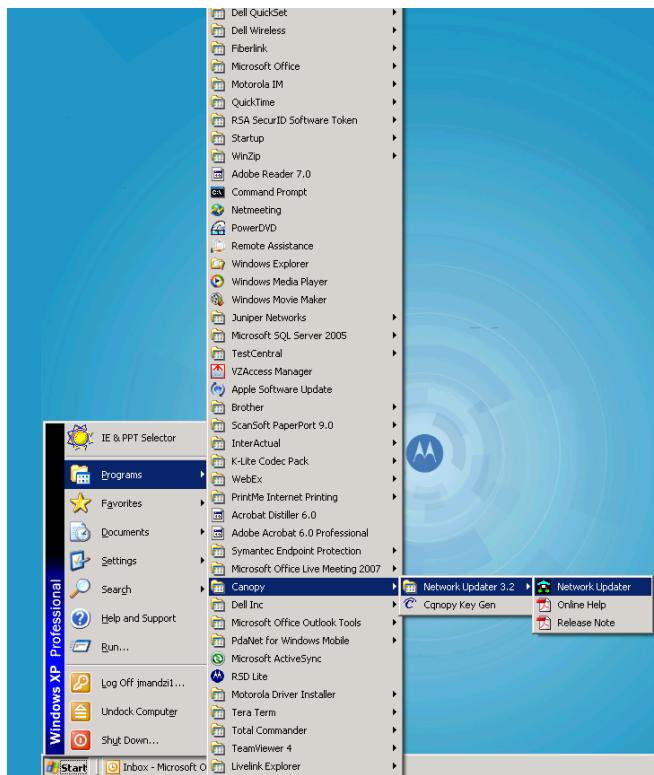
4.4 Upgrading to the latest Software Revision on the Access Point and the CPE

4.4.1 Updating your devices

In order to update your PMP320 devices you will need to download and install the latest version (currently 3.2.7) of the Canopy Network Updating Tool (CNUT) as well as the latest firmware package files (pkg3) for the AP and the SM (CPE).

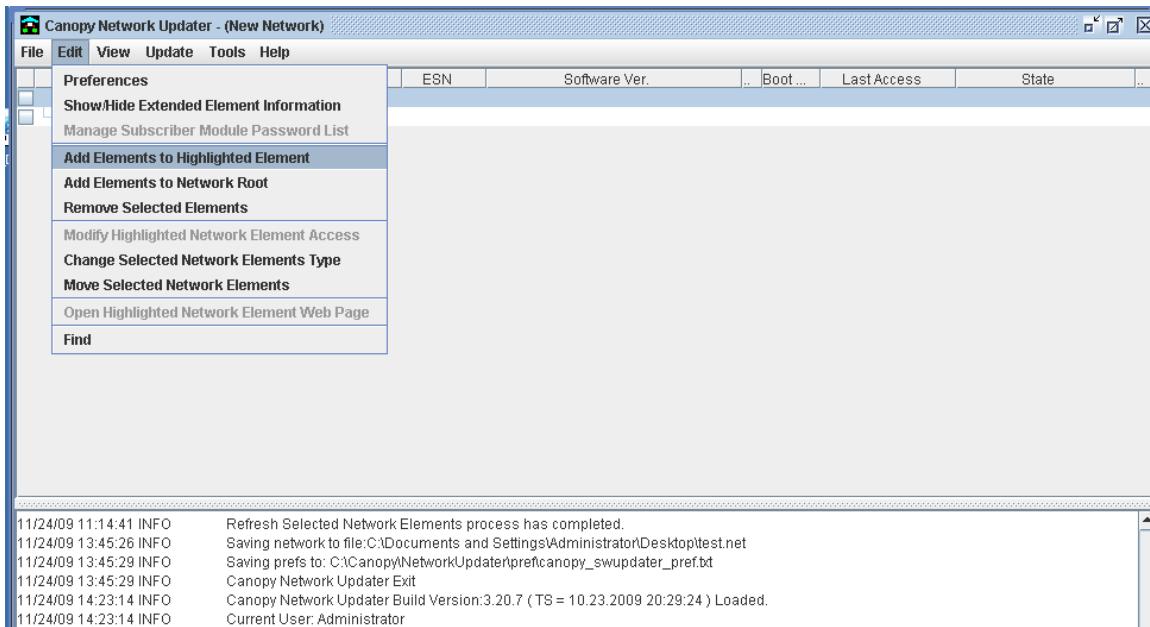
Starting the CNUT application:

Start → Programs → Canopy → Network Updater 3.2 → Network Updater



4.4.2 Adding your PMP320 AP(s) into CNUT

Edit → Add Canopy Element to Network Root



Select “PMP 300 Access Point (PMP)

Uncheck “Use Default/Inherit Settings from Parent Element”

Use “admin” for the Telnet/FTP login ID

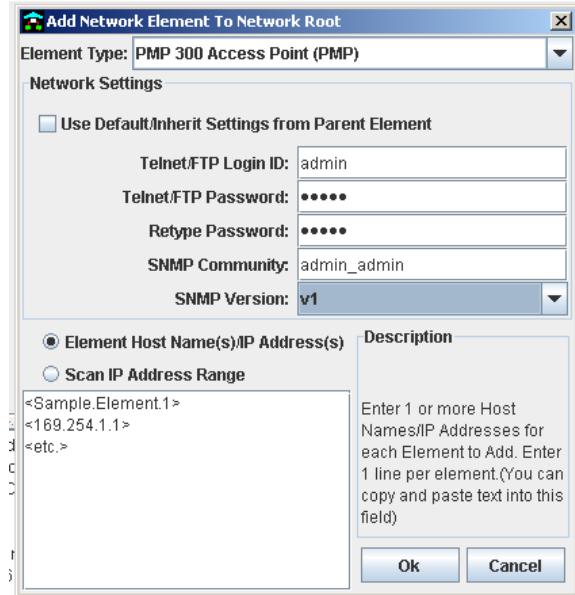
Use “admin” for the Telnet/FTP Password

Use “admin_admin” for the SNMP Community String

Use “v1” for the SNMP Version

Provide the IP(s) of your AP's

Hit “ok”



Adding your SM/CPE(s) into CNUT:

Edit → Add Canopy Element to Network Root

Select “PMP 300 SM (CPE)

Uncheck “Use Default/Inherit Settings from Parent Element”

Use “admin” for the Telnet/FTP login ID

Use “admin” for the Telnet/FTP Password

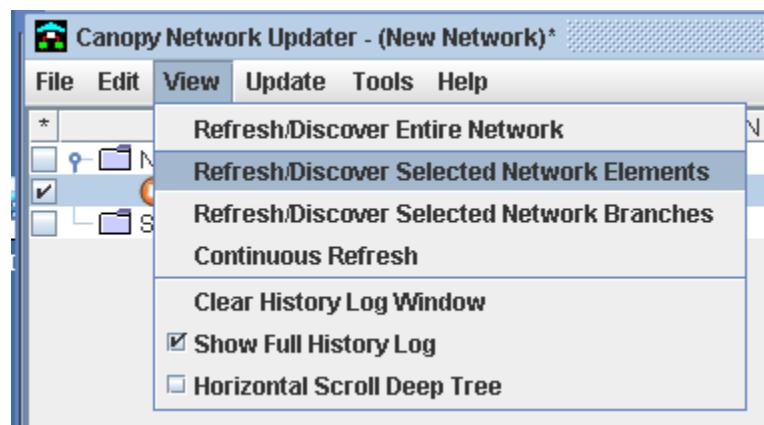
Use “private” for the SNMP Community String

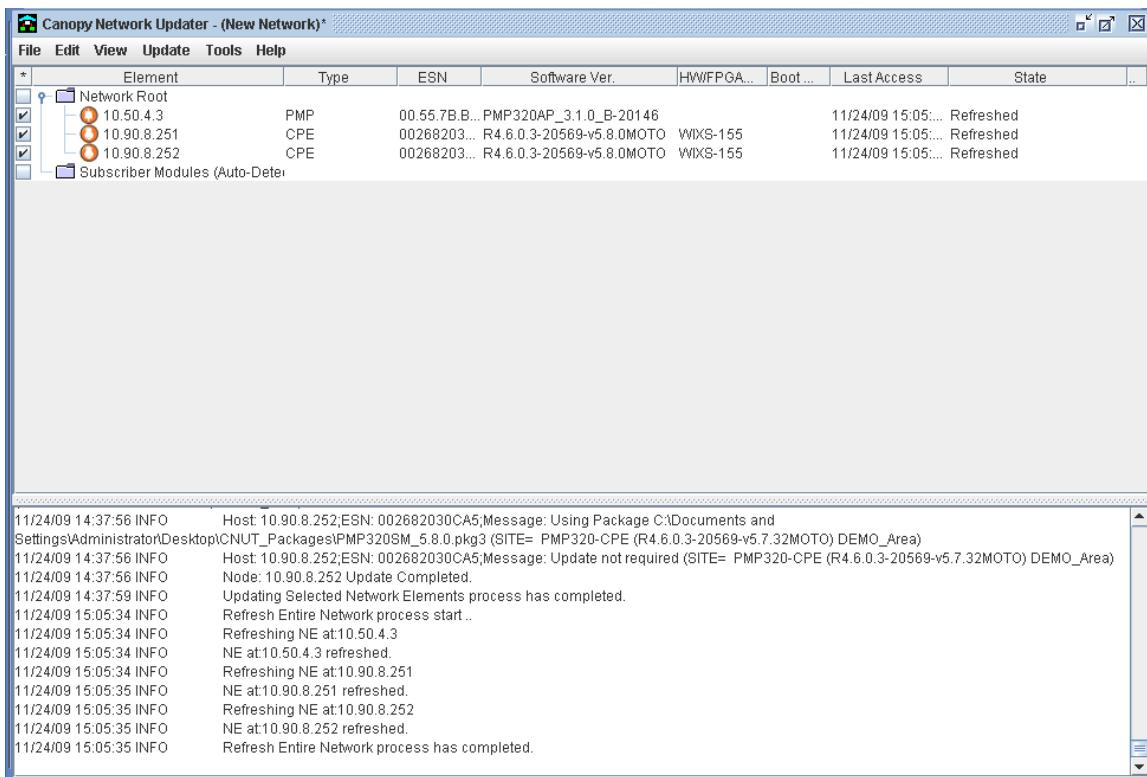
Use “v1” for the SNMP Version

Provide the IP(s) of your CPE(s)

Hit “ok”

Refresh the recently added elements and verify if the Software Version requires upgrading.



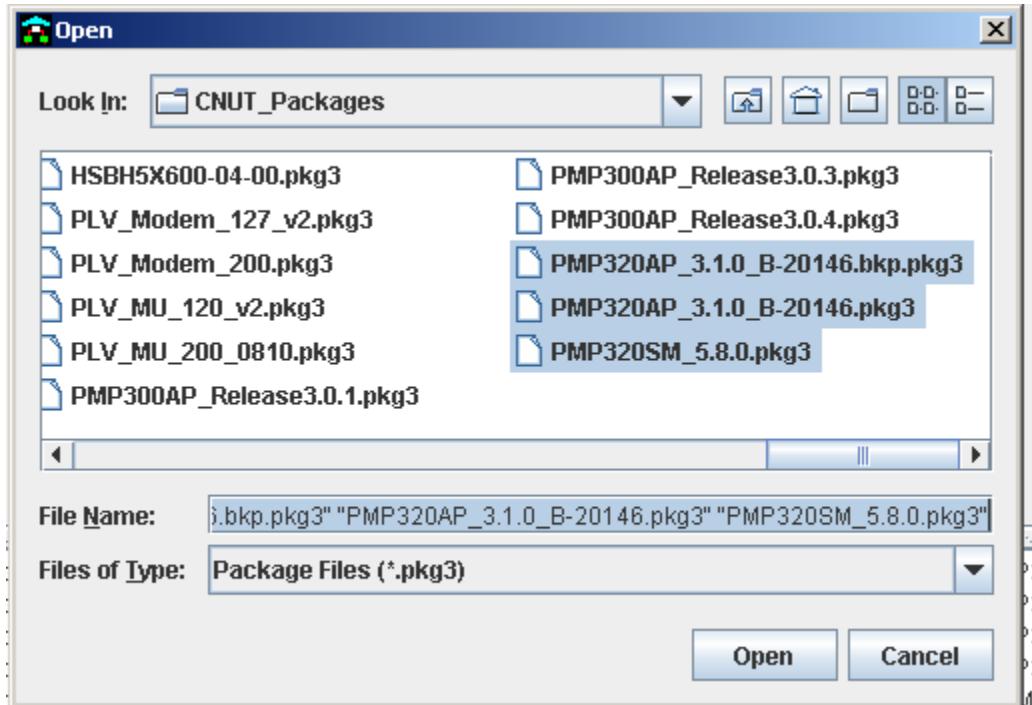


4.4.3 Managing CNUT packages

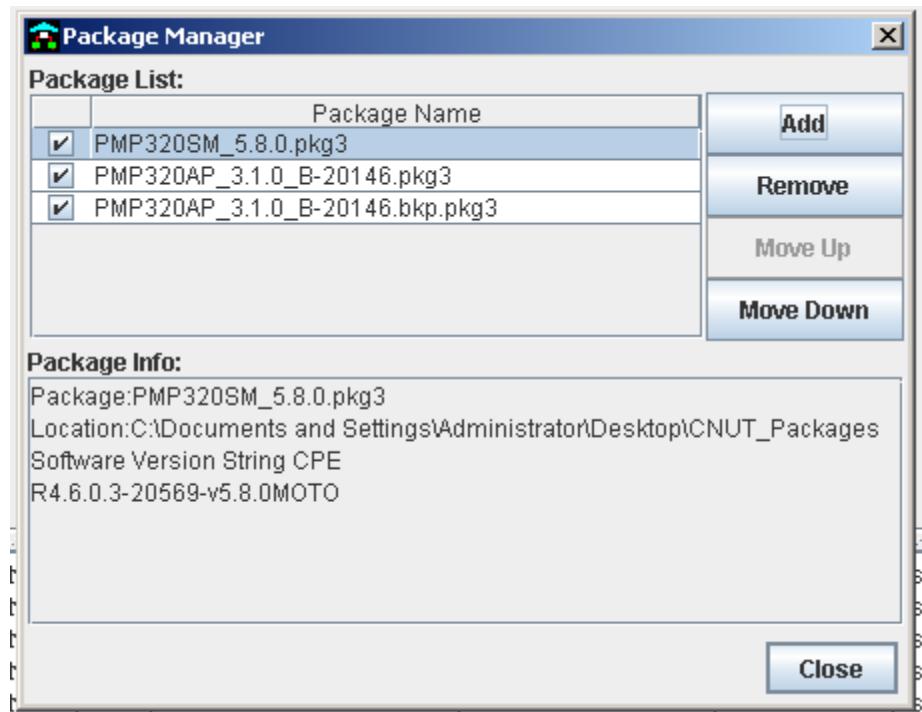
Update → Manage Packages

Click on Add

Select the PMP320AP (primary and backup) and PMP320SM pkg3 files and hit "Open"

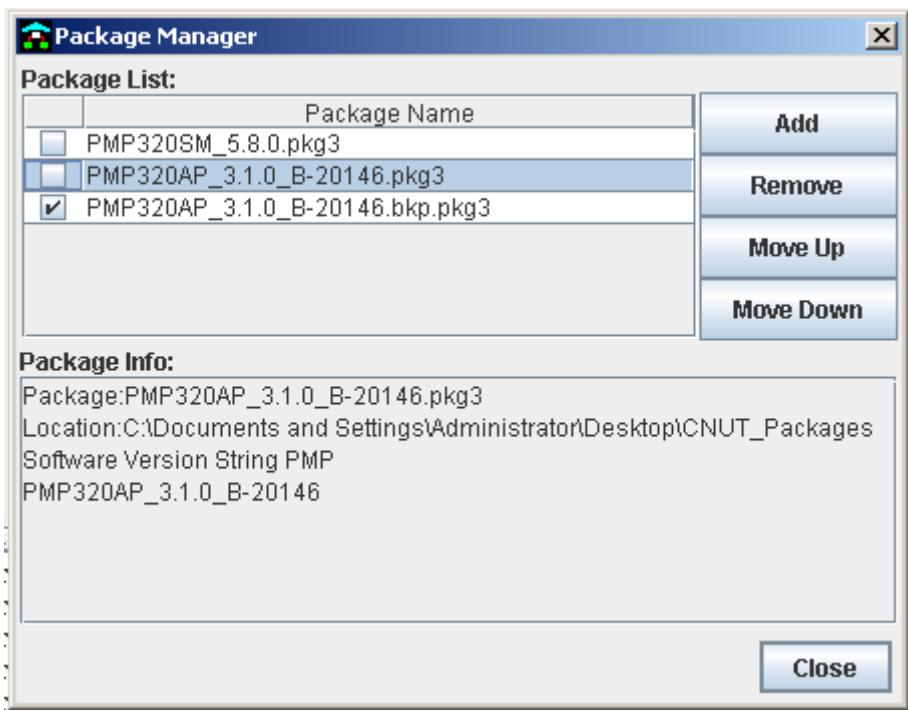


Verify that the packages have been added:

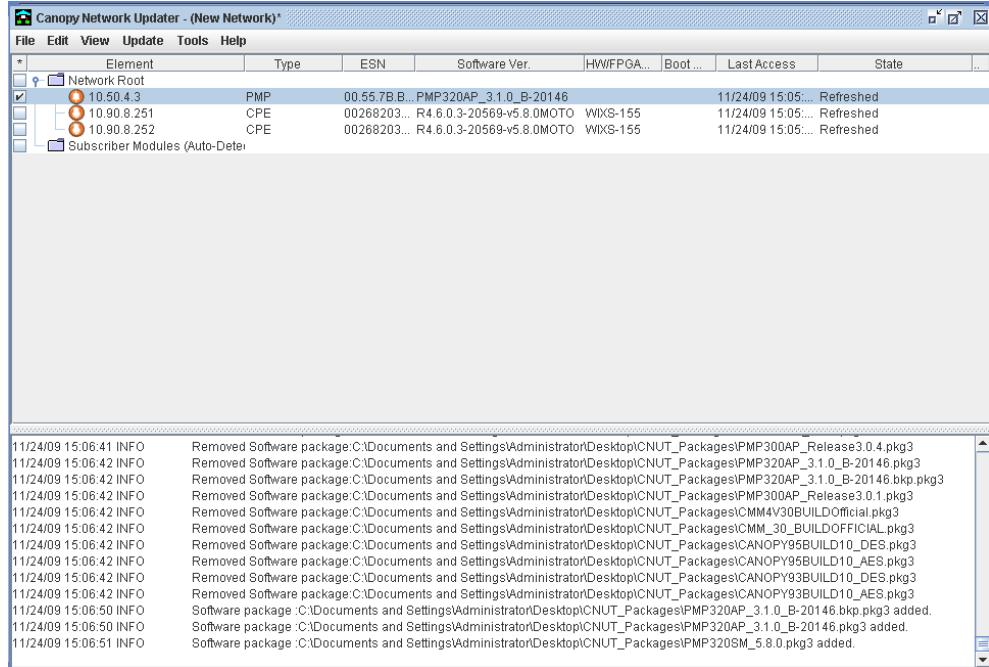


Upgrading the backup image on your AP:

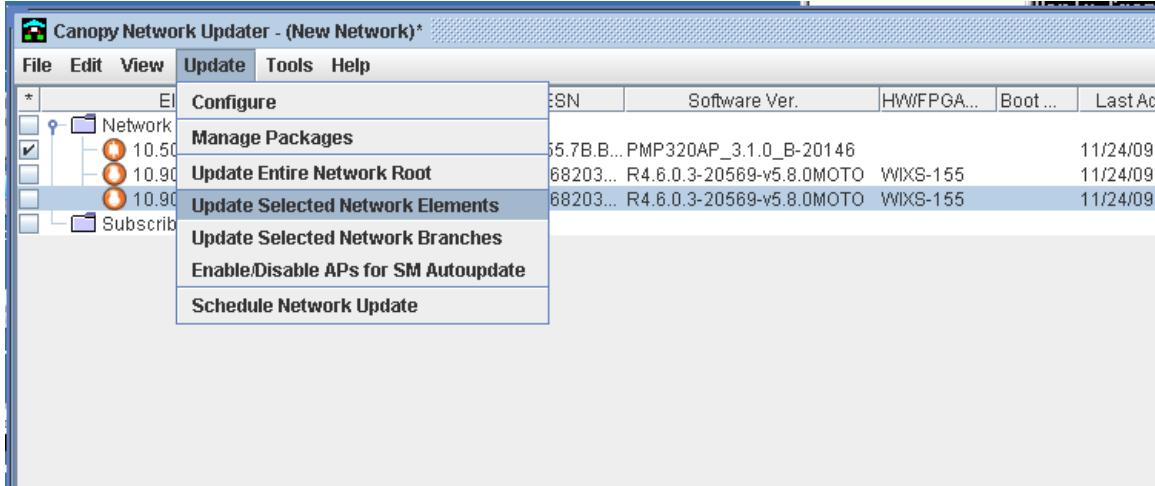
Select the backup AP pkg3 file:
Update → Manage Packages



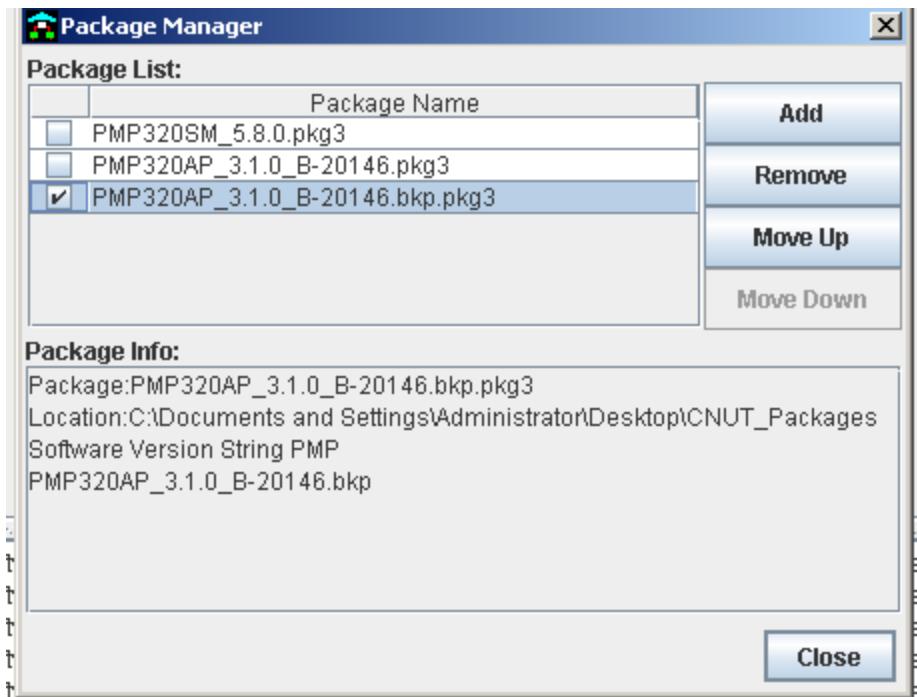
Select your AP(s)



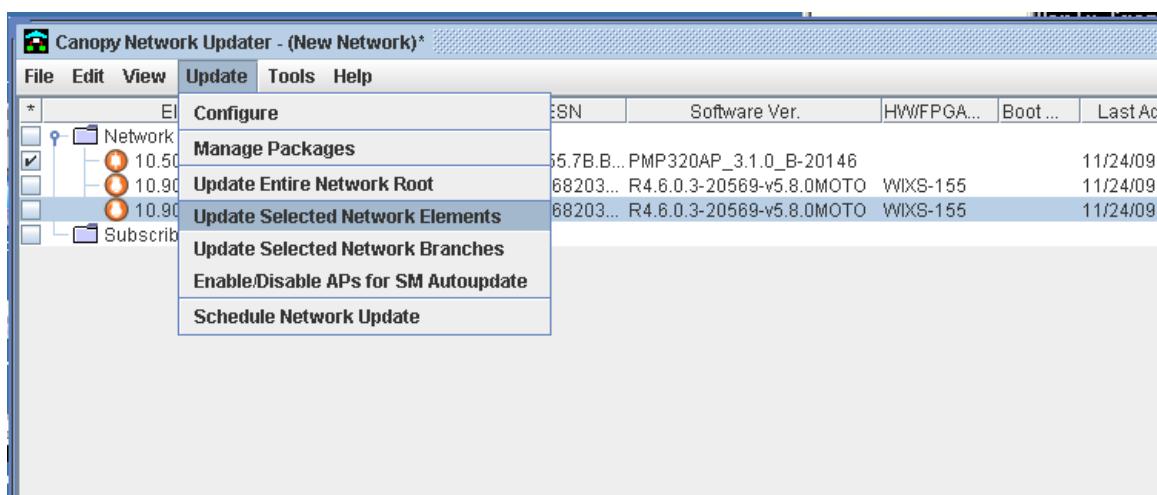
Update → Update Selected Network Elements



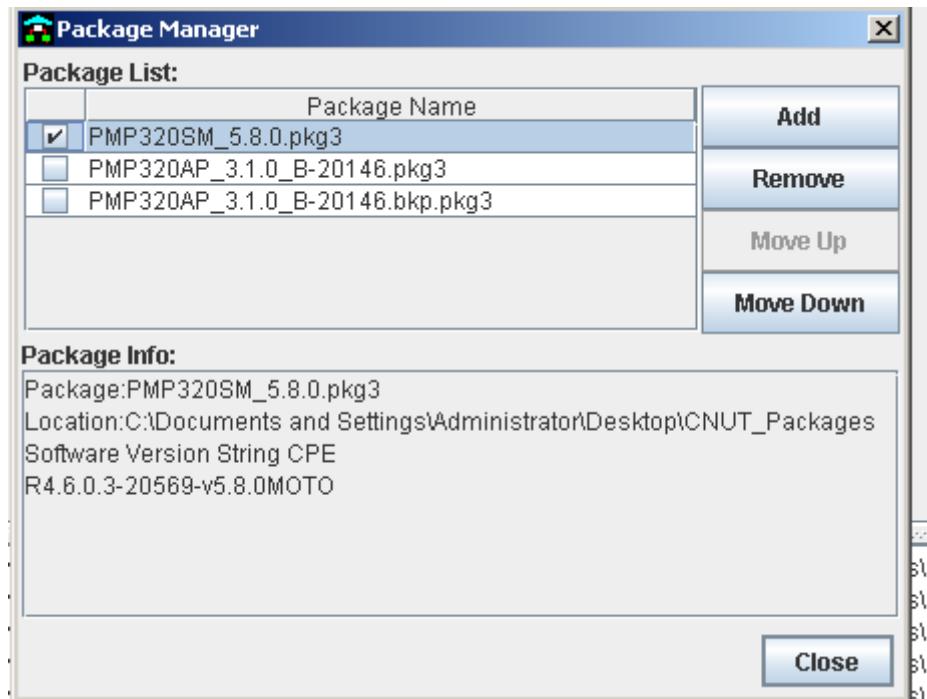
Upgrading the primary image on your AP
Select the primary AP pkg3 file:



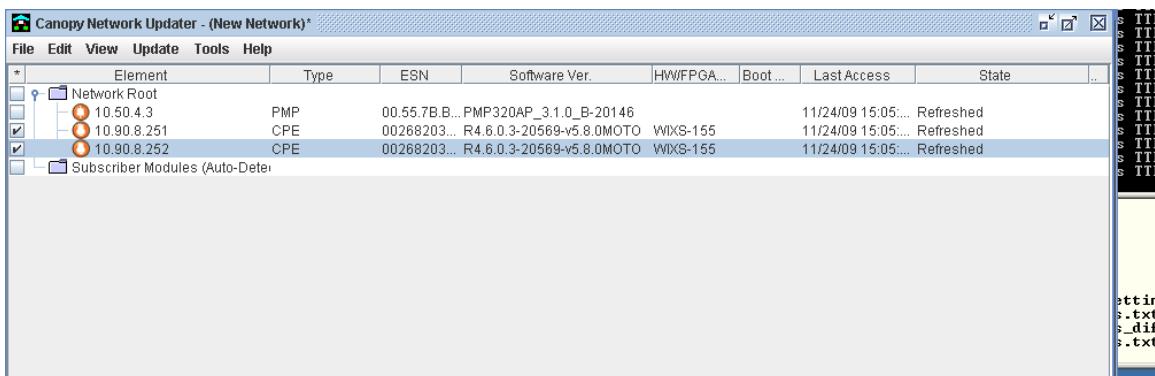
Verify that your AP(s) are still selected
Update → Update Selected Network Elements



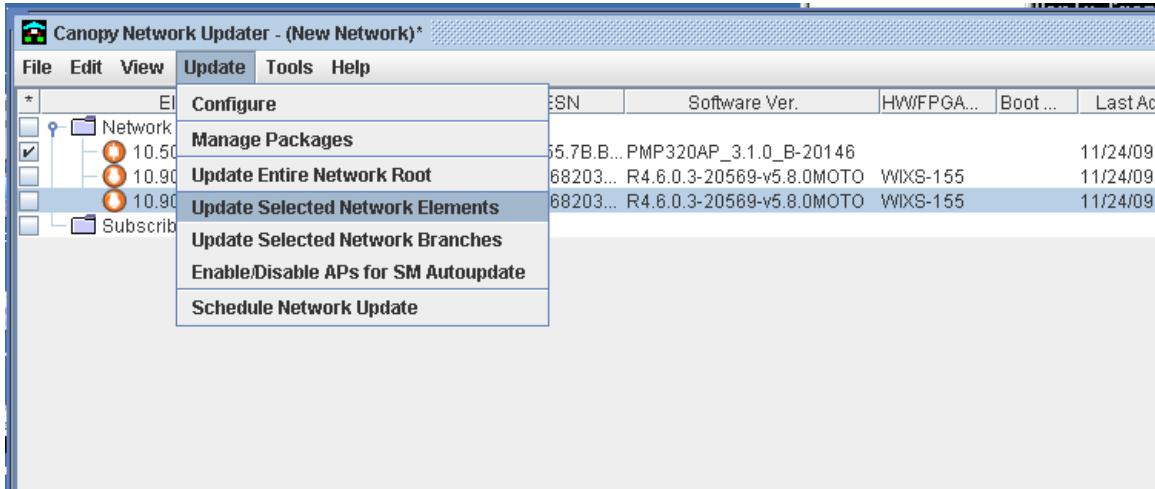
Upgrading your CPE(s)
Select the CPE pkg3 file



Select your CPE(s)



Update → Update Selected Network Elements



Verify that your devices are on the current software:

Element	Type	ESN	Software Ver.	HW/FPGA...	Boot...	Last Access	State
Network Root							
10.50.4.3	PMP	0055.7B.B...	PMP320AP_3.1.0_B-20146			11/24/09 15:05...	Refreshed
10.90.8.251	CPE	00268203...	R4.6.0.3-20569-v5.8.0MOTO	WIXS-155		11/24/09 15:05...	Refreshed
10.90.8.252	CPE	00268203...	R4.6.0.3-20569-v5.8.0MOTO	WIXS-155		11/24/09 15:05...	Refreshed
Subscriber Modules (Auto-Dete...							

```

11/24/09 14:37:56 INFO Host: 10.90.8.252;ESN: 002682030CA5;Message: Using Package C:\Documents and Settings\Administrator\Desktop\CNUT_Packages\PMP320SM_5.8.0.pkg3 (SITE= PMP320-CPE (R4.6.0.3-20569-v5.7.32MOTO) DEMO_Area)
11/24/09 14:37:56 INFO Host: 10.90.8.252;ESN: 002682030CA5;Message: Update not required (SITE= PMP320-CPE (R4.6.0.3-20569-v5.7.32MOTO) DEMO_Area)
11/24/09 14:37:56 INFO Node: 10.90.8.252 Update Completed.
11/24/09 14:37:59 INFO Updating Selected Network Elements process has completed.
11/24/09 15:05:34 INFO Refresh Entire Network process start..
11/24/09 15:05:34 INFO Refreshing NE at:10.50.4.3
11/24/09 15:05:34 INFO NE at:10.50.4.3 refreshed.
11/24/09 15:05:34 INFO Refreshing NE at:10.90.8.251
11/24/09 15:05:35 INFO NE at:10.90.8.251 refreshed.
11/24/09 15:05:35 INFO Refreshing NE at:10.90.8.252
11/24/09 15:05:35 INFO NE at:10.90.8.252 refreshed.
11/24/09 15:05:35 INFO Refresh Entire Network process has completed.

```

5 User Account Overview

5.1 AP User Accounts

The access point supports the following two user account levels

Admin User Level: The admin user account is pre-configured from the factory with the default password of “admin”. This privilege level is targeted towards the service provider/operator/ who is in charge of managing the entire network. This is also the level used for initial discovery of the AP via the Wireless Manager and is the default username, password in the community string

Login: admin

Password: admin

Installer User Level: The installer user account is also pre-configured from the factory with the default user level password “super”. This level of privilege is available and targeted towards the installer who will actually be installing the access point on the tower. It is assumed that the installer may be a sub contractor and may not require the full levels of permission that the admin user provides.

Login: installer

Password: super

In order to create additional users follow the steps below:

Log into the AP GUI via your web browser

Go to “administration” on the left hand size of the menu

In the main screen, populate the user name, password, user level and status and press “add” below. This will create the new user account and set the status and level.

As an admin user level you are allowed to create up to 10 different combinations of admin or installer accounts.

AP User Account Screen

	User Name	User Level	Status
<input checked="" type="radio"/>	admin	Admin	Enabled
<input checked="" type="radio"/>	guest	Guest	Disabled
<input checked="" type="radio"/>	installer	Installer	Enabled

User Name	Password	Confirm Password	User Level	Status
<input type="text"/>	<input type="password"/>	<input type="password"/>	<input type="button" value="Guest"/>	<input type="button" value="Disabled"/>

5.2 CPE User Accounts

The following user levels are pre-configured from the factory for the CPE

Admin level login for the home/end user

Login: admin

Password: admin

This user level is provided for the end user of the CPE and does not carry the same level of access as the operator/service provider

Operator level login for the service provider

Login: operator

Password: operator

This user level is provider for the operator/service provider to access further parameters of the CPE for debugging/configuration purposes.



6 IP Configuration

6.1 IP Overview

In the PMP320 system, there are three interfaces that need to have IP addresses intelligently assigned to them in order for the system to operate properly. The three interfaces are: 1) The APs wired (GMAC) and 2) wireless (WMAC) interfaces, and 3) the CPEs wireless (WLAN) interfaces. The two AP interfaces can either be statically assigned via the GUI or SNMP, or they can be set via an external DHCP server. The CPE WAN interfaces must be assigned via DHCP in order for the AP to properly route user traffic to the correct CPE.

The recommended configuration is to set up static reservations for the AP's two interfaces on an external DHCP server so that all AP IP addresses can be centrally controlled and changed if necessary. Although these addresses are being set via a DHCP server, it is important to note that the AP will not attempt to renew these addresses unless the AP is rebooted. In general, there should not be a need for an APs GMAC and WMAC interfaces to change once the network design has been completed.

In order to set the CPE WAN IP addresses, either the AP's internal DHCP server can be used, or, the AP can act as a DHCP relay agent and relay DHCP requests to the external DHCP server.

If the internal DHCP server is used, the AP can either handout addresses from a general pool, or the AP can be configured to use static reservations based on the MAC address of the requesting CPE.

When the external DHCP server is used, the server should be setup so that a unique address pool is allocated for each AP. As previously mentioned, one address in each pool should be statically reserved for each AP's WMAC interface. When the AP forwards the CPE's DHCP request to the DHCP server, it will set the gateway address in the request message to its WMAC IP address. The DHCP server will use the gateway address to determine which of its configured IP pools to use in order to service this request. The end result is that the CPEs will receive DHCP IP addresses on the same subnet as the WMAC IP address of the AP that they are registered to.

6.2 Key IP guidelines

- The AP's Wired and Wireless interface must be on different subnets.
- Static reservations must be made for the AP's wireless(WMAC) and wired(GMAC) interface

- Infinite lease time must be configured for the static reservations
- CPEs WAN interface IP must be assigned via DHCP
- All CPEs under an AP must have their WAN IP on the same subnet as the AP's wireless interface.

6.3 Configuring AP IP Settings

Log into the AP Gui via a web browser

Go to General → IP Configuration

The two entries for Wireless and Wired will be pre-configured from the factory
Select Wireless and then Wired and in each case choose DHCP client to “enable” mode. Hit “update”

Top right corner hit the disc icon to save the configuration. The disc changes to blue indicating that a configuration save is required

Following the configuration save, the icon to the right will change to yellow indicating that a reboot is required. Hit the icon to reboot the radio.

IP Interface Configuration

	Index	Name	IP Address / Mask	MTU	Mac Address	Admin Status	DHCP Client
C	0	Wireless	10.90.7.254/24	1500	00:26:82:2F:22:ac	up	disable
C	3	Wired	10.90.1.27/24	1500	00:26:82:1F:22:ac	up	disable

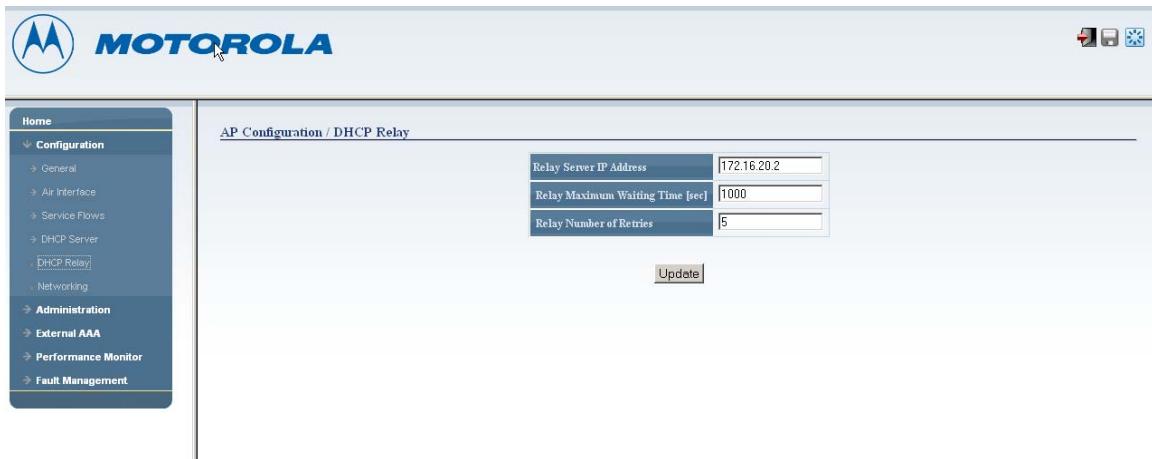
	Index	Name	IP Address / Mask	MTU	Mac Address	Admin Status	DHCP Client
							<input checked="" type="checkbox"/>

[Update](#) [Cancel](#)

Configure the DHCP server address in the DHCP Relay configuration

Go to Configuration → DHCP Server → DHCP Relay
Enter the external DHCP server IP address

Enter the Relay Maximum Wait time and Relay number of Retries



Go to “configuration” → Networking → and configure the following:

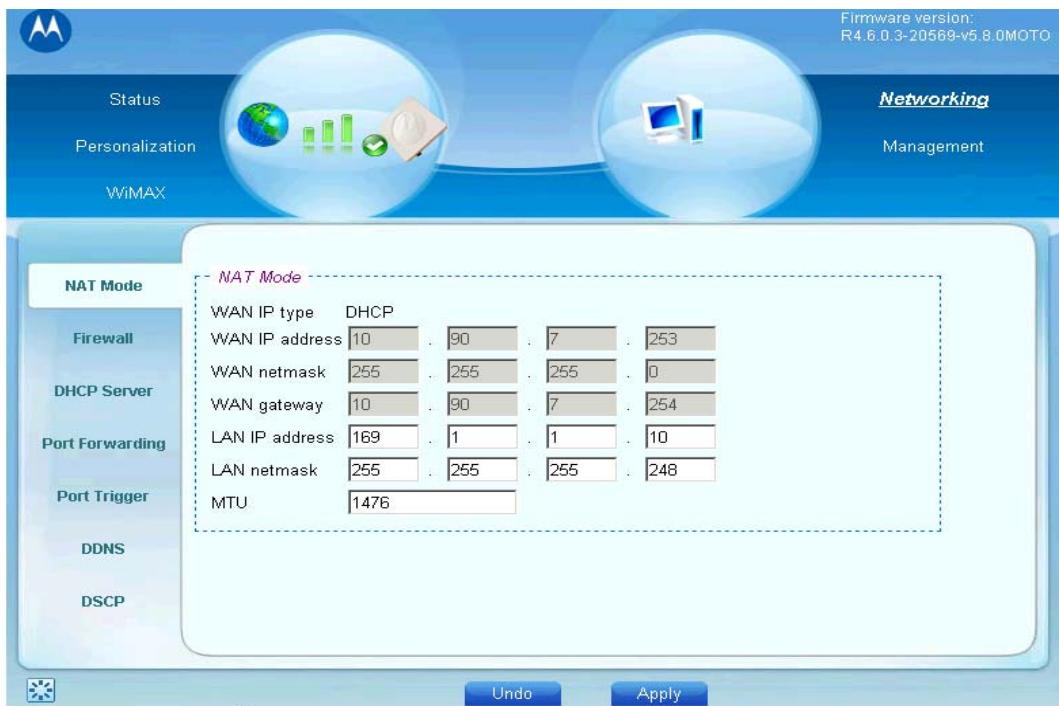
Enter the “default gateway”, “syslog IP”, DNS server IP and choose the appropriate status for the above

Add NTP server IP addresses

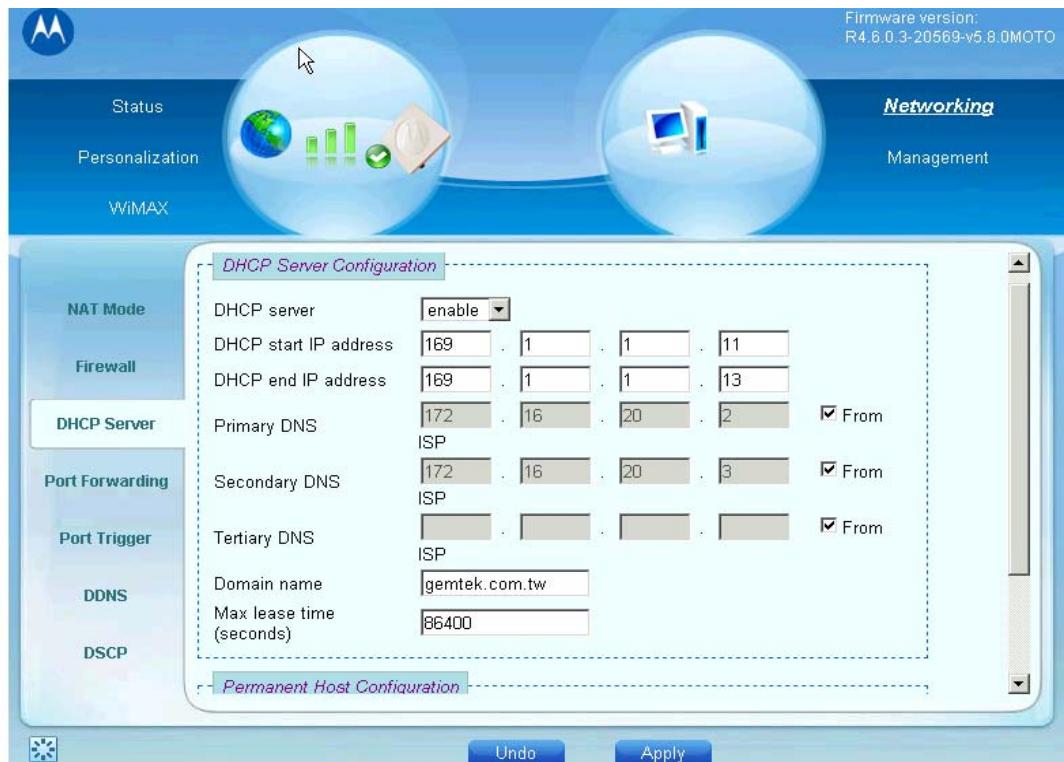
6.4 Configure the CPE IP Settings

Log into the CPE using “operator” and password “wimax”

Go to NAT Mode once you are logged in and configure LAN IP address and LAN netmask. You have the option to choose a different LAN network for devices below your CPE



Go to DHCP Server page, configure DHCP start IP address and end IP address.
Configure Domain name and Max lease time.



Go to Port Forwarding page and configure the necessary ports you would like to forward and enable them accordingly

No.	WAN Port		LAN IP Address		LAN Port		Protocol	Enable
	Begin	End			Begin	End		
1	5001	5030	169.1.1.11		5001	5030	TCP/UDP	<input checked="" type="checkbox"/>
2	5001	5030	169.1.1.12		5001	5030	TCP/UDP	<input checked="" type="checkbox"/>
3	5001	5030	169.1.1.13		5001	5030	TCP/UDP	<input checked="" type="checkbox"/>

Go to Firewall Page and configure the CPE Access control items. In addition, configure the DMZ host IP if necessary.

CPE Access Control

Allow Web accessing from WAN

Allow Telnet accessing from WAN

DMZ

Host IP: 169.1.1.9

Redirect ICMP to the host

Firewall Filter

Enable Firewall Filter

7 RF Parameter Configuration

7.1 AP RF Parameter Configuration (WiMAX Capabilities)

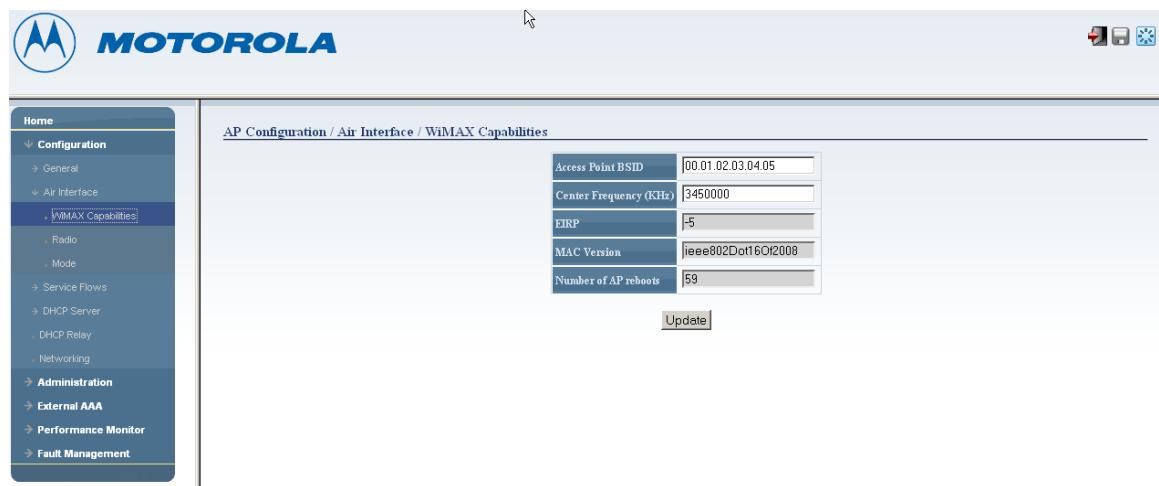
Log into the AP gui per section xxx

Go to → Configuration → Air Interface → WiMAX Capabilities

Configure Access Point BSID with the MAC address of the AP

Configure Center frequency

Hit update



7.2 AP RF Parameter Configuration (Radio)

Log into the AP gui per section xxx

Go to → Configuration → Air Interface → Radio

Configure the Tx Power, Antenna gain, Direction and Antenna Height. Hit update

The screenshot shows the Motorola AP Configuration interface. The left sidebar has a 'Configuration' section with 'Mode' selected. The main content area is titled 'AP Configuration / Air Interface / Radio'. It displays two tables. The top table shows two radio configurations with index 0 and 2, frequency 3450000, tx power -5.000, antenna gain 0, antenna direction 0, and antenna height 0. The bottom table is empty. At the bottom are 'Update' and 'Cancel' buttons.

Radio Index	Frequency	Tx Power	Antenna Gain	Antenna Direction	Antenna Height
0	3450000	-5.000	0	0	0
2	3450000	-5.000	0	0	0

Radio Index	Frequency	Tx Power	Antenna Gain	Antenna Direction	Antenna Height

7.3 AP RF Parameter Configuration (Mode)

Go to → Configuration → Air Interface → Mode

Configure the Selected channel bandwidth and Downlink/Uplink Ratio. Hit update

The screenshot shows the Motorola AP Configuration interface. The left sidebar has a 'Configuration' section with 'Mode' selected. The main content area is titled 'AP Configuration / Air Interface / Mode'. It displays two dropdown menus: 'Selected Bandwidth' set to 10 MHz and 'Selected DLUL Ratio' set to 75% / 25%. At the bottom is an 'Update' button.

8 CPE RF Parameter Configuration

8.1 CPE Frequency and Channel bandwidth Configuration

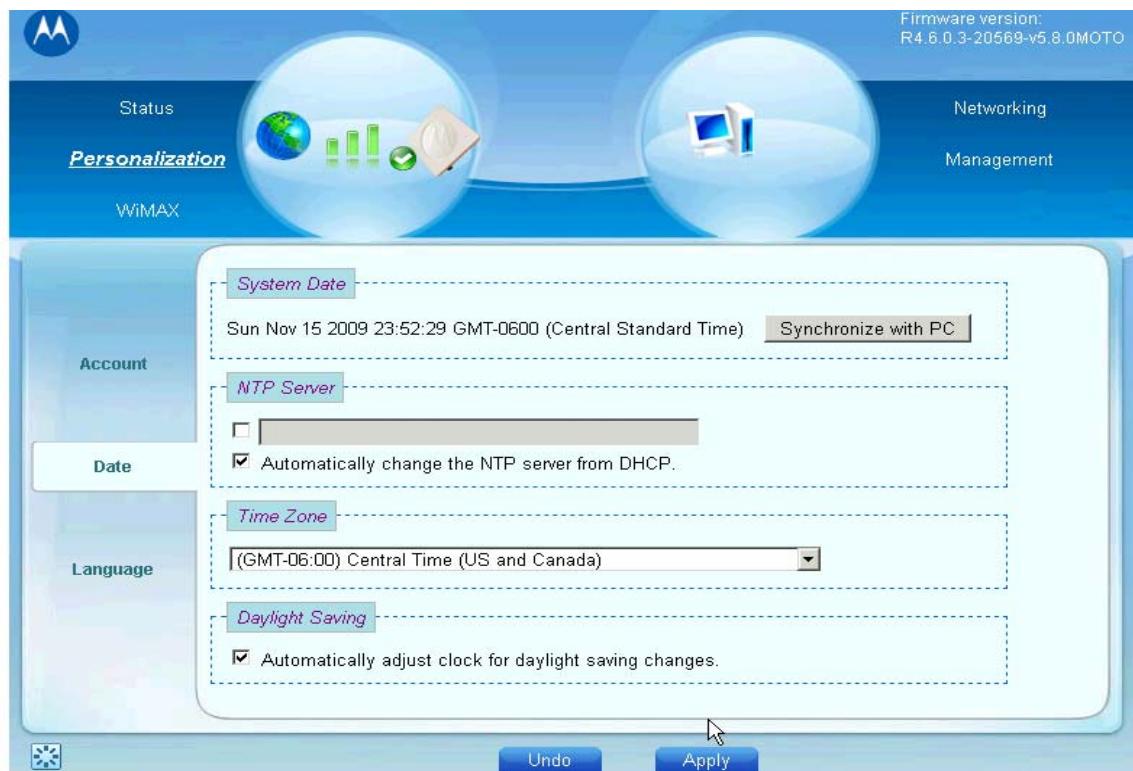
Log into the CPE using the “admin” or “operator” login

Click on “WiMAX” and then click on “scanner”

Click on “edit” and add the desired frequency and channel bandwidth



Configure additional information under the “date” tab or refer to the CSM35320 CPE User Guide



9 Authentication Configuration

9.1 AP Authentication Parameter Configuration

Log into the AP and launch the web GUI using “admin” for both log in and password

Navigate from the left side menu to “Configuration” → “General” → “Settings”

Choose the operational mode to be “External AAA”

On the right hand side populate with the following information

- AAA Server IP
- AAA Server port
- AAA Client port
- AAA NAS Name (Note: This will also need to be populated in the AAA)
- Shared Secret (Note: This will also need to be populated in the AAA)
- Choose “yes” or “no” for allowing unauthorized subscribers.

AAA Server IP	10.90.1.251
AAA Server Port	1812
AAA Client Port	1813
AAA NAS Name	PRANAV
Shared Secret	REDACTED
Allow unauthorized subscribers	YES

AP External AAA / General Settings

Update

9.2 AAA Authentication Configuration

Note: Both the Aradial AAA and Free Radius AAA is supported with the PMP320 product but only the Aradial configuration is noted in this user guide

9.3 Aradial server installation (Refer to Appendix A for initial steps)

From the Aradial installation folder, click on the Aradial installation executable (Appendix A - e.g. AradialSetup-5-1-10.EXE).

In the screen mentioning the license mode (by default Demo mode), choose "Registered mode".

In the screen demanding to enter the name of the server, the administration username and password, enter the input of your choice.

After setup is completed, restart of the computer is required.

After restart, the WEB admin window of the Aradial is opened automatically. Log in with the administration username/password you chose.

On the right side of the window, in the "STATISTICS" tab, press the "show" button for "users in the database" and delete the dummy users registered.



Do the same for the "Network Access Servers configured".

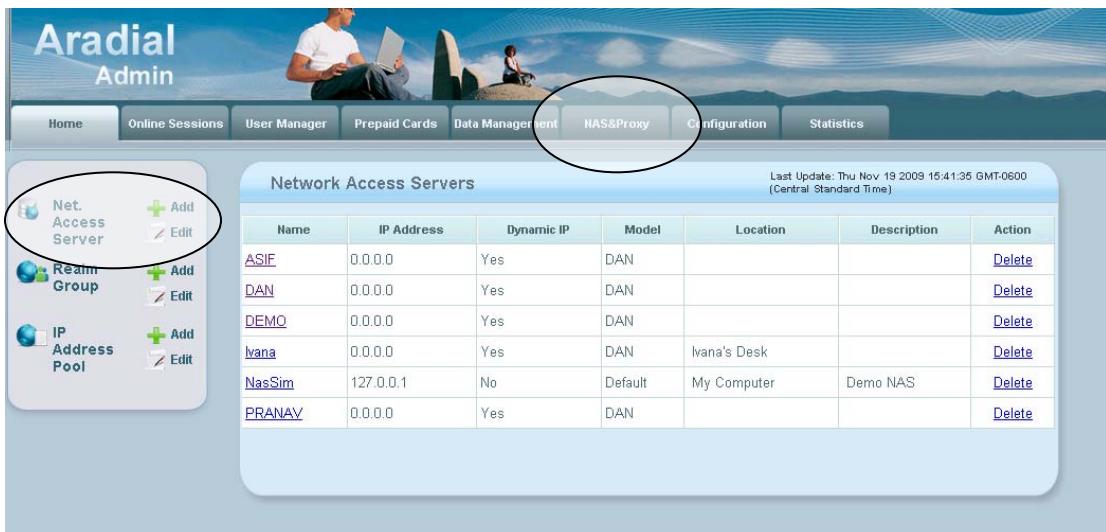
From the Aradial installation folder, click on the ARDKEY.reg file, in order to register the license key in the Windows registry.

Open the directory where Aradial is installed. By default it is "C:\Program Files\Aradial". In the Aradial installation folder open the Aradial_cfg folder. Copy from there in "C:\Program Files\Aradial", the DemoCerts folder (that contains the Free radius server certificates we used before Aradial was available), the eap_cfg.xml file (that defines the preferred EAP method, in our case TTLS) and the eap_tls_cert_cfg.xml file (that defines the path to the certificates, in our case, the DemoCerts folder).

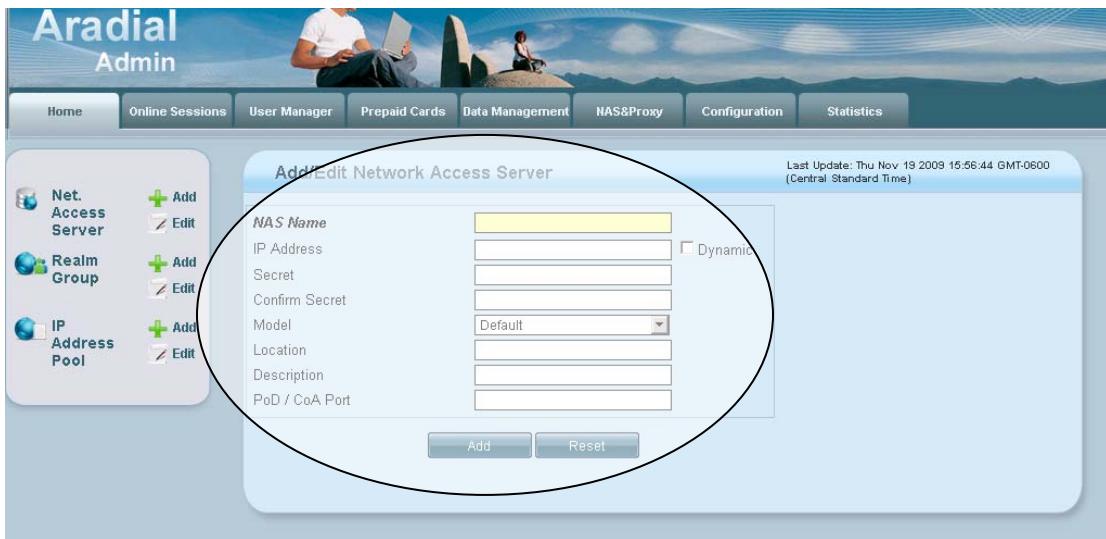
Copy the NasCfgDbs file (containing all the NAS the server supports, we added DAN NAS with the services level this NAS supports as example), and the DAN.dic file (containing the VSA attributes definition), into the "C:\Program Files\Aradial\RadDb" directory.

In the Windows services window, restart all the Aradial related services.

9.4 Add a NAS



Name	IP Address	Dynamic IP	Model	Location	Description	Action
ASIF	0.0.0.0	Yes	DAN			Delete
DAN	0.0.0.0	Yes	DAN			Delete
DEMO	0.0.0.0	Yes	DAN			Delete
Ivana	0.0.0.0	Yes	DAN	Ivana's Desk		Delete
NasSim	127.0.0.1	No	Default	My Computer	Demo NAS	Delete
PRANAV	0.0.0.0	Yes	DAN			Delete



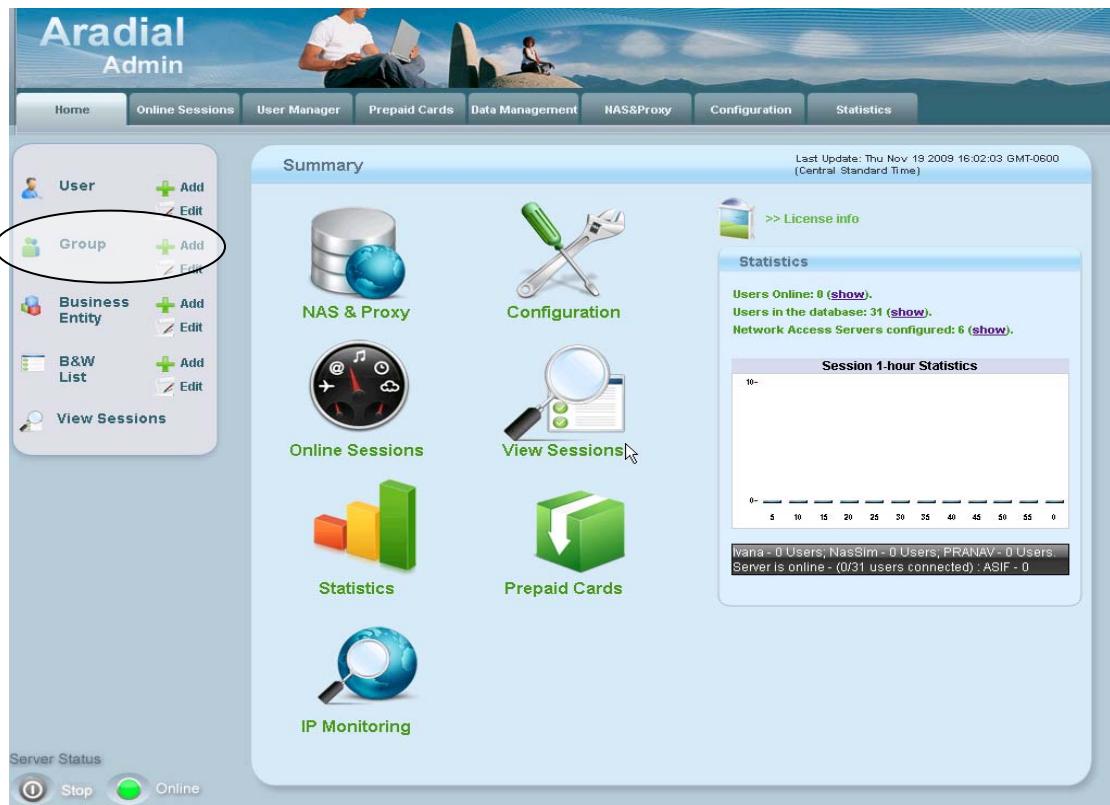
Click on the NAS&Proxy tab. Click on the "Net. Access Server" add button. Fill the NAS Name field with the same NAS name configured in the PMP320AP (Access Point) in the configuration parameter.

Set the IP address of the GMAC interface of the PMP320AP in the IP Address field.

Fill the secret and Confirm secret fields with the configured secret in the PMP320AP by the configuration parameter.

In the Model field, choose the DAN model in the list.
Click the "ADD" button.

9.5 Add a GROUP



Click on the Home tab. Click on the "Group" add button. Fill the Group Name field with a name in relation with the service level this group will provide.

Group Name: PPP

Service Type: PPP

IP Pools: <IP Pools>

>Password Source: <User DB>

Active:

Enable Callback:

MultiLink:

Auto Add on 1st Connect:

Add | Reset

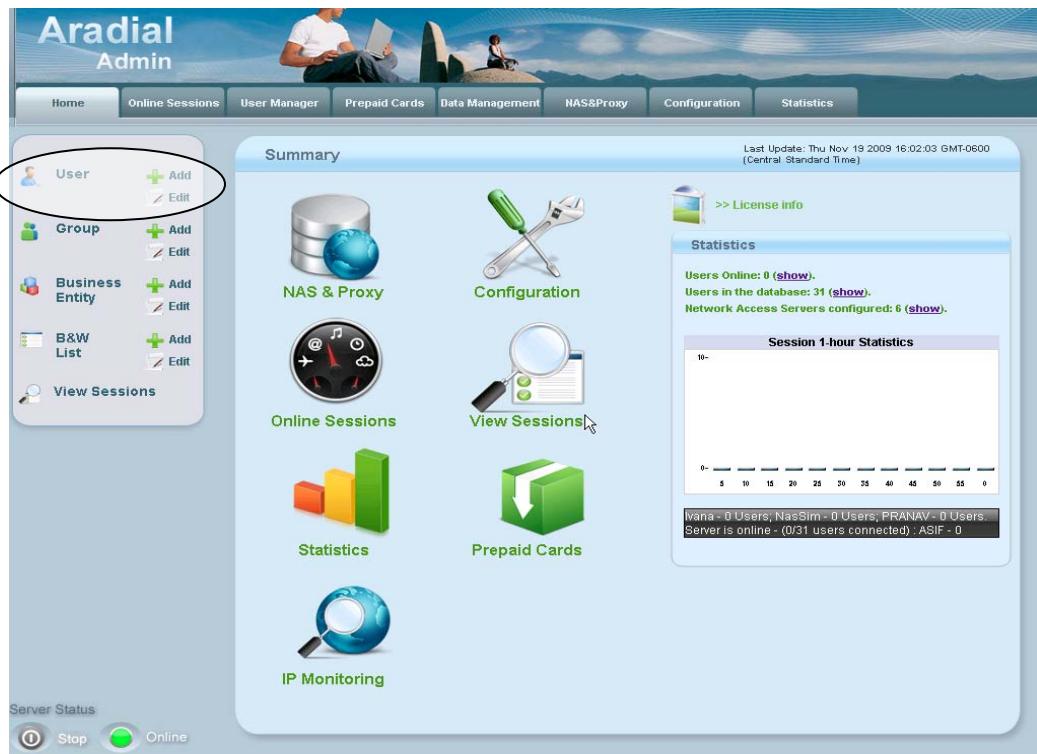
Choose from the list, one of the service type defined by DAN in the NasCfgDbs file. For example: WimaxGold.

In the IP Pools list, choose NAS, and click "ADD".

The Password Source field should remain as the default, ie: <User DB>

Click the "Add" button in the bottom of the page.

9.6 Add a USER



Click on the Home tab. Click on the "User" add button. Fill the User Id and Password fields with the username and password which CPE will use for authentication and authorization.

Password Source should remain the same as the default to be <Group>, means that the password policy is defined in the Group definition.

In the Association fields, choose in the Group list, the group you want the user to be associated with.

(Optional step) You could fill the Caller Id field with the GMAC MAC address of the AP, so this user will be authorized and provisioned only in the case it got connected via this specific NAS (PMP320AP).

Aradial Admin

Home Online Sessions User Manager Prepaid Cards Data Management NAS&Proxy Configuration Statistics

User **Add** **Edit**

Group **Add** **Edit**

Business Entity **Add** **Edit**

B&W List **Add** **Edit**

View Sessions

Access Information

Last Update: Thu Nov 19 2009 16:30:13 GMT-0600 (Central Standard Time)

User Id Active

Password Confirm Lock Out

Password Source <Group> Force Password

Association Group <None> Business Entity <None>

Administrative Rights <None>

Caller Id

Callback Number

Dates

Dates Created Modified Last Login

Activation Expiration

Override Group Profile (leave blank to use default Group profile)

Service <None>

Remote IP

Filter

Max Sessions

RADIUS Attributes

Additional

Metering

Time (Seconds) Meter Bank Other Enforce

Data (MB) Other Enforce

Custom & Comments

Custom Info 1 Info 2
Info 3 Info 4

Comments

Add Reset

Server Status **Stop** **Online**

Server Status **Stop** **Online**

Check the "Active" checkbox, and the "Add" button in the bottom of the page.

9.7 *Verification of AAA configuration*

In the PMP320AP, be sure the authentication feature is enabled.

With Wireshark, be sure the Radius negotiation between the Aradial server and the PMP320AP, is ending by a Radius Accept packet.

Start the CPE and observe it's getting authenticated and enters the network successfully.

Observe after network entry that the CPE is getting provisioned via VSA messages sent from the Aradial server through the AP, according to the group the CPE (user) is associated to and the level of service defined for this group.

9.8 *Setting up CPE for Authentication*

Under Authentication section select EAP-TTLS and MSCHAPV2.

Enter Username and Password that you created during Aradial configuration.

Uncheck use device certificates. For Identity you can check Random identity or for ease in troubleshooting can define you own identity. Uncheck realm portion.

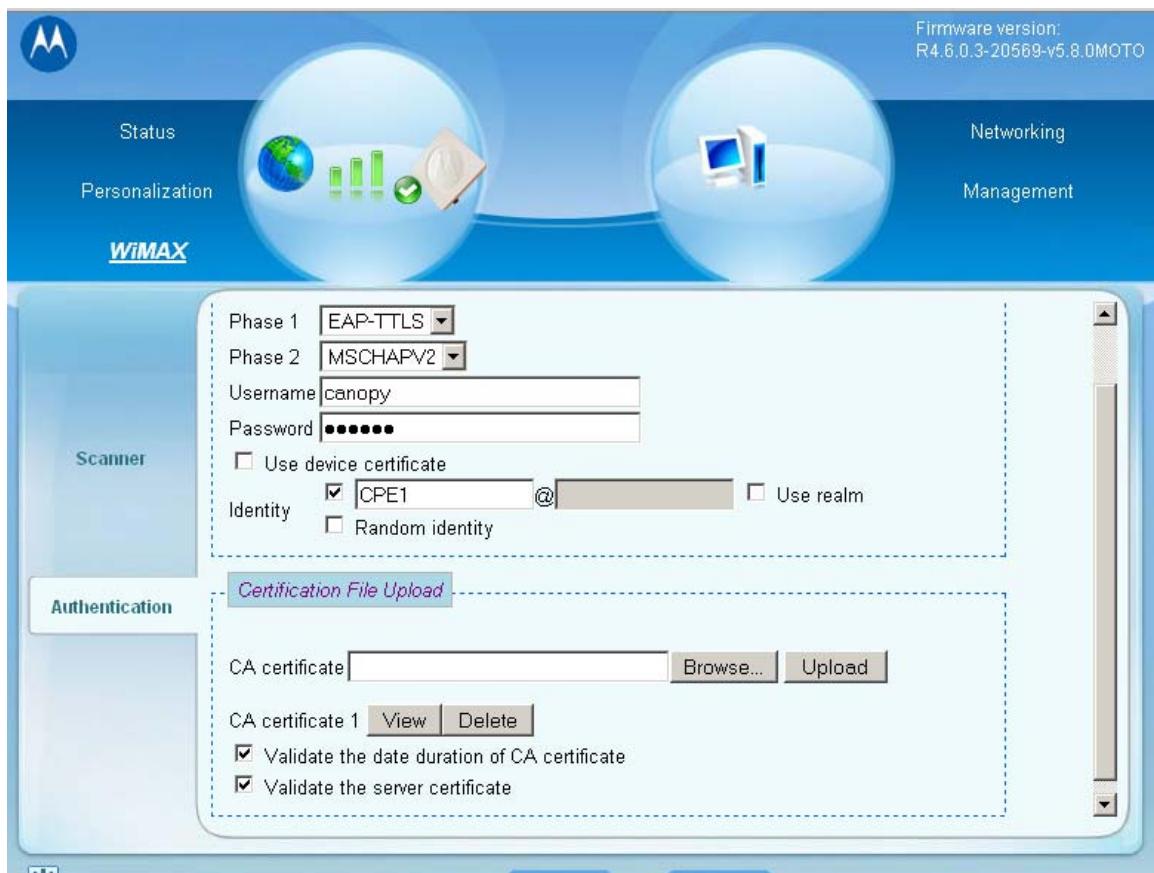
CPE comes with Motorola created CA certificate and Wimax forum CA certificate. If you decide to use you own certificates you can upload them in this section.

Under Certification File Upload section, browse to the folder where you have you CA certificate and upload it. Once the certificate is uploaded you should be able to see it.

Update the DemoCerts folder located in "C:\Program Files\Aradial", with your own Server and CA certificate. Also make necessary changes to eap_cfg.xml file. Refer to Section "1 – Aradial server installation (Appendix A)" for more information.

Check "Validate the date duration of CA certificate" and "Validate the server certificate".

Save the changes and reboot the CPE.



10 Quality of Service Configuration

10.1 Brief overview of the quality of service section

PMP320 provides different quality of service (QOS) settings per the 802.16e specification e.g UGS, rtPS, nrtPS and BE. User can choose the appropriate QoS profile based on the application needs. It is recommended that each QoS profile is created with specific Maximum Information Rate (MIR) and Committed Information Rate (CIR) as dictated by the application needs. The PMP320 system can support several QoS profiles (e.g. 256) with different combinations of QoS types, MIR and CIR.

Each PMP320AP serves several CPEs under given sector. Each CPE could have multiple service flows in both UL and DL direction. Each flow is associated with a given QoS profile which is configured based on end user need. One CPE could have multiple flows to serve different applications simultaneously. To differentiate multiple flows under a single CPE, PMP320 uses classification profiles. These classification profiles are associated with specific service flows. Different applications, both over UL and DL can send their data using classifications which helps CPE and AP to associate data traffic to specific service flow with QoS type. PMP320 supports source/destination IP address and TOS/DSCP (Diff Serve Code Point) classifications.

10.2 QoS profile creation

Create/Add/Update/Delete additional QoS profiles using AP GUI, “Configuration” → “QoS Profile”. AP will have QoS profile number 0 and 1 created by default which is fixed. One can add different QoS profile as needed.

To add a new QoS profile, provide the new index, name if needed, selection of HARQ, # Retries, security enabled or disable, DSCP marking disable or enable, appropriate DSCP mark value (e.g TOS value) if DSCP Marking is enabled. By default, HARQ is enabled with retries “0”, Security and DSCP Marking is disabled. Recommended configuration for the DL flow is HARQ enabled with retry “0” and for the UL flow is HARQ disabled.

AP Configuration / Service Flows / QoS Profiles / Basic Options

	Index	Name	HARQ	HARQ Retries	Security	DSCP Marking	DSCP Mark
0	DL Default	enable	0		disable	disable	0
1	UL Default	disable	0		disable	disable	0
2		disable	0		disable	disable	0
3		enable	0		disable	disable	0
4		enable	0		disable	disable	0

Basic Advanced

Index Name HARQ HARQ Retries Security DSCP Marking DSCP Mark

Add Update Delete Cancel

Upon creation of new profile, go on the Advanced tab

And update the appropriate values for the “Max Sustained Rate” and “Data Delivery Type”.

If the nrtPS is selected as the “Data Delivery Type”, provide “Unsolicited poll interval” e.g 150ms and “Min Reserved Rate” as needed. Polling interval value is not needed for DL flow.

If the rtPS is selected as the “Data Delivery Type”, provide “Unsolicited poll interval” e.g 60ms, appropriate “Min Reserved Rate” and “Max Latency” value. Polling interval value is not needed for DL flow.

If the UGS is selected as the “Data Delivery Type”, provide “Unsolicited Grant Interval” e.g 40ms and “Min Reserved Rate” same as “Max Sustained Rate”.



The screenshot shows the Motorola AP Configuration interface. The left sidebar has a 'Service Flows' section with 'QoS Profiles' selected. The main content area is titled 'AP Configuration / Service Flows / QoS Profiles / Advanced Options'. It shows a table of QoS profiles with the following data:

Profile No.	Max Sustained Rate	Max Traffic Burst	Min Reserved Rate	Max Latency	Data Delivery Type	Unsolicited Grant Interval	Unsolicited Poll Interval
0	25000000	0	0	200	Best Effort	0	0
1	25000000	0	0	200	Best Effort	0	0
2	25000000	0	0	200	Best Effort	0	0
3	25000000	0	0	200	Best Effort	0	0
4	25000000	0	0	200	Best Effort	0	0

Below the table are input fields for adding a new profile:

Profile No.	Max Sustained Rate	Max Traffic Burst	Min Reserved Rate	Max Latency	Data Delivery Type	Unsolicited Grant Interval	Unsolicited Poll Interval
<input type="text"/>	<input type="button" value="Best Effort"/>	<input type="text"/>	<input type="text"/>				

Buttons at the bottom: Add, Update, Delete, Cancel.

After network entry to get an IP address, AP will use the default parameters to create a service flows. By default, QoS profile "0" and "1" is configured for that, as shown in picture below. One can use the different QoS profile by changing these values to other QoS profile indexes.



The screenshot shows the Motorola AP Configuration interface. The left sidebar has a 'Service Flows' section with 'Default Parameters' selected. The main content area is titled 'AP Configuration / Service Flows / Default Parameters'. It shows two input fields for setting default QoS profiles:

Default DL QoS Profile	<input type="text" value="0"/>
Default UL QoS Profile	<input type="text" value="1"/>

A 'Update' button is located below the fields.

10.3 Classification profile creation:

Create (Add)/Update/Delete classification profiles using AP GUI, "Configuration" → "Classification Rules".

To add or update, select or update the specific profile index under “Profile”, select the “Type” and provide “ToS” or “IP Address” and IP Mask Length”. Do not enter the rule ID until unless you want to create multiple rules for given profile, rules are not needed on the normal basis.

	Profile	Rule	Type	Tos	IP Address	IP Mask Length
C	1	0	IP TOS	32	0.0.0.0	0
C	2	0	IP TOS	64	0.0.0.0	0
C	3	0	IP TOS	96	0.0.0.0	0
C	4	0	IP TOS	128	0.0.0.0	0
C	5	0	IP TOS	160	0.0.0.0	0

10.4 Service flow creation:

AAA will be provide VSA information to create different service flow(s) for the CPE based on the username and password configured on the CPE for authentication. User profile is created at AAA (described at 10.6.1) with this username and password

Upon successful service flow creation AP will show the flows associated with given CPE. It shows all active service flows with associated QoS profile index, classification profile index and the direction (UL or DL).

CPE MAC	SF ID	Direction	QoS Profile	Class Profile	Packet Count	Bytes Count	Packets Dropped	Bytes Dropped
00:21:00:dc:d8:e3	5122	0	13	0	27637	2630169	0	0
00:21:00:dc:d8:e3	5123	1	12	0	27820	2689061	0	0
00:21:00:dc:d8:e3	5124	0	18	1	0	0	0	0
00:21:00:dc:d8:e3	5125	1	17	1	0	0	0	0

Upon successful service flow creation CPE will show the flows associated its own.



11 Appendix A – AAA Server Installation

For Windows:

Download Aradial RADIUS and Prepaid server for evaluation from:

<http://www.aradial.com/Ftp>

* Open explorer and put it in the URL.

User: ARADIALEVAL

password: ardpower

Note: The cases for the username and password are important.

Or

For Windows: <ftp://ARADIALEVAL:ardpower@www.aradial.com/Windows-v51>

- Aradial Installation Screen-cast:

http://www.aradial.com/DownLoads/Demos/Installing_Aradial.wmv

- The quick install PDF can be found in each of the download folders.

<http://www.aradial.com/DownLoads/Windows-quick-installation-guide.pdf>

- Please download the temporary registration key '**ARDKEY.reg_**' can be found in each of the download folders. To install it import it with 'regedit' and reboot.

- Aradial is installed with MS Access database as default. Aradial supports MySQL, MS SQL and Oracle.

- After the installation the documentation will be under: c:\program files\Aradial\Docs

- Aradial Training: <http://www.aradial.com/DownLoads/AradialTraining.zip>

For Linux: (CentOS 5.3 Linux)

You can download Aradial RADIUS and Prepaid server for evaluation from:

<http://www.aradial.com/Ftp>

* Open explorer and put it in the URL.

User: ARADIALEVAL

password: ardpower

Note: The cases for the username and password are important.

Or

For Linux: <ftp://ARADIALEVAL:ardpower@www.aradial.com/Linux>

- Please download the temporary registration key '**ARDKEY.reg_**' can be found in

each of the download folders.

To install it import it with 'regedit' and reboot.

- Aradial Training: <http://www.aradial.com/DownLoads/AradialTraining.zip>

If using MySQL 5.0.77 you would need to upgrade the mysql-connector, you can download it from:

<http://www.aradial.com/Ftp/Linux/UnixODBC/CentOS5.3/mysql-connector-odbc-3.51.27-0.i386.rpm>

2. add the below to /etc/odbc.ini
[aradial]
...
...
Socket = **/var/lib/mysql/mysql.sock**

Aradial is installed at:

/usr/local/aradial

Start/stop it: service ardrad start | stop | status | restart

Aradialip = your Aradial computer external IP.

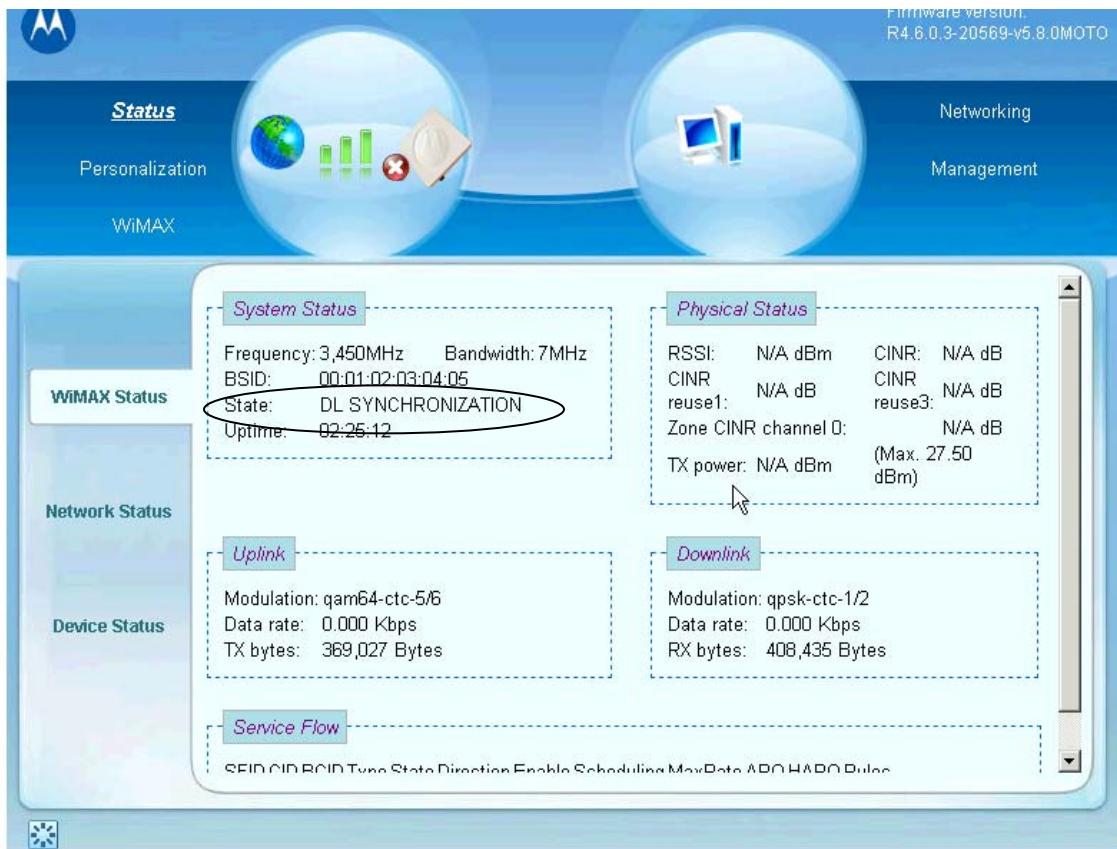
<http://Aradialip:8000> for Aradial admin - user:admin / pwd: password

All the documentation is at: /usr/local/aradial/Docs

12 Appendix B – Troubleshooting

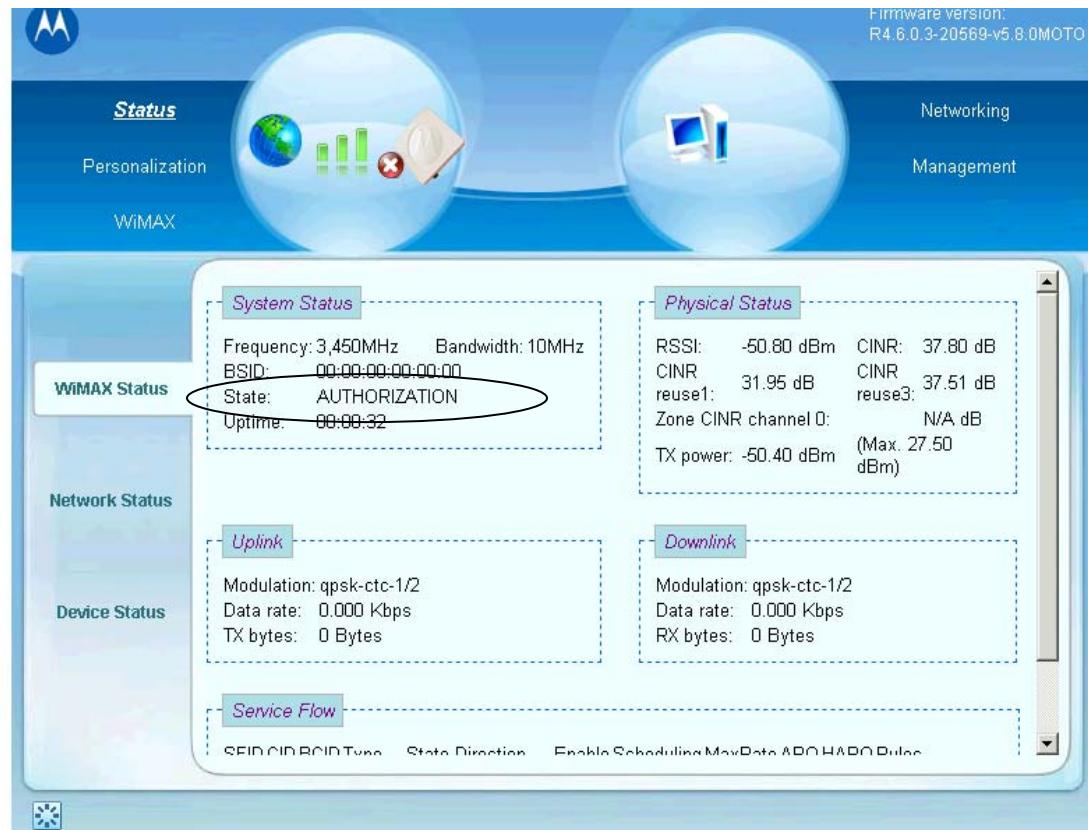
a. CPE shows DL synchronization – no other messages for CPE status

- Check the frequency and channel bandwidth settings on AP and CPE, make sure they are aligned
- Also make sure the distance and direction to the AP is correct. AP TX power and antenna gain value set appropriately.\



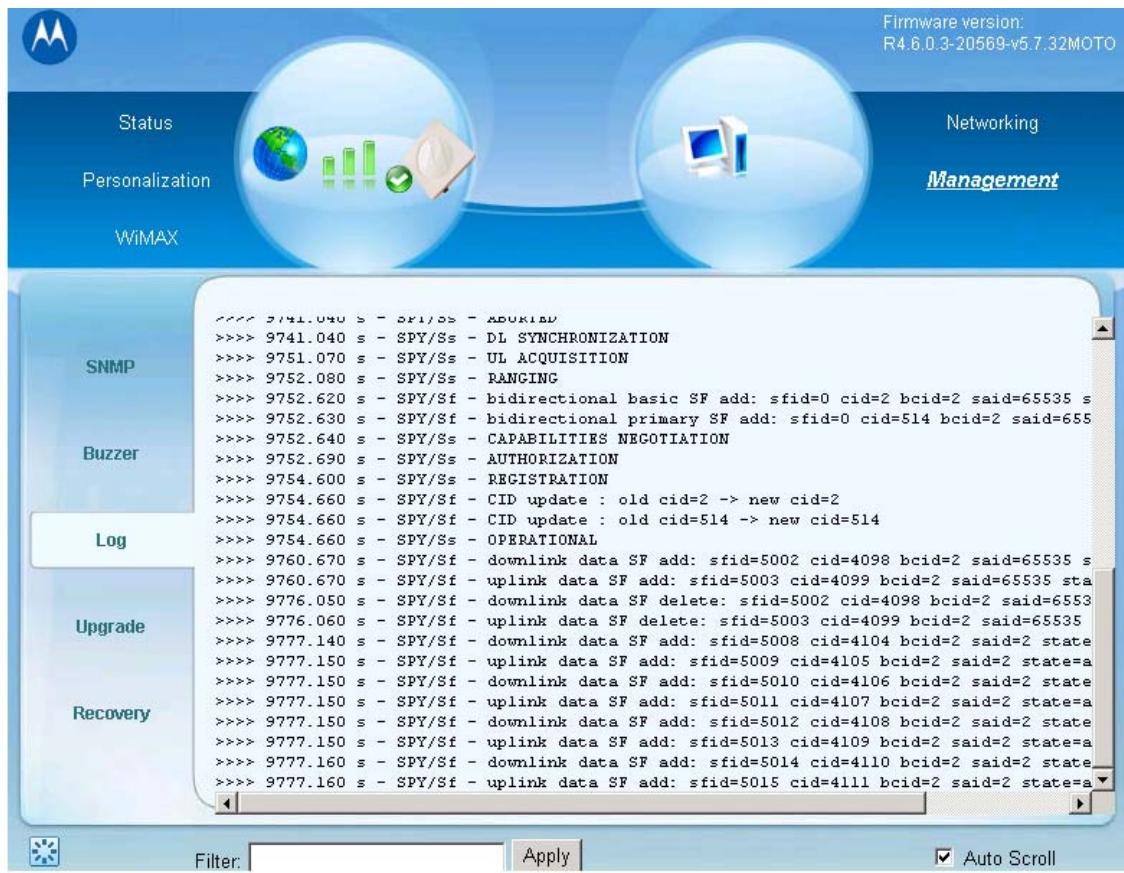
b. CPE stuck in Authorization – on CPE status

- Check the authorization credential on the CPE
- Make sure the AP can able to talk with AAA
- AAA has the correct provisioning for the CPE
- AP has the QoS profiles and Classification profile created which is used by AAA



c. **CPE is flipping between DL sync -> Ranging -> Operational -> DL sync**

- Check the DHCP configuration is accurate
- VSA is created properly at AAA
- QoS profiles are created matching with the VSA
- Look at the CPE logs under “Management” → “Log”, for more information.
- If the problem persists, collect the syslog generated by AP.



d. CPE is Operational – but now WAN IP address

- Check the DHCP configuration on AP is set correct. DHCP server is reachable from network where AP's GMAC is connected to.
- Check the DHCP relay and server configuration.
- If the problem persists, collect the syslog generated by AP.

MOTOROLA

AP Configuration / Networking

Default Gateway: 10.90.1.254

SYSLOG Status: enable

SYSLOG IP: 10.90.1.203

NTP Client: enable

DNS Status: disable

Primary DNS Server IP: 0.0.0.0

Secondary DNS Server IP: 0.0.0.0

Update

NTP Servers

No Data in The Table

Server Index: []

Server Address: []

Add/Update | Delete | Cancel

