



# *WAP 400 Series Access Point for WiMAX*



**MOTO***wi*<sup>4</sup>™



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# Motorola is committed to leading the industry with end-to-end WiMAX solutions

## Broadband Wireless Access

Broadband Wireless Access promises to enhance the lives of people around the globe in both mature and developing markets. Whether end-users are demanding access to increasingly rich, interactive and personalized content anytime and anywhere, or simply basic voice connections and the ability to access and share information with their communities and the world, Broadband Wireless Access will provide dynamic solutions.

WiMAX enables operators to offer versatile solutions that are high performing, cost-effective, and quick-to-deploy. With WiMAX, operators will be able to extend the coverage and capabilities of their networks to serve today's large metro areas as well as new markets previously not reached.

WiMAX is designed to support last-mile broadband connectivity to homes and businesses. Connections that were once dependent on wireline networks, can become wireless and mobile with WiMAX. While vendors have been providing proprietary solutions for many years now, WiMAX promises to standardize the equipment, making it interoperable and more affordable.

WiMAX provides enhanced broadband wireless access in fixed, nomadic and mobile environments. WiMAX solutions can be deployed as complementary to existing networks or as a primary access technology where alternatives do not exist. With new fixed and mobile services based on WiMAX, users in rural markets and developing countries will finally have broadband services that they can afford, while mobile users will benefit from access to new mobile multimedia services and instant access to the whole of the Internet, wherever and whenever they want it.

Motorola is committed to leading the industry with end-to-end WiMAX solutions addressing the full scope of the operator's deployment needs including access, core, devices, network management and services.

## MOTOwi4™

MOTOwi4 is a comprehensive platform of wireless broadband solutions and services. Designed to complement and complete operator networks, MOTOwi4 includes wi4 WiMAX, wi4 Fixed, wi4 Mesh, and wi4 Broadband over Power Line solutions. The MOTOwi4 portfolio also includes backhaul solutions that provide low-cost alternatives to leased wireline connections for managing aggregate data demands for both backhaul and bridging applications. MOTOwi4 solutions are versatile and address a broad range of applications across operator segments.

The Motorola vision provides seamless availability of personal wireless broadband services in any type of environment. As an individual travels from office to home to the outdoor network and into hotspot locations, wireless broadband coverage will follow. MOTOwi4 solutions coexist gracefully with a number of networks and standards, so that the end user's experience is rich and compelling.

MOTOwi4 is extending the reach and capabilities of operator networks, from basic connections in unserved regions to high-speed, mobile access in dense metro markets. Motorola's wi4 WiMAX, wi4 Fixed, wi4 Mesh, and wi4 Broadband over Power Line solutions help people access information and share content wherever they might be.



# Introducing the WAP 400 Series Access Point



**Figure 1:**  
**WAP 400 Access Point**

Motorola's WAP 400 Access Point with diversity antenna techniques delivers on the performance and cost advantages of WiMAX, standards-based wireless broadband. Featuring highly integrated and flexible design as well as enhanced RF capabilities, the WAP 400 Access Point is an ideal solution for an operator's fixed and mobile service applications.

Compliant to 802.16e standards, the WAP 400 Series Access Points provide high-performance broadband wireless access in 2.3, 2.5 and 3.5 GHz spectrum. The system addresses the operator's need for carrier class security, redundancy, and QoS features for robust voice, data, and mobility deployments.

Diversity antenna techniques allow the realization of Multiple-Input, Multiple-Output (MIMO) capability enhancing the coverage and capacity of these WiMAX systems, offering deep indoor penetration, and supporting full mobility applications.

The WiMAX system with the WAP Access Point includes the following elements:

- Diversity RF Modules
- Base Control Unit
- GPS Antenna Site Synchronization
- All-IP Broadband Backhaul Interface
- Portal Operations & Management Software Tools
- Carrier Access Point Controller

## WAP 400 Access Point

The WAP 400 Access Point consists of two major subsystems: the RF Modules and the Base Control Unit (BCU) as shown in Figure 1.

The RF Modules, featuring diversity, contain a dual antenna RF section that performs all radio transmit and receive processing to deliver baseband signaling to the BCU. By integrating the RF processing at the tower-top, the need for heavy RF coaxial cable is eliminated. Instead, the RF module utilizes a simple fiber connection and a power cable for connectivity to the BCU. The two antenna RF section is a single, self-contained field replaceable unit (FRU).

The BCU can reside at the bottom of the antenna tower or more opportune locations based on operator selection. The BCU contains hot-pluggable slots for up to two site controllers and up to four modem boards to support a four sector site configuration. Additionally, the BCU contains an Alarm I/O board, fans and heating, and the power distribution system for the entire site.

The WAP 400 Access Point solution is designed for four sector configuration with four RF Modules supported by a single Base Control Unit. The WAP 400 Access Point system supports frequency reuse for effective spectrum and channel management with an N=2 frequency plan.

## System Design Benefits

### High Performing

The WAP 400 Series Access Points are based on the IEEE 802.16e-2005 technology standard, and will benefit from such features as the spectrally efficient S-OFDMA interface, low latency performance, and IP based architecture. Enhanced system gain supported by diversity MIMO antenna capabilities allows strong indoor penetration as well as support for cellular-like mobility applications. Additionally, QoS capabilities, security features, and redundancy options make the WAP 400 Access Point platform a true carrier-class solution.

### Fixed & Mobile Application

The WAP 400 Access Point provides Non-Line-of-Sight, fixed and mobile wireless broadband connections. Paired with a common IP core, the WAP 400 Access Point will support seamless inter-technology handovers.

### Ease of Installation & Management

Motorola's design philosophy for the WiMAX product portfolio focuses on ease of installation, management, and operation. The WAP 400 Access Point features small, "zero-footprint" base sites with an all-outdoors design and flexible mounting options for both the RF Modules and the Base Control Unit. Simple Operations & Management software allow for configuration, authentication, and over-the-air system updates.

As coverage or capacity needs grow, additional base sites can be readily deployed and seamlessly “dropped” into the distributed architecture.



Figure 2:  
RF Module

#### Reduced CAPEX

The WAP 400 Access Point system benefits from an integrated design that reduces real estate requirements and allows for simple connections between components. Flexible hardware and software programmable radios provide the benefit of no-touch software updates. Integrated RF antenna design eliminates the need for costly and heavy coaxial cables between antennas and baseband modules and avoids power losses associated with heavy RF coaxial cables

#### Reduced OPEX

The WAP 400 Access Point has been designed as IP end-to-end. The network architecture eliminates high-cost centralized boxes, simplifies management, and reduces core transport costs. Connectivity to standard IP equipment allows operators to realize significant cost advantages.

#### RF Modules

The RF Module is a self-contained unit and consists of two transmitter lineups, two receiver lineups, two duplexer filters, two antenna elements, redundant fiber optic interfaces and DC power conversion. The RF Modules have a built in surge suppressor to protect the incoming power feed from the BCU Power Distribution Unit. The RF Module outputs one watt power per each of the two antenna elements.

For severe interference environments, optional filters can be introduced to the RF Module to improve interference mitigation.

The integrated RF architecture eliminates the need for heavy RF coaxial cables to be run between the BCU and the RF Module. A simple fiber optic cable with redundancy option and a standard power feed are the only connections required from the BCU to the RF Module at the tower top.

Traditional RF coax cables experience significant path loss and increase the system power requirements to account for signal degradation. By removing the need for heavy RF coaxial cabling, the power requirements for the WAP 400 Access Point are reduced by over two-fold. The reduced power requirement in turn reduces the number of active power elements required by the system and offers the added advantage of improved equipment reliability.

Further, positioning the active RF elements and heat sinks within the integrated RF Module more effectively supports heat dissipation and eases the cooling requirements of the Base Control Unit. Better management of heat dissipation eliminates the need for dedicated real estate and air conditioning for the BCU resulting in ease of installation and cost advantages.

The WAP 400 is designed to support up to 256 active users per sector (example:  $256 \times 4 = 1024$  active users for four sector configuration). Additionally, up to 3000 users can be supported across the site as a combination of active, idle, and sleeping users.

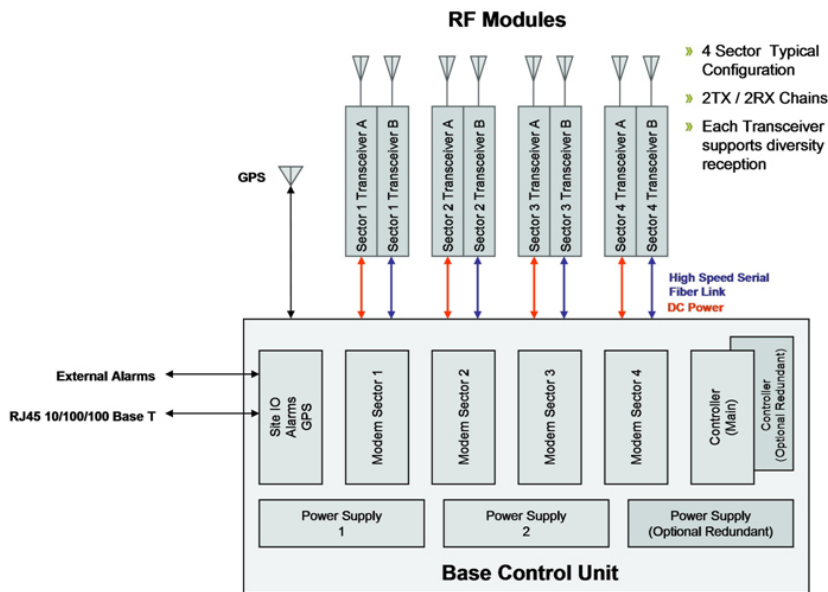


Figure 3:  
WAP 400 Access Point Logical Schematic

## Base Control Unit

The Base Control Unit (BCU) performs baseband processing, site synchronization, power distribution, and network interfacing. Additionally, the unit hosts site level software and provides interfaces for site backhaul.

The Base Control Unit includes the following components as represented in Figure 4:

### Site Controller Card

The Site Controller Card is a digital processing card containing a microprocessor platform for the site level software, a frequency/timing reference circuit, an Ethernet switch, and interfaces for backhaul and site alarms. The BCU cabinet contains slots for two Site Controller Cards in a redundant (1+1) model.

### Modem Card

The Modem Card is a digital baseband card containing host microprocessors, DSPs, and an FPGA for performing 802.16e MAC and PHY processing. The Modem Card allows for software only upgrades for PHY and MAC layer modifications. The BCU includes four Modem Card slots with typical configuration requiring one Modem Card per sector. Alternatively, one Modem Card can be configured to support two sectors using a trunked configuration.

### Alarm Card

The Alarm Card provides customer alarm inputs and relay control outputs, cabinet alarm inputs, power supply ID information, Layer 1 switching for Ethernet backhaul, power and interface signals to a GPS receiver, and power and interface signals to an optional High Stability Oscillator (HSO) reference.

### Power Supply

The BCU contains slots for three main power supply units. Two power supplies are required to support a fully populated site, with an optional third unit to allow for N+1 redundancy.

### Fan

The BCU is cooled by forced air via the air plenum. The BCU utilizes a fan enclosed within a fan tray. The BCU fan has a tachometer output that will provide alarm triggering approximately one week prior to fan failure.

### Backplane

The Backplane allows for interconnectivity of the Site Controller Cards, Modem Card, and the Alarm Card. The Backplane provides +27 VDC power to each of the cards.

### High Stability Oscillator (HSO)

The HSO is an optional module residing within the BCU cabinet and will be introduced in a future system release. The HSO plugs directly into the BCU Backplane and provides a highly stable 1 pulse per second signal which the Alarm Card distributes to the Site Controller Cards for use as a frequency reference in the event of GPS failure. The HSO can provide up to 24 hours of holdover.

### Surge Protection

The BCU has two surge elements. One surge card protects the main power input and a second surge card protects the backhaul, GPS, customer I/O, and power feeds to the RF heads.

### Direct Air Cooling (DAC) Filter

The DAC filter is an element that restricts movement of moisture and small and large particulate matter across its membrane. It is a cost and size effective method for cabinet cooling compared to a traditional heat exchanger. The DAC filter provides the added benefit of a much lower internal air temperature rise than a traditional heat exchanger. The DAC filter will require periodic replacement due to particulate clogging or filter aging. The life of the filter element is dependent upon local site conditions.

### Heater

A heater module is included within the BCU cabinet for operations in cold environments. A two-stage heater is controlled by a thermistor and control circuitry within the heater module. During cold startup both elements operate to quickly raise the internal temperatures to 0°C. During "cold day" operation only one heater element is used. The heat from that element plus heat dissipation within the BCU can maintain the internal temperatures above 0°C.

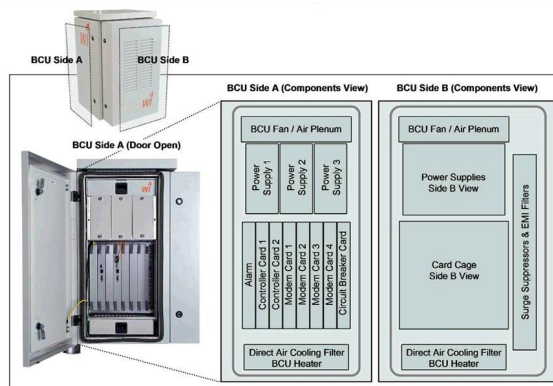


Figure 4:  
Base Control Unit Internal Components View

## WAP 400 Redundancy

The WAP 400 Access Point has been designed to achieve high availability for carrier class deployments and can be configured to support various redundancy options.

Redundant Ethernet backhaul interfaces maintain integrity of site throughput aggregation and distribution to the network core.

The two transceivers line-ups contained within each RF Module are implemented in a “soft-fail” fashion. In the event that one of the transceivers should fail, the RF Module will continue to operate utilizing a single transceiver chain. Each user will effectively operate at a lower modulation and coding rate to compensate for the reduction in diversity gain.

Future releases will support additional high-availability configuration options within the Base Controller Unit (BCU) subsystem using either 1+1 or N+1 redundancy including:

- Site Controller Cards (1+1)
- Modem Cards
  - o For four sector configuration, two modem cards can be set up in a trunked configuration with each supporting two RF heads
- Optional High Stability Oscillator (HSO) - Providing up to 24 hours of operation in case of GPS signal failure
- Power supply modules (N+1)

The RF Module has also been designed with redundancy features. Redundant fiber links are supported between the RF Module and the BCU to maintain the data link in the event of damage to a given fiber connection.

## WAP 400 Access Point System Specifications

Application	Fixed and Mobile (optional)
Base Site Architecture	Active RF heads with integrated antennas and high-speed digital connections to Base Control Unit over fiber
Frequency Bands	2.3 GHz (2.300 – 2.400 GHz); 2.5 GHz (2.495 – 2.690 GHz); 3.5 GHz (3.400 – 3.600 GHz)
Channel Bandwidth	2.3 GHz: 5 or 10 MHz; 2.5 GHz: 5 or 10 MHz; 3.5 GHz: 5 or 7 MHz
Air Interface	IEEE 802.16e-2005 (S-OFDMA)
Duplex Mode	TDD
Subscriber Devices Supported	256 active subscriber devices per sector; 3000 subscriber devices across base site
Frequency Reuse	4 sector: N=2 recommended; Other configurations supported
Physical Dimensions -	
Diversity RF Module	(HxWxD): 712 x 178 x 229 mm (28" x 7" x 9"); Weight: 16 kg (35 lbs)
Control Unit	(HxWxD): 788 x 508 x 483 mm (31" x 20" x 19"); Weight: 68 kg (150 lbs)
Operating Temperature	-40°C to 55°C Outdoor and Indoor
Modulation and Coding	QPSK (coding rates of 1/2 and 3/4); 16QAM (coding rates of 1/2 and 3/4); 64 QAM (coding rates of 1/2, 2/3, 3/4, and 5/6)
Maximum Transmit Output Power	2000mW (2 x 1000mW transmit output power per antenna element)
EIRP*	49.5 dBm EIRP = 33 dBm + 16.5 dBi (Single Sector)
Power Inputs	-48 VDC, +27 VDC, 88-240 VAC
Power Consumption	1.3KW typical (4-sector base site with full redundancy configuration)
Traffic Prioritization Features	IEEE 802.1Q Layer 2 IEEE 802.1p, IPv4 Diffserv (DSCP)
QoS	Unsolicited Grant Service (UGS), Real-time Polling Service (rtPS), Extended Real-time Polling service (ertPS), Non-real-time Polling Service (nrtPS) and Best Effort (BE)
Security	EAP authentication; CCM-AES 128bit data encryption and authentication; PKMv2 key management protocol
Baseband Control Unit to RF Access Point Cabling Connection	Optical Fiber, DC Power
Wireline Interface	IEEE 802.3 (10/100/1000 Base T Ethernet)
Availability	Up to 99.995%
Regulatory Compliance	Mandatory applicable requirements. ETSI EN302 021, 753, FCC, CALEA (47 USC.1001-1010), E911 (§9.47), RoHS/WEEE, ETSI EN 302 326-2
Antenna Elements	2
Transmit / Receive Chains	2/2

\* Actual EIRP may vary as a function of government regulation and spectral mask requirements (country specific)

## Throughput & Coverage

In Broadband wireless network deployments, capacity or coverage requirements will typically determine how to dimension the network for necessary performance. For capacity-focused deployments, the operator's primary objective may be to deliver a specified average throughput to a discrete subscriber base within a focused region. For coverage-focused deployments, the operator's primary objective may be to provide a basic level of service to a broad geographic area, extending the reach of the network to address as many subscribers as possible.

The WAP 400 Access Point can be effectively deployed to address both throughput and coverage. Throughput and coverage capabilities of broadband wireless networks are highly influenced by the radio environment, the profile of data and voice traffic on the network, fixed versus mobile application, throughput requirements of subscribers, and the level of interference present at the system.

The WAP 400 Access Point is expected to deliver over 12 Mbps throughput per sector and upwards of 5 km maximum cell radius when considering Indoor Subscriber Units (operating at 2.5 GHz with 10 MHz channel bandwidth). The coverage can extend to over 20 km when Outdoor Subscriber Units (CPE0) are utilized.

## Distributed Network Architecture

A WAP 400 system is deployed based on a distributed network architecture. Capacity and coverage requirements will factor into network dimensioning to determine the initial scale of the deployment. As coverage or capacity needs grow, additional base sites can be readily deployed and seamlessly "dropped" into the distributed architecture.

Conventional cellular systems have relied on hierarchical architectures with multiple layers of control and interconnect platforms. Motorola's WiMAX systems leverage a simplified, peer-to-peer network architecture that is a flat, IP-based design in a manner similar to that of current 802.11 Wi-Fi Access Points.

Initially proposed for cellular systems, this distributed architecture was adopted by Motorola's WiMAX systems and offers full support of mobility applications.

The WiMAX distributed network architecture approach offers the following benefits:

- Seamlessly integrates wireless technology specific functionality with IP networking equipment
- Allows for the use of a common network for multiple wireless access technologies

- Enables cost-effective implementation for deployments ranging from small to large scale
- Enables the use of mobile devices
- Eliminates high-cost centralized boxes
- Enables new types of transport networks such as metro Ethernet for backhaul
- Reduces latencies due to elimination of multiple boxes
- Enables distribution of "application level" functionality such as content delivery networks

## Carrier Access Point Controller

While preserving the benefits of a distributed network architecture, the WAP 400 Access Point system also maintains a centralized platform for those functions best served by localized management. The Motorola Carrier Access Point Controller (CAP-C) provides management of key security and mobility related functions in a WAP 400 network deployment.

The CAP-C supports the following features:

- Authentication liaison between the user/device and the AAA server
- Security functions such as Local Key Distribution Function (LKDF) for delivering Authentication Keys
- Paging Controller (PC)
- QoS Policy Decision Point
- Flow admission control related to handovers
- Access Control
- Handover Decision Point
- Proxy Mobile IP Client Validation
- Context Repository (CR) function

The CAP-C is designed to support up to 1 million users on a single chassis and up to 1000 Access Points. The CAP-C is based on the ATCA platform architecture and designed to be highly scalable. The CAP-C is built upon the Motorola Embedded Communications Computing Avantis 3406 server and operates MontaVista CGL (Carrier Grade Linux) OS. The Avantis product line encompasses the hardware platform, hardware control software, middleware, and operating system environment.

A deployment of WAP 400 Access Points in conjunction with a CAP Controller forms the Access Service Network as defined in the WiMAX Forum Reference Architecture.

## QoS

The WAP 400 system utilizes five classes of QoS as defined by the IEEE 802.16e specification. The broad support of the varied scheduling classes at the MAC level enable a range of services including robust voice and data management and service level assurance.

The five QoS classes supported by Motorola are Unsolicited Grant Service (UGS), Real-time Polling Service (rtPS), Extended Real-time Polling service (ertPS), Non-real-time Polling Service (nrtPS) and Best Effort (BE)

Further enhancing the QoS capabilities of the WAP 400 system, Motorola extends the QoS capability with an end-to-end QoS framework to meet the needs of true carrier-class deployments.

Each end-user is provisioned with a set of service flows mapping to the various services offered by the operator. For example, VoIP and data services may be defined as two distinct service flows for an end-user. Both service flows could be associated with appropriate QoS related parameters including the 802.16e defined scheduling class, DiffServ CodePoint (DSCP), as well as minimum and maximum data rates. These parameters are utilized at multiple points across the network to providing proper handling of the end-to-end service.

## Security

The WAP 400 system implements 802.16e based security architecture to ensure inter-network and device compatibility and interoperability.

For over-the-air traffic, PKMv2 protocol is implemented between the device and the Access Point to carry the EAP messages. CCM-mode AES is implemented for data encryption and authentication. EAP is carried using AAA protocols (RADIUS) between the AAA proxy in the CAP Controller and the AAA server. Both device and user authentication is supported.

AAA servers are an integral part of the security infrastructure for the Diversity Access Point. The AAA framework calls for a Supplicant, Authenticator, and an Authentication Server role. The user device is the Supplicant, the CAP Controller provides the Authenticator function and the AAA server plays the Authentication Server role.

The WAP 400 solution supports standard, off-the-shelf AAA servers for ease in network design.

The WAP 400 solution is being designed to achieve a high degree of security to prevent attacks such as Denial of Service. A future release will introduce a host-based Intrusion Detection System (IDS) and a host-based firewall are into the system design. When implemented in individual network elements, the IDS

monitors system logs, critical system resources, and sensitive files, and provided immediate visibility into unauthorized access.

## Devices

Motorola's wi4 WiMAX portfolio will offer a full suite of WiMAX 802.16e-2005 compliant end-user devices. Because WiMAX standards-based technology is backed by major chipset manufacturers, WiMAX operators will benefit from significant cost reductions as deployments expand and they are able to deliver connections to a large ecosystem of WiMAX compliant devices.

Motorola's wi4 WiMAX portfolio is conformant to the 802.16e-2005 specification and will follow the certification requirements defined by the WiMAX Forum industry group. This will ensure that Motorola's WiMAX equipment and devices are capable of interoperating with equipment and devices from a broad spectrum of compliant vendors.

Motorola's suite of WiMAX devices will include:

### Outdoor Subscriber Unit (CPEo)

Intended for fixed broadband application, the Outdoor Subscriber Unit (CPEo) can be unobtrusively mounted outside a residence or business to deliver WiMAX connections via Ethernet to the indoors. The CPEo provides significant advantage in extended coverage and capacity.

### Desktop Subscriber Units (CPEi)

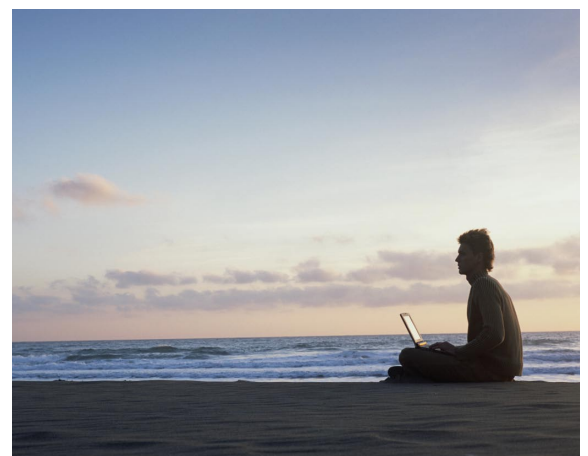
Simple, self-install devices that operate indoors to receive WiMAX signals through the building walls. A variety of CPEi units will be included in the portfolio to address varying feature sets including basic data connection, VoIP, and Wi-Fi.

### PC Card

WiMAX PC cards can be utilized to bring the WiMAX connection directly to the laptop for a truly nomadic experience

### Handsets

A suite of multimode mobile handsets featuring fashionable design will deliver cellular-like mobile performance with broadband-like data throughput.



## Backhaul

Diversity Access Point deployments will use backhaul solutions to manage the aggregate data throughputs serviced by each base site.

The WAP 400 system will support a host of wireline and wireless backhaul options. Motorola's WAP 400 Access Point sites and the Carrier Access Point Controller can be connected to an operator's existing network through simple L2, Ethernet connections. Typical implementations benefit by using Motorola's Wireless Backhaul Solutions configured in a Point-to-Point manner.

Multiple WAP 400 base sites can be paired with Motorola Wireless Backhaul Modules to direct traffic from each individual base site to a single WAP 400 base site location. There, the traffic can be aggregated and delivered to the operator's core network.

## Portal Element Management System

Motorola offers the Portal Element Management System (EMS) to address the operations and management requirements of WiMAX deployments. Motorola Portal EMS leverages Motorola's extensive experience in managing wireless broadband networks. Portal EMS was developed to address Motorola's WiMAX portfolio of infrastructure and devices.

Portal EMS is designed on a highly flexible and scalable platform to meet an operator's provisioning and management requirements today as well as grow to meet the needs of an expanded network tomorrow.

Portal EMS can be integrated with other OSS systems using 3GPP/3GPP2 defined north-bound interfaces (NBI). The Portal EMS functional elements can be distributed across multiple servers. Table 3 highlights key platform specifications for Portal EMS and table 4 highlights key features & benefits.

Portal EMS provides functional and operational features designed to increase system availability, improve service levels, and simplify provisioning and management of network operations.

Some of the key innovations of the Portal EMS include

- Actionable alarms and incidents
- Dashboards
- Wizards and wizard templates
- Incident and consolidated information reports

## Portal EMS Platform Specifications

Environment	
Hardware platform:	Intel based PC
OS:	Windows 2003 Server or Windows XP Professional
Software:	Java™ Runtime Environment
Capacity	
	Up to 500 WiMAX base sites
	Up to 100,000 subscriber devices
	2 Carrier Access Point Controllers
Interface to Network Elements	
	XML flat files
	SNMPv3
	Secure FTP
	HTTP/HTTPS
NBI	
	SNMPv1
User Interfaces	
	Web access to EMS (local and remote)
	Local EMS applications for security management

## Portal EMS Features & Benefits

Features	Benefits
<b>Fault Management</b>	
<ul style="list-style-type: none"> <li>• Real-time alarm viewer and alarm management</li> <li>• Event logging</li> <li>• E-mail event notifications</li> <li>• Network Element availability reporting</li> <li>• Network Element diagnostics</li> </ul>	<ul style="list-style-type: none"> <li>• Reduces the number of maintenance dispatches</li> <li>• Provides targeted issue identification lowering resolution time</li> </ul>
<b>Configuration Management</b>	
<ul style="list-style-type: none"> <li>• Software and configuration distribution</li> <li>• Configuration reports</li> <li>• Inventory data</li> <li>• Auto discovery and configuration</li> </ul>	<ul style="list-style-type: none"> <li>• Simplified provisioning of new network elements and devices</li> <li>• Improved service reliability by managing effective installations and automated product updates</li> </ul>
<b>Performance Management</b>	
<ul style="list-style-type: none"> <li>• Historical statistics retrieve and processing</li> <li>• Real-time and historical statistics display</li> <li>• Statistics storage</li> </ul>	<ul style="list-style-type: none"> <li>• Improved service availability through monitoring of network performance and trends to identify issues early</li> </ul>
<b>Security Management</b>	
<ul style="list-style-type: none"> <li>• EMS access control</li> <li>• Security logging</li> </ul>	<ul style="list-style-type: none"> <li>• Safeguards the network and ensures appropriate levels of security</li> </ul>



## WAP 400 Feature Set

The following is a list of high-level features supported by the WAP 400 Access Point architecture:

- Fixed and nomadic application
- Full mobility support (up to 120 km/hr) to be introduced via software update in future system release
- Compliant to IEEE 802.16e specifications
- Multi-band and multi-frequency support
  - 2.3 GHz band with 5 MHz and 10 MHz channel bandwidth
  - 2.5 GHz band with 5 MHz and 10 MHz channel bandwidth
  - 3.5 GHz band with 5 MHz and 7 MHz channel bandwidth
  - Other band class under consideration
- WAP 400 design features
  - Trunked modems
  - 4-sector support
  - MIMO ready system
  - Diversity antenna schemes
- Physical layer
  - Partially Used Sub-Channeling (PUSC)
  - Adaptive modulation up 64 QAM downlink & 16 QAM uplink
- MAC layer
  - Compressed MAP
  - HARQ
  - Channel sounding
  - QoS support
  - Encryption
  - IPv4 CS (IPv6 planned)
  - PHS, RoHC
- EAP support
- Security key distribution
- AAA authentication
- Mobile IP proxy MIP function (future system release)
- SNMPv3
- IPSec
- Firewall, IDS (future system release)
- Sleep & idle modes (future system release)
- L2 and L3 handovers with roaming support (future system release)
- High availability
- IMS integration
- Network management options

## IMS Based Features & Services

The IP Multimedia Subsystem (IMS) represents an evolved vision of the carrier class all-IP core network and is a significant component of Motorola's network evolution strategy. Motorola IMS unleashes the true potential of packet-based broadband networks.

The WAP 400 system combined with the Motorola IMS solution can provide a compelling array of features and applications further enhancing the service to the end user.

These services may include, but are not limited to the following:

- VoIP
- Seamless Mobility (WiFi/Cellular)
- Seamless Mobility (Common Service Profile)
- Presence
- Common Address Book
- Location
- Video Call
- Video Streaming (e.g. Advertising, TV, VOD)
- Audio Streaming (e.g. Advertising, Radio, MOD)
- Audio/Video File Download
- Machine to Machine Solutions (e.g. Vending Machines)
- Prepaid Push To X (Talk, View, Video)
- Instant Messaging (Picture or Video Component)
- Instant Voice Message
- Unified Messaging
- Text Messaging (Alerts, Notifications)
- Conferencing (Audio/Video)
- Find Me/Follow Me
- Multi-Player Gaming
- IVR
- Ring Back Tones



## Summary

The WAP 400 Access Point solution featuring diversity antenna techniques addresses the market need for cost-effective, high-performing, broadband wireless access solutions. Based on 802.16e-2005 technology, the WAP 400 solution will allow operators to service their fixed and mobile broadband wireless requirements.

Motorola is uniquely positioned to address the wireless broadband market through the MOTOwi4™ vision. Motorola has aligned its business units and roadmaps to provide a comprehensive, end-to-end solution covering all aspects of the broadband wireless access deployment. With our deep and extensive patent portfolio, over a decade of R&D investment, and our experience as a global supplier of broadband wireless access solutions, Motorola is primed to deliver its best-of-breed WiMAX solutions.

With the advancement of wireless broadband, we have the opportunity to further advance our service to the end-user – from basic connections in unserved regions to high-speed, mobile access in dense metro markets. Motorola offers operators a means to truly transform the end-user experience.



**MOTOROLA**

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