mēa

Setup and Installation Guide

Version 3.0

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Foreword

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Section 1 - Overview

Introduction

The MEA wireless broadband system allows a network operator to deploy a wireless, multi-hopping ad hoc network. This document describes how to setup, configure, and deploy a MEA system to operate in infrastructure mode.

The MEA system is designed for easy installation. The infrastructure components of a MEA system are preinstalled with a default configuration for connection to a wired network. Any configuration items described in this document are for site-specific information.

MeshNetworks recommends that the Network Operator receive setup and deployment training at MeshNetworks' facility prior to deploying the MEA network. MeshNetworks may optionally provide the Network Operator assistance with site surveys and deployment.

Note: The MEA MWR6300 Wireless Routers and IAP6300 Intelligent Access Points require professional installation to ensure the installation is performed in accordance with FCC licensing regulations.

Documentation Overview

The MEA Setup and Deployment User's Guide is arranged in the following sections:

Section 1 - Overview provides an overview of the MEA Starter Kit and the organization of the User's Guide.

Section 2 – Description of the MEA System provides a general overview of a complete MEA Network.

Section 3 - Starter Kit Setup and Deployment provides installation and configuration information for the Subscriber Device, Wireless Router, Intelligent Access Point, and the MiSC.

Section 4 - MAC Address Tables provides three convenient tables to record network configuration data.

Section 5 – Site Selection Guidelines provides deployment and installation suggestions.

Section 6 - The Customer Service Information section provides contact information if you need assistance with your MEA Starter Kit.

Section 7 - License and Warranty Information contains MeshNetworks' License Agreement and Warranty for the MEA products.

Section 8 - FCC Regulatory Information provides important warnings and safety information.

Acronyms

HAS	Hardware Authentication Server
IAP	Intelligent Access Point
MEA	Mesh Enabled Architecture
MiSC	Mobile Internet Switching Controller
SD	Subscriber Device (a host device with a WMC6300 installed and operational)
WMC	Wireless Modem Card
WR	Wireless Router
PWR	Portable Wireless Router
VMM	Vehicle Wireless Router
EWR	Enhanced Wireless Router

Related Documentation

MEA WMC6300 Wireless Modem Card User's Guide for Windows 2000

MEA WMC6300 Wireless Modem Card User's Guide for Windows XP

MeshView Administration Tool User's Guide

MeshManager User's Guide

MeshFlash User's Guide

Location Analyzer Deployment Tool User's Guide

Section 2 - Description of the MEA System

Introduction

MeshNetworks develops Mobile Broadband communications systems with ad hoc architectures. That is, each node can connect directly, or indirectly (by hopping through other nodes), with any other node in the network. The peer-to-peer nature of the ad hoc architecture combined with data rate control in each subscriber and infrastructure node in the network insures reliable delivery while providing increased network capacity through geographic reuse of the frequency spectrum.

The network is comprised of following distinct elements:

- Subscriber Devices (SDs) and Vehicle Mounted Modems (VMMs)
- Wireless Routers (WRs), Enhanced Wireless Routers (EWRs) and Portable Wireless Routers (PWRs)
- Intelligent Access Points (IAPs)
- Mobile Internet Switching Controllers (MiSCs)

Additional SD and infrastructure components are described separately.

The overwhelming portion of the value that MeshNetworks provides is in the Wireless Modem Card (WMC). The WMC functionality is used in Subscriber Devices as well as in the Wireless Router and Intelligent Access Point (IAP), both of which are types of infrastructure equipment. MeshNetworks provides a Mobile Internet Switching Controller (MiSC) which is assembled from industry standard equipment and conforms to industry standards. MeshNetworks also provides the network applications, which are required for proper operation and value extraction from the MEA mobile Internet system.

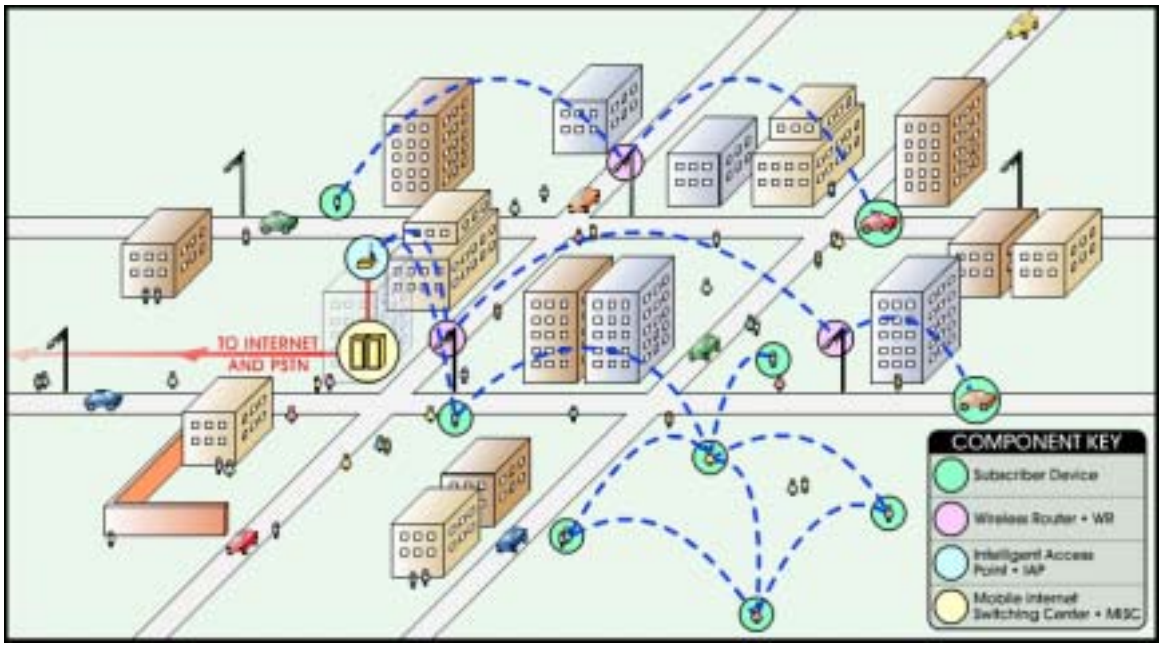


Figure 1. Elements of the MEA System

All network elements are designed to support mobile applications. Subscriber Devices can be either mobile or fixed, while the remaining components are typically fixed. Wireless Routers and IAPs can be mounted on utility poles, light poles, traffic apparatus, billboards, and buildings. Their fixed positions allow the Subscriber Device to pinpoint its location within one second. WRs and IAPs can also be mobile, attached to emergency vehicles, utility vehicles, or fleet vehicles. It is important to note that the WMC technology within a Subscriber Device is identical to the WMC technology in Wireless Routers and IAPs.

The MEA system was designed to minimize the cost associated with deploying a broadband mobile network with end user data access rates on the order of DSL or Cable Modem. The chosen metric of network efficiency for a data centric network is bits per second per Hertz per square kilometer per dollar (bps/hz/km^2/$). This metric balances the user data rates, allocated bandwidth, coverage area, and cost.

Subscriber Devices (SDs)

The MeshNetworks' Wireless Modem Card (WMC) is provided as a PCMCIA form factor device. The WMC is used with an off-the-shelf IP-enabled laptop computer or PDA. These two devices together make up a Subscriber Device (SD).

The WMC provides access to the fixed infrastructure network and other networks, such as the Internet, and it can also function as a Wireless Router and repeater for other SDs.

SDs can therefore be a key part of the network infrastructure. Adding subscribers can effectively increase the number of Wireless Routers in the network, which increases the number of alternative paths that subscribers may utilize. This can reduce both the time and cost to deploy network infrastructure, while also increasing the spectral efficiency and therefore the capacity of the network. In addition, because SDs can also operate in an ad hoc peer-to-peer mode, two or more SDs can form a network without the need for any fixed infrastructure.

Wireless Routers (WRs)

The Wireless Router (WR) is a low-cost small-sized wireless device that is primarily deployed to seed a geographical area, extending the range between IAPs and subscribers, and to simultaneously increase the network's spectral efficiency. Wireless Routers provide a number of functions in the network, such as:

- Range Extension for Subscriber Devices and IAPs
- Automatic Load Balancing
- Route Selection
- Network capacity optimization through small packet consolidation
- Fixed reference for geo-location services

The Wireless Router's small size and light weight allow it to be mounted almost anywhere. No towers are required. WR software can be updated via over-the-air downloads.

Intelligent Access Points (IAPs)

The Intelligent Access Point (IAP) is a low-cost, small device that acts as the transition point from the wireless network to the wired core network and from there, through media gateways, out to the Internet. Each IAP offers up to 6 Mbps burst data rate to subscribers. IAPs support the 10/100 base-T Ethernet interface. Other interfaces are supported through commercially available media translation devices. If additional network capacity is required, more IAPs can be easily deployed - without the need for extensive RF or site planning. IAPs provide functions such as:

- Local mobility management of SDs
- Fixed reference for geo-location services
- Hopping points for subscriber peer-to-peer networking
- Transition point from the wireless to the wired portions of the network
- Route Selection

The IAP's small size and lightweight allow it to be mounted anywhere power and network connectivity is available. No towers are required. The IAP software can be updated via over-the-wire downloads.

VMM6300 - Vehicle Mounted Modem

Compact and ruggedly designed, the MeshNetworks Vehicle Mounted Modem (VMM) turns a vehicle into a mobile office. Mobile Data Terminals (MDT), IP video cameras, and other IP ready devices can access a high-speed, mobile broadband network via a standard RJ45 Ethernet Port. This low cost, high performance, wireless modem supports up to 6 Mbps burst data rates at speeds of over 100 mph.

The VMM provides high bandwidth access to mission-critical information on the move. Remote database inquiries, on-scene report submission, multi-megabyte file transfers and live video streams will make field personnel more efficient. The VMM also supports real-time position location without relying on GPS.

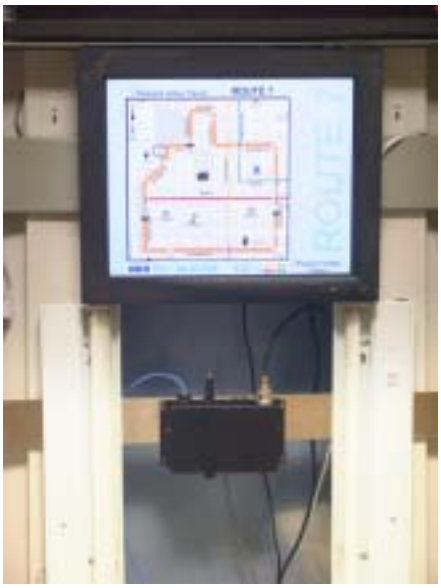
Like all MEA products, the VMM acts as a wireless router/repeater – automatically extending the range, robustness and performance of the wireless network.

EWR6300 - Enhanced Wireless Router

The Enhanced Wireless Router (EWR) is deployed to guarantee wireless coverage in large geographic areas while providing wireless network access to one or more IP devices via its built-in RJ45 Ethernet port. The EWR efficiently combines the functionality of a MeshNetworks Wireless Router and client modem in a single, cost-effective, wireless network component. This makes it easy for any Ethernet ready device to access a Mesh-Enabled Architecture (MEA) mobile broadband network. Computers, IP video cameras (as pictured at right), sensors, signs, signals, etc. can all be Mesh-Enabled to send and receive data at burst rates of up to 6 Mbps. All of the standard Wireless Router functionality, including Multi-Hopping, non-line-of-sight communications and position location services, is fully supported. EWRs also provide:

- Range extension between clients an IAPs
- Fixed reference points between clients and IAPs
- Up to three assignable IP addresses

PWR6300 Portable Wireless Router



The PWR6300 Portable Wireless Router (PWR) has the same functionality as the EWR, but in a smaller form factor like the VMM. It combines the functionality of a Wireless Router and the Wireless Modem Card into a single device. By adding an Ethernet port to a Wireless Router, MeshNetworks enables video cameras, computers or any other Ethernet-capable device to get high-speed access to the MEA wireless broadband network, without the need to purchase a separate Wireless Modem Card. The PWR also provides the same functionality as the MWR, including network routing, Multi-Hopping™ and geo-location services.

- Range extension between clients an IAPs
- Fixed reference points between clients and IAPs
- Up to three assignable IP addresses

Mobile Internet Switching Controller (MiSC)

The Mobile Internet Switching Controller (MiSC) provides connectivity between the IAPs and the wired world, and hosts the network's management and provisioning functions. The MiSC is composed of off-the-shelf hardware components, such as LAN routers and application servers. MiSC software consists of both off-the-shelf and MeshNetworks' proprietary software, MeshManager. The MeshManager software provides functions for the network such as:

- Subscriber Provisioning, Management, and Authentication
- Configuration and Fault Management
- Network Monitoring and Reporting

Operational View of the MEA System

Figure 2 shows the different ways a subscriber can reach an IAP. It can connect directly, or hop through any number or combination of WRs and SDs. Additionally, if the subscriber wishes to execute a peer-to-peer application such as a file transfer, the subscriber can communicate directly, or through any combination of SDs, WRs, and IAPs.

The ability to use ad hoc routing to forward traffic improves the scalability of the mobile wireless network. In particular, the ability for the user to accomplish a peer-to-peer application without the use of infrastructure has tremendous advantages.

A significant problem in every mobile wireless network is backhaul. The MEA architecture provides the ability to route traffic from applications through SDs and WRs without ever reaching an IAP or the wired network. This reduces the amount of backhaul required by enabling the SDs to accomplish the backhaul whenever the opportunity arises. In turn, this results in lower deployment costs, reduced backhaul, and lower operating expenditures. The service provider can provide the same level of service with less equipment by empowering the SDs with ad hoc networking capability.

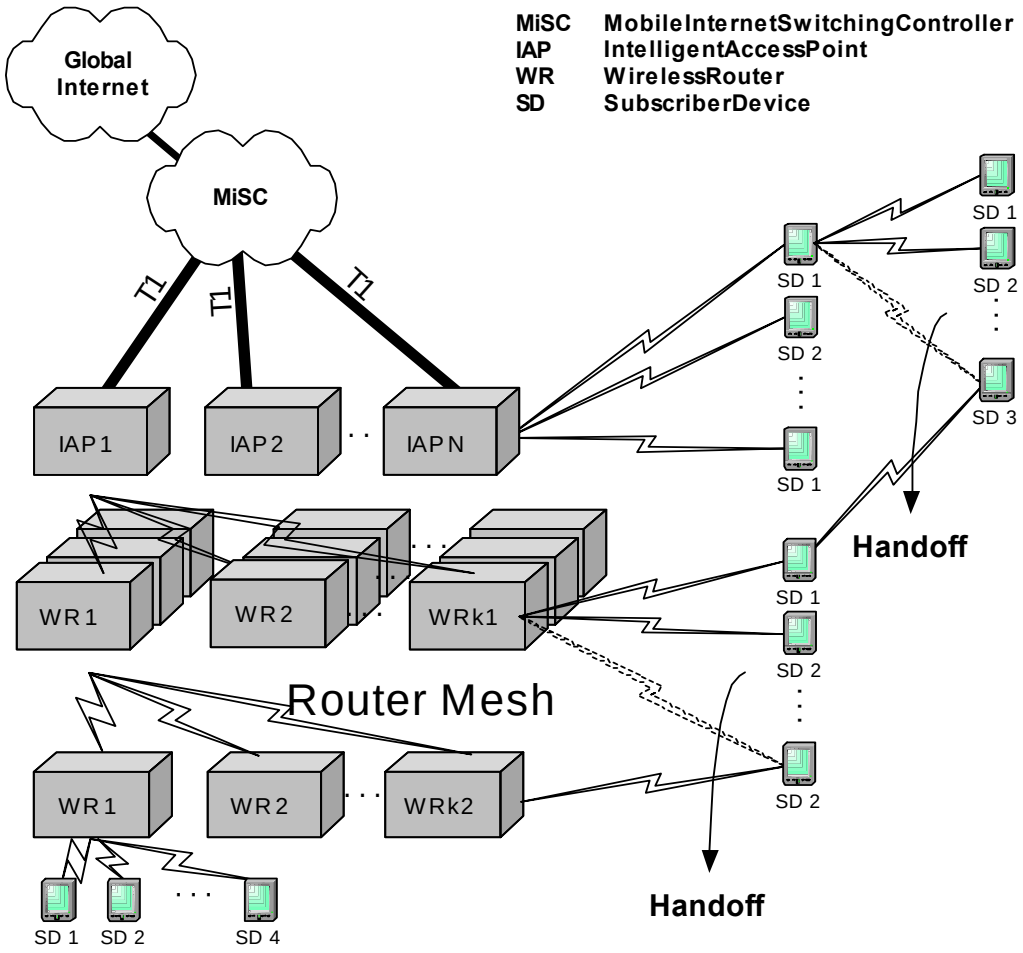


Figure 2. Operational View of the MEA System

Network Architecture

The basic MEA network utilizes two subnets, one for the MEA wireless elements and one for the server elements. For seamless IAP mobility, all of the MEA wireless elements must be in the same subnet. The subnets are connected together by the core router, and the edge router provides Internet connectivity.

Figure 3 shows the logical network layout of a MEA network.

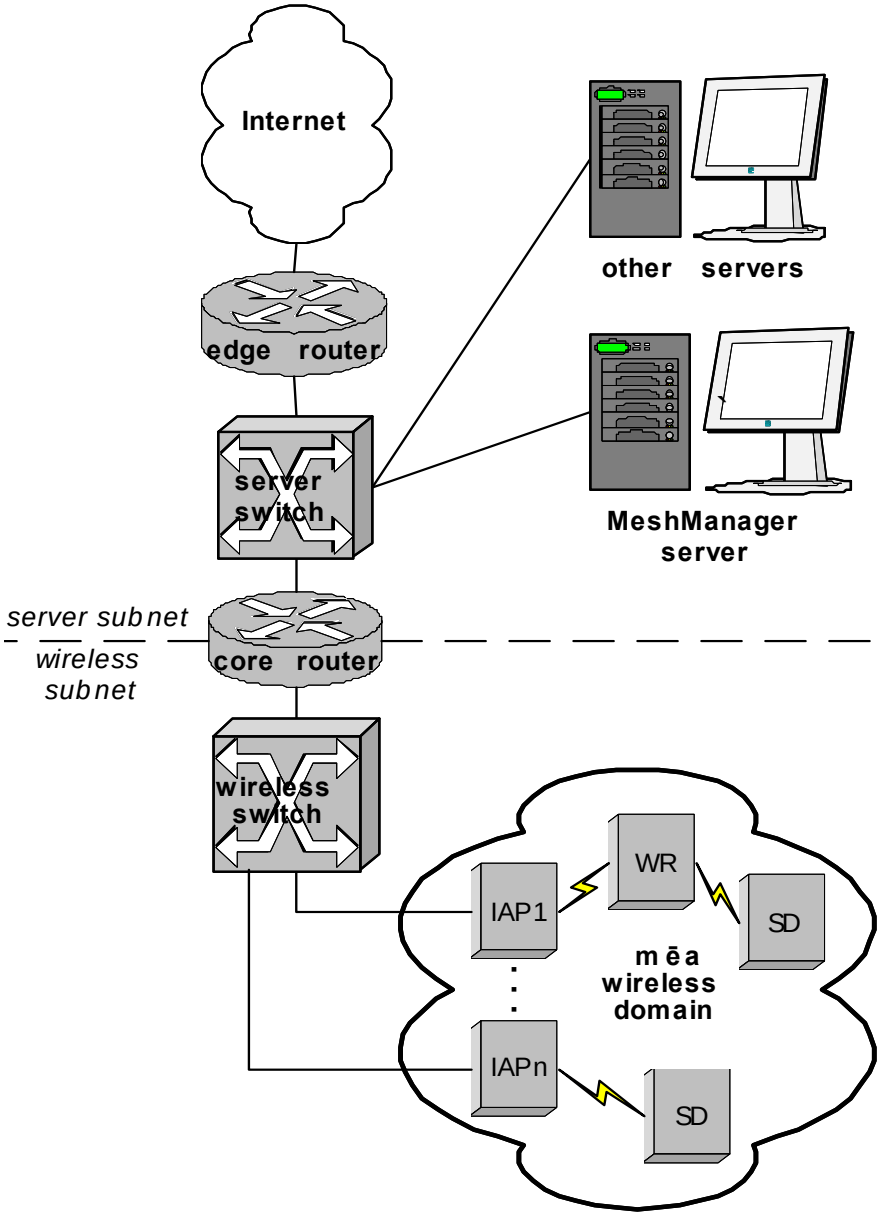


Figure 3. MEA Network Architecture

Unified Modes of Operation

With MEA Release 3.0, the concept of modes has been replaced by unified modes of operation addressing scheme. The concept of unified modes of operation centers on the current state of network communication: Associated State and Unassociated State. There are three addressing schemes that allow the IT manager increased flexibility in deployment.

Network DHCP Scheme

Operation under the *Network DHCP* scheme is similar to that of MEARelease 2 in *Infrastructure Mode*. The primary difference is that users are now allowed to temporarily wander outside the network infrastructure without losing connectivity.

Network DCHP requires that the user's host device be configured to request an address from a DHCP server and the inclusion of a DHCP server in the core network configuration to answer these requests. With Network DHCP selected, the network device will forward any DHCP requests to the core network once it becomes associated and establishes communications with the infrastructure.

The server may be configured by the operator to hand out temporary or static leases. The user must associate and acquire an address from the network before establishing communications. Once a lease has been granted, the address may be *dragged* out of network coverage for the remainder of the lease or, if a static lease was granted, until the next power cycle. If the lease expires or the user cycles power while outside of network coverage, the user will again lose the ability to communicate.

This scheme is best for a larger, closely managed network of subscribers who don't need to communicate, or communicate only briefly, outside of network coverage.

Statically Provisioned Scheme

Operation under the *Statically Provisioned* scheme is similar to that of MEA Release 2 in *Peer-to-Peer Mode*. The primary difference is that addresses are configured by the network operator rather than hashed from the MAC address. This serves to eliminate the 10.x.x.x limitation on the network range.

When operating under the Statically Provisioned scheme, the network device will accept DHCP requests from the user's host and internally generate responses to grant the host an IP address and assign any other provisioned options.

This scheme requires that the host be configured to request an address from a DHCP server but does *not* require a DHCP server on the core network.

It should be noted that a DHCP server can still exist on the network to hand out addresses to other nodes using the Network DHCP Scheme as long as the server's address range does not conflict with addresses assigned to devices using the Statically Provisioned or User Supplied Schemes.

The granted IP addresses granted by the server and options are configurable per-device using MeshManager. The internally generated DHCP messages will assign the host a static lease to the provisioned address, which may be freely used to communicate while associated or unassociated.

The operator must ensure that the provisioned addresses are routable and do not conflict with any other addresses in use. The operator is free to provision any option ordinarily provisioned by a DHCP server (subnet mask, DNS, etc.) through programming of the appropriate fields in each device using MeshManager.

This scheme is ideal for a managed network of users who regularly need to communicate inside and outside of network coverage or for a network lacking a DHCP server.

User Supplied Scheme

Operating under the *User Supplied* scheme, the user's host device is configured to use a *fixed*

IP address and subnet mask. The user is responsible for configuring options that would otherwise be configured by a DHCP server.

It is also up to the user to ensure that the assigned address is routable on the core network (if core network access is needed) and that it does not conflict with other addresses in use. This is analogous to and carries the same caveats as plugging an Ethernet card into a LAN and manually assigning an address to the card.

The user is free to communicate while associated or unassociated. This scheme is ideal for small, unmanaged networks lacking a DHCP server.

All of these schemes may be assigned per device, either by the user or by the network manager. The network manager can also limit the user-selectable schemes or force a specific scheme. Devices in each of these schemes can interoperate and communicate with each other, so long as the assigned addresses do not conflict and are mutually routable.

Setting the User Supplied IP Address

To setup the addressing for the User Supplied Scheme, first obtain a valid IP address from your Network Administrator. This is the IP address to be entered in the IP Address box on the Internet Protocol (TCP/IP) Properties dialog General tab.

From the **Start** menu, select **Settings → Control Panel**. Double click on the Network and Dial-up Connections icon.

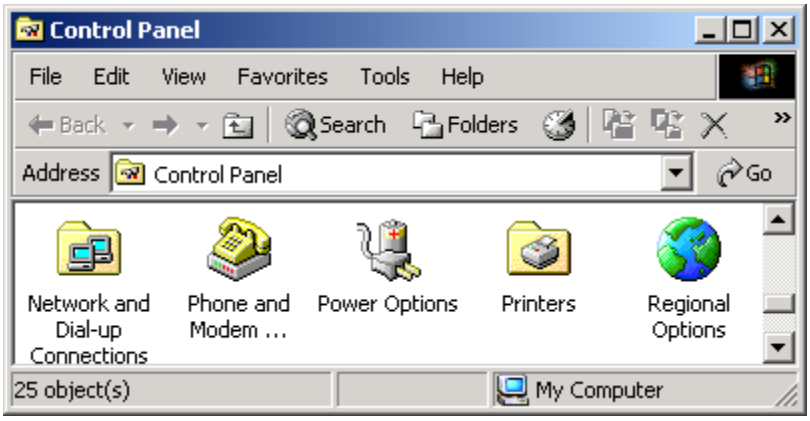


Figure 4. Control Panel – Network and Dial-up Connections Icon

The *Network and Dial-up Connections* window will be displayed. Double click on the *Local Area Connection* icon.

Figure 5. Network and Dial-up Connections Window

On the *Local Area Connection Properties* dialog, click to select *Internet Protocol (TCP/IP)* then click on the **Properties** button.

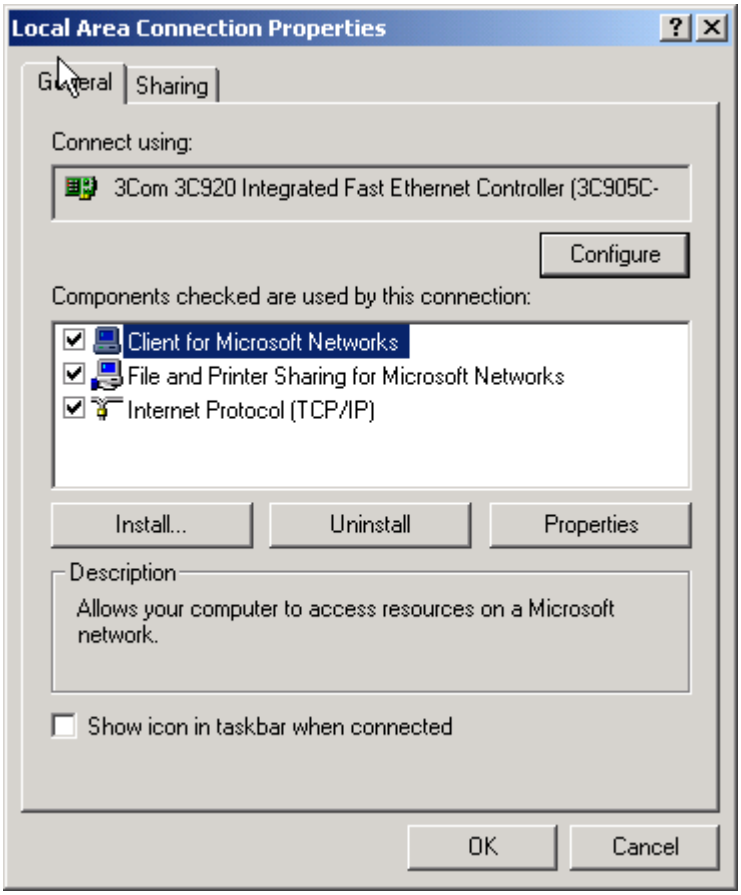


Figure 6. Local Area Connection Properties Dialog Box

The *Internet Protocol (TCP/IP) Properties* dialog box will be displayed.

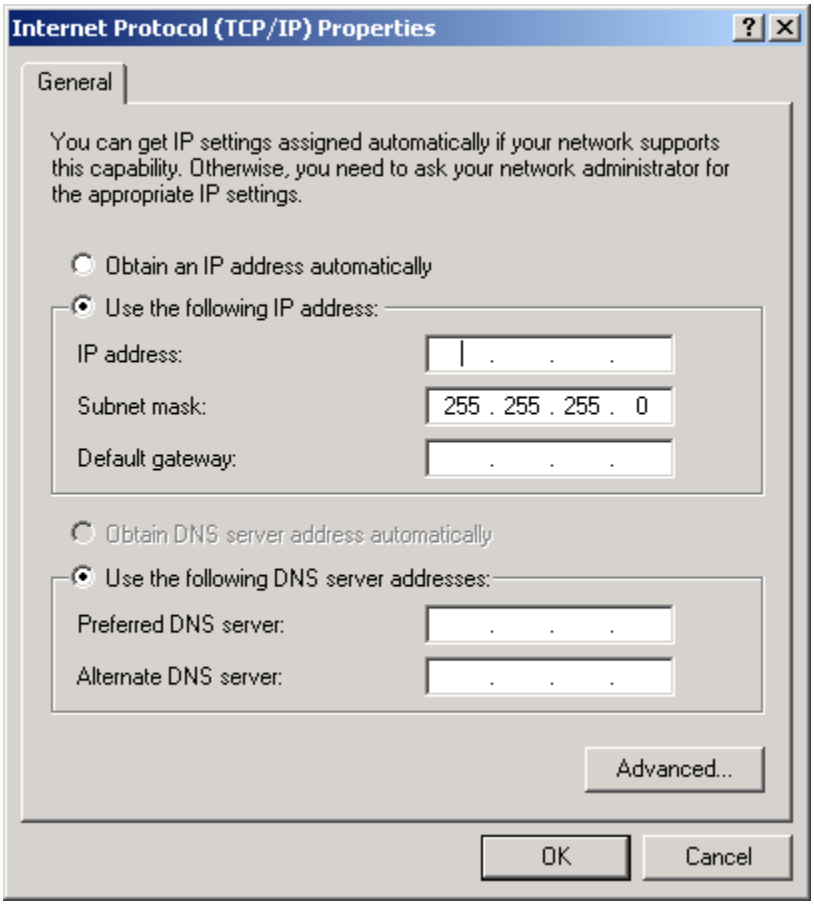


Figure 7. Internet Protocol (TCP/IP) Properties Dialog Box

With the *Use the following IP address:* radio button selected, enter the IP address supplied by the Network Administrator in the *IP Address:* box. Double click in the *Subnet Mask:* box to set the default subnt mask. The *Default gateway:* and the DNS server addresses should have already been set by the Network Administrator. Click on the **OK** button to accept the changes and dismiss the dialog box.

Quality of Service (QoS) and User Priority Features

The MeshNetworks MEA system offers lower throughput than typical wired network systems. As a result, it may be necessary to regulate traffic flows over the wireless portion of the network so that interactive data flows and bulk data flows can be provided the proper levels of latency and reliability. The required level of regulation is provided by the *Quality of Service* (QoS) feature of the MEA system.

It may also be necessary to provide certain nodes higher priority access to the wireless network for all of their traffic, such as in emergency or tiered service systems. This functionality is provided by the *User Priority* feature.

Both QoS and User Priority deal with prioritization and shaping of packet traffic, are incorporated into the MEA system design as a single design feature. QoS allows a traffic generator to request special handling for enhanced throughput or reliability versus the standard

best effort traffic. User Priority allows a user to request that traffic to/from a node be given preferential treatment. The resulting priority order is reflective of queuing order.

Quality of Service

The primary objective for QoS is to provide the capability of differentiating traffic classes. The QoS provision will be implemented on a per-hop basis without explicit end-to-end QoS management.

Three main QoS functionalities have been implemented:

1) Packet classification
2) Prioritized channel access
3) Priority queue management with rate limiting

User Priority

The User Priority service can be provisioned per-node for use with tiered service and emergency access systems. This priority feature is unique to the MEA network and only exists between endpoints within the MEA network or between a MEA network node and the ingress/egress node on the MEA network.

Nodes outside of the MEA Core LAN cannot request a particular priority for transmitted or received traffic. Any traffic into the MEA network needing prioritization must be prioritized at the ingress access point or router. Any traffic out of the MEA network will lose its priority assignment at the egress.

MEA wireless traffic will carry priorities attached to each packet. The MeshAPI can be used to tune the default priority of the local node

There is also an optional *Emergency* mode for use by special applications. The priority for use in emergency mode is separately provisioned and must be explicitly enabled per node by the network operator.

Section 3 - Setup and Installation

Subscriber Device (SD)

A Subscriber Device consists of both a Wireless Modem Card (WMC6300) and an End User provided host device such as a notebook computer. The WMC6300 is designed for insertion into an industry-standard Type II PCMCIA card slot located in a Host device. The WMC6300 has an antenna port to connect the external antenna and two LED Indicators. The Red LED is the transmit indicator and the Green LED is the receive indicator as shown in Figure 8.

Equipment

The following list defines the MEA hardware components required to setup the WMC6300:

- WMC6300 Wireless Modem Card
- Antenna with a MMCX connector
- WMC6300 Software and Documentation CD for Windows 2000™ and Windows XP™

Equipment that must be supplied by the End User includes the following:

- Notebook PCs running the Microsoft Windows 2000 (service pack 3) or Windows XP (service pack 1) Operating System

Record MAC Address of the WMC6300

The transceiver MAC address is recorded on the back of the WMC6300 cards. Record this number in *Section 4 - MAC Address Tables*, as it will be required later to configure and test the device.

Figure 8. WMC6300 Antenna Port and LED Indicators

Loading and Verifying WMC6300 Software

The MEA WMC6300 Software and Documentation CD contains the MEA drivers and MeshTray software for use on the End User's equipment. Please review the instructions for each

operating system as there is a different sequence of events depending on the operating system. Detailed instructions can be found in the WMC6300 User's Guide for each operating system.

In addition, the MEA Administration Software and Documentation CD includes installation software to load the MeshView Administration Tool. MeshView may be installed as an option on a subscriber device to assist the Network Operator with network deployment. Refer to the MEA MeshView Administration Tool User's Guide for additional information on this application.

Installing the WMC6300 Software for Windows XP

The MEA WMC6300 Wireless Modem Card User's Guide for Windows XP provides complete step-by-step instructions for use during the installation and configuration of the WMC6300. The following is an abbreviated version of the installation process.

Note: Please install the MEA Software **after** you insert the WMC6300 card. .

Complete the following procedure to install the WMC6300 software and drivers:

1. Insert the antenna into the WMC6300 card.
2. Insert the WMC6300 card into the computer.
3. Click the **Cancel** button for the 2 *Found New Hardware* windows.
4. Insert the WMC6300 Software and Documentation CD into the computer's CD-ROM drive.
5. Start driver install by clicking on d:\software\meaclientinstall.exe (where "d" is the CD-ROM drive)
6. The MEA Setup program will be displayed. Click the **OK** button.
7. Click the **Next** button to continue the software installation process.
8. Follow the onscreen prompts to complete the software installation process.

Installing the MeshView Administration Tool

Complete the following procedure to install MeshView:

1. Insert the MEA Administration Software and Documentation CD into the CD-ROM drive.
2. Click the Windows **Start** menu. Click on **Run** and enter **d:setupmv.exe** in the textbox (Note: **d** is the letter of the CD-ROM drive). Click the **OK** button to continue the installation process.
3. Follow onscreen prompts to complete the installation process.

DNS Server Configuration

The DNS server IP address is automatically supplied to the Subscriber Device upon successfully connecting to the Network. If there are problems with resolving web URLs, the DNS address can also be manually configured. The Network Operator must supply the DNS IP address for the Internet connection.

Instructions to setup a Windows 2000 Host:

1. Start/Settings/Network and Dial-up Connections/Local Area Connection (choose the Local Area Connection Corresponding to the Wireless Modem Card)
2. Click on the **Properties** button.

3. Highlight **Internet Protocol (TCP/IP)** in the Components window.
4. Click on the **Properties** button.
5. Click on the **Advanced** button.
6. Click on the **DNS** tab
7. Click on the DNS **Add** button.
8. Enter the *DNS Server IP Address* provided by the network administrator and then click the **Add** button.
9. Click the **OK** button to close the Advanced TCP/IP Settings windows.
10. Click the **OK** button to close the Internet Protocol (TCP/IP) Properties windows.
11. Click the **OK** button to close the Local Area Connection Properties windows.
12. Click the **Close** button to close the Local Area Connection Status window.

This configuration should remain in the Windows 2000 host.

Instructions to setup a Windows XP host:

1. Click on Start/Control Panel/Network and Dial-up Connections/Local Area Connection
2. Right click on the Local Area Connection Corresponding to the Wireless Modem Card and select **Properties** from the pop up menu.
3. Highlight **Internet Protocol (TCP/IP)** in the Components window.
4. Click on the **Properties** button.
5. Click on the **Advanced** button.
6. Click on the **DNS** tab
7. Click on the DNS **Add** button.
8. Enter the *DNS Server IP Address* provided by the network administrator and then click the **Add** button.
9. Click the **OK** button to close the Advanced TCP/IP Settings windows.
10. Click the **OK** button to close the Internet Protocol (TCP/IP) Properties windows.
11. Click the **OK** button to close the Local Area Connection Properties windows.
12. Click the **Close** button to close the Local Area Connection Status window.
13. This configuration should remain in the Windows XP host.

Installing the WMC6300 Software for Windows 2000

The MEA WMC6300 Wireless Modem Card User's Guide for Windows 2000 provides complete step-by-step instructions for use during the installation and configuration of the WMC6300. The following is an abbreviated version of the installation process.

Note: Please install the MEA Software **before** you insert the WMC6300 card.

Complete the following procedure to install the WMC6300 software and drivers:

1. Insert the WMC6300 Software and Documentation CD into the computer's CD-ROM drive.

2. Start driver install by clicking on d:\software\meaclientinstall.exe (where “d” is the CD-ROM drive)
3. The MEA Setup program will be displayed. Click the **OK** button.
4. Click the **Next** button to continue the software installation process.
5. Follow the onscreen prompts to complete the installation process.
6. Insert the antenna into the WMC6300 card.
7. Insert theWMC6300 card into the PCMCIA slot of the host computer.

If MeshView is desired, insert the MEA Administration Software and Documentation CD, open the Windows **Start** menu, click on **Run**, and then type **d:\software\meamvsetup.exe** (where **d** is the letter of the CD-ROM drive) and click the **OK** button. Follow onscreen prompts to complete the installation process.

Testing

When the WMC6300 is inserted, you should receive an audible indicator that the device has been recognized. (If there was a problem with the driver installation, Windows will prompt you for a new device installation.)

Using MeshTray, select the **Configuration** tab, and then configure the WMC6300 address scheme to be “User Supplied”.

Click on the Windows **Start** button and select **Run** from the popup menu. Enter the command **ipconfig** in the textbox and click on the **OK** button to check your IP address. If an IP address in the range of **10.x.y.2** is displayed, the transceiver is working properly. Using MeshTray, reset the WMC6300 back to addressing scheme used to deploy the network.

Intelligent Access Point (IAP)

The IAP is an infrastructure device that is positioned at a fixed location such as a building rooftop. The IAP6300 requires professional installation to ensure that the installation is performed in accordance with FCC licensing regulations.

The principle function of the IAP is to provide the Subscriber Devices in the coverage area of the IAP access to wired services. The IAP also provides a fixed location reference for Geo-Location, provides wireless routing for units in the IAPs coverage area, and is the principal network management interface to associated Wireless Routers and Subscriber Devices.

The MEA IAP provides a mounting bracket designed to be attached to a pole. For a MEA deployment, a permanent power source for each IAP must be provided. The standard IAP requires AC power, however there is an optional configuration for DC power. The RJ-45 weatherproof plug can be terminated in the field, allowing custom lengths to be assembled quickly on site.

Equipment

The following list defines the standard MEA hardware components for the IAP:

- IAP Box with N-type Female Antenna Connector
- 120V A/C Power Cable with a NEMA 5-15 plug
- Antenna with N-type Male Antenna Connector

- Weatherproof RJ-45 Connector
- Mounting Bracket

The Network Operator must supply the following:

- Mounting Location
- Power Source (120V A/C or 5V D/C, depending on IAP configuration)
- Ethernet connection between the IAP and the MiSC
- Hand tools for bracket installation (7/16 wrench (2), Phillips screwdriver)

Optional Equipment:

- DC powered IAP (IAP6300-DC-IN)
- Power cord to connect to a photoelectric cell

Optional FCC Approved Antennas:

Manufacturer	**Part Number**	**Gain**	**Usage**
Maxrad	MFB24008	8 dBi	Infrastructure
Maxrad	MFB24004	4 dBi	Infrastructure
Hyperlink	HG2409U	8 dBi	Infrastructure
Centurion	WCR2400MMCX	2 dBi	Laptop/PDA
Centurion	WCR2400MMCX12	1 dBi	Laptop/PDA
Maxrad	BMMG2400ML195MSMA	0 dBi	Mobile
Antenex	TRA24003	3 dBi	Mobile

Record MAC Address of the IAP

The transceiver MAC address is recorded on a label located on the antenna end of the IAP as shown in Figure 9. Record this number in ***Section 4 - MAC Address Tables***, because it will be required later to configure and test the device. Both SBC ETH and XCVR MAC addresses should be recorded.

Figure 9 IAP6300 Identification Label

IAP Assembly

The Figure 10 shows the external connection points on an IAP6300 box. Figure 11 show the mounting bracket.

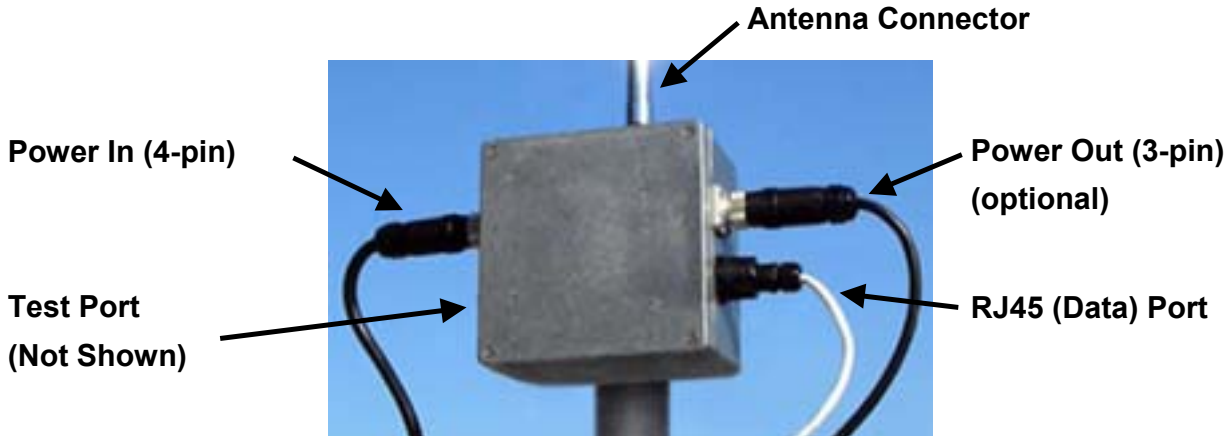


Figure 10. IAP6300 Connection Points

Figure 11. IAP6300 Bracket

Assemble the IAP using the following procedure:

1. If desired, mount the IAP6300 box using the enclosed bracket. Refer to Figure 11.
2. Place the bracket at the desired position on the pole The bracket can accommodate pole diameters between 1-3.5 inches.
3. Adjust the position of the box so that the antenna will be in a vertical position. Tighten the pivot and angle locking bolts on the shaft of the bracket as shown in Figure 12
4. Insert the antenna into the N-type Connector on the top of the box, and rotate to close.
5. Insert the IAP Power Plug into the 4-pin connector.
6. Install the weatherproof connector on the Ethernet cable as described at: *http://www.siemon.com/installation_instructions/pdf/IMAXIndustrialUTPPlug.pdf*
7. Insert the Ethernet Cable into the RJ-45 port and tighten the connector to ensure a weatherproof seal.
8. If used, insert the Media Converter Power Cable into the optional 3-pin connector.
9. The Test Port is unused during deployment

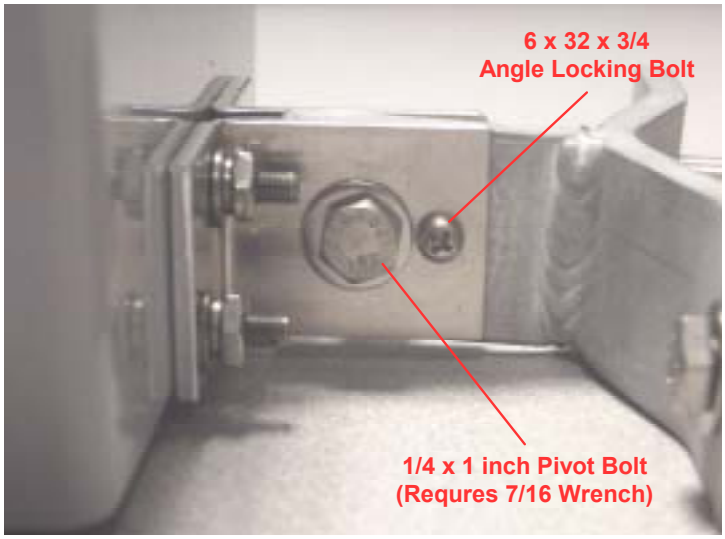


Figure 12. Bracket Adjustment Bolts

Deployment

The IAP may be mounted on a pole having a diameter of 1-3.5 inches, utilizing the provided bracket. The antenna must have a separation distance of at least 2 meters from the body of all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. Users and installers must be provided with antenna installation and transmitter operating conditions to satisfy RF exposure compliance.

When deploying the IAP, the antenna should be a minimum of 30 inches from any nearby metal poles to avoid distortion of the RF pattern.

The IAP must have an Ethernet connection to the MiSC. If the distance between the IAP and

the MiSC is greater than 100 meters, the Network Operator may utilize a T1 with the optional Net-to-Net boxes. The IAP optionally has a 5V, 3-pin, power out connection on the side of the box to power the Net-to-Net boxes. Other media converters may be used at the network operator's discretion.

The installation location must provide power to the IAP.

It is the responsibility of the Network Operator to ensure that the installation complies with any local building codes and permits.

Initial IAP Configuration

Prior to attempting configuration of the IAP, the IAP must be powered on and have connectivity to the MiSC.

Geo-location is an configuration item that is entered into an infrastructure device via the *Device Manager* tool, located on the MeshManager server (refer to the MeshManager User's Guide). MeshNetworks recommends that a DGPS receiver be used to obtain accurate GPS coordinates, and that the longitude, latitude, and altitude values have a precision of 5 digits following the decimal point.

Testing

Once there is an Ethernet connection to the MiSC, verify the health of the IAP with the following procedure:

1. Apply power to the IAP.
2. Obtain the transceiver and SBC MAC addresses that were recorded in ***Section 4 - MAC Address Tables***. The address will be in the format 00-05-12-0A-xx-yy.
3. From MeshManager, display devices using the MAC address.
4. Select the appropriate IAP in the device tree, and then ping the device (right click and select ping).

A response to the ping commands verifies that both the transceiver and SBC are communicating.

Wireless Router (WR)

The MWR6300 (Wireless Router) is an infrastructure device positioned in a fixed location, such as on a pole, wall, or rooftop. The MWR6300 requires professional installation to ensure the installation is performed in accordance with FCC licensing regulations.

The Wireless Routers provides range extension, a means to route around obstructions, and a fixed location reference for use in Geo-Location.

The MEA MWR6300s comes with a mounting bracket that can be attached to a pole with a diameter of 1-3.5 inches. For a MEA deployment, a power source for each WR must be provided.

Equipment

The following list defines the standard MEA hardware components needed to setup a WR:

- WR Box with N-type Antenna Connector
- 120V A/C Power Cable with a NEMA 5-15 plug
- Antenna with N-type Male Antenna Connector
- Mounting Bracket

The Network Operator must supply the following:

- Mounting Location
- Power Source (120V A/C or 5 V D/C depending on WR configuration)
- Hand tools for bracket installation (7/16 wrench (2), Phillips screwdriver)

Optional Equipment:

- DC powered WR (MWR6300-DC-IN)
- Power cord to connect to a photoelectric cell

Optional FCC Approved Antennas:

Manufacturer	Part Number	Gain	Type
Maxrad	Z1578	8 dBi	Omni
Maxrad	Z1576	4 dBi	Omni
Hyperlink	HG2409U	8 dBi	Omni
Maxrad	BMMG2400ML195MS	0 dBi	Mobile
Antenex	TRA24003	3 dBi	Mobile

Record MAC Address of the MWR6300

The transceiver MAC address is recorded on the label located on the antenna end of the MWR6300 as shown in Figure 13.

Record this number in ***Section 4 - MAC Address Tables***, because it will be required later to configure and test the device.

Figure 13. MWR6300 Identification Label

MWR6300 Assembly

Figure 14 shows the external; connection points on a MWR6300 box.

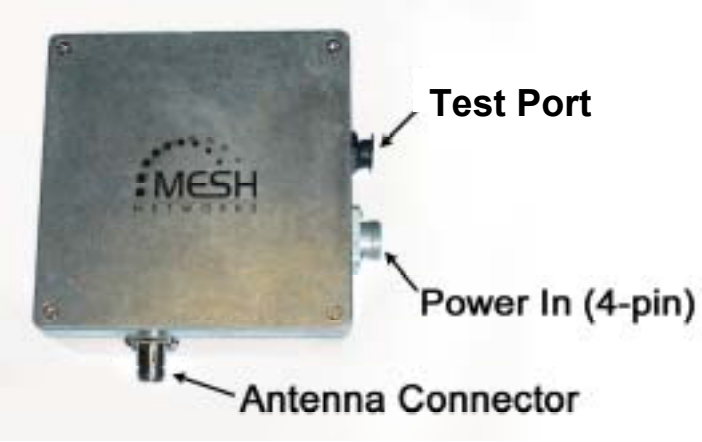


Figure 14. MWR6300 External Connection Points

Assemble the WR using the following procedure:

1. If desired, mount the WR box using the enclosed bracket. Refer to the procedure in the IAP assembly section of this document.
2. Insert the Antenna into the N-type Connector on the top of the box, and rotate to close.
3. Insert the Power Plug into the 4-pin Connector.

4. Verify the MAC address has been recorded in ***Section 4 - MAC Address Tables***, as it will be required to configure and test the device.
5. The Test Port is unused during deployment.

Deployment

The MWR6300 can be mounted on a pole by using the provided bracket.

When deploying the MWR6300, the antenna should be a minimum of 30 inches from any nearby metal poles to avoid distortion of the RF pattern. The antenna must have a separation distance of at least 2 meters from the body of all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. Users and installers must be provided with antenna installation and transmitter operating conditions to satisfy RF exposure compliance.

Typically, wireless routers are distributed within a network to extend range and guarantee coverage. A rule of thumb is to deploy 3-4 hop networks to optimize range, latency, and throughput.

The MWR6300 installation location must provide applicable AC or DC power for the device.

It is the responsibility of the Network Operator to ensure that the installation complies with any local building codes and permits.

Initial Configuration

The configuration process for Geo-Location is the same as the IAP.

Testing

Verify the operation of the MWR6300 using the following procedure:

1. Apply power to the MWR6300.
2. Obtain the transceiver MAC address that was recorded in ***Section 4 - MAC Address Tables***. The address will be in the format 00-05-12-0A-xx-yy.
3. From MeshManager, display devices using the MAC address.
4. Select the appropriate WR in the device tree, and then ping the device (right click and select ping).

A response to the ping command verifies that the transceiver is communicating.

Mobile Internet Switching Controller (MiSC)

The MiSC provides routing, switching, and management functions for the wireless network, and the connection to the wired world.

Equipment

The following list defines the standard MEA components needed for the MiSC:

- SMC 24 Port Switch
- Cisco 1721 – Edge Router
- Cisco 1721 – Core Router

- MeshManager Server (Server, Monitor, Keyboard, Mouse), pre-installed with the MeshManager software
- 5 Ethernet Cables

The Network Operator must supply the following:

- Physical location and AC power for the routers, switch, and server(s)
- Ethernet connection(s) from the switch to the IAP(s)
- Ethernet connection to Internet or to Network Operator's private network (Custom IP network configuration may be required depending on Network Operator's network configuration)
- Public address for Edge Router, DNS resolver address
- PC running Windows 2000 with an Ethernet Port for site-specific MiSC Configuration and MeshView
- Optional Equipment:
- Geo Server
- T1 Network Extenders

Network Setup Description

The basic MiSC hardware configuration is shown in Figure 15.

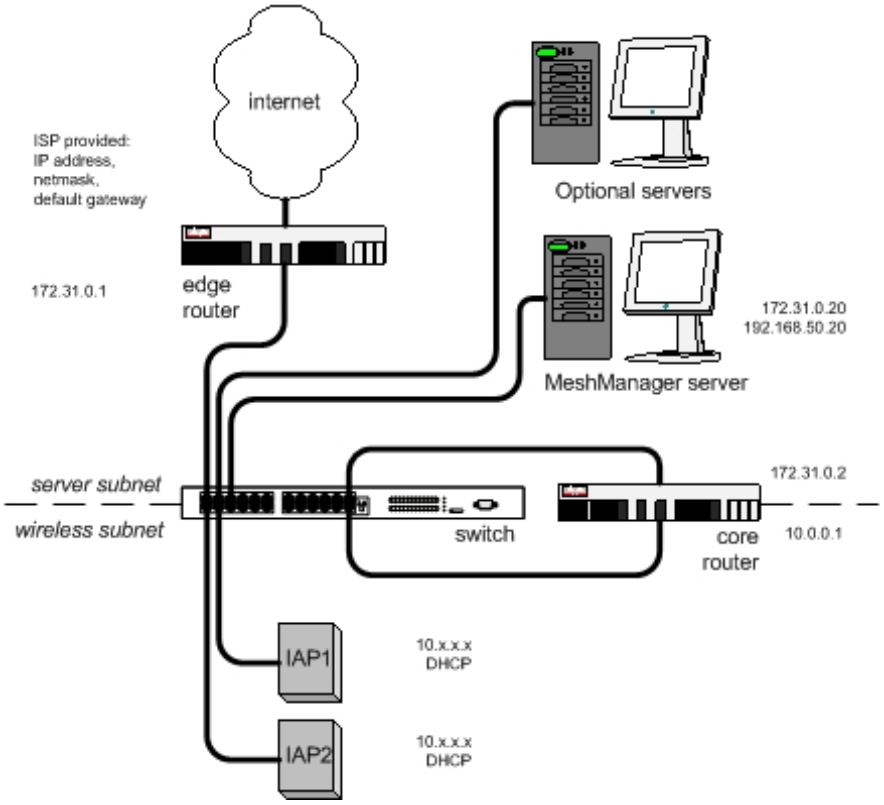


Figure 15. Basic MiSC Configuration

The following describes the parameters for setting up the network:

- All MEA wireless devices must be within the same subnet.
- MEA currently uses the non-routable 10.x.x.x (8 bit) subnet as defined in RFC 1918.
- The IAPs, WRs, and SDs will use DHCP to obtain an IP address, the default configuration returns a 10.x.x.x address.

Subnet information may be modified by editing the DHCP configuration file (dhcpd.conf) located on the MeshManager Server.

MiSC Assembly

The MiSC hardware consists of commercial off-the-shelf components. The components are pre-configured with a basic configuration that requires minimal site-specific changes.

The SMC switch arrives configured as two virtual LANs. The upper row of Ethernet ports is for the server subnet; the lower row of ports is for the wireless subnet.

Unpack the SMC switch and mount as desired (either in a rack or on a table top). Connect the switch to a power source.

Unpack the Cisco router labeled *EdgeRTR* and connect to a power source. Plug interface labeled *10BT Ethernet* into the Internet or the Network Operator's private network. (The network operator supplies this cable; it will be an Ethernet cable for connecting to a hub or switch, or an Ethernet crossover cable if connecting to another router.) Plug interface labeled *10/100 Ethernet* into the SMC switch on port 1.

Unpack the Cisco router labeled *CoreRTR* and connect to a power source. Plug interface labeled *10BT Ethernet* into the SMC switch on port 12. Plug the interface labeled *10/100 Ethernet* into the SMC switch on port 24.

Unpack the Sun Blade/MeshManager server and monitor and connect to a power source. Plug the network interface into any of the ports 2-11 on the SMC Switch.

Connect Network Operator supplied computer running Windows 2000. Plug the network interface into any of the ports 2-11 on the SMC Switch.

Connect the IAPs to any of the ports 13-23 on the SMC switch.

Upgrade MiSC/DHCP Configuration (optional)

Mea Version 1.x required the wireless subnet to be configured as 10.x.x.x. mea Version 2 continues to use the 10.x.x.x addressing scheme as a default; however it can be changed to a site specific address. The following procedure describes the changes necessary to accomplish this.

The following items must be configured to change the MEA wireless subnet. (Refer to **Error! Reference source not found.**)

Edge router

- IP route to the wireless subnet via the core router (default 10.0.0.1)
- NAT access list for wireless subnet

Core router

- IP address of the wireless network interface (default 10.0.0.1)

Sun server

- DHCP dhcpd.conf, for the new pool of addresses, new default router, new broadcast address
- DNS named.conf and zones file, for the new subnet range

The SMC switch does not require any changes, since the partitioning of the switch does not involve IP addresses.

When the mea Version 2 upgrade of the IAPs is complete, the IAPs, WRs, and SDs should all

be handled automatically by the DHCP changes. These should refresh automatically when the DHCP lease time expires (600 seconds) and they refresh their DHCP lease. This can be hurried by simply resetting the devices once the other changes have been completed.

Changing the Wireless Subnet

The IP address of the default gateway used by any MEA device must not be within the either of the wireless subnets configured in all IAPs. Otherwise, SD hosts will be unable to resolve the IP address of the default gateway. There are two wireless subnets configured for IAPs in MeshManager on the IAP device configuration window, the local wireless subnet, fields Local Wireless Subnet and Local Wireless Subnet CIDR (defaults are 10.2.0.0 and 16), and the global wireless subnet, fields Global Wireless Subnet and Global Wireless Subnet CIDR (defaults are 172.16.1.50 and 24).

If wired devices will be connected to the MEA subnet, all IAPs must be configured with the address range of the wired devices if MEA devices need to communicate with them. Otherwise, SD hosts will be unable to resolve IP addresses of wired devices within the same subnet. The wired device address range is configured for IAPs in MeshManager on the IAP device configuration window, fields Global Wireless Subnet and Global Wireless Subnet CIDR (defaults are 172.16.1.50 and 24).

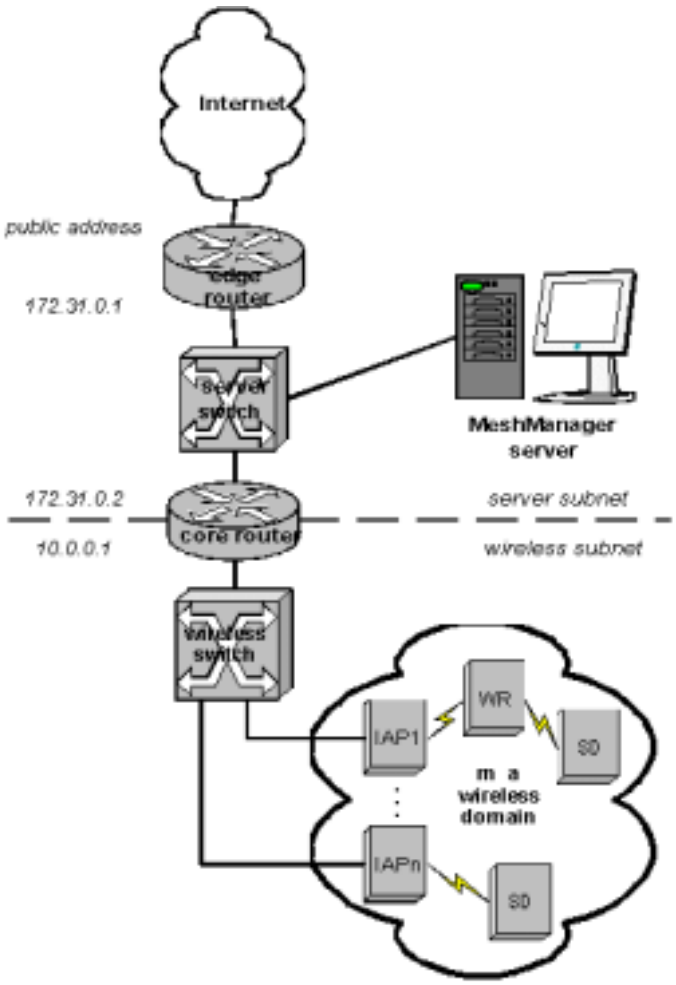


Figure 16 MEA Subnet Data

Onsite Configuration of Routers

EdgeRTR Configuration

The EdgeRTR must have on-site configuration done if there is a desire to connect to the Internet. Prior to performing the following steps, obtain the IP address, netmask, and default gateway for the public interface from the Internet Service Provider. These are shown as ***ip.ip.ip.ip***, ***nm.nm.nm.nm***, and ***gw.gw.gw.gw***, respectively, in the instructions below. Also, obtain the IP address of the EdgeRTR, it will be in the form of 172.31.0.1.

Telnet into the EdgeRTR from a computer connected to the server subnet. Use the address 172.31.0.1 to connect to the EdgeRTR.

Update the public IP information using the commands below

```
Password:g0ld1
EdgeRTR>enable
Password:g0ld11
EdgeRTR#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
EdgeRTR(config)#interface Ethernet0
EdgeRTR(config-if)#ip address ip.ip.ip.ip mm.nm.nm.nm
EdgeRTR(config-if)#exit
EdgeRTR(config)#no ip route 0.0.0.0 0.0.0.0
EdgeRTR(config)#ip route 0.0.0.0 0.0.0.0 gw.gw.gw.gw
EdgeRTR(config)#exit
EdgeRTR#copy running-config startup-config
Destination filename [startup-config]? <return>
Building configuration...
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!![OK]
EdgeRTR#exit
```

EdgeRTR TEST

Use a computer connected to the switch (in either the server or wireless subnet) to ping to the ISP gateway IP. Next, test access to the Internet using a web browser. If this fails troubleshoot and retry.

Network Configuration – Device Manager

Device Manager is a utility located on the MeshManager server. It is used to configure and monitor the deployed network. Refer to the MeshManager User's Guide for detailed instructions on how to use the Device Manager.

MEA systems are delivered with the initial configuration of IAPs, WRs, and SDs in the MeshManager system. This allows for easy testing of the system as units are tested on site.

Network Configuration – IAP Configuration Via Web Interface

A second method of performing various network configuration functions for an IAP may be accomplished using a standard web browser. Connect a host PC to the switch in the MiSC. Using a standard Internet Browser such as Microsoft's Internet Explorer or Netscape, enter the IP Address corresponding to the IAP's SBC MAC to be configured as shown in **Figure 17**. It is recommended that you install and configure the IAPs one at a time.

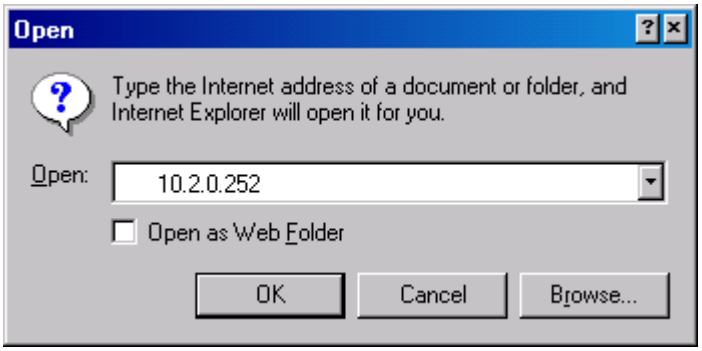


Figure 17. MEA Device Administration Connection

A Log On window for the Administration Utility will be displayed in the browser, as shown in **Figure 18**. Before the Administration Utility is displayed, the user must complete the simple logon procedure before proceeding. The default login is ***admin*** and the password is ***admin***. The password can be changed, as described further in this document.

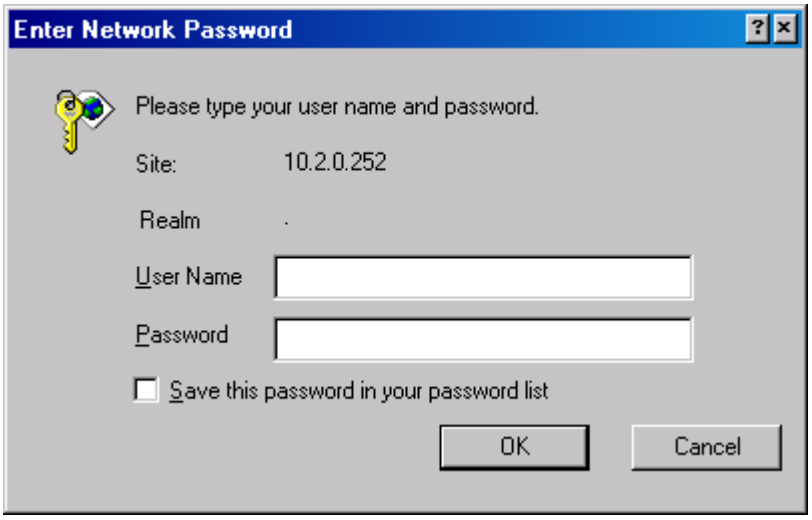


Figure 18. MEA Device Administration Logon Window

When the User Name and Password has been verified, the Administration window will be displayed as shown in **Figure 19**.

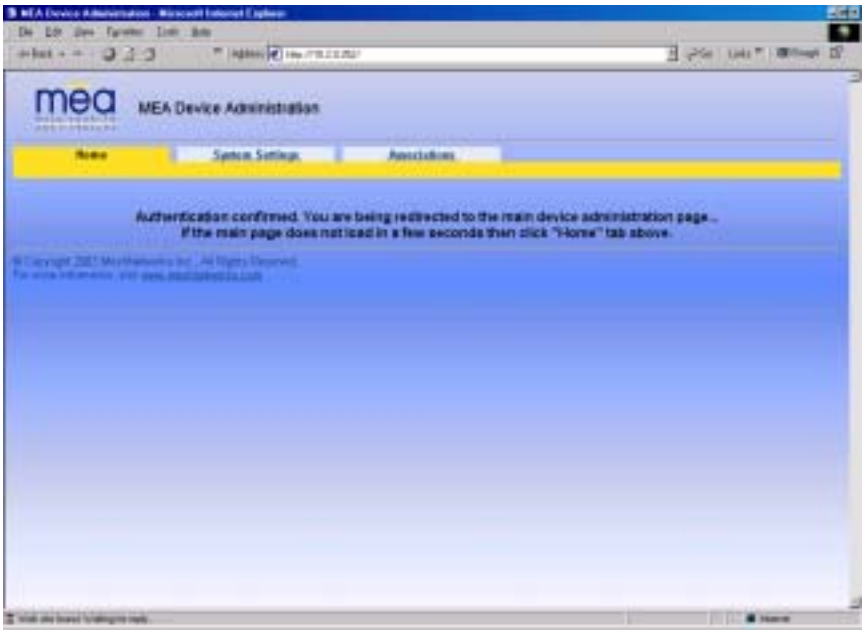


Figure 19. MEA Device Administration Authentication Window

At the completion of the logon, the Home Tab screen will be displayed as shown in Figure 20.

Home Tab

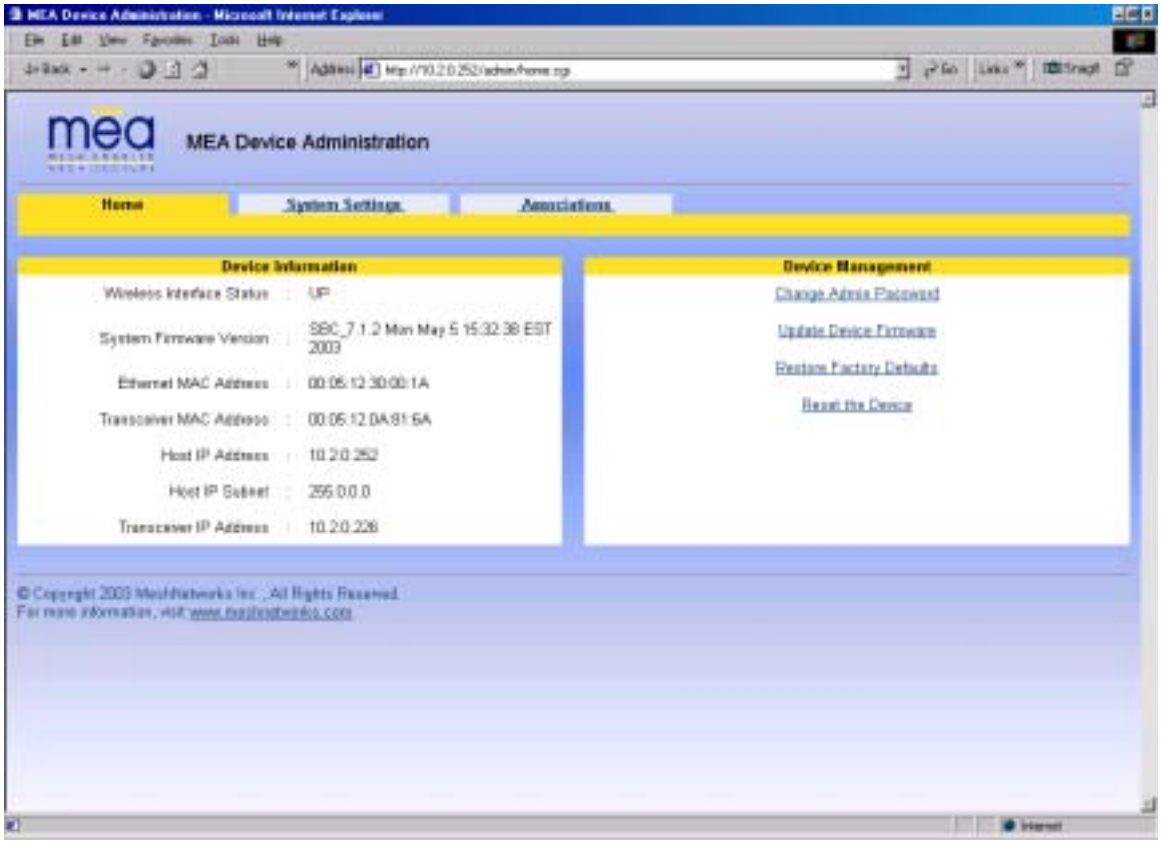


Figure 20. MEA Device Administration Home Tab

The Device Information window provides data on:

- Wireless Interface Status (interface between the Host and the transceiver)
- System Firmware Version (software running on the Host in the IAP)
- Ethernet MAC Address (MAC address of the Host)
- Wireless MAC Address (MAC address of the transceiver)
- Host IP Address (the DHCP provided address for the Host)
- Transceiver IP Address (the DHCP provided address for the transceiver)

Also located on the Home Tab are Device Management options for

- Change Administration Password
- Update Device Firmware
- Restore Factory Defaults
- Reset the Device

The Device Management options are detailed below.

Home Tab – Change Admin Password

From the Home tab, the user can select the **Change Admin Password** to change the administrator password of the device.

WARNING – If the password is lost, the password can only be reset at the factory. Do not forget to record the information in an appropriate location for future use.

1. To change the password, select **Change Admin Password**.
2. *Enter the new password* will be displayed on the Change Password window as shown in Figure 21. Enter the new password in the **New Password** textbox.
3. Enter the new password again in the **New Password (again)** textbox.

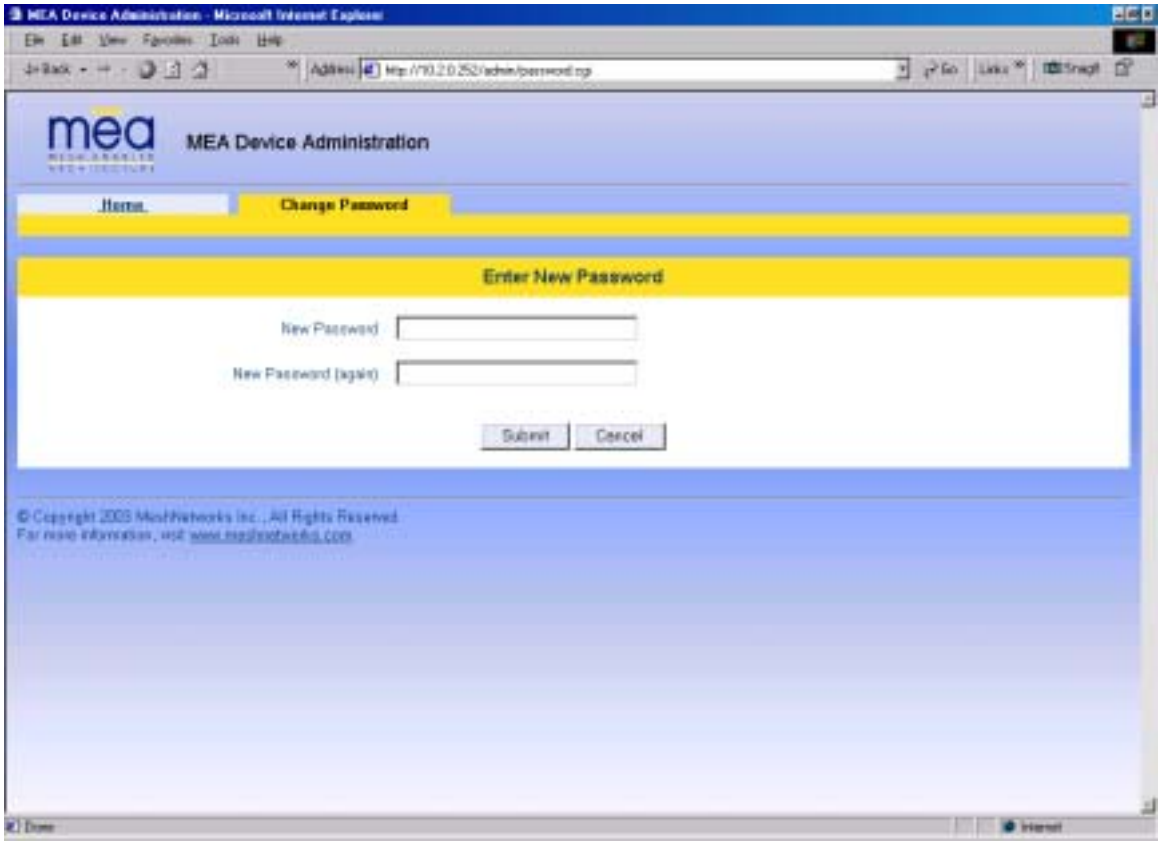


Figure 21. MEA Device Administration Enter New Password Window

4. Click on the **Submit** button. A confirmation window will appear as shown in Figure 22. Click on the **OK** button to continue.

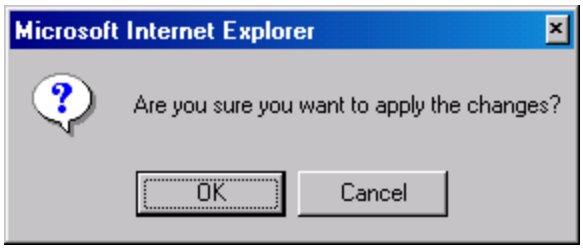


Figure 22. MEA Device Administration Confirmation Window

5. The browser will display a message that confirms the password change as shown in Figure 23. Click on the **Finished** button to continue.

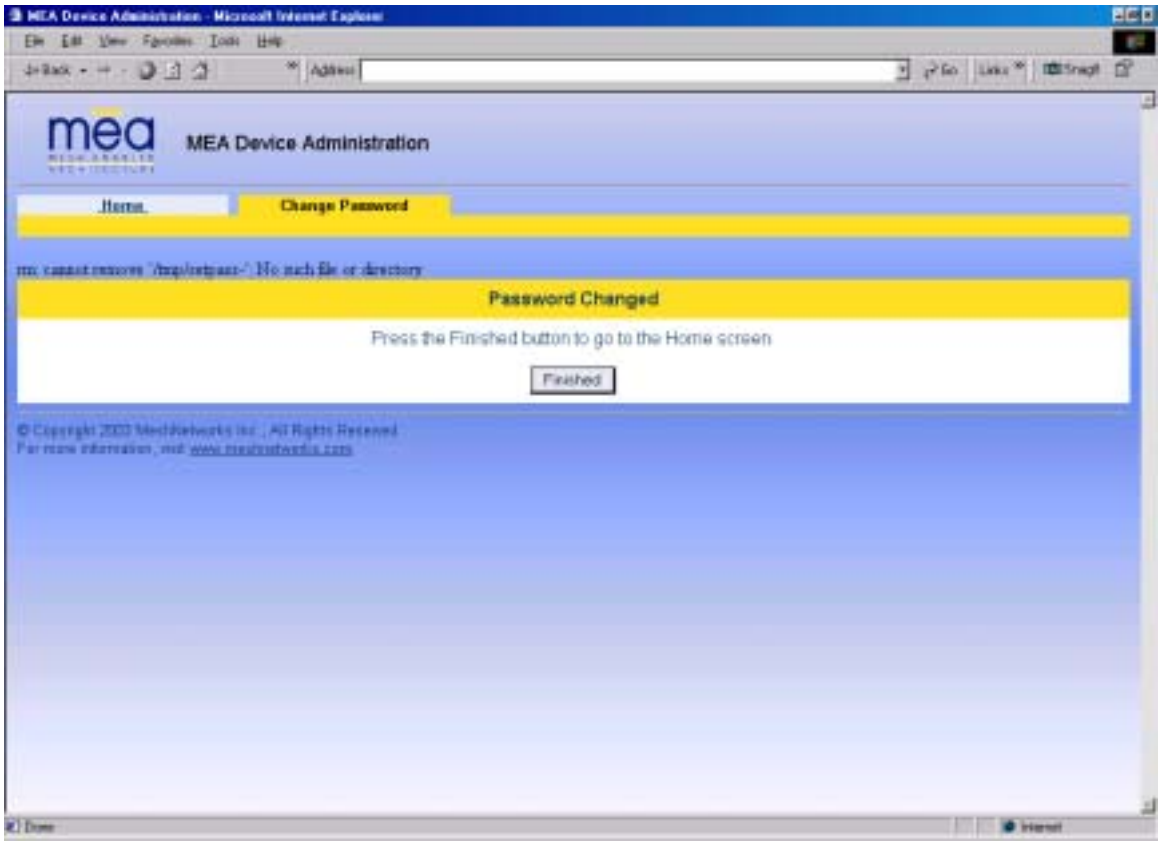


Figure 23. MEA Device Administration Password Changed Window

6. A Logon window will now prompt for the new password.

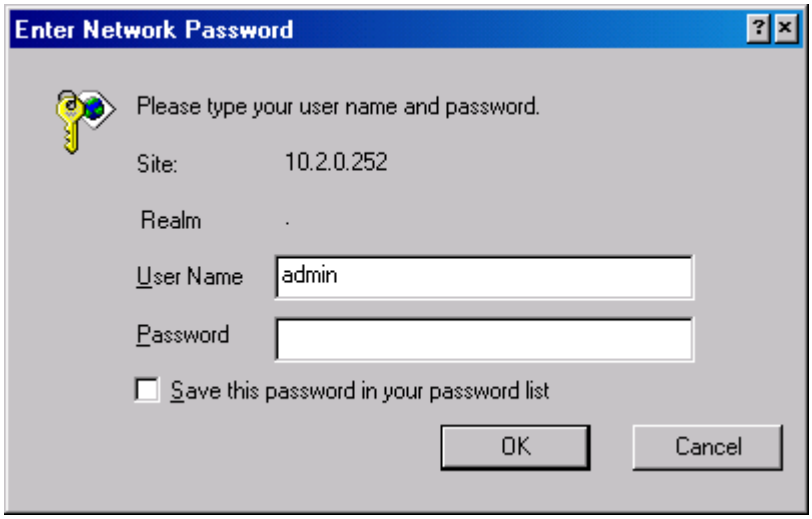


Figure 24. MEA Device Administration Logon Window

Home Tab – Update Device Firmware

From the Home Tab, select **Update Device Firmware** to load a new version of the firmware into the IAP.

. A New Device Firmware window will be displayed as shown in Figure 25

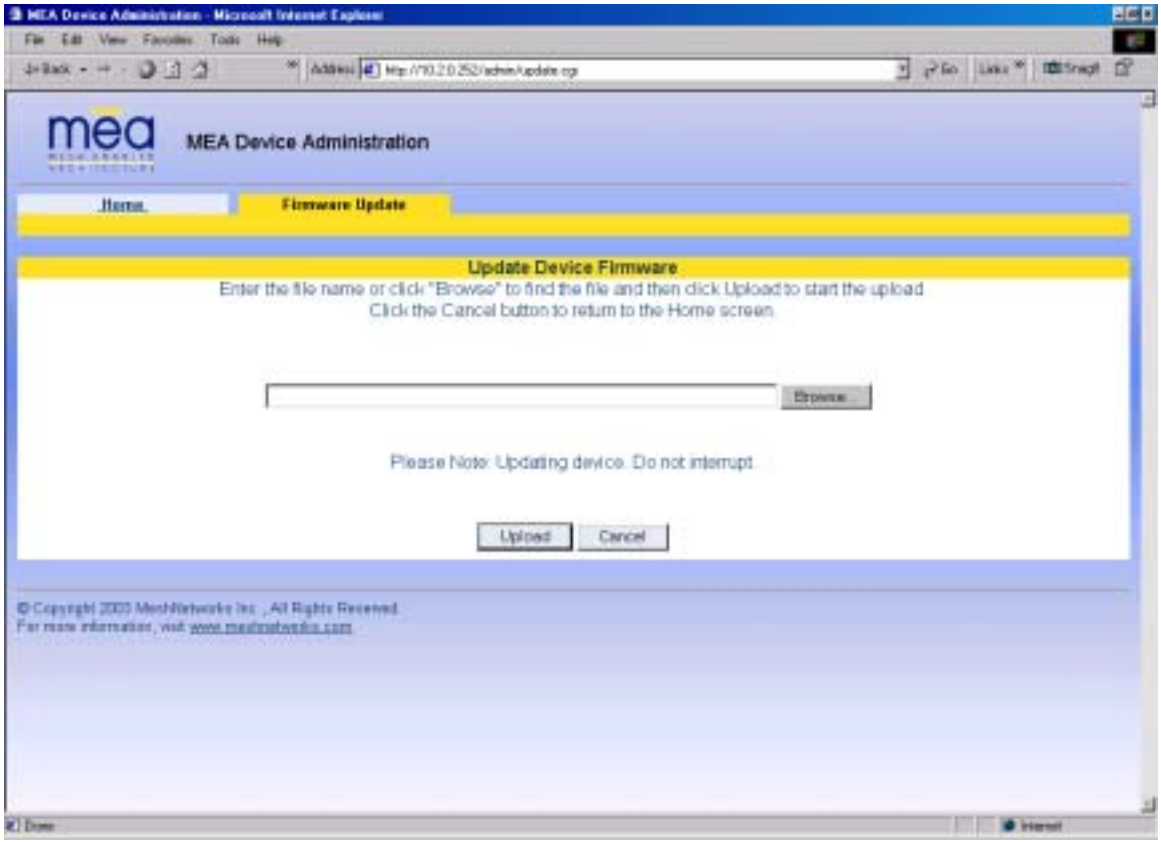


Figure 25. MEA Device Administration Update Device Firmware Window

1. Specify the path and file name of the firmware *bin* file to be uploaded to the device. Or click on the **Browse** button to navigate to the correct location of the firmware *bin* file. If the **Browse** button is selected, the **Choose file** window is displayed as shown in *Figure 26*. Locate and select the desired firmware bin file to be uploaded to the device. Then click on the **OK** button.

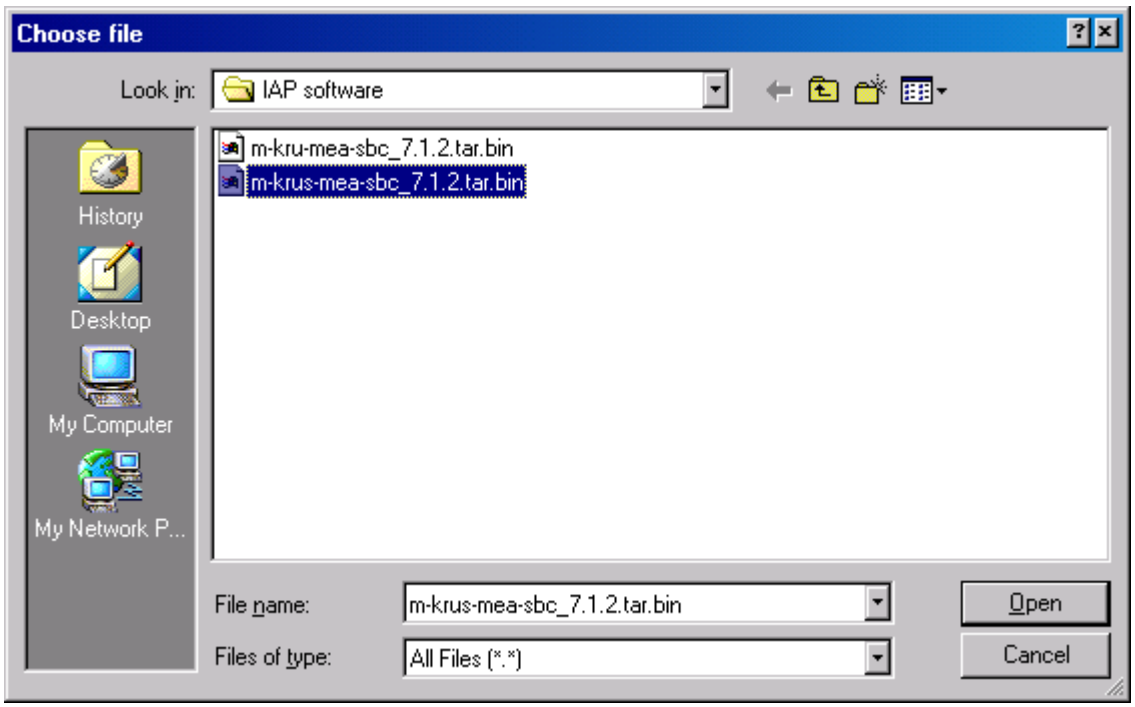


Figure 26. MEA Device Administration Choose File Window

The path and file name of the firmware *bin* file will be displayed in the Update Device Firmware window as shown in *Figure 27*. Click on the **Upload** button to continue the process or select **Cancel** to terminate the Firmware Update procedure

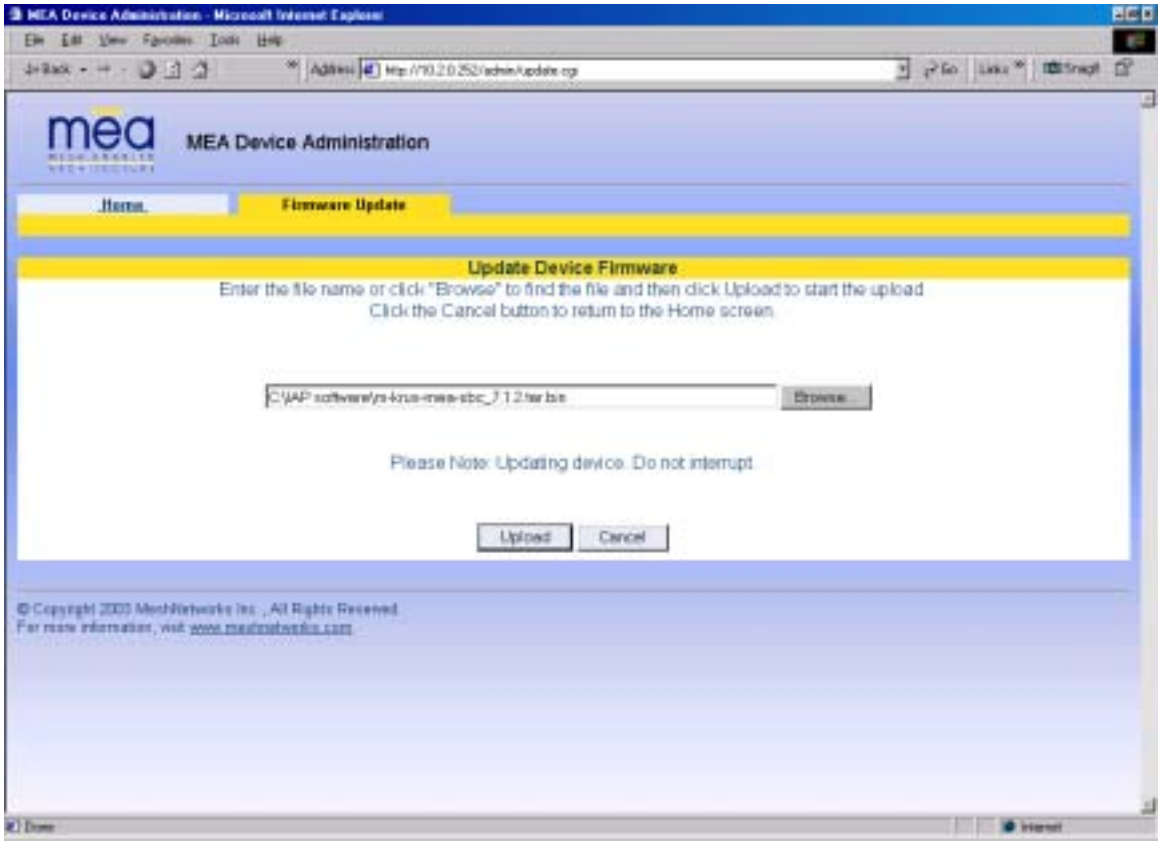


Figure 27. MEA Device Administration Update Device Firmware Window (2)

2. If the **Upload** button is selected, an upload confirmation message is displayed as shown in *Figure 28* to confirm that you want to continue the Firmware Update procedure. Click on the **OK** button to continue or select **Cancel** to terminate the Firmware Update procedure.

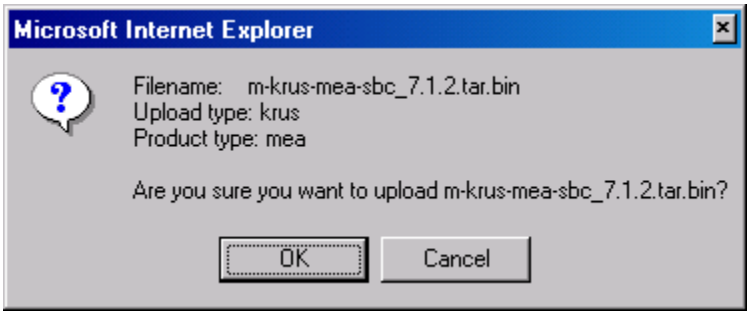


Figure 28. MEA Device Administration Update Confirmation Window

3. If the **OK** button is selected, the new Firmware is loaded into the device. The Firmware Update window will then be displayed to indicate that the selected file was successfully uploaded and to recommend that you reboot the device.

4. As the Firmware is being uploaded, a status page is displayed as shown in *Figure 29*.

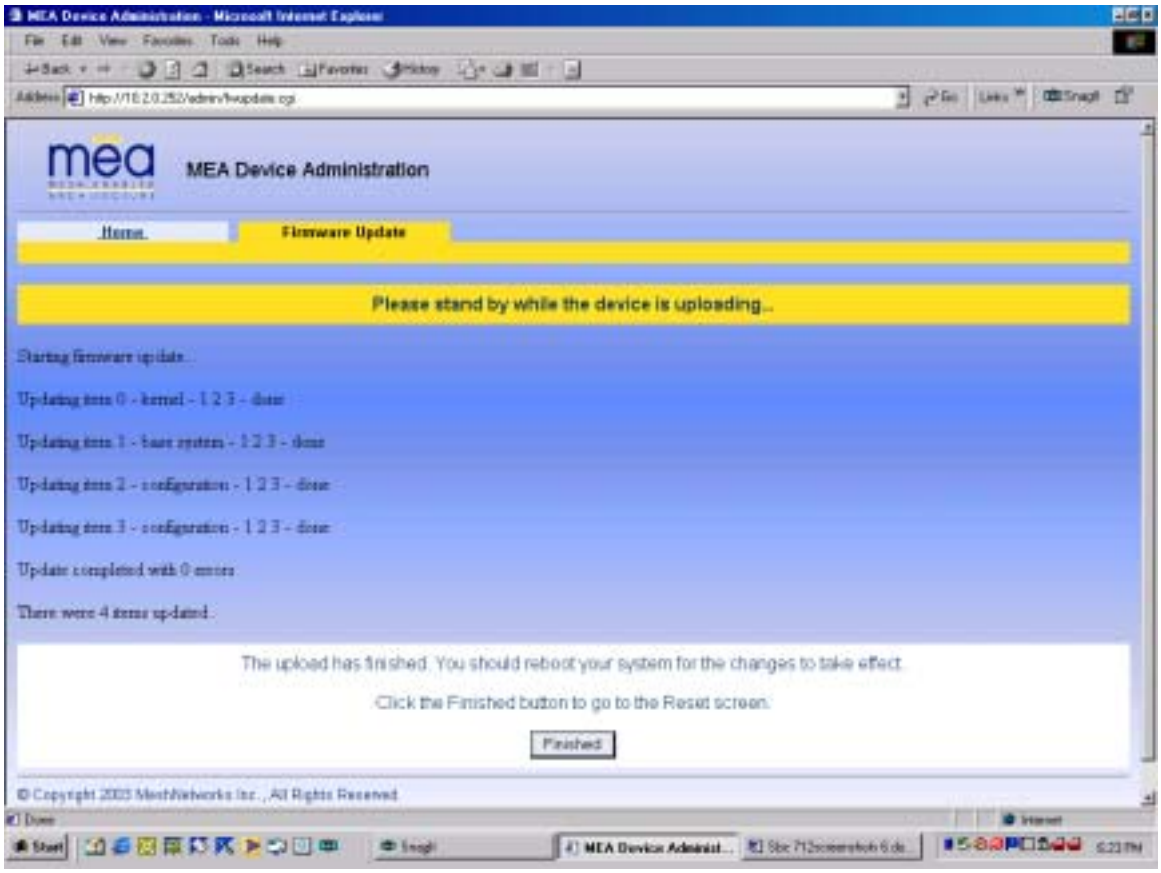


Figure 29. MEA Device Administration Update Device Status Window

5. At the completion of the update, the IAP's SBC must be reset for the update to take effect. Select the **Finished** button to navigate to the Reset Device window, and then click on the **Reset** button as described in the procedure located on page 30. The device will reset and return to the **Home** tab.

   Note: Do not close the browser until the process is complete.

Home Tab – Restore Factory Defaults

From the Home Tab, the user can select **Restore Factory Defaults** to restore the configuration settings to Factory Default settings. By selecting the **Restore Factory Defaults** button, the IAP setting will be returned to the default configuration. The user will receive a caution message before proceeding with the restore process as shown in *Figure 30*.

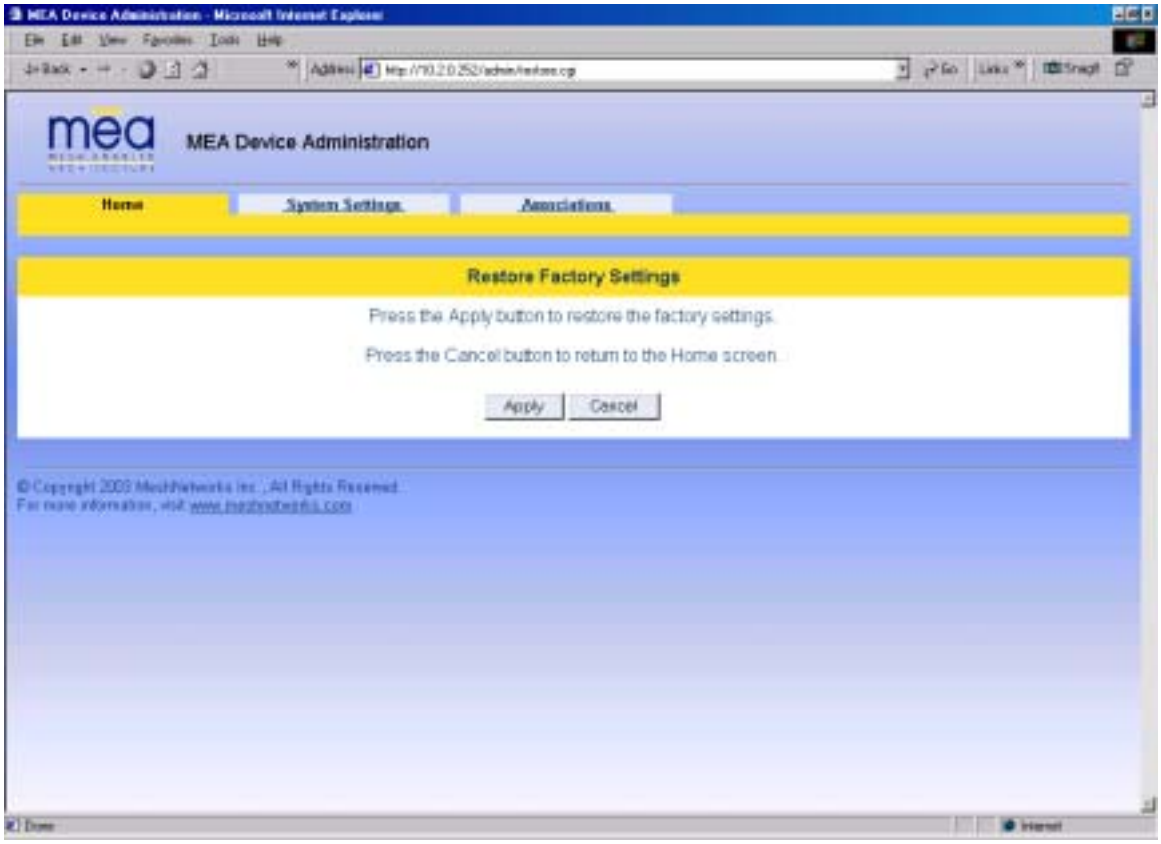


Figure 30. MEA Device Administration Restore Factory Defaults Window

6. Click on the **Apply** button to continue the restore process or select the **Cancel** button to terminate the process with out changing the device settings.
7. If the **Apply** button is selected, a confirmation message is displayed as shown in *Figure 31* to confirm that you want to continue the Restore Factory Settings procedure.

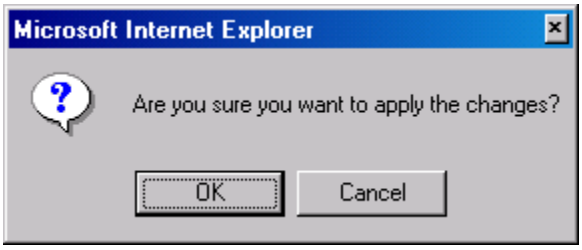


Figure 31. Restore Factory Defaults Confirmation Message

8. Click on the **OK** button to continue or select **Cancel** to terminate the procedure.

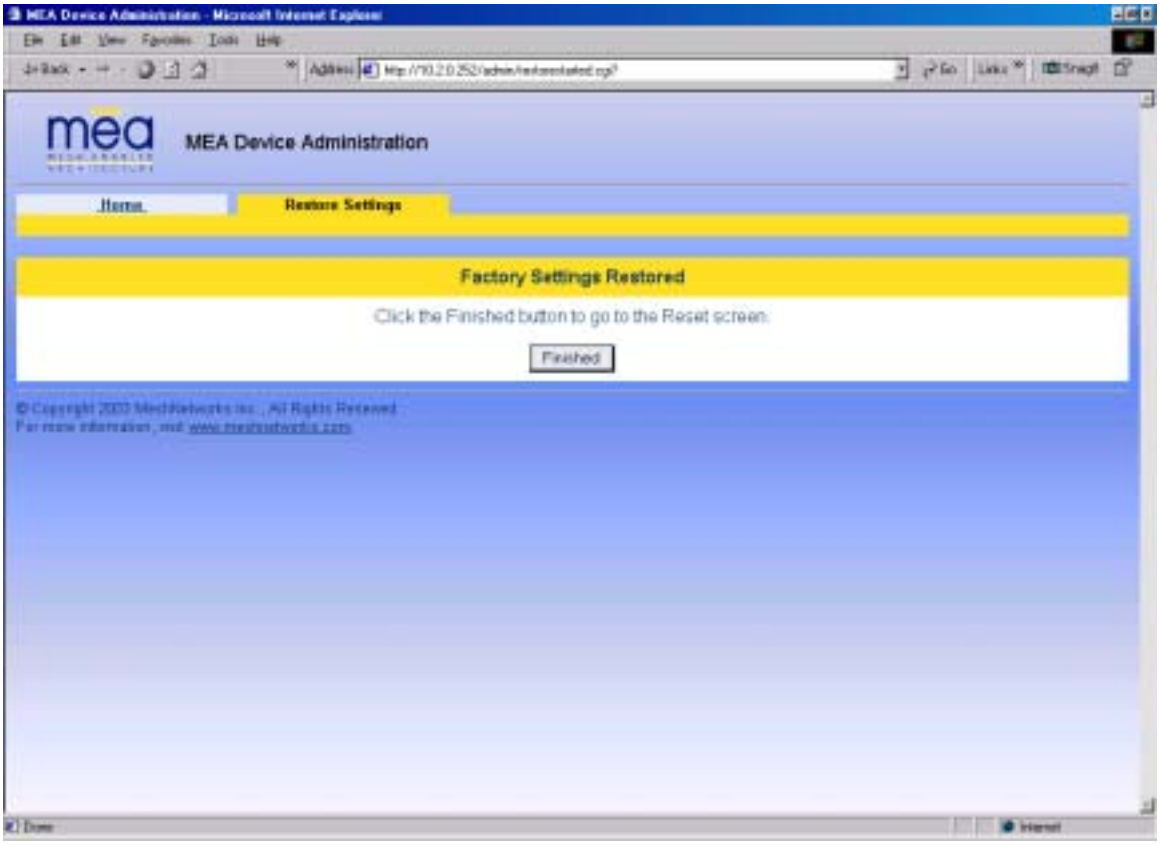


Figure 32. MEA Device Administration Factory Settings Restored Window

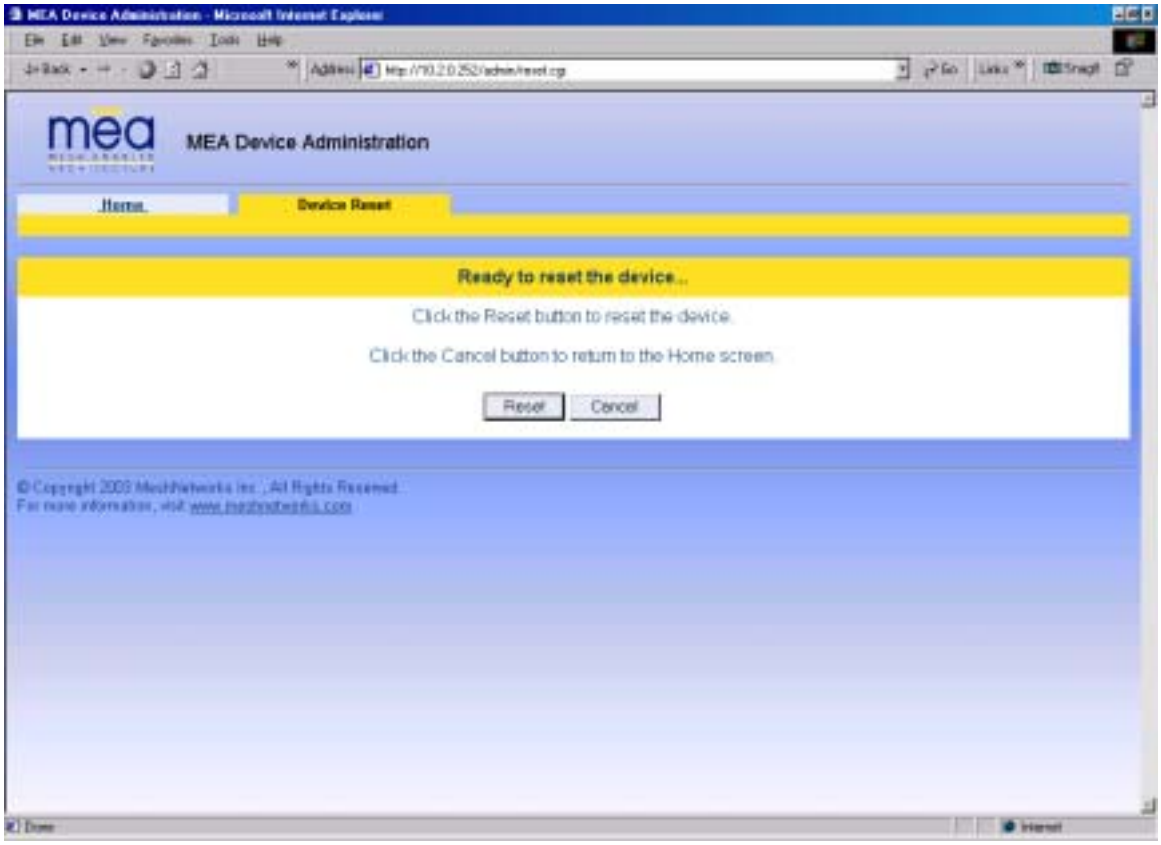


Figure 33 MEA Device Administration Device Reset Window

If the OK button is selected, the configuration settings will be restored and the device will reset automatically. Upon completion of the process, the browser will return automatically to the **Home** tab.

Home Tab – Reset Device

From the Home tab, the user can select the **Reset the Device** option to reset the device and reinitialize the IAP. The configuration settings are preserved during the initialization process. The user will receive a caution message before proceeding with the reset.

1. Select the **Reset the Device** button to initiate the reset process on the IAP.
2. The Reset the Device window is displayed as shown in *Figure 34*. Select the **Reset** button to continue the process.

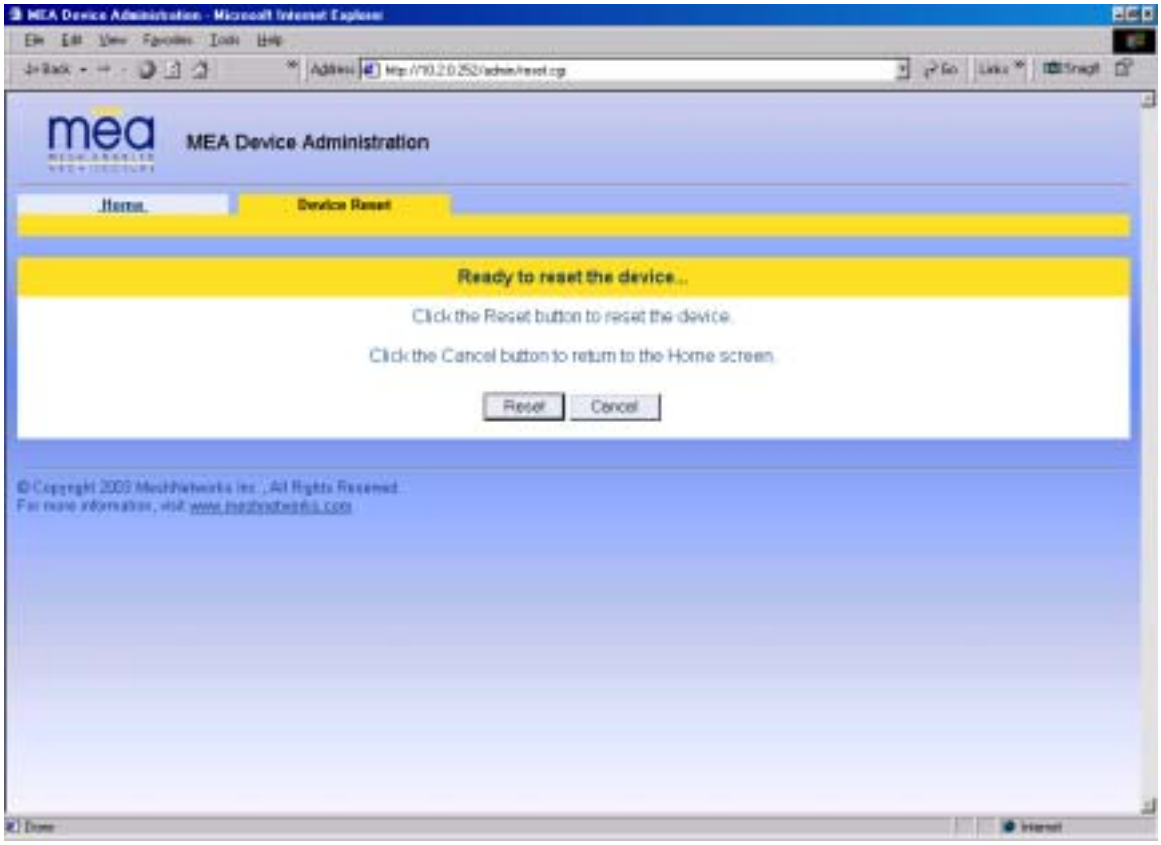


Figure 34. MEA Device Administration Device Reset Window

3. The Reset the Device window displays a message that describes the process and the time to completion as shown in *Figure 35*. The browser window will return to the **Home** tab at the completion of the reset.

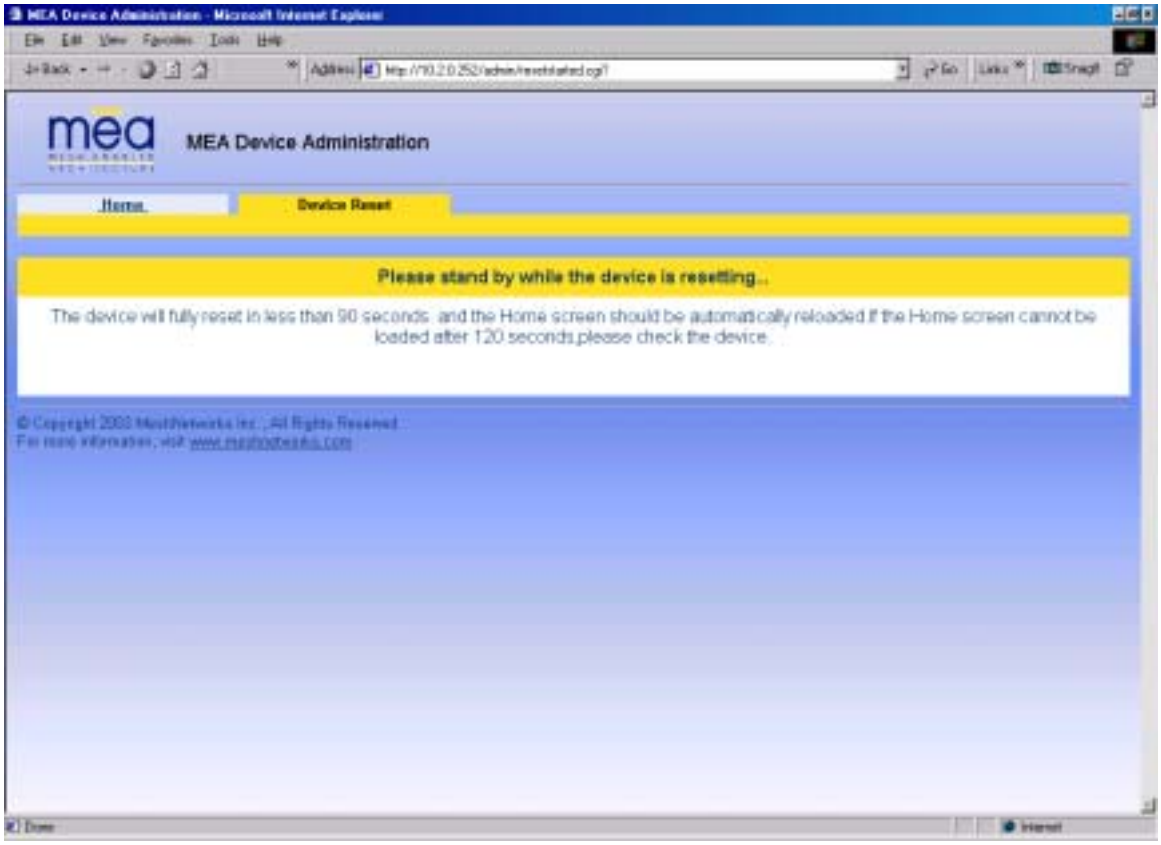


Figure 35. MEA Device Administration Device Reset Window (2)

System Settings Tab

The System Settings Tab is shown in *Figure 36*.

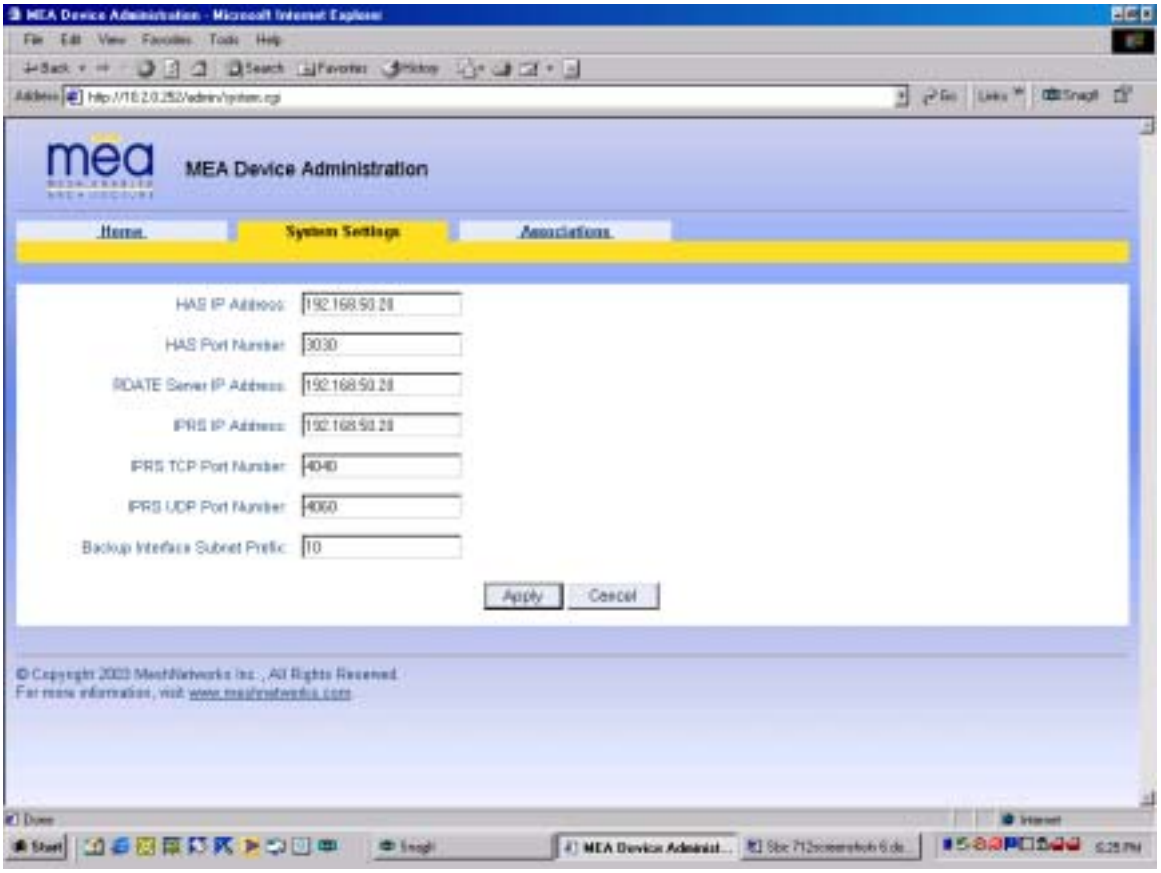


Figure 36. MEA Device Administration System Settings Tab

The System Settings tab allows the network operator to change the following values:

HAS IP Address – (Hardware Authentication Server) Network host from which authentication is requested.

HAS Port Number – Port number on the Network host from which authorization is requested (a value of zero causes the IAP to not request authentication).

RDATE Server IP Address – Network host from which time and date information is retrieved.

IPRS IP Address - (Internet Protocol Resolution Server) Network host that the IAP relays IP/MAC address information to

IPRS TCP Port - Port number on the Network host which the IAP relays IP/MAC address information

IPRS UDP Port - Port number on the Network host that the IAP responds to when asked for unknown address information

Backup Interface Subnet Prefix – Allows an alternate subnet prefix to be used for the IAPs in the event that the 10.x.x.x subnet is already in use.

Click the **Apply** button to save the changes, or click the **Cancel** button to delete any changes. If the **Apply** button is selected, a confirmation window will appear as in *Figure 37*. Click on the **OK** button to continue or select **Cancel** to terminate the procedure.

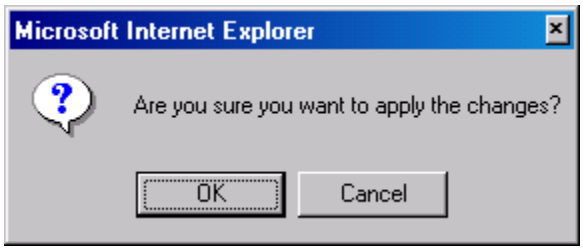


Figure 37. System Settings Confirmation Message

If the Apply button is selected, the new values will be saved and *Figure 38* will be displayed. The changes will not take effect until the device is reset. Select the **Finished** button to navigate to the Device Reset option.

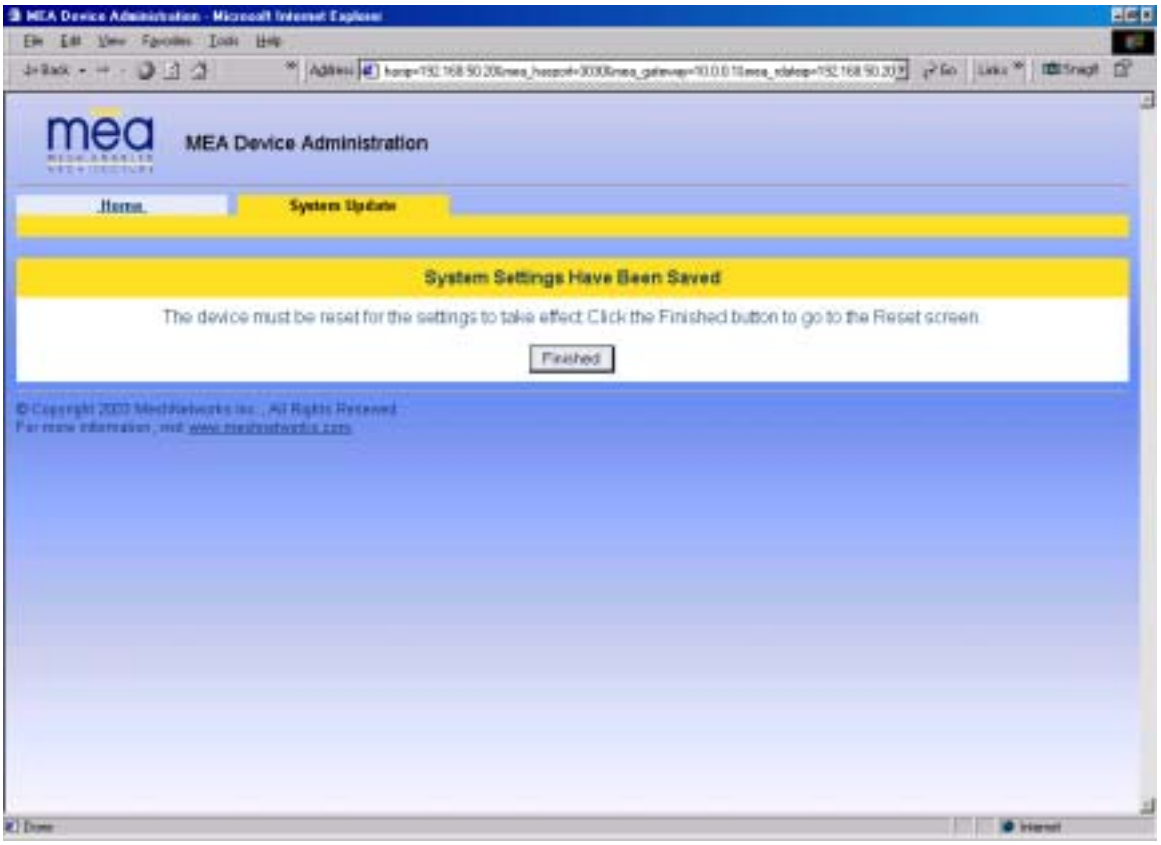


Figure 38. System Settings Saved Message

Associations Tab

The Associations Tab is an information only window as is shown in *Figure 39*.

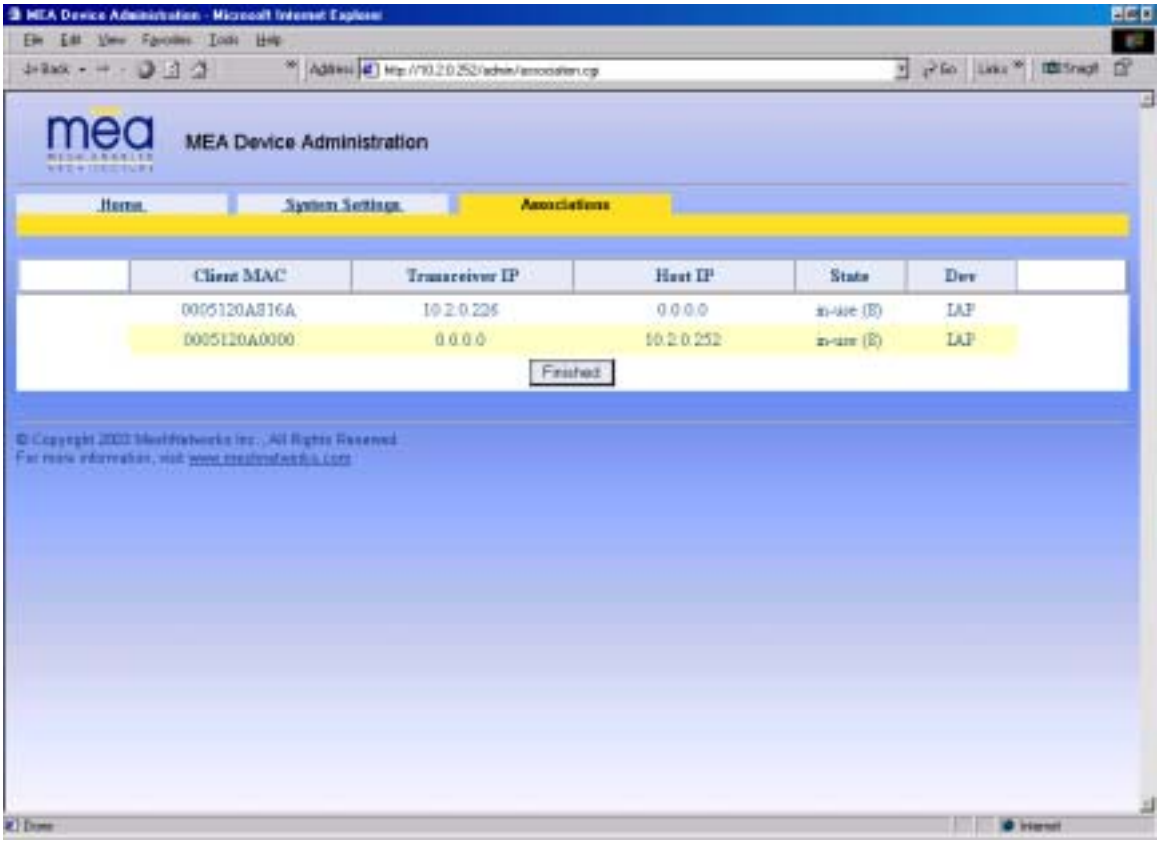


Figure 39. MEA Device Administration Associations Tab

This window displays all devices currently associated with an IAP. There will always be at least 2 entries: one for the IAP's SBC and one for the IAP's transceiver. For every wireless router and subscriber device currently associated with the IAP, there will be an additional entry in the table.

Testing

Basic MiSC Tests

To verify the basic connectivity of the MiSC, conduct the following from the a computer connected to the server subnet of the MiSC:

- Ping an IAP
- Ping the Core Router
- Ping the Edge Router

Wireless System Tests

There are two basic tests to verify correct operation the system. The first test is to perform ping tests to each device and the second test is to verify access the Internet.

Ping Test

From Device Manager, complete the following to verify correct operation of the system:

1. Ping the SBC of the deployed IAPs
   - From the Device Manager drop down menu, select Preferences/Use SBC Address
   - For each IAP in the device tree, right click and select **Ping Device**
2. Ping the transceiver of the deployed IAPs
   - From the Device Manager drop down menu, select Preferences/Use Transceiver Address
   - For each IAP in the device tree, right click and select **Ping Device**
3. Ping the transceiver of the deployed WRs
   - From the Device Manager drop down menu, select Preferences/Use Transceiver Address
   - For each WR in the device tree, right click and select **Ping Device**
4. Ping the transceiver of each Subscriber Devices
   - From the Device Manager drop down menu, select Preferences/Use Transceiver Address
   - For each SD in the device tree, right click and select **Ping Device**

Internet Test

If the MEA system has been configured to access the Internet, complete one of the two following tests to verify correct network setup:

1. From a provisioned SD, start the web browser and enter a URL such as *http://www.MeshNetworks.com*.
2. From a SD, open a DOS/cmd window and ping an URL, e.g., **ping www.meshnetworks.com**.

Default Addresses and Logins

The following are the default values for the system components. These may be updated during installation.

Device	Description	Default
Core Router	login password	**g0ld1**
Core Router	enable password	**g0ld11**
Core Router	IP address on Sever	**172.31.0.2**

Device	Description	Default
Core Router	Wireless subnet IP address for Core Router	**10.0.0.1**
Edge Router	login password	**g0ld1**
Edge Router	enable password	**g0ld11**
Edge Router	IP address on Server	**172.31.0.1**
Sun Blade	root password	**g0ld11**
Sun Blade	node name	**MeshManager**
Sun Blade	IP address for next-level hierarchical DNS server	**(none**)
Sun Blade	IP address if Mesh VPN support is provided	**172.31.0.20**
Sun Blade	Secondary IP address for IAP rdate server	**192.168.50.20**
Sun Blade	Secondary IP address for IAP HAS server	**192.168.50.20**
Sun Blade	HAS port address	**3030**
Sun Blade	Secondary IP address for IAP syslog server	**172.18.0.50**
Sun Blade	Server subnet DHCP range	**172.31.1.1 to 172.31.1.254**
Sun Blade	Wireless subnet DHCP range	**10.2.0.1 to 10.2.0.254**
IAP	Default Gateway	**10.0.0.1**
IAP	IP address for rdate server	**192.168.50.20**
IAP	IP address for HAS server	**192.168.50.20**
IAP	IP address for syslog server	**172.18.0.50**
Subscriber Device	Default Gateway	**10.0.0.1**
Subscriber Device	DNS Server	**172.31.0.20**

Section 4 - MAC Address Tables

This table has been included for recording the Ethernet MAC address and transceiver MAC address for a set of EWR devices as a quick reference. These addresses will be required for configuration and management of these devices.

IAP MAC Addresses

IAP MAC Address 00-05-12-0A-xx-yy	IAP ETH MAC Address 00-05-12-0A-xx-yy

WR MAC Addresses

WR MAC Address 00-05-12-0A-xx-yy

WMC MAC Addresses

WMC MAC Address 00-05-12-0A-xx-yy

Section 5 - Site Selection/Deployment Guidelines

General Site Selection Guidelines

The IAP location(s) should be selected first since they have the additional requirement of routing information back to the MiSC. This may be done via an Ethernet cable if the IAP and MiSC are located within 100 meters (the max length permitted for standard Ethernet) of each other. If the distance is greater than 100 meters, a mechanism for extending the Ethernet connection will be required, e.g., using fiber or T1. (MeshNetworks recommends T1 backhaul equipment from Net-to-Net Technologies.)

Once the IAPs have been placed, then the location of the WRs can be determined. Optimally, the devices should be distributed such that a SD has no more than 3 hops to an IAP.

Power must be available for both IAPs and WRs. Both IAPs and WRs come standard with AC power; DC power is available as an option.

Lastly, any local building/structure codes must be adhered to, as well as proper permits for placing devices on structures that are not owned by the Network Operator (e.g., light poles).

MeshNetworks has developed the *Location Analyzer* tool to assist in the placement of infrastructure. This tool runs on a Windows 2000 SD. The tool collects and analyzes data, ultimately resulting in a deployment quality indication. Refer to the Location Analyzer documentation for information on configuring and using this tool.

Antenna Guidelines

The location of fixed infrastructure antennas must address proper antenna orientation, selection of elevation pattern for the specific locale, the avoidance of pattern distortion, and the impact of obstructions and non-line-of-sight paths.

Polarization - Most of the antennas used in deployment will be vertically polarized. To maximize line-of-sight signal reception, both the transmitting and receiving antennas should be vertically oriented to avoid signal loss due to polarization mismatch. This applies to mobile and stationary antennas. For example, placing a magnetically mounted vehicle antenna on a curved portion of the vehicle roof so that its axis is not vertical risks a measure of signal loss at range, dependent upon the specific elevation pattern details, as discussed above.

Local obstructions - Antennas should be mounted either above or below the plane of obstructions as shown in *Figure 40*.

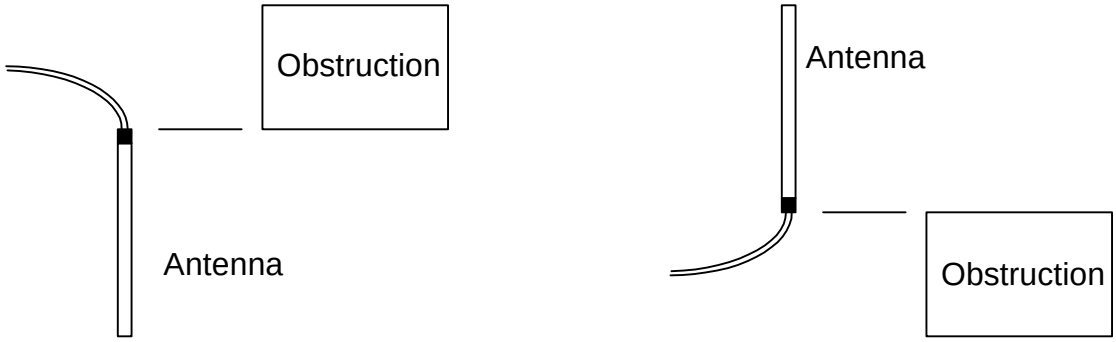


Figure 40. Antenna Mounting

Low gain rubber duck antennas that are mounted directly to Mesh transceivers are designed for transmitting and receiving vertically polarized radiation. Hence, care must be taken to insure close-to-vertical orientation of these antennas to avoid substantial signal loss due to polarization mismatch. Additionally, attenuation sustained by use of these antennas inside vehicles can be as high as 10 dB. Typically, losses are in the 4 to 7 dB range if the antenna is above the metal can of the vehicle so that radiation and reception occur at window level.

Lab Checkout

Prior to deploying any equipment in the field, it is recommended to test the equipment in a lab environment to ensure the equipment is functioning.

Step 1 - Verify MiSC

Set up the MiSC as discussed in the MiSC Assembly section. Attach a Windows computer to the SMC switch. Verify that the following can be pinged: edge router, core router, MeshManager. Refer to the Default Addresses and Logins section for the addresses.

Step 2 – Verify IAPs.

Using an Ethernet cable, attach the IAPs, one at a time, to the SMC switch. Using either the MAC or ETH address on the IAP box for reference, use MeshManager to verify that the IAP can be reached, and that it is obtaining an address from the DHCP server. Next, start an SD in infrastructure mode, and ensure that it also receives an IP address from the DHCP server. This verifies that both the SBC and the transceiver in the IAP are functioning.

Step 3 – Verify WRs

Connect an IAP as described in Step 2. Power up the WRs one at a time. Using the MAC address on the WR box for reference, verify that the MeshManager console can reach each WR, and that an appropriate IP address is displayed.

Step 4 – Verify PCMCIA cards

Connect an IAP as described in Step 2, Load a host computer with the WMC6300 drivers as described in Loading and Verifying WMC6300 Software. Insert a WMC6300 card into the host device. Start MeshTray. Verify that the status tab displays a valid IP address. Eject the WMC6300 card utilizing the *Unplug or Eject Hardware* icon. Insert another WMC6300 card and repeat the MeshTray test.

General Deployment Guidelines

It is recommended that field deployment follow the same steps as described in the Lab Checkout Procedures. IAPs should be deployed first and verified as functional. Next the WRs

should be deployed in a *near to far* pattern; in other words, WRs that are 1 hop from an IAP should be deployed first, followed by WRs that are 2 hops from an IAP, etc. This allows the functionality of each WR to be determined at the time of installation, thus eliminating any extra truck rolls to trouble-shoot a WR.

Section 6 - Customer Service Information

If you have read this document, and made every effort to resolve installation or operation issues yourself and still require help, please contact MeshNetworks Customer Support using the following contact information:

MeshNetworks, Inc.
Attention: Customer Support
PO Box 948133
Maitland, Florida 32794-8133

Hours of Operation

Monday through Friday	**8:00 AM – 5:00 PM (Eastern Standard Time)**
Technical Support:	**(800) 311 – 3365 (USA)**
	(407) 659 – 5300
e-mail	***measupport@meshnetworks.com***

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7 **SUPPORT SERVICES.** The Source may provide You with support services related to the Licensed Software (Support Services). Use of Support Services is governed by the Source's policies and programs or in other materials from the Source. Any Updates or other supplemental software code provided to You as part of the Support Services are considered part of the Licensed Software and subject to the terms and conditions of this Agreement. You acknowledge and agree that MeshNetworks and its licensors, contractors, resellers and distributors may use technical information You provide to them as part of the Support Services for its business purposes, including for product support and development.

8 **INDEMNIFICATION.** MeshNetworks will defend, indemnify and hold You harmless from any liability arising from any third party claim or proceeding against You to the extent that such claim or proceeding is based on an assertion that the Licensed Software infringes any issued United States patent or any trade secret or copyright of any third party; provided, however, that You notify MeshNetworks promptly in writing of any such claim or proceeding and give MeshNetworks full and complete authority, information and assistance to defend such claim or proceeding at the expense of MeshNetworks; and further provided that You give MeshNetworks sole control of the selection of counsel and the defense of any such claim or proceeding and all negotiations for its compromise or settlement. Should the Licensed Software become, or in MeshNetworks' opinion be likely to become, the subject of a claim of infringement, MeshNetworks will have the right, at MeshNetworks' option and expense, (i) to procure for You the right to continue using the Licensed Software, or (ii) to replace or modify the Licensed Software with a non-infringing version of substantially equivalent function and performance.

9 **LIMITATION.** MeshNetworks will have no liability to You hereunder for any infringement based upon (i) the combination of the Licensed Software with other products not provided by MeshNetworks; (ii) the use of other than a current, unaltered version of the Licensed Software; (iii) the use of any derivative works, modification or improvement of the Licensed Software not created by MeshNetworks; (iv) any use of the Licensed Software in the practice of a process not specified by MeshNetworks. Section 8 and 9 state the sole, exclusive and entire liability of MeshNetworks, and the sole, exclusive and entire remedy with respect to any claim of intellectual property infringement by the Licensed Software.

10 **TERMINATION.** If You breach any provision of this Agreement, then MeshNetworks may, in addition to any other remedies it may have under law, terminate any license granted hereunder effective immediately without liability after ten (10) days written notice to You, and You will promptly cease all use of the Licensed Software and will return to MeshNetworks all copies of the Licensed Software. In such event, at the request of MeshNetworks you will certify in writing that the original and all copies of the Licensed Software has been destroyed or returned to MeshNetworks.

11 **ASSIGNMENT AND MESHNETWORKS EQUIPMENT TRANSFER.** You may not sublicense or assign this Agreement or any interest or right granted herein without MeshNetworks' prior written consent. The Licensed Software is designed and configured for the sole purpose of operating with the MeshNetworks Equipment, and accordingly this Agreement will be automatically assigned on the sale or transfer of the MeshNetworks Equipment with which the Licensed Software operates to the person or entity who takes title to such MeshNetworks Equipment; provided, however, that such assignee or transferee abides by the obligations and restrictions set forth in this Agreement.

12 **GOVERNMENT LICENSEE.** The MeshNetworks Equipment and Licensed Software and accompanying documentation were developed at private expense and no part of them is in the public domain. The Licensed Software is Restricted Computer Software and Commercial Computer Software and if You are acquiring the Licensed Software for the United States

Government, then it is acquiring only restricted rights in the Licensed Software and its Documentation, all as defined in the applicable provisions of the Department of Defense Federal Acquisition Regulation Supplement and the Federal Acquisition Regulations. Such unit will include a restricted rights legend on the MeshNetworks Equipment and Licensed Software as may be necessary to insure the limitation of rights acquired by the government. Notwithstanding the foregoing, this Agreement will not become effective with respect to the United States Government without MeshNetworks' prior written approval.

13 **EXPORT CONTROLS.** This Agreement is subject to the laws, regulations, orders, and decrees of the United States that may be imposed from time to time restricting the import/export of the Products to/from the United States. You will not export or re-export the Licensed Software, or any part of the Licensed Software, directly or indirectly, prohibited by or in violation of the laws, rules or regulations of the United States or any applicable jurisdiction. Nor will You export or re-export the Licensed Software, or any part of the Licensed Software, directly or indirectly without first obtaining the required permission to do so from the applicable governmental agencies.

14 **COMPLIANCE WITH LICENSES.** You agree that upon request from MeshNetworks or the Source, You will within fifteen (15) days fully document and certify in writing that use of any and all Licensed Software at the time of the request is in conformity with this Agreement or some other valid license from MeshNetworks.

15 **MISCELLANEOUS.** This Agreement is governed by the laws of the state of Florida, United States of America. The state or federal courts located in or having jurisdiction over Orlando, Florida, United States of America will have exclusive jurisdiction over all maters pertaining to this Agreement. If any term or condition of this Agreement is or will become invalid or unenforceable, then such part will be ineffective to the extent of such invalidity only, without affecting this Agreement's remaining provisions. Those rights and obligation, which by their nature are intended to survive the expiration or termination of this Agreement, will survive. The remedies at law of either party in the event of default or impending default by the other party in the performance of any terms of this Agreement will not be adequate, and such terms may be specifically enforced by a decree for specific performance, injunction or other appropriate equitable relief. The failure of MeshNetworks to enforce at any time any provision of this Agreement will in no way be construed to be a present or future waiver of such provision, nor will it affect MeshNetworks ability to enforce any provisions of this Agreement. This Agreement is the entire agreement between the parties with respect to the subject matter set forth herein and supersedes all prior oral written agreements between the parties with respect thereto and may only be amended in writing by the parties.

Section 8 - FCC Regulatory Information

FCC Information

This device complies with Part 15 of the FCC Rules. 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.

The IAP6300 (Intelligent Access Point) is an infrastructure device that is positioned at a fixed location such as a building rooftop. The IAP6300 requires professional installation to ensure that the installation is performed in accordance with FCC licensing regulations.

The MWR6300 (Wireless Router) is an infrastructure device positioned in a fixed location, such as on a pole, wall, or rooftop. The MWR6300 requires professional installation to ensure the installation is performed in accordance with FCC licensing regulations.

Federal Communications Commission (FCC) Statement:

This Equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a commercial installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Any changes or modifications not expressly approved by MeshNetworks could void the user's authority to operate the equipment.

FCC RF Radiation Exposure Statement

1. **CAUTION:** This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 2 meters between the antenna and your body.
2. This Transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Section 9 - Safety Information for the MEA Products

The Federal Communications Commission (FCC) with its action in ET Docket 96-8 has adopted a safety standard for human exposure to radio frequency (RF) electromagnetic energy emitted by FCC certified equipment. MeshNetworks' MEA products meet the uncontrolled environmental limits found in OET-65 and ANSI C95.1, 1991. Proper operation of this radio according to the instructions found in this manual and the hardware and software guides on the MEA CD will result in user exposure that is substantially below the FCC recommended limits.

- Do not touch or move the antenna(s) while the unit is transmitting or receiving.
- Do not hold any component containing a radio such that the antenna is very close to or touching any exposed parts of the body, especially the face or eyes, while transmitting.
- Do not operate a portable transmitter near unshielded blasting caps or in an explosive environment unless it is a type especially qualified for such use.
- Do not operate the radio or attempt to transmit data unless the antenna is connected; otherwise, the radio may be damaged.

Antenna use:

- In order to comply with FCC RF exposure limits, dipole antennas should be located at a minimum distance of 2 meters or more from the body of all persons.

Section 10 - Safety Certification

3041788

Conforms to UL STD ANSI/UL 60950 3rd Edition

Certified to CAN/CSA C22.2 NO. 60950-00

Equipment shall be suitable for use in Air pressure: 86kPa to106kPa.

CE Mark Certification

The CE mark is the official marking required by the European Community for all Electric and Electronic equipment that will be sold, or put into service for the first time, anywhere in the European community. It proves to the buyer or user that this product fulfills all essential safety and environmental requirements as they are defined in the European Directives.

MeshNetworks Products are covered under the following product certification Europe:

ETSI EN 300 328 V 141 (2003-04)

Products covered - IAP6300, EWR6300 , WMC6300, and MWR6300

ETSI EN 301 489-1 (2002-08) and 301 489-17

Products covered - IAP6300, EWR6300 , WMC6300, and MWR6300

EN 55022:1998 and EN 55024:1998

Products covered - IAP6300, EWR6300 , WMC6300, and MWR6300

CENELEC EN 50360 and EN50371 – Specific Absorption Test - SAR

Products covered - WMC6300

The following countries are covered under the CE Mark:

Austria, Belgium, Demark, Finland, Germany, Greece, Ireland, Italy, Luxemburg, Netherlands, Portugal, Spain, Sweden, UK

CE Marking on the product will gain you access to the European Economic Area (EEA). Some countries may require a declaration of conformity, please check with your MeshNetworks sales team for details.

An example of the CE Marking on a product label:

The alert symbol indicates that MeshNetwork's products are ***not*** certified to operate in France. France outdoor use is restricted to 10mW EIRP for band 2454 - 2483.5 MHz.