Volume

1

POINTRED TECHNOLOGIES, INC.

MICRORED INSTALLATION GUIDE

POINTRED TECHNOLOGIES, INC.

Microred 2.4 GHz Installation Guide version 1.0

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FCC Information to Users of this Equipment

NOTE: Changes or modifications not expressly approved by Pointred Technologies could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with 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.

FCC Information regarding Installation

To meet regulatory restrictions, antennas must be professionally installed.

Paragraph 1.1307 of FCC rules requires that to meet RF exposure limits, antennas must be installed so as to maintain at least 2m separation from all persons.

This transmitter may not be co-located or operating in conjunction with other transmitters or antennas separated by less than 2m.

This product may be used with a number of different antennas in either point to point (p2p) or point to multipoint (p2mp) configurations. FCC EIRP requirements limit power inputs to p2p and p2mp antennas. The installer shall insure that the maximum power delivered to antennas is in keeping with the table below:

Description	Antenna gain,	Maximum power, p2mp	Maximum power, p2P
Dish/grid	24 dbi	12 dBm	24 dBm
Flat panel	15 dBi	21 dBm	26 dBm
yagi	15 dBi	21 dBm	26 dBm
omni	9 dBi	26 dBm	26 dBm

Introduction

Manual Pointred Technologies, Inc.

Purpose

This document describes the installation and configuration steps required for the Pointred Technologies, Inc. Microred Wireless Access system.

Product Description

TECHNICAL DESCRIPTION

1. System Description

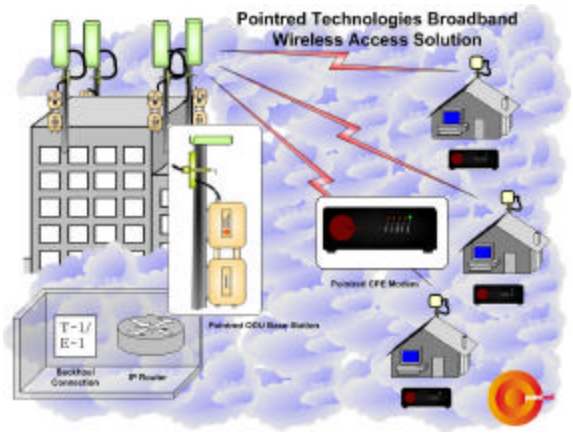
The MicroRed is a low to medium capacity Point to Multipoint Broadband Wireless Access operating in the frequency bands from 2.2Ghz to 2.9Ghz.

The MicroRed is offered in two main standard versions:

- 4Mbit/sec Capacity
- 8Mbit/sec Capacity

Operation of the MicroRed is enhanced via the use of extensive software implementation and management functions. All configuration, operation and maintenance functions are performed either locally via the RS232 console or from remote via Pointred's Network Management System (NMS).

The MicroRed consists of a completely outdoor Base Station and of a desktop Customer Premises Equipment. On request Pointred offers Sector and Remote Antennas.



The main advantages of the MicroRed system are:

- Completely Outdoor Base Station, installable anywhere with no need for Head End or equipment room
- On Board Routing
- Superior Throughput
- Point to Point and Point to Multipoint operation capability on the same platform.
- Frequency Agility via software programmable Synthesizer
- Modularity: any Modem Unit or Indoor Unit operates with any transceiver.
- Non line of sight operation via routing through a Line of Sight CPE. Identification of all possible routing path to the NLOS CPE and storage in memory of the information. Periodic refresh of the database to avoid loss of the link with NLOS CPE.
- Single interconnecting cable carrying the signals, the DC Power and the Telemetry Channels
- Supports DHCP
- 1+1 Hot Standby redundancy at the Base station

2. Base Station

The Base Station is the Wide Area Network Interface to the wireless system. A single 10BaseT port is provided to interface the network end at the Modem Unit. The Base Station consists of:

- Base Station Unit
- Transceiver
- Sector Antenna

Base Station Antenna with Microred Transceiver

Base Station Unit

The main characteristics of the transceiver are:

- Frequency Agility
- Extremely compact and lightweight
- Ease of installation

The Sector Antenna defines the size and the depth of the sector on the basis of the beam width and antenna gain. Pointred offers three different versions with 60, 90, 120 degree beam width.

The main features of the Modem Unit are:

- Sending and receiving the data from/to the network through the Ethernet interface
- Routing the data to the proper CPE based on the IP Address
- Modulating/demodulating the data
- Monitoring the LOS status of each CPE in the sector.
- Allocating the specified bandwidth to each CPE based on the Quality of Service tool input
- Supply the DC power to the Transceiver
- Periodically polling each CPE with control packets to verify the its bandwidth demand
- Provide diagnostic information through the Network Management System
- Configure the Transceiver through the Telemetry channel

The Microwave Transceiver includes an up converter a down converter and a frequency agile programmable synthesizer.

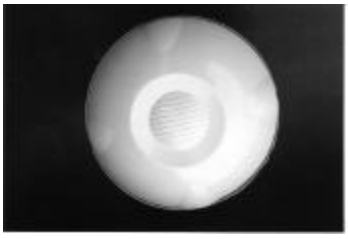
3. Customer Premises Equipment (CPE)

A CPE consists of a desktop Indoor Unit of an outdoor Microwave Transceiver identical to the one used for the Base Station and of a small antenna.

CPE Modem Module

Corner reflector

Spot Beam



Flat Panel

The CPE Indoor Unit major features are:

- Ease of installation
- Small Size and Weight
- Capable of supporting other LAN devices like Voice over IP phone, either SIP or H323 protocol, and 802.11b Access Point.
- 110/220VAC operation
- Low Cost

In its simplest operation, the CPE can be connected to the Ethernet port of a computer to provide broadband access to the end user.

Pointred offering for the Remote Antennas are:

- Corner Reflector
- Spot Beam
- Flat Panel

All antennas need a remote mount and antenna jumper cable to connect to the transceiver.

Technical Specifications

Base Station Includes:

- 1 Modem/Network Interface Unit (Ethernet Interface)
- 1 Microwave Transceiver
- 1 Transceiver Installation Kit (includes mounting brackets)
- Base Station mounting bracket includes bracket that mounts to the pole/mast, size of bracket 1.25" for small pole/mast
- 1 Installation and Configuration Manual

Base Station Backhaul Interface Options:

- 1T1 Interface
- 1E1 Interface
- 2T1 Interface
- 2E1 Interface
- Uninterrupted Conditioned Power Backup for Base Station.

Base Station 4Mbit/sec Specification:

- Frequency: 2400-2486Mhz
- Frequency Agile to any 1 MHz channel via software controls
- Power Agile from 1 milliwatt to 250 milliwatt
- Frequency Step: 1 MHz

- Capacity: 4Mb / s
- Max Throughput: 5Mb / s
- Channels Allocation: 1 MHz
- BTS Network Interface: 10BaseT, E1 (optional), 2xE1 (optional)
- Power Supply: 110 / 220 VAC for Base Station
- Power Consumption: 17 Watt
- Dimensions: 525x212x125 mm for the Base Station 165x165x40 mm for the Transceiver
- Antenna Interface: N Connector 50ohm Female
- Alarming: Transceiver not responding, WAN Packets Loss
- Output Power: +22dBm guaranteed
- Receiver Sensitivity: -75dBm

C 95% humidity°C +65°Environmental: -30

CPE Unit Includes:

- 1 CPE Modem unit.
- 1 Microwave Transceiver.
- 1 Installation and Configuration Manual.

CPE Antenna Option:

- Omni Antenna 6dBi
- Omni Antenna 8dBi
- Spot Beam 15dBi
- Panel Antenna 14 & 15dBi
- Reflector Antenna 24dBi
- Corner Reflector 12dBi

CPE 4Mbit / Sec Specification:

- Frequency: 2400-2486 MHz
- Frequency Step: 1.0 MHz
- Capacity: 4Mb / s
- Max Throughput: 5Mb / s
- Channels Allocation: 1 MHz
- CPE Network Interface: 10BaseT
- Power Supply: 110 / 220 VAC
- Power Consumption: 17 Watt
- Ventilation: Not Applicable
- Dimensions: 200x138x57mm for the CPE, 165x165x40 mm for the Transceiver.
- Antenna Interface: N Connector 50ohm Female
- Alarming: Transceiver not responding, WAN Packets Loss
- Output Power: +22dBm guaranteed
- Receiver Sensitivity: -75dBm
- Environmental: -10°C to + 50°C for the CPE Modem Unit. -30°C to +65° 95% humidity for the Transceiver.

Point to Point Specification 4Mbit / sec

- Frequency: 2400-2486 MHz Band
- Frequency Step: 1 MHz
- Capacity: 4Mb / s
- Max Throughput: 5Mb / s
- Channels Allocation: 1 MHz
- BTS Network Interface: 10BaseT, E1, 2E1
- Power Supply: 110 / 220 VAC
- Power Consumption: 17 Watt
- Ventilation: Not Applicable
- Dimensions: 525x212x125 mm for the Modem Unit; 165x165x40 mm for the Transceiver
- Antenna Interface: N Connector 50ohm Female
- Alarming: Transceiver not responding & WAN Packets Loss
- Output Power: +22dBm guaranteed
- Receiver Sensitivity: -75dBm

C 95% humidity°C +65°Environmental: -30

1.0 BTS Site Qualification

1.1 Terrain Factors

Choose Base Station locations based upon the following Factors:

a. Broadcast Coverage

b. Obstructions in the Broadcast Area

c. Subscriber Potential

d. Costs to Operate

1.2 Licensing: Federal, State, County, and Sales Taxes

Operators must comply with all Local Spectrum and Facilities Licensing Regulations, Fees, and Taxes prior to Broadcasting.

2.0 Base Station Installation

1.1 Interference Testing Steps

Wireless Data operators are faced with hundreds of antenna installations. Each subscriber presents a unique set of circumstances that must be considered when setting up a subscriber system. The variables which govern decision-making include - (1) the distance and direction to broadcast antenna, (2) any signal blockage at the residence, (3) the type of structure, and (4) the orientation of the structure with respect to the broadcast antenna. Distant blockage, which cannot be seen at the residence, can sometimes influence *line-of-sight reception.* Thus, the location of the antenna can sometimes be critical to reception. It can mean the difference between connecting a new subscriber and losing one. As a result, a wide variety of antenna mounting systems has evolved building upon systems created for mounting other types of antennas.

Prepare a Site survey Kit that includes the following basic items:

1. Lightweight Survey Antenna w/Mount kit
2. Telescopic Survey Mast or “Hotstick”
3. Microred Transceiver Unit
4. Signal Level Meter w/power supply onboard
5. 2 25 meter RG-6 Coaxial Cable w/connectors
6. Test CPE with RF Splitter (5-500Mhz)
7. 1 10meter RG-6 Coaxial Cable w/connectors
8. Expandable Ladder
9. Basic Hand Tools
10. Documentation
11. Notebook PC and Null Modem Serial Cable
12. 50Ohm Coax cable 3 meters w/ connectors

Optional Accessories:

2. GPS
3. Compass
4. Binoculars
5. Location Map
6. First Aid Kit
7. Spectrum analyzer
8. Coaxial Adapters

Survey Steps:

NOTE: The Site survey performs as a test of the LOS at various locations within the Base Station installation location. Considerations for Reception and Transmission quality are LOS (line of Site), Interference, and Multi-path, cable routing, and permissions. The Survey Technican must evaluate several Possible Antenna Mounting locations for the Base Antenna and determine the best location that accomidates the above considerations.

1. Connect a CPE Pannel antenna to a 50Ohm Coax cable.
2. Connect the Other end of the 50Ohm cable to the Spectrum Analyzer
3. Tune the Analyser to view the desired portion of the spectrum
4. Holding the antenna in you hand in vertical polarity begin to pass the antenna from left to right a full 360 across the desired broadcast area. Note the signals detected and record them in the documentations. Repeat the process in Horizontal polarity. Ideally you will not detect any other signals within your desired band. If there are “undertermined or unwanted signals” in the area in which you intend to broadcast, consult you system RF engineering team.
5. Document all information like height, GPS, and Rooftop location in the site survey form.
6. Repeat steps 1-5 at various other possible mounting locations on the roof.
7. Finally, determine which of the surveyed locations is the best for the following considerations:

a. Cable Routing, LOS coverage, Interference rejection, Mounting potential

1.2 Back Haul Access

Determine where in the Backhaul connection is located and note this in the Survey form. The backhaul availability and configuration will be determined by the system Network administrator. The Survey technician must realize the distance and route to the Backhaul from the Base Station/Router location.

1.3 Site Access

In choosing a Base Station location, determine if the location is suitable for operational personnel. The site MUS have 24/7 physical access for support and recovery operations.

1.4 Power Quality

The Base station power source must compliant to the local Electrical code. Consult the location owner for qualification information. In some cases a Un-interrupted power supply may be used to both provide power failure recovery and power conditioning. Consult you Network administrator for Configuration and installation instructions

1.5 Zoning

Zoning and license permissions for the site to be used for Radio broadcasting must be complied with. Consult your Network administrator for verification of the approval and or process.

1.6 Aeronautical Concerns

The proposed Base Station site must comply with all Local Aeronautical regulations such as Antenna height and location, Beacon marking requirements, and notices

1.8 Hard Ware installation Steps

Pre-Installation Requirements:

1. Surveyed BST Mounting location with suitable grounding connection.
2. 110/220VDC source
3. Internet or Other media Connection interface (IP Router)
4. Suitable Broadcast Antenna
5. Basic Hand Tools

Component Inspection:

1. Carefully unpack the Base Station package and inspect the unit for physical damage.
2. Verify that all the components are present against the shipping information or Purchase order.

Immediately contact PointRed Technologies if any portion of the system base station package is missing or damaged.

Mounting the BASE STATION:

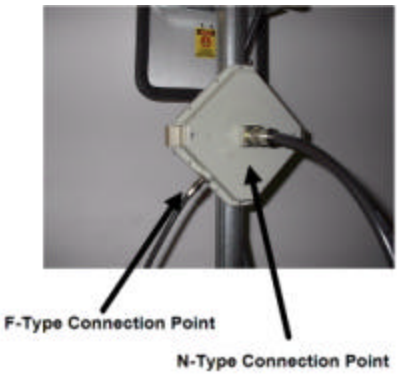
1. Vertically mount the BST using the supplied mounting hardware with the F-Type 75ohm connection downward.

Connecting the BASE STATION:

1. Connect the Ground point to the BASE STATION mount.

2. Connect a F-Type 75ohm Coaxial cable to the F-Type 75ohm connection point of the BST. Note: DO NOT OVERTIGHTEN the F-Type 75ohm connector and **DO NOT connect any cable to the BST while the unit is powered! POWER OFF FIRST!**

3. Connect the other end of the F-Type 75ohm Coax cable to the PointRed Transceivers F-Type 75ohm connection point. As pictured below. Then, connect an N-Type 50ohm Coax Cable to the Transceivers N-Type 50ohm connection point.



4. Connect the other end N-Type 50ohm coax cable to BAST Station Antenna's N-Type 50ohm Connection Port as pictured below.

N-Type Coax Connection Point

5. Connect an Ethernet CROSSED cable with a standard RJ-45 connector to the Backhaul connection point of the BASE STATION. The other end of the Ethernet Crossed cable to your Media Connection such as a Router.

Here is an image of the final installation configuration below

1.10 Connecting to the Base Station

Connecting to the System Using Hyper term

Pre-Configuration Requirements:

1. Installed BASE Station and CPE Modem
2. PC with Win 2000, 128megRam, Pentium II, with Serial Port
3. 9-pin RS-232 Serial Cable with Null Modem 9pin
4. Ethernet 10baseT CROSSED Cable
1. Test Server PC

Connecting to the Base Station and CPE console port

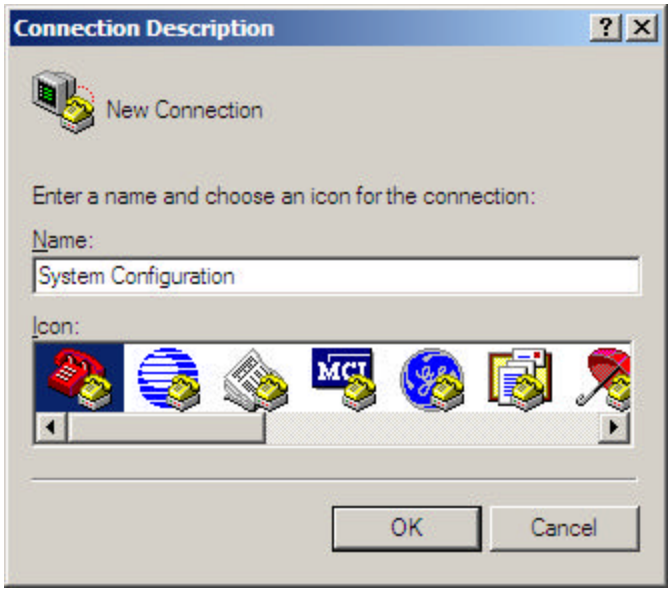
1. Connect the RS-232 cable to the CPE Modem RS-232 Port or the Base Station RS-232 port. (See Configuring the Base Station)
2. Connect the other end of the RS-232 Serial cable to the Null Modem.
3. Connect the Null Modem to the RS-232 port of the PC.

4. Left Click, Start>Programs>Accessories>Communications>Hyper terminal

5. Click to Open Hyper terminal.

6. At the Hyper Terminal Window you will see a dialog box (Connection description). Enter the following: "System Configuration"

Here is an image of the Dialog Box "Connection Description"



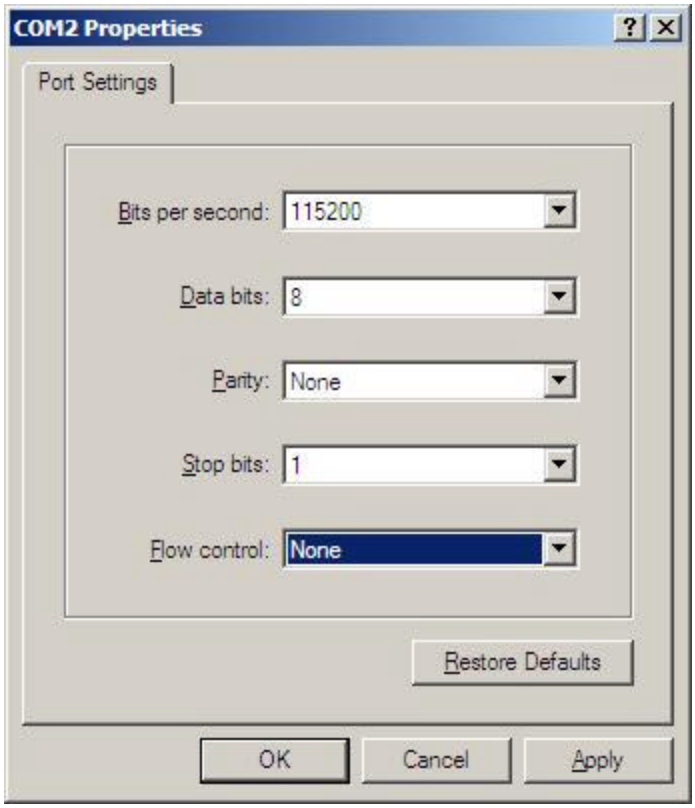
7. Click OK. You should see a dialog box named "Connect To". Select the proper COM port connected to the RS-232 Serial cable.

Here is an image of the Dialog Box "Connect to"

8. Click OK. You should see a dialog Box named "Com (your com port)"

Select the following: 115,200 bits per second, 8 data bits, None Parity, and None for Flow control. Also assign your PC's Com Port. If you are unsure of you COM port, click Start>Control Panel>Ports to find your Com Port configuration

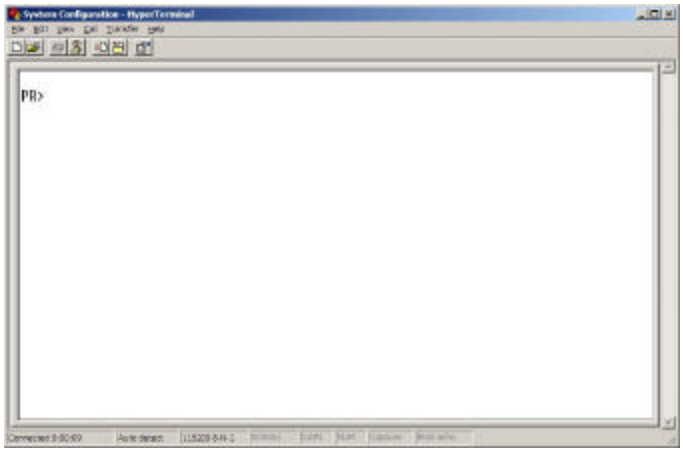
Here is an image of the Dialog Box with " COM2 Properties"



9. Click OK. You should now return to the hyper terminal window. Type “Enter” You should see the Point Red Configuration Prompt.

Cont.

Here is an image of the Hyper Terminal Window: Type “Enter” to see the PR> prompt.



You are now ready to configure the Network Settings for the PointRed System.

1.11 Configuring the Base Station Steps

This Chapter describes all the commands available for the user/administrator to see and modify the system settings.
This document also provides the commands syntax and system response for each command.

The system commands are:

1. "help"

The "help" command introduce all available commands.

a. On the BASE-STATION system:

Command:

```
help<ENTER>
```

Response:

```
help       - Show this help menu
enable     - UART: login Administrator
disable    - UART: logout Administrator
state      - Show current station setup
lanip      - Show/Set LAN IP Address
landg      - Show/Set LAN Default Gateway IP Address
wanip      - Show/Set WAN IP Address
wgateip    - Show/Set WAN Default Gateway IP Address
addcpe     - Add CPE to the system
delcpe     - Remove CPE from the system
listcpe    - List CPEs in the system
commit     - Save configuration to the FLASH
reset      - Reset System
trfrq      - Set transmit frequency
trmode     - Set frequency band
```

```
trpwr     - Set the output power level
```

On the CPE-MODEM system:

Command:

```
help<ENTER>
```

Response:

```
help      - Show this help menu
enable    - UART: login Administrator
disable   - UART: logout Administrator
lanip     - Show/Set LAN IP Address
landg     - Show/Set LAN Default Gateway IP Address
commit    - Save configuration to the FLASH
reset     - Reset System
```

2. "enable"

The "enable" command allows the user to login as the administrator for modifying the system settings.

Command:

```
enable<ENTER>
```

Response:

```
Password:
```

Command:

```
<password><ENTER>
```

Response:

```
--  Welcome to UART Admin
```

3. "disable"

The "disable" command causes the system to exit from administrator.

Command:

```
disable<ENTER>
```

Response:

```
<prompt>
```

4. "state"

The "state" command allows the user to see the current system configuration.

Command:

```
state<ENTER>
```

Response:

```
Base Station
LAN IPAddress:192.168.0.2 IPMask:255.255.255.0
Gateway:192.168.0.1
WAN IPAddress:  192.0.0.1 IPMask:255.255.255.224
```

5. "lanip", "landg", "wanip" and "wgateip"

The "lanip", "landg", "wanip" and "wgateip" commands allow the user to see the current system IP settings and to the administrator to modify these settings.

a. To see the current system LAN IP address:

Command:

```
lanip<ENTER>
```

Response:

```
Current Lan IP: 10.0.0.2
   usage: lanip X.X.X.X [ netmask ]
```

b. To modify the current system WAN IP address:

Command:

```
wanip 192.0.0.7 255.255.255.0<ENTER>
```

Response:

```
replacing net if2 IP address 192.0.0.1 with 192.0.0.7
```

6. "addcpe" and "delcpe"

The "addcpe" and "delcpe" commands allow the administrator to add new CPE to the system or to remove unused CPE from the system.

Add command syntax: `addcpe <mac address> <LAN address><ENTER>`
Delete command syntax: `delcpe <LAN address><ENTER>`

a. For example:

Command:

```
addcpe 00.11.22.33.44.55 10.0.8.1<ENTER>
```

Response:

```
....   CPE added to the list successfully ...
```

b. Another example:

Command:

```
delcpe 10.0.8.1<ENTER>
```

Response:

```
Entry successfully deleted ....
```

7. "listcpe"

The "listcpe" command shows to the user all the CPE's that configured in the system.

For example:

Command:

```
listcpe<ENTER>
```

Response:

```
CPE list:
     Number of CPE(s) : 2

[CPE 1]
   Mac address 0.11.22.33.44.c2
   LanIP   10.0.1.1        WanIP   192.0.0.3

   Number of packets sent  : 0
   Number of bytes sent    : 0


[CPE 2]
   Mac address 0.11.22.33.44.c8
   LanIP   10.0.0.1        WanIP   192.0.0.2

   Number of packets sent  : 38440
   Number of bytes sent    : 53989430
```

8. "commit"

The "commit" command lets the administrator to save the new settings in the flash so if the system restarts due to user demand or power failure, no new settings will be lost.

Command:

```
commit<ENTER>
```

Response:

```
copy -f –f 0x7F0000 0xBFDF0000 0x4000
100%, 0x4000/0x4000 bytes loaded
```

9. "reset"

The "reset" command lets the administrator to reset the system. Reset command must be applied for the new IP settings to take place.

Command:

```
reset<ENTER>
```

Response:

```
<system restart>
```

10. "trfrq"

The "trfrq" command lets the administrator to set the transceiver frequency. Valid values range from 2405 to 2480 in increments of 5 MHz.

Command:

```
trfrq 2450<ENTER>
```

Response:

```
Transceiver Frequency Changed: Old=2475, New=2450
```

11. "trmode"

The "trmode" command lets the administrator set the CPE to the transceiver frequency band. 2.4Ghz =trmode 0

Command:

```
Trmode 0 <ENTER>
```

Response:

```
2.4 Ghz system frequency band
```

12. "trpwr"

The "trpwr" command lets the administrator to set the transceiver power. Valid values range from 0 to 255.

Command:

```
trpwr 128<ENTER>
```

Response:

```
Transceiver Power Changed: Old=119, New=128
```

RF Configuration Procedure for the Base Station

This procedure details the steps needed to set the base station's RF operational parameters.

1. Open the Base Station cover and connect to the RS-232 port and your PC. Open Hyperterminal and type enter. You should see the PR> prompt.

2. To Set the Frequency for 2.4 Ghz range type "enable" then enter the password. Type "admin". You should see the admin> prompt. Type "trmode 0" for 2.4 Ghz range.

3. Next, determine the center frequency for radio channel you which to use. Type "trfrq xxxx" and type enter. Example: trfrq 2475. Type "commit" enter and Y" enter to save the setting. Next, type tfrq to verify system settings. Example : trfrq OLD=2450 NEW=2475.

4. To set the System power level. Type "trpwr 255" enter. Type "commit" and "Y" to save the setting. You may type "trpwr" again to verify. This will set the system power level to maximum output. It is recommended to use maximum power level for most configurations.

5. The PoinRed CPE modem is configured exactly as detailed the previous steps. All CPE modem that subscribe to the Base Station in a given MicroCell must have the same Radio Frequency configuration as the Base Station

This Completes the RF configuration

Network Configuration Procedure for the Base Station

This procedure details the steps needed to set the base station's IP Network operational parameters. Contact Pointred Technical support fro assistance in determining your network IP scheme.

1. Open the Base Station cover and connect to the RS-232 port and your PC. Open Hyperterminal and type enter. You should see the PR> prompt.

2. Type, "enable" and enter the Password "admin'". You should see the admin prompt. Type "lanip xxx.xxx.xxx.xxx" then enter and commit to set the IP of the Base Station.

3. Next type "landg xxx.xxx.xxx.xxx" to set the Default Gateway for the Base Station then, enter and commit to save the setting.

4. Type "wanip xxx.xxx.xxx.xxx enter and then commit and y to save the setting.

5. Next, type "wgateip xxx.xxx.xxx.xxx" to set the WAN default gateway. Type commit and y to save the setting.

6. Type, "state" to verify all the above settings. The PoinRed CPE modem is configured exactly as detailed the previous steps. All CPE modem that subscribe to the Base Station in a given MicroCell must have the same Radio Frequency configuration as the Base Station.

7. Type disable to exit the Administrator login

This Completes the RF and Network configuration.

Add/Delete CPE at the Base Station

This procedure details the steps needed to add CPE's to the base station's database. Contact Pointred Technical support for assistance or questions.

1. At the Base Station via RS-232 connection type enable and the password admin to enter the administrator functions.

2. Type " listcpe" to show all of the current added cpe. Next type "addcpe" and enter the IP address and MAC address of the CPE you wish to add to the system.

3. To delete a CPE entry type "delcpe".

4. To save the CPE's you have added to the system type "commit" and "Y" then enter.

This completes the step to add or remove a CPE at the Base Station.

Contact PointRed Technical support for assistance.

Call: 1-408-383-0153 for Customer Support

www.pointredtech.com

1.12 Configuring the Linksys Router Steps

Backgrounder:

The Linksys BESFR41 router is used to set a Static IP route for connectivity between the Microred CPE Modem Module and the Microred Base Station. The Router also provides Backhaul Internet connectivity to devices connected to CPE modems on the Microred network. Below are the steps required to configure the router for use with a standard Microred IP configuration. The BESFR41 router has a default configuration that must be re-configured in order to comply with the Microred system standard IP configuration. The default IP address of the BEFSR41 is 192.168.1.1. The default password is "admin" with NO user name entered in the Loggin field.

Requirements:
The following items are needed to configure the BEFSR41:

1. Linksys BEFSR41 Cable/DSL router with supplied power supply
2. Straight Ethernet cable/RJ-45 connectorized
3. Win 95 or higher PC with NiC 10/100BT.
4. Compliant 110vdc power source

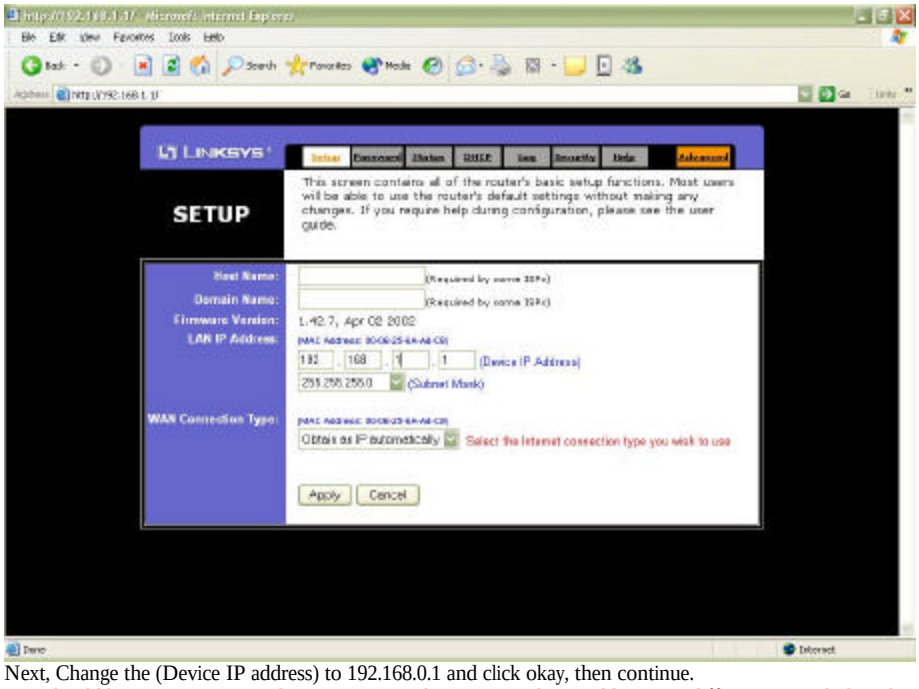
Configuration Steps:

1. Connect the BEFSR41 to the supplies power supply and plug the power supply into the compliant 110vdc source.
2. Connect one end of the Ethernet Straight cable to the PC's Nic RJ-45 interface.
3. Connect the other end of the Ethernet straight cable to Port 4 of the BEFSR41 router.
4. Set the IP address of the PC NiC to the following settings and Reboot the PC.

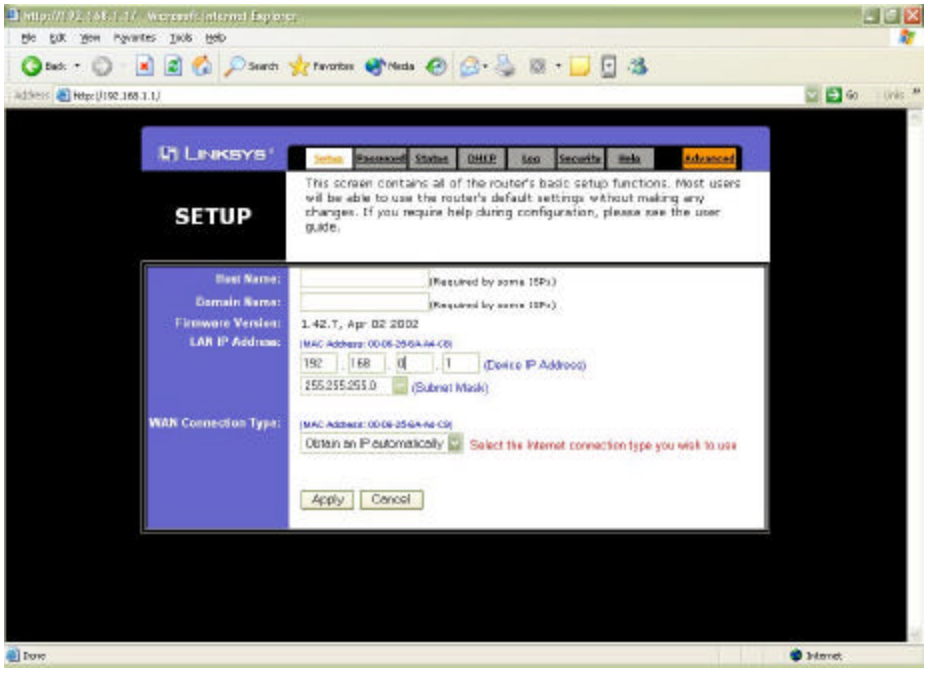
IP	192.168.1.5
Subnet	255.255.255.0
Default Gateway	192.168.1.1
DNS	0.0.0.0

5. Optional step. Verify the PC's IP address setting by opening the windows Command Prompt window and typing Ipconfig or winipconfig.
6. Next open the IE explore application and enter the Routers default IP address into the address bar of IE explorer. Click "GO".
7. You should see the following window:

8. Enter the router default password in the Password box. "admin". Click okay.
9. You should see the following window appear. If not, verify the IP address of the PC you are using.

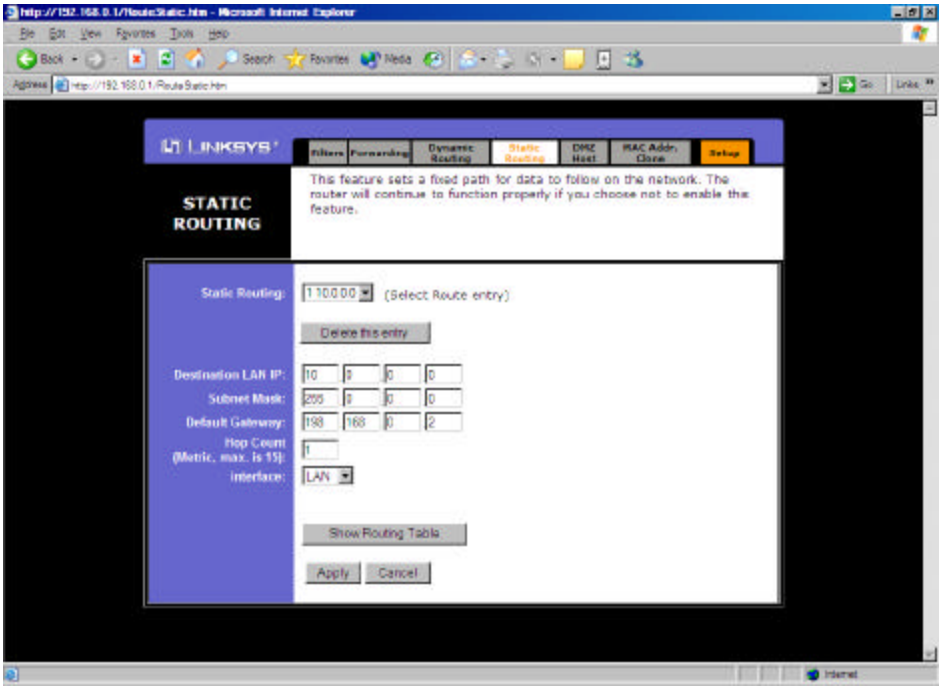


10. Next, Change the (Device IP address) to 192.168.0.1 and click okay, then continue.
11. You should lose connectivity to the Router as you have just set the IP address to a different network than the network address set on your PC. Set the PC to 192.168.1.5 and the Default Gateway to 192.168.1.1 to match the Routers new IP settings. Reboot the PC and re-open IE explorer.
12. Type 192.168.0.1 in the address box and click GO. You should see the following box appear. Enter the "admin" password as before and click OK. You should see the following window appear showing the new IP address of the route as pictured below.

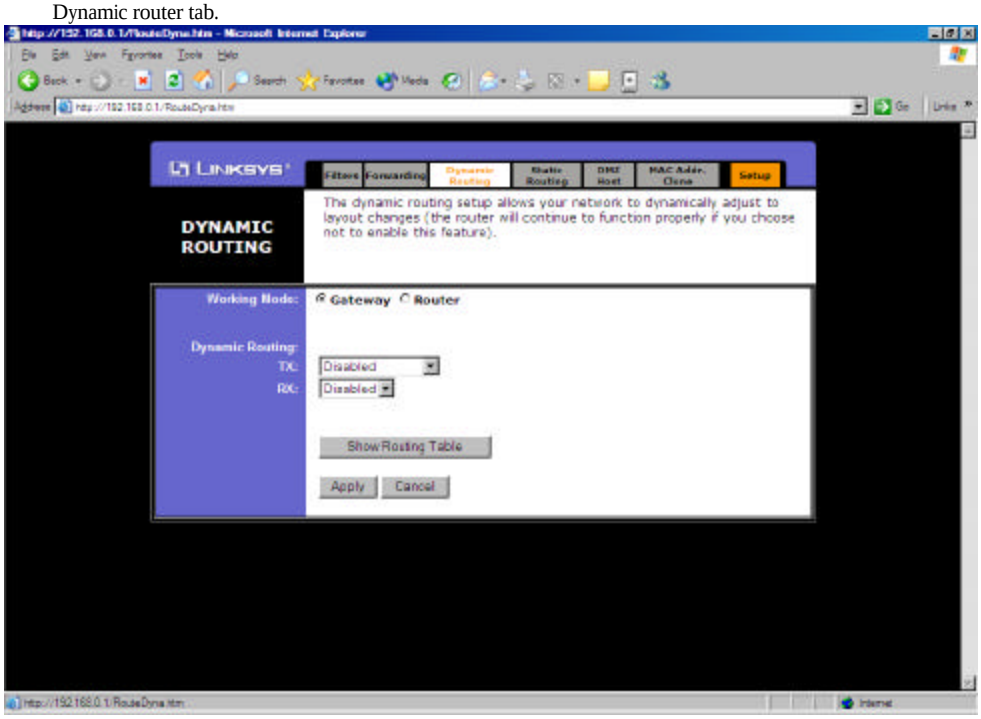


13. Next, Click the Advanced tab on the top right of the window. Then click the Static Routing tab. You should see the following window appear. This is the configuration dialog for routing the CPE 10.0.X.X IP address' to the BTS. We will

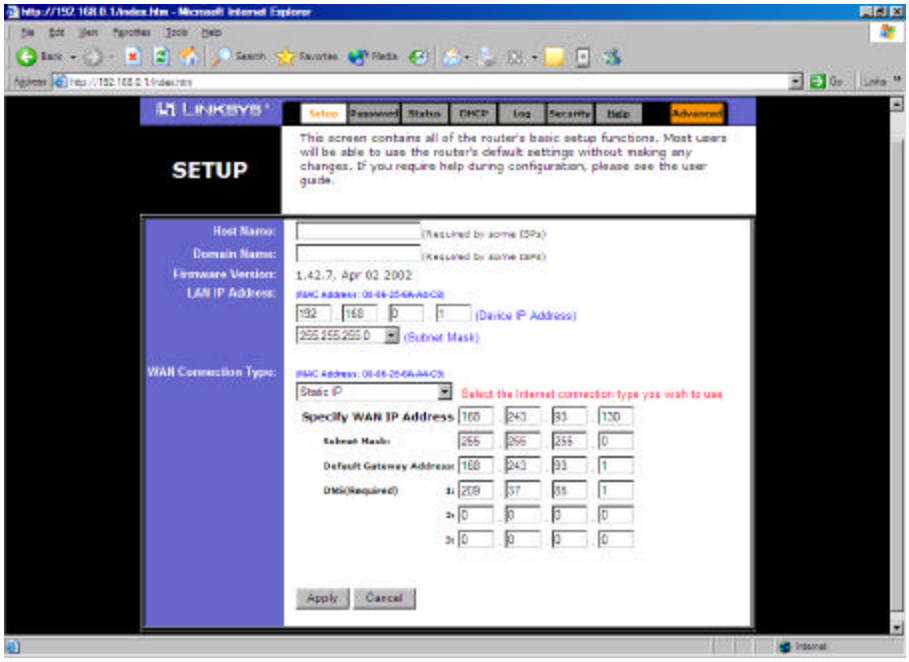
set a route of 10.0.0.0 to 192.168.0.2 as pictured on the next page below. Enter the address of 10.0.0.1 in to the Destination LAN IP dialog of the router. Enter 255.255.255.0 into the Subnet dialog. Enter 192.168.0.2 into the Default gateway dialog and click “apply” then continue. You should see the following window on the next page. HOP count of “5” and LAN should be set also. Set them in this window also.



14. Click the Dynamic Routing Tab. You should see to Radio buttons. Click on the “Router” button. This will enable the Router to perform the Static route you set in step 13. You should see the window below when you first select the Dynamic router tab.



15. Next Click the Setup Tab again and Click on the Wan Connection Type Drop down box. Select “Static IP”. This is where you will enter the Backhaul connection IP information. Enter the IP, Subnet Mask, Default Gateway and DNS server address'. Consult your Network administrator for these settings. The next section describes the Backhaul interface requirements. Once you have entered these setting Click “Apply” and “Continue “. This completes the BEFSR41 Configuration.



1.12 Backhaul Interface

The Base Station Router requires an IP address that is either Public or Private to connect to the internet and other servers. Consult you System network Administrator for these settings:

IP address: xxx.xxx.xxx.xxx

Subnet: xxx.xxx.xxx.xxx.

Gateway: xxx.xxx.xxx.xxx

DNS: xxx.xxx.xxx.xxx

You will need to enter these as the WAN settings of the Router.

1.14 Power Configuration Steps

Consult you local Network Administrator for the proper configuration and Installation steps for both Power connection and UPS configurations.

1.15 Cable Routing

Down-Lead Routing: The coaxial down lead should be routed to the entry point by the most direct route possible. However, the route should always be either vertical or horizontal. Down-leads should never be routed across a wall at an angle. Sharp bends or kinks in a coaxial cable should be avoided since they can influence the cable's frequency response. The effect of a sharp bend or kink can be so serious that the response may create a deep "notch" in the frequency response at some particular frequency. Damaged or broken coax can result in signal leakage. If external signals leak into the system, it can degrade reception. Also, if signals leak out of the system it could interfere with other radio services. Leakage is never one way. If signals are leaking into the down-lead system, they will also be leaking out.

It is good practice to make a "drip loop" at the point where the coaxial cable enters the building. This loop prevents water from entering the building by dripping down the coaxial cable. It is also good practice to make *service loops* with the coax near the connectors at both the top and bottom of down lead. Service loops are also made on both connections to the ground block or at any point where an F connector is used. These loops provide extra cable for connecting test equipment during troubleshooting. They also provide some extra cable length in the event that bad connectors have to be replaced sometime in the future. Service loops are made twisting several turns of coax into a *4*-inch loop and securing them with tie-wraps. Service loops perform three functions. First, the additional cable length makes it easier to connect test equipment. Second, the additional length makes it easier to replace F-connectors. Third, in some instances service loops may double as drip loops.

The RG-6 IF Cable routing consideration are:

a. Distance from the Transceiver port to the Location (Maximum is 66 meters or 200 feet.)

b. Follow the shortest possible route to the BTS

c. Attach the cable to the building structure with a cable clip at least every meter in straight direct lines. Use Cable Ties to provide for replacement of connectors.

1.16 Grounding

Grounding: Most experts agree that the most important purpose over-riding of grounding is safety. There are two aspects of grounding an antenna system. The first involves grounding the coaxial down lead. The second involves grounding the antenna mounting system. Proper grounding is a concern for several reasons. Improper grounding could present a shock or fire hazard. It could also create regulatory problems with respect to local codes and ordinances. It is incumbent upon each wireless operator to assure that installation practices in any particular locality comply with all federal, state, and local fire codes and electrical codes. Failure to scrupulously follow such standards could create a serious liability for the data operator if a subscriber's home burns down as a result of lightning strike.

a. Connect a Grounding block in line between the Transceiver and the BTS.

b. Connect a #10 copper ground wire to the Ground block Ground terminal

c. Route the Copper Ground wire to the Closest approved ground point. Consult you local Network administrator for local regulations pertaining to grounding.

Grounding Masts & Supports: Article 810 of the *NEC* stipulates that masts and supporting mounts be grounded to provide discharge path to ground. When a near lightning strike occurs, powerful electromagnetic fields can induce surges in nearby conductors. Static charges can also build up during high winds. Hence, masts and supporting structures should be grounded using # 10 gauge wire. Connecting a second ground lead between the masts, mounting tripod, does this and coaxial ground block at the entry point. The ground lead may be attached to a mast using a ground strap. However, some installers use another ground block on the mast. The ground wire is then run from the *antenna mount* to the *mast block* and then down to the *ground block* at the near the point of entry. Article 810-17 (b) requires that any splices in a ground line must be *permanent* crimped splices made with a crimping tool. If the ground block at the point of entry is connected to a power riser, the mast and supporting mount may also be grounded to the same riser pipe (at the top).

Ground Wire Routing: Like the coaxial down lead, the ground lead should routed to ground outside the building by the straightest and most direct route possible. However, this route should always be either vertical or horizontal. Usually this is done by simply following the coaxial cable. Sharp bends in the ground wire should be avoided. It is important for the installer to assure a physically secure ground with a good electrical bond. A physically insecure connection could work loose. An electrically unsound bond will result in a high resistance ground. Ground wires should also be marked with warning labels, which read:

- CAUTION -
Ground Wire
Do Not Remove

Although Articles 810 and 820 allow inside routing of ground wires, ground wires should always be routed *outside the building.* In the event of a lightning strike, the outside routing will canny the lightning surge directly to ground on the outside of the building rather than carrying the surge inside the building.

Driving Ground Rods: It is generally a good idea to avoid driving ground rods if the power service ground can be used. Although driving a ground rod costs more than using a preexisting ground, the reason for preferring the power company's ground is technical rather than financial. When a building has *two earth grounds*, the possibility of a *difference of potential* between the two around points exists. This presents a potential *shock hazard.* It also creates the possibility of *arcing* during an electrical storm. However, there are occasionally situations in which it may be necessary to drive a ground rod

When it is not feasible to reach the power service ground, a ground may be established using an 8-foot rod. Articles 250-8 1 and 250-83(cX3) recommend either a stainless steel rod with a diameter of 1/2-inch or an iron or steel rod with a diameter of 5/8th inch. Whenever an additional ground is used, both Articles 810 and 820 require that the second ground rod be interconnected to the power service ground using # 6 gauge wire. This cable functions to equalize any difference between the two grounds and may be routed inside the building. Allowing the mast to extend above the Antenna will help protect the Transceiver from lightning strokes. However, since lighting can strike horizontally, this procedure may not always protect the Transceiver. Nevertheless, it will make the Transceiver a less likely target.

Grounding Towers: Because tall towers make good targets for lightning, it is essential to ground both the tower structure and the down lead correctly. Masts should be grounded directly to the tower structure. The tower structure should be grounded to *an* eight-foot ground rod

Driven completely into the earth at the bottom of the tower. If shale or rock makes use of an eight-foot ground rod impossible, then two four foot ground rods should be driven *eight feet apart* and connected in parallel. The down lead should be *grounded to the tower structure* using a ground block at the top of the tower, at the bottom of the tower and at intervals of 150-feet along the tower structure. Since most towers used for wireless reception systems are one hundred feet or less in height, most reception systems only need a ground block at the top and the bottom of the tower. The down lead should be grounded again to the power service ground using an additional ground block where the cable enters the building. The purpose of this strategy is to short lightning strikes, which hit the tower structure,

directly to ground. Because the pound resistance is lower, the ground blocks mounted on the tower structure will short lightning surges or static charges directly to ground through the tower structure rather than the down-lead shield. Any remaining charge on the down-lead shield will be shorted to the power service ground.

1.17 Weather Protection

Weatherproofing: External F Type connectors are weatherproofed against corrosion using Teflon sealant (grease) on the inside of the connector. A air-shrink" boot may be used to weatherize splices. Silicone paste should be used on the inside of the boot and electrical tape may be wrapped around the outside. *Multi/ink Inc.* makes a series of coaxial splice enclosures called a *"Gelseal tm"'* designed for weatherproofing underground splices. Three different models are made for use with RG-6 cable (part number 3610-OS), RG-11 cable (part number 3611-OS). Although *"Gelseal tm"* splice enclosures cannot be used with ground blocks, they are appropriate for use with a barrel connector and two male F-connectors. The coax enters the building through a wall plug. The wall plug should also be weather proofed with RTV cement to prevent water from leaking inside.

a. Verify that all outdoor exposed connectors are weather sealed in accordance with the local system standards.

3.0 LOS CPE Installation

1.1 Installation Proofing Steps

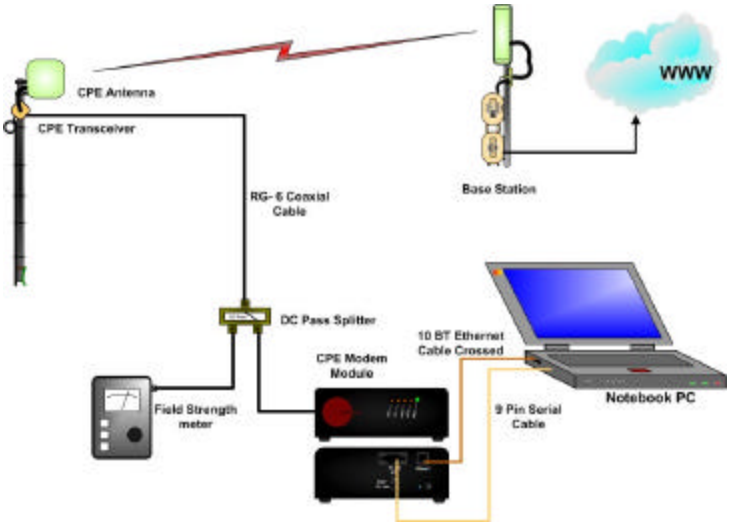
Prepare a Site survey Kit that includes the following basic items:

13. Lightweight Survey Antenna w/Mount kit
14. Telescopic Survey Mast or “Hotstick”
15. Microred Transceiver Unit
16. Signal Level Meter w/power supply onboard
17. 2 25 meter RG-6 Coaxial Cable w/connectors
18. Test CPE with RF Splitter (5-500Mhz)
19. 1 10meter RG-6 Coaxial Cable w/connectors
20. Expandable Ladder
21. Basic Hand Tools
22. Documentation
23. Notebook PC and Null Modem Serial Cable
24. 50Ohm Coax cable 3 meters w/ connectors

Optional Accessories:

9. GPS
10. Compass
11. Binoculars
12. Location Map
13. First Aid Kit
14. Spectrum analyzer
15. Coaxial Adapters

Site Survey Diagram



1.2 Mounting Options

Mounting Systems: The ingenuity of the wireless industry is proven by the fact that there are currently more than twelve different types of mounting systems in use to adapt an antenna to every conceivable type of structure. The most mounts are pipe mounts, eave mounts, chimney mounts, flat base mounts, and wall mounts can be used for smaller antennas of limited height on multistory buildings when other systems are inappropriate. Some of the more common application instructions for various types of mounting systems are covered below for general purposes. However, each mounting system has a specific set of assembly, application, and installation instruction provided by the manufacturer. Such detailed instructions should be scrupulously followed for proper performance of any specific product.

Pipe Mounts. Pipe mounts are usually limited to small antennas in strong reception areas, which do not require significant height. They allow installers to attach a mast to a vent pipe. A pipe mount consists of a mast fitting with straps, which wrap around the pipe. *They are used only with small antennas and short masts on heavy sewer pipes.* Light aluminum pipes should be avoided with large antennas, which experience significant wind loading.

Peak Mounts. Peak mounts use mast fittings, which have a base, which is shaped like an inverted "V." They allow installers to anchor masts to peaked roofs. They may be used independently with short masts or with other kinds of mounting systems. Frequently they are used on peaked roofs to turn a tripod mount into a quadpod mount.

Universal Base Mount: Universal base mounts can be used to adapt a mast to a roof with any slope. Like peak mounts, they are sometimes used with quadpods. The mast fitting is equipped with a *hinge* which allowing a mast to be anchored to a roof at any angle.

Guy Wire. Guy wires are attached to tall masts or towers to provide additional physical support. Current practice is to use a set of three or four guy wires for each ten-foot mast section starting at the top of the mast. At one end, the guy wires are attached to the mast using a guy ring and clamp. At the other end, the wires are anchored to solid building rafters or beams with appropriate screw eyes hooks or ram hooks. *Guy wires should never be spliced.* On masts *under thirty-five feet,* three guys are usually arranged at 120-degree angles. On masts *over thirty five-feet* an arrangement of four guy wires at ninety-degree angles should be used. Guys will provide maximum support at a 45-degree angle with respect to either the mast or the ground.

Quadpod Mounts: Quadpods have four legs. One of the Legs is actually the antenna mast. Quadpods are sometimes used for mounting a mast on either a flat roof or a sloped roof where a tripod will not work. Quadpods are made by using a tripod with a flat base, a peak mount, or a universal base mount. At least one of the legs should be anchored to a rafter. The mast *must be vertical* before all of the legs are anchored to the roof a tar pad and two lag screws are used on each of the diagonal legs. The center leg is anchored with either two or four lag screws depending upon the type of center mount used. Like tripods, quadpods are never used on tin roofs.

Ground Mounts: In general, ground mounts can be classified into two groups - (1) Free standing ground mounts, and (2) those, which use a building for support. Freestanding ground mounts depend *exclusively* upon a ground anchor and guy wires for support. Building supported ground mounts relay upon the earth and an adjacent structure for support.

In some areas of the country with single story buildings and flat terrain, ground mounts are used more often than tripods. They are used on single story structures because they are so easy to erect and ground. Ground mounts are also very solid and often do not require guys. The mast is anchored in the earth and supported by a building using a bracket. Twenty-foot ground mounts attached to a building do not require guy wires. However, mounts over twenty feet must be guyed. Eave mounts and wall mounts can also be combined with flat base systems to erect a ground mount when additional support is needed.

1.3 Grounding Steps

Grounding Masts & Supports: Article 810 of the *NEC* stipulates that masts and supporting mounts be grounded to provide discharge path to ground. When a near lightning strike occurs, powerful electromagnetic fields can induce surges in nearby conductors. Static charges can also build up during high winds. Hence, masts and supporting structures should be grounded using # 10 gauge wire. Connecting a second ground lead between the masts, mounting tripod, does this and coaxial ground block at the entry point. The ground lead may be attached to a mast using a ground strap. However, some installers use another ground block on the mast. The ground wire is then run from the *antenna mount* to the *mast block* and then down to the *ground block* at the near the point of entry. Article 810-17 (b) requires that any splices in a ground line must be *permanent* crimped splices made with a crimping tool. If the ground block at the point of entry is connected to a power riser, the mast and supporting mount may also be grounded to the same riser pipe (at the top).

1.4 Cable Installation Steps

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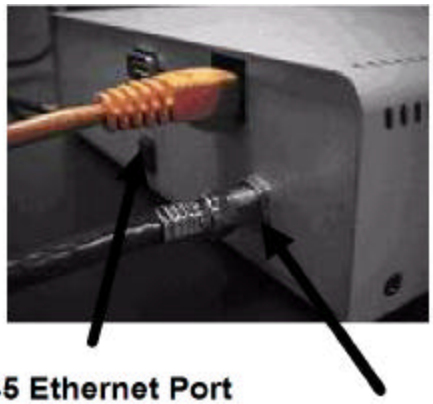
1.5 Modem Module Installation Steps

1. With the CPE modem disconnected from power, Connect the RG-6 Cable to the IF Connection on the back of the CPE.



RJ-45 Ethernet Port

IF Connection Point

2. Connect the 10BaseT port of the CPE modem to your laptop using a Ethernet Crossed cable as partially pictured above

3. Connect the Supplied Power supply to the CPE modem and the compliant power source.

4. Configure the CPE with the RF and IP parameters. Consult your System Administrator for the settings

5. Configure the CPE PC with the proper network settings

1.12 Weather Protection

Weatherproofing: External F Type connectors are weatherproofed against corrosion using Teflon sealant (grease) on the inside of the connector. A air-shrink" boot may be used to weatherize splices. Silicone paste should be used on the inside of the boot and electrical tape may be wrapped around the outside. *Multi/ink Inc.* makes a series of coaxial splice enclosures called a *"Gelseal tm"'* designed for weatherproofing underground splices. Three different models are made for use with RG-6 cable (part number 3610-OS), RG-11 cable (part number 3611-OS). Although *"Gelseal tm"* splice enclosures cannot be used with ground blocks, they are appropriate for use with a barrel connector and two male F-connectors. The coax enters the building through a wall plug. The wall plug should also be weather proofed with RTV cement to prevent water from leaking inside. Verify that all outdoor exposed connectors are weathersealed in accordance with the local system standards.

1.13 Documentation Steps

Record all Relevant Installation and Customer Information per your System Administrator Guidelines.

4.0 Network Management System (snmp)

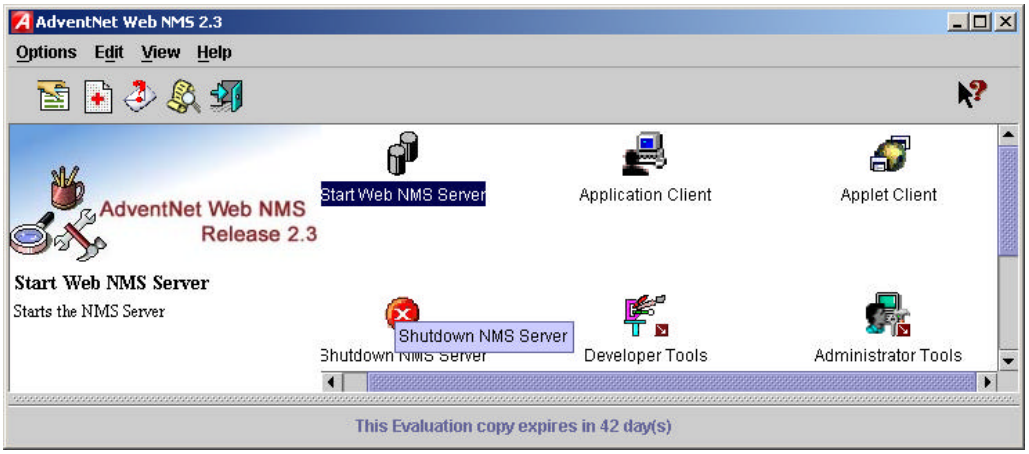
Configuring the Microred System using SNMP and an NMS

This Chapter describes how to configure the system using the industry standard SNMP (Simple Network Management Protocol) and an NMS MIB Browser (Network Management System Management Information Base Browser). In this chapter we will be using the Adventnet Web-based NMS as our user interface application. However, any NMS, such as HP OpenView, can be used to configure and monitor the system. You will need to have the Pointred Technologies' enterprise MIB file and the NMS loaded on a computer. The Pointred Technologies MIB file is named `prt.mib` . The Adventnet Web NMS is available for windows on a demo basis from `http://www.adventnet.com` .

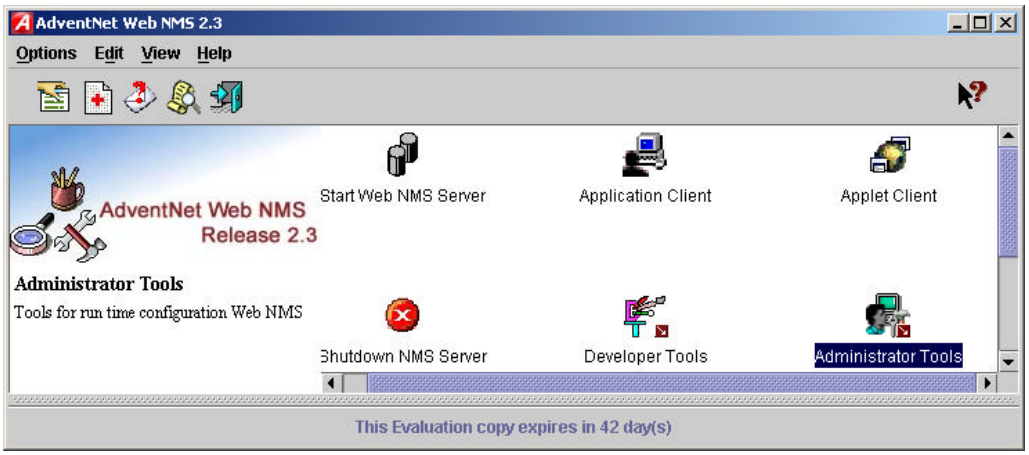
To configure the system, you will also need to know the system's LAN IP address. This can be set or read from the RS232 port. See above. You will need to know the SNMP read-write community for the system. This defaults to `public` .

Note also that the system implements both the Pointred Technologies enterprise MIB and the standard RFC-1213 MIB. Only the Pointred Technologies enterprise MIB is used to configure the system, as described below. The RFC-1213 MIB is used mainly for monitoring standard aspects of the system.

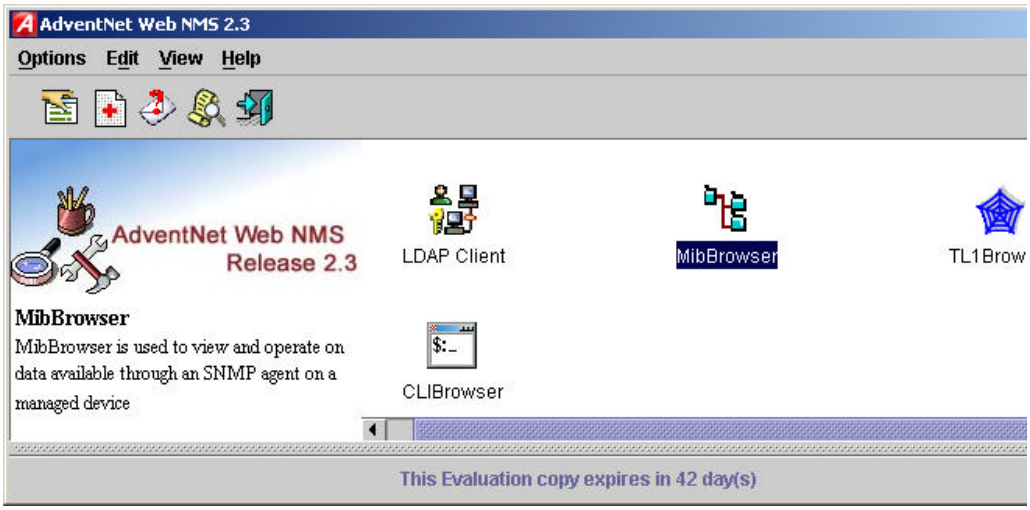
Start the NMS from the start bar. Then double click the “Start Web NMS Server” icon:



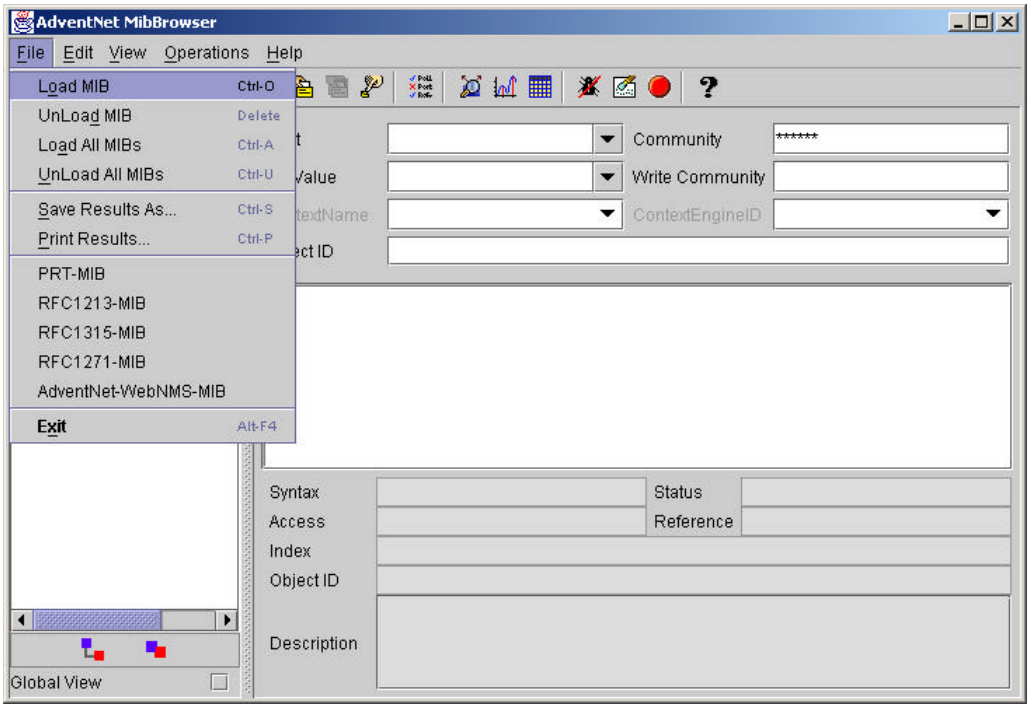
This will start the back end of the NMS. Now click on the “Administrator Tools” icon:



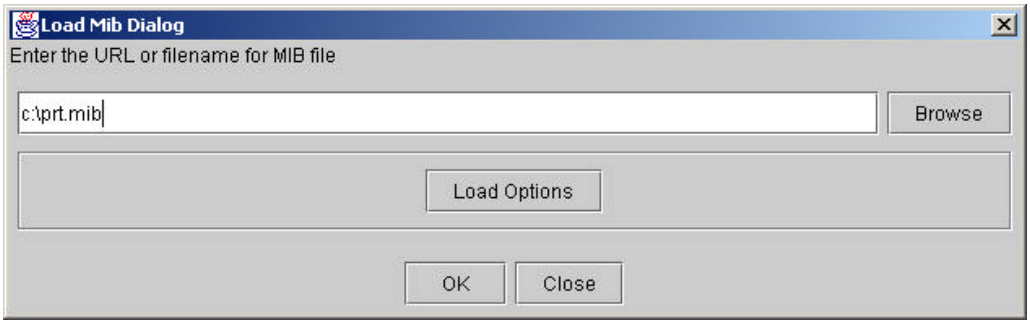
Now click on the “MIB Browser” icon:



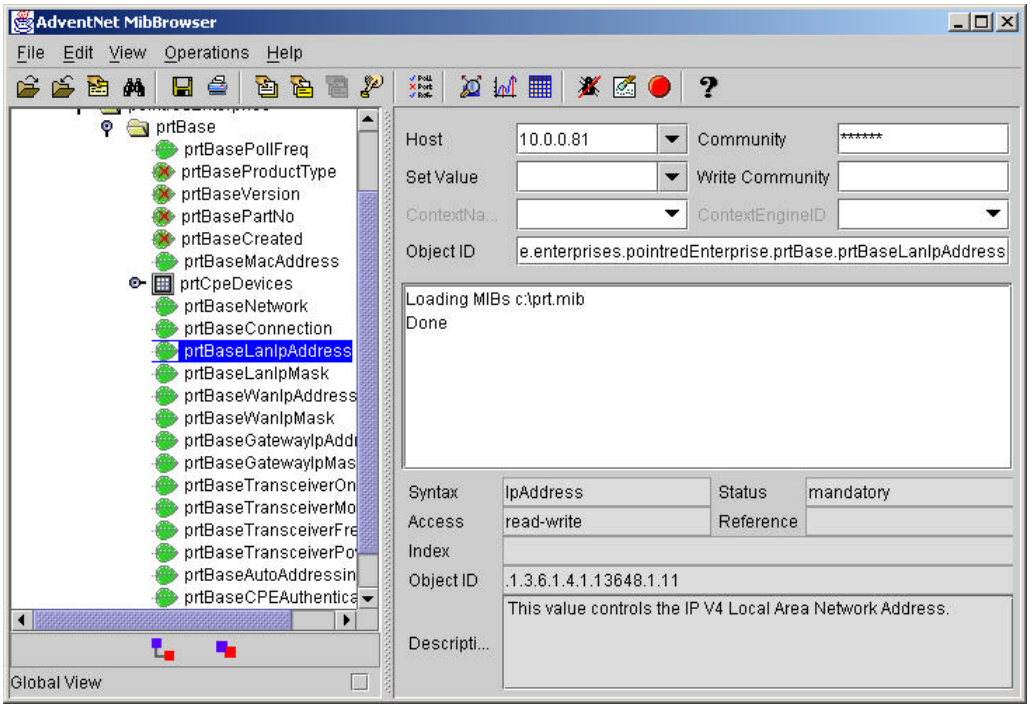
This will bring up the MIB Browser: Go to *File* > *Load MIB*



Enter the full file path to the `prt.mib` file:



The Pointred Technologies MIB tree can be expanded in the right window. Now enter the systems LAN IP address in the *Host* field.



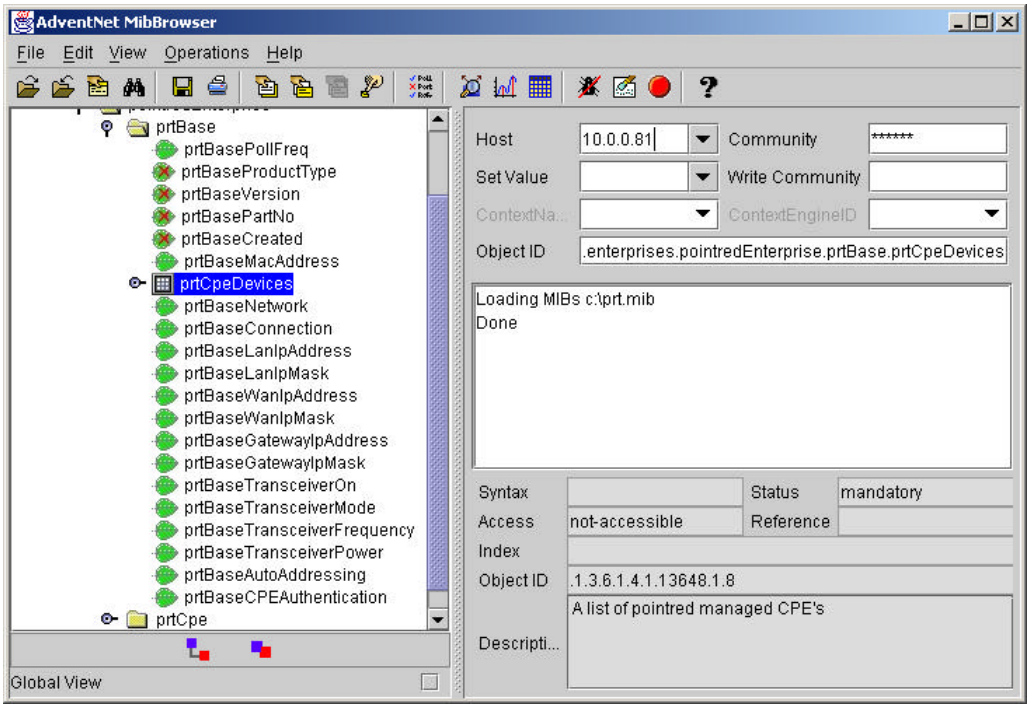
The leaf icons at the right indicate the various values that can be read using the *GET* command on the menu bar. Leaf icons with X's on them indicate read-only values. The other icons can also be written via the *SET* command on the menu bar in conjunction with the *Set Value* field in the upper right. Whenever a leaf is selected, information about the leaf appears in the lower right section. Values can be read or written in any order. However, changing the LAN IP address or the LAN IP MASK may make the system unreachable by the NMS. You will have to use the RS232 port to access the system in that case.

The table below gives important values that you may want to examine or set in a Base station:

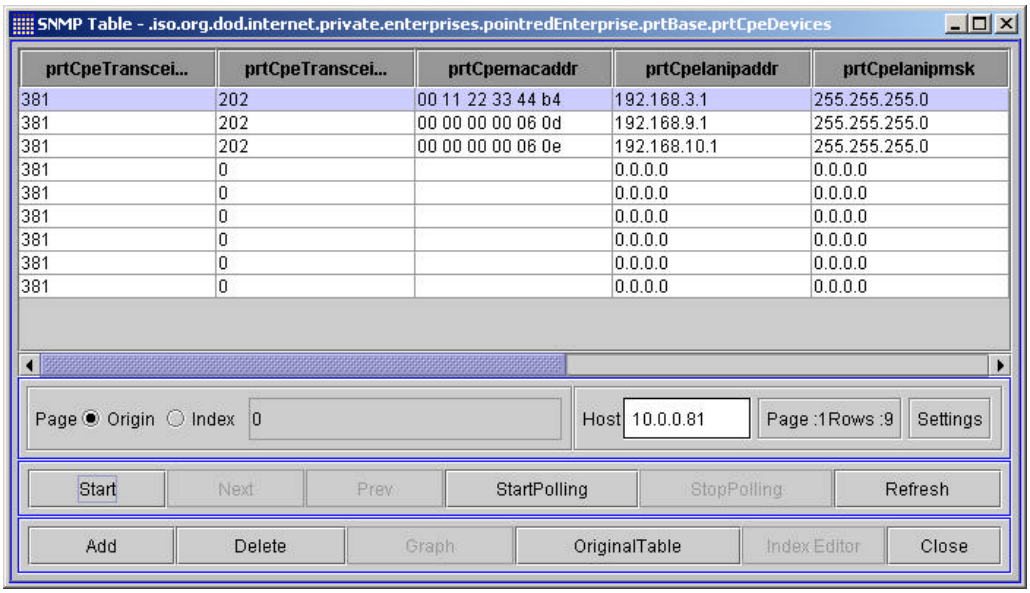
Leaf Name	Description	Writable	Values
prtBaseProductType	product type	No	CPE (1), BASE (2), etc
prtBaseVersion	product version	No	A character string
prtBasePartNo	Part Number	No	A character string
prtBaseCreated	software creation date	No	A character string
prtBaseMacAddress	MAC address of the Base's 10BaseT Ethernet controller	Yes	Any unique 6 byte value (entered as in this example: 00:11:22:33:44:55)
prtBaseNetwork	network structure of the Base	Yes	PointToMultipoint (1) or PointToPoint (2)
prtBaseConnection	type of connection used to communicate with the CPE(s)	Yes	CableApplication (1), TransceiverApplication (2)
prtBaseLanIpAddress	LAN IP address	Yes	Dot notation as in: 0.1.2.3
prtBaseLanIpMask	LAN IP mask	Yes	Dot notation as in: 255.255.255.0 (only lowest order byte is settable).
prtBaseWanIpAddress	WAN IP address	Yes	Dot notation as in: 0.1.2.3
prtBaseWanIpMask	WAN IP mask	Yes	Dot notation as in: 255.255.255.0
prtBaseGatewayIpAddress	Gateway IP Address	Yes	Dot notation as in: 0.1.2.3
prtBaseGatewayIpMask	Gateway IP mask	Yes	Dot notation as in: 255.255.255.0
prtBaseTransceiverOn	turns the transceiver on or off	Yes	ON (1) or OFF (2)
prtBaseTransceiverMode	transceiver Mode	Yes	1 through 5
prtBaseTransceiverFrequency	transceiver frequency in Mhz	Yes	2405 to 2480 in increments of 5.
prtBaseTransceiverPower	transceiver transmit power	Yes	off (represented by a value of 1) to maximum (represented by a value of 255)

`prtBaseAutoAddressing`	controls whether CPE(s) are added with Automatic IP Numbering	Yes	ON (1) or OFF (2)
`prtBaseCPEAuthentication`	controls whether CPE Authen-tication is enabled	Yes	ON (1) or OFF (2)

The Base system also controls the CPE with which it communicates. This control includes adding and deleting CPE's from its view and changing various CPE values. This is accomplished by using the SNMP table feature of the MIB Browser. First select `prtCpeDevices` from the right hand tree view:

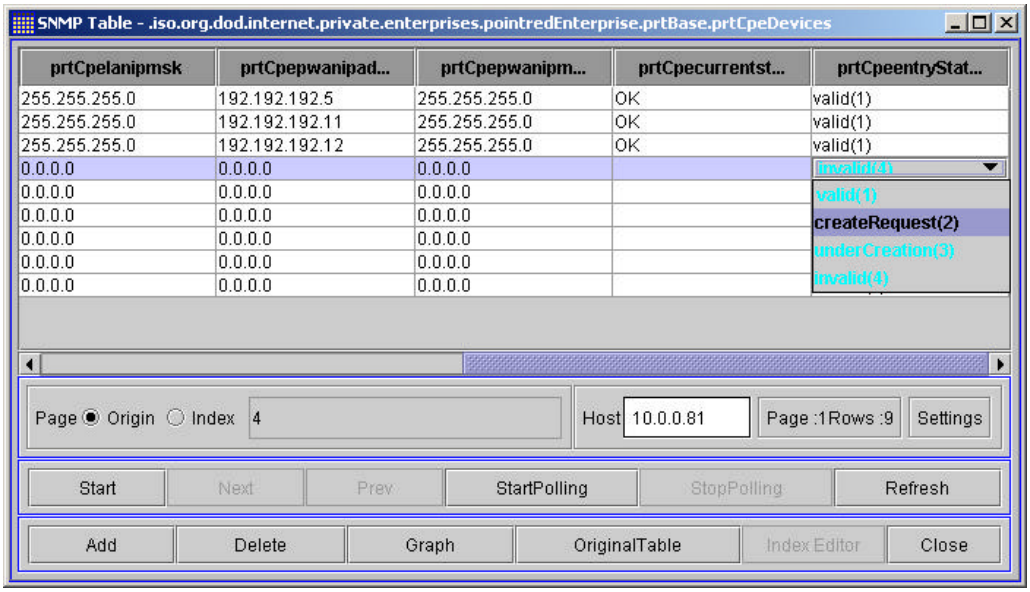


Now go to *View* > *Snmp Table* > *Start.* You will see a table of all available CPE's and some empty entries:



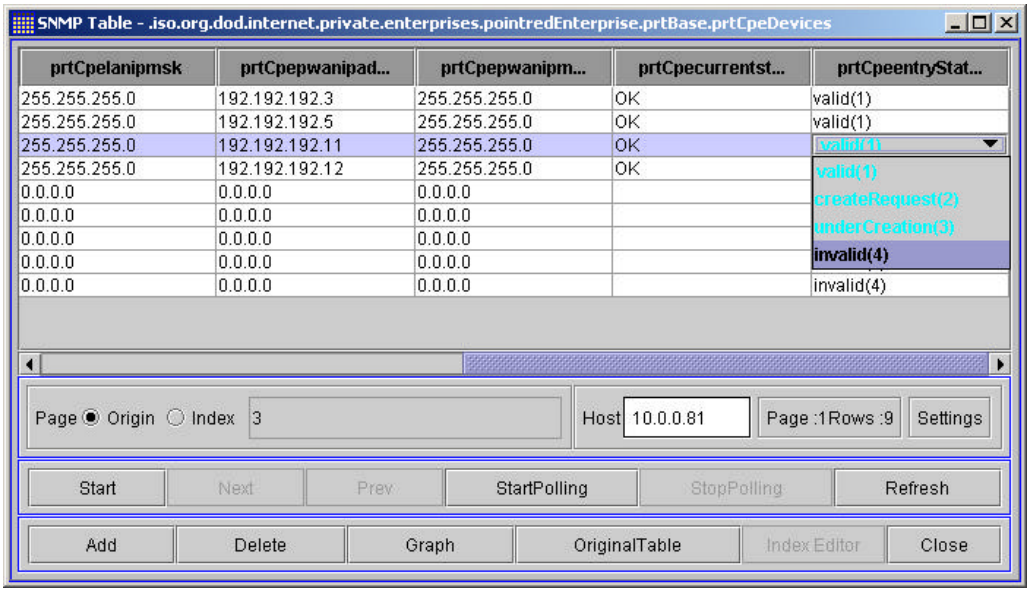
prtCpeTranscei...	prtCpeTranscei...	prtCpemacaddr	prtCpelanipaddr	prtCpelanipmsk
381	202	00 11 22 33 44 b4	192.168.3.1	255.255.255.0
381	202	00 00 00 00 06 0d	192.168.9.1	255.255.255.0
381	202	00 00 00 00 06 0e	192.168.10.1	255.255.255.0
381	0		0.0.0.0	0.0.0.0
381	0		0.0.0.0	0.0.0.0
381	0		0.0.0.0	0.0.0.0
381	0		0.0.0.0	0.0.0.0
381	0		0.0.0.0	0.0.0.0
381	0		0.0.0.0	0.0.0.0

Make sure auto addressing is on (see `prtBaseAutoAddressing` in the table above). You add a CPE with default values, using the `createRequest` setting in the last field of the table:



prtCpelanipmsk	prtCpepwanipad...	prtCpepwanipm...	prtCpecurrentst...	prtCpeentryStat...
255.255.255.0	192.192.192.5	255.255.255.0	OK	valid(1)
255.255.255.0	192.192.192.11	255.255.255.0	OK	valid(1)
255.255.255.0	192.192.192.12	255.255.255.0	OK	valid(1)
0.0.0.0	0.0.0.0	0.0.0.0		
0.0.0.0	0.0.0.0	0.0.0.0		
0.0.0.0	0.0.0.0	0.0.0.0		
0.0.0.0	0.0.0.0	0.0.0.0		
0.0.0.0	0.0.0.0	0.0.0.0		
0.0.0.0	0.0.0.0	0.0.0.0		

Refresh the table using either the *Start* or the *Refresh* button. The field will now show valid if the CPE entry was committed successfully in the Base. To delete a CPE, set the same field to invalid:



Any changes to a field in this table will be committed in the Base only after another createRequest is issued on the respective line.

Here are the available fields in the CPE table:

Leaf Name	Description	Writable	Values
`prtCpeTransceiverFrq`	transceiver frequency in Mhz	Yes	`2405` to `2480` in increments of `5`.
`prtCpeTransceiverPwr`	transceiver transmit power	Yes	off (represented by a value of `1`) to maximum (represented by a value of `255`)
`prtCpemacaddr`	MAC address of the CPE's transceiver	Yes	Any unique 6 byte value (entered as in this example: `00:11:22:33:44:55`)
`prtCpelanipaddr`	CPE's LAN IP address	Yes	Dot notation as in: `0.1.2.3`
`prtCpelanipmsk`	CPE's LAN IP mask	Yes	Dot notation as in: `255.255.255.0` (only lowest order byte is settable).
`prtCpepwanipaddr`	CPE's WAN IP address	Yes	Dot notation as in: `0.1.2.3`
`prtCpepwanipmsk`	CPE's WAN IP mask	Yes	Dot notation as in: `255.255.255.0`
`prtCpecurrentstatus`	CPE's status string	Yes	"`OK`" if Base sees this CPE entry as good
`prtCpeentryStatus`	Setting this values performs a commit for the whole CPE row	Yes	`valid` (`1`), `createRequest` (`2`), `createPending` (`3`), `invalid` (`4`)