ARCADIAN
Networks

V390i User Guide

Part Number 3BR0020-A

Version 010

(Doc P/N: FLI0023)

Copyright and Compliance

Copyright Information

FCC Compliance Information

NOTE: This equipment is authorized under FCC ID:V72390-IA to operate in the A block of the Upper 700 MHz Guard Band pursuant to Part 27 of the FCC's rules.

In addition, 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's 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. In addition, 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 on and off, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the antenna.
- Increase the distance between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver was connected.

Consult the dealer or an experienced radio/TV technician for assistance.

NOTE: This equipment contains WiFi nodem which is authorized under FCC ID:LDK102052P and complies with **15C.**

User installation is prohibited. The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. End-users and installers must be provided with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance.

⚠️ **Warning!** *Changes or modifications to this equipment not expressly approved by Arcadian Networks Inc. could void the user's authority to operate the equipment.*

This product was tested with shielded coaxial cable (not provided by Arcadian Networks) and   Category 5 Ethernet cable (optional) equipped with a shielded RJ-45 connector.
These types of cables must be used with the unit to ensure compliance.

⚠️ **Warning!** *Maximum Power Level and Antenna Gain*

IEEE 802.11g (2.4 GHz Band)
An improper combination of power level and antenna gain can result in equivalent isotopic radiated power (EIRP). The following table indicates the maximum power levels and antenna gains allowed for each IEEE802.11g regulatory domain.

Regulatory domain	Antenna Gain (dBi)	Maximum power level (mW)	
		CCK	OFDM
America (-A) (4 W EIRP maximum)	2.2	100	30
	6	100	30
	6.5	100	30
	10	100	30
	13.5	100	30
	15	50	20
	20	50	10

NOTE: The UHF (746 – 788 MHz) antenna should be mounted outdoors (outside of any booth), while the WiFi antennas should be mounted indoors (inside the booth).

⚠️ **Warning!** *Radio Frequency Exposure*
The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating with any other antenna or transmitter.
Contact a professional installer or antenna manufacturer for proper installation requirements.

Safety Instructions

Follow all safety instructions and precautions as detailed in the Safety Precautions document.

Table of Contents

About This Guide

The V390i User Guide is part of the documentation package for the Arcadian Networks wireless access system. The guide describes the V390i device, and how to install, configure and maintain the V390i.

☑ **Note:** The V390i replaces the V290iA device. The V390i supports A-Guard Band after the 700 MHz Band Restructure. This guide does not explain how to upgrade from the V290iA to the V390i.

☑ **Note:** For instructions on installing the antenna, refer to the appropriate guide. An antenna must be installed by a professional following all safety precautions.

Intended Audience

This guide is intended for service personnel required to install, configure or maintain the V390i.

Document Objectives

This guide is designed to be used as a tool in the initial installation and periodic maintenance of the V390i. It contains information on how to perform the following tasks:

- Installing the V390i
- Configuring the V390i
- Maintaining the V390i
- Troubleshooting the V390i

Document Conventions

The following icons appear throughout this guide:

☑ **Note:** This is a note. It provides additional information on the current topic.

⚠ **Warning:** *This is a warning. It contains cautionary information on the current topic.*

💡 **Tip:** This is a tip. It provides time saving information to the reader.

How This Guide is Organized

This guide is organized into the following chapters and appendices:

Chapter 1: Overview

This chapter provides an overview of the V390i and the Arcadian Networks wireless access system.

Chapter 2: Physical and Functional Description

This chapter includes a physical and functional description of the V390i and its components, as well as an overview of the process of modem initialization.

Chapter 3: Installing the V390i

This chapter details installation prerequisites, explains the various mounting options and how to connect the cables, and describes initial operation.

Chapter 4: Configuring the V390i

This chapter explains how to configure the V390i components.

Chapter 5: Maintaining the V390i

This chapter details the normal operation of the V390i LEDs and describes how to upgrade the V390i software.

Chapter 6: Troubleshooting

This chapter provides troubleshooting information to help solve common problems.

Appendix A: V390i Technical Specifications

This appendix provides technical specifications for the V390i.

Appendix B: Antennas Technical Specifications

This appendix provides technical specifications for the two optional antennas.

Appendix C: Cables Specifications

This appendix provides technical specifications for the various cables and their connectors.

Appendix D: FCC Declaration of Conformity

This appendix displays Arcadian Networks's FCC Declaration of Conformity.

Related Documentation

For information on other Arcadian Networks wireless system topics, see the following guides:

- *NMS User Guide – Part Number 3BR0023-A*
- *Base Station User Guide – Part Number 3BR0022-A*

Obtaining Documentation

To obtain additional documentation, please contact helpdesk@arcadiannetworks.com.

Documentation Feedback

We welcome your comments about this guide. Please send comments to:

Address: 4 negev street, P.O.B 197 Airport City Ben Gurion Airport 70100

Tel: 972-3-9769999

Fax: 972-3-9769998

Email address: helpdesk@arcadiannetworks.com

Please include in the comment the name and version number of the guide.

List of Abbreviations

Following is a list of the abbreviations used in the guide.

Abbreviation	Meaning
BPI	Baseline Privacy Interface
BIST	Built In Self Test
BSR	Base Station Rack
BTS	Base Stations
BW	bandwidth
CLI	Command Line Interface
CPE	Customer Premises Equipment
CRC	Cyclic Redundancy Check
dB	Decibels
dBmV	Decibel-Millivolt
DES	Digital Encryption Standard
DHCP	Dynamic Host Configuration Protocol
DOCSIS	Data-Over-Cable Service Interface Specifications
DS	Downstream
DSCP	Differentiated Services Code Point
FAT	Factory Acceptance Test
FDD	Frequency Division Duplexing
FEC	Forward Error Correction
FTP	File Transfer Protocol
GHz	Gigahertz
ICMP	Internet Control Message Protocol
IEEE	Institute of Electrical and Electronic Engineers
IETF	Internet Engineering Task Force
IGMP	Internet Group Management Protocol
IP	Internet Protocol
ISO	International Standards Organization
ITU	International Telecommunications Union

Abbreviation	Meaning
ITU-T	Telecommunication Standardization Sector of the International Telecommunication Union
Kbps	Kilobits per second
kHz	Kilohertz
LAN	Local Area Network
LOS	Line of Sight
LLC	Logical Link Control procedure
MAC	Media Access Control
Mbps	Megabits per second
MHz	Megahertz
MIB	Management Information Base
MPEG	Moving Picture Experts Group
Ms	Millisecond
MTU	Maximum Transmission Unit
NIC	Network Interface Card
NLOS	Non Line of Sight
NMS	Network Management System
Ns	Nanosecond
PHY	Physical Layer
PPP	Point-to-Point Protocol
QAM	Quadrature Amplitude Modulation
QoS	Quality of Service
QPSK	Quadrature Phase-Shift Keying
RF	Radio Frequency
RFC	Request For Comments
SCADA	Supervisory Control and Data Acquisition
SNAP	Subnetwork Access Protocol
SNMP	Simple Network Management Protocol
SNR	Signal-to-Noise Ratio
TCP	Transmission Control Protocol
TFTP	Trivial File-Transfer Protocol
US	Upstream
WMTS	Wireless Modem Termination System

1 Overview

The V390i is a Customer Premises Equipment (CPE) device used to provide wireless communications at remote locations as part of a Arcadian Networks wireless network. The V390i provides remote connectivity for SCADA and IP devices.

The V390i consists of three major components, integrated into a single chassis:

- A Arcadian Networks wireless modem, used for communicating over the Arcadian Networks wireless network.

- A Cisco® 3200-series router, providing IP routing capability for the Arcadian Networks wireless network and integration into an enterprise network. Ethernet ports provide connectivity to IP devices located at the CPE site. Serial ports provide connectivity to SCADA devices.

- A manageable Power and Control Card.

The V390i connects to an external UHF antenna and two WiFi antennas.

V390i and the Arcadian Networks BWA System

The V390i is the CPE component of the Arcadian Networks Broadband Wireless Access (BWA) system, which resides at the Sub Station. The BWA system is designed to provide end-to-end wireless connectivity for SCADA and IP devices, and to interconnect seamlessly with your enterprise network. The V390i communicates on the 700 MHz wireless band.

The following figure shows the Arcadian Networks BWA network topology:
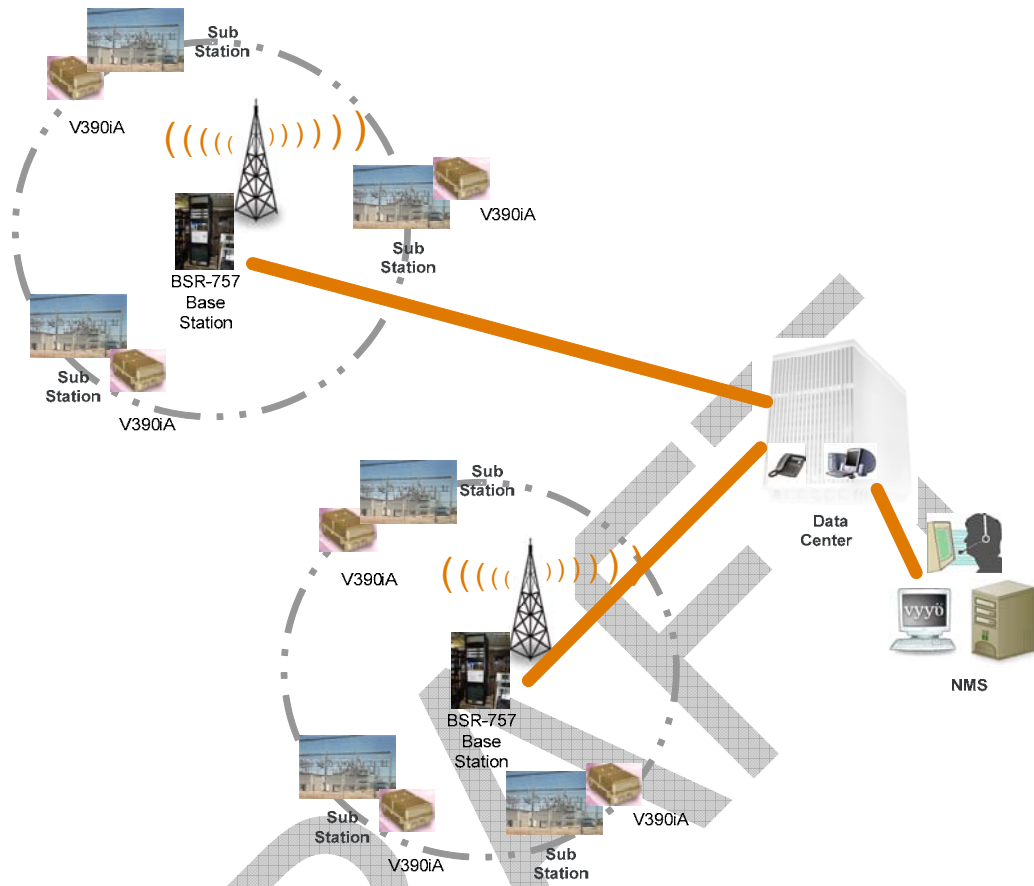
Figure 1: Arcadian Networks BWA Network Topology

2   Physical and Functional Description

The V390i is comprised of a Arcadian Networks V384+A UHF modem board and a Cisco 3200-series router, integrated into a single housing. This housing is designed for easy mounting on a wall, shelf, or pole at the remote location.

V390i Basic Description

The following is a general block diagram of the V390i.
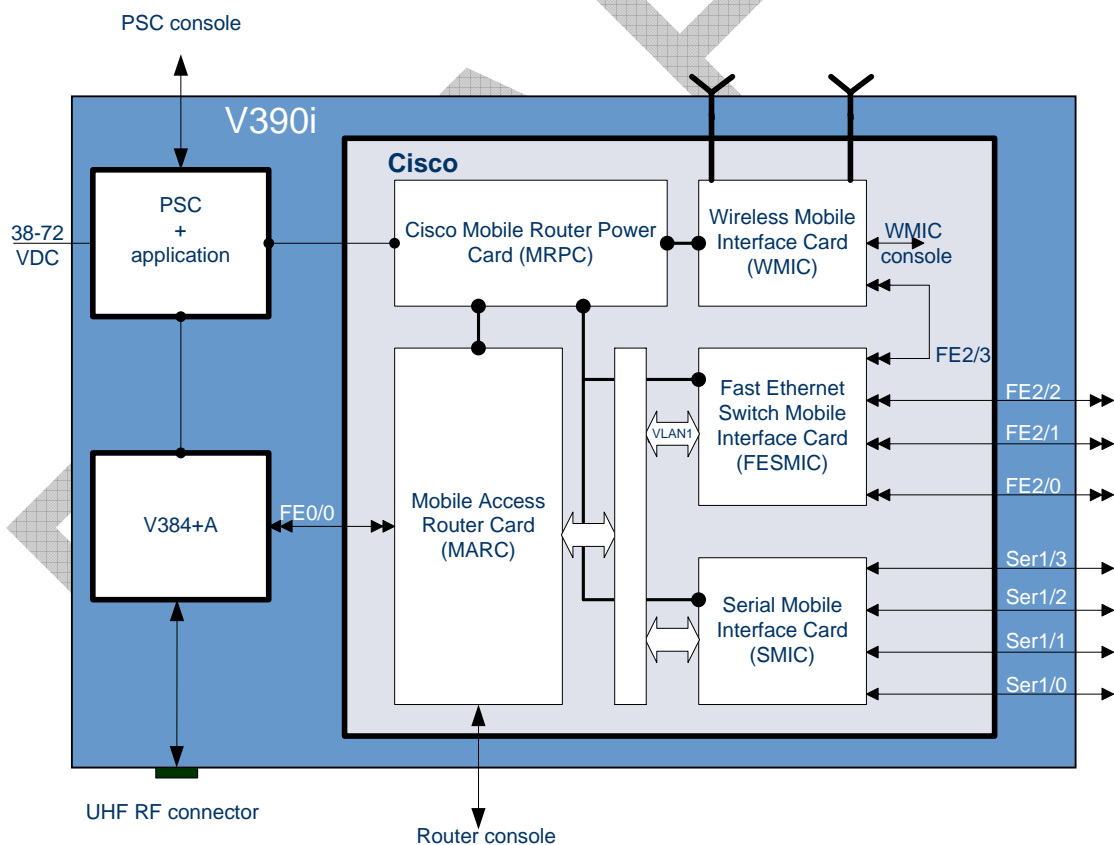
Figure 2: V390i General Block Diagram

The V390i includes the following main components:

- **V384+A board** – A UHF FDD radio modem operating in the 757-788 MHz frequency range.

- **Cisco cards** – These include the following:

  - **Mobile Access Router Card (MARC)** – The routing engine includes the host processor and memory. It is connected to the V384+A through a Fast Ethernet interface.

  - **4-Port Fast Ethernet Switch Mobile Interface Card (FESMIC)** – The 4-port FESMIC provides four sets of Fast Ethernet signals. One of these is internally connected to the WMIC.

  - **4-Port Serial Mobile Interface Card (SMIC)** – The 4-port SMIC provides four sets of serial signals.

  - **Wireless Mobile Interface Card (WMIC)** – The 2.4-GHz WMIC can be optionally configured as an access point (AP), a root bridge, or a non-root bridge. The WMIC is connected to a Fast Ethernet port on the FESMIC.

  - **Mobile Router Power Card (MPRC)**

- **Arcadian Networks Power Supply Controller (PSC) card** – The PSC provides power management of the V390i units: the V384+A, the Cisco cards, and the temperature control system.

Following are top and bottom views of the V390i device:
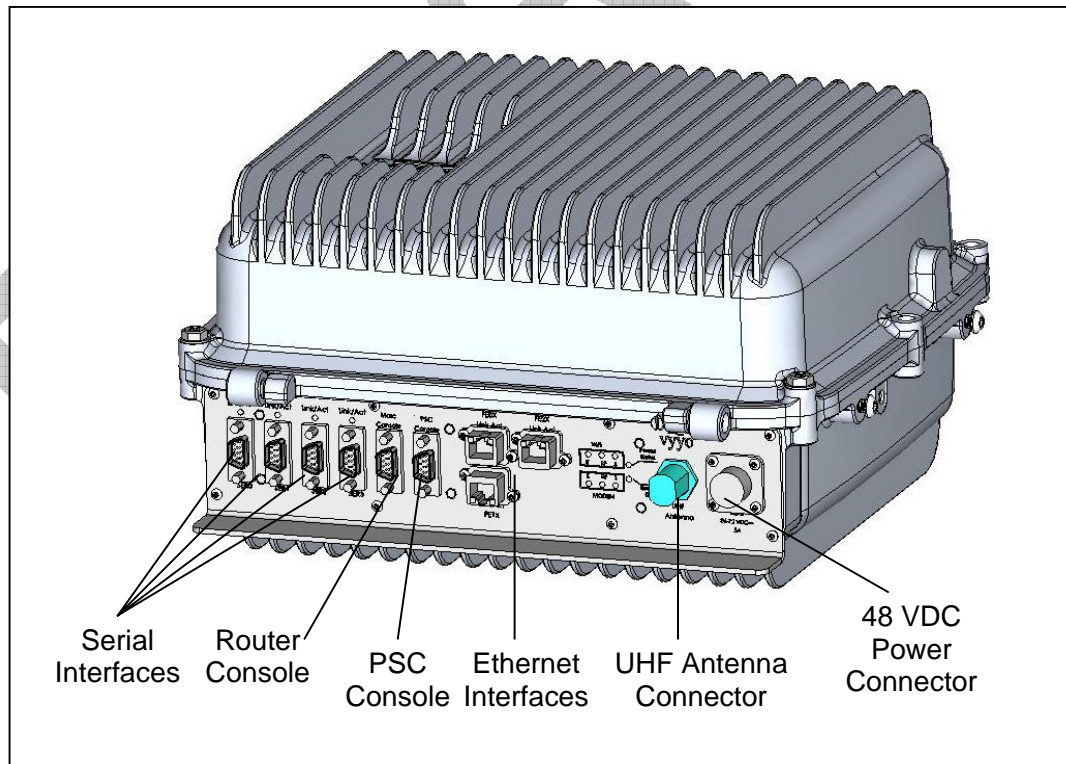
Figure 3: Arcadian Networks V390i Bottom View
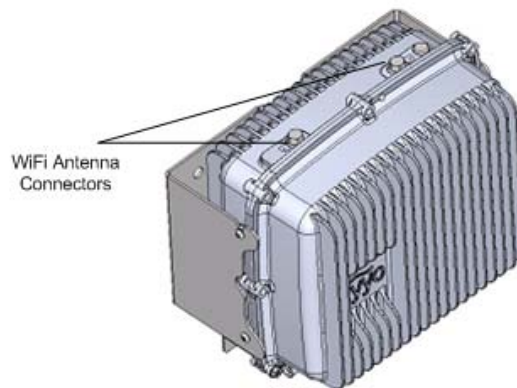
Figure 4: Arcadian Networks V390i Top View

Interfaces

The following interfaces are available in the V390i:

■ **Six DB-9 serial ports** – Four serial ports are available to connect serial devices such as SCADA devices. Two ports serve as console ports: one for the Cisco router, and one for the Power and Control Card. For cable specifications refer to *Appendix* C: *Cable Specifications*.

■ **Three RJ-45 Ethernet ports** – Three Ethernet ports are available to connect IP devices such as security devices. For cable specifications refer to *Appendix* C: *Cable Specifications*.

■ **RF UHF N-Type antenna connector** – Use for connecting to the Arcadian Networks wireless network.

■ **Two TNC WiFi antenna connectors** – The Cisco router has wireless routing capabilities to connect WiFi devices to the enterprise network. For more information on WiFi antennas, see the Cisco antenna guide: http://www.cisco.com/en/US/products/hw/routers/ps272/prod_brochure0900aecd80 371218.html.

Housing

The V390i is housed in a case designed to be resistant to moisture and extremes in temperature. The V390i is not intended for field servicing.

The housing is fully sealed, and uses a pressure valve to equalize pressure inside and outside the housing while holding out water molecules. The housing is designed to provide a fully stable environment with the ability to resist moisture even in full immersion. The housing is held in place by locking screws to maintain a proper seal.

The Ethernet and Serial interfaces use a rugged design to protect the interface pins. The interface panel is located on the bottom of the V390i when it is mounted in the standard way, and the WiFi antenna connections are on the top.

Heating and Cooling

In order to maintain the proper working temperature, the V390i has a temperature control system included inside the housing. This temperature control system allows the V390i to maintain an ambient temperature range of between -30° C and 60° C.

Power

The V390i supports an input voltage of 38-72 VDC, optimized for 48 VDC, with 5A input current protection. The V390i has a manageable Power and Control Card, providing power to the different units, such as the Cisco cards, the V384+A card, and the temperature control system.

Modem V390i Initialization Process

Once powered, the V390i performs the following:

1. **Scans for a UHF downstream channel** – The modem always stores the last set of parameters it was able to work with. It therefore first tries to reacquire the last working downstream channel.

2. **Synchronizes to the downstream channel** – The downstream signal is valid when the modem has the following:

   ■ QAM synchronization.

   ■ FEC synchronization.

   ■ MPEG frames synchronization.

   ■ Recognition of a MAC synchronization message.

3. **Receives upstream parameters** – The WMTS periodically transmits on the downstream channel a broadcast message to all modems on the sector regarding upstream channels in the sector. The upstream information includes symbol rate, modulation, FEC, preamble and scrambling.

4. **Receives bandwidth allocation MAP** – The WMTS periodically transmits on the downstream channel a broadcast message to all modems on the sector regarding the upstream bandwidth access opportunities of a coming time interval.

5. **Performs ranging and adjustments** – The modem synchronizes with the WMTS on the upstream timing, frequency and transmission power.

6. **Establishes IP connectivity** – The modem acquires the network setting (IP address, subnet mask and more) from the DHCP server. The modem entry in the DHCP server is configured through the Arcadian Networks Web NMS (refer to the *NMS User Guide*).

7. **Establishes Time of Day** – The modem acquires the date and time from a time server, for proper messaging.

8. **Acquires configuration** – The modem downloads its configuration file from a TFTP server. The TFTP file name is provided by the DHCP server, and is configured through the Arcadian Networks Web NMS (refer to the *NMS User Guide*). The modem configuration file includes information about downstream and upstream channels, available services, service classifiers and priorities, etc.

9. **Registers with the WMTS**.

10. **The Cisco Router establishes IP connectivity** – The router acquires the network setting (IP address, subnet mask and more) from the DHCP server.

☑ **Note:** The description of how the Cisco router establishes IP connectivity, applies to the V390i default Cisco setting. You may change the Cisco setting to a fixed IP address, or any other IP addressing method supported by the Cisco IOS. The Cisco addressing is not managed by the Arcadian Networks NMS, and should be configured by the system administrator.

3   Installing the V390i

The V390i is designed to be installed on a wall, shelf, or pole. This section describes the steps required for installation. It also explains how to connect the cables, and describes initial operation.

☑ For instructions on installing the antenna, refer to the appropriate guide. An antenna must be installed by a professional following all safety precautions.

Preparing an Installation Kit

Before traveling to the Sub Station, make sure you bring with you the following items, which are necessary for installation:

1. Cables – as many Serial and/or Ethernet cables as required by the particular installation. For cable specifications, refer to *Appendix* C: *Cable Specifications.*

2. Wireless equipment:

   ■ Two WiFi antennas, if WiFi is required.

   ■ Attenuator kit, according to your cellular plan. Refer to *Setting an Attenuator for the UHF Antenna Input* on page 30.

3. A PC for connecting to one of the Console ports, as well as a PSC Console/Router Console cable. For cable specifications, refer to *Appendix* C: *Cable Specifications*.

4. Tools needed for the installation:

   ■ 1/4" standard 6-Point socket wrench.

   ■ 3/8" standard 6-Point socket wrench.

   ■ Ratchet torque tool 5-30 Nm.

5. Four screws suitable for wall mounting, if you intend to mount the V390i on the wall. The screws should be able to carry 20 kg.

Prerequisites to Installation

Before installing the V390i:

1. Make sure the UHF antenna is installed and adjusted towards the relevant Base Station.

2. Check the installation environment to ensure compliance with the following requirements:

   ■ Install the V390i indoors, not open to the elements.

   ■ Install the V390i so that air can flow around the heat sink fins, therefore do not install it in a small closed confined space.

   ■ Operating temperature: -22°F to +158°F, -30°C to +60°C.

   ■ Storage temperature: 40°F to +185°F, -40°C to +85°C.

   ■ Relative humidity: 55% average (non-condensing), 95% for 96 hours (non-condensing).

3. If you are mounting the V390i on a wall or pole, make sure they can carry 20 kg.

4. Check the installation infrastructure and make sure you have the following cables:

   ■ Power cable with fuse. The requirements for the power inlet matching connector include:

     • Cable – CABLE SHIELDED 4 X 22AWG.

     • Plug sealed – Manufactured by Tyco, MFG: 796094-2.

     • Pin – Sock pins 15u gold 16-18awg, manufactured by Tyco, MFG: 66101-3.

     • Boot #11 – Manufactured by Tyco, MFG: 207489-1.

     • This connector is the same as the one used for the Cisco 3230.

   ■ Ground wire with soldier lug, according to the following specifications:

     • Inner STUD Size: AWG ¼, 6.4 mm.

     • Terminal material: Copper.

     • Wire range: AWG 14 to 16, 1.5 to 2.5 mm^2.

     • Max electric current: 27 Amp.

   ■ UHF Antenna cable. To achieve maximum coverage in distant or NLOS locations, use low loss cables (loss below 2 dB) between the V390i and the antenna. Typical low loss cables are:

     • LMR900 – Loss 1.1 dB/100 feet @ 770 MHz.

     • 7/8 HELIAX – Loss 1.1 dB/100 feet @ 770 MHz.

     • 1/2 HELIAX – Loss 1.8 dB/100 feet @ 770 MHz).

5. Provision the V390i in the NMS (refer to the *NMS User Guide*). You need the V390i's MAC address, which is displayed on the V390i label, as shown in Figure 5.

Figure 5: V390i MAC Address

6. Provision the Router MAC address in a DHCP, or set it with a fixed IP address. By default, the Router will try to acquire an IP address from the network.

Verifying Package Contents

Make sure the package contains the following:

- One pole mounting bracket.
- One main mounting bracket.
- Four HEX HD SST 1/4-20 NC x 5/8" screws.
- Four SST FLAT-RU #1/4 washers.
- Four HEX HD SST 3/8-16 UNC x 3.5" FULL THREAD screws.
- Four SST LOCK ¼" washers.
- Four SST LOCK 3/8" washers.

Mounting the V390i

The V390i can be mounted on a wall, shelf, or pole.

⚠ **Warning:** *The V390i weighs approximately 13.5 kg. Employ skilled personnel who will take care to keep the unit steady and prevent it from falling during the installation.*

The following sections provide detailed instructions for each type of mounting.

Mounting Kit Parts List

The following figure and its accompanying table label and describe the mounting parts required for wall, shelf, or pole installation.
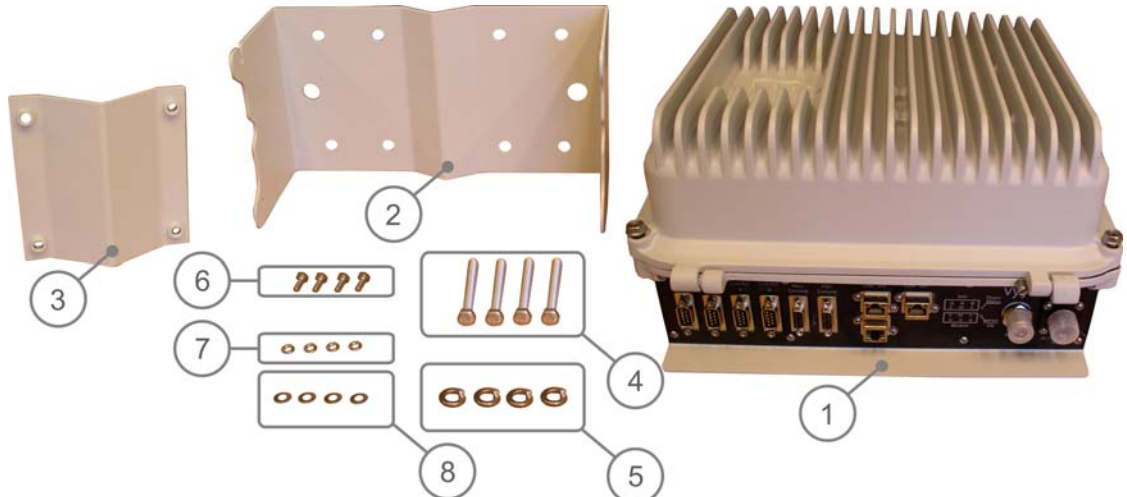
Figure 6: Mounting Kit

The following table describes the parts shown in Figure 6. These parts are referred to by number throughout the pictures in the Mounting sections.

Table 1: Mounting Kit – Parts and Descriptions

Reference Number	Description	Torque Inch -lbr	Torque N-m	Number of Parts	Remarks
1	V390i unit			1	
2	Main bracket V390			1	
3	Pole mount hanging bracket			1	
4	Screw Hex HD SST 3/8"-16U			4	
5	Washer SST Lock 3/8"			4	
6	Screw Hex HD SST ¼"-20U			4	
7	Spring Washer SST Lock ¼"			4	
8	Washer SST Flat ¼"			4	
9	Screw ¼" with Spring and Flat Washer	76	9	4	Composed of part numbers 6, 7 and 8 (see Figure 9 on page 20)
10	Screw 3/8" with Spring Washer	236	27		Composed of part numbers 4 and 5 (see Figure 16 on page 25)
11	Wall screws (not supplied)			4	V390i weight: 13.5 kg

Wall or Shelf Mounting Procedure

The following steps describe how to mount the V390i on a wall or shelf. The numbered references in the figures below refer to the numbered items in Table 1 on page 18.

☑ Shelf mounting is identical to Wall mounting. Consider the shelf a horizontal wall. Follow all instructions for wall mounting, substituting the word "shelf" for "wall".

To mount the V390i on a wall:

1. Attach a ground wire with a ring terminal to the grounding screw, shown in Figure 7. Perform the following:

   a. Unscrew the grounding screw (a ¼" screw with a spring washer and flat washer) from the V390i chassis.

   b. Thread the ring onto the grounding screw.

   c. Screw the grounding screw back into place, so that the ring is pressed between the flat washer and the V390i chassis.

Figure 7: Attaching to Ground

   d. Attach the other end of the ground wire to ground.

2. Attach the main bracket to the wall using four Wall screws (not supplied by Arcadian Networks). Make sure the two side grooves are facing up, as shown in Figure 8.

☑ The Wall screws must be capable of carrying a minimum of 20 kg in a stable position.
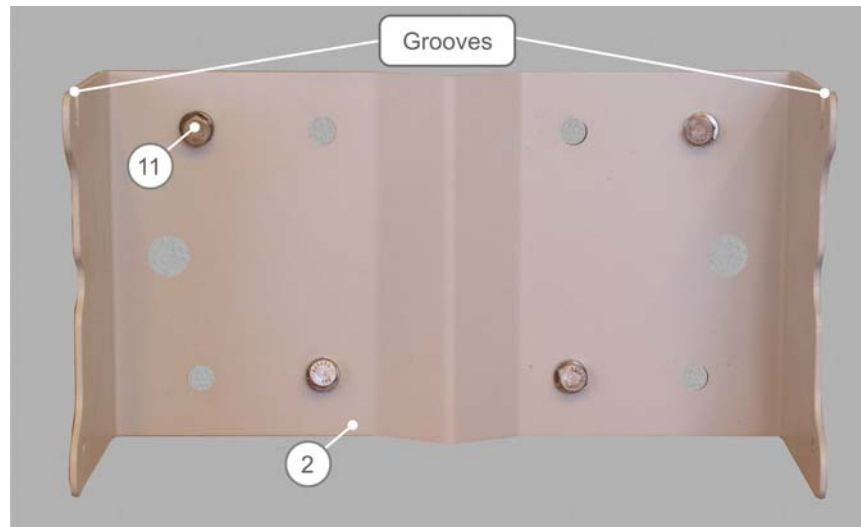
Figure 8: Wall Mounting – Attaching Bracket to Wall

3. Tighten the four wall screws.

4. Assemble the spring washers (7) and flat washers (8) on the ¼" screws (6) as shown in Figure 9.

Figure 9: Wall Mounting – Assembling ¼" Screws

5. Screw two assembled ¼" screws (9) into the V390i, one on either side, close to the WiFi Antennas side (see Figure 10 and Figure 11). Do not tighten the screws.
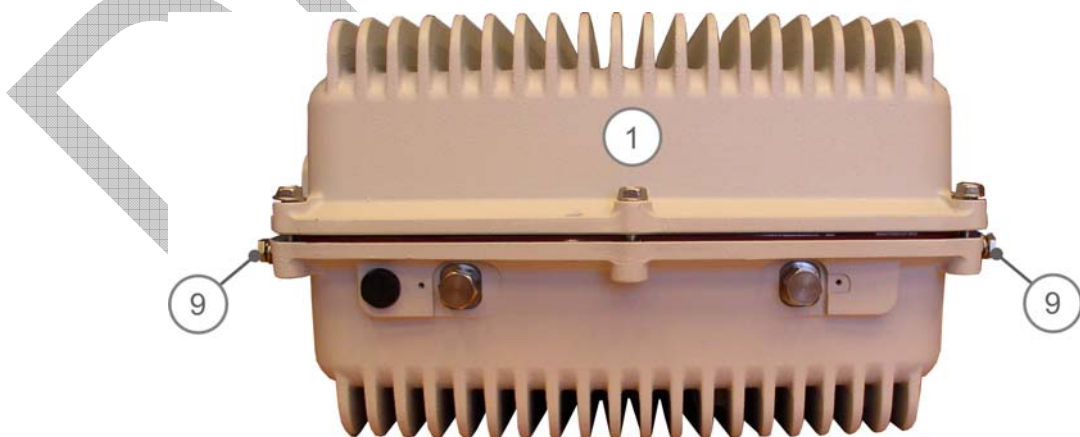
Figure 10: Wall Mounting – Screwing Two ¼" Screws (WiFi Antennas Side View)
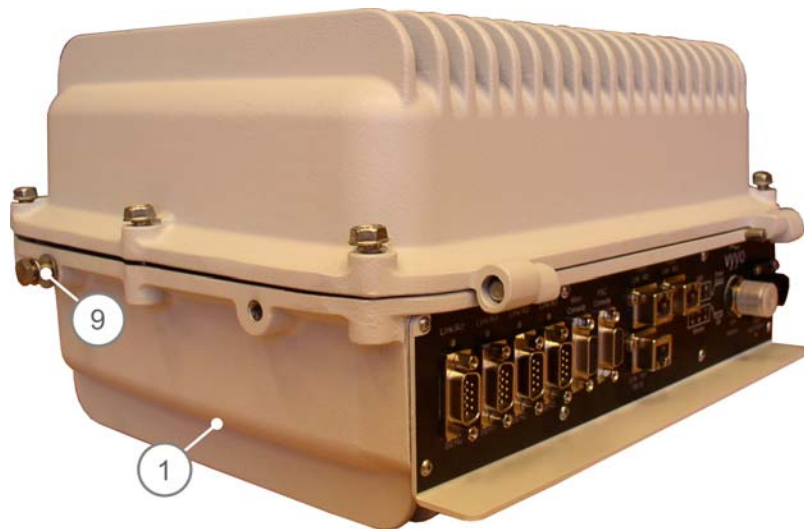
Figure 11: Wall Mounting – Screwing Two ¼" Screws (Interface Panel Side View)

6. Position the V390i so that the interface panel is facing the floor. Slide the unit into the main bracket by inserting it very carefully from the top through the grooves in such a way that the V390i hangs on the ¼" (9) screws.

Figure 12: Wall Mounting – Inserting the V390i into the Bracket

7. Screw the remaining two ¼" screws (9) into the bottom of the main bracket, one on each side of the bracket. Figure 13 shows the addition of one ¼" screw (9).
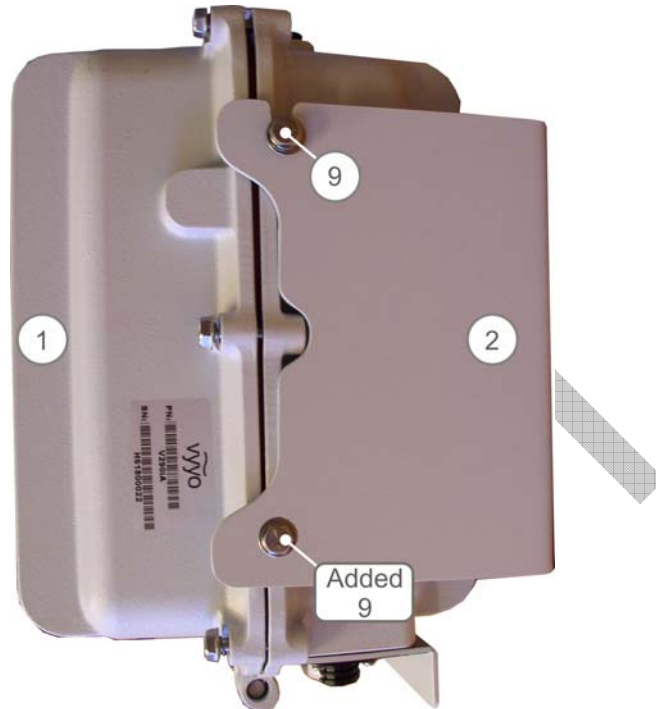
Figure 13: Wall Mounting – Screwing in the Remaining ¼" Screws

8. Tighten all four ¼" screws (9).

The Interface Panel of the V390i can now be accessed from the bottom (see Figure 14).
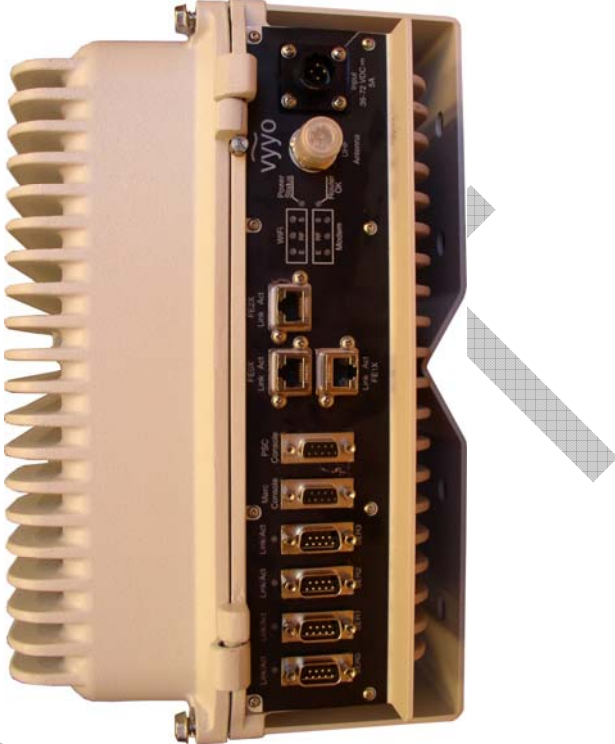
Figure 14: Wall Mounting – Interface Panel Facing the Floor

Pole Mounting Procedure

The following steps describe how to mount the V390i on a pole. The callouts in the figures below refer to the numbered items in Table 1 on page 18.

To mount the V390i on a pole:

1. Attach a ground wire with a ring terminal to the grounding screw, shown in Figure 15. Perform the following:

    a. Unscrew the grounding screw (a ¼" screw with a spring washer and flat washer) from the V390i chassis.

    b. Thread the ring onto the grounding screw.

    c. Screw the grounding screw back into place, so that the ring is pressed between the flat washer and the V390i chassis.

Grounding Screw
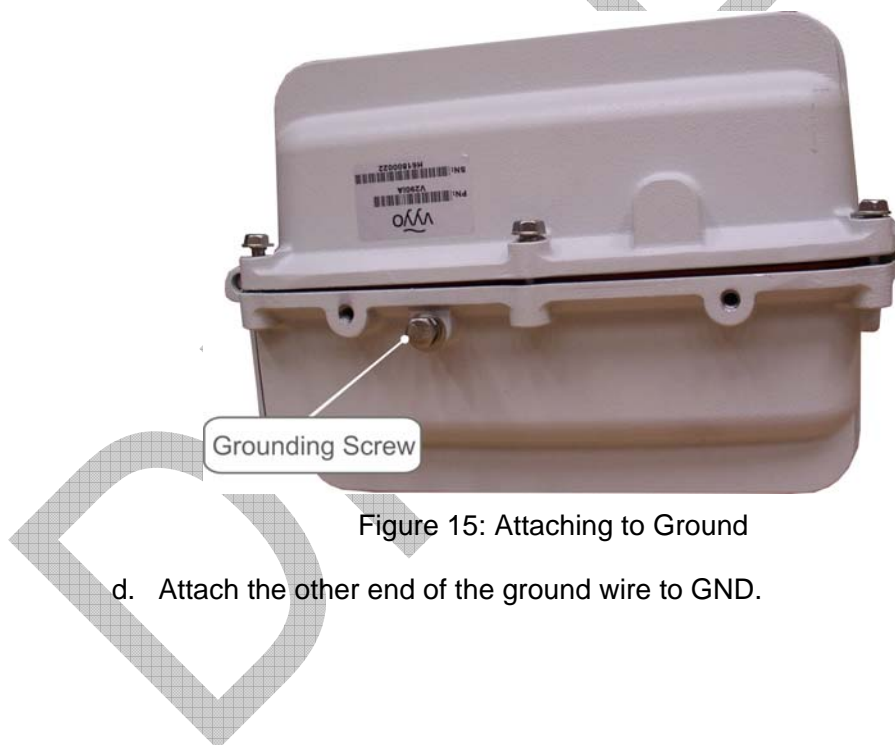
Figure 15: Attaching to Ground

    d. Attach the other end of the ground wire to GND.

2. Assemble the spring washers (4) on the 3/8" screws (5), as shown in Figure 16.

Figure 16: Pole Mounting – Assembling 3/8" Screws

3. In this step, you will be "sandwiching" the pole between the main bracket from one side, and the pole mount hanging bracket from the other. To do so:

   a. Hold the main bracket with the grooves facing up, and insert the four 3/8" screws (10) through the four holes indicated in Figure 17.
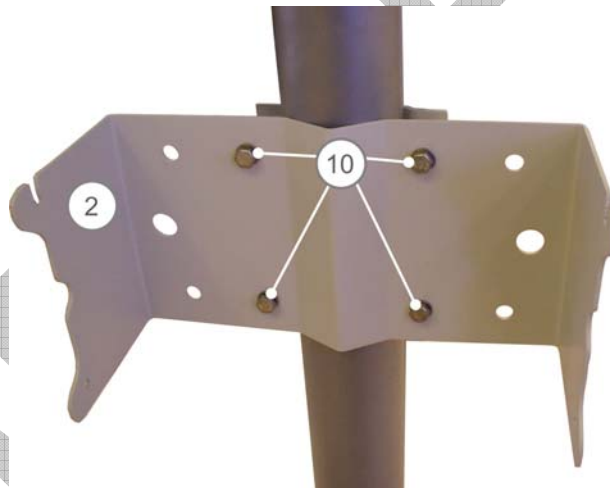
Figure 17: Pole Mounting – Inserting the four 3/8" Screws

   b. Place the main bracket on the pole as shown in Figure 17 at the desired height, and place the pole mount hanging bracket on the other side of the pole. The holes in the pole mount hanging bracket will line up with the ends of the 3/8" screws (10).

3 Installing the V390i

     c. Thread the screws (10) through the holes in the pole mount hanging bracket, and tighten them. See Figure 18.
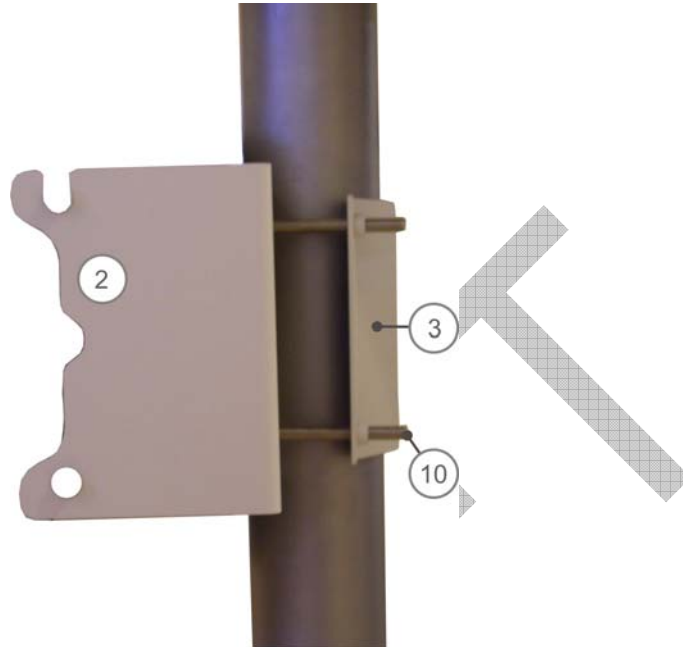
Figure 18: Pole Mounting – Attaching the Two Brackets, with Pole in the Middle

4. Assemble the spring washers (7) and flat washers (8) on the ¼" screws (6) as shown in Figure 19.
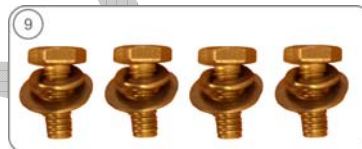
Figure 19: Wall Mounting – Assembling ¼" Screws

5. Screw two assembled ¼" screws (9) into the V390i, one on either side, close to the WiFi Antennas side (see Figure 20 and Figure 21). Do not tighten the screws.
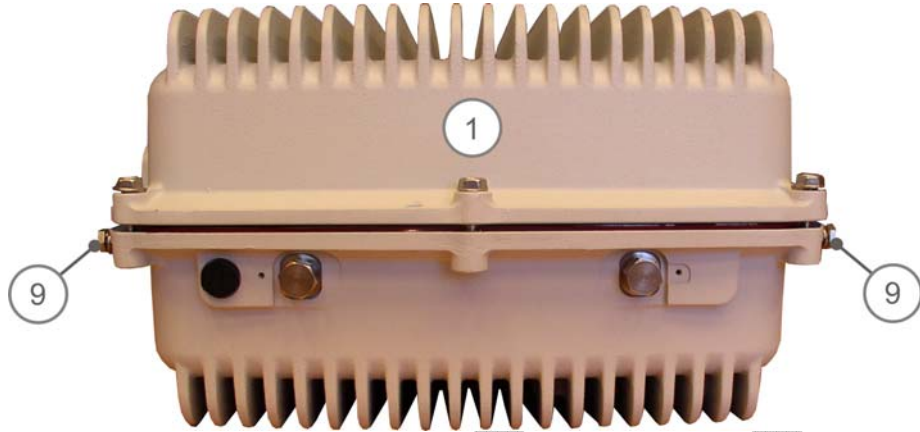
Figure 20: Pole Mounting – Screwing Two ¼" Screws (WiFi Antennas Side View)
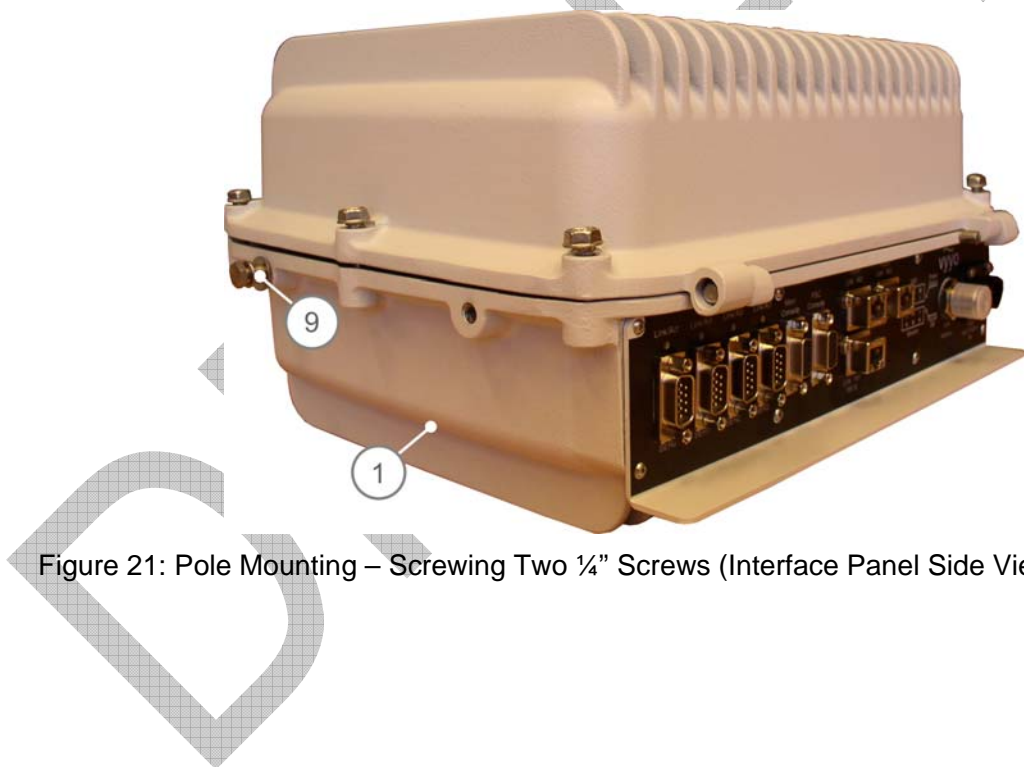
Figure 21: Pole Mounting – Screwing Two ¼" Screws (Interface Panel Side View)

6. Position the V390i so that the interface panel is facing the floor. Slide the unit into the Main bracket by inserting it very carefully from the top through the grooves in such a way that the V390i hangs on the ¼" (9) screws.
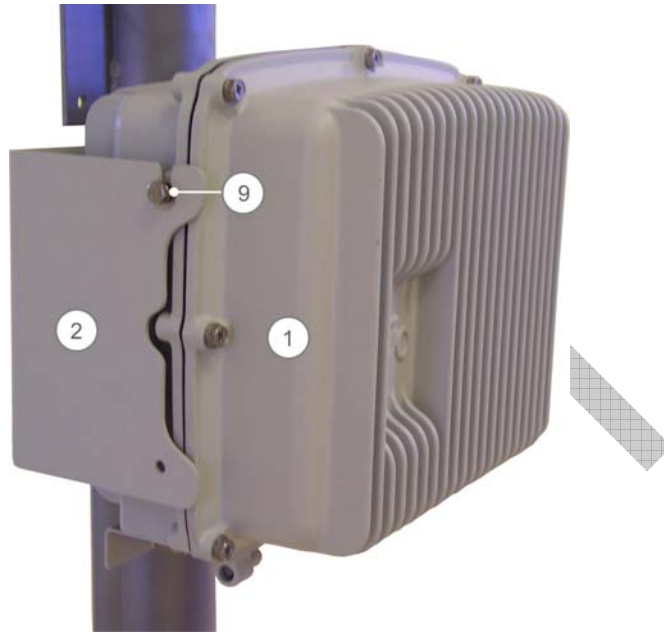
Figure 22: Pole Mounting – Inserting the V390i into the Main Bracket

7. Add the remaining two ¼" screws (9) into the bottom of the main bracket, one on each side of the bracket. Figure 23 shows the addition of one ¼" screw (9).

Figure 23: Pole Mounting – Screwing in the Remaining ¼" Screws

8. Tighten all four ¼" screws.

    The V390i is now firmly affixed to the pole (see Figure 24). The Interface Panel can be accessed from the bottom.

Figure 24: Pole Mounting – Mounting Complete

Cable Connections

Prior to connecting the cables to the V390i, you should determine whether an attenuator is needed. An attenuator is required in cases of an excessive received signal level.

Setting an Attenuator for the UHF Antenna Input

The V390i received signal level range is between -87 to -49 dBm (-38 to 0 dBmV). The received signal level is determined largely by the distance between the Base Station and the CPE, but can also be influenced by environmental conditions such as antenna height, NLOS, etc. To avoid excessive received signal level at close distances, an attenuator should be added between the V390i and the antenna.

To choose the attenuator value:

1. Use the simulated expected received signal level for the specific location. If the expected received signal level is above -49 dBm (0 dBmV), choose an attenuator value that will reduce the received signal level to be in the range -87 to -49 dBm (-38 to 0 dBmV).

2. If a simulated expected received signal level is not available, use the following table for choosing the initial attenuation value. The expected covered range is calculated to meet the proper received signal level at minimum and maximum path loss.

Table 2: Expected Coverage Range vs. Attenuator Level

Attenuation level [dB]	Expected covered range [miles]
0	12.5 to 20
6	6.5 to 15
10	3.75 to 12.5
20	1.25 to 6
30	0.4 to 3

☑ **Note:** Following initial installation, you can learn the V390i actual received signal level (refer to *Verifying RF Connection with the Base Station* on page 32). Generally, the initial attenuator setting covers the actual received range. You may need to update the attenuator value in order to match the actual received signal level to the proper range

Connecting the V390i Cables

Refer to the following figure when performing cable connections. The figure displays the V390i interface panel connectors.
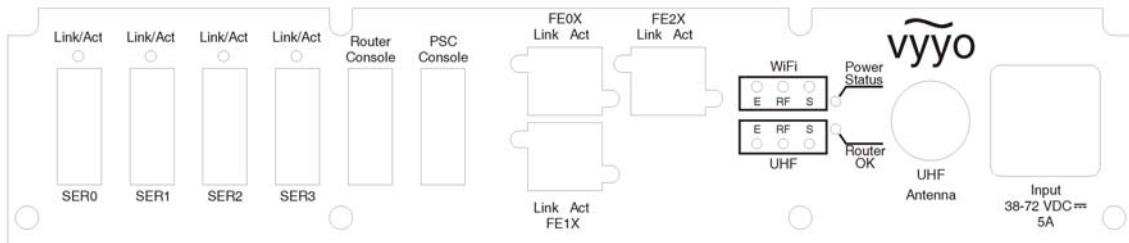
Figure 25: V390i Interface Panel Connectors

Perform the following cable connections (refer to Figure 25):

1. Connect the V390i to the UHF antenna as follows:
   - If an attenuator is needed, use a 50 ohm N-type Female to Male attenuator with the chosen value. Connect the attenuator to the UHF antenna connector of the V390i, and then connect the antenna cable to the attenuator.
   - If there is no need for an attenuator, connect the antenna cable directly to the UHF antenna connector.

2. Optionally connect WiFi antennas to the two WiFi TNC connectors, located on the top of the V390i chassis (see Figure 4).

3. Optionally connect serial devices (e.g., SCADA) to the DB-9 serial ports: SER0, SER1, SER2, and SER3.

4. Optionally connect IP devices (e.g., security devices) to the Ethernet ports: FE0X, FE1X, and FE2X.

5. Connect the power cable to the power connector, as follows:
   a. Before connecting the power cable, verify that the voltage is between 38 - 72Vdc.
   b. Before connecting the power cable, if an external power switch exists, turn it OFF.
   c. Connect the power cable.

Initial Operation

The V390i starts operating as soon as power is connected. If you turned off the external power switch prior to connecting the power cable, turn it ON.

The interface panel LEDs behave as described in *Interface Panel LEDs* on page 49. If the behavior of the LEDs deviates from standard, refer to *Troubleshooting* on page 53.

Verify connection with the Base Station, as described in the following sections:

- Verify RF connection with the Base Station.
- Verify network connection with the Base Station.

☑ **Note:** A first time startup may take up to five minutes.

Verifying RF Connection with the Base Station

The V390i acquires the downstream signal and makes a connection with the Base Station soon after initial operation.

To verify proper RF connection with the Base Station:

1. Create a Telnet connection to the V390i (for instructions refer to *Telnet Connection to the V390i* on page 33).

2. Type `su operator` to login as an operator.

3. Type the password you receive from your Systems Administrator or an authorized Arcadian Networks representative, and press **Enter**.

4. Type `cd d`.

5. View the RF levels:

   ■ Type `dsd` to read the Rx Level and Received SNR.

   ■ Type `usd` to read the Tx Level.

6. Verify proper RF level according to the following table.

Table 3: V390i Expected RF Parameters

Parameter	Expected Value	Recommended Action
Rx level	-87 to -49 dBm (-38 to 0 dBmV)	If the Rx level is too high, change the attenuator on the antenna port to adjust the level. If the Rx level is too low, check the cable connections and/or the antenna adjustment.
Received SNR	>27 dB	Typical SNR is above 30 dB. For low SNR, check the cable connections and/or the antenna adjustment.
Tx level	-17 to 27 dBm (32 to 76 dBmV)	If the level is close to the maximum, and the location is not in the border range, check the cable connections and/or the antenna adjustment.

7. If the RF parameters are not within the expected levels, perform the recommended actions.

Verifying Network Connection with the Base Station

To verify network connection with the Base Station:

1. Connect a PC (laptop) to one of the three V390i Ethernet ports: FE0X, FE1X, or FE2X.

2. Verify that the PC is in the same network as the router, and set its default gateway to be the router VLAN1 IP address.

3. From the PC, ping the IP host address of a device in the Base Station with which the V390i is associated. The device can be either the WMTS or a router connected to the WMTS.

Telnet Connection to the V390i

You can connect via Telnet to the V390i, either locally using the Router Console interface, or remotely from the NMS. The following sections describe both options.

Creating a Local Telnet Connection

To connect locally:

1. Connect a PC or laptop serial port to the Router Console serial port (see Figure 29 on page 49).

2. From the PC or laptop add a new HyperTerminal connection, with the following settings:
   - Bits per seconds: 9600
   - Data bits: 8
   - Parity: None
   - Stop bits: 1
   - Flow control: None

3. At the prompt, type `en` and press the **Enter** key.

   The prompt changes.

4. At the new prompt type `telnet 192.168.100.1` and press the **Enter** key.

   The following message appears:

   ```
   Vyyo's Wireless Modem Telnet Server

   WARNING:  Access allowed by authorized users only.
   ```

5. Press the **Enter** key.

   HyperTerminal displays the `login` *prompt.*

   ```
   login: █
   ```

6. At the prompt, type Arcadian Networks, and press the **Enter** key.

   Telnet displays a password prompt.

7. Type the password, and press the **Enter** key.

☑ **Note:** You must obtain the password from your Systems Administrator or an authorized Arcadian Networks representative.

Telnet indicates that you have successfully logged on by displaying login information followed by the CM> prompt.

```
WARNING:  It is possible to crash the system, cause a deadlock,
          or cause the connection to be shut down via Telnet.
          Run commands with caution!

Console now switched to Telnet session...

CM> █
```

Creating a Remote Telnet Connection

> ☑ **Note:** Only users with 'Administrator' or 'Advanced User' access rights can use the Telnet utility from the NMS.

To connect remotely:

1. Navigate to the V390i screen and select the **Admin** tab.
2. Click **Telnet**.
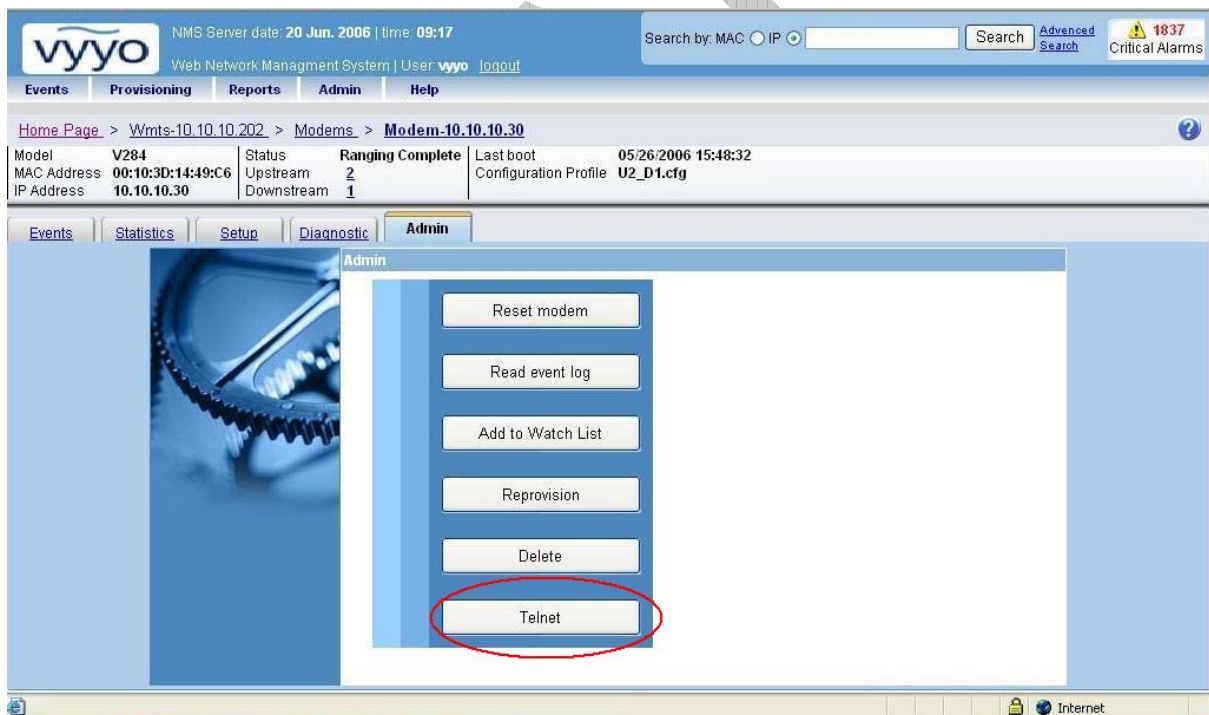
Figure 26: Creating a Remote Telnet Connection to the V390i

A Telnet session to the V390i is created. You are automatically logged on as user Arcadian Networks..

4 Configuring the V390i

The V390i comes with a standard configuration on delivery. The V390i uses the embedded Cisco 3200-series router to enable IP routing and bridging functionality, and can be configured to provide additional services beyond those provided by the standard configuration. The Arcadian Networks V384+UHF modem board is configured to work as delivered. For advanced modifications to modem settings, refer to the *Arcadian Networks NMS User Guide*.

Default Configuration Parameters

The standard configuration includes default IP address and Netmask information for the V384+A modem and the Cisco router. The default IP information is as follows:

Table 4: Default IP Settings

Parameter	Value
V384+A IP address	192.168.100.1
V384+A Netmask	255.255.255.0
V384+A default router	192.168.100.10
Cisco Router Ethernet IP address*	192.168.100.10
Cisco Router Fast Ethernet 0/0 Netmask	255.255.255.240
Cisco Router VLAN Loopback IP	10.0.0.30
Cisco Router VLAN Loopback Netmask	255.255.255.224
Cisco WMIC IP address	10.0.0.1

*This IP address is provided by the V384+A DHCP server.

The V390i default IP settings are used only for initial local management. After initial connection with the Base Station, the V384+A acquires new IP settings from a remote DHCP server. The V384+A DHCP server is then disabled, and the Cisco router re-acquires its IP setting from a new DHCP server. The default IP settings of the V384+A cannot be changed. The Cisco IP settings can be changed, but by doing so may not enable local Telnet access to the V384+ and A WMIC.

Configuring V390i Components

The V390i contains two configurable components:

- **V384+A UHF Modem Board** – All V384+A configuration is performed using the NMS (refer to the *NMS User Guide*).
- **Cisco Router** – detailed in the following section.

Configuring the Cisco Router

This section describes the Cisco default configuration, and an example of SCADA traffic configuration. It also provides a QoS configuration example and WiFi configuration instructions.

V390i Cisco 3200 Default Configuration

The V390i Cisco 3200 component default configuration enables the following operations:

- Local Telnet connectivity to the UHF modem via the FESMIC LAN interfaces for management and monitoring purpose.
- Local Telnet connectivity to the WMIC card via the FESMIC LAN interfaces for management purpose.
- WiFi client's connectivity.
- Serial ports connectivity by Telnet tunneling. In this configuration, data can be received or transmitted using Telnet to the router IP address with the relevant TCP port.

The default configuration disables all the dynamic routing protocols and the Cisco discovery protocol.

Cisco 3200 Default Configuration CLI Commands

The following displays the V390i Cisco 3200 default values' running configuration.

```
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
no service config
!
hostname Router
!
boot-start-marker
boot-end-marker
!
!
no aaa new-model
```

```
!
resource policy
!
ip subnet-zero
ip cef
!
!
no ip dhcp use vrf connected
!
!
no ip ips deny-action ips-interface
!
!
!
interface FastEthernet0/0
 ip address dhcp
 no shutdown
 duplex auto
 speed auto
!
interface Serial1/0
 physical-layer async
 no ip address
!
interface Serial1/1
 physical-layer async
 no ip address
!
interface Serial1/2
 physical-layer async
 no ip address
!
interface Serial1/3
 physical-layer async
 no ip address
!
interface FastEthernet2/0
!
interface FastEthernet2/1
!
interface FastEthernet2/2
!
interface FastEthernet2/3
!
interface Vlan1
 ip address 10.0.0.30 255.255.255.224
 no shutdown
!
ip classless
!
!
no ip http server
no ip http secure-server
!
!
!
```

```
control-plane
!
!
line con 0
 exec-timeout 0 0
 stopbits 1
line 1 4
 exec-timeout 0 0
 session-limit 1
 modem InOut
 no exec
 transport input telnet
 transport output telnet
 escape-character NONE
 telnet break-on-ip
 stopbits 1
line aux 0
line vty 0 4
 password vyyo
 login
!
end

Router#
```

SCADA Traffic Configuration

The V390i is designed to interface with asynchronous SCADA devices via serial ports Ser0 – Ser3. This section illustrates the configuration under which SCADA traffic transmission traffic was tested in Arcadian Networks's lab.

An optional network configuration for transmitting SCADA through the V390i is to use TCP encapsulation over Telnet tunneling. Using this method, the router directs the Telnet packets to the desired serial port according to the destination TCP port of the Telnet connection (4001 is the default port for Serial Port 1 Raw Data, 4002 for port 2, and so on). The SCADA master is connected to a router that functions as the Telnet caller, and the SCADA device is connected to the V390i, which is the called.

Once the caller receives serial data, it initiates a permanent TCP connection.
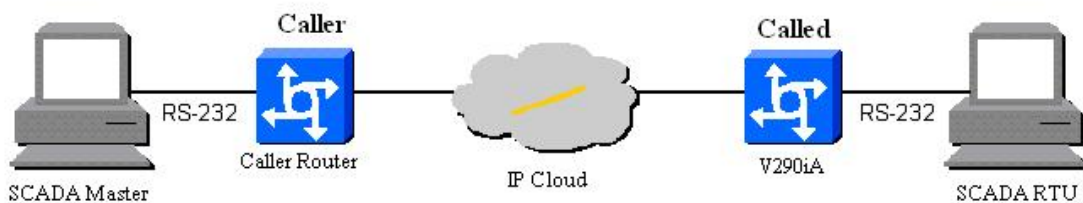
Figure 27: SCADA Traffic Tunneling

Caller Side Configuration

The following displays an example of the caller-side configuration.

```
!
version 12.4
service tcp-keepalives-out
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
no service config
!
hostname Router
!
boot-start-marker
boot-end-marker
!
!
no aaa new-model
!
resource policy
!
ip subnet-zero
ip cef
!
!
no ip dhcp use vrf connected
!
!
ip host SER1 4001 10.1.1.2
ip host SER2 4002 10.1.1.2
ip host SER3 4003 10.1.1.2
ip host SER4 4004 10.1.1.2
no ip ips deny-action ips-interface
!
!
!
!
no spanning-tree vlan 1
!
!
!
interface FastEthernet0/0
 ip address 10.1.1.1 255.255.255.0
 no shutdown
 duplex auto
 speed auto
!
interface Serial1/0
 physical-layer async
 no ip address
!
interface Serial1/1
 physical-layer async
 no ip address
!
```

```
interface Serial1/2
 physical-layer async no ip address
!
interface Serial1/3
 physical-layer async
 no ip address
!
interface FastEthernet2/0
!
interface FastEthernet2/1
!
interface FastEthernet2/2
!
interface FastEthernet2/3
!
interface Vlan1
 ip address 10.0.0.30 255.255.255.224
 no shutdown
!
ip classless
ip route 0.0.0.0 0.0.0.0 FastEthernet0/0
!
!
no ip http server
no ip http secure-server
!
no cdp run
busy-message SER1 ^C ^C
busy-message SER2 ^C ^C
busy-message SER3 ^C ^C
busy-message SER4 ^C ^C
!
!
control-plane
!
!
line con 0
 stopbits 1
 flowcontrol NONE
line 1
 no motd-banner
 no exec-banner
 exec-timeout 0 0
 session-timeout 2
 no flush-at-activation
 no vacant-message
 no modem inout
 autocommand telnet SER1 /stream
 no activation-character
 special-character-bits 8
 escape-character NONE
 autohangup session-timeout
 stopbits 1
 exec
 no autobaud
 speed 9600
```

```
 flowcontrol NONE
 transport input NONE
line 2
 no motd-banner
 no exec-banner
 exec-timeout 0 0
 session-timeout 0 0
 no flush-at-activation
 no vacant-message
 no modem inout
 autocommand telnet SER2 /stream
 no activation-character
 special-character-bits 8
 escape-character NONE
 autohangup
 stopbits 1
 exec
 no autobaud
 speed 9600
 flowcontrol NONE
 transport input NONE
line 3
 no motd-banner
 no exec-banner
 exec-timeout 0 0
 session-timeout 0 0
 no flush-at-activation
 no vacant-message
 no modem inout
 autocommand  telnet SER3 /stream
 no activation-character
 special-character-bits 8
 escape-character NONE
 autohangup
 stopbits 1
 exec
 no autobaud
 speed 9600
 flowcontrol NONE
 transport input NONE
line 4
 no motd-banner
 no exec-banner
 exec-timeout 0 0
 session-timeout 0 0
 no flush-at-activation
 no vacant-message
 no modem inout
 autocommand  telnet SER4 /stream
 no activation-character
 special-character-bits 8
 escape-character NONE
 autohangup
 stopbits 1
 exec
 no autobaud
```

```
 speed 9600
 flowcontrol NONE
 transport input NONE
line aux 0
line vty 0 4
!
end
```

V390i (Called side) Configuration

The following displays an example of the called-side configuration.

```
Current configuration : 1719 bytes
!
version 12.4
service tcp-keepalives-in
no banner incoming
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
no service config
!
hostname Router
!
boot-start-marker
boot-end-marker
!
!
no aaa new-model
!
resource policy
!
ip subnet-zero
ip cef
!
!
no ip dhcp use vrf connected
!
!
no ip ips deny-action ips-interface
!
!
no spanning-tree vlan 1
!
!
!
interface FastEthernet0/0
 ip address 10.1.1.2 255.255.255.0
 no shutdown
 duplex auto
 speed auto
!
interface Serial1/0
 physical-layer async
 no ip address
!
interface Serial1/1
```

```
 physical-layer async
no ip address
!
interface Serial1/2
 physical-layer async
 no ip address
!
interface Serial1/3
 physical-layer async
 no ip address
!
interface FastEthernet2/0
!
interface FastEthernet2/1
!
interface FastEthernet2/2
!
interface FastEthernet2/3
!
interface Vlan1
 ip address 10.0.0.62 255.255.255.224
 no shutdown
!
ip classless
ip route 0.0.0.0 0.0.0.0 FastEthernet0/0
!
!
no ip http server
no ip http secure-server
!
no cdp run
!
!
control-plane
!
!
line con 0
 stopbits 1
line 1 4
 no exec-banner
 no vacant-message
 modem DTR-active
 special-character-bits 8
 no autobaud
 speed 9600
 no exec
 flowcontrol NONE
 transport input telnet
 escape-character NONE
 dispatch-character 5
 stopbits 1
line aux 0
line vty 0 4
!
end
Router#
```

Quality of Service

The V390i includes tools to provide prioritization of specific traffic over the regular traffic. This feature was designed to ensure that high capacity applications would not take over the bandwidth and starve low rate applications such as SCADA.

The QoS architecture involves several components. In the Base Station site, a router is assumed between the WMTS and the backbone network. Both the WMTS and the router participate in the downstream QoS process. The V390i and the WMTS participate in the upstream QoS process, in which the Cisco 3200 router and the V384+A UHF modem board components of the V390i must take action.
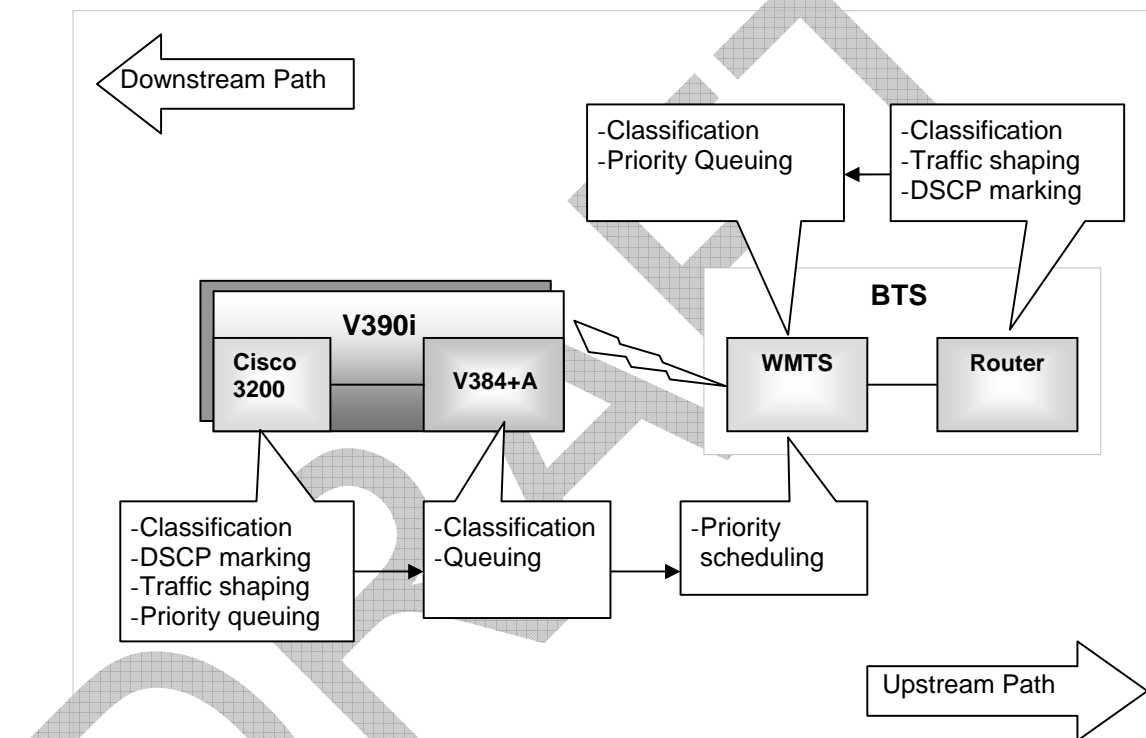

Figure 28: QoS Architecture Components

Configuring Prioritization

Configuring the V384+A for prioritization is detailed in the *NMS User Guide*.

Configuring the WMTS is detailed in the *Base Station User Guide*.

The following sections explain how to configure the Cisco 3200 unit within the V390i to provide priority for SCADA traffic.

Classification

The Cisco 3200 router classifies the packets transmitted to the V384+A UHF modem board via the Fast Ethernet0/0 port. SCADA packets are identified by their destination IP address and their destination TCP port and are marked with the value EF on the DSCP bits. DSCP of other traffic is marked with a zero value.

Traffic Shaping

Traffic going from the Cisco 3200 toward the V384+A modem is shaped to match the rate of the wireless UHF upstream channel.

Traffic Priority

The SCADA traffic is prioritized over any other traffic when it is transmitted over the FastEthernet0/0 port.

The following set of commands provides the prioritization:

```
!
class-map match-any All_IP_Traffic
 match access-group 101
class-map match-any SCADA_Traffic
 match access-group 102
!
!
policy-map SCADA_Policy
 class SCADA_Traffic
   priority 128
   set dscp ef
policy-map SCADA_Priority
 class All_IP_Traffic
   shape average 1000000
   service-policy SCADA_Policy
!
!
interface FastEthernet0/0
 ip address 10.1.1.2 255.255.255.0
 no shutdown
 duplex auto
 speed auto
 service-policy output SCADA_Priority
!
!
access-list 101 permit ip any any
access-list 102 permit tcp host 10.1.1.2 range 4001 4004 host 10.1.1.1
access-list 102 deny   ip any any
no cdp run
!
```

Configuring the WiFi Interface

The V390i is supplied with the Cisco WiFi default configuration. The default settings include:

- Radio enabled.
- Role in radio network: Root.
- IP address: 10.0.0.1.
- Subnet mask: 255.255.255.224.
- Default gateway: 0.0.0.0.
- Network name: tsunami.
- No security.
- The following services are enabled: Telnet, HTTP, CDP.
- The following services are disabled: SSH, DNS, QoS, NTP, STP, Filters, Proxy mobile IP, SNMP, VLAN, ARP caching.

If you do not plan on using the WiFi interface, it is recommended to disable it. If you do plan on using the WiFi interface, you may wish to configure it to match your needs.

You can configure the WiFi interface using either of two methods: via Telnet using CLI commands, or via an HTTP browser. The following sections describe both methods.

Configuring the WiFi Interface via Telnet

To configure the WiFi interface via Telnet:

1. Connect a direct Ethernet cable between the PC/laptop LAN interface and one of the V390i LAN interfaces: FEX0, FEX1 or FEX2.

2. Set the PC/Laptop IP address to the WMIC network setting. For the V390i default configuration, set the PC/laptop to the following:
   - IP address: 10.0.0.2.
   - Subnet mask: 255.255.255.224 .
   - Default gateway: 10.0.0.30.

3. Select **Start > Programs > Accessories > Telnet**. If Telnet is not listed in the Accessories menu, select **Start > Run**, type `Telnet` in the **Open** field, and press **Enter**.

   The Telnet window appears.

4. Click **Connect** and select **Remote System**.

> ☑ In Windows 2000, the Telnet window does not contain drop-down menus. To start the Telnet session in Windows 2000, type `open` followed by the WMIC IP address.

---

5. In the **Host Name** field, type the WMIC IP address and click **Connect**.

For more information on WiFi configuration options and commands see the document: *Cisco 3200 Series Wireless MIC Software Configuration Guide*, located in: http://www.cisco.com/application/pdf/en/us/guest/products/ps272/c2001/ccmigration_09186a008022ac30.pdf.

Configuring the WiFi Interface via an HTTP Browser

To configure the WiFi interface via an HTTP browser:

1. Connect a direct Ethernet cable between the PC/laptop LAN interface and one of the V390i LAN interfaces: FEX0, FEX1 or FEX2.

2. Set the PC/Laptop IP address to the WMIC network setting. For the V390i default configuration, set the PC/laptop to the following:

    - IP address: 10.0.0.2.

    - Subnet mask: 255.255.255.224.

    - Default gateway: 10.0.0.30.

3. Open your Internet browser. You must use Microsoft Internet Explorer (version 5.x or later) or Netscape Navigator (version 4.x).

4. Type the WMIC IP address (default: `10.0.0.1`) in the browser address line and press **Enter**.

    An Enter Network Password screen appears.

5. Type your username (default: `Cisco`) in the **User Name** field

6. Type the wireless device password (default: `Cisco`) in the **Password** field and press **Enter**.

    The Summary Status page appears.

For more information on WiFi configuration options and commands see the document: *Cisco 3200 Series Wireless MIC Software Configuration Guide*, located in: http://www.cisco.com/application/pdf/en/us/guest/products/ps272/c2001/ccmigration_09186a008022ac30.pdf.

5   Maintenance

The V390i is designed for high reliability and requires only limited maintenance. This chapter describes the behavior of the V390i LEDs during normal operation. In the event of device functionality issues, refer to *Troubleshooting* on page 53.

Interface Panel LEDs

The following figure shows the LEDs on the V390i's interface panel. These LEDs provide performance indications for the V390i.
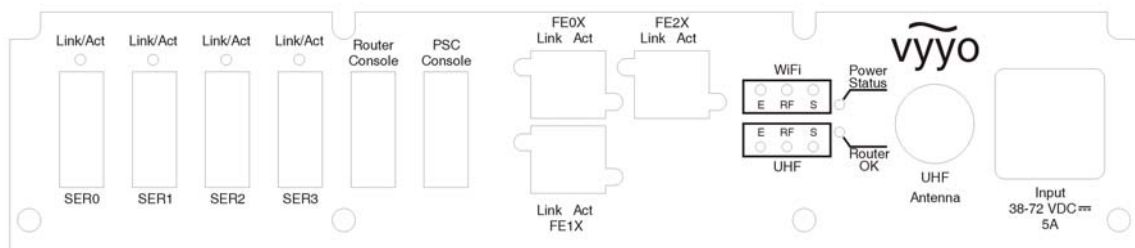
Figure 29: V390i Interface Panel LEDs

The following table describes the LEDs and their standard behavior and functions.

Table 5: V390i LEDs

LED	Function
Power Status	Amber when power is supplied to both the V384+A and the Cisco router. If the Power LED behaves differently, this indicates some kind of power failure. Refer to *Power Failure Indications Provided by the Power LED* on page *55* for details.
Router OK	Blinks green during router boot-up sequence. Green when the router is operational.
WiFi Ethernet (E)	■ Blinks green when transmitting/receiving Ethernet packets. ■ Green when Ethernet link operational.
WiFi RF (RF)	■ Blinks green when transmitting/receiving radio packets. ■ Green when RF link is operational.

LED	Function
WiFi Status (S)	■ Blinks green when no WiFi devices are associated with the WiFi interface. ■ Green when at least one device is associated with the WiFi interface.
UHF Ethernet (E)	■ On when the Ethernet link is operational. ■ Off when the Ethernet link is not operational. ■ Flashing when data is being transmitted/received.
UHF Status (S)	■ On when the V384+A is registered. ■ Off when the V384+A is not registered.

UHF RF Link (RF)	*When **Status** LED is Off:*
	   ■ On when the downstream link is operational.
	   ■ Off when the modem has not yet begun downstream acquisition, the downstream link is idle, or there is a problem with data reception.
	   ■ Flashing when the downstream link is being acquired.
	*When **Status** LED is On:*
	   ■ Flashing when data is transferring in either in the Upstream or Downstream direction.

Link/Act (for each Serial port)	■ Green when the serial port is operational. ■ Blinks red when packets are transmitted or received.
Link (for each Ethernet port)	Green when the Ethernet port is connected to a device.
Act (for each Ethernet port)	Blinks green when packets are transmitted or received.

WiFi LEDs Operation

As shown in Figure 29, the V390i interface panel includes three WiFi LEDs: Ethernet (E), Status (S), and Radio (RF). These LEDs are used in combination to determine overall V390i device status.

If any of the WiFi LEDs is Red or Amber (steady or blinking) this indicates an initialization state, warning or a failure state. Refer to *Device Status Indications Provided by WiFi LEDs* on page 55 for details.

Upgrading Software

The V390i has two upgradeable software elements:

- The V384+ A UHF modem. The standard procedure for upgrading the modem is performed using the NMS (refer to the *NMS User Guide*). A local software upgrade is rarely performed (refer to *Upgrading the V384+A Software Locally* on page 51).

- The Cisco IOS software. The software upgrade is performed by Cisco tools. Refer to the Cisco 3200 release notes:
http://www.cisco.com/univercd/cc/td/doc/product/access/mar_3200/mar_rlsn/index.htm

Upgrading the V384+A Software Locally

To locally upgrade the V384+A:

1. Ensure that the latest release of the V390i software is loaded on a laptop that is running a TFTP server, such as the pumpkin TFTP server that is supplied with the Base Station CD.

2. Make sure the TFTP server is activated, and set the server download directory to permit access to the directory in which the software package is located.

3. Use a direct Ethernet cable to connect the laptop's LAN interface to one of the V390i's LAN interfaces: FE0X, FE1X or FE2X.

4. Make sure the laptop's NIC parameters are:

   - IP Address: 10.0.0.10.

   - Subnet Mast: 255.255.255.0.

   - Default Router: 10.0.0.30.

5. If the laptop has more then one NIC, make sure that no other NIC on the laptop has a default router.

6. Disconnect the RF Cable from the V390i and then turn the V390i ON.

7. Connect a serial cable from the serial port on the laptop to the Router Console port on the interface panel.

8. Start Telnet on the laptop (refer to *Creating a Local Telnet Connection* on page 33') and verify the connection with the V390i.

9. Type `cd i` to go to the `IpHal` directory.

10. Type `dload <ipaddress> <image_name>`, where:

    - `ipaddress` is the IP address of the laptop running the TFTP server.

    - `image_name` is the filename of the software package.

The download process takes a few moments. When download is complete, the V384+A resets itself.

6 Troubleshooting

This chapter includes:

- A list of common issues and the troubleshooting actions to be taken when they are encountered. The issues are composed of two types: issues that must be dealt with on-site, and issues that can be dealt with remotely.

- The on-site troubleshooting section includes also a list of device status indications, as provided by the state of the WiFi interface panel LEDs.

- Instructions for remote and local Telnet access to the V390i.

☑ For a description of the V390i LEDs, refer to Chapter 2, *Interface Panel LEDs* on page 49.

On-site Troubleshooting Issues

Table 6: On-Site Troubleshooting Issues

Issue	Actions
All LEDs are OFF	■ Check that the power cable is properly connected. ■ Check the power at the cable end connecting to the V390. If it is OK: 　■ Check whether there is a problem with your electrical system. 　■ Otherwise, replace the V390i.
Power is not stable (power LED is not steady)	■ Verify that the power supply in use can deliver 5A at the required voltage and temperature range. 　■ If power supply cannot deliver it – there is a problem with your electrical system. 　■ Otherwise, replace the V390i.

Issue	Actions
Modem status LED not ON	1. Open a local Telnet session with the V390i, as described in *Creating a Local Telnet Connection* on page 33.
	2. Check the downstream parameters by entering `cd doc > dsdiag`.
	3. The following downstream parameters should have the following values: `QAM = LOCKED, FEC = LOCKED,` `SNR =` at least `24 dB` for 64QAM, at least `19 dB` for 16QAM , and at least `13 dB` for QPSK. If the values differ:
	■ If other modems in this sector are working, the problem lies with the CPE antenna.
	■ Otherwise, it is a Base Station problem. Refer to the Troubleshooting chapter in the *Base Station User Guide*.
	4. Check the upstream parameters by entering `usdiag`.
	5. The following upstream parameters should have the following values: `Upstream Status = UP`. If the values differ:
	■ If other modems in this sector are working, the problem lies with the CPE antenna.
	■ Otherwise, it is a Base Station problem. Refer to the Troubleshooting chapter in the *Base Station User Guide*.
	6. Check the Ranging parameters by entering `rng_rsp true`.
	7. The following ranging parameter should have the following value: `Stat=Success`. If the value differs:
	■ If other modems in this sector are working, the problem lies with the CPE antenna.
	■ Otherwise, it is a Base Station problem. Refer to the Troubleshooting chapter in the *Base Station User Guide*.
	8. Type `rng_rsp false` to disable ranging messages.
	9. Check IP acquisition by entering `ip_show`.
	10. The V390i correct IP address and subnet mask should display on screen. If the values differ:
	■ Check the modem provisioning settings (IP address and subnet settings) in the NMS. Refer to the *NMS User Guide* for instructions.

Issue	Actions
	11. Check the Registration status by entering `state`.

	12. The Registration status should display the following:
	`fRngSuccess = true, fLastRngRspStatus = 3,`
	`fCmIpInitState = 2, fCmRegState = 2.`
	If the values differ:
	
	■ Check the modem provisioning settings (modem configuration file setting) in the NMS. Refer to the *NMS User Guide* for instructions.

Power Failure Indications Provided by the Power LED

The Power LED provides the following failure indications:

■ Green when power is supplied only to the V384+A.

■ Red when power is supplied only to the Cisco router.

■ Blinks green when a power fault is detected in the V384+A.

■ Blinks red when a power fault is detected in the Cisco router.

■ Blinks amber when a power fault is detected in both the V384+A and the Cisco router.

Device Status Indications Provided by WiFi LEDs

The three WiFi LEDs are grouped together on the interface panel of the V390i: Ethernet (E), Status (S), and Radio (RF). These LEDs are used in combination to determine overall V390i device status.

To determine the status of the device, find the combination of LED colors in the following table.

Table 7: Device Status as Indicated by WiFi LEDs

Ethernet LED Color	Radio LED Color	Status LED Color	Device Status
Green	Green	-	Boot loader DRAM memory test.
-	Red	Amber	Boot loader board initialization test.
-	Blinking Green	Blinking Green	Boot loader flash memory test.
Amber	-	Green	Boot loader Ethernet initialization test.
Green	Green	Green	Boot loader starting router software.

Ethernet LED Color	Radio LED Color	Status LED Color	Device Status
-	-	Green	At least one device is associated with the V390i.
-	-	Blinking Green	No WiFi devices are associated with the WiFi interface.
-	Blinking Green	Green	Transmitting/receiving radio packets.
Green	-	-	Ethernet link operational.
Blinking Green	-	-	Transmitting/receiving Ethernet packets.
Red	Red	-	DRAM memory test failed.
-	Red	Red	File system failure.
Red	-	Red	Ethernet failure.
Amber	Amber	Green	Boot environment failure.
Red	Red	Green	No Cisco IOS loaded.
Amber	Amber	Amber	Boot failure.
-	Blinking Amber	Green	Radio Buffer full or Maximum retries.
Blinking Amber	-	-	Transmit/receive Ethernet error.
-	-	Blinking Amber	General Warning.
-	-	Amber	Resetting configuration to factory default.
Red	Red	Red	Firmware failure.
Blinking Red	-	-	Hardware failure.
-	-	Red	Loading new firmware image.

Remote Location Troubleshooting Issues

Table 8: Remote Location Troubleshooting Issues

Issue	Actions

V390i is not operational	1. Check that the WMTS is functioning (refer to the *NMS User Guide*).
	
	2. Check if the Monitoring modem of this sector is operational.
	
	  ■ If it is not operational, it is a general Base Station problem. Refer to the Troubleshooting section in the *Base Station User Guide*.
	
	3. Check other modems in the sector.
	
	  ■ If they are not operational, the Base Station antenna of this sector is the problem.
	
	4. Otherwise, the problem is in the specific V390i. Check the following (refer to the *NMS User Guide*):
	
	  ■ Check the modem DHCP and TFTP events.
	
	  ■ Check the modem configuration file.
	
	  ■ If no problem is located, the V390i requires on-site troubleshooting (refer to *Table 6: On-Site Troubleshooting Issues* on page53).

A Modem Threshold Crossing Alarm (TCA) occurred. The alarm can be any of the following:
 	
■ Downstream SNR
 	
■ Downstream Rx. Power
 	
■ Downstream Corrected/Uncorrected Codewords
 	
■ Upstream Tx. Level
 	
■ Upstream Rx. Power
 	
■ Downstream / Upstream Uncorrected Codewords
	■ If the alarm does not concern Upstream Tx. Power or Downstream Rx. Power, compare the results with the sector's Monitoring modem.
	
	■ If there is degradation in the Monitoring modem, the problem lies with the Base Station. Refer to the Troubleshooting section in the *Base Station User Guide*.
	
	■ Check the performance of other modems in the sector.
	
	■ If there is degradation in the other modems' performance but the Monitoring modem is OK, the problem lies with the Base Station sector antenna.
	
	■ If the other modems in the sector are OK, the problem lies with the V390i.
	
	  ■ Study and analyze the performance – is it a sudden event, or degradation over a time period.
	
	  ■ Check the following parameters: Downstream SNR, Upstream SNR, Downstream Rx. Power, Downstream Corrected/Uncorrected Codewords, Upstream Tx. Level, Upstream Rx. Power
	
	  ■ Downstream / Upstream Uncorrected Codewords You will probably need to go to the site to locate the problem.

Issue	Actions

Bad Temperature Sensor event occurred	1. Open a Telnet session with the V390i, either locally or remotely (refer to *Telnet Connection to the V390i* on page 33).
	
	2. Type the following CLI commands to check which temperature sensor is malfunctioning:
	
	`cd /v/v`
	`get_bist_results`
	
	3. The following sensors are checked:
	Tuner Sensor, CPU Sensor, Cisco Sensor, Environment Sensor, RTC (Real Time Clock).
	View the results of the check on-screen. You should take action in the following cases:
	
	■ If the CPU temperature sensor is malfunctioning, the V390i will shut itself down. You must replace the V390i.
	
	■ The Cisco temperature sensor and the Environment temperature sensor both measure the same thing. Therefore, the V390i will shut itself down only if both of them are malfunctioning. If one of these sensors is malfunctioning, the V390i should be fixed, but it need not be done immediately.

A device attached to the V390i is not operating	■ Ping the V390i Cisco Router IP address. ■ If the ping is successful, the problem probably lies with the device. ■ If the ping is not successful, ping the IP address of the V384+A: ■ If the ping is successful, check the Cisco router IP configuration. ■ Otherwise, follow the instructions in *V390i is not operational* on page 57.

A   V390i Technical Specifications

This appendix lists the V390i technical specifications.

When installing the V390i, you must ensure that the physical environment and RF configuration meet these requirements. For example, the pole must be able to support the device's weight, and the antenna must be compatible with the listed frequency ranges.

V390i General Characteristics

	Parameter	Specification
Physical		
	Dimensions	13.4" x 12.2" x 7.1", 340 x 310 x 180 mm
	Max. Weight	30 lbs, 13.5 Kg.
Environmental		
	Operating temperature	-22°F to +158°F, -30°C to +60°C
	Storage temperature	-40°F to +185°F, -40°C to +85°C
	Relative humidity	Up to 55%, 95% (non-condensing for 96 hours)
	Vibration	IEEE 1613, Class V.S.2
	Shock	IEEE 1613, 100 mm
	Ingress Protection	IP40 (1 mm objects)
Regulations		
	IEEE	std-1613-2003 compliance
	FCC	C.F.R 47 - Part 15B and Part 27
	FCC	C.F.R 47 - part 15C
Power		
	Power supply range	38 to 72 VDC
	Power Polarity	±
	Rated voltage	48V
	Maximum consumption	96W

UHF Radio Characteristics

Parameter	Specification		
Downstream			
Frequency	757-758 MHz		
Channel bandwidth	330 KHz		
Modulations	64QAM	16QAM	QPSK
SNR for BER < 10-E6	24 dB	19 dB	13 dB
Minimum signal level	-87 dBm		
Maximal signal level	-49 dBm		
Frequency tolerance	± 50 KHz		
Adjacent channels for BER < 10E6	10 dB		
FEC	ITU-T J.83 Reed Solomon/Trellis Decoder		
Upstream			
Frequency	787-788 MHz		
Channel bandwidth	325 KHz		
Modulation	16QAM or QPSK		
Transmit level	-17 to +27 dBm		
FEC	Reed Solomon, with optional training		

B Antennas Technical Specifications

This appendix lists the technical specifications of the two optional UHF antennas.

Shrouded Yagi Antenna

Following are the specifications for the 4RF0054-A model of the 746 -788 MHz shrouded Yagi antenna.

Yagi Electrical and Mechanical Specifications

Parameter	Specification
Frequency range	746-788 MHz
Input Impedance	50 Ohms
Return Loss	>15 dB
Front to Back Ratio	20 dB
Maximum Input Power	250 Watts
Polarization	Vertical & Horizontal
Forward Gain	11.5dBd
3 dB Beamwidth	E Plane 37º, H Plane 41º
Connection	N socket
Radiator	ptfe Printed Circuit
Elements	Aluminium Alloy
Radiator Feed	Sucoform 141
Antenna Base	Sandcast Aluminium Alloy Grade LM25
Radome	Fire retardant Polyurethane Moulding
Fasteners	Stainless Steel Grade A2-70
Lightning protection	Direct Grounded
Mounting Brackets	Hot Dip Galvanized Steel to suit 38 - 60mm. dia.

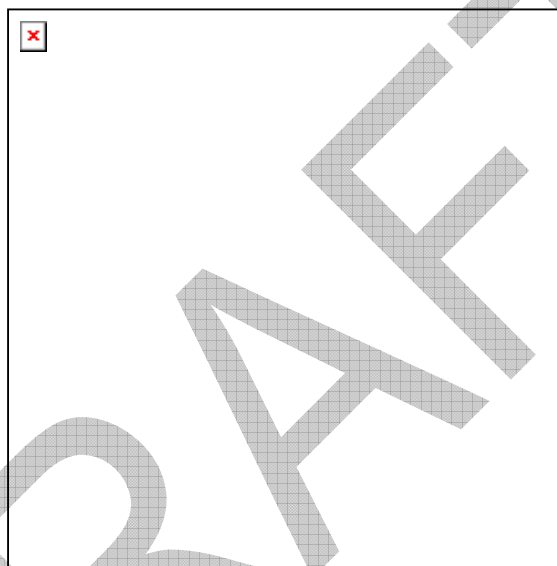| Parameter	Specification
Typical Weight	6 kg (inc. clamp)
Typical Length	1.3 m
Typical Wind loading @ 45m/s	285N, with 1/2" radial ice 306N
Survival Wind Speed	300km/h with 1/2" radial ice
Operational Temperature Range	-50ºC to +80ºC

Mounting Options for the Yagi Antenna

Figure 30: Mounting for Vertical Polarization of the Yagi Antenna

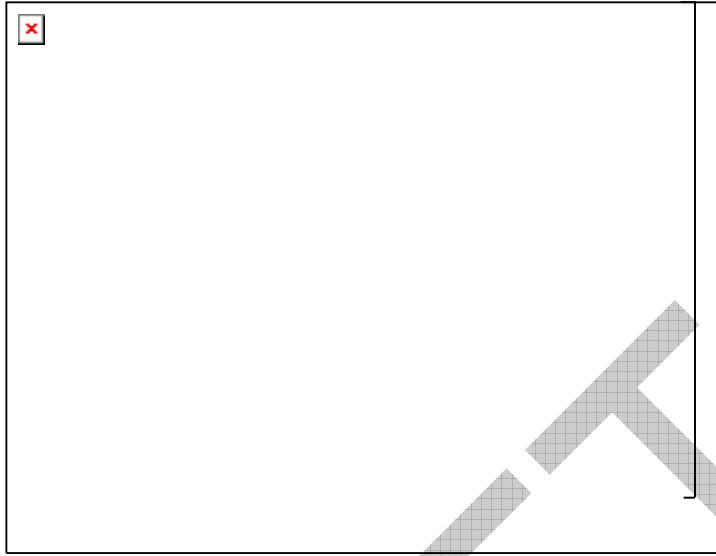Figure 31: Mounting for Horizontal Polarization of the Yagi Antenna

Flat Panel Subscriber Antenna

Following are the specifications for the 746-788 MHz, 9.5 dBi flat panel subscriber antenna.

Flat Panel – Electrical and Mechanical Specifications

	Parameter	Specification
	Regulatory Compliance	RoHS, CE 0682
Electrical		
	Frequency range	746-788 MHz
	Gain	9.5 dBi (min)
	VSWR	2 : 1 (max)
	S dB beamwidth	AZ: 43º(typ)
		EL: 55º(typ)
	Polarization	Linear (Vertical or Horizontal)
	Cross polarization	AZ: -26 dB (max)
		EL: -26 dB (max)
	F/B ration	-25 dB (max)
	Input impedance	50 (ohm)
	Input power	6 W (max)
	Lightning protection	DC Grounded
Mechanical		
	Dimensions (L x W x D)	450 x 450 x 30 mm (max)
	Weight	3 Kg (max)
	Connector	N type Female
	Radome	Plastic
	Base plate	Aluminum with chemical conversion coating
	Outline drawing	
Mounting Kit		

Flat Panel – Environmental Specifications

Test	Standard	Duration	Temperature	Notes
Low temperature	IEC 68-2-1	72 h	-55ºC	–
High temperature	IEC 68-2-2	72 h	+71ºC	–
Temp. cycling	IEC 68-2-14	1 h	-45ºC + 70ºC	3 Cycles
Vibration	IEC 60721-3-4	30 min/axis	–	Random 4M5
Shock Mechanical	IEC 60721-3-4	–	–	4M5
Humidity	ESTI EN300-2-4 T4.1 E	144 h	–	95%
Water Tightness	IEC 529	–	–	IP63
Solar Radiation	ASTAM G53	1000 h	–	–
Flammability	UL 94	–	–	Class HB
Salt Spray	IEC 68-2-11 Ka	500 h	–	–
Ice and Snow	–	–	–	25 mm Radial
Wind Speed Survival Operation	–	–	–	220 Km/h 160 Km/h
Wind Load (Survival): Front Thrust Side Thrust	– –	– –	–	39.6 kg 4.3 kg

C Cable Specifications

This appendix lists the technical specifications of the various cables necessary or optional for V390i installation: Serial, PSC Console, Router Console, Ethernet, UHF antenna and Power.

Cable Requirements

- Use cables suitable for the environmental required specification.
- Do not exceed the allowed cable length according to the common STD (Serial and Ethernet).
- Use the pin out description (refer to *Cable Connectors Specifications* below) to prepare the proper cable wiring for the specific cable necessary

Cable Connectors Specifications

Use the following pin out descriptions to prepare the proper cable wiring for the specific cable you need: Serial, PSC Console, Router Console, Ethernet, UHF antenna or Power.
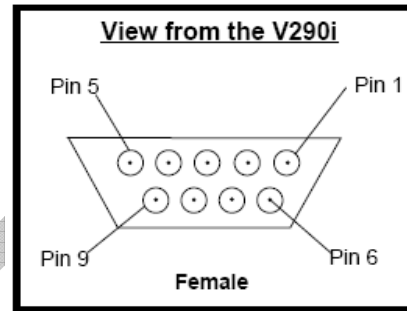
Serial Cable – Connector Description

V390i Name	Connector Description	Pin Number
SER 0 to SER3	Connector D-Type 9 pin Male	Pin1 = DCD
		Pin2 = RxD
		Pin3 = TxD
		Pin4 = DTR
		Pin5 = GND
		Pin6 = DSR
		Pin7 = RTS
		Pin8 = CTS
		Pin9 = NC

View from the V290i
Pin 1   Pin 5
Pin 6   Pin 9
Male
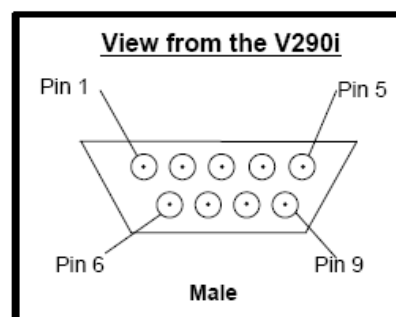
PSC Console and Router Console Cables – Connector Description

V390i Name	Connector Description	Pin Number
PSC console	Connector D-Type 9 pin Female	Pin2 = TxD
		Pin3 = RxD
		Pin5 = GND
		Pin1,4,6,7,8,9=NC

V390i Name	Connector Description	Pin Number
Router console	Connector D-Type 9 pin Female	Pin1,9 = NC
		Pin2 = TxD out
		Pin3 = RxD in
		Pin4 = DSR in
		Pin5 = GND
		Pin6 = DTR out
		Pin7 = CTS in
		Pin8 = RTS out

View from the V290i

Pin 5   Pin 1
Pin 9   Pin 6
Female

Ethernet Cable – Connector Description

V390i Name	Connector Description	Pin Number
FE0X to FE2X	Connector RJ45 Female	Pin1 = RxPO
		Pin2 = RxNO
		Pin3 = TxPO
		Pin4 & 5 = TxC
		Pin6 = TxNO
		Pin7 & 8= RxC

View from the V290i

Pin 1
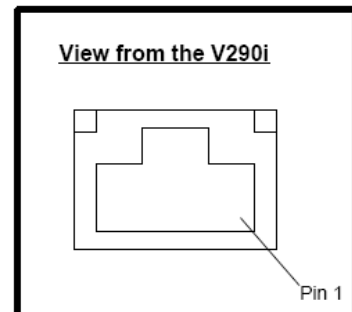
UHF Antenna Cable – Connector Description

V390i Name	Connector Description	Pin Number
UHF antenna	Connector N-Type female 50 ohm	Standard

DC Power Inlet – Connector Description

V390i Name	Connector Description	Pin Number
DC Input	Circular plastic connector 4 pin male	Pin1 = Negative
		Pin2 = Positive
		Pin3 = Negative
		Pin4 = Positive
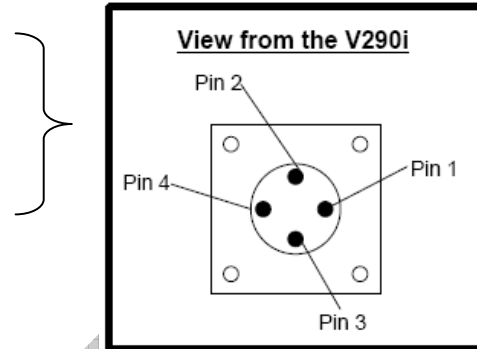
D   FCC Declaration of Conformity

We, the undersigned,

Company: Arcadian Networks, Inc.

Address:400 Columbus Avenue, Valhalla, NY 10595

Country: USA

Telephone number: 001-650-3194037

Fax number: 001-650-3194066

Are the Responsible Party for this Declaration, certify and declare under our sole responsibility that the following equipment:

Brand	Type	Product description
Arcadian Networks	V390i	UHF INDUSTRIAL MODEM WITH WiFi ACCESS POINT

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.

Drawn up at: Arcadian Networks Inc. 400 Columbus Avenue Valhalla, NY 10595 USA	On April 28, 2008
Arcadian Networks Inc.	Arnon Afgin General Manager and VP RND