EMC Technologies Report Number: M061023_Cert_RX-INN_Class_2

APPENDIX E

USER MANUAL

RX INN

Intelligent Network Node Installation Guide

aCure Technology Pty Ltd

Model: RX-4002

May, 2007 Version 1.6

Copyright Notice

FCC Notice

RX INN FCC Number: UWT-RX-4002-02

The enclosed wireless network device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.

2. This device must accept any interference received, including interference that may cause undesired operation.

This wireless network device 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 wireless network device generates, uses, and radiates 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 wireless network device does cause harmful interference to radio or television reception, which can be determined by turning the wireless network device off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

1. Reorient or relocate the receiving antenna.

2. Increase the separation between the wireless network device and the affected receiver.

3. Connect the wireless network device into an outlet on a circuit different from that to which the receiver is connected.

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

Limited Warranty Notice

Hardware: aCure Technology warrants all supplied equipment (INN, INS, IGS and accessories), for the term of one year from the shipping date to be free of defects in materials and workmanship under normal use and service. All parts will be repaired or replaced with similar or functionally equivalent parts by aCure Technology during the warranty term, except in case the returned parts have mechanical, electrical or other accidental or intended damages caused by improper use or due to wind, rain, fire or other acts of nature.

Parts (or systems) must be shipped pre-paid to our facility in Perth, Australia. All items must have a Return Authorisation (RA) number which you can get by contacting us via email, telephone or fax. The RA must be printed, signed, and enclosed with the shipment, also the RA number must be written on the package itself. Parts sent without following the proper procedure will be treated as those not to be repaired or replaced due to the above mentioned conditions. Items proved to be free of defects in our lab will be returned to the customer at the customer's expense. Those that do meet the warranty repair requirements will be repaired or

replaced, and returned to the customer's location at our expense, extending the warranty term for the time the items are being shipped to and from our facility and replaced or repaired.

Printed Materials: Any manuals, brochures, product sheets, marketing material or other material related to aCure Technology supplied hardware is provided “as is” without a warranty of any kind, expressed or implied, including, but not limited to, the implied warranty of merchantability and fitness for a particular purpose. The manufacturer has made every effort to ensure the accuracy of printed materials; however, it is possible that it may contain technical inaccuracies, typographical or other errors. No liability is assumed for any inaccuracy found in this publication, nor for direct or indirect, incidental, consequential or other damages that may result from such an inaccuracy, including, but not limited to, loss of data or profits. Please report any inaccuracies found to support@acure.com.au.

Modification Statement

Unauthorised modifications to hardware or software may violate FCC requirements and void warranty.

RF Exposure Notice

To ensure compliance with FCC RF exposure requirements, the antenna used for this wireless network device must be installed to provide a separation distance of a minimum of 1 meter or more from all persons, and must not be co-located or operated in conjunction with any other antenna or radio transmitter. Installers and end-users must follow these installation instructions.

Safety Warnings

This unit must be installed by a trained professional installer only. Read the following safety warnings before commencing an installation.

General Safety Warning

Always be aware of electrical power lines!

You can be killed if any antennas come near electrical power lines. Carefully read and follow all instructions in this manual.

Electrical Power Warning

This unit must be installed by a trained professional installer only. Read the installation instructions before you connect the wireless network device to its power source.

Lightning Activity Warning

Do not connect or disconnect cables during periods of lightning activity.

For each antenna it is recommended that surge protective devices are installed and that the surge protective devices are properly earthed.

Grounding Warning

An external grounding wire must be installed for correct operation of this equipment. The ground connection must be complete before connecting power to the chassis and a simple continuity check between the enclosure and the ground termination point can confirm this.

Power Cord

A power cord is not provided with this equipment.

Installation

This product should be installed by a qualified professional.

Powered by RoamAD

This equipment is powered by RoamAD.

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Outdoor RX INN Introduction

RX INN Overview

The RX INN comprises an Intel compatible XScale main board, the “Pronghorn Metro” from ADI Engineering loaded with RoamAD software. It can therefore be easily customised for specific service provider requirements.

Each RX INN contains up to 4 embedded IEEE 802.11 compatible radios (supporting the 802.11 a/b/g standards) and six antenna connection points for end user connectivity, or wireless backhaul as well as dual Ethernet ports for local network connectivity.

The easy-to-use, web-based management platform allows a service provider to carry out remote, real-time, web-based management and control of the RX INN.

This allows the service provider to undertake real-time diagnostics on the INN and of the end user experience (channel use, coverage level, bandwidth and data use) empowering the service provider with accurate real-time knowledge to give remote end user support that is relevant.

The RX INN auto-configuration procedure means that the device configuration code is efficiently downloaded to each RX INN over the network during device boot-up using advanced encryption standard (*AES*) technology.

Use of AES to encrypt all network management information that is delivered between the RX INN and the service provider’s network ensures network integrity during software upgrades, security patch installation or general network management.

RX INN network service packages may include DHCP, DNS, NTP, web servers, firewall rules, intrusion detection, routing policy rule-sets, and end-user rate-limiting.

The RX INN requires an Intelligent Network Server (INS), one or more Gateway Servers (GS), or Gateway Nodes to function in an overall RoamAD solution. An Inter-Network Controller (INC) may also be used to allow end users to roam seamlessly between RX INNs that are located in adjacent network areas.

The RX INN uses the NMP-8602 mini-PCI type III B High-Power card (installed by default unless otherwise specified. Other modules may be installed), which supports dual-band (2.4GHz & 5GHz) radio operation. It provides high-speed wireless connection with data rate up to 54Mbps.

RX INN Product Family

The RX-4002 is one in a family of products consisting of:

Model	**Configuration**
RX-4002	Four radio, dual band 2.4GHz/5GHz
RX-4003	Four radio, tri band 2.4GHz/4.9GHz/5GHz
RX-4004	Four radio, quad band 900Mhz/2.4GHz/4.9GHz/5GHz

Pronghorn Metro Main Board Overview

The Pronghorn Metro is a modular, multi-radio, high-power mesh wireless platform that is based on industry-standard, open-architecture interfaces and hardware. Pronghorn Metro is a RoamAD-compliant Intelligent Network Node (INN), with RoamAD's wireless networking software already ported and fully validated on the platform. The open, modular architecture of Pronghorn Metro combined with innovative wireless networking software from aCure Technology provides a highly flexible yet very low cost mesh infrastructure solution, with a clear upgrade path to WiMAX and other next-generation radio technologies.

The Pronghorn Metro Main Board is designed specifically for metro-scale outdoor wireless infrastructure applications. Among its key features are:

- Intel® IXP425™ Network Processor at 533 MHz
- 64MB SDRAM standard (pad out for up to 128MB)
- 16MB Intel® StrataFlash™ standard (pad out for up to 32MB)
- Four MiniPCI slots
    - Total of 25W of power available to the four slots
    - The 25W can be delivered in any combination of 3.3V or 5V power to the MiniPCI slots (i.e., 3.3V @ 7.6A, 5V @ 5A, or any combination of 3.3V and 5V that constitutes 25W total load)
    - 25W of available power for the radios allows Pronghorn Metro to be configured with any combination of four high-power Wi-Fi or WiMAX MiniPCI radios. Modular upgrade to WiMAX readily achieved.
    - All four slots can accommodate 80mm long MiniPCI WiMAX cards or standard size Wi-Fi cards
    - 33MHz Clock
- 48VDC local power input
- High-power passive Power Over Ethernet input voltage (range 36-60V, 48V nominal) with $1500V_{RMS}$ electrical isolation
- Dual surge protected 10/100 Ethernet ports, Auto-MDIX
- Compact Flash socket
- Temperature and voltage monitor
- On-board hardware watchdog
- RS-232 port (male DB-9 connector)
- ARM-standard 20-pin JTAG emulator connector (populated on eval units only)
- LED indicators (7 total):
    - Status
    - WLAN 0-3
    - ETH 0-1
- Input for cover open tamper switch
- For ease of installation and maintenance, all four MiniPCI slots and the Compact Flash socket are mounted on one side of the board, and are easily accessible with the enclosure cover open
- Extended operating temperature: -40C to +85C
- RoHS 5/6 compliant network infrastructure equipment, moving to a fully lead-free design in Q4 2006
- FCC Part 15 Class B compliance

Unpacking Equipment

Unpacking

The RX INN can be unpacked from the delivery box by the customer. Please ensure the shipping contents are correctly supplied and it is advisable to take a few moments to familiarise yourself with the contents of the delivery cartons.

Each RX INN should be supplied inside either a polycarbonate enclosure or die cast aluminium enclosure (cabinet). The cabinet will contain a notice on the lid that provides the INN name and quality check information. If the INS network database has been populated with the network design information for your network, then each INN name may be seen in the map view of RAMP (RoamAD Management Platform). The extent of pre-configuration required will differ for each customer. Depending on the agreement and the level of configuration that the customer has agreed to, the network database in the INS may be provided as empty, partially populated or fully populated.

For shipping purposes, each INN has been safely packaged inside its cabinet. The packaging material **MUST** be removed before connecting the INNs. Please remove the lid of each cabinet and remove all packing material.

With each INN, physically check that all components are accounted for and intact. Once you have removed the packaging, you will see that the radio cards may have been taped for travel; it is safe to leave this tape in place for the duration of testing.

- **Note that Ethernet cables and antenna coax cables are NOT provided as each customer will have differing deployment requirements**

Please ensure that cabinets are not interchanged and that labels are not removed from the equipment. This will ensure that antennas are correctly connected to the required port on the correct INN.

Labeling

Do not remove any of the labeling from the equipment.

Hardware Installation

Overview

Commissioning and testing of the network is mandatory before end users are allowed access. Typically, some radio links will need to be optimised by antenna re-pointing and throughput tests on all backhaul links will need to be completed and shown to operate reliably. Wireless networks have the potential to be slightly less stable than wired networks, particularly when operating in public spectrum, and therefore extended testing needs to be completed to ensure that each link is operating to the best of its ability and within design considerations.

During commissioning it is quite common for devices to be rebooted and for upstream nodes to be turned off in order to test redundancy, routing and network self-healing. For this reason it is recommended that end users are not allowed access until the entire deployment is complete and tested fully.

At boot-up, the INN establishes network connectivity with an INS server via radio contact with another network radio (or Ethernet link if deployed with wired connectivity), and downloads its configuration and boot-up files from the INS. In a remote network the Gateway Server provides the default pathway to the INS. Each individual embedded radio begins operation with the network parameters that were pre-configured in the INS database, specific to the class of INN that is to be deployed at that site.

Installing Antennas

The Stub-Loaded Helix (SLH) circular polarised antennas are recommended for use with the RoamAD solution at 2.4 GHz frequencies. Alternative antenna models, polarization and gain are used with 5 GHz frequencies. The SLH antennas can be mounted easily in most situations, however the following should be noted during installation to assure that the system is operating optimally when powered up.

Antenna placement

Antennas that form backhaul links should be installed with clear line of site (LOS) between the .source. and the .target. (parent and child radios within a wireless link, respectively) antennas

The term line of site can be defined as having a visible path between two points that is clear of obstruction such as foliage, building material, land or any other substance other than air.

The distance between the two antennas dictates the size of the Fresnel zone around the LOS path. The Fresnel zone must also be clear of obstructions to minimise attenuation on the link.

- **There must be at least 1 meters of vertical or horizontal separation (the more the better) between the cones of the installed antennas.**
- **Antennas using the same channel should NOT be able to "see" each other. ("See" meaning in this case, the ability to identify RF signal from another node or AP on the same or nearby channel) If there is an existing radio on the same channel as the antenna that you are installing, ensure that from the installation site, you cannot pick up a strong signal from the existing radio. Generally the 2.4 GHz radios on any site should be set to have four channels of separation between them and any other radio visible to them.**

- **Mounting an antenna away from the INN installation site, i.e. behind structure or lower down a wall can effectively negate the presence of interfering signal enough to operate a significantly better radio link. Low loss cable types are used to provide flexibility in antenna placement.**

Antenna Alignment

The orientation of the antenna can be the difference between a solid reliable high performance link and a signal that is unusable. Always remember:

- **The antennas on a link should be pointing towards each other. Each antenna has a 3dB main beamwidth of 45–48 degrees and is circularly polarised. The person installing the antenna should ensure that if a signal were to emanate from one of the antenna (the source antenna) at 23 degrees on either side of the centre line of the antenna cone, the target antenna would be inside that 46-degree area (when viewed from the source antenna) on both a horizontal and vertical plane. The same set up must occur with the other antenna.**
- **In a RoamAD network, it is typical that other RoamAD radios nearby have the potential to cause significant interference on any specific radio. The installer must therefore ensure that RoamAD antennas are deployed in such a fashion as to not splash signal around an area unnecessarily or overlap beams. Unless the antenna is required to cover an area of the building far above it, each antenna should be installed with a –10 to –25 degree orientation to the horizontal plane, i.e. pointing towards the ground slightly. This enables most of the usable signal to be targeted into areas where it is needed while eliminating unwanted signal into other areas, that may cause some interference.**
- **In some situations a link of maximum strength can be made by pointing both antenna cones directly at each other or by pointing one or both of the cones away by 23 degrees and using the outer edge of the main beam to make the connection.**
- **For coverage radios, the antenna should be installed to provide maximum LOS to the target area if possible. If the target area is NLOS, then the antenna should be installed with at least 30 m of clear space between it and the first obstruction, and where possible the signal should enter the obstruction on two faces. As an example, rather than placing an antenna where its direction of signal would be perpendicular to a building wall, it is recommended that the antenna is aligned to face the corner of a building.**
- **Always look at building structure to ensure the radio signal enters the building at the easiest point, maximising RF penetration and minimising signal attenuation. Windows and non-structural walls are generally good, metal and heavily reinforced concrete are not so good.**
- **Never shoot an antenna directly into foliage, reflective material, or dense building structure from a very close range.**

Antenna parapet mounts

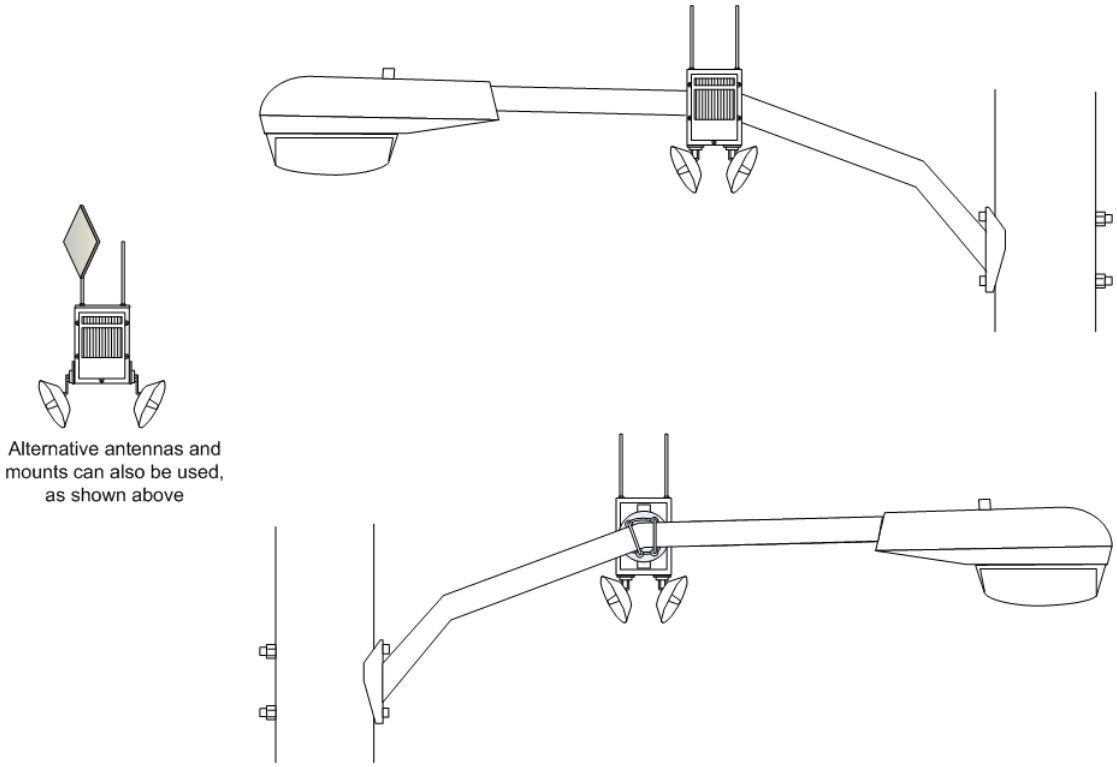
Standard antenna mounts are designed for installation on flat surfaces such as building parapets and vertical walls, providing approximately 360 degree by 180-degree adjustability.

In some cases the standard system mount will not be able to provide clear LOS or achieve the correct orientation so alternative mounts such as a ‘mast and stay’ type of antenna mount, may be required.

Typically there is a requirement for an adjustable connection between the antenna and the mast to allow flexibility of antenna orientation. The mast gives the installer the ability to move an antenna out (or up) some distance from the building to allow for LOS or the correct signal orientation to enter a building. This scenario also allows for multiple antennas to be mounted on the same mast.

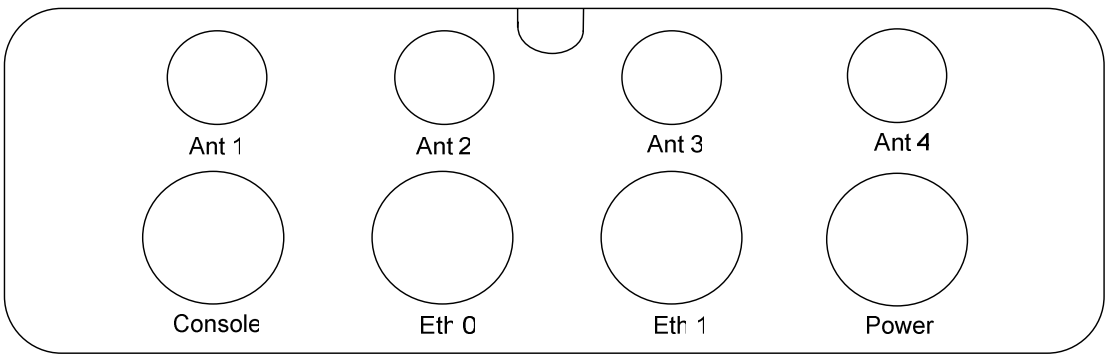
Antenna universal mounts

A universal antenna mount is also available that allows the RX INN to be installed on poles in a variety of configurations.



External Connections

External connections are located on the bottom and top of the RX INN. Most of the primary connections are located at the bottom of the unit with the following designation:



Antenna Connections

There are a total of six antenna connections available of the RX INN and typically installed with an N type female connector. This allows for external antennas as well a optional omni directional antenna to be installed.

Four antenna connections are located at the bottom of the chassis and are classified as Ant 0, Ant 1, Ant 2 and Ant 3.

There are also two optionally installed antenna ports at the top of the chassis which are classified as Ant 4 and Ant 5. The top connectors are typically used with omni directional antenna's.

Ethernet Connections

The RX INN has two Ethernet 10/100BaseT interfaces, implemented with Ethernet coprocessors built into the NPEs. The RX INN uses the Broadcom BCM5241 Ethernet PHYs. Both ports support Auto-MDIX, automatically sensing and adjusting to work with whatever type of Ethernet device is at the other end of the Cat5 cable. The Ethernet interfaces automatically adapts to match the polarity of Ethernet signals on the cable and swapping of the recieve and transmit pairs when connecting to Ethernet devices other than switch/hub ports – without the need for crossover cables.

They support both full-duplex and half-duplex mode of operation and also contain two 256-byte FIFO: one for transmit data and the other for receive data.

Eth0 also supports Power over Ethernet (see Power Connection details below).

Console Connection

The RX INN provides two dedicated asynchronous, serial, I/O ports (UART0 and UART1), however, only one of these are exposed through the bottom connectors. These UARTs are 16550-compliant with flow control and enhanced with larger 64-byte transmit and receive buffers.

UART1 is provided through a male DB-9 connector and presented at the bottom of the unit through the Console port as an RJ45 connector. The interface uses standard RS-232 levels. The interface is DTE and supports handshaking via RTS and CTS. The pinout of the DB-9 appears in the table below:

Pin Number	Signal Name	Pin Number	Signal Name
1	Not Connected	2	URT1_RXD
3	URT1_TXD	4	Not Connected
5	GND	6	Not Connected
7	URT1_RTS	8	URT1_CTS
9	Not Connected		

UART0 is intended for use as a console port during development and debug of custom software for Pronghorn Metro. UART0 is not intended for normal user access during system operation – this serial port uses 3.3V logic level signals (not RS-232 level) brought to 6-pin

header J1 and is not surge protected or EMI filtered. The UART0 serial connector is not accessible when the board is installed in its enclosure.

Power Connection

The input power to the RX INN is through an external DC power supply to the Power Connector, or via passive PoE at Ethernet port, ETH0. Both the PoE and the coaxial power inputs are electrically isolated from all other circuitry on the RX INN to 1500Vrms.

If power is connected to both the power jack and the passive PoE simultaneously, no harm will be done, but in that case, the RX INN will draw current from the supply on the power jack.

The External supplies must be connected with the correct polarity. A supply connected in the reverse polarity will not cause any harm to RX INN or itself since there is reverse polarity protection built into Pronghorn Metro main board; it simply won't power anything. The polarity is explained in the following table.

J11, Power Jack Pin	Signal Name	J10*, Ethernet Pin	Signal Name
1 – Center	48V-DC-Power+	4,5	48V-passive-PoE+
3 – Outer	48V-DC-Power-	7,8	48V-passive-PoE-
		1,2	Ethernet Tx pair**
		3,6	Ethernet Rx pair**

***NOTE:** If passive PoE power is inadvertently applied to the other Ethernet port, J9, there is no risk of damage. Nothing will happen.

****NOTE: Do not energize pins 1,2,3,6 on any Ethernet port with PoE power!** That could cause damage to the RX INN and void warranty. (If an IEEE802.3af compliant PSE is inadvertently attached, there is no risk of damage. The PSE will not energize these pairs because it requires the PD to identify itself as IEEE802.3af compliant.)

The voltage from the external supplies must be within the PoE range +36V to +60V, (+48V nominal) at the input to RX INN.

Up to 25W can be supplied on a continuous basis to the four MiniPCI slots. The architecture of the RX INN's power supply allows this 25W to be delivered all at 3.3V, all at 5V, or in any combination of 3.3V and 5V not exceeding 25W.

Regardless of the port used to power the RX INN, the supply must be able to provide enough current for the RX INN application including the radios.

The PoE input and 48VDC local power inputs are both electrically isolated from the Pronghorn Metro's other circuitry by $1500V_{RMS}$ isolation. This is important in outdoor and remotely mounted applications to control ground loops, to minimize noise, and to assist with managing surges.

NOTE: In the event power supplies are connected to both the power jack and passive PoE inputs simultaneously, each external supply must offer electrical isolation. Since the conductors from each supply will be brought in proximity to one another spurious energy on the Ethernet lines could be conducted into the power supply connected to the power jack. Pronghorn Metro isolates its

circuitry from the external supplies with 1500V_{RMS} isolation, but it does not isolate two simultaneously connected external supplies from one another.

The external Power Connector also provides connections for an optional battery backup enclosure or for power sources such as solar panels, etc.

LED Indicator

An optional LED indicator is available and plugged into the Console port when available.

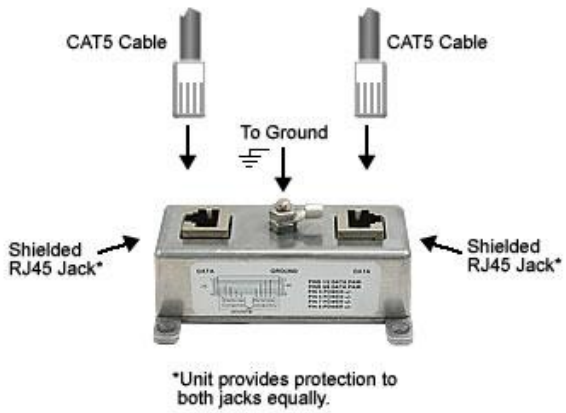
Earth Connections

There are several points within the RX INN that should be grounded. For correct operation and protection each of the individual antenna lighting suppressors should be grounded during the installation of the equipment. The back of the RX INN has several mounting points that should be used for earthing.

If the RX INN is powered by the Ethernet port then either shielded external grade Ethernet cable should be used or a PoE Lighting Suppressor that supports grounding should be installed. The preferred method should be determined by the installation on a per site basis.

The use of shielded RJ45 jacks along with a metal housing helps reduce the effects of EMI interference. Additional features include a ground lug and terminal provided directly on the lightning protector housing allowing for superior grounding.

For maximum protection from lightning on long cable runs, two units can be used, one at each end of the cable. A PoE injector, similar to that shown below, is supplied as a standard item with each RX INN.



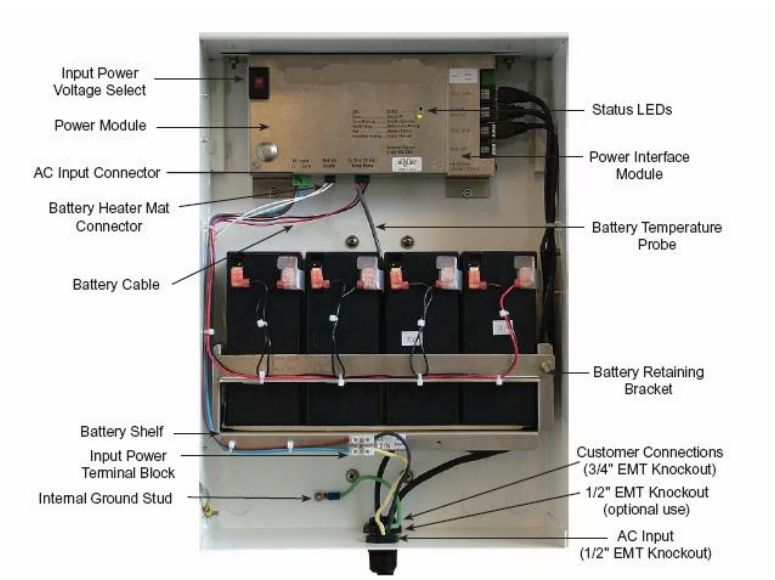
Battery Backup Options

A high availability battery backup solution is available for the RX INN which is ordered optionally and can be field installable.

The RX INN battery backup option (RX-UPS50) is a multipurpose power supply providing primary and standby power to RX Intelligent Network Nodes (INN). The multipurpose power supply provides filtered and regulated 50W output power during normal line operation. During line disruptions, the RX-UPS50 supplies uninterrupted regulated output power of 50W, using a string of four 7.2Ah batteries.

The RX-UPS50 options include batteries, 120Vac or 240Vac battery heater mat, and the following features:

- Rugged 48Vdc indoor or outdoor UPS
- Multi-use mounting bracket for wall-mount, roof-top, or pole-top applications
- Temperature compensated battery charging for optimum battery life
- Local and remote status monitoring and reporting
- Battery heater provides extended runtimes in cold conditions
- 50W, 48Vdc output (70W max for 10 seconds)
- 18 hour standby at 20W load
- Wide temperature range with internal heater



Software Configuration

Overview

The RX INN cannot be used in a standalone environment and requires the Intelligent Network Server (INS) for operational use. The RX INN is configured with a basic operating system that enables it to search out a connection to an INS so that it may download it's configuration and operational software for network use.

The RX INN will be delivered in Configuration Mode so that customers may make a web based connection to the unit for correct operation within their environment. Unless otherwise directed at the time of ordering no other configuration of the unit will be made.

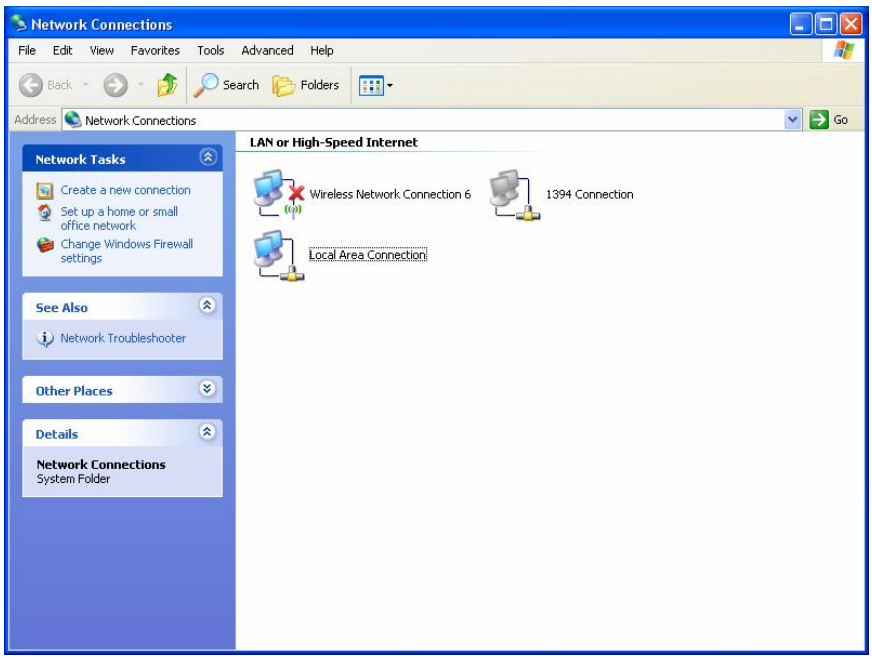
The installation process below should be followed to enable the RX INN to boot a suitable configuration once the INN has been built in the RAMP software.

Configuring RX INN

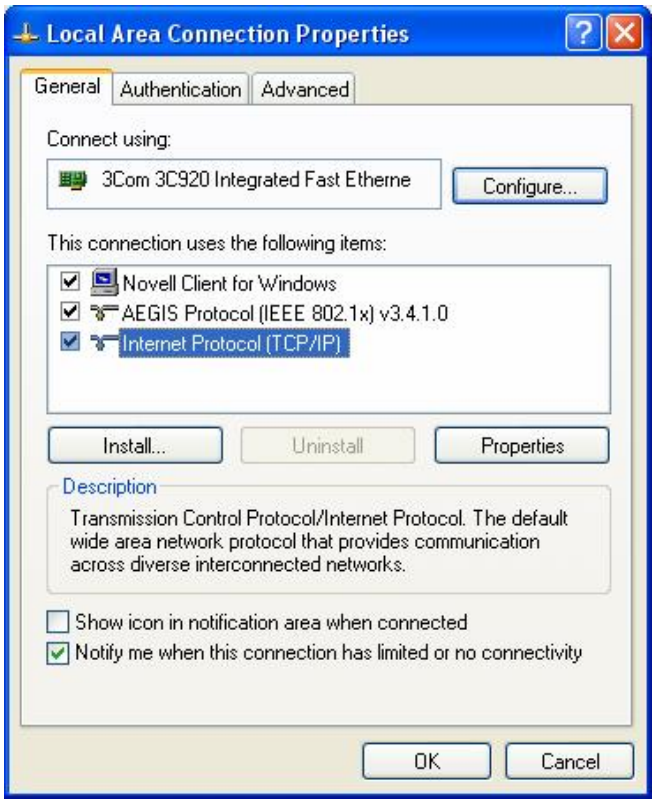
Connecting a PC

1. Plug an Ethernet cable into the RX INN Eth 1 port and then into the network port of the PC (a normal or cross over cable can be used).

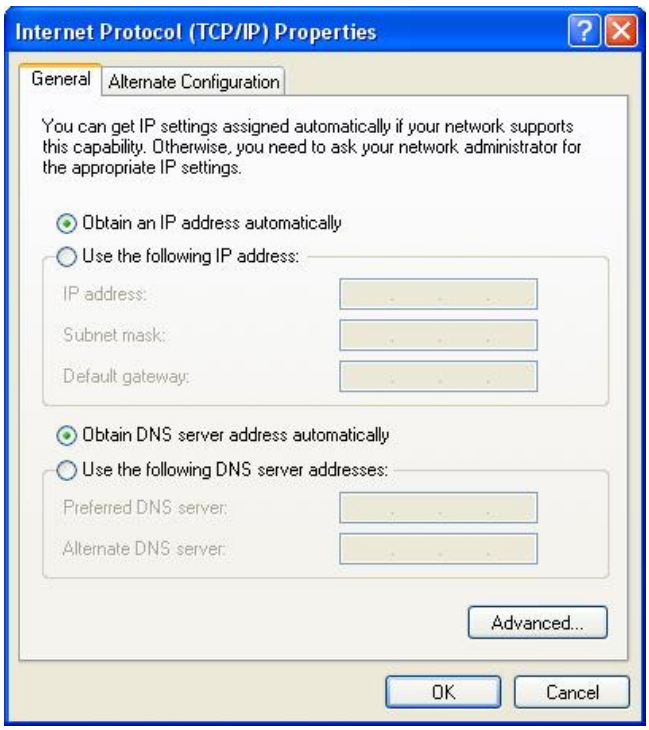
2. Go to the Network Configuration.



3. Select Properties on the Local Area Connection and then the Properties on the TCP/IP option.

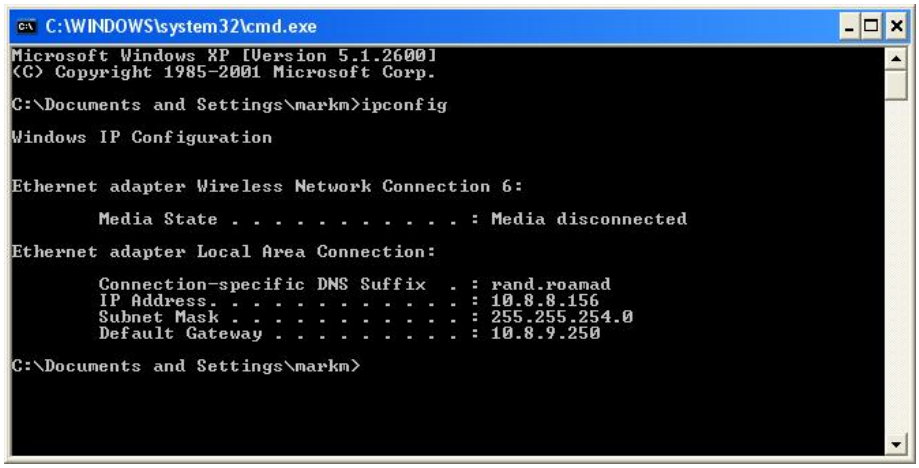


4. Ensure that the TCP/IP options are set to allow a DHCP address as shown below.



5. Select OK.

6. Go to the Command Processor and check that the PC receives an IP address.



Logging into RX INN

1. Using a web browser such as Internet Explorer and go to the site https://master.roamad/admin/

   Note: Please ensure that you have disabled any virus protection software on your workstation, including Windows XP Firewall. Also ensure that any internal proxy servers have been disabled.

2. Depending on the browser used, accept the certificate that appears by selecting Yes.

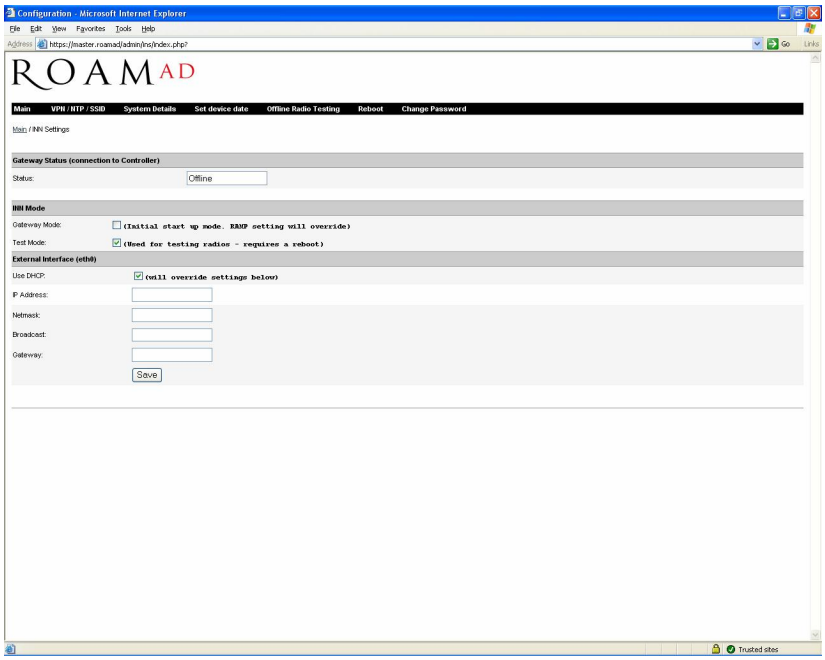
3. The login prompt will appear:

   The username is: admin

   The password is: admin

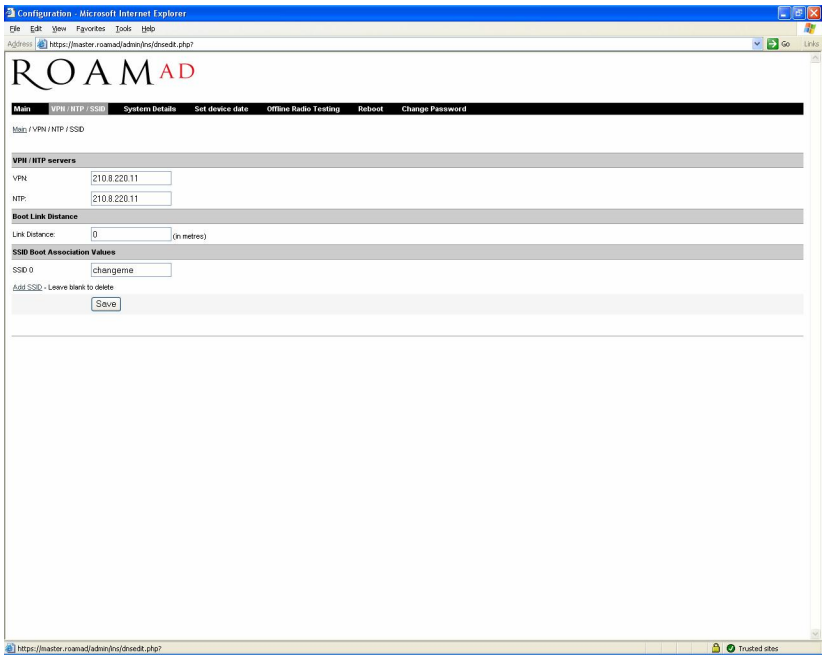
Web based Configuration

1. With a successful login the RX INN web based configuration Main menu screen will appear:



2. Uncheck the “Test Mode” option and select “Save” to ensure the RX INN will not continue to boot into configuration mode.

3. Select the “VPN / NTP / SSID” menu option:

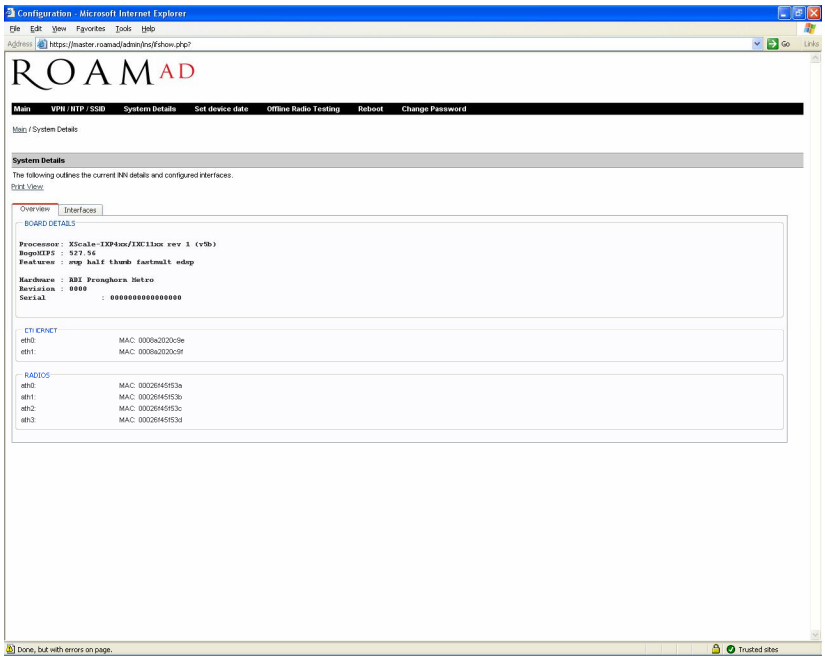


4. Update the VPN and NTP addresses to the correct address of the INS server.

5. Update the SSID that the RX INN will search for to establish a wireless backhaul link to the INS unless an Ethernet connection can be made.

6. Save the changes.

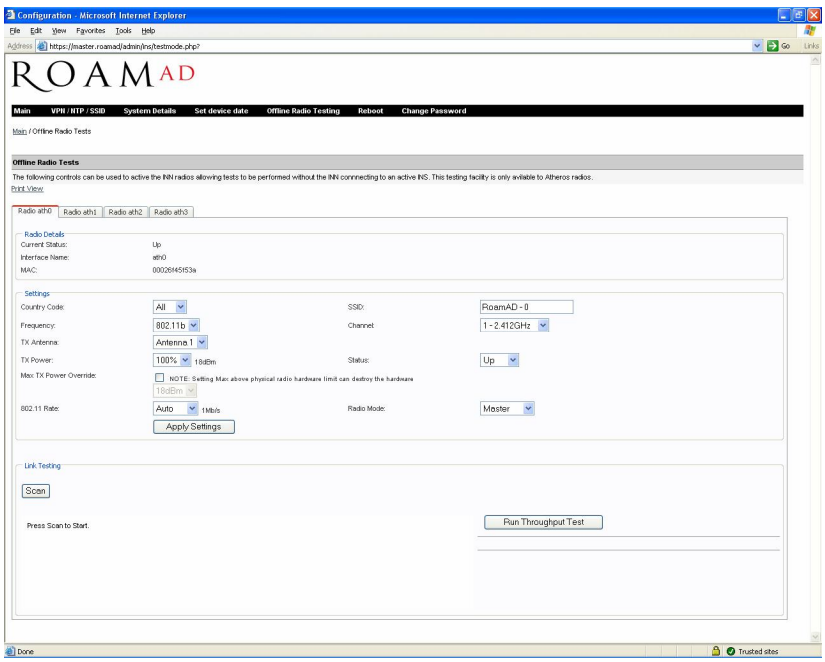
7. Select the “System Details” menu option:



8. Ensure that the Ethernet MAC addresses and Radio MAC addresses are configured in RAMP.

9. Also ensure that four Radio MAC addresses appear to indicate the RX INN boot process has four radios. If the number of radios installed do not match then it may have become dislodged during shipping and should be rectified.

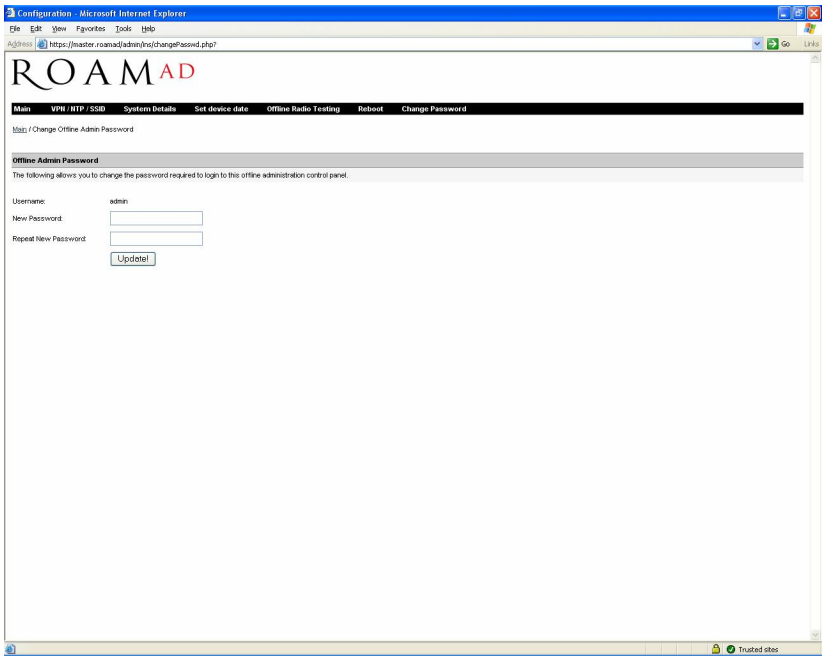
10. Select the “Offline Radio Testing” menu option:



11. This option allows installers to configure the radios for checking of correct installation before establishing a download from the INS.

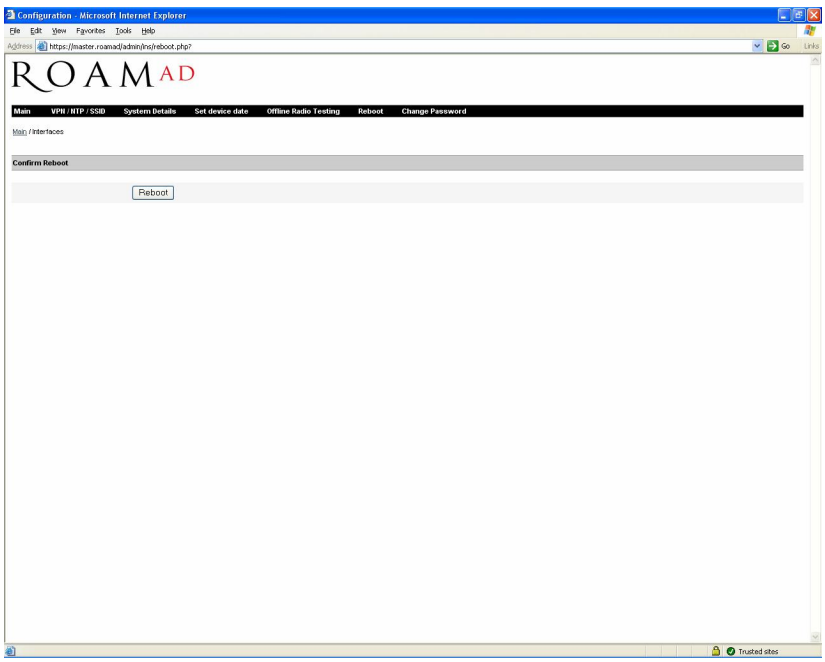
12. The “Country Code” will be set to FCC and cannot be changed. This limits the 802.11a capabilities so that the frequency band 5150 – 5350 MHz is disabled, and configures the FCC approved power output for each frequency band.

13. Select the “Change Password” menu option:



14. It is highly recommended that the password is changed and “Updated”.

15. Reboot the RX INN when all configuration changes have been made, by selecting the “Reboot” menu option and the “Reboot” button.



Appendix A – Antenna Specifications

The following antenna specifications are supported antennas from a standard configuration. Only supported antennas may be used and with the power setting shown to meet FCC requirements. The FCC approved maximum power is set in software to ensure that the radios do not transmit above the FCC approved power level.

802.11b SLH 12dBi external directional antennas	**Description**
Transmit power to antenna.	Radio and system dependent, typically between 30–400 mW (15–26 dBm).
FCC approved maximum power.	22 dBm.
Antenna gain.	12 dBi.
Horizontal beamwidth.	48 degrees.
Vertical beamwidth.	48 degrees.
Polarity.	Circularly polarised (right hand orientation).
Model.	SLH12.
Impedance.	50 ohms.
Coaxial cable.	LMR 195, LMR 400, LMR 600.
EIRP at external antenna.	Depends on radio and system losses, typically 100 mW – 4 W (20–36 dBm).
Connector.	Standard TNC.

FCC Approval

The maximum power output for each RX INN is set through the RAMP configuration software. The country setting will be set to FCC which will limit the power output to that listed in the table above and customers will not be able to change this setting.

802.11g SLH 12dBi external directional antennas	Description
Transmit power to antenna.	Radio and system dependent, typically between 30–400 mW (15–26 dBm).
FCC approved maximum power.	15 dBm.
Antenna gain.	12 dBi.
Horizontal beamwidth.	48 degrees.
Vertical beamwidth.	48 degrees.
Polarity.	Circularly polarised (right hand orientation).
Model.	SLH12.
Impedance.	50 ohms.
Coaxial cable.	LMR 195, LMR 400, LMR 600.
EIRP at external antenna.	Depends on radio and system losses, typically 100 mW – 4 W (20–36 dBm).
Connector.	Standard TNC.

FCC Approval

The maximum power output for each RX INN is set through the RAMP configuration software. The country setting will be set to FCC which will limit the power output to that listed in the table above and customers will not be able to change this setting.

802.11a 22 dBi external flat panel directional antennas.	Description.
Transmit power to antenna.	Radio and system dependent, typically between 100 – 400 mW (20–26 dBm).
FCC approved maximum power.	12 dBm.
Antenna gain.	22 dBi.
Horizontal beamwidth.	9 degrees.
Vertical beamwidth.	9 degrees.
Polarity.	Linear polarised (typically vertically oriented).
Model.	PAN22.
Impedance.	50 ohms.
Coaxial cable.	LMR 195, LMR 400, LMR 600.
EIRP at external antenna.	Depends on radio and system losses, typically 100 mW – 4 W (20 – 36 dBm).
Connector.	Standard N.

FCC Approval

The maximum power output for each RX INN is set through the RAMP configuration software. The country setting will be set to FCC which will limit the power output to that listed in the table above and customers will not be able to change this setting.

Appendix B – Pronghorn Metro Redboot Operation

The RX INN has been pre-configured for correct operation in a RoamAD solution, although additional RedBoot configuration is available.

RedBoot Operation

Follow the steps below to setup Pronghorn Metro for RedBoot operation:

1. Disconnect power from Pronghorn Metro
2. Connect the null modem serial cable (not a straight thru cable) to the port at J7
3. Start a terminal emulator (eg Minicom, HyperTerminal) and configure for 115200-8-N-1-N.
4. Connect a CAT5 Ethernet cable from the ETH0 port (J10, the RJ-45 closest to the center of the board) to your network
5. Power Pronghorn Metro and look for activity on the terminal emulator.

The RedBoot Boot Monitor included in the Pronghorn Metro is primarily used as a basis for further software development. RedBoot communicates to a host computer through the Pronghorn Metro serial port. The host computer must use a terminal emulator like Window's **HyperTerminal** or Linux's **minicom**. The following table specifies the default parameters for correct serial port operation.

Parameter	Value
Bits per second	115200
Data bits	8
Parity	None
Stop bits	1
Flow control	None

Power Up

When the Pronghorn Metro is powered on, RedBoot starts, attempts to DHCP an IP address, and the following is displayed if successful:. Note the message "No devices on IDE controller 0" may appear if a compact flash device is not present in the J2 socket located on the back side of the board.

```
+No devices on IDE controller 0

Trying NPE-B...success. Using NPE-B with PHY 0.
... waiting for BOOTP information
Ethernet eth0: MAC address 00:08:a2:01:7c:24
IP: 192.0.0.62/255.255.255.0, Gateway: 192.0.0.1
Default server: 192.0.0.8

RedBoot(tm) bootstrap and debug environment [ROM]
Red Hat certified release, version 1.04 - built 17:24:09, Jun
12 2006

Platform: ADI Engineering Pronghorn Metro (IXP42X 533MHz) BE
Copyright (C) 2000, 2001, 2002, 2003, 2004 Red Hat, Inc.

RAM: 0x00000000-0x04000000, [0x00029a40-0x01fc1000] available
FLASH: 0x50000000 - 0x51000000, 128 blocks of 0x00020000 bytes
each.

RedBoot>
```

RedBoot Commands

This section provides a brief summary of RedBoot commands and is intended only as a quick reference. RedBoot provides three basic classes of commands:

- Program loading and execution
- Flash image and configuration management
- Miscellaneous commands

The basic format for commands is:

RedBoot> COMMAND [-S] [-s val] operand

Commands may require additional information beyond the basic command name. In most cases this additional information is optional, with suitable default values provided if they are not present. The type of information required affects how it is specified.

1. **[-S]** indicates an optional switch. If this switch is present, then some particular action will take place. For example in the command

   RedBoot> fis init –f

   the -f switch indicates to perform a full file system initialization.

2. **[-s val]** indicates an optional switch that requires an associated value. For example the command:

   RedBoot> load -b 0x20000 data_file

   specifies downloading a file (via TFTP) into memory, relocating it to location 0x20000.

3. **operand** This format is used in a case where a command has one operand which must always be present (no -s is required since it is always implied). For example the command

   RedBoot> go 0x20000

   specifies executing the code starting at location 0x20000.

The list of available commands, and their syntax, can be obtained by typing help at the command line:

```
RedBoot> help
Manage aliases kept in FLASH memory
   alias name [value]
Set/Query the system console baud rate
   baudrate [-b <rate>]
Manage machine caches
   cache [ON | OFF]
Display/switch console channel
   channel [-1|<channel number>]
Compute a 32bit checksum [POSIX algorithm] for a range of
memory
   cksum -b <location> -l <length>
Display (hex dump) a range of memory
   dump -b <location> [-l <length>] [-s] [-1|2|4]
Execute an image - with MMU off
   exec [-w timeout] [-b <load addr> [-l <length>]]
        [-r <ramdisk addr> [-s <ramdisk length>]]
        [-c "kernel command line"] [<entry_point>]
Manage FLASH images
   fis {cmds}
Manage configuration kept in FLASH memory
   fconfig [-i] [-l] [-n] [-f] [-d] | [-d] nickname [value]
Execute code at a location
   go [-w <timeout>] [entry]
Help about help?
   help [<topic>]
Set/change IP addresses
   ip_address [-l <local_ip_address>] [-h <server_address>]
Load a file
   load [-r] [-v] [-d] [-h <host>] [-m <varies>] [-c
   <channel_number>]
        [-b <base_address>] <file_name>
Compare two blocks of memory
   mcmp -s <location> -d <location> -l <length> [-1|-2|-4]
Copy memory
   mcopy -s <location> -d <location> -l <length> [-1|-2|-4]
Compute a 128bit checksum [RSA Data Security, Inc. MD5 Message-
Digest Algorithm] for a range of memory.
   md5sum -b <location> -l <length>
Set/Fill memory location(s)
   mem [-b <location>] [-l <length>] [-1|2|4] [-w] <data>
Fill a block of memory with a pattern
   mfill -b <location> -l <length> -p <pattern> [-1|-2|-4]
Print information about the 64-bit OTP value
   otp_read
Writes a 64-bit ascii hex value to the OTP area of flash
*PERMANENTLY*
   otp_write <otp-value>
Scans PCI devices and reports findings
   pciscan
Converts a virtual to a physical address
   physaddr <virtual address>
Network connectivity test
   ping [-v] [-n <count>] [-l <length>] [-t <timeout>]
      [-r <rate>] [-i <IP_addr>] -h <IP_addr>
Print information about the current settings within the main
processor
   processor
```

```
Reset the system
   reset
Display RedBoot version information
   version
Converts a physical to a virtual address
   virtaddr <physical address>
Display (hex dump) a range of memory
   x -b <location> [-l <length>] [-s] [-1|2|4]
RedBoot>
```

Commands can be abbreviated to their shortest unique string. Thus in the list above, d,du,dum and dump are all valid for the dump command. The fconfig command can be abbreviated fc, but f would be ambiguous with fis.

Configure Pronghorn Metro

Use the command **`fconfig -i`** to set the configuration parameters. Use **`fconfig -l`** to list the configuration parameters, example below:

```
RedBoot> fconfig -l
Run script at boot: false
Use BOOTP for network configuration: true
Default server IP address: 0.0.0.0
Console baud rate: 115200
GDB connection port: 9000
Force console for special debug messages: false
Network debug at boot time: false
Default network device: npe_eth0
Network hardware address [MAC] for NPE eth0:
0x00:0x08:0xA2:0x01:0x7C:0x24
Network hardware address [MAC] for NPE eth1:
0x00:0x08:0xA2:0x01:0x7C:0x25
RedBoot>
```

The above represents the default RedBoot parameter settings for Pronghorn Metro. Note that it is setup to DHCP an IP address from the network using the NPE0 Ethernet port. This is the port closest to the middle of the board.

Should you desire to change any of the settings, entering the <**`fconfig`**> command without any switches will enable you to change parameters.

```
RedBoot> fconfig
```

RedBoot will display the first parameter and its value. If you are satisfied with the current value, hit **`[enter]`**. Otherwise, type the desired value and then hit **`[enter]`**. When you have gone through the entire parameter list, a final confirmation is required before the modified configuration is written to flash. Upon completion, issue the <**`fconfig -l`**> command again to verify that your changes have been made. Then reboot the Pronghorn Metro to have the new boot parameters take effect.