

Certification Exhibit

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IC Radio Standards Specification: RSS-210**

ACS Project Number: 14-0131

**Manufacturer: AirNetix, LLC
Model: ARX-200**

Manual

AiRocks Pro ARX-200

Digital Wireless Audio Repeater

User Guide

V1.0

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Preliminary

Introduction

1 AIROCKS PRO OVERVIEW

AiRocks Pro is a revolutionary new digital wireless audio system designed to provide significantly extended coverage area, ultra-reliable audio distribution for pro-audio sound reinforcement applications. AiRocks Pro is typically used in large indoor or outdoor venues to distribute analog audio from a main mixer board to multiple powered speakers distributed over a wide area. Based on its novel “repeater” technology, AiRocks Pro can be used to go around obstacles, such as buildings, trees, or other obstructions, or to dramatically extend the coverage area compared to traditional wireless audio products.



Figure 1 AiRocks Pro ARX-200

1.1 TRADITIONAL WIRELESS AUDIO

Traditional wireless audio equipment consists of a “transmitter” and a “receiver” which send analog audio from point A to point B. This type of network is called a “point-to-point” network. Most wireless microphones, wireless in-ear devices, and wireless instrument equipment are point-to-point products.

Some newer wireless audio products provide the ability to send a signal from a single transmitter to multiple receivers. This type of network is called “point-to-multipoint” and can be effective if all receivers are within the transmission range of the transmitter. However, since the FCC limits the amount of power that each transmitter can radiate, the effective range of this type of system is somewhat limited.

Also, some of these newer devices include what are called “transceivers”. These devices give a single unit the ability to be manually configured as EITHER a transmitter OR receiver, but not both simultaneously.

1.2 THE AIROCKS PRO REPEATER

AiRocks Pro is the world’s first digital wireless audio “**repeater**”. Each AiRocks Pro unit includes BOTH a transmitter AND a receiver operating **simultaneously** in the same unit. A signal that is received by an AiRocks Pro unit is immediately re-transmitted on a different frequency to other AiRocks Pro units within its transmission range. When AiRocks Pro units are positioned in a “line” (linear fashion) they form what is called a “multi-hop” wireless audio network. The range of this type of network is theoretically “un-limited”, however, practical considerations (such as path obstructions and interference) can limit the actual size of the achievable coverage area.

1.3 THE AIROCKS PRO NETWORK

An AiRocks Pro **network** consists of a single Master and one or more Relay units. Each AiRocks Pro unit can be configured to operate either as the network “Master” unit or as a “Relay” unit (all AiRocks Pro units are identical and include the same hardware and software). The number of Relay units is limited by both the practical considerations mentioned above, as well as network “polling” when using the AiRocks Pro Network Management System (NMS) discussed below.

In an AiRocks Pro network, each AiRocks Pro Relay unit receives an audio transmission from a single “upstream” unit, and then re-transmits that same signal to one or more downstream units. Thus, each AiRocks Pro unit creates its own point-to-multipoint sub-network. The input to each sub-network is the signal received by the single uplink AiRocks Pro unit. Therefore, *an AiRocks Pro network is a group of one or more sub networks all of which emanate from a single network Master*. Networks can be as simple as one Master unit and one Relay unit in a point-to-point configuration, or as complex as hundreds of units with multiple “branches” and “sub-networks”.

If there is a failure of one of the upstream AiRocks Pro units, the downstream units automatically begin scanning for any other AiRocks Pro transmission within range. If an acceptable signal is found, it then becomes the input signal for that sub-network, or any newly created sub-networks. Thus an automatic switchover is accomplished without the need for manual intervention.

An AiRocks Pro network creates an extensive “cloud” of ultra-reliable wireless audio for both small and large venue sound reinforcement applications. AiRocks Pro operates in the license-free 2.4GHz frequency band and includes fully automatic channel scanning and selection, so there is no need for complex frequency coordination or intermodulation calculations.

AiRocks Pro units are designed to be very simple to install. When initially powered up, an AiRocks Pro unit enters the Relay operating mode (unless it was previously configured as a Master unit) and begins scanning for an upstream signal. When a signal is found, the unit begins sending the received analog audio out to the connected speaker via an XLR connector. It also begins relaying the digital wireless signal, on a different frequency, to any downstream units within range. Front panel controls allow the installer to manually configure many of the operating parameters, as well as monitor several key functions such as received signal level, and audio level and activity.

1.4 NETWORK OVERVIEW

An AiRocks Pro network can operate in one of two modes: **Managed** or **Unmanaged**.

1.4.1 Unmanaged Network

An unmanaged network is simply an AiRocks Pro network that does not use the Network Management System. If the user wishes to merely deploy one or more Relay units in a small network, this can be done by simply plugging the units in and turning on the power. The AiRocks Pro units function fully automatically and autonomously. Front panel controls give the user full control of configuration parameters and monitor functions.

1.4.2 Managed Network

A managed network is one that employs the AiRocks Pro Network Management System (NMS) application. Use of the NMS is strictly optional, but highly recommended since it can give valuable information for configuring the network for optimum performance in the presence of interference, range, or obstruction limitations of the venue. The NMS gives a graphical view of everything that is happening in the network and can help quickly diagnose problems that arise during an event.

1.5 EQUIPMENT OVERVIEW

The AiRocks Pro system consists of the ARX-200 Wireless Audio Repeater and an optional ARX-200-BOB “breakout box”. The BOB is essentially an extender for the IO ports on the ARX-200 as well as a remote AC or DC power injector. Below is a diagram of the typical Master configuration.

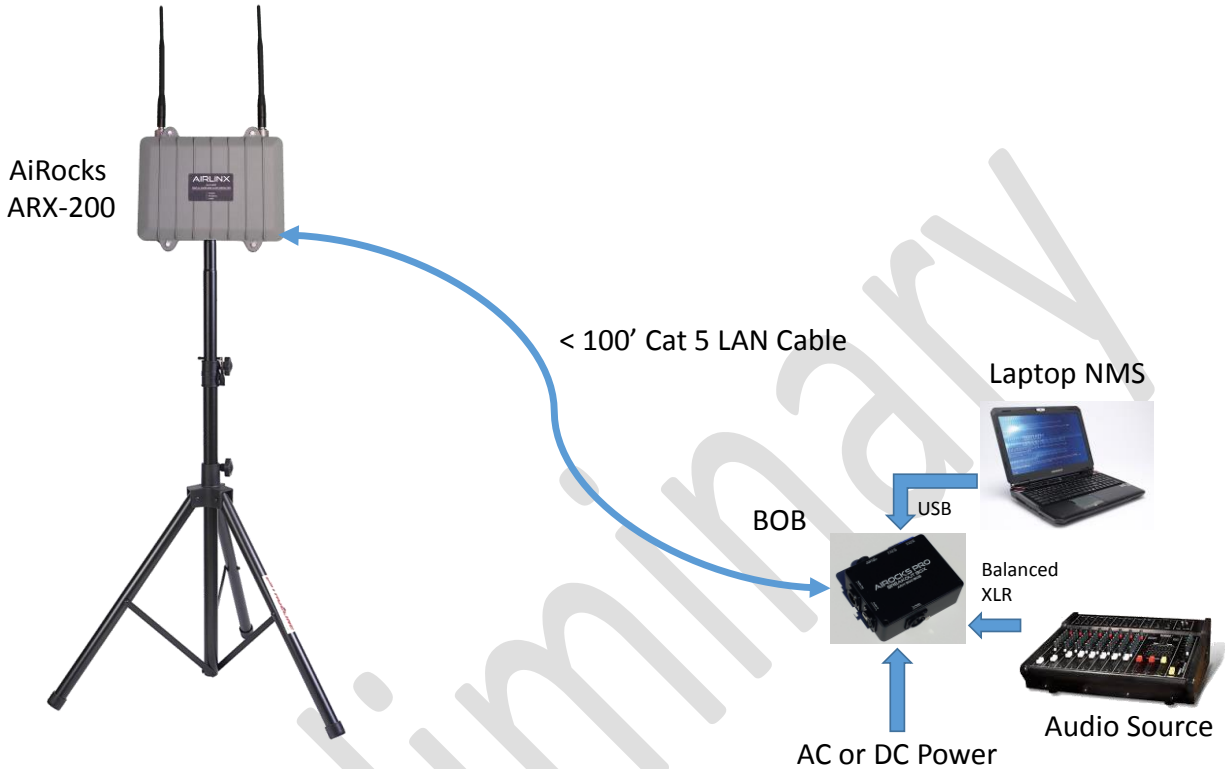


Figure 2 - Typical Master Location Setup

1.5.1 AiRocks Pro ARX-200 Wireless Audio Repeater

The ARX-200 is enclosed in a weather resistant outdoor enclosure and includes a sealed pushbutton front panel interface with an LCD display. The user can configure the unit from either the front panel, via the USB port of the BOB, or over the air by using the Network Management System.



Figure 3 - AiRocks Pro ARX-200 Wireless Audio Repeater

1.5.2 AiRocks Pro ARX-200-BOB Breakout Box

The ARX-200-BOB is an optional remote connector interface that duplicates audio interfaces, AC power connection, DC power connection, and USB interface of the ARX-200 repeater. The BOB allows the ARX-200 to be placed up to 100 feet away (i.e. on a pole to raise it above any obstructions in a venue to provide better line-of-sight to other nodes). The interconnection between the ARX-200 and the BOB is a standard 8-conductor CAT5e shielded LAN cable.



Figure 4 - ARX-200-BOB Breakout Box

2 EQUIPMENT INSTALLATION AND OPERATION

2.1 INSTALLING THE ARX-200 MASTER AND RELAY UNITS

To install the ARX-200, you must be a qualified installation professional, licensed or certified in accordance with local regulations. The FCC deems that it the responsibility of the installer to know, understand, and abide by the rules.

The ARX-200 is designed to be installed by professional audio engineers, technicians, and network operators who have an in-depth understanding of wireless radio technology and who are knowledgeable in local regulations including building and wiring codes, safety, channel, power, outdoor/indoor restrictions, and license requirements. It is important to follow the installation and configuration instructions in this document in order to comply with the rules and restrictions imposed by the FCC and other government bodies who regulate the airwaves. The ARX-200 has passed certain FCC mandated testing using the equipment listed in this document, including the antennas. Use of other antennas or amplifying devices not listed in this document may violate these FCC regulations.

The ARX-200 is designed to be mounted in a vertical orientation for optimum results and to comply with FCC certification requirements.

The ARX-200 should be mounted as high as possible above any obstructions to achieve optimum performance. Direct line-of-sight to other ARX-200 units is very important. Distances of several hundred feet can easily be achieved with a properly installed unit. The unit includes a pole mount which gives the user a variety of installation options.

The recommended mounting location of the ARX-200 is on a pole, such as a speaker stand, that allows it to be mounted 10 feet or more off the ground. Obstructions, such as people, trees, building, or other solid structures, can dramatically affect the quality of the radio transmission, and hence the achievable range of the unit for reliable, error-free operation.

Interference in the Wi-Fi band will also affect network performance. The range of each link is dependent upon, not only clear line-of-sight, but also the level of Wi-Fi interference in the area. The ARX-200 system is designed to avoid interference and co-operate in the presence other Wi-Fi band systems. Additionally, the Network Management System provides the user with several tools to detect and avoid interfering signals.

2.1.1 Installing the Master Unit

Install the Master unit as high as possible, and with good line-of-sight to the first Relay unit. Typically, a Breakout Box (ARX-200-BOB or BOB) will be used to allow the Master to be mounted at a significant distance from the network operator position. The BOB provides an input for the Master audio source, as well as AC or DC power inputs, and a USB interface for the Network Management System.

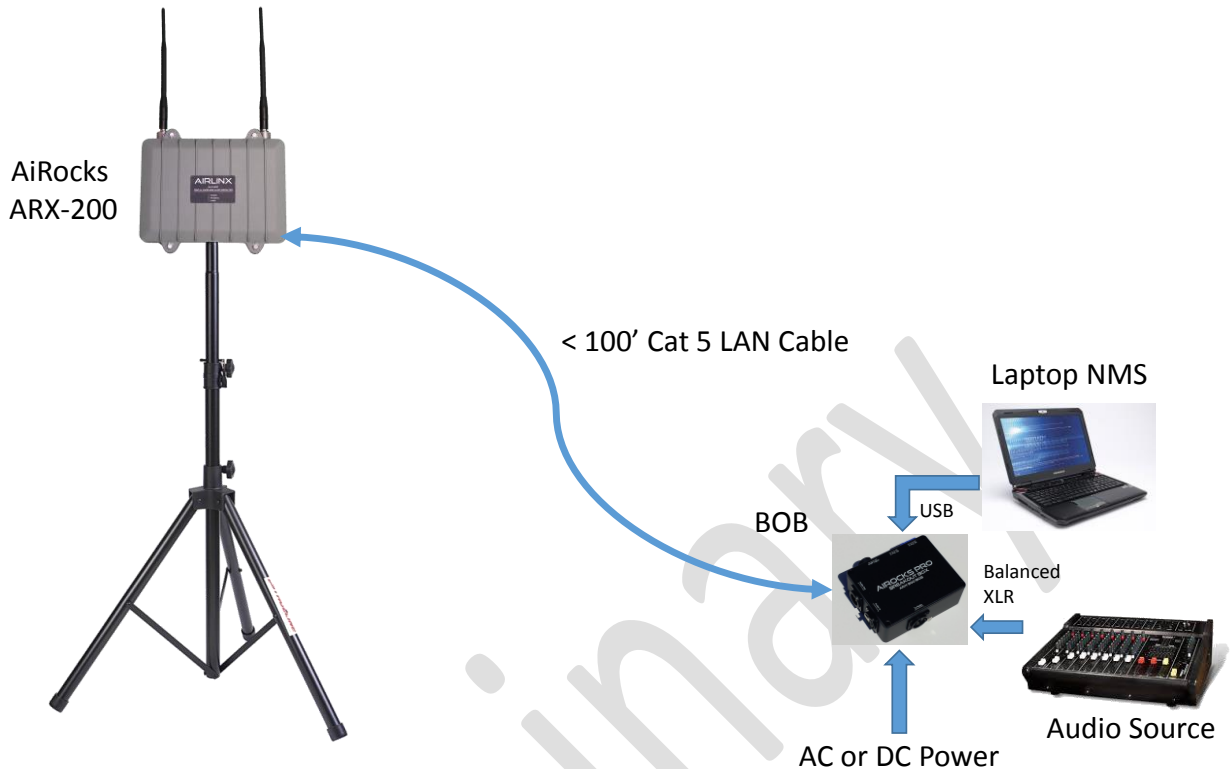


Figure 5 - Master Unit Installation

- Once all cables are attached, apply AC or DC power to the BOB.
- Start the NMS application. The Master unit should appear in the Welcome Screen.
- Switch the NMS to the Master operating mode by selecting the Master tab on the NMS screen.
- The Master unit is now transmitting and any Relay units in the area will attempt to join the network. See the Network Management System section for further details on managing the network.
- Note that the connectors on the ARX-200 are still active even when the BOB is used. For example, an audio cable could be directly attached to the ARX-200 while power and USB cables could be connected to the BOB.
- Note that if AC power is applied directly to the ARX-200, power (either AC or DC) must also be applied to the BOB to activate the USB interface. Applying power to both the ARX-200 and the BOB is not a problem.

2.1.2 Installing Relay Units

Install Relay units as high as possible, and with good line-of-sight to either the Master unit, or to the closest Relay unit. Typically a BOB is not used with a Relay unit since Relay units are normally mounted close to the powered speaker to which it is providing audio. However, a BOB can be used if desired.

Figure

- Once the audio and power cables are attached to the Relay unit, apply AC power.

- The front panel display should show that the unit is in the Relay mode. If not, press the navigation switches on the unit's front panel to select the Relay mode.
- If the Master unit is transmitting, the Relay unit will automatically connect and the RF Signal LED will illuminate. If audio is being sent by the Master, the Audio Signal LED will also illuminate.
- If the NMS is not being used (open network) the RF Signal LED will constantly illuminated while the signal is being received, and the display will show "Open Network".
- If the NMS is connected to the Master, the RF Signal LED on the Relay unit will blink until the NMS has assigned it a network ID. Once a network ID is assigned, the RF Signal LED will be constantly illuminated and the LCD display will show the network ID number.

3 NETWORK MANAGEMENT SYSTEM

3.1 NMS OVERVIEW

The AiRocks Network Management System (NMS) is a PC-based application that give the user a broad array of tools for configuring, operating, and diagnosing the AiRocks network. The NMS connects via USB to the Master unit and communicates over the air with all Relay units in the network. The communications with the Relay units is bi-directional so that the NMS is able to monitor AND control each unit from a central location.



Figure 6 NMS Welcome Screen

When a Relay unit “joins” the managed network it is assigned a unique Network ID. This allows the NMS to independently address each Relay unit to monitor its critical parameters (such as received signal strength, packet error rate, transmit power, audio level, etc.) and to control certain functions such as output volume or setting audio delay through the units. A network map gives the user a graphical representation of the network topology showing which Relay units are communicating with each other, and on which frequencies.

3.2 GUIDS AND REGISTRATION

Each AiRocks unit has a unique 16-digit hex number assigned to the unit during manufacturing (similar to a MAC address in a LAN network). This is called the Globally Unique ID, or GUID. The GUID is used by the NMS to create a database that allows the network operator to assign a “friendly name” to each unit during deployment. Names such as “Stage Left” or “Middle Tower” can help keep track of where units are deployed in the venue.

During (or prior to) network deployment each AiRocks unit must be physically connected to the NMS USB port to become “registered” with the NMS. During the registration process the NMS captures the GUID and gives the user the opportunity to enter a friendly name. Once the unit is registered in the database this information can be used to (optionally) provide network security by only allowing registered units to participate in the network.

If AiRocks units are not registered prior to deployment they will appear as “unregistered” nodes in the NMS network map if the network security is “Open” (see Network Security section below). At this point the unit can be registered “over the air” by the network operator if desired (however, if network security is “Secure”, these nodes will not appear on the network map).

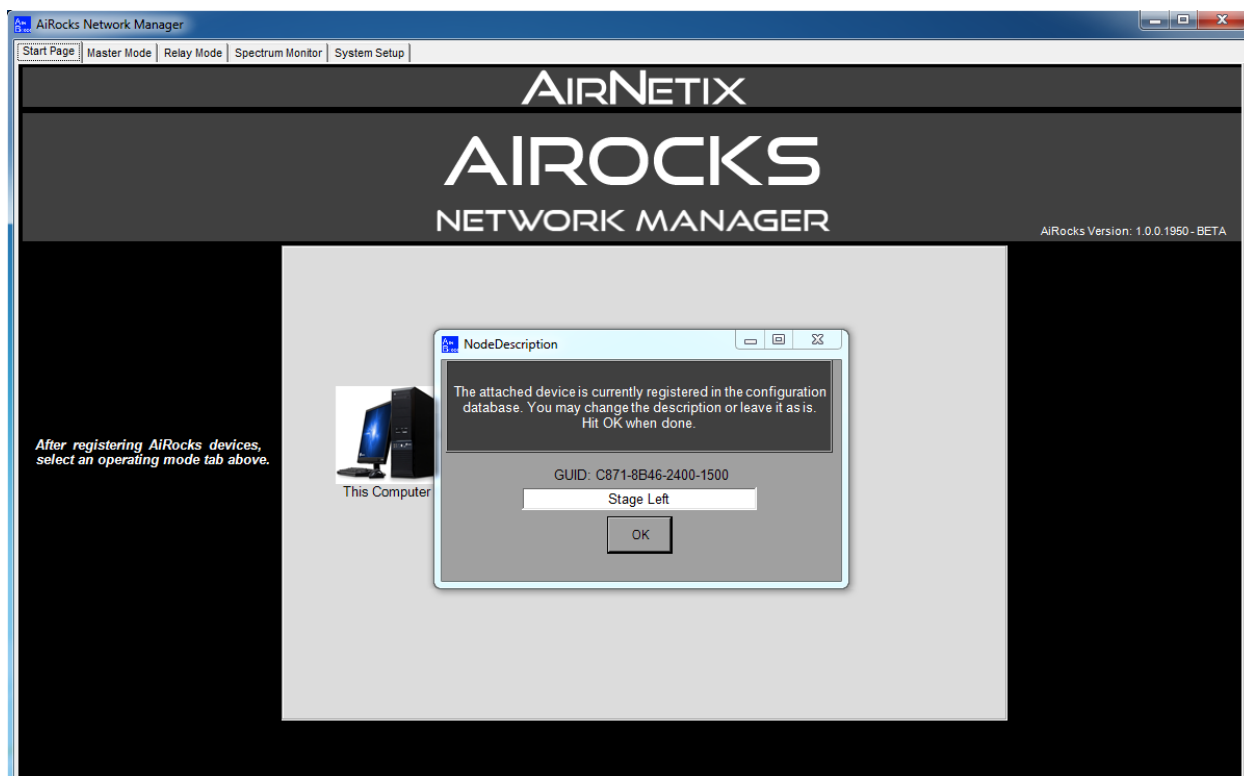


Figure 7 Registering a Node

3.3 NETWORK SECURITY

AiRocks networks can operate as either **Open** networks or **Secure** networks.

3.3.1 Open Networks

Open networks are networks in which any AiRocks unit can “participate” in the network, regardless of whether or not it has been registered in the NMS database. During initial deployment, the network operator may wish to configure the network as Open to facilitate the deployment process, but then switch to Secure once the event begins.

3.3.2 Secure Networks

Secure networks are networks in which only “registered” AiRocks units can participate in the network.

3.4 MASTER MODE

An AiRocks network has only one Master unit. The Master is located near the main audio source and transmits its signal to all Relay units within its transmission range. The NMS is connected to the Master via a USB connection from the PC or laptop on which the NMS resides.

3.4.1 Master Mode Screen

After registering units using the Welcome screen (shown above), the network operator selects the “Master Mode” tab at the top of the NMS screen. The NMS then switches to the Master Mode window shown below.

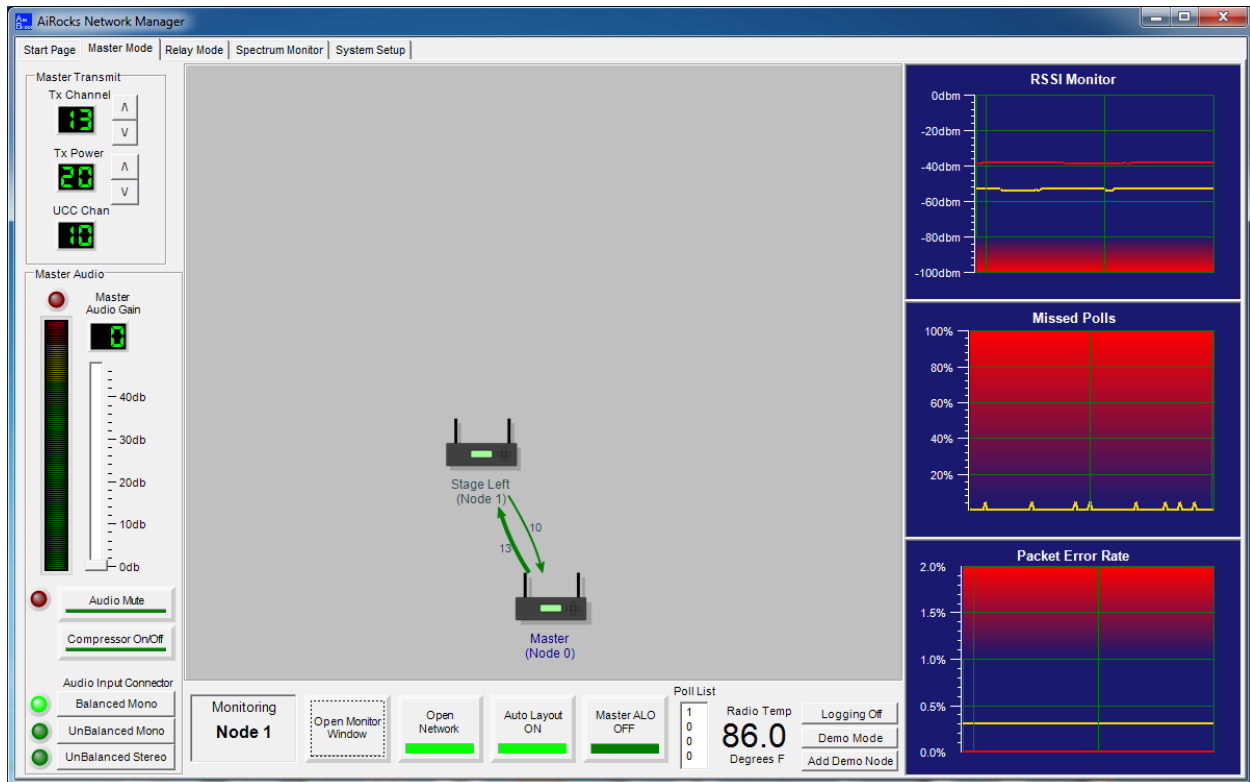


Figure 8 - Master Mode screen

Any Relay unit that has been powered ON will attempt to connect to the Master. Once successfully connected, the Relay unit has “joined” the network and the NMS can be used to monitor and controls its functions. In the example screen above, one Relay unit named “Stage Left” has joined the network. The outbound link from the Master is using channel 13 (large arrow from Master to Relay), and the inbound link is using channel 10 (small arrow from Relay to Master).

The network operator can now get additional detail on the Relay node (or any other Relay nodes on the network map) by opening a Relay Monitor Window. This is done by highlighting the desired node in the network map and then hitting the “Open Monitor Window” button at the bottom of the screen.

3.4.2 Relay Monitor Window

Once a Relay Monitor window has been opened, the network operator has full monitor and control capability over the remote Relay node.



Control functions include:

- Audio output gain (volume)
- Audio Delay (cumulative or non-cumulative delay through the node)
- Node Registration
- Transmit Channel
- Transmit Power
- Automatic Link Optimization (ALO)
- Manual ALO re-scan request
- Setting of ALO packet error rate threshold
- Manual re-scanning of receive channel
- Audio output connector type

Monitor functions include:

- Network ID
- Node description
- GUID
- Radio temperature
- Downstream poll list
- Transmit Channel
- Transmit Power
- ALO status
- Audio output level indicator
- Audio Delay settings

- Audio output connector settings
- Receive channel
- Uplink Node ID
- Uplink Control Channel
- ALO Threshold indicator
- Frame Lock Indicator
- Active receive antenna indicator (Ant 1 or 2)
- Real time RSSI indicator and plot for antennas 1 and 2
- Real time Packet Error Rate (PER) indicator and plot

3.5 SPECTRUM ANALYZER MODE

The screen below shows the Spectrum Analyzer mode. Transmissions from the Master and any Relay units are shown in green. Interference is shown in red. The spectrum is divided into 16 discrete channels which are used by the ARX-200. The blue horizontal indicators show peak signal levels in the channel, while the white indicators show a 10 second average of the signal power in the channel. These indicators can be reset by pressing the “Reset Peaks” button in the upper left.

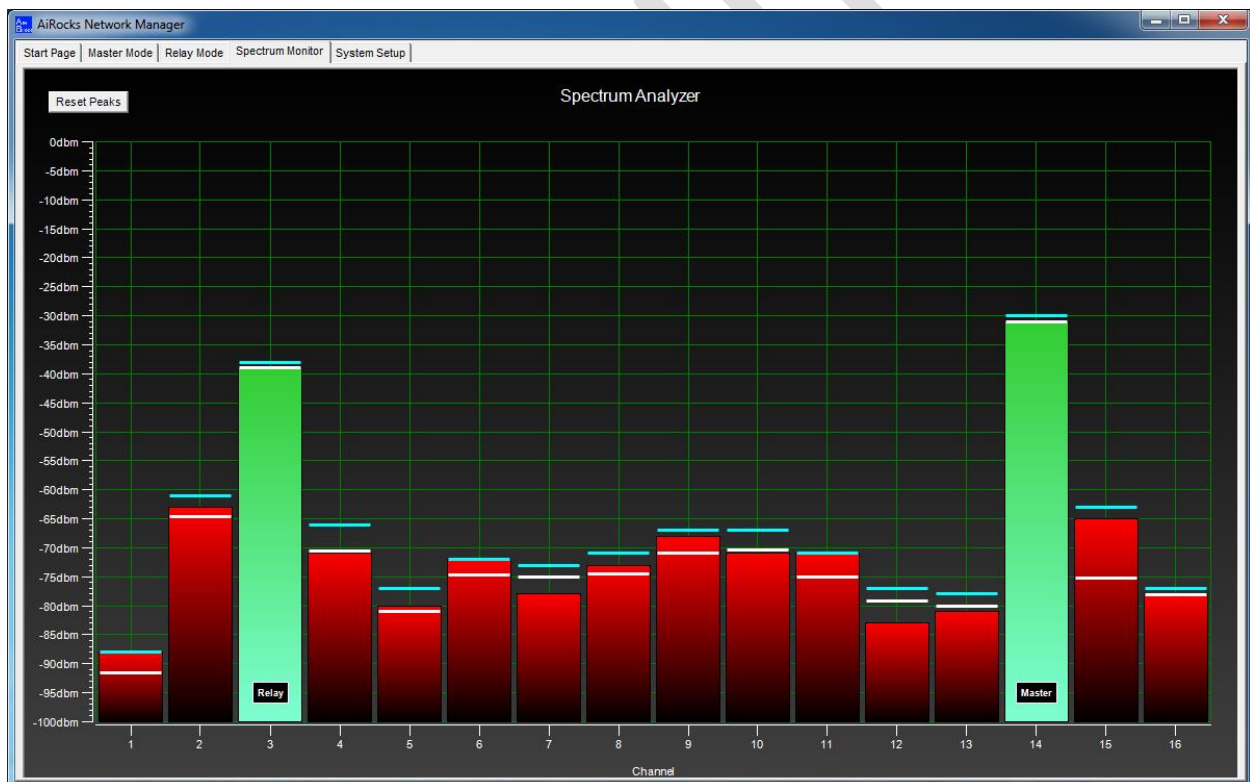


Figure 9 Spectrum Analyzer Mode

3.6 RELAY MODE

This screen is used when the operator wishes to directly attach to a Relay unit within the network. The screen gives the same information and controls of the Relay Monitor window discussed above.

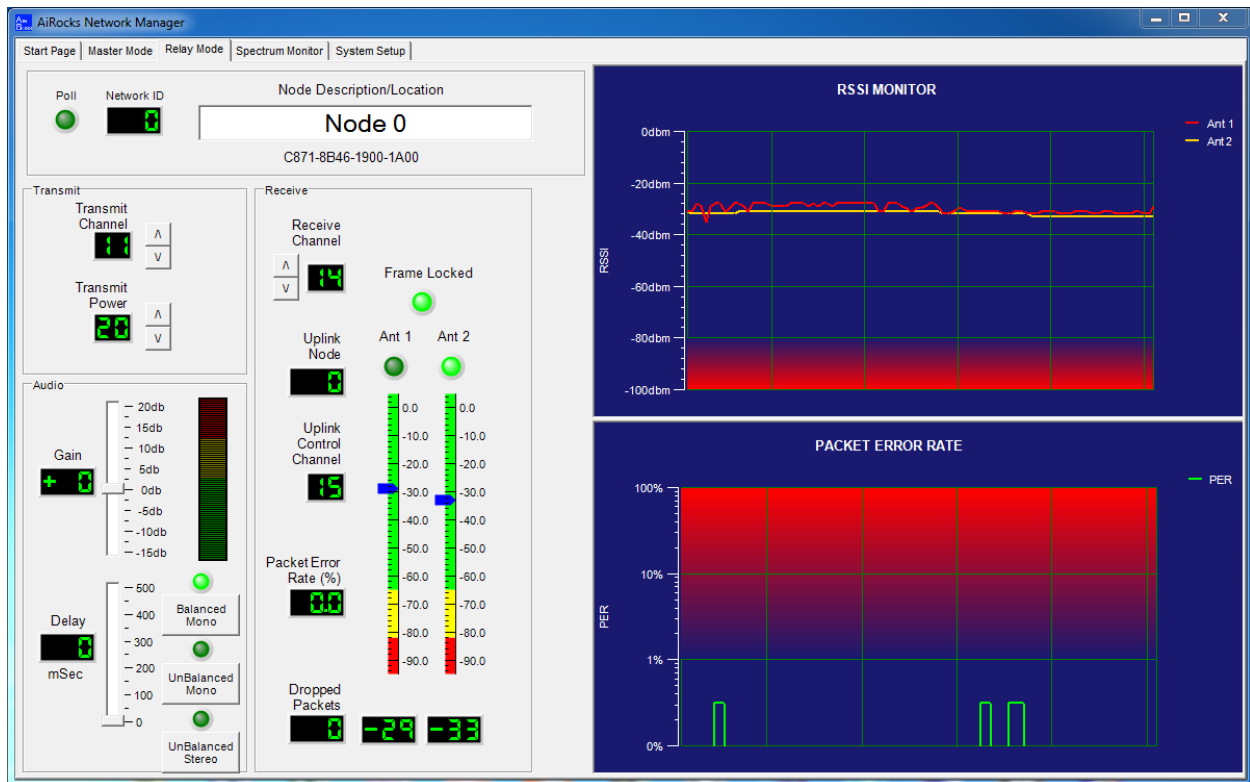


Figure 10 Relay Mode Window

3.7 INSTALLING THE NETWORK MANAGEMENT SYSTEM APPLICATION

3.8 DEPLOYING AND MANAGING A NETWORK

4 FCC STATEMENTS

Warning: Changes or modifications to this device not expressly approved AirNetix, LLC could void the user's authority to operate the equipment.

4.1 CLASS A DEVICES:

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

4.2 RF EXPOSURE AND SAFETY INFORMATION

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

5 INDUSTRY CANADA SPECIFIC STATEMENTS:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

This radio transmitter **11944A-ARX200** has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for

each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Le présent émetteur radio **11944A-ARX200** a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

- 5 dBi dipole - N-Male Connector

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.