CENTRAL RECEIVER X6

Dual 6 Way Diversity Receiver

User Manual

IMT PUBLICATION: M43-CRX6-2M2 REV 1.2

Revision History

Date	Revision	Modified by	Description
Aug 11, 2015	1.0	Sean Van	Initial Release
Mar 8, 2016	1.1	Malweeka Sree Vishnuram	Editing
April 13 2016	1.2	Sean Van	Added new webpage features

Central Receiver X6
User Manual

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Central Receiver X6
User Manual

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Chapter One 1

Introduction

1 Introduction

This document is a user manual for Nucomm's Central Receive X6 [CRX6]. The Nucomm Central Receiver X6 (CRX6) is a ruggedized COFDM (DVB-T compliant) six-way diversity central receiver. It offers exceptional RF performance and IP66 environmental durability for external use. The CRX6 is the new generation of receive systems. Typical diversity receive sites would have the antennas and LNA's or BDCs mounted at the top of the tower with coaxial cables running the length of the tower to a receiver and decoder. This design made the entire system susceptible to lightning and other EMI disturbances. By integrating the receiver with the antennas Nucomm has reduced the coaxial runs from six to one Ethernet cable, while decreasing the susceptibility to lightning and overall system costs.

The Central Receiver (CRX6) accepts 6 RF inputs from external antennas and features a compact, lightweight rugged IP rated chassis enabling it to be mounted on vehicles, towers or building tops in any weather conditions. The CRX6 sends the MPEG Transport Stream over IP either by an Ethernet cable or over ruggedized fiber to a computer-based software or hardware decoder and is powered via a single cable. The CRX6 also features optional 2 or 4 channel, 6-way diversity reception in the same package. All of these features provide unequaled value in a high quality COFDM receiver.

The Nucomm CRX6 system was designed to automatically optimize the receive signal at all times, and virtually eliminate all human intervention. In contrast to the old single, highly directional antenna, the CRX6 employs multiple antenna elements that are arranged to cover 360°of azimuth in overlapping sectors. The key to Nucomm's success is improving operation efficiency in signal acquisition. Nucomm focuses its approach on the integration and optimization of the antenna design, use of adaptive digital signal processing (ADSP) and maximal ratio combining (MRC) techniques. In the past, these three areas have been treated and controlled independently. By combining and optimizing these areas, Nucomm is able to provide a new class of fully autonomous Central Receiving Systems that provide significant value and efficiency to the industry.

A webpage controller is used to set-up or monitor the CRX6. The webpage controller features channel control, antenna receiver statistics and the ability to shut down specific directional antennas. The unit requires minimal setup to operate. For advanced functions such as changing frequency plans, AES decryption keys, or unit naming, an easy to use WEB based administration software package is supplied.

1.1 Manual Overview

Throughout this manual, the product is referred to as the 'Central Receive X6" or the CRX6.

The contents of this manual are as follows:

Chapter 2 – Describes the features and theory of operation of the CRX6 receiver.

Chapter 3 – Contains a list of product specifications. The specifications include the receiver's frequency bands, channels, size, power requirements, environmental specifications, and I/O specifications.

Chapter 4 – Explains how to install the product.

Chapter 5 – Describes operating procedures for the receiver.

The rear of the manual contains warranty and repair information.

Chapter Two 2

Description

2 Description

This chapter describes the CRX6 features and theory of operation. It also includes a block diagram of the CRX6 and a description of the internal circuits.

2.1 Features and Benefits

The Central Receiver X6 is a receiver that utilizes advanced silicon tuners and six antenna inputs for robust, error free signal reception. The CRX6 can receive either HD or SD video transmissions using COFDM modulated microwave signals. The Nucomm CRX6 receiver is configured with six diversity COFDM demodulators using maximum-ratio combining (MRC), which significantly improves the robustness of higher data rate COFDM modulation. Spatial diversity increases system performance by digitally combining signals with different characteristics. This essentially fills in the gaps in the channel and provides improved path reliability. The built-in spectrum analyzer gives an instant analysis of the selected channel and can be used to minimize multi-path or see if the channel is clear from interference.

The CRX6 is integrated at the antenna location and features direct frequency input, enabling it to be used without LNAs and down converters. The CRX6 features an Ethernet port used for transport stream out, command/control and power in. It also optionally features dual ASI outputs. The CRX6 also features AES decryption capabilities, for public security monitoring, covert and other secure transmission applications. The transport stream may be decoded by a PC based application decoder or an IMT decoder.

The CRX6 is available as a single, dual or quad channel receiver. The Transport Stream output uses either the traditional RJ45 or optional Fiber output. Power is supplied via the Ethernet cable as Power over Ethernet (PoE) or by two wire power if the system built (4 channel) draws too much current for PoE to handle.

Feature	Benefit
COFDM HD and SD Microwave Receiver	COFDM facilitates high data rates and robust signal reception. Receives both high definition and standard definition video transmissions.
6 Way Antenna Diversity Using Maximal-Ratio Combining	Best aspects of the transport stream received using either antenna is used, yielding robust, error free reception.
Dual ASI Output	Option to output 2 ASI streams
Ethernet Out	Transport Stream available at Ethernet Port
Fiber Output	Transport Stream available at fiber output as an option
Remote Control Via Ethernet	Unit maybe remotely controlled by either the Web Page application or the *NanoController* application
Multichannel Option	Available in dual or quad channel option
Outdoor Unit	Housed in an IP66 outdoor mountable housing
Lightning Protection	Stringent lightning protect

Table 2-1: - Summary of Features and Benefits

2.2 Frequency Bands

The *Central Receiver* is available in the following bands:

Table 2-2: *CRX6* Frequency Bands

Base Model Number	Frequency (GHz)	Description
23CRX6	2.025 - 2.500	2.025 - 2.500GHz Single Channel Compact Portable Central Diversity COFDM Tower/Truck Mounted Receiver
23CRX6-2	2.025 – 2.500 2.025 – 2.500	2.025 – 2.500 Dual Channel Compact Portable Central Diversity COFDM Tower/Truck Mounted Receiver
23CRX6-4	2.025 – 2.500 2.025 – 2.500 2.025 – 2.500 2.025 – 2.500	2.025 – 2.500 QUAD Channel Compact Portable Central Diversity COFDM Tower/Truck Mounted Receiver
70CRX6	6.425 - 7.150	6.425 - 7.150 Single Channel Compact Portable Central Diversity COFDM Tower/Truck Mounted Receiver
70CRX6-2	6.425 – 7.150 6.425 – 7.150	6.425 – 7.150 Dual Channel Compact Portable Central Diversity COFDM Tower/Truck Mounted Receiver
70CRX6-4	6.425 – 7.150 6.425 – 7.150 6.425 – 7.150 6.425 – 7.150	6.425 – 7.150 QUAD Channel Compact Portable Central Diversity COFDM Tower/Truck Mounted Receiver
72CRX6	6.700 – 7.400	6.700 – 7.400 Single Channel Compact Portable Central Diversity COFDM Tower/Truck Mounted Receiver
72CRX6-2	6.700 – 7.400 6.700 – 7.400	6.700 – 7.400 Dual Channel Compact Portable Central Diversity COFDM Tower/Truck Mounted Receiver
72CRX6-4	6.700 – 7.400 6.700 – 7.400 6.700 – 7.400 6.700 – 7.400	6.700 – 7.400 QUAD Channel Compact Portable Central Diversity COFDM Tower/Truck Mounted Receiver

2.3 Theory of Operation

The Nucomm 6-way receiver is the heart of each CRX6 model type. The 6-way module housed in its own individual chassis and is the base functional component used in the CRX6. The CRx6 incorporates 3 direct input dual diversity RF boards, and digital receiver board.

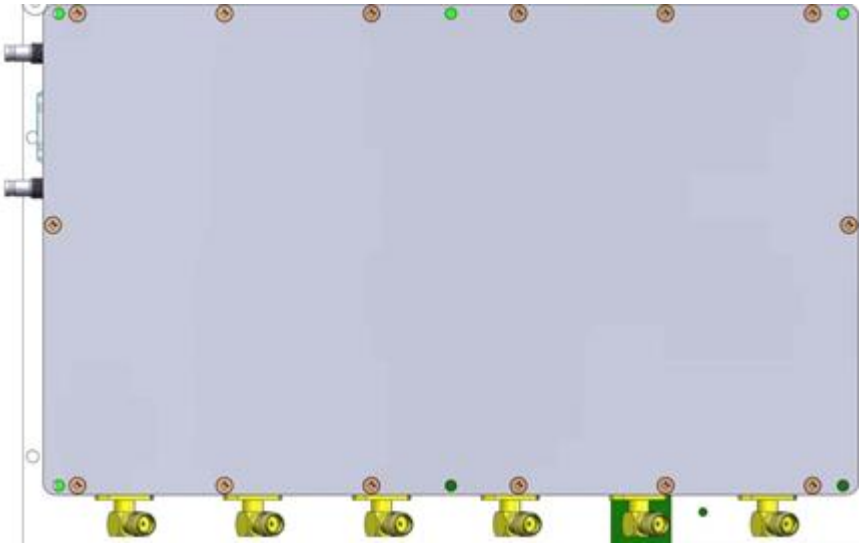


Figure 2-1: 6 Way Receiver in Chassis

2.3.1 Dual RF Input Board

The dual diversity board filters any unwanted RF signals and amplifies the RF input via a high dynamic range low noise amplifier. It then down converts the signal to 810MHz. The 810MHz signal is routed through a 12dB coupler where it is then sent to the main UHF input of the receiver and the spectrum viewer input of the receiver.

2.3.2 Diversity Receiver Board

The Diversity Receiver Board consists of the following main blocks:

- Power Supply
- Microprocessor and control
- 6 UHF Receivers
- Diversity Bus
- Demodulator
- Inputs/Outputs

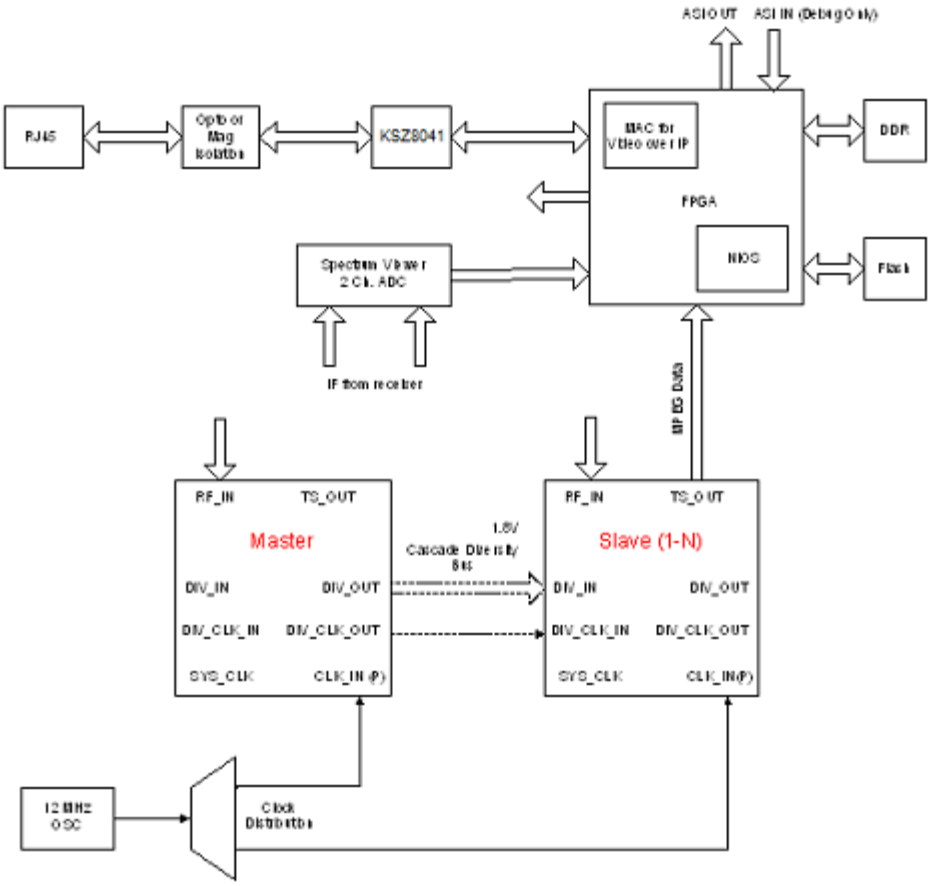


Figure 2-2: 6 Way Receiver Board Block Diagram

The UHF is received from each of the 6 antenna inputs by the 6 individual receivers and demodulated. The resulting outputs from each receiver is processed using the 6-way Maximum Ratio Combining algorithm and the resulting signal is a robust diversity combined signal. The signal is output as a MPEG and ASI Transport Stream. The CRX6 features a 100 Mbps Ethernet LAN interface for streaming video over IP.

Table 2-3: 6 Way Receiver Inputs and Outputs

Function	Connector	Number
RF Input	DIN	6
ASI Output	DIN	2
TS Output/Control	RJ 45	1
Power	2 pin Molex	1

2.4 CRX6 Models and Description

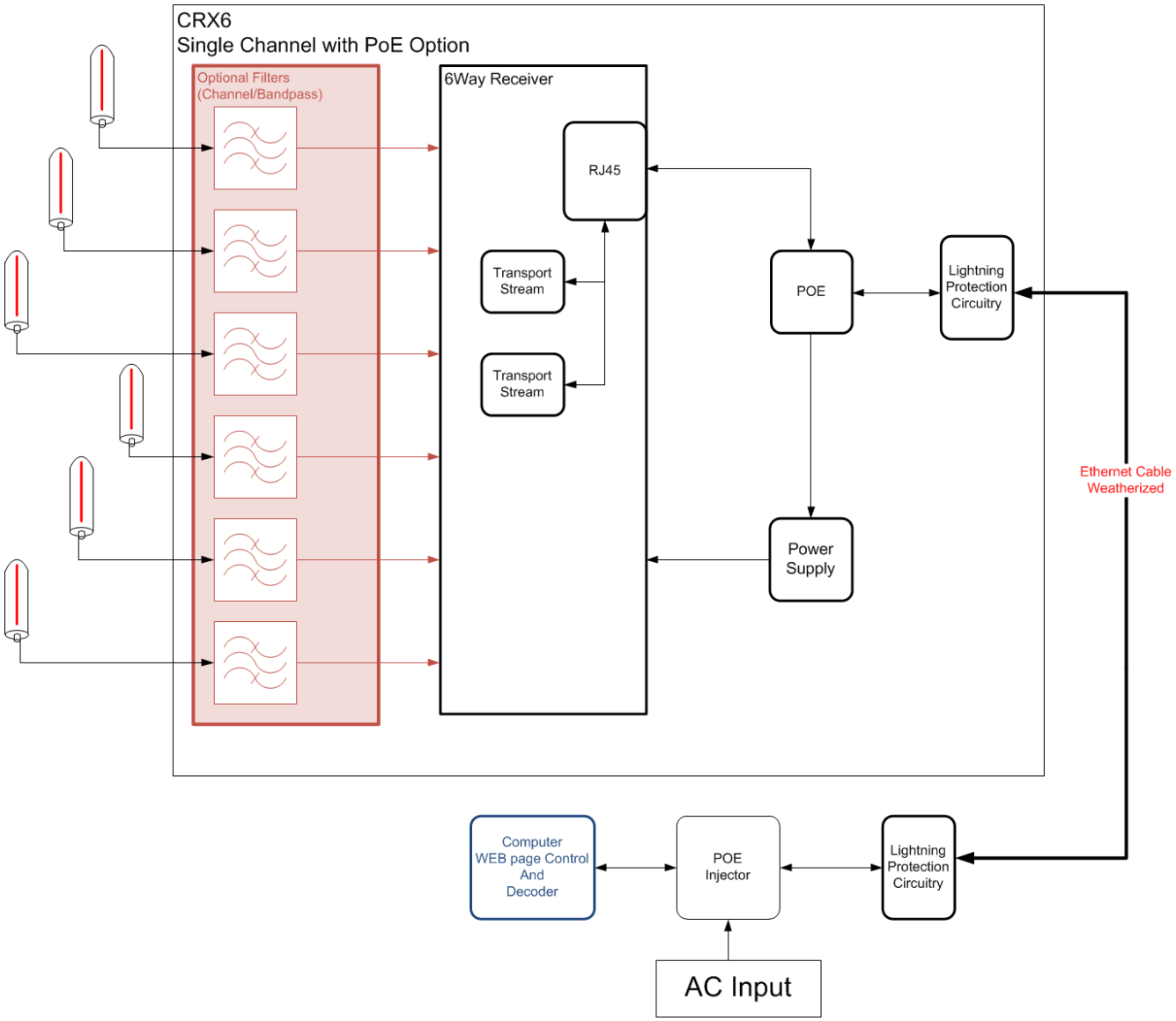
2.5 Models Available

There are four basic models of the CRX6:

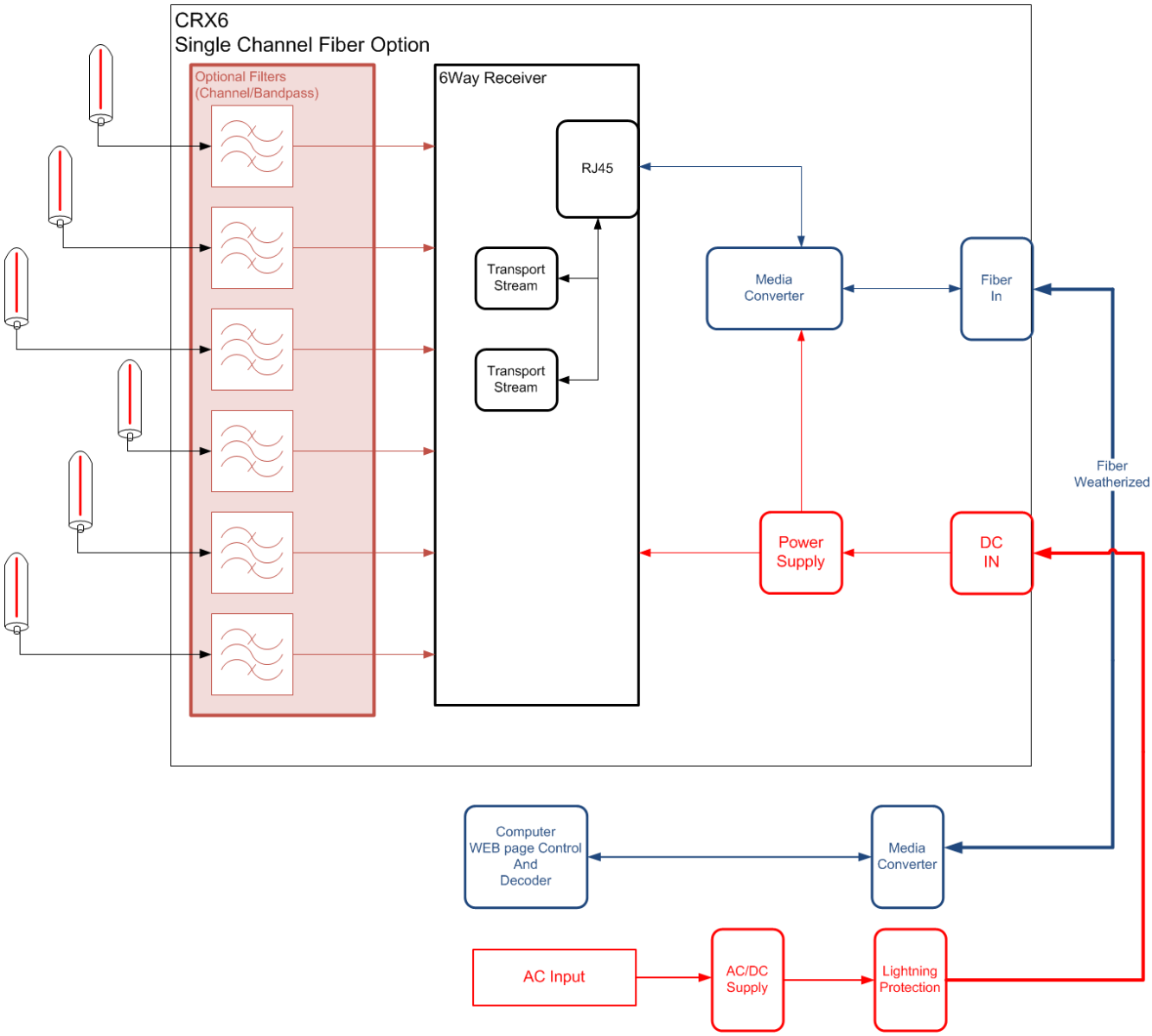
- Single Channel Ethernet
- Multi-Channel Ethernet
    - Dual
    - Quad (Not available with PoE)
- Single Channel Fiber
- Multi-Channel Fiber
    - Dual
    - Quad (Not available with PoE)

Each model may be ordered in the frequency bands indicated in **Table 2-2: CRX6 Frequency Bands.**

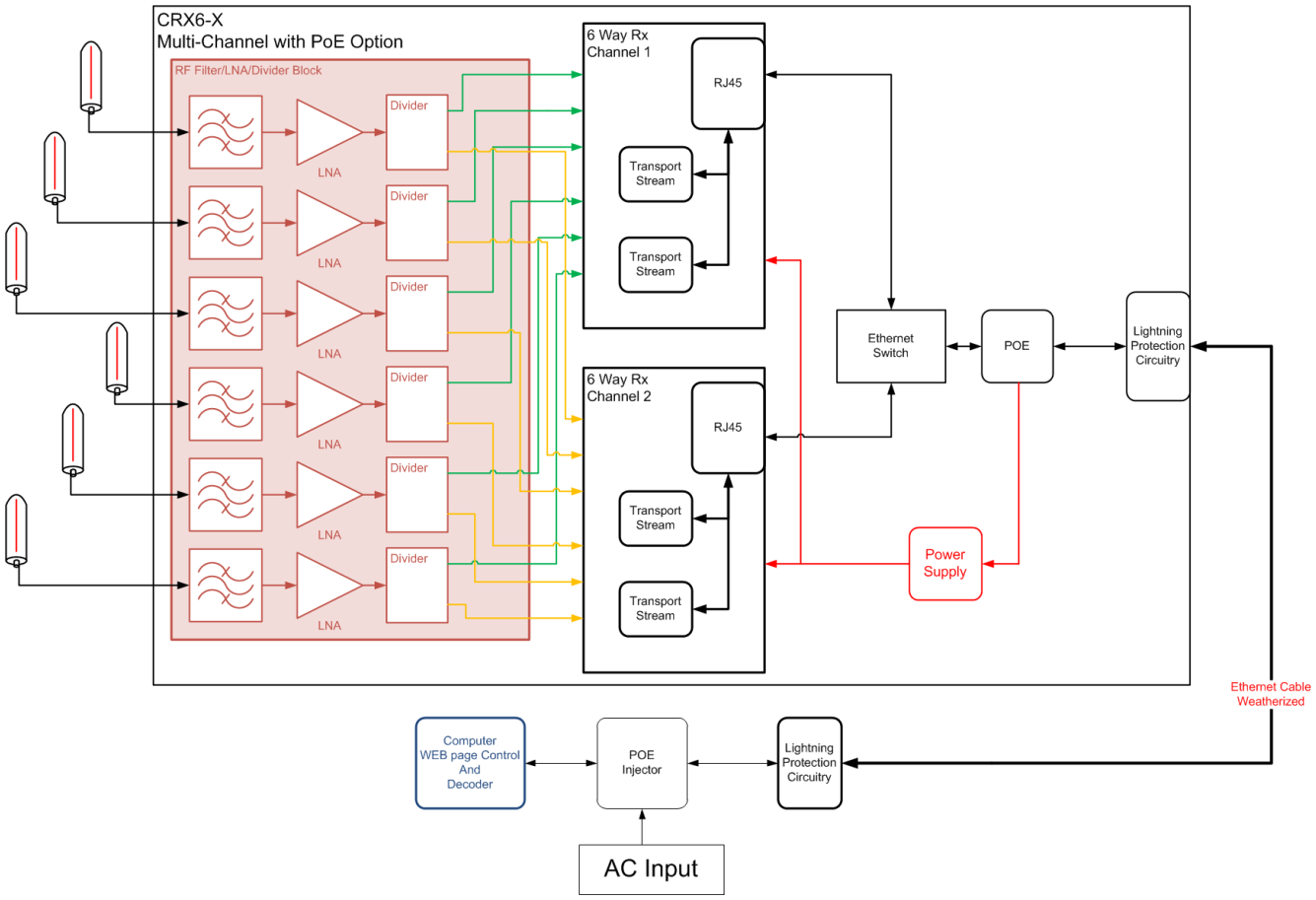
2.6 Block Diagrams



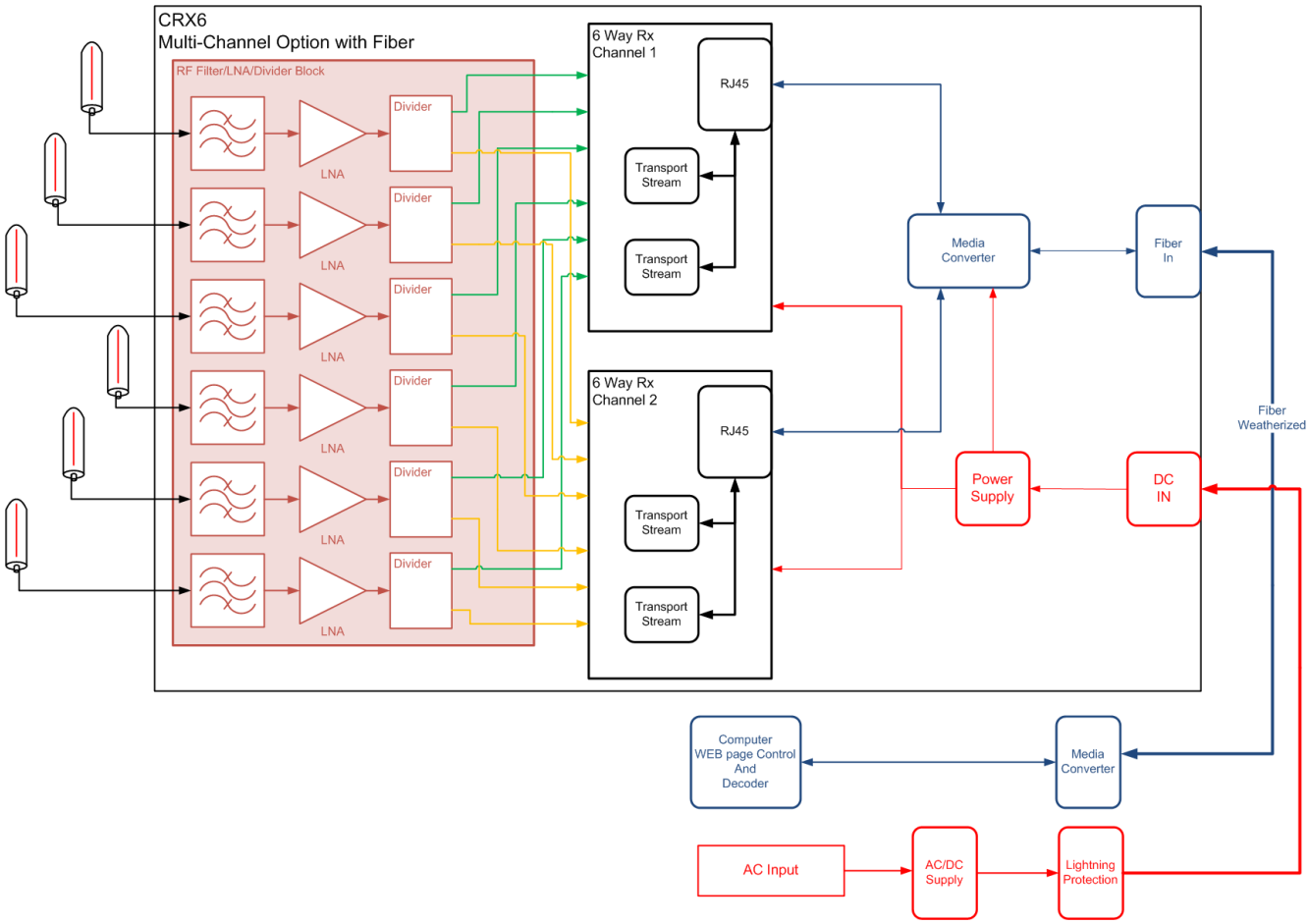
Block Diagram 2-1: Single Channel with POE



Block Diagram 2-2: Single Channel with Fiber



Block Diagram 2-3: Multi-Channel with PoE



Block Diagram 2-4: Multi-Channel with Fiber

2.7 Electrical Overview

All CRX6 models have the same building blocks and consist of the tower central receiver and the ground control units.

2.7.1 Tower Equipment

The tower or vehicle mounted portion of the Nucomm Central Receive includes the following:

- Antennas – The antennas are part of the system but are sold separately.
- Central Receiver Box – Weatherized enclosure containing the IMT CRX6.
- Mounting Kit – Different options available.
- Cabling – Application specific.

2.7.1.1 Antennas

The 6 antennas may be Omni or Sector Antennas and are sold separately. The user will specify the type of antennas based on the application. Multi-Channel units will share the six antennas between all channels.

2.7.1.2 CRX6 Outdoor Unit (ODU)

The CRX6 main tower, building or vehicle mounted ODU contains the 6-way receiver and associate electronics. As shown in the above block diagrams each CRX6 may be slightly different but will contain the following:

- RF Chain/Divider Block
  - Single channel – Lightning arrestor and cabling
  - Dual or quad channel - Lightning arrestor, band filter, LNA, RF divider and cabling.
- 6-way receiver – On for each channel of reception.
- Power and Transport Stream Conditioning
  - Lightning protection
  - PoE Splitter for PoE models
  - Power Supply for high current and fiber models
  - Ethernet Switch for multi-channel units
  - Media converters for fiber units
- Outside Interface
  - Power Connector for high current and fiber units
  - Ethernet for PoE/non-fiber units
  - Fiber connector for fiber units

2.7.1.2.1 RF Divider Chain for Multi-Channel Units

The input for each antenna is routed through an independent RF chain for signal conditioning before being input to each individual 6-way receiver input. The RF chain consists of a band filter, 12dB gain high dynamic range low noise amplifier and a RF divider. This enables all receivers to share the same antennas while at the same time ensuring the integrity of the incoming signal.

2.7.1.2.2 Optional Channel Filters

The CRX6 receiver is equipped with standard band filters. In high traffic areas there may be a need for channel filters depending on the specific application. These are available as an option and are integrated into the CRX6 ODU.

2.7.1.3 Mounting Kits

There are two mounting kits available as options:

- Heavy duty tower mount kits
- Light weight portable mounting kits

2.7.1.4 Cabling

Since each tower/building or vehicle mounting is different, cables are not supplied with the unit. The connectors for the cables are supplied. Test cables however are supplied, so bench testing may be done before installation.

2.7.2 Ground Controls and Hardware

2.7.2.1 Hardware

Lightning protection and power supplies are standard for each unit and include the following:

- Lightning Protection for input power and transport stream
- PoE injector with power supply for PoE units
- Media Converter for fiber units
- AC/DC supply for all units that are not PoE
- Test cables
- Power connection

2.7.2.2 Webpage Controller

The CRX6 is loaded with a Webpage controller which may be accessed through a standard web browser (Mozilla Firefox recommended). The webpage contains the following:

- Real time status
- Real time control
- Integrated VLC for confidence monitoring
- Product information page
- Software upgrade page

Chapter Three 3

Specifications

3 Specifications

3.1 Frequency Bands and RF Performance

Base Model Number	Frequency (GHz)	Description	Power Consumption
23CRX6	2.025 - 2.500	2.025 - 2.500GHz Single Channel Compact Portable Central Diversity COFDM Tower/Truck Mounted Receiver	<20
23CRX6-2	2.025 – 2.500 2.025 – 2.500	2.025 – 2.500 Dual Channel Compact Portable Central Diversity COFDM Tower/Truck Mounted Receiver	<50
23CRX6-4	2.025 – 2.500 2.025 – 2.500 2.025 – 2.500 2.025 – 2.500	2.025 – 2.500 QUAD Channel Compact Portable Central Diversity COFDM Tower/Truck Mounted Receiver	<90
70CRX6	6.425 - 7.150	6.425 - 7.150 Single Channel Compact Portable Central Diversity COFDM Tower/Truck Mounted Receiver	<22
70CRX6-2	6.425 – 7.150 6.425 – 7.150	6.425 – 7.150 Dual Channel Compact Portable Central Diversity COFDM Tower/Truck Mounted Receiver	<60
70CRX6-4	6.425 – 7.150 6.425 – 7.150 6.425 – 7.150 6.425 – 7.150	6.425 – 7.150 QUAD Channel Compact Portable Central Diversity COFDM Tower/Truck Mounted Receiver	<110
72CRX6	6.700 – 7.400	6.700 – 7.400 Single Channel Compact Portable Central Diversity COFDM Tower/Truck Mounted Receiver	<24
72CRX6-2	6.700 – 7.400 6.700 – 7.400	6.700 – 7.400 Dual Channel Compact Portable Central Diversity COFDM Tower/Truck Mounted Receiver	<62
72CRX6-4	6.700 – 7.400 6.700 – 7.400 6.700 – 7.400 6.700 – 7.400	6.700 – 7.400 QUAD Channel Compact Portable Central Diversity COFDM Tower/Truck Mounted Receiver	<112

- Tuning step size: 250 KHz
- Frequency stability: ± 10ppm

3.2 Modulation Modes

Modes are auto detected within modulation format

Modulation Formats: ..... *COFDM (DVB-T)*
Carriers: *2K*
Constellation: ..... *QPSK, 16QAM*
Code Rate: *1/2, 2/3, 3/4, 5/6, 7/8*
Guard Interval: *1/32, 1/16, 1/8, 1/4*
Bandwidth: ..... *6 MHz, and 8 MHz*

3.3 Diversity

Channels: ..... *6 input Maximum Ratio Combining*

3.4 System

User Data: ..... *Via LAN over UDP/TCP*
Ethernet: ..... *100 Mbps Ethernet interface*
Streaming Video: ..... *Streaming MPEG-TS over UDP/RTSP*
Remote Control: ..... *Via LAN and/or PC GUI*
Sensitivity: ..... *-92dBm single antenna*
..... *@QPSK ½, 1/32*
..... *6-way diversity adds to sensitivity*
Decryption: ..... *AES 128/256 bit BCRYPT1 or 2*
..... *(FIPS PUB 197)*

3.5 Power Requirements

PoE: ..... *Ethernet*
..... *Pins 4/5 DC+*
..... *Pins 7/8 Ground*
..... *48 – 56VDC*
Fiber/high power: ..... *2 Pin, 12 Gauge Amphenol*
..... *+24VDC*
Power consumption: ..... *See Table Above*

3.6 Environmental

3.6.1 Temperature Range

Full specification: ..... *-10° to 50°C Ambient*
Storage: ..... *-40° to 80°C*
Humidity: ..... *0 to 95% non-condensing*

3.6.2 Altitude

Operating: ..... *20,000ft (6,000 m)*
Storage: ..... *50,000ft (15,000 m)*

3.6.3 Physical Characteristics

Size: ..... *Version dependent*
Weight: ..... *Type dependent*

3.7 User Interface and Remote Control

No Local Interface
Remote Control ..... *Webpage*

Chapter Four 4

Installation

4 Installation

4.1 Overview

This chapter contains steps for installing the *Central Receiver* in typical environments where it may be used.

4.2 Identifying CRX6 Physical Features and Interfaces

4.2.1 Connectors

The CRX6 physical connectors are located on the bottom of each models outdoor chassis. Each model may have slight connector variances.

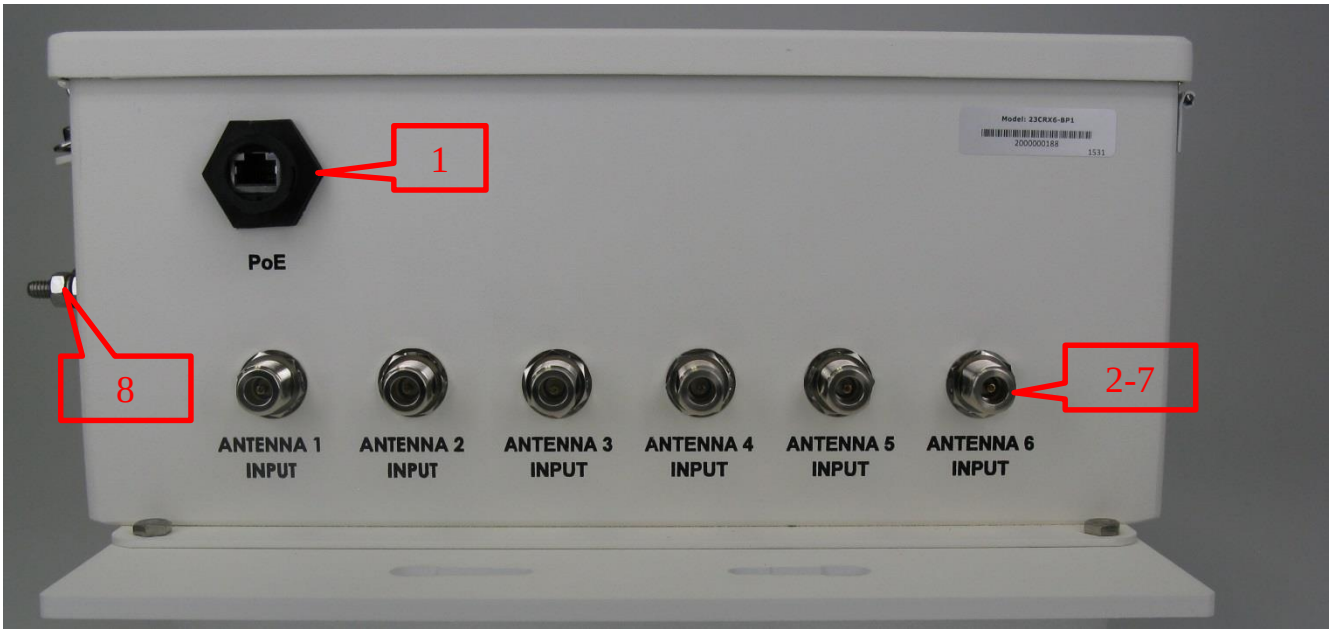


Figure 4-1: Single Channel PoE Connector View

Table 4-1: Single Channel, PoE Connectors

Reference	Description	Type	Label
1	PoE – Power and Transport Stream	RJ45	PoE
2-7	RF Input – Antenna 1-6	N-Female	Antenna X Input
8	Ground	Lug Nut	None

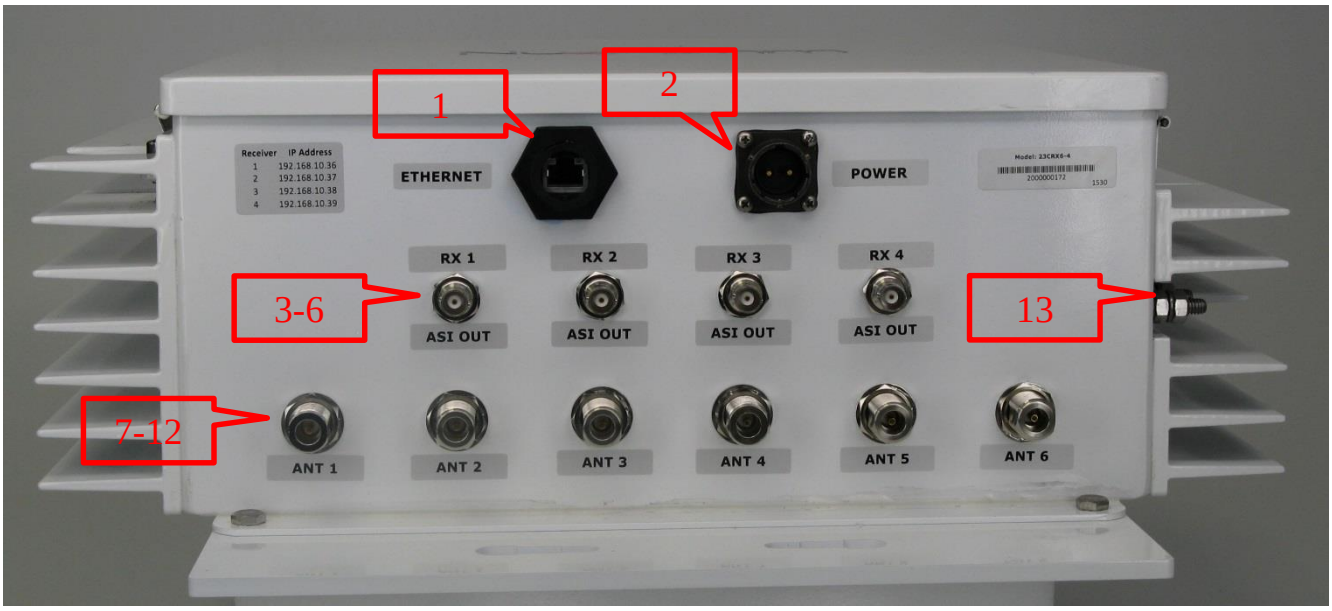


Figure 4-2: Multi-Channel, Ethernet, Power and ASI Option

Table 4-2: Multi-Channel, Ethernet, Power and ASI Option Connectors

Reference	Description	Type	Label
1	Ethernet – Transport Stream In	RJ45	Ethernet
2	Power Input	2 Pin, 12 Gauge	Power
3 – 6	ASI Outputs – Channels 1-4 (optional)	BNC Female	RX X ASI Out
7 – 12	RF Inputs – Antennas 1-6	N-Female	ANT X
13	Ground	Lug	None

4.2.2 Standard Ship Kit

Each CRX6 ships with a standard kit that includes all the power, link, protection and test hardware needed to power up, control and test the units.

Figure 4-3: Ship Kit - CRX6 with PoE

Table 4-3: Ship Kit - CRX6 with PoE

Reference	Description	Purpose	Part Number	QTY
1	PoE lightning protection	Protect incoming TS/PoE from strikes		1
2	PoE power supply with detachable instrument cord	Power up the CRX6		1
3	Outdoor Ethernet connector	Used for building outdoor Ethernet cable		1

4	1 meter Ethernet cable	Used for testing	2
5	Manual on USB flash drive	Manual	1
n/a	Quick Start Guide	Quick Start Guide	1

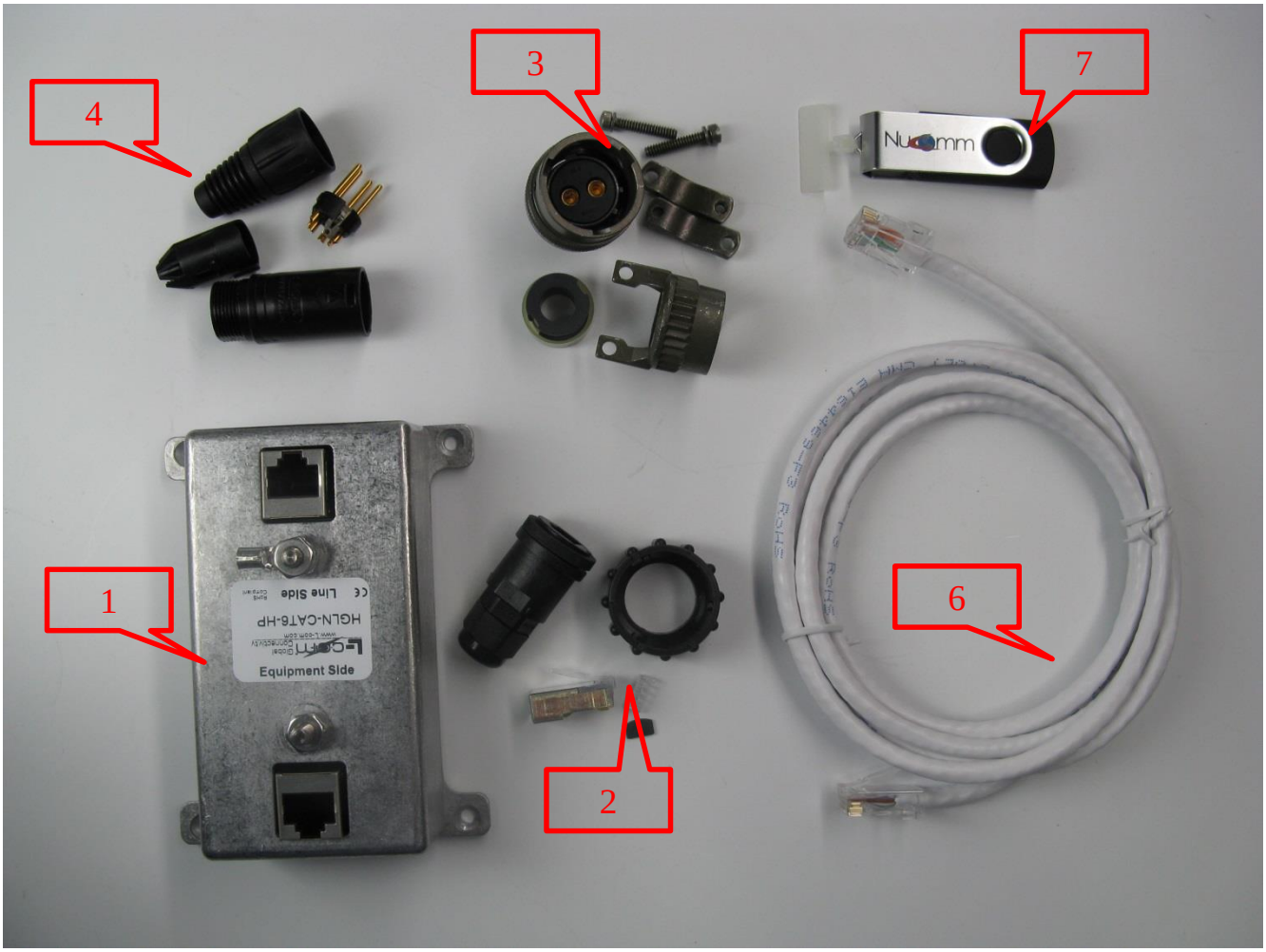


Figure 4-4: Ship Kit (Partial) - CRX6 with External Power

Table 4-4: Ship Kit - CRX6 with External Power

Reference	Description	Purpose	Part Number	QTY
1	Ethernet Lightning Protector	Protect incoming TS/PoE from strikes		
2	24VDC power supply with 4 pin XLR	Power up the CRX6		
3	Outdoor Ethernet connector	Build outdoor Ethernet cable		
4	Input power connector	Build indoor power cable		
5	1-meter copper power test cable	Test unit		

6	1 meter Ethernet cable	Test unit
7	Connector for lightning box and power supply	Build indoor power cable between power supply and lightning protector
8	Manual on USB flash drive	Manual
9	Quick Start Guide	Quick Start Guide

4.2.3 Mounting Kits

The CRX6 features an optional heavy duty mounting kit. The mounting kit include mounting plates and all the hardware needed to mount the CRX6 on towers, poles, building or similar structures.

Figure 4-5: CRX6 Mounting Brackets

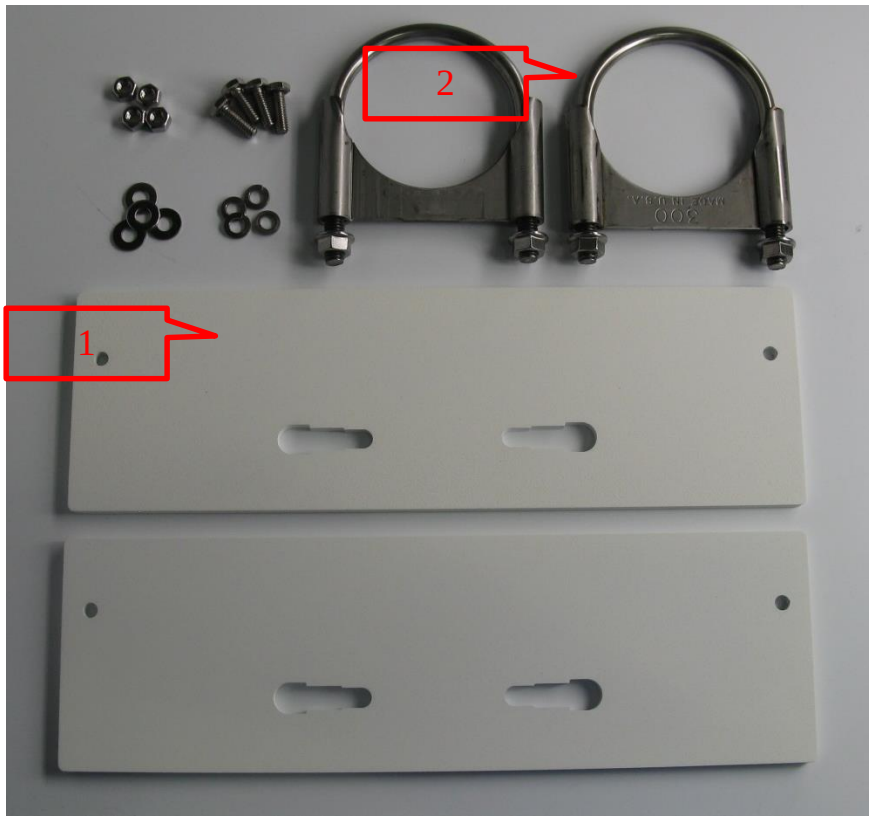


Figure 4-6: Tower Mount Kit

Reference	Description	Purpose	QTY
1	Mounting plates	Mounting plates to attach to the top and bottom of the CRX6	2
2	U-Bolts	Connects bracket to tower or pole	2

4.3 Pre Mount Quick Test

4.4 Physical Installation

4.4.1 Mounting CRX6 to Tower or Pole

4.4.2 Installing Ground Cable

4.4.3 Making, Installing and Running Cable from CRX6 to Control

4.4.4 Indoor Power and Control Setup

4.4.4.1 PoE Models

The lightning/surge protection box must be placed as close to where the Ethernet cable enters into the building.

1. Secure PoE/Ethernet lightning/surge protector as close to the Ethernet line entrance to the building as possible.
2. **Connect both side ground lugs to the building earth ground.**

3. Connect Ethernet (should be CAT 5e, CAT 6 or CAT 7) cable for CRX6 to 'Equipment' side of the lightning/surge protector.
4. Connect Ethernet cable from 'Line' side of the surge protector to the 'Ethernet + DC' Output of the PoE Injector.
5. Connect Ethernet cable from 'Ethernet' connector to computer or the network.
6. Connect PoE power supply to the PoE DC input (labeled '56V DC').
7. When ready to power up the CRX6, connect PoE Power Supply to AC outlet. There is no on/off switch, so this action will power up the unit.

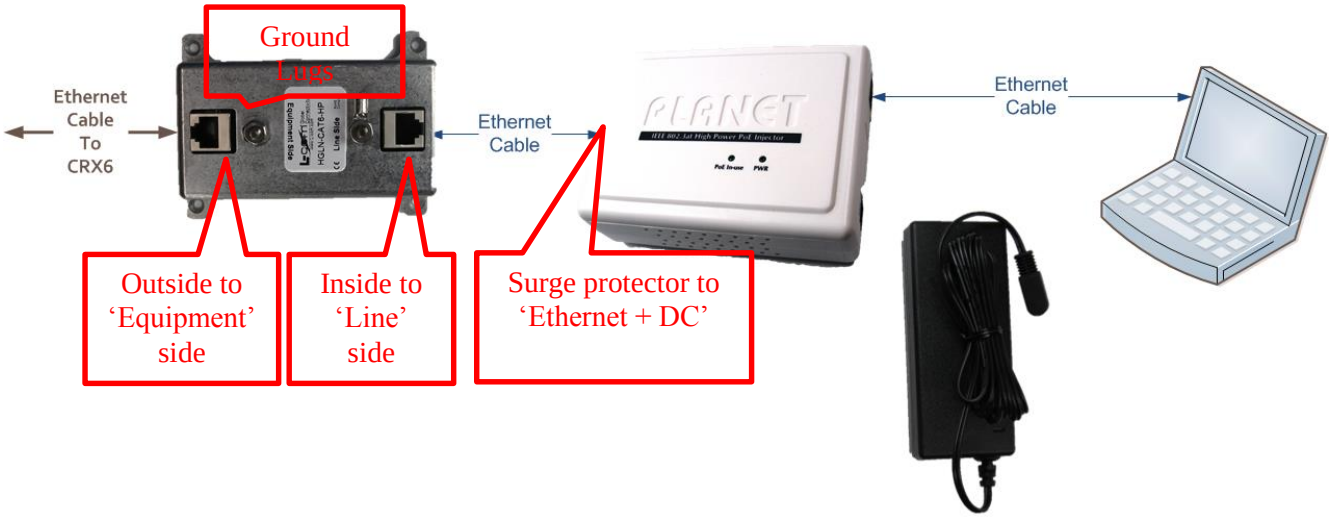


Figure 4-7: PoE Power Configuration

4.4.4.2 Models with TS over Ethernet and separate DC power Input

The lightning/surge protection for both the Ethernet (Transport Stream) and the Power must be placed as closed to where the cables comes into the building.

4.4.4.2.1 Connecting the Transport Stream Ethernet Cable

1. Connect Ethernet (should be CAT 5e, CAT 6 or CAT 7) cable for CRX6 to 'Line' side of the lightning/surge protector.
2. Connect Ethernet cable from 'Equipment' side of the surge protector to computer or the network.
3. **Connect both side ground lugs to the building earth ground.**

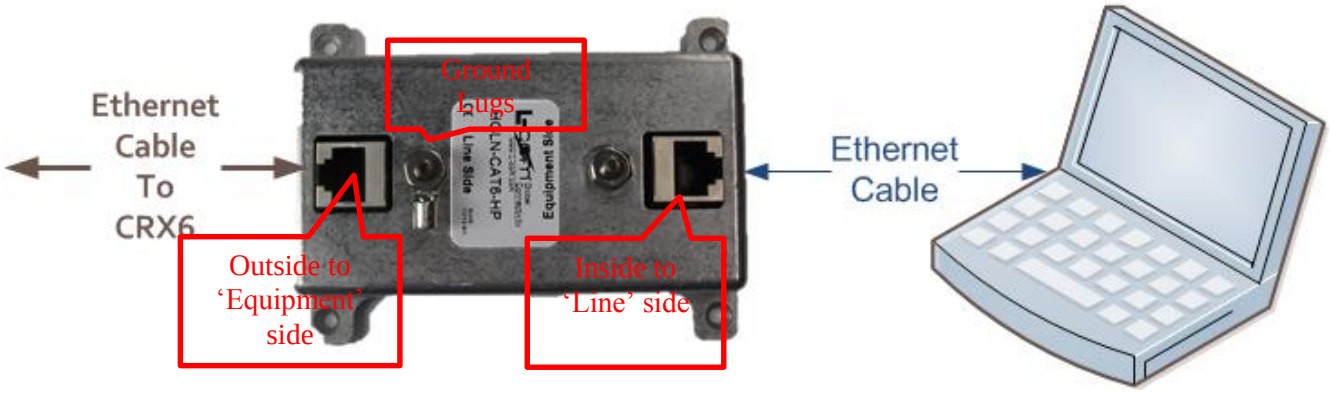


Figure 4-8: Ethernet Connection for Non-PoE Models

4.4.4.2.2 Power Configuration

The lightning/surge protection for the Power must be placed as closed to where the cables comes into the building.

1. Secure the DC line lightning/surge protection box as close as possible to the power cable entry point of the building.
2. Connect the ground lug to the building earth ground.
3. Open the box and run the wires through the 'Equipment' side grommet. Connect to the positive DC to the DC+ terminal and the negative DC to the DC- terminal.
4. Measure the distance from the surge protector to you power source. Cut two lengths of 14 to 16-gauge wire using two different colors for the DC+ and DC-. On one side strip and tin both wires approximately ½ inch, run through the 'Line' side grommet of the surge protector and connect to the DC+ and DC- terminals. On the other side of the cable, solder the wires to the 4 pin XLR (Male) connector supplied (DC+ to pin 4 and the DC- to pin 1).
5. Connect 4 pin XLR from the surge protector to the 4 pin XLR (female) of the power supply provided.
6. When ready to power up the CRX6, connect the power supply to an AC source.

Figure 4-9: Power Configuration for Non-PoE Models

4.5 Installing IMT Software Applications

4.5.1 NanoController

The *NanoController* software is shipped with the unit on an USB flash drive. Simply plug the USB flash drive, open the drive and double click on "NanoControllerInstaller.X.X.msi". The installation wizard will guide you through the process and place the *NanoController* icon on the desktop.

Chapter Five 5

Operation

5 Operation

This chapter contains basic information about the operation of the CRX6 and programming of the unit (including preset configuration) via the NanoController GUI.

5.1 Power up the *Central Receiver*

When power configuration is complete as shown in section **4.4.4.** simply connect the power supply to an AC source. The CRX6 requires up to 40 seconds to complete the power up sequence.

The *CRX6* contains flash memory, which retains all stored preset configuration settings when the unit is not powered.

5.2 Pre-Configure the *CRX6* user options

The CRX6 has a limited amount of programmable settings, however there are several setting that must be matched to the transmitter being used. If the Transmitter settings are known and fixed, IMT can ship the CRX6 with a custom default frequency and preset plan. Before using the CRX6 in your application, you should pre-configure it to for the settings you wish to use in your application. Settings are selected and configured using the NanoController software. See NanoController in section **5.10** for configuration software.

5.3 Using the IMT internal Webpage

The CRX6 features an internal Webpage for control, monitoring and software upgrade. To access the webpage, open a browser (Mozilla Firefox is recommended) and type in the IP Address of the CRX6. The default IP address is **192.168.10.35** for the single channel CRX6. For the Dual or Quad channels, the default addresses are the following:

- RX 1 – 192.168.10.36
- RX 2 – 192.168.10.37
- RX 3 – 192.168.10.38
- RX 4 – 192.168.10.39

5.4 Webpage Features

The main Webpage contains the following 4 main sections:

- Product Information
- Configuration
- Monitor Decoder
- Receiver Status

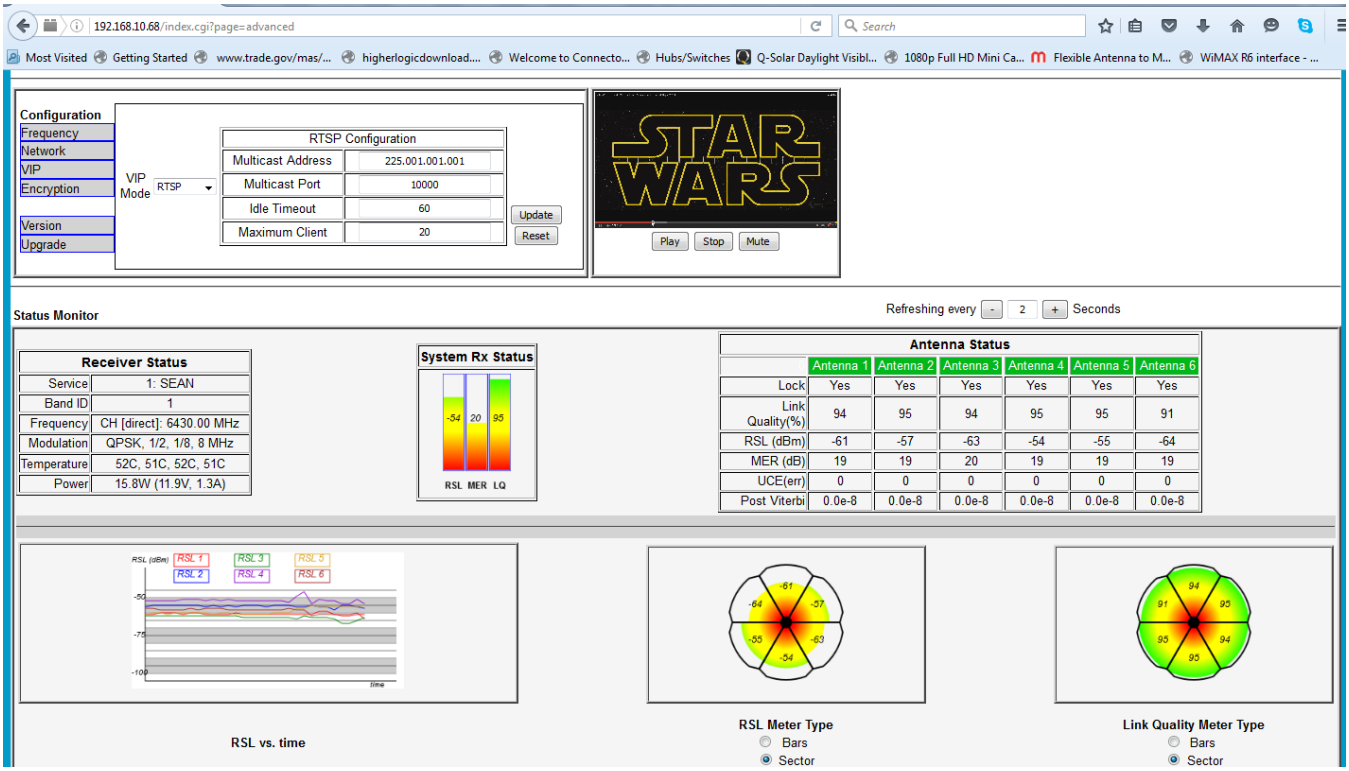


Figure 5-1: Main Webpage Screen

5.5 Product Information Section

This section contains the Model number, serial number and a link to the IMT Website. Click on the IMT logo to link you to the Website.

5.6 Configuration Section

The configuration section allows real time control and software update of the CRX6. The real time controls include:

- Frequency Control
- Network Control
- Video Streaming Parameters
- Encryption Settings
- Product Version page link
- Software Upgrade Page and Configuration Uploader

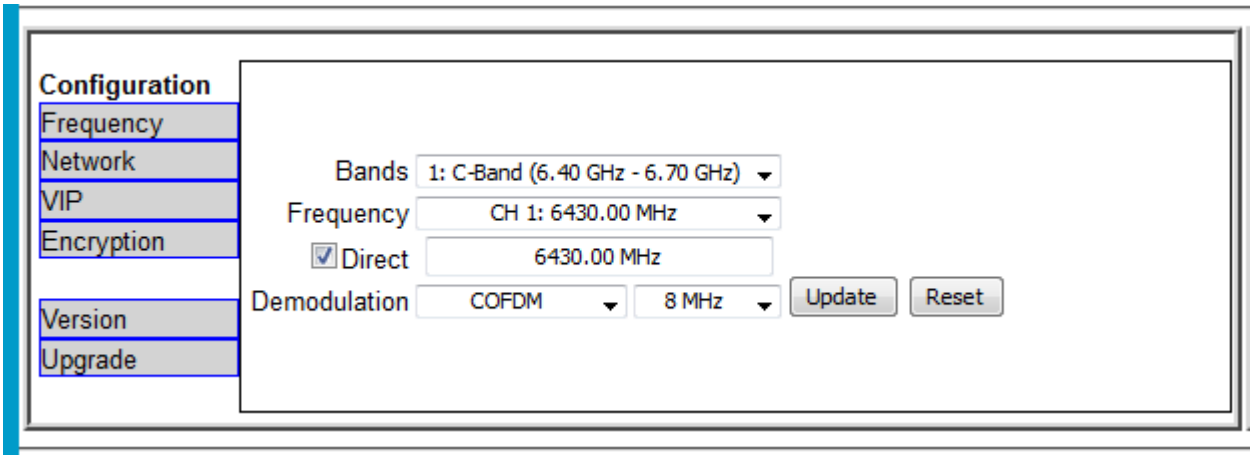


Figure 5-2: Real Time Control and Configuration Section

5.6.1 Frequency Control

Click on the 'Frequency' button to access the frequency controls as shown in **Figure 5-2.** To change to a pre-configured frequency:

1. Open the frequency drop down frequency menu.
2. Choose the channel and frequency desired.
3. Click on the 'Update' button for the change to take effect.

To enter a direct frequency:

1. Click on the 'Direct' check box.
2. Put the mouse in the direct frequency text box and change to the desired frequency. The frequency must be in the format as shown in **Figure 5-2,** and within the band of the CRX6.
3. Click on the 'Update' button for the change to take effect.
4. Verify the frequency change by checking the frequency status.

5.6.2 Network Controls

To change the network parameters, click the 'network' button. The default network parameters are shown in the figure below. It leaves the factory with a static IP address.

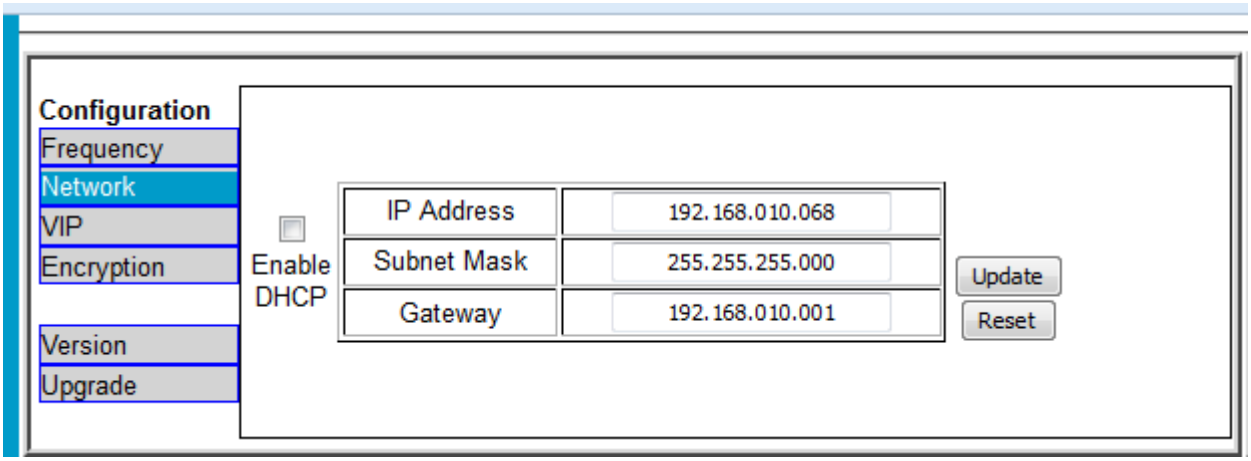


Figure 5-3: Network Controls

The IP Address or the Subnet may be changed by clicking into the appropriate text area. The full IP address must be entered, however the '.' does not need to be entered. Click the 'Update' button for the change to take effect.

Note: When the IP Address has been changed the Webpage will no longer respond to the CRX6. To re-access the Webpage – enter the new IP Address into the Browser.

Note: Do not enable the DHCP mode unless the CRX6 is part of a network system in which you can gain access to the given IP Address.

To enable the DHCP mode, click on the 'Enable DHCP' check box. Click the 'Update' button for the change to take effect. The Webpage will stop responding because the CRX6 has a new IP Address. To establish a new connection with the Webpage, retrieve the IP Address of the CRX6 given to it by the DHCP server and enter it into the browser.

5.6.3 Streaming Parameter Controls

The main output of the CRX6 is a Transport Stream. The Webpage may be used to control the parameters of the output stream. To access the streaming parameters, click on the 'VIP' button. The default from the factory is RTSP.

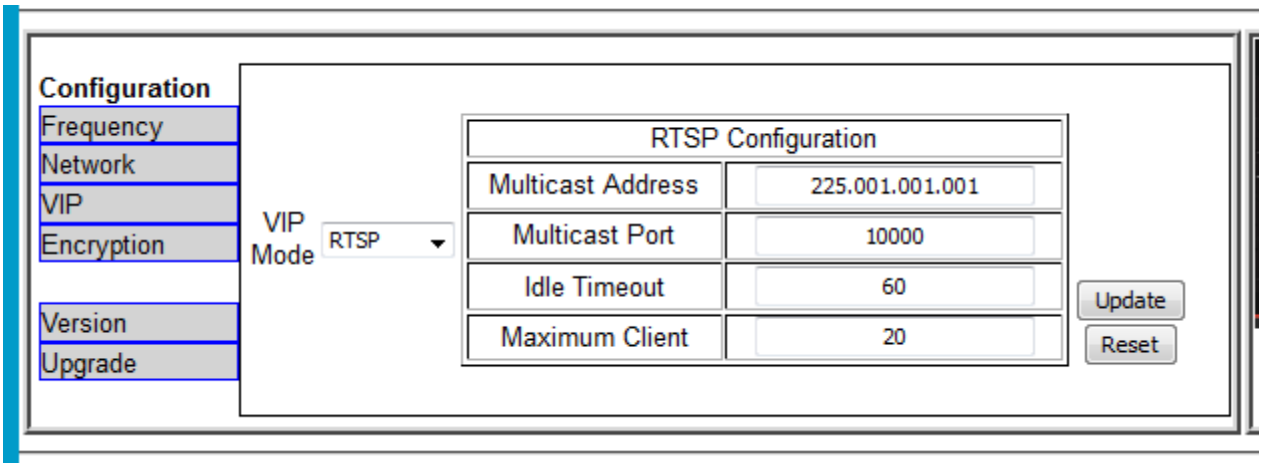


Figure 5-4: Streaming Video Over Internet Protocol Controls

5.6.3.1 Streaming Modes

There are three selections for streaming:

- **Off** - The unit does not stream in the "Off" mode. The RTSP service is disabled.
- **RTSP** - In the RTSP mode the video streaming is sent only as clients request it. This can occur via unicast (single client) or multicast (multiple client). NOTE: The RTSP server has a limitation of only supports a single streaming session. Therefor if multiple clients are desired multicasting must be setup.
- **Manual** - In the manual mode, streaming is always on. The stream is sent to a single client or multiple clients using a multicast destination address.

The below examples assumes the client PC has a single Ethernet adapter. If multiple Ethernet adapters are present within the system, please consult your Network Administration for setup as this may vary depending on your default interface.

5.6.3.2 RTSP Streaming Modes

There are four supported streaming modes from the RTSP server:

- Unicast, RTP
- Unicast, UDP
- Multicast, RTP
- Multicast, UDP

When the RTSP server is enabled, the streaming encapsulation (RTP/UDP) is requested by the client. For multicasting in RTSP mode, the multicasting address and port must be configured.

5.6.3.3 RTSP Mode Set-up

1. Set to RTSP mode by using the 'VIP Mode' drop down menu.
2. If multicasting is utilized, enter the multicast address and port. If unicast is to be used the multicasting address and port can be ignored.
3. The Idle Session Timeout is the maximum time between RTSP keep alive signals. If the RTSP client stops sending keep alive signals the server will reset after 60 sec (default).
4. The Max Number Clients is the maximum number of client decoders supported in a multicast environment. The default is 20. Note this does not apply to RTSP clients where the maximum is one.
5. Click on the 'Update' button for the changes to take effect.

5.6.4 Encryption Configuration

5.6.4.1 Enabling and setting keys.

1) Select 'Mode'

- Disable – setting for no encryption
- Enable – Setting for Keys 1-5

2) Select 'Key'

- Chose Keys 1-5
- Chose 'Auto' - This will auto detect the encryption key from the transmitter. The 'Auto' encryption will only work if the 'Mode' is enabled.

3) Press 'Update' to take effect.

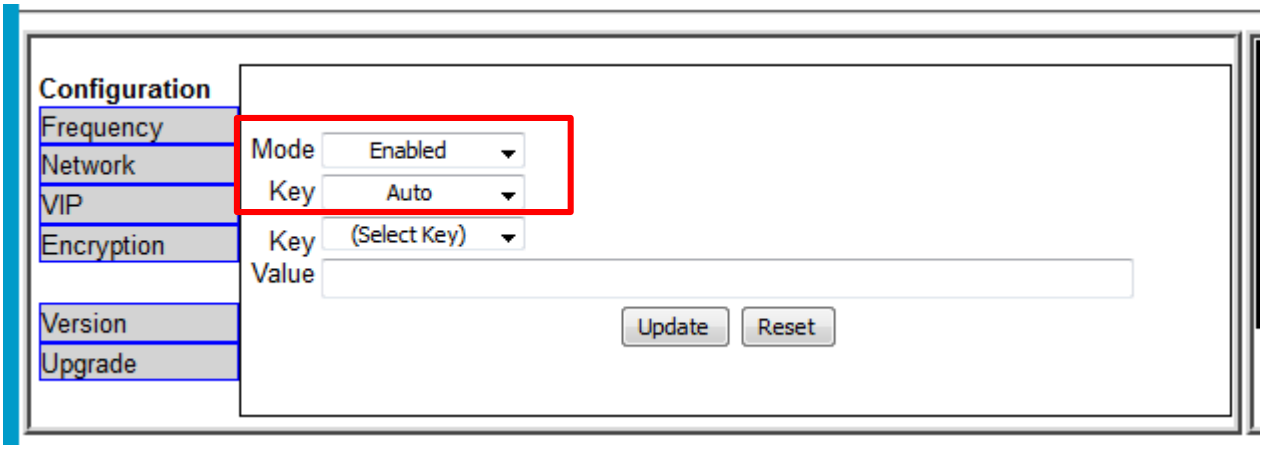


Figure 5-5: Encryption Key Settings

5.6.4.2 Changing the Encryption Key Value

1) Enter the key you wish to change the value with the 'Key Value' '(Select Key)' drop down menu. Chose 1-5.
2) Enter the 128bit or 256bit key into text box. Only hexadecimal numbers may be added (0,1,2,3,4,5,6,7,8,9,0,a,b,c,d,e,f)
3) Press the 'Update' button to take effect.

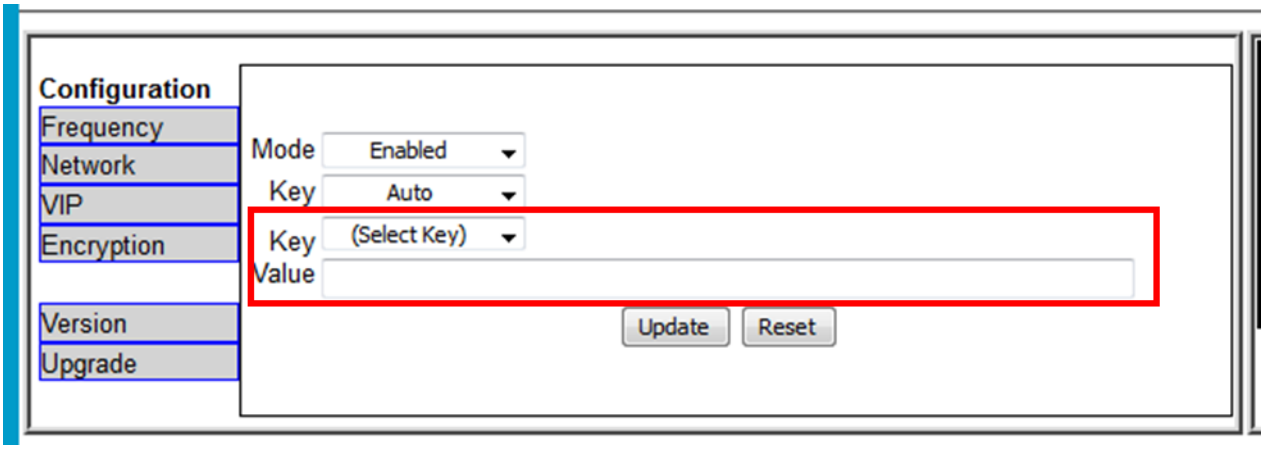


Figure 5-6: Encryption Key Value Entry

5.6.5 Product Version Page

Click on the 'Version' button to access the extended product information page. The product information includes:

- Unit serial number
- MAC address
- Licensed Options
- Software version and build
- Hardware

5.6.6 Upgrading Software and Configuration Files

5.6.6.1 Upgrading Software

Software upgrade may be facilitated using the Webpage. To upgrade the software, follow the steps below:

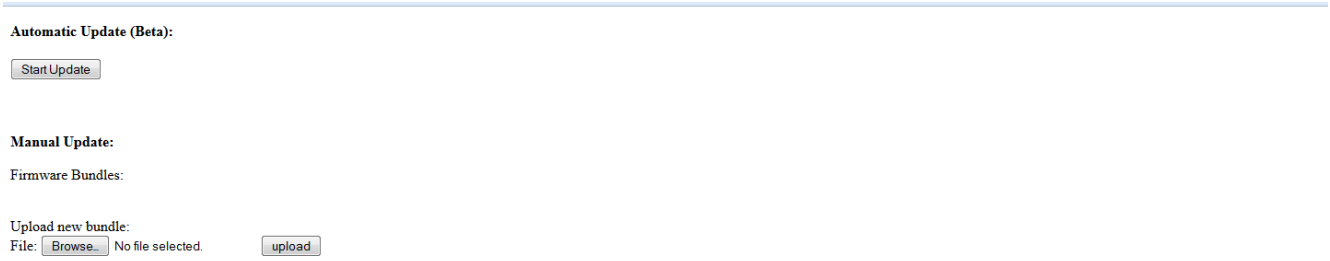


Figure 5-7: Software Update Page

5. Obtain copy of the new software from IMT and place the file in a known location on the server. The name of the file for the CRX6 will always be A01-D096-09Ax.x.tgz, with Ax.x being the version number.
6. Click the 'Upgrade' button to take you to the upgrade page.
7. Click on the 'Browse…' button to select the new software file.
8. Once the file is selected an 'Open' prompt is shown. Click on the prompt.
9. Once software bundle is extracted and checked, the 'Install' button will be displayed. Click on the 'Install' button. Software will upload into unit.
10. When software has finished loading reboot the CRX6. All configured setting will remain in the unit

Below are the screen shots of each step:

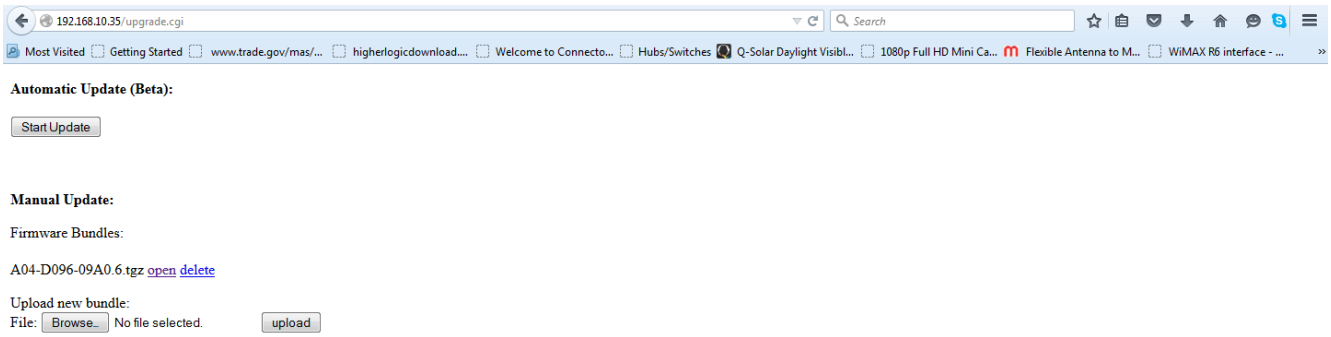
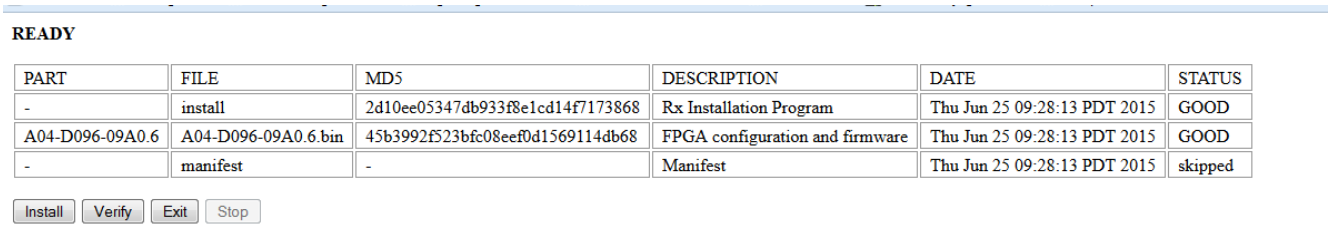


Figure 5-8: Software Bundle Loaded

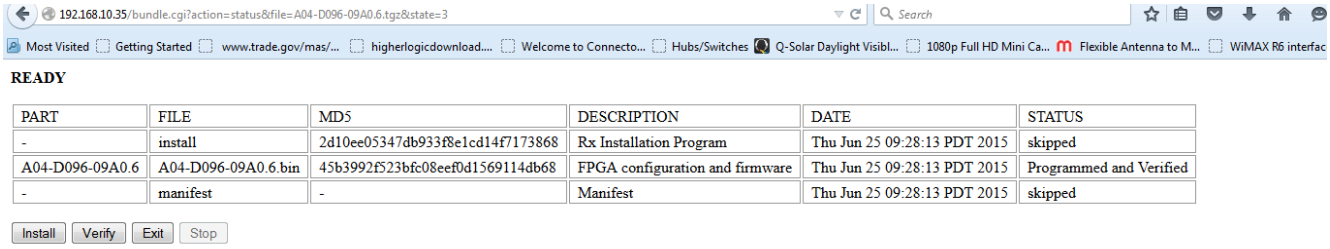


READY

PART	FILE	MD5	DESCRIPTION	DATE	STATUS
-	install	2d10ee05347db933f8e1cd14f7173868	Rx Installation Program	Thu Jun 25 09:28:13 PDT 2015	GOOD
A04-D096-09A0.6	A04-D096-09A0.6.bin	45b3992f523bfc08eef0d1569114db68	FPGA configuration and firmware	Thu Jun 25 09:28:13 PDT 2015	GOOD
-	manifest	-	Manifest	Thu Jun 25 09:28:13 PDT 2015	skipped

Install Verify Exit Stop

Figure 5-9: Software Bundle Extracted and Checked



READY

PART	FILE	MD5	DESCRIPTION	DATE	STATUS
-	install	2d10ee05347db933f8e1cd14f7173868	Rx Installation Program	Thu Jun 25 09:28:13 PDT 2015	skipped
A04-D096-09A0.6	A04-D096-09A0.6.bin	45b3992f523bfc08eef0d1569114db68	FPGA configuration and firmware	Thu Jun 25 09:28:13 PDT 2015	Programmed and Verified
-	manifest	-	Manifest	Thu Jun 25 09:28:13 PDT 2015	skipped

Install Verify Exit Stop

Figure 5-10: Software Load Complete

5.6.6.2 Upgrading Configuration Files

Software upgrade may be facilitated using the Webpage. To upgrade the software, follow the steps below:

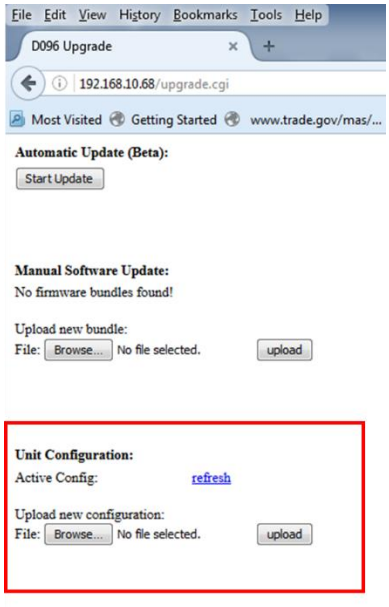


Figure 5-11: Updating Configuration files

1) Obtain copy of the new configuration files from IMT and place the file in a known location on the server. The name of the file for the CRX6or CIRAS will always be config<xxx>.imt, were <xxx> may be the name.
2) Click the 'Upgrade' button to take you to the upgrade page.
3) Click on the 'Browse…' button to select the new file.
4) Once the file is selected an 'Open' prompt is shown. Click on the prompt.
5) Once bundle is uploaded, press 'Apply'. The new files are installed.

5.6.6.3 Extracting configuration files

The configure files may be extracted for evaluation. On the configuration load section, press the red 'refresh' to extract them from the unit. Save, and send to IMT customer service for evaluation.

5.7 Monitor Decoder Section of the Webpage

The Webpage features an integrated VLC decoder. The first time connecting to the Webpage, the VLC plugin may need to be installed. Click on the prompt to install. This will have to be done every time a new IP Address is used.

To start decoding the receiver (at least one antenna) must be locked to the transmitter. Press the play button. Video will start to decode. Use the 'Stop', 'Play' and 'Mute' buttons to control the decode.

5.8 Status Section of the Webpage

The status section contains real time information of the CRX6 both in analytical numbers and in graphs. The overall status and individual antennas are shown.

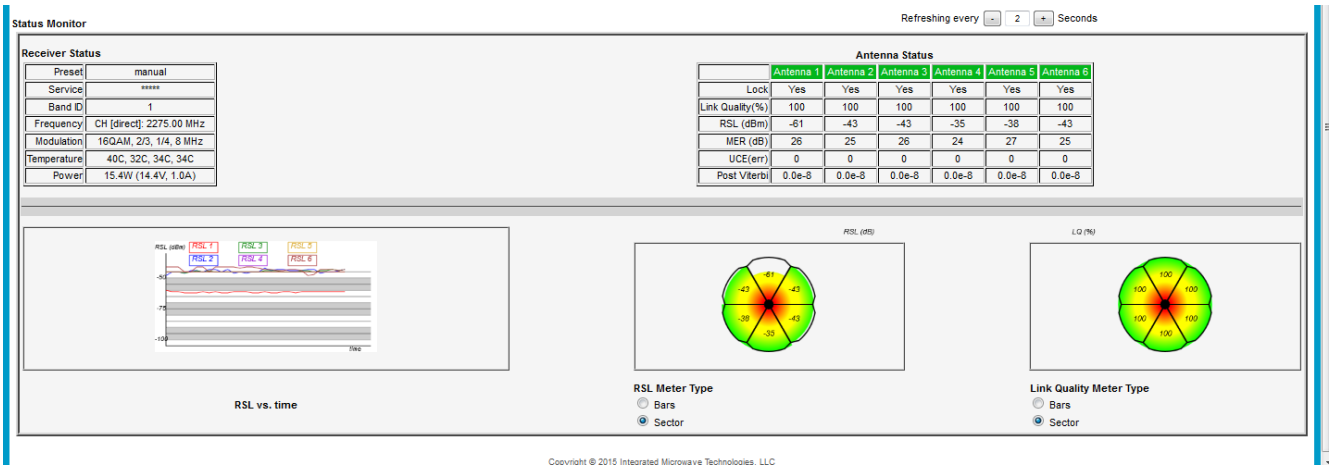


Figure 5-12: Webpage CRX6 Status Section

There are 5 main displays in the Status Monitor section:

1. Receiver Status contain the following:
    - Service Name
    - Frequency
    - Modulation
    - Unit temperature – main board and each RF board
    - Power Consumption
2. Antenna 1-6 Status. Green fill in the antenna section header indicates the antenna is locked, while red indicates unlocked. Each antennas' parameters are measured and displayed. This includes the following:
    - Lock
    - Link Quality Metric
    - Receive Signal Level (RSL) in dBm
    - MER in dBm
    - Uncorrected Errors
    - Post Viterbi Error in scientific notation
3. A colored chart of RSL vs Time
4. A RSL Meter – this may be displayed as bars or sectors. If it is displayed as sectors, the 12 o'clock position is antenna 1, and the sectors rotate in a clock-wise manner. The graph is color coded as:
    - Red – Low signal level
    - Yellow/Orange – Good signal level
    - Green – Great signal level
5. A Link Quality Meter in percentage. The link quality meter works the same as the RSL meter.

5.9 Streaming Video to VLC or Decoder

Note: VLC is the example decoder used in the below examples. Other decoders or video management systems may vary from these instructions.

The CRX6 has the ability to stream live video via the Ethernet connector using User Datagram Protocol (UDP) or RTP/PTSP for the Video over Internet Protocol function. The CRX6 has the ability to stream manually to a device or unicast/multicast over a network. To activate the Video over Internet Protocol, open the Webpage Configuration Section and click on the 'VIP' button. The menu screen will access the streaming menu as shown in **Figure 5-13: Streaming Video Menu**.

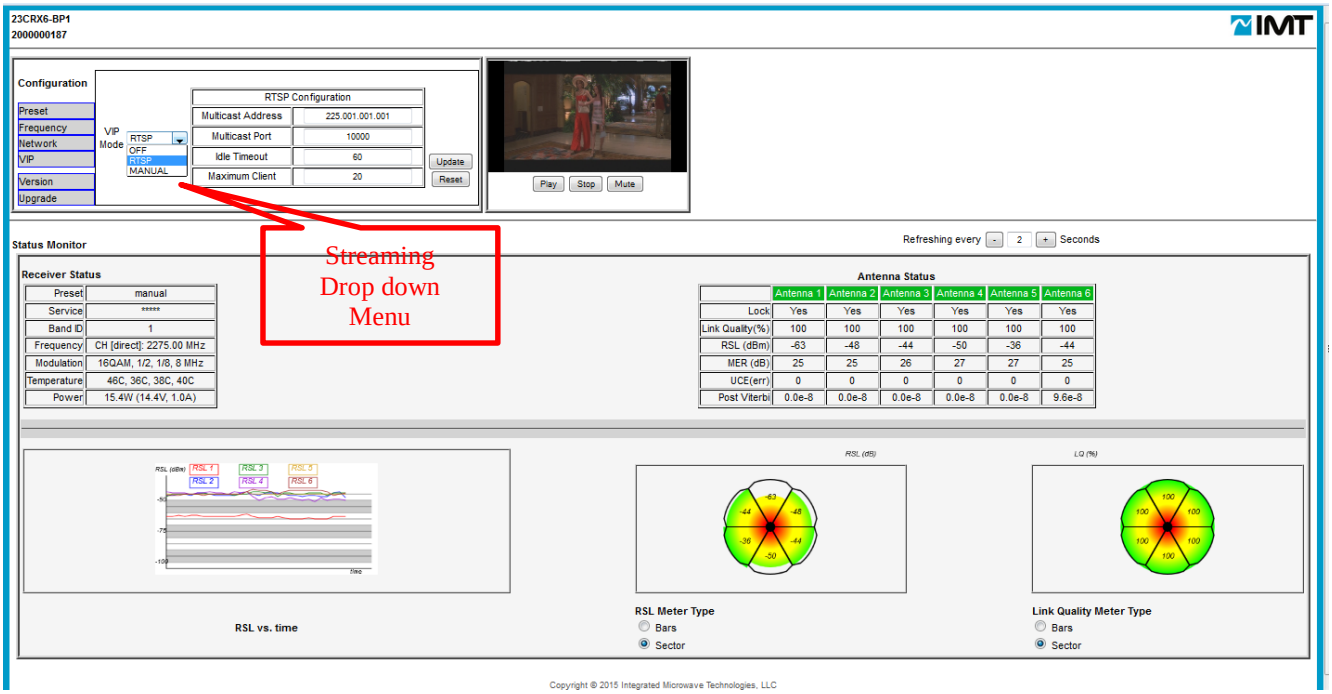


Figure 5-13: Streaming Video Menu

5.9.1 Manual Streaming RTP

5.9.1.1 RTP Unicast

This mode will stream the data packets encapsulated by an RTP header to a single client only. The default network URL for this method is rtp://@:<*Destination Stream Port*>. To configure VLC to request a stream, the following is an example URL: rtp://@:1234, where 1234 is the destination port.

1. Open up VIP menu and using the 'VIP Mode' drop down menu, press the 'MANUAL' option. The 'Manual Streaming Configuration' menu will be accessed as shown in **Figure 5-14.**
2. Choose RTP-TS from the 'Encapsulation' drop down menu.
3. Enter the IP address of the device you wish to stream to in the 'Stream Destination Address' text box.
4. Enter the destination port into the unit. Default is 1234. If you are streaming more than one CRX6 channel to the same device you must use a different destination port (i.e., 1235)
5. Click on the 'Update' button for change to take effect.
6. Open VLC and access the 'Open Network Stream' from the 'Media' drop down menu.
7. Set up your stream device with rtp://@:1234. The video will start to stream to your device.

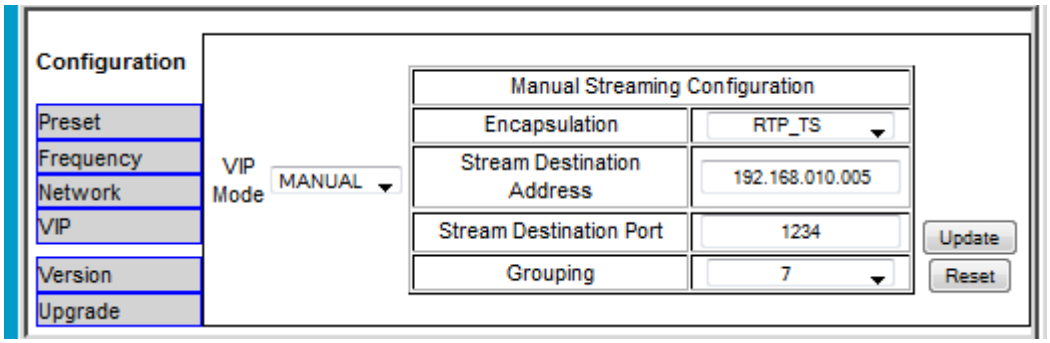


Figure 5-14: Manual Streaming Configuration

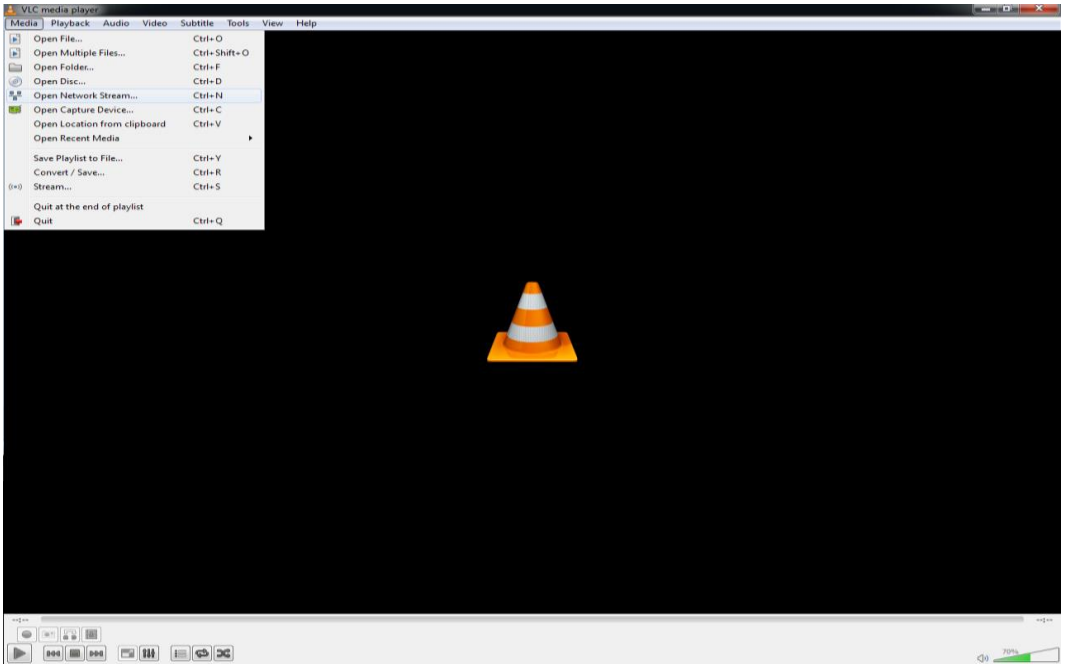


Figure 5-15:: VLC Media Menu

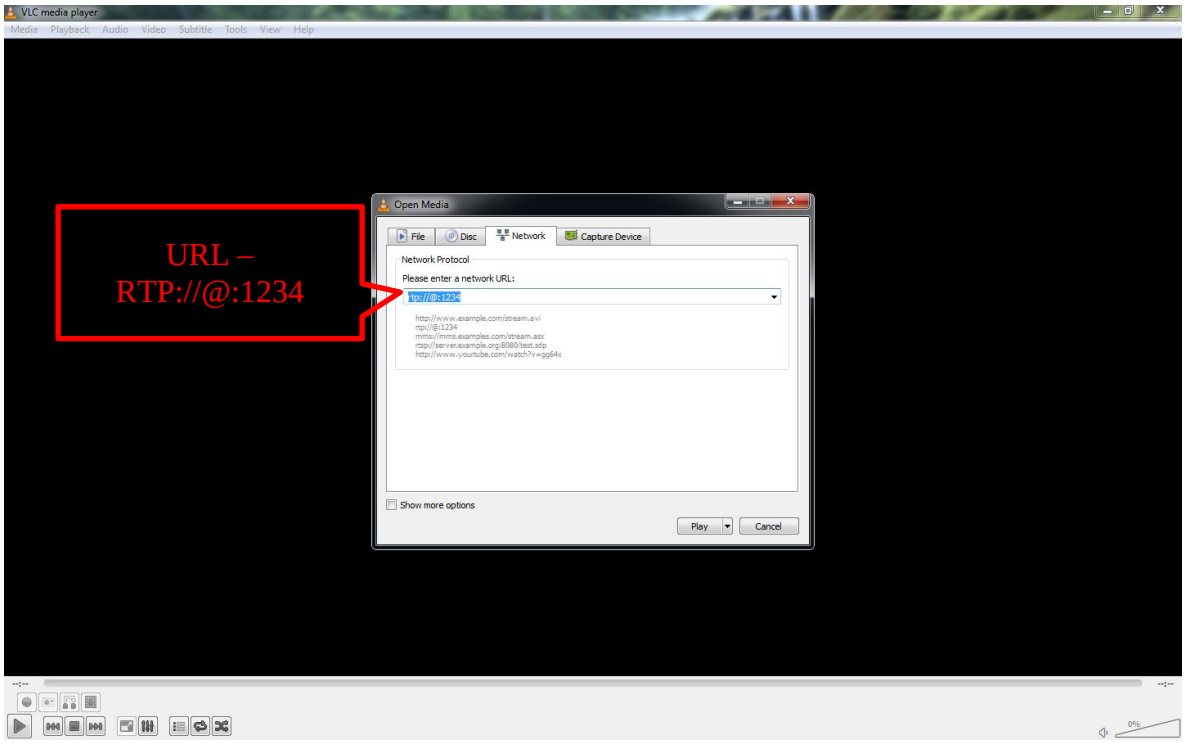


Figure 5-16: VLC RTP Unicast URL Example

5.9.1.2 RTP Multicast

This method will stream the data packets with the RTP header to multiple clients. The default network URL for this method is rtp://<multicast address>:<destination port>. To configure VLC or to request a stream, the following is an example URL: rtp://255.1.1.1:1234, where 255.1.1.1 is the multicast address and 1234 is the port. The receiver will stream to the multicast address configured in the setup. In the example this will be: 225.1.1.1.

1. Open up VIP menu and using the 'VIP Mode' drop down press the 'MANUAL' option. The 'Manual Streaming Configuration' menu will be accessed as shown in **Figure 5-14.**
2. Choose RTP-TS from the 'Encapsulation' drop down menu.
3. Enter a multicast address in the 'Stream Destination Address' text box. The multicast address or group range is 224.0.0.0 to 239.255.255.255.
4. Enter the destination port into the unit. Default is 1234. If you are streaming more than one CRX6 channel to the same device you must use a different destination port (i.e., 1235)
5. Click on the 'Update' button for change to take effect.
6. Open VLC and access the 'Open Network Stream' from the 'Media' drop down menu.
7. Set up your stream device with rtp://<multicast address>:<destination port>. The video will start to stream to your device.

5.9.2 Manual Streaming UDP

5.9.2.1 Unicast, UDP

This mode will stream the data packets without a RTP header up to a single client. The default network URL for this method is udp://@:<*Destination Stream Port*>. To configure VLC to request a stream, the following is an example URL: udp://@:1234, where 1234 is the destination port.

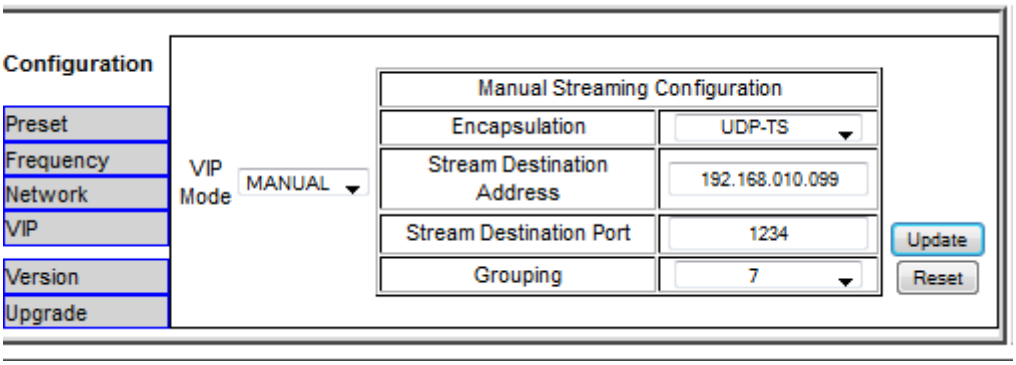


Figure 5-17: Manual Streaming UDP Menu

1. Open up VIP menu and using the 'VIP Mode' drop down press the 'MANUAL' option. The 'Manual Streaming Configuration' menu will be accessed as shown in **Figure 5-14.**
2. Choose UDP-TS from the 'Encapsulation' drop down menu.
3. Enter the IP address of the device you wish to stream to in the 'Stream Destination Address' text box.
4. Enter the destination port into the unit. Default is 1234. If you are streaming more than one CRX6 channel to the same device you must use a different destination port (i.e., 1235)
5. Click on the 'Update' button for change to take effect.
6. Open VLC and access the 'Open Network Stream' from the 'Media' drop down menu.
7. Set up your stream device with udp://@:1234. The video will start to stream to your device.

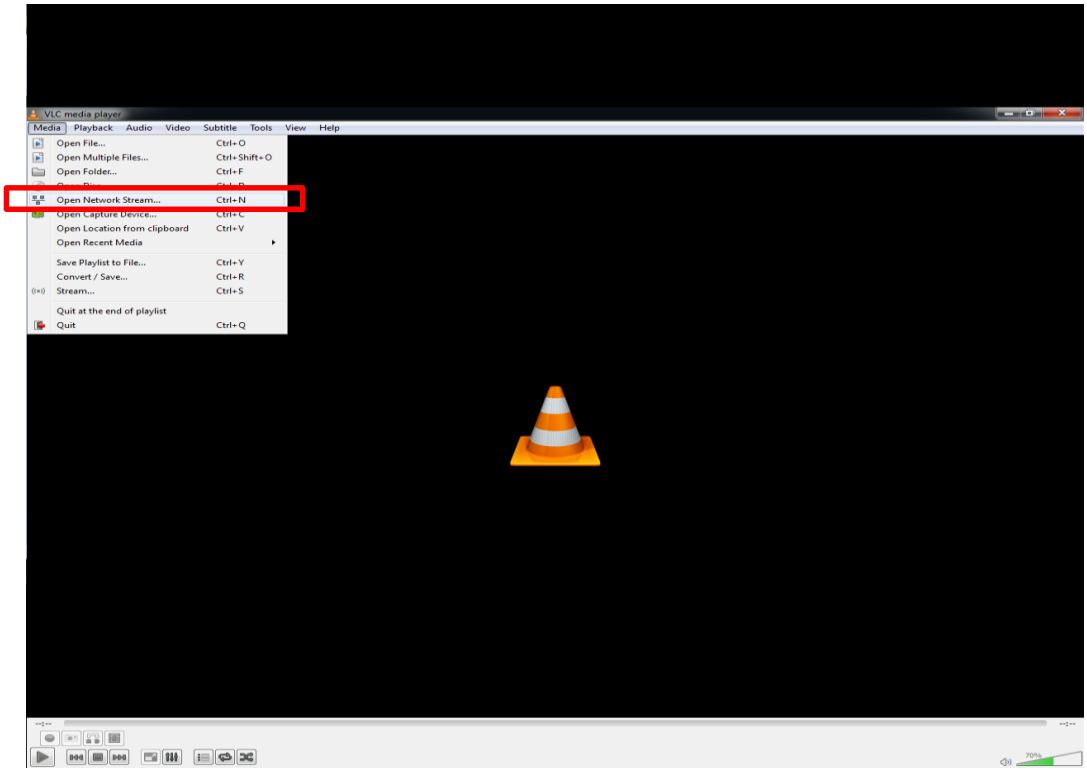


Figure 5-18: VLC Network Stream Menu

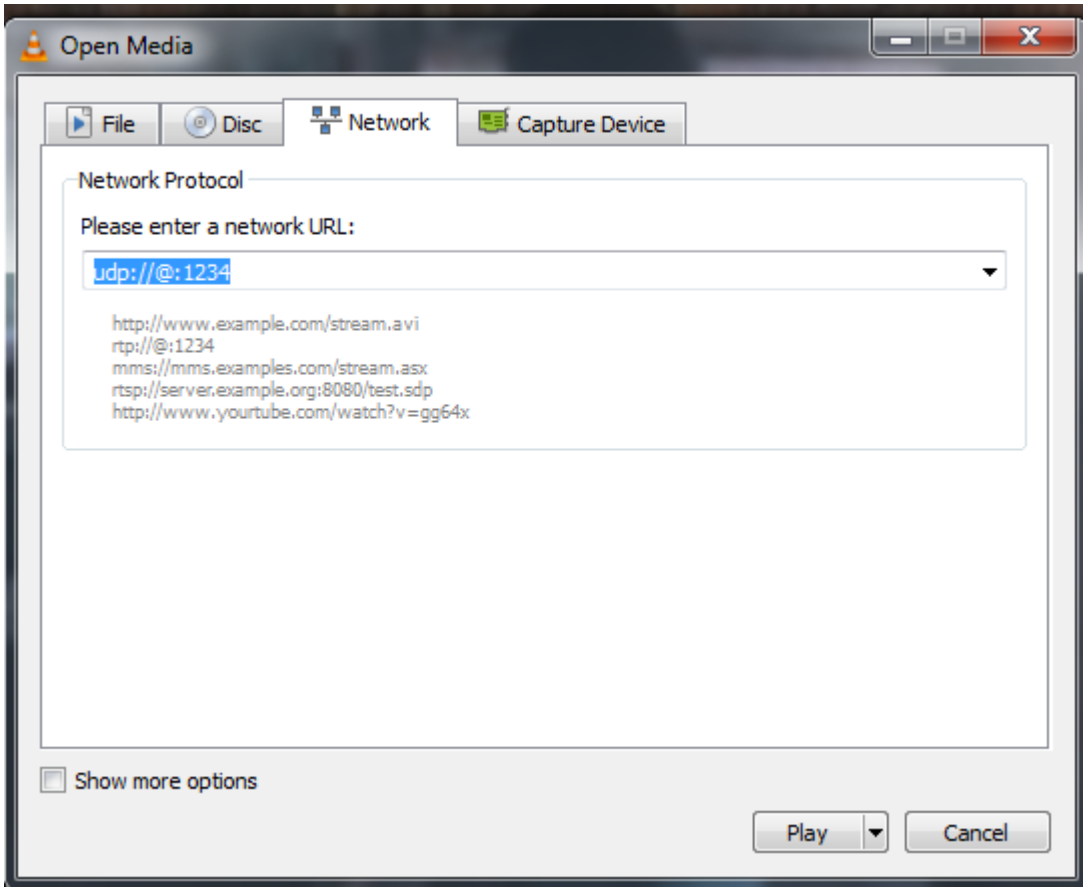


Figure 5-19: Streaming – Enter Network URL for UDP

5.9.2.2 Multicast, UDP

This method will stream the data packets without the RTP header to multiple clients. The default network URL for this method is udp://<multicast address>:<destination port>. To configure VLC or to request a stream, the following is an example URL: udp://255.1.1.1:1234, where 255.1.1.1 is the multicast address and 1234 is the port. The receiver will stream to the multicast address configured in the setup. In the example this will be: 225.1.1.1.

1. Open up VIP menu and using the 'VIP Mode' drop down press the 'MANUAL' option. The 'Manual Streaming Configuration' menu will be accessed as shown in **Figure 5-14.**
2. Choose UDP-TS from the 'Encapsulation' drop down menu.
3. Enter a multicast address in the 'Stream Destination Address' text box. The multicast address or group range is 224.0.0.0 to 239.255.255.255.
4. Enter the destination port into the unit. Default is 1234. If you are streaming more than one CRX6 channel to the same device you must use a different destination port (i.e., 1235)
5. Click on the 'Update' button for change to take effect.
6. Open VLC and access the 'Open Network Stream' from the 'Media' drop down menu.
7. Set up your stream device with udp://<multicast address>:<destination port>. The video will start to stream to your device.

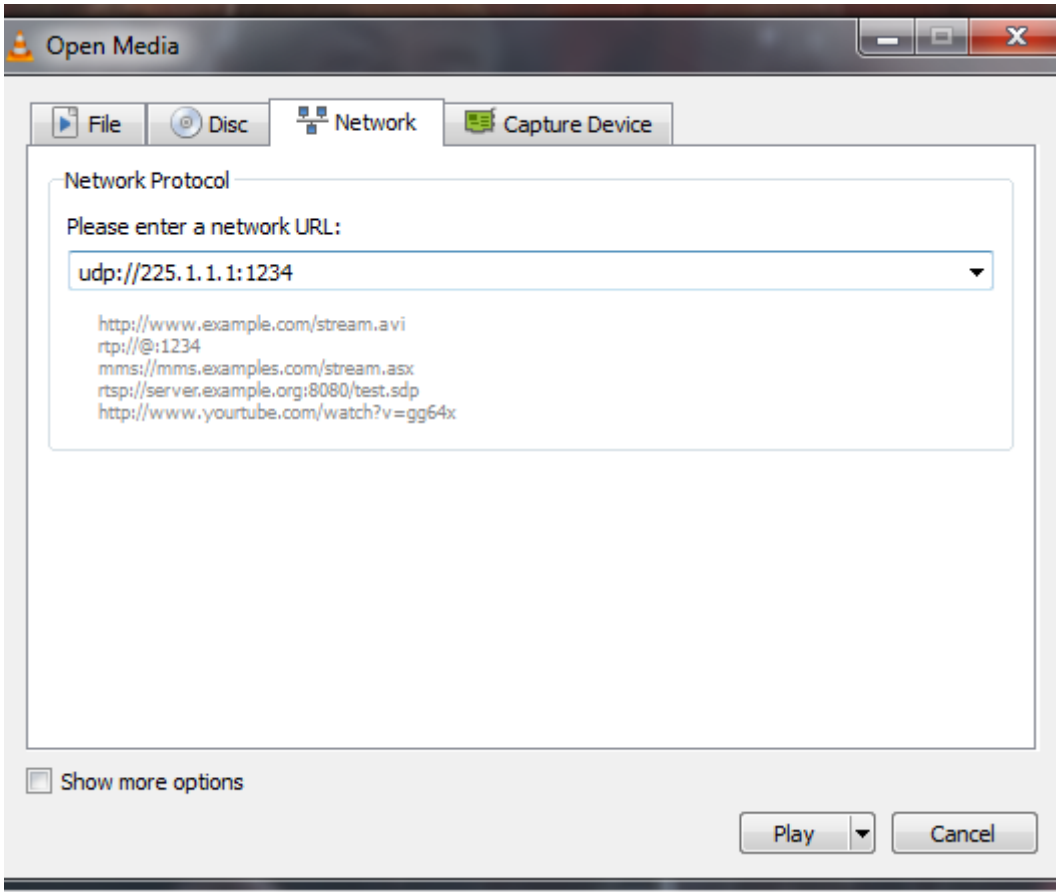


Figure 5-20: UDP Manual Multicast URL for VLC

5.9.3 RTSP Streaming

5.9.3.1 RTSP Streaming Modes

There are four supported streaming modes from the RTSP server.

- Unicast, RTP
- Unicast, UDP
- Multicast, RTP
- Multicast, UDP

When the RTSP server is enabled, the streaming encapsulation (RTP/UDP) is requested by the client. For multicasting in RTSP mode the multicasting address and port must be configured.

5.9.3.2 RTSP Mode Set-up

1. Set to RTSP mode by using the 'VIP Mode' drop down menu.

2. If multicasting is utilized, enter the multicast address and port. If unicast is to be used the multicasting address and port can be ignored. The default multicast address (group) from the factory is 225.1.1.1. The multicast range is 224.0.0.0 to 239.255.255.255.
3. The *Idle Session Timeout* is the maximum time between RTSP keep alive signals. If the RTSP client stops sending keep alive signals the server will reset after 60 sec (default).
4. The *Max Number Clients* is the maximum number of client decoders supported in a multicast environment. The default is 20. Note this does not apply to RTSP clients where the maximum is one.
5. Click on the 'Update' button for the changes to take effect.

5.9.3.3 Unicast, RTP

This mode will stream the data packets encapsulated by an RTP header to a single client only. The default network URL for this method is rtsp://<device ip address>. To configure VLC to request a stream, the following is an example URL: rtsp://192.168.10.35, where 192.168.10.35 is the IP address of the CRX6.

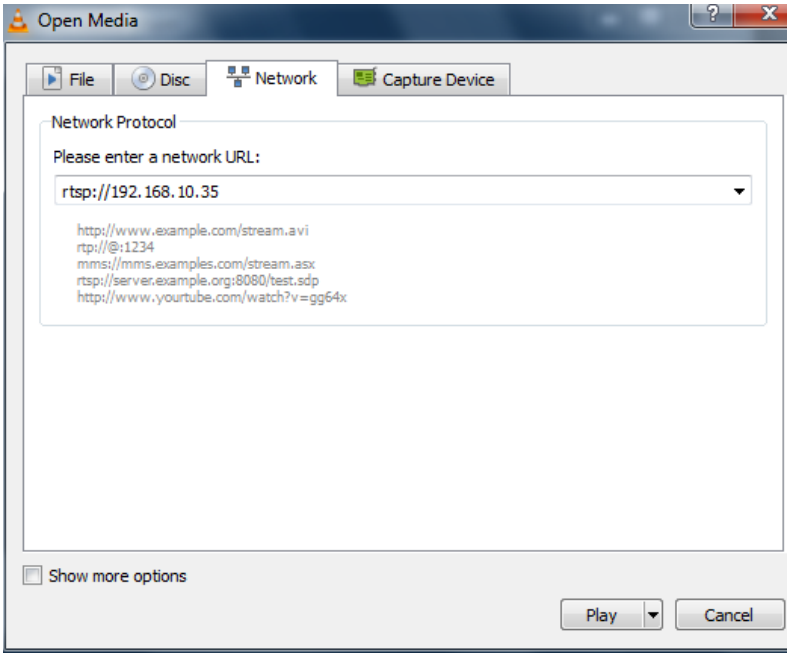


Figure 5-21: VLC configuration RTSP, RTP

5.9.3.4 Unicast, UDP

This method will stream the data packets without the RTP header to a single client. The default network URL for this method is rtsp://<device ip address>/unicast/udp. To configure VLC to request a stream, the following is an example URL: rtsp://192.168.10.35/unicast/udp, where 192.168.10.35 is the IP address of the microwave receiver.

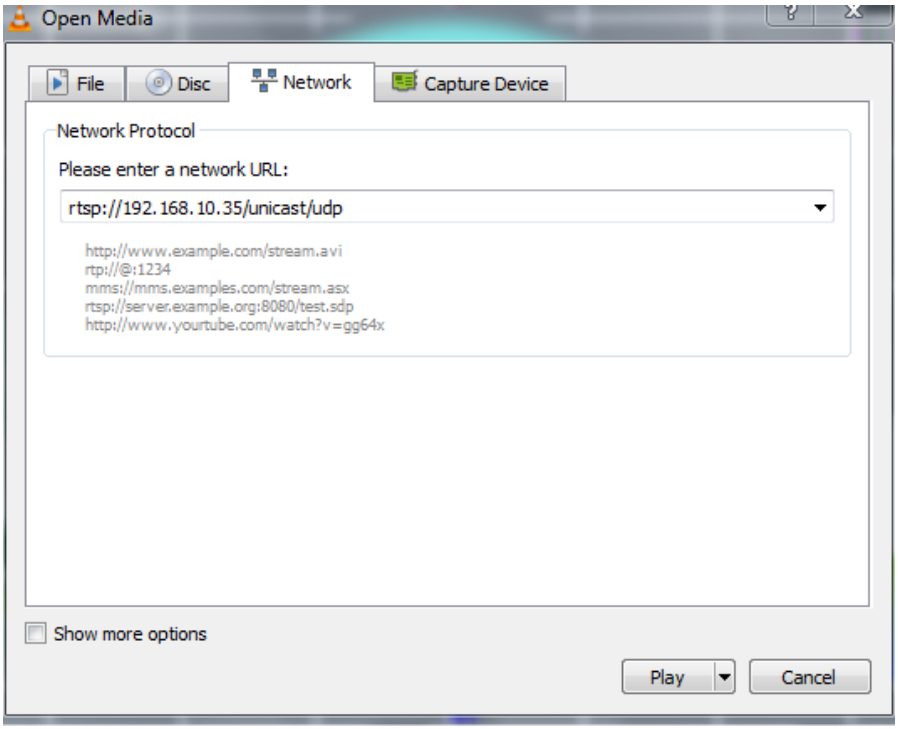


Figure 5-22: VLC configuration RTSP, UDP

5.9.3.5 Multicast, RTP

This method will stream the data packets with the RTP header to multiple clients. The default network URL for this method is rtsp://<device ip address>/multicast. To configure VLC to request a stream, the following is an example URL: rtsp://192.168.10.35/multicast, where 192.168.10.35 is the IP address of the microwave receiver. The receiver will stream to the multicast address configured in the setup. In the example this will be: 225.1.1.1.

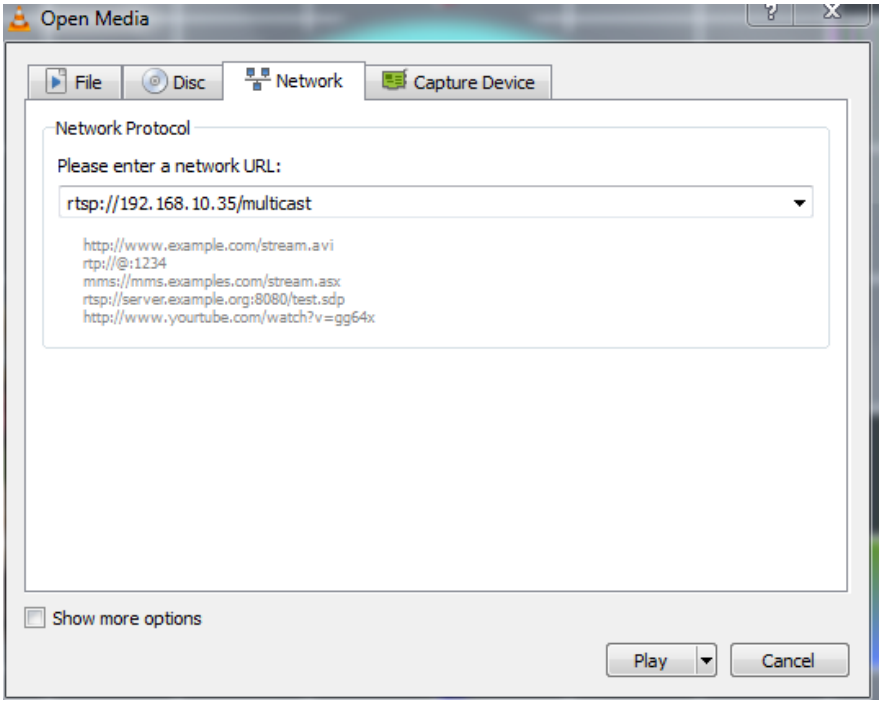


Figure 5-23: VLC configuration RTSP Multicast, RTP

5.9.3.6 Multicast, UDP

This method will stream the data packets without the RTP header to multiple clients. The default network URL for this method is rtsp://<device ip address>/multicast/udp. To configure VLC to request a stream, the following is an example URL: rtsp://192.168.10.35/multicast/udp, where 192.168.10.35 is the IP address of the microwave receiver. The receiver will stream to the multicast address configured in the setup. In the example this will be: 225.1.1.1.

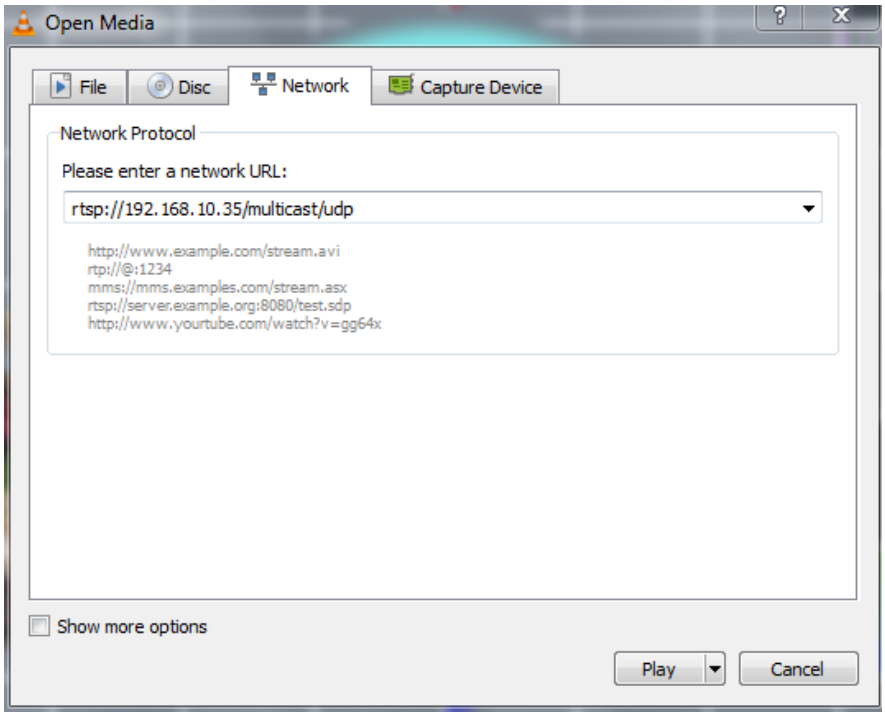


Figure 5-24: VLC configuration RTSP Multicast, UDP

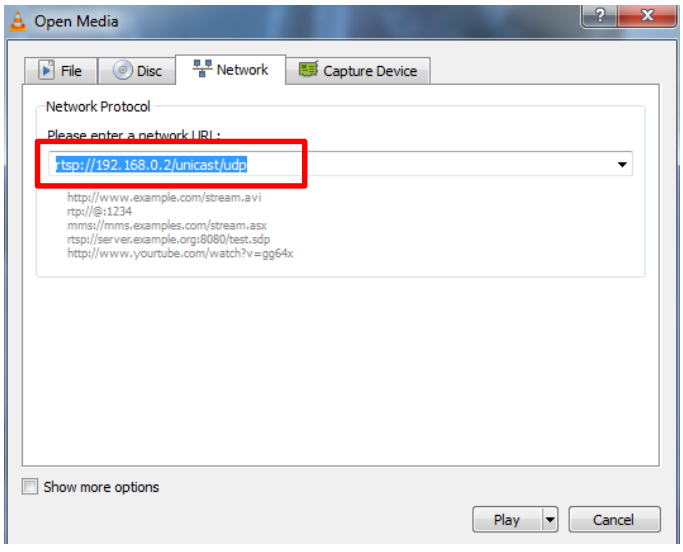


Figure 5-25: VLC URL for Unicast UDP Streaming

5.9.4 DHCP Mode when streaming

If on a network, you may use DHCP address instead of static IP address. Once the DHCP server of the network has assigned an address, look at the assigned address of MMCR has and use the same way you used the static address for streaming. All networks may not have the ability to multicast, check with your IT support team.

5.10 Retrieving User Data, Telemetry Information, TX GPS and Local GPS Data from the CRX6

5.10.1 Retrieving Transmitter User Data

All of IMT's Transmitters have the ability to send user data. The SkyMaster TX features the ability to send GPS data over 'User Data'. The user data is de-multiplexed from the transport stream and sent as a User Datagram Protocol or Transmission Control Protocol over IP. To retrieve the 'User Data', chose the protocol in which to use, and set with the NanoController software. If using UDP set the destination address and port using the NanoController Software. If using TCP/IP the port is 49993.

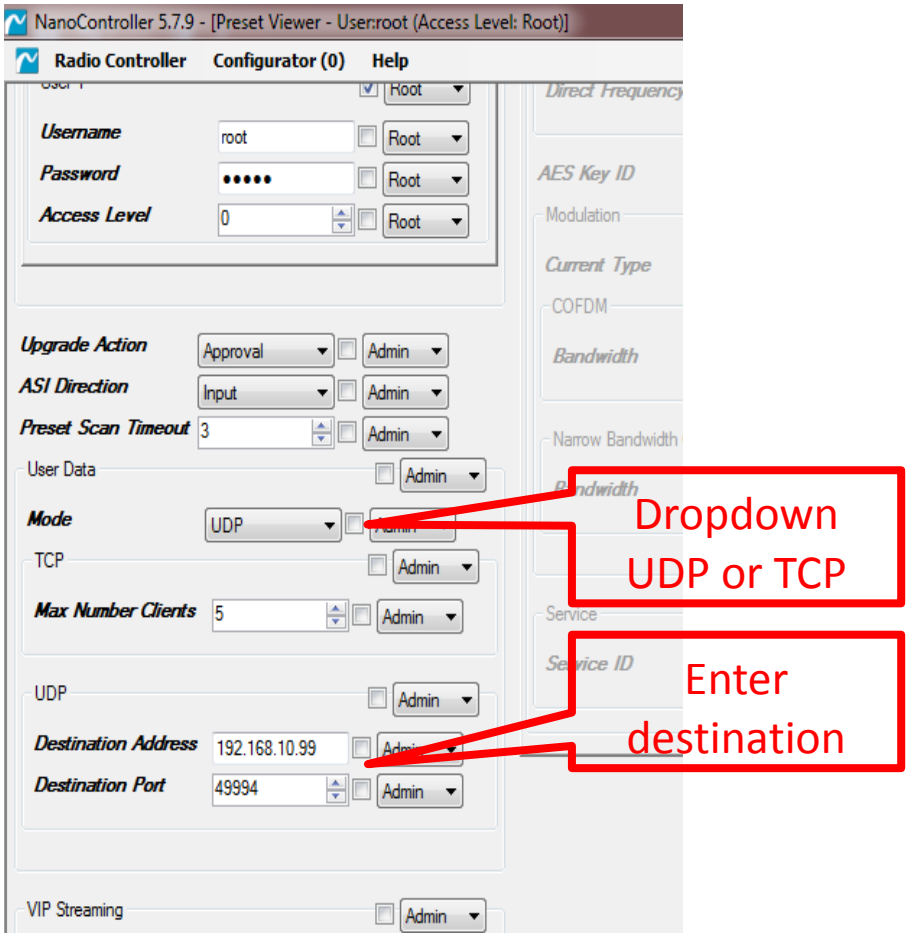


Figure 5-26: Setting User Data Output Protocol

5.10.2 Retrieving Transmitter GPS Information

The GPS information is de-multiplexed from the transport stream and sent via UDP or TCP/IP. Set up the GPS information using the NanoController, Preset Files, GPS section. 'Tab 1' is reserved for the Receiver GPS while 'Tab 2' is reserved for the transmitter GPS. To set the GPS settings, download the preset configuration files as shown in section 5.11.

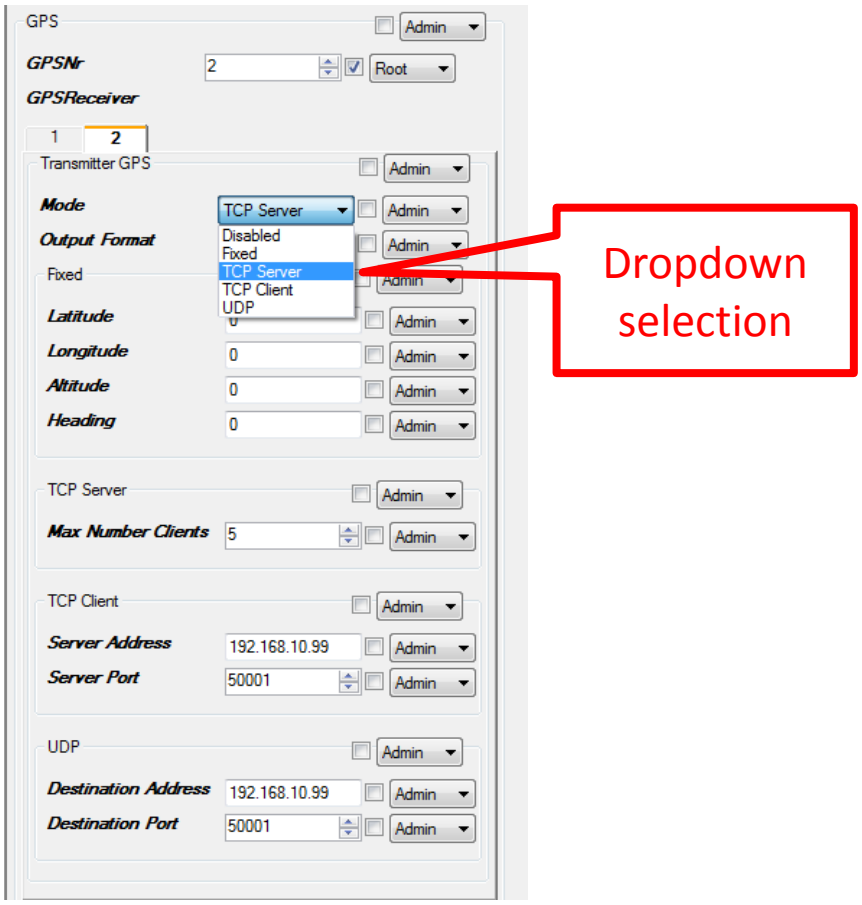


Figure 5-27: Transmitter GPS Data Output Selection

5.10.2.1 Transmitter Data Output Selection

There are 5 selections for the output GPS data.

6) Disable – No output data
7) Fixed – May enter fixed coordinates to be used as a separate application or the CRX6 internal webpage mapping.
8) TCP Server – acts as a TCP server.
9) TCP Client – acts as a TCP client
10) UDP – send UDP/IP

When using it is recommended using as TCP Server or UDP. Set the destination address and port if using in UDP. The default port is 50001. As 'TCP Server' the TCP/IP address is <IP Address of the Unit>/<port>. The port is 50001.

The GPS data is in compliance with NMEA standards.

5.11 Using the NanoController

The NanoController is a PC application control and configuration for the CRX6. It contains three basic elements:

- Real time status and controller
- Frequency plan editor
- Preset plan editor

5.11.1 Installing NanoController

The NanoController software is shipped with the unit on an USB flash drive. Simply plug the USB flash drive, open the drive and double click on "NanoControllerInstaller.X.X.msi". The installation wizard will guide you through the process and place the *NanoController* icon on the desktop.

5.11.2 Starting NanoController

On the PC, choose "IMT Software" in the Start > IMT software folder or double click on the *NanoController* icon on the desktop to open the "*IMT NanoController*" Remote Control PC GUI software. The NanoController Icon is placed on the desktop upon installation. Upon opening, the main window is displayed. The main window as shown below includes three menus:

- **Radio Controller** Used to select which type of product you wish to control.
- **Configurator** Used to edit Preset programming windows.
- **Help** Displays the GUI version.

Figure 5-28: GUI main window

5.11.3 Connecting to the Unit

Connect the receiver Ethernet output to the computer. The computer IP address has to be on the same subnet as the CRX6. The default unit CRX6 IP address is ***192.168.010.035***. When you pick the Ethernet COM, the NanoController will automatically find the receiver.

5.11.4 Radio Controller connection

Open the drop down port menu window as shown in **Figure 5-29**. Select the port needed to connect to the device. Select the Network port.

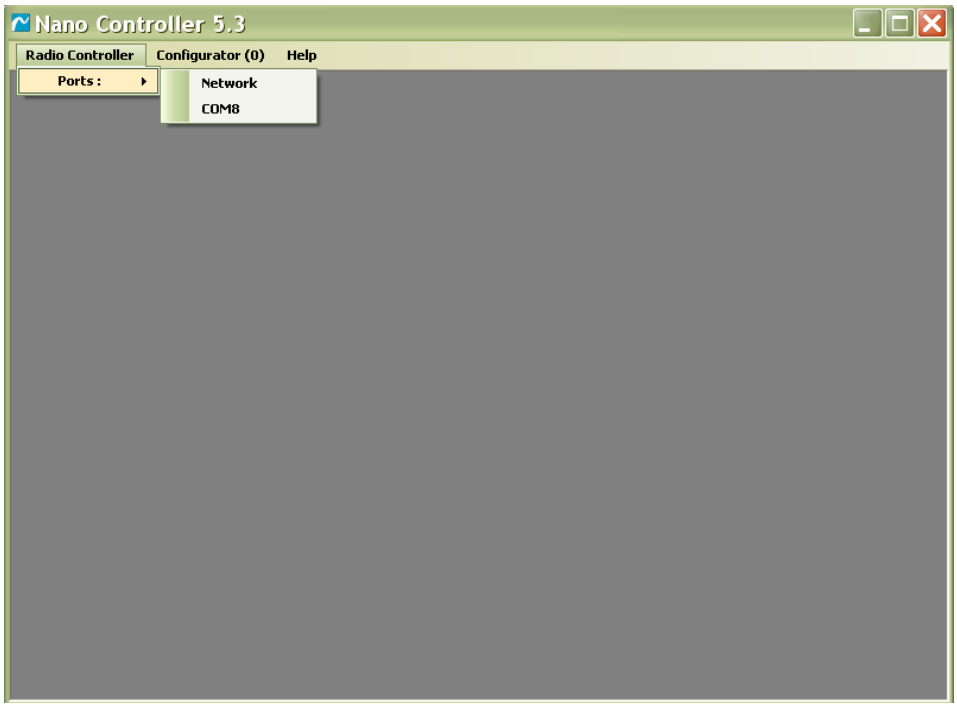


Figure 5-29: NanoController COM menu

5.11.5 Start Search Menu

Selecting the Network will bring up the Start Search menu. Ensure that the IP address is correct, and if not change it to the correct address. Enter the Username and Password. The CRX6 includes two levels of access:

- User
  - Username – 'user'
  - Password – 'user'
- Administration
  - Username – 'admin'
  - Password – 'admin'

The 'User' access level features a full real time status display but limited real time control and configuration access. The Administration access level gives the user full control and configuration privileges. The administration mode also features the ability to change the privileges of the 'User' mode.

Check the Store this setting and/or Keep Config in Sync if desired from the menu window. Refer to **Figure 5-30**.

- **Keep Config. in Sync** check box will automatically download the preset and frequency plan files. This is only necessary if you wish to reconfigure the presets or the frequency plan.
- **Store this setting** button will populate this menu the same way every time you boot up the NanoController until the inputs are manually changed.

Click "Search" and the program will automatically detect the connected unit and display the unit interface GUI (Device Controller).

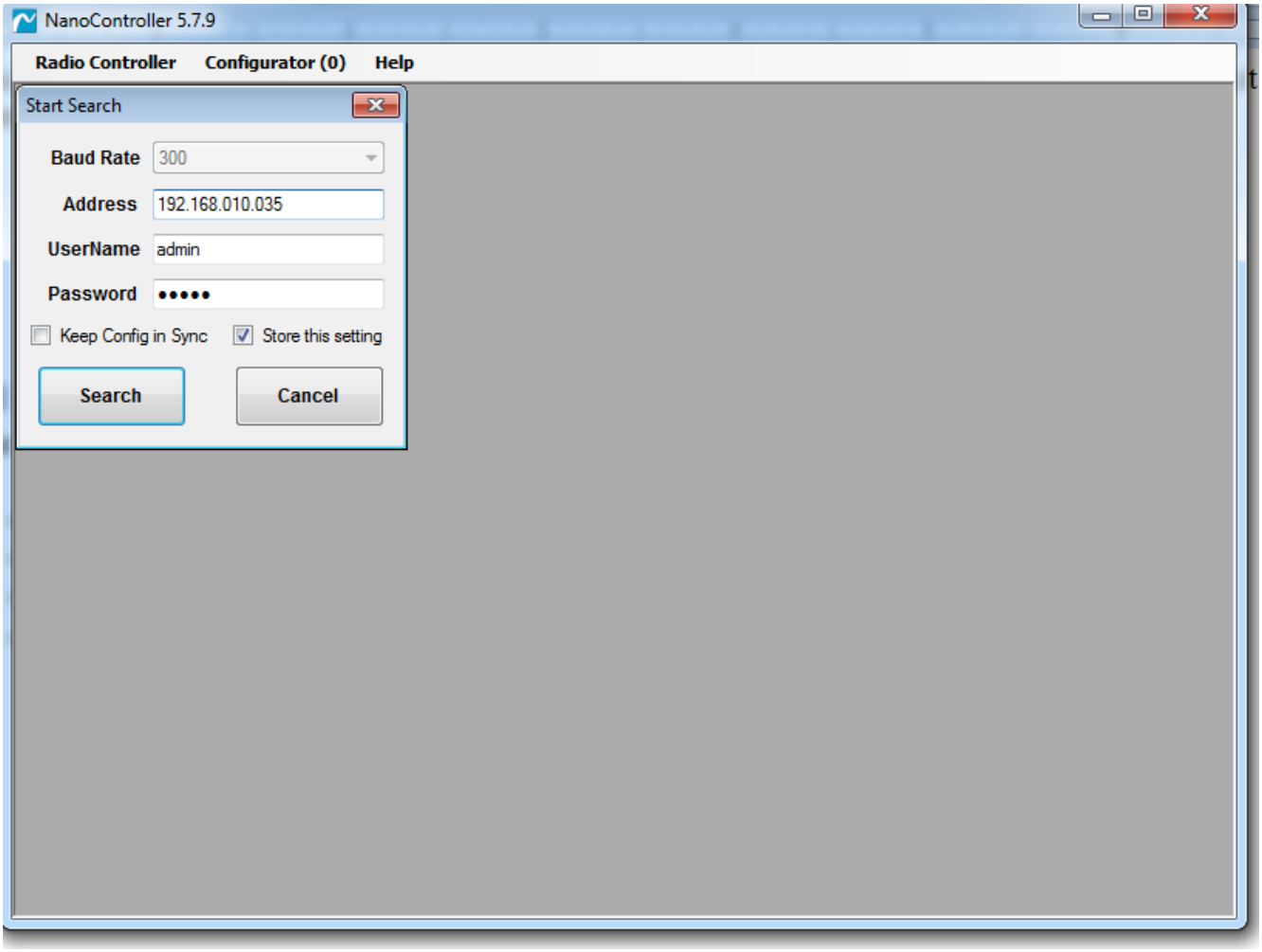


Figure 5-30: COM port detection

5.12 CRX6 NanoController Real Time Status and Control Interface

The NanoController Real Time Interface contains 4 main sections:

- Product Type
- Real Time Interface

- Receiver Status
- Alarms, Information and Configuration Access and Controls

Figure 5-31: CRX6 NanoController Real Time Interface

5.12.1 Device Controller Unit Description Block

The Unit Information window contains the following information:

- Unit family (6Way shown)
- Model number (23CRX6-BP1 is shown)
- Serial number

Figure 5-32: NanoController Unit Information Block

5.12.2 The Receiver Unit Interface Block

The Receiver Unit Interface includes the following elements:

- **Preset Menu button** – allows user to select Preset configurations. The button will also contain the current preset.

  ***Note:* Unit is shown in Manual Preset 0. This will happen anytime you change a parameter from the "Live" interface menu.**

- **RF Channel button** –Used to change channel and frequency. The button will also contain the current band and channel. If the display reads 'CH: ****' that means the CRX6 is in direct frequency mode and is not on a standard frequency plan channel.
- **Modulation button** – allows user to select unit bandwidth.
- **Latency –** Normal is the standard latency setting.

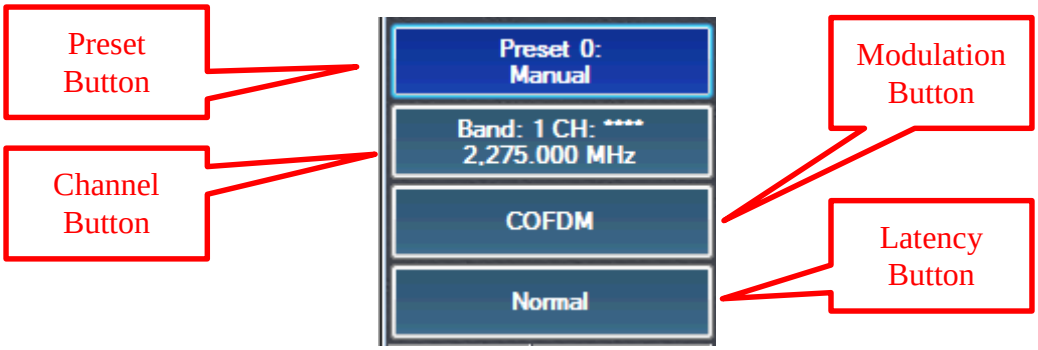


Figure 5-33: Unit Interface Block

5.12.2.1 Changing Presets with NanoController

11) Click on the 'Preset Button' to access the preset drop down menu.
12) Locate desired preset and click on it.
13) Change will immediately take place.

5.12.2.2 Changing Channels with NanoController

Changing to standard frequency plan channels:

1) Click on the 'Channel' button to access the band/channel selection menu.
2) Click on the 'Channel' drop down menu, locate desired preset and click on it.
3) Click on the 'Ok' button for the change to take effect.

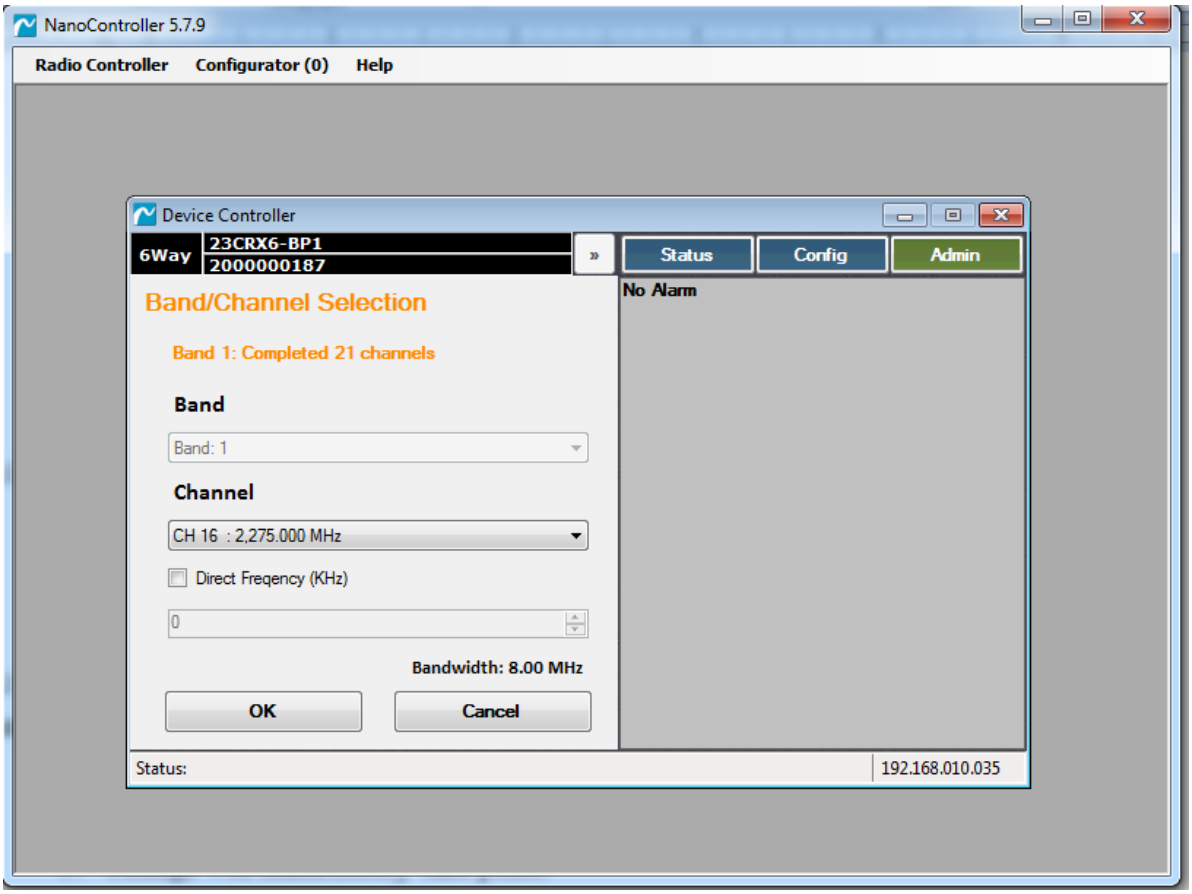


Figure 5-34: NanoController Channel/Band Selection Menu

Using direct frequency input to tune to an in-band frequency, but not a frequency plan channel:

1) Click on the 'Channel' button to access the band/channel selection menu.
2) Click in the 'Direct Frequency' check box, to activate the direct frequency text box. Enter the new frequency in kHz, using commas, example: 2,275,000. The frequency must however be within the band limits of the CRX6. If the entry is not within the band limits when the ok button is clicked, the NanoController will respond with an error message and display the min and max limits.
3) Click on the 'Ok' button for the change to take effect.

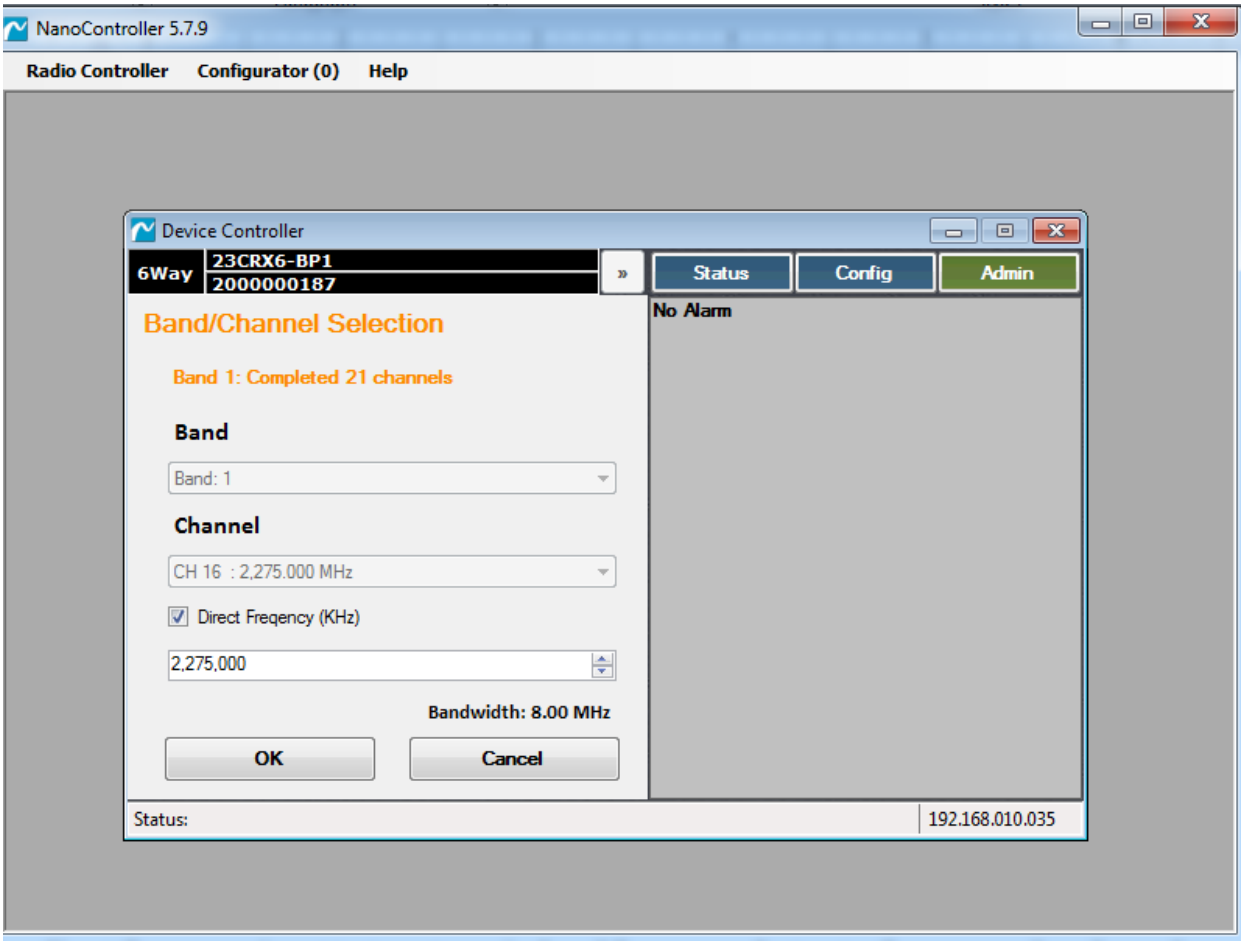


Figure 5-35: NanoController Direct Frequency Entry

5.12.3 The Receiver Statistic Window

The Receiver Statistics are displayed in two distinct blocks.

5.12.3.1 Modulation/Decode

The Modulation and Decoder statistics are shown in the figure below:

Modulation	QPSK
Bandwidth	8 MHz
Code Rate	1/2
Guard Int.	1/32
Post Vit	9.9e-1
UCE	0

Figure 5-36: Modulation/decoder Statistics

5.12.4 RF Link Quality Statistics

RF Link Quality statistics are located to the right of the column of the control buttons and displays three bar graphs and the corresponding numerical values. The three statistics displayed are as follows:

- RSL (Received Signal Level)
- MER in dbs.
- Link Q (link quality is an Nucomm metric for determining quality of received signal)

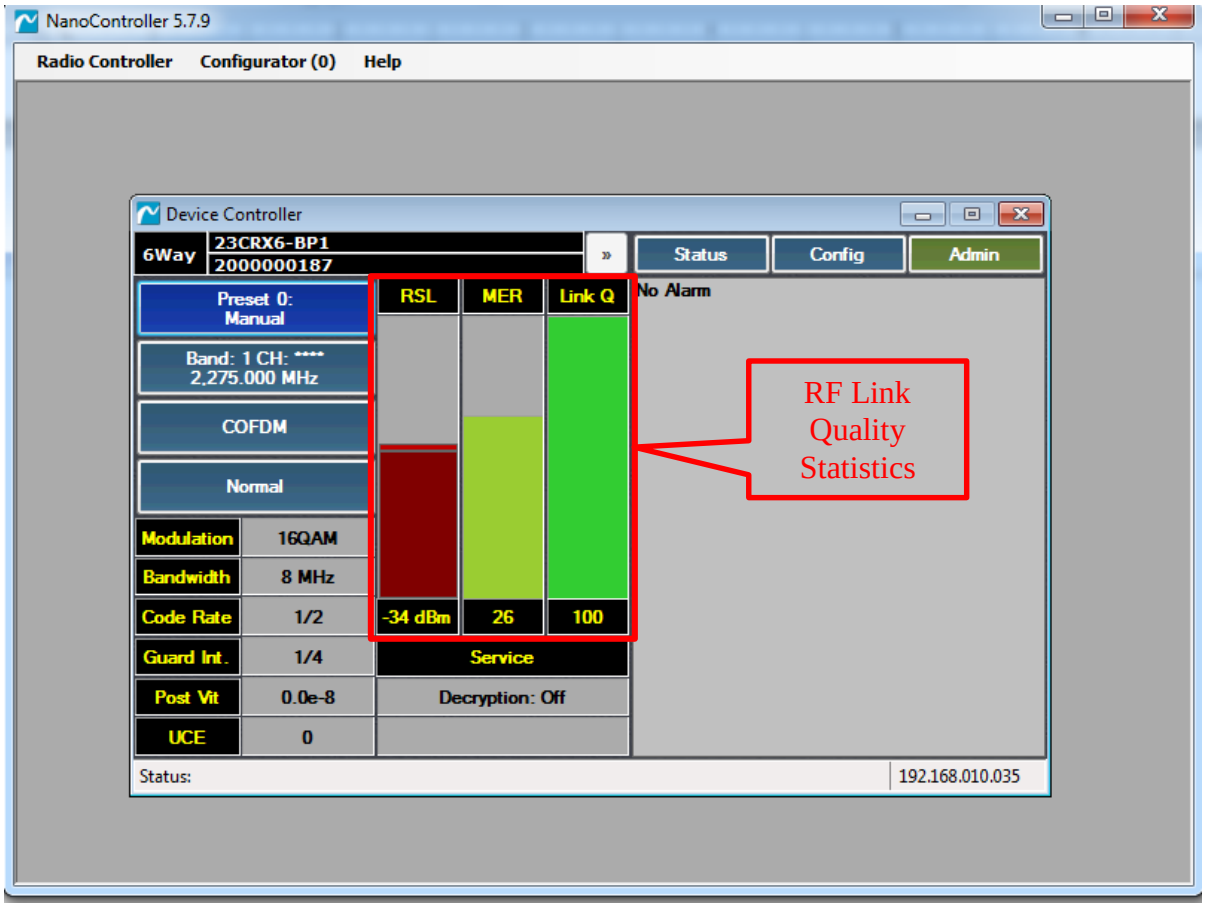


Figure 5-37: RF Link Quality window

5.12.5 Unit Information and Configuration Window

The right half of the RX Controller window displays Alarms, Unit Information or Configuration Data. The block contains three control buttons and one text block as shown below.

Figure 5-38: Unit Information and Configuration Block

5.12.6 Display Text Box

The text box will display live unit alarms. No alarm is displayed in the above example. The potential alarms are as follows:

- "Demod unlocked"
- "Vin High Voltage"
- "RF Unlocked"
- "Over Temperature"

5.12.7 Status Button

The status button allows access to either view the Alarms, Unit Version Information or Unit Network Information. Upon start up the NanoController will default to view the alarms. Click on the 'Status' button to access the drop down menu as shown in **Figure 5-39**. Click on the desired option. Network status is shown in **Figure 5-40.**

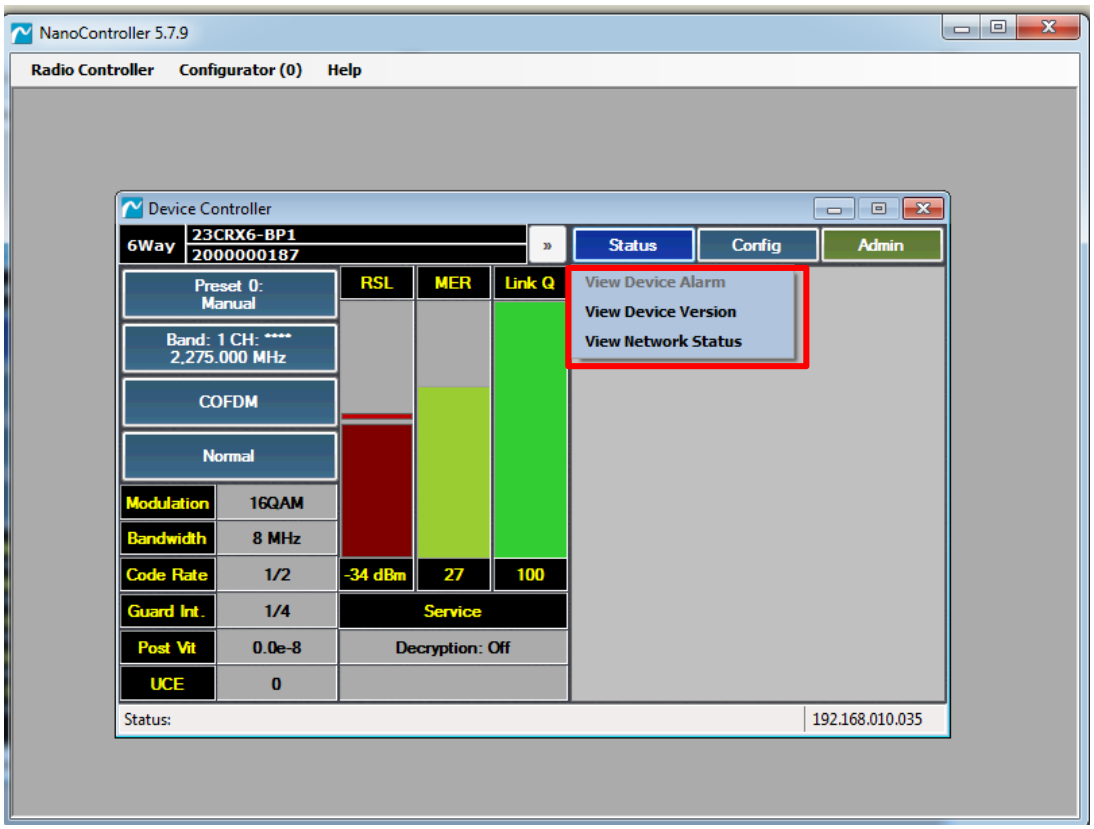


Figure 5-39: NanoController Status Button Menu

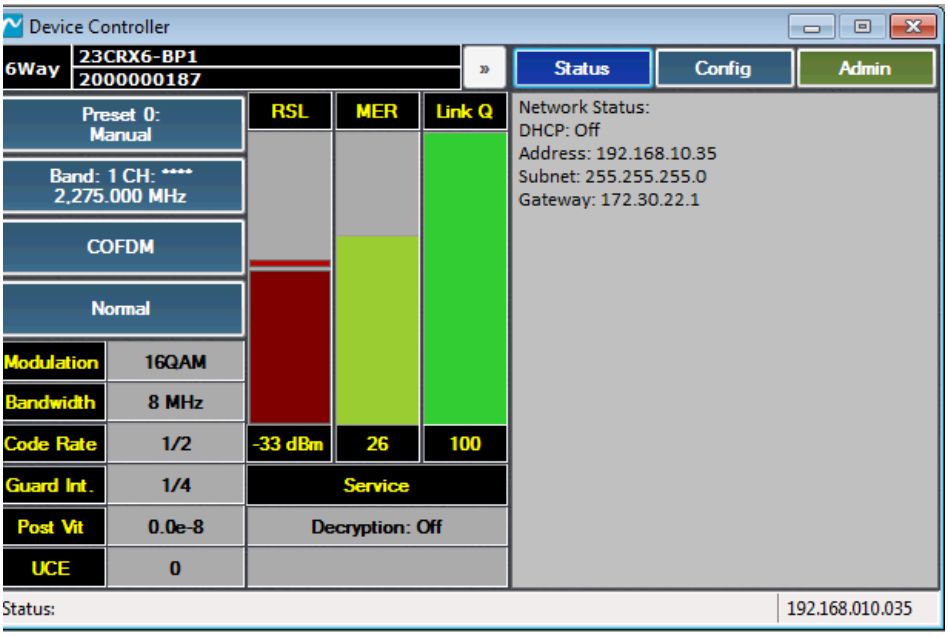


Figure 5-40: Network Status View

5.12.8 Configuration Button

The Config button allows the user to upload or download radio configurations and to access the preset and frequency plan files. Refer to chapter-5 for unit configuration details.

5.12.9 Login Button

The Login button displays the current access level. Selecting the login button activates the login window. There are two access levels:

- User – Lets the user control the basic unit parameters on both the Unit Interface and the Configuration files.
- Administration – Gives the user greater access to the unit's Unit Interface and Configuration files.

5.12.10 Saving a Changed Setting Configuration to a Preset

The NanoController features the ability to save any changed parameter to a permanent Preset from the Live controller. When parameters desired have been changed the following steps:

4) Click on the preset button, a drop down menu will be accessed.
5) Choose 'Save to Preset'. The 'Assign Preset' menu will pop up.
6) From the drop down menu in the preset box choose the numbered preset you wish to assign.
7) Enter the preset name into the 'Preset Name' text box. Helo 1 shown in example below.
8) Click on the 'Apply' button. Changes will immediately take place.

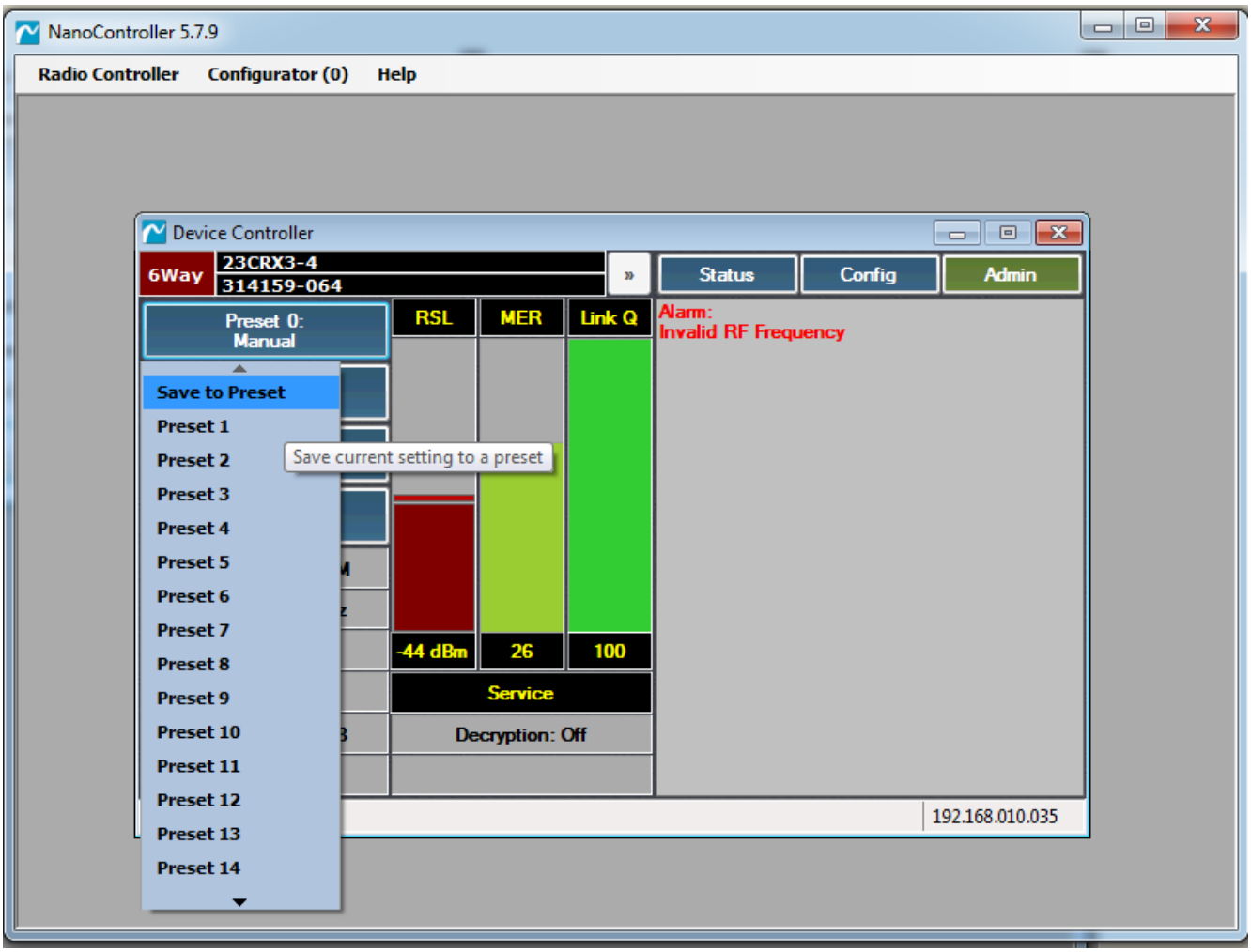


Figure 5-41: NanoController - Save to Preset

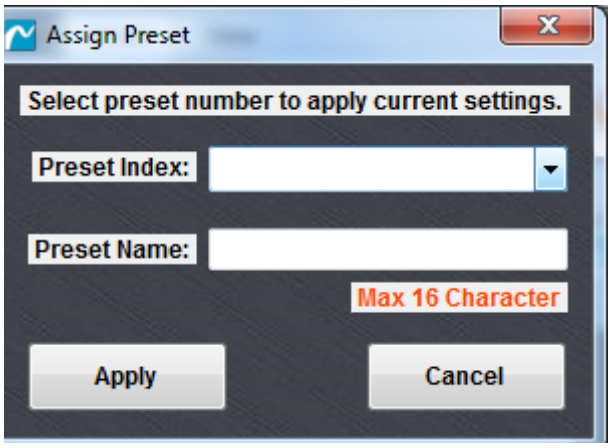


Figure 5-42: Assign Preset Menu

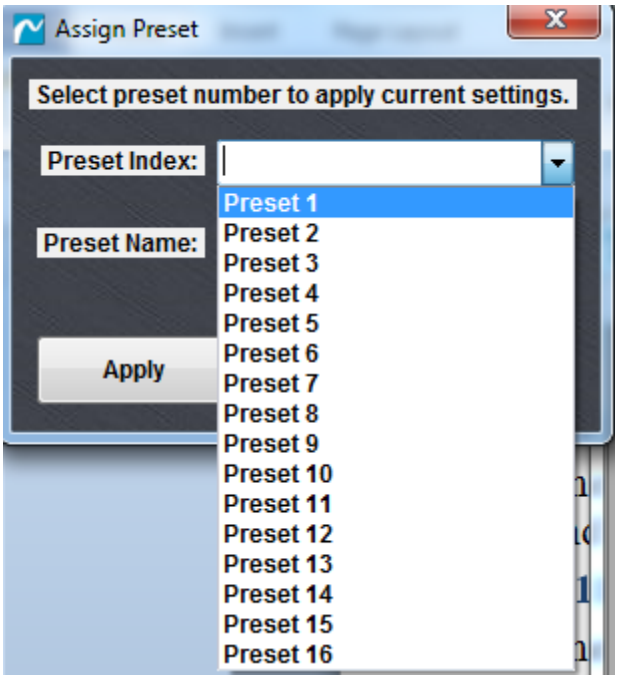


Figure 5-43: Assign Preset Drop Down

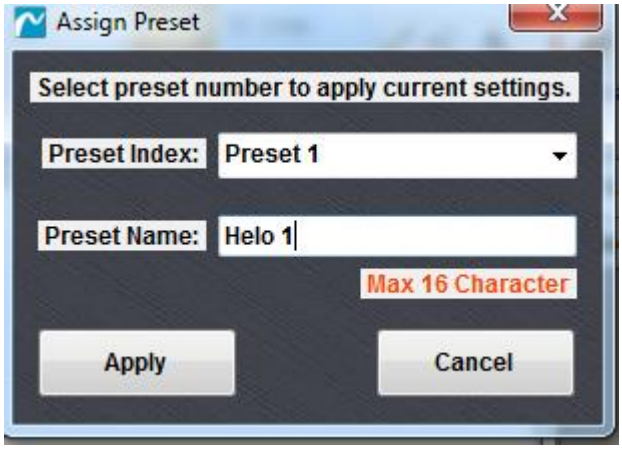


Figure 5-44: Enter Preset Name and Apply

5.13 Using the NanoController to Configure the CRX6

5.13.1 Downloading Configuration Files

Choose Download Configuration from the drop down menu from the Config tab. The unit will now download the Preset and Frequency Plan configuration files from the unit.
Note: Skipped this step if the "Keep Config in Sync" box was checked when first booting up the NanoController.

If the files have already been downloaded the drop down menu will have the following options:

- Save Package to Disk
- Upload Package to Device
- Config
  - Frequency Plan
  - Preset Plan

Once the configuration files are downloaded, choose the desired file to upload to the NanoController as shown below.

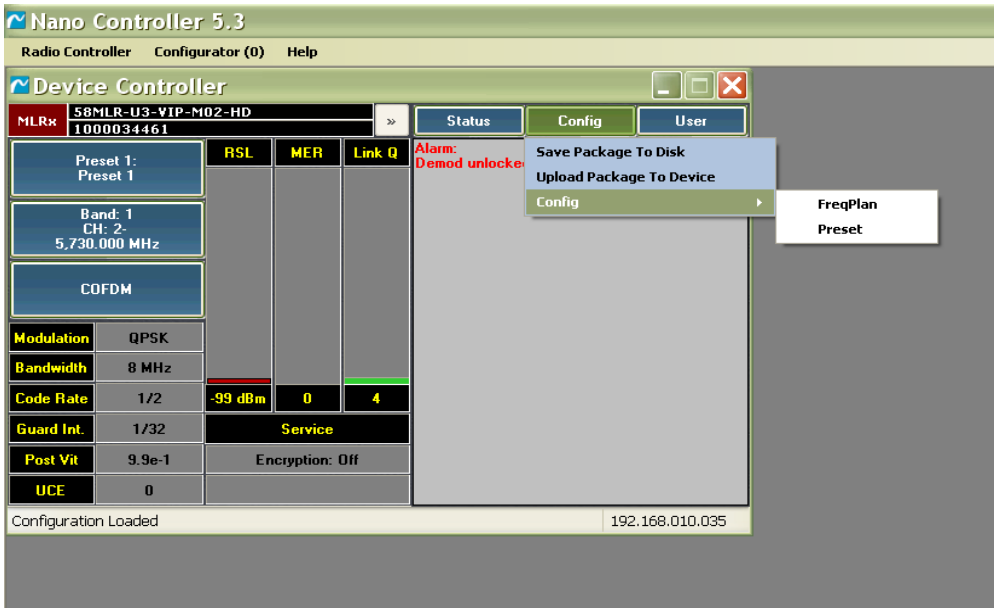


Figure 5-45: Config File Menu

- Preset settings include all programmable options, including modulation parameters, frequencies and channels, and streaming video over Ethernet options, if available.
- Frequency plan includes the frequency plan and the channels.

5.13.2 Preset Configuration Page

The preset configuration page includes a global setting section and an individual preset configuration change section. The global section is located on the left side of the page, and the individual preset configurations are located under the tabs 1-16. Each tab represents the individual corresponding preset.

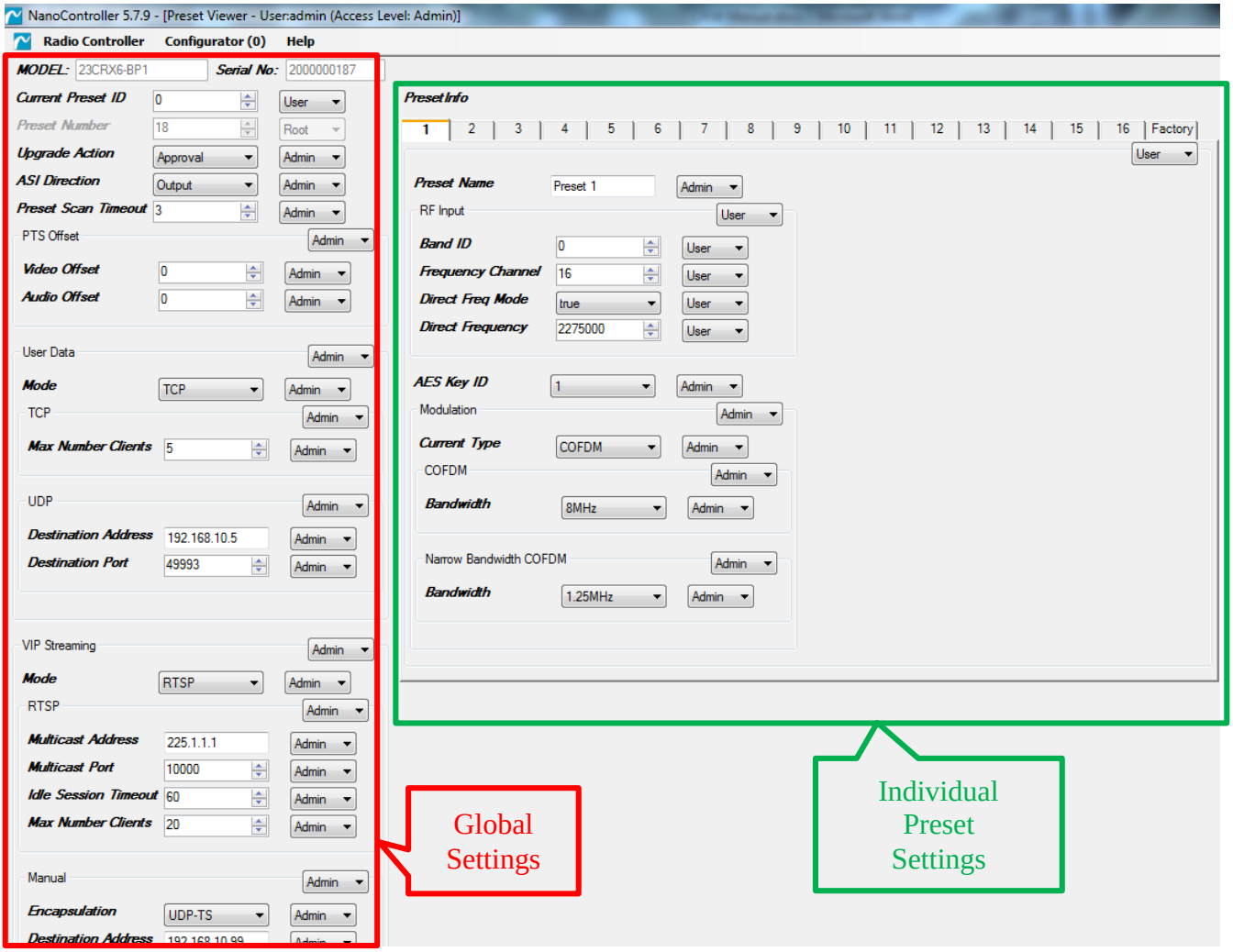


Figure 5-46: Preset Configuration Page

5.13.3 Editing Receiver Individual Presets

Choose the preset you wish to change by selecting the preset tab. Alternatively you may change the same parameter on multiple presets at the same time by picking the first preset you wish to change and pressing the 'Shift' or 'Ctrl' button on the key board and select a range of presets or a number of presets. The 'Shift' and "Ctrl' buttons work the same for NanoController as they do for Windows. If multiple presets have been chosen, parameters that vary between presets will be highlighted in green.
You may select multiple presets by using the following steps:

- Hold down the “control” key and click each tab to select multiple presets.
- Hold down the “shift” and click a tab to select a range of presets
- The fields that are not universally the same through all presets will be highlighted in green. A change to the field will transfer to all the selected presets.

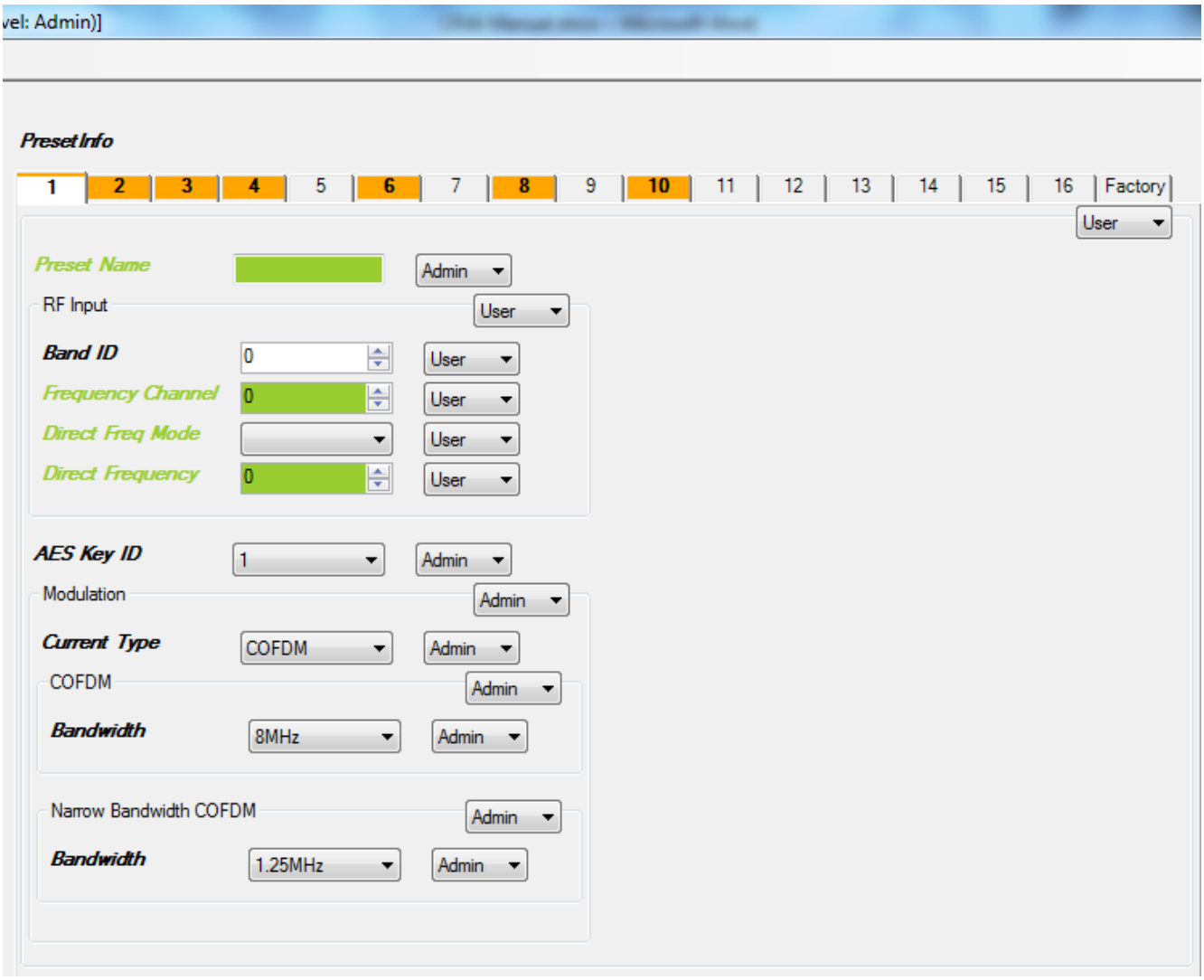


Figure 5-47: Preset Configuration Tabs with Multiple Presets Selected

The preset configuration example above show that presets 1,2,3,4,6,8 & 10 have been selected with the ‘Preset Name’, ‘Frequency Channel’, ‘Direct Freq Mode’, and the ‘Direct Frequency’ being different on at least one other preset. When changes are made, they will be changed on all presets selected.

Change the parameters that need to be changed. Follow the guide as shown in **Table 5-1.**

Table 5-1: Receiver Preset Info, RF Input, Decryption and Modulation Settings

Section	Parameter	Menu Type	Settings/Guide
Preset Name	Preset Name	Text Box	Name of preset in 16 characters
RF Input			
	Band ID	Text Box	0 for Band 1 1 for Band 2
	Frequency Channel	Text Box	1 – Number of channels in the frequency plan
	Direct Freq Mode	True/False Drop Down	True – to place unit in direct frequency mode False – for not direct frquency
	Direct Frequency	Text Box	Enter frequncy in MHz, i.e. 2275000
Decryption	AES Decryption	Drop Down	Keys 1 to 5 selectable
Modulation			
	Current Tpye	Drop Down	COFDM or NB-COFDM
COFDM	Bandwidth	Drop Down	6, 7, or 8MHz
NBCOFDM	Bandwidth	Drop Down	2.5 MHz

5.13.4 Receiver Global Settings

The CRX6 global settings will change the parameter through the radio as a whole and not to just the individual presets.

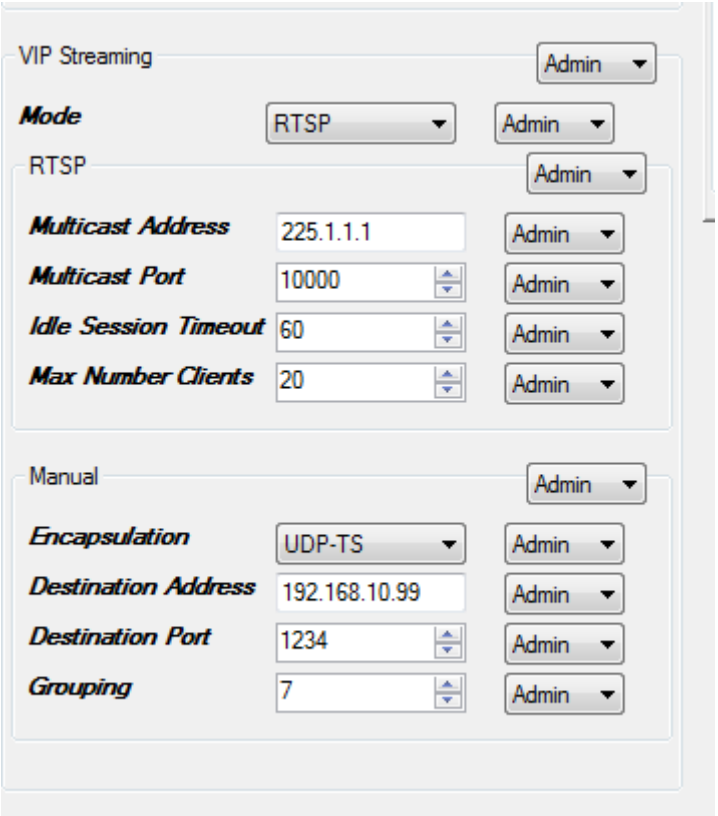


Figure 5-48: ViP Configuration Settings for NanoController

5.13.5 RTSP Streaming

5.13.5.1 RTSP Streaming Modes

There are four supported streaming modes from the RTSP server.

- Unicast, RTP
- Unicast, UDP
- Multicast, RTP
- Multicast, UDP

When the RTSP server is enabled, the streaming encapsulation (RTP/UDP) is requested by the client. For multicasting in RTSP mode the multicasting address and port must be configured.

5.13.5.2 RTSP Mode Set-up

1. Set to RTSP mode by using the 'Mode' drop down menu.
   If multicasting is utilized, enter the multicast address and port. If unicast is to be used, the multicasting address and port can be ignored. The default multicast address (group) from the factory is 225.1.1.1. The multicast range is 224.0.0.0 to 239.255.255.255.

The *Idle Session Timeout* is the maximum time between RTSP that keeps alive signals. If the RTSP client stops sending keep alive signals the server will reset after 60 sec (default).
The *Max Number Clients* is the maximum number of client decoders supported in a multicast environment. The default is 20. Note this does not apply to RTSP clients where the maximum is one.
Click on the 'Update' button for the changes to take effect.

5.13.6 Manual Streaming

1. Set to Manual mode by using the 'Mode' drop down menu. Choose 'Manual'
2. If multicasting is utilized, enter the multicast address and port. If unicast is to be used, the multicasting address and port can be ignored. The default multicast address (group) from the factory is 225.1.1.1. The multicast range is 224.0.0.0 to 239.255.255.255.
3. The *Idle Session Timeout* is the maximum time between RTSP that keeps alive signals. If the RTSP client stops sending keep alive signals the server will reset after 60 sec (default).
4. The *Max Number Clients* is the maximum number of client decoders supported in a multicast environment. The default is 20. Note this does not apply to RTSP clients where the maximum is one.
5. Click on the 'Update' button for the changes to take effect.

5.13.7 Manual Streaming

5.13.7.1 RTP

This mode will stream the data packets encapsulated by an RTP header to a single client only. The default network URL for this method is rtp://@<*Destination Stream Port*>.

1. In the 'Mode' drop down choose the 'MANUAL' option.
2. Choose RTP-TS from the 'Encapsulation' drop down menu.
3. Enter the IP address of the device you wish to stream to in the 'Destination Address' text box.
4. Enter the destination port into the unit. Default is 1234. If you are streaming more than one CRX6 channel to the same device you must use a different destination port (i.e., 1235)

5.13.7.2 UDP

This mode will stream the data packets without a RTP header up to a single client. The default network URL for this method is udp://@:<*Destination Stream Port*>.

1. In the 'Mode' drop down choose the 'MANUAL' option.
2. Choose RTP-TS from the 'Encapsulation' drop down menu.
3. Enter the IP address of the device you wish to stream to in the 'Destination Address' text box.
4. Enter the destination port into the unit. Default is 1234. If you are streaming more than one CRX6 channel to the same device you must use a different destination port (i.e., 1235)

Table 5-2: VIP Streaming Settings in NanoController

Section	Parameter	Menu Type	Settings/Guide
VIP Streaming	Mode	Drop Down	Off/RTSP/Manual

RTSP	Multicast	Text Box	Multicast address
	Multicast Port	Text Box	
	Idle Sesion Timeout	Text Box	Entered in seconds
	Max Number of clients	Text Box	Enter Max of clients
Manual	Encapsulation	Drop Down	UDP-TS or RTP-TS
	Destination Address	Text Box	Enter address
	Destination Port	Text Box	Enter port
	Grouping	Text Box	Enter number

5.13.8 Encryption Settings

The 'Encryption Settings' Section allows for encryption configuration for the CRX6. Individual presets may be configured 'Off' or by 'Key'

To set the encryption parameters, use the 'AES Mode' drop down menu to choose encryption type:

- Disable – turns encryption off
- BCRYPT 1 – Standard encryption

The receiver features entry up to 5 different keys. To enter the configuration of the individual keys, select the corresponding tab and enter the parameters:

- Key Name – Text Box – Enter the key name (16 characters allowed)
- Key Length – 128 or 256
- Key – Enter Key. The key will be blocked out or censored for key integrity.

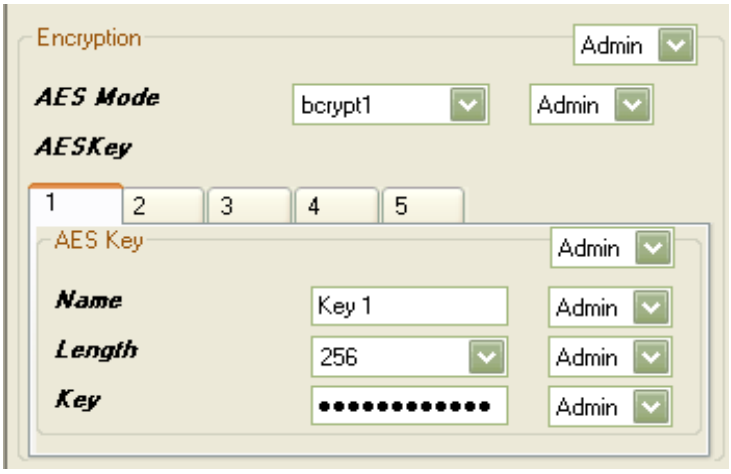


Figure 5-49: Receiver Encryption Settings

Table 5-3: Receiver Encryption Settings with NanoControllers

Section	Parameter	Menu Type	Settings/Guide
Encryption	AES Mode	Drop Down	Disable/bcrypt 1/bcrypt 2
AES Key	Name	Text Box	Name of Key in 16 characters
	Length		128 or 256
	Key		1 to 5

5.13.9 Remote and Ethernet settings

Follow the table guide below to enter the Ethernet settings.

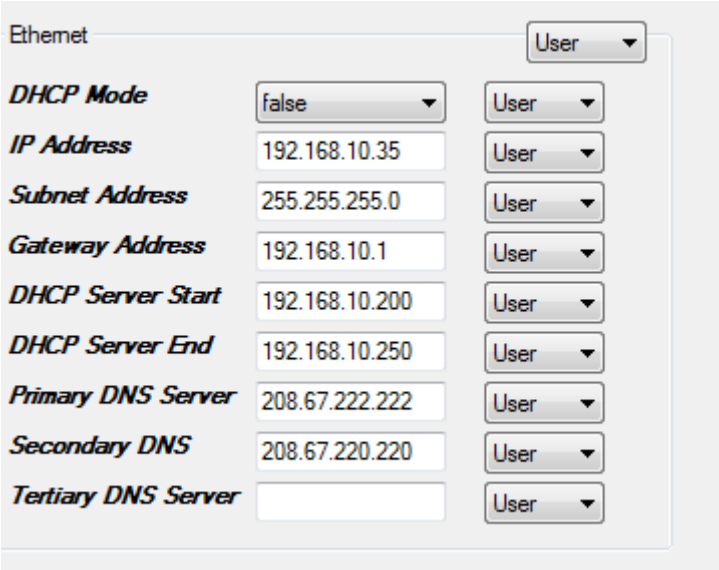


Figure 5-50: Receiver Remote and Ethernet Settings

Table 5-4: Receiver Remote and Ethernet Settings with NanoController

Field	Setting	Menu Type	Setting/Guide
Ethernet	DHCPMode	Drop Down	True (on) False (off) Server (CRX6 acts as a DHCP server)
	IP Address	Text Box	Enter IP Address
	Subnet Address	Text Box	Enter Subnet Address

	Gateway Address	Text Box	Enter gateway if needed
	DHCP Server Etart	Text Box	Enter the DHCP server start address Default is 192.168.10.200*
	DHCP Sever end	Text Box	Enter the DHCP server stop address Default is 192.168.10.250*
	Primary DNS Server	Text Box	Enter the Primary DNS Server Address Default is 208.67.222.222
	Secondary DNS Server	Text Box	Enter the Primary DNS Server Address Default is 208.67.220.220
	Tertiar DNS Server	Text Box	

*** Will give out up to 50 IP addresses ranging from 192.168.10.200 - 250**

5.14 Administrator control

The *NanoController* features the ability of the administrator to change the parameters that the user can access. The drop down menus to the right of each field allows the administrator to control the access of the field, but it still shows up to the user subdued. Control of the inner fields is nested by the parent controls in the upper right corner of each section.

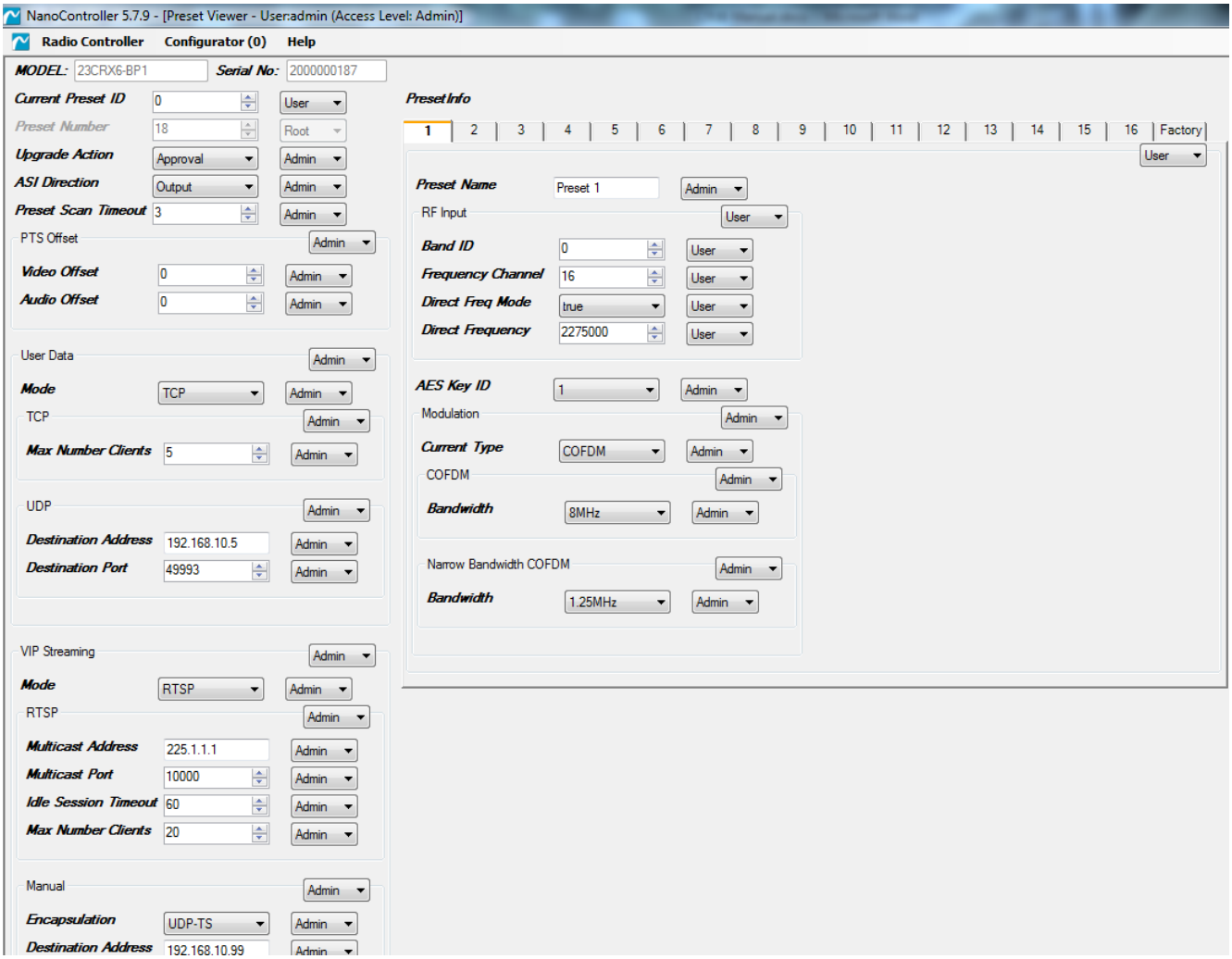


Figure 5-51: Administration Controls in the NanoController

5.15 Frequency Plan Configuration

Use the Frequency Plan configuration files to set up the frequencies and channels of the CRX6

5.15.1 Band (Factory Set Only)

Band 0 refers to the lower frequency band and Band 1 refers to the higher frequency Band if applicable. All band parameters are factory level settings.

5.15.2 Channel Tabs

Choose the set of fields you wish to edit. The Channel Tab number will correspond to the channel number in the frequency plan.

Figure 5-52: Frequency Plan Window

Table 5-5: Frequency Plan Settings

Section	Parameter	Type Menu	Settings/Guide
Band	MaxNrBands	Text Box	The number of bands available
	BandName	Text Box	Name of band in 16 characters
	LowLimit	Text Box	Factory set
	HighLimit	Text Box	Factory set
	StartChnl	Text Box	Factory set
	StopChnl	Text Box	Factory set
	OffsetOption	Text Box	Factory set
	OffsetFreq	Text Box	Factory set
	Direct Freq	Text Box	Band range in 1Mhz steps
	Inverted Flag	Text Box	Factory Set
	CurrentPresetID	Text Box	Preset value at bootup
Channel 1-16	Name	Text Box	Name of Channel in 16 characters
	Freq	Text Box	Channel Frequency (in kHz)

5.16 Uploading Preset Configuration Files

To upload the new preset configuration files to the unit, follow the steps below:

- Click on the Config Tab and choose the "Save Package to Disk". This will send both the FreqPlan and Preset files as a package with an. imt file extension to a directory chosen by the user. This step does not have to be done to upload files to the unit.
- Click on the "Upload Package to Device" to send the FreqPlan and/or Preset files as a package to the unit. The NanoController will automatically load the files and reboot the unit.

5.17 Remote Control Using Nucomm Command.

The implementation of an RS-232 command set, or Remote Protocol, allows the use of customized interfaces to perform virtually all unit operations, including:

- Configure Settings
- Query Status

The Remote Protocol consists of command and response messages, or packets. The internal CPU handles interpretation of the packets to set unit parameters, and provide responses back through the serial interface.

In addition to IMT's Nano Controller, alternate control interfaces may be developed, or available from third parties. Additionally, commands and responses may be entered and viewed manually using a command terminal.

5.17.1.1 Serial Interface Rate, Parity, and Stop Bit Specifications

Refer to the Remote Protocol for information about the baud rate, number of data bits, stop bits, and flow control methods.

5.17.1.2 Command and Response Packet Formats

This section provides a brief introduction to the serial interface command and response packet formats. The command packets use the following format:

NU <tt> <ss><##><cc><dd><CS><CR><LF>

Where the fields are ASCII and are defined as follows:

NU	Literal
<tt>	Address of target (0x01 – 0xFF)
<ss>	Address of source (0x00 – 0xFF)
<##>	Packet Length (Packet Length = Command Length + Data Length)
<cc>	Command (0x00-0xFF) – Different values are used for each command.
<dd>	Data (Hex Format) – Data values are encoded with a variety of meanings.
<CS>	(1's complement of <tt> to end of data)
<CR>	Carriage Return
<LF>	Line Feed

After a command packet is received, the unit returns a response packet. Response packets have the same basic format as command packets, except that the source and destination are reversed, and the command field specifies the type of response being sent.

Notes:

[1] Device sends this packet and will not respond to it.
[2] Command NOT Implemented Yet.
[3] Factory use only.
[4] Unless command 0x6F is used, you must wait 5 seconds between each set commands.

Wait for response to each command before sending next command.
P: command for public use
I: Command for internal (Nucomm) use only.
R: Read only indication
W: Write only indication

.

Command String Nomenclature:

NU	Literal
<tt>	Address of target (0x01 – 0xFF)
<ss>	Address of source (0x00 – 0xFF)
<##>	Packet length (Range: Command Length + Data Length)
<cc>	Command (0x00-0xFF)
<dd>	Data (Hex Format)
<CS>	(1's complement of <tt> to end of data)
<CR>	Carriage Return
<LF>	Line Feed

Notes:

[1] Device sends this packet and will not respond to it.
[2] Command NOT Implemented Yet.
[3] Factory use only.
[4] Unless command 0x6F is used, you must wait 5 seconds between each set commands.

Wait for response to each command before sending next command.
P: command for public use
I: Command for internal (Nucomm) use only.
R: Read only indication
W: Write only indication

P	Command	R/ W	Command String
P	Set/Response AES Encryption Parameters	RW	NU<tt><ss><##><00><AA><dd>…<dd><CS><CR><LF> <AA> = 0x04: AES Encryption Mode NU<tt><ss><03><00><04><dd><CS><CR><LF> 1.<dd>: AES Encryption Mode 00 – disable 01 – bcrypt1

P	Command	R/ W	Command String
			02 – bcrypt2 <AA> = 0x05: Set AES Encryption Key 1 NU<tt><ss><##><00><05><dd>…<dd><CS><CR><LF> 1.<dd>: AES Encryption Key 1 Example: The following command sets AES key 1 to 00112233. The AES key 1 will be to 32. NU01000600050011223 38D <AA> = 0x06: Set AES Encryption Key 2 <AA> = 0x07: Set AES Encryption Key 3 <AA> = 0x08: Set AES Encryption Key 4 <AA> = 0x09: Set AES Encryption Key 5 NOTE: AES Key cannot be read back from the unit. <AA> = 0x0A: AES Encryption Key ID NU<tt><ss><03><00><0A><dd><CS><CR><LF> 1.<dd>: AES Encryption Key ID 00 – Off 01-05 – Key ID 1 - 5 FF – Auto
P	Request AES Encryption Parameters	W	NU<tt><ss><02><80><AA><CS><CR><LF> <AA> = 0x04: Request AES Encryption Mode <AA> = 0x0A: Request Current AES Encryption Key ID
P	Response GPS Fix	RW	NU<tt><ss><1A><00><D3><dd>…<dd><CS><CR><LF> 1.<dd>: Device 00 - Receiver 01 - Transmitter 2.<dd>: Fix Valid 00 - Not Valid 01 - Valid 3.<dd><dd><dd><dd>: Latitude (Signed Degrees * 1,000,000) 4.<dd><dd><dd><dd>: Longitude (Signed Degrees * 1,000,000) 5.<dd><dd>: Altitude (Meters * 100) 6.<dd><dd>: Speed (Knots * 100) 7.<dd><dd>: Heading (Degrees * 100) 8.<dd>: Month 9.<dd>: Day 10.<dd><dd>: Year 11.<dd>: Hour 12.<dd>: Minute 13.<dd><dd>: Millisecond

P	Command	R/ W	Command String
			Note: If the time parameters are all 0 with a valid fix, the report is a statically configured position.
P	Request GPS Fix	W	NU<tt><ss><03><80><D3><dd><CS><CR><LF> 1.<dd>: Device 00 - Receiver 01 - Transmitter
P	Set/Response Video-over-IP Streaming Parameters	RW	NU<tt><ss><15><00><F3><dd>…<dd><CS><CR><LF> 1.<dd>: Video Streaming mode 00 - Off 01 - RTSP 02 - Manual 2.<dd><dd><dd><dd>: RTSP Multicast Address (MSB first) 3.<dd><dd>: RTSP Multicast Port (MSB first) 4.<dd><dd>: RTSP Idle Session Timeout (MSB first) 5.<dd><dd>: RTSP Maximum Number of Clients (MSB first) 6.<dd>: Manual Encapsulation Type 00 – UDP-TS 01 – RTP-TS 7.<dd><dd><dd><dd>: Manual Destination Address (MSB first) 8.<dd><dd>: Manual Destination Port (MSB first) 9.<dd>: Manual Transport Stream Packet Grouping
P	Set Video-over-IP Mode	W	NU<tt><ss><03><00><F4><dd><CS><CR><LF> 1.<dd>: Video Streaming mode 00 - Off 01 - RTSP 02 - Manual
P	Set Video-over-IP RTSP Parameters	W	NU<tt><ss><0C><00><F5><dd>…<dd><CS><CR><LF> 1.<dd><dd><dd><dd>: Multicast Address (MSB first) 2.<dd><dd>: Multicast Port (MSB first) 3.<dd><dd>: Idle Session Timeout (MSB first) 4.<dd><dd>: Maximum Number of Clients (MSB first)
P	Set Video-over-IP Manual Parameters	W	NU<tt><ss><0A><00><F6><dd>…<dd><CS><CR><LF> 1.<dd>: Encapsulation Type 00 – UDP-TS 01 – RTP-TS 2.<dd><dd><dd><dd>: Destination Address (MSB first) 3.<dd><dd>: Destination Port (MSB first) 4.<dd>: Transport Stream Packet Grouping
P	Request Video-over-IP Parameters	R	NU<tt><ss><02><80><F3><CS><CR><LF>

P	Command	R/ W	Command String
P	Response Capabilities [1] Note: This command returns data that describes the physical capabilities and the licensed capabilities of the unit queried.	R	NU<tt><ss><0A><01><AA><dd>…<dd><CS><CR><LF> 1.<dd>: Modulation Capabilities (bitmask) (1 – Enabled, 0 – Disabled) Bit 7: COFDM 1.25, 2.5MHz Bit 6: COFDM DVB-T Bit 5 ~ 0: Not used report 0 2.<dd>: TS Options (bitmask) Bit 7 ~ 3: Not used Bit 2: VIP Streaming Bit 1 ~ 0: Not used 3.<dd>: Video Encoding 1 Capabilities (bitmask) Bit 7: MPEG2 Bit 6: MPEG4 Bit 5: SD Bit 4: HD Bit 3 ~ 0: Not used report 0 4.<dd>: Video Encoding 2 Capabilities (bitmask) Bit 7 ~ 0: Not used report 0 5.<dd>: Encryption Capabilities (bitmask) Bit 7: AES-256 Bit 6: AES-128 Bit 5 ~ 0: Not used report 0 6.<dd>: Other Capabilities (bitmask) Bit 7 ~ 0: Not used report 0 7.<dd>: Other Capabilities (bitmask) Bit 7 ~ 0: Not used report 0 8.<dd>: Other Capabilities (bitmask) Bit 7 ~ 0: Not used report 0
P	Request Capabilities	W	NU<tt><ss><02><81><AA><CS><CR><LF> <AA> = 0; Request unit capability. <AA> = 1; Request unit Licensing
P	Response Modulation Parameters [4] Note: This command is used to provide status of the current mode of the receiver	R	NU<tt><ss><06><02><dd><dd><dd><dd><dd><CS><CR><LF> Note that the definitions of data fields 2 through 5 are slightly different for COFDM and NB-COFDM modes. COFDM: 1.<dd>: Modulation Type 01 – COFDM DVB-T 2.<dd>: Constellation 00 – QPSK 01 – 16QAM 02 – 64QAM 3.<dd>: Code Rate

P	Command	R/ W	Command String
			00 – 1/2 01 – 2/3 02 – 3/4 03 – 5/6 04 – 7/8 4.<dd>: Guard 00 – 1/32 01 – 1/16 02 – 1/8 03 – 1/4 5.<dd>: Bandwidth 00 – 6 MHz 01 – 7 MHz 02 – 8 MHz 03 – 5 MHz NB-COFDM: 1.<dd>: Modulation Type 02 – NBCOFDM 2.<dd>: Constellation 00 – QPSK 3.<dd>: Code Rate 00 – 1/2 01 – 2/3 02 – 3/4 4.<dd>: Guard 00 – 1/32 01 – 1/16 02 – 1/8 03 – 1/4 5.<dd>: Bandwidth 00 – 1.25 MHz 01 – 2.5MHz Auto Bandwidth: 1.<dd>: Modulation Type 03 – Auto 2.<dd>: Constellation 00 – QPSK 01 – 16QAM 02 – 64QAM 3.<dd>: Code Rate 00 – 1/2 01 – 2/3 02 – 3/4 03 – 5/6 04 – 7/8 4.<dd>: Guard 00 – 1/32 01 – 1/16 02 – 1/8 03 – 1/4 5.<dd>: Bandwidth 00 – 6 MHz 01 – 7 MHz 02 – 8 MHz 03 – 5 MHz 06 – 1.25 MHz 07 – 2.5 MHz
P	Set demodulation Parameters [4]	W	NU<tt><ss><03><02><dd><dd><CS><CR><LF> COFDM:

P	Command	R/ W	Command String
	Note: This command is used to set the default demodulator parameters of the receiver.		1.<dd>: Modulation Type 01 – COFDM 2.<dd>: Bandwidth 00 – 6 MHz 01 – 7 MHz 02 – 8 MHz NB-COFDM: 1.<dd>: Modulation Type 02 –NBCOFDM 2.<dd>: Bandwidth 00 – 1.25 MHz 01 – 2.5MHz Auto Bandwidth: 1.<dd>: Modulation Type 03 – Auto
P	Request Demodulator Parameters	W	NU<tt><ss><01><82><CS><CR><LF>
P	Response PCR/Video/Audio PIDs	W	NU<tt><ss><0B><08><dd>…<dd><CRC><CR><LF> 1.<dd><dd>: PCR PID (MSB first) 2.<dd><dd>: Video PID (MSB first) 3.<dd><dd>: Audio1 PID (MSB first) 4.<dd><dd>: Audio2 PID (MSB first) 5.<dd><dd>: User Data PID (MSB first) (0xFFFF means invalid)
P	Request PCR/Video/Audio PIDs	R	NU<tt><ss><01><88><CRC><CR><LF>
I	Set MPEG Service ID Note: This command is used to select the Service ID to decode when a multi program stream is present.	W	NU<tt><ss><03><09><dd><dd><CS><CR><LF> 1.<dd><dd>: Service ID (0x0001 ~ 0xFFFF)
I	Response MPEG Service ID Note: This command returns the selected Service ID being decoded as well	R	NU<tt><ss><03><09><aa><aa><dd><dd><CS><CR><LF> 1.<aa><aa>: Service ID (0x0001 ~ 0xFFFF) 2.<dd>…<dd>: Service Name (at most 16 characters) <4E><45><57><53><43><4F><44><45><52>…: NEWSCODER…

P	Command	R/ W	Command String
	as the Service name.		
I	Request Service ID	W	NU<tt><ss><01><89><CS><CR><LF>
I	Response MPEG Service Name	R	NU<tt><ss><##><0A><dd> ... <dd><CS><CR><LF> 1.<dd>…<dd>: Service Name (at most 16 characters) <4E><45><57><53><43><4F><44><45><52>…: NEWSCODER…
I	Request Service Name	W	NU<tt><ss><03><8A><dd><dd><CS><CR><LF> Where <dd><dd>: Service ID (0x0001 ~ 0xFFFF) Set <dd><dd> = 0x0000 to return the default Service ID.
I	Response MPEG Service Provider	R	NU<tt><ss><##><0B><dd> ... <dd><CS><CR><LF> 1.<dd>…<dd>: Service Provider (at most 16 characters) <4E><55><43><4F><4D><4D>…: NUCOMM…
I	Request Service Provider	W	NU<tt><ss><01><8B><CS><CR><LF>
P	Response Frequency NOTE: Return the current RF Frequency	R	NU<tt><ss><05><20><dd><dd><dd><dd><CS><CR><LF> 1.<dd><dd><dd><dd>: Frequency in kHz 0x001F392A = 2046250kHz = 2,046.25MHz
I	Set Specific Frequency NOTE: Set Direct RF Frequency in Current Band	W	NU<tt><ss><05><20><dd><dd><dd><dd><CS><CR><LF> 1.<dd><dd><dd><dd>: Frequency in kHz 0x001F392A = 2046250kHz = 2,046.25MHz
P	Request Current RF Frequency	W	NU<tt><ss><01><A0><CS><CR><LF>
I	Response Frequency Plan Channel Frequency	R	NU<tt><ss><07><21><dd><dd><dd><dd><dd><dd><CS><CR><LF> 1.<dd>: Band Index Number 00: Band 0 Single band units 01: Band 1 Second band of dual band units 02: Band 2 Third band of tri-band unit 2.<dd>: Preset (0 ~ 255) 3.<dd><dd><dd><dd>: Frequency in kHz
I	Request RF Frequency Plan	W	NU<tt><ss><03><A1><dd><dd><CS><CR><LF> 1.<dd>: Band Index Number 00: Band 0 Single band units

P	Command	R/ W	Command String
	Channel Frequency		01: Band 1 Second band of dual band units 02: Band 2 Third band of tri-band unit 2.<dd>: Preset (0 ~ 255)
P	Response Band Frequency Information [1]	R	NU<tt><ss><0B><22><dd> … <dd><CS><CR><LF> 1.<dd><dd><dd><dd>: Upper Frequency Limit in kHz 2.<dd><dd><dd><dd>: Lower Frequency Limit in kHz 3.<dd><dd>: Step Size in kHz
P	Request Band Frequency Information	W	NU<tt><ss><02><A2><Band><CS><CR><LF> <Band> = 0x00
I	Response Frequency Plan Channel Name	R	NU<tt><ss><##><28><00><dd><dd><dd>…<dd><CS><CR><LF> 1.<00>: Sub Command Index 2.<dd>: Band Index Number 00: Band 0 Single band units 01: Band 1 Second band of dual band units 02: Band 2 Third band of tri-band unit 3.<dd>: Preset (0 ~ 255) 4.<dd>…<dd>: Channel Name <49><4D><54>…: IMT…
I	Request RF Frequency Plan Channel Name	W	NU<tt><ss><04><A8><00><dd><dd><CS><CR><LF> 1.<00>: Sub Command Index 2.<dd>: Band Index Number 00: Band 0 Single band units 01: Band 1 Second band of dual band units 02: Band 2 Third band of tri-band unit 3.<dd>: Preset (0 ~ 255)
P	Set/Response Current Band	RW	NU<tt><ss><02><30><dd><CS><CR><LF> 1.<dd>: Band Index Number 00: Band 0 Single band units 01: Band 1 Second band of dual band units 02: Band 2 Third band of tri-band units
P	Request Current Band	W	NU<tt><ss><01><B0><CS><CR><LF>
I	Response Total Enabled Band Number	R	NU<tt><ss><02><36><dd><CS><CR><LF> 1.<dd>: Total Enabled Band Number 01: Single band units 02: Dual band units 03:Tri-band unit

P	Command	R/ W	Command String
I	Request Total Enabled Band Number	W	NU<tt><ss><01><B6><CS><CR><LF>
P	Set/Response Current RF Channel Preset NOTE: Used to select and request a RF channel presets.	RW	NU<tt><ss><02><37><dd><CS><CR><LF> 1.<dd>: Current Band RF Frequency Preset Number (0 - 255)
P	Request Current RF Channel Preset	W	NU<tt><ss><01><B7><CS><CR><LF>
I	Response Band Channel Configuration	R	NU<tt><ss><05><38><Band><Offset><Start><Stop><CS><CR><LF> 1.<dd>: Band 2.<dd>: Offset <0000|(++)(+)(o)(-)> 3.<dd>: Start Channel 4.<dd>: Stop Channel
I	Request Band Channel Configuration	W	NU<tt><ss><02><B8><Band><CS><CR><LF> 1.<dd>: Band
P	Response Band Designator	R	NU<tt><ss><##><41><dd><dd>…<dd><CS><CR><LF> 1.<dd>: Band ID 2.<dd>…<dd>: Band Designator <37><20><47><48><7A>: 7 GHz
P	Request Band Designator	W	NU<tt><ss><02><C1><dd><CS><CR><LF> 1.<dd>: Band ID
P	Response Quick Preset Number NOTE: Returns current user presets ID and Name or indexed user presets ID and Name.	RW	NU<tt><ss><##><50><dd>…<dd><CS><CR><LF> If requesting current preset: 1.<dd>: Quick Preset Number 01 – Quick Preset 1 02 – Quick Preset 2 …… 0F – Quick Preset 15 10 – Quick Preset 16 2.<dd>: Total number of presets If requesting preset name: 1.<dd>: Quick Preset Number 01 – Quick Preset 1 02 – Quick Preset 2 …… 0F – Quick Preset 15 10 – Quick Preset 16

P	Command	R/ W	Command String
			2.<dd>…<dd>: Quick Preset Name
P	Set/Save Quick Preset Set Quick Preset Name NOTE: Used to select 1 of 16 user presets or save to 1 of 16 user presets or set preset's name.	RW	NU<tt><ss><##><50><dd><dd><dd>…<dd><CS><CR><LF> 1.<dd>: Quick Preset Number 01 – Quick Preset 1 02 – Quick Preset 2 …… 0F – Quick Preset 15 10 – Quick Preset 16 2.<dd>: Set or Save flag 00 – Set Quick Preset 01 – Save to Quick Preset 02 – Set Quick Preset Name 3.<dd>…<dd>: Quick Preset Name (only for setting quick preset name)
P	Request Quick Preset Number Note: Used to request current User Preset ID and name or indexed User Preset name.	W	NU<tt><ss><02><D0><AA><CS><CR><LF> <AA> = 0 Request current Preset <AA> = 1..16 Request <AA> Preset Name
I	Response Miscellaneous Information NOTE: Used to request groups of parameters from the unit.	R	NU<tt><ss><##><52 ><dd>...<dd><CS><CR><LF> **<AA> = 0; System-level information only.** Overall system 1. <dd>: Modulation type 01 – COFDM 02 – NBCOFDM 2. <dd>: Constellation (0=QPSK, 1=16QAM, 2=64QAM) 3. <dd>: Code Rate (0=1/2, 1=2/3, 2=3/4, 3=5/6, 4=7/8) 4. <dd>: Guard Interval (0=1/32, 1=1/16, 2=1/8, 3=1/4) 5. <dd>: Locked Bandwidth (Refer to Command 0x02 for enumeration) 6. <dd>: Current Band 7. <dd>: Current RF Channel Preset 8. <dd><dd><dd><dd>: RF Frequency 9.<dd><dd>: Demodulator Lock Status Bit 0- Demod 1 (LSB) Bit 1- Demod 2 Bit 2- Demod 3 Bit 3- Demod 4 Bit 4- Demod 5 Bit 5- Demod 6 Bits 7 to 11 – set to 0

P	Command	R/ W	Command String
			Bits 12 to 15 – Total Number of Demodulator 10. <dd><dd>: UCE (MSB first) *This is the total number of uncorrected errors passing out of the MRC demodulator. When the system is out of lock FFFF will be reported.* 11. <dd>: SystemMER *This is the MER of the overall system in dB. If the system is out of lock the MER will report as 0. The range is 0 to 40dB. See Appendix B for details on calculation.* 12. <dd>: SystemLQ (Link Quality) *This reports the MRC link quality metric. The value is between 0 and 100decimal reported in hex. A 0 represents a very poor link where a 100 represents a perfect link. Appendix B for details on calculation.* 13 .<dd>: SystemRSL(Received signal level) *This reports the signal level in dBm. The value is a signed number where a 0xD8 represents -40dBm and a 0xA1 represents -95dBm. Appendix B for details on calculation.* **<AA> = 1; Detailed information.** Overall system 1-13: Same as above Antenna 1 14. <dd><dd><dd>: Pre Viterbi (<Integer Part><Decimal Part><Exponential Part>) *The Integer and decimal portion will always be 1.0 for values of Exponents <-9. therefore 3.1e-6 will read 1.0e-6 and 6.1e-10 will report as 0.0e0. This will extend to all the antennas. When the demodulator is out of lock 9.9e-1 will be reported.* 15. <dd><dd><dd>: Post Viterbi *This will report accurately as the demodulator reports. This will extend to all the antennas. When the demodulator is out of lock 9.9e-1 will be reported.* 16. <dd><dd>: UCE (MSB first) (0xFFFF means invalid) *This is the total number of uncorrected errors passing out of the modulator. When the demodulator is out of lock FFFF will be reported.* 17. <dd>: MER *This is the MER in dB. If the demodulator is out of lock the MER will report as 0. The range is 0 to 40dB.* 18. <dd>: Link Quality

P	Command	R/ W	Command String
			This reports the link quality metric. The value is between 0 and 100decimal reported in hex. A 0 represents a very poor link where a 100 represents a perfect link. 19. <dd>: RSL(Received signal level) *This reports the signal level in dBm. The value is a signed number where a 0xD8 represents -40dBm and a 0xA1 represents -95dBm.See Table 1.* Antenna 2 20. <dd><dd><dd>: Pre Viterbi 21. <dd><dd><dd>: Post Viterbi 22. <dd><dd>: UCE (MSB first) 23. <dd>: MER 24. <dd>: Link Quality 25. <dd>: RSL Antenna 3 26. <dd><dd><dd>: Pre Viterbi 27. <dd><dd><dd>: Post Viterbi 28. <dd><dd>: UCE (MSB first) 29. <dd>: MER 30. <dd>: Link Quality 31. <dd>: RSL Antenna 4 32. <dd><dd><dd>: Pre Viterbi 33. <dd><dd><dd>: Post Viterbi 34. <dd><dd>: UCE (MSB first) 35. <dd>: MER 36. <dd>: Link Quality 37. <dd>: RSL Antenna 5 38. <dd><dd><dd>: Pre Viterbi 39. <dd><dd><dd>: Post Viterbi 40. <dd><dd>: UCE (MSB first) 41. <dd>: MER 42. <dd>: Link Quality 43. <dd>: RSL Antenna 6 44. <dd><dd><dd>: Pre Viterbi 45. <dd><dd><dd>: Post Viterbi 46. <dd><dd>: UCE (MSB first) 47. <dd>: MER 48. <dd>: Link Quality 49. <dd>: RSL

P	Command	R/ W	Command String
I	Request Quick System Status	W	NU<tt><ss><02><D2><AA><CS><CR><LF> <AA> = 0; system level information only. <AA> = 1; Detailed information.
P	Set/Response Baud Rate	R/W	NU<tt><ss><05><6C><dd><dd><dd><dd><CS><CR><LF> 1.<dd><dd><dd><dd>: Baud Rate (MSB first) Valid Baud Rate – 300, 600, 1200, 2400, 9600, 19200, 38400, 57600, 115200
P	Request Baud Rate	W	NU<tt><ss><01><EC><CS><CR><LF>
I	Response Temperature	R	NU<tt><ss><05><6D><dd><dd><dd><dd><CS><CR><LF> 1.<dd>: Temperature (signed number) (main board) EC – -20C 2.<dd>: Temperature (signed number) (slot 1) 3.<dd>: Temperature (signed number) (slot 2) 4.<dd>: Temperature (signed number) (slot 3) NOTE: CC is returned if I2C communication error happens.
I	Request Temperature	W	NU<tt><ss><01><ED><CS><CR><LF>
I	Response Configuration Data NOTE: Internal Factory use to support system tracker.	R	NU<tt><ss><##><6E><dd..dd><CS><CR><LF> <##> = 0 to request number of data lines available <##> = 1+ to request specific data line. 1.<dd>: - Number of data lines available (or) <dd..dd>: - Configuration data
I	Request Configuration Data	W	NU<tt><ss><02><EE><dd><CS><CR><LF> 1.<dd>: 00 – Get number of data lines available 01..nn – Get specified data line
P	Response Unit Type [1]	R	NU<tt><ss><02><71><dd><CS><CR><LF> 1.<dd>: Unit Type 00 – General 01 – Master (Remote control) 02 – PT6 03 – RX6 04 – Newscoder TX1/2 05 – Newscoder RX1/2 06 – VT1 07 – MMPT6 08 – M2 Encoder 09 – M2 Decoder 0A – Seamless Switch 0B – CAMPAC 0C – Nulinx FT6 0D – Nulinx FR6 0E – Newscaster CR6 0F – GO PAC

P	Command	R/ W	Command String
			10 – Newscaster VT2 11 – Newscaster VT7 (HD) 12 – Newscoder TX3 13 – Newscoder RX3 14 – Newscoder TX7 (HD) 15 – Newscoder RX7 (HD) 1A – Newscaster CR7 (HD) 1E – PS18 1F – PS15 20 – Channel Master TX1 21 – Channel Master TX2 22 – Channel Master RX1 23 – Channel Master RX2 24 – Channel Master TX7 (HD) 25 – Channel Master TX7S (HD) 26 – Channel Master RX7 (HD) 27 – Channel Master RX7S (HD) 30 – Analog Coder TX 31 – Analog Coder RX 32 – Vstream Encoder 33 – Vstream Decoder 40 – Access RC 41 – ProQ 42 – IP Bridge 43 – nanoTx 44 – microTx 45 – nanoRx 46 – microRx 47 – CPTx 48 – MobilCMDR 49 – X-Tender microTx 4A – X-Tender microRx 4B – MicroLite Tx 4C – MicroLite Rx 4D – Newscoder 4 4E – Mobil Tactical Rx 4F – MicroLite Rx with ASI input 50 – nanoRx with Ethernet 51 – Skymaster Tx 52 – DirectVU 53 – CTx 54 - MobileViewer 60 – N-Way Diversity Receiver **61 – CRx6** 64 – Spectrum Viewer 80 – Diversity Receiver 1 81 – NewsHub 82 – Campac 2
P	Request Unit Type	W	NU<tt><ss><01><F1><CS><CR><LF>
P	Response Model # [1]	R	NU<tt><ss><10><72><dd> ... <dd><CS><CR><LF> 1.<dd>…<dd>: Model Number <37><30><4E><43><56><54><31><2D><4A>…: 70NCVT1-J…
P	Request Model #	W	NU<tt><ss><01><F2><CS><CR><LF>
P	Response Serial # [1]	R	NU<tt><ss><09><74><dd> ... <dd><CS><CR><LF> 1.<dd>…<dd>: Serial Number <34><38><30><39><2D><30><30><35>…: 4809-005…
P	Request Serial #	W	NU<tt><ss><01><F4><CS><CR><LF>
P	Response Software Version Information [1]	R	NU<tt><ss><10><75><dd> ... <dd><CS><CR><LF> 1.<dd>…<dd>: Software Version Number <41><31>…: A1.0…

<table>
<tr><th>P</th><th>Command</th><th>R/ W</th><th>Command String</th></tr>
<tr><td>P</td><td>Request Software Version Information</td><td>W</td><td>NU<tt><ss><02><F5><dd><CS><CR><LF>
1.<dd>: Module Address
00 – system Version</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>P</td><td>Response Current Alarms [1]</td><td>R</td><td>NU<tt><ss><##><76><dd> ... <dd><CS><CR><LF>
1.<dd>: Current Total Alarm Number
2.<dd>: Module Address
3.<dd>: Module Alarm Code</td></tr>
<tr><td>P</td><td>Request Current Alarms</td><td>W</td><td>NU<tt><ss><01><F6><CS><CR><LF></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>P</td><td>Response Alarm Description [1]</td><td>R</td><td>NU<tt><ss><##><77><dd> ... <dd><CS><CR><LF></td></tr>
<tr><td>P</td><td>Request Alarm Description</td><td>W</td><td>NU<tt><ss><03><F7><dd><dd><CS><CR><LF>
1.<dd>: Module Address
2.<dd>: Module Alarm Code</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>P</td><td>Response Network Parameters</td><td>R</td><td>NU<tt><ss><0E><7D><dd> ... <dd><CS><CR><LF>
1. <dd>: DHCP Mode
00: Disabled 01: Enabled
2.<dd><dd><dd><dd>: IP Address
3.<dd><dd><dd><dd>: Subnet Mask
4.<dd><dd><dd><dd>: Default Gateway
NOTE: CC is returned if DHCP is enabled but no IP address is assigned.</td></tr>
<tr><td>P</td><td>Request Network Parameters</td><td>W</td><td>NU<tt><ss><01><FD><CS><CR><LF></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>P</td><td>Response Factory Test Data</td><td>R</td><td>NU<tt><ss><##><00><dd> … <dd><CS><CR><LF>

Receiver summary data:

<table>
<tr><th>Offset</th><th>Format</th><th>Name</th></tr>
<tr><td>0</td><td><dd><dd><dd><dd></td><td>adc_power_i</td></tr>
<tr><td>4</td><td><dd><dd><dd><dd></td><td>adc_power_q</td></tr>
<tr><td>8</td><td><dd><dd></td><td>rf_power</td></tr>
<tr><td>10</td><td><dd><dd></td><td>agc_wbd</td></tr>
<tr><td>12</td><td><dd><dd></td><td>agc1</td></tr>
<tr><td>14</td><td><dd><dd></td><td>agc2</td></tr>
<tr><td>16</td><td><dd></td><td>agc_split</td></tr>
<tr><td>17</td><td><dd></td><td>rf_atten</td></tr>
<tr><td>18</td><td><dd></td><td>mer_mant</td></tr>
<tr><td>19</td><td><dd></td><td>mer_exp</td></tr>
<tr><td>20</td><td><dd><dd><dd><dd></td><td>ber</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td>P</td><td>Command</td><td>R/ W</td><td>
<table>
<tr><td>24</td><td><dd></td><td>eq_signal_mant</td></tr>
<tr><td>25</td><td><dd></td><td>eq_signal_exp</td></tr>
<tr><td>26</td><td><dd></td><td>eq_noise_mant</td></tr>
<tr><td>27</td><td><dd></td><td>eq_noise_exp</td></tr>
<tr><td>28</td><td><dd><dd></td><td>viterbi_syndrome</td></tr>
<tr><td>30</td><td><dd><dd></td><td>uce</td></tr>
<tr><td>32</td><td><dd><dd></td><td>uce_per_second</td></tr>
<tr><td>34</td><td><dd><dd></td><td>locks</td></tr>
<tr><td>36</td><td><dd><dd><dd><dd></td><td>dds_freq</td></tr>
<tr><td>40</td><td><dd><dd><dd><dd></td><td>p_dds_freq</td></tr>
</table>
See Appendix B for description of each field.
</td></tr>
<tr><td>P</td><td>Request Factory Test Data</td><td>W</td><td>NU<tt><ss><03><80><dd><dd><CS><CR><LF>
1.<dd>: Data set
00 – Receiver summary data
2.<dd>: Antenna
00 – Antenna 1
01 – Antenna 2
02 – Antenna 3
03 – Antenna 4
04 – Antenna 5
05 – Antenna 6</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>P</td><td>Receive Packet Response</td><td>R</td><td>NU<tt><ss><02><7F><dd><CS><CR><LF>
1.<dd>: Response to Receive Packet
00 – Packet No Error 55 – Invalid Data
CC – I^2C Error FF – Packet Error</td></tr>
<tr><td colspan="4">Error Responses:

In the event of a communications error, the device will respond with an error byte in the format:

<02><7F><xx>

Where error code byte xx indicates:
00 hex Good data (no error, this is the normal response for commands)
55 hex Invalid Data
CC hex Internal error processing command
AA hex Remote commands locked out
FF hex Bad command packet received</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
</table>

Appendix A: Usage Examples

Communication overview:
To communicate with CRx6 a standard ASCII byte oriented packet is used over a UDP.

Unit default IP address is 192.168.10.35. Ethernet related parameters are defined in the Ethernet section of Preset.xml.
DHCP mode: false, true, server
false: static IP address mode
true: DHCP client mode (IP address is assigned by a DHCP server)
server: DHCP server mode (CRx6 assigns IP addresses to its clients)
IP Address: unit's static IP address
Subnet Address: Network subnet mask
Gateway Address: Gateway IP address
DHCP Server Start Address: Start IP address when unit is in DHCP server mode
DHCP Server End Address: End IP address when unit is in DHCP server mode

Port number: 49994

Unit always listens to UDP port number 49994. When the remote command is received in that UDP port, the unit will process the command and return the response to the command initiator.

Packet outline:
<NU><Target address><source address><><Length><command><data>

Command String:
NU – ASCII code for N <4Eh> and U <55h>
<tt>Target address (00 – 99): This is the address of the unit. (Default = 01)
<ss>Address of source (00 –99):
This is the address of the master controller. (Nucomm's controller uses 00).
Packet length (Range: 02-17 (Command Length + Data Length))
Command (00-FF)
Data (Hex Format)
<checksum> – (1's complement of <Target address> to end of data)
<CR> - Carriage Return
<LF> - Line Feed

In all examples shown the packets are as they would be displayed on an ASCII terminal the "<> "'s have been added to the packet for visual delimiters only and do not appear on the terminal.

A <01> is actually transmitted as a 2-digit ASCII code 30h and 31h.

Example: To calculate checksum

Request Model #	NU<01><00><01><F2><0B><CR><LF>

Here are the steps to calculate checksum:

1. Add data from <target address> to end of data (all data listed in HEX):
   01 + 00 + 01 + F2 = F4
2. The above sum AND 0xFF to keep the lowest byte and ignore the others:
   F4 & FF = F4
3. The above sum XOR 0xFF:
   F4 ^ FF = 0B (this is the checksum)

In all, checksum = ((01 + 00 + 01 + F2) & FF) ^ FF = 0B

Example: To Request unit model number

To request the unit model number two commands exist one for the first half of the model number and another for the second half. The following procedure is used to retrieve data from the unit:

1. A request for the model number is sent. (Command F2)
2. The unit will respond with response Command 72

Request Model #	NU<01><00><01><F2><0B><CR><LF>

Respond with Model #	NU<00><01><10><72><32><33><43><52><37><44><2D> <33><35><30><2D><41><32><43><31><2E><CR><LF> Model Nuber is ”23CR7D-350-A2C1”

Example: To Request unit serial number

Request Serial #	NU<01><00><01><F4><09><CR><LF>

Send Serial #	NU<00><01><09><74><32><31><31><32><2d><59><59> <5a><82><CR><LF> Serial Number is ”t2112-YYZ.”

Proprietary Information and Disclaimer Notice

IMT has made every effort to ensure the accuracy of this material at the time of printing. However, as the specifications, equipment, and this manual are subject to change without notice, IMT assumes no responsibility or liability whatsoever for any errors or inaccuracies that may appear in this manual, or for any decisions based on its use. This manual is supplied for informational purposes only and should not be construed as a commitment by IMT.

Warranty

Equipment manufactured by IMT, LLC is warranted to meet all published specifications and to be free from defects in material and workmanship within a period of two years from date of original shipment. The company's liability under this warranty is limited to:

- Servicing or adjusting equipment.
- Replacement of defective parts.

Any equipment returned to the factory shall have the freight paid for by the buyer.

Equipment showing damage by misuse, abnormal conditions of operation, or attempts to repair by other than authorized service personnel shall be excluded from this warranty. IMT shall in no event be responsible for incidental injury or property damage. Since IMT has no control over conditions of use, no warranty is made or implied as to suitability for the customer's intended use, beyond such performance specifications as are made part of the purchase order. There are no warranties expressed or implied, except as stated herein. This limitation on warranties shall not be modified by verbal representations.

Shipping Damage

Equipment shipped FOB IMT shall become the property of buyer upon delivery and receipt from carrier. Any damage in shipment should be handled by the buyer directly with the carrier. Immediately request the carrier's inspection upon evidence of damage in shipment.

Field Service

IMT products are designed with easy access to components to facilitate service. However, some modules cannot be service in the field. To prevent voiding of the warranty, please contact Tech Support before servicing or making any repairs. The user is cautioned to read all module descriptions in this manual. Warnings are included in the circuit descriptions and on certain modules themselves.

Replacement Modules

Troubleshooting to the component level is often not cost-effective and frequently impossible. Often the practical method of effecting repairs is to substitute known good spare modules for suspect units. Replacement modules for our standard product line are usually available.
Technical Support Information

Technical Support personnel are available to extend technical assistance to customers while installing, operating, or troubleshooting IMT equipment. Please have your model number and serial number available.

Telephone

During IMT business hours, 8:30am - 5:30pm EST (-5 Hours, GMT), call:

US 908-852-3700

International 001-1-908-852-3700

After hours, call:

US or International.....888-531-3892

Email

Email address .....service@nucomm.com

Internet

Web address .....www.imt-solutions.com

Equipment Returns

If equipment cannot be successfully restored through telephone consultation, return to the factory may be required. Loaner items may be available until the repaired items are returned.

For out-of-warranty equipment only: We evaluate all returned units, and then confers with the client on corrective action. If no fault is found, or no corrective action is authorized, a diagnostic fee may be charged.

Prior to returning products to the factory, please obtain a return material authorization (RMA) number and shipping instructions from Tech Support.

When returning equipment, it is very helpful to enclose a note containing the following:

- RMA number.
- Serial number.
- A detailed description of the problem.
- Name of an engineer or technician we may contact regarding problems encountered.
- A "ship to" and "bill to" address.

Ship all returns to:

IMT, LLC
Attn: RMA# (your RMA number)
200 International Drive
Mt. Olive, NJ, 07828, USA
(908) 852-3700

For International returns:

In addition to the instructions above, when shipping internationally we recommend the use of a courier such as Federal Express, UPS, etc, and that the goods be shipped DOOR-TO-DOOR PRE-PAID. This will reduce Customs costs, handling charges and delays. Enclose all the information above, plus a statement that the equipment was manufactured in the United States (*the latter is needed to expedite customs processing*).

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