-- DRAFT ---

Networked Receiver Controller

NRC-3.0

Users' Guide

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Proprietary Statement

Disclaimer

Information furnished in this manual is believed to accurate and reliable. However, no responsibility is assumed for its use, or for any infringements of patents or other rights of third parties that may result from its use.

Warning

This equipment utilizes voltages which are potentially dangerous and may be fatal if contacted. Exercise caution when working with the equipment any time the protective cover is removed.

License Agreement

By logging into this system, or by configuring installing, copying, or otherwise using the NRC and/or NRC interface protocol (NIP) and any code, protocol, or data provided, including within or for use with the NRC, you agree to be bound by the terms of the NRC & NIP license agreements. If you do not agree to the terms of these agreements, do not install, configure, or use this system.

The license is available for review in this manual and by request from www.aegis-inc.net

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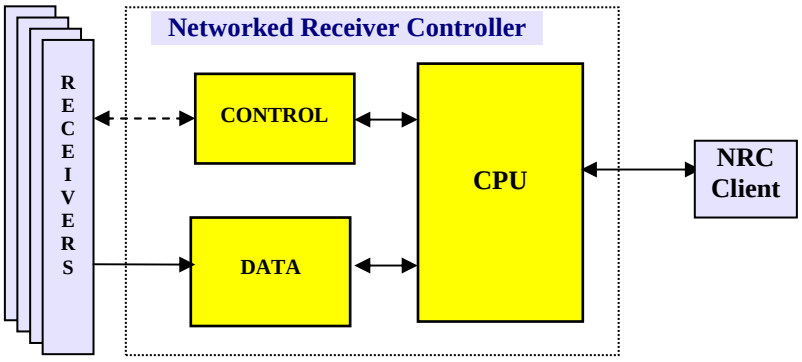
General Information

The Networked Receiver Controller (NRC) is a single node network device capable of simultaneously:

- collecting and digitizing up to 8 attached receivers analog audio output signal
- controlling and configuring up to 8 attached receivers for data collection
- formatting and routing the digitized receiver's signal to one or more attached network clients.

A simple diagram of the NRC system is shown below.



The NRC is the server portion of a network based client/server architecture. NRC clients connect and disconnect from the NRC via an Ethernet network connection as necessary. When connected a client has the ability to control, configure and collect digitized audio from the associated receiver.

Each receiver is physically connected to the NRC via an audio input port and an optional RS-232 command/control port. The receiver's analog audio output is connected to an A/D where it is sampled at 16 KHz with 16 bit resolution. The resultant digitized audio signal is available for secondary processing and distribution from the NRC as required. The default NRC configuration provides a 4 KHz band-limited, 8 KHz sampled data signal. This digital audio signal is available to the NRC client through a simple packet based protocol, which aggregates samples into a single data packet for forwarding to the client.

The NRC is a 1 rack unit system with Figure 1 and Figure 2 showing the front and rear views.

Figure 1 - NRC Front Panel

Figure 2 - NRC Rear Panel

Throughout this chapter, the various features of the NRC will be discussed.

Channel Architecture

A channel defines a virtual connection between a client application and a receiver connected to the NRC. There are two types of channel connections which can be established to a receiver; a Primary connection and a Piggy-back connection.

1. A Primary Connection
    a. A Primary connection is established with a receiver when the receiver is free of any other client connections.
    b. A Primary connected client has full access and control of the receiver and its resources.
2. Piggy-back Connection
    a. A Piggy-back connection is established with a receiver when the receiver currently has one or more other clients already attached to it.
    b. A Piggy-back connected client cannot change any receivers settings, although it can view the current receiver settings, and capture and format the receivers audio output.

The NRC supports one Primary connection per receiver and multiple Piggy-back connections, with the NRC able to support an aggregate of 64 simultaneous Primary/Piggy-back connections.

Audio Data Capture

The NRC uses an 8 channel PCI-based Analog/Digital converter card to digitize each receiver's audio output signal. Each receiver's audio signal is digitized into 16-bit samples (14.8 effective bits/sample) at a sampling rate of 16 KHz.

Each client attached to the receiver can receive a copy of this sampled audio data through a simple packet based protocol, and can specify:

- the number of samples to be contained within a data packet
- the effective sampling rate of the data - either 8 KHz or 16 KHz.
- the audio data filtering option – 4 KHz LPF ON or OFF, and
- the packet time stamping – TAI64N ON or OFF
- the type of data to receive – PCM16, A-law or Mu-law

The 16KHz data acquisition sampling clock is derived from one of the following options:

- The high precision crystal oscillator circuitry on the NRC's DAQ (Data Acquisition) card. This option uses a software count-down timer to trigger the sampling clock.
- The NRC's internal stable 10MHz reference circuitry. This signal is generated internally on an Aegis developed, PLL processing card, which divides down this reference signal to a 16KHz signal to clock the DAQ card.
- An external 10MHz reference signal which is input into the NRC. This signal is then locked to and divided down by the Aegis developed PLL processing card, to provide the necessary 16KHz clock signal to the DAQ card.

The NRC also provides an option to synchronize the start of each client's channel data acquisition to the next rising edge of an external 1Hz (1 pulse/sec) synchronization pulse or not.

Whichever sampling/synchronization option combination is selected is applied across all 8 channels.

Universal Receiver Translation/Abstraction

The NRC abstracts the user from needing to know each receiver's proprietary low-level communications protocol by presenting a common receiver translation software tasking interface to the user. This common software interface allows the user to task the receivers at a logical level without the need to worry about how to implement this tasking. This allows a wide range of different receivers to be tasked via the NRC in the same manner regardless of the number, model or configuration of the receivers.

This receiver hardware abstraction allows the NRC:

- To be easily programmed to connect to almost any receiver with a remote interface.
- To accommodate being connected to different receiver models simultaneously.
- To control the major functions of any receiver through a simple tasking protocol.
- To provide receiver vendor independence, allowing the user to utilize the most appropriate receiver for any given application.

Each supported receiver has an XML configuration file which maps its low-level commands to NRC's common protocol. This allows new receivers to be added to the NRC relatively quickly through the generation and integration of new receiver XML profile files.

The NRC supports 3 different types of receiver profiles:

- FULL – these profiles completely define the receiver-NRC protocol mappings. This allows the receiver to be fully controlled through the NRC's abstracted command protocol. Ideally, each receiver model will have a FULL receiver profile file.
- BLANK – these profiles only define the low-level transport options needed to communicate with the receiver, along with the receiver's transmit and receive packet delimiting characters. This allows new receivers to be supported quickly, although control of these receivers is more complex as the user needs to send native low-level commands to the receivers through the NRC as there is no receiver-NRC protocol mapping.
- ANALOG – this profile defines a null receiver interface which allows analog signals to be input into the NRC without the need for a receiver control interface to be present. This allows the analog signals to be input into the NRC, digitized and made available on the network.

A list of currently supported receivers can be found in the *specifications* section of this document, with additional receiver support able to be provided upon request.

Capabilities Summary

Receiver Controllable Settings

- Frequency
- Detection Mode
- IF Bandwidth
- AGC mode
- BFO
- Reset / Reboot
- Pass native commands to the receiver
  - By-pass the generic receiver interface and send the receiver proprietary commands
- Receiver Memory Interface Support
  - Save, recall and query receiver configuration memory settings

Client Connection Options

- Up to 24 simultaneous client connections
- Primary - connection to a receiver when it is free
  - Full control and access to the receiver, the audio data and its configuration options.
- Piggyback - connection to a receiver that already has a Primary client attached
  - Limited connection privileges
  - No control of the receiver but visibility of the receiver's settings.
  - Full access to the receiver's audio configuration and data options.
  - Can be promoted to Primary connection status if the existing Primary client disconnects

Remote NRC System Monitoring

- View current state of receiver configurations and attached clients
- View health and well being of NRC

Digitized Audio Channel Output Options

- Sampling Rate: 8 KHz (default), 16 KHz
- Filtering: 4 KHz LPF (default), None
- Samples/Data Packet: 640 (default), 128-4096
- Data Type: PCM16(default), A-law, Mu-law
- Packet Time Stamping: None (default), TAI64N
- Retune Samples skipped: 350 (default), variable
- Collection Control: Start / Stop

Receiver Channel Test

- A self test is used to verify each receiver's control and audio signal path are correct at:
  - power on
  - when the receiver type is changed
  - when the receiver returns to an on-line state

Data Acquisition Options

- Sample Clock Source: DAQ Card, Int 10MHz (default), Ext 10MHz
- Sample Loss Handling: Continue (default), Stop
- Synchronization: Ext 1Hz (rising edge), None (default)
- Sync Loss Handling: Continue (default), Stop
- DAQ Card Channel Gains: 1 (default), 2, 4, 8
- Signal Type: Differential (default), Single Ended

Network Time Protocol (NTP) Client

- The NRC is configurable to obtain and synchronize time with an NTP Server

Specifications

System Hardware

- CPU System:
  - PC x86 SBC based system
- Operating System
  - Linux OS, Compact Flash based file system
- PLL Sub-System:
  - Aegis PLL Card
  - FPGA Card
- I/O Sub-System
  - Octal RS-232 card
  - Octal channel DAQ card

Supported Receivers

- Full Receivers:
  - DRS WJ-8723 HF Receiver
  - Ten-Tec RX-331HF Receiver
- Blank Receivers (RS-232;19.2k)
  - RxModem / RxNullModem, with Tx and Rx command string terminators:
    - CR-CR
    - LF-CRLF
- Analog Receiver
- Additional receivers available upon request

Physical Inputs/Outputs

- Number of controllable receivers: 1 to 8
- Connections/Receiver
  - 1x Audio Input Port (DB-15)
  - 1x Control Port (RJ-45, RS-232) - optional
- Network Port (RJ-45, 10/100 Base-T Ethernet)
- Remote Serial Terminal Port (DB-9, RS-232)
- External 10MHz Ref. (BNC, +/-10dBm sinusoidal)
- External 1Hz Sync. (BNC, TTL signal)

A/D Conversion

- Sample Resolution:
  - 16-bit (14.8 effective bits)
- Channel Sampling Rate: 16 KHz
- Pre-A/D Channel Gain: 1 (default), 2, 4, 8
- Sample Clock source options:
  - DAQ Card Oscillator
    - Accuracy: 10ppm 0-85C
    - Stability: 10ppm 0-85C
  - Internal 10MHz reference (default)
  - External 10MHz reference
- Signal Types: Single-Ended / Differential (default)
- Analog Signal Input Range: -5V to +5V

Chassis

- 1RU (19"x 20"x1.75"), fits standard 19" racks
- Jonathan 375QD-20 slide mounts fitted
- Weight: 10lbs
- Ventilation: Positive internal pressure
- Internal Heating Profile:
  - Fully loaded NRC, temperature increase <+15F above ambient
- Earth Ground Stud
- FCC Class B certified
  - With use of shielded Ethernet network cable

Note: Chassis not recommended to be solely mounted in 19" rack by bolts through the chassis' front panel
- rack slides or rack shelving recommended.

Support Software

- Java and C++ programming APIs
- Example Client Program
- Remote software upgrade capability

Power

- Nominal power: 30 W
- Max power: 35 W
- Operating Range:
  100-240 VAC, @47-63Hz (Auto-Select)

Documentation

- Programmers Manual
- Users Manual
- Protocol Interfacing Document

Installation

Contents

The following is a list of items delivered with the NRC unit.

- Networked Receiver Controller unit (1)
- Power cable (1)
- Users' Guide (1)
- Programmers' Guide (1)
- Documentation and SDK CD (1)
- For BAE Systems WJ-8723 systems
    - Receiver Control Cables (8) - DB25M-RJ45 - grey cables
    - Receiver Audio Cables (8) - DB15M/DB15M audio cables
- For TenTec RX331 systems:
    - Receiver Control Cables (8) - DB25M-RJ45 - black cables
    - Receiver Audio Cables (8) - DB15M/DB15M audio cables

Note: NRC3.0 Receiver Control Cables have a blue label at each end of the cable and are incompatible with all earlier NRC1.x and NRC2.x systems.

Hardware Installation

Step 1: Receiver Audio Signal Termination Type

The NRC supports both differential and single-end audio signals, with the factory system default being configured to support Differential Mode.

If Single-End mode is required, proceed as follows:

1. Ensure the NRC is powered off
2. Remove the top cover of the NRC.
3. Locate the two banks of 4x DIP switches, **D1** and **D2**.
4. Set all switches to the ON position for single-ended operation.
    a. Conversely, set each switch to the OFF position for differential operation.
5. Replace the cover and install the screws.

Note: The NRC software's default configuration is to support Differential Mode, and hence it must also be configured to match the desired audio signal state. The *NRC Configuration* section will address this requirement.

Step 2: Rack Mount the NRC unit

The NRC chassis supports Jonathan Type 375QD-20 chassis slides and these are recommended for rack mounting the NRC where necessary.

Note: It is not recommended that the NRC Chassis be solely mounted in 19" rack by bolts through the chassis' front panel - rack slides or rack shelving recommended.

Step 3: Connect Power

The supplied power cable should connect the power adapter on the back panel power socket of the NRC. The NRC power supply is an auto-sensing unit which can accept voltages between 100-240VAC @47-63Hz.

Step 4: Connect Receivers

Each brand and model of receiver has specific configuration and installation instructions that must be followed prior to operation with the NRC. Please refer to Appendix A.

Step 5: Optional - Connect External 10MHz Reference

If an external 10MHz reference is required to stabilize the DAQ card sampling, use a coaxial cable to connect a +/-10dBm sinusoidal external reference signal to the "EXT REF" port on the back panel of the NRC.

The default configuration uses the internal 10MHz reference signal and hence the system will need to be re-configured to use this external signal. This can be achieved after the Hardware Installation through the NRC Java client's "Global NRC Properties" dialog, or via the programmers' SDK.

Step 6: Optional - Connect External 1Hz Synchronization Signal

If an external 1Hz Sync signal is required to initialize channel acquisition, use a coaxial cable to connect a TTL level, 50% duty cycle signal to the "1Hz Sync" port on the back panel of the NRC.

The NRC's default configuration doesn't use this signal and hence the system will need to be re-configured to use this external signal. This can be achieved after the Hardware Installation through the NRC Java client's "Global NRC Properties" dialog, or via the programmers' SDK.

Step 7: Connect to the Network

A Cat-5 cable should be used to connect between the ETHERNET port on the back panel of the NRC and the local area network.

Note: In order for the NRC3.0 system to meet FCC Class B standards a shielded Ethernet cable should be used.

NRC Configuration

Prerequisites:

In order to successfully configure the NRC for operational use, the installer must have access to:

1. A terminal emulation program
    a. Before using the NRC on the network it must be properly configured, by running a configuration utility on the NRC through a remote terminal session. This requires connecting serially to the NRC from another computer. The operating system of the computer is not important as long as it has a compatible terminal emulation program. For example, most Linux distributions contain **minicom** and the Windows systems contain **HyperTerminal**, both of which are suitable to run this application. In addition, the computer must contain an available serial port.
2. A computer machine on which the NRC java client can be run
    a. In order to configure the NRC to understand the type of attached receivers, the supplied NRC Java client needs to be able to run. This computer needs to be on the same network as the NRC unit so it can attach to the NRC.

Step 1: Connect to the NRC

Before using it on the network the NRC must be properly configured by running a configuration utility on the NRC through a remote terminal session. This requires connecting serially to the NRC from another computer. The Linux based **minicom** or the Windows based **HyperTerminal** applications are both suitable for this. In addition, the computer must contain an available serial port.

The following steps describe the remote terminal connection process:

1. Connect a DB9 null modem cable from the remote terminal port on the NRC to a serial port on the computer.
2. Start the terminal emulation application on the computer.
3. Specify correct terminal settings on the terminal emulation application. Please refer to the application documentation for instructions on how to make these settings.
    - COM Port: *use the serial port on the computer that connects to the NRC.*
    - Bits per second: 9600
    - Data bits: 8
    - Parity: none
    - Stop bits: 1
    - Flow control: None
    - Terminal emulation: vt100
4. Power on the NRC
5. Activate the terminal (press Enter a few times). You may need to send a terminal *break* if this doesn't work.
6. Once this terminal is active the linux system and NRC boot-up messages will be echoed to the remote terminal. Once the NRC system has finished booting, a user login prompt will appear as shown in Figure 3.

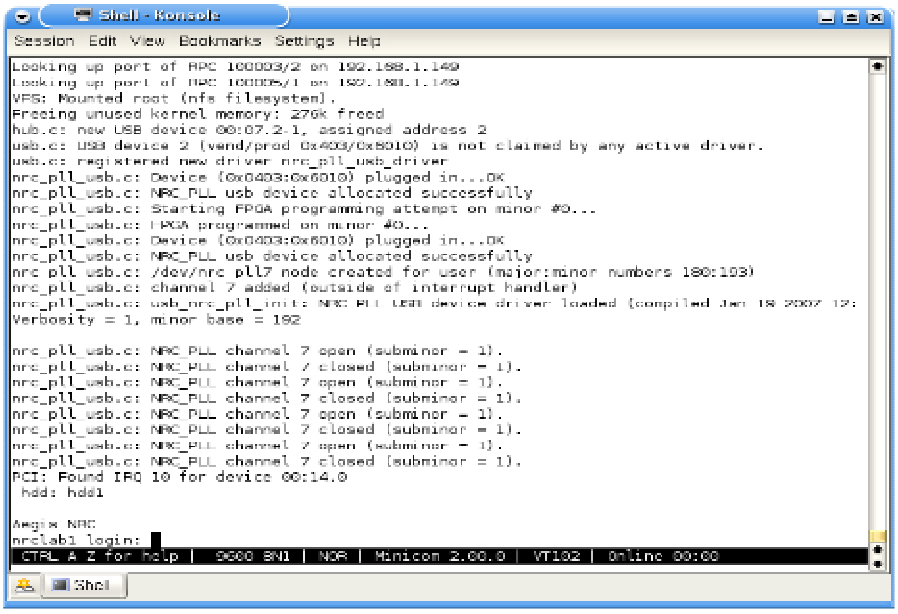


Figure 3- NRC Boot Up and Log In

7. If this is the first time the NRC has been turned-on, once the NRC has completed its initial system boot-up process, the NRC will uploaded the initial graphics files into the LCD display. The NRC's LCD display will indicate which LCD memory location the current image is being uploaded into and once this image upload process is finished, the LCD display will display 8 small channel status windows above the system version message "NRC-3.0".[1]
8. Once the NRC has reached this stage, the user should then log in to the NRC via the remote terminal.

   Note: If you login before the NRC system has completed the LCD image file upload and the LCD display isn't displaying the 8 channel status icons, the NRC file system will be in a read-only state. This will mean that none of the NRC configuration changes available through the NRC Configuration Utility will be able to changed.
9. Login as *root*, with the Aegis shipped *root* password set to *aegisnrc*. The option on how to change the password will be discussed shortly. Once logged in, the user will automatically initiate the running of the NRC Configuration Utility.

Step 2: NRC License Agreement

In order to configure and operate the NRC system, the user must first accept the NRC system license agreement. Once the user has accepted the licensing agreement, the user will not be required to walk through this step.

Initially the license splash screen with basic information will be displayed as shown in Figure 4.

1 See "*Interpreting the LCD display" for details*

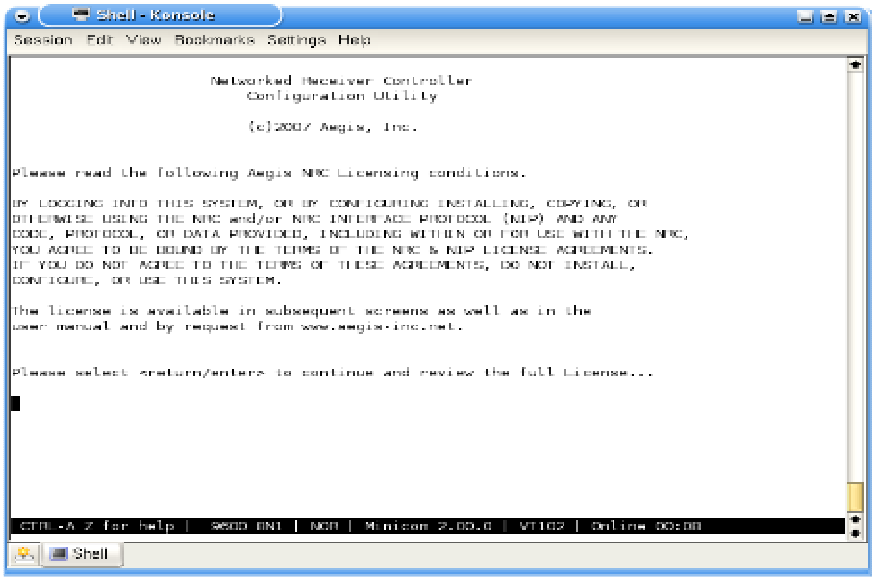


Figure 4 – License Agreement Splash Screen

Once the user has read this splash screen and hit <*return/enter*> at the prompt, the full license is displayed (see Figure 5**Error! Reference source not found.**) to the user in pages, which can be stepped through by hitting <*space*> on the keyboard.

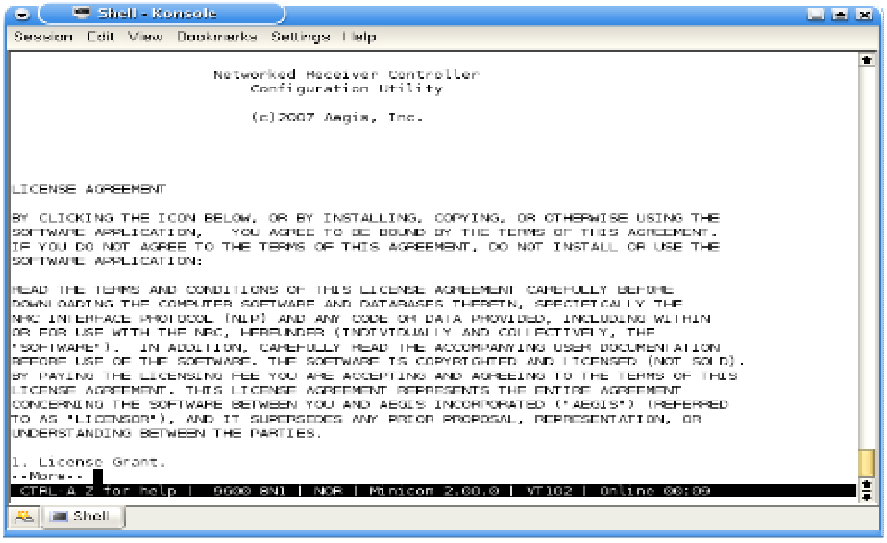


Figure 5 - NRC License Agreement - First Page

Once the final page of the License agreement has been displayed the user will be asked to accept the terms associated with the License by entering <*YES/yes*> at the final prompt, as shown in Figure 6.

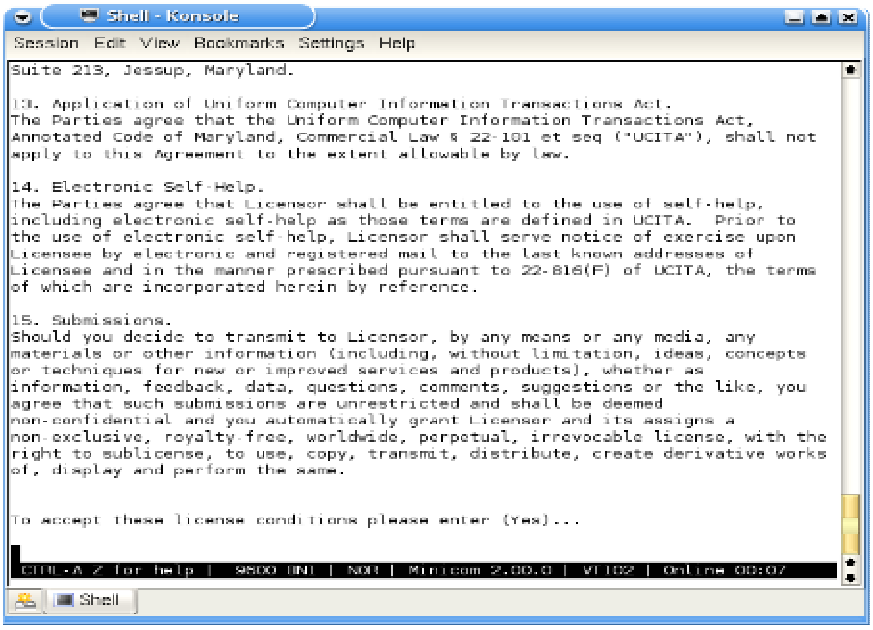


Figure 6 - NRC License Agreement - Final Page

Once the license agreement has be accepted, a confirmation window will appear re-stating that the user has selected to accept this license agreement, as shown in Figure 7.

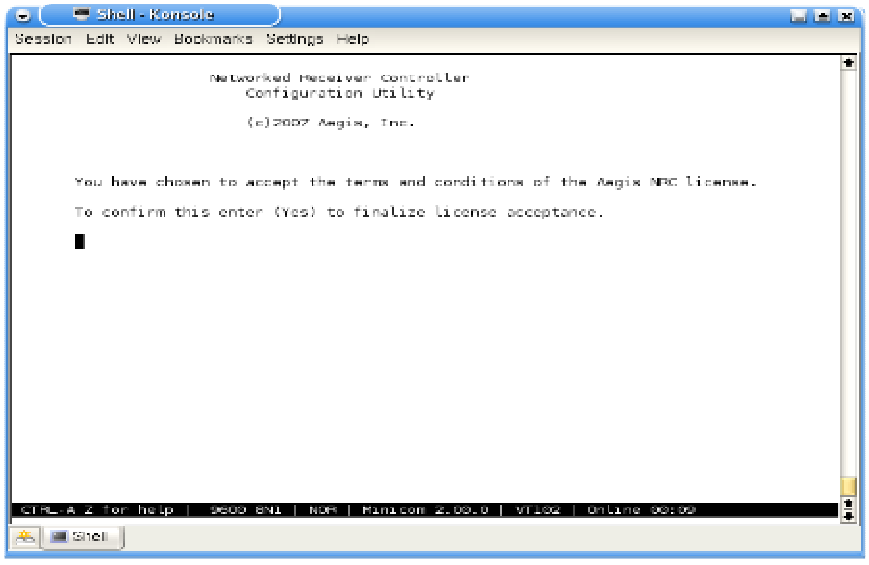


Figure 7 - NRC License Confirmation

Once the user has entered <*Yes*> at this confirmation screen, confirmation will be returned to the user that they have accepted the NRC license agreement and then they will be presented with the NRC Configuration Utilities main menu, as show in Figure 8.
When subsequent users log into the NRC system, a licensing splash display will indicate that the NRC License agreement has already been accepted for this NRC unit, and then users will be directed to this main NRC configuration window.

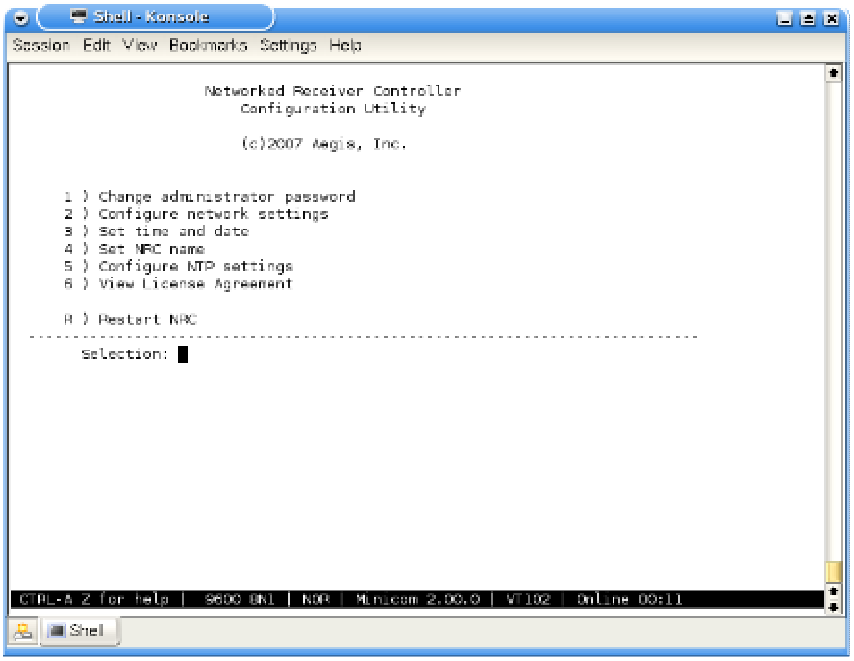


Figure 8 - NRC Configuration Utility - Main Screen

Step 3: Change Administrator Password

It is important to change the root password immediately to secure the machine. Select option *<1>* and follow the screen prompts to enter a new password. Below in Figure 9 is an example of when the password is being changed. Notice that the NRC will warn the user selects a weak password.

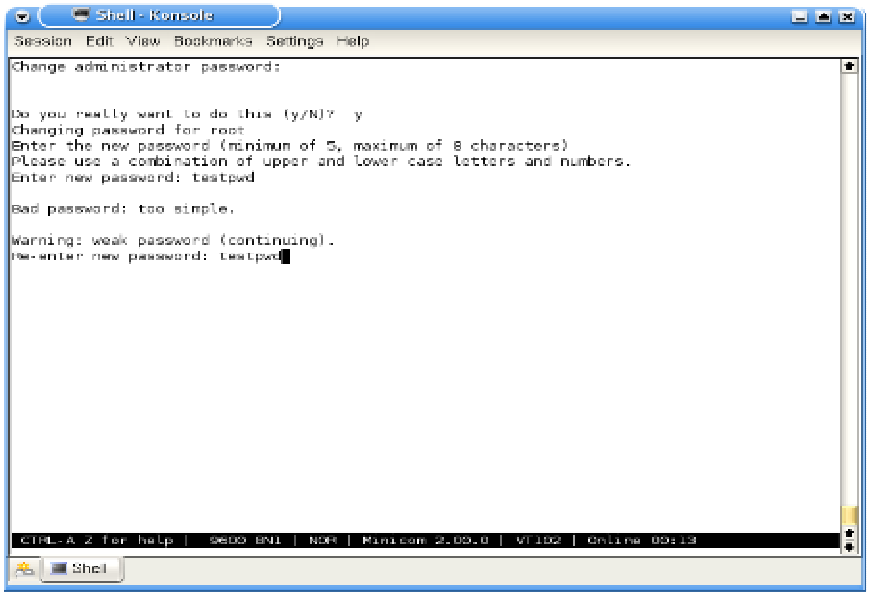


Figure 9 - Changing Administrator Password

Important: don't forget or lose the root password. Doing so will make it impossible to administer these settings or to make any upgrades or changes to the NRC. In the case that this does occur, call Aegis, Inc. for recovery information.

Step 4: Configure Network Settings

Before the NRC can be accessed from the network, it must be assigned a network address. Select option <*2*> and follow the screen prompts to configure the network options.

Figure 10 shows an example screen sequence as the IP address settings are configured or changed.

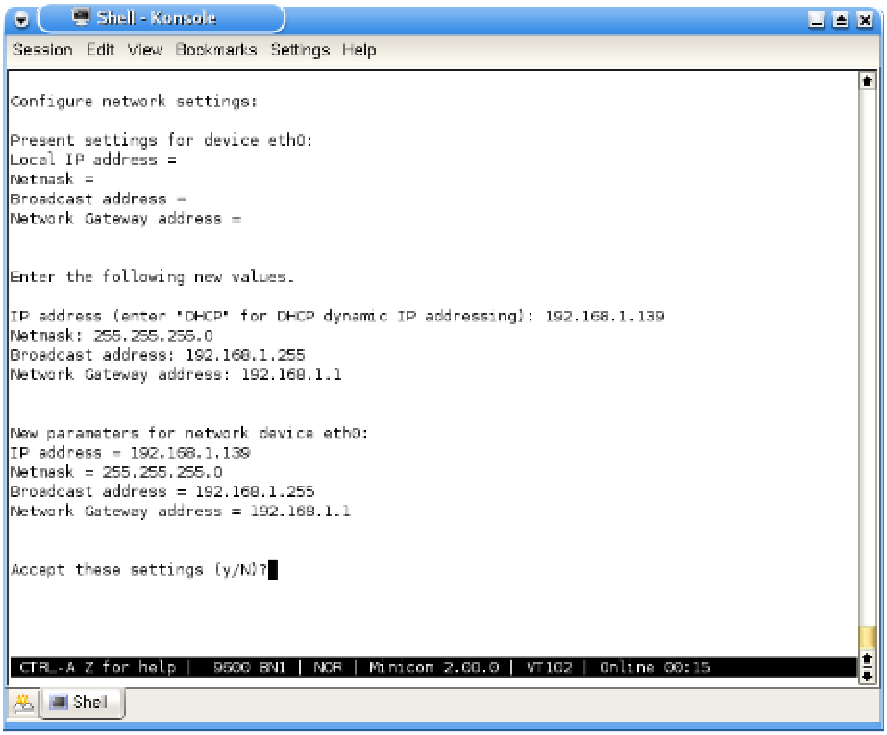


Figure 10 - Setting the Network IP Information

The following IP information is needed to configure the NRC:

1. IP address
   The IP address of the NRC if one has been assigned by the network administrator or "DHCP" if dynamic network addressing is supported in the network.
2. Subnet mask
   Obtain the correct value from your network administrator or press *Enter* for none.
3. Broadcast address
   Obtain the correct value from your network administrator or press *Enter* for none.
4. Network Gateway address
   Obtain the correct value from your network administrator or press *Enter* for none.

Once these input changes have been accepted, these changes will take effect immediately.

Step 5: Set the Time and Date

Select option <3> and follow the screen prompts to set the correct time and date.
Figure 11 shows a screen sequence example for when the time and date are configured.

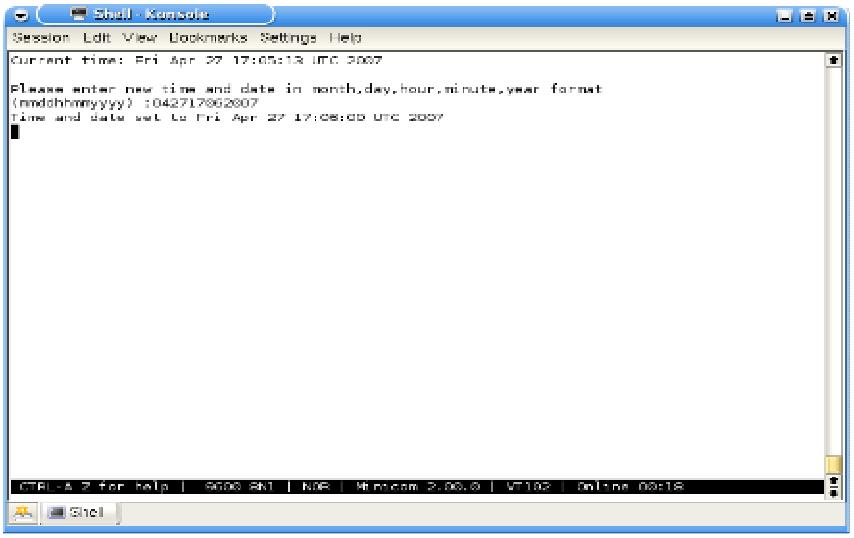


Figure 11 - Setting the NRC System Time and Date

Please note the time/date format - month/day/hour/minute/year (MMDDHHMMYYYY).
If you enter return without entering a new time string the time and date will not be changed.

Step 6: Set the Host Name

Select option <4> and follow the screen prompts to enter a name for this NRC. This name should be unique for this NRC. Figure 12 is a screen sequence example as the NRC name is changed.

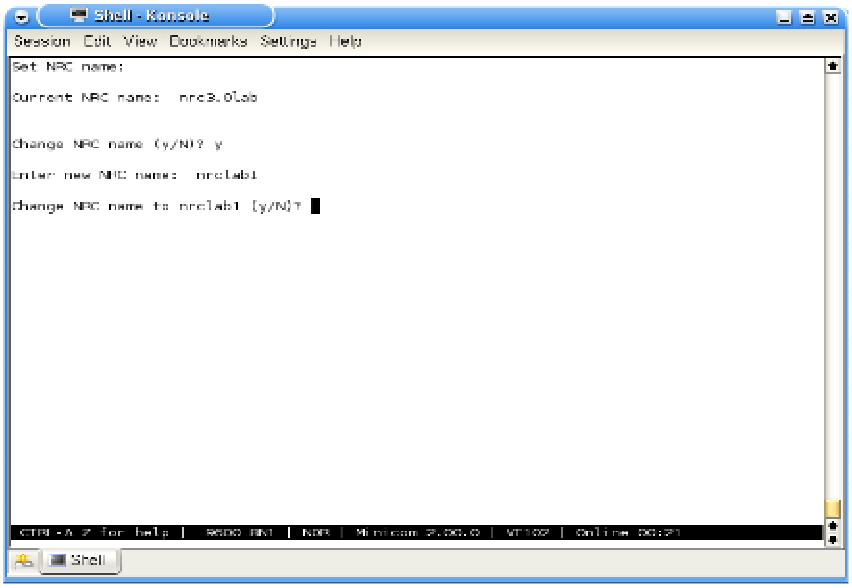


Figure 12 - Setting the NRC System Host Name

Step 7: Configure the Network Time Daemon (Optional)

You can optionally configure the NRC to use the Network Time Protocol daemon (NTPd) to keep the NRC system clock synchronized with other machines on the network.

Typical NTPd configuration requires only the IP address of a time server. This can be provided by either another machine on the local network with NTPd already configured, or from one of many free public NTP servers. Detailed information about NTP and a Public NTP Server list can be found at http://www.ntp.org.

Select option <*5*> to select the configure NTPd option, which displays the NTP Configuration Utility as shown in Figure 13.

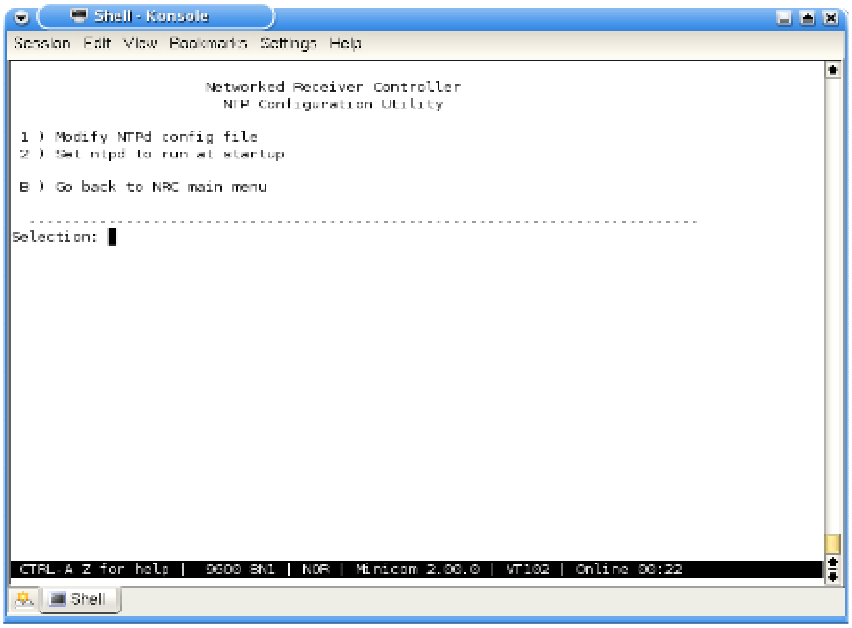


Figure 13 - NTP Configuration Utility

To modify or view the current NTPd configuration file select <*1*> from this menu. Figure 14 shows a screen sequence example as the NTPd is configured. The NRC can be configured to accept NTP signals from multiple NTP servers.

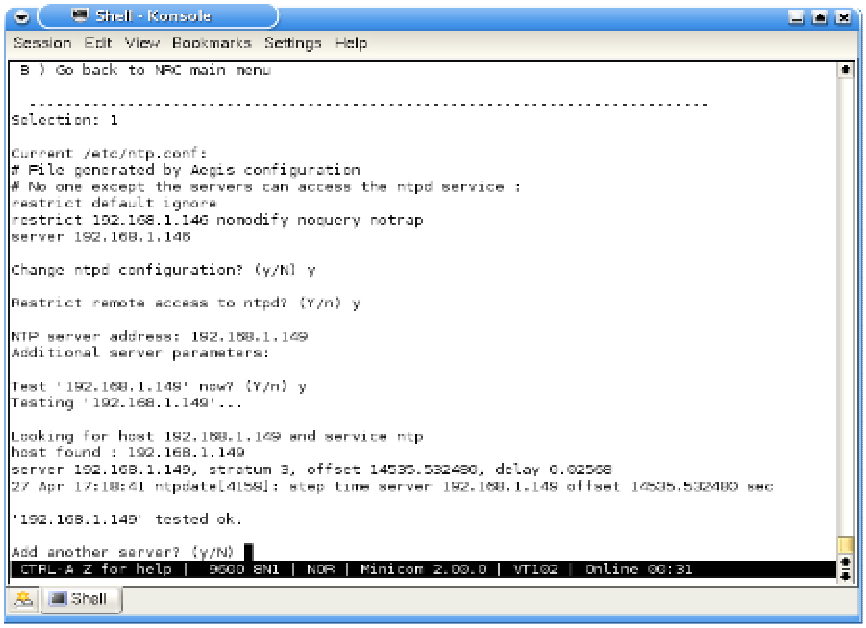


Figure 14 - Configuring the NTP

After the above change sequence is completed the NRC system ntp.conf file contains the following:

```
restrict default ignore
restrict 192.168.1.149 nomodify noquery notrap
server 192.168.1.149
```

Once the ntp information has been configured the ntp daemon needs to be started and added to the server startup. Select option <*2*> from the NTP Configuration Utility. Figure 15 shows a screen sequence example as the NTPd daemon is enabled.

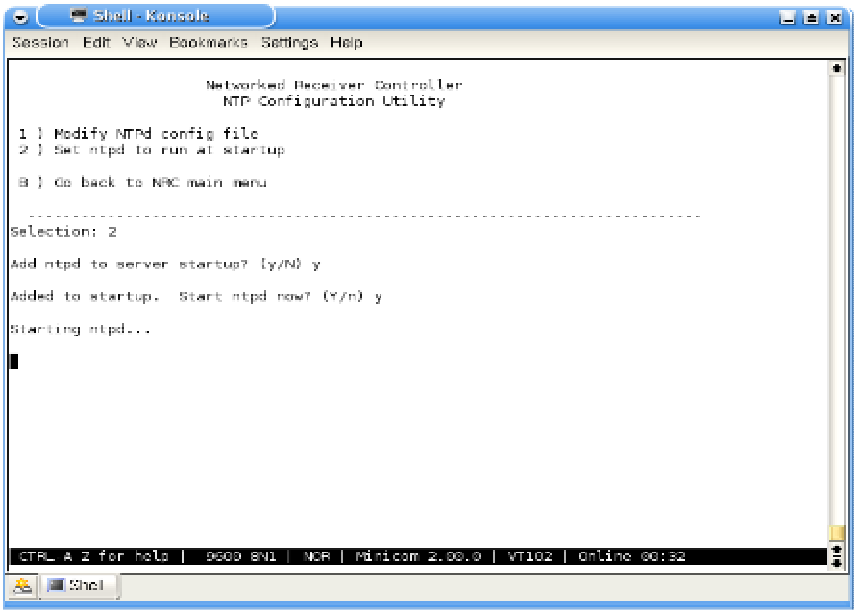


Figure 15 - Starting the NTP daemon

The ntp daemon can be stopped and removed from the start-up by re-selecting option <*2*> from the NTP Configuration Utility, which toggles to now show a remove ntpd option. Figure 16 is a screen sequence example as the NTPd daemon is disabled and removed from the server startup.

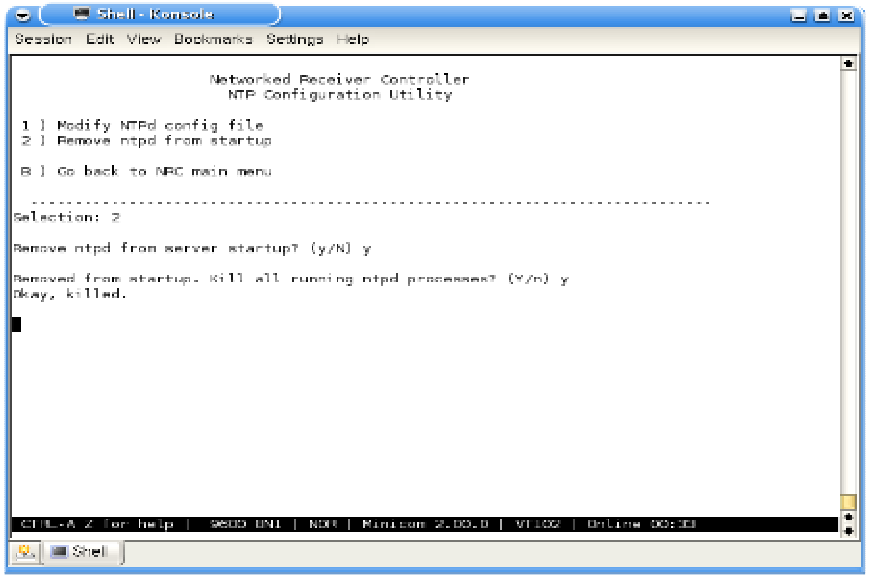


Figure 16 - Stopping the NTP daemon

Step 8: Viewing the NRC License Agreement

Select option <6> to step through the full NRC license agreement. As with the earlier outlined license agreement process, the full license is displayed to the user in pages (see Figure 17) which can be stepped through by hitting <*space*> on the keyboard. Once the end of the License Agreement is reached simply enter <return/enter> to return to the main menu.

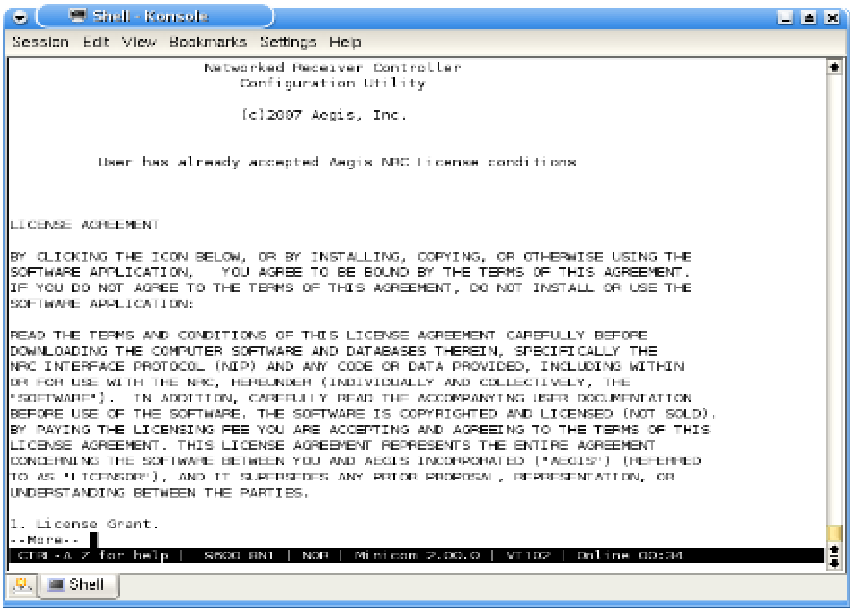


Figure 17 - Viewing License Agreement

Step 9: Restart the NRC

Select option *R* to restart the NRC. The NRC has two restart options – a system halt and a system reboot.

The system's reboot and halt operations both shutdown the NRC system, with the reboot command initiating a follow-on system restart.

Figure 18 below shows a screen sequence example as the NRC is reboot.

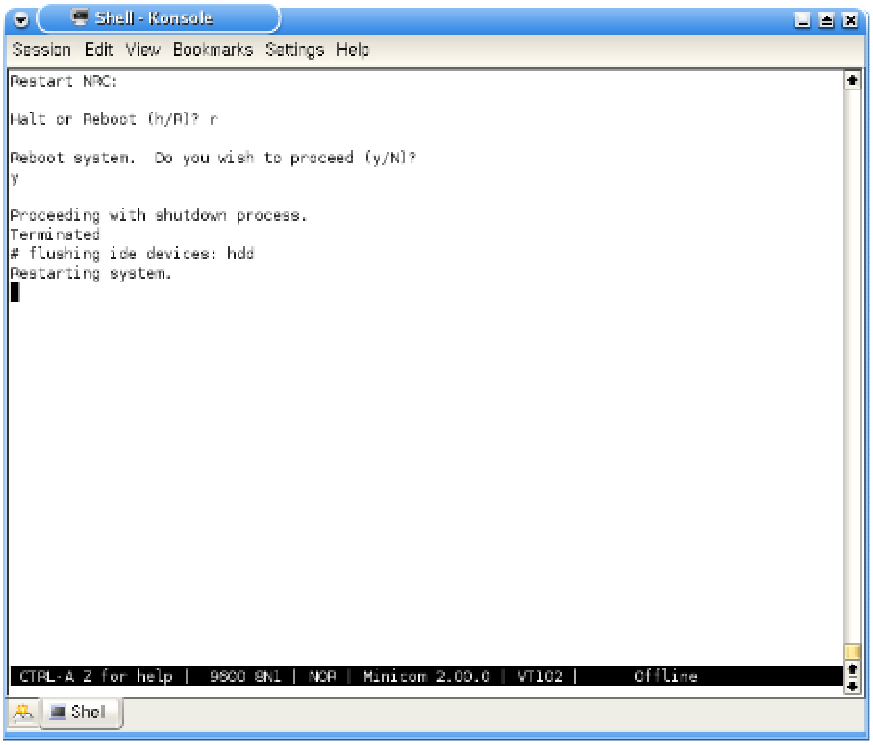


Figure 18 - NRC Reboot Sequence

Note: Normal operation is suspended in the NRC when using the remote terminal. Be sure to restart the NRC after using the remote terminal to resume normal operation.

Step 10: Configure the NRC for Receivers

From a computer, start the NRC Java Client. See the section, *Using the NRC Java Client Application* for details on requirements and running the NRC Java Client.

Configure the Signal termination type and DAQ Channel Gain

After connecting to the NRC from the NRC Java Client, right click on the NRC node, identified by its machine name or IP address. Click Properties and the "NRC Properties" dialog will appear. Configure the necessary options.[2]

Ensure that the following NRC software options match the previously set hardware options:

- DAQ Card Clock Source (DAQ Card, Internal 10MHz Ref or External 10MHz Ref)
- Audio Input Type (Differential or Single-Ended)

The pre-A/D converter receiver gain for each receiver channel is also set through this dialog, with the default being a gain of 1 with gains of 2, 4 and 8 also being available.

Note: When changes are made to any of these NRC attributes, all NRC channels will be stopped, reconfigured and restarted, disrupting any current processing on any of these channels.

Assign receiver models to each channel

Connect to the first channel that is attached to a receiver. Right click on the channel node and select "Change receiver model." The "Change receiver model" dialog will appear.[3]

Select the desired receiver model from the list. Press Enter or click the Enter button and the dialog will be dismissed. Confirm the change by noting the contents of the tree.

Repeat this process for each channel that is attached to a receiver.

Note:

> It is important to ensure the correct format receiver control cables are used to connect the receiver to the NRC unit. Installing the wrong format cables will prohibit the NRC from successfully communicating with the receiver, and hence the system installation will fail. eg. Trying to use TenTec RX331 receiver format control cables to connect to WJ-8723 receiver will fail as they have different signaling requirements.

Congratulations. The setup process is now complete. The NRC Java Client application can now be used to connect to the NRC.

---

2 See "*Using the NRC Java Client Application – NRC Properties dialog"* for further details.

3 See "*Using the NRC Java Client Application – Change receiver model dialog"* for further details

Operation

Using the NRC

Starting the NRC

After pressing the power button, the NRC may take up to 60 seconds to initialize and be ready for operation. Initially the display will show "Networked Receiver Controller" and NRC version. When initialization is complete, the NRC LCD display will be activated and display 8 channel status windows above the Aegis version message "NRC-3.0".

Self Test (ST)

A Self Test (ST) is incorporated into the NRC to allow the connection integrity of each receiver channel to be tested. During this test the control and audio connections for each channel are checked for proper connection and operation to and with the NRC.

When run, the ST configures the NRC's attached receiver to generate and output a unique frequency test tone, which is then digitally processed by the NRC to ensure it is at the expected frequency. If the NRC is able to successfully configure the receiver and process the test tone, then the receiver is deemed to have passed the ST and be available for use. The success or failure of each channel's ST is reported on the LCD display[4]. If the ST fails, the NRC will attempt to repeat the ST every 5secs until it passes.

This ST is run on a per-channel basis when:

1. A new receiver type is attached to the NRC and configured for the channel.
2. A receiver is powered on or otherwise comes on-line, after a period of being off-line, including when the NRC is initially turned on or re-boot.
3. A receiver is "reboot" via the Java GUI.

Note: The ST can only be run while there are no clients connected to that receiver. If there is a client attached, the ST will be pending and run when the all attached clients disconnect from that receiver channel. This allows the NRC to run the ST in the background only when the receiver is free. When a ST is running, clients will be inhibited from connecting to the channel until the ST test is completed (~1-2sec). The ST is only able to be run for receivers whose receiver type is set to "FULL".

Interpreting the LCD Display

The LCD display contains important information regarding the status and use of the NRC. During normal operation, the LCD will display a symbol reflecting the current status of each channel, with the display's left-most symbol being channel 1's status across to channel 8's status on the right hand side.

Only one symbol is displayed to reflect the status of a given channel and hence the symbols have an inherent priority and hence only the highest priority symbol will be displayed.

The LCD display symbols are listed – from highest to lowest priority, along with their meaning in the

4 See "*Interpreting the LCD Display" for details*

following table.

The NRC is not configured for this channel; Configure the correct receiver for this channel.

The receiver attached to this channel is currently offline.

- Caused when the NRC is unable to communicate with the receiver via the RS-232 connection.
- Check the receiver and its NRC connections, whether the receiver is powered on, and whether the receiver is operational or needs to be reset or needs the power cycled.

The receiver attached to this channel has failed the ST test and hence the attached receiver's data integrity is questionable. Once an F flag has been detected it will remain displayed until the receiver undergoes the ST test, and subsequently passes or the receiver goes offline.

- Caused when the receiver is able to communicate with the NRC via RS-232, but it fails to output the expected audio test signal during the ST test.
- Check the receiver's audio connections to the NRC match and then reboot/re-power the receiver and/or the NRC.

The receiver attached to this channel is undergoing the ST test.

A client is currently connected to this channel and is receiving data from this channel.

A client is currently connected to this channel.

This channel is fully functional and available for use.

When the NRC is configured and operating correctly symbols  ,  and  will be most often displayed.

Using the NRC Java Client Application

Requirements

The NRC Java Client application can be executed on any computer that supports the Java 2 platform and is connected to the network. It is most thoroughly tested with the Sun Java 2 Platform, Standard Edition (version 1.4), which can be downloaded freely from http://java.sun.com/j2se/1.4.2/download.html. It is recommended that the newest version of the Java 2 Platform be used. Consult your system administrator for more information on running Java on your system.

Running the NRC Java Client

On systems that support automatic execution for known file types, the application can be run by double-clicking the NRCJavaClient.jar file.
Otherwise, from a command prompt, navigate to the directory that contains this file. Type: `java -jar NRCJavaClient.jar` and press Enter. If the java.exe application is not found in a path pointed to by the PATH environment variable, specify the path on the command line.

Connect to NRC Server Dialog

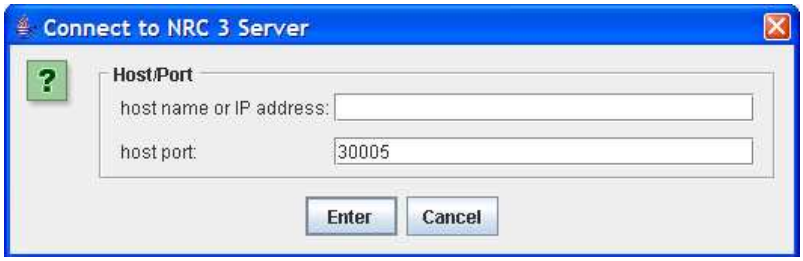


Figure 19 - NRC Log In

The first order of business is to make a network connection with an NRC server. This can be done with knowledge of the IP address or DNS-resolvable hostname given to the NRC during the software configuration. The NRC Java Client can attach to multiple NRC servers or the same NRC server multiple times.

When starting the NRC Java Client, the "Connect to NRC server" dialog box appears as shown in Figure 19. This dialog can be raised at any time by clicking the "Connect to NRC server" button on the toolbar of the main application window.

Enter the IP address or hostname of the NRC server and the port number in this dialog and click the Enter button or press the Enter key.

Note: the default port number is automatically generated before the dialog appears.

The Main Application Window

The window, as shown in Figure 20, is split into several functional areas. On the left is the tree, and to the right is the content panel. A toolbar is found at the top, and a status bar can be seen at the bottom of the window. Each of these components is discussed in detail below.

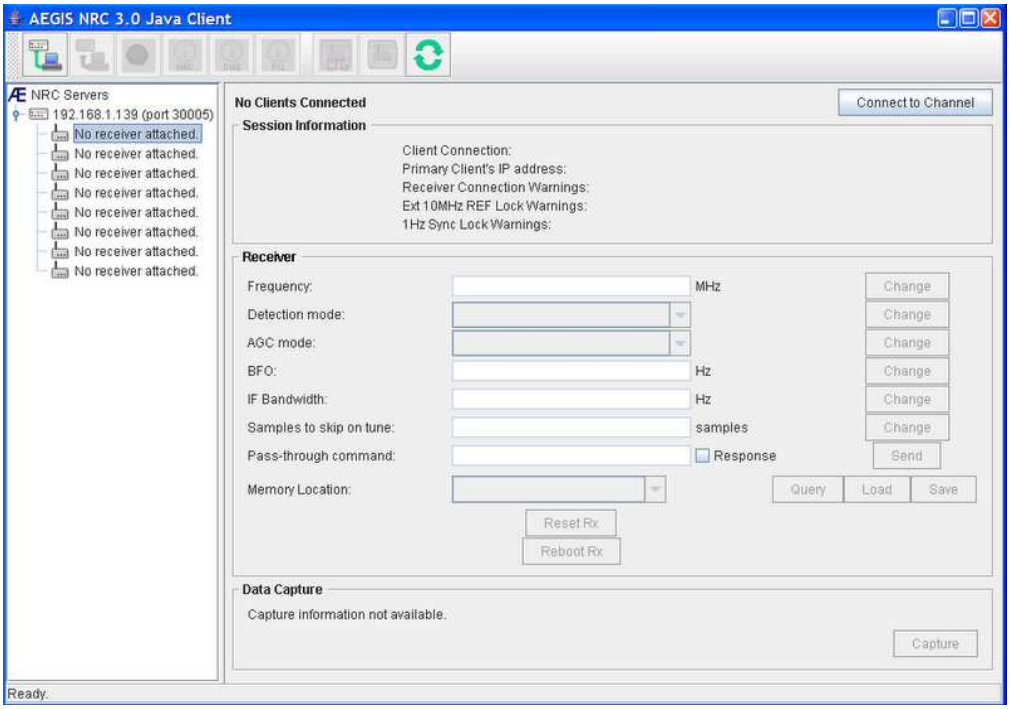


Figure 20 - NRC Main Application Window

Tree

The tree control is found on the left-hand side of the main application window and functions much like the similar control found in file browsing applications. Each component in the tree is referred to as a node. Nodes are organized in a hierarchical fashion. The tree is navigated by clicking the various nodes in the tree. When a node is clicked, the content panel is updated to provide detailed information and control options corresponding to that node in the tree. In addition, some of the toolbar buttons are enabled or disabled to reflect their use when that node is selected.

Each time a connection is made with an NRC server, a node is inserted in the tree below the "NRC Servers" node representing the connection to that server. The title of the node is the IP address or hostname entered. Below this NRC node, several "channel" nodes are inserted. Each node represents a channel of that NRC server.

Channel Nodes

Channel nodes provide some immediate information on the current state of that channel. The title of each node is the model name of the receiver attached to that channel. The NRC has 8 channels and these are represented with the top node being tied to channel 1, node 2 tied to channel 2, and sequentially down to node 8 being tied to channel 8. If there is no receiver configured for that channel, the node will read, "No receiver attached."
In addition, the color of the node shows the connection state of that channel.

- Gray: no receiver is attached to that channel
- Beige: the channel is free
- Green: a primary client is attached to that channel with full access privileges
- Red: the channel is in use by another client
- Yellow: a piggyback client is attached to that channel with limited privileges

Content Panel

The content panel contains a display corresponding to the current selection in the tree. This display typically provides information regarding the tree selection as well as controls that can be used to modify this information. The following sections discuss the content panels displayed when the various node types are selected.

"NRC Servers" Node

There is no function for this node currently, so the content panel appears blank when this node is selected.

NRC Server Node

Each NRC server node represents an existing connection between the client and an NRC server. When a server node is selected, "Monitor" information is displayed in the content panel. The monitor information provides a scrollable summary of the NRC's current status. Figure 21 and Figure 22 show the details of a typical Monitor window, which include:

- NRC Server's Identification information
  - name, IP address
- NRC Server's Configuration information
  - Clock Status, Channel Gain settings, NTP status.
- NRC Data Acquisition Settings
  - ADC Clock Settings, Sync Settings, Signal Type, configuration of Ext signals and their associated signal lock status
- NRC Server's Performance information
  - Length of time the NRC server has been running - uptime
  - Current CPU usage - average over the last 5 seconds
  - Current memory usage
  - Current network usage (outgoing and incoming data)
- NRC Channel Summary Information
  - Summary of each channel's current status and receiver configuration
  - Summary of all clients currently connected to each channel

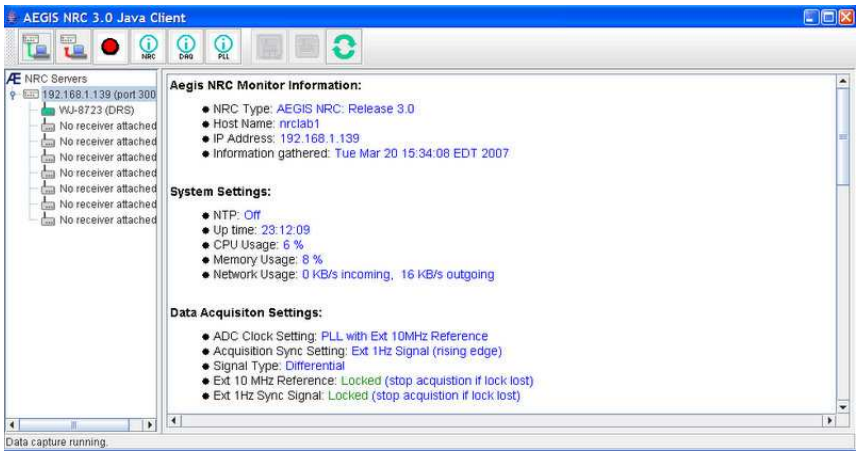


Figure 21 - NRC Monitor Window - Part 1

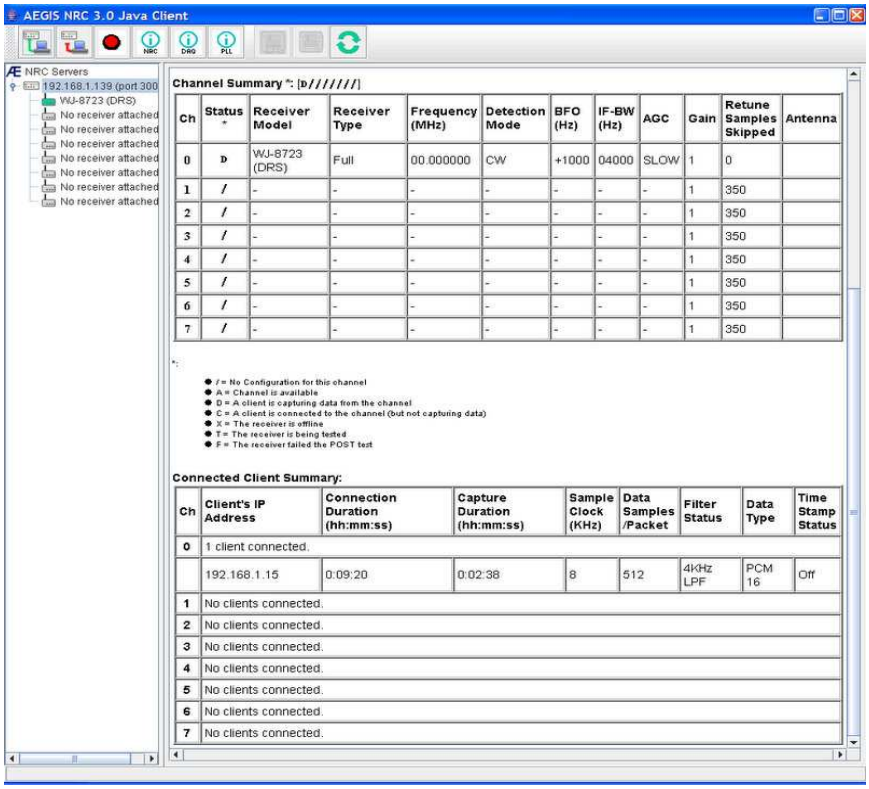


Figure 22 - NRC Monitor Window - Part 2

Channel Node

Most of the functionality of the NRC Java Client is provided in the content panel when a channel node is selected in the tree. Figure 23 shows the details of this panel.

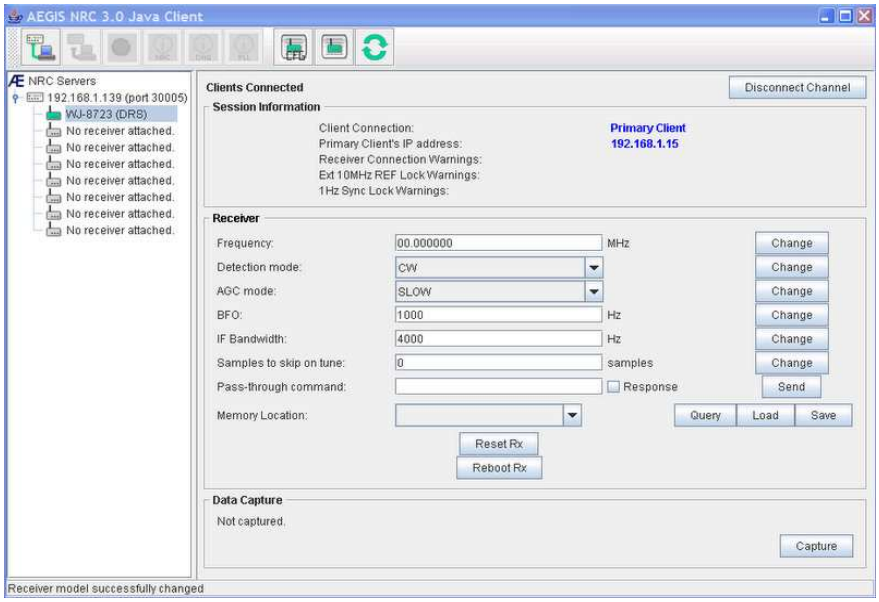


Figure 23 - NRC Channel Node Panel

This panel is separated into three areas:

- Session Panel
  Positioned at the top, is a session information panel, which shows:
  - Client Connection – Displays whether this attached client has a primary or piggy back connection to the receiver.
  - Primary Client's IP address – the IP address of the primary client attached to this receiver.
  - Receiver Connection Warnings – this field is populated with receiver connection warnings such as "Receiver Offline" and "No Receiver attached". When the Receiver connection is fully functional no messages are displayed here.
  - Ext 10MHz REF Lock Warnings: This field is populated with a "Lock Lost" message if the NRC loses lock with the external 10MHz REF signal. This message is only enabled for display when the NRC is configured to use the 10MHz REF signal.
  - 1Hz Sync Lock Warnings: This field is populated with a "Lock Lost" message if the NRC loses lock with the external 1Hz Sync signal. This message is only enabled for display when the NRC is configured to use the 1Hz Sync signal.

  These fields are up-dated every 5 seconds by a task on the NRC.
- Receiver
  - Receiver Configurable Options
    The receiver section contains the current state of the configurable receiver parameters for the receiver attached to the channel - frequency, detection mode, AGC mode, BFO, IF Bandwidth. Each of these parameters can be changed by entering the new value in the corresponding field and then pressing Enter or clicking the corresponding Change button.
    NOTE: You must hit the change button for new pull down options in Detection Mode or AGC Mode to take effect. Figure 24 shows the changing of the Detection Mode option.

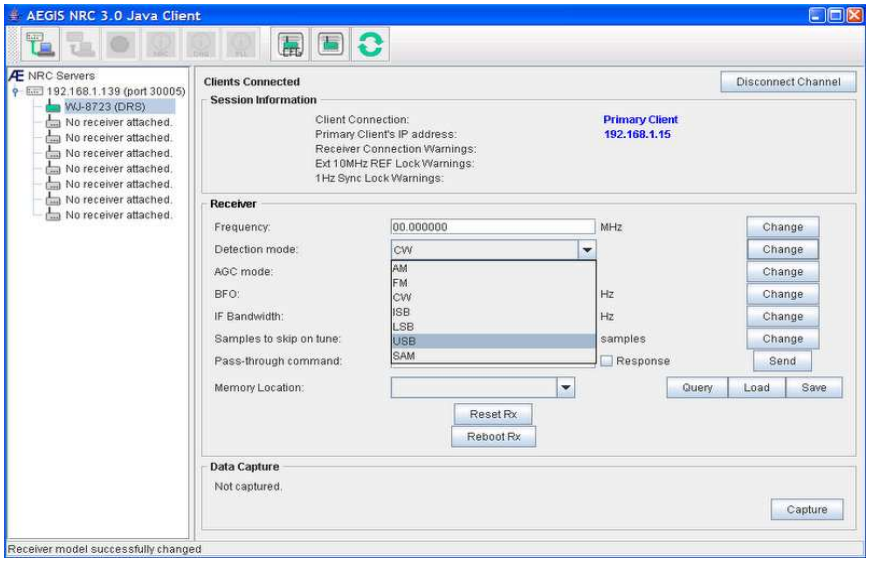


Figure 24 - Changing Receiver Attributes

- Samples to skip on tune
  This indicates the number of audio samples to discard when changing receiver parameters, and ensures the output signal reflects that associated with the changed values. Any change in Samples to skip is persistent and will be resident even after the NRC server is powered off.

- Receiver Memory Interface
  The memory location interface allows the receiver's internal memory locations to be accessed and receiver parameters to be queried, loaded or saved.
    - Query – This button allows you to query the receiver to find out which parameters are stored in memory. Some receiver types also support the ability to display what values are currently stored at a specific memory location. Below is a query on a WJ receiver.
    - Load – This option loads the receiver configuration from the specified memory location into the receiver's current configuration. If nothing is stored at the memory location the behavior of this operation is dependant on the type of receiver. Some receivers may ignore the command or load a default configuration, or for example.
    - Save – This option saves the receiver's current configuration to the specified memory location. The number of locations varies with each type of receiver. It is important to note that the volatility of the memory is also dependant on the type of receiver. Some receivers may clear all saved settings if the "Reset Rx" button is pressed, others may maintain the memory until the receiver is powered down.

  Note: Different receivers store different attributes and hence there is no uniform list of options which are saved for all receivers, with not even the basic frequency, detection mode, AGC mode, BFO and IF Bandwidth parameters saved for all receivers.

- Receiver Pass thru Command
  An ACSII-based text command can be sent directly to the receiver using the "Pass-thru command". Enter the command string into the corresponding text field and press Enter or click "Send". Please refer to the receiver operator's manual for the valid command set for each receiver. If the "Response" box is checked, then an ASCII response is expected from the receiver and it will be delivered back to the client. If the box is checked but no response is generated by the receiver then the receiver will briefly go offline while the NRC re-synchronizes communication. If a receiver response is generated when the box is not checked, the response is simply discarded. The "Response" box should not be checked unless a response is required by the user.

  Note: This interface should only be used by advance users who are familiar with the impact of issuing commands directly to the receivers.

- Receiver Reset
  The receiver reset button provides a receiver reset capability, although it is

important to note that the result of a reset can be different for different receivers.
eg. Resetting the WJ-8723 receiver resets the receiver back to a known configuration profile, while resetting the TenTec Rx331 refreshes the receiver with its most recent user programmed settings.

- Receiver Reboot
  The receiver reboot button allows a low level receiver reboot sequence to be sent to the receiver where supported. It should be used when the receiver has entered into some unknown state and is a last resort before a power-off reset is tried.
  The receiver reboot process also initiates a ST of the receiver and will take about 15secs.

- Data capture
  The bottom section of the content panel allows the user to capture audio data samples from the receiver attached to this channel. Clicking the Capture button will launch the Capture channel data dialog. While capturing, the Stop button allows the user to stop data capture. Figure 25 shows the Capture Data window which pops-up when the <capture> option is selected. In this example the data type is being set for PCM16.

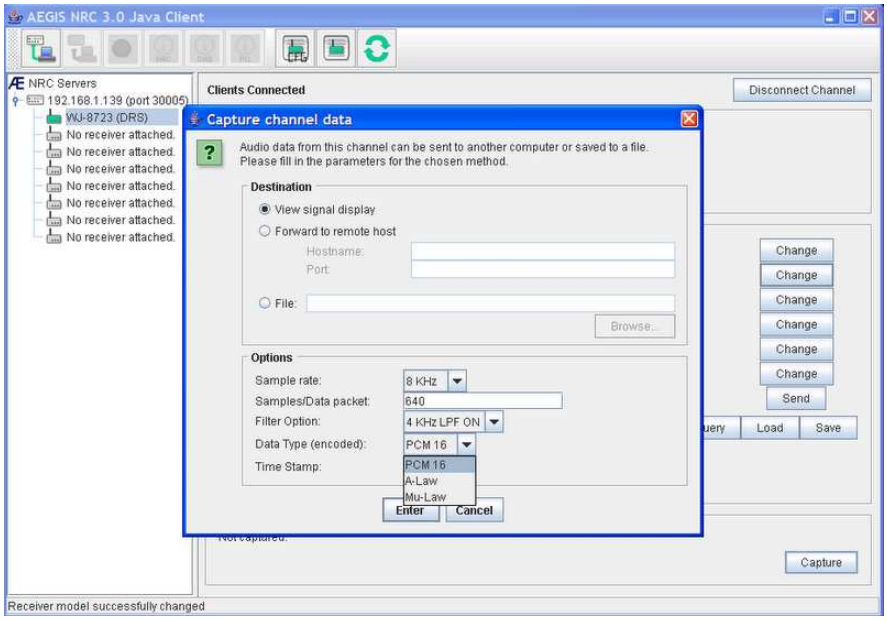
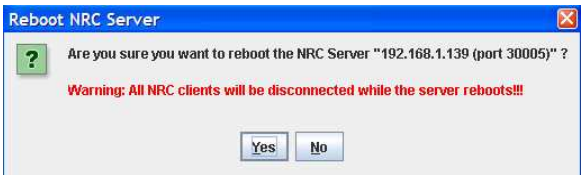
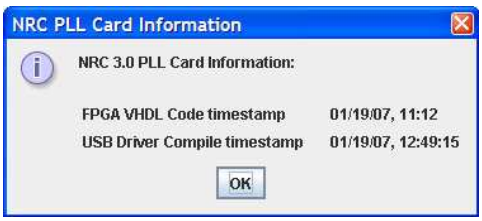
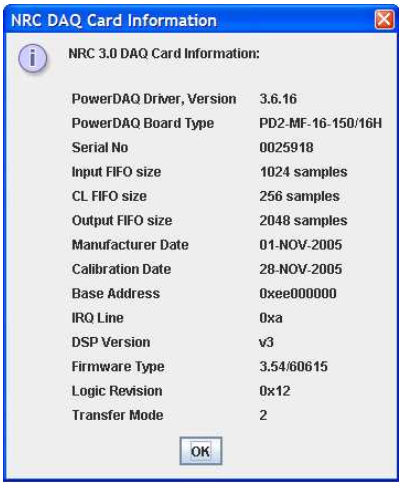
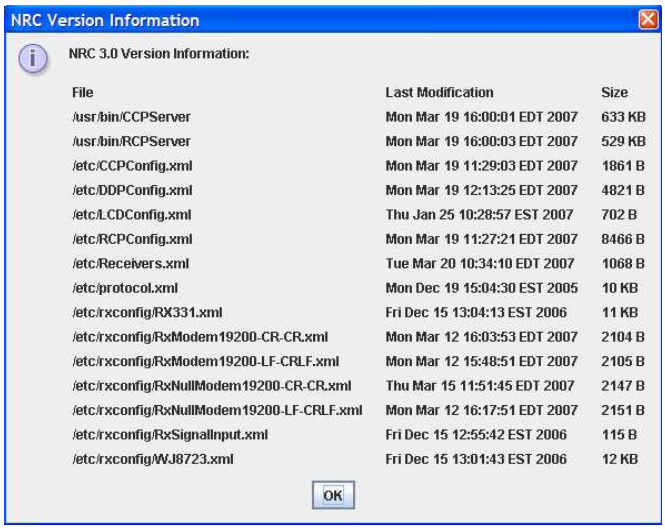


Figure 25 - NRC Data Capture Window

Toolbar

The icon buttons on the top toolbar provide quick access to common functions. The below table summaries these:

	"Connect to NRC server" button: when clicking this button, the "Connect to NRC server" dialog is raised, allowing the user to connect to an NRC server. This dialog window can also be popped-up using the <Alt-C> shortcut when the window is active. 
	"Disconnect from NRC server" button: this button is enabled when an NRC server is selected in the tree. When clicking this button, the user can choose to disconnect from the selected NRC server. This dialog window can also be popped-up using the <Alt-D> shortcut when the window is active. 
	"Reboot NRC Server" button: This button is enabled when an NRC server is selected in the tree. When clicking this button, a dialog will appear asking if you really want to reboot the NRC server. Selecting yes in this dialog will cause the NRC server to perform a warm re-start. All connections to the NRC server will be terminated and new connections will need to be established with the NRC once it is fully reboot, about 60 seconds later. This dialog window can also be popped-up using the <Alt-B> shortcut when the window is active. 
	"PLL Card Configuration" button: This button is enabled when the NRC server is selected in the tree. When clicking this button, a summary of the NRC's PLL Card settings are displayed. This dialog window can also be popped-up using the <Alt-P> shortcut when the window is active. 

	"DAQ Card Configuration" button: This button is enabled when the NRC server is selected in the tree. When clicking this button, a summary of the NRC's DAQ Card settings are displayed. This dialog window can also be popped-up using the <Alt-Q> shortcut when the window is active. 
	"NRC Receiver version" button: This button is enabled when the NRC server is selected in the tree. When clicking this button, a summary of the NRC software modules is displayed. This dialog window can also be popped-up using the <Alt-V> shortcut when the window is active. 
	"Receiver configuration" button: This button is enabled when a connected channel node is selected in the tree. When clicking this button, the configuration options of that receiver are presented. The receiver provides the actual text, so the user will need to decode the message using the receiver's manual. This dialog window can also be popped-up using the <Alt-F> shortcut when the window is active. 

	"Receiver status" button: this button is enabled when a connected channel node is selected in the tree. When clicking this button, the status of that receiver is presented. The receiver provides the actual text, so the user is referred to the receiver operating manual to decode the text. This dialog window can also be popped-up using the <Alt-S> shortcut when the window is active. 
	"Refresh" button: when clicking this button, the information on the various panels of the main application window is refreshed from the NRC server, ensuring the most up-to-date information is displayed. This action can also be initiated by using the <Alt-R> shortcut when the window is active.

Status Bar

The status bar exists at the bottom of the screen. It will contain informative messages as commands are executed.

Change Receiver Model Dialog

The model of the receiver attached to a channel may be changed from the channel node in the tree if the client is currently connected to that channel. Right-click on the channel node, (See Figure 26) select "Change receiver model" and the "Change receiver model" dialog appears.

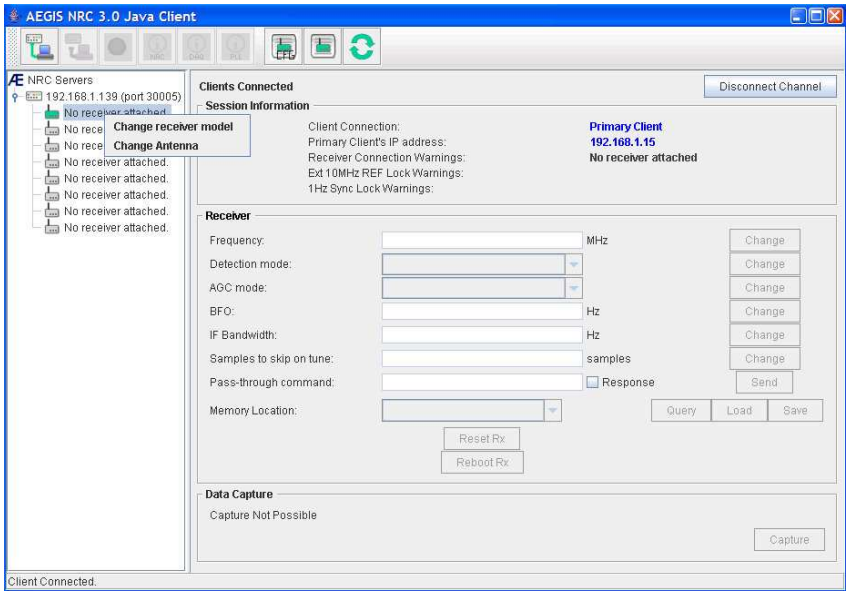


Figure 26 - Change Receiver Model - Part 1

The current receiver is displayed, and a dropdown box contains a list of receiver models supported by the NRC server. Select the new model from the list or select "None" to indicate that no receiver is attached to this channel. See Figure 27 for an outline of these dropdown menu options.

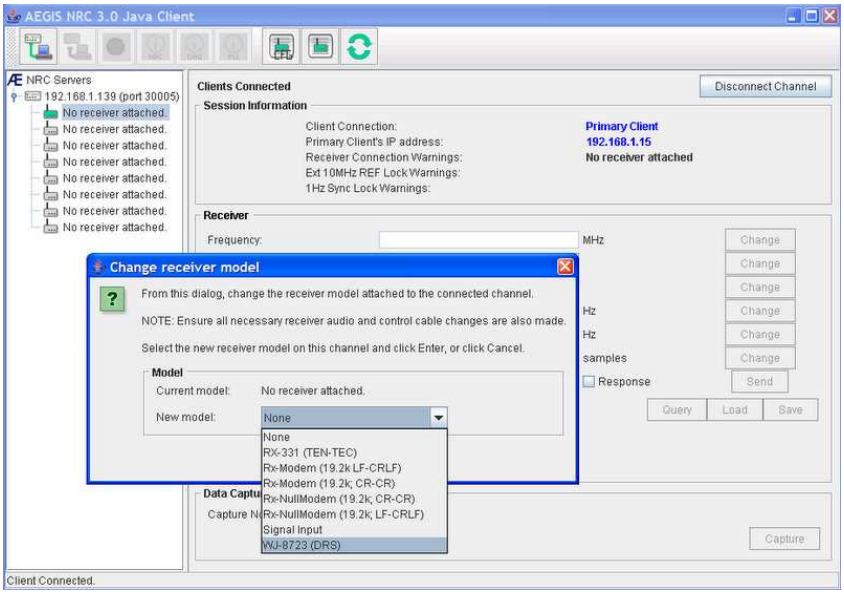


Figure 27 - Change Receiver Model - Part 2

Press Enter or click the Enter button and the dialog will be dismissed. Confirm the change by noting

the contents of the tree. Figure 28 shows the final changes now reflected on the tree.

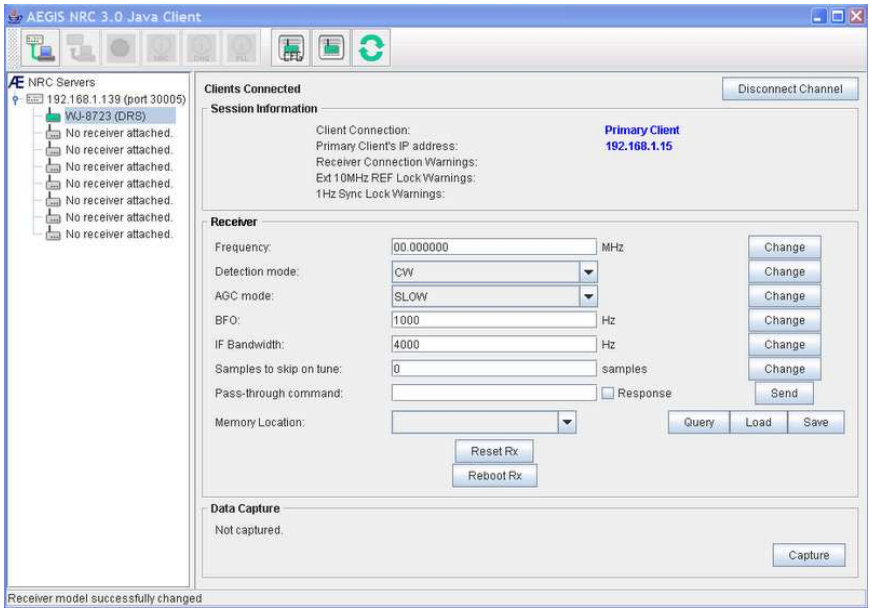


Figure 28 - Change Receiver Model - Part 3

The change in receiver model is persistent and will be resident even after the NRC server is powered off.

Note: Cable changes to connect the new receiver up to the NRC maybe necessary. If so, proceed by following these steps:

1. Set the receiver type to “None”
2. Power down the NRC unit
3. Change or connect the appropriate cables between the NRC and the receiver
4. Power up the NRC unit
5. Reconfigure the receiver type to the now connected receiver type.

Change Antenna Model Dialog

The name of the antenna connected to a receiver may be changed from the channel node in the tree if the client is currently connected to that channel. Right-click on the channel node, (See Figure 26) select "Change antenna", and the "Change antenna" dialog appears as shown in Figure 29.

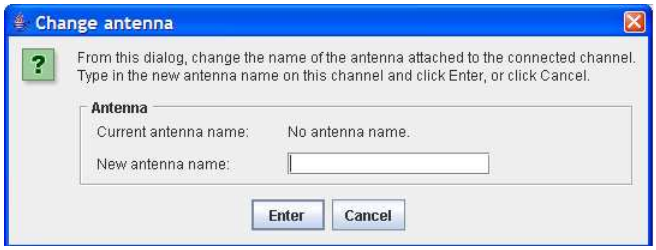


Figure 29 - Change Receiver Antenna Description

The current antenna name is displayed. Type in the new antenna name in the text box provided. Press Enter or click the Enter button and the dialog will be dismissed.

The change in antenna name is persistent and will be resident even after the NRC server is powered off.

NRC Properties Dialog

Global NRC properties can be viewed and modified from the respective NRC node in the tree. Right-click on the desired NRC node, select “Properties (as shown in Figure 30) and the “NRC Properties” dialog appears as shown in

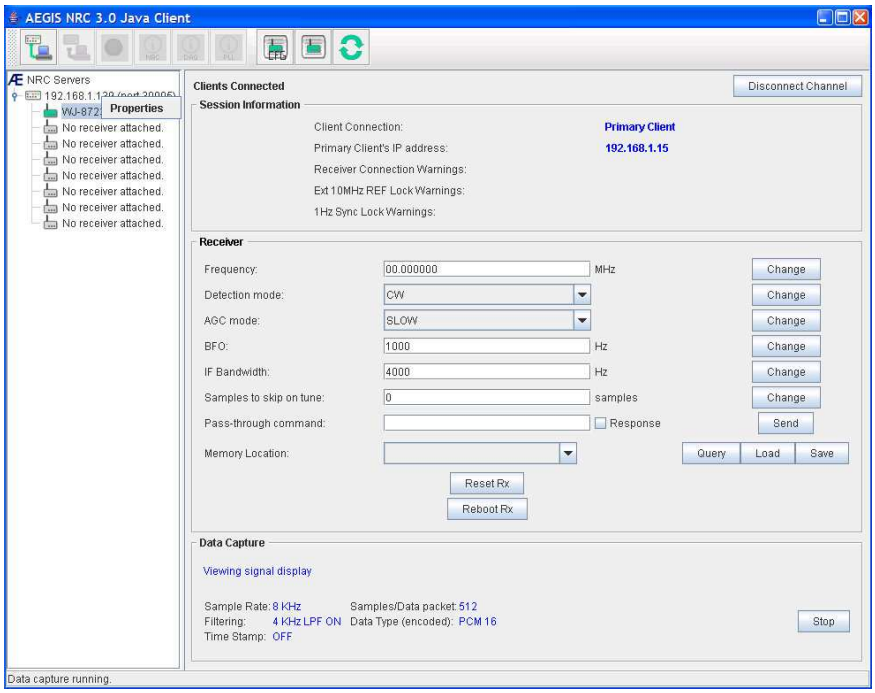


Figure 30 - Change NRC Properties - Part 1

This NRC Properties dialog, as shown in Figure 31, presents a range of NRC Audio/Digital conversion properties which can be changed

- Conversion clock source: This selects whether the DAQ card’s sampling clock is derived from:
    - the DAQ card’s own on board crystal oscillator
    - the NRC’s internal 10MHz reference
    - an External 10MHz reference signal
- Capture sync option. This selects whether the Data Acquisition is started on a rising 1 Hz signal or not.
- Lock Lost Options: If the associated signal is being used in the acquisition process, these options allow data acquisition to either *continue* or *stop* in the advent of the NRC loosing signal lock with one of these external signals.
- Analog signal type: This selects whether the audio signal is a single-ended or differential signal.
- DAQ card channel gains: This selects the pre-gain which is applied to the receiver’s incoming analog signal before it is digitized by the DAQ card.

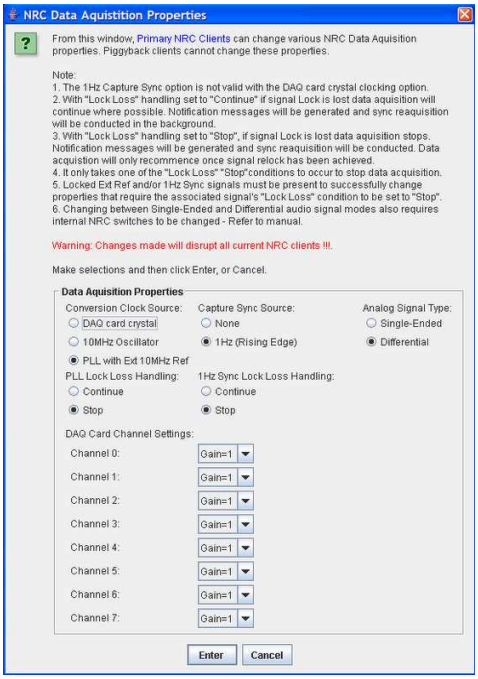


Figure 31 - Change NRC Properties - Part 2

Notes: If any of the property settings are modified, the NRC DAQ card is reset which will disrupt data capture on all channels. Use with care. The NRC client will ask for change conformation before instigating the user changes, as shown in Figure 32.

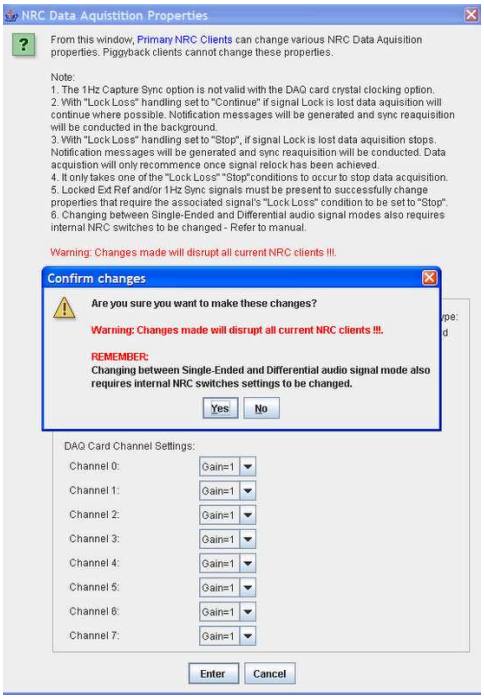


Figure 32 - Change NRC Properties - Part 3

These changes are persistent and will be resident even after the NRC server is powered off.

Capture Channel Data Dialog

The capture dialog allows the user to start capturing digital analog samples from the channel and forward them to a variety of destinations. Selecting the Capture button from the content panel launches the dialog shown in Figure 33. This button is only available if the channel is connected.

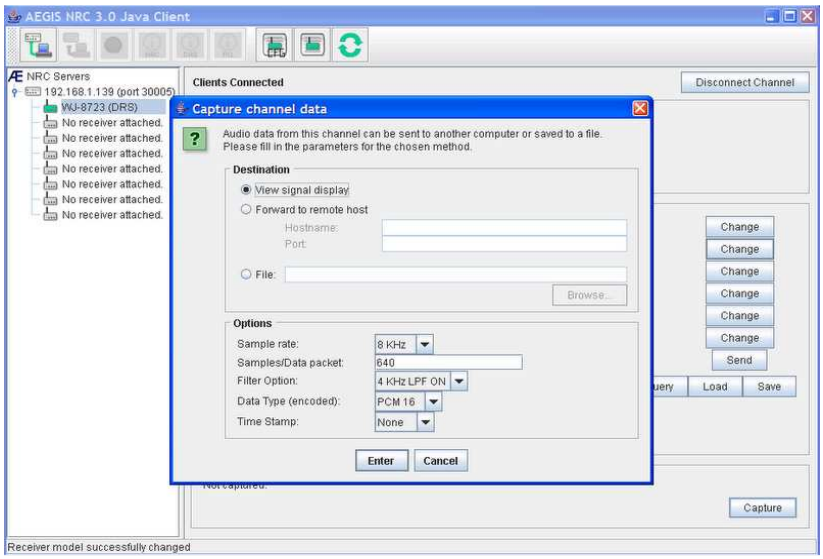


Figure 33 - Capture Channel Data

Destination

- View signal display: This option displays the Signal display dialog and uses the audio samples from this channel to drive the display. The signal can be displayed as a time based signal or a frequency based signal.[5]
- Forward to remote host: Using this option, the audio data samples are forwarded via socket to the remote host and port specified.
- File: If this option is selected, the audio samples are saved to file. Either type the full path to the file or use the browse facility to determine the file name.

Options

- Sample rate: Select either 8 KHz (default) or 16 KHz sample rate for the data collection.
- Samples/Data packet: Specify the number of samples the NRC server should collect before forwarding them to the client. The default is 640.
- Filter Option: If enabled, the server will filter the data through a 4KHz Low Pass Filter before sending it to the client.
- Data Type: Specifies the input data type, the options are PCM 16, A-LAW, and MU_LAW. The default data type is PCM 16.
- Time Stamp: If enabled, the server will time stamp[6] each data packet with the TAI64N time stamp of the last sample in that packet. The default is for the time stamp to be disabled.

---

[5] If the A-Law or MU-Law data option is selected,, only *encoded* data packets which will be displayed.

[6] If the NRC's ntp is configured the time stamp will be in synchronized with the network time, otherwise this timestamp will be synchronized to the NRC's internal system clock.

Signal Display Dialog

This dialog provides two graphical representations of the data being acquired. The first is signal mode, where data is graphed along the time domain as shown in Figure 34.

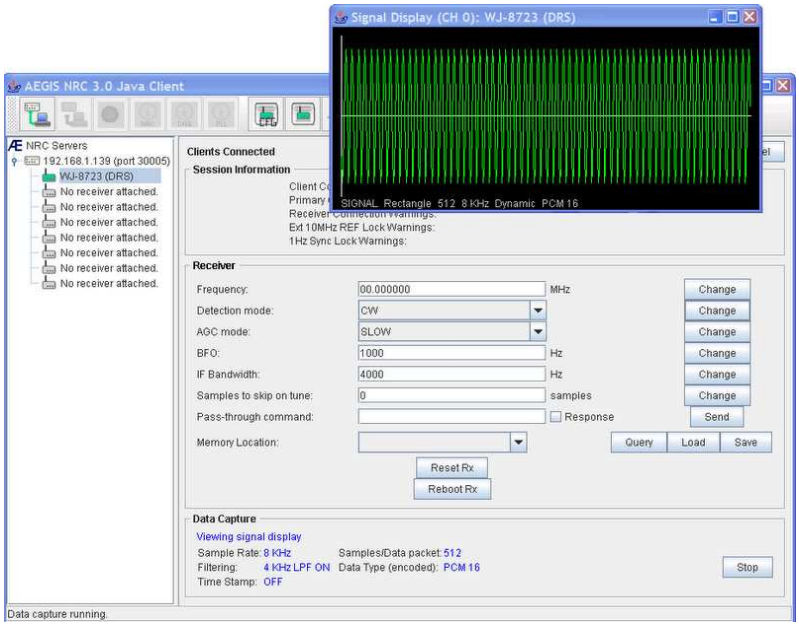


Figure 34 - Data Capture - Time Based Display

The second is a spectral mode, where the data is graphed in the frequency domain[7], as shown in Figure 35.

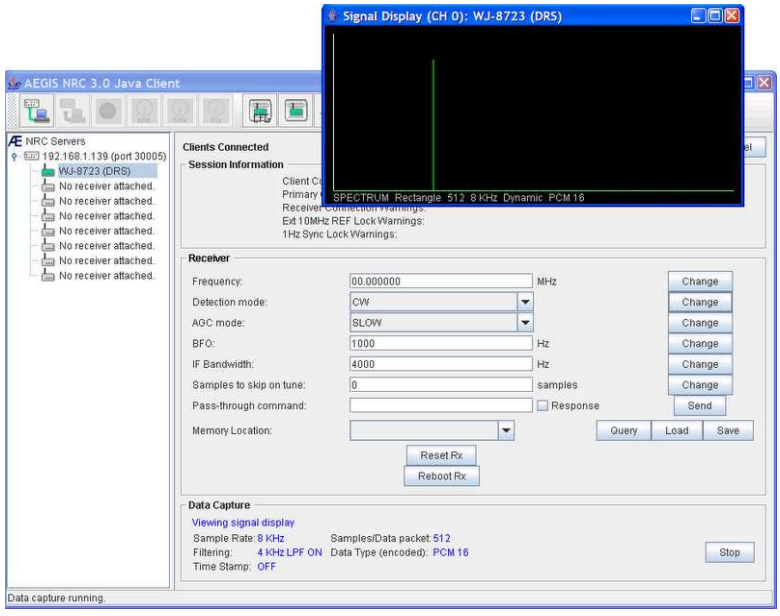


Figure 35 - Data Capture - Frequency Based Display

7 Valid frequency spectral displays are only available for data packets of sizes of: 128, 256, 512, 1024, 2048 and 4096. For other data packet sizes a null spectral display is shown.

The user can switch between modes by right-clicking on the display and using the Display menu as shown in Figure 36.

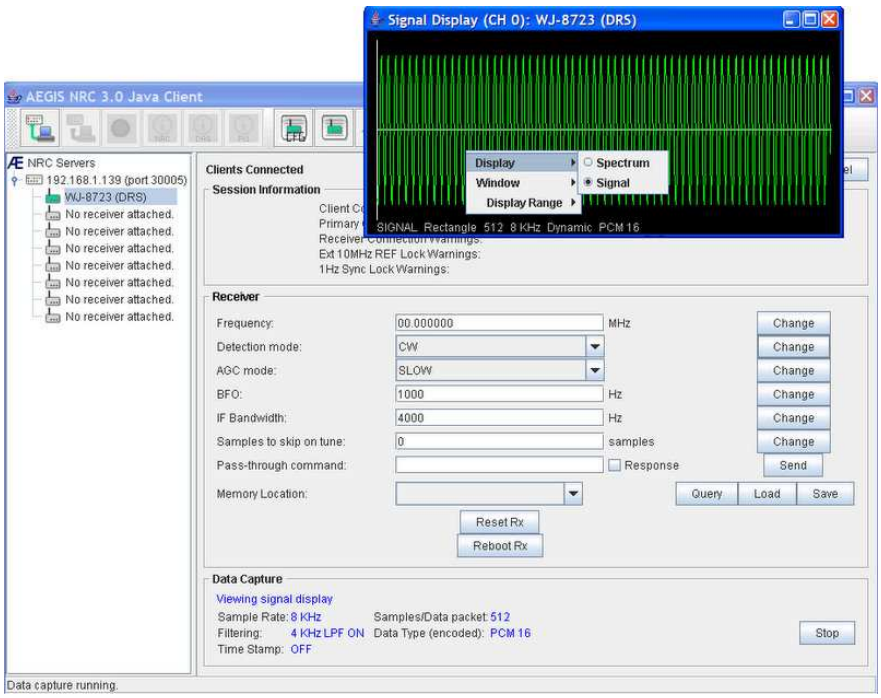


Figure 36 - Data Capture - Switching Display Views

Additional information about the signal can be gleaned by moving the mouse cursor around the signal display. The cursor will turn into a crosshair design, and information regarding that point of display will be displayed at the bottom-right of the dialog. In signal mode, the time in milliseconds (x) will appear, followed by the voltage (y). In spectrum mode, the frequency in hertz (x) will be shown, followed by the voltage (y).

Closing the display dialog will stop capture on that channel.

In addition to providing different graph domains, the data can be viewed using various well-known window functions: Rectangular, Bartlett, Hanning, Hamming, Blackman. Switch between modes by right-clicking on the display and using the Window menu as shown in Figure 37.

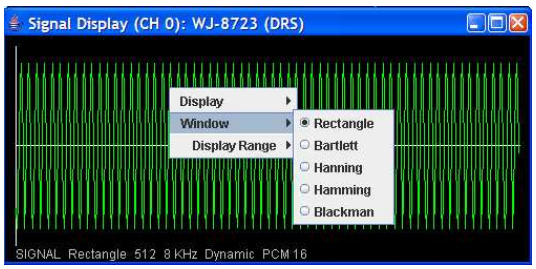


Figure 37 - Data Capture - Window Options

The display signals levels can be set using the Display Range menu options, which provides:

- Dynamic scaling: dynamically adjusts the signal amplitude to maximize the size of the data in the viewing window. This is the default scaling option.
- Static scaling: provides a number of different static amplitude ranges for the viewing window.

Figure 38 shows how to adjust the display scaling.

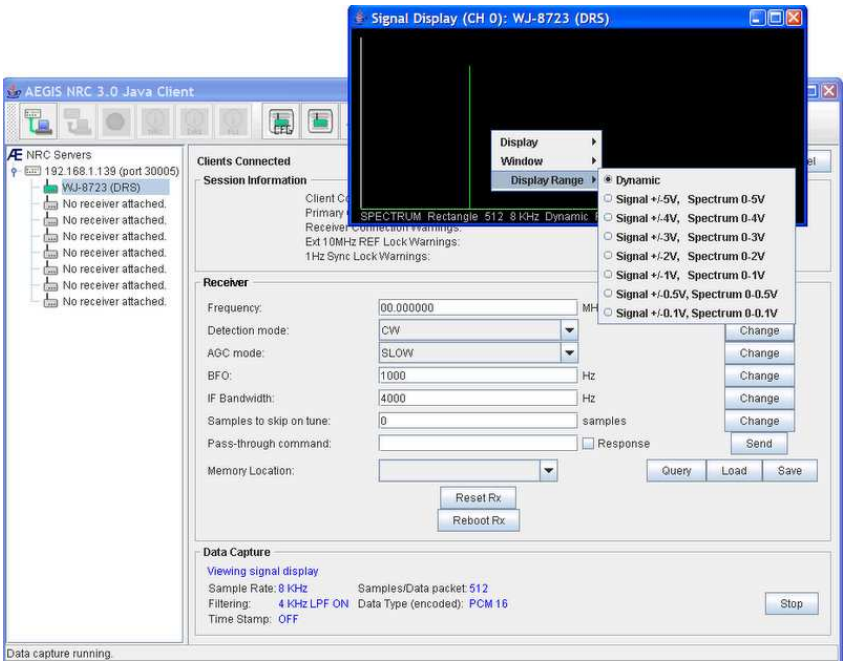


Figure 38 - Data Capture - Display Scaling

Piggy-Backing Clients

The NRC provides two types of client connections to a given receiver; the primary client connection and the piggy-back client connection.

The primary client is able to control all the receiver attributes and change global NRC system properties, while the piggy-back client is connected in a "read-only" type of mode. Piggy-back clients can connect and access a receiver to read its current settings and access the output data stream (which can be uniquely formatted), but they cannot change any of the receiver's writeable attributes or any of the NRC global properties.

If a primary client disconnects from a channel, the longest connected Piggy-back client is promoted to primary status, at which stage they take over full control of the receiver.

Figure 39 shows where two clients are connected to a single receiver and both are accessing the data feed from the receiver and displaying the data on the time domain display.

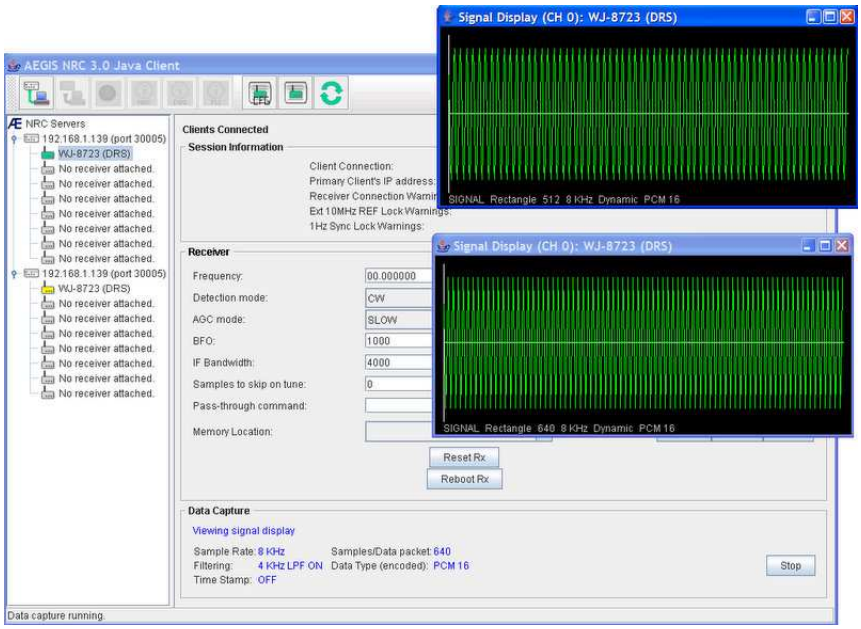


Figure 39 - Data Capture - Primary and Piggyback Clients

Appendix A - Receiver Configurations

The NRC supports 3 different type of receiver's profiles; Full receivers, Blank receivers and Analog receivers.

Full Receivers are those receivers for which a full profile xml command extraction file has been created for use with the NRC. The communications interfaces and protocols of these receivers are fully known and defined within the xml file, which allows the receiver to be fully controlled via the standardized NRC command set.

This type of receiver profile is desired profile for all receiver's as it allows the user to take advantage of the protocol abstraction offered by the NRC.

Blank Receivers are those receivers for which a basic xml interface extraction file has been created for use with the NRC. The communications interfaces and protocols of these receivers are only defined in terms of speed, RS-232 type (modem/null-modem) and transmit and receive command string termination fields. Command packets are sent to and from these receivers using the NRC's "pass-thru" message passing capability. This allows low-level native receiver commands to be passed between the user and the receiver by the NRC, although the NRC itself doesn't have any understanding of the payload.

This type of receiver profile is usually used to support a new receiver for which a full xml profile is yet to be created, or for proto-typing one-off applications.

Analog Receivers are those receivers for which a null xml interface extraction file has been created for use with the NRC. There is no communications interface associated with an Analog receiver type with the audio being the only signal of interest coming from these receivers. The audio is connected into the NRC unit and processed for acquisition and distribution, without any control or feedback to the Analog receiver.

The NRC currently has the following receiver profiles available.

Full Receiver Profiles

BAE Systems WJ-8723

- The WJ-8723 must be configured to operate and communicate with the NRC units. This is achieved by configuring the WJ-8723 DIP switches A2S1 and A2S2[8, 9] to:
    - set the receiver mode to SINGLE-DROP mode
        - set rocker switches 1-5 of DIP switch A2S2 to 1
    - set the serial communications to 19,200 bps
        - set rocker switches 1-3 of DIP switch A2S1 to 1,0,0 respectively
- Once the receiver switch settings have been adjusted, cycle the receiver power for switch settings to become active.
- Be sure to use the BAE Systems WJ-8723 correct control and audio cables.[10]
- Connect the control cable from the RS-232/CTL port (D25F) on the receiver to one of the NRC's COM ports (RJ-45F). The number of this NRC COM port determines the channel number of that receiver.
- Connect the audio cable (DB15M/DB15M) from the AUDIO OUT/AUX port on the receiver to the corresponding RECEIVER port on the NRC. Be sure to select the RECEIVER port with the same number as the COM port chosen in the previous step.

TenTec RX331

- The RX-331 must be configured to operate and communicate with the NRC units. This is achieved by configuring the RX-331 DIP switches S1 and S2[11, 8] to:
    - set the receiver address to 1
        - set rocker switches 1-8 of DIP switch S2 to 0,0,0,0,0,0,0,1 respectively
    - set the serial communications to 19,200 bps, , 8 data bits, no parity, and 1 stop bit.
        - set rocker switches 1-8 of DIP switch S1 to 0,1,1,1,1,0,0,0 respectively.
- Once the receiver switch settings have been adjusted, cycle the receiver power for switch settings to become active.
- Be sure to use the correct control and audio cables for the TEN-TEC RX-331. [12, 13]
- Connect the D25M end of the combined NULL modem/control cable to the RS232, J1 port (D25F) on the receiver and the other end to one of the NRC's COM ports (RJ-45F). The number of this NRC COM port determines the channel number of that receiver.
- Connect the audio cable (DB15M/DB15M) from the J8 port on the receiver to the corresponding RECEIVER port on the NRC. Be sure to select the RECEIVER port with the same number as the COM port chosen in the previous step.

---

8 Full Instructions on page 2-9 of the "Installation and Operation Manual for the WJ-8723 Digital HF Receiver" Manual

9 Switch settings: 1 is UP/ON, 0 is DOWN/OFF.

10 These cables can be obtained from Aegis Inc.

11 Refer to page 4-12 of the " HF DSP Receiver Model RX-331 - Technical Manual" for full instructions

12 These cables can be obtained from Aegis Inc.

13 To convert between TEN-TEC RX-331 and WJ-8723 control cables requires a standard RS-232 crossover to be used in conjunction with the DB25-RJ45 cable

Blank Receiver Profiles

RxNullModem (19.2k, CR-CR)

- This profile supports any receivers that use a 19.2k Null-Modem RS-232 connection and a CR and a CR as the transmit and receive command control string terminators respectively.

RxNullModem (19.2k, CR-CRLF)

- This profile supports any receivers that use a 19.2k Null-Modem RS-232 connection and a CR and a CRLF as the transmit and receive command control string terminators respectively.

RxModem (19.2k, CR-CR)

- This profile supports any receivers that use a 19.2k Modem RS-232 connection and a CR and a CR as the transmit and receive command control string terminators respectively.

RxModem (19.2k, CR-CRLF)

- This profile supports any receivers that use a 19.2k Modem RS-232 connection and a CR and a CRLF as the transmit and receive command control string terminators respectively.

Cabling

To use any of the above profiles the user must ensure the receiver is correctly cabled to the NRC.

**** WARNING ****

Incorrectly connecting receiver cables to the NRC unit may cause damage to the NRC unit.

Specifically:

a. the receiver's audio signal needs to be mapped to the correct signal lines on the NRC's "RECEIVER x" port at the rear of the NRC unit (DB15M connector).
   i. For Balanced signals: Pin 3: -SIGNAL Pin 5: +SIGNAL
   ii. For Unbalanced signals: Pin 3: GND Pin 5: +SIGNAL

b. The analog signals can be either balanced or unbalanced, at levels of up to +/- 5V with bandwidths of up to <8KHz.

c. the receiver's RS-232 appropriate control signals need to be are mapped to the correct pins on the NRC's "COM x" port at the rear of the NRC unit (RJ-45M connector), with the minimal Tx, Rx, GND format being satisfactory for operation. The RS-232 pin-outs on the NRC "COM x" port are:

Pin 1 – RTS	Pin 5 - GND
Pin 2 – DTR	Pin 6 - CTS
Pin 3 – DSR	Pin 7 - Rx
Pin 4 – Tx	Pin 8 - DCD

Analog Receiver Profile

This profile supports any receiver that needs to output an analog signal without the need for any command and control signaling.

The NRC can accept analog signals that are either balanced or unbalanced, at levels of up to +/- 5V with bandwidths of up to <8KHz.

The receiver's audio signal needs to be mapped to the correct signal lines on the NRC's "RECEIVER x" port at the rear of the NRC unit (DB15M connector).

- For Balanced signals: Pin 3: -SIGNAL Pin 5: +SIGNAL
- For Unbalanced signals: Pin 3: GND Pin 5: +SIGNAL

Appendix B - Software Upgrades

From time to time Aegis may release an upgrade the NRC system software. This can be integrated into the NRC by either replacing the NRC systems' internal compact flash card or by remotely downloading new files into the NRC system. This appendix discusses the second option of downloading remotely new files into the NRC.

This information is provided for reference and is not expected to be needed by every user.

NOTE: Any NRC system upgrades need to be performed by a Linux, UNIX IT system administrator and coordinated with Aegis to ensure a smooth upgrade.

NRC File System

The NRC is built upon a Gentoo Linux file system, which includes a script file which runs during the reboot process. This script file looks to see if there are any particular system files which have been placed in certain directories since the last reboot.

The file relevant portion of the system file tree is: */root/code_changes/* directory and its sub-directories. Figure 40 shows an extract of the relevant NRC directory structure

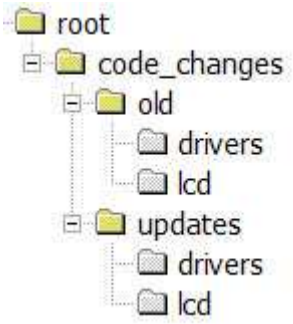


Figure 40 - NRC File System - Extract

where:

code_changes	is a command file directory
updates	is the directory where new system files are copied to for subsequent installation into the NRC system
updates/drivers	is the directory where new driver files (PLL card, DAQ card) are placed for installation into the NRC system
updates/lcd	is the directory where new lcd files are placed for installation into the LCD Display
old	is the directory where original system files are moved to as a result of a software update
old/drivers	is the directory where old driver files (PLL card, DAQ card) are moved to as a result of a software update
old/lcd	is the directory where original lcd files are moved to as a result of a software update

NRC Software Update Protocol

The NRC software update protocol supports 3 null-sized command files which when placed in the *code_change* directory initiate action; UPDATE, RESTORE and CLEAN. A command file is simply a regular file of no content that has a specific file name.

UPDATE Command

If the UPDATE command file is present in the *code_changes* directory during an NRC system boot-up, the following directory checks will be made:

1. in *update*, check for:
    a. CCPServer and RCPServer
    b. CCPConfig.xml, RCPconfig.xml, DDPConfig.xml, and LCDConfig.xml
    c. Receivers.xml, WJ8723.xml, RX331.xml, RxModem19200-CR-CR.xml, RxModem19200-LF-CRLF.xml, RxNullModem19200-CR-CR.xml, RxModemNull19200-LF-CRLF.xml and RxSignalInput.xml
2. *in update/lcd*, check for any ".bmp" files
3. *in update/drivers*, check for:
    a. pll_usb_driver.o and pwrdaq.o

If one or more valid files are found across these directories at boot-up, the current existing NRC system files of the same name are moved into the *code_changes/old* directory and the new system files are moved into the appropriate NRC system directories.

If valid ".bmp" files (LCD image files) are found in *update/lcd*, the current NRC directory of lcd files are copied from the NRC system into the *old/lcd* directory, and the lcd files in *update/lcd* are moved into the NRC system lcd directory.

When the NRC system boots up these new files will be integrated into the NRC, and the UPDATE command file in *code_changes* will be replaced with an UPDATE_COMPLETE command file.

RESTORE Command

The RESTORE command allows the NRC system to be rolled back to the original configuration in the advent that recently installed UPDATE changes need to be replaced.

If the RESTORE command file is present in the *code_changes* directory during an NRC system boot-up, the following directory checks will be made:

4. in *old*, check for:
    a. CCPServer and RCPServer
    b. CCPConfig.xml, RCPconfig.xml, DDPConfig.xml, and LCDConfig.xml
    c. Receivers.xml, WJ8723.xml, RX331.xml, RxModem19200-CR-CR.xml, RxModem19200-LF-CRLF.xml, RxNullModem19200-CR-CR.xml, RxModemNull19200-LF-CRLF.xml and RxSignalInput.xml
5. *in old/lcd*, check for any ".bmp" files
6. *in old/drivers*, check for:
    a. pll_usb_driver.o and pwrdaq.o

If one or more valid files are found across these directories at boot-up, the current existing NRC system files of the same name are moved into the *code_changes/update* directory and the old system files are moved into the appropriate NRC system directories.

If valid ".bmp" files are found in *old/lcd*, the current NRC directory of lcd files are copied from the NRC system into the *update/lcd* directory, and the lcd files in *old/lcd* are moved into the NRC system *lcd* directory.

When the NRC system boots up these old files will be integrated into the NRC, and the RESTORE command file in *code_changes* will be replaced with an RESTORE_COMPLETE command file.

CLEAN Command

The CLEAN command removes all command, command acknowledgement files and system files from *code_changes* directory tree.

If the CLEAN command file is present in *code_changes* directory during an NRC system boot-up, all the files in the *code_changes* directory tree will be deleted and hence cleaned.

Once this process is completed the CLEAN command file in *code_changes* is simply deleted – there is no acknowledgement file generated for this activity.

Upgrade Procedure

To perform a software upgrade, the necessary files need to be downloaded into the NRC system itself. The following describes how to transfer update files and command files to the NRC.

Set Up the NRC System to accept incoming files

The NRC file system is set as "read-only", which doesn't allow files to be written to the file system. In order to change this, an *ssh* shell session needs to be established with the NRC, through which the NRC configuration utility can be run.

Step 1: Open up a new console session on the unix workstation.

Step 2: From this console session open up an *ssh* terminal session into the NRC system
#. ssh root@<NRC ip address>
#. password <enter NRC root password>

Step 3: Once the NRC Configuration Utility appears, "ctrl-c" out of this application and leave this session open.

Download the new NRC system files

Step 1: Open up a new console session on the unix workstation

Step 2: From this console session use *scp* to download the necessary NRC system files into the appropriate update directory, either *code_changes/updates*, *code_changes/updates/lcd*, or *code_changes/updates/drivers*
eg. to download a new CCPServer
scp CCPServer root@<NRC ip address>:/root/code_changes/updates
password <enter NRC root password>
- an acknowledgement of 100% complete will be echoed back to the terminal window for each file transferred.

Step 3: Repeat Step 2 as many time as is needed to download all necessary files into the necessary directories. Note that *scp* supports wildcarding, so multiple files can be downloaded in one command.
eg. to copy all bmp display files into the appropriate NRC directory:
scp *.bmp root@<NRC ip address>:/root/code_changes/updates/lcd
password <enter NRC root password>
- an acknowledgement of 100% complete will be echoed back to the terminal window for each file transferred.

Download the Command file

Step 1: In the console session on the unix workstation create an empty command file (either UPDATE, RESTORE or CLEAN)
eg. # touch UPDATE

Step 2: Download the command file
eg. # scp UPDATE root@<NRC ip address>:/root/code_changes
password <enter NRC root password>
- an acknowledgement of 100% complete will be echoed back to the terminal window for the transferred command file.

Step 3: Optional – Check file transfer
From the open ssh session view that the files have been transferred by navigating to the appropriate directory and listing the contents of that directory
eg. Navigate to */root/code_changes* to view files

Alternative – Create the Command file on the NRC

Step 1: From the *ssh* shell navigate on the NRC */root/code_changes*

Step 2: Use touch to create an empty command file directly in the */root/code_changes* directory.
eg. touch UPDATE

Initiate Command action

The NRC needs to be re-booted for the changes to take effect.

Step 1: Reboot the NRC system by typing *reboot* in the NRC's ssh terminal session or cycle the NRC power.

Step 2: During up the reboot process the */root/code_changes* directory will be read and if one of the three command files is found the necessary action will be initiated.

Step 3: Once the changes have taken place, the command file will be replaced by the corresponding command acknowledgement file. This can be optionally viewed via an *ssh* session.

Appendix C- NRC License Agreement

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8. **Governing Law**. This License Agreement shall be construed and governed in accordance with the laws of the State of Maryland. Any and all claims, demands, disputes, controversies, differences or misunderstandings arising out of or relating to this License Agreement, the business dealings between Licensor and Licensee related to the Software, or the failure or refusal to perform the whole or any part hereof, shall be settled by arbitration, shall be conducted in Columbia, Maryland by the rules of the American Arbitration Association (the "AAA"), by a single arbitrator knowledgeable in the software industry, and in accordance with the rules thereof then pertaining. Each of the parties hereto hereby submit to the exclusive jurisdiction of the courts of the State of Maryland in any suit, hearing or other legal proceeding of every nature, kind and description whatsoever in the event of any dispute or controversy arising hereunder or relating hereto, or in the event any ruling, finding or other legal determination is required or desired hereunder including any proceeding for the enforcement of this License Agreement to arbitrate and for the enforcement of the award rendered by the arbitrators, and agree that judgment upon such award may be entered in any court, in or out of the State of Maryland, having jurisdiction thereof. The fees of the AAA shall be borne by the parties equally. This section shall not, in the event arbitration is chosen, prevent either party from instituting litigation, in order to obtain standing, and seeking injunctive relief from any state or federal court under any law or ordinance.

9. **Costs of Litigation**. If any action is brought by either party to this License Agreement against the other party regarding the subject matter hereof, the prevailing party shall be entitled to recover, in addition to any other relief granted, reasonable attorney fees and expenses of litigation.

10. **Severability**. Should any term of this License Agreement be declared void or unenforceable by any court of competent jurisdiction, such declaration shall have no effect on the remaining terms hereof. Any provisions which by their terms and conditions contemplate survival of the expiration of the term of this License Agreement, or any earlier termination of this License Agreement, shall survive such expiration or earlier termination.

11. **No Waiver**. A waiver by either Licensor of any of the terms and conditions of this Agreement or failure by Licensor to exercise any option, right, or privilege on any occasion or through the course of dealing, shall not prevent enforceability of such term or be deemed a waiver of any subsequent breach thereof.

12. **U.S. Government Restricted Rights**. The Software and related documentation are provided with RESTRICTED RIGHTS. Use, duplication, or disclosure by the Government is subject to restrictions as set forth in subparagraph (c)(1)(ii) of the Rights in Technical Data and Computer Software clause at DFARS 252.227-7013 or subparagraphs (c)(1) and (2) of the Commercial Computer Software - Restricted Rights at 48 CFR 52.227-19, as applicable. Manufacturer for such purpose is Aegis 8610 Washington Boulevard, Suite 213, Jessup, Maryland.

13. **Application of Uniform Computer Information Transactions Act**. The Parties agree that the Uniform Computer Information Transactions Act, Annotated Code of Maryland,

Commercial Law § 22-101 et seq ("UCITA"), shall not apply to this Agreement to the extent allowable by law.

14. **Electronic Self-Help**. The Parties agree that Licensor shall be entitled to the use of self-help, including electronic self-help as those terms are defined in UCITA. Prior to the use of electronic self-help, Licensor shall serve notice of exercise upon Licensee by electronic and registered mail to the last known addresses of Licensee and in the manner prescribed pursuant to 22-816(F) of UCITA, the terms of which are incorporated herein by reference.

15. **Submissions**. Should you decide to transmit to Licensor, by any means or any media, any materials or other information (including, without limitation, ideas, concepts or techniques for new or improved services and products), whether as information, feedback, data, questions, comments, suggestions or the like, you agree that such submissions are unrestricted and shall be deemed non-confidential and you automatically grant Licensor and its assigns a non-exclusive, royalty-free, worldwide, perpetual, irrevocable license, with the right to sublicense, to use, copy, transmit, distribute, create derivative works of, display and perform the same.