



# **Ulyssix Bald Eagle RF Plug-In for DeweSoft**

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## Introduction

The Ulyssix Bald Eagle RF is a Plug-In for DeweSoft. Plug-Ins extend the functionality of DeweSoft. This plug-in adds controls and display for the Ulyssix Bald Eagle RF receiver and transmitter. The plug-in The Bald Eagle RF is only accessed in DeweSoft Channel Setup Mode. It has user controls to configure the Bald Eagle RF receiver and transmitter settings. These settings are stored in the DeweSoft DXS file. The plug-in also has Time and Frequency (FFT) displays of the incoming signal. The Ulyssix Bald Eagle RF Plug-In is not used in Measure Mode.

The Bald Eagle RF is a daughter card to the Tarsus3. Combined, this hardware solution demodulates, bit synchronizes, frame synchronizes, and decommuates an RF telemetry signal. The Ulyssix Bald Eagle RF Plug-In and the DeweSoft PCM Plug-In work together to configure the Ulyssix hardware. The Ulyssix Bald Eagle RF Plug-In configures the RF Receiver and RF Transmitter. The DeweSoft PCM Plug-In configures the Bit Sync, Frame Sync, and Decom.

The Bald Eagle RF has multiple version and optional licensed features. The licensed features add an additional cost to the base Bald Eagle RF. This manual depicts the Bald Eagle RF-02 (two Receivers, two Bit Syncs, two Frame Syncs and two Decoms) with the Transmitter Licensed Feature.

## Installation and Registration

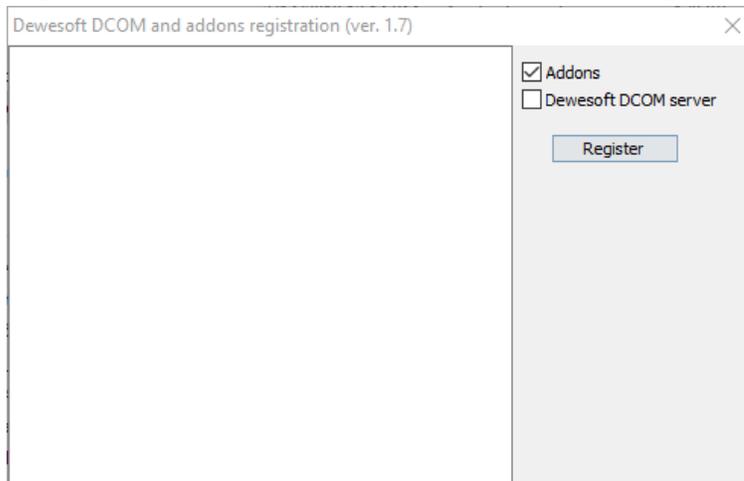
The Ulyssix Bald Eagle RF Plug-In has different DLL for 32-bit version of DeweSoft and 64-bit version of DeweSoft. The DLLs are in the folders 32-bit and 64-bit. All Ulyssix supported version of DeweSoft X2 are 32-bit. DeweSoft X3 has 32-bit and 64-bit version. DeweSoft changed the default folder structure starting in Service Pack 5 (SP5). Please identify your version of DeweSoft before proceeding.

The Installation and Registration process involves copying the BaldEalgeRf.dll to the DeweSoft Addons folder and then running the DeweSoft Registration tool. Please note, registering the Ulyssix Bald Eagle RF Plug-In requires Administrator privileges. If you do not have Administrator privileges on the computer, please consult your IT or Security department.

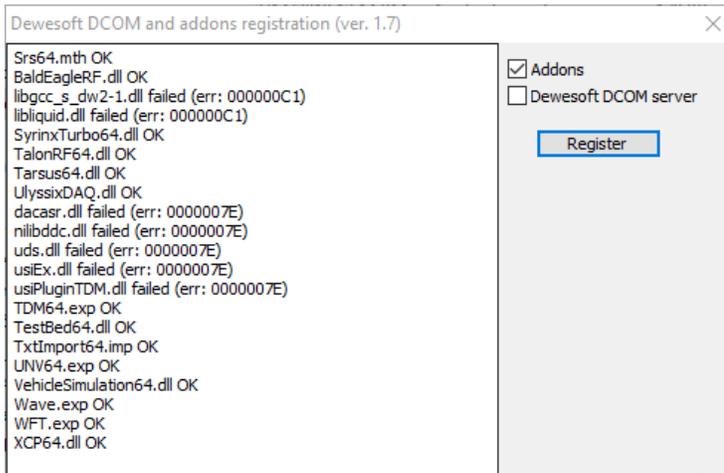
1. Identify if DeweSoft is 32-bit or 64-bit. Open a Windows Explorer and navigate to the DeweSoft folder. Copy the BaldEalgeRf.dll to one of the following directories:
  - a. For DeweSoft X2: C:\DEWEsoft7\bin\X2\Addons.
  - b. For DeweSoft X3 32-bit SP4 and lower: C:\DEWEsoft\bin\X3\Addons.
  - c. For DeweSoft X3 64-bit SP4 and lower: C:\DEWEsoft\bin64\X3\Addons64
  - d. For DeweSoft X3 32-bit SP5 and higher: C:\DEWEsoft\bin\X3\Addons\Tarsus
  - e. For DeweSoft X3 64-bit SP5 and higher: C:\DEWEsoft\bin64\X3\Addons64\Tarsus

To register the Ulyssix Bald Eagle RF Plug-In, please do the following:

1. Navigate to the folder where DeweSoft.exe is located. The typical folder directories for each version of DeweSoft are listed below:
  - a. For DeweSoft X2: C:\DEWEsoft7\bin\X2\
  - b. For DeweSoft X3 32-bit SP4 and lower: C:\DEWEsoft\bin\X3\
  - c. For DeweSoft X3 64-bit SP4 and lower: C:\DEWEsoft\bin64\X3\
2. Inside this folder locate DCOMReg.exe. Right click on the file and select "Run as Administrator."
3. Click the Yes button in the pop-up window "Do you want to allow this app to make changes to your device?"
4. In the DeweSoft DECOM and Registration window check the Addons box and then click the Register button. This will start the DeweSoft Addons registration process.



5. When the log window stops updating with more lines, the registration process is complete.



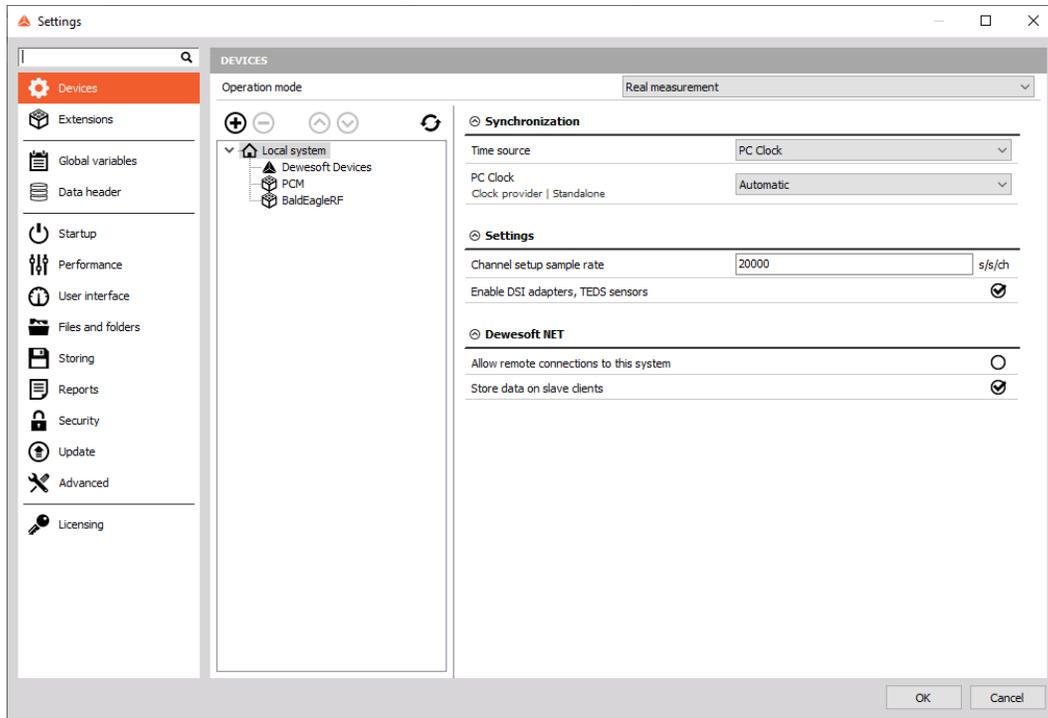
6. Close the window.

## DeweSoft Configuration

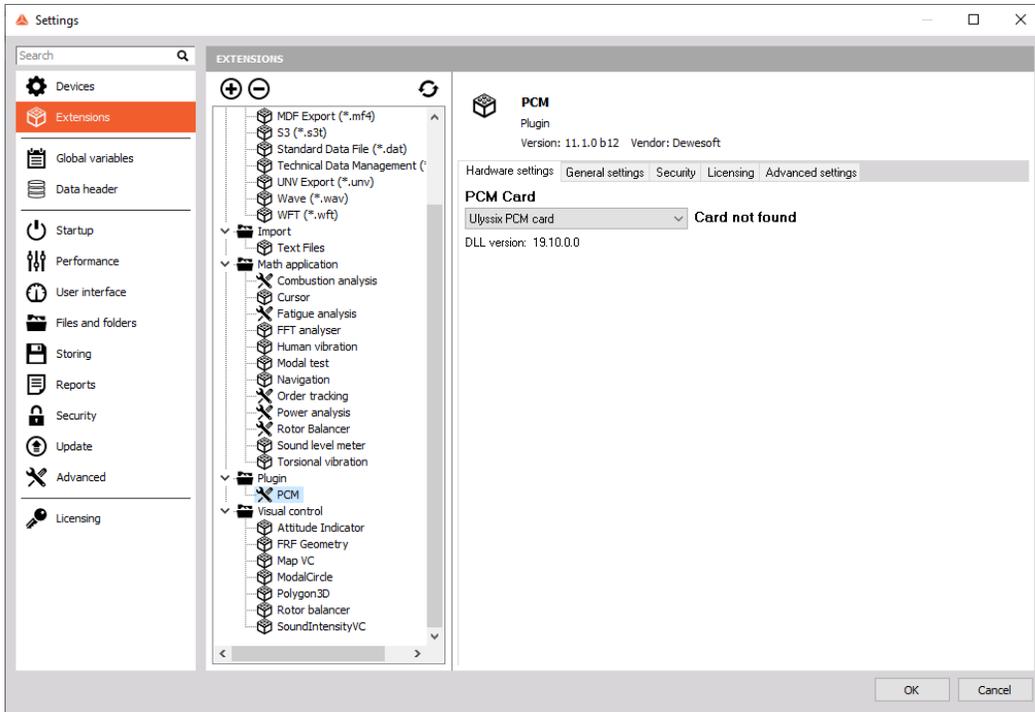
While the Ulyssix Bald Eagle RF is compatible with DeweSoft X2, this configuration guide is based on DeweSoft X3. The follow section explains the steps required to enable the Ulyssix Bald Eagle RF Plug-In and configure DeweSoft.

### Enable the Ulyssix Bald Eagle RF Plug-in

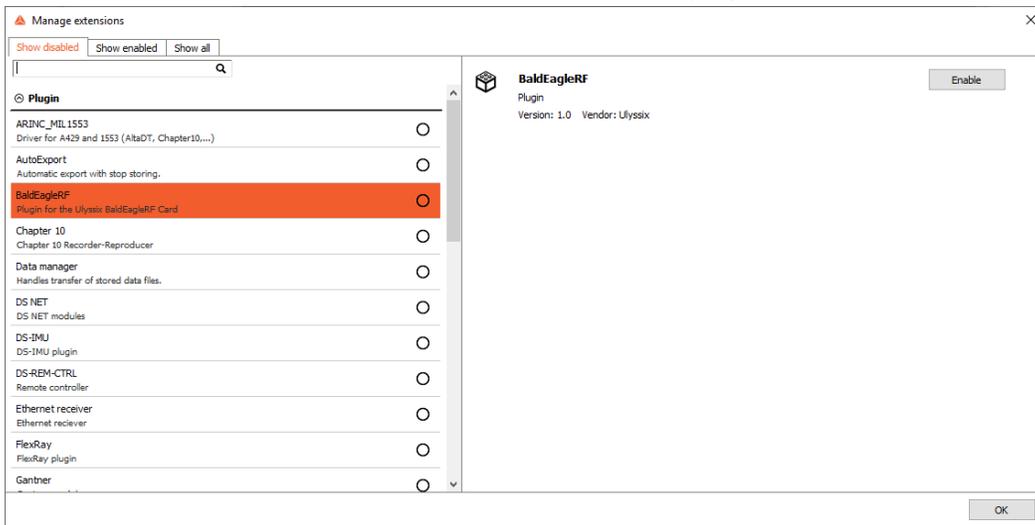
1. In the upper right corner of the DeweSoft window, click the Settings button to display the Settings Menu. In the Settings Menu, click Settings to launch the Settings window.



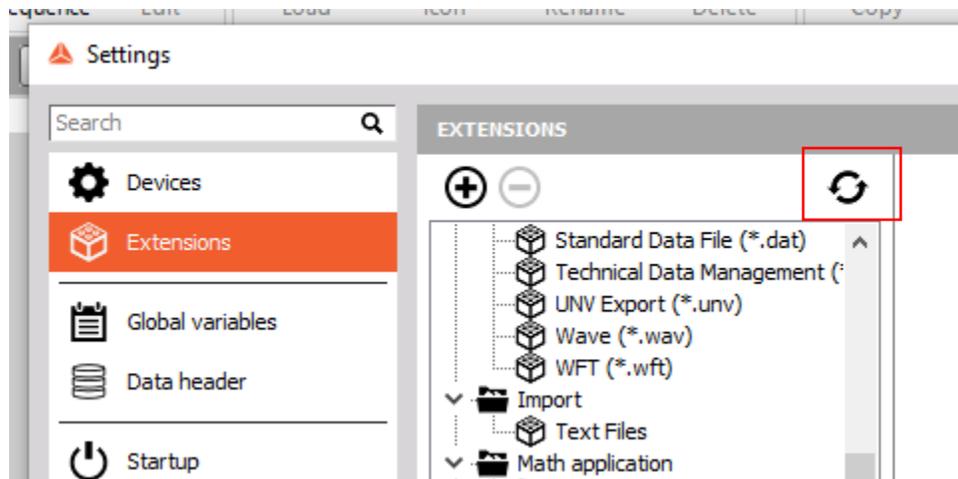
2. In the upper left corner of the Settings window, click Extensions. The Extensions pane will appear to the right.
3. In the Extensions pane, click the plus sign to launch the Manage Extensions window.



4. In the Manage Extensions window, scroll down to find the desired Ulyssix Bald Eagle RF Plug-In and click in the circle to add a check mark and enable the plug-in.



5. Click OK to return to the Settings window.
6. If the Ulyssix Bald Eagle RF Plug-In is not listed in the Manage Extensions window:
  - a. Close the Manage Extensions window.
  - b. You are now in the Settings window. Select Extensions from the menu on the left
  - c. Locate the circular arrow icon and click it (red box in image below). This will register all of the DeweSoft Plug-Ins.



- d. Windows will ask if you want to allow this application to make changes to your application. This process requires Administrator privileges in Windows 10 because it makes changes to the DeweSoft registry settings. Click Yes.
- e. A pop-up window will scroll through the DeweSoft Plug-Ins and attempt to register them. When this process is done, a window will ask you to restart DeweSoft.
- f. Restart DeweSoft and try to add the Ulyssix Bald Eagle RF Plug-in again.

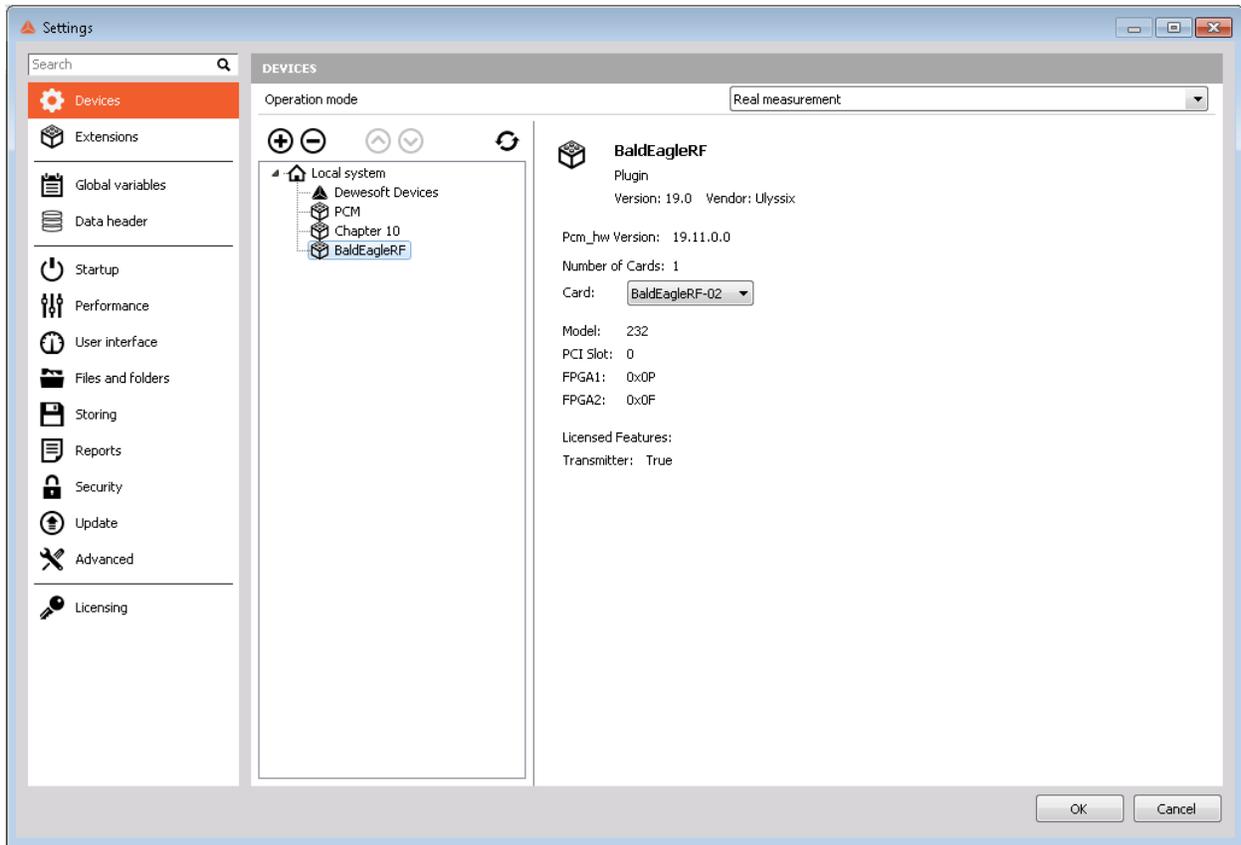
### DeweSoft Settings Window for the Ulyssix Bald Eagle RF Plug-In

Once the Ulyssix Bald Eagle RF Plug-In is enabled, it will appear in the list of devices in the Local System the setting window. Selecting BaldEagleRF from the list brings up the Ulyssix Bald Eagle RF Plug-In Hardware Configuration in the panel to the right.

This panel lists important information about the Ulyssix Bald Eagle RF card. There is a drop-down box to select which Bald Eagle RF card has its information displayed. If there is only one Bald Eagle RF card in the system, then this drop-down box will only have one entry.

The Hardware Configuration window displays the following information:

1. Ulyssix Bald Eagle RF Plug-In Version Number
2. Pcm\_hw.dll Version Number
3. Number of Bald Eagle RF cards in the system.
4. The Model Number of selected Bald Eagle RF card.
5. The PCI Slot for the selected Bald Eagle RF card.
6. The FPGA versions for the selected Bald Eagle RF card.
7. A list of the Bald Eagle RF Licensed Features including which licensed features were activated for this card.



## The Ulyssix Bald Eagle RF

The Ulyssix Bald Eagle RF Plug-In icon appears in the toolbar along with the PCM Plug-In. When selected, a graphical user interface (GUI) appears in the DeweSoft window.



The Ulyssix Bald Eagle RF Plug-In has a toolbar at the top. Below the toolbar is the control selection buttons. These buttons that determine which controls are displayed in the control panel. The control panel is the left side of the plug-in where the user enters the settings for the Bald Eagle RF Receiver or Transmitter. To the right of the control panel is the display panel. The display panel shows a time domain plot and a frequency domain plot of the data coming into the selected receiver.

In the toolbar is the drop-down box to select which Bald Eagle RF card is displayed below (in a system with one Bald Eagle RF card the drop-down box only has one entry). There is a Receiver power indicator for the two receivers in the Bald Eagle RF. There is a Bit Lock Indicator for both Bit Sync 1 and Bit Sync 2 to aid in adjusting the Bald Eagle RF receiver settings to acquire Bit Lock. And there is a Debug button to help troubleshoot any hardware issues by accessing the registers on the card.

Below the toolbar is the control selection buttons. There are three buttons: Receiver Standard, Receiver Advanced, and Transmitter. Clicking the Receiver Standard button causes the control panel to the display the standard receiver controls. The standard receiver controls use the bit rate to determine the correct settings for the receiver. Clicking the Receiver Advanced button causes the control panel to

display the advanced receiver controls. The advanced receiver controls allow you the user specify the values for the RF Auto Gain Control and the RF Filters in the receiver. Clicking the Transmitter button causes the control panel to display the transmitter controls.

Each for the three control panels have a drop-down box to select the desired channel for the settings. The Bald Eagle RF-01 has one receiver. The Bald Eagle RF-02 has two receivers. Both the Bald Eagle RF-01 and the Bald Eagle RF-02 have a licensed feature to add one transmitter (licensed feature has an additional cost).

## DeweSoft PCM Plug-In Settings

The Bald Eagle RF card can connect the output of the RF Receiver to the input of the Bit Sync on board the card (no cabling required). Follow the instructions below to configure the DeweSoft PCM Plug-In for the Bit Sync input to be from the RF Receiver.

1. Click on the PCM Plug-In icon in the DeweSoft toolbar (red rectangle in the image below). The icon is of a Space Shuttle.
2. Locate the Bit Sync Settings heading. Under this heading, locate the control for the Input. The Input control (blue rectangle in the image below) is a drop-down box with the following options.
  - a. Input BNC – the input to the Bit Sync is the singled end BNC input connector.
  - b. Input DIFF – the input to the Bit Sync is the differential Trumpter connector.
  - c. Input RX – the input to the Bit Sync is the output of the Bald Eagle RF Receiver.
3. Select Input RX to connect the output of the RF Receiver to the input of the Bit Sync.

Info	ON/OFF	Bit rate	Signal strength	Bit sync	Polarity
Main stream		1000000	0.0 %	Lock	Normal
PCM Output		1000000	100.0 %		

## Receiver Standard Controls

The Receiver Standard Controls use the Bit Rate to calculate the required filters for the RF receiver. These standard controls are sufficient for most use cases. For more detailed control over the RF receiver settings, please use the Receiver Advanced Controls. The settings are not sent to the Bald Eagle RF card until the Apply button is sent.

Clicking the Apply button validates the user settings before sending them to the Bald Eagle RF card. If there is an issue with the settings, a pop-up window will appear with directions on the invalid setting.



The Receiver Standard Controls:

1. Rx Index – This drop-down box selects the receiver that is configured and displayed. A Bald Eagle RF-01 has one receiver. A Bald Eagle RF-02 has two receivers.
2. Frequency Band Controls
  - a. Frequency Band – This drop-down box selects the desired frequency band for the receiver. The frequency range for the selected frequency band is displayed in the Band Range.
    - i. C Band – 4400 MHz to 5200 MHz.
    - ii. S Band – 2185 MHz to 2485 MHz.
    - iii. L Band – 1420 MHz to 1850 MHz.

- iv. Extend P Band – 500 MHz to 1250 MHz.
    - v. P Band – 200 MHz to 500 MHz.
    - vi. IF Band – 50 MHz to 90 MHz.
  - b. Band Range – Displays the frequency range, in MHz, selected in the Frequency Band drop-down box.
  - c. RF Frequency – User entry for the desired center frequency of the receiver. The entry is in units of MHz and accepts decimal notation. If the entered value is not in the selected Frequency Band, then the RF Freq turns red and the plug-in will not send the settings to the Bald Eagle RF card until the RF Frequency is corrected.
- 3. Demodulator:
  - a. Bit Rate – The user entry for the Bit Rate has a numeric entry and units selection drop down box. The user entry allows decimal notation. The maximum Bit Rate is 40Mbps.
  - b. Modulation – Drop-down box to select the modulation type of the RF signal. The only current option is FM, but BPSK, SOQPSK, QPSK, OQPSK, and AUQPSK are in development.
  - c. Without PreMod Filter – When checked, this option increases the bandwidth of the default calculation to compensate for the wider requirements of a non pre-modulation filtered frequency modulated PCM signal.
  - d. Diversity Combiner – When checked the Bald Eagle RF-02 uses both Receiver 1 and Receiver 2 to output the best possible PCM stream from the receiver. This feature is only available on Receiver 1 of a Bald Eagle RF-02 card.
- 4. DAC Outputs:
  - a. DAC Enable – This check box enables and disables the DAC outputs.
  - b. DAC – This drop-down box selects the DAC data source: Off, AGC, or Demod.
  - c. Gain – The voltage peak to peak for the output of the DAC.
  - d. Offset – The offset from 0V for the output of the DAC.
  - e. Invert – When checked, this inverts the signal output of the DAC.

## Receiver Advanced Controls

The Receiver Advanced Controls allows the user to determine the settings for the Auto Gain Control and the RF Filters. If the user hits apply in the Receiver Standard control panel, then the RF filters settings are calculated based on the bit rate. These calculated settings are visible and editable in the Receiver Advanced Controls.

Clicking the Apply button validates the user settings before sending them to the Bald Eagle RF card. If there is an issue with the settings, a pop-up window will appear with directions on the invalid setting.



The Receiver Advanced Controls:

1. Rx Index – This drop-down box selects the receiver that is configured and displayed. A Bald Eagle RF-01 has one receiver. A Bald Eagle RF-02 has two receivers.
2. Frequency Band Controls
  - a. Frequency Band – This drop-down box selects the desired frequency band for the receiver. The frequency range for the selected frequency band is displayed in the Band Range.
    - i. C Band – 4400 MHz to 5200 MHz.
    - ii. S Band – 2185 MHz to 2485 MHz.
    - iii. L Band – 1420 MHz to 1850 MHz.

- iv. Extend P Band – 500 MHz to 1250 MHz.
    - v. P Band – 200 MHz to 500 MHz.
    - vi. IF Band – 50 MHz to 90 MHz.
  - b. Band Range – Displays the frequency range, in MHz, selected in the Frequency Band drop-down box.
  - c. RF Frequency – User entry for the desired center frequency of the receiver. The entry is in units of MHz and accepts decimal notation. If the entered value is not in the selected Frequency Band, then the RF Freq turns red and the plug-in will not send the settings to the Bald Eagle RF card until the RF Frequency is corrected.
  - d. IF Bandwidth – The user entry for the IF Bandwidth has a numeric entry and a units selection drop down box. The user entry allows decimal notation. The maximum IF Bandwidth is 56MHz. The Receiver Standard Controls calculates the IF Bandwidth for a Frequency Modulated PCM signal as  $1.16 * \text{Bit Rate}$ . If the signal is not pre-modulation filtered, then the IF Bandwidth is calculated as  $1.42 * \text{Bit Rate}$ .
  - e. Diversity Combiner – When checked the Bald Eagle RF-02 uses both Receiver 1 and Receiver 2 to output the best possible PCM stream from the receiver. This feature is only available on Receiver 1 of a Bald Eagle RF-02 card.
  - f. AGC Mode – This feature is under development.
- 3. Auto Gain Control:
  - a. AGC Mode – This drop-down box sets the auto gain control to one of these options:
    - i. Auto – Uses an internal algorithm to adjust the receiver gain as needed to optimize the acquired RF signal.
    - ii. Manual – the user enters a power value and the receiver uses that value as the receiver gain.
    - iii. Freeze – after the AGC has settled to a value, the Freeze option locks the gain value and does not the AGC change it.
  - b. Time Constant – The Time Constant is used when the AGC Mode is set to Auto. The values for the time constant are: 1mS, 100uS, and 10uS.
  - c. Power Level – This control is used when the AGC Mode is set to Manual. The value is the gain that receiver applies to the incoming signal.
- 4. Demodulator:
  - a. Bit Rate – The user entry for the Bit Rate has a numeric entry and units selection drop down box. The user entry allows decimal notation. The maximum Bit Rate is 40Mbps.
  - b. Without PreMod Filter – When checked, this option increases the bandwidth of the default signal to compensate for the wider requirements of a non pre-modulation filtered frequency modulated PCM signal.
  - c. Modulation – Drop-down box to select the modulation type of the RF signal. The only current option is FM, but BPSK, SOQPSK, QPSK, OSPK, and AUQPSK are in development.
  - d. Output Filter – This drop-down box determines if the receiver uses a filter on the output of the demodulator.
  - e. Output Filter – This user entry has a numeric control and a units drop-down box. The numeric entry allows for decimal notation. This control determines the cut off

frequency for the filter after the demodulator. It's accepted range is from IF Bandwidth divided by two to IF Bandwidth divided one hundred and twenty eight.

5. DAC Outputs:

- a. DAC Enable – This check box enables and disables the DAC outputs.
- b. DAC – This drop-down box selects the DAC data source: Off, AGC, or Demod.
- c. Gain – The voltage peak to peak for the output of the DAC.
- d. Offset – The offset from 0V for the output of the DAC.
- e. Invert – When checked, this inverts the signal output of the DAC.

### Transmitter Controls

The Bald Eagle RF has a licensed feature for a RF Transmitter. The RF Transmitter match the RF Receiver in frequency band and has configurable power output from approximately 0dB to -75dB (this range depends on the frequency band selected). The Rf Transmitter can use the Bald Eagle RF PCM simulator as a data source, generate a Continuous Wave (CW) signal, or take the input from the RF Receiver and transmit it at a different frequency.

Clicking the Apply button validates the user settings before sending them to the Bald Eagle RF card. If there is an issue with the settings, a pop-up window will appear with directions on the invalid setting.



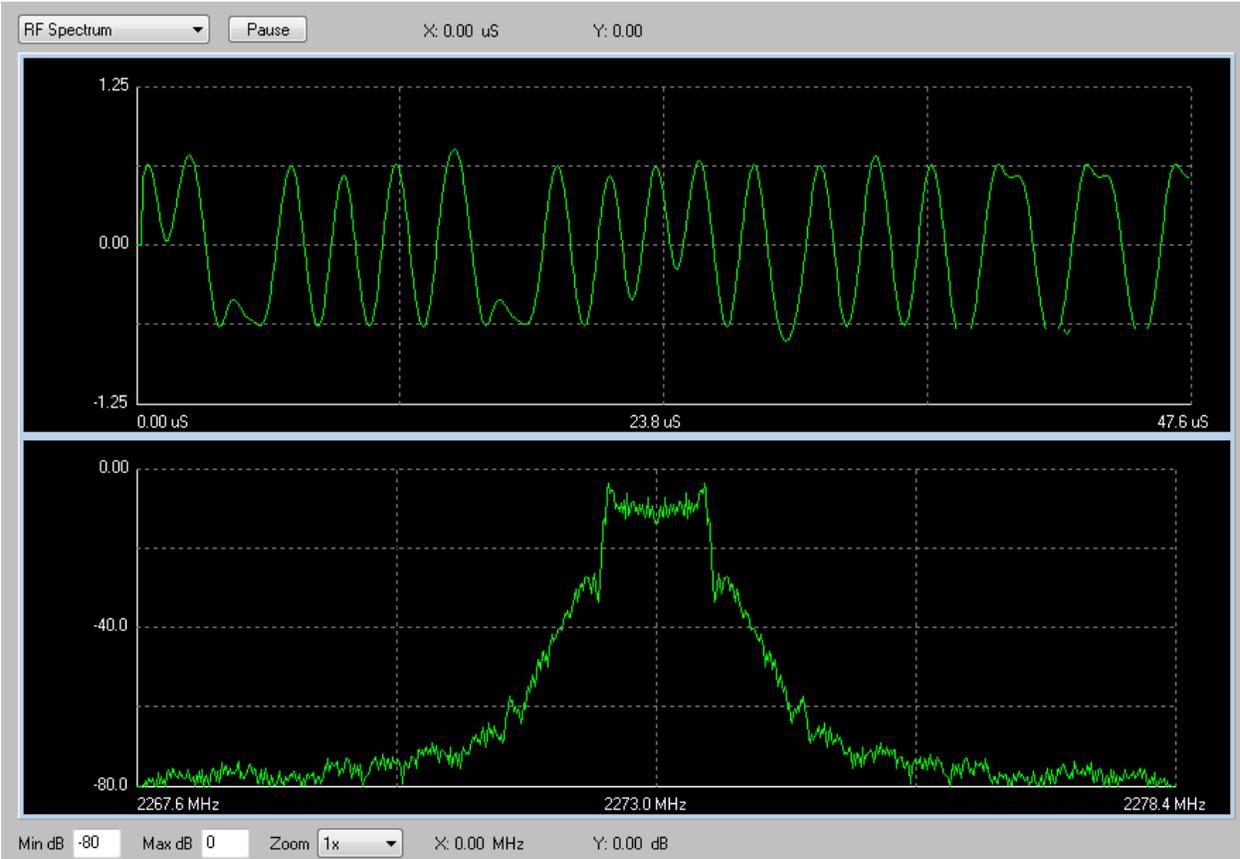
## The Transmitter Controls:

1. Tx Index – This drop-down box selects the receiver that is configured and displayed. There is only one transmitter, so there is only one entry in the drop-down box.
2. Settings:
  - a. Enable – This drop-down box determines if the RF transmitter is on or off.
  - b. Source – This drop-down box determines the source of the data for the RF Transmitter.
    - i. Simulator – The data for the RF Transmitter is the PCM from the Bald Eagle RF PCM Simulator (the PCM Simulator is setup in the DeweSoft PCM Plug-In).
    - ii. Frequency Translator – The data for the RF Transmitter is from the down converted data from the RF Receiver. This feature is used, for example, to take S-Band signal and convert it to C-Band.
  - c. Modulation – this is the modulation scheme for the RF Transmitter when the Source is set to Simulator. The options are Frequency Modulation (FM) and Continuous Wave (CW). Modulation schemes for BPSK, SOQPSK, QPSK, OQPSK, and AUQPSK are in development.
  - d. Pre-Modulation Filter – This drop-down box determines if a filter is applied to the PCM signal before it is modulated. This option only applies with the Source is Simulator and the Modulation is not CW.
3. Frequency:
  - a. Frequency Band – This drop-down box selects the desired frequency band for the receiver. The frequency range for the selected frequency band is displayed in the Band Range.
    - i. C Band – 4400 MHz to 5200 MHz.
    - ii. S Band – 2185 MHz to 2485 MHz.
    - iii. L Band – 1420 MHz to 1850 MHz.
    - iv. Extend P Band – 500 MHz to 1250 MHz.
    - v. P Band – 200 MHz to 500 MHz.
    - vi. IF Band – 50 MHz to 90 MHz.
  - b. Band Range – Displays the frequency range, in MHz, selected in the Frequency Band drop-down box.
  - c. RF Frequency – User entry for the desired center frequency of the transmitter. The entry is in units of MHz and accepts decimal notation. If the entered value is not in the selected Frequency Band, then the RF Freq turns red and the plug-in will not send the settings to the Bald Eagle RF card until the RF Frequency is corrected.
  - d. Bit Rate – The user entry for the Bit Rate has a numeric entry and units selection drop down box. The user entry allows decimal notation. The maximum Bit Rate is 40Mbps. This option is only used when the Source is set to Simulator and the Modulation is not CW. The Bit Rate should match the Bit Rate Value in the DeweSoft PCM Plug-In PCM Simulator. The Bit Rate is used in the calculation for the modulation of the PCM data.
  - e. RF Power – This control sets the output RF power of the RF Transmitter. Decimal notation is allowed. The maximum power is 0 dB, but 0 dB is not attainable across all

frequency bands. The minimum power is approximately -75 dB. The minimum power level is not the same across all frequency bands.

### Display Panel

The Display Panel has a time domain plot and a frequency domain plot for the current signal in the Bald Eagle RF Receiver. The time domain plot is calculated via a Fast Fourier Transform using the Hanning window function. The FFT data is averaged across eight plots to smooth out the data. The power readings in the FFT plot are relative to the measured signal and are not a representation of the power input to the Bald Eagle RF receiver.



Above the time domain plot are two controls a drop-down box for data source selection and a pause button for the both plots. Next to the Pause button is the X and Y indicators for the time domain cursor.

The drop-down box selects the source of the data for the displays. The two options are RF Spectrum and Demodulator Out Filtered. The RF Spectrum is the data after the input filter is applied. The Demodulator Out Filtered is the demodulated data after the applied Output Filter.

Below the frequency domain plot are the controls for the frequency plot Y-axis minimum and maximum setting. A drop-down box to zoom the X-axis of the frequency domain plot, and the X and Y indicators for the frequency domain cursor

When the mouse is over a plot, a yellow cursor appears on that plot. The cursor uses the mouse X-axis position to select the location in the plot and then the Y-axis location is determined by the data in the plot. For the time domain plot the cursors values are displayed above the plot. For the frequency domain plot the cursor values are displayed below the plot. The cursors are best used when the plots are paused.

In the image below, the plots are paused, and the cursor is position at the center of the PCM spectrum. The cursor shows the frequency to be 2273.0 MHz.

