

Scholar Radar Kit Quick Start Guide

Scholar P400 Series

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Introduction

Welcome to the world of Ultra Wideband (UWB) radar! Within the next 30 minutes, this *Quick Start Guide* will help you set up, configure, and operate the units in your Scholar Radar Kit as either a monostatic or bistatic radar.

Humatics® is also pleased to introduce our latest addition to the P400 family, the P440. It is the culmination of over a decade of research and product development in UWB radar and sensing, including six generations of UWB-enabling silicon. It is intended for customers who recognize the need for a low-cost, short-range radar platform capable of providing superior performance inside buildings and other high clutter environments.

The P440 allows you to fully capitalize on that capability. The P440 is a high performance radar front end that provides raw radar scan data so that you can develop filtering and detection strategies targeted to your specific application. We designed the P440 to be easy to integrate and use, with a robust Application Programming Interface (API) and support for interfacing to both PC and embedded processors.

This Guide is divided into two parts. In the first part, you will use the Monostatic Radar Module (MRM) software to operate the P440 as a monostatic radar. In the second part, you will use the Channel Analysis Tool (CAT) to operate a pair of P440s as a bistatic or multistatic radar.

The Channel Analysis Tool is not only a bistatic radar, but is also a tool for developing propagation models of a given channel and analyzing communications statistics. Users interested in only this capability can skip the MRM section.

While you can connect to the P440 with Serial, CAN, SPI, USB or Ethernet, this document assumes that you will be connecting to the unit with USB. If you want to connect through Ethernet, then see the application note *Connecting to a P440 via Ethernet*. However, please try this *after* you have completed the *Quick Start Guide* process. The Serial and CAN interfaces are very slow interfaces (115 kbps and <1 Mbps) and are therefore not recommended for use with the radar software.

This guide is divided into the following sections:

- What's in the box?
- What's on the disk?
- What you will need to work with the P440

MRM: Demonstrating Monostatic Radar Operation

- Loading the PC Software
- Configuring the P440
- Initial System Power-Up
- Connecting to the P440
- Operating the P440 as a Monostatic Radar
- Logging Radar Data

CAT: Demonstrating Bistatic Radar Operation

- Loading the PC Software
- Configuring the P440
- Initial System Power-Up

- Connecting to the P440
- Operating the P440 as a Bistatic Radar
- Logging Radar Data
- Where do you go from here?

What's in the box?

Upon receipt of your Radar Kit, inspect the shipping container and contents. If the contents of the Kit appear to be incomplete, or if there is mechanical damage, notify Humatics immediately. Humatics has supplied the following items with your kit:

Name	Part #	Qty.
P440 UWB Module	140RM01 or 02	2
Broadspec Antennas	100ANR3	4
P440 Enclosures	340EN01	2
Rechargeable UWB Batteries	340RB01	2
USB Wall Charger/Supply	N/A	2
USB Cable 6 ft./1.8 m	N/A	2
USB Power Cable 6 in./15 cm	N/A	2
Radar Kit Software & Docs USB Flash Drive	N/A	1

Table 1: Contents of the Scholar Radar Kit

Please note that a 140RM01 is intended for use in areas that conform with the US FCC regulations for UWB transmissions while the 140RM02 is intended for use in areas that require conformance to the European or ETSI standard. In addition, if you are outside the US, you may also have been provided with adapters to allow the Wall Charger/Supplies to plug into your AC power sockets.

What's on the disk?

The Radar Kit Software and Documentation USB Flash Drive contains the following two directories:

- 140-0022D Monostatic Radar Sftw & Lit
- 140-0023C CAT & Bistatic Radar Sftw & Lit

Within each directory are three sub directories:

- **1-Embedded:** This directory contains all of the files necessary for updating the embedded code in any P4xx units you might have received prior to receiving this package. The units received in a kit are already at the latest revision level and do not require updating.
- **2-Host & Sample Code:** This directory has several sub directories which contain Sample Applications and programs. The Monostatic version of this directory contains an installer for the Windows-based Graphical User Interface (GUI) MRM RET and a tool for changing the IP address of a P440. The Bistatic version of this directory contains an installer for the Windows-based Graphical User Interface (GUI) CAT and a tool for changing the IP address of a P440.

- **3 - Documentation:** This directory contains all the documentation.

More specifically, the Monostatic Radar documentation directory contains the following:

- **Scholar Radar Kit Quick Start Guide:** A soft copy of the manual you are currently reading.
- **MRM API Specification:** The Application Programming Interface (API) specification for the P4xx platforms describing interface and operation as a monostatic radar.
- **MRM RET User Guide:** Document which explains in detail the user interface for MRM RET.
- **P440 Data Sheet / User Guide:** Detailed specification for the P440 UWB platform.
- **Using the USB and Serial Interfaces:** Application note describing how to use the USB and 3.3V TTL UART microcontroller interfaces.
- **Updating P400 Series Modules with New Embedded Code:** Instructions on how to update the embedded code on any P4xx when new software releases are introduced.
- **Application Note:** *CAN Interface Application Note*
- **Application Note:** *Connecting to a P440 via Ethernet*
- **Back-Reflector Guidelines:** How to build a simple backreflector so that radar will have be more direction
- **Antenna Spec:** Spec sheet for the standard Broadspec antenna.
- **MRM Common Questions:** Frequently asked questions
- **Sample Code:** Located in directory “2 – Host & Sample Code,” this sub-directory contains sample code intended to provide the user with additional help in starting their development and evaluation efforts, including:
 - **Sample C:** A directory containing sample C code. This may be useful to users in jumpstarting software development efforts.
 - **Sample MATLAB:** A directory containing sample MATLAB code. This may be useful to users in jumpstarting system analysis efforts.
 - **MRM RET Setup MSI:** A tool for loading the Monostatic Radar Graphic User Interface for demonstration radar functionality.
 - **PulSON IP Utility Setup:** A tool which allows the user to change the IP address of the radar.

The CAT documentation directory contains the following:

- **Scholar Radar Kit Quick Start Guide:** A soft copy of the manual you are currently reading.
- **CAT API Specification:** The Application Programming Interface (API) specification for the P4xx platforms specific to CAT.
- **CAT User Guide:** Document which explains in detail the user interface for CAT.
- **P440 Data Sheet / User Guide:** Detailed specification for the P440 UWB platform.
- **Using the USB and Serial Interfaces:** Application note describing how to use the USB and 3.3V TTL UART microcontroller interfaces.
- **Updating P400 Series Modules with New Embedded Code:** Instructions on how to update the embedded code on any P4xx when new software releases are introduced.
- **Application Note:** *Connecting to a P440 via Ethernet*
- **Application Note:** *Using CAT to Implement Multistatic Radar*
- **Back-Reflector Guidelines:** How to build a simple backreflector so that radar will have be more direction
- **Antenna Spec:** Spec sheet for the standard Broadspec antenna.
- **Application Note:** *CAN Interface Application Note*
- **Sample Code:** Located in directory “2 – Host & Sample Code”, this sub-directory contains sample code for developing RF propagation models from data collected by CAT.
 - **CAT MATLAB CLEAN Algorithm:** Since a bistatic radar return is also a channel impulse response, Humatics developed this MATLAB software package for channel propagation modeling. This software also contains other tools for calculating delay spread and various communications statistics. This software was developed by a team of 3 over the course of 5 years. Humatics no longer supports this code but it is a fine resource for anyone interested studying different types of RF behavior from a communications perspective. In order to run the sample code you will need MATLAB Version 2011B and Signal Processing Toolbox.
 - **CAT Setup MSI:** A tool for loading the Channel Analysis Tool (CAT) Graphic User Interface for capturing channel responses or for demonstrating bistatic and Multistatic radar functionality.
 - **PulsON IP Utility Setup:** A tool which allows the user to change the IP address of the P440.

What you will need to work with the P440

In order to connect to and control the P440, the user will need the hardware and software as described below.

- **PC running Windows 7, Windows 8, or Windows 10** -- The MRM RET software has been developed to work with Windows 7 (32 and 64 bit), Windows 8 (32 and 64 bit), and Windows 10 (32 and 64 bit).
- **A 1.6 m (6 ft.) USB 2.0 A to Micro-B cable** (2 cables are provided with each kit.)
- **A 15 cm (6 in.) USB Power cable** (2 cables are provided with each kit.)

MRM: Demonstrating Monostatic Radar Operation

Loading the PC Software

MRM RET software has been developed to work with Windows 7 (32 and 64 bit), Windows 8 (32 and 64 bit) and Windows 10 (32 and 64 bit).

However, operation of the MRM RET software on these operating systems requires that the Windows operating system on your Host computer has been provided with a reasonably current version of the Windows .NET Framework program. If your computer has a reasonably current version, then the MRM RET setup software will load in about a minute and you will be done.

If your computer doesn't have a recent version loaded, then you will be prompted to go to the Microsoft web site and download a newer version of code. Depending on the version of your operating system this prompt might appear as you run the MRM setup or the first time you try to run MRM RET. Downloading the proper version is very easy. You click on a few buttons, wait 15 to 20 minutes for the code to load and you are done. This process only needs to be performed once per computer. If a download is required, then please refer to **Appendix A** for a step-by-step walk-through of the download process.

The following steps are required to install the Host portion of MRM RET on your computer.

1. Log in as **Administrator** or with administrative privileges.
2. Insert the Humatics-branded USB Flash Drive into a USB port on your computer. Navigate to the file MRM RET setup.msi. (It can be found in the following directory: 140-0022D Monostatic Radar Sftw & Lit/2-Host & Sample Code). Double-click on MRM RET Setup.msi.

If a screen similar to the one shown in **Figure 1A** appears, then you will need to download a newer version of .NET Framework from the Microsoft website. See **Appendix A** for details. If not, then you should see the box shown in **Figure 1B**.

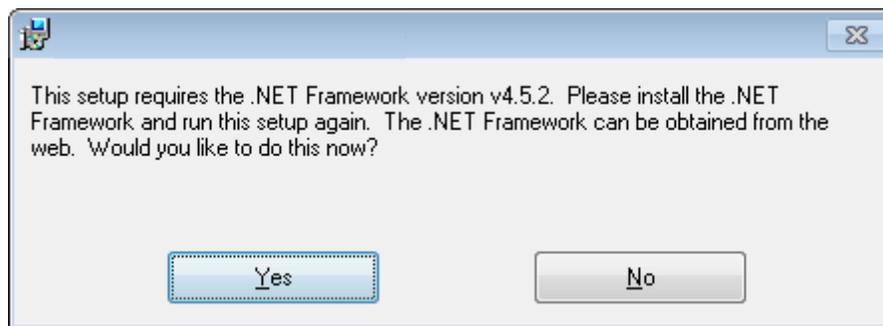


Fig. 1A: Message warning that you will need to download a newer version of .NET Framework

3. On screen, you should see the box shown in **Figure 1B**.

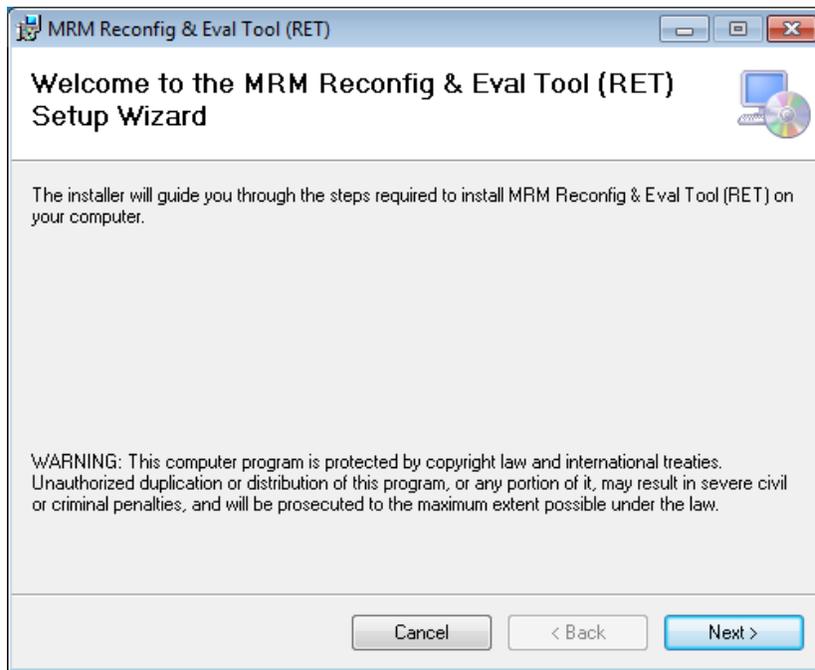


Fig. 1B: Initial installation screen for the MRM RET software

4. Click the Next > button.
5. When you reach the screen shown in **Figure 2**, you will be given a choice of directories into which the MRM RET software can be loaded.

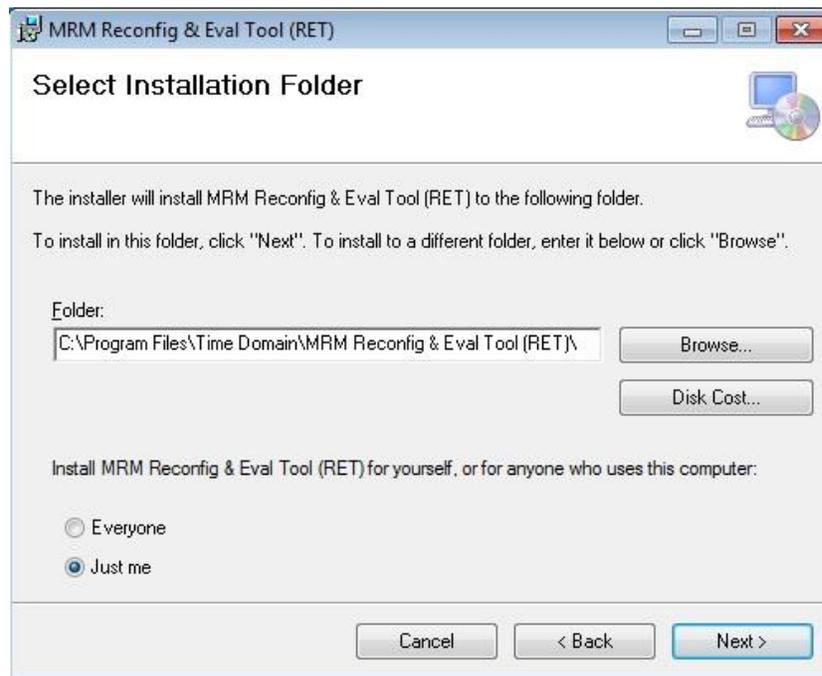


Fig. 2: Screen for designating Program Files location for MRM RET software

6. Follow the instructions onscreen for the remainder of the installation process.
7. Close the application. Program installation is complete. During this installation process, the icon shown in **Figure 3** will be installed on the Desktop.



Fig. 3: MRM RET Icon installed on Desktop

8. During the MRM RET installation process, the USB drivers will be loaded. This process starts when the screen shown in **Figure 4** appears.

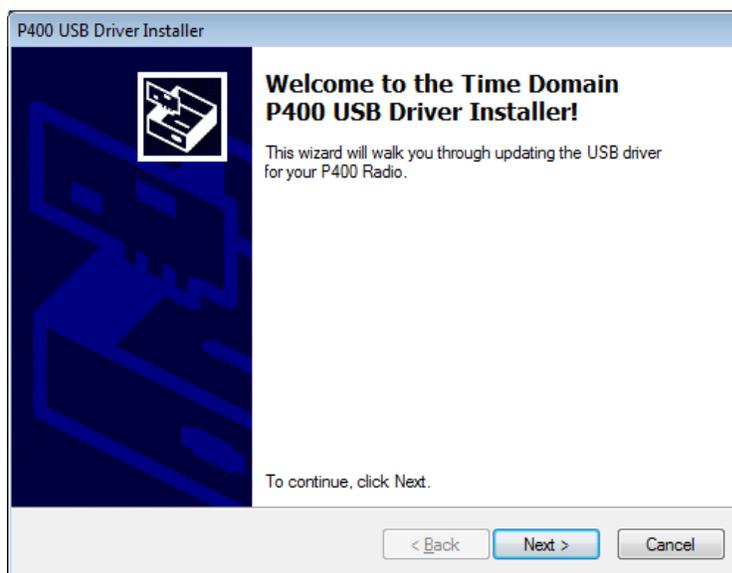


Fig. 4: USB driver installation screen

9. Follow the instructions onscreen for the remainder of the installation process.
10. When complete, close the application.

The MRM RET application should be successfully installed on your PC. At this time, we recommend that you copy the remaining files onto your PC at a location of your choice.

Configuring the P440

Each of the P440s in your kit will have a label on the RF shield below the Humatics logo bearing a three-digit number (100 or 101). These numbers represents the P440's unique UWB IDs and are also the last three digits of the unit's Ethernet IP address. (The first digits are 192.168.1.xxx). Remove the P440 bearing the ID # 100 from the box, along with two Broadspec antennas, one Power Supply, a short USB power cable and long USB cable.

1. When handling the P440, take care to prevent electrostatic discharge from damaging the unit. We recommend grounding yourself first by touching a piece of metal and then grasping the P440 by the SMA connector.
2. Attach the Broadspec antennas to both SMA port "A" and port "B" (the port A connector in line with the Ethernet connector; see **Figure 5**). The Broadspec antenna is omni-directional.



Ensure that the SMA connector on both the antenna and 90-degree connector are firmly tightened over the connection to avoid accidental disconnection. Do NOT over-tighten. Use only your fingers or an approved 5/16" SMA torque wrench (Digi-Key, part number A99929-ND or equivalent) with the P440. The connector center pins on the SMA cables are fragile. If you meet resistance when connecting a cable to a port, either during insertion or when tightening the connector nut, do not force the connection. Abort this attempt and try again. Damage to the SMA connector caused by over-tightening is not covered by the warranty.



Each P440 as supplied by Humatics includes four rubber feet to provide a stable base for the module and to prevent slippage. Underneath these rubber feet are mounting holes for 4/40 screws. These may be used to mount the enclosure inside a different housing. Alternatively you can remove the P440 from the plastic enclosure and mount the board in a housing of your choice.

Initial System Power-Up

Use one of the short USB Power cables to connect either an Anker USB Power Supply (itself plugged into an AC socket) or a rechargeable battery to the P440 USB "PWR" connector. To disconnect the power supply from the power interface, pull the power connector from the power interface.

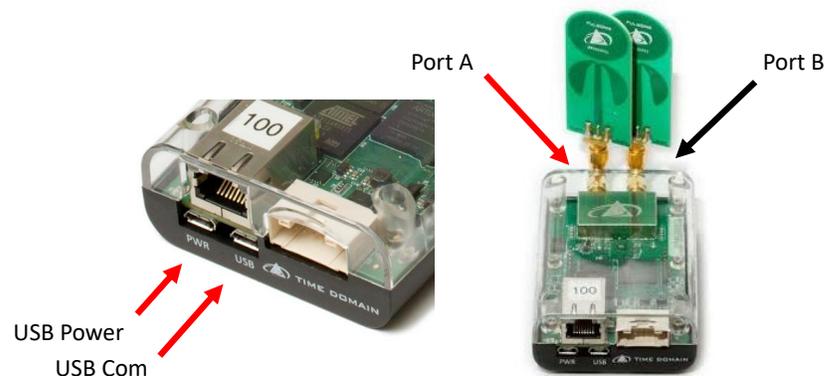


Fig. 5: P440 with both antennas connected and USB Power and COM ports identified

The P440 powers up automatically when the power supply is connected and the P440 LEDs (see **Figure 6**) will activate in the following sequence:

1. As soon as the power supply is connected, the Blue LED in the lower left (Built-in-Test LED or BIT LED) will turn on and stay on for about 10 – 15 seconds. This indicates that the unit is going through a self-test procedure. At the same time, the Green LED on the right side (FPGA LED) of the board will blink about 3 or 4 times per second. This indicates that the FPGA is loaded and ready. The Green LED on the left side of the board (UWB Activity LED) will be off.
2. Approximately 10-15 seconds later, the UWB Activity LED will turn on and the BIT LED will blink once every 2-3 seconds. This indicates that the P440 processor has successfully booted and it is ready to send and receive UWB packets. Each time a UWB activity occurs (see Section 4.9 of the *P440 Data Sheet* for details) the UWB activity will toggle (turn off if it is on or turn on if it is off).

If the LEDs do not behave in this fashion, then the board is not working properly and you should contact Humatics. Examples of problems would include, but are not limited to, the following: the FPGA LED remaining on (or off) continuously, the BIT LED remaining on (or off) continuously, or the BIT LED blinking at a very fast rate.

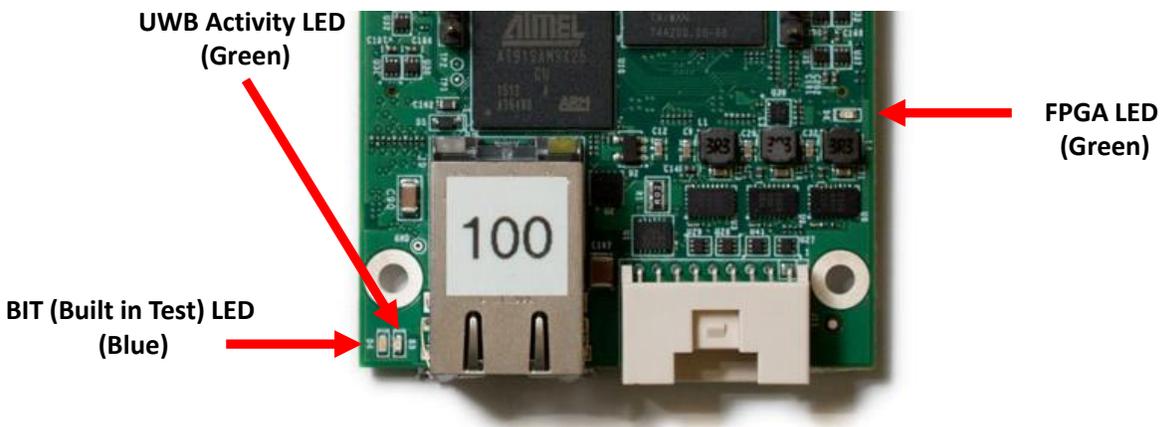


Fig. 6: Indicating LEDs

Connecting to the P440

Once you have loaded the PC software and set up the PC, you are ready to begin using the MRM RET to generate waveform scans. A detailed description of the MRM RET application will not be provided here; for more detailed information on using MRM RET, please refer to the *MRM RET User Guide*.

The following procedure will launch the MRM RET application and connect to the MRM.

1. Double click on the MRM RET icon. The screen shown below in **Figure 7** will appear. Depending on the version of your Windows OS, the screen shown in **Figure 1A** may appear instead. If it does please follow the instructions in **Appendix A**.

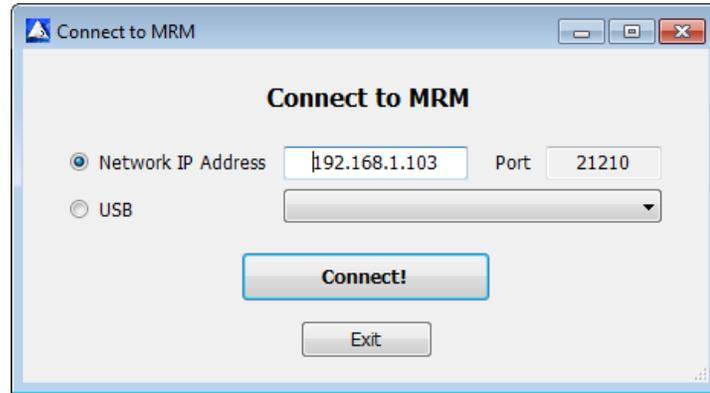


Fig. 7: MRM RET connect screen prior to USB hookup

2. Connect the USB cable to both the P440 and the Host computer. A system message should appear indicating that the system has identified a new connection and the correct driver is being connected. This identification process could take as long as two minutes. Once the process is complete, subsequent connects will take only a few seconds. At this point, MRM RET will set the USB button and indicate which COM port is connected to the P440. This is illustrated below in **Figure 8**.

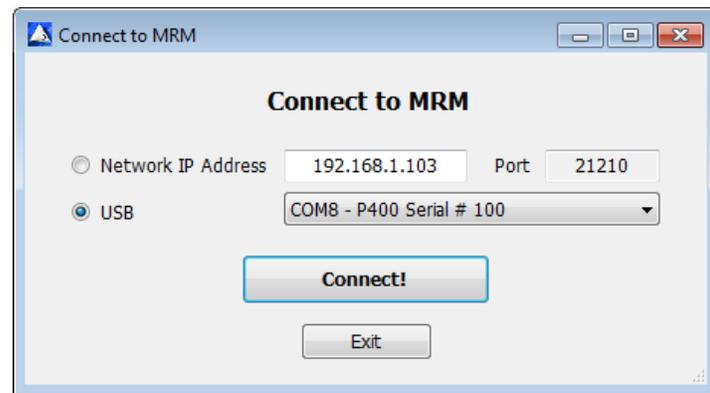


Fig. 8: MRM RET connect screen after USB connection

If the USB connection does not appear, then (a) check the P440 LEDs to confirm that the P440 has successfully powered up and booted, (b) confirm that the USB connector is properly connected to both the P440 and the Host USB connector, and (c) confirm that the system recognizes that the USB port is active. This can be confirmed by clicking on the Windows Start button > Device Manager and confirming that the port is connected. See **Figure 9** for examples of successful and unsuccessful connections.

If the port is functioning and the Device Manager shows a failure, then either the USB cable or the computer port is defective.

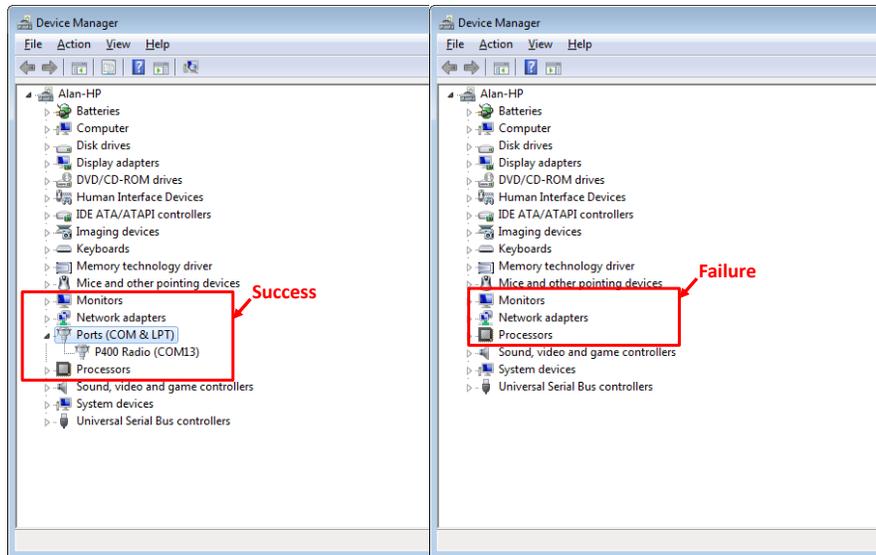


Fig. 9: Successful connection (left), unsuccessful connection (right)

If the port is functioning and the Device Manager shows a failure, then either the USB cable or the computer port is defective.

3. If the connection is successful, click the **Connect!** button. The main operating window will open (**Figure 10**). Several messages should appear in the status window at the bottom of the screen. The final line should read “Status Info Get: Successful.”

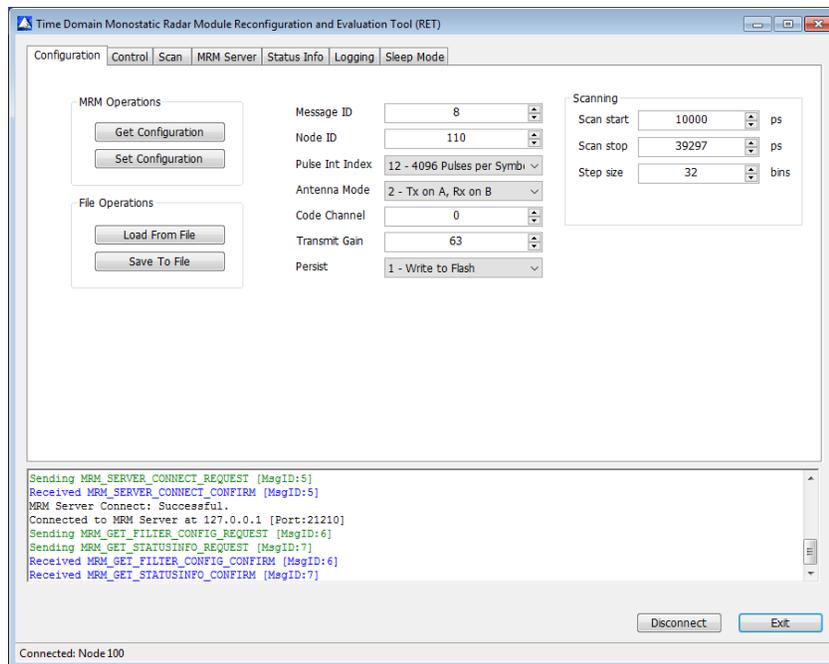


Fig. 10: MRM RET connected to the P440

At this stage you have established that the PC and P440 are communicating and that the unit has powered up successfully.

Operating the P440 as a Monostatic Radar

You are now ready to demonstrate operation as a monostatic radar and to save radar waveform scan data to a logfile.

1. In the MRM RET application, click on the Control tab. (See **Figure 11**.)
2. Click **Start Scanning**.

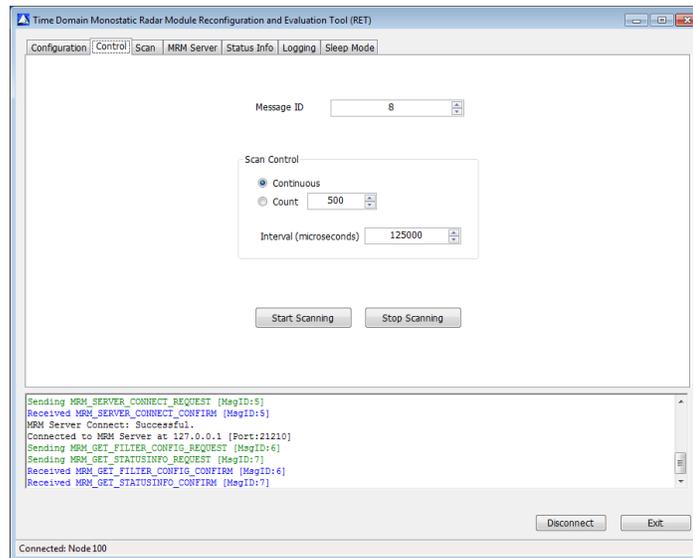


Fig. 11: MRM RET Control Tab

3. Click on the Scan tab.
4. Wait until the message “Finished collecting background scans” appears. This will take approximately 15 seconds. While waiting, stay very still. (This will give the detection filter time to stabilize.)
5. Slowly move away from the P440. You will notice a red detection line (and a trailing set of detection points) that will crawl to the right as you move away from the antenna. This is illustrated in **Figure 12**. When you are finished, click the Stop Scanning button on the Control tab.

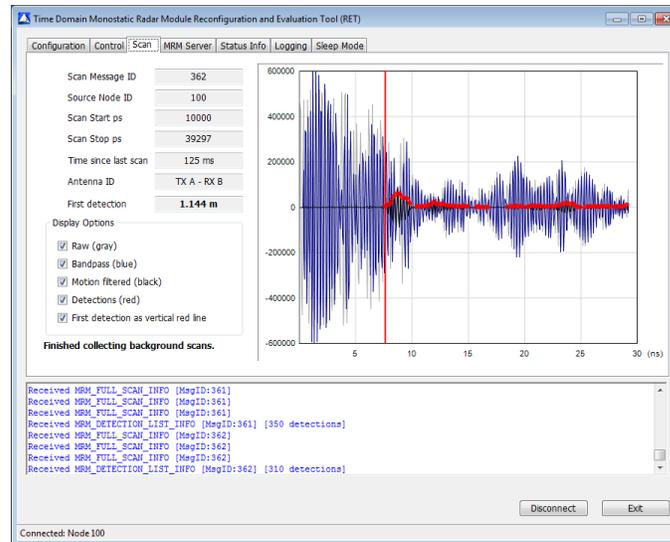


Fig. 12: MRM RET Scan Tab showing detection of person walking

Logging Radar Data

The process to collect waveform scan data using MRM RET is simple.

1. In the MRM RET software application, select the Logging tab.
2. You will need to specify a location where the collected ranging data logfile can be stored. We recommend that you create a desktop folder titled MRM_RET_DATA. You can specify a different destination by clicking the Change button.
3. Click **Start Logging**. The message “Logging to File: RetLog_000.csv” will appear.
4. Select the Control tab. In the Scan Control section, select “Count.” Enter a value for the count (e.g., 150).
5. Click **Start Scanning**. The status will scroll while the ranges are being calculated.
6. After “Count” scans are collected, select Logging tab and click **Stop Logging** to close the logfile.
7. Open your waveform scan data destination folder. You should see a text document titled “RetLog_000.” This is your logfile. (Each successive logfile will be numbered sequentially.)
8. You can open and plot the logfile using any spreadsheet program capable of reading comma separated values (.csv files). (You may also use the MATLAB logfile script provided in the MATLAB sample application folder found on your Software and Documentation USB flash drive or by request from Humatics.)

This concludes the demonstration of monostatic radar operation. For more information on configuring the various MRM RET parameters, please refer to the *MRM RET User Guide*.

CAT: Demonstrating Bistatic Radar Operation

Loading the PC Software

Next you will need to install the Host portion of CAT on your computer.

1. Log in as **Administrator** or with administrative privileges.
2. Insert the Humatics-branded USB Flash Drive into a USB port on your computer. Navigate to the file CAT setup.msi. (It can be found in the following directory: 140-0023C Cat & Bistatic Radar Sftw & Lit/2-Host & Sample Code). Double-click on CAT RET Setup.msi.
3. Onscreen, you should see the box shown in **Figure 13**.

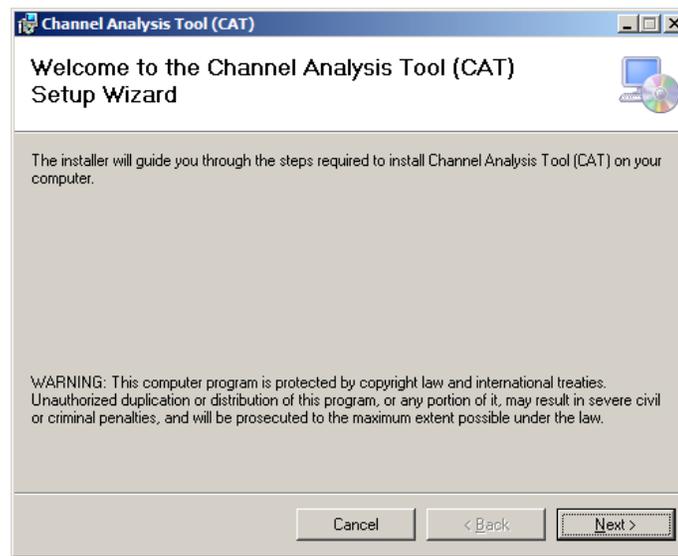


Fig. 13: Initial installation screen for the CAT software

4. Click the Next > button.
5. When you reach the screen shown in **Figure 14**, you will be given a choice of directories into which the CAT software (including the default settings) can be loaded.

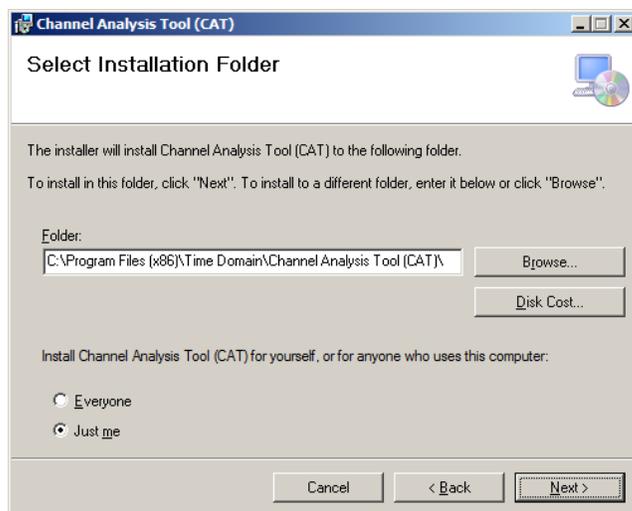


Fig. 14: Screen for designating location of CAT Program Files

6. Follow the instructions onscreen for the remainder of the installation process.
7. Close the application. Program installation is complete. During this installation process, the icon shown in **Figure 15** will be installed on the Desktop.



Fig. 15: CAT Icon installed on Desktop

8. During the CAT installation process, the USB drivers will be loaded. This process starts when the screen shown in **Figure 16** appears.



Fig. 16: USB driver installation screen

9. Follow the instructions onscreen for the remainder of the installation process.
10. When complete, close the application.

The CAT application should be successfully installed on your PC. At this time, we recommend that you copy the remaining files onto your PC at a location of your choice.

Configuring the P440

Each of the P440s in your kit will have a label on the RF shield below the Humatics logo bearing a three-digit number (100 or 101). These numbers represents the P440's unique UWB IDs and are also the last three digits of the unit's Ethernet IP address. (The first digits are 192.168.1.xxx). Remove the P440 bearing the ID # 100 from the box, along with two Broadspec antennas, one Power Supply, a short USB power cable and long USB cable.

1. When handling the P440, take care to prevent electrostatic discharge from damaging the unit. We recommend grounding yourself first by touching a piece of metal and then grasping the P440 by the SMA connector.
2. Attach the Broadspec antennas to SMA port "A." (The port A connector in line with the Ethernet connector; see **Figure 17**). The Broadspec antenna is omni-directional.



Ensure that the SMA connector on both the antenna and 90degree connector are firmly tightened over the connection to avoid accidental disconnection. Do NOT over-tighten. Use only your fingers or an approved 5/16" SMA torque wrench (Digi-Key, part number A99929-ND or equivalent) with the P440. The connector center pins on the SMA cables are fragile. If you meet resistance when connecting a cable to a port, either during insertion or when tightening the connector nut, do not force the connection. Abort this attempt and try again. Damage to the SMA connector caused by over-tightening is not covered by the warranty.



Each P440 as supplied by Humatics includes four rubber feet to provide a stable base for the module and to prevent slippage. Underneath these rubber feet are mounting holes for 4/40 screws. These may be used to mount the enclosure inside a different housing. Alternatively you can remove the P440 from the plastic enclosure and mount the board in an housing of your choice.

Initial System Power-Up

Use one of the short USB Power cables to connect either an Anker USB Power Supply (itself plugged into an AC socket) or a rechargeable battery to the P440 USB "PWR" connector. To disconnect the power supply from the power interface, pull the power connector from the power interface.



Fig. 17: P440 with antenna connected and USB Power and COM ports identified

The P440 powers up automatically when the power supply is connected and the P440 LEDs (see **Figure 18**) will activate in the following sequence:

3. As soon as the power supply is connected, the Blue LED in the lower left (Built-in-Test LED or BIT LED) will turn on and stay on for about 10 – 15 seconds. This indicates that the unit is going through a self-test procedure. At the same time, the Green LED on the right side (FPGA LED) of the board will blink about 3 or 4 times per second. This indicates that the FPGA is loaded and ready. The Green LED on the left side of the board (UWB Activity LED) will be off.
4. Approximately 10-15 seconds later, the UWB Activity LED will turn on and the BIT LED will blink once every 2-3 seconds. This indicates that the P440 processor has successfully booted and it is ready to send and receive UWB packets. Each time a UWB activity occurs (see Section 4.9 of the *P440 Data Sheet* for details) the UWB activity will toggle (turn off if it is on or turn on if it is off).

If the LEDs do not behave in this fashion, then the board is not working properly and you should contact Humatics. Examples problems would include, but are not limited to the following: the FPGA LED remaining on (or off) continuously, the BIT LED remaining on (or off) continuously, or the BIT LED blinking at a very fast rate.

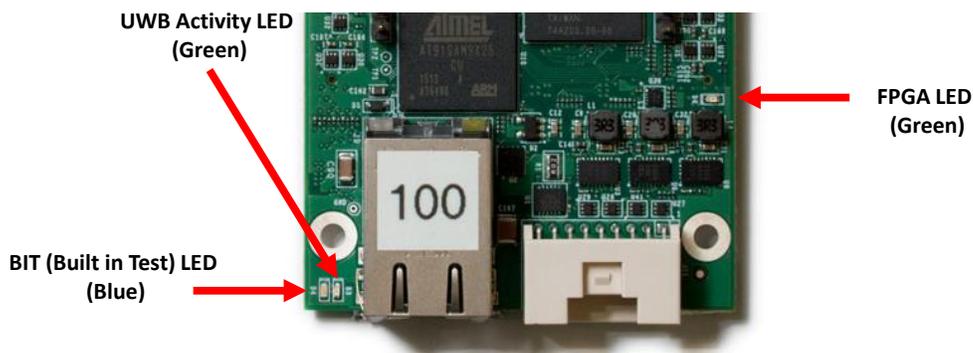


Fig. 18: Indicating LEDs

Connecting to the P440

Once you have loaded the PC software and set up the PC, you are ready to begin using CAT to send and capture waveforms as well as communications statistics. A detailed description of the CAT application will not be provided here; for more detailed information please refer to the *CAT User Guide*.

The following procedure will launch the CAT application and connect to the P440. The following graphics assume that you are connected to the P440 with ID#100.

1. Double click on the CAT icon. The screen shown below in **Figure 19** will appear.

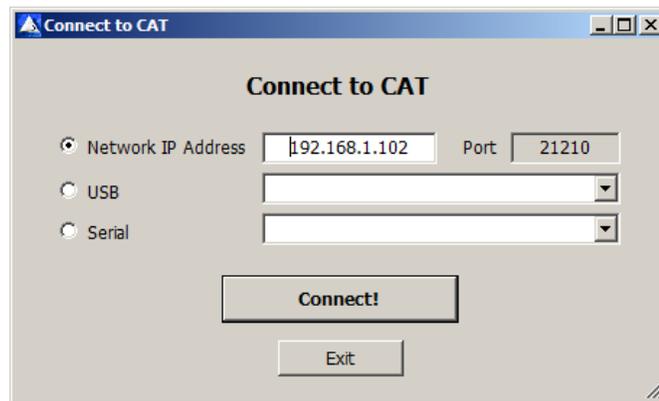


Fig. 19: CAT connect screen prior to USB hookup

2. Connect the USB cable to both the P440 and the Host computer. A system message should appear indicating that the system has identified a new connection and the correct driver is being connected. This typically takes only a few seconds but on some systems could take as long as two minutes. Once that process is complete, CAT will set the USB button and indicate which COM port is connected to the P440. This is illustrated below in **Figure 20**.

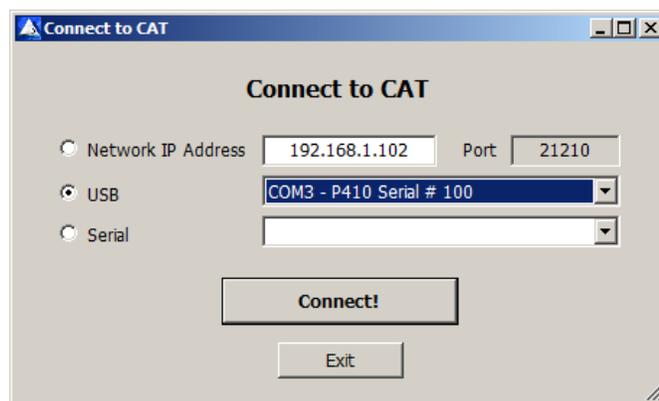


Fig. 20: CAT connect screen after USB connection

If the USB connection does not appear, then (a) check the P440 LEDs to confirm that the P440 has successfully powered up and booted, (b) confirm that the USB connector is properly connected to both the P440 and the Host USB connector, and (c) confirm that the system

recognizes that the USB port is active. This can be accomplished by clicking on the Windows Start Button > Device Manager and confirming that the port is connected. See **Figure 21** for examples of successful and unsuccessful connections.

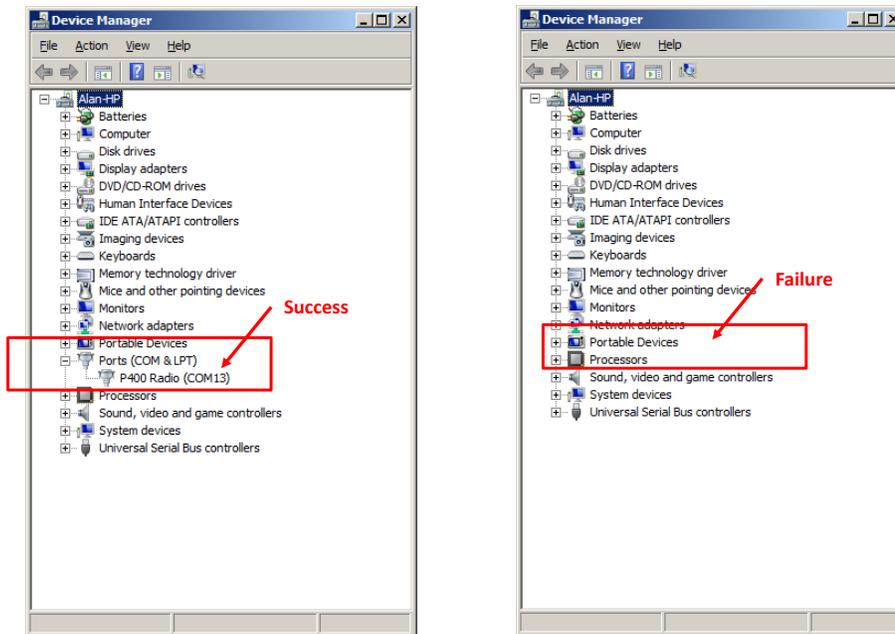


Fig. 21: Successful connection (left), unsuccessful connection (right)

If the P440 is functioning and the Device Manager shows a failure (no connection), then either the USB cable or the computer port is defective.

3. If the connection is successful, click the **Connect!** button. The main operating window will open (**Figure 22**). In the bottom left corner you should see a message confirming that CAT is connected to Node 100.

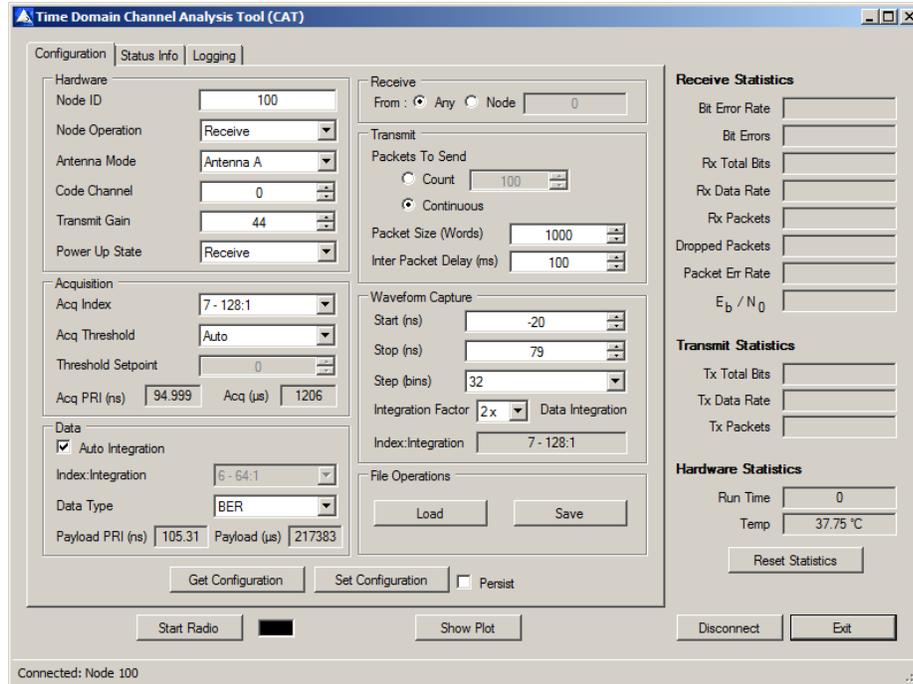


Fig. 22: CAT connected to the P440

At this stage you have established that the PC and P440 are communicating and that the radio has powered up successfully.

Operating the P440 as a Bistatic Radar

The next step is to establish a link between two P440s and begin collecting waveform data. For the purposes of this demonstration, we will use the P440 with UWB ID # 100 as the transmitter and the P440 with UWB ID # 101 as the receiver.

1. Ensure that the factory defaults are loaded in unit #100. In the CAT screen, under File Operations, click on the Load button and select the file CAT Factory Defaults.cat. This will load the factory defaults to CAT and turn the Set Configuration button to yellow. Click on the Set Configuration button. This will load the factory defaults from CAT to the P440. If your P440 is enabled with the optional high power amps, then set the Transmit Gain to 0 and click on the Set Configuration button. This will ensure that the transmit power is not set so high that the receiver will saturate.
2. Set the Node Operation button to Transmit, click Set Configuration and then click on the Start Radio button. This will cause the unit to transmit packets. Note that configuration fields are disabled (turned gray) and that the Transmit Statistics will show how many bits and packets have been sent, as well as how long the unit has been transmitting. Note also that the UWB Activity LED is blinking approximately three times per second.

3. Remove the P440 #101 from the box, attach a Broadspec antenna, connect to a P440 power supply and wait for the board-mounted LEDs to blink. Place it about 1 meter (~3.3ft) from unit #100.
4. Once the P440 #101 onboard LEDs are blinking, click on the CAT Disconnect button. Next disconnect the USB cable from Unit #100 and reconnect to Unit #101.
5. Click on the CAT Connect button. This will bring up the CAT connect screen. This screen should show a USB connection is available to unit #101. Click the Connect button.
6. Ensure that the factory defaults are loaded. In the CAT screen, under File Operations click on the Load button. This will load the factory defaults to CAT and will also turn the Set Configuration button to yellow. Click on the Set Configuration button.
7. To initiate reception of transmissions, click on the Start Radio button. Note that all of the control settings are then disabled, and the Receive Statistics are now reporting values.
8. To see a received waveform, click on Show Plot and then click on Start Scanning. The waveform you see should be similar to the one shown below in **Figure 23**.

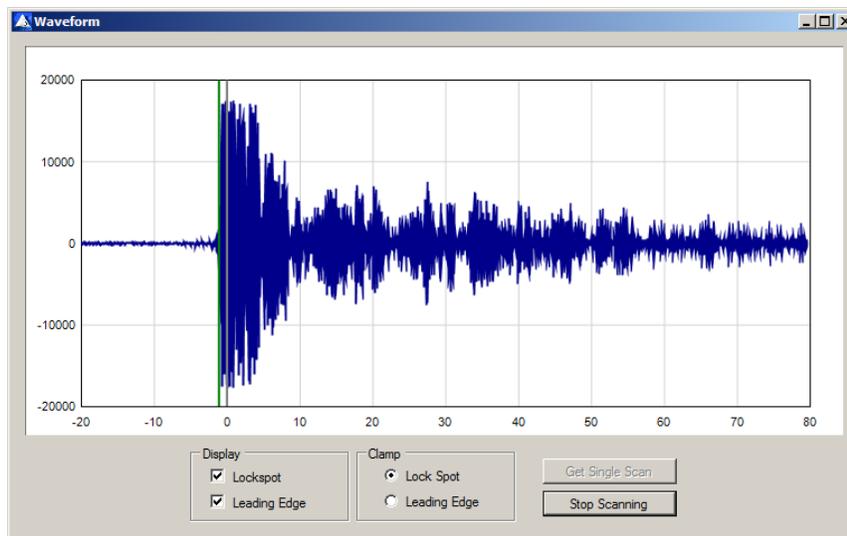


Fig. 23: Example received waveform

Logging Radar Data

To log a waveform using CAT, follow these steps:

1. Confirm that the unit is still scanning and producing waveforms. (If scanning is off, no scans will be logged.)
2. Click on the Logging Tab. The screen shown in **Figure 24** should appear.

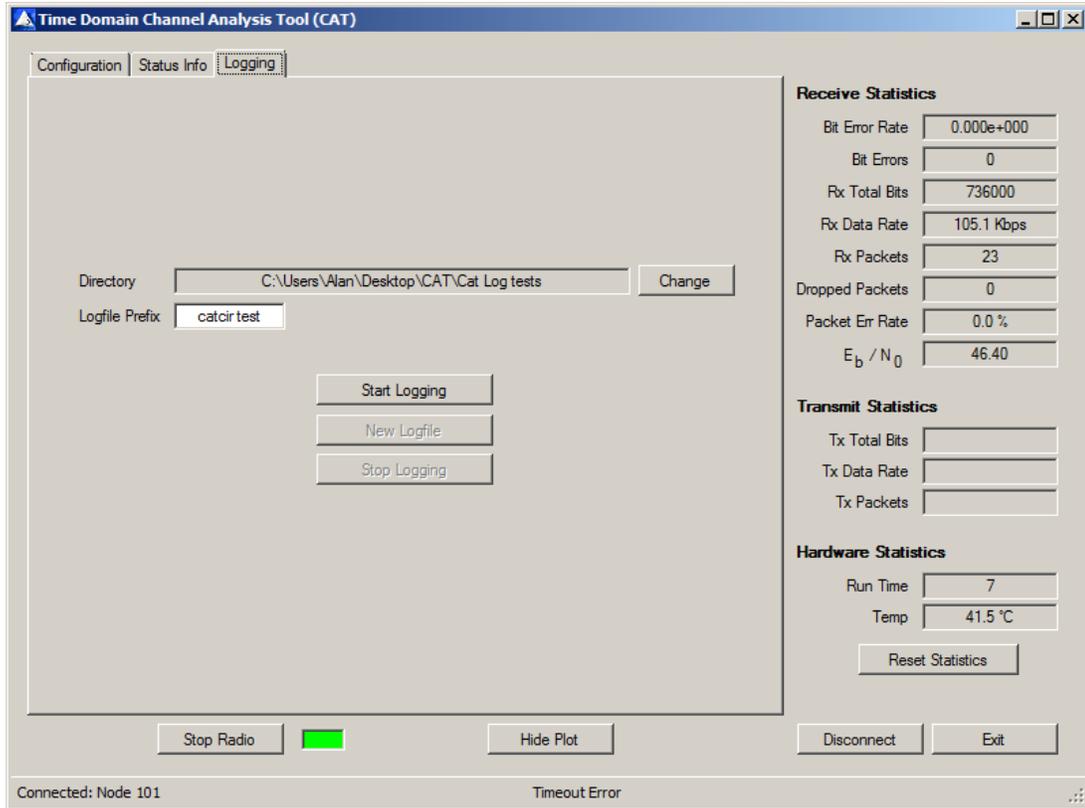


Fig. 24: Logging Tab

3. Click on the Change button and browse to (or create) a directory where you want the logfile to be recorded.
4. Enter the name you wish to call the logfile in the field labeled “Logfile Prefix.” CAT will append the number 000 to this name and use the result as the logfile’s name. Subsequent logfiles will be sequentially numbered.
5. Click on Start Logging. Each scan will be logged to a MS Excel-compatible .csv file.
6. To halt logging, simply click on Stop Logging.
7. **Figure 25** shows a sample logfile. The file has been annotated in a number of ways. First, the upper line highlighted in blue provides the names of each of the column entries. Second, the lower line highlighted in blue provides the data for each of the column entries. For example, the waveform scan collected in row 7 was taken at a Timestamp of 2661432 ms relative to the boot time and recorded a peak voltage (vPeak) of 65,016. The recorded scan consists of 1,632 (NumSamp) measurements, the first of which is shown in the left-most column in the yellow row. Finally, to illustrate that the measurements are reasonable, a plot of the 1,632 readings is also shown.

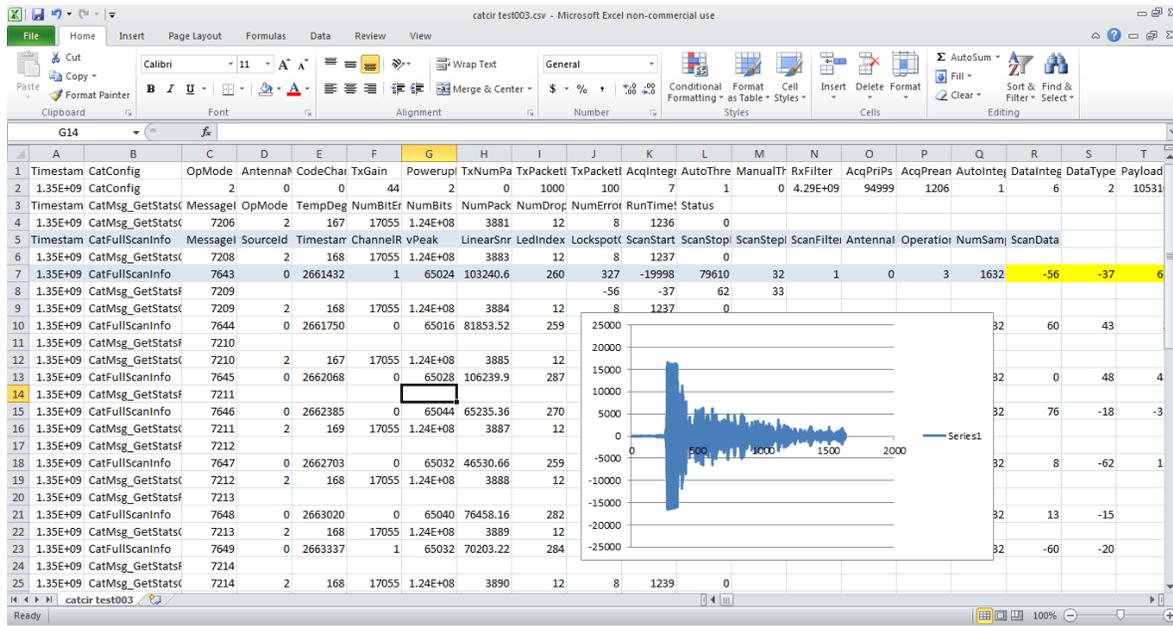


Fig. 25: Annotated text logfile containing CAT waveform data

This completes the demonstration. For additional information on how to configure the various parameters as well as the meaning of each entry in the log, please refer to the *CAT User Guide* and *CAT API Specification*.

Where do you go from here?

We hope that this document provides the information you need to begin using the Scholar Radar Kit. If you have any problems, please use the Humatics website (www.humatics.com) as your first point of contact. We offer multiple levels of support depending on your needs. To discuss how we can help you, please feel free to contact us:

E-Mail: support@humatics.com
 Telephone: +1 256.922.9229
 Fax: +1 256.922.0387

Appendix A – Updating Microsoft .NET Framework

Operating any of Humatics' Host-based software (RangeNet, MRM, CAT) requires that your computer have a reasonably recent version of Microsoft .NET Framework software. Most computers have a reasonably recent version but that is not guaranteed. When you try to load or operate CAT, MRM RET or RangeNet RET software, you may receive the popup message shown in **Figure A-1**. If this happens, then you will need to follow the instructions and upgrade your system. The operation only needs to be done once per computer and is both safe and easy.

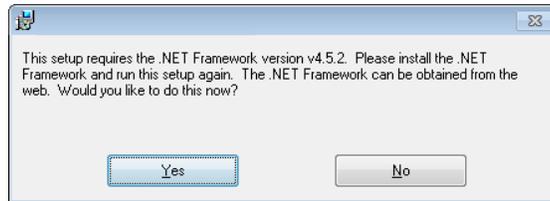


Fig. A-1: Message warning you will need to update your version of .NET Framework

If you receive this message, then click YES. You will then be directed to a website that looks like the one shown in **Figure A-2**. (The website you are directed to changes depending on your version of operating system.) Click the Download button. This will then download a copy of the .NET Framework installer. This is an executable file.

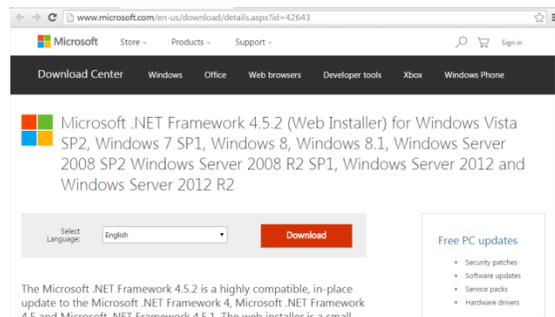


Fig. A-2: Website where you can download a current version of .NET Framework

Copy the installer to your desktop and double click on the .exe. On some machines this may begin automatically. After a few moments the display shown in **Figure A-3** will appear.



Fig. A-3: License agreement for .NET Framework

Click the “I have read and accept the license terms” and then click the Install button. You will be advised that the program will take 15-20 minutes to download via broadband and will show the progress bar shown in **Figure A-4**. This would be a good time to get a cup of coffee.

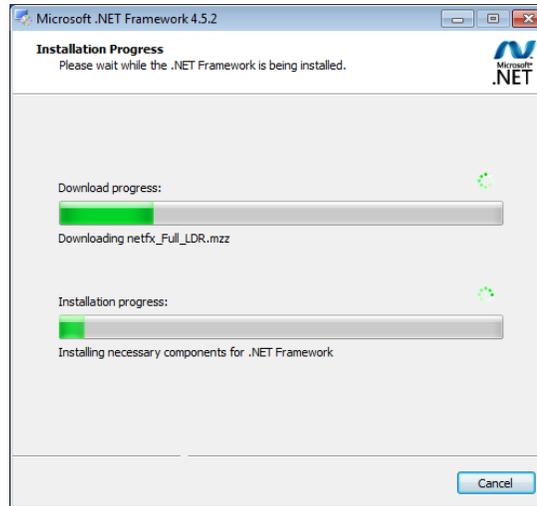


Fig. A-4: Progress bar shown while .NET Framework installs

On completion, you will see a screen that looks similar to the one in **Figure A-5**. Unless you need to run this program on another computer you will probably never need to run this program again. You are done and can return to the point in the *Quick Start Guide* that brought you here.

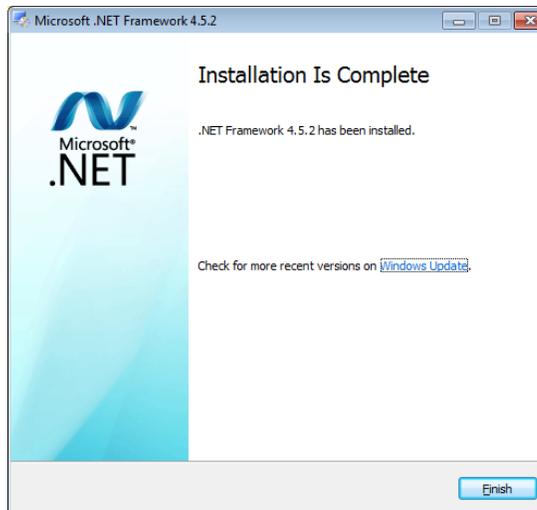


Fig. A-5: License agreement for .NET Framework