Getting Started Guide

PulsON 200™ UWB Evaluation Kit

Time Domain Corporation
Cummings Research Park
7057 Old Madison Pike
Huntsville, AL 35806 USA
http://www.timedomain.com
Tel: +1 256.428.6333
          +1 888.826.8378 ext 6333
Fax: +1.256.922.0387

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Regulatory Notice

This device does not comply with any RF emissions regulations in any country. Users should consult their spectrum management authorities before use.

- **U.S Operation**: This device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions: (1) this device may not cause harmful interference; (2) this device must accept any interference received, including interference that may cause undesired operation; (3) this device must be operated indoors; and (4) the emissions from equipment operated under this section shall not be intentionally directed outside of the building in which the equipment is located, such as through a window or a doorway, to perform an outside function, such as detection of people about to enter a building. Operation in disregard of these conditions is a violation of 47 U.S.C. 301 and could subject the operator to serious legal penalties

- If you have questions, please consult with Time Domain Corporation before you use this device.

- **Non-U.S.:** PulsON® technology has not been authorized for use or commercial exploitation under the regulations of any government agency. Please confer with your government's regulatory agency to ensure proper authorizations are obtained.

Introduction

Congratulations on stepping in to the world of Ultra Wideband (UWB) technology! The Evaluation Kit (EVK) is the key hardware tool for UWB evaluation and application development. Within the next thirty minutes, this guide will help you set up, configure and test your PulsON 200™ radios. The initial functionality of the EVK includes tools to examine the performance of the PulsON 200 radio and a development environment that allows users to explore the possibilities provided by UWB.

This *Getting Started Guide* takes the user from initial radio setup through first power-up and to the radio connection to the computer interface. At the completion of this guide, you will have confirmed that the radios are functional and the correct setup configuration between the radios and the user's computer.

What is in the box?

Upon receipt of your shipment, inspect the shipping container and contents. If the contents of the shipment are incomplete or if there is mechanical damage, notify Time Domain Corp. (TDC) immediately at 1-800-826-6333. TDC has supplied the following items with your shipment.

Qty.	Name	Part #
2	PulsON 200™ Radio	100-0017
2	Broadspec® Model P200 Antenna, EVK	220-0126
2	Power Supply, 90-264 VAC in/7.5 VCD out	024-0003
2	Power Cord	017-0029
1	Software CD	150-0015A
1	Documentation CD	10D-0014A

Table 1: Supplied components of the Evaluation Kit

The software CD (150-0014A) contains a copy of the embedded elements already loaded on your radios as well as the necessary PC software. These elements include:

- UWB Kernel (in executable form)
- Performance Analysis Tool (PAT) embedded (in executable form)
- PAT GUI (Self-extracting executable)
- Basic Host Translator (Host API)
- Flash Loader Utility

The embedded code is provided should the radio software need to be reloaded. The *Troubleshooting the Radio* section of this Guide provides instructions for this software load. Instructions on loading the PAT GUI appear in this document.

The documentation CD (10D-0015A) contains this document as well as the *PulsON™ 200 UWB Evaluation Kit Users' Manual* (P200-320-0049) and the *Programming Guide for the PulsON 200™ Evaluation Kit* (P200-320-0050A). Updates to these documents will be provided as functions are added.

What You Will Need to Work with the Unit

In order to connect to and control the PulsON 200™ radios, the user will need at least one PC, hardware, and software as described below.

- **PC running Windows 2000 or Windows NT--** EVK software has been developed to work with Windows 2000 and Windows NT. The EVK software will work with Windows 98 and Windows ME operating systems, but the Flash Loader Utility will not. Windows 98 and Windows ME should not be used with this device.

- **Dedicated 10/100 Mbps Ethernet Network Interface Card--** Each PC used to control a PulsON 200 radio should be configured with a 10/100 Mbps Ethernet Network Interface Card (NIC) configured for dedicated communication with the radio. If the PC already has a NIC installed to provide LAN access, a second NIC card should be installed and configured for communication with the radio. See *Installing and Configuring an Ethernet Network Interface Card* in the *Troubleshooting the Radio* appendix of this document for the setup procedure.

- **Ethernet Cables--** CAT-5 Standard or Crossover Ethernet cables will be needed to connect a PC to the PulsON 200 radio. Refer to section *PC-to-PulsON 200 Radio Ethernet Connection Options* of this document for information on specific configurations.

- **Ethernet Hub**—An Ethernet hub may be required to connect a PC to one or more PulsON 200 radios. Refer to section *PC-to-PulsON Radio Ethernet Connection Options* of this document for more information.

- **RS-232 Cable (optional)** A DB9 male-to-female RS-232 cable is needed if the user intends to communicate with the PulsON 200 using a terminal application (e.g. `HyperTerminal') running on a PC. Examples of RS 232 use include Built-In Test (BIT) results and radio internet protocol (IP) address modification. Both topics are covered later in this document.

Configuring the Hardware

Please be careful when you remove the units and the antenna assemblies from their boxes. The antenna solder joint between the antenna plane and the end-launch connection can be damaged if handled improperly. Please inspect this connection and contact TDC if there appears to be a problem. Also inspect the PulsON 200 radios for damage, including loose or missing screws. Contact TDC if there is a problem.

1.   Using a Phillips-head screwdriver, attach the Broadspec™ Model P200 antennas to the antenna brackets on the rear of the units.

2.   Connect the antenna cable to the port labeled **ANTENNA**. The antenna is omni-directional. Once connected, do not adjust the antenna orientation as it may overstress the attached cable through unnecessary bending.

Use of another antenna element other than the one provided in the kit is a violation of FCC rules governing the transmission of UWB signals

Ensure that the cable connector nut is firmly tightened over the connection to avoid accidental disconnection. Do NOT over-tighten. Seven to ten inch-pounds torque using an approved connector wrench (Huber & Suhner, part number 74Z0-0-21 or equivalent) is recommended. The connector center pins on the 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 connecter caused by over-tightening is not covered by the warranty.

3. Connect the supplied power supply to the **POWER IN** interface (Fig. 1).

Initial System Power-Up

The radio is now ready to be powered on. To turn the radio on, place the power switch on the rear panel in the **ON** position. The rear panel LEDs will activate in the following sequence:

1. As soon as the power switch is placed in the "on" position, the LED on the right side labeled **POWER** will turn on and remain lit with a steady glow.

2. Almost immediately after the **POWER** LED turns on, the LED labeled **HEARTBEAT** will turn on and remain lit with a steady glow.
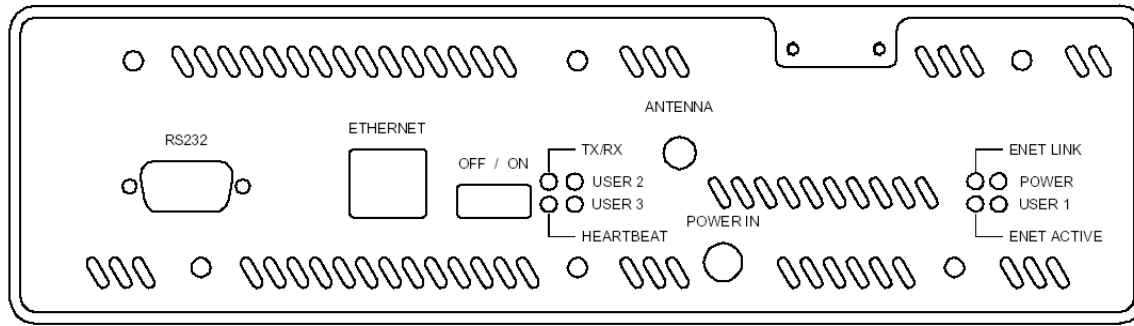
Fig. 1: Rear panel of the PulsON 200 radio

3. After several seconds, if an Ethernet cable is connected and an Ethernet network connection exists, the **ENET LINK** LED will turn on and remain lit with a steady glow. It may blink briefly before becoming steady.

4. After several seconds, the **TX/RX** LED will turn on and glow steadily, indicating the radio is configured for transmit mode. This does not mean the radio is actively transmitting. In the default power-on condition, the radio configures itself for transmit mode and then idles until it is given a "start" command.

5. After several seconds, the **HEARTBEAT** LED will begin to blink to indicate the status of the Built-In Test (BIT) initiated at power up .
    * If **HEARTBEAT** blinks at a 1 Hz rate, then BIT has passed. Proceed to the *PC Configuration* section of this document.
    * If the **HEARTBEAT** blinks at a fast rate (approx. 10 Hz), or shows other behavior, then BIT has failed. Turn the radio **OFF** and then back **ON**. If the **HEARTBEAT** again blinks at a fast rate, then the radio is reporting a BIT error. At this point, you have two options. You can proceed to the *PC Configuration* section of this document and attempt to make Ethernet connection to the radio. If you are successful, the Users' Manual will explain how BIT results can be collected using the Performance Analysis Tool (PAT). Alternatively, you can use the RS232 interface to obtain the BIT results. The procedure for doing this appears in the *Troubleshooting the Radio* appendix of this document.

PC Configuration

Loading the PC Software

Next you will need to install the Host portion of PAT on your computer.
1. Login as **Administrator** or with administrative privileges.
2. Insert the compact disk labeled "*PulsON™ 200 EVK Software, Version 1.0*" into your disk drive. Set up should launch automatically. If it does not,
    * Click the **Start** button, point to **Settings**, and then click **Control Panel**.
    * Double –Click the **Add/Remove Programs** Icon
    * On the **Install/Uninstall** tab, click Install
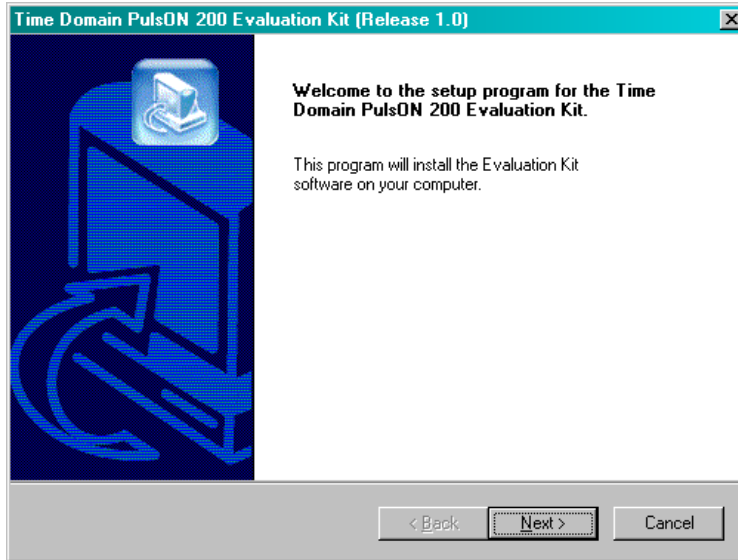3. You should see a box as shown in Fig. 2.

Fig. 2: Initial installation screen for the EVK software

4. Follow the instructions on the screen

5. When you reach the screen shown in Fig. 3, you will be given a choice of directories in which the TDC software can be loaded.

What is actually loaded on your PC is the Host side of PAT and the Flash Loader utility, which contains all of the embedded files needed to rebuild the EVK radio embedded software if necessary.
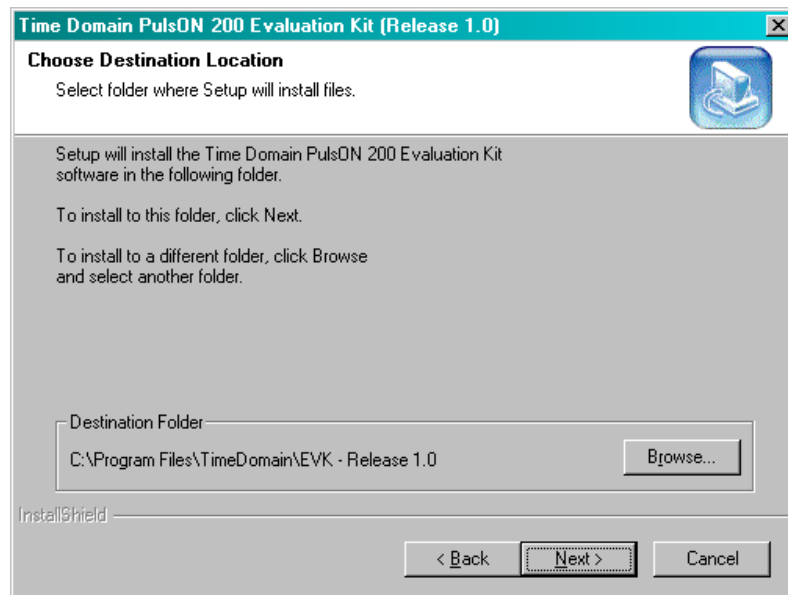

Fig. 3: Screen for designating Program Files location for EVK software.

6. Close the application at the completion of the installation

On your desktop you should find a short cut icon to the PAT Host ![icon] . You can also access the PAT Host by going to **Start\Programs\Time Domain\P200 EVK Release 1.0\Performance Analysis Tool.**

PC-to-PulsON 200 Radio Ethernet Connection Options

TDC strongly recommends that there be a dedicated Ethernet Network Interface Card (NIC) in the PC you intend to use with the Radios. A description of how to install and configure a NIC card is provided in the *Troubleshooting the Radio* appendix of this document. This must be done before establishing a link between the PC and radio.

There are several methods for setting up an Ethernet connection between a PC and one or more radios. Two common configurations are shown below

Figure 4 shows a method for connecting one PC to one PulsON radios with minimal hardware. A commercially available Ethernet crossover cable eliminates the need for an Ethernet hub or other interfacing hardware. This configuration allows the radio to be used with its default IP address of 10.1.4.2.
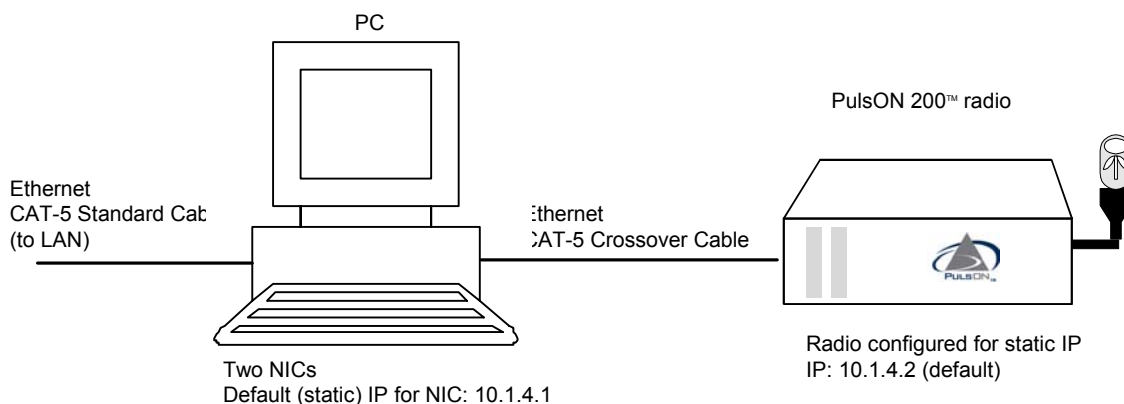

Fig 4: A single PC/radio link showing key components.

Figure 5 shows a method for connecting one PC to one or more radios. In this configuration, standard Ethernet cables are used to interface to an Ethernet hub. If the PC or radio is connected to a hub port that can be set for "standard" or "uplink" mode, confirm that the port is in "standard" mode. If only one radio is connected, it can use its default IP address of 10.1.4.2. If additional radios are added, each radio must be configured with a different IP address. See *Setting the PulsON 200 Radio IP Address* below.
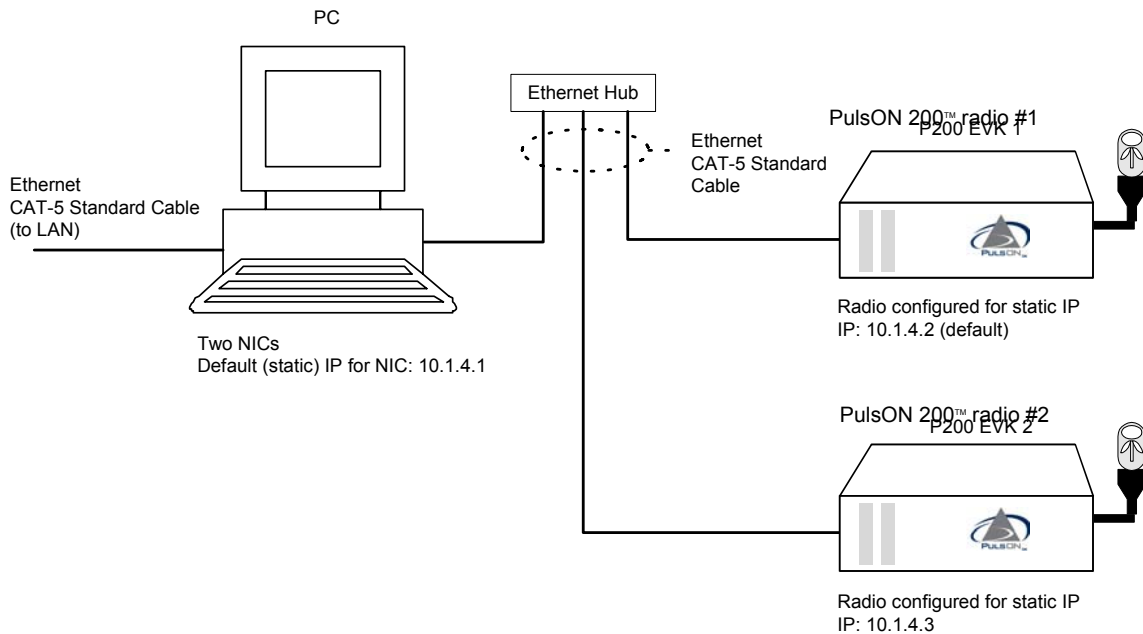
Fig. 5: A multiple PC/ PulsON 200 radio link using an Ethernet hub and multiple IP addresses

Setting the PulsON 200 Radio IP Address

This section describes how to assign a static IP address to the radio using a terminal connection. The default IP of each radio is 10.1.4.2. If you are connecting a radio to a single PC, and the IP address of the radio has not been changed previously, it is not necessary to set the IP to begin using the radio. This procedure describes how to connect using the HyperTerminal application available on Windows NT and Windows 2000 operating systems. Other terminal applications may be substituted at the user's discretion.

1. Connect the radio to a PC using a DB9 serial cable as described in the *Configuring the Hardware* section of this Getting Started guide.

2. Run Hyperterminal by clicking Windows **Start** > **Programs** > **Accessories** >**Communications** > **HyperTerminal**

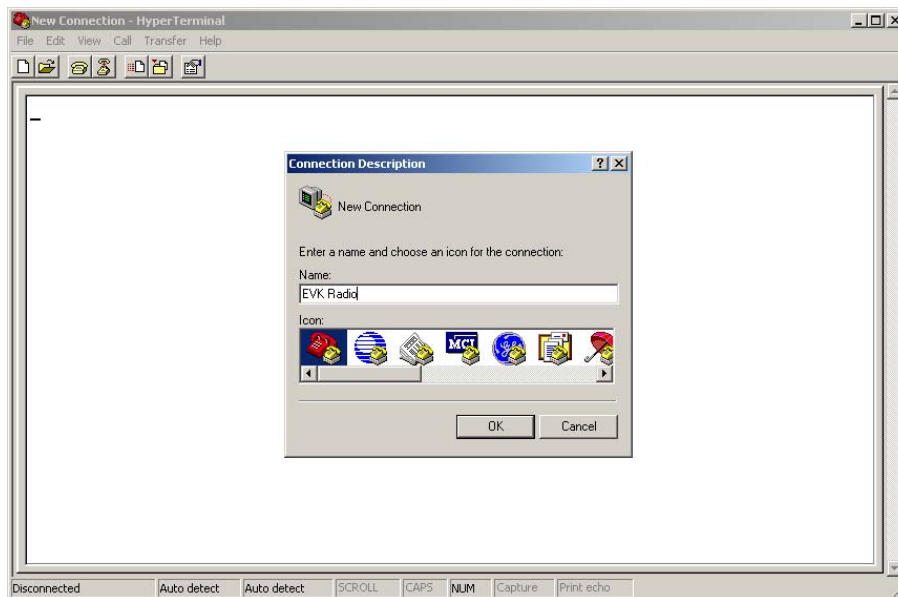3. Enter a name for the connection (i.e. "EVK Radio, or EVK Radio #1 etc,") and click **OK** (Fig.6).

Fig. 6: Establishing a new connection for the radio using HyperTerminal

4. Using the screens shown in Fig. 7, select the correct COM port for your computer in the **Connect Using** drop down. In the **COM1 Properties** screen, set **Bits per second** to 9600, **Flow control** to "None", and click **OK**.
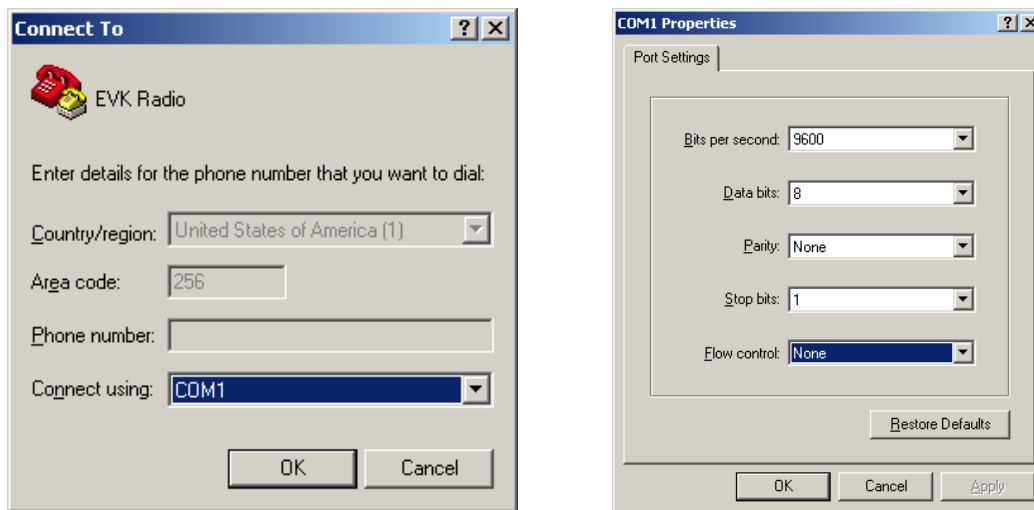

Fig. 7: Designating the connection port (left) and specifying its settings (right).

5. Power on the radio. The terminal window should scroll as boot information from the radio is sent to the serial port. When the terminal window displays "Embedded PAT has successfully initialized", the radio has finished booting (Fig 8).

Fig. 8: The terminal display screen indicating that the PC and radio are communicating (outlined in red box)

6. Hit <enter> on the keyboard. A command prompt "**->**" should appear, indicating the radio will respond to PC commands.

7. Type the words "bootChange" (this is case sensitive) and hit <enter> (Fig. 9). Continue to hit <enter> to scroll down until the "inet on ethernet (e)" line is displayed. *Caution: Do not change the other boot entries, or your radio may fail to boot!*

8. Do not overwrite or try to erase the old address. Position the cursor after the currently displayed IP address and enter the new IP address. Type the new IP Address and submask text and hit <enter> as shown in (Fig. 9). Since the default radio IP address is 10.1.4.2, the typical address assigned to a *second* radio is 10.1.4.3. The submask should be set to "ffffff00" (six f's followed by two 0's).

Fig. 9: Fields where commands and data must be entered to change a radio's address

9. Continue hitting <enter>, to scroll through fields that will not be changed until the bootChange program exits, indicated by reappearance of the command prompt "**->**". The next time the radio is powered on it will use the newly assigned IP address.

Test the Radio-to-PC Interface

Once you have loaded the PC software and set up the PC, you will need to establish the Ethernet connection to the radio. To do that, you will use the TDC PAT application. Establishing an Ethernet connection to the radio confirms correct installation of application software on the PC, proper NIC card setup, correct Ethernet cabling and an operational radio. Use of the PAT application beyond connecting to the radio will not be covered here; for more detailed information on using the PAT application, refer to the *PulsON 200 UWB Evaluation Kit Users' Manual.*

1. Run "pat.exe" by double-clicking on the shortcut on the desktop, or by clicking **Start > Programs > Time Domain > PulsOn200 EVK Release 1.0 > Performance Analysis Tool >.**

2. Enter the Radio IP Address on the Setup tab (Fig.10). The default IP address is 10.1.4.2.
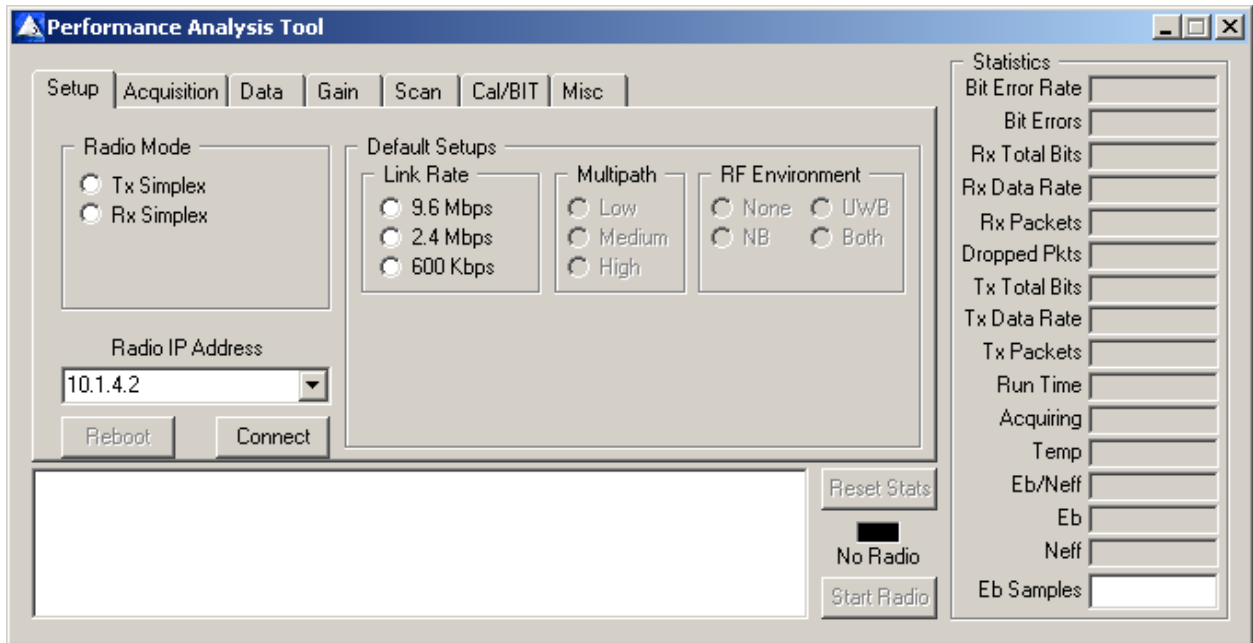
Fig. 10: Using the PAT interface to connect with the PulsON 200 radio

3. Click the **Connect** button. The status window should return with the message "Connected to Radio (*radioserialnumber)"* and will indicate the current operating state of the radio. The default operating state of the radio after power-on will indicate "stopped" (Fig. 11).
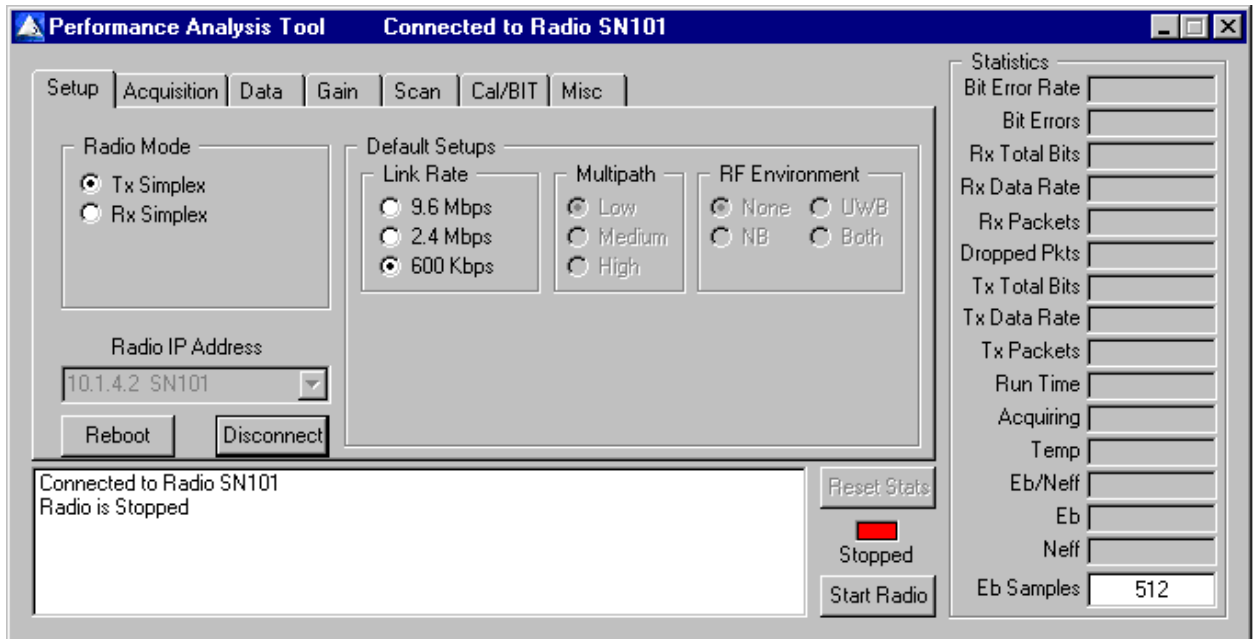

Fig. 11: Performance Analysis Tool (PAT) connected to the radio in the default 'stopped' state

At this stage you have established that the PC and radio are communicating and the radio has powered up successfully. If the connection failed, you may have to reconfigure the NIC settings. Further work with the EVK is documented in the *PulsON™ 200 UWB Evaluation Kit Users' Manual.*

Where do you go from here?

If you have followed the instructions in this manual, and have passed both the System Boot up and Radio to PC test, you are ready to explore UWB in greater detail. Based on your experience and background, you have two different places to go:

- If you are relatively new to UWB or would like a refresher on the basics so you won't miss something critical when you read the Users' manual, please go through the UWB tutorial found on the Developers Website. This presentation will familiarize you with the terms and definitions necessary to understand the information your radio provides. It will also serve to instruct or remind you of the fundamental concept of the PulsON 200 radio. The tutorial describes topics such as code files, integration rates, acquisition methods, modulation and demodulation. We encourage you to understand these terms thoroughly before you work with the radio. Users who have experience with the P100 PADs should look through the tutorial, as there are significant differences between the PulsON 200 and PAD radios.

- If you are comfortable with UWB concepts and terminology you are ready examine specific aspects of the technology. The Users' Manual found on the documentation CD is the place to start. The Users' Manual contains a small UWB refresher section that touches on the key attributes of the PulsON radio. However, most of the Users' Manual assumes the user has a certain comfort with UWB and in particular with the implementation of TDC's PulsON technology. The Users' Manual explains the use of the Performance Analysis Tool (PAT) and provides you Functional Use Cases that should help you evaluate the technology.

Technical Support

We hope this document and the Users' Manual provide the information you need to use the PulsON 200 radios. Additional information, including FAQ, will always be available to you on the Developers Website (http://www.pulsondevelopers.com). If you have any problems, please use the Website as your first point of contact. If you need additional assistance, please contact Time Domain customer support at:

Web: http://www.pulsondevelopers.com
E-Mail: Customer.Service@timedomain.com
Telephone: +1 256.428.6333
Fax: +1 256.428.6622

Appendix A: Troubleshooting the Radio

Reading BIT Results through a Terminal Application

1. Connect the radio to a PC using a DB9 serial cable as described in the *Configuring the Hardware* section of this Getting Started guide.

2. Establish a terminal connection to the radio (9600 baud, Hardware Flow Control OFF). If you need more details on how to establish a terminal connection, refer to the *Setting the PulsON Radio IP Address* section of the Getting Started Guide.

3. At the command prompt, type **"uwbBitExec"** and hit <enter>. Then type **"uwbBitResultsShow"** and hit <enter>.

4. The BIT results will be displayed in the terminal window.

Installing and Configuring an Ethernet Network Interface Card

Although an existing Ethernet Network Interface Card (NIC) normally used for computer LAN and internet communications can be used to communicate with the PulsON 200 radios, Time Domain recommends a separate NIC be dedicated to communications with the radios. This dedicated card simplifies the setup task and eliminates the need to switch back and forth between normal LAN connections and radio activities.

1. Follow the manufacturer's instructions to install the NIC card and load the necessary drivers.
2. Log on to the computer by using the Administrator account.
3. Click **Start** (Lower left hand corner), click **Settings**, and then click **Control Panel**.
4. In Control Panel, double-click **Network and Dial-up Connections**.
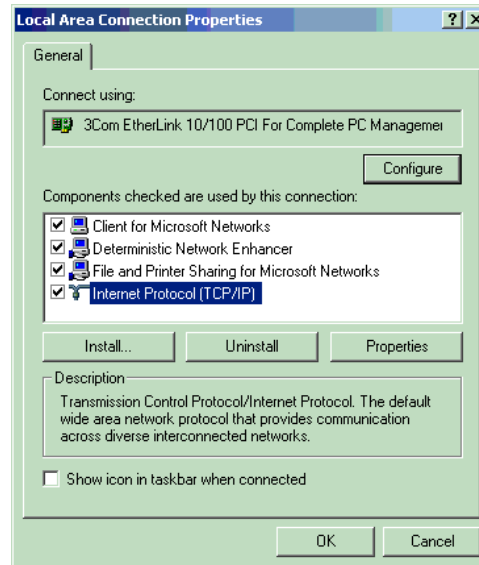5. *Right*-click the **Local Area Connection**, and then click **Properties** from the drop down menu (Fig. A1).

Fig. A1:   Selecting the Internet Protocol

6. The **Local Area Network Connection Properties** dialog box opens. In the **Components checked are used by this connection,** select **Internet Protocol (TCP/IP)**, and then click **Properties**.

7. When the **Internet Protocol (TCP/IP) Properties** dialog box appears, select **Use the following IP address**. (Fig.A2).
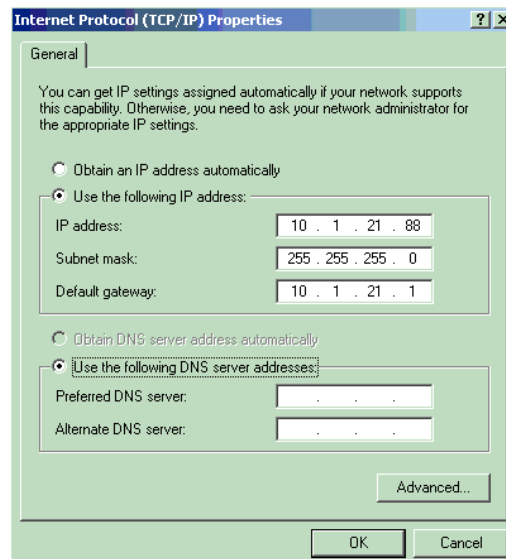

Fig. A2: IP Address menu.

8. In the **IP address** box, type 10.1.4.1. (the radio IP address)

9. In the **Subnet mask** box, type 255.255.255.0.

10. If the NIC used for communicating with the radio is also part of an established network, contact the network administrator to obtain a list of valid IP addresses for your network.