Brand name: IgniteNet

60GHz Module

Model name: RDO-60-FB-USBB-8

User's Manual

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1. Introduction

This document will explain the steps required in order to create a network connection using the PRS4601, including driver installation, firmware upgrades, and network configuration.

1.1 Overview

Product Specification Creation

Operating Frequency: 57 – 64 GHz

Channel Bandwidth Setting: 2160 MHz

Channel 1: Fc = 58.32 GHz

Channel 2: Fc = 60.48 GHz

Channel 3: Fc = 62.64 GHz

TX Power: 13.78 dBm nominal at RFIC output

TX EVM: -11 dB for MCS6/ -12 dB for MCS7/ -13 dB for MCS8

RX Sensitivity: -63 dBm for MCS6/ -62 dBm for MCS7/ -61dBm for MCS8

Highest Raw Data Rate: 1-stream MCS8 (2310 Mbps @ QPSK)

Throughput: 1500 Mbps typical with appropriate test setup

Interface: USB 3.0 mini connector

Power Consumption: 4 Watt typical

Operating Temperature: -40 to +70 °C

1.2 Definitions and Acronyms

ADC   Analog-to-digital converter

AFE   Analog Front End

ARC   ARC 625D CPU

DWC   Design Ware Core

GPIO

LMAC

General Purpose IO

Lower MAC

PIO   Programmable IO

PWM   Pulse Width Modulator

SSI   Synchronous Serial Interface

UART

UMAC

Universal Asynchronous Receiver / Transmitter

Upper MAC

1.3 Background

The PRS4601 MAC is designed around a pair of ARC 625 CPUs, referred to as Upper MAC (UMAC) and Lower MAC (LMAC). These CPUs utilize two independent buses for peripheral connection:

1. An AHB bus which connects to an AHB-Lite fabric and provides access to shared peripherals and memory

2. A dedicated ARC Peripheral Bus

The UMAC and LMAC CPUs share access to the following peripherals:

IPC: Provides atomic inter-processor communication with both locks and events

MAC Timer: Provides a precise over-the-air MAC time (at the MAC_CLK and 1 MHz)

AFE Test, Configuration and Control:

o The UMAC has access to AFE Test and Configuration

o The LMAC has access to AFE Control functions

The UMAC CPU has dedicated access to the following peripherals:

Host Interfaces

o USB 3.0 (and 2.0) Configuration

Other peripherals

o UMAC DMA: to assist in moving data between shared memory and DCCM

o UART: for test and debug

o SSI: for boot and configuration data (via serial flash or EEPROM)

o ARC Timer: general purpose timer (MQX)

o Interrupt control

o GPIO: for boot configuration (straps) and status/control/debug

o PWM: pulse width modulator for LEDs and other status/debug

o Top Level Chip Control: Reset, Power Down, etc.

o General Purpose ADC (not functional in PRS4601)

o A programmable IO block that allows most IO pins to be configured as GPIO

The LMAC CPU has dedicated access to the following peripherals:

MAC/PHY Interface Other peripherals

o TX DMA: Used to send data from shared MAC memory to the MAC/PHY

o RX DMA: Used to receive data from MAC/PHY to shared MAC memory

o UART: for test and debug

o SSI: for radio configuration, control and status

o ARC Timer: general purpose timer (MQX)

o Interrupt control

o GPIO: for radio control and status, and general status/debug

o PWM: pulse width modulator for status/debug

o Calibration Timer: to allow precise frequency locking of the crystal oscillator and to allowing

locking of MAC time to an external clock

o A programmable IO block that allows most IO pins to be configured as GPIO

2. Functional Description

2.1 Enable Test Mode on Windows Host PC

Before installing drivers for the PRS4601, one must configure the Host to be able to install a test driver

2.1.1 Disable Driver Signing

1) Run command prompt as administrator (enter cmd.exe in search field, right click on it)

2) Enter the following two lines:

a) bcdedit.exe –set loadoptions DDISABLE_INTEGRITY_CHECKS

b) bcdedit.exe -set TESTSIGNING ON

2.1.2 Adding Test Certificate

1) Open Microsoft Management Console - Type mmc in search and press enter
2) File -> Add/Remove Snap-in
3) Select Certificates and press the Add > button
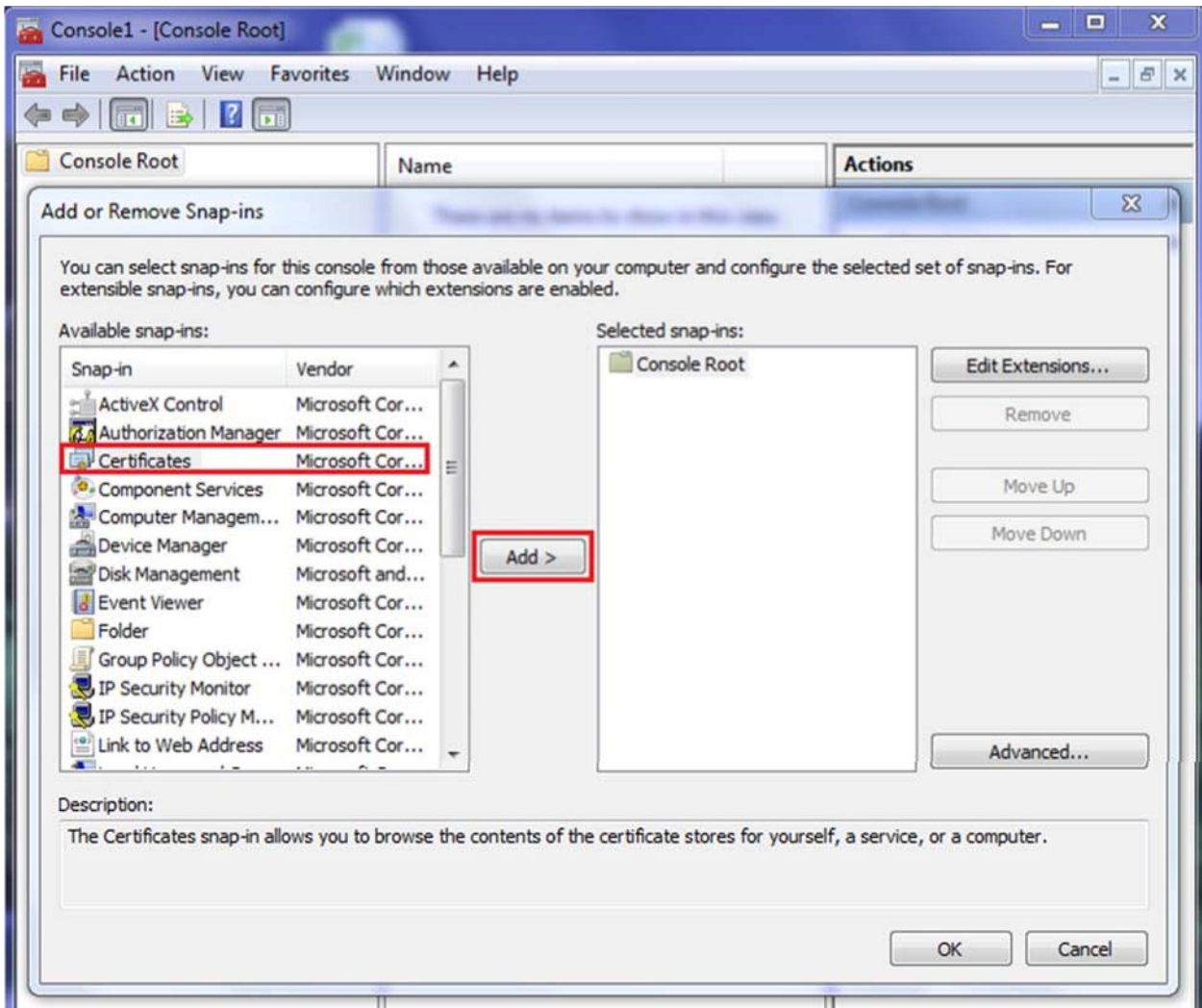
4) Select the Computer Account radio button
5) Choose Local computer then press the Finish Button
6) Import the prswigigusb certification to Trusted Root and Trusted Publishers
a) The certificate can be found in <build>\host\win\WinRelease_wlan\

b) To import the certificate, right-click Trusted Root or Trusted Publishers and then select All Tasks -> Import.
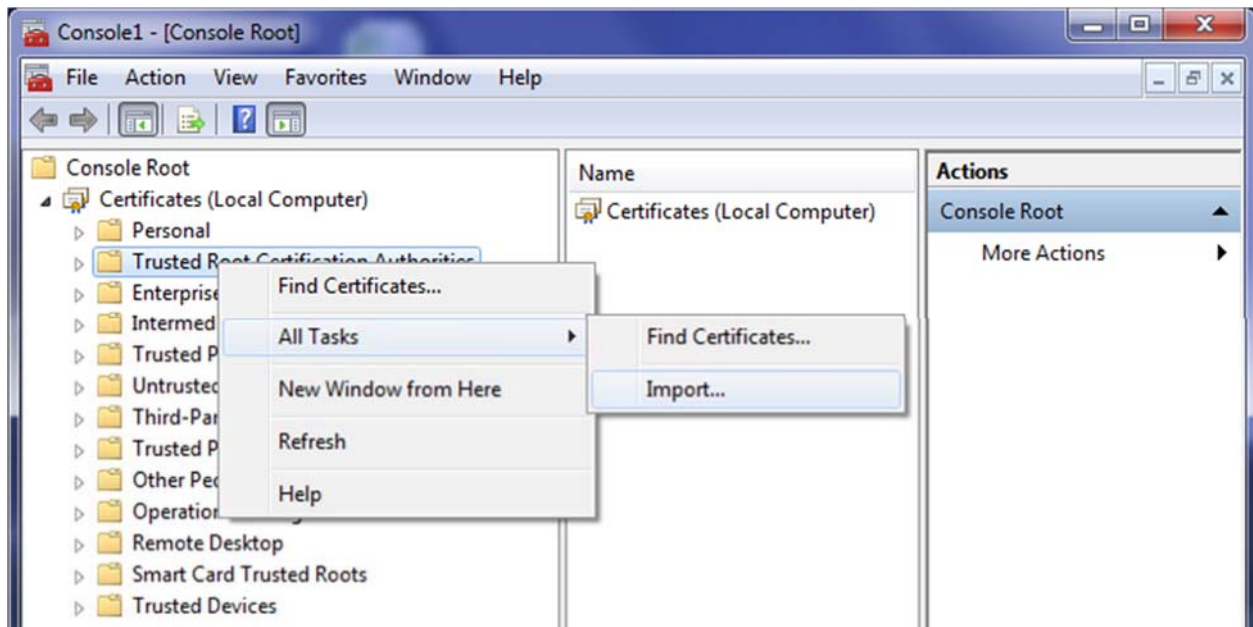
2.2 Installing the Host and Network driver

In order to create a network, the PRS4601 boards must be connected to a host computer which has the appropriate device drivers installed. At the time of writing this document, only host computers running the Windows 7 operating system was supported.

2.2.1 Installing driver on Windows 7

In order to install the host drivers, a user must have the PRS4601 device with a valid firmware image programmed.

The steps for installing the host driver are detailed below:

1. Plug in the PRS4601 device to a USB3 port on the host computer. Immediately this provides power to the device and a flashing green status LED indicates that the device is ready for use.

2. Navigate to the Device Manager on the host computer (Right click on My Computer and select Properties. A link to the Device Manager can be found in the left panel in the opened window)

3. Two unknown device should now be visible under "Other devices" (see Figure below)
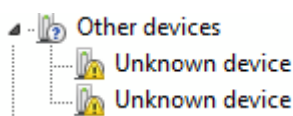

Figure 2-1: Missing driver for plugged in PRS4601 device

4. Right click on the first unknown device and select Update Driver Software

5. Select "Browse my computer for driver software" then browse to the appropriate location of the drivers.

6. Select Next to start the installation

7. After the installation completes, click the Close button

8. Repeat steps 4 to 7 for the remaining unknown device.

2.3 Loading image onto boards

2.3.1 Loading image onto device for the very first time

The bootloader is used to program the boards for the very first time. The PRS4601 enables communication with the bootloader via the USB interface assuming the Serial driver was installed (see Section 2.2.1). TeraTerm (or any other terminal application that emulates communication with a CDC device) can be used to verify communicatio

n to the bootloader. The user can pressed the "Enter" key or enter the "version" command and view the response.

Before programming the image, the user must decide whether to load the image to:

1. RAM in which case the program would be lost after resetting the device
2. Flash in which case the program would be persisted even after resetting the device

Note: If the status LED on PRS4601 is blinking a green pattern, you can skip this step and go to section 2.3.2. When installing the firmware for the first time the bootloader must be running – this is indicated with a flashing yellow LED.

The download_elf.exe utility is used to load the image to RAM only. This utility must be executed from the same directory that has the firmware images. Note: Please ensure to run this utility as an administrator by right clicking on the download_elf.exe file and selecting option to "Run as Administrator".

The download_flash.exe utility is used to load the image to Flash. Similarly, this utility must be executed from the same directory that has the firmware images. Note: Please ensure to run this utility as an administrator by right clicking on the download_flash.exe file and selecting option to "Run as Administrator".

 Note: For the majority of user scenarios, option #2 would generally be preferred.

2.3.2   Loading image   onto device   that already   have a   prior image

The image on the board can be upgraded or downgraded by double clicking the prs_flash_bin.bat script provided with the firmware image. The board must be reset for the new image to take effect.

2.4   Creating   a   Network   with two   PRS4601s

When attempting to create a network between two PRS4601s (wired or wireless), the user may choose to configure a specific node as the network coordinator (more appropriately known as the PCP in an 802.11ad PBS S network) while configuring the other node as a Station (STA). Alternately, a user may also opt for having the P CP and STA selections be negotiated allowing the devices to choose among themselves the role each node will p lay.

2.4.1   Configuring   PCP/STA   Modes

In order to set the node to PCP or STA mode, we will need to use the Device Manager.

The Device Manager can be found under Control Panel -> Device Manager.

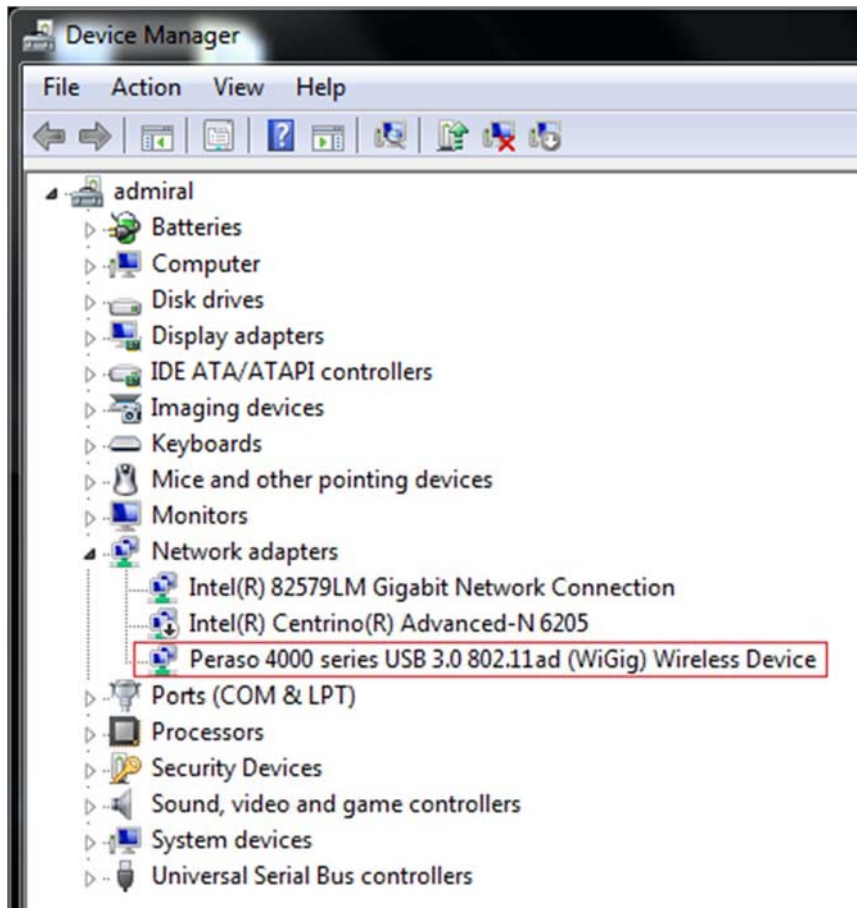Find the correct network adapter, right click -> properties.

Figure 2-2: Device manager

Then, go to the advanced tab and set:

AMSDU -> ON

Device Mode -> PCP or STA

Repeat these steps for both nodes, one with Device Mode set to PCP, the other with Device Mode set to STA.

2.4.2   Creating a   network   profile

After configuring discovery mode on both host computers, the next step will be to create a profile for the network.

This will need to be done on the node set to PCP mode. The steps for doing this is outlined below.

1.   Open the Network and Sharing Center from Control Panel

2.   Click on the "Manage wireless network" link on the left panel for the window

3.   Click Add then choose "Create an ad hoc network".

4.   Choose the Next button after reading the description for setting up a wireless ad hoc network

5.   Fill out the form which is used to provide details about network (see Figure below)

Figure 2-3: Creating a network profile

6. Click the Next button after filling form
7. Click the close button after network is ready for use (see Figure below)
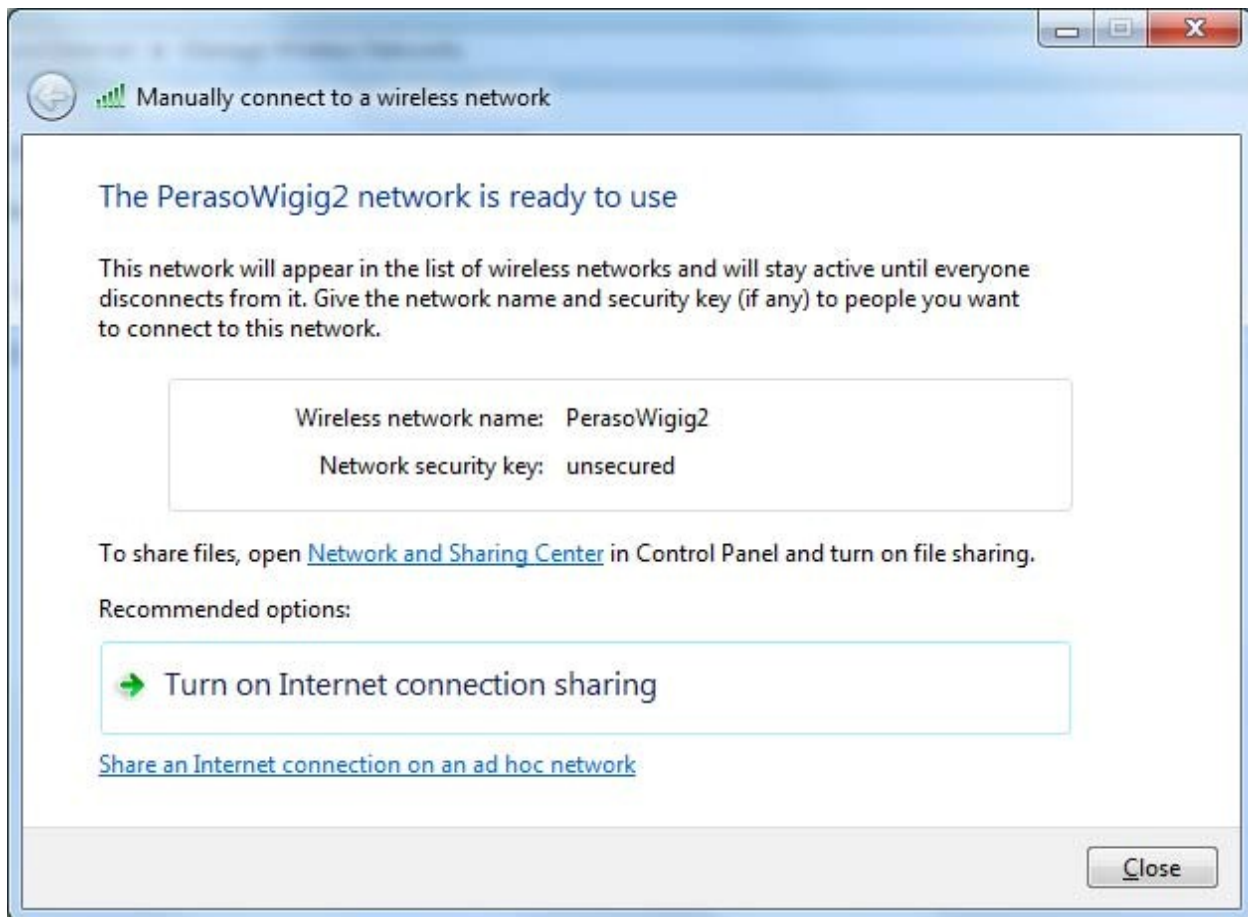
Figure 3-2-4: Network profile successfully create

2.4.3 Starting and connecting to created network

The network must be started from the node that is set to PCP. From the tray icons click on the icon for Wireless Connection. This should display the network that was created above. Double click on the network name (or Right Click and choose Connect) to start the network. Once started you should notice the status change to "Waiting for users" (see Figure below)

The user can also know that the network has been started by looking on the PRS4601 device. There will be a fast blinking pattern of the green TX LED indicating that frames (in this case beacons) are being transmitted by the device.
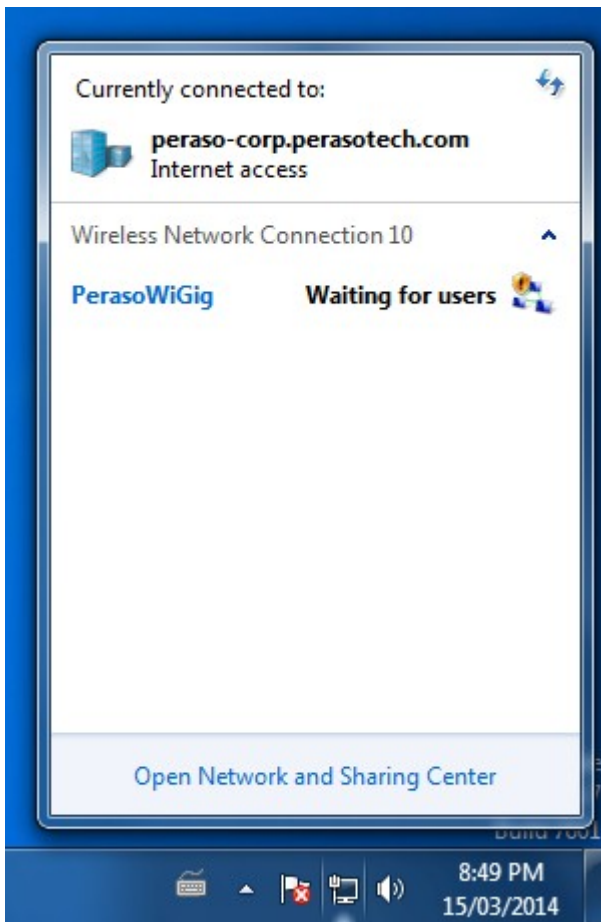
Figure 3-2-5: Status after starting PCP

From the host computer configured to be a STA, the network should now be visible when the user clicks on the wireless connection tray icon. The user can then double click on the network they wish to connect to. Note: this step is the same as connecting to any wireless network.

If connection was successful, the status will be updated to Connected on both host computers.

2.4.4   Setting staticIP   addresses for   host machines

While each node on the network will be given an IP address automatically, static IP addresses can be configured for each host. This is not required for traffic to be sent over the network. Setting static IP addresses can be done from the Adapter properties for the device (same as any other network device) and selecting the Internet Protocol Version 4 (TCP/IPv4) properties. Ensure that different IP addresses are used for both devices. Figure # below shows the configuring of static addresses for one of the host machines
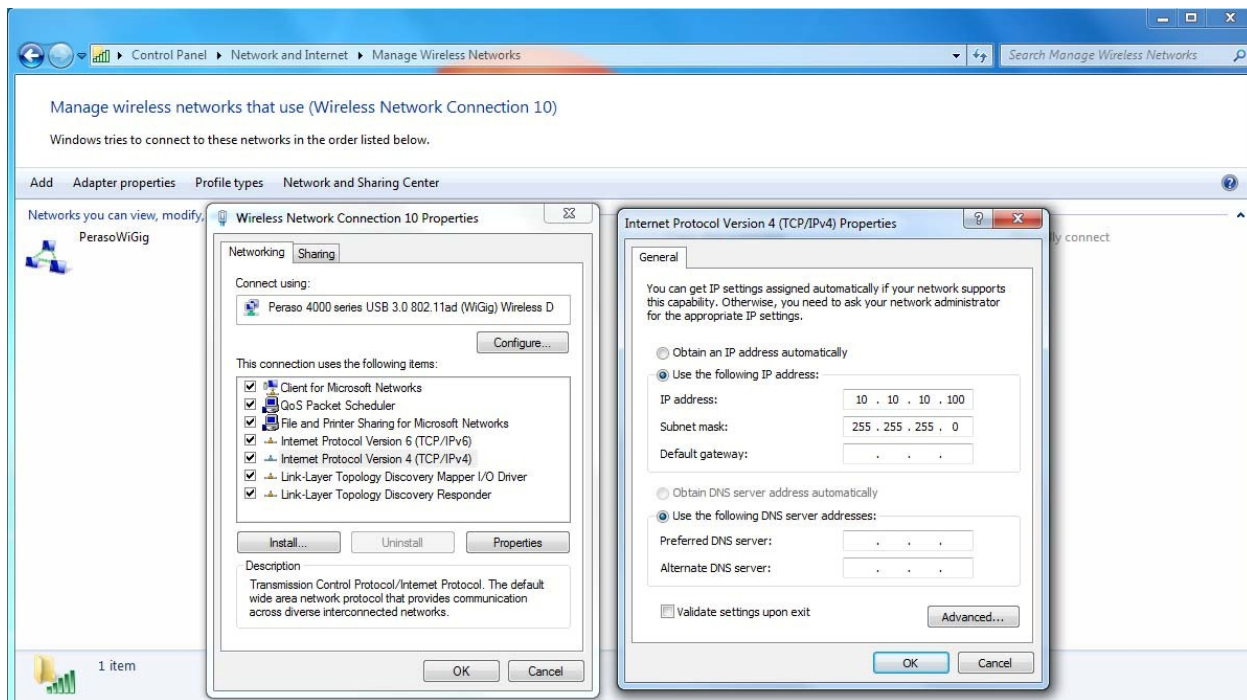
Figure 3-2-6: Configuring static IP addresses

3. Appendix

3.1 Appendix A - Enabling Driver Signing

If ever the user wants to stop using a computer as a host machine, they can disable test mode with the following steps:

1) Run command prompt as administrator (enter cmd.exe in search field, right click on it)
2) Enter the following two lines
a) bcdedit.exe –set loadoptions ENABLE_INTEGRITY_CHECKS
b) bcdedit.exe -set TESTSIGNING OFF

3.2 Appendix B – Setting up TeraTerm

The steps to configure TeraTerm on first use are described below.

1. Open the previously downloaded TeraTerm application
2. Navigate to Setup->Terminal and apply the following setting(s)
o Receive: AUTO
o Check "Local Echo"
3. Navigate to Setup->Serial Port and apply the following setting(s)
o Baud Rate: 115200
4. Save the changes by navigating to Setup->Save Setup

Next, you will want to plug in PRS4601 via USB. If you see a flashing yellow light, you will need to install new firmware. If you see a green light, you can update existing firmware. If there is no light visible, PRS4601 is not powered on, and nothing will work.

In either case, open up TeraTerm and choose the correct serial port.

Press enter a few times. If there is no firmware, you will get a simple message after the second enter press, but no commands will work.

If you have a green light on PRS4601, the following commands will give some output to TeraTerm:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

IMPORTANT NOTE:
FCC Radiation Exposure Statement:
This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 56 cm between the radiator & your body.

IMPORTANT NOTE:
This module is intended for OEM integrator only and limited to host with brand: IgniteNet and model: ML-60-35, ML-60-35-1. The OEM integrator is still responsible for the FCC compliance requirement of the end product, which integrates this module.

USERS MANUAL OF THE END PRODUCT:
In the users manual of the end product, the end user has to be informed to keep at least 56 cm separation with the antenna while this end product is installed and operated. The end user has to be informed that the FCC radio-frequency exposure guidelines for an uncontrolled environment can be satisfied.

The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

LABEL OF THE END PRODUCT:
The final end product must be labeled in a visible area with the following " Contains TX FCC ID: HED-ML60MDSB ".

The FCC part 15.19 statement below has to also be available on the label: This device complies with Part 15 of FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

This Module may not be integrated into host devices that are addressed for operation inside airplanes/satellites.

Antenna list:

Ant.	Brand	P/N	Antenna Type	Connector	Gain (dBi)
1	Accton	123400001084A	Dish Ant.	N/A	42

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device. Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

IMPORTANT NOTE:
IC Radiation Exposure Statement:
This equipment complies with IC RSS-102 radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator & your body.
Cet équipement est conforme aux limites d'exposition aux rayonnements IC établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre la source de rayonnement et votre corps.

IMPORTANT NOTE:
This module is intended for OEM integrator only and limited to host with brand: IgniteNet and model: ML-60-35, ML-60-35-1. The OEM integrator is still responsible for the IC compliance requirement of the end product, which integrates this module.

Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

USERS MANUAL OF THE END PRODUCT:
In the users manual of the end product, the end user has to be informed to keep at least 20 cm separation with the antenna while this end product is installed and operated. The end user has to be informed that the IC radio-frequency exposure guidelines for an uncontrolled environment can be satisfied. The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

LABEL OF THE END PRODUCT:
The final end product must be labeled in a visible area with the following " Contains IC: 3857A-ML6035G3 ".
The Host Model Number (HMN) must be indicated at any location on the exterior of the end product or product packaging or product literature which shall be available with the end product or online.