Impinj R700 RAIN RFID Reader

Installation and Operations Guide

Version 6.2.0

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PRODUCTS COVERED BY THIS GUIDE

This guide pertains to readers with the following part numbers and communication codes:

Table: Impinj R700 RAIN RFID Reader Part Numbers and Frequency Plan for North America

Reader	Communication Code	Part Number
Impinj R700 RAIN RFID Reader	FCC	IPJ-R700-410

Transmit Channel Number	Center Frequency (MHz)
1	902.75
2	903.25
3	903.75
4	904.25
…	…
49	926.75
50	927.25

Federal Communications Commission (FCC) Compliance

This equipment was tested and complies with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy. If not installed and used in accordance with the instructions, the equipment may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in an installation and cause harmful interference to radio or television reception. To determine if this equipment causes harmful interference to radio or television reception, turn the equipment off and on.

You are encouraged to try to correct the interference by one or more of the following:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Consult the dealer or a qualified radio/TV technician for assistance.

Per FCC 15.19(a)(3) and (a)(4)

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.

- This device must accept any interference received, including interference that may cause undesired operation.

Per FCC 15.21

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Minimum Separation Distance

This device has been evaluated for compliance with FCC and IC RF exposure limits in a mobile configuration. At least 35 cm of separation distance between the device and the user's body must be maintained at all times. This device must not be used with any other antenna or transmitter that has not been approved to operate in conjunction with this device.

Industry Canada (IC) Compliance Operation is subject to the following two conditions: 1. This device may not cause interference. 2. This device must accept any interference, including interference that may cause undesired operation of the device. This device has been designed to operate with the antenna(s) listed in section 9 that have a maximum gain of 6 dB. Antennas not included in this list or having a gain greater than 6 dB are strictly prohibited for use with this device. The required antenna impedance is 50 ohms. To reduce potential radio interference to other users, the antenna type and its gain should be chosen so that the equivalent isotropically radiated power (EIRP) is not more than that permitted for successful communication. The term "IC" before the radio certification number only signifies that Industry of Canada technical specifications were met.	**Industrie Canada (IC) Conformité** Son fonctionnement est soumis aux deux conditions suivantes: 1. Cet appareil ne doit pas provoquer d'interférences. 2. Cet appareil doit accepter toute interférence, y compris celles pouvant causer un mauvais fonctionnement de l'appareil. Cet appareil a été conçu pour fonctionner avec l'antenne (s) énumérées à la section 9 qui ont un gain maximum de 6 dB. Antennes pas inclus dans cette liste ou présentant un gain supérieur à 6 dB sont strictement interdits pour utilisation avec cet appareil. L'impédance d'antenne requise est de 50 ohms. Afin de réduire le risque d'interférence avec d'autres utilisateurs, le type d'antenne et son gain doivent être choisis de telle sorte que la puissance isotrope rayonnée équivalente (PIRE) ne soit pas supérieure à celle permise pour une communication réussie. expression "IC" avant le numéro de certification radio signifie seulement que l'industrie des spécifications techniques Canada ont été respectées.

CE Marking and European Economic Area (EEA)

RFID devices designed for use throughout the EEA operate in two approved frequency bands: (1) 865.6-867.6MHz limited to maximum radiated transmit power of 2W ERP, and (2) 916.1-918.9MHz limited to maximum radiated transmit power of 4W ERP. For other EEA restrictions on RFID device use, please refer to the Impinj Declaration of Conformity (DoC) located at support.impinj.com.

Environmental Air Handling Space (EAHS) Applications

This device is suitable for use in Environmental Air Handling Space (EAHS) in accordance with Section 300-22(c) of the National Electric Code. Cables, antennas, power adaptors, PoE (Power Injectors), or other devices shall not be installed in the Environmental Air Handling Space unless they are suitable for use in the EAHS per UL 2043.

Power Requirements

The RF transmit power is limited to +30dBm when it is supplied from an IEEE802.3af (Power over Ethernet) compliant power source that is certified by the appropriate agencies. If it is supplied by the Impinj-approved Listed/Certified POE injector model number **IPJ-A2010-000**, the RF transmit power supports up to +33.5dBm. Operating above +30 dBm requires professional installation to comply with radio regulatory laws in many countries.

Warning: This product may be powered by an IEEE 802.3af (Power over Ethernet) compliant power source that is certified by the appropriate agencies, or with a listed/certified power supply marked LPS or Class 2, with 24Vdc output, rated minimum 2.5A. The use of alternative power supply will invalidate any approval given to this device and may be dangerous.	**Attention:** Ce produit peut être alimenté par un IEEE 802.3af (Power over Ethernet) source d'alimentation conforme qui est certifié par les organismes appropriés, ou avec une alimentation inscrite/certifié LPS ou classe 2 marquée, avec une sortie 24V, 2,5A nominal minimal. L'utilisation d'une autre alimentation annule toute autorisation liée à cet appareil et peut être dangereuse.

When supplied by the Impinj-approved listed/certified PoE injector model number IPJ-A2010-000, the available AC power cords are:

- IPJ-A2051-USA (for North America)
- IPJ-A2051-EU1 (for European Union)
- IPJ-A2051-JPN (for Japan)
- IPJ-A2051-BRA (for Brazil)
- IPJ-A2051-CHN (for China)

Before You Begin

Warning: Please read this document in its entirety before operating the Impinj R700 RAIN RFID Reader products, as serious personal injury or equipment damage may result from improper use. Unauthorized opening of the Impinj R700 RAIN RFID Reader enclosure voids the warranty.	**Avertissement:** S'il vous plaît lire ce document dans son intégralité avant d'utiliser le Impinj R700 RAIN RFID Reader, comme des blessures graves ou des dommages matériels peuvent résulter d'une mauvaise utilization. Ouverture non autorisée du lecteur Impinj R700 RAIN RFID Reader boîtier annule la garantie.

INTRODUCTION

About this Guide

This guide provides detailed instructions for installing, connecting, configuring, operating, upgrading, and troubleshooting the Impinj R700 RAIN RFID Reader. To shorten the length of this guide, the content focuses on the installation and operation of one Reader.

Intended Audience

The intended audience for this guide is anyone installing an Impinj R700 RAIN RFID Reader. The assumed primary users of this guide are systems engineers and IT personnel with experience and basic knowledge of:

- Software development
- Hardware systems integration
- Network connectivity

This guide also assumes that the user has a high-level understanding of RFID, RFID systems management, and a basic familiarity with the EPCglobal Gen 2 specification.

Other Documents of Interest

This guide is part of a larger documentation set that supports Impinj R700 RAIN RFID Reader. The document set includes the following seven documents:

- ***Impinj R700 RAIN RFID Reader Getting Started Guide*** is a one-page guide included with the Impinj R700 RAIN RFID Reader. It provides basic information about the hardware and instructions for obtaining additional documentation, firmware upgrades and downloads, and other support software.
- ***LTK Programmer's Guide*** provides software engineers with guidelines and best practices for working with the Low Level Reader Protocol (LLRP) Toolkit. Software engineers can also access language-specific reference guides and sample applications that illustrate the scenarios discussed in the Programmer's Guide.
- ***Octane LLRP*** is intended for software engineers and describes the LLRP capabilities supported by Impinj R700 RAIN RFID Reader, which includes Impinj's custom LLRP extensions.

Note: Octane is the name for the Impinj R700 RAIN RFID Reader firmware.

- ***RShell Reference Manual*** describes the syntax and command language for the Impinj R700 RAIN RFID Reader RShell Console.
- ***Octane SNMP Guide*** provides monitoring and reference information for working with the SNMP MIBs (Management Information Base), which is related to Impinj R700 RAIN RFID Reader (the standard TCP/IP networking MIB (MIB-II) and a subset of the standard EPCglobal RM MIB).
- ***Firmware Upgrade Reference Manual*** includes detailed procedures, reference information for upgrading firmware installed on single Readers, and procedures for creating a metafile to automate upgrading of multiple Readers.
- ***Impinj R700 RAIN RFID Reader Embedded Developer's Guide*** provides a high-level description of the Impinj Reader platform and a high-level view of its architecture. This guide is intended for software engineers who design custom application software for the Reader.

Document Conventions

Throughout this document, references are made to both standard and extended LLRP messages, parameters, and fields. To help visually distinguish between these different types, the table below provides details on the conventions that are used.

Table: Document Style Conventions

Type	Example	Style
LLRP message	IMPINJ_ENABLE_EXTENSIONS	CAPS_UNDERSCORES
LLRP parameter	AntennaConfiguration	Italics Camel Case
LLRP field	ResetToFactoryDefault	Italics Camel Case
Enumerated field value	'Upon N Tags or End of AISpec'	'Single-Quoted String'
Filename	**'ImpinjDef.xml'**	'Single-quoted bold'
LTK function	**getLLRPStatus**	Bold italics case matches programming syntax
LTK class names	**CIMPINJ_TCS_RESPONSE**	Bold case matches programming syntax

Impinj Support Information

Visit the Impinj Support Web site at support.impinj.com for information about technical assistance. For guidelines about capturing data for analysis by Impinj technical support personnel, see ***Submitting Diagnostic Data for Analysis by Impinj Technical Support*** section.

INTRODUCTION TO IMPINJ R700 RAIN RFID Reader

Impinj R700 RAIN RFID Reader is a stationary, small form factor, UHF Gen2 RFID tag Reader.

Impinj R700 RAIN RFID Reader

The Reader provides network connectivity between tag data and enterprise system software. Impinj R700 RAIN RFID Reader offers many key features that increase application flexibility:

- **Low Power Usage**

  With a low power design, Impinj R700 RAIN RFID Reader is capable of using Power over Ethernet (PoE). Using PoE simplifies deployment and dramatically reduces costs and greenhouse gas emissions of your RFID infrastructure. Using PoE does not compromise Speed- way performance. It delivers the full 30 dBm transmit power. It is recommended that either the external Universal power supply or Power-over-Ethernet should be used to power the Impinj R700 RAIN RFID Reader, not both.

Note: Using an AC/DC power module, the maximum transmit power is +33.5 dBm. Impinj R700 RAIN RFID Reader supports the IEEE standard 802.3af for PoE.

- **Compact Form Factor**

The compact size of Impinj R700 RAIN RFID Reader, 7.4 x 6.9 x 1.2 inches or 18.8 x 17.5 x 3 cm, eases installation in tight spaces and in embedded applications.

- **High-Performance Features**

Impinj R700 RAIN RFID Reader uses a variety of high-performance features making it possible to read more than 1100 tags per second. Features include Autoset, Low Duty Cycle, dynamic antenna switching, inventory search modes that improve tag population management, and receive sensitivity filtering for read zone confinement.

- **Ease of Use Features**

Impinj R700 RAIN RFID Reader uses industry-standard application interfaces, which simplifies integration with RFID middleware or custom software solutions. The Reader also offers enterprise class management and monitoring capability.

- **Robust Reader Design**

Impinj R700 RAIN RFID Reader uses a single circuit board design that delivers field-proven, enterprise class quality and reliability.

Supported Operating Environments

This section describes the environments in which you can access the Impinj R700 RAIN RFID Reader RShell console that is used for configuring, monitoring, and maintaining the Reader. The tools that you use when you access the RShell console depend on how you connect your PC to the Reader, either by a serial connection (RS-232) or by an Ethernet connection (SSH/Telnet). On computers running Microsoft Windows, you can now use Putty for both types of connections.

Table: Supported Operating Environments

Interface	Protocol	Recommended Tools	
		Microsoft Windows	Linux
Ethernet	SSHPort 22 TelnetPort 23	Putty [1]	SSH or Telnet
Serial	RS-232	Putty (version 0.60 and higher supports serial)	Minicom

[1] http://www.chiark.greenend.org.uk/~sgtatham/putty/

Supported Communication Protocol

For client control of the Reader, Impinj R700 RAIN RFID Reader supports the EPCglobal Low Level Reader Protocol (LLRP) v1.0.1. LLRP is an EPCglobal standard interface that allows communication with the Reader, which in turn reads EPCglobal Gen 2 RFID tags.

Antenna Requirements

Depending on the Reader model you are installing, Impinj R700 RAIN RFID Reader is equipped with two or four independent, bidirectional, and full duplex TX/RX monostatic antenna ports.

Antenna requirements vary by regulatory region. For details about the requirements for a specific region, see the relevant antenna section in Appendix A: Information Specific to Regions of Operation.

INSTALLING AND CONNECTING IMPINJ R700 RAIN RFID READER

This section provides details about Impinj R700 RAIN RFID Reader I/O ports and status LEDs. It also explains how to install the Reader and connect it to your network.

Impinj R700 RAIN RFID Reader Ports and LEDs

Impinj R700 RAIN RFID Reader LED Blink Patterns section describes the three primary LED categories and their blink patterns. ***LED Behavior in Scenarios for Startup, Upgrade, Detection, Inventory, and LLRP*** section describes the LED behavior for various Reader operation scenarios.

Impinj R700 RAIN RFID Reader LED Blink Patterns

The Impinj R700 RAIN RFID Reader has several LEDs to indicate Reader operational status. The three primary LED categories are power, Reader status, and antenna status. Each LED has its own blink patterns to convey status to the user. The tables below document the defined patterns for the Power LED, for the Reader Status LED, and for the Antenna Status LEDs.

Table: Power LED Patterns

LED State	Reader State
Solid RED (after power-on or reset)	Power applied, attempting to start boot code
OFF	Default Restore button pressed
One short RED blink	Configuration Default Restore detected
Two short RED blinks	Factory Default Restore detected
Blinking RED (4 Hz)	Unable to boot (see console for details)
Solid GREEN	Done booting, starting application image
Blinking ORANGE (1Hz)	USB flash drive upgrade in progress
Blinking RED (2 Hz)	USB flash drive upgrade failure

Table: Reader Status LED Patterns

LED State	Reader State
OFF	Application image booting, RFID not available
Alternating RED and GREEN	Application image booting, RFID not available, File system operation in progress (after upgrade)
Solid GREEN	Application image booted; RFID available
Two short GREEN blinks	LLRP connection active

One short GREEN blink	LLRP active, but no LLRP connection
Blinking ORANGE	Inventory active, blinking rate increases with an increased number of tags in the Reader FOV

Table: Antenna Status LED Patterns

LED State	Reader State
OFF	Antenna inactive
Solid GREEN	Antenna actively transmitting

LED Behavior in Scenarios for Startup, Upgrade, Detection, Inventory, and LLRP

The tables in this section describe the LED behavior for various reader operation scenarios.

Table: Startup (Power On), Normal Completion

Reader Operation	LED	Expected Behavior
Power applied, attempting to start boot code	Power: Status:	Solid red Off
Bootloader calling firmware image	Power: Status:	Solid green Off
Bootloader completed successfully, Reader is ready	Power: Status:	Solid green Solid green

Table: Startup (Reset), Normal Completion

Reader Operation	LED	Expected Behavior
Default Restore button pressed	Power: Status:	Turns off Off
Default Restore button pressed for 3 seconds	Power:	Blinks once (red), indicates a configuration default restore will occur.
Default Restore button pressed for 10 seconds	Power:	Blinks twice (red), indicates a factory default restore will occur. Resets Reader

		configuration and removes CAP (if present).

Table: Startup (Failure)

Reader Operation	LED	Expected Behavior
Hardware problems detected unable to boot	Power: Status:	Continuous blinking red Off

Table: Upgrade Activity

Reader Operation	LED	Expected Behavior
Upgrading the firmware during boot process	Status:	Alternates between red and green

Table: Detection of Antenna Activity

Reader Operation	LED	Expected Behavior
Detects no activity on antenna port	Antenna:	Off
Detects antenna transmission activity on antenna port	Antenna:	Solid green

Table: Inventory Activity

Reader Operation	LED	Expected Behavior
Performing an inventory operation	Status:	Blinks orange, blinks faster as tag volume increases

Table: LLRP Activity

Reader Operation	LED	Expected Behavior
Active LLRP connection	Status:	Double blink pattern (green)
Disconnected operation	Status:	Single blink pattern (green)

Installing and Connecting the Reader

The primary installation and connection steps for Impinj R700 RAIN RFID Reader are:

1. Position the Reader appropriately for your environment. This may or may not involve mounting the Reader.
2. Connect the antenna(s) to the appropriate ports on the Reader.
3. Connect power to the Reader.
4. Connect the Reader to the network.
5. Configure region setting on the Reader (not required if FCC, ETSI, Japan, or Australia).
6. Test the Reader installation by reading tags.

Detailed Installation Procedures

This section provides the details for each installation and connection step.

Step 1: Position the Impinj R700 RAIN RFID Reader and (optionally) Mount the Reader

Choose the appropriate location for the Reader. Ideally you should always keep the unit away from direct sunlight, high humidity, extreme temperatures, and sources of electromagnetic interference. Any combination of these conditions might degrade performance or shorten the life of the unit. Additionally, you need to account for the bend radius of the coaxial cable at the antenna connection points if it is mounted close to another perpendicular object. The Impinj R700 RAIN RFID Reader supports Power over Ethernet (PoE) and can obtain its electrical power with data via standard cable in an Ethernet network.

If powering the Reader by using an external universal power supply, confirm that there is a standard 120 or 220 VAC outlet nearby. Depending on your environment, you might need to mount the Reader to a wall or another object.

To Mount the Impinj R700 RAIN RFID Reader

1. Locate the four mounting slots on the Reader.
2. Use a ¼ inch diameter bolt with 20 threads per inch (¼–20) or M6 screws to secure the unit. You can mount the Reader either horizontally or vertically.

Caution: If there is any chance of dust or water exposure, you should mount the Reader so that the Ethernet, USB, Console and GPIO ports are facing down to prevent ingress.	**Attention:** Si il n'y a aucune chance de poussière ou d'eau exposition, vous devez monter le lecteur de sorte que les ports Ethernet, USB, console et GPIO sont orientés vers le bas pour empêcher la pénétration.

Step 2: Connect the Antenna(s) to the Impinj R700 RAIN RFID Reader

Depending on the Impinj R700 RAIN RFID Reader model you are installing, the Reader has either two antenna ports or four antenna ports. Each port is independent, bidirectional, and full duplex TX/RX (monostatic).

Warning: You must use Impinj-approved antennas with Impinj R700 RAIN RFID Reader. Using any other antenna may adversely affect performance or damage the Reader. Impinj R700 RAIN RFID Reader requires professional installation to correctly set the TX power for the RF cable and antenna selected.	**Avertissement:** Vous devez utiliser des antennes Impinj-approuvés avec Impinj R700 RAIN RFID Reader. Utilisation de toute autre antenne peut affecter les performances ou endommager le lecteur. Impinj R700 RAIN RFID Reader exige installation professionnelle pour définir correctement la puissance d'émission pour le câble RF et une antenne sélectionné.

To Connect the Antenna(s) to the Reader

1. Position each Reader antenna, keeping the following points in mind:
   - Position the antenna(s) to achieve the most effective and efficient tag reads.
   - Position the antenna(s) to maximize operator safety. Personnel should remain at a safe distance at all times. For the specific requirements for your regulatory region.
2. Mount the antenna(s) according to the instructions provided by the antenna manufacturer.
3. Attach the antenna cable(s) to the antenna port(s) on the Reader. Choose any port for any antenna.
4. Finger-tighten each connection, making sure the connection is secure. The antenna cable is properly tightened when you are no longer able to twist the cable inside the connector.

   Note: A loose connection negatively impacts the performance of the antenna.

Caution: Impinj designed the Impinj R700 RAIN RFID Reader antenna ports to be self-terminating. It is important that you do **not** terminate unused antenna ports. Leave them unconnected.	**Avertissement:** Impinj conçu les ports antenne de Impinj R700 RAIN RFID Reader à auto-terminaison. C'est important que vous ne résiliez pas ports d'antenne pas utilisés Laisser-les sans rapport.

Step 3: Power the Reader

You have two choices for powering Impinj R700 RAIN RFID Reader:

- Power over Ethernet (PoE)

- Power over Ethernet (PoE)+

If your network switch is PoE-enabled, the Reader powers on when you connect it to the network.

If you are using a listed/certified power supply, connect the AC power plug into a suitable 100–240 VAC, 50–60 Hz power outlet.

Note, on Cisco Catalyst series switches the Ethernet POE port will automatically disable itself if the reader has a listed/certified power supply connected. In this situation, the Cisco port must be set to POE = "never", using the following Cisco configuration commands.

In this example slot 5, port 2 is being set to POE = "never".

```
Switch# configure terminal
Switch(config)# interface fastethernet 5/2
Switch(config-if)# power inline never
Switch(config-if)# end
Switch#
```

The boot sequence begins in either case when power is supplied to the Reader. This sequence typically completes within 30 seconds. After the boot sequence finishes, the Reader accepts commands, not before. The Power and Status LEDs on the Reader alert you to the status. For more information, see ***Impinj R700 RAIN RFID Reader Ports and LEDs*** section.

! **Important:** We recommend you do not connect both a POE and a listed/certified power supply to the Reader. If a Reader is receiving power via PoE and the Reader detects that a listed/certified power supply has been connected, the Reader reboots and switches to the listed/certified power supply source. If, however, the Reader is receiving power via a listed/certified power supply and detects the connection to a PoE-enabled network switch, nothing changes. The Reader continues to receive power from the listed/certified power supply. The listed/certified power supply always takes precedence over PoE because the listed/certified power supply is capable of higher power if both sources are connected.

Step 4: Connect the Impinj R700 RAIN RFID Reader to the Network

You are now ready to connect the installed Impinj R700 RAIN RFID Reader to your network. You have two options:

- If your network supports DHCP, you can connect the Reader directly to your Ethernet network. After the Reader is powered, immediately communicate with it via Telnet (TCP/IP). Note that Telnet is disabled by default on the Reader. Refer to the RShell Reference manual for instructions on enabling Telnet.
- If your network does not support DHCP, or if you want to connect a PC directly to the Reader via Ethernet cable, the Reader defaults to the following fixed IP address: 169.254.1.1. If this

address is already in use, the Reader will select a random fixed IP address in the 169.254.xxx.xxx link local address range. You can also connect to the Reader by using an RS-232 serial connection via the Console port. Use the Reader's RShell command- line interface to configure a static IP address for the Reader. After that is completed, you can connect the Reader to your Ethernet network.

Starting with the Octane 4.8 release, WiFi (wireless networking) is supported by using an adapter connected to the USB port on Impinj R700 RAIN RFID Reader. Only WiFi adapters that use the Realtek 8187 chipset/driver are supported. Contact Impinj to obtain a list of compatible WiFi USB adapters brands/models and use the *RShell Reference Manual* to get more information about how to configure WiFi.

Details about how to complete each connection option are described in the table below. Before proceeding, make note of the Reader's factory default network settings.

Table: Default Network Settings

Settings	Description
Hostname	impinj-XX-XX-XX where XX-XX-XX is the last three bytes of the Reader's MAC address (which is printed on the version label attached to the Reader case.
DHCP	When the reader is plugged into a network that doesn't have a DHCP server **OR** when the PC is connected directly to the Reader via Ethernet cable, the Reader defaults to a fixed IP address (169.254.1.1). If this address is not available, the Reader then randomly selects a fixed IP address in the 169.254.xxx.xxx link local address range.

To Connect the Impinj R700 RAIN RFID Reader to the Ethernet Network

- Using a standard Ethernet cable, connect the RJ-45 connector on the Reader to a LAN drop or network switch.

Note: If you need to connect a PC directly to the Ethernet port, you can use a standard Ethernet cable. A crossover cable is not necessary.

To Troubleshoot Ethernet Network Connections

Use the following steps to troubleshoot problems with connecting to the Reader over TCP/IP:

1. "Ping" the Reader, for example **ping impinj-10-28-42.local** (for the Impinj R700 RAIN RFID Reader Reader). If you are on an enterprise network, you usually don't have to use '.local'. When the Reader is directly connected to the PC, make sure the PC is on the same subnet as the Reader. For example, if the Reader's IP address is 169.254.1.1, set the PC's IP address somewhere in the 169.254.xxx.xxx address range.

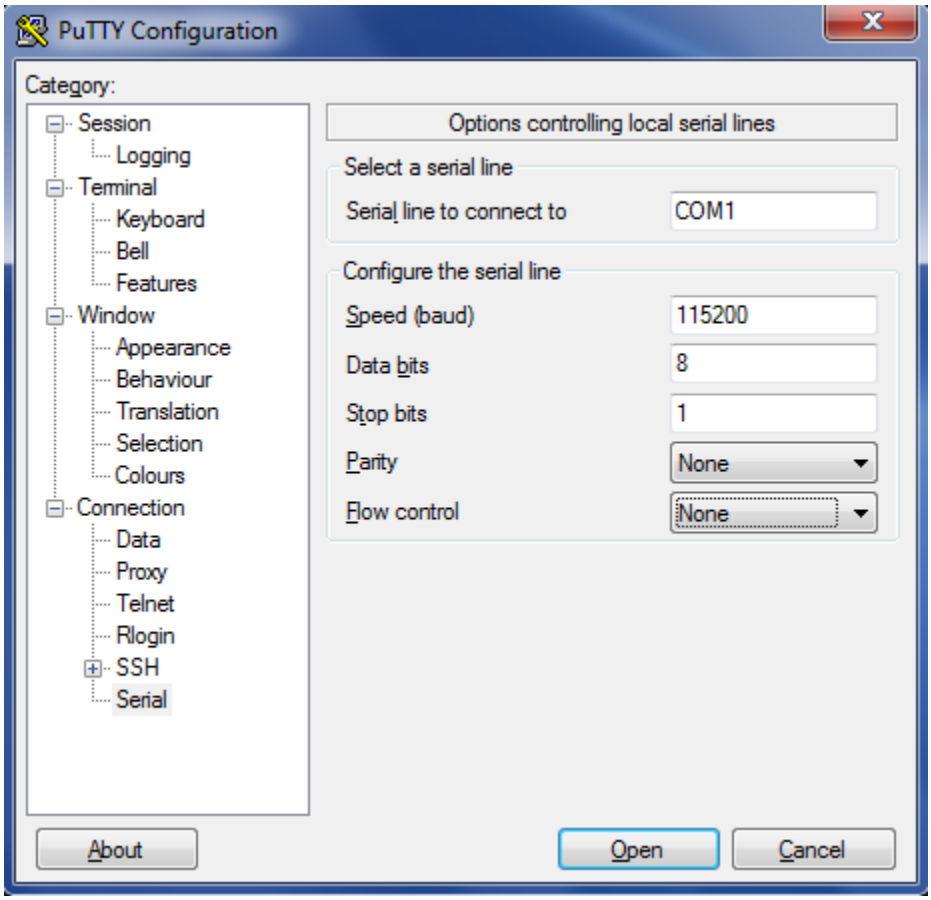
2. If the ping is **NOT** successful, you will probably see one of these three error messages:

   - "Ping request could not find host"
   - "Request timed out"
   - "Destination host unreachable"

The likely cause for these errors is that your PC doesn't have Bonjour Print Services installed. For installation instructions, see http://support.apple.com/kb/dl999.

To Connect the Impinj R700 RAIN RFID Reader to Your PC Over a Serial Connection

1. Confirm that you have the latest version of Putty, a free and reliable SSH, Telnet, and serial client. Putty version 0.60 or later contains support for serial connections.
2. Use a Cisco style Console cable RJ-45 to DB9, Impinj part number IPJA4000000, to connect your PC's valid/active COM port to the serial port on the Reader.
3. Power up the Reader and wait for the boot sequence to complete. For more information, see ***Detailed Installation Procedure section, Step 3: Power the Reader*.**
4. On the PC, run the Putty application and select the **Serial** connection option.
5. On the Putty Configuration dialog, shown in the figure below, verify that **Serial line to connect to** is set to **COM1**. Note: If you are using a serial to USB adapter, this field can be set to a different COM port.
6. Set **Speed** to **115200**.
7. Set **Flow control** to **None**, and then click **Open**.



Putty Configuration Settings

8. On the RShell console window, press **Enter**. The RShell login prompt displays.

COM1 Putty Login Prompt

9. At the RShell login prompt shown in the figure above, log in with the following default credentials, unless you have customized them:

   user name: **root**

password: **impinj**

10. When the RShell command-line prompt displays, begin configuring the network settings for the Reader. For more information, see ***Using RShell to Configure Network Settings for*** Impinj R700 RAIN RFID Reader section.

11. When you have completed configuration of the appropriate network settings, connect the Reader to your Ethernet network. For more information about how to do this, see ***Detailed Installation Procedures section, Step 4: Connect the*** Impinj R700 RAIN RFID Reader ***to the Network***.

    Note: If you decide to connect to DHCP after connecting serially, remember to use RShell to change the IP address on the Reader from static to dynamic. For more information, see **Using RShell to Configure Network Settings for** Impinj R700 RAIN RFID Reader section.

CONFIGURING AND MONITORING IMPINJ R700 RAIN RFID READER

This section provides a high-level overview of the configuration and monitoring options available for Impinj R700 RAIN RFID Reader.

Configuring Impinj R700 RAIN RFID Reader

You can think of Impinj R700 RAIN RFID Reader configuration in two categories: configuring the device itself and configuring the Reader's RF behavior. This section provides the basics for each type of configuration.

Device Configuration

RShell is a proprietary command-line management interface used to configure and manage network settings, firmware upgrades, and other device-oriented operations. This section introduces the RShell commands to use to install and connect the Reader. The *RShell Reference Manual* provides full details and syntax for all RShell commands.

Note: RShell is a machine interface and is almost always backward-compatible with previous Impinj R700 RAIN RFID Reader versions. Existing inputs and outputs will never change. When new commands are added, new optional arguments are added at the end.

Using RShell to Configure Network Settings for Impinj R700 RAIN RFID Reader

You can often get up and running with little or no configuration if you use the default configuration settings in Impinj R700 RAIN RFID Reader. However, if you are not using DHCP to assign IP addresses, you will need to configure a few of the Reader's network settings.

The following procedure outlines the RShell commands you might need to connect the Reader to your network.

To Configure the Reader's Network Settings

1. Open the RShell console. For more information, see the procedure "To connect a Impinj R700 RAIN RFID Reader to your PC over a serial connection" in section 5.3.4.
2. View the Reader's current configuration settings by entering the show network summary command at the RShell command prompt as shown in the following example:

```
> show network summary

Status='0,Success'
PrimaryInterface='eth0
'ActiveInterface='eth0'
Hostname='impinj-00-00-B9'
connectionStatus='Connected'
ipAddressMode='Dynamic'
ipAddress='10.0.10.41'
'ipMask='255.255.0.0'
ReaderAddress='10.0.0.10'
broadcastAddress='10.0.255.255'
LLAStatus='enabled'
```

3. Configure the appropriate TCP/IP parameters for your environment. The applicable commands are:

   - **Setting Hostname**
     > config network hostname <HOSTNAME>
   - **Setting Static IP Address**
     > config network ip static <IP ADDRESS><NETMASK> <READER>

   Note: The IP address is required, however the other parameters are optional. The default value is used if an optional parameter is omitted from the ip command.

   - **Enabling DHCP**
     > config network ip dynamic
   - **Configuring NTP Servers**
     > config network ntp add <NTP SERVER ADDRESS>

4. After successfully configuring all required network settings, connect the Reader to the network through the Impinj R700 RAIN RFID Reader Ethernet port.

RF Configuration

How you configure your Reader's RF behavior depends entirely on your implementation approach. You might be using a custom software application, middleware running on a server, or some other approach. ItemTest, described in the next section, is an example of a PC client application. Regardless of the application you're using, the underlying protocol is the same, Low-Level Reader Protocol (LLRP). LLRP is a standard, asymmetric, binary protocol used for communication between a client application and the Reader. LLRP controls the configuration of the antenna transmit power, the receive sensitivity, the operating Reader, and more. For more information about LLRP, see the following documents:

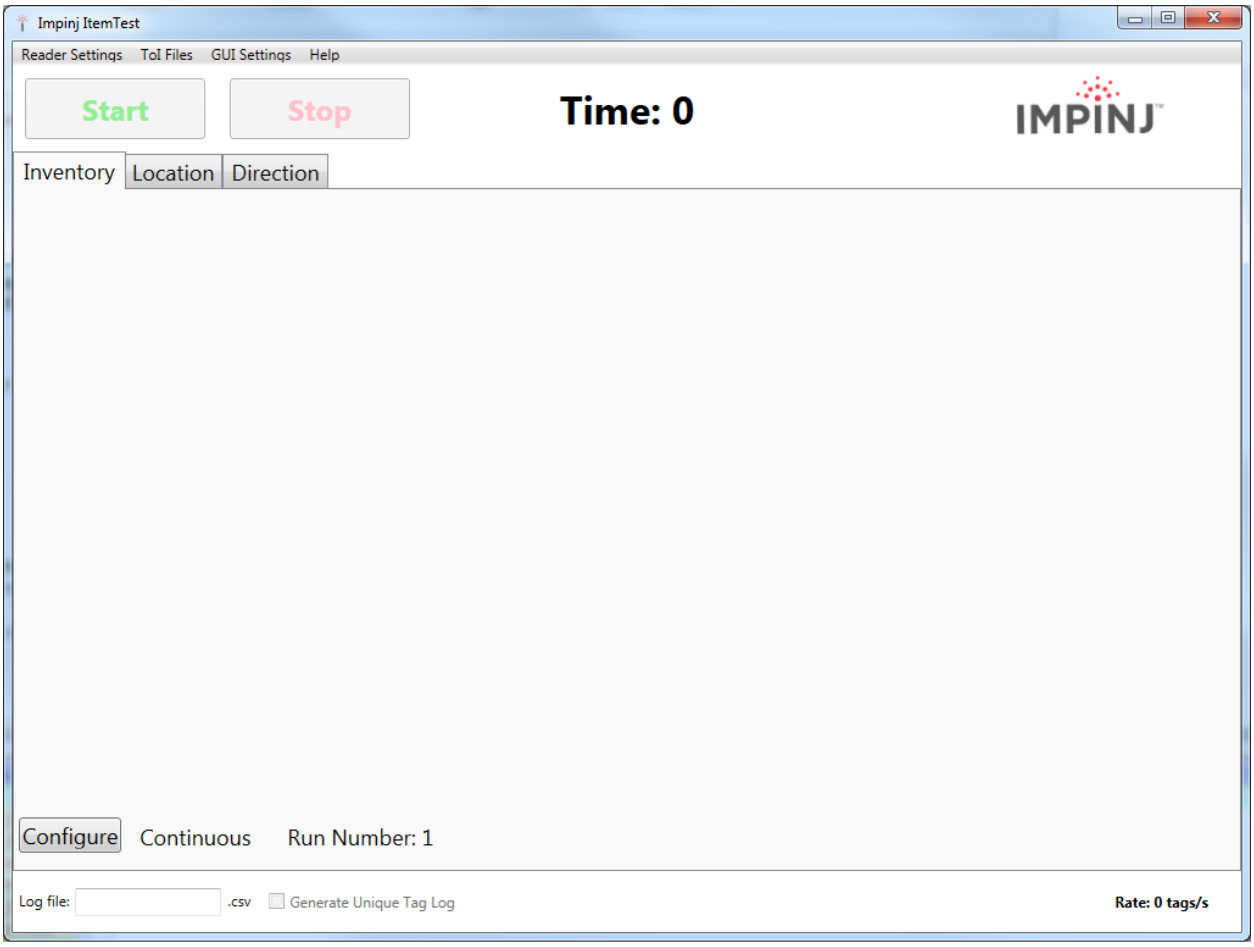
- ***LLRP Standard*** This document provides the specifics of the LLRP standard ratified by EPCglobal. http://www.epcglobalinc.org/standards/llrp/llrp_1_0_ 1-standard-20070813.pdf
- ***Octane LLRP*** This document provides details of the LLRP capabilities that are supported by Impinj R700 RAIN RFID Reader. It also describes custom LLRP extensions added by Impinj.
- ***Impinj LTK Programmer's Guide*** This guide is intended for software engineers and provides guidelines and best practices for working with the LLRP Toolkit. In addition, software engineers can access language-specific reference guides and sample applications that illustrate the scenarios discussed in the Programmer's Guide.

Download ItemTest

Download ItemTest from the Impinj support Web site at support.impinj.com. To use ItemTest, your computer must be running Microsoft Windows 7 or later.

Install and Launch ItemTest

Launch the Installer from the ItemTest download. Follow the step-by-step instructions to install ItemTest on your PC. After a successful installation, double-click **ItemStart** to start the application. You should see the opening screen as shown in the figure below.



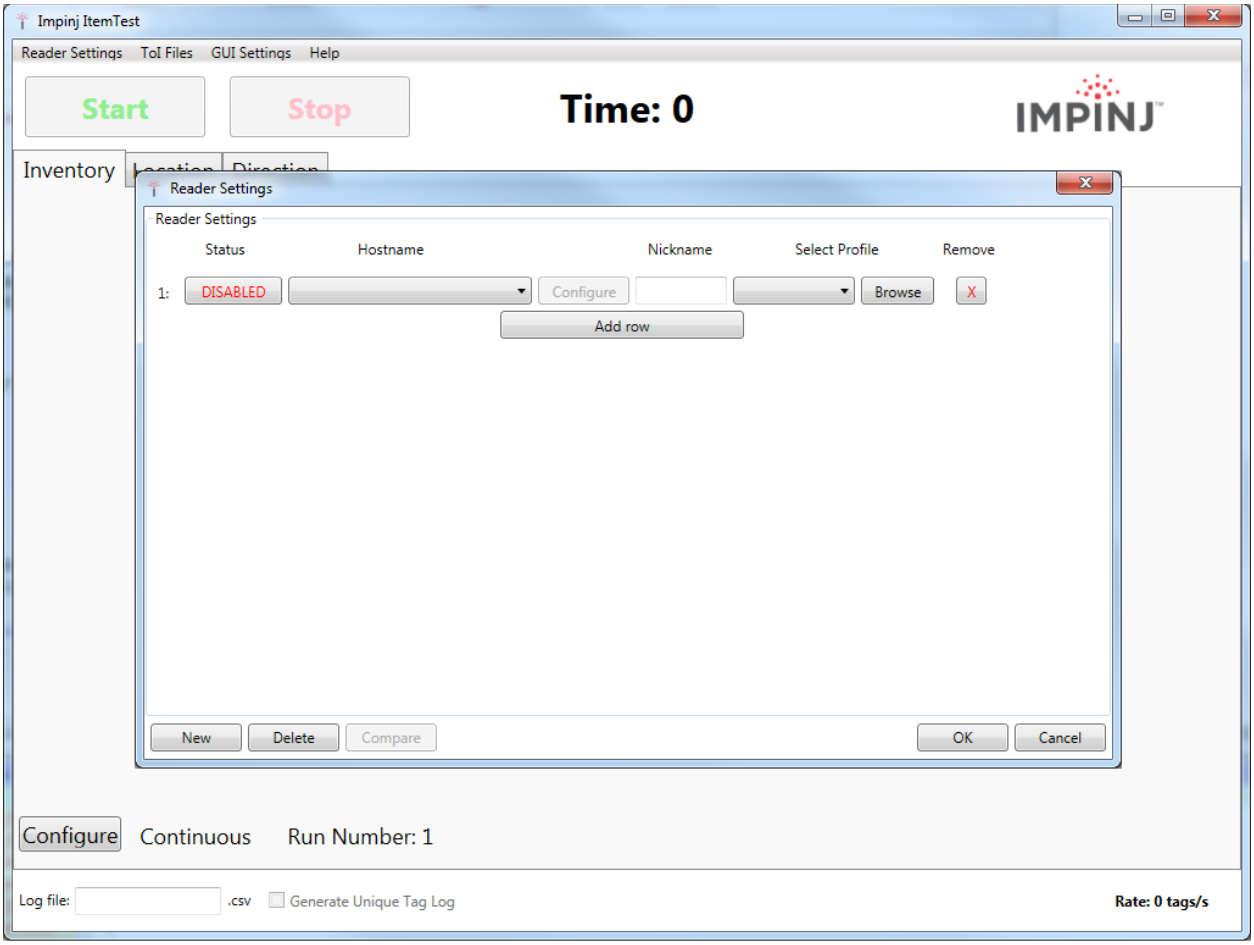
ItemTest Opening Screen

Connect and Configure the Reader

Now that ItemTest is running, the next step is to connect and configure your Reader device, using the following procedure.

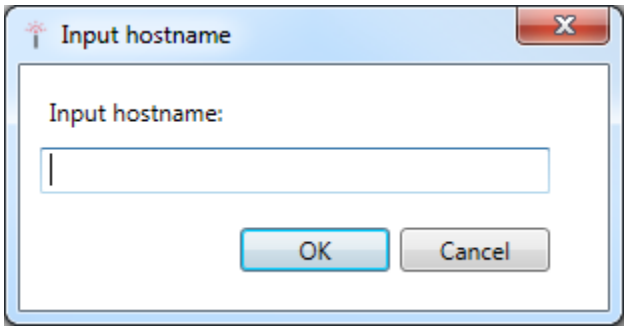
To Connect and Configure Your Reader

1) Select the **Reader Settings** menu, which opens the **Reader Settings** window, as shown in the figure below.



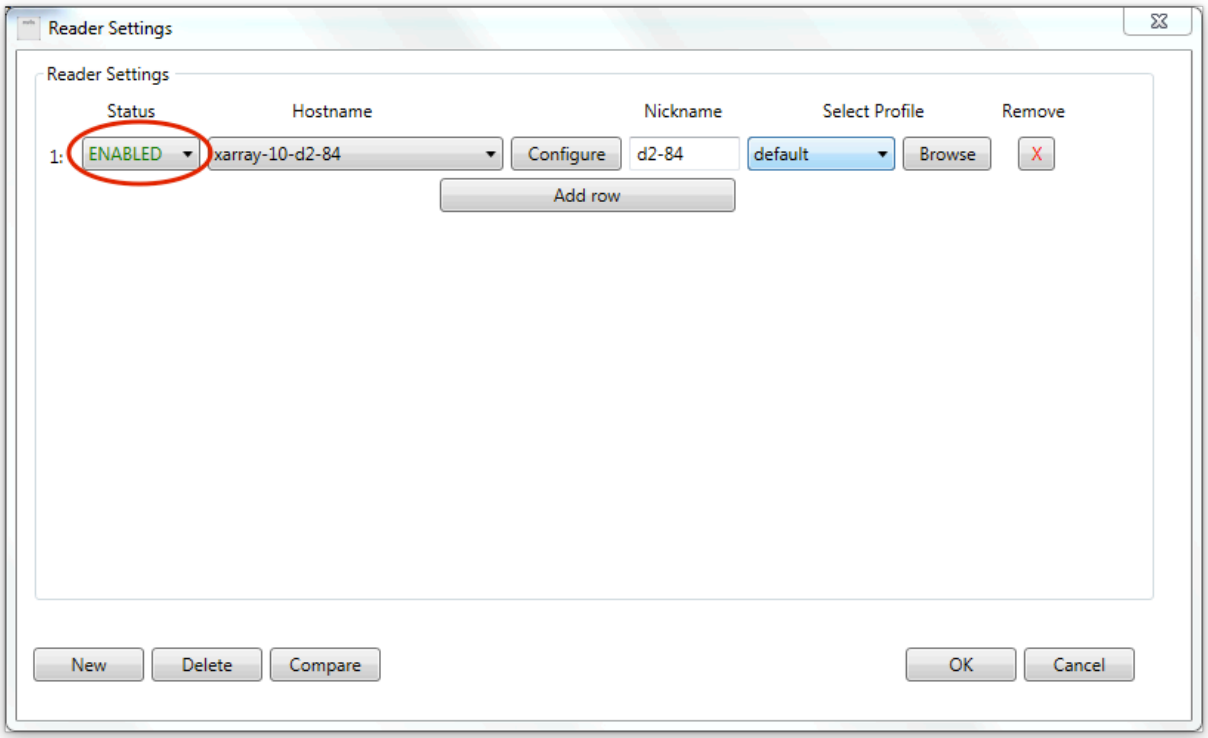
ItemTest - Reader Settings Screen

2) On the **Reader Settings** page, click **New** to add a new Reader configuration. The **Input reader name** dialog opens, as shown in the figure below.



ItemTest - Input Reader Name

3) In **Reader name**, type the Reader hostname or IP address.
4) Click **OK**. ItemTest establishes a TCP/IP connection to your Reader.
5) On the **Reader Settings** page, select **ENABLED** from the **Status** drop down menu to enable the Reader.
6) If required, continue to add additional Impinj R700 RAIN RFID Readers for operation and testing.

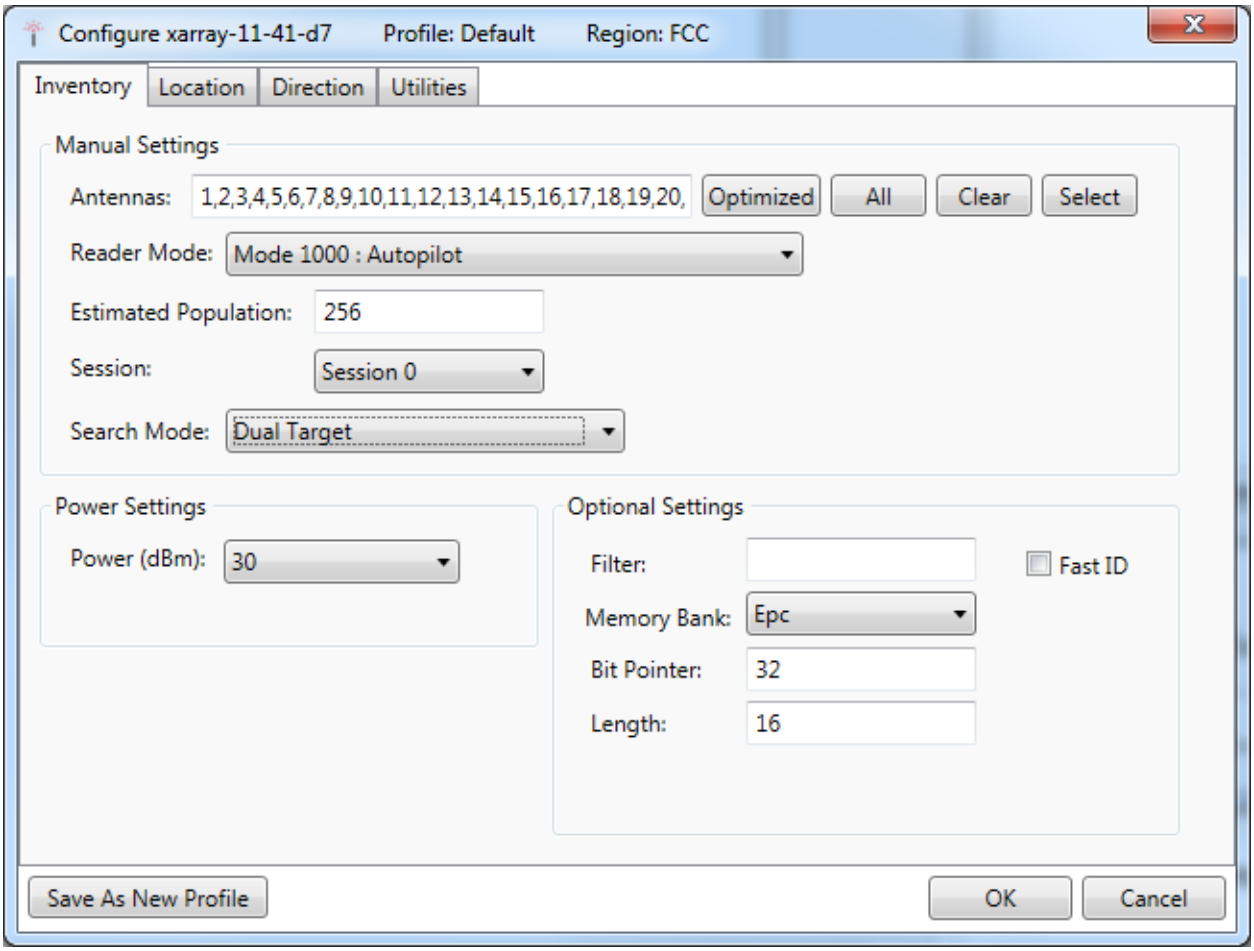


ItemTest - Add and Enable Reader Settings

Now you can configure the Reader for Inventory (Inventory).

To Configure the Reader for Inventory

1) On the Reader Settings page, click Configure.
2) Make sure that you open the **Inventory** tab (not **Location** or **Utilities**), as shown in the figure below.



Configure Reader for Inventory

3) To allow the Reader to read from all available beams, on the **Inventory** tab, click **All** after the **Antennas** field.
4) For this initial test, set **Mode** to **Mode 1000:Autopilot** and **Target** to **Dual Target**. Keep the default settings for all other parameters.

Monitoring Impinj R700 RAIN RFID Reader

Use RShell to monitor the health and performance of the Reader when Impinj R700 RAIN RFID Reader is up and running. This section presents the primary RShell commands to use for viewing network and RFID statistics, in addition to the Reader logs. For more information about these commands, see the *RShell Reference Manual*.

Impinj R700 RAIN RFID Reader also supports industry standard SNMP, with MIB2 and EPCglobal Reader Management MIB. For more information, see the *Octane SNMP Guide*.

Viewing Network Parameters and Statistics

Use the RShell show network command to display networking parameters and statistics. When you use this command with the parameters shown in Table 15, you can see the following information:

Table: Show Network Command Parameters

Parameter	Displayed Information
dhcp	Summary of DHCP client configuration
dns	Summary of DNS settings
icmp	ICMP statistics
ip	IP statistics
ntp	Summary of NTP settings
summary	Summary of network settings
tcp	TCP statistics
udp	UDP statistics

For details about the specific settings and statistics available for each of these parameters, see the *RShell Reference Manual*.

Viewing RFID Parameters and Statistics

Use the RShell **show rfid stat** command to display a Reader's RFID parameters and statistics. Using this command with the appropriate parameter, you can view information shown in the Parameter and display table below.

Table: Description of "*show rfid stat*" Command Parameters

Parameter	Description
ReaderOperationalStatus	Indicates whether RFID applications are running on the Reader.
Antenna<n>OperationalStatus	Indicates if an antenna is physically connected to the Reader and operating properly. Note that <n> indicates the antenna port on the Reader, a value of 1-4.
Antenna<n>EnergizedTime	Indicates the elapsed time that antenna<n> has been powered, in milliseconds.
Antenna<n>UniqueInventory-Count	Indicates the number of unique tags counted at antenna<n>.
Antenna<n>TotalInventory-Count	Indicates the total inventory count for antenna<n>.
Antenna<n>ReadCount	Indicates the number of tags read at antenna<n> that matched the configured filters.
Antenna<n>FailedReadCount	Indicates the number of tags where a read was attempted at antenna<n> because the tag matched the configured filter, but the read failed.

Table 16 shows a sample of the commands available to get RFID statistics. For the full list as well as syntax details, see the *RShell Reference Manual*.

Note: You can see statistics for the LLRP interface between the Reader and a client by using the **show rfid llrp stat** command. For more information, see the *RShell Reference Manual*.

Configuring and Viewing Impinj R700 RAIN RFID Reader Logs

Impinj R700 RAIN RFID Reader uses the standard Syslog protocol to forward its logged events to a remote Syslog server. The Reader stores the logged events in its file system, accumulating and retaining this information across reboots. Logs are classified into three categories:

- Management
- RFID
- System

All logged events have an associated severity level. There are eight possible levels listed in decreasing order from most severe to least severe:

1. Emergency
2. Alert
3. Critical
4. Error
5. Warning
6. Notice
7. Info
8. Debug

Configure the log levels that you want to display. The Reader then retains only the events with a severity greater than or equal to the configured level. For example, if you choose a logging level of Warning, then the logs will contain the following levels: Warning, Error, Critical, Alert, and Emergency.

Note: Regardless of the configured log level, the Reader always retains logs of events with **Error** level or higher in an independent log.

Use the **RShell config logging** command to configure options for storing and forwarding logged events. Use the **show logging** command to display the logging configuration as well as the actual logged information in text form. For more information about these commands, see the *RShell Reference Manual*.

Viewing the State of the Impinj R700 RAIN RFID Reader

To display information about the current state of the Reader itself, use the RShell **show system** command. When you use this command, you can see the following statistics:

- A summary of system information — **show system summary**
- Platform memory usage and available application space — **show system cpu**
- Generic platform statistics — **show system platform**

For more information about the **show system** command, see the *RShell Reference Manual*.

UPGRADING THE IMINJ R700 RAIN RFID READER FIRMWARE

Impinj R700 RAIN RFID Reader contains firmware known as Octane. This section describes how to manually upgrade a single Reader.

In addition to supporting upgrade procedures, Impinj R700 RAIN RFID Reader also provides methods for reverting firmware to a previous valid image and restoring firmware to factory default settings. The procedure for reverting to the previous valid image is explained in this section. The procedure for returning to factory defaults is explained in the ***Troubleshooting*** section below.

A Brief Overview of the Impinj R700 RAIN RFID Reader Firmware

To minimize downtime and maximize the robust handling of possible upgrade failures, Impinj R700 RAIN RFID Reader contains dual images of its firmware. When a firmware image upgrade is requested, the Reader continues to operate using the primary image. In the background, Impinj R700 RAIN RFID Reader upgrades the secondary image. When the upgrade completes, the Reader reboots to the newly upgraded image. Impinj R700 RAIN RFID Reader retains the previous firmware version in case there are problems with the upgrade.

There are three individual partitions within each firmware image that logically organize the system software. Although you do not need a full understanding of this architecture to perform a simple manual upgrade, it is a good idea to be familiar with its structure at a high level. For a more in-depth discussion of the firmware and how firmware is organized, see the *Embedded Developer's Guide*.

The three partitions in firmware are:

1. **System Operating Partition (SOP)** — The SOP is the primary system partition of the Impinj R700 RAIN RFID Reader Reader. It contains the Linux kernel, FPGA firmware, RFID management software, Reader management software (RShell), logging management software, firmware upgrade control, system watchdog software, and the factory default data.
2. **System Persistent Partition (SPP)** — Files in this partition are automatically generated and maintained by the software that runs on the Reader. It contains the Reader configuration (network settings, LLRP configuration, log settings, and so on), Reader logs, and debug information used by Impinj engineers.
3. **Custom Application Partition (CAP)** — This partition contains custom application software, other items required by the custom application (extra libraries or tools, and configuration files), and custom application logs.

Upgrading the Firmware

Impinj R700 RAIN RFID Reader provides three methods for upgrading:

1. Using RShell, the command line interface.
2. Copying the firmware to a USB memory drive and plugging it into the Reader's host port.
3. Using the Impinj R700 RAIN RFID Reader Management web page.

Upgrading the Firmware by Using RShell

Use this procedure to use RShell to upgrade the firmware:

1. Obtain the firmware upgrade file from the Impinj support Web site, support.impinj.com. The upgrade file extension is .upg. (Example: octane_4_12_0.upg).

2. Place the upgrade file on a server (http, tftp, or ftp) that is accessible by the Reader you are upgrading.

3. Using the Putty application, connect to the Reader using by telnet, SSH, or serial, and then log in.

4. From the RShell command prompt, issue the following command:

   > config image upgrade <URI>

   where <URI> is the server location and the name of the upgrade file.

For example:

> config image upgrade http://usacorp/rfid/reader/image/octane_4_10_0.upg
> config image upgrade ftp://anonymous:abc@myserver/ftpdirecotry/octane_4_10_0.upg.upg
> tftp://server/octane_4_10_0.upg

5. After you start the upgrade, view the upgrade status at any time by issuing the following command:

   > show image summary

6. This command provides a display of the current upgrade status, the last operation, the status of the last operation, and information about the primary and secondary images. Reissue the show image summary command if you want to track the upgrade status. Some status values you might see are:

   WaitingForImageFileTransfer
   WaitingForCommitImage
   WaitingToActivateImmediate

The upgrade is complete when the **UpgradeStatus** parameter value is **Ready**

The **LastOperation** parameter should be set to **WaitingToActivateImmediate** and the **LastOperationStatus** should be set to **WaitingForManualReboot**.

7. Reboot the Reader by issuing the following command:

```
> reboot
```

The Impinj R700 RAIN RFID Reader reboot process displays messages in the RShell console as it goes through each stage of the process. The reboot completes, and then the Reader login prompt displays on the console. The Reader status light displays solid green. For more information, see the tables in the Impinj R700 RAIN RFID Reader ***Ports and LEDs*** section.

Upgrading the Firmware by Using a USB Drive

A Impinj R700 RAIN RFID Reader that runs Octane and later supports upgrading the firmware by using a USB drive.

First, obtain the firmware upgrade file from the Impinj support Web site, support.impinj.com. The upgrade file extension is **.upg**. (Example: octane_4_12_0.upg).

To Prepare the USB Drive for the Upgrade

1. Insert a USB drive into your computer.
2. Create a directory named **impinj** in the root of the USB drive, and create the subdirectories **revolution, upgrade, and images**. The names of these directories are case sensitive and must all be lower case.
3. Copy the desired firmware upgrade **.upg** file into the directory:
   `\impinj\revolution\upgrade\images\`

   Note: If multiple **.upg** files exist in the images directory, the Reader will use the most recently modified file.

4. Remove the USB drive from your computer.

To Use the USB Drive to Update the Reader

1. Confirm that the Reader is ready for upgrade, and that the Power and Status LEDs are illuminated.
2. Insert the USB drive into the “USB Host” port on the Reader. Within 5-10 seconds, the Reader will begin upgrading the Reader and the Power LED will blink amber. If the Power LED remains solid green, the Reader likely cannot locate the images directory and **.upg** file on the USB drive.
3. The upgrade process completes in 20-60 seconds and then the Power LED changes to solid

green.

4. Remove the USB drive from the “USB Host” port and reboot the Reader.

During the upgrade process, the Reader will attempt to append information to a status.log file in the impinj/revolution/upgrade directory. The status.log file is intended to provide an audit trail for the upgrade of one or more Readers.

If the firmware upgrade process fails, the Power LED will blink red. Remove the USB drive, reboot the Reader, and check the “status.log” file for the reason of the failure.

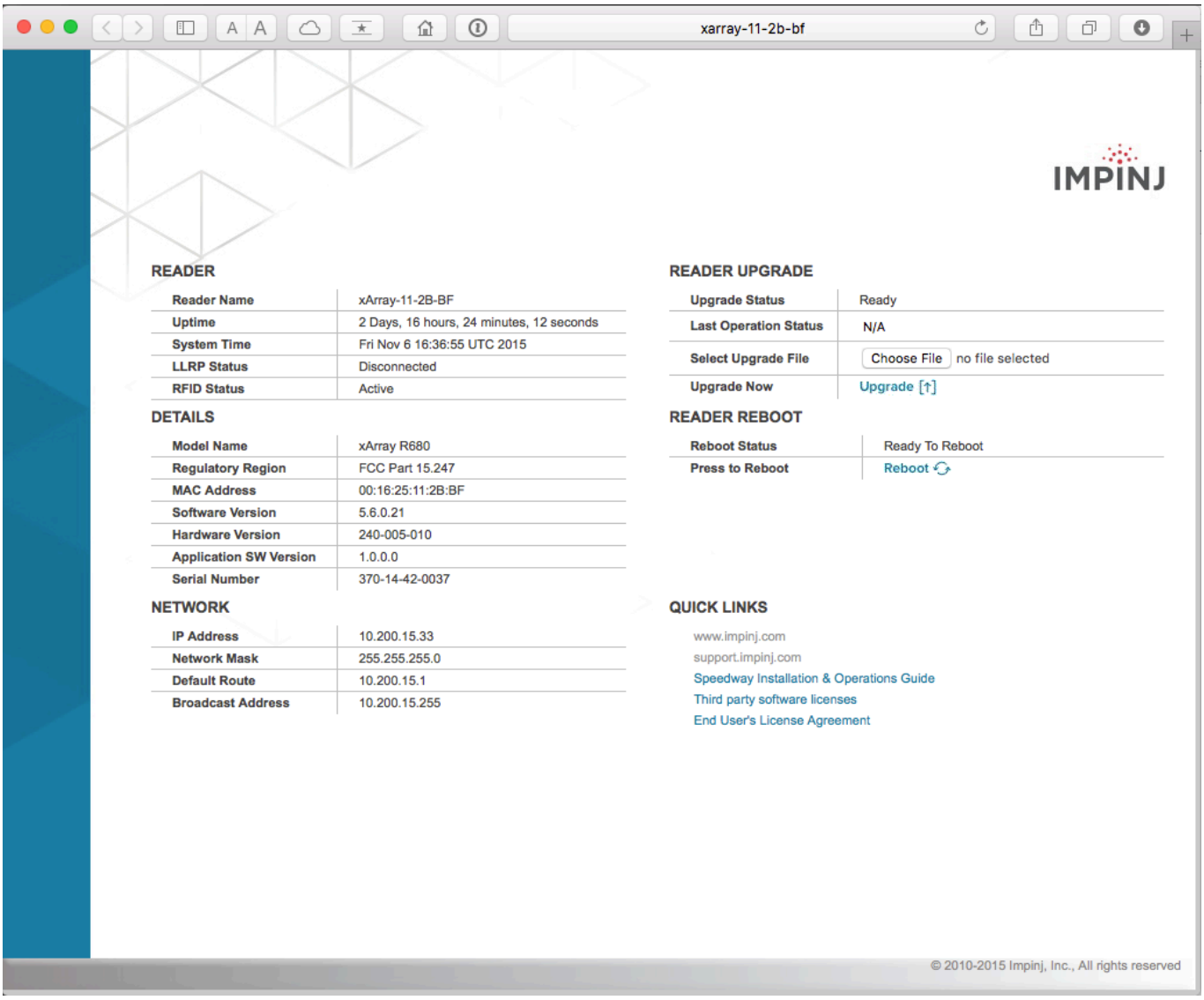
Upgrading the Firmware Through the Impinj Management Web UI

You can also upgrade the firmware by accessing the Impinj Reader Management web page, and running the upgrade from the management web page.

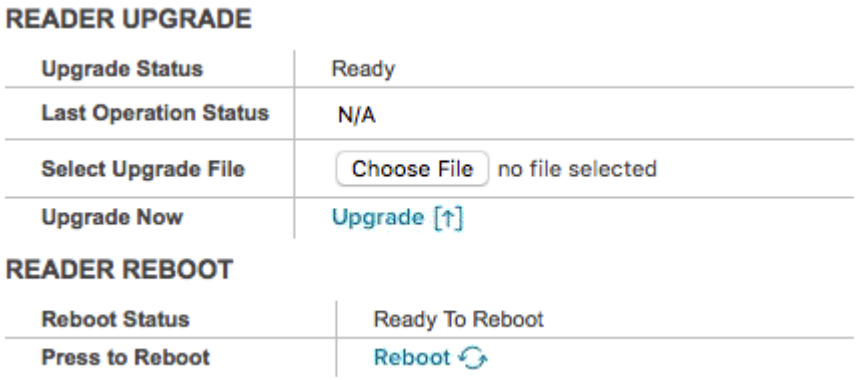
1) Connect to the reader using a web browser http://<reader name or IP address>. Examples: http://impinj-10-00-DD or http://10.0.10.44
2) Log in to the reader using the default user name and password:

   user name: **root**
   password: **impinj**

3) Click **Choose File**, and then select the firmware upgrade **.upg** file.
4) Click **Upgrade**
5) After the upgrade is complete, click **Reboot**.



Reader Management Web Page



Close-up of Reader Upgrade and Reboot Section of Management Web Page

Reverting to the Previous Image

Use the following procedure if you need to revert to the pre-upgrade image.

1. To revert to the pre-upgrade image, enter the following command from the RShell prompt:

   > config image fallback

   When the command completes successfully, the Reader automatically reboots and returns to the login prompt.

2. Log in to the Reader. The pre-upgrade image is now running.

   Note: If there is no valid previous image, the response to the **config image fallback** command is Status='8, Permission-Denied'.

TROUBLESHOOTING

If you experience a problem with Impinj R700 RAIN RFID Reader, this brief section presents a few suggestions to correct the issue.

Returning to the Default Configuration

If you are experiencing a problem with the Reader and are having difficulty pinpointing the cause, it is useful to return the Reader to a known state. We recommend resetting to the default configuration. Then try your Reader again.

! Important: Configuration Default Restore returns the Reader configuration to its default state. It leaves any custom applications installed in the CAP intact. To restore the Reader to its default state **and** remove any CAP contents, use Factory Default Restore. See the **Warning** below.

There are two ways to return Impinj R700 RAIN RFID Reader to its defaults:

1. Issue an RShell command.
2. Press the **Default Restore** button on the device.

To Use RShell to Return the Reader to Its Default Configuration and Leave CAP Intact

1. At the RShell prompt, enter the following command:

   > config image default

   When the command completes successfully, the Reader automatically reboots and returns to the login prompt.

2. Log in to the Reader. The Reader is now running with the default configuration, and CAP applications are intact.

To Use the Default Restore Button on the Reader to Restore to Its Default Configuration

1. Use an object with a sharp tip, such as a probe or paper clip, to press and hold the **Default Restore** button on the back of the Reader while the Reader is powered on.
2. Continue holding the Default Restore button for 3 seconds after the Power LED light turns off, but not longer than 10 seconds.
3. Release the Default Restore button when the LED blinks red once. The Reader will boot up normally with the default configuration.

Warning: Pressing the Default Restore button for 10 seconds or more will cause a factory default restore to occur. The factory default restore removes the Reader's custom application partition (CAP) if one exists. The Reader returns to the original, factory shipped state. It is important to avoid accidentally removing the CAP. There may be situations where CAP removal is necessary.	**Avertissement**: Appuyer sur le Défaut Bouton Restaurer pendant 10 secondes ou plus entraîne une restauration. D'usine par défaut de se produire restaurer la valeur par défaut supprime partition d'application personnalisée du lecteur (CAP) s'il existe. Le lecteur retourne à l'état usine original expédié. C'est important d'éviter de supprimer accidentellement la CAP. Il peut y avoir des situations où l'enlèvement de la CAP est nécessaire.

Table: Default Configuration Values

Parameter	Default Value
User	root
Password	impinj
Upgrade Retrieve Mode	Manual
Logging	No syslog servers
Management Logging Level	Error
RFID Logging Level	Error
System Logging Level	Error
Network Mode	Dynamic (DHCP)
DHCP Send Hostname	On
Hostname	impinj-xx-xx-xx (where xx-xx-xx are the last three digits of the MAC address)
Static DNS Servers	None
Static NTP Servers	None
LLRP Inbound Port	5084
LLRP Inbound Service	Enabled
LLRP Outbound Service	Enabled
LLRP Outbound Servers	None
LLRP Outbound Retry Secs	5
LLRP Outbound Timeout Secs	2

APPENDIX A: INFORMATION SPECIFIC TO REGIONS OF OPERATION

Speedway is designed to work in various regulatory regions. This appendix contains frequency ranges and antenna requirements specific to each supported region.

Operation in North America

Frequency Plan

The FCC specifies frequency hopping across the North American spectrum (USA, Canada, and Mexico) allocated to UHF RFID (902-928 MHz) using FHSS. The frequency plan is further explained in the table below:

Table: Frequency Plan for North America

Transmit Channel Number	Center Frequency (MHz)
1	902.75
2	903.25
3	903.75
4	904.25
…	…
49	926.75
50	927.25

Antenna Requirements Positioning

FCC Maximum Permissible Exposure (MPE) guidelines require the antenna's surface to be at least 25 centimeters away from personnel working in the area.

For more information, see the following FCC bulletins:

- FCC OET Bulletin 65: *Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields*
- FCC OET Bulletin 56: *Questions and Answers about Biological Effects and Potential Hazards of Radiofrequency Electromagnetic Fields*

Canadian ISED Maximum Permissible Exposure Guidelines require the antenna's surface to be at least 35 centimeters from personnel working in the area.

For more information see Radio Standards Specification RSS-102 Issue 5 dated April 2018.

Installation

Impinj R700 RAIN RFID Reader is capable of up to +33.5 dBm conducted power on the housing RF connector and requires professional installation.

Power

When paired with an antenna, Speedway may radiate no more than 36dBm EIRP per FCC Part 15.247 regulations. The Speedway output power can be increased to provide the maximum allowable EIRP subject to a maximum conducted power allowance of 30 dBm at the antenna connector.
The maximum allowable output power of the Reader can be set to satisfy both the conductor and radiated maximum criteria. The expression for the maximum Reader power setting is:

Maximum power setting (in dBm) = the Smaller of:		
(36 – Composite Antenna Gain (in dBm))	OR	(30 + Cable Loss (in dBm))

where the composite antenna gain comprises, the maximum linear antenna gain in dBi minus any cable loss between the Reader and antenna in dB. Approved antenna vendors, model numbers, and associated gains are listed in the next section.

Note: The composite antenna gain comprises the maximum linear antenna gain in dBi minus any cable loss between the Reader and antenna in dB.

Impinj R700 RAIN RFID Reader may be operated with any antenna which has been certified by Impinj for FCC compliance in conjunction with the reader. Alternatively, an antenna may be used in lieu of a certified antenna if it is of the same type with equal or lower gain. The reader may not be operated with any antenna that is neither certified nor of the same type/gain as that of a certified antenna. Certified antennas, including vendor, model number, and associated gain are listed in the next section.

Certified Antennas

- Laird Technologies model number S9028PCL/R (left- or right-hand CP), with integrated 8 foot pigtail to RP-TNC male connector; 6 dBi composite gain
- Impinj model number IPJ-A0301-USA (Mini-Guardrail) with SMA female connector; -15 dBi gain
- Impinj model number IPJ-A0310-USA Threshold Antennas (IPJ-A0311-USA and IPJ-A0311-EU1) with 12 inch integrated pigtail to BNC male connector, 6 dBi composite gain
- Impinj model number IPJ-A0400-USA, CSL CS-777-2 (Brickyard) with 7 foot integrated pigtail to RP-TNC male connector; 2 dBi composite gain
- Impinj model number IPJ-A0401-USA or IPJ-A0402-USA (both Guardwall) with 6 foot integrated pigtail to RP-TNC male connector; 6 dBi composite gain
- Impinj model number IPJ-A0404-000, Matchbox antenna with 20cm integrated pigtall to SMA connector; -20 dBi composite gain.
- MA/COM MAAN-000246-FL1 integrated RFID floor-mounted stand (multiple configurations available, 2 or 4 antennas left-hand and right-hand CP) with 8 foot integrated pigtail to RP-TNC male connector; 6 dBi composite gain
- MA/COM MAAN-000246-WL1 integrated RFID wall-mounted stand (multiple configurations available, 2 antennas left-hand and right-hand CP) with 8 foot integrated pigtail to RP-TNC male connector; 6 dBi composite gain
- MTI MT-262006/TLH (left-hand CP) or MT-262006/TRH (right-hand CP) with RPTNC female connector (antennas available in IP54 or IP67 ratings); 6 dBi gain
- MTI MT-262013/NLH (left-hand CP) or MT-262013/NRH (right-hand CP) with Ntype female connector (antennas available in IP54 or IP67 ratings); 4.5 dBi gain
- MTI MT-262013/TLH (left-hand CP) or MT-262013/TRH (right-hand CP) with RPTNC female connector (antennas available in IP54 or IP67 ratings); 4.5 dBi gain
- Sensormatic Electronics Corp. model number IDANT20TNA25 with 25 foot Belden 7806A RG-58 coaxial cable (0.1 dB per foot loss) to RP-TNC male connector; 5.5 dBi composite gain
- Sensormatic Electronics Corp. model number IDANT10CNA25 with 25 foot Belden 7806A coaxial cable (0.1 dB per foot loss) to RP-TNC male connector; 3.5 dBi composite gain
- Sensormatic Electronics Corp. model number IDANT10CNA25 with 6 foot Belden 7806A coaxial cable (0.1 dB per foot loss) to RP-TNC male connector; 5.4 dBi composite gain

- Impinj model number IPJ-A1100-USA (Times-7 model A5010, part # 60001 or 60003) with SMA female connector; 8.5 dBi composite gain
- Impinj model number IPJ-A1200-USA (Times-7 model A5020, part # 60010) with SMA female connector; 5.5 dBi composite gain

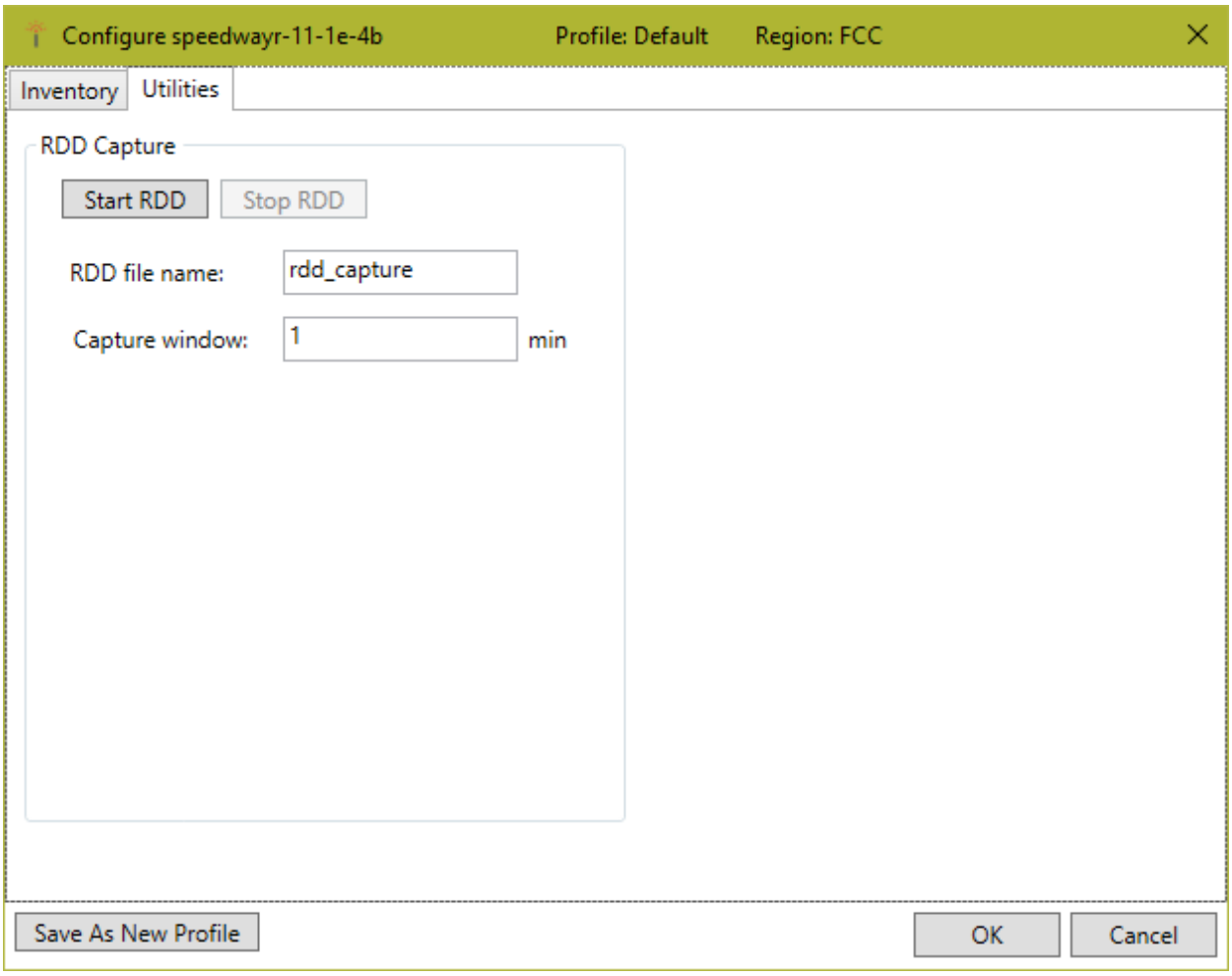
Warning: The use of any antenna not listed above may damage the Reader or adversely affect performance.	**Avertissement**: L'utilisation de toute antenne ne figurent pas ci-dessus peut endommager le lecteur ou affecter les performances.

APPENDIX B: SUBMITTING DIAGNOSTIC DATA FOR ANALYSIS BY IMPINJ TECHNICAL SUPPORT

If Impinj R700 RAIN RFID Reader is exhibiting RF behavior that is different from what you expect and you are unable to determine the cause, you might want to submit relevant data for analysis by Impinj Technical Support. You can use the Impinj ItemTest application to easily capture data related to the problem scenario. By creating and providing a Reader Diagnostic Data file, Impinj's Technical Support team can troubleshoot your issue.

To capture data to a Reader Diagnostic Data file

1. Open ItemTest and connect to the appropriate Speedway reader. For more information, see Figure 6.1 earlier in this document.
2. Select **Reader Settings** then **Configure** for the specific Reader.
3. Select the **Utilities** tab.
4. Choose an RDD file name and the desired capture window in minutes.
5. Select **Start RDD** to begin the capture session. ItemTest connects to the Reader and begins "listening" for any RF activity. The Reader captures data surrounding any RF activity it detects.



Reader Settings, Tag History & Debug Data Capture

6. Select **Stop RDD** to stop the session. The rdd file will be saved in the **rdd** folder where you installed ItemTest. This completes the capture activity.
7. **Send the *.rdd* file that contains binary data to Impinj Technical** Support.

Visit the Impinj support Web site, support.impinj.com., for submission details or talk with your Impinj representative.

Note: Another option to capture diagnostic data is to create a network trace by using Wireshark, a free protocol analyzer download from the Internet.

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