



Impinj ItemTest User Guide

Version 2.6.0

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Contents

1	Introduction	2
2	Terms	3
3	Installation	3
3.1	Minimum System Requirements	3
3.2	Installing ItemTest	3
3.3	Installation Location	4
3.4	Starting the ItemTest Application	4
3.5	About ItemTest	5
3.6	Automatic Updating	5
4	Navigating the New User Interface	5
5	Adding a Data Source	7
5.1	Using Automatic Discovery to Add a Data Source	7
5.2	Manually Adding a Data Source	8
6	Deleting a Data Source	9
6.1	Toggling Readers On/Off	9
6.2	Configuring Data Sources	10
6.3	Unreachable Data Sources	11
6.4	Configuring a Data Source for Inventory	12
6.4.1	IoT Configuraton	12
6.4.2	Manual Settings	14
6.4.3	Power and Sensitivity Settings	19
6.4.4	GPI Configuration	21
6.4.5	Gen2 Filtering for Inventory	22
6.4.6	Truncated Reply	24
6.4.7	Protected Mode	25
6.4.8	Frequency Settings	26
6.4.9	Low Duty Cycle	27
6.5	Location Configuration	28
6.5.1	Gen2 Parameters	28
6.5.2	Gen2 Filtering for Location	29
6.5.3	Antenna Configuration	29
6.5.4	Interval Configuration	29
6.5.5	Placement Configuration	29
6.5.6	Location Reporting	30
6.5.7	Frequency Configuration	30
6.6	Direction Configuration	30
6.6.1	Sectors	31
6.6.2	Gen2 Filtering for Direction	33
6.7	Data Source Diagnostics	33
6.7.1	Diagnostic Data Capture	33
6.7.2	GPO Testing	34
6.8	Data Source Profiles	34
6.8.1	Creating a Profile	35
6.8.2	Saving A Profile	35
6.8.3	Deleting A Profile	35
6.8.4	Resetting A Profile	36
6.8.5	Exporting A Profile	36
6.8.6	Importing A Profile	36

6.8.7	Refreshing a Profile	36
7	Showcases	36
7.1	Inventory Showcase	36
7.1.1	Inventory Overview	37
7.1.2	List View	37
7.1.3	Table View	39
7.1.4	Advanced Run Scenarios	40
7.1.5	Unique Tags Plot	44
7.1.6	Inventory Logs	45
7.2	Location Showcase	45
7.2.1	Location Overview	46
7.2.2	Point Display Settings	47
7.2.3	Computed Position Settings	48
7.2.4	Custom Display Settings	49
7.2.5	Custom Floor Plan Settings	49
7.2.6	Running the Location Showcase	51
7.2.7	Location Logs	53
7.3	Direction Showcase	53
7.3.1	Direction Overview	53
7.3.2	Metrics Area	54
7.3.3	Running the Direction Showcase	55
7.3.4	Direction Logs	57
7.4	Tag Memory Showcase	57
7.4.1	Tag Memory Overview	57
7.4.2	Reading Tag Memory (Step-by-Step)	60
7.4.3	Writing Tag Memory (Step-by-Step)	61
7.4.4	Tag Memory Logs	62
8	Tags of Interest	62
8.1	Adding Tags of Interest	62
8.2	JSON Format Example	62
8.3	Legacy CSV Format Example	63
8.4	Tags of Interest Window	64
8.5	TOI Import Exceptions	64
9	Application Settings	64
9.1	Update Configuration	64
9.2	Tag Logging	65
10	Uninstallation Procedure	65
10.1	Uninstall Impinj ItemTest	65
11	Software License & Notices	66
11.1	Impinj Standard License	66

1 Introduction

Impinj ItemTest version 2.6.0 is a simple, easy-to-use, Windows-compatible application enabling performance evaluation of one or many Impinj readers and/or gateways. ItemTest supports a wide range of inventory use case tests, permits basic tag memory options, and allows a user to demonstrate the direction capabilities of Impinj gateways.

ItemTest 2 is a total replacement of ItemTest 1.x. It offers enhanced performance and improved usability features. It is architected in a deeply modular fashion so future features can be added quickly.

This User Guide describes how to install, configure, and use ItemTest to perform basic tests and demonstrations of Impinj RAIN RFID. It includes detailed instructions showing how to exercise each feature (demonstrable by "Showcases") on supported Impinj readers and gateways.

2 Terms

Technical terms in this User Guide and their definitions are listed below:

Reader: An Impinj reader without embedded antennas.

- Impinj Speedway Revolution R120, R220 and R420, and Impinj R700 Readers.

Gateway: An Impinj reader with embedded antennas.

- Impinj xPortal, xSpan and xArray gateways.

Electronic Product Code (EPC): Both a unique number identifying a RAIN RFID tag and a named memory bank in which said number is stored.

Tag Identifier (TID): Both a unique, non-alterable number written to a tag by the tag's manufacturer and a named memory bank in which said number is stored.

Tag of Interest (TOI): A RAIN RFID tag for which the electronic product code (EPC) is known prior to it being read.

Data Source: An Impinj reader or gateway.

Showcase: A capability demonstration built into ItemTest. There are four Showcase types: Inventory, Location, Direction, and Tag Memory Access.

- SpeedwayR and R700 readers support the Inventory and Tag Memory Showcases only.
- xSpan gateways support all the Showcase types except Location.
- xArray gateways support all four Showcase types.

Effective/Equivalent Isotropically Radiated Power (EIRP): The effective electromagnetic power radiated by an ideal antenna emitting a spherically uniform signal strength in all directions.

3 Installation

3.1 Minimum System Requirements

ItemTest 2 requires, at a minimum, a Windows 10 machine with **Microsoft .NET Framework 4.6.1 or greater installed**. ItemTest requires the machine have a minimum of 4GB of RAM to operate but will take advantage of as much memory as is available. Long running operations and/or operations involving 100s or 1000s of tags are likely memory intensive. For those operations 8GB or more of RAM is **strongly recommended**.

3.2 Installing ItemTest

Note: It is recommended, though not required, that you uninstall any ItemTest 1.x versions prior to launching ItemTest 2.

1. Download the latest version of **ItemTest 2** from the Impinj support web site at <http://support.impinj.com>.
2. Double click the downloaded setup.exe file to launch the installer.
3. Unlike ItemTest 1.x, ItemTest 2 is an unattended install. The application will immediately start as soon as installation completes.

3.3 Installation Location

ItemTest 2's combined installation and auto-update system use the open-source tool, see Squirrel. One uncommon aspect of this installation tool is that the installation path of ItemTest is not user-settable during install.

The installation path on most machines will be: C:\Users\[UserName]\AppData\Local\ItemTest with C:\ being the typical drive letter and [UserName] being the current user's username.

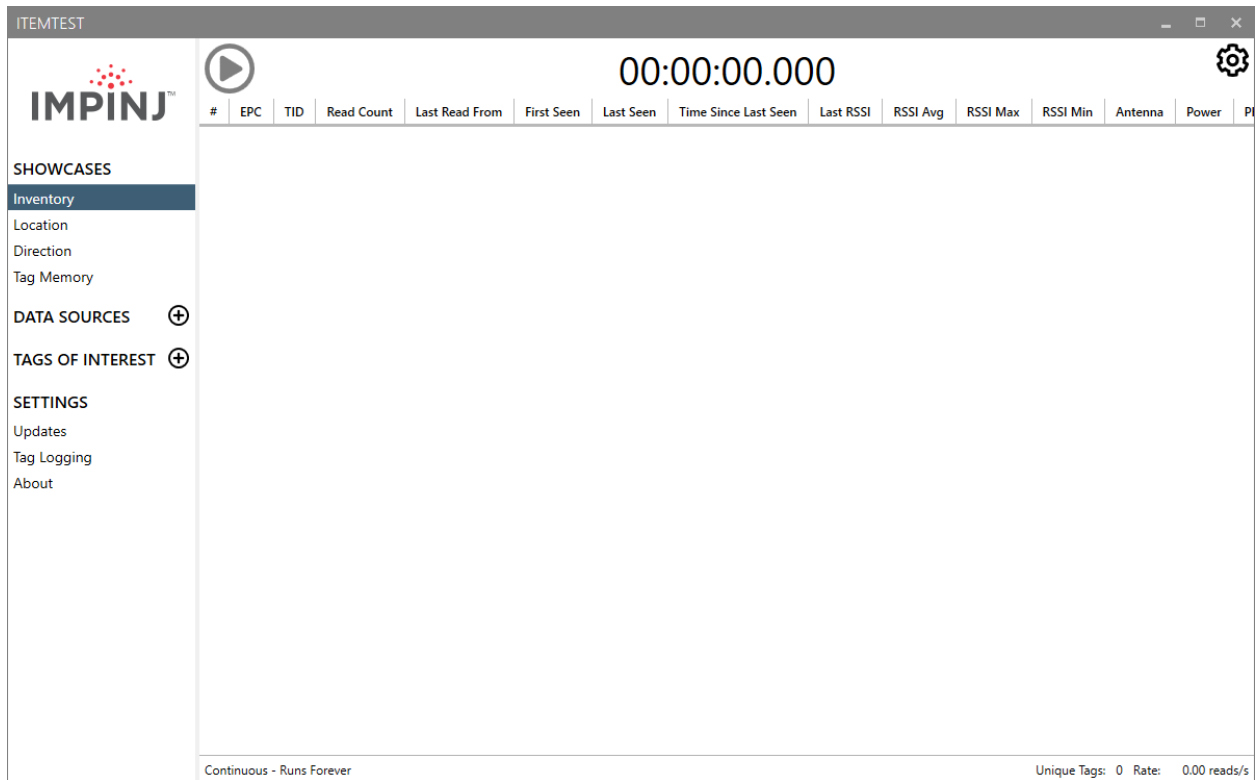
If desired, move the ItemTest folder and its contents after installation to a more convenient place, assuming the new destination is one where you have read and write access rights. Be aware that if you choose to move the ItemTest folder then you need to update the shortcuts generated at install time to point to the new path. Finally, if you change the directory, be aware that the automatic updating feature will likely reinstall any updates to the default directory referenced above.

3.4 Starting the ItemTest Application

Use this procedure to start ItemTest from a PC running Microsoft Windows 10.

1. Start ItemTest. If you do not know where your ItemTest application is located, click **Start** (the Windows icon in lower left of screen), and type **ItemTest**. Click on the application name returned. Make sure it is in fact ItemTest 2 and not ItemTest 1.x in the event if ItemTest 1.x has not been uninstalled.
2. Upon starting you will see an ItemTest splash screen. This will be visible for roughly 2 to 6 seconds. While this is visible, ItemTest is background-loading all necessary libraries.
3. Once the libraries have been completely loaded you will see the screen as shown below.

Initial ItemTest Screen



NOTE: Be aware that ItemTest will launch as many instances as you wish. We strongly advise you launch only one instance to prevent any inadvertent conflicts or confusion.

3.5 About ItemTest

To get version information about ItemTest, click the word **About** on the left-hand side under the heading **Settings**. The main view will appear with the Impinj logo. Under it will appear application version information and a button which, when clicked, brings up this document in the operating system's PDF viewer.

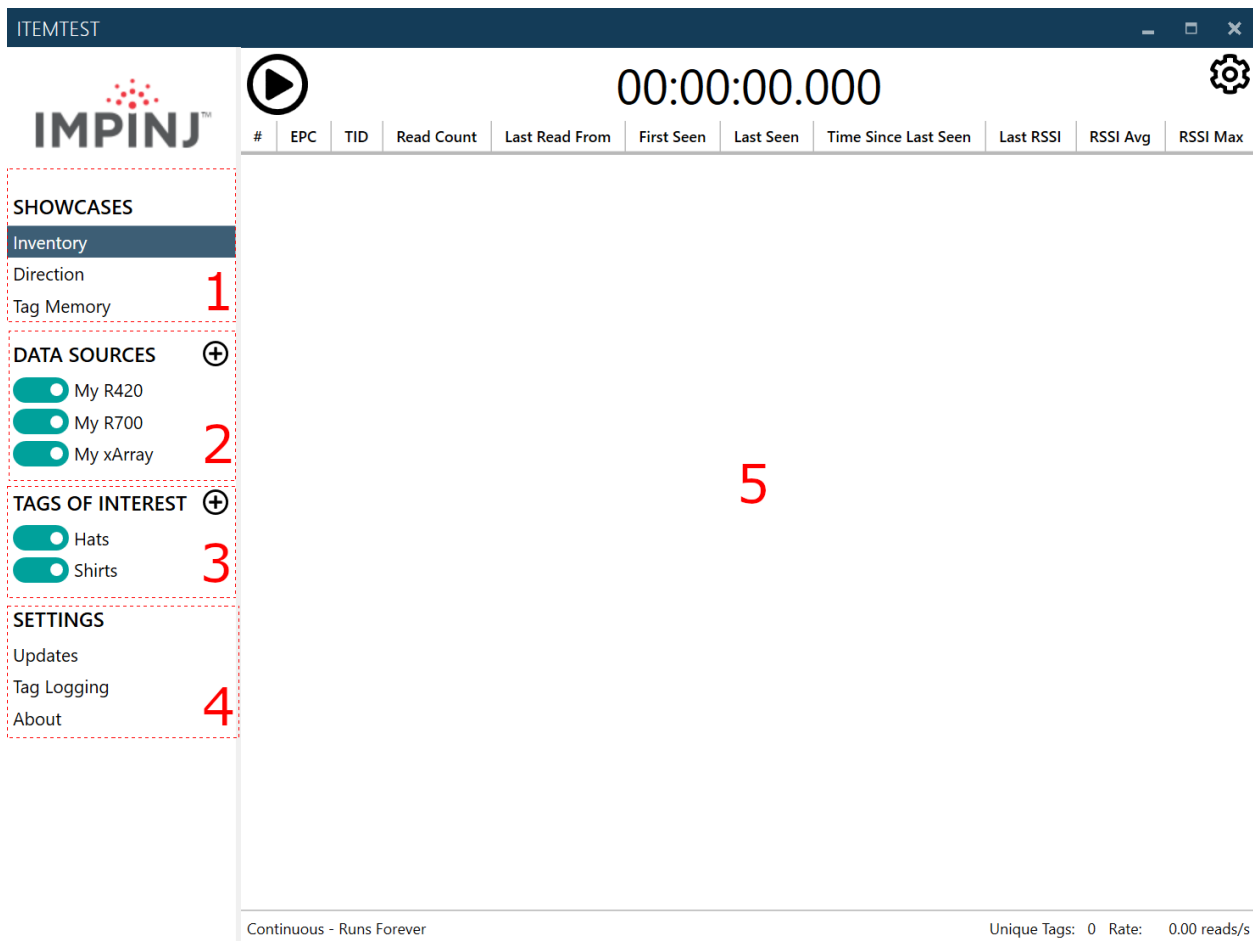
3.6 Automatic Updating

ItemTest 2 now supports automatic updating via an open-source package called Squirrel. The built-in upgrade engine will check a secured, remote Impinj site for application updates. For additional information about configuring the updater see Update Configuration.

4 Navigating the New User Interface

The User Interface is divided into grouped areas. The numbers below correspond to the numbered elements in the figure.

Navigation



Use the numbers on the figure above as a reference for the listed elements.

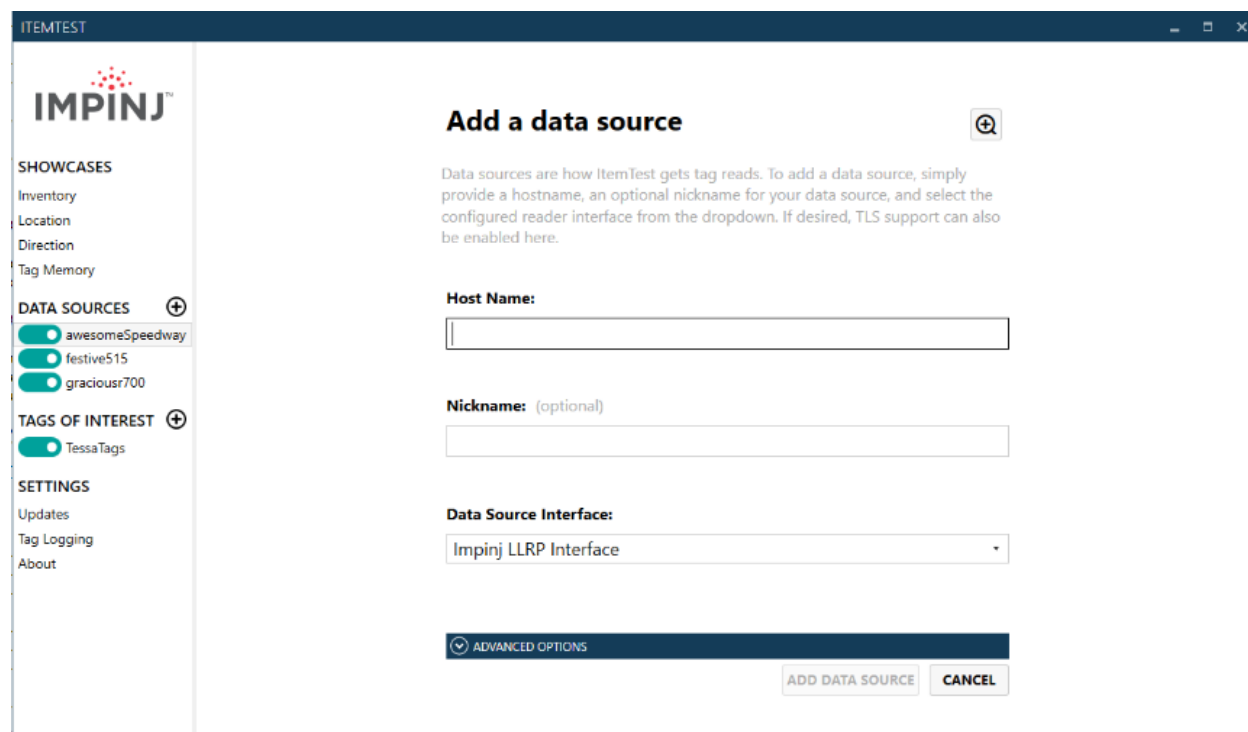
1. On the far left is the **SHOWCASES** selector section. When you select a Showcase, registered data sources that can be used for the chosen Showcase become enabled. Enabled for use is indicated by color: teal if enabled, gray if not.
2. Immediately below the **SHOWCASES** section is the **DATA SOURCES** section. The "+" button causes ItemTest to display an **Add Data Source** page in the main area.
 - In ItemTest a **Data Source** is synonymous with an Impinj reader or gateway.
 - Likewise, clicking the "x" button appearing next to a previously added data source will remove it.
3. Below the data sources section is the **TAGS OF INTEREST** section. Here you can add or remove tags of interest (TOI) files. When ItemTest receives tag reports from active data sources in a running Showcase, it will apply special coloring and grouping logic to EPCs matching in enabled TOI file(s).
4. Below **TAGS OF INTEREST** is the **SETTINGS** region. The few settings you can change here apply to the application itself, as opposed to configuring data sources.
5. To the right of the above-mentioned areas, and typically the biggest area of the UI, is the **main display** panel. The main display panel will show different content based on the current context.
 - If you click on a data source, the main display area will fill with data source settings you can change.
 - If you click on an item under **SHOWCASES**, the Showcase-specific demo will appear.
 - If you click on the gear icon, appearing in the upper right when a Showcase has been selected, ItemTest displays a settings page allowing you to configure Showcase-specific settings.

5 Adding a Data Source

The first task with a newly installed ItemTest is to add one or more readers/gateways as data sources, as these are how ItemTest retrieves information from RFID readers. ItemTest requires at least one data source to run a Showcase.

To add a data source, the reader/gateway must be online, reachable by ItemTest, and not already communicating with another client.

Add Data Source Dialog



The screenshot shows the 'ITEMTEST' application window with the 'Add a data source' dialog open. The dialog has a sidebar on the left with sections: SHOWCASES (Inventory, Location, Direction, Tag Memory), DATA SOURCES (with a '+' button and three active sources: awesomeSpeedway, festive515, gracious700), TAGS OF INTEREST (with a '+' button and one active tag: TessaTags), and SETTINGS (Updates, Tag Logging, About). The main area of the dialog is titled 'Add a data source' and contains a help icon. Below the title is a paragraph explaining that data sources are how ItemTest gets tag reads and that users should provide a hostname, an optional nickname, and select a configured reader interface. There are three input fields: 'Host Name:' (a text box), 'Nickname: (optional)' (a text box), and 'Data Source Interface:' (a dropdown menu currently showing 'Impinj LLRP Interface'). At the bottom, there is a dark blue bar with a checkmark icon and the text 'ADVANCED OPTIONS'. Below this bar are two buttons: 'ADD DATA SOURCE' and 'CANCEL'.

The "+" button immediately to the right of **DATA SOURCES** opens the **Add a data source** dialog. From this dialog, ItemTest provides two options for adding a data source, manually and through Automatic Discovery.

5.1 Using Automatic Discovery to Add a Data Source

Automatic Discovery uses mDNS to find and create a list of all Impinj Readers on the network as shown in the image below.

Automatic Discovery

To add a data source using Automatic discovery:

1. Click the **Looking Glass** button to the right of **Add a data source**.
2. From the generated list, select a data source.
3. Optionally, enter a **Nickname** to more easily identify the device. Nicknames must be unique but can be changed after the data source is added. To change the nickname, right-click on the data source and click **edit nickname**. In the dialog that appears, enter the new nickname and click **Save**.
4. Select either the **Impinj LLRP Interface** or **Impinj IoT Device Interface**. Note that the IoT Device Interface provides fewer options than the LLRP interface but allows the user to configure each antenna individually. See **Configuring Data Sources** for more information about each interface.
5. Click the **Add Data Source** button to finalize. Upon clicking, ItemTest will:
 - Initiate communications with the device
 - Retrieve the device's capabilities and use these to present and validate settings throughout the application.
 - Present an error dialog if unable to communicate with the device.

To close the list, click on the arrow button above **Online Data Sources**

Note: Automatic Discovery requires that dnssd be enabled on your server. dnssd is a node.js package for working with DNS. If you are unable to generate a list of data sources using Automatic Discovery, contact your server administrator. Many enterprises turn off dnssd for security purposes.

5.2 Manually Adding a Data Source

To add a data source manually:

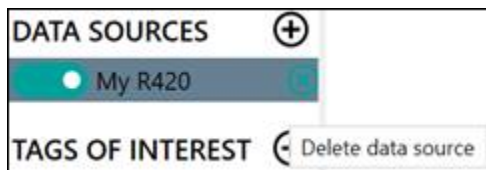
1. Click the "+" button to bring up the data source addition page.
2. To enter **Hostname**, enter either a hostname or IP address of an Impinj reader or gateway. You can also enter a port number to the host name. The default port for LLRP is 5084.

- Example 1: 192.168.1.242
 - Example 2: speedwayr-01-02-03.internal.mycompany.com
 - Example 3: 192.168.1.240:80
3. Optionally, enter a **Nickname** to more easily identify the device. Nicknames must be unique but can be changed after the data source is added. To change the nickname, right-click on the data source and click **edit nickname**. In the dialog that appears, enter the new nickname and click **Save**.
 4. Select either the **Impinj LLRP Interface** or **Impinj IoT Device Interface**. Note that the IoT Device Interface provides fewer options than the LLRP interface. See **Configuring Data Sources** for more information about each interface.
 5. Click the **Add Data Source** button to finalize. Upon clicking, ItemTest will:
 - Initiate communications with the device
 - Retrieve the device’s capabilities and use these to present and validate settings throughout the application.
 - Present an error dialog if unable to communicate with the device

6 Deleting a Data Source

If you would like to delete a data source permanently along with all associated profiles, you can hover over the data source you want to delete in the sidebar and click the “x” button.

Delete Button

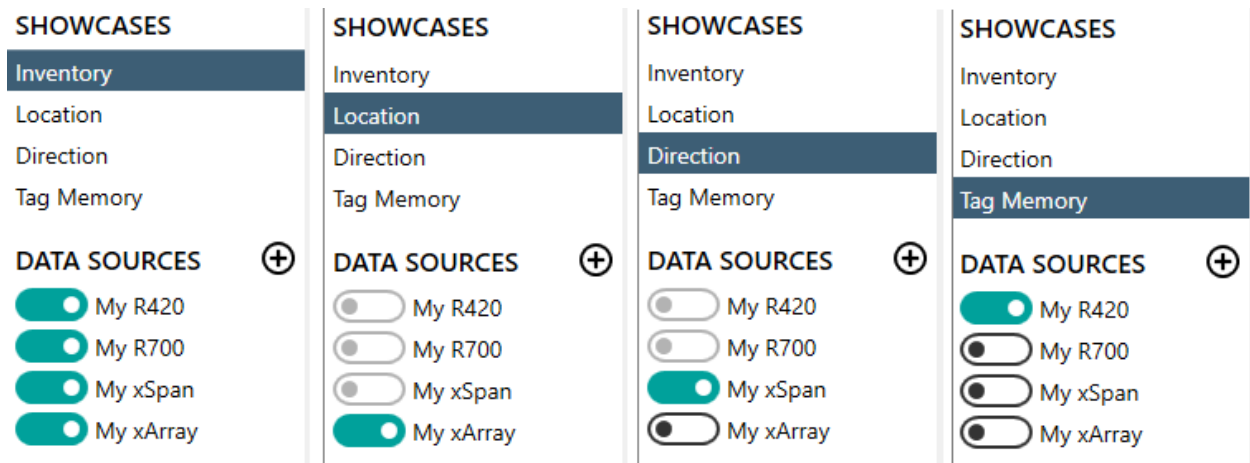


6.1 Toggling Readers On/Off

You can toggle readers on and off by clicking the toggle button next to the data source in the sidebar. Some Showcases have requirements constraining the device types used. For example, the Direction Showcase only works with a single xArray or xSpan. The Inventory Showcase, in contrast, supports all device types, and all enabled devices can be run simultaneously. Because of these Showcase-specific requirements, each Showcase has its own set of enabled readers. Therefore, depending on the data sources you have added, you may notice the enabled data sources changing between enabled and disabled states as you select different Showcases.

Below are different showcases with different enabled data sources.

Different showcases



Inventory may have any number of enabled data sources of any type. Direction may only have one data source enabled and the enabled reader must be an xSpan or xArray. Tag Memory may have only one data source enabled but allows any type of reader.

6.2 Configuring Data Sources

To achieve optimal results, configure the data sources for the Showcase you want to run. To open the configuration page for a reader, click on its name under **DATA SOURCES**. Different readers have different capabilities. The configuration page reflects these differences. For example, since only xArrays and xSpans can be configured for the Direction Showcase, The Optimize and Select buttons, under Manual Settings, only appear for those readers.

Note: It is possible to make settings changes in ItemTest if sometime after startup the reader loses its connection to ItemTest, either intentionally by sliding the Data Source's toggle to the left so it becomes gray, or unintentionally if there is network loss. The device settings will be saved to disk and reapplied when ItemTest establishes a connection with the device.

Example Configuration of an Impinj R700



Data Source Configuration

Data source configuration is a critical task in conducting effective tests and performing demonstrations. A variety of user-selectable settings control reader and tag behaviors. ItemTest offers a wide variety of configuration options. Once you have determined the optimal settings, they can be saved to a user-created “Profile”. Profiles save time and ensure consistent application of settings across repeated invocations of ItemTest. ItemTest groups settings by Showcase type.

6.4 Configuring a Data Source for Inventory

6.4.1 IoT Configuraton

ItemTest supports the IoT Device Interface, starting with the r700 reader. It is currently enabled for the Inventory showcase, and offers fewer options than the LLRP interface, but enables you to configure each antenna individually. The image below displays the options that the IoT interface provides. Note that both HTTP and HTTPS must be enabled to use the IoT interface.

Note: The IoT interface enables multiple client connections, which could result in possible conflicts.

The greatest difference between the IoT and LLRP interfaces is found in **ANTENNA CONFIGURATION**. The IoT interface enables you to add and configure each antenna individually.

To add a new antenna, click the **ADD ANTENNA** button. If there are no more antennas to add, the button is disabled and grayed out. To remove an antenna, click the **REMOVE ANTENNA** button.

Antenna options, with the exception of **RF Mode**, can be unique to each antenna. The only exception, **RF Mode**, must be the same across all antenna configurations. Following is a list of configurable options for

each antenna, with links to more detailed information for each option.

- **Antenna Port:** ItemTest automatically assigns the next available Port when you add an Antenna. To change this, click the Antenna Port dropdown list and select a port from the list of those available.
- **Search Mode:** Select from the Search Mode dropdown list. See Search Modes.
- **Session:** Default Session setting is 2. See Session.
- **Power(dBm):** Default power setting is 33. See Power and Sensitivity Settings.
- **RF Mode:** RF Mode must be consistent across all antennas. For more detailed information about RF Modes, see RF Modes.
- **Tag Population:** Default tag population is 32. For more detail see **Estimated Tag Population.
- **Enable Fast ID:** Check Enable Fast ID to get both the EPC and Tag Identifier (TID) when using tags with Impinj ICs. See FastID™ for more detail.
- **Rx Sensitivity:** Default is -80. Rx Sensitivity allows you to reduce sensitivity without reducing power.

Configure main screen - IoT Device Interface

Profile: copy_of_default

COPY RESET DELETE

ANTENNA CONFIGURATION

ADD ANTENNA

Antenna Port:	1
Search Mode:	Dual Target
Session:	Session 2
Power (dBm):	33
RF Mode:	1110
Tag Population:	32
Enable Fast ID:	<input type="checkbox"/>
Rx Sensitivity:	-80

REMOVE ANTENNA

GEN 2 FILTERING

Mode: None

	Filter 1	Filter 2
Filter:	<input type="text"/>	<input type="text"/>
Length:	0	0
Offset:	0	0
Memory Bank:	Epc	Epc
Filter Option:	Include	Include

GPI CONFIGURATION

GPI PORT	START	LEVEL	STOP	LEVEL
1	<input type="checkbox"/>	Low	<input type="checkbox"/>	Low
2	<input type="checkbox"/>	Low	<input type="checkbox"/>	Low

Gen 2 filtering for the IoT interface is unchanged from the LLRP interface. For more detailed configuration information, see Gen 2 filtering for inventory.

GPI Configuration with the IoT interface is also similar to the LLRP interface, but has removed the debounce option, as this is not supported by the IoT interface. For detailed information about GPI Ports, see GPI Configuration.

Configure main screen - LLRP Device Interface

1. Click on the text **"Inventory"** appearing at the top of the main display. This brings up the settings applicable to the Inventory mode of operation. Pay attention to the possible appearance of a scroll bar on the right hand if the content cannot fit entirely within the current viewport.
2. In the figure above there are three data sources: an xArray gateway, an xSpan gateway and an R420 reader. All three, in this example, are FCC devices. The settings depicted throughout this document reflect FCC options. This document will note any differences when using readers for other regions.
3. The tabs at the top in the example show the selected device (an R420, named speedwayr-12-06-ae) supports just one operational/Showcase mode. That mode is Inventory.

6.4.2 Manual Settings

Configure Main Screen - Manual Settings

MANUAL SETTINGS

Antennas:	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
	<div>ALL CLEAR OPTIMIZE SELECT...</div>
RF Mode:	1002 - Auto Set Dense Reader Deep Scan ▼
Search Mode:	Dual Target ▼
Enable Fast ID:	<input type="checkbox"/>
Estimated Tag Population:	32
Session:	Session 2 ▼

POWER AND SENSITIVITY SETTINGS

Power (dBm):	30 ▼
Rx Sensitivity:	-80 ▼

INDIVIDUAL ANTENNAS

1. In the **MANUAL SETTINGS** section, in the **Antennas** box, enter a comma-separated list of antennas to be used.
2. The default value is the entire list of antennas reported by the device.
3. The number of antennas will vary by device type.
 - Clicking **All** on a reader model will fill the box with the number of antennas the reader reports.
 - **Antenna Hub(s)**, external antenna multiplexers available from Impinj, when added to a reader increase the number of antennas displayed. See **Antenna Hub Port Numbering**.
 - The maximum number of **Antenna Hubs** supported on an R120 is 1, giving a potential total of 8 antenna ports.
 - The maximum number of **Antenna Hubs** supported on an R220 is 2, giving a potential total of 16 antenna ports.
 - The maximum number of **Antenna Hubs** supported on an R420 or R700 is 4, giving a potential total of 32 antenna ports.
 - xArrays, xSpans and xPortals do not support Antenna Hubs.
 - Clicking **All** when an **xSpan** is the data source fills the box with the numbers 1-13.
 - Clicking **All** when an **xArray** is the data source fills the box with the numbers 1-52.
4. To clear the **Antennas** box of its contents, click the **Clear** button.

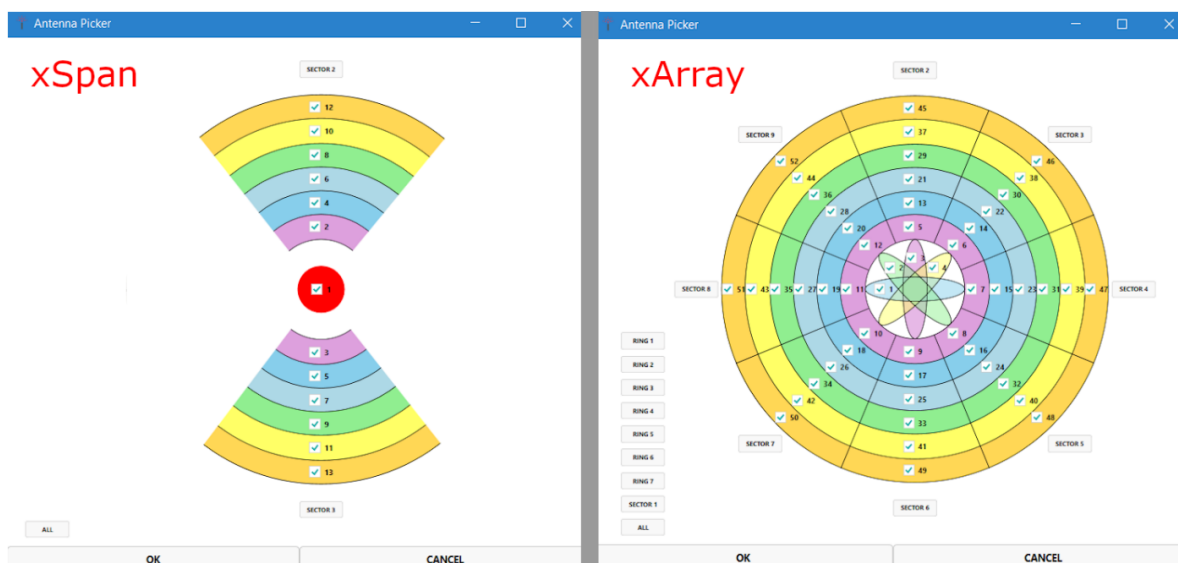
Note: Additional antennas *may* exist on certain gateway products that are not available for configuration in ItemTest. They can, however, be configured using an API such as LLRP or the Octane SDK. Please consult the device's User Guide to learn more about "virtual" antenna numbers corresponding to specific

beam polarizations.

6.4.2.1 Gateway Antenna Settings

1. When configuring an xArray, clicking the “**Optimized**” button fills the box with an antenna list Impinj engineers have determined provides an optimal firing order that balances coverage area against computation time.
2. If using an xArray or xSpan reader, you can graphically choose antennas by clicking the **Select** button. This action displays the antenna selector dialog. Below are 2 figures, one showing the display for an xSpan, the other for an xArray.

Graphical Antenna Selector – xSpan and xArray



For an xSpan:

- Click **any of the 1-13 numbered** check boxes to toggle the inclusion of that antenna.
- Click the “**Sector2**” check box to toggle antennas **2, 4, 6, 8, 10, and 12**.
- Click the “**Sector3**” check box to toggle antennas **3, 5, 7, 9, 11, and 13**.
- Click the “**All**” check box to toggle all the antennas.

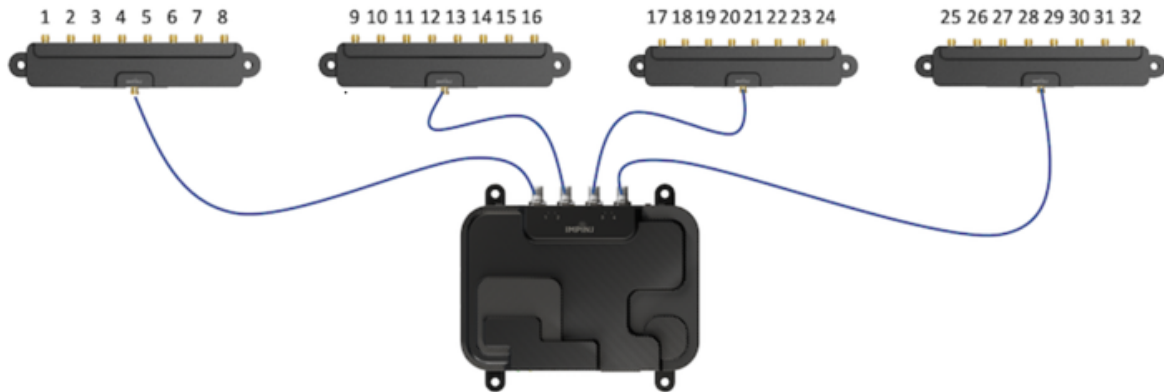
For an xArray:

- Click **any of the 1-52 numbered** check boxes to toggle the inclusion of that antenna.
- Click the “**Sector1**” check box to toggle antennas **1, 2, 3, and 4**.
- Click the “**Sector2**” check box to toggle antennas **5, 13, 21, 29, 37, and 45**.
- Click the “**Sector3**” check box to toggle antennas **6, 14, 22, 30, 38, and 46**.
- Click the “**Sector4**” check box to toggle antennas **7, 15, 23, 31, 39, and 47**.
- Click the “**Sector5**” check box to toggle antennas **8, 16, 24, 32, 40, and 48**.
- Click the “**Sector6**” check box to toggle antennas **9, 17, 25, 33, 41, and 49**.
- Click the “**Sector7**” check box to toggle antennas **10, 18, 26, 34, 42, and 50**.
- Click the “**Sector8**” check box to toggle antennas **11, 19, 27, 35, 43, and 51**.
- Click the “**Sector9**” check box to toggle antennas **12, 20, 28, 36, 44, and 52**.
- Click the “**Ring 1**” check box to toggle antennas **5, 6, 7, 8, 9, 10, 11, and 12**.
- Click the “**Ring 2**” check box to toggle antennas **13, 14, 15, 16, 17, 18, 19, and 20**.
- Click the “**Ring 3**” check box to toggle antennas **21, 22, 23, 24, 25, 26, 27, and 28**.
- Click the “**Ring 4**” check box to toggle antennas **29, 30, 31, 32, 33, 34, 35, and 36**.
- Click the “**Ring 5**” check box to toggle antennas **37, 38, 39, 40, 41, 42, 43, and 44**.
- Click the “**Ring 6**” check box to toggle antennas **45, 46, 47, 48, 49, 50, 51, and 52**.

- Click the “All” check box to toggle all the antennas.

6.4.2.2 Antenna Hub Numbering The following graphic depicts a Speedway reader with 4 Antenna Hubs enabled and the resulting antenna numbers.

Antenna Hub Port Numbering



6.4.2.3 RF Modes To set the **RF Mode**, select one of the modes from the **RF Mode** dropdown list. Values are:

- **Mode 0 - Max Throughput**
 - High Speed 640k bps backscatter data rate
 - Fastest possible data transfer rates between tag and reader.
 - Use when readers are sufficiently separated so that interference between readers is low.
 - Not supported on all devices.
- **Mode 1 - Hybrid Mode (High throughput (M=2))**
 - Hybrid 80k/160k bps
 - Provides a relatively fast read rate when there is modest interference from other readers, but a low likelihood of co-channel, adjacent-channel, or alternate-channel interferers.
- **Mode 2 - Dense Reader (M=4)**
 - Provides an intermediate read rate when the population of readers is large, and/or readers are relatively close to one another, and the likelihood of interference is moderate to high.
- **Mode 3 - Dense Reader (M=8)**
 - Hybrid 80k/160k bps
 - Provides a low read rate (~half that of Dense Reader M=4) for extreme interference environments and where tags are stationary or moving slowly.
- **Mode 4 - Max Miller (High throughput (M=4))**
 - Provides maximum reliability and read rate when the reader population is low and the likelihood of interference is low to moderate.
 - *Not all regions support this mode.*
- **Mode 1000 - AutoSet Dense Reader**
 - The reader monitors RF interference and then automatically and continuously optimizes the reader’s configuration, selecting the appropriate RF modes for the best, most reliable performance in environments where tags might be moving.
 - Not supported on all devices.
- **Mode 1002 - AutoSet Dense Reader Deep Scan**

- The reader cycles between a subset of reader modes and then continuously optimizes the reader’s configuration, selecting the appropriate configuration settings for the best, most reliable performance in environments where tags are moving little (for example, static tags).
- **Mode 1003 - AutoSet Static Fast**
 - A refinement of AutoSet Dense Reader Deep Scan; targeted toward static environments where difficult to read tags are not expected.
- **Mode 1004 - AutoSet Static Dense Reader**
 - A refinement of AutoSet Dense Reader Deep Scan; targeted toward static environments (i.e., tags are not experiencing much movement) where difficult to read tags are expected and speed can be sacrificed to ensure the weakest tags are read.
- **Mode 1005 - AutoSet Custom** - Reserved for future use.

Note: Modes 1110 - 1312, below, are new for the R700 readers. If configuring an R700 reader, new modes will appear in the **RF Mode** dropdown.

- **Mode 1110** – same as Mode 1002 (only appears for FCC R700 readers)
- **Mode 1210** – same as Mode 1002 (only appears for EU traditional band, aka EU1)
- **Mode 1310** – same as Mode 1002 (only appears for EU high power band, aka EU2)
- **Mode 1111** – same as Mode 1003 (only appears for FCC R700 readers)
- **Mode 1211** – same as Mode 1003 (only appears for EU traditional band, aka EU1)
- **Mode 1311** – same as Mode 1003 (only appears for EU high power band, aka EU2)
- **Mode 1112** – same as Mode 1004 (only appears for FCC R700 readers)
- **Mode 1212** – same as Mode 1004 (only appears for EU traditional band, aka EU1)
- **Mode 1312** – same as Mode 1004 (only appears for EU high power band, aka EU2)

Note: Not all modes may be available in the dropdown. For example, Max Miller (Mode 4) is not available for Japan device SKUs, and Mode 0 is not available on certain readers. If operating an R700, you will need to ensure you are operating in the correct mode. Some EU countries support high power channels (EU2), such as France, while others presently do not, such as Germany.

6.4.2.4 Search Modes Select the Search Mode from the **Target** dropdown list. Values are Impinj terms of art and are explained below:

- **Single Target:**
 - In Single Target, the reader first reads all tags in the ‘A’ state. After being read the tag internally moves to the ‘B’ state. Depending on the Session chosen, you may or may not read the same tags repeatedly.
 - This mode may work best in high population, dynamic environments.
- **Dual Target**
 - Instructs the device to read all tags in the ‘A’ state and once read, the tag moves to its internal ‘B’ state. Once no tags reply to the ‘A’-state query, the device reads all tags in the ‘B’ state. Upon replying to the reader, the tag moves back again to its ‘A’ state. The device repeats this process subject to any user-provided timeouts, or infinitely, if a timeout has not been provided.
 - This mode is suggested for small population, dynamic environments.
- **TagFocus™, aka Single Target w/ Suppression:**
 - Same as Single Target, but mimics Sessions 2/3 persistence times so long as the tag continues to hear the TagFocus™ command from the device. This feature allows other, weaker tags to be read.
 - This search mode requires Impinj Monza 4 or newer Impinj tag integrated circuits (ICs).
 - Once the tag no longer hears the device emitting the TagFocus™ command, it reverts to Session 1 persistence times. Meaning, it will revert quickly to the ‘A’ state and be available for another reader down to query within seconds. In practice, only about 70%-80% of moderately sized tag populations supporting TagFocus™ will behave as intended. This is largely due to tags sometimes missing the continual emission of TagFocus™ commands from the device.
- **Single Target Reset:**

- Reader inventories tags that are in inventory state B and resets the inventory flag to state A so that they will respond to reader queries.
- This is useful for high-throughput applications when used in conjunction with Single Target and session 2 or 3, which have relatively long decay times in the absence of RF, and unbounded decay times when powered.
- **Dual Target Select B to A:**
 - Inventories all tags in the A state and once no more tags are found in the field of view in the A state, the reader issues a command to switch all tags from the B state back to the A state.
 - Use this search mode for applications with large numbers of tags entering and exiting the field randomly.

6.4.2.5 FastID™ If using tags with Impinj Monza or M700 chips, you can use Impinj’s patented FastID™ feature. FastID™ enables an Impinj tag IC to append its TID to its backscattered EPC. This is the fastest way to get both the EPC and TID. Check the **Enable Fast ID** checkbox to receive the tag’s EPC and internal Tag Identifier (TID) at the same time when using tags with Impinj ICs. “Impinj Serialized TID” is an older name with the same meaning as the official term, FastID™.

Note: If reading non-Impinj tags, **Enable FastID** will return tag TIDs but at a *substantially* slower rate versus reading Impinj-based tags. This is due to the device having to issue a separate command to read TID memory.

6.4.2.6 Estimated Tag Population Enter an estimate of the expected number of tags in the **Estimated Tag Population** box.

- Set this to a power of two and choose a value relatively close to the average number of tags the device is expected see at any given time.
- The value must be a 16-bit positive integer.
- If there is variability in the number of tags that may be seen, always choose the lowest value in the range. It is more efficient for the device to inventory a tag population exceeding the expected value than it is to set the value too high.
- The default value is 32.

6.4.3 Power and Sensitivity Settings

- You can set the power and sensitivity for all antennas or set both for individual antennas. The maximum permissible output power varies by region, device type, and power source (i.e., if the reader is powered by brick, POE or POE+). To make reader-wide changes (i.e., use the same values for all antennas), under **POWER AND SENSITIVITY SETTINGS**, select the RF power of the reader from the **Power (dBm)** dropdown list.

Power Settings

Inventory Direction Diagnostics

Profile: Default

IMPORT EXPORT COPY RESET DELETE

MANUAL SETTINGS

Antennas: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13

ALL CLEAR OPTIMIZE SELECT...

RF Mode: 1002 - Auto Set Dense Reader Deep Scan

Search Mode: Dual Target

Enable Fast ID: ☐

Estimated Tag Population: 32

Session: Session 2

GEN 2 FILTERING

Mode: None

Filter 1 Filter 2

Filter:

Length: 0 0

Offset: 0 0

Memory Bank: Reserved Reserved

Filter Option: Match Match

POWER AND SENSITIVITY SETTINGS

Power (dBm): 30

Rx Sensitivity: -80

INDIVIDUAL ANTENNAS

FREQUENCY SETTINGS

Reduced Power: Disabled

LOW DUTY CYCLE

☐ Enable

Empty Field Timeout (ms): 500

Field Ping Interval (ms): 200

- In certain environments, you may wish to lower power to reduce spectrum congestion, or to reduce the read range of tags.
- Power levels can be set individually by clicking the **INDIVIDUAL ANTENNAS** drop down. All antennas currently supported by the selected reader will appear. Here you can set power levels by antenna, which can be useful for fine-tuning the reader in certain use cases. *Remember to use the scroll bar on the right to scroll any antennas into view that might not be visible, especially when configuring an xArray due to its high antenna count.*
- The maximum value you will see in the power dropdown depends on the type of device and its source of power. You are encouraged to read the User Guide for your device to learn more about the conditions governing the maximum power displayed. As an example, an Impinj R700 powered via a PoE+ (802.3at) source supports a higher maximum power output than one powered via a POE (802.3af) source.
- The maximum radiated power varies by region. Selecting 30 dBm won't necessarily produce 30 dBm of power as measured at the antenna port. The 30 dBm figure accounts for local radio regulations and, in the case of gateway products, the antenna gain.
- For all devices, the default **Power (dBm)** value is 30 dBm.

Individual Tx Power Configuration

Hostname: xarray-14 Region: FCC

Inventory Direction Location Diagnostics

Profile: Default

IMPORT EXPORT COPY RESET DELETE

MANUAL SETTINGS

Antennas: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20

ALL CLEAR OPTIMIZE SELECT...

RF Mode: 1002 - Auto Set Dense Reader Deep Scan

Search Mode: Dual Target

Enable Fast ID: ☐

Estimated Tag Population: 32

Session: Session 2

GEN 2 FILTERING

Mode: None

Filter 1 Filter 2

Filter:

Length: 0 0

Offset: 0 0

Memory Bank: Reserved Reserved

Filter Option: Match Match

POWER AND SENSITIVITY SETTINGS

Power (dBm): 30

Rx Sensitivity: -80

INDIVIDUAL ANTENNAS

Antenna	Tx Power	Rx Sensitivity
Antenna 1	30	-80
Antenna 2	30	-80
Antenna 3	30	-80

FREQUENCY SETTINGS

Reduced Power: Disabled

LOW DUTY CYCLE

☐ Enable

Empty Field Timeout (ms): 500

Field Ping Interval (ms): 200

SAVE CANCEL

- Sensitivity per antenna is configurable and appears directly under the power entry box under the section titled **INDIVIDUAL ANTENNAS**.
- A sensitivity filter, either device-wide or per antenna, is set in the **Rx Sensitivity** box. In certain environments, you might want to reduce sensitivity to limit range without reducing power.

Note: For devices *other than* the Impinj R700, the most sensitive value permitted is -80 dBm. This corresponds to ItemTest 1's "Max Sensitivity" value. Note that the Impinj R700 reader, supports a maximum sensitivity of -90 dBm.

6.4.4 GPI Configuration

ItemTest allows inventory operations to be started and stopped by GPI signals. Using ItemTest, a user can validate proper GPI signaling prior to deploying reader and GPI-enabled triggering devices, such as photo eyes and infrared "people detectors."

GPI Triggering



- #### 6.4.5 Gen2 Filtering for Inventory

Mode

- Choose the logical operator to apply between filters. Filters can be applied individually (e.g., just apply Filter 1) or combined using Boolean AND and OR operations, with the operands being the filter values. See **Gen2 Filters**.

Filter Verification

- Click the dropdown box to select an option. Choices are Enable, Disable, or Reader Default. By default, filter verification is disabled on the Speedway. It is enabled by default on the R700.

Filter

- This is the **hexadecimal string** (e.g., "F71F8F22") used to Select a population of tags before inventorying.
- Each character is a hexadecimal representation of a 4-bit nibble.

Bit Length

- Since the filter is applied bit-by-bit, the length is the number of bits represented by the filter. For example, you would enter 16 if the filter were 4 hex characters, such as "ABCD".
- Default value is set to 0.
- The value must be an integer.
- This value is automatically calculated for you based on the Filter value.

Gen2 Filters

The screenshot shows the IMPINJ Inventory Diagnostics web interface. The top bar includes the hostname '10.146.1.187' and region 'FCC'. The main content area is divided into two panels. The left panel, titled 'MANUAL SETTINGS', contains fields for 'Antennas' (1, 2, 3, 4), 'RF Mode' (1110), 'Search Mode' (Dual Target), 'Enable Fast ID' (unchecked), 'Estimated Tag Population' (32), and 'Session' (Session 2). The right panel, titled 'GEN 2 FILTERING', shows a 'Mode' dropdown set to 'Filter 1 and 2'. It contains two filter configuration sections. Filter 1 has a 'Filter' value of 'F71F8F22', 'Bit Length' of '32', 'Offset' of '32', 'Memory Bank' of 'EPC', and 'Filter Option' of 'Match'. Filter 2 has a 'Filter' value of 'FFAA', 'Bit Length' of '16', 'Offset' of '32', 'Memory Bank' of 'TID', and 'Filter Option' of 'Don't Match'. Buttons for 'IMPORT', 'EXPORT', 'COPY', 'RESET', and 'DELETE' are located at the top right of the interface.

Offset

- The bit pointer is an offset from the selected memory bank that tells the reader where in memory to start applying the filter.
- Default value is set to 0. For typical applications you should enter 32 as the EPC starts at bit 32 in the EPC memory bank.
- Must be a non-negative integer.

Memory Bank

- EPC is the memory partition containing the EPC.
- TID is the memory partition containing the read-only tag identifier written by the IC manufacturer.
- User is the memory partition containing the user memory (if applicable).
- Reserved is the memory partition containing reserved memory (if applicable).


Filter Option

- A dropdown with just two values: **Match** or **Don't Match**. This is used to either select or deselect tag populations. You are encouraged to consult GS1 Gen2 specifications for additional clarity on these concepts.

6.4.6 Truncated Reply

- If you are using an Impinj R700, ItemTest supports configuring the reader for truncated reply. See **Truncated Reply Configuration**. This feature is designed to work with homogeneous tag populations, where “homogenous” means all tags have identical EPC lengths, for example, 96 bits if reading tags encoded as SGTIN-96.
- Truncated reply is most effective with tags supporting the Gen2V2 standard.
- Truncated reply may be used to substantially increase the tag read rate by reducing the number of bits a tag backscatters. Click the **Enable** checkbox to turn on truncated reply, only if you are well versed in its implications.
- There are two ways to use truncated reply:
 - The first is when there is a known EPC prefix common to all the tags. This is the Mask. When truncated reply is enabled and a **Mask** is set, the reader produces a full EPC by concatenating the “known” prefix (i.e., the portion you set) with the partial part of the EPC backscattered by tags. When using this method of truncated reply, **Gen2 Filters are NOT permitted**. Said alternatively, the presence of a **Mask** prohibits Gen2 filtering.
 - The second option is termed a “zero-length truncated reply.” zero-length refers to the **mask** being empty. Here there is no foreknowledge about the tags’ prefixes and the user is interested in obtaining only the trailing bits of EPCs. In this case, the reader reports only the trailing portion of the EPC. With zero-length EPC enabled, the user may still use **Gen2 Filters**.
- In both methods, the user must enter the expected length of the EPC, so the reader knows where the backscatter stops. If a tag population has tags with varying lengths, do not use truncated reply!
- ItemTest supports Truncated Reply only in the Inventory Showcase, and only on R700 readers.

Truncated Reply Configuration

 **TRUNCATED REPLY CONFIGURATION**

☒ **Enable**

Gen2 V2 Tags Only: ☒

Tag Mask (optional):

EPC Length (in words):

Bit Pointer:

Gen2 V2 Tags Only

- Check this box if the tags to be inventoried are all Gen2 V2 tags. Enabling this setting ensures maximum data integrity due to an additional CRC check. See the “EPC™ Radio-Frequency Identity

Protocols Generation-2 UHF RFID Specification for RFID Air Interface Protocol for Communications at 860 MHz – 960 MHz Version 2.0.1 Ratified” document for details.

- **If this box is checked, non-Gen2 V2 tags will not be successfully decoded.**
- Must be checked in order to use FastID™ with truncated reply at the same time.
- Impinj chips tag ICs currently supporting this setting as of May 2020 are:
 - Impinj Monza R6-P
 - Impinj M700

Note: If *any* doubt exists about a tag population’s Gen2V2 compatibility, ***please do not enable***.

Tag Mask (optional)

- This is the **hexadecimal string** (e.g., "AAAA") representation of the bit sequence a tag must have in its EPC memory bank. The initial position to begin the match is determined by the **Bit Pointer**.
- The end of the mask is where matching tags begin backscattering their EPC contents.
- If left empty, **Gen2 Filters** may be used, but if the tag mask length is non-zero, **Gen2 Filters** must be disabled.
- Each character is a hexadecimal representation of a 4-bit nibble.

EPC Length (in words)

- This value must be set correctly to observe meaningful improvement in tag read rate.
- Specify the EPC length, in 16-bit words, all tags in the field of view are expected to have. Only tags of this length can be decoded properly. Tags with EPCs that are **not** this length will respond **but will not be successfully decoded**.
- Default value is set to 0.
- Must be an integer. Remember the **EPC Length** is specified in *words*, not bits.

Bit Pointer

- The bit pointer is the offset in EPC memory to start applying the **Mask**.
- The default value is set to 32 as a convenience to you because the EPC starts at bit 32 (i.e., start of the 3rd word) in the EPC memory bank.
- Must be a non-negative integer.

6.4.7 Protected Mode

ItemTest supports Protected Mode for the Impinj M700 series of tags. When in Protected Mode, tags will not listen to or respond to any commands. They are hidden from inventory until they receive the appropriately formatted command and correct password. The **Protected Mode** setting in ItemTest enables you to access those tags so that they are included when an Inventory Showcase is run.

As shown in the figure below, you can configure Protected Mode in the settings page of your reader under the following conditions:

- You have an R700 Reader, running the LLRP interface.
- You have one or more Protected Mode-compatible tags encoded with a single password.
- You know that password.

Note: Protected Mode requires FastID.

Protected Mode in Settings

The screenshot displays a configuration interface with several sections:

- Search Mode:** Dual Target
- Enable Fast ID:** ☐
- Estimated Tag Population:** 32
- Session:** Session 2
- Report Phase Angle:** ☐
- Report Doppler Frequency:** ☐
- POWER AND SENSITIVITY SETTINGS**
 - Power (dBm):** 30
 - Rx Sensitivity:** -90
 - Enable Max Sensitivity:** ☒
- INDIVIDUAL ANTENNAS**
- GPI CONFIGURATION**

GPI PORT	STAR	LEVEL	STOP	LEVEL	DEBOUNCE (M)
1	<input type="checkbox"/>	Lo	<input type="checkbox"/>	Lo	20 + -
2	<input type="checkbox"/>	Lo	<input type="checkbox"/>	Lo	20 + -
- Filter:** [Empty]
- Bit Length:** 0
- Offset:** 32
- Memory Bank:** EPC
- Filter Option:** Match
- TRUNCATED REPLY CONFIGURATION**
 - Enable:** ☐
 - Gen2 V2 Tags Only:** ☒
 - Tag Mask (optional):** [Empty]
 - EPC Length (in words):** 0
 - Bit Pointer:** 32
- PROTECTED MODE** (highlighted with a red dashed box and a red arrow)
 - Read Protected Mode Tags:** ☐
 - Access Password:** [Empty]
- LOW DUTY CYCLE**
 - Enable:** ☐
 - Empty Field Timeout (ms):** 500
 - Field Ping Interval (ms):** 200

To configure Protected Mode:

1. Click the **Read Protected Mode Tags** check box.
2. Enter the password in the **Access Password** text box.
3. Ensure that **FastID** is enabled under Manual Settings.

The protected tags will appear in Inventory the next time Inventory Showcase is run.

Note: Activating Protected Mode from the main configuration page is most useful when you have a number of protected tags with the same password. It allows you to temporarily remove protection from those tags in order to read them but provides for no other interaction. To actually turn protected mode on or off for a specific Protected Mode-compatible tag, go to the Tag Memory Showcase.

6.4.8 Frequency Settings

- When using an **FCC** device **ONLY**, you can set **Reduced Power** frequencies under **Frequency Settings** by choosing up to 10 of them. The reader will transmit a maximum of 10 dBm when hopping to these frequencies. By marking frequencies as low power, you may mitigate potential interference with some legacy 900 MHz FCC equipment. “Carving out” these channels is likely to reduce reader performance, so you should only set these frequencies when there is provable interference.
 - Available only on FCC devices
 - Defaults to “Disabled” (i.e., no channels will have lowered power)
 - If any frequency channels are checked in the dropdown, the reduced power configuration will become “Enabled”

- You can select a maximum of 10 frequencies with reduced power.
- When using a reader supporting fixed frequencies (e.g., EU1, EU2, JPN, GX2, etc.) you can specify the frequencies the reader will use under **Frequency Settings**. By staggering the choice of channels between adjacent readers, you can reduce the amount of interference between devices, if desired.
- **Defaults to using a single channel for fixed-frequency regions.**
 - Example: Channel 1 for China readers, Channel 3 for EU readers
- **Use Specified Frequencies:** if checked, the frequency channel checkboxes become enabled and you can specify which channels to use for channel hopping, as shown in the image below.

Use Specified Frequencies

⬆ GEN 2 FILTERING

Mode:	None	
	Filter 1	Filter 2
Filter:		
Bit Length:	0	0
Offset:	32	32
Memory Bank:	EPC	EPC
Filter Option:	Match	Match

⬆ FREQUENCY SETTINGS

Use Specified Frequencies: Disabled

☐ 865.7 MHz
☐ 866.3 MHz
☐ 866.9 MHz
☐ 867.5 MHz

⬆ LOW DUTY CYCLE

☐ **Enable**

Empty Field Timeout (ms): 500

Field Ping Interval (ms): 200

Note: See the Impinj Octane LLRP guide for information about the default channel for each region.

6.4.9 Low Duty Cycle

Click the **Low Duty Cycle Enable** checkbox to enable low duty cycle mode. Low duty cycle mode allows the device to temporarily turn off RF to reduce power consumption when tags are not in the field of view. In low duty cycle mode, the device stops emitting RF after reading no tags for the user specified **Empty Field Timeout**, in milliseconds. Then every specified **Field Ping Interval** milliseconds, the device emits a quick burst of RF searching for the presence of any tag. If no tags respond to this quick search, the device resumes its cycle of RF sleeping and periodic check-for-tags-wake-up. If any tags are found, the device inventories all tags and only then resumes its sleep once the **Empty Field Timeout** passes without a tag response.

- Low duty cycle: **Empty Field Timeout (ms)**:
 - This is the amount of time that must pass without seeing any tags before entering low duty cycle mode.
 - The value must be a positive integer.
- Low duty cycle: **Field Ping Interval (ms)**:
 - Once in low duty cycle mode, this is how often the reader should perform a quick check for tags. If a tag is detected, the device will exit low duty cycle mode and run normally.
 - The value must be a positive integer.

Click the “**Save**” button to apply all configuration settings to the selected device.

6.5 Location Configuration

To configure an xArray data source for location, click an xArray data source (Step 1) and then the Location tab (Step 2) as shown in the figure below. Please note that all subsections within this section will refer to this figure.

Location Configuration Screen

The screenshot shows the IMPINJ web interface for configuring a reader. The 'Location' tab is active, and the 'xarray-11-2f-5e.im...' data source is selected. The configuration panels are as follows:

- GEN 2 PARAMETERS:** RF Mode (1002 - Auto Set Dense Reader Deep Scan), Session (Session 2), Power (dBm) (30).
- GEN 2 FILTERING:** Mode (None), Filter 1 and Filter 2 (empty), Bit Length (0), Offset (32), Memory Bank (EPC), Filter Option (Match).
- ANTENNA CONFIGURATION:** Disabled Antennas (empty), SELECT, CLEAR buttons.
- INTERVAL CONFIGURATION:** Compute Window (s) (10), Tag Age Interval (s) (20), Update Interval (s) (5).
- PLACEMENT CONFIGURATION:** Height (cm) (400), X Location (cm) (0), Y Location (cm) (0), Orientation (degrees) (0).
- LOCATION REPORTING:** Enable location update report, Enable location exit report, Enable location entry report (all checked).
- FREQUENCY SETTINGS:** Frequency Configuration (Disabled).

6.5.1 Gen2 Parameters

On the **Location** tab, select the Reader Operation mode for the Gen 2 parameters from the **Mode** dropdown list. Values include:

- In the **RF Mode** drop down choose an appropriate mode. See **RF Modes** for detailed information.
- In the **Session** drop down you can choose only 2 or 3. The reader’s location algorithm prohibits using session 0 or 1.

- **Power (dBm):** this value represents the output power.

6.5.2 Gen2 Filtering for Location

See **Gen2 Filtering for Inventory** for detailed information.

6.5.3 Antenna Configuration

- In **Disabled Antennas** you may choose up to a maximum of 24 antenna/beams to disable. Users may choose to disable select beams to a) better confine the read zone and/or b) optimize the time spent on antennas/beams where tags are most likely to be present. By disabling beams that are likely to have fewer tags, the reader does not waste time reading areas producing little data.

6.5.4 Interval Configuration

- In **Compute Window** enter a value to control the amount of time over which the location is computed. Fundamentally, this value is loosely related to the amount of history the algorithm uses to calculate the position of each tag. Slow moving and stationary items typically will do better with longer compute windows, while fast moving items should have shorter windows.
- Defaults to 10 seconds. This value is reasonable for tracking items at a slow walking speed.
- In **Tag Age Interval** enter a value to control the length of time a tag must remain un-read before being reported as having exited.
 - Defaults to 20 seconds.
- In **Update Interval Seconds** enter a value to control how often the reader emits location reports, including diagnostics.
 - Default is 5 seconds

6.5.5 Placement Configuration

- In **Height (cm)** enter the height of the xArray above the height where most tags will appear when measured directly under the xArray. As an example: if tagged items are moving through on a plastic cart that has two levels, where the bottom level is 20 cm above the ground and the top level is 90 cm above the ground, you may want to first take the mid-point $((90 + 20) \div 2) = 55\text{cm}$. And assuming that the xArray in this example is installed so that the bottom of it is 320cm above the ground, then a reasonable value for **Height (cm)** would be $320\text{cm} - 55\text{cm} = 265\text{cm}$. In other words, the height you enter is the distance between the xArray and where most tags are likely to be relative to the xArray. Caution: *this value is **not** the height of the xArray above the floor, unless the majority of tagged items are likely to be actually at floor-level.*
- For **X location (cm)** enter a value representing the distance on your x-axis of this xArray from whatever you have chosen to be your origin.
- For **Y location (cm)** enter a value representing the distance on your y-axis of this xArray from whatever you have chosen to be your origin.
- For **Orientation (degrees)** enter a value that represents the anti-clockwise degree of rotation with respect to the 0 orientation, where the LEDs are aligned to the positive direction of the Y Axis. Please consult the xArray User Guide for additional information for more detailed information.

6.5.6 Location Reporting

- Check the box for **Enable location update** report if you want to receive update reports per the interval specified above. If this box is unchecked, then the only reports you will receive are Entry and Exit reports provided you have checked the boxes for those reports.
- Check the box for **Enable location Exit report** to receive Exit reports.
- Check the box for **Enable location Entry reports** to receive Entry reports.
- If no boxes are checked (*not* recommended), then you will receive no location reports whatsoever.

6.5.7 Frequency Configuration

If you are in a non-hopping region then you can choose the frequencies/channels you wish to use. For specific information please see **Frequency Settings**.

6.6 Direction Configuration

xSpan and xArray gateways natively support detecting the direction of tag travel. Configuration settings made in the Direction Configuration control how the tag direction feature operates.

Click an xArray or xSpan device from **DATA SOURCES** list to configure the device for use in the direction Showcase. Next you will click the word **DIRECTION** appearing between the faint words **INVENTORY** and **DIAGNOSTICS**. This action places you into the direction configuration screen. Settings made here control parameters used by the direction-detection algorithm residing on the gateway.

Direction Configuration Screen

ITEMTEST

Hostname: xspan-11-b7-14.i4j.io Nickname: My xSpan Region: FCC

Inventory Direction Diagnostics

Profile: Default

IMPORT EXPORT COPY RESET DELETE

SHOWCASES

- Inventory
- Location
- Direction
- Tag Memory

DATA SOURCES

- My xArray
- My xSpan
- My R420

TAGS OF INTEREST

SETTINGS

- Updates
- Tag Logging
- About

DIRECTION CONFIGURATION

Tag Age Interval: 20

Tag Update Interval: 5

Tag Population Limit: 0

Field of View: Wide

Direction Mode: High Performance

Power (dBm): 30

GEN 2 FILTERING

Mode: None

Filter 1 Filter 2

Filter:

Bit Length: 0 0

Offset: 32 32

Memory Bank: EPC EPC

Filter Option: Match Match

SAVE CANCEL

Only one direction-supporting gateway can be used in the direction Showcase.

- **Tag Age Interval:** this value sets the amount of time a tag will be stored in the gateway's internal processing database. Once a tag is no longer visible for **Tag Age Interval** seconds, the reader sends a tag Exit Report. If the tag is read later, ItemTest treats it as a *new* tag.
 - Must be an integer
 - Recommended value is between 2 and 5
- **Tag Update Interval:** this value sets the amount of time between Update Reports sent by the gateway. Update Reports contain the Current Sector for the tag.

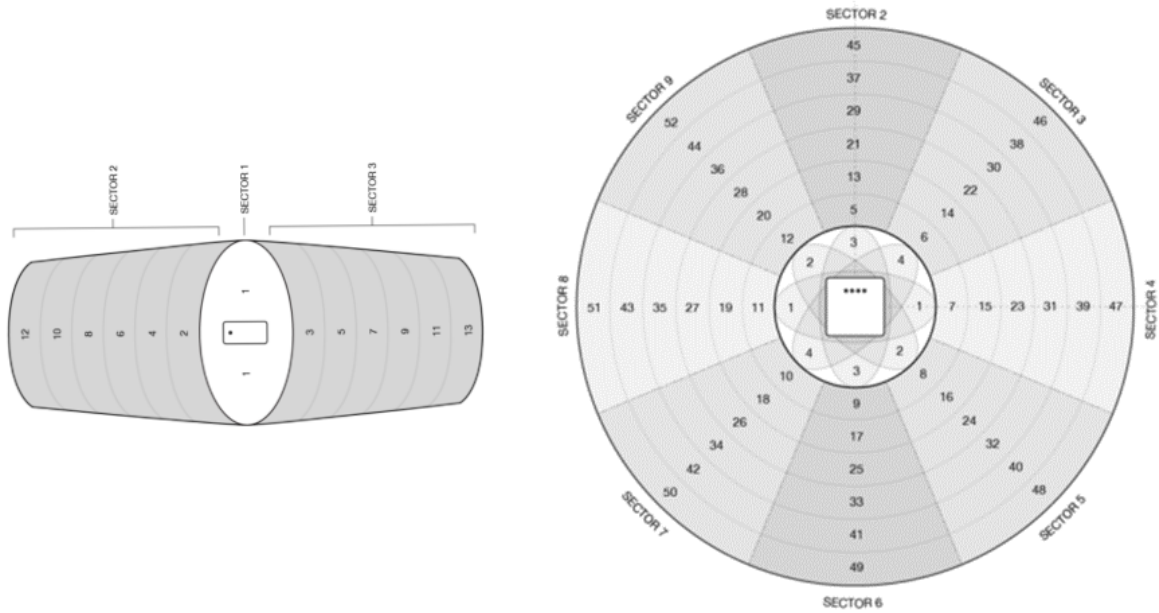
- Recommended value is 2
- **Tag Population Limit:** this value sets the `USER_OVERFLOW` threshold. When a gateway sees more tags than the Tag Population Limit, it will send a `USER_OVERFLOW` message. The purpose of this warning is to alert a user when tag populations may be approaching levels where accuracy suffers. See the Impinj Octane LLRP document for further information about overflows.
 - A value of 0 means never generate a `USER_OVERFLOW` warning
 - Currently, ItemTest does nothing when receiving a `USER_OVERFLOW` warning from a gateway.
 - Value must be less than 50 as the internal `SYSTEM_OVERFLOW` is hardcoded to 50. The `SYSTEM_OVERFLOW` is the maximum number of tags the gateway can simultaneously track while still providing reliable direction data.
- **Field of View:** this value sets the beams the gateway uses to track tag direction. See the illustration, **Beams and Sectors**, below.
 - **Wide:** if an xSpan, beams 8 and 9 are used, if an xArray more than 2 sectors can be enabled
 - **Narrow:** if an xSpan, beams 4 and 5 are used, if an xArray then 2 sectors are used
- **Direction Mode:** this value sets the underlying RF Modes used by the gateway to track tags.
 - **High Sensitivity:** use this mode when tags may be difficult to read, the tag counts are generally low, and/or when the transitioning speed is approximately human walking speed.
 - **High Performance:** use this mode when tags are relatively easy to read, tags may be moving at speeds faster than a human walk, and/or where the tag count is 20 or more.
- **Power (dBm):** this value sets the power applied to all active beams. Select a value from the dropdown list.
 - In certain environments, you may wish to lower power to reduce spectrum congestion, or to reduce the read range of tags.
 - The maximum value you will see in the power dropdown depends on the type of device and its source of power. You are encouraged to read the User Guide for your device to learn more about the conditions governing the maximum power displayed.
 - The maximum radiated power varies by region. Selecting 30 dBm won't necessarily produce 30 dBm of power as measured at the antenna port. The 30 dBm figure accounts for local radio regulations and the antenna gain.
 - For all devices, the default **Power (dBm)** value is 30 dBm.

6.6.1 Sectors

Both xSpans and xArrays have the concept of “sectors.” Sectors represent discrete coverage areas resulting from one or more RF beam patterns. The xSpan has just two sectors, comprised of 13 beams in total. The xArray has 9 sectors, comprised of 52 beams in total. For direction detection, the center sector is not configurable by the user for either device type.

The following image is an illustration of beams and sectors. xSpan is on the left. xArray is on the right.

Beams and Sectors



- ItemTest will not present a sector selector option when the data source is an xSpan.
- ItemTest will present a sector selector when the data source is an xArray. It will appear as a numbered disc whose sectors can be clicked to enable or disable sectors for use as illustrated in the image below.

xArray Sector Selector

Hostname: xarray-11-fd-19.14j.io Nickname: My xArray Region: FCC

Inventory Location Direction Diagnostics

Profile:

DIRECTION CONFIGURATION	
Tag Age Interval:	<input type="text" value="20"/>
Tag Update Interval:	<input type="text" value="5"/>
Tag Population Limit:	<input type="text" value="0"/>
Field of View:	<input type="text" value="Wide"/>
Direction Mode:	<input type="text" value="High Performance"/>
Power (dBm):	<input type="text" value="30"/>

SECTORS

GEN 2 FILTERING	
Mode:	<input type="text" value="None"/>
Filter:	<div>Filter 1</div> <input type="text"/>
Bit Length:	<div>Filter 2</div> <input type="text"/>
Offset:	<input type="text" value="32"/>
Memory Bank:	<input type="text" value="EPC"/>
Filter Option:	<input type="text" value="Match"/>

- Using the selector disk, 2, 3 or 4 sectors can be selected, but no two enabled (light blue color) sectors may touch.

6.6.2 Gen2 Filtering for Direction

To understand the details of using Gen2 filters, see **Gen2 Filtering for Inventory**.

6.7 Data Source Diagnostics

The diagnostics section of ItemTest is where users configure diagnostic report collection (to be sent to Impinj engineers for analysis when doing complex troubleshooting) and to do simple GPO signaling tests.

6.7.1 Diagnostic Data Capture

Click the **Diagnostics** tab to capture both RDD and FDD data streams, and to test GPOs, for the selected device.

Diagnostics and RDD/FDD Capture

ITEMTEST

Hostname: speedwayr-11-05-9e.i4j.io Nickname: My R420 Region: FCC

Inventory Diagnostics

DIAGNOSTICS

START STOP

Destination: C:\Users\your_name\Documents\ItemTest\Diagnostics BROWSE...

Prefix: MyPrefix

Capture window: 1 min

GPO CONTROL

☒ GPO 1 ☐ GPO 2

☐ GPO 3 ☐ GPO 4

SAVE

CANCEL

1. In the **Destination** field in the **DIAGNOSTICS** box, click the **BROWSE** button to select the folder where ItemTest stores capture data.
 - ItemTest will create a master folder above the one you select, and the name of the containing folder will be the device's hostname.
 - ItemTest keeps the files open while streaming and closes them when the stream when **STOP** is clicked.
2. In the **Prefix** box, enter a string of text to prepend to the filenames created by ItemTest.
 - Filenames after the prefix will be in the format MM-DD-YYYY_HHh-MMm-SSs.fdd for FPGA debug data (FDD) and the same format with 'rdd' as the filename extension for reader diagnostic data (RDD).
3. In **Capture window**, enter a numeric value for how long you want RDD and FDD logs to be captured from the device.
 - Specifies the duration in minutes you want to capture diagnostic data. For example, if 10 minutes is specified, then only the last 10 minutes of RDD capture will be saved; everything before 10 minutes will be discarded.

Note: The capture window time value does not indicate that ItemTest will stop the stream capture once the interval is reached. You must explicitly **Stop** the capture by going back to this screen when you no longer wish to capture diagnostic data. Failure to **Stop** the capture can cause excessive disk usage!

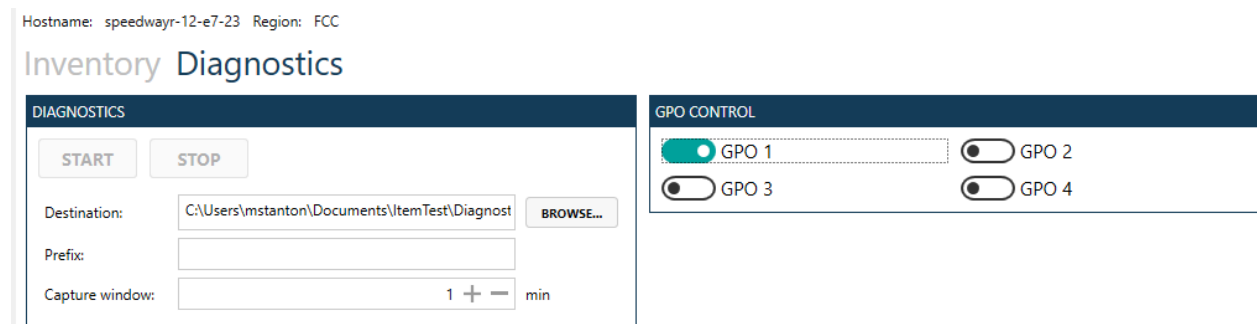
1. On the **Diagnostics** tab, click the **Start** button to begin capturing and saving the diagnostic streams.
2. To stop a diagnostic capture, click the **Stop** button.
3. Make sure you click the **Save** button at the bottom of the screen to ensure ItemTest records the streams as you run Showcases.
4. The captured files must be sent to Impinj for analysis. They are binary and require custom-built parsers to decode.

6.7.2 GPO Testing

In the **Diagnostics** tab you may find a **GPO CONTROL** box. xSpan and xArray gateways do not support GPOs. When configuring those gateways, no **GPO CONTROL** box appears. If using a an R120 or R420 reader with Antenna Hubs enabled, you will not see a **GPO CONTROL** box. Impinj R700 readers permit both GPO control and antenna hubs. Finally, the number of GPOs varies based on device type. R700 readers have fewer GPOs than Speedway Revolutions.

To test that a GPO is functional, click on the toggle for the relevant GPO number. The toggle turns teal in color to indicate that the GPO has been set.

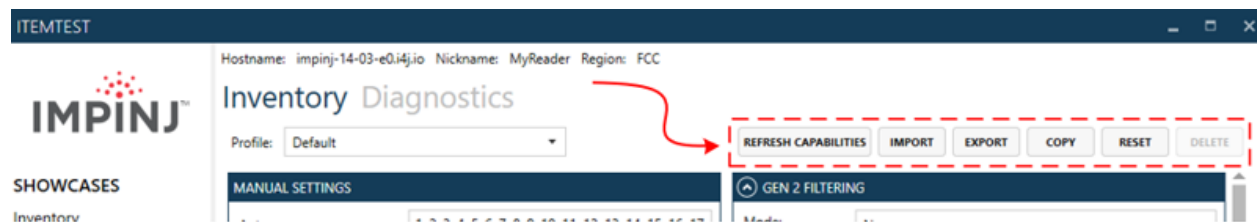
GPO Testing



6.8 Data Source Profiles

A profile is a json-formatted settings file for a device. Profiles are useful to record and reapply previously created settings. Profiles can either be default or they can be user-created. The profile named 'Default' can be modified, but use-case specific profiles, such as 'DeepScan' or 'DRM', cannot. Impinj recommends beginning your profiles with your company name to avoid any confusion. All operations involving Profiles can be exercised via the buttons appearing in the figure below. The operations are: **REFRESH CAPABILITIES**, **IMPORT**, **EXPORT**, **COPY**, **RESET**, **DELETE**.

Profile Operations Buttons



6.8.1 Creating a Profile

- The primary means to create a new profile is by copying an existing profile and then modifying it to the user's preferences. Choose a profile you wish to serve as the base of your new profile as illustrated in the following image.
- Click the **Copy** button. This will create a blank-named profile using the settings of the profile being copied. The **Profile:** box will be empty at this point.
- Enter a name for the Profile, e.g., "ExampleCompany_InventoryProfile". Spaces are not allowed.
- If you decide to abandon the profile creation, enter a random name, press **Enter/Return**, and then click the **Delete** button.

Creating A Profile By Copying

The screenshot shows the IMPINJ Inventory Diagnostics web interface. The top bar displays 'ITEMTEST' and 'Hostname: speedwayr-12-e7-23 Region: FCC'. The main header is 'Inventory Diagnostics' with a 'Profile:' dropdown menu containing 'MyCompany_InventoryProfile'. To the right of the profile dropdown are buttons for 'IMPORT', 'EXPORT', 'COPY', 'RESET', and 'DELETE'. A yellow hand icon points to the 'COPY' button. The interface is divided into several sections: 'MANUAL SETTINGS' (Antennas: 1, 2, 3, 4; RF Mode: 1002 - Auto Set Dense Reader Deep Scan; Search Mode: Dual Target; Enable Fast ID: [checkbox]; Estimated Tag Population: 32; Session: Session 1), 'POWER AND SENSITIVITY SETTINGS' (Power (dBm): 30; Rx Sensitivity: -80), 'INDIVIDUAL ANTENNAS', 'GPI CONFIGURATION' (table with 3 rows), 'GEN 2 FILTERING' (Mode: None; Filter 1 and Filter 2 settings), 'FREQUENCY SETTINGS' (Reduced Power: Disabled), and 'LOW DUTY CYCLE' (Empty Field Timeout (ms): 500; Field Ping Interval (ms): 200).

GPI PORT	START	LEVEL	STOP	LEVEL	DEBOUNCE (MS)
1	<input type="checkbox"/>	Low	<input type="checkbox"/>	Low	10
2	<input type="checkbox"/>	Low	<input type="checkbox"/>	Low	10
3	<input type="checkbox"/>	Low	<input type="checkbox"/>	Low	10

6.8.2 Saving A Profile

- After creating the profile, Press **Enter/Return** to save the new profile.
- Note:** Be sure to press **Enter/Return** to save the changes or the profile will be abandoned.
- Verify the profile name you just created is in the **Profile:** dropdown menu.
 - To permanently save any configuration changes to the profile and to disk, press the *Save* button at the bottom of the main area

6.8.3 Deleting A Profile

If the profile name appearing in the **Profile** box is not a default (i.e., is not named Default, or DRM, or Deep Scan), click the **Delete** button to remove your user-defined profile.

6.8.4 Resetting A Profile

Users can discard unsaved changes by clicking the **Reset** button.

- A default profile that has been reset will return to the last-saved values.
- A user-created profile will return to the state it has on the disk. Thus, if the **Save** button has not been clicked at the bottom of the main area, the profile settings will revert to what they were.

Note: After you click the **Save** button at the bottom of the screen, you will not be able to reset.

6.8.5 Exporting A Profile

You can export user-defined profiles by clicking on the **Export** button. A file dialog appears allowing you to set the folder and filename of the profile.

6.8.6 Importing A Profile

You can import a previously exported profile by clicking on the **Import** button. A file dialog appears allowing you to choose the path for the profile on disk.

6.8.7 Refreshing a Profile

After enabling or disabling Antenna Hub on a reader, click this button to refresh profile without restarting ItemTest or deleting and re-adding the data source.

7 Showcases

Showcases are demonstrations of reader use-cases that ItemTest supports. Choose a Showcase type to test or demonstrate one or more devices. The Showcase types are: Inventory, Location, Direction, and Tag Memory. Multiple devices can be used in certain Showcases.

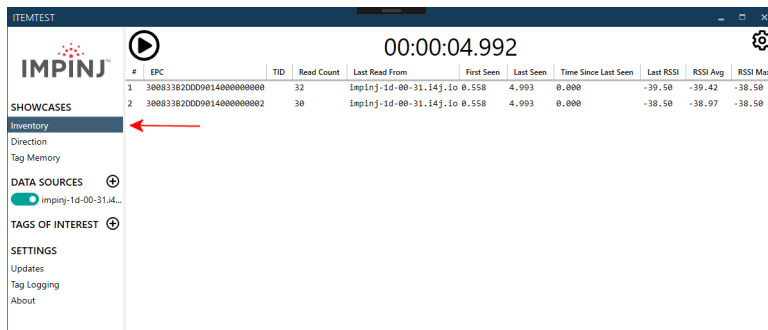
Each Showcase type is aware of compatible device types and readers. Consequently, clicking on a Showcase will dynamically toggle off data sources if there are too many, or if the data source is not supported by the Showcase.

7.1 Inventory Showcase

Inventory is a Showcase used to discover all tags within range of selected readers and list their associated EPC and other information such as the RSSI and reader antenna they were read with.

An example of an inventory use case is obtaining the counts of each type of tagged apparel item in a clothing store.

Inventory Showcase



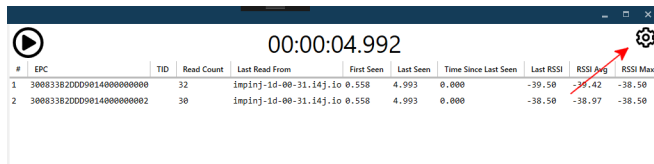
Make sure you have added one or more **DATA SOURCES** and configured their Inventory-specific settings. Click on the word "Inventory" in the **SHOWCASES** section (left hand side of the application).

You will find useful information at the bottom of the table:

1. **Run Scenario** - the type of run (**Continuous**, **Timed** or **Margin Test**)
2. **reads/s** - displays the average reads/second when the Showcase is running
3. **Unique Tags** - the count of unique EPCs

To configure the Inventory Showcase, click on the gear icon in the upper right corner.

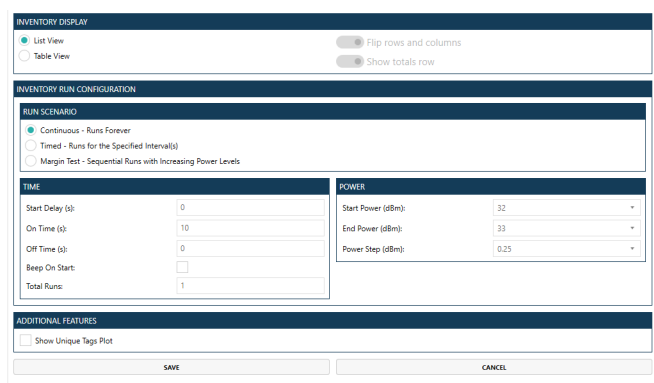
Gear



7.1.1 Inventory Overview

The main area fills with the settings specific to the Inventory Showcase as shown below.

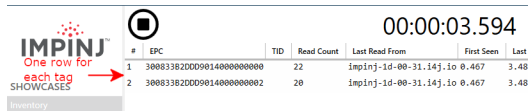
Inventory Visualization Settings Page



7.1.2 List View

Click on the **List View** button to display per-tag information in real-time. A running inventory Showcase with a list view display type looks structurally like this:

List View

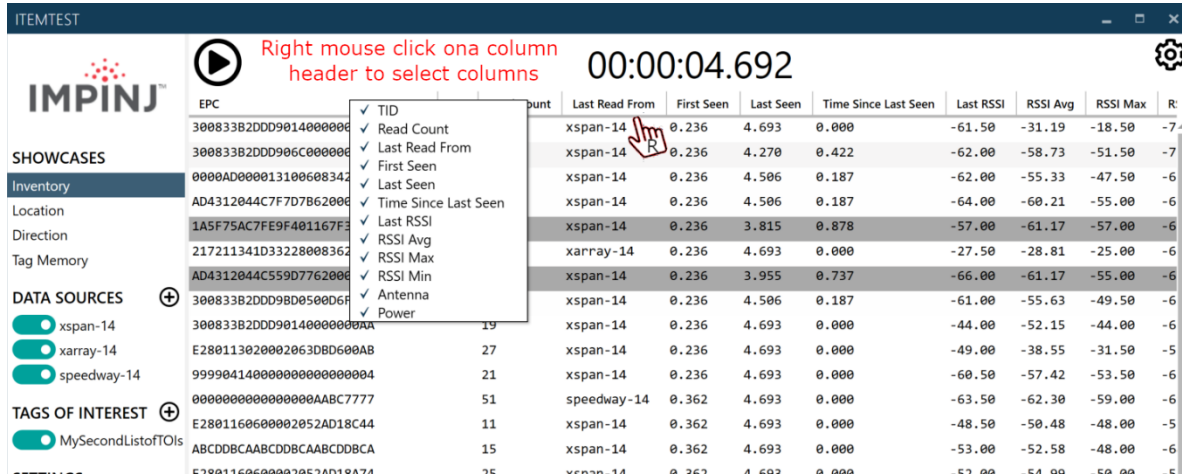


#	EPC	TID	Read Count	Last Read From	First Seen	Last
1	300833B2DD090140000000	22		Impinj-1d-00-31.14j.io 0.467	3.48	
2	300833B2DD0901400000002	20		Impinj-1d-00-31.14j.io 0.467	3.48	

Once the Inventory Showcase is running in **List View**, the background color of each tag row will change based on the time since the tag was last read. Recently read tags have a white background; older tags display progressively darker backgrounds as the time since last read increases.

The following is an example of running an Inventory Report in list view:

Inventory List View Showcase



EPC	TID	Read Count	Last Read From	First Seen	Last Seen	Time Since Last Seen	Last RSSI	RSSI Avg	RSSI Max	R
300833B2DD090140000000			xspan-14	0.236	4.693	0.000	-61.50	-31.19	-18.50	-7
300833B2DD0906C000000			xspan-14	0.236	4.270	0.422	-62.00	-58.73	-51.50	-7
0000AD000013100608342			xspan-14	0.236	4.506	0.187	-62.00	-55.33	-47.50	-6
AD4312044C7F7D7B62000			xspan-14	0.236	4.506	0.187	-64.00	-60.21	-55.00	-6
1A5F75AC7FE9F401167F3			xspan-14	0.236	3.815	0.878	-57.00	-61.17	-57.00	-6
217211341D33228008362			xarray-14	0.236	4.693	0.000	-27.50	-28.81	-25.00	-6
AD4312044C559D7762000			xspan-14	0.236	3.955	0.737	-66.00	-61.17	-55.00	-6
300833B2DD0908D0500D6F			xspan-14	0.236	4.506	0.187	-61.00	-55.63	-49.50	-6
300833B2DD090140000000A		19	xspan-14	0.236	4.693	0.000	-44.00	-52.15	-44.00	-6
E2801130200020630BD600AB		27	xspan-14	0.236	4.693	0.000	-49.00	-38.55	-31.50	-5
99990414000000000000004		21	xspan-14	0.236	4.693	0.000	-60.50	-57.42	-53.50	-6
0000000000000000AABC777		51	speedway-14	0.362	4.693	0.000	-63.50	-62.30	-59.00	-6
E2801160600002052AD18C44		11	xspan-14	0.362	4.693	0.000	-48.50	-50.48	-48.00	-5
ABCDDBCAABCDDBCAABCDDBCA		15	xspan-14	0.362	4.693	0.000	-53.00	-52.58	-48.00	-6
E2801160600002052AD18C44		25	xspan-14	0.362	4.693	0.000	-53.00	-52.58	-48.00	-6

Descriptions of the columns:

- **EPC:**
 - Each row has the EPC of the tag read.
 - White rows indicate the tag was seen within the last second.
 - As tags go longer without being read, the background turns gradually darker.
- **TID:**
 - The tag identifier (TID)
- **Read Count:**
 - The number of times the tag has been read across all devices.
- **Last Read From:**
 - The alias of the device that most recently read the tag.
- **First Seen:**
 - The time stamp of when the tag was first read.
- **Last Seen:**
 - The time stamp of when the tag was last read.
- **Time since last seen:**
 - The time delta since the tag was last read.
- **Last RSSI:**
 - The last RSSI of the most recent read.
- **RSSI Avg:**
 - The Average Received Signal Strength Indication value.
- **RSSI Max:**
 - The Maximum Received Signal Strength Indication value.
- **RSSI Min:**
 - The Minimum Received Signal Strength Indication value.
- **Antenna:**
 - The last antenna that read the tag.

- **Power:**
 - The output power of the device when the tag was read the first time. Useful when performing Margin Read tests

Note: ItemTest supports column re-arrangement. Click a column header and drag it to another slot in the table to rearrange. Clicking a column header performs lexical sorting.

7.1.3 Table View

Click on the **Table View** instead of **List View** to see table summaries of both TOI files and strays. A "stray" tag is any tag that does not appear in a TOI file.

Inventory Showcase Table View Configuration Panel

INVENTORY DISPLAY

☐ List View
 ☒ Table View

☐ Flip rows and columns
 ☒ Show totals row

If **Table View** is selected, you can choose to **Flip rows and columns**. Toggling this to the enabled position organizes the table columns according to tag type (i.e., TOI file source or stray) and sets rows by data source, as shown in the figure below. Toggling to the disabled position organizes table columns according to data source and sets rows by tag type, as shown in the figure above.

When **Show Totals Row** is toggled on, you will see a row column which is the sum across the columns. In the previous figures, **Show Totals Row** was toggled on.

The following is an example of an Inventory Showcase that has run with table view set:

Inventory Table View Run

ITEMTEST

00:00:03.901

IMPINJ

SHOWCASES

Inventory

Location

Direction

Tag Memory

DATA SOURCES

xspan-14

xarray-14

speedway-14

TAGS OF INTEREST

SETTINGS

Updates

Tag Logging

About

Name	Strays
xspan-14	25
xarray-14	3
speedway-14	3
Total	28

Left col = Device Name

Right col = count

If TOIs are loaded you will see % of TOIs, like this:

Name	MySecondListofTOIs	Strays
xspan-14	3 (75.0%)	24
xarray-14	1 (25.0%)	3
speedway-14	0 (0.0%)	2
Total	3 (75.0%)	25

Below are descriptions of the columns in the Inventory Table View report shown above:

- **Name:** the name of the TOI file, if using TOI files.
- **Strays:** the total number of tags found whose EPCs do not appear in any of the enabled TOI files.
- **xarray-14:** an example data source.
 - Each device column lists the number of read tags matching those in TOI files. The number as a percentage of the total number of tags in the TOI file appears in parentheses.

- **Total** - The total percentage of TOIs that were read, if using TOIs.

Footer Summary Statistics:

- **All files** - Count of all tags found that match all TOI files.
- **All files %** - Percent found in all TOI files.
- **Overall Total** - Count of all TOI tags and Strays found.

7.1.4 Advanced Run Scenarios

You have several options for running the Inventory Showcase.

7.1.4.1 Run Scenario. Inventory Run Configuration

INVENTORY RUN CONFIGURATION	
RUN SCENARIO <input checked="" type="radio"/> Continuous - Runs Forever <input type="radio"/> Timed - Runs for the Specified Interval(s) <input type="radio"/> Margin Test - Sequential Runs with Increasing Power Levels	
TIME Start Delay (s): <input type="text" value="0"/> On Time (s): <input type="text" value="3"/> Off Time (s): <input type="text" value="1"/> Beep On Start: <input checked="" type="checkbox"/> Total Runs: <input type="text" value="5"/>	POWER Start Power (dBm): <input type="text" value="29"/> End Power (dBm): <input type="text" value="30"/> Power Step (dBm): <input type="text" value="0.25"/>

- **Continuous - Runs Forever:** Select this option if you want the Inventory Showcase to run continuously until you click the "Stop" button.
 - This is the default
 - Recommended mode if you are using GPI triggers
- **Timed:** Select this option if you want the Inventory Showcase to run for a specific amount of time. You can do multiple automated timed runs by specifying the parameters in the **TIME** group box.
- **Margin Test – Sequential Runs with Increasing Power Levels:** Select this option if you want the Inventory Showcase to perform power sweeps to determine, for example, the minimum power level required to energize the tag(s) under test.
- **GPI-Triggered (not listed) – A GPI Trigger Initiates the Inventory:** Select **Continuous** if you want the Inventory Showcase to be triggered by a GPI. GPI Triggers are configured on a per-reader basis. You can find more information about how to configure GPI Triggers in Section 6.1.3.

7.1.4.2 Time

- Here you configure timer-specific settings
- Enter a value in seconds for the **Start Delay (s)** setting.
 - Specifies how much time to delay before starting the margin test.
 - Default is 0 seconds.
 - Must be a positive integer.
- Enter a value in seconds for the **On Time (s)** setting.
 - Specifies how long, in seconds, the device should be on during each run.
 - Default is 10 seconds.

- Must be a positive integer.
- Enter the value for the **Off Time (s)** setting.
 - Specifies the amount of time, in seconds, the device should be off before starting the next run in the set.
 - Default is 0 seconds.
 - Must be a positive integer.
- Check **Beep On Start** if you would like to hear an audible beep every time a run starts.
 - This can be useful if you cannot be in front of your PC when running the test.
- Enter a value for the **Total Runs** setting to set the number of inventory tests to perform.
 - The **Total Runs** option is disabled in **Margin Test** mode because the number of runs that will be performed is dictated by the Start Power, End Power, and Power Step.

7.1.4.3 Power

- In the **POWER** box, configure the Power settings *only* if Margin Test has been specified.
- Click the **Start Power (dBm)** dropdown arrow and select the appropriate value.
 - Specifies the start power value to start incrementing from.
 - Defaults to 29
- Click the **End Power (dBm)** dropdown arrow and select the appropriate value.
 - Specifies the final power value to end incrementing at.
 - Defaults to 30
- Click the **Power Step (dBm)** dropdown arrow and select the appropriate value.
 - Specifies how much to increase the current power by during each increment.
 - Defaults to 0.25
- Click **Save** to apply the Power Sweep/Margin Test Changes.

If you are interested in doing a Power Sweep (aka Margin Test), the **Margin Test** option gives you this capability. A power sweep is useful for determining the minimum power required to read a tag or group of tags.

7.1.4.4 Configure a Margin Test:

1. Click the **Gear icon** to display the Run Configuration for the Inventory Showcase.

Margin Test Configuration

2. Enter the **Start Power (dBm)**. In the example, 18 dBm is chosen.
3. Enter the **End Power (dBm)**. In the example, 30 dBm is selected.
4. Enter the **Power Step (dBm)** value. The dropdown has 20 choices – 5 dB broken down into 1/4 dB increments. In the example figure the power increases in 1/2 dB steps.
5. Click **Save** to apply the settings.

Note: Margin tests can be executed using multiple devices. All device types support running a margin test.

7.1.4.5 Margin Test Logging ItemTest will create a log file for each power step executed in the margin test. To illustrate, if your start power is 15dBm, with a power increment of 0.25 dB, and an ending power of 18dBm, then you would have $18\text{dBm} - 15\text{dBm} = 3\text{ dBm}$ of test range x 4 (this is the number of 1/4 dB steps per dB) for a total of 12 log files.

7.1.4.6 Configure a GPI-Triggered Run ItemTest is capable of GPI-triggered inventory runs. The purpose of this mode is to use a GPI trigger to start and stop the device.

1. Using the figure below as a guide, click a single **Data Source**, which takes you to the settings for the data source, then scroll down to the **GPI Configuration** box on the Inventory tab. You may need to scroll down to bring the **GPI Configuration** box fully into view.

GPI Trigger Run Configuration Window

Hostname: speedway-14 Region: FCC

Inventory Diagnostics

Profile: **Default**

SHOWCASES

- Inventory
- Location
- Direction
- Tag Memory

DATA SOURCES

- xarray-14
- speedway-14**

TAGS OF INTEREST

- MySecondListofTOIs

SETTINGS

- Updates
- Tag Logging
- About

POWER AND SENSITIVITY SETTINGS

RF Mode: 1002 - Auto Set Dense Reader Deep Scan

Search Mode: Dual Target

Enable Fast ID: ☐

Estimated Tag Population: 32

Session: Session 0

FREQUENCY SETTINGS

Reduced Power: Disabled

LOW DUTY CYCLE

☐ Enable

Empty Field Timeout (ms): 500

Field Ping Interval (ms): 200

GPI CONFIGURATION

GPI PORT	START	LEVEL	STOP	LEVEL	DEBOUNCE (MS)
1	<input type="checkbox"/>	Low	<input type="checkbox"/>	Low	10
2	<input type="checkbox"/>	Low	<input type="checkbox"/>	Low	10
3	<input type="checkbox"/>	Low	<input type="checkbox"/>	Low	10
4	<input type="checkbox"/>	Low	<input type="checkbox"/>	Low	10

Filter 1

Filter:

Length: 0

Offset: 0

Memory Bank: Reserved

Filter Option: Match

Filter 2

Filter:

Length: 0

Offset: 0

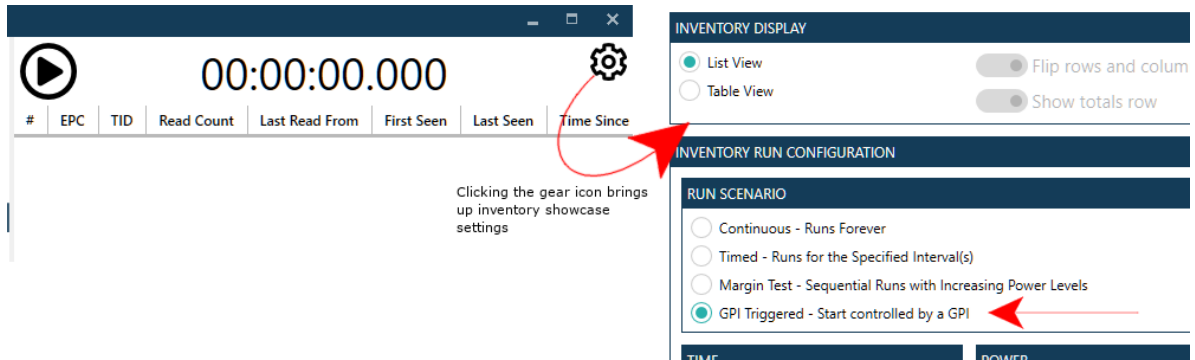
Memory Bank: Reserved

Filter Option: Match

SAVE **CANCEL**

- In the **Start** column, check the box next to the port where a received signal should Start an inventory.
 - Specifies the type of GPI trigger that would start a run.
- In the **LEVEL** column, use the dropdown to select the signal type for the **Start**.
 - Low
 - High
- In the **Stop** column, check the box next to the port where a received signal should Stop an inventory.
 - Specifies the type of GPI trigger that would stop a run.
- In the **LEVEL** column, use the dropdown to select the signal type for the **Stop**.
 - Low
 - High
- Enter a value for the **DEBOUNCE (MS)** setting.
 - After the device initially detects a transition, subsequent transitions are ignored for the set value of milliseconds.
 - Default is 10 milliseconds; 50 milliseconds is reasonable in most situations. The maximum usable value is 1000 milliseconds.
 - 0 to not perform debounce.
- Click the **Save** button to commit your changes. **Note:** The number of GPIs exposed to the reader varies based on device type.
- After making sure *that only the one data source* having a GPI autostart is enabled (meaning, it is *the only data source displaying with the toggle moved to the right, and showing a teal color*), next click on the word Inventory in the SHOWCASES section.
- Click on the gear icon to configure the inventory showcase itself for GPI triggering, as shown below:

Inventory Showcase - GPI Triggered Run Scenario Settings



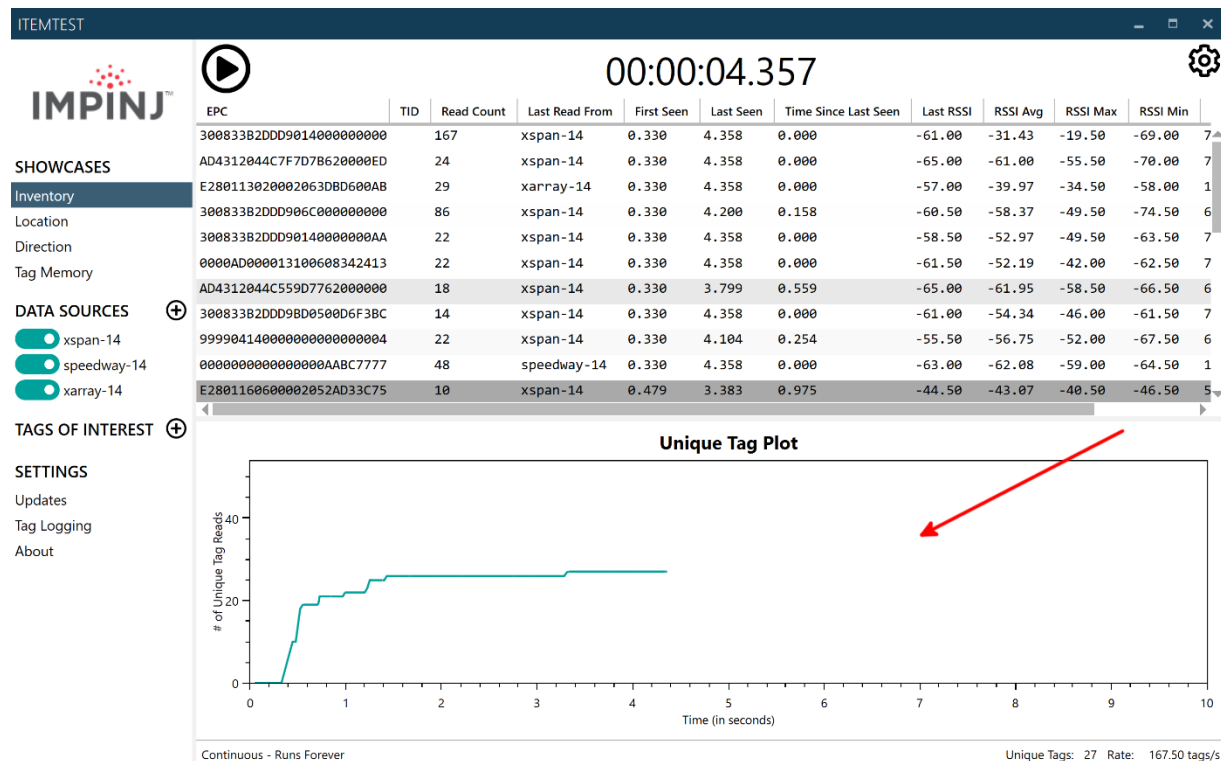
10. Under **INVENTORY RUN CONFIGURATION** in the **RUN SCENARIO** section click the **GPI Triggered – Start controlled by a GPI** radio button.
11. Next click **Save**; if there are error conditions you will see a dialog box containing one of the warnings below:
 - if there is no data source enabled, then you see an error telling you that a data source is not enabled (*corrective action: enable a GPI-supporting data source*)
 - if the enabled data source does not support GPI triggering (e.g., gateway products) then you see an error telling you that the enabled data source does not support GPI triggering (*corrective action: disable this data source and enable a different data source, one that has GPI triggering capabilities*)
 - if more than 1 data source is enabled then you will see an error telling you that only 1 data source can be enabled when using GPI triggering (*corrective action: enable only one (1) data source*)
 - if there is just 1 data source enabled but it does not have an auto start GPI configured then you will see an error telling you that you must enable a data source with a GPI configured for auto start (*corrective action: ensure you check one of the Start boxes in the data source configuration*)
12. If no error conditions exist, the showcase will immediately start running. You will know this because the stopwatch is running, and the play button displays instead of . The stopwatch simply shows that the showcase is running but **it does NOT mean the reader is reading tags. *The reader only starts reading and reporting tags once the GPI auto start condition physically occurs.***
13. As soon as the GPI auto start condition physically occurs (e.g., GPI 1 goes high because a light sensor was tripped) then:
 - the stopwatch will instantaneously reset to 00:00:00.000 and immediately begin running. You do not have to do anything; the UI will automatically switch to show a running showcase
 - the reader starts inventorying and tag reads appear in the showcase area
14. To stop the GPI Triggered run:
 - if an auto stop GPI was configured and the condition physically occurs, the showcase will automatically stop -or-
 - you press the stop button , which immediately stops the showcase
15. Running GPI Triggered scenarios back-to-back is permitted but be aware that the same conditions as documented in item 13, above, still hold.
16. When running back-to-back GPI-Triggered runs you must click the button on each subsequent run to see the tag reads once the GPI auto start trigger becomes asserted.

7.1.5 Unique Tags Plot

When checked, a plot displaying the cumulative count of unique tags during the inventory appears at the bottom of both List View and Table View inventory Showcases. The x-axis is time, and the y-axis is the cumulative tag count.

The tag plot is useful for assessing the time required for enabled device(s) to read a targeted tag population.

Unique Tag Plot



7.1.6 Inventory Logs

If logging is enabled (See Tag Logging, running an Inventory Showcase causes ItemTest to generate Inventory log files. Each execution of an Inventory Run, including automated runs, as described in Advanced Run Scenarios, generates a csv-formatted file whose contents are:

- TimeStampOfRead, EPC, Antenna, RSSI, Frequency/Channel, DeviceName
- TIDs are not presently logged to file by default. To log TIDs, check the **Enable Fast ID** under the reader's manual settings. Note that TIDs are logged only by those readers that have had FastID enabled.
- Field headers are omitted
- GPI events will appear in the logs as non-CSV-formatted comments designated with a leading "#". They will appear amongst the tag reads at the time of their occurrence on dedicated lines.

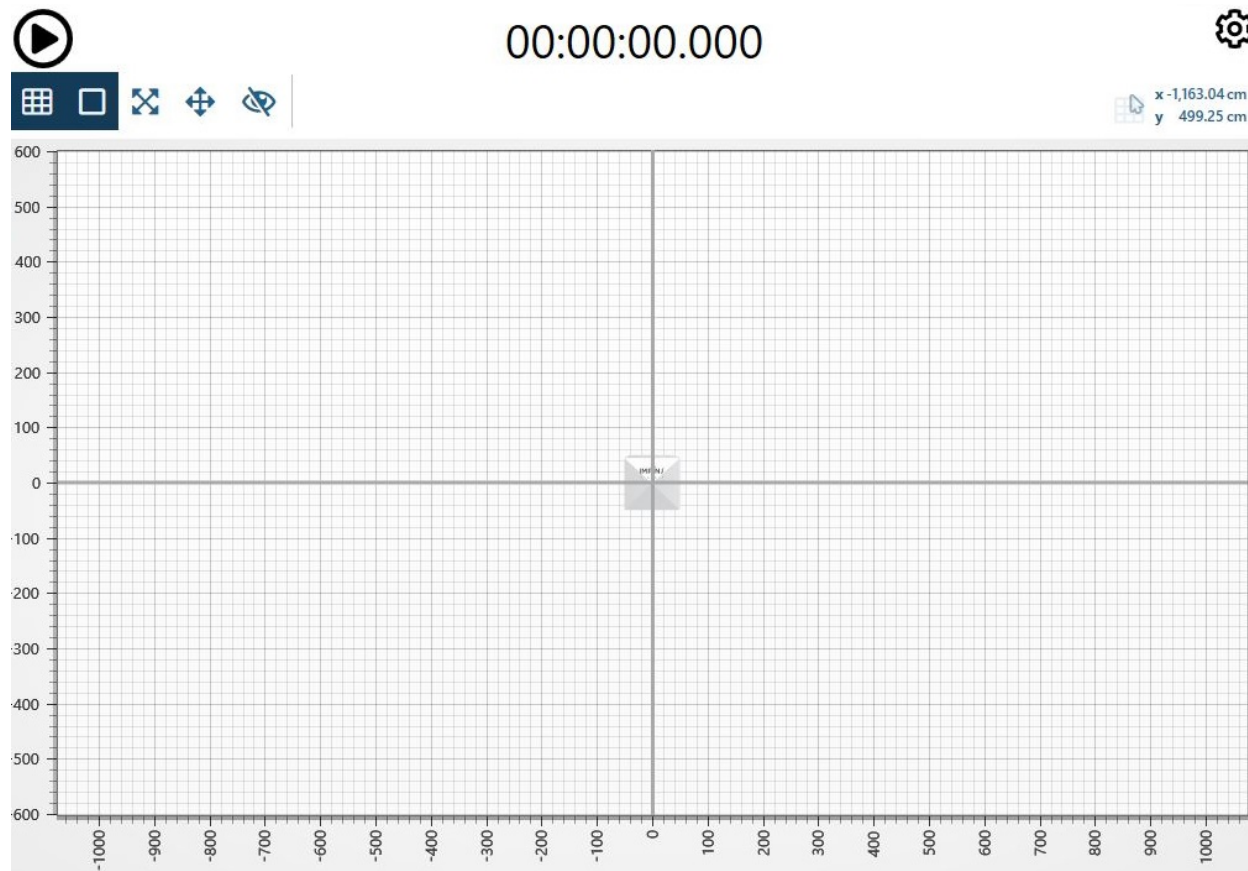
7.2 Location Showcase

Impinj xArray gateways can track the 2-D coordinates of tagged items with an optimal resolution of 1m in certain environments. Use cases where xArrays have been used to track location include retail, where tagged merchandise is tracked as it moves between display cases, and tracking the location of work-in-progress items in manufacturing facilities ranging from commercial tractors to electronic sub-assemblies. The greater the density of xArrays in the coverage area, the more accurate the reported location. In the following, we will show how to configure and demo both a single xArray and multiple xArray environment.

7.2.1 Location Overview

When an xArray is selected as the data source, and while **Location** is selected under **SHOWCASES**, the main view will appear as shown in the image below.

Location View (xArray only)



- The **Location Visualization Toolbar** just above the grid provides quick access to some, but not all, of the visualization options for the Location Showcase. From left to right, the options are:
 - **Show/Hide Gridlines** – Toggling will show/hide the gridlines. The X and Y axis will always stay visible.
 - **Show/Hide xArrays** – Toggling will show/hide the xArray icons on the plot.
 - **Enable/Disable Fullscreen** – Toggling will make the grid full screen. It can be useful for demos.
 - **Enable/Disable Keep Out Areas** – ItemTest can be configured to have Keep Out Areas on the grid which will ensure tags do not get plotted in certain areas. If a tag would be plotted in a Keep Out Area, it will plot to the nearest edge of the configured Keep Out Area. More details on how to configure Keep Out Areas can be found under **Custom Display Settings**.
 - **Show/Hide Keep Out Areas** – If you would like to use the keep out areas you have configured, but not show them on the plot, you can hide them.
- Directly to the right of the toolbar is an indicator that reports the current position of your mouse pointer on the grid. Default is in centimeters, but it can be changed by clicking on the grid to feet or meters.
- More visualization options can be found by clicking the gear icon in the top right of the screen.

Location Visualization Settings (xArray only)

LOCATION DISPLAY

POINT DISPLAY SETTINGS

☒ Display only computed position
☐ Display all reported positions
☐ Display all reported and computed positions
☐ Heat Map

Persistence:200

Radius (cm):50

Intensity (0-255):50

COMPUTED POSITION SETTINGS

☐ Enable Movement Threshold (cm)0
☐ Enable Smooth Movement Time (s)0

CUSTOM DISPLAY SETTINGS

☒ Visible Grid Lines
☒ Visible Reader(s)
☐ Maximize Window (Press Esc to Exit)
☐ Black Background
☐ Enable Tag of Interest Summary
☐ Exclude Low Confidence Tags

Confidence Threshold (%):0

Stray Tag Color:

CUSTOM FLOOR PLAN SETTINGS

☐ Enable Floor Plan

BROWSE

CONFIGURE LAYOUT

FLOOR PLAN POSITION

Center (cm):

Size (cm):

Rotation Around Center:

X: 0

Y: 0

Width: 0

Height: 0

Degrees: 0

☐ Enable Keep Out Areas
 ☐ Show/Hide Keep Out Areas

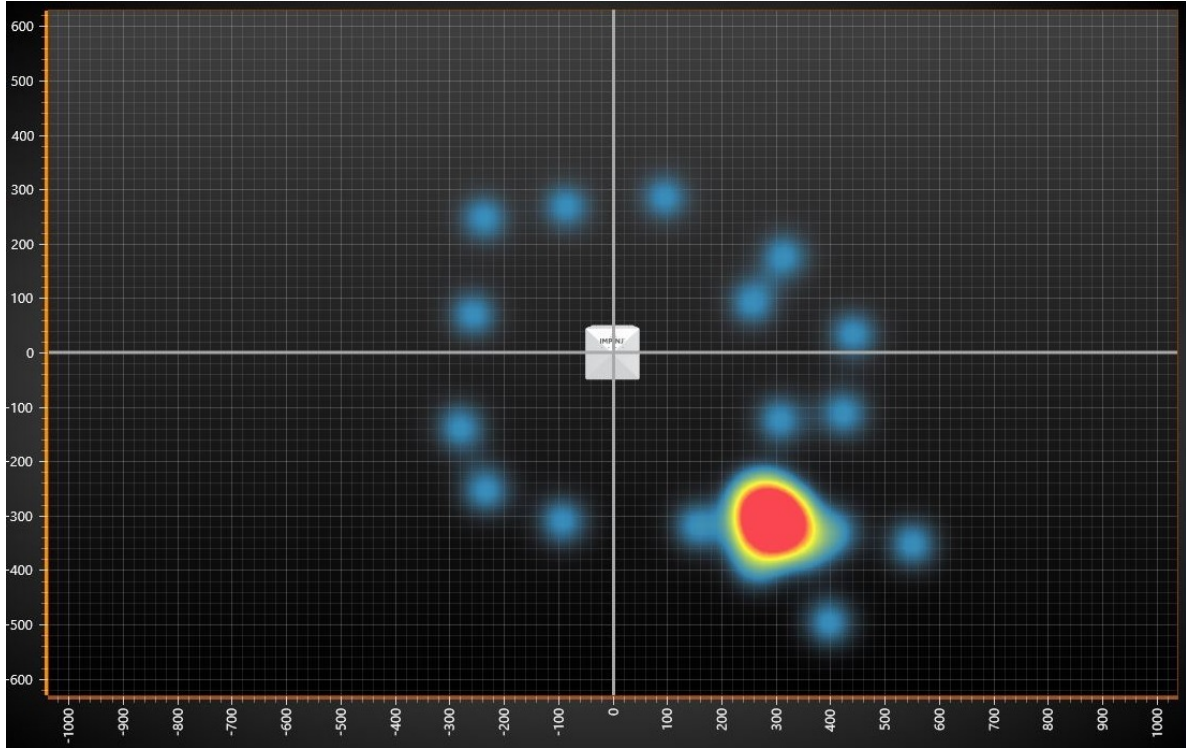
SAVE

CANCEL

7.2.2 Point Display Settings

- **Display only computed position** – When selected, the computed position of the tag will be displayed as circles on the plot. The location is computed using reported locations provided by all readers.
- **Display all reported positions** – When selected, the reported position of the tag from all readers will be displayed as squares on the plot. There can be multiple reported positions for the same tag if multiple xArrays saw the tag.
- **Display all reported locations and computed positions** – When selected, both computed and reported positions are plotted,
- **Heat Map** – When selected, displays a heat map of tag reports received. Only the heat signatures of the tags can be seen.

Heat Map Example



The example above shows a single reader heat map with tags placed in a square formation and a large group of tags in the bottom right. The persistence before decaying, radius of each point, and intensity of the colors can be controlled and are explained below.

- **Heat Map Settings:**
 - **Persistence:** A representation of time the heat should stay on-screen before decaying. The value must be between 0 and 2147483647. Values closer to 0 cause decay to occur more quickly.
 - **Radius (cm):** The radius in centimeters of the heat map circle around the location of a tag. A circle with specified radius will get hotter at the x and y location for a tag when it reports. The value must be between 0 and 2147483647.
 - **Intensity (0-255):** The Intensity reflects how “hot” a point on the heat map gets each time it is encountered. The value must be between 0 and 255. Values closer to 255 are “hotter” (red) while values closer to 0 are “colder” (blue) when tags appear.

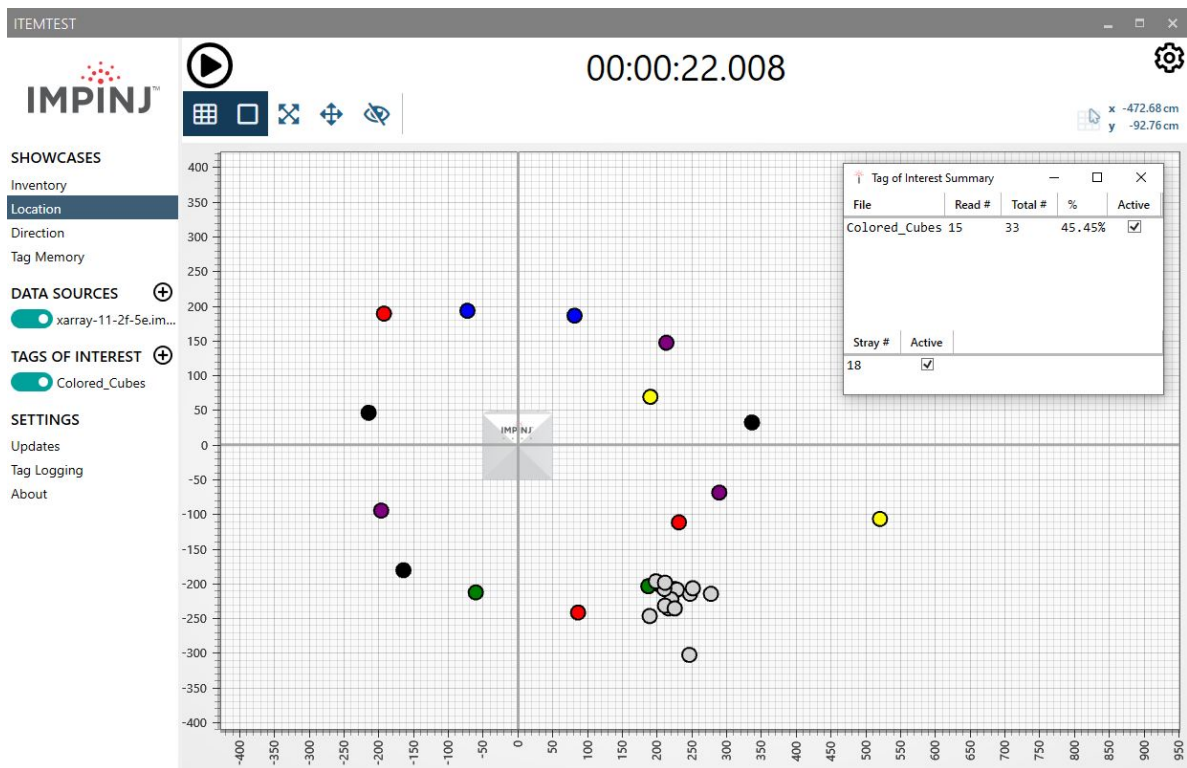
7.2.3 Computed Position Settings

- **Enable Movement Threshold (cm)** – When this setting is enabled, subsequent tag locations are not updated if they are within the specified distance (in centimeters) of the first reported location. If a new location exceeds the threshold, a new location is reported, and subsequent reports are now compared to this new position. The suppression of updated positions helps to visually separate static tags, or very slow-moving tags, from those that are moving more quickly.
- **Enable Smooth Movement Time (s)** – When this setting is enabled, updates between subsequent tag locations are animated over a time interval given by the specified value (in whole integer seconds). To avoid missing any intermediate reported positions, this value should be less than or equal to the lowest update interval for all xArrays included in the running Location showcase.

7.2.4 Custom Display Settings

- **Visible Gridlines** – Determines whether the gridlines will show on the plot or not. Also configurable in the Location toolbar.
- **Visible Reader(s)** – Determines whether the readers will show on the plot or not. Also configurable in the Location toolbar.
- **Maximize Window** – Determines whether or not the plot will be full screen or not. Can also enter full screen from the Location toolbar.
- **Black Background** – Sets the background of the plot to be black. Very useful for demoing the heat map.
- **Enable Tags of Interest Summary** – Creates a tag of interest summary window at the start of a location run that can be used to toggle the visibility of the tags from each file.

Location Running with Tags of Interest Summary



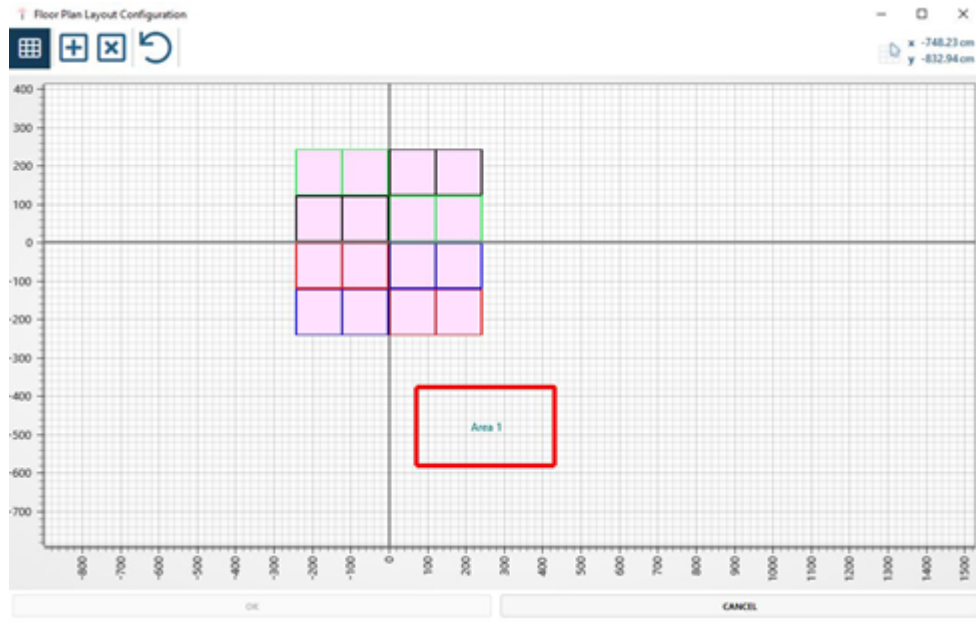
- **Exclude Low Confidence Tags** – When checked, it will apply a filter on low confidence tags that do not meet the configured threshold. Based on the number of tag reads per cycle, the bottom X percent will be hidden from the location plot where X is the number specified in the text box.
- **Stray Tag Color** – Allows you to customize the color of stray tags (tags not found in an enabled Tags of Interest file) in the visualization. Can accept color names or hex codes. Default is gray.

7.2.5 Custom Floor Plan Settings

- **Enable Floor Plan** – When checked, will use the floor plan specified as the background image of the Location plot. This is useful for displaying xArrays in their actual space.
- **Floor Plan**

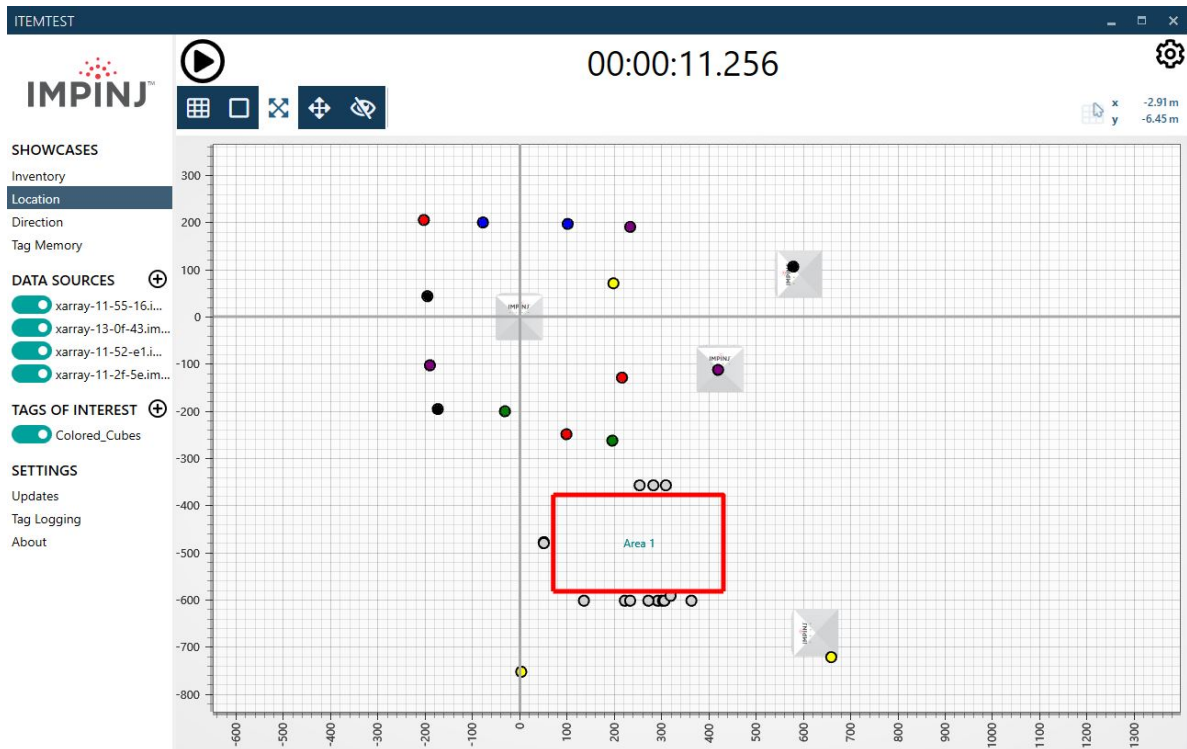
- Specifies the file name to load into the background image of the Location plot.
- Images (.png, .jpg, etc.) can be used as the floor plan.
- The **Floor Plan Position** can be configured below the floor plan file picker. If left unconfigured, ItemTest will use the image size unless it is greater than the screen size and then it will adjust to fit to the screen.
- **Configure Layout** – You can also further configure the floor plan and add Keep Out Areas by clicking this button. It will open a window for adjusting the floor plan and creating and placing Keep Out Areas on the plot.

Configure Layout Window with Floor Plan Image and Keep Out Area



- **Enable Keep Out Areas** - ItemTest can be configured to have Keep Out Areas on the grid which will ensure tags do not get plotted in certain areas. If a tag would be plotted in a Keep Out Area, it will plot to the nearest edge of the configured Keep Out Area. An example of how this works can be found below in the image below.
- **Show/Hide Keep Out Areas** - If you would like to use the keep out areas you have configured, but not show them on the plot, you can hide them. This is also configurable in the Location toolbar.

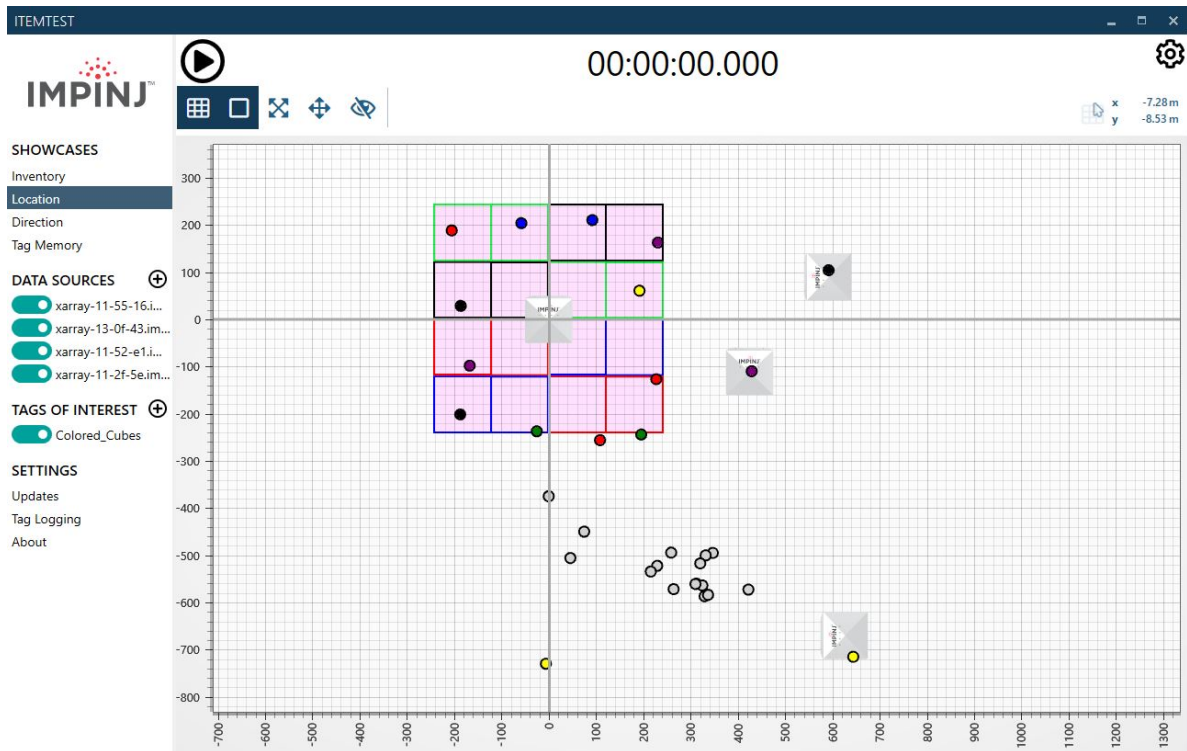
Location Running with Multiple xArrays and Visible Keep Out Areas



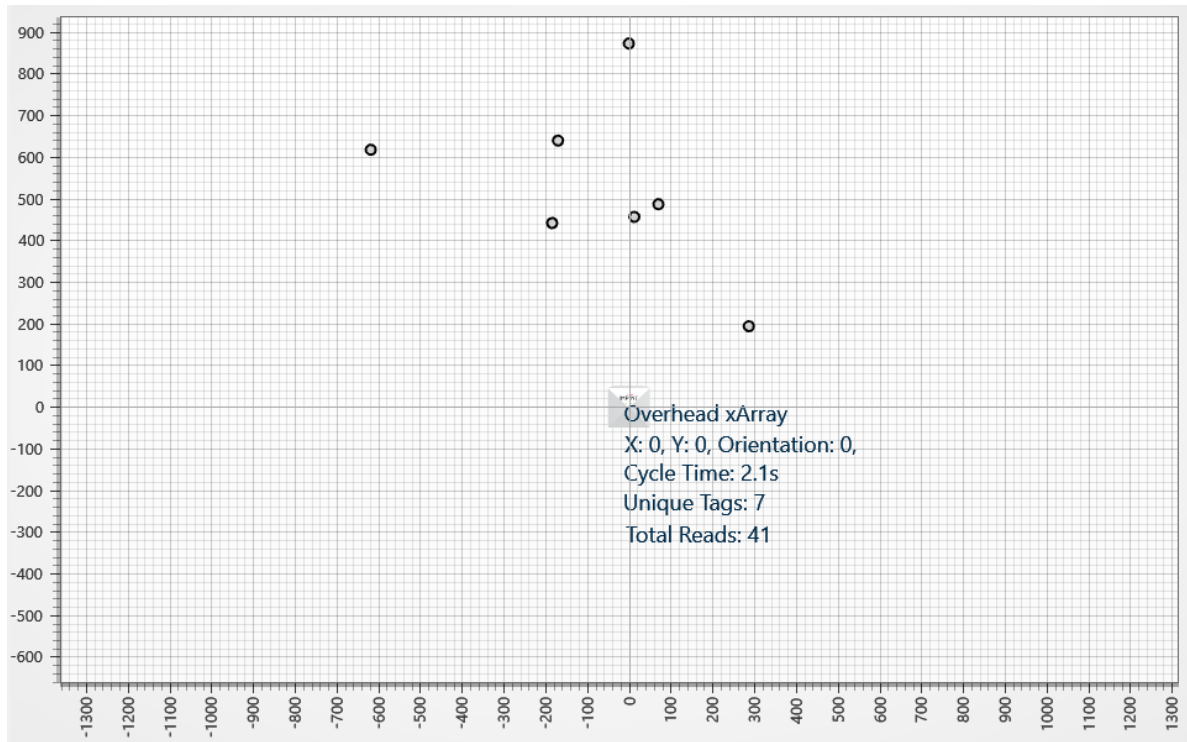
7.2.6 Running the Location Showcase

1. Toggle on the xArray data sources you want to run making sure they are configured properly. For more on configuring xArrays for Location, see Location Configuration.
2. Click the “Play” button – visually this is an encircled triangle on its side – in the upper left portion of the application. This starts the selected gateways.
3. If tags are in the field of view, they will begin to show up on the Location plot as they come in.
 - ItemTest presents the computed position of tags as a colored dot and reported position as a colored square.
 - The tag’s position is based on the X and Y reported by the xArray(s).
 - The tag’s color corresponds to the color associated with the EPC if such an assignment has been made in an enabled TOI file. If the tag is not found in an enabled TOI file and no color is configured, it will be gray.
4. As tags are being plotted, you can click and drag to pan around the grid and mouse wheel up/down to zoom in and out.
5. Hovering over a computed position will show the summary of the tag and will include the EPC and all the hostnames of readers that found the tag. Hovering over a reported position will only show the EPC and the single reader that reported that location.
6. Hovering over the icon for an xArray will display a summary of reported tag locations for that xArray, including the position and orientation of the xArray, the cycle time, and the number of unique tags and raw reads performed during that cycle time. The report is available while a Location Showcase is running but will show the statistics for the most recent cycle for as long as the pointer hovers over the icon. Even after a Location Showcase has stopped running, the report is available and will show the statistics for the last reported cycle. The following image shows an example summary report.

Location Running with 4 xArrays, a Custom Floor Plan, and an enabled TOI File



Example xArray Summary Report



7.2.7 Location Logs

Location reports can be logged to a file. See **Tag Logging** for details. The data fields captured during a Location Showcase run are:

- Hostname
- Timestamp
- HostTimestamp
- ReportType
- EPC
- LocationXCentimeter
- LocationYCentimeter
- ReadCount
- AlgorithmConfigurationData
- PeakRssiInDbmFirstSeenSector

7.3 Direction Showcase

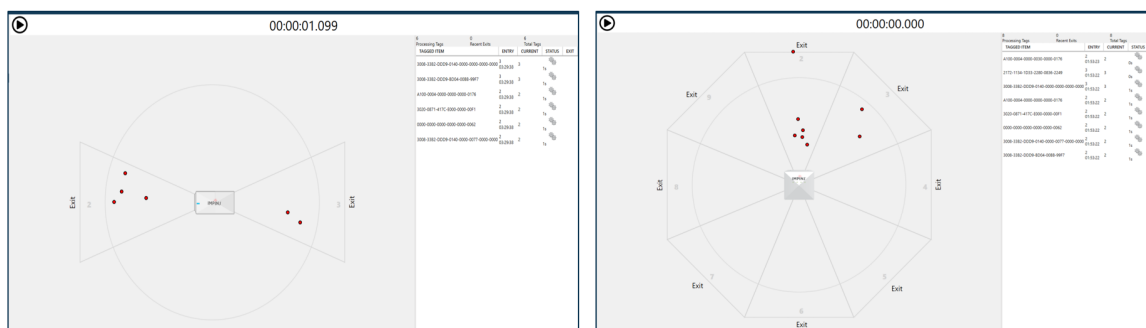
Impinj xSpan and xArray gateways natively have the ability to detect and report the direction of travel of tags passing by. Example use cases of this feature include tracking tagged objects and employees wearing tags in and out of secure areas, and tracking objects passing through doorways. xArray's 2-D tag tracking capability allows customers to track tagged medical assets passing through intersecting hallways, aka "4-way" intersections.

7.3.1 Direction Overview

When an xSpan or xArray is selected as the data source, and while **Direction** is selected under **SHOW-CASES**, the main view will appear as shown in either of the halves depicted in the following figure.

- Note the xArray icon (right) and the number and arrangement of sectors. Only sectors 2 and 3 show for xSpan (left).

Direction View (Left: xSpan, Right: xArray)



- xSpan As Data Source (left image above)
 - Sector 2 is the one closest to the LED on the front of the xSpan; Sector 3 is opposite that. There are just these 2 sectors with an xSpan; the 2 sectors are 180 degrees apart.
- xArray As Data Source (right image above)
 - Sectors 2 (top) through 9 appear. Sector numbers increase in a clockwise manner and the width of a sector is approximately 45 degrees

- An xArray can track tags across more than 2 sectors, provided the sectors are not immediately adjacent. This means up to 4 sectors can be used to track direction with an xArray.
- xArray permits tracking tags entering and exiting in V-shapes, L-shapes, and many other patterns that result from combinations of 2, 3 and 4 sectors all being observed nearly simultaneously.

7.3.2 Metrics Area

Appearing on the right side of the main window is a top row containing running totals. Just below that is a table where information about every tag read by the gateway appears.

Direction Metrics

16 Processing Tags	0 Recent Exits	16 Total Tags			
TAGGED ITEM	ENTRY	CURRENT	STATUS	EXIT	
3008-33B2-DDD9-0480-3505-0005	4 02:46:31	4	11s		
0000-0000-0000-0000-AABC-7777	6 02:46:30	6	11s		
0006-33B2-DDD9-0140-0000-0000-0000	6 02:46:14	4	27s		
3008-33B2-DDD9-0140-0000-00DD	6 02:46:14	4	27s		
3008-33B2-DDD9-0480-3505-0001	6 02:46:14	4	28s		
3008-33B2-DDD9-0140-0000-0077-0000-0000	6 02:46:14	4	28s		
3020-0871-417C-E000-0000-00F1	6 02:46:13	4	28s		
3008-33B2-DDD9-0480-3505-0002	6 02:46:13	4	28s		
0000-0000-0000-0000-0000-0062	6 02:46:13	4	28s		
3008-33B2-DDD9-0140-0000-005C-0000-0000	6 02:46:13	6	28s		
AD88-1900-1C78-A58D-1900-00AC	6 02:46:13	4	28s		
2172-1134-1D33-2280-0836-2249	6 02:46:13	2	28s		
3008-33B2-DDD9-0140-0000-0000-0000-0000	6 02:46:12	6	29s		
AD29-2200-1983-798A-6600-00C5	6 02:46:10	6	31s		

- **Processing Tags** - this number represents the number of tags currently being tracked by the gateway. A tag is in the “processing” state from the time its Entry Report is received until the time its Exit Report is received.
- **Recent Exits** - reports the most recent exited tags. “Recent” is defined as the last 2 seconds.
- **Total Tags** - the total number of tags the gateway has tracked since the Showcase started.

The Tag Table contains four columns as follows. Clicking a column header sorts the column.

- **TAGGED ITEM** - the EPC (hyphenated every 16 bits, or every Gen2 word)
- **ENTRY** - a horizontally split cell where the top number indicates the sector associated with the Entry Report and the bottom timestamp is the Entry Report timestamp.
- **CURRENT** - The current sector the gateway calculates the tag to be in.
- **STATUS** - a horizontally split cell showing both the status of a tag (*Processing* or *Exited*) via an icon on the top, and the number of seconds the tag has been in the processing state.
 - *Gears icon* = Processing status
 - *Door with Arrow icon* = Exited status

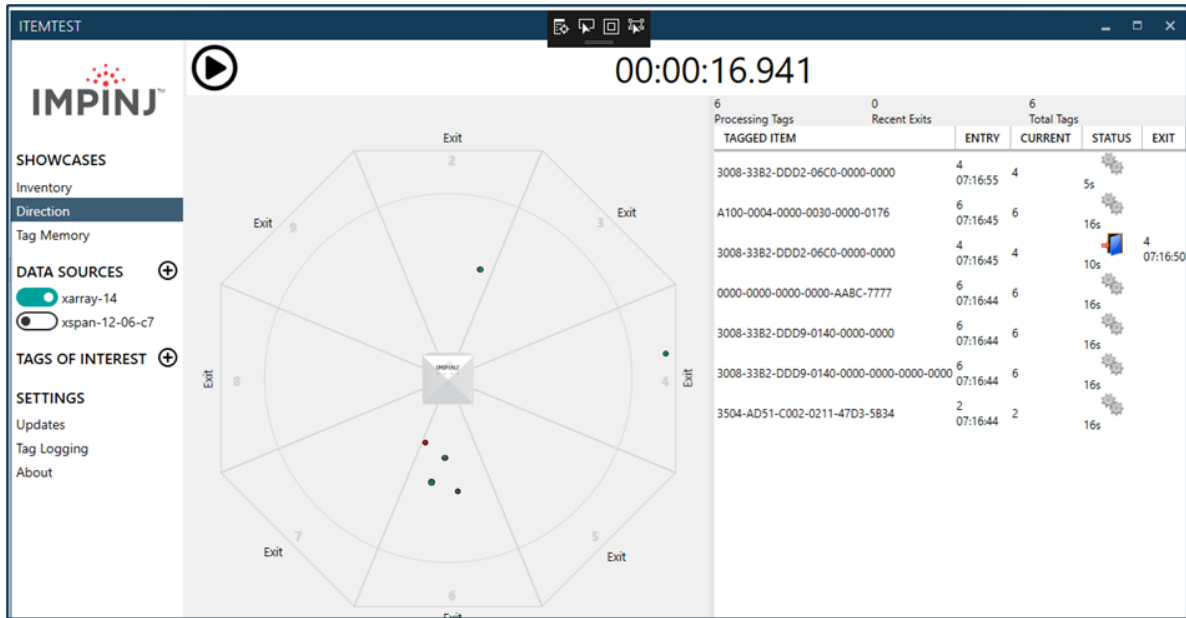
The status time stops upon receipt of a tag’s exit report.

NOTE: If the tag is read again after an exit report has been generated for it, a new row appears in the table for the tag, and its status timer will run.

7.3.3 Running the Direction Showcase

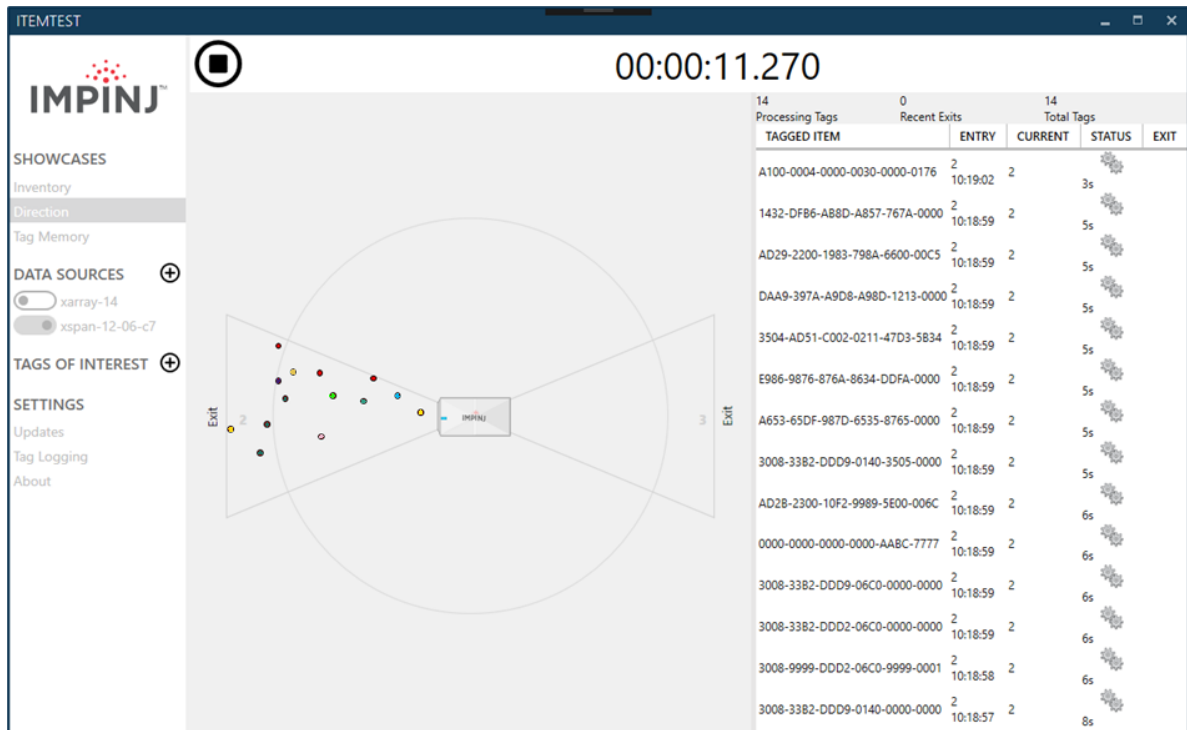
1. Toggle on an xSpan or xArray data source. (*Recall that only 1 gateway can be selected for direction.*)
2. Click the “Play” button – visually this is an encircled triangle on its side – in the upper left portion of the application. This starts the selected gateway.
3. A read tag will first appear in the sector in its Tag Entry Report.
4. ItemTest presents the tag as a colored dot, appearing at a random place within the entry sector.
5. The dot’s position is random within the sector for no other reason than to aid visualization.
6. The dot’s color corresponds to the color associated with the EPC if such an assignment has been made in an enabled TOI file.
7. The dot’s color will be teal if there is no match made in a TOI file, or if no TOI file has been enabled.
8. There is a chance two or more dots could be randomly plotted on top of each other. Observe the real-time list metrics on the right to help resolve any ambiguity in this infrequent case.
9. The metrics table to the right will contain a new row with the EPC, Tag Entry Report data and the Status column will show a gear icon (indicating “processing”) with a running timer underneath.
10. The value entered in **Update Interval** set in the Direction Configuration of the xSpan governs the frequency of tag update reports. Every **Update Interval** seconds the gateway sends a new report containing the sector the tag is in.
11. All times in the direction UI are host timestamps. Direction logs record reader timestamps. To avoid confusion, Impinj always recommends time syncing both the Impinj device and host computer running ItemTest. See the *Impinj RShell Reference Manual* for device NTP configuration.
12. If the current sector has not changed, the dot corresponding to the tag will not move.
13. If the current sector changes from the tag’s last reported sector, the dot replots in the current sector and the value in the Current column likewise updates to show the current sector.

Example xArray



14. Upon determining a tag has exited – that is, the gateway is no longer reading the tag and the algorithm has completed processing – the gateway sends an Exit Report for the tag.
15. Visually, the tag will slide via animation from its current position to the word “Exit” appearing next to the exit sector.
16. If a tag exits from the sector where it is currently plotted, the tag “slides” backwards from its current position to the word “Exit” on the same sector.
17. The metrics table Exit column updates to reflect the sector on which the tag exited, and the timestamp of the Exit report will appear underneath.
18. Exited tags appear in the metrics table as a door icon. A tag’s status timer stops immediately upon receipt of an Exit Report.

Example xSpan Running Direction



7.3.4 Direction Logs

Direction reports can be logged to a file. See **Tag Logging** for details. The data fields captured during a Direction Showcase run are:

- HostTimestamp
- EPC, ReportType
- FirstSeenSector
- FirstSeenTimestamp
- LastSeenSector
- LastSeenTimestamp
- Hostname

7.4 Tag Memory Showcase

The Tag Memory Showcase can be used to read and write the various memory banks of a single tag. An example use case could be writing additional identifying information to a tag user memory, such as a link to a website about the tagged product.

7.4.1 Tag Memory Overview

You can get to the Tag Memory Showcase in two ways:

1. Click on the Tag Memory Showcase
2. Run an Inventory job in List View, stop the job, and then right mouse click any of the tags appearing in the list

The figure below shows the second method:

The screenshot displays the IMPINJ software interface. At the top, the 'IMPINJ' logo is visible. The main window is divided into several sections: 'SHOWCASES', 'Inventory', 'Tag Memory', 'DATA SOURCES', 'TAGS OF INTEREST', and 'SETTINGS'. The 'Inventory' tab is selected, showing a table of EPCs (Electronic Product Codes) and their corresponding data. A red arrow points to the 'Tag Memory Access' button in the 'Inventory' section. Below the 'Inventory' tab, the 'Tag Memory' section shows a list of tags and their memory access status. The 'DATA SOURCES' section shows two sources: 'xspan-14' and 'xarray-14'. The 'TAGS OF INTEREST' section shows a list of tags. The 'SETTINGS' section shows 'Tag Logging' and 'About' options. At the bottom, a 'Unique Tag Plot' graph shows the number of unique tag reads over time (in seconds). The graph shows a sharp increase in reads around 0.5 seconds, followed by a plateau. The status bar at the bottom indicates 'Continuous - Runs Forever' and 'Unique Tags: 25 Rate: 0.00 tags/s'.

00:00:00.959

SHOWCASES

Inventory

Tag Memory

Tag Memory Access

DATA SOURCES

xspan-14

xarray-14

TAGS OF INTEREST

SETTINGS

Tag Logging

About

Unique Tag Plot

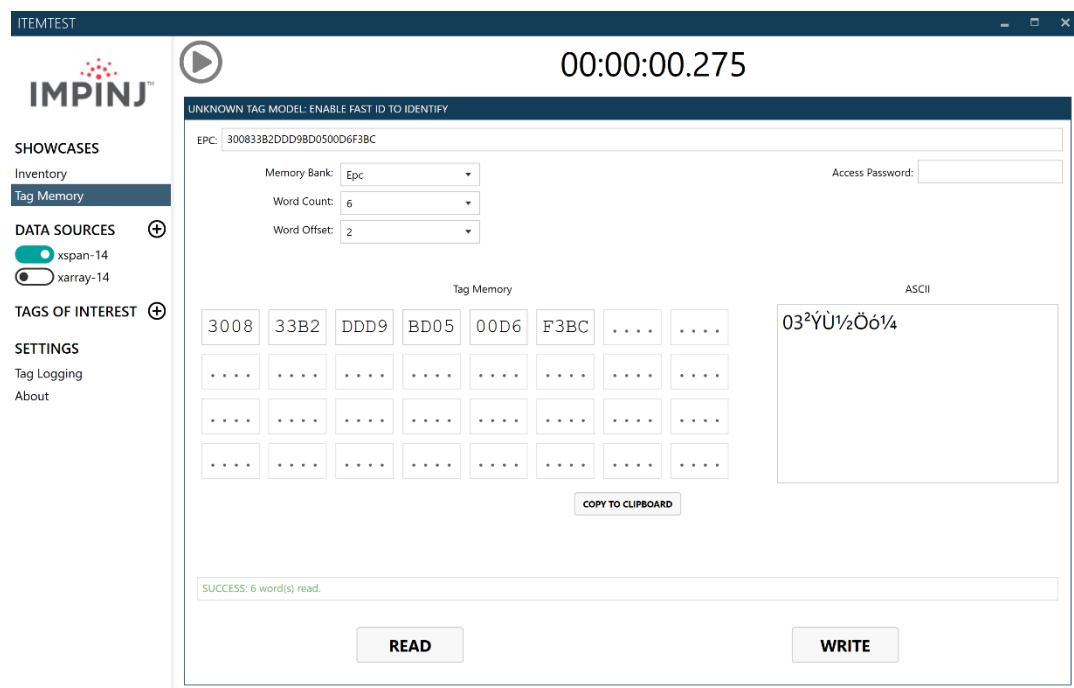
of Unique Tag Reads

Time (in seconds)

Continuous - Runs Forever

Unique Tags: 25 Rate: 0.00 tags/s

Tag Memory Showcase



Note: You must enter a *full* EPC in the **EPC** box. The reader uses this as a Select Filter to ensure it is interacting with one and only one tag, during the Tag Memory operation. The authors of ItemTest do this

to prevent inadvertent mass-writing of tags.

The following is a list of Tag Memory operation parameters:

- **Memory Bank:** Select the memory bank to access.
- **Word Count:** Specify the number of words to read or write. The maximum word count in one operation is 32 words.
- **Word Offset:** Specify an offset into the selected memory bank. This moves the start location of memory operation. Note that the offset is specified in words (i.e., 16-bit words) and not bits.
- **Access Password:**
 - You must provide a passcode if the memory you seek to access is locked.
- **Turn on Protected Mode Button:**
 - Click this button to put a tag into Protected Mode. Requires a password. Currently valid for the Impinj M700 series of tags only.
- **Turn off Protected Mode Button:**
 - Click to take a tag out of Protected Mode. Requires a password. Currently valid for the Impinj M700 series of tags.
- **Tag Memory Displays:**
 - **Hexadecimal Tag Memory Display:** This section (labelled **Tag Memory** and depicted as boxes with “...” in them) displays the hex memory data of the tag retrieved or written by the operation. Each box represents a word (4 hex characters, cumulatively representing 16 bits). If performing a read operation, the boxes fill with the memory contents retrieved from the tag. If performing a write operation, enter the information to be written to the tag in these boxes. See the Read and Write Buttons topic below for a step-by-step tutorial.
 - **ASCII Tag Memory Display:** This section (labelled **ASCII**) displays the ASCII representation of the memory data. It is extended (i.e., 8-bit) ASCII. Use it to read or write human-readable data to tags. You can edit it any time. As you type or delete a new character in this box, the hex memory updates to stay consistent with the extended ASCII display; it also functions vice versa.
- **Status Bar:**
 - This bar displays the status of the operations. When an operation is executed, the reader returns the result of the operation and ItemTest displays it. ItemTest translates the reader message into a user-friendly status message so you can discern and troubleshoot any problems that may occur. Some tag memory operations may yield results for which no explanatory text appears.
- **Read Button**
 - Click the read button to start a read operation with the selected parameters.
 - Once the read operation starts, if the device does not find a tag with a matching EPC within 5 seconds, the operation times out.
 - If the operation completes, the read data will appear on the memory displays and a status message will appear indicating success.
 - ItemTest disables all the components of the window until the operation either completes or times out.
- **Write Button**
 - To write to the selected tag, write the hex data inside the “...” boxes and click the write button.
 - Once the write operation starts, if the device does not find a tag with a matching EPC after 5 seconds, it will time out.
 - If the operation completes, the data you typed into the boxes will remain unchanged, but the status message will update to reflect the number of words written.
 - ItemTest disables all the components of the window until the operation either completes or times out.

Note: The **Turn On Protected Mode** and **Turn Off Protected Mode** buttons only appear in Tag Memory if the tag is one of the Impinj M700 series.

7.4.2 Reading Tag Memory (Step-by-Step)

1. By default, you will notice the selected memory bank is EPC. The memory has not been read yet and the boxes default to “...”. This indicates an *unread* status of memory.

Tag Memory Showcase – EPC Memory Bank

The screenshot shows the 'Tag Memory Showcase' interface for the 'EPC' memory bank. At the top, the title bar reads 'CLASS E2 : (MIPRU) : MONZA X-8K'. Below it, the EPC address '30083382CDD9014000000002' is displayed. The 'Memory Bank' dropdown is set to 'Epc'. The 'Word Count' is set to '1' and 'Word Offset' is set to '0'. An 'Access Password' field is empty. The 'Tag Memory' section contains a 4x8 grid of 32 boxes, each displaying '...'. To the right is an 'ASCII' text area. A 'COPY TO CLIPBOARD' button is located below the grid. At the bottom, there is a large empty input field and two buttons: 'READ' and 'WRITE'.

2. Use the **Memory Bank** drop down to select the **User Memory** bank. On selection, the memory screen will present additional textboxes. This is because, in this example, the tag we are writing to happens to be a Monza X-8K Tag. This tag type has considerably more user memory (512 words or 8,192 bits) than typical tags. Since an operation cannot have a word count exceeding 32 words, a maximum of 32 textboxes will be shown on the display at any given time. (You can access the rest of this particular tag type’s memory using the **Word Offset** feature and doing successive 32-word reads).

Tag Memory Showcase – User Memory Bank

The screenshot shows the 'Tag Memory Showcase' interface for the 'User' memory bank. The title bar remains 'CLASS E2 : (MIPRU) : MONZA X-8K'. The EPC address is still '30083382CDD9014000000002'. The 'Memory Bank' dropdown is now set to 'User'. The 'Word Count' is still '1' and 'Word Offset' is still '0'. The 'Access Password' field is empty. The 'Tag Memory' section contains a 4x8 grid of 32 boxes, each displaying '...'. To the right is an 'ASCII' text area. A 'COPY TO CLIPBOARD' button is located below the grid. At the bottom, there is a large empty input field and two buttons: 'READ' and 'WRITE'.

3. Notice that only one textbox is enabled. This is because the word count defaults to 1. Assume we want to read 29 words for this read operation. Select 29 in the **Word Count** drop down. This will enable the first 29 “...” memory boxes. Leave the **Word Offset** at 0.

Tag Memory Showcase – Word Count

CLASS E2 / IMPINJ / MONZA X-8K

EPC: 30083382D0C9014000000002

Memory Bank: Access Password:

Word Count:

Word Offset:

Tag Memory								ASCII							
...								
...								
...								
...								

- Click the **Read** button to begin the operation. Once the attempt to read the tag's memory completes, the status bar will contain a message. If a red message appears, the read failed and you should try again. On success, you will see something like what is depicted below in green text:

Tag Memory Showcase – Read Success

CLASS E2 / IMPINJ / MONZA X-8K

EPC: 30083382D0C9014000000002

Memory Bank: Access Password:

Word Count:

Word Offset:

Tag Memory								ASCII							
04D2	2694	BEEF	4567	89AB	CDEF	BEEF	0123	Ô&¼iEg=î¼i#Egb b¼=î¼p¼i4V							
4567	FEED	FEED	89AB	CDEF	FEED	BEEF	1234	x¼pð							
5678	9ABC	DEF0	0000	0000	0000	0000	0000								
0000	0000	0000	0000	0000								

SUCCESS: 29 word(s) read.

7.4.3 Writing Tag Memory (Step-by-Step)

- Obtain a tag with user memory:
 - Make sure the user memory is not perma-locked. If perma-locked, you will not be able to alter the memory.
 - If locked, make sure you know the access password.
 - In this example, we are using a Monza 4U tag and we know the access password (“AABBCCDD” in this simple example).
- Next, type “*Wireless memory is cool!*” into the **ASCII** textbox. See Tag Memory Showcase - Writing Tag Memory Success. Notice that ItemTest automatically generates the hexadecimal after each keystroke is entered. It requires 2 hexadecimal characters to represent 1 ASCII character (recall, this is 8-bit ASCII) so every keystroke in the ASCII textbox produces 2 hex characters in the **Tag Memory** boxes.
- If the tag is locked and you enter no or the wrong password, when you click **Write**, you will receive an error. This can be resolved, in this example, by simply entering the **Access Password**, which happens to be “AABBCCDD*” for this tag. Once the password is entered, click the **Write** button again and you should now see a SUCCESS message in green text:

Tag Memory Showcase – Writing Tag Memory Success

CLASS E2 : IMPINJ : MONZA 4U

EPC: 300833B2DDD901400000007700000000

Memory Bank: User

Access Password: AABBCDD

Word Count: 14

Word Offset: 0

Tag Memory

5769	7265	6C65	7373	206D	656D	6F72	7920
6973	2063	6F6F	6C00	0000	0000
....
....

COPY TO CLIPBOARD

ASCII

Wireless memory is cool

SUCCESS: 14 word(s) read.

READ

WRITE

7.4.4 Tag Memory Logs

Logging is not supported for Tag Memory Operations.

8 Tags of Interest

In the **TAGS OF INTEREST** section, ItemTest allows you to colorize and group tags using a TOI file. ItemTest will keep statistics on the counts of tags in the TOI file if seen and apply a set color when displaying tags in a Showcase.

ItemTest supports two different TOI formats: CSV, the traditional format, identical to ItemTest 1 format, and JSON, new to ItemTest 2.

- With a CSV file, the filename is used as the name of the TOI file in the application
- With a JSON file, the TOI name is taken from a dedicated field titled “Name”

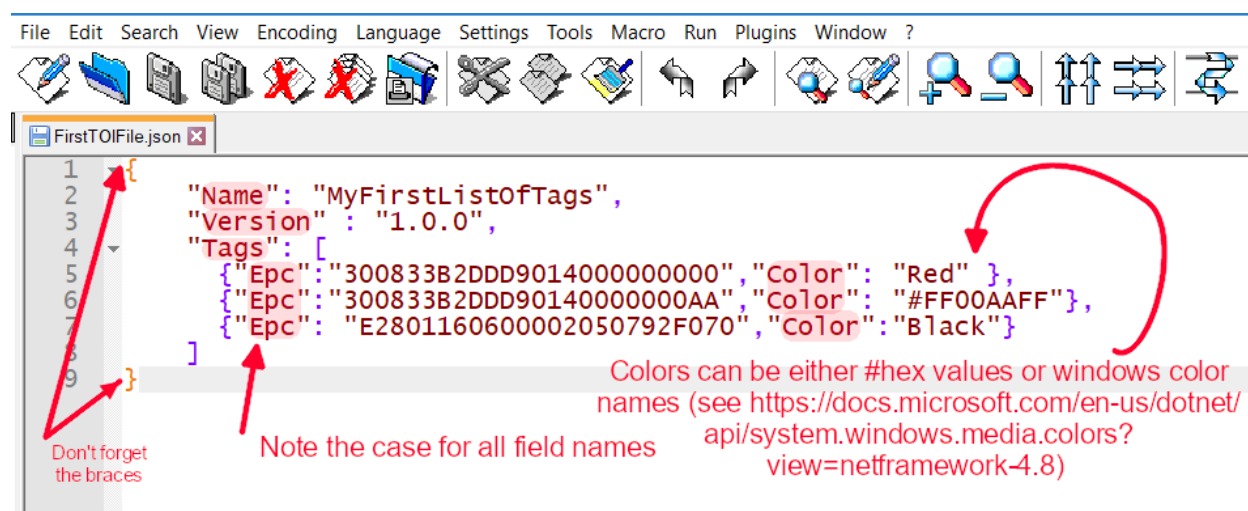
8.1 Adding Tags of Interest

1. To add TOIs, click on the “+” button next to the **TAGS OF INTEREST** section on the left side of the application.
2. When prompted, enter the path to the TOI file.

8.2 JSON Format Example

A JSON formatted TOI should be formatted as shown below:

Tags of Interest File Format



- The "Version:" field in the TOI file must be set to "1.0.0".
- The name can be anything you desire. It will be the name that appears in the **TAGS OF INTEREST** section.
- You can use standard Windows color names. See <https://docs.microsoft.com/en-us/dotnet/api/system.windows.media.colors?view=netframework-4.8>
- You can also use hex strings in the form **#XXXXXX** to denote a color. The alpha channel value is not used.
- If unable to parse the color strings ItemTest will assign the default color.

8.3 Legacy CSV Format Example

A CSV formatted file should be formatted as shown below:

- EPC
- Color=<color>
- Here is an example of a CSV formatted TOI file:

CSV Formatted TOI file

```
444433B2DDD9014000000000,Color=Green
444433B2DDD9014000000001,Color=Black
444433B2DDD9014000000002,Color=Red
444433B2DDD9014000000003,Color=Crimson
444433B2DDD9014000000004,Color=Gray
444433B2DDD9014000000005,Color=Olive
444433B2DDD9014000000006,Color=DarkSalmon
444433B2DDD9014000000007,Color=CornflowerBlue
444433B2DDD9014000000008,Color=#69BE28
444433B2DDD9014000000009,Color=#002244
```


8.4 Tags of Interest Window

Once you have imported your TOI file(s), you can view them within ItemTest by clicking on the TOI's name under the **TAGS OF INTEREST** section.

Tags of Interest Display Table (JSON Format)

ITEMTEST

MyFirstTOIFile

EPC	COLOR
0000000000000000AABC7777	
300833B2DD901400000000	

SHOWCASES

Inventory

Direction

Tag Memory

DATA SOURCES (+)

speedwayr-11-33-...

TAGS OF INTEREST (+)

MyFirstTOIFile

This display is view-only. You cannot change values.

To enable a loaded TOI, click the toggle so it is teal.

Click the named TOI to view a visual mapping of EPC to color.

8.5 TOI Import Exceptions

1. You will get an error if you attempt to load a TOI file where the "Name:" field is identical to a previously imported TOI file. If the same EPC appears in an already enabled TOI File, you will not be able to enable the file until disabling the other TOI file containing the duplicate EPC.
2. You may assign the same color to different EPCs, if desired, though this will make it difficult to differentiate visually the tags in a running Showcase.

9 Application Settings

9.1 Update Configuration

The check for updates can be configured by following the steps below:

1. Click the word **Updates** under **SETTINGS** on the left side of the application.
2. By clicking the **Check for Updates** button, you can immediately determine if a new version is available. You will need Internet connectivity so the update agent can communicate with the remote update server. If there is an update you will be prompted to install it.
 - Installing a new version will overwrite the old binaries.
 - Installing a new version will preserve the existing configuration settings and any custom profiles you may have created.
3. Checking the **Automatic Updates** box and setting the interval via the **Check Update Interval** dropdown enables automatic periodic update checks. You will always be prompted to install a new update and must manually confirm. Please note that the upgrade agent runs only at application startup.
4. Click **OK** to install if an update has been found.

5. You must restart ItemTest to finish the upgrade.

9.2 Tag Logging

You can enable detailed logs by clicking on the **Tag Logging** text appearing under the **SETTINGS** section in the left sidebar.

Log Tag Data

ITEMTEST

IMPINJ™

SHOWCASES

- Inventory
- Direction
- Tag Memory

DATA SOURCES (+)

- ☒ impinj-1d-00-31.i4...

TAGS OF INTEREST (+)

SETTINGS

- Updates
- Tag Logging**
- About

☒ **Log tag data**

ItemTest allows you to log tag reads to a file as they are received from data sources. Simply enable tag logging, define a destination directory, and a prefix for the log. Additionally, a list of unique EPC's can also be logged to a separate file with the same prefix.

TAG LOGGING CONFIGURATION

Destination Directory:

C:\Users\tanderso\Documents\ItemTest\TagLogs **BROWSE...**

Prefix:

mylogs

☐ Generate Unique Tag Log

SAVE **CANCEL**

1. To enable logging, slide the toggle next to **Log tag data** to the right. The color will become teal.
2. Click the **BROWSE** button to select the directory where logs should be stored.
3. A user-defined **Prefix** is optional. If you enter a prefix, it will be added to the beginning of any file created.
Note: Prefixes must not contain Windows file system reserved characters (e.g., /, ~, <, >, *, \, etc.).
4. When toggled, **Generate Unique Tag Log** generates a second log file whose content is a list of the unique EPCs.
5. The contents of the file will vary based on the Showcase. See each Showcase section in this document for details about the contents of logs captured during a logged Showcase.

10 Uninstallation Procedure

10.1 Uninstall Impinj ItemTest

1. In Windows 10 click the **Start** button.
2. Type "Add or remove programs".

3. Under **Apps and Features** scroll until you find **ItemTest**.
4. Click the **Uninstall** button underneath and follow the directions.

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ItemTest Gen2 RFID Utility

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