User Guide

# ITEMTEST VERSION 2.5.0

## USER GUIDE

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# 1 INTRODUCTION

Impinj ItemTest version 2.5.0 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

1. Download the latest version of **ItemTest 2** from the Impinj support web site at http://support.impinj.com.
   - *It is recommended, though not required, that you uninstall any ItemTest 1.x versions prior to launching ItemTest 2.*
2. Double click the downloaded setup.exe file to launch the installer.
3. Unlike ItemTest 1.x, ItemTest 2 is an unattended install and 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, Squirrel; see https://github.com/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.

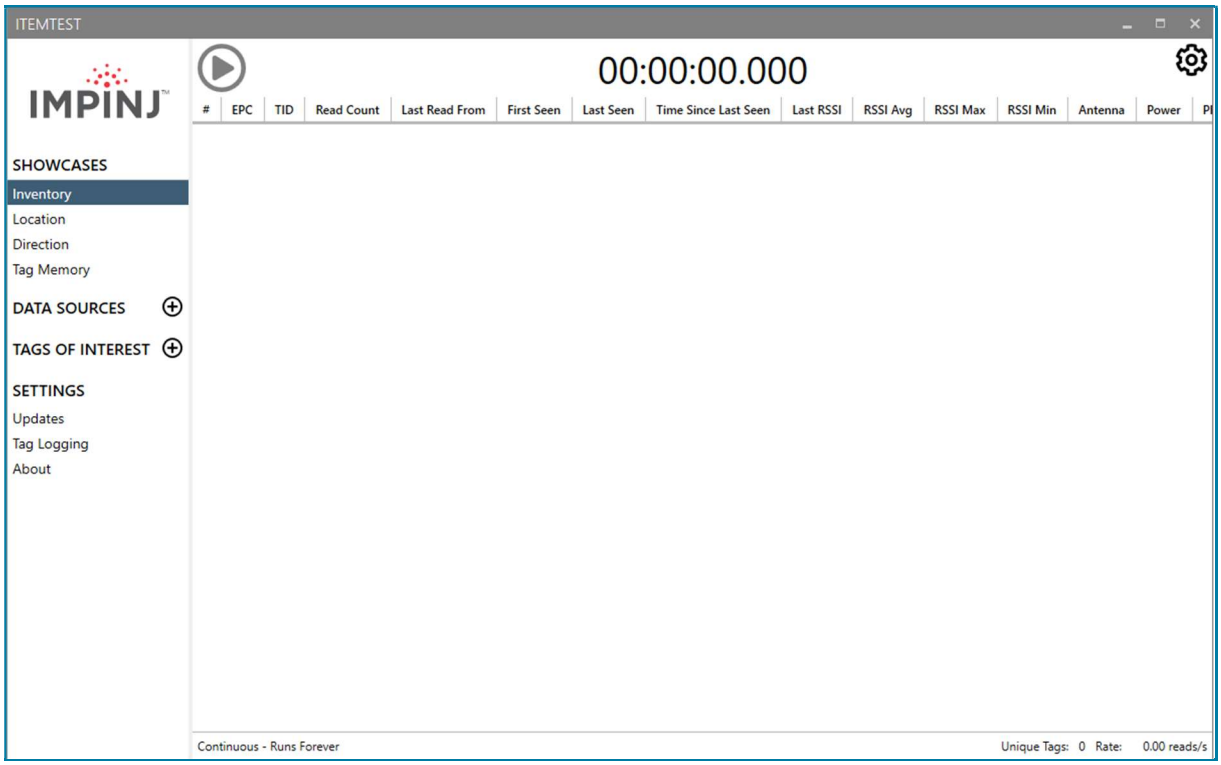
If desired, you can move the ItemTest folder and its contents after installation to a more convenient place, assuming the new destination is one where you have read and write access rights. Be aware that if you choose to move the ItemTest folder then you need to update the shortcuts generated at install 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 this screen.

**Figure 1: 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.

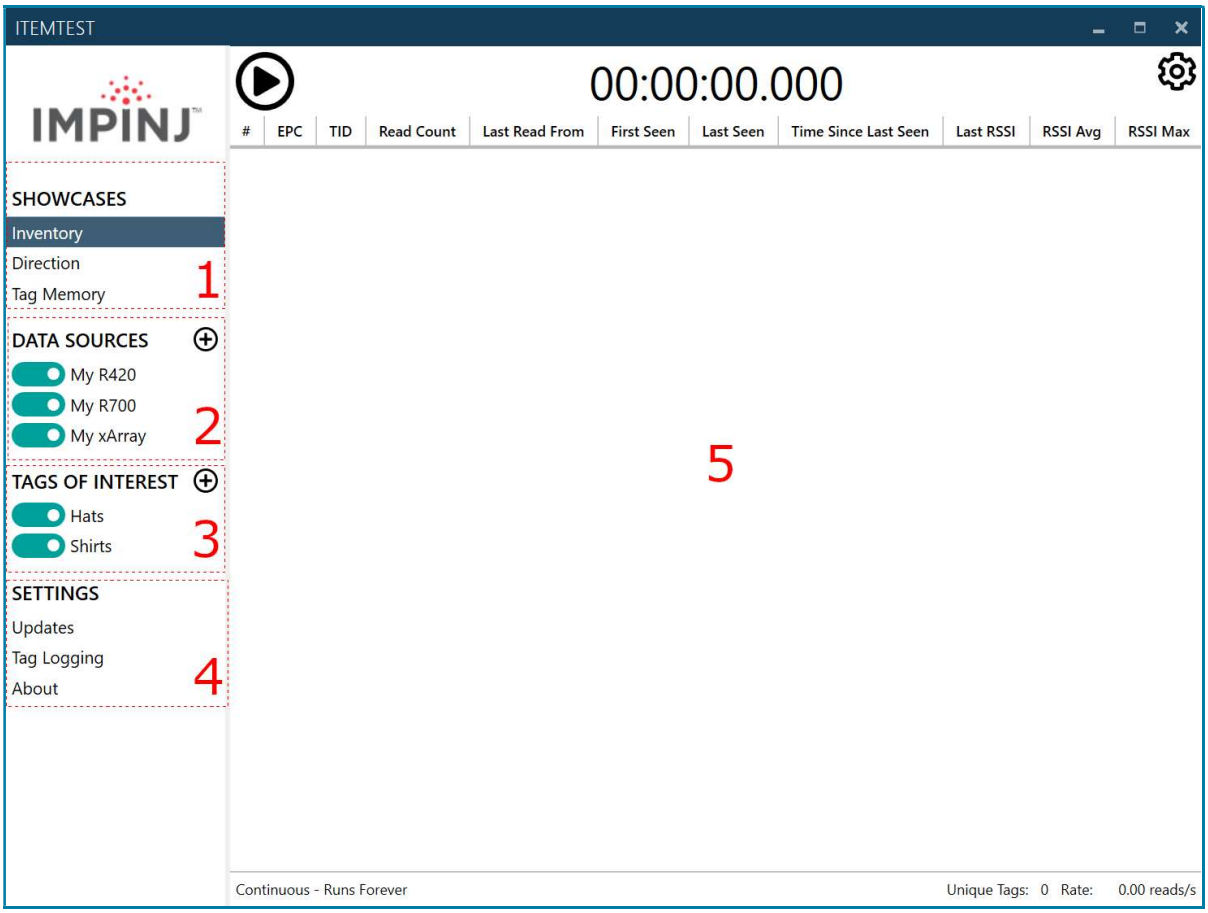
## 3.6 Automatic Updating

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 Section 9.1.

# 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.

**Figure 2: Navigation**




*Use the numbers on this figure 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.

6. 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/DELETING DATA SOURCES

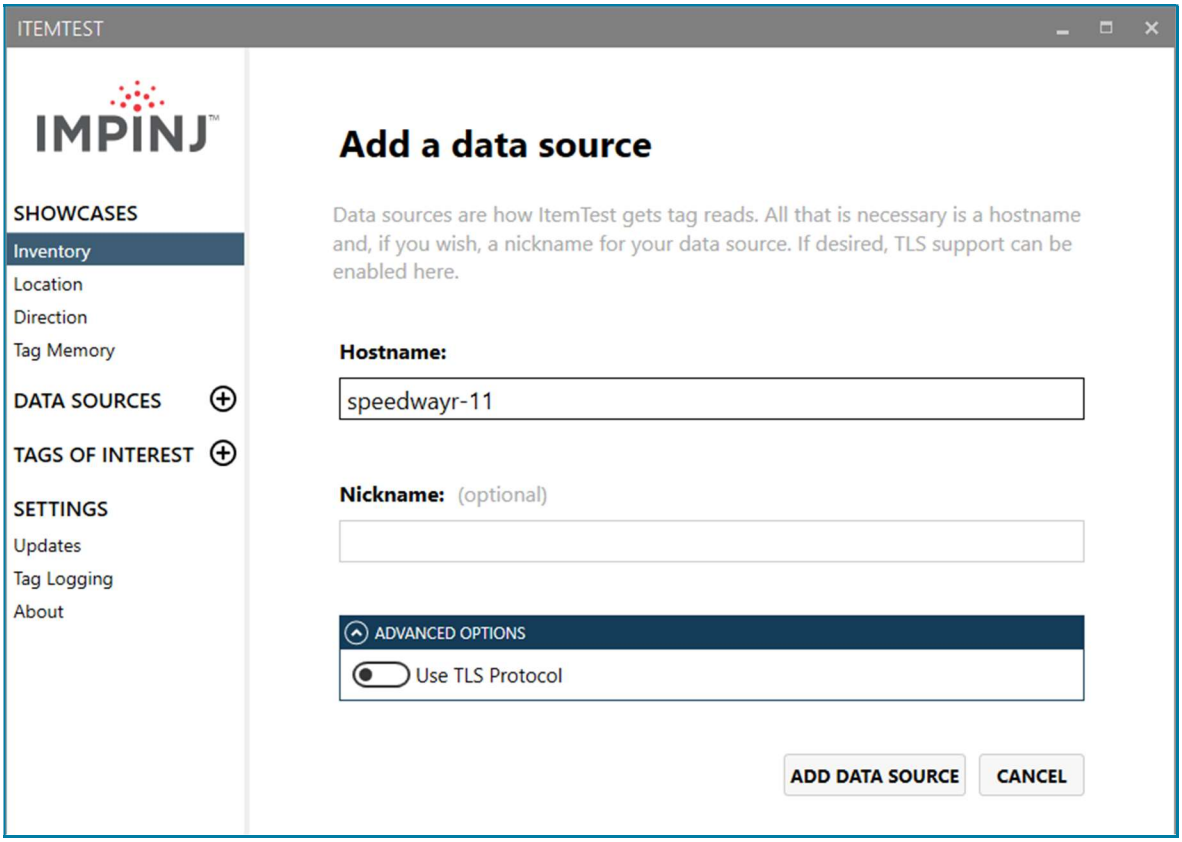
Data sources are how ItemTest retrieves information from RFID readers. You will need to add at least one data source to run a Showcase.

## 5.1 Adding a Data Source

The first task with a newly installed ItemTest is to add one or more data sources. The **DATA SOURCES** section has an encircled **"+"** button immediately to the right.

1. Click the **"+"** button to bring up the data source addition page.

**Figure 3: Add Data Source Dialog**




2. In **Hostname**, enter either a hostname or IP address of an Impinj reader or gateway.
   - Example 1: 192.168.1.242
   - Example 2: speedwayr-01-02-03.internal.mycompany.com
3. An optional **Nickname**, or alias, may be entered to make it easier to identify the device. Nicknames must be unique.
4. 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

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

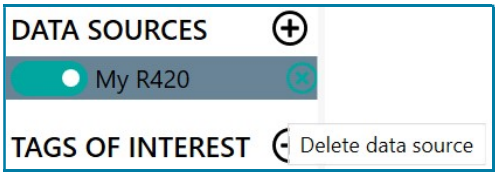
**NOTE:** Note that it is possible to make settings changes in ItemTest if sometime after startup the reader loses its connection to ItemTest, either intentionally by sliding the Data Source's toggle to the left so it becomes gray, or unintentionally if there is network loss. The device settings will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

5. Once a data source has been successfully added via the user interface, you are returned to the main screen.

## 5.2 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

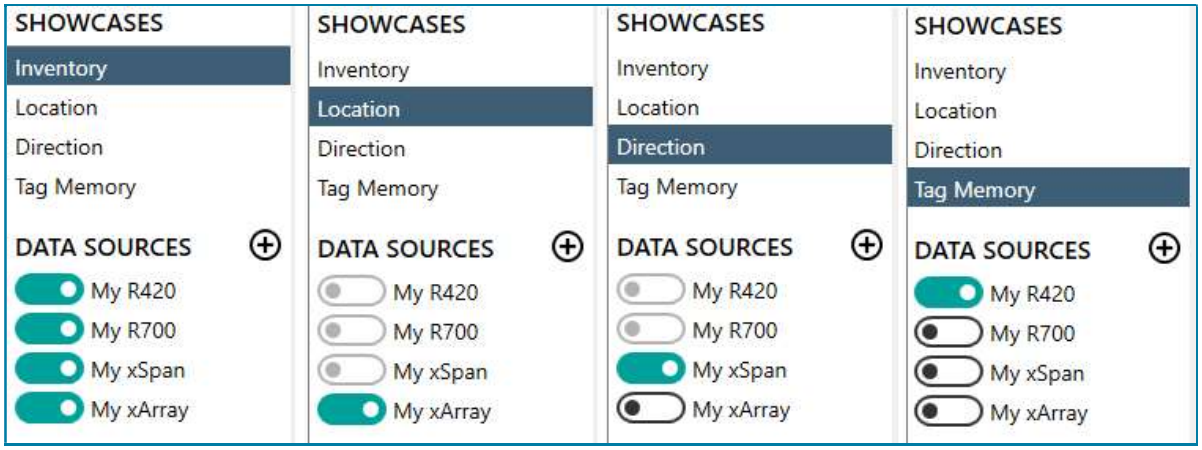
**Figure 4: Delete Button**




## 5.3 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.

**Figure 5: Different Showcases with Different Enabled Data Sources**

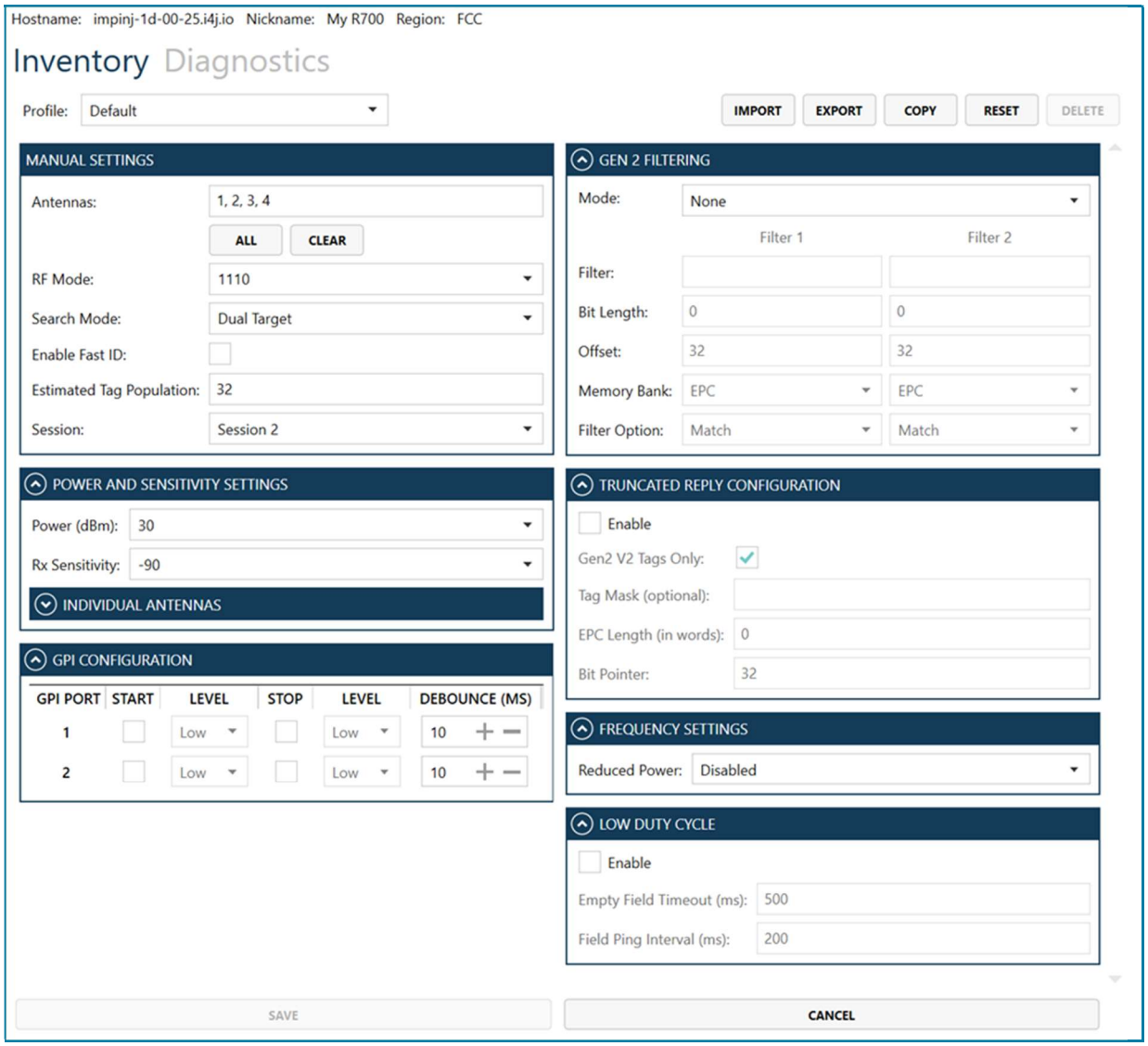



*Inventory may have any number of enabled data sources of any type. Direction may only have one data source enabled and the enabled reader must be an xSpan or xArray. Tag Memory may have only one data source enabled but allows any type of reader.*

## 5.4 Configuring Data Sources

To achieve optimal results, you need to configure the data sources for the Showcase you will be running. You will want to click on the data source in the sidebar. This displays the selected data source's configuration page. 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 Direction tab only shows up for those types of readers.

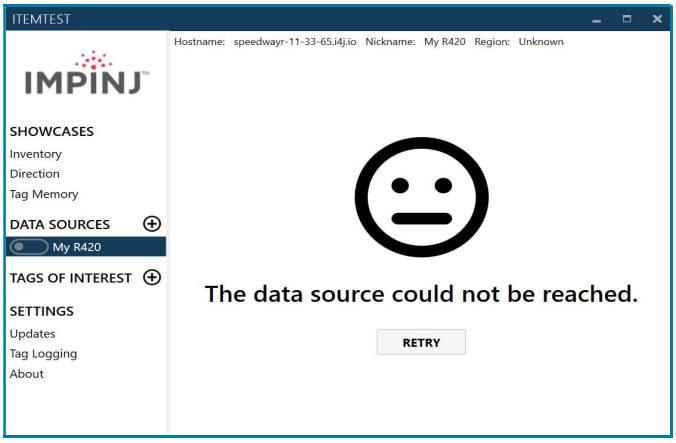
**Figure 6: Example Configuration of an Impinj R700**




## 5.5 Unreachable Data Sources

If ItemTest is unable to establish communications with a previously added data source, its name will still appear in the data source list, but in a disabled state (gray color). You may click on the unreachable data source name and then click the **RETRY** button to attempt a re-connection.

Figure 7: Unreachable Data Sources

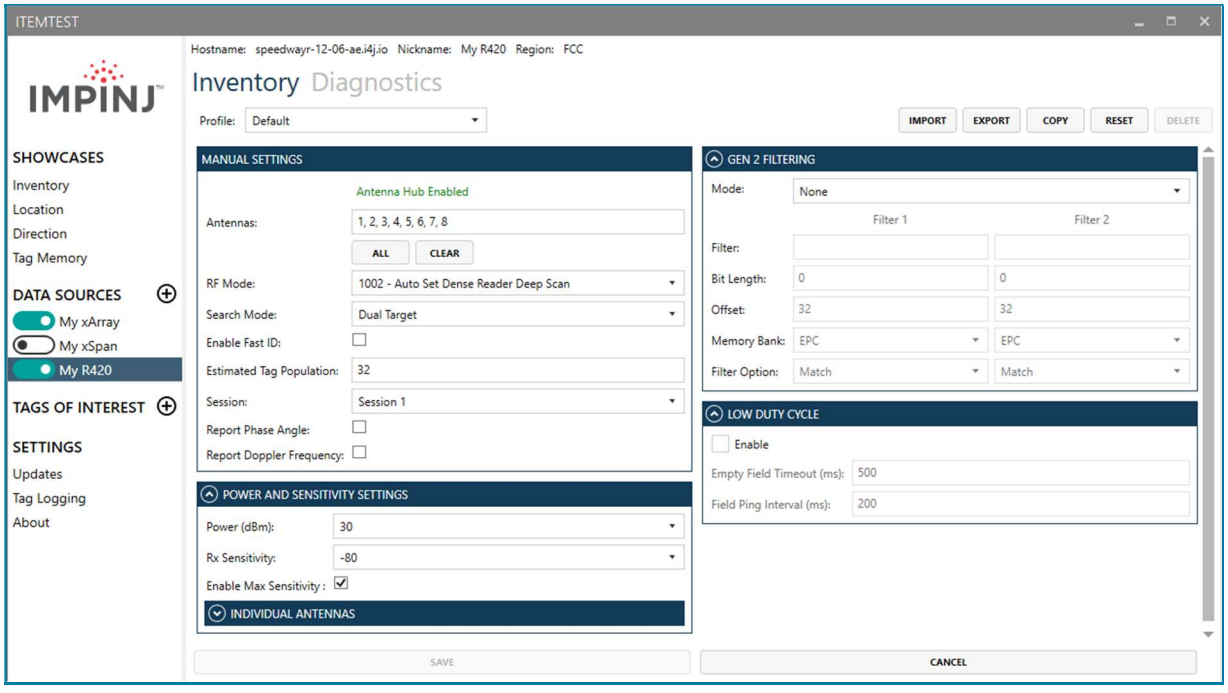



# 6 DATA SOURCE CONFIGURATION

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.

## 6.1 Configuring a Data Source for Inventory

Figure 8: Configure Main Screen

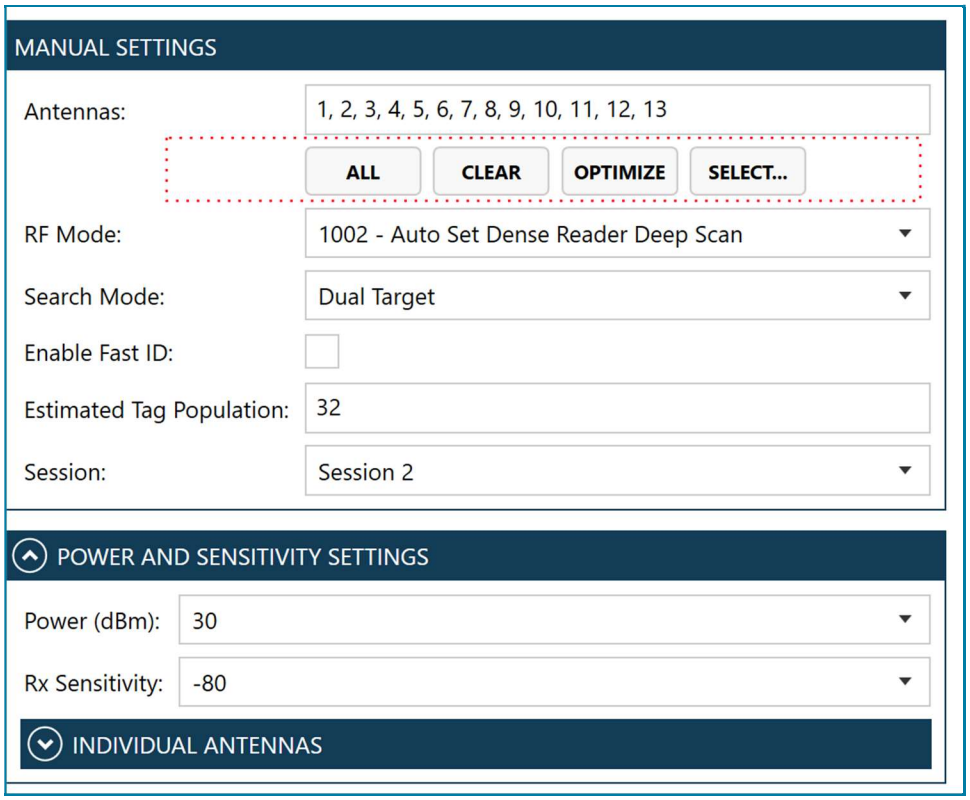


1. Click on the text "**Inventory**" appearing at the top of the main display. This brings up the settings applicable to the Inventory mode of operation. Pay attention to the possible appearance of a scroll bar on the right hand if the content cannot fit entirely within the current viewport.
2. In the 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.

### 6.1.1 Manual Settings

1. In the **MANUAL SETTINGS** section, in the **Antennas** box, enter a comma-separated list of antennas to be used.

**Figure 9: Configure Main Screen - Manual Settings**




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 Figure 11.
   - The maximum number of *Antenna Hubs* supported on an R120, R420, or R700 is 4, giving a potential total of 32 antenna ports. xArrays, xSpans and xPortals do not support Antenna Hubs.
   - If one or more **Antenna Hubs** have been added to a reader, then you will see in green text the words *"Antenna Hub"* above the **Antennas** input box. See Figure 11.
   - 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.

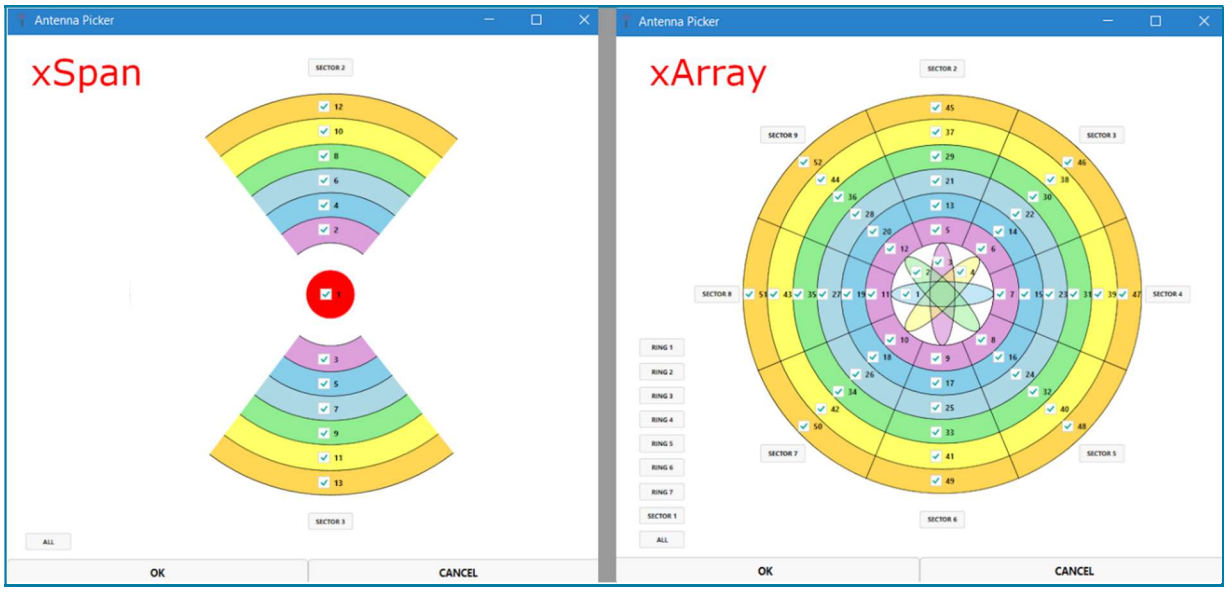
**NOTE:** Additional antennas *may* exist on certain gateway products that are not available for configuration in ItemTest. They can, however, be configured using an API such as LLRP or the Octane SDK. Please consult the device's User Guide to learn more about "virtual" antenna numbers corresponding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

4. To clear the **Antennas** box of its contents, click the **Clear** button.

#### 6.1.1.1 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.

**Figure 10: Graphical Antenna Selector – xSpan and xArray**



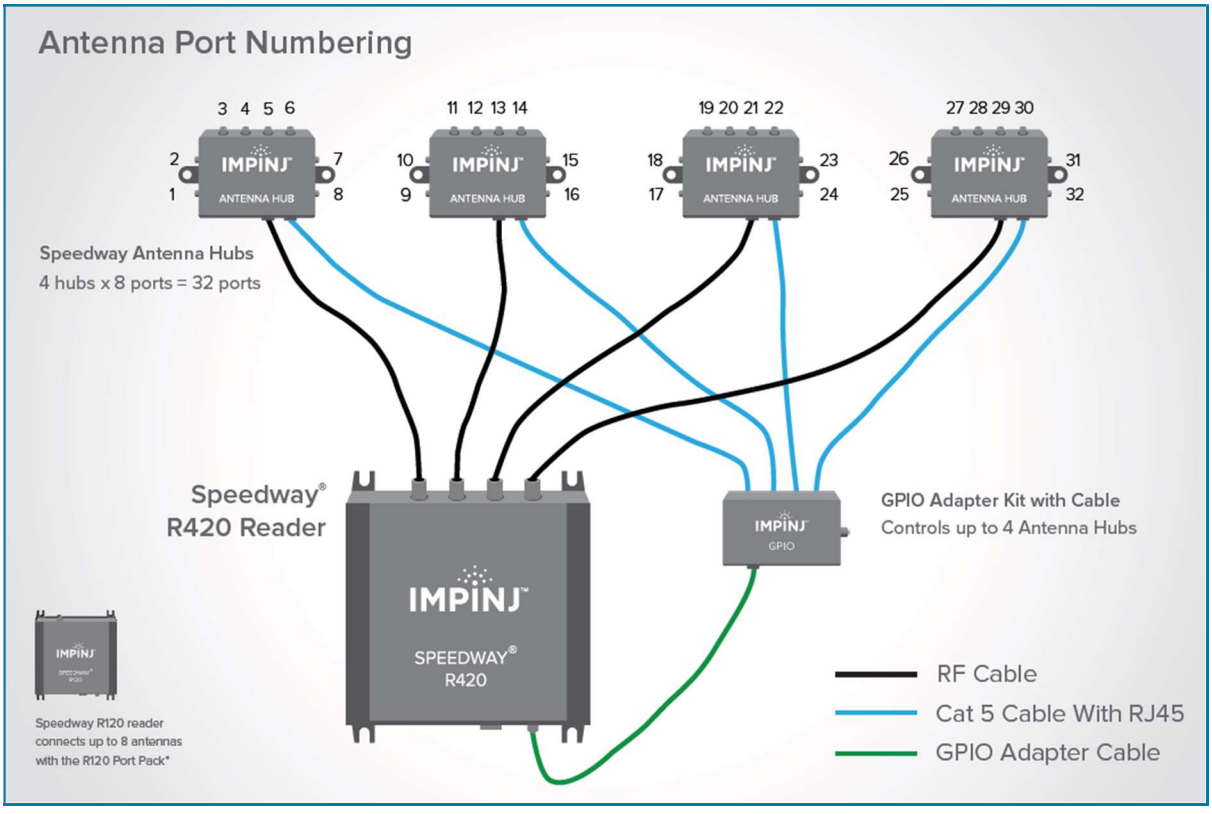

- For an **xSpan**:
  - Click **any of the 1-13 numbered** check boxes to toggle the inclusion of that antenna.
  - Click the **"Sector2"** check box to toggle antennas **2, 4, 6, 8, 10, and 12**.
  - Click the **"Sector3"** check box to toggle antennas **3, 5, 7, 9, 11, and 13**.
  - Click the **"All"**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

### 6.1.1.2 Antenna Hub Numbering

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

**Figure 11: Antenna Hub Port Numbering**




### 6.1.1.3 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)**
  - 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.

| New Modes for 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.

#### 6.1.1.4 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.

#### 6.1.1.5 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.

#### 6.1.1.6 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.

#### 6.1.1.7 Session

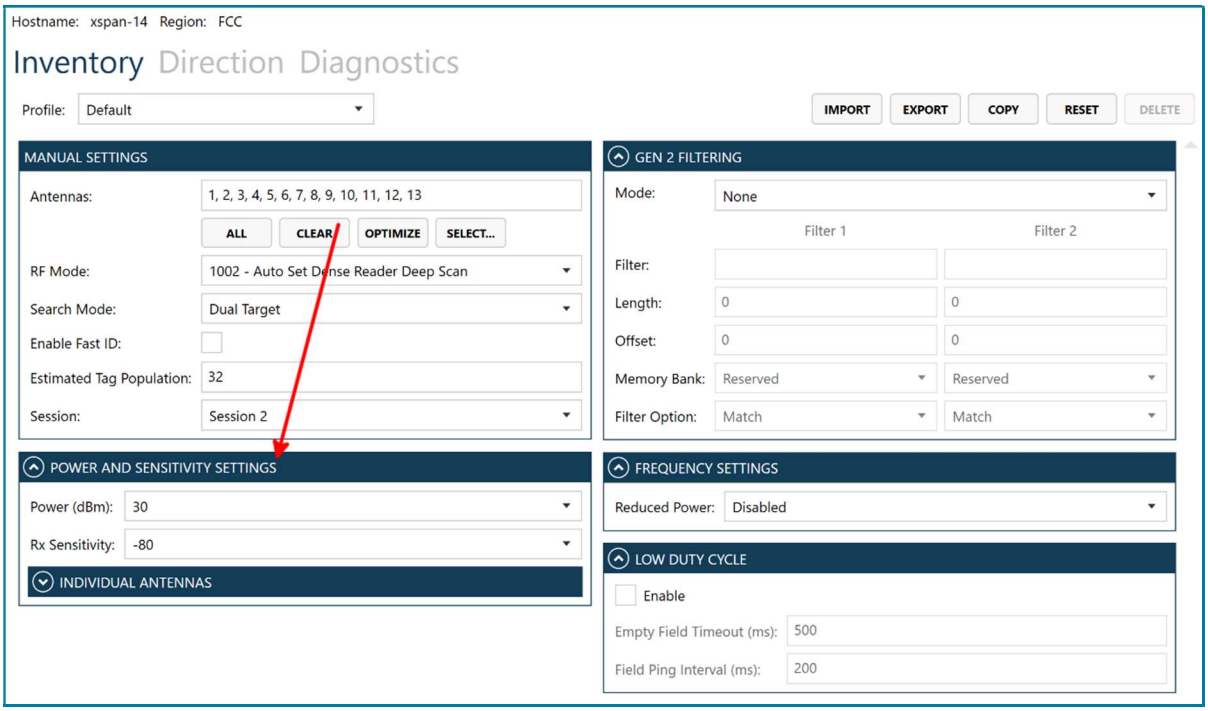
Select a Session from the **Session** dropdown list. Values are:

- **Session 0**
  - *Impinj strongly recommends that you NOT use Session 0.* This session is mainly for specific types of testing that are beyond the scope of this User Guide. Unless you are well-versed in the implications of Session 0, choosing it is likely to result in dramatically poor performance for many use cases.
- **Session 1**
  - Use when you want tags to quickly revert their inventoried state (reverts to the 'A' state between 0.5 and 5 seconds regardless of RF being on/off).
- **Session 2**
  - An inventoried tag reverts to the 'A' state at least 2 seconds after RF power is off.
  - There is no upper bound, other than technical, governing how long it takes an unenergized tag to revert to the 'A' state.
- **Session 3**
  - Behavior is identical to Session 2.

### 6.1.2 Power and Sensitivity Settings

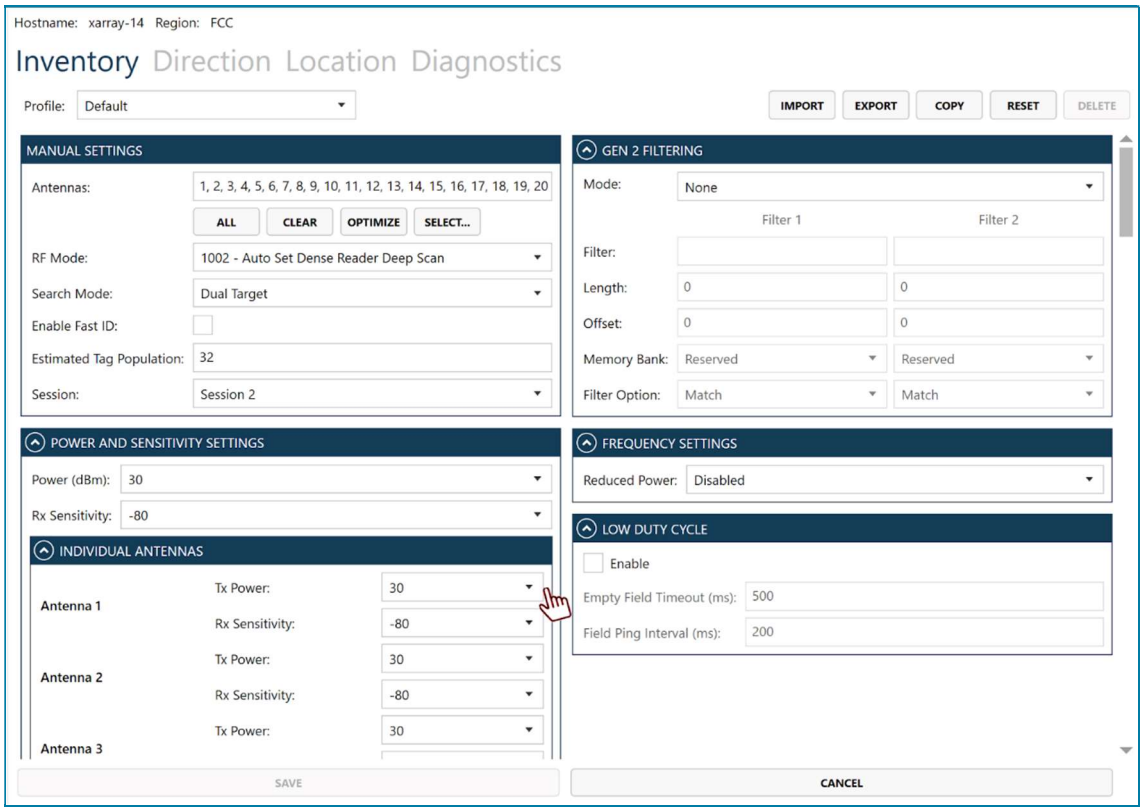
- You can set the power and sensitivity for all antennas or set both for individual antennas. The maximum permissible output power varies by region, device type, and power source (i.e., if the reader is powered by brick, POE or POE+). To make reader-wide changes (i.e., use the same values for all antennas),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

**Figure 12: Power Settings**




- 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.

**Figure 13: Individual Tx Power Configuration**



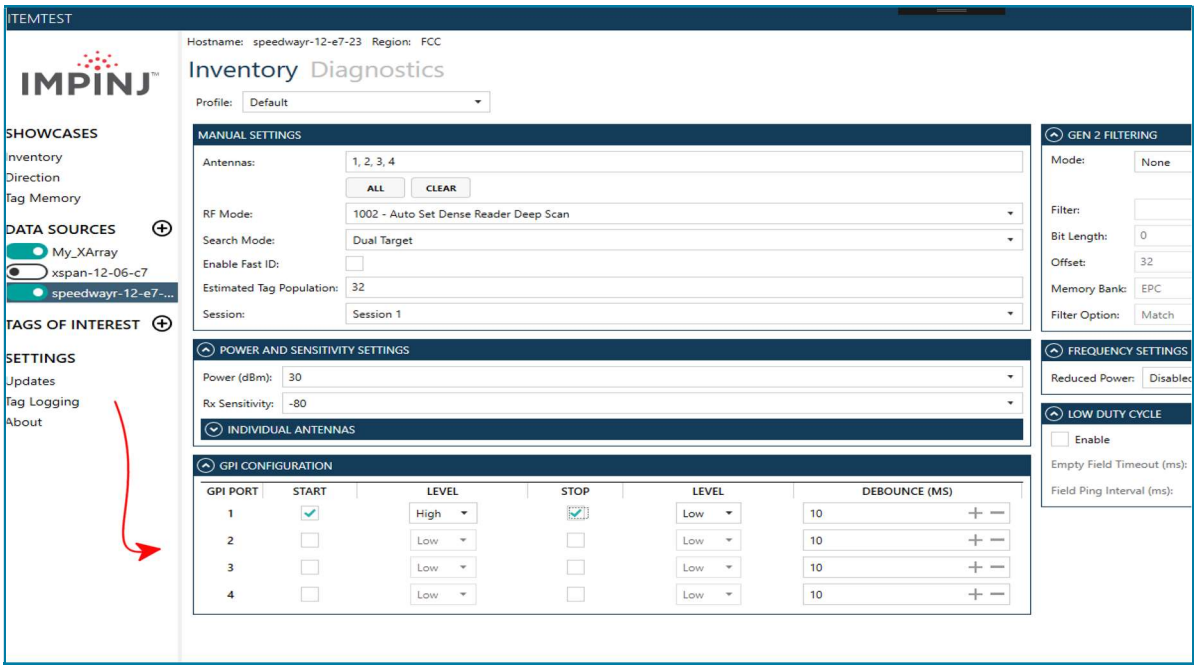

- To add a sensitivity filter either device-wide or per antenna, set the desired value in the **Rx Sensitivity** box. Note that for devices except the Impinj R700, the most sensitive value permitted is -80 dBm. This corresponds to ItemTest 1's "Max Sensitivity" value. For the newest device, the Impinj R700 reader, the maximum sensitivity supported is now -90 dBm.
  - Sensitivity per antenna is configurable and appears directly under the power entry box under the section titled **INDIVIDUAL ANTENNAS**.
  - In certain environments, you might want to reduce sensitivity to limit range without reducing power.

**NOTE:** Make sure you set this to -80 if you want the most sensitive setting for a Speedway R120, R220 and R420 reader, or any gateway. Set it to -90 for an Impinj R700 reader and prepare to be wowed!

### 6.1.3 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.”

**Figure 14: GPI Triggering**




1. Click the checkbox in the **START** column next to the GPI port carrying the “start” signal. Only 1 GPI port can be enabled to receive the “start” signal.
2. Click the **LEVEL** dropdown immediately to the right to choose the signal level that will start the inventory operation. Options are **Low and High.**
3. Click the checkbox in the **STOP** column for the GPI Port carrying the “stop” signal. *This port does not need to be the same as the start GPI port.*
4. Just as you did for the **START LEVEL**, click the rightmost **LEVEL** dropdown to choose the signal level that will stop the inventory operation. Options are **Low and High.**
5. You will get an error (red highlight around the GPI boxes) if you configure both the Start and Stop to have the same level on the same GPI.
6. To suppress any unwanted signal bounce, enter the number of milliseconds over which to debounce the signal by entering a value in **DEBOUNCE (MS).** The default is 10 milliseconds. The maximum value is 1000 milliseconds.
7. In the screenshot above, the reader will start to inventory when it senses a **High** signal on GPI Port #1 and will stop inventorying when receiving a **Low** signal on the same port.

### 6.1.4 Gen2 Filtering

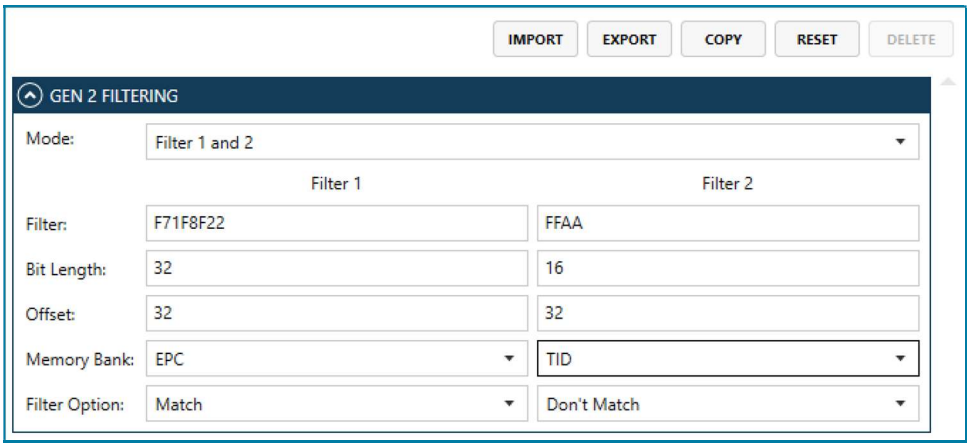
ItemTest supports a maximum of two filters that can be combined per GS1 “Gen2” specifications. Impinj readers and gateways can support more filters when using Impinj APIs.

1. **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 Figure 15.
2. **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.

3. **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.

**Figure 15: Gen2 Filters**



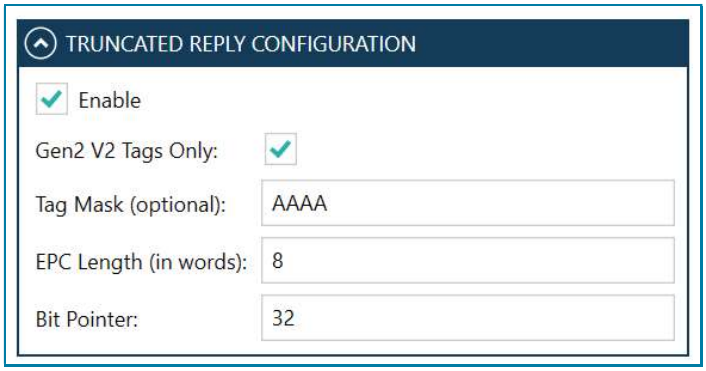

4. **Offset**
   - The bit pointer is an offset from the selected memory bank that tells the reader where in memory to start applying the filter.
   - Default value is set to 0. For typical applications you should enter 32 as the EPC starts at bit 32 in the EPC memory bank.
   - Must be a non-negative integer.
5. **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).
6. **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.

### 6.1.5 Truncated Reply

- If you are using an Impinj R700, ItemTest supports configuring the reader for truncated reply. See Figure 16. 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, and 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." 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**.
    - The zero-length term refers to the **Mask** being empty.
- 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.

**Figure 16: Truncated Reply Configuration**




1. **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

     If *any* doubt exists about a tag population's Gen2V2 compatibility**,** please do not enable**.**
2. **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.**

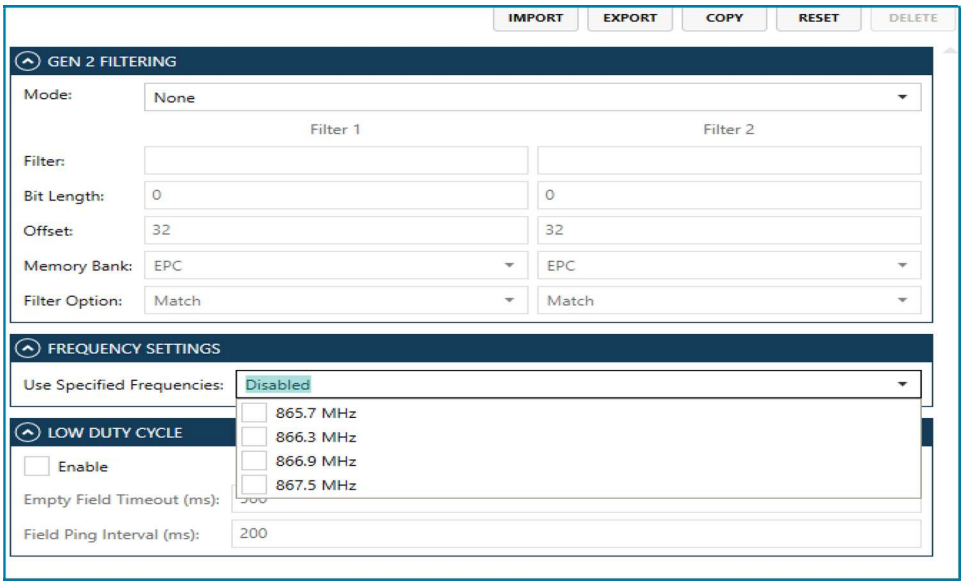
- The end of the mask is where matching tags begin backscattering their EPC contents.
- If left empty, **Gen2 Filters** may be used, but if the tag mask length is non-zero, **Gen2 Filters** must be disabled.
- Each character is a hexadecimal representation of a 4-bit nibble.

3. **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.
4. **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.

### 6.1.6 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. See Figure 17.

**Figure 17: Use Specified Frequencies**




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

### 6.1.7 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.

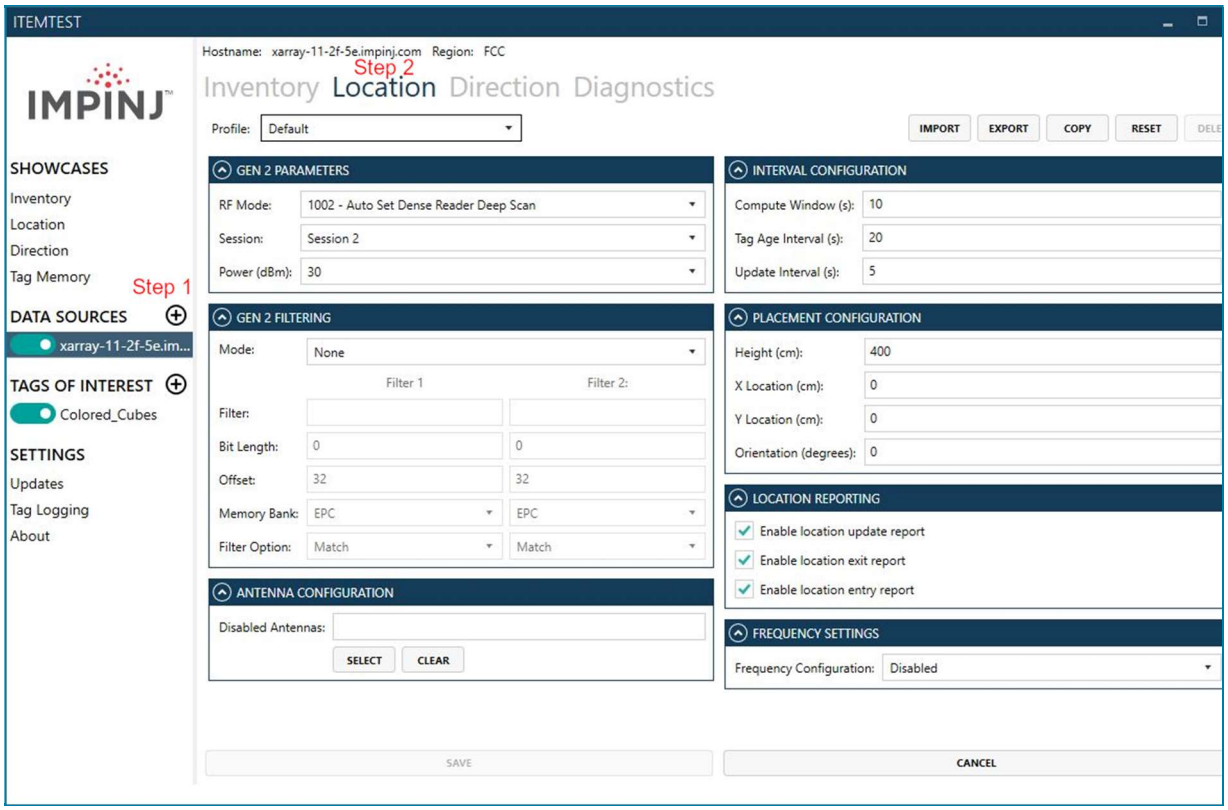
- Low duty cycle: **Empty Field Timeout (ms)**:
  - This is the amount of time that must pass without seeing any tags before entering low duty cycle mode.
  - The value must be a positive integer.
- Low duty cycle: **Field Ping Interval (ms)**:
  - Once in low duty cycle mode, this is how often the reader 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.

## 6.2 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.

**Figure 18: Location Configuration Screen**




### 6.2.1 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 section 6.1.1.3 ***Error! Reference source not found.*** 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.

### 6.2.2 Gen2 Filtering

- See section 6.1.4 *Gen2 Filtering* for detailed information.

### 6.2.3 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.

### 6.2.4 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

### 6.2.5 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) ÷ 2) = 55cm. 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 320cm - 55cm = *265cm.* In other worse, 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.

### 6.2.6 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 and 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.

### 6.2.7 Frequency Configuration

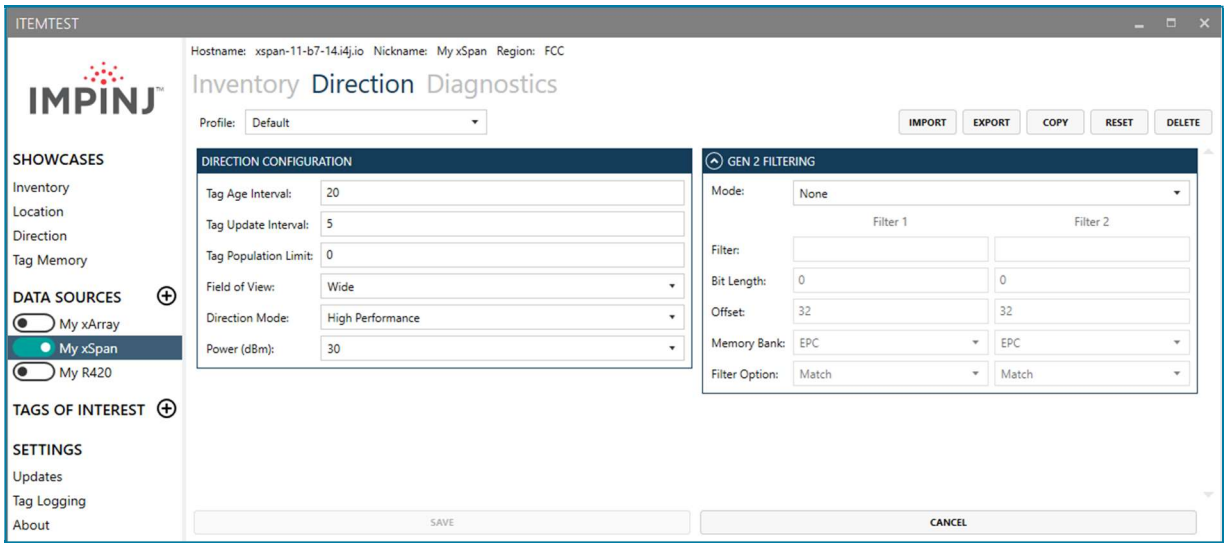
- If you are in a non-hopping region then you can choose the frequencies/channels you wish to use. For specific information please see Section 6.1.6***Error! Reference source not found.***

## 6.3 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.

**Figure 19: Direction Configuration Screen**




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

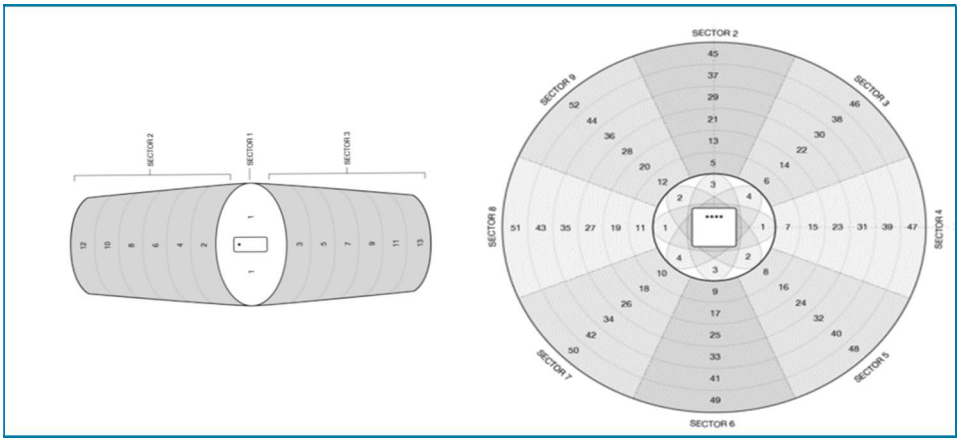
- **Tag Age Interval:** this value sets the amount of time a tag will be stored in the gateway's internal processing database. Once a tag is no longer visible for **Tag Age Interval** seconds, the reader sends a tag Exit Report. If the tag is read later, ItemTest treats it as a *new* tag.
  - Must be 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 Figure 19 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 drop-down 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.

### 6.3.1 Sectors

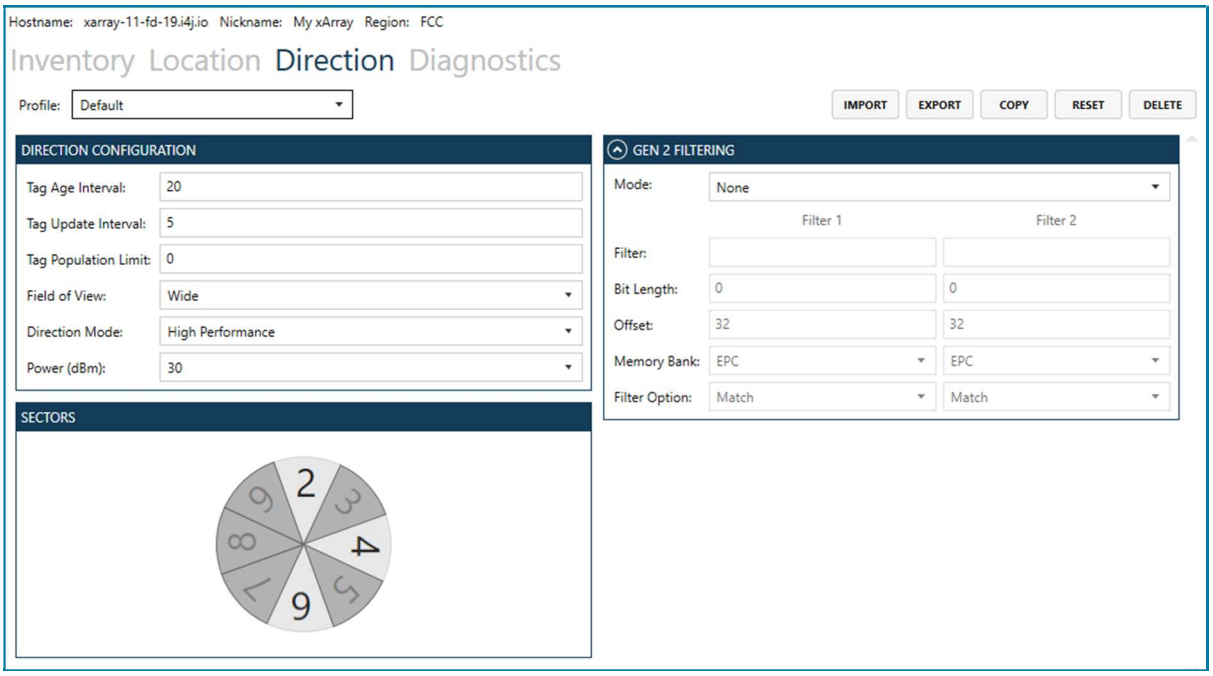
Both xSpans and xArrays have the concept of "sectors." Sectors represent discrete coverage areas resulting from one or more RF beam patterns. The xSpan has just two sectors, comprised of 13 beams in total. The xArray has 9 sectors, comprised of 52 beams in total. For direction detection, the center sector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

**Figure 20: Beams and Sectors (Left: xSpan, Right: xArray)**




- 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. See Figure 20 below

**Figure 21: xArray Sector Selector**




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

### 6.3.2 Gen 2 Filtering

To understand the details of using Gen 2 filters, see Section 6.1.4.

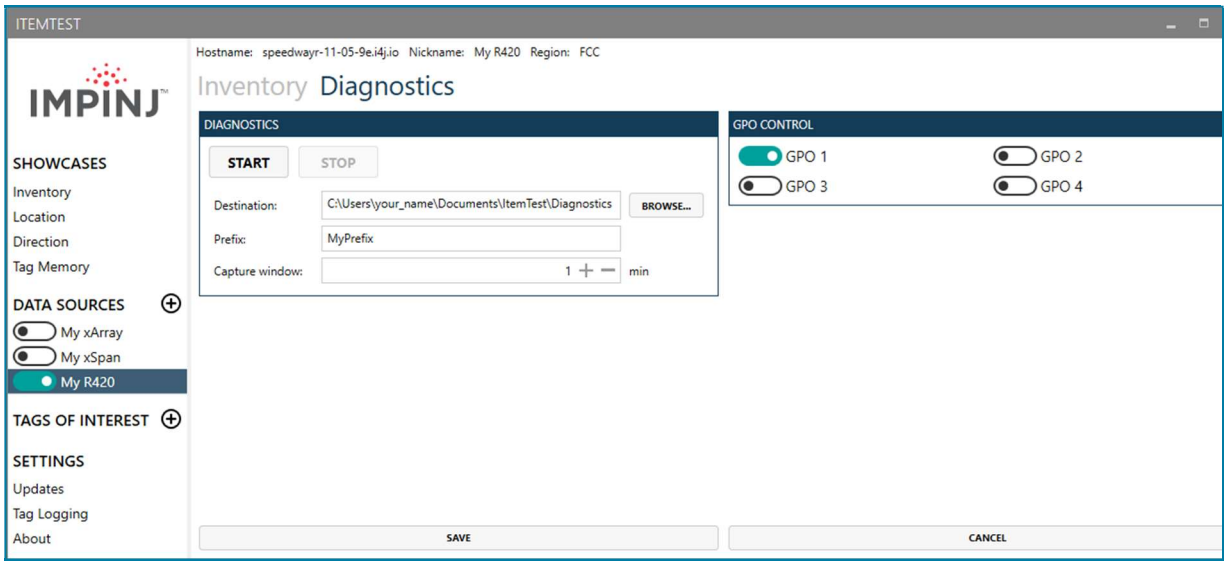
## 6.4 Data Source Diagnostics

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.

### 6.4.1 Diagnostic Data Capture

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

**Figure 22: Diagnostics and RDD/FDD Capture**




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!

**NOTE:** Currently ItemTest supports capturing RDD streams from just one reader. This limitation will be corrected in a forthcoming release to permit capturing RDD streams from all enabled devices.

4. On the **Diagnostics** tab, click the **Start** button to begin capturing and saving the diagnostic streams.
5. To stop a diagnostic capture, click the **Stop** button.
6. Make sure you click the **Save** button at the bottom of the screen to ensure ItemTest records the streams as you run Showcases.

7. The captured files must be sent to Impinj for analysis. They are binary and require custom-built parsers to decode.

### 6.4.2 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.

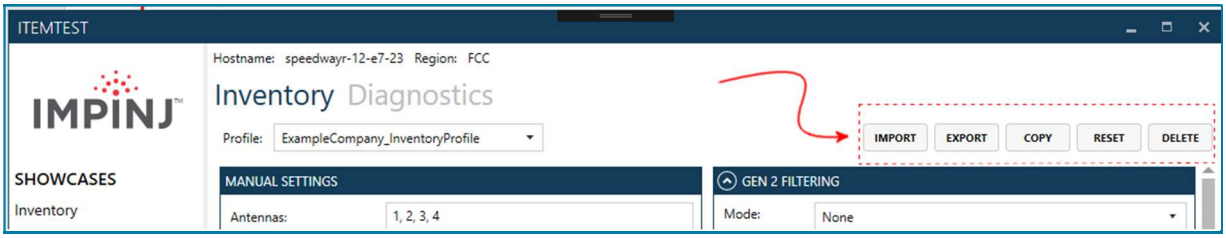
**Figure 23: GPO Testing**




## 6.5 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: **IMPORT, EXPORT, COPY, RESET, DELETE**.

**Figure 24: Profile Operations Buttons**

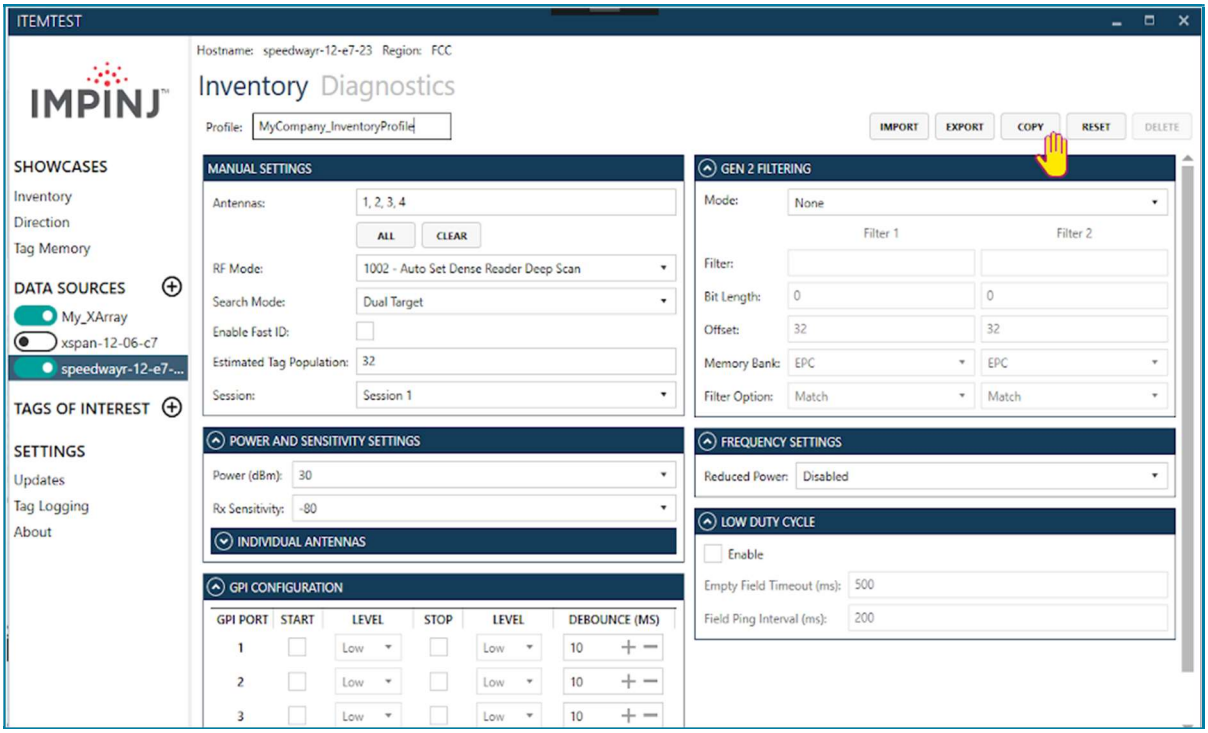



### 6.5.1 Creating a Profile

- 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. See Figure 24.
- 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.

**Figure 25: Creating A Profile By Copying**




## 6.5.2 Saving A Profile

- After creating the profile, Press ⏎ Enter/Return to save the new profile.

**NOTE:** Ensure you press ⏎ **Enter/Return** to save the changes. Many people forget to do this step and the omission causes the profile to 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

## 6.5.3 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.

## 6.5.4 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. *See Note about Default profiles modifications above.*
- 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 formerly.

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

### 6.5.5 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.

### 6.5.6 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.

# 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.

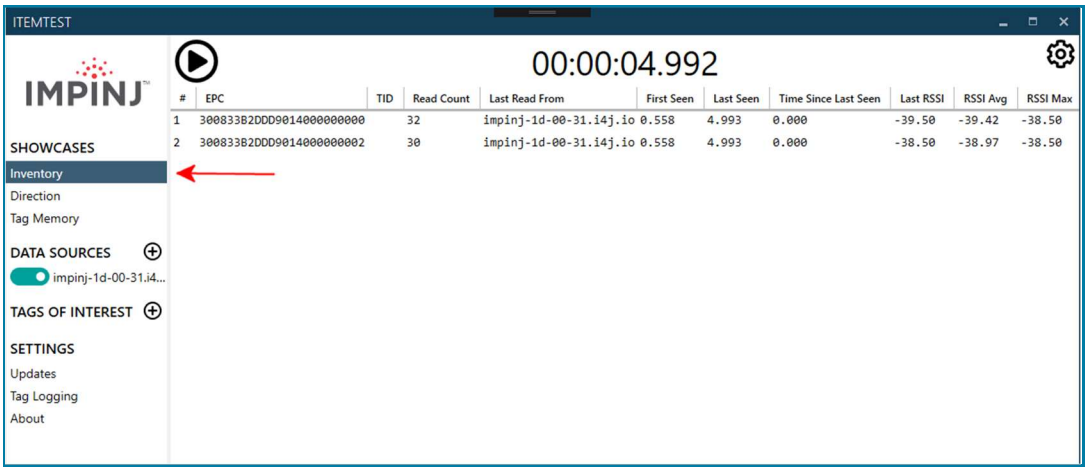
Each Showcase type is aware of compatible device types and readers. Consequently, clicking on a Showcase will dynamically toggle off data sources if there are too many, or if the data source is not supported by the Showcase.

## 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.

**Figure 26: Inventory Showcase**



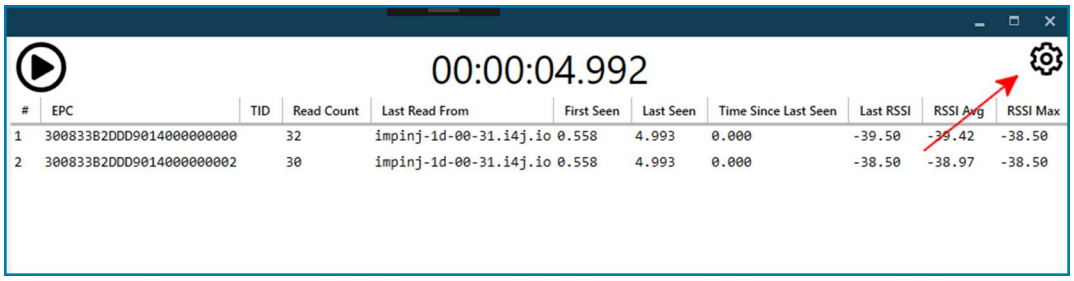

Ensure you have added one or more **DATA SOURCES** and configured their Inventory-specific settings. Click on the word "Inventory" in the **SHOWCASES** section (left hand side of the application).

At the bottom, you will see useful information at the bottom of the table:

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

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

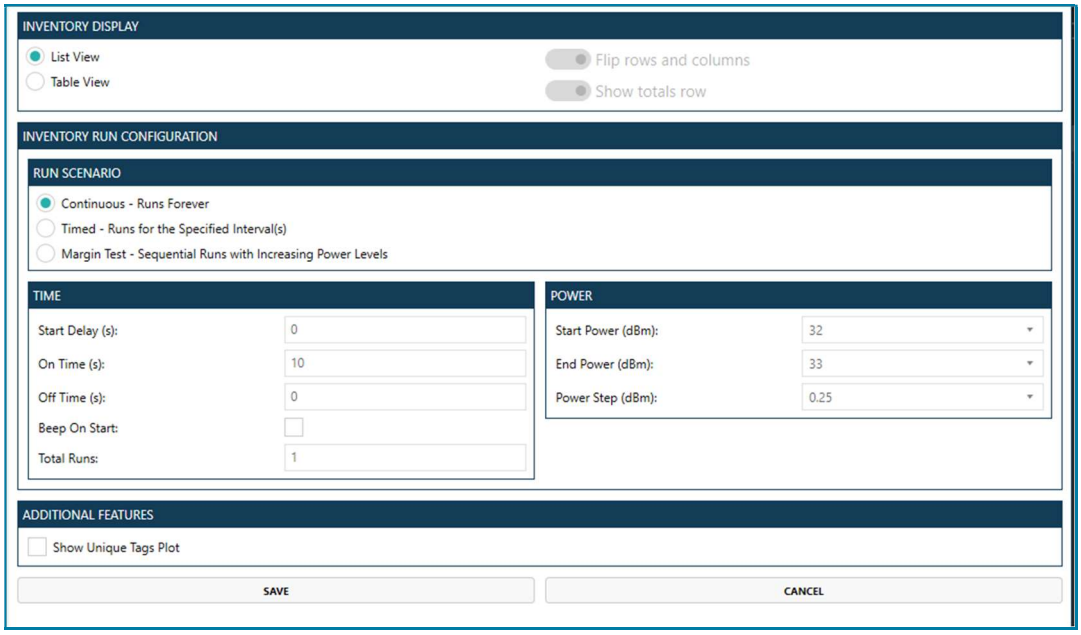
**Figure 27: Gear**




### 7.1.1 Inventory Overview

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

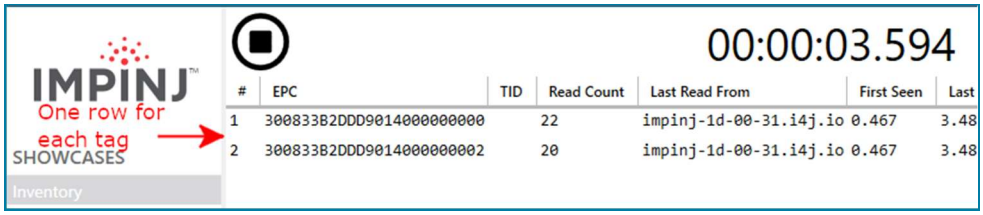
**Figure 28: Inventory Visualization Settings Page**




### 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:

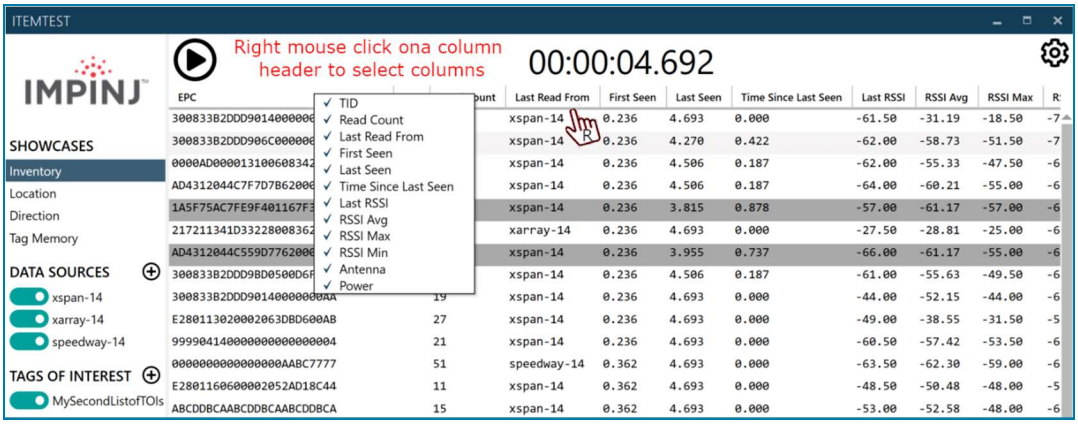
**Figure 29: List View**



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:

**Figure 30: Inventory List View Showcase**




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.

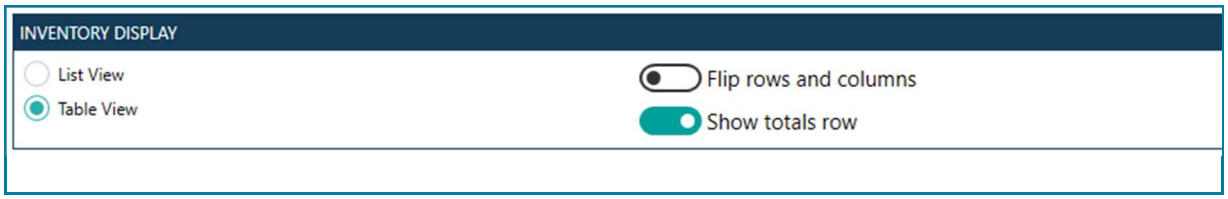
- **RSSI Min**:
  - The Minimum Received Signal Strength Indication value.
- **Antenna**:
  - The last antenna that read the tag.
- **Power**:
  - The output power of the device when the tag was read the first time.
    - Useful when performing Margin Read tests

**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.

**Figure 31: Inventory Showcase Table View Configuration Panel**

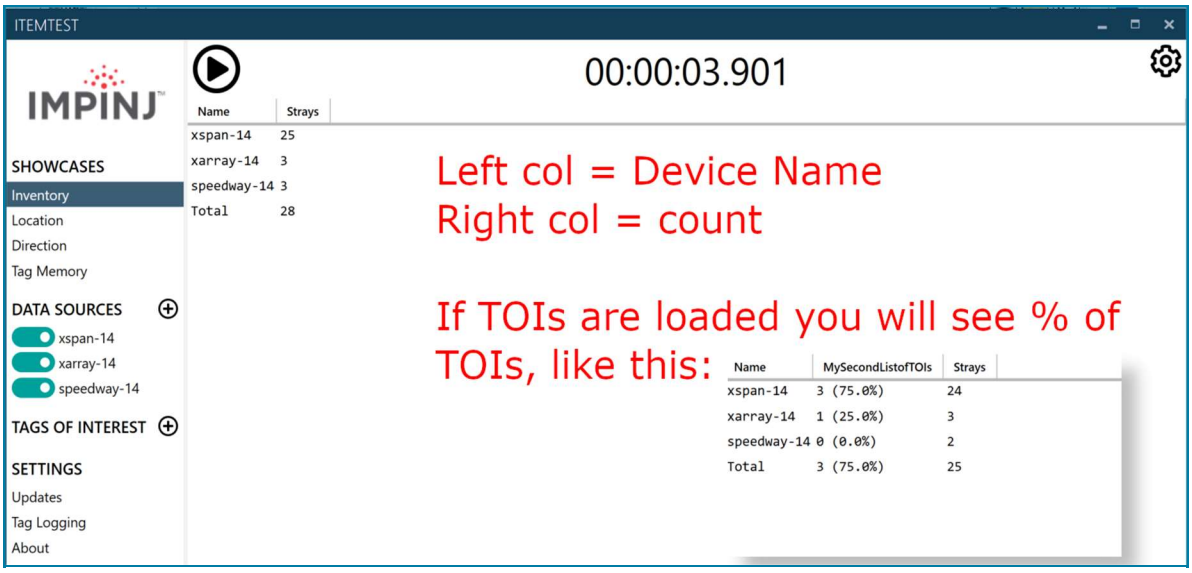



If **Table View** is selected, you can choose to **Flip rows and columns**. Toggling this to the enabled position organizes the table columns according to tag type (i.e., TOI file source or stray) and sets rows by data source, as shown in Figure 32. Toggling to the disabled position organizes table columns according to data source and sets rows by tag type, as shown in Figure 31.

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:

**Figure 32: Inventory Table View Run**




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:

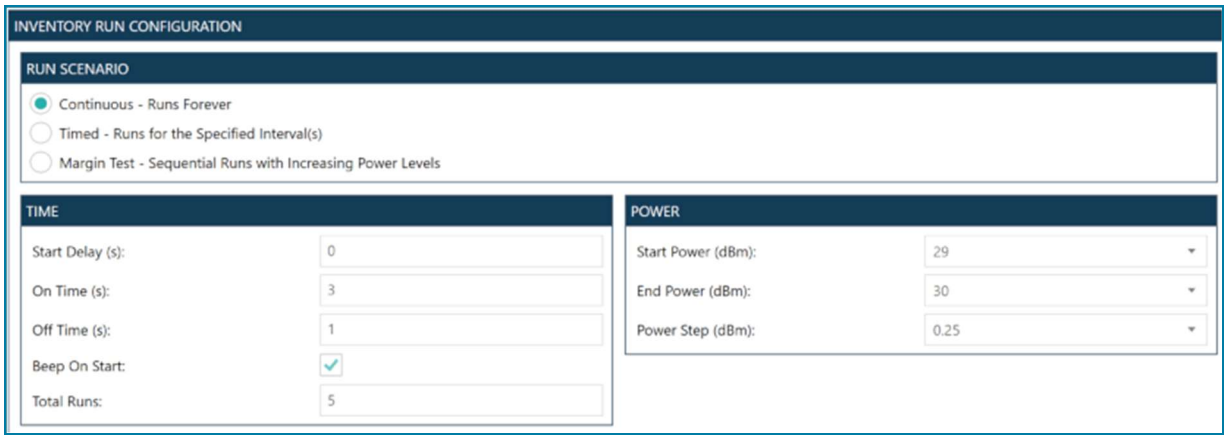
- **All files** - Count of all tags found that match all TOI files.
- **All files %** - Percent found in all TOI files.
- **Overall Total** - Count of all TOI tags and Strays found.

### 7.1.4 Advanced Run Scenarios

You have several options for running the Inventory Showcase.

### 7.1.4.1 Run Scenario.

**Figure 33: Inventory Run Configuration**




- **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

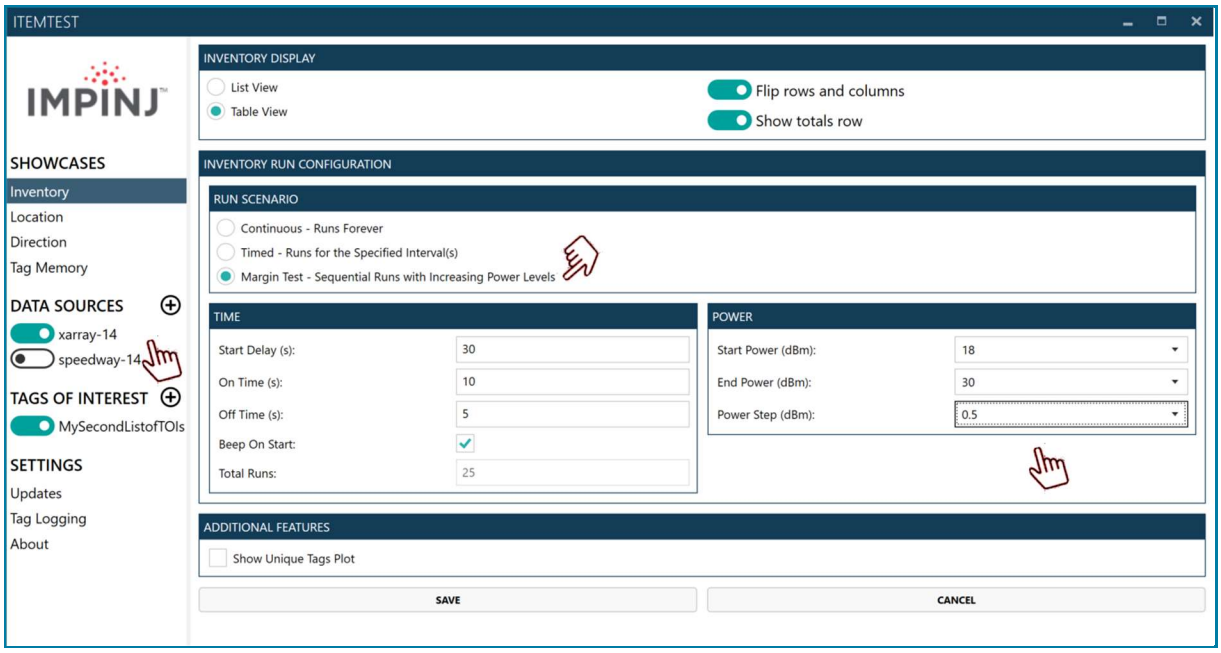
- In the **POWER** box, configure the Power settings *only* if Margin Test has been specified.
- Click the **Start Power (dBm)** dropdown arrow and select the appropriate value.
  - Specifies the start power value to start incrementing from.
  - Defaults to 29
- Click the **End Power (dBm)** dropdown 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.

**Figure 34: 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:** Note that margin tests can be executed using multiple devices. All device types support running a margin test.

### 7.1.4.5 Margin Test Logging

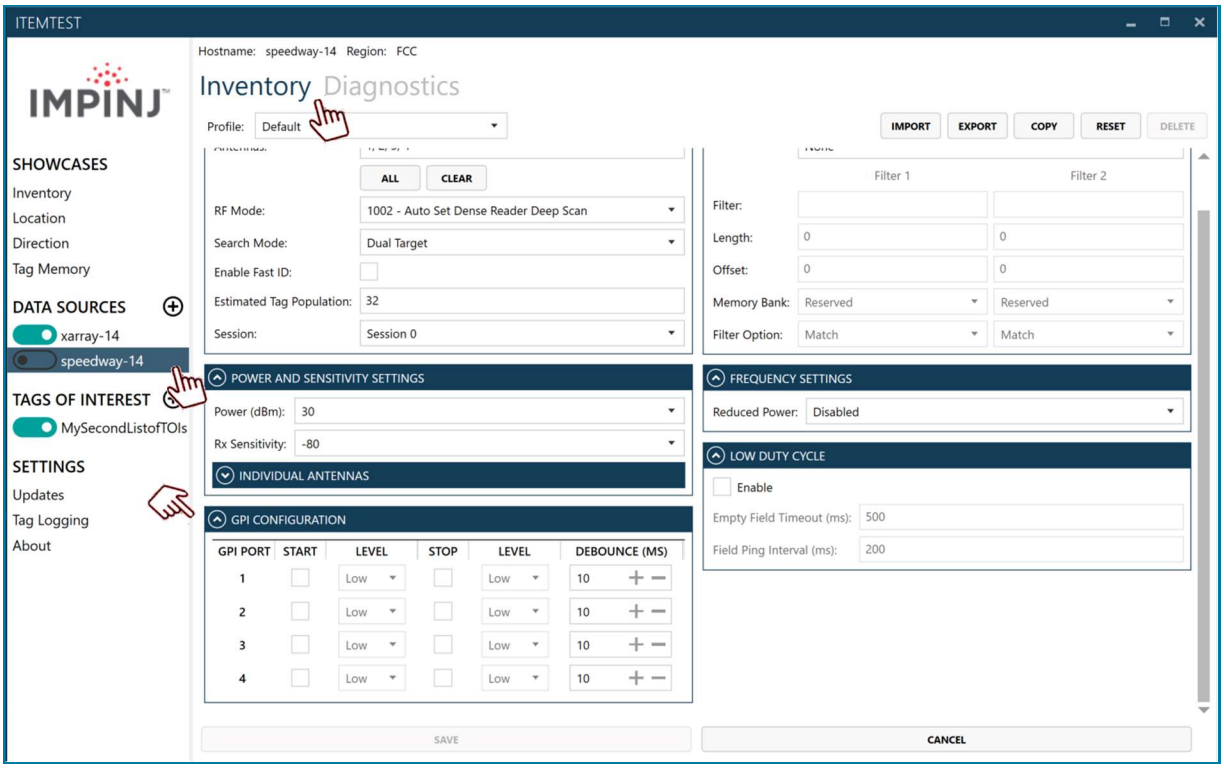
ItemTest will create a log file for each power step executed in the margin test. To illustrate, if your start power is 15dBm, with a power increment of 0.25 dB, and an ending power of 18dBm, then you would have 18dBm – 15dBm = 3 dBm of test range x 4 (this is the number of ¼ dB steps per dB) for a total 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.

**Figure 35: GPI Trigger Run Configuration Window**

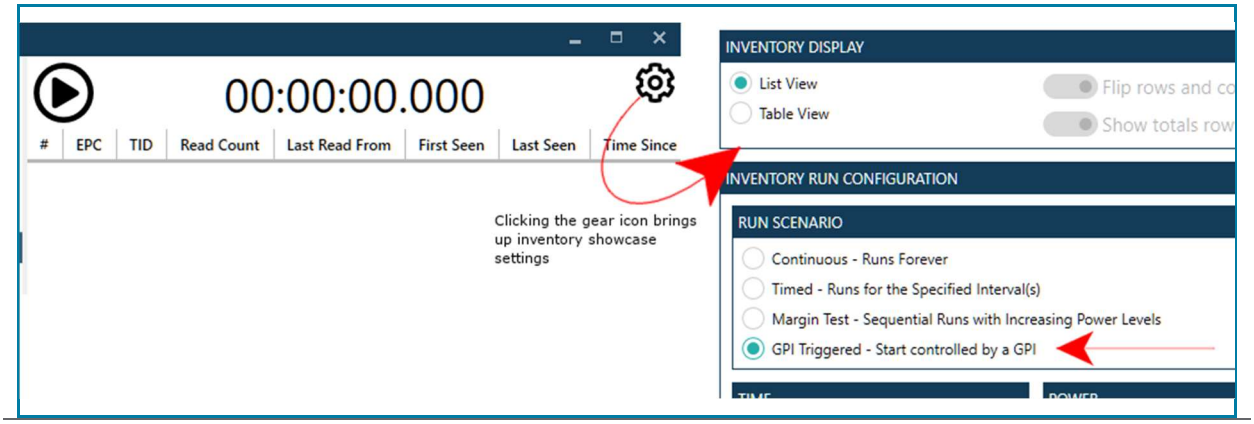



1. In the **Start** column, check the box next to the port where a received signal should Start an inventory.
   - Specifies the type of GPI trigger that would start a run.
2. In the **LEVEL** column, use the dropdown to select the signal type for the **Start**.
   - Low
   - High
3. In the **Stop** 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.
4. In the **LEVEL** column, use the dropdown to select the signal type for the **Stop**.
   - Low
   - High
5. 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.
6. Click the **Save** button to commit your changes.

**NOTE:** The number of GPIs exposed to the reader varies based on device type.

7. 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.
8. Click on the gear icon to configure the inventory showcase itself for GPI triggering, as shown below:

**Figure 36: Inventory Showcase - GPI Triggered Run Scenario Settings**




9. Under **INVENTORY RUN CONFIGURATION** in the **RUN SCENARIO** section click the **GPI Triggered – Start controlled by a GPI** radio button.
10. 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)*
11. 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.**
12. 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 afresh (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
13. 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

14. Running GPI Triggered scenarios back-to-back is permitted but *be aware that the same conditions as documented in bullet 12 above still hold*.

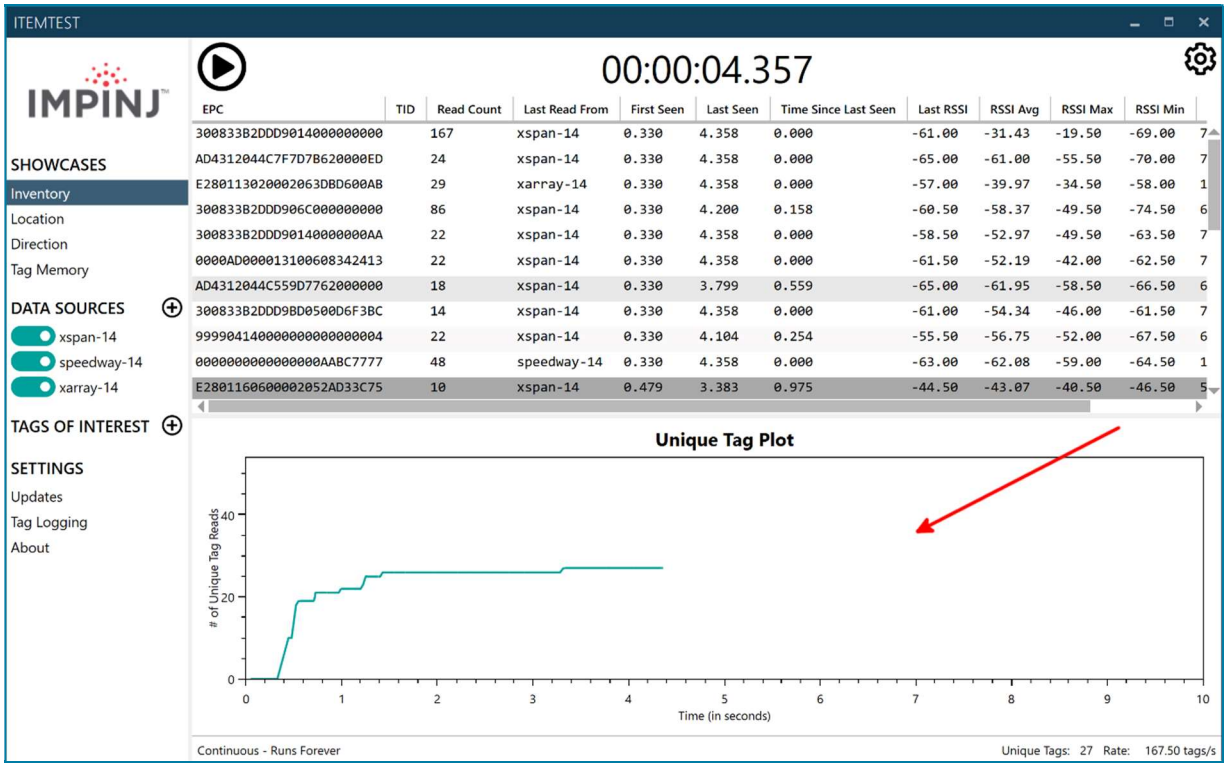
**NOTE:** When running back-to-back GPI-Triggered runs you must click the ► button on each subsequent run to see the tag reads once the GPI auto start trigger becomes asserted.

### 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.

**Figure 37: Unique Tag Plot**




### 7.1.6 Inventory Logs

If logging is enabled (See Section 9.2), running an Inventory Showcase causes ItemTest to generate Inventory log files. Each execution of an Inventory Run, including automated runs as described in Section 7.1.4 generates a csv-formatted file whose contents are:

- TimeStampOfRead, EPC, Antenna, RSSI, Frequency/Channel, DeviceName
- TIDs are not presently logged to file

- 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.

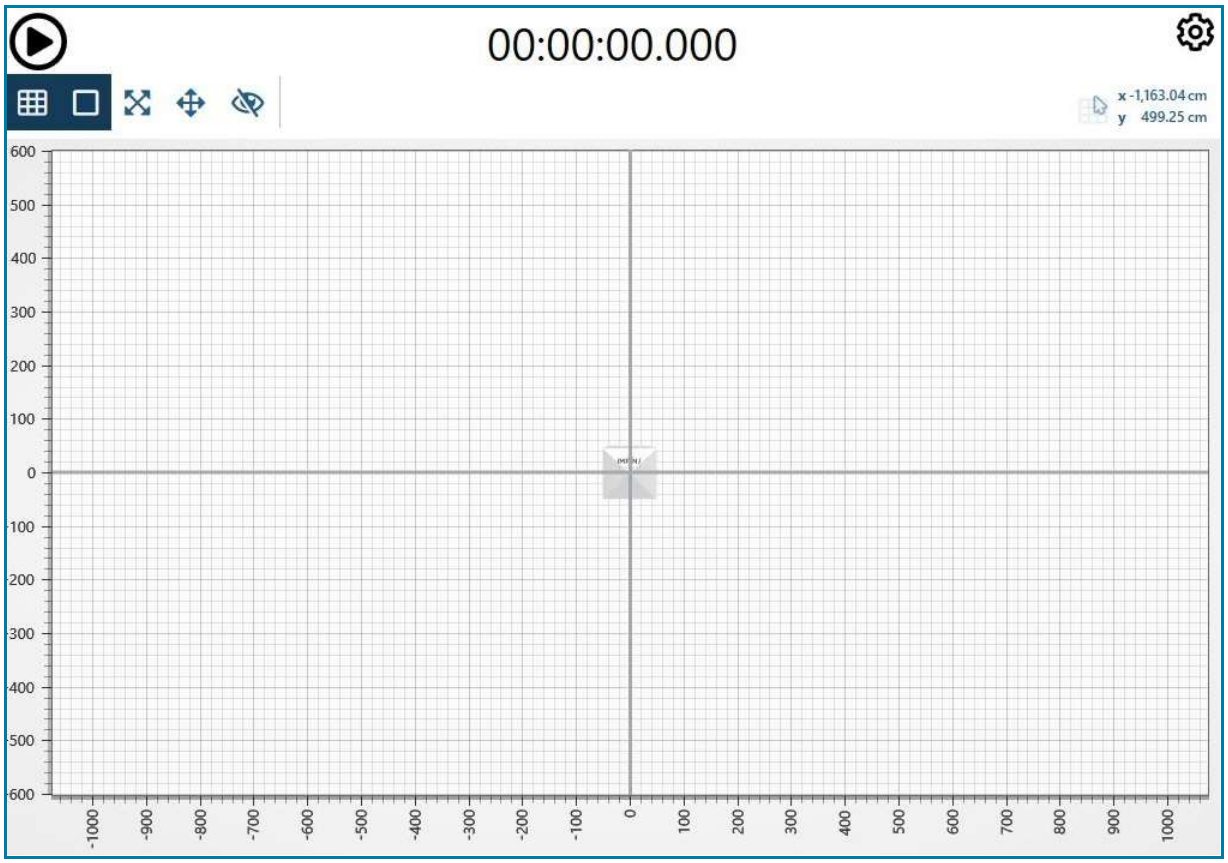
## 7.2 Location Showcase

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 Figure 38.

**Figure 38: Location View (*xArray only*)**

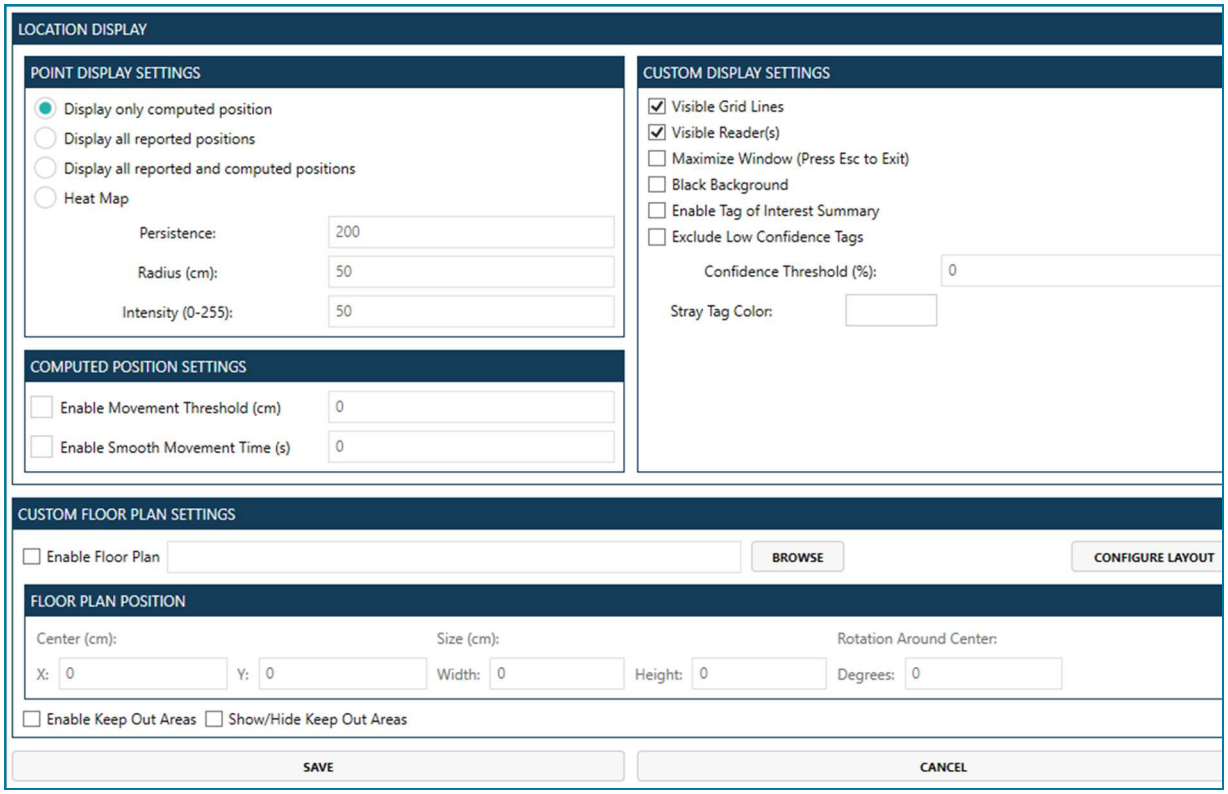



- The **Location Visualization Toolbar** just above the grid provides quick access to some, but not all, of the visualization options for the Location Showcase. From left to right, the options are:
  - **Show/Hide Gridlines** – Toggling will show/hide the gridlines. The X and Y axis will always stay 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 in Section 7.2.4.
- **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 (Figure 39).

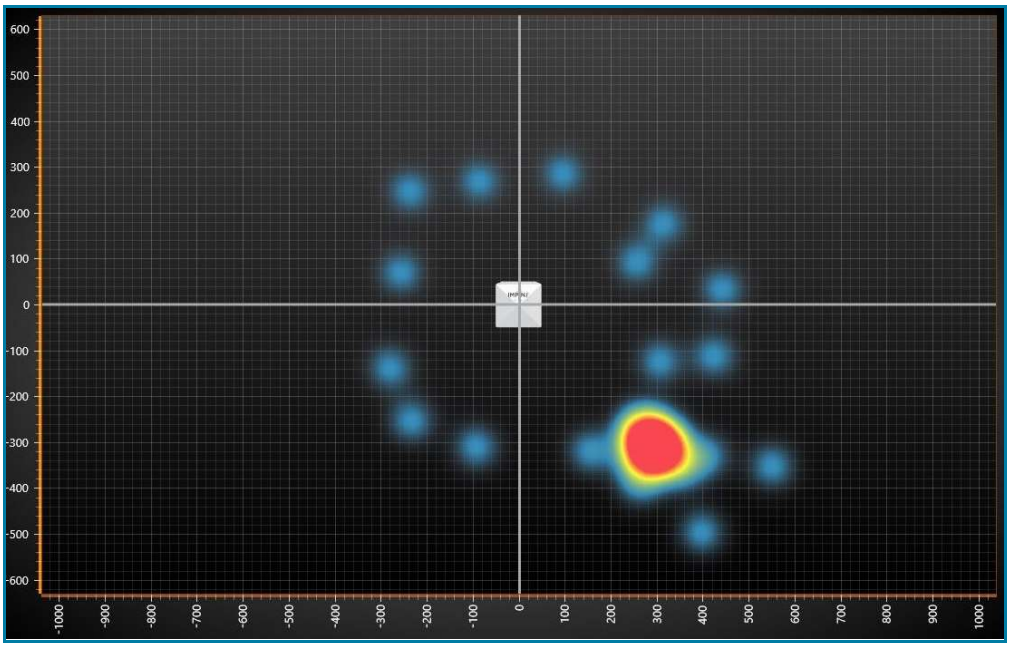
**Figure 39: Location Visualization Settings (*xArray only)***




## 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.

**Figure 40: 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.

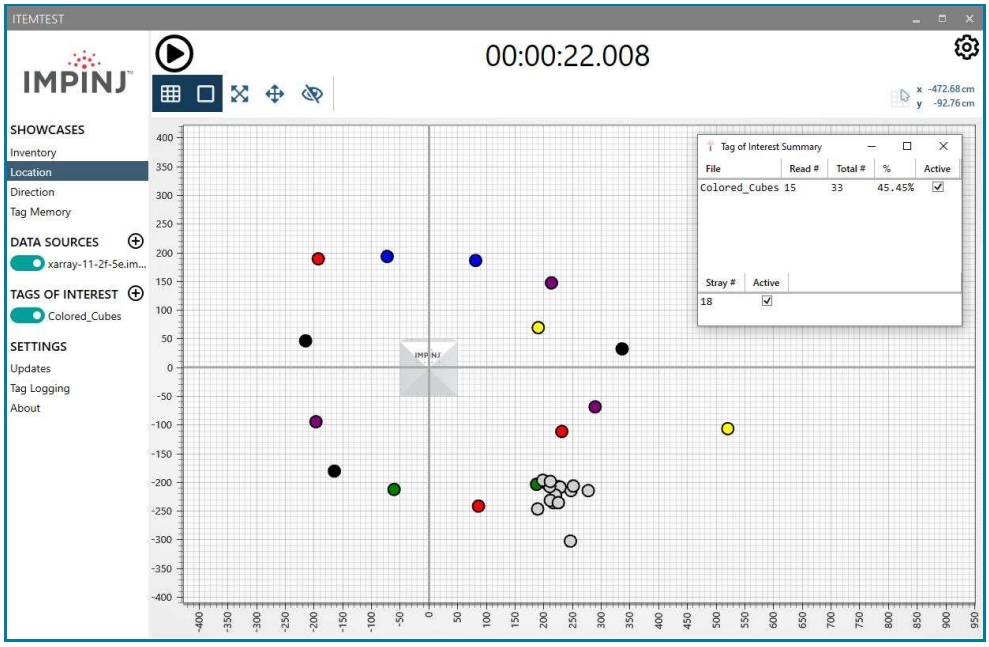
### 7.2.3 Computed Position Settings

- **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.

**Figure 41: 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.

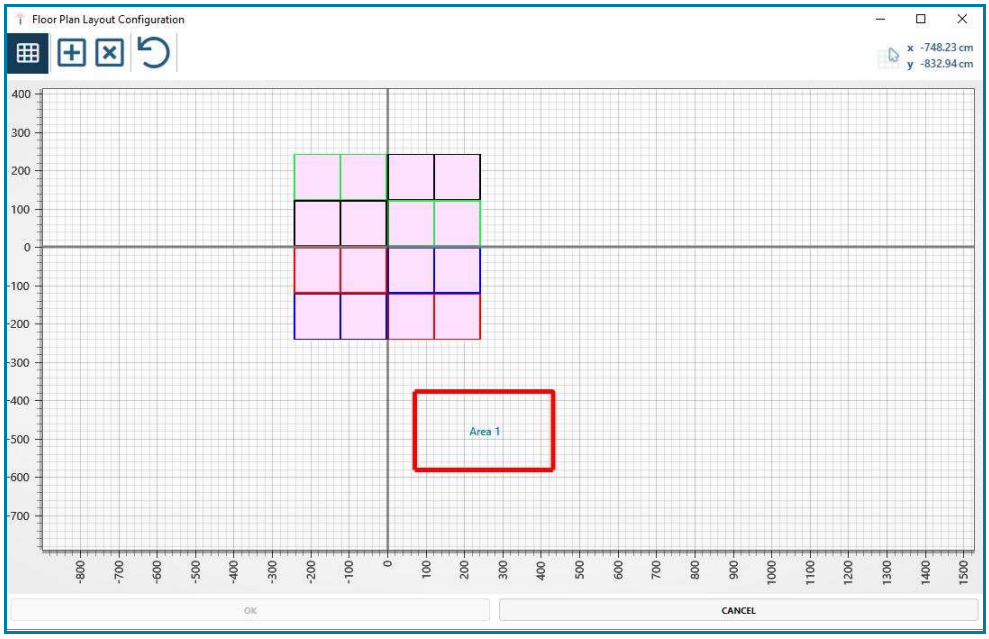
### 7.2.5 Custom Floor Plan Settings

- **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.

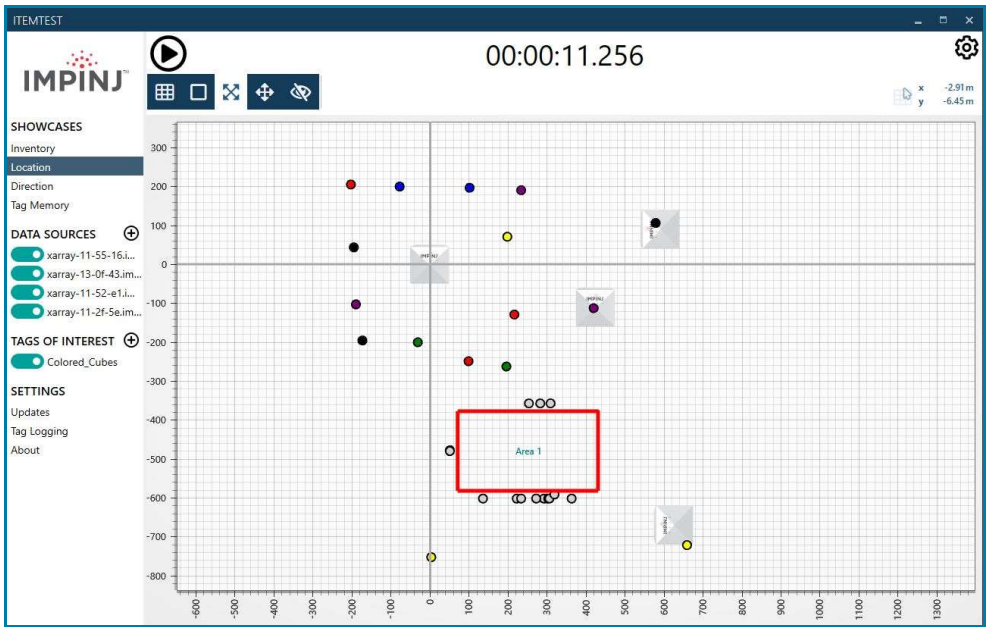
**Figure 42: Configure Layout Window with Floor Plan Image and Keep Out Area**




- **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 Figure 43.

- **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.

**Figure 43: 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 Section 6.2.
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. Figure 45 shows an example summary report.

## Figure 44: Location Running with 4 xArrays, a Custom Floor Plan, and an enabled TOI File

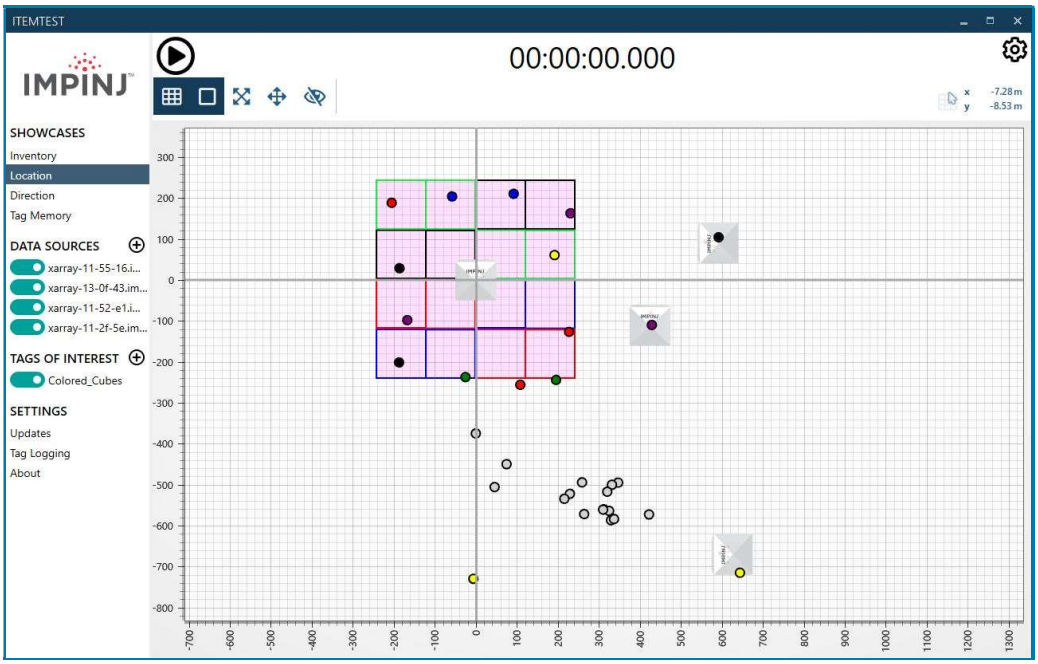
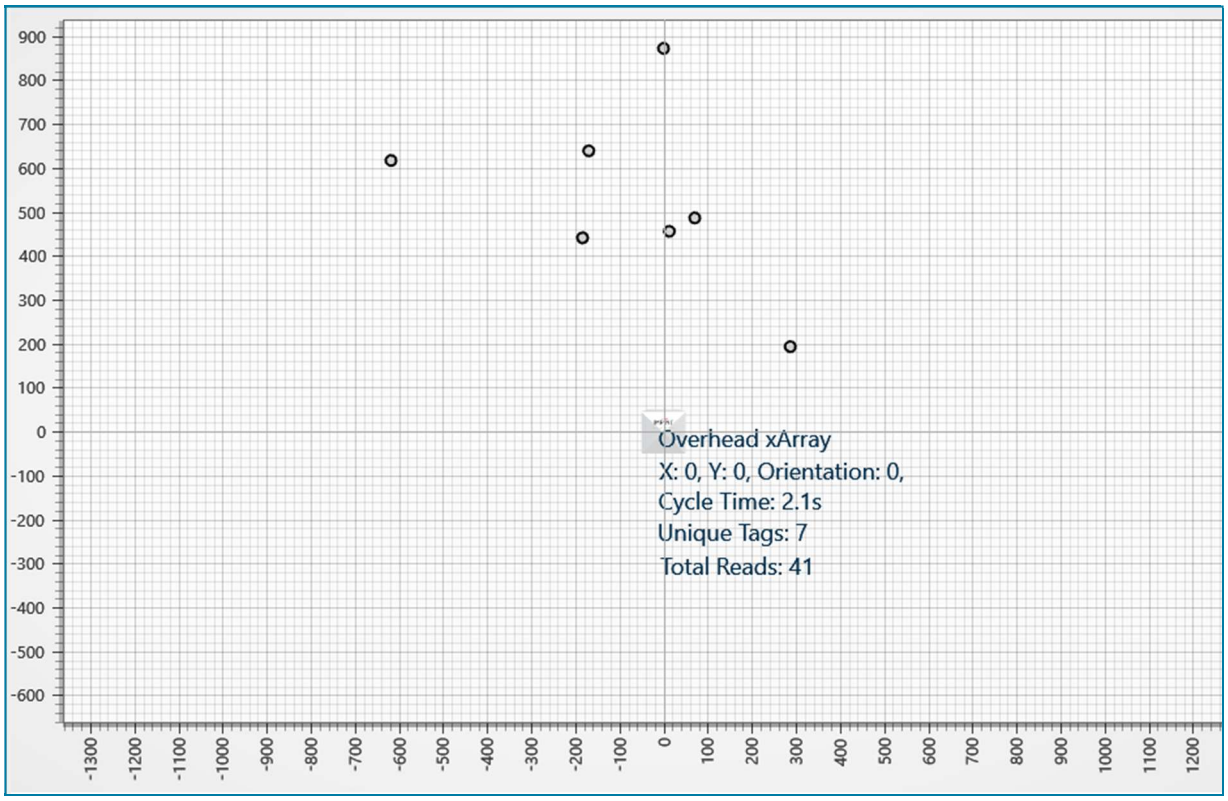


**Figure 45: Example xArray Summary Report**




### 7.2.7 Location Logs

Location reports can be logged to a file. See Section 9.2 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

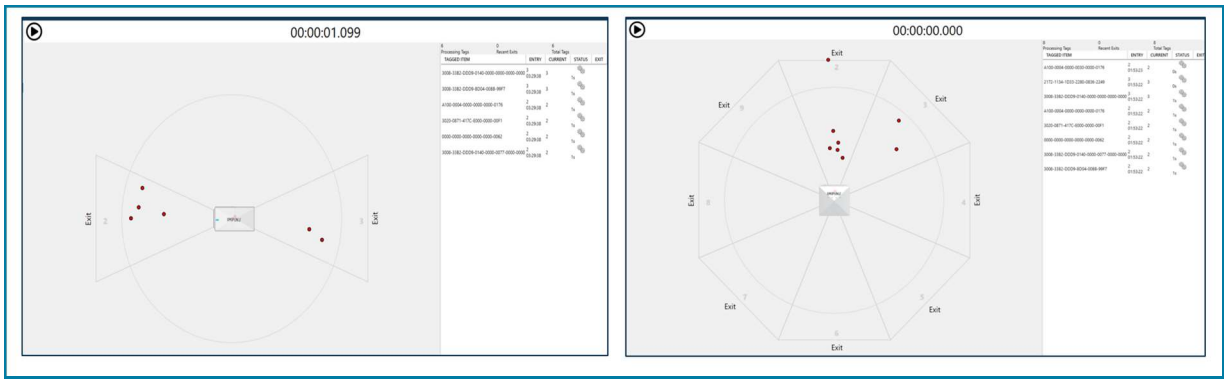
Impinj xSpan and xArray gateways natively have the ability to detect and report the direction of travel of tags passing by. Example use cases of this feature include tracking tagged objects and employees wearing tags in and out of secure areas, and tracking objects passing through doorways. xArray's 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 **SHOWCASES**, the main view will appear as shown in either of the halves depicted in Figure 38.

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

**Figure 46: Direction View (*Left: xSpan, Right: xArray)***

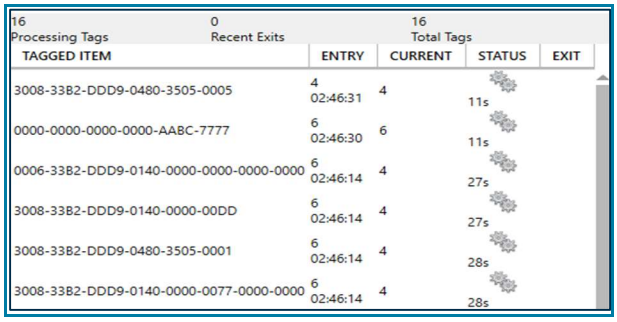



- xSpan As Data Source (left image above)
  - Sector 2 is the one closest to the LED on the front of the xSpan; Sector 3 is opposite that. There are just these 2 sectors with an xSpan; the 2 sectors are 180 degrees apart.
- xArray As Data Source (right image above)
  - Sectors 2 (top) through 9 appear. 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.

**Figure 47: Direction Metrics**




  - **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.
- Tag Table Columns

- **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.
- Clicking a column header sorts the column.

**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.

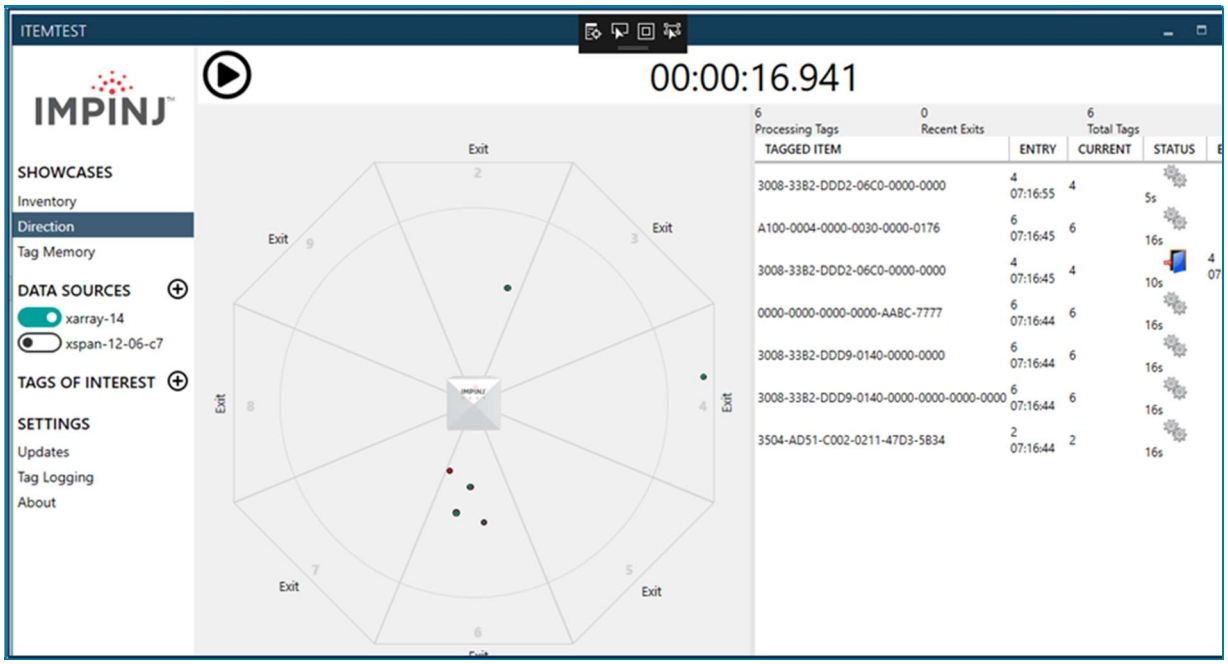
### 7.3.3 Running the Direction Showcase

7. Toggle on an xSpan or xArray data source. *(Recall that only 1 gateway can be selected for direction.)*
8. 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.
9. A read tag will first appear in the sector in its Tag Entry Report.
   - ItemTest presents the tag as a colored dot, appearing at a random place within the entry sector.
   - The dot's position is random within the sector for no other reason than to aid visualization.
   - The dot's color corresponds to the color associated with the EPC if such an assignment has been made in an enabled TOI file.
   - 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.
   - 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.
10. 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.
    - 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.

**NOTE:** All times in the direction UI are host timestamps. Direction logs record reader timestamps. To avoid confusion, Impinj always recommends time synching both the Impinj device and host computer running ItemTest. See the *Impinj RShell Reference Manual* for device NTP configuration.

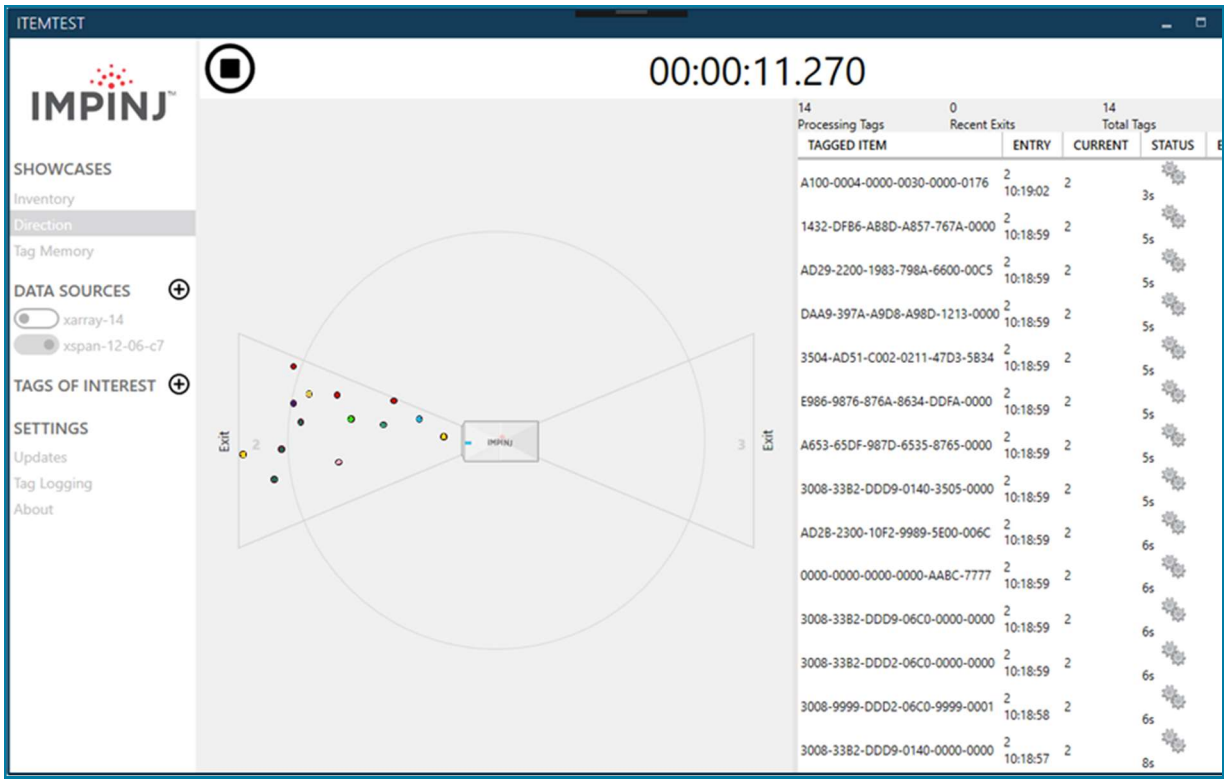
- If the current sector has not changed, the dot corresponding to the tag will not move.
- If the current sector changes from the tag's last reported sector, the dot replots in the current sector and the value in the Current column likewise updates to show the current sector.

**Figure 48: Example xArray**




11. 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.
    - Visually, the tag will slide via animation from its current position to the word “Exit” appearing next to the exit sector.
    - 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.
    - 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.
    - Exited tags appear in the metrics table as a door icon. A tag’s status timer stops immediately upon receipt of an Exit Report.

**Figure 49: Example xSpan Running Direction**




### 7.3.4 Direction Logs

Direction reports can be logged to a file. See Section 9.2 for details. The data fields captured during a Direction Showcase run are:

- HostTimestamp, EPC, ReportType, FirstSeenSector, FirstSeenTimestamp, LastSeenSector, LastSeenTimestamp, and 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.

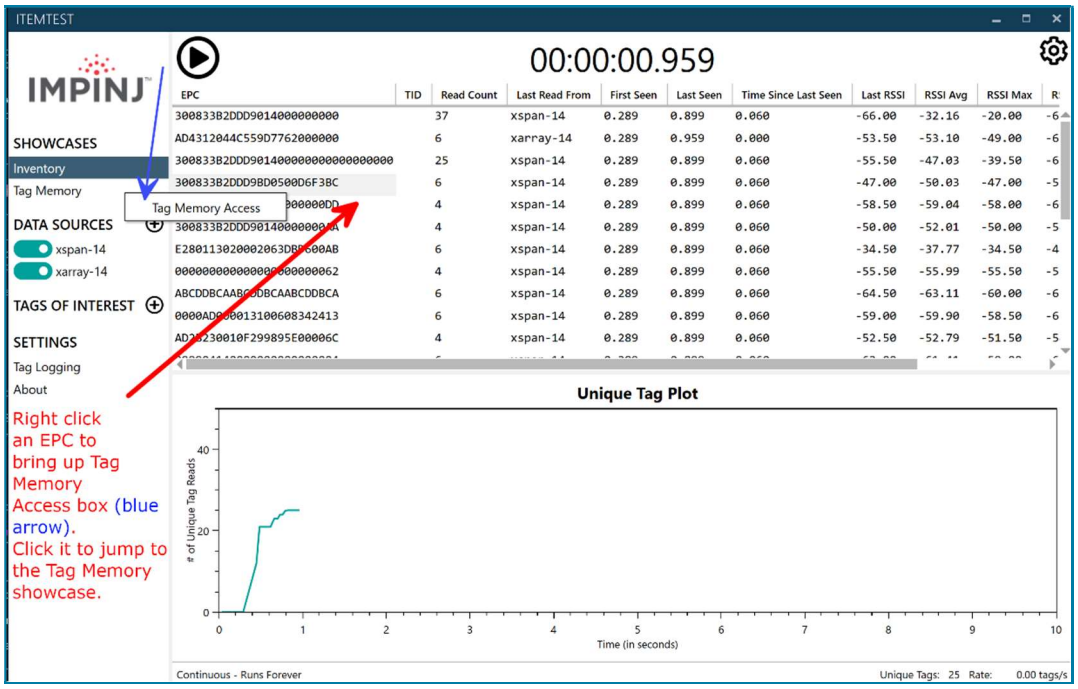
### 7.4.1 Tag Memory Overview

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

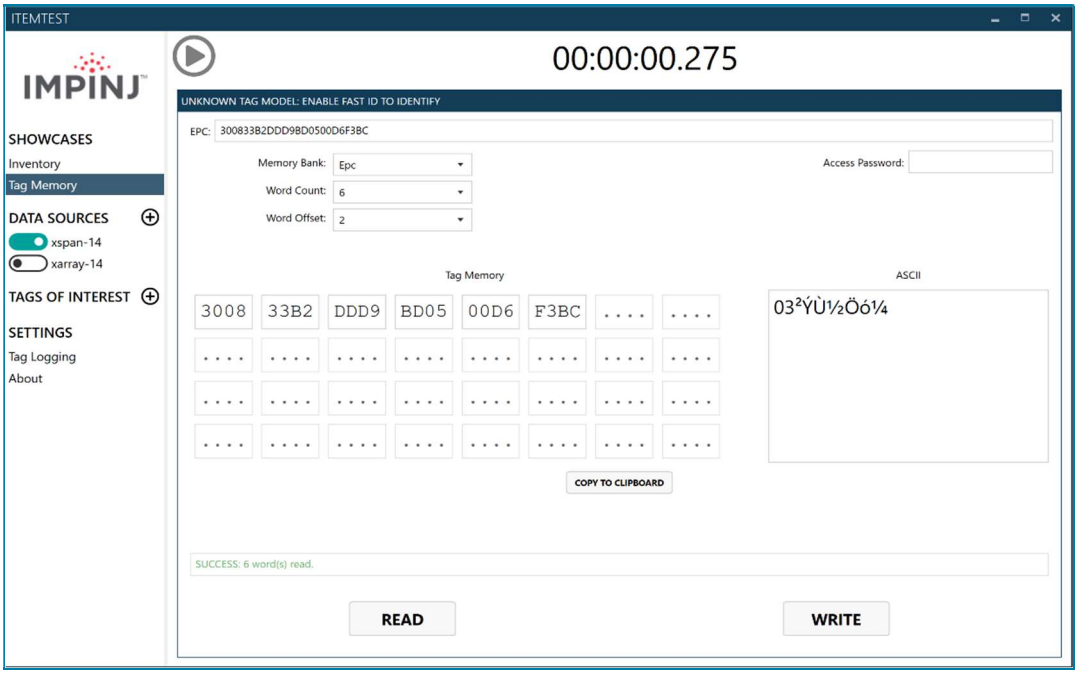
The figure below shows the second method:

## Figure 50: Tag Memory Access Window




ItemTest allows you to read/write to the memory banks of tags whose EPC is known ahead of time.

## Figure 51: Tag Memory Showcase



The **Tag Memory Showcase** screen displays a status bar and **Read** and **Write** buttons for interacting with a tag matching the EPC in the **EPC** box. Only one data source can be used to perform a tag memory operation.

**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:** The offset is specified in words (i.e., 16-bit words) and not bits.

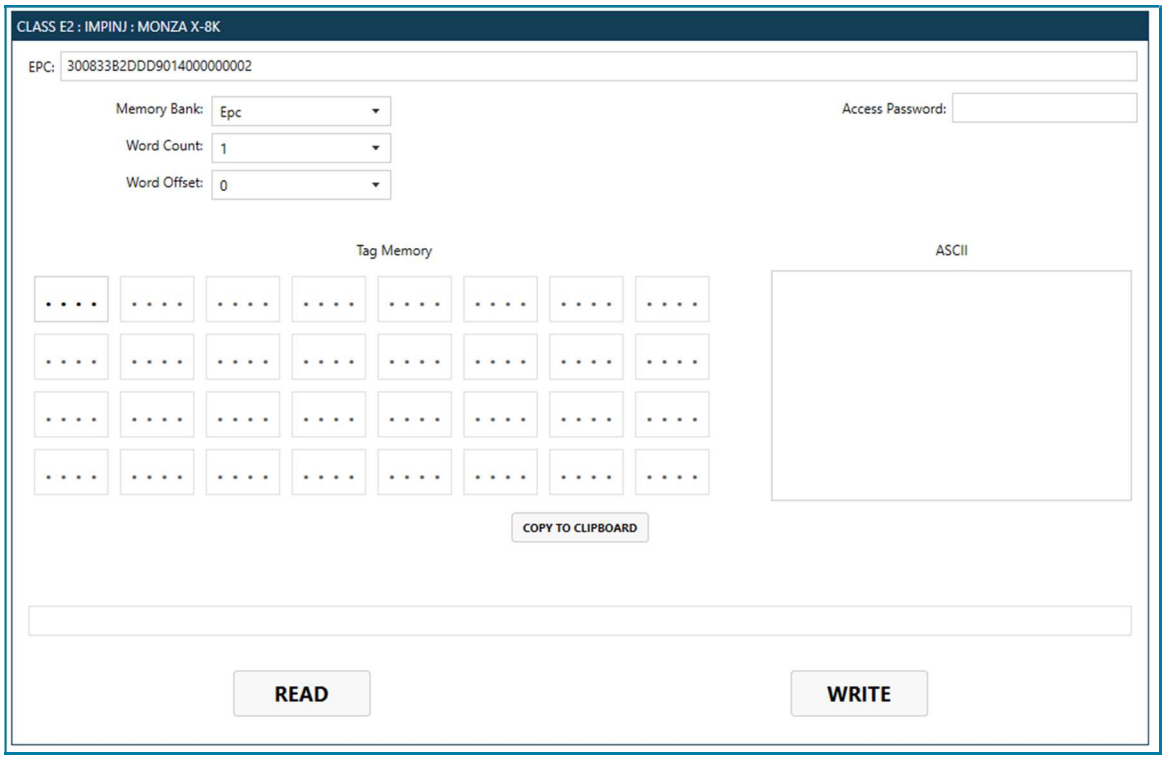
- **Access Password**:
  - You must provide a passcode if the memory you seek to access is locked.
- **Tag Memory Displays**:
  - **Hexadecimal Tag Memory Display**: This section (labelled **Tag Memory** and depicted as boxes with "….” In them) displays the hex memory data of the tag retrieved or written 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 and Write Buttons**:
  - **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.

### 7.4.2 Reading Tag Memory (Step-by-Step)

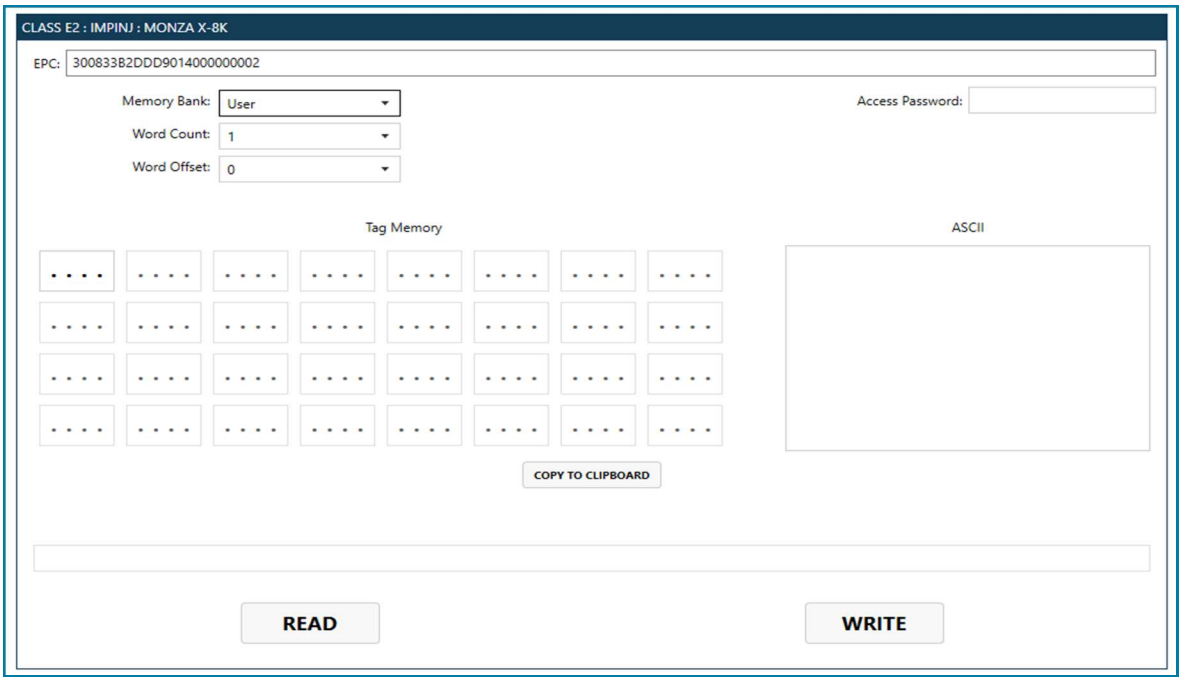
1. By default, you will notice the selected memory bank is EPC. The memory has not been read yet and the boxes default to "….". This indicates an *unread* status of memory.

**Figure 52: Tag Memory Showcase – EPC Memory Bank**



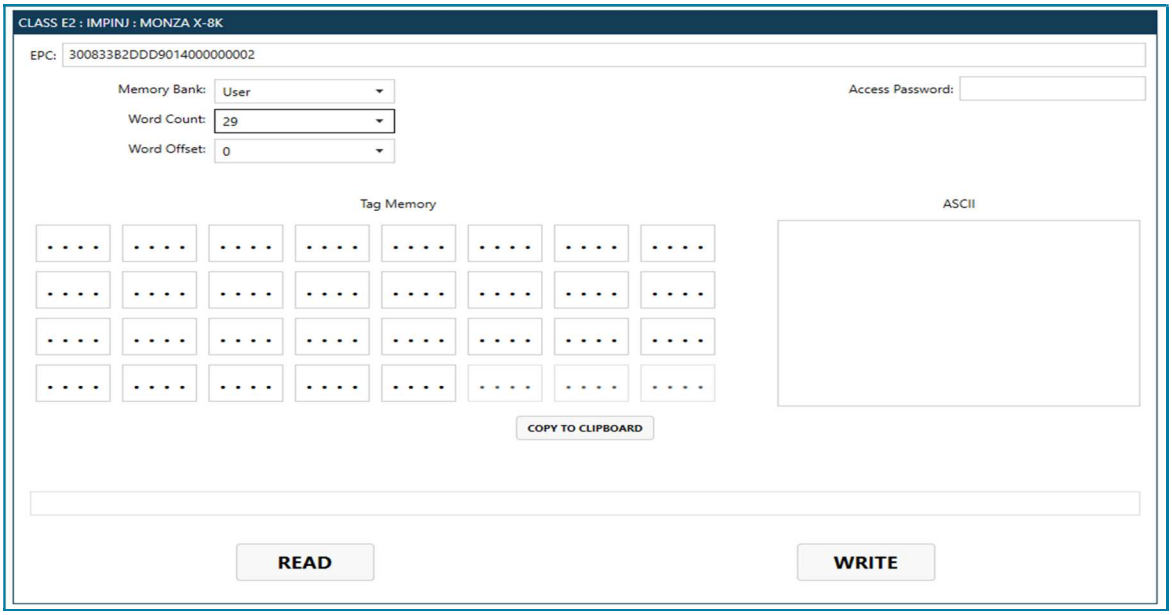

2. Use the **Memory Bank** drop down to select the **User Memory** bank. On selection, the memory screen will present additional textboxes. This is because, in this example, the tag we are writing to happens to be a Monza X-8K Tag. This tag type has considerably more user memory (512 words or 8,192 bits) 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).

**Figure 53: Tag Memory Showcase – User Memory Bank**



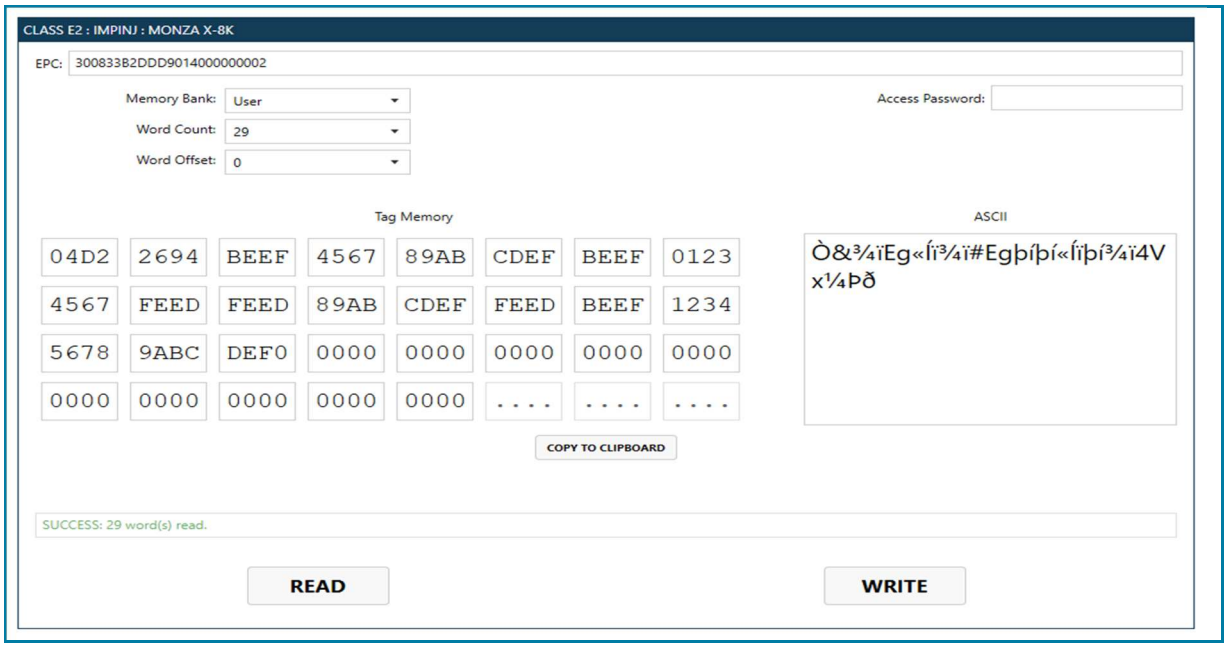

3. Notice that only one textbox is enabled. This is because the word count defaults to 1. Assume we want to read 29 words for this read operation. Select 29 in the **Word Count** drop down. This will enable the first 29 "…" memory boxes. Leave the **Word Offset** at 0.

**Figure 54: Tag Memory Showcase – Word Count**




4. 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:

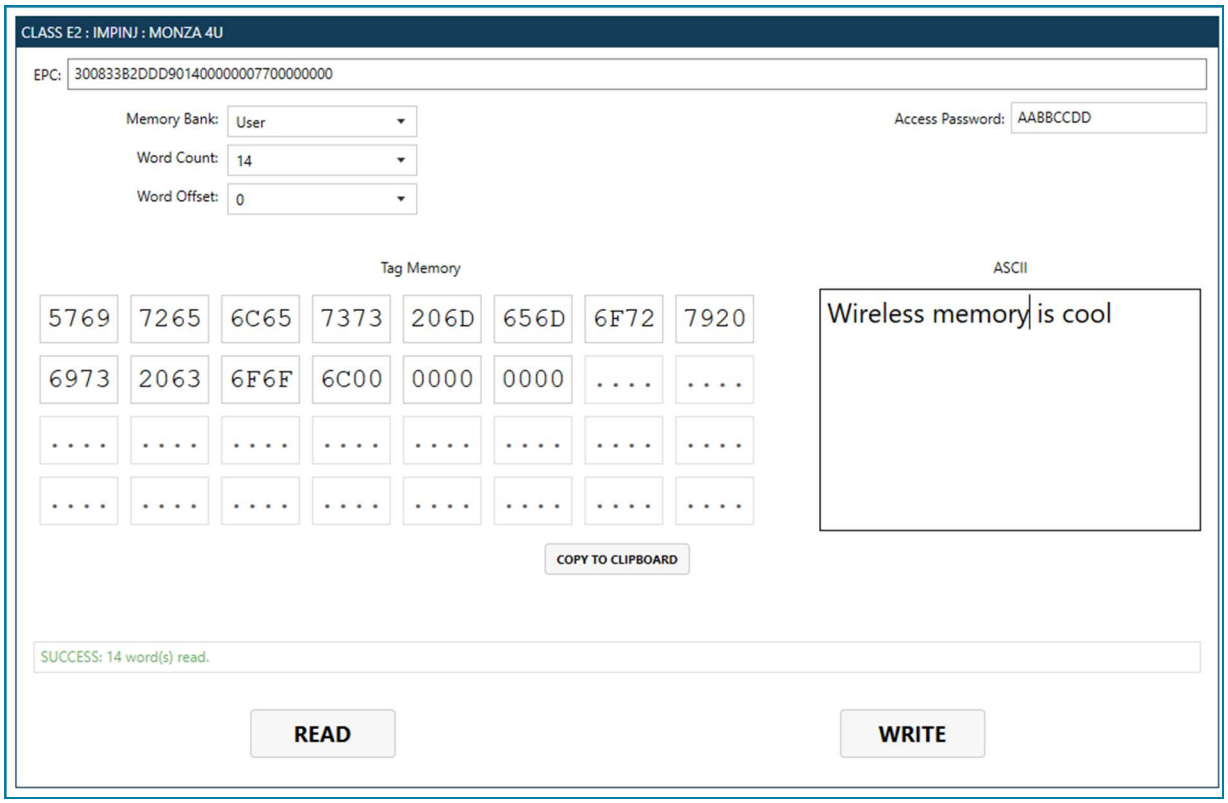
**Figure 55: Tag Memory Showcase – Read Success**




## 7.4.3 Writing Tag Memory (Step-by-Step)

1. 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).
2. Next, type "*Wireless memory is cool!*" into the **ASCII** textbox. See Figure 56. 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.
3. 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:

**Figure 56: Tag Memory Showcase – Writing Tag Memory Success**




### 7.4.4 Tag Memory Logs

Logging is not supported for Tag Memory Operations.

# 8 TAGS OF INTEREST

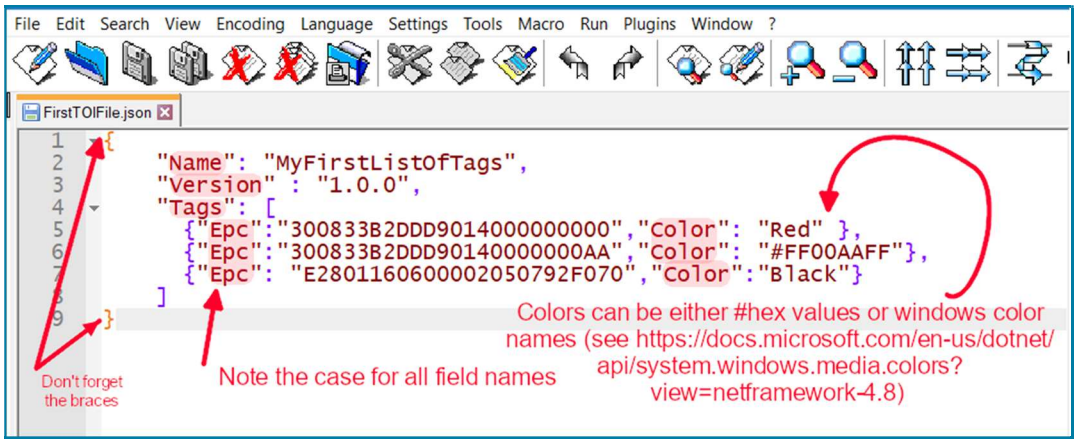
In the **TAGS OF INTEREST** section, ItemTest allows you to colorize and group tags using a TOI file. ItemTest will keep statistics on the counts of tags in the TOI file if seen and apply a set color when displaying tags in a Showcase.

1. To add TOIs you need to click on the "**+**" button next to the **TAGS OF INTEREST** section on the left side of the application.
2. You are prompted to enter the path to the TOI file.
   - ItemTest supports two different TOI formats: CSV (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 JSON Format Example

A JSON formatted TOI should be formatted as shown below:

**Figure 57: 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.con/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.
- Color strings that cannot be parsed will be ignored and ItemTest will assign the default color.

## 8.2 Legacy CSV Format Example

A CSV formatted file should be formatted as shown below:

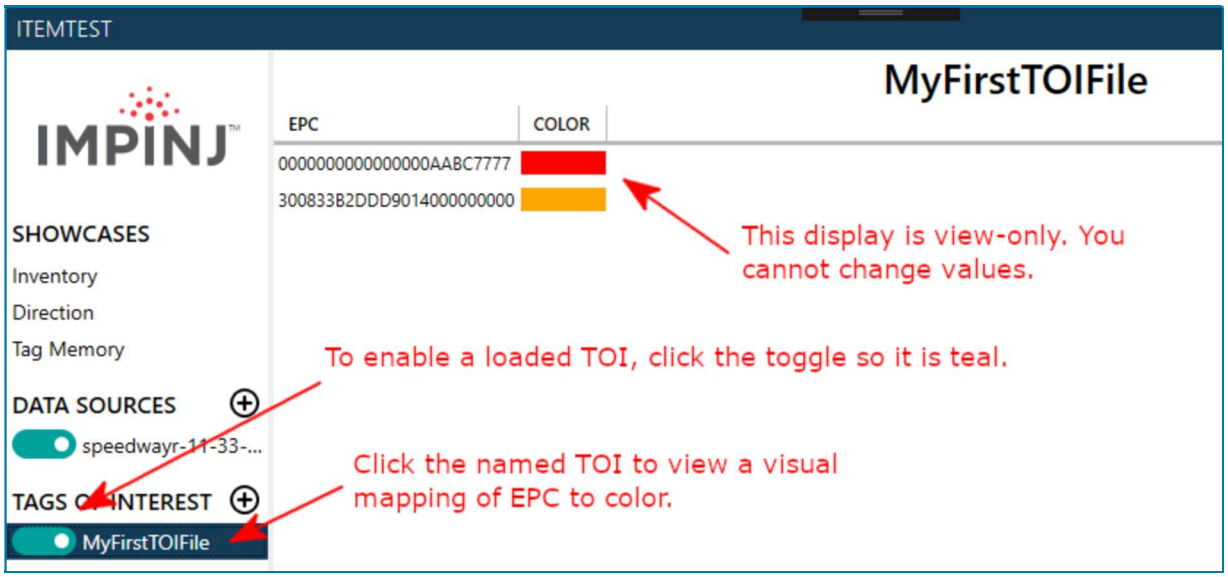
- EPC
- Color=<color>
- Here is an example of a CSV formatted TOI file:

```
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
```

## 8.3 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.

Figure 58: Tags of Interest Display Table (JSON Format)




## 8.4 TOI Import Exceptions

**NOTE:** 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.

**NOTE:** 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

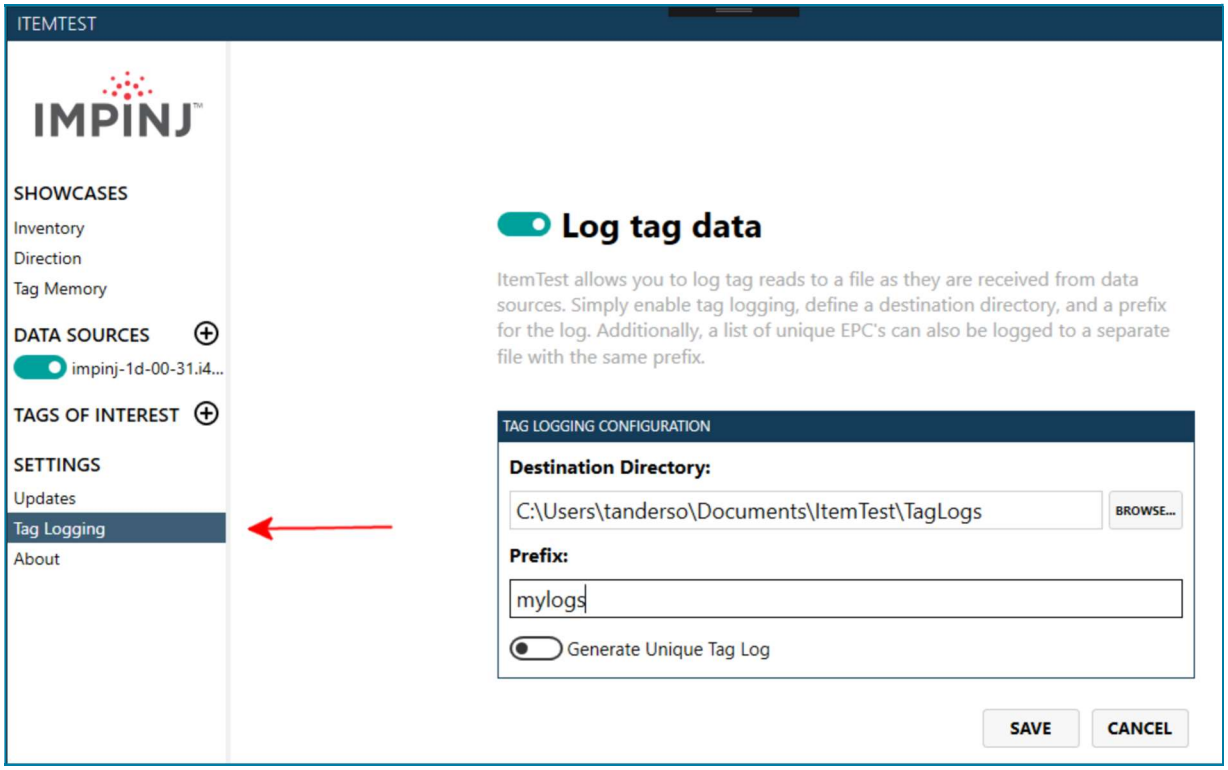
The check for updates can be configured by following the steps below:

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.

**Figure 59: Log Tag Data**




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.
   - 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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