ON Semiconductor

Is Now

To learn more about onsemi™, please visit our website at
www.onsemi.com

AND9978/D

SPSDEVK1-A2P-GEVK: Getting Started Guide

ON Semiconductor®

www.onsemi.com

APPLICATION NOTE

Introduction;

The SPSDEVK1 Cold Chain Development Kit enables evaluation of Smart Passive Sensor™ data logger tags. This development kit includes:

- SPSPRDR1−8 UHF SPS Reader
- Application Note (this document)
- SPSPRDA2−P RFID Antenna
- Antenna Cable
- USB Cable to connect Reader to a PC
- Ethernet Cable as Alternative Connectivity to a PC or Host System
- 30 SPS1T001LOG SPS Data Logger Tags
- 12V Power Supply
- Tag Reader Application Software
- Cold Chain Application Software

Software Tools

ON Semiconductor has developed an application specifically for reading Smart Passive Sensors that also includes drivers for the SPS reader. This application is known as TagReader and can be found on this kit's landing page under "Software".

Additionally, a Demo Package has been included that provides the application interface for the data logger tags send with the DevKit. Instructions for the use of this application is below in the section labeled "Cold Chain Demo Guide".

Figure 1. SPSDEVK1 Reader

Figure 2. SPSDEVK1 Hardware Setup

Hardware Setup

The SPSDEVK1 requires three hardware connections to be made in the following order:

- Connect at the one antenna to any RF RPSMA port on the SPSPRDR1−8 reader
- Connect a USB or Ethernet cable from the SPSPRDR1−8 to the host computer that will be running the application software
- Plug in the 12 VDC supply that was included with the kit

Note: please refer to SPS tag and antenna datasheets to verify optimal positioning of each to achieve best results.

TagReader Software Setup

Once the reader is connected and the correct drivers are installed, please run the TagReader application downloaded from the ON Semiconductor website. Figure 3 shows the setup screen that will open when the TagReader application is run. The ON Semiconductor SPSPRDR1−8 will be autodetected and should be displayed in the “Select Reader” drop−down menu. If the drop−down menu is empty, confirm that the reader is powered on and the USB/Ethernet is connected to the host PC and click the “Rescan Readers” button.

With “ON Semiconductor SPSPRDR1−8” selected, please select the antenna port(s) that the antenna(s) is connected to as well as the correct UHF region for your location (North America, Europe, etc). The rest of the settings will depend on the test environment and the type of tags being used and will be discussed further in the next section.

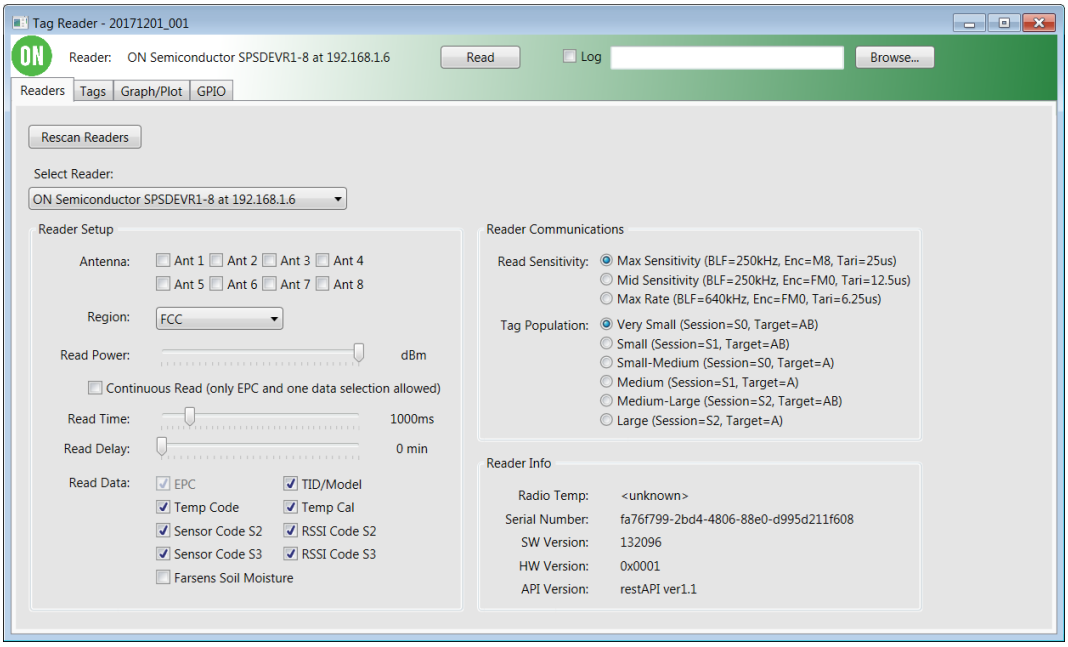

Figure 3. TagReader Setup Screen

Cold Chain Demo Guide

Thank you very much for your interest in the ON Semiconductor Cold Chain Data Logger. This is a new generation of RFID sensor tags built around an ON Semiconductor microprocessor. This design gives us memory to store sensor data as well as other data such as package handoffs, or product warranty or shipment information, as well as on−board processing for data evaluation. The microprocessor uses I^2C bus architecture to communicate with multiple sensors, utilize a battery or other energy source, and enable output devices such as an LED or display to be attached for human readable codes to be displayed based on the tag. This design gives us significant flexibility for customer demands.

For the moment we will be using the most basic version of the tag – Cold Chain Data Logger. See the last page for a Data Sheet with specifications. If you see anything missing, please let me know immediately.

This generation of tag does not depend on any modifications or upgrades to an RFID reader. Any RFID Gen2 compliant reader can read and program the tag, maximizing the flexibility and existing RFID Track−and−Trace infrastructure installed in many customer locations. The software was designed to run with the ON reader API and makes the demo most straightforward. If another reader is going to be used, please contact me so we can assess the actions needed to get drivers working for the reader.

This document will provide an introduction to the tag and the software demonstration. The entire demo can be completed in a few minutes, highlighting the ease of use of this tag.

Demo Overview

Before we get into the details of the demo setup, let's review the application. When receiving blood from a blood bank, how can you validate that the blood remained within the required thresholds the entire journey, and the elapsed time is within the margins of safety? If the blood has been compromised in any way, how can you know that before using it for a patient?

The first step in the process is at the blood bank location. Once the product is packaged, a reusable data logger is inserted on the side of the bag so the temperature data can be captured.

The blood bank needs to capture the tag ID associated with the tag, set the parameters for temperature (upper and lower bounds), set how frequently a temperature measurement should be made in transit, clear memory from previous runs, synchronize the tag clock, and start the tag.

At the hospital end, the nurse needs to be able to validate instantly whether the blood is in compliance. Currently we are using a reader to get the "go/no go" flag from the tag, but in the future a LED could be added to display this information without requiring a reader.

What you see in the demo is the process at the shipping side to set all the parameters on one or multiple tags. The tag parameters are set, and the tags are activated. At the receiving end, the temperature compliance information is displayed. If the carton did not remain in compliance, the data log can be downloaded to see exactly when and for how long the excursion occurred.

The demo was specifically written for a cold chain application moving refrigerated goods from a manufacturer to a distributor. The screens are set up with this application in mind. These screens can be customized and we can provide the programming manual for the data logger tags.

If you have any issues with setting up the reader, connectivity, please contact the SPS team immediately for assistance.

Ethernet Connectivity

If you choose to use Ethernet connectivity, an Ethernet cord is provided in the DevKit. Connect the reader to the PC. Note: There will be a delay of several minutes while Microsoft Windows establishes a connection between the PC and the reader. Once the connection is established this delay is not necessary. But for demos, we urge the USB connection to keep this simplified.

Activate the Software

Once the software is started, the following screen will pop up.

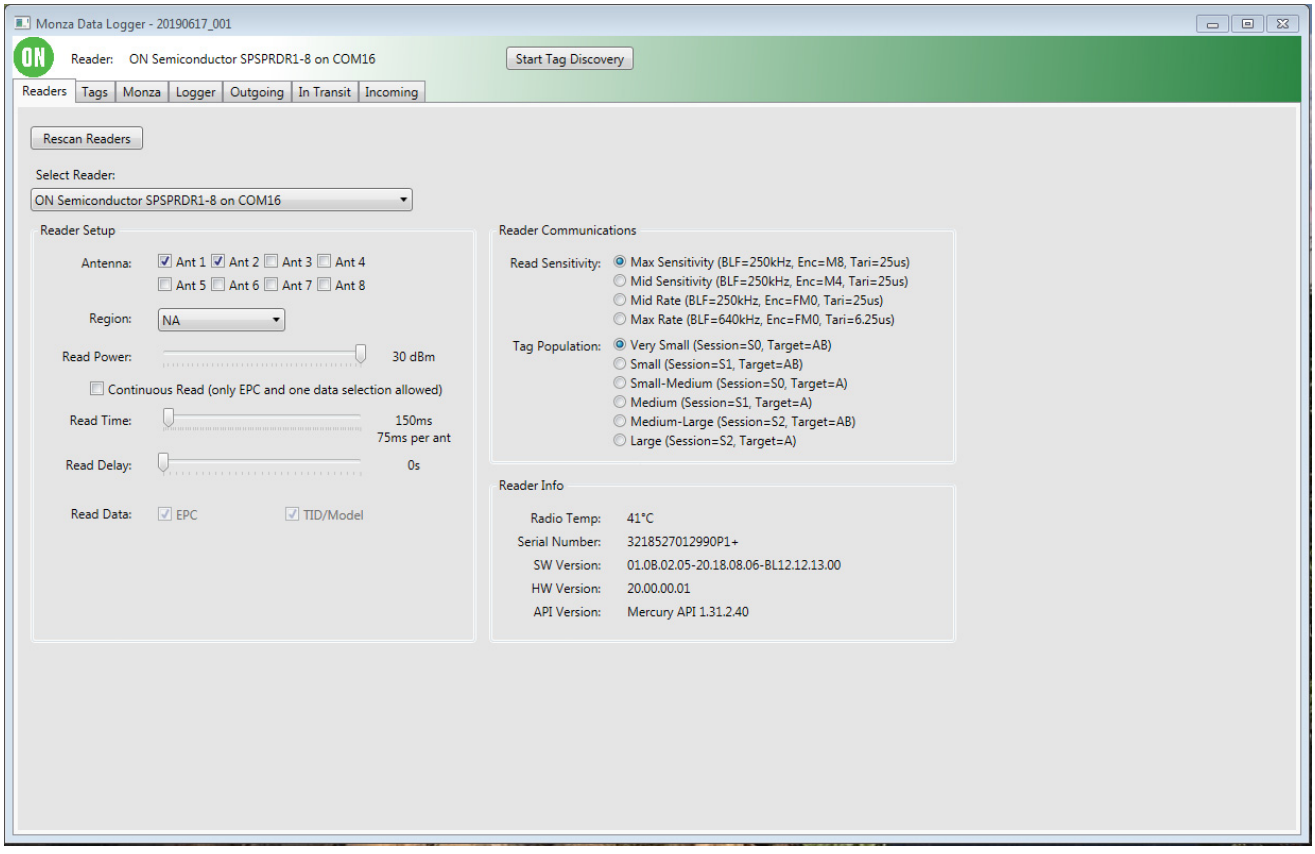

Figure 4.

The reader information will be filled in. Select the antenna(s) to use, and click on your geography. NA for North America, EU3 for Europe, and so forth.
Let everything else default.

Ready to Start the Demo

Set All Tag Parameters and Prepare for Shipment

Let's review the fundamental use case. A carton that needs to be maintained in a temperature controlled environment is about to be shipped. The objective is to place a tag on or in the carton to ensure that the carton remains within the desired temperature range during the entire journey.

The steps necessary to set up any data logger tag are:

1. Set the upper and lower threshold temperatures
2. Set the time frequency for how often you want to sample the temperature
3. Clear out any prior log data
4. Synchronize the tag clock with current time
5. Activate the tag to start logging

Typically it is necessary to handle each tag to set the parameters and activate. One major innovation with our tag is that multiple tags can all be set with the same parameters and activated together.

Select the Outgoing tab.

Below is a screenshot showing how 2 tags, in this case, are set with an upper threshold level of 30 °C and a lower threshold of 20 °C. This is room temperature simply to make the demo easier. The time interval is set for 5 seconds (it can be set from 1 second to 1 hour). The memory is cleared and the tag is ready for activation.

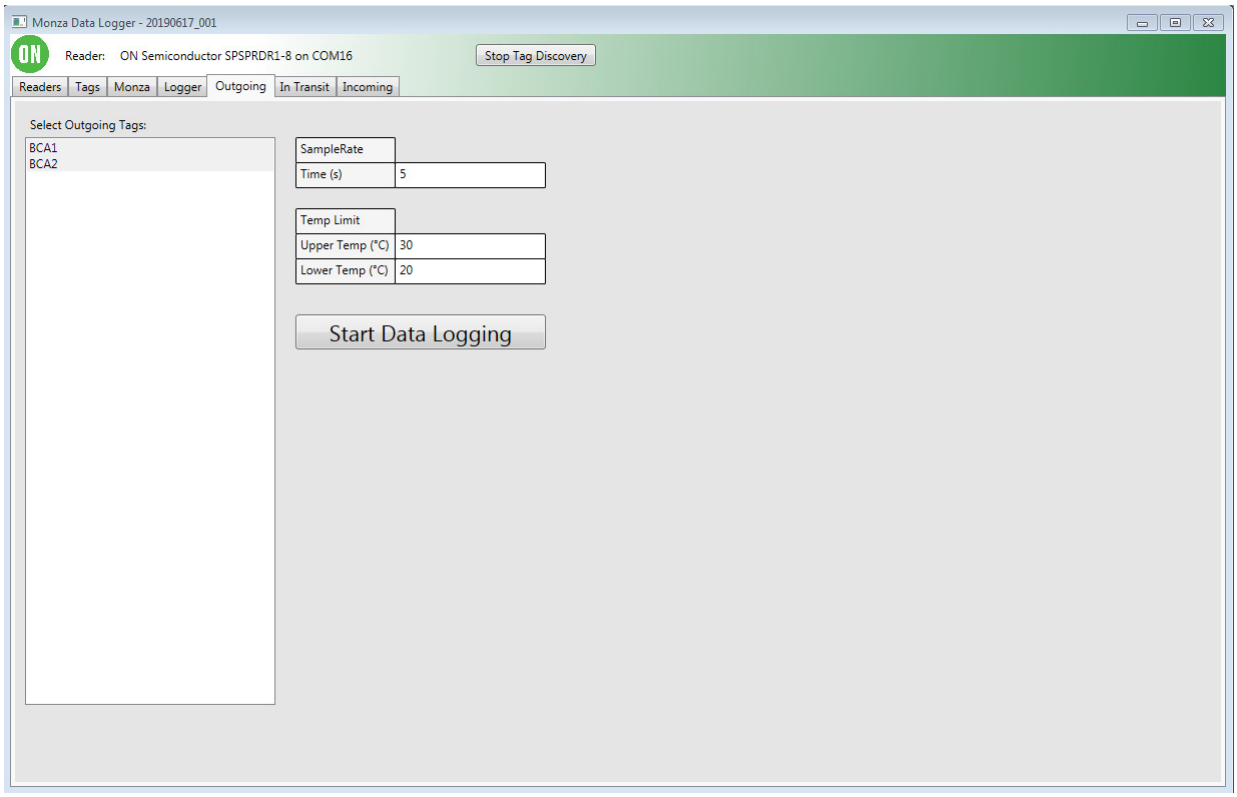

Figure 5.

Once the tag has been activated, the screen is updated to reflect that the tag is now active and logging.

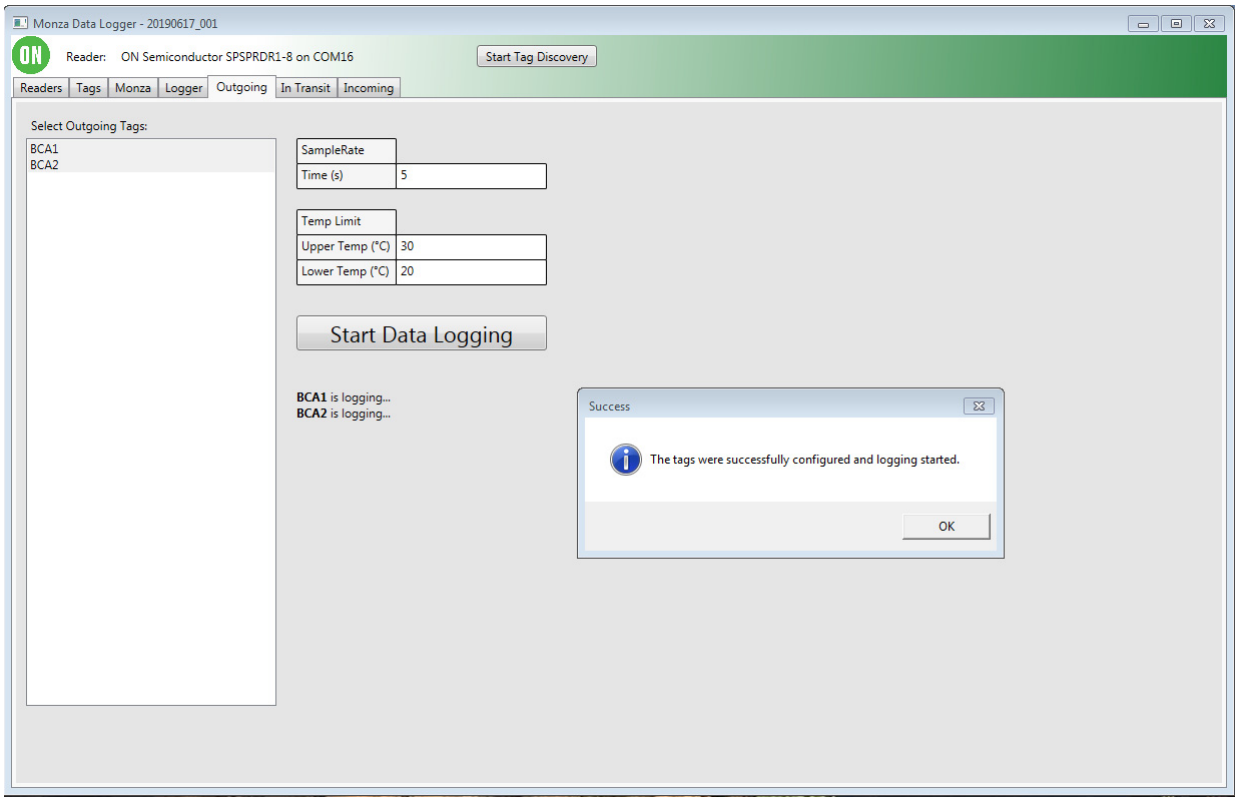

Figure 6.

Track the Temperature in Transit

In many situations, once the data logger has been activated, it will not be looked at again until the carton arrives as the destination. There are, however, applications where the transportation company or possibly the manufacturer would like to monitor the temperature of each carton in transit. Is the truck has an RFID reader for asset tracking, the reader can also be used to continuously monitor the temperature.

Select the “In−Transit” tab.

Below is a screenshot of an example of monitoring two cartons. As you can see, one carton was exposed to a heat source taking the tag above the upper threshold. Even after the tag returned to normal temperature, the flag was still active that the temperature threshold had been exceeded.

A demo recommendation is to, at some point, take the tag outside the read range and place the tag in a freezer for a minute or two. Then take the same tag or a different tag and put it under a lamp, or in the sun, or someplace where the temperature will get above the upper threshold. Then bring both tags back to the table. This shows that the tags continue to capture temperature even if not in an RF field.

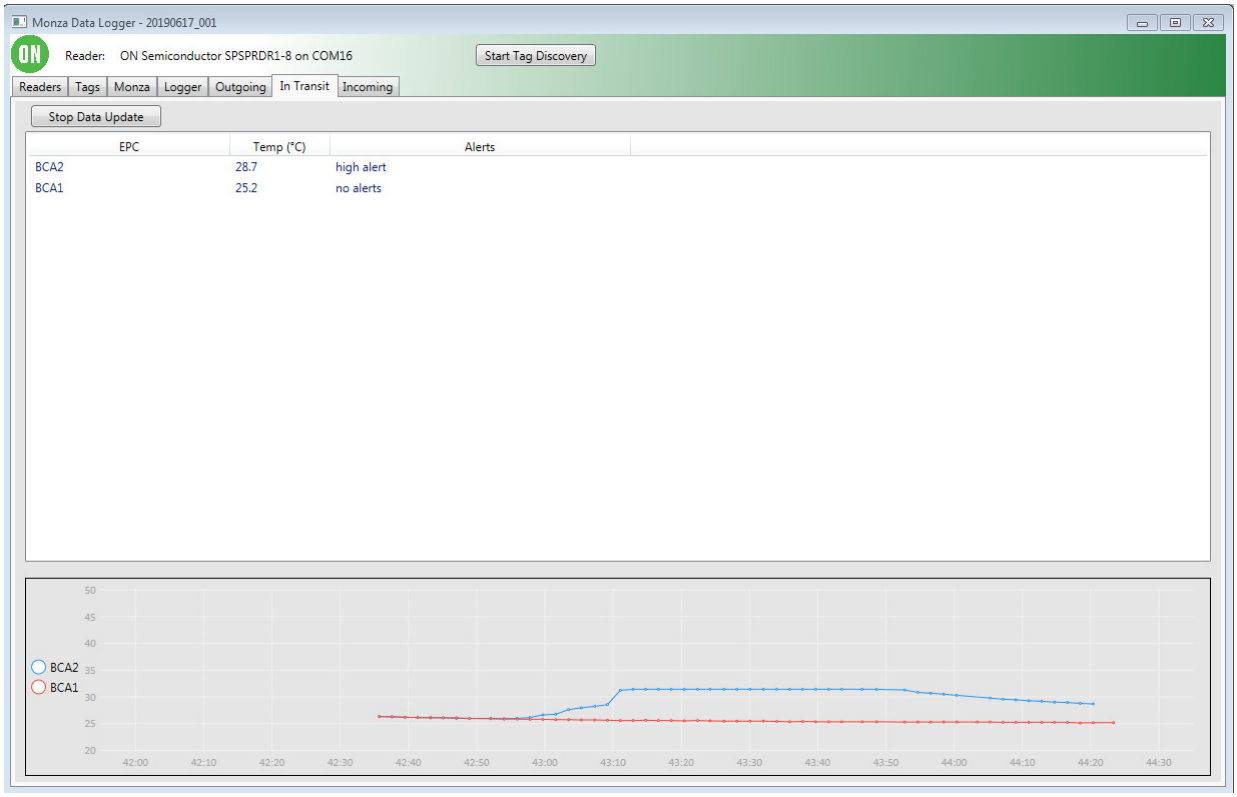

Figure 7.

Validate Temperature Compliance at the Receiving Location

Now that the truck has arrived at the destination, another advantage of the ON Semiconductor data logger becomes immediately apparent. Typically data loggers need to be retrieved from the carton and either plugged into a USB port, touched with a probe, or synched with a Bluetooth reader one at a time to capture the temperature data. This is simply too slow.

With the data logger tag, the data is picked up on all cartons at forklift speed as the cartons enter the warehouse. The screen on the forklift (for example) immediately displays whether the cartons remained in compliance.

Select the Receiving tab.

In the example below, you can see that the tag that was exposed to the heat source, but cooled back down shows a red square indicating that the upper limit temperature was exceeded. This is the receiving dock's indication that this carton is suspect and needs to have the log details pulled.

The other carton remained within compliance and can be processed as normal.

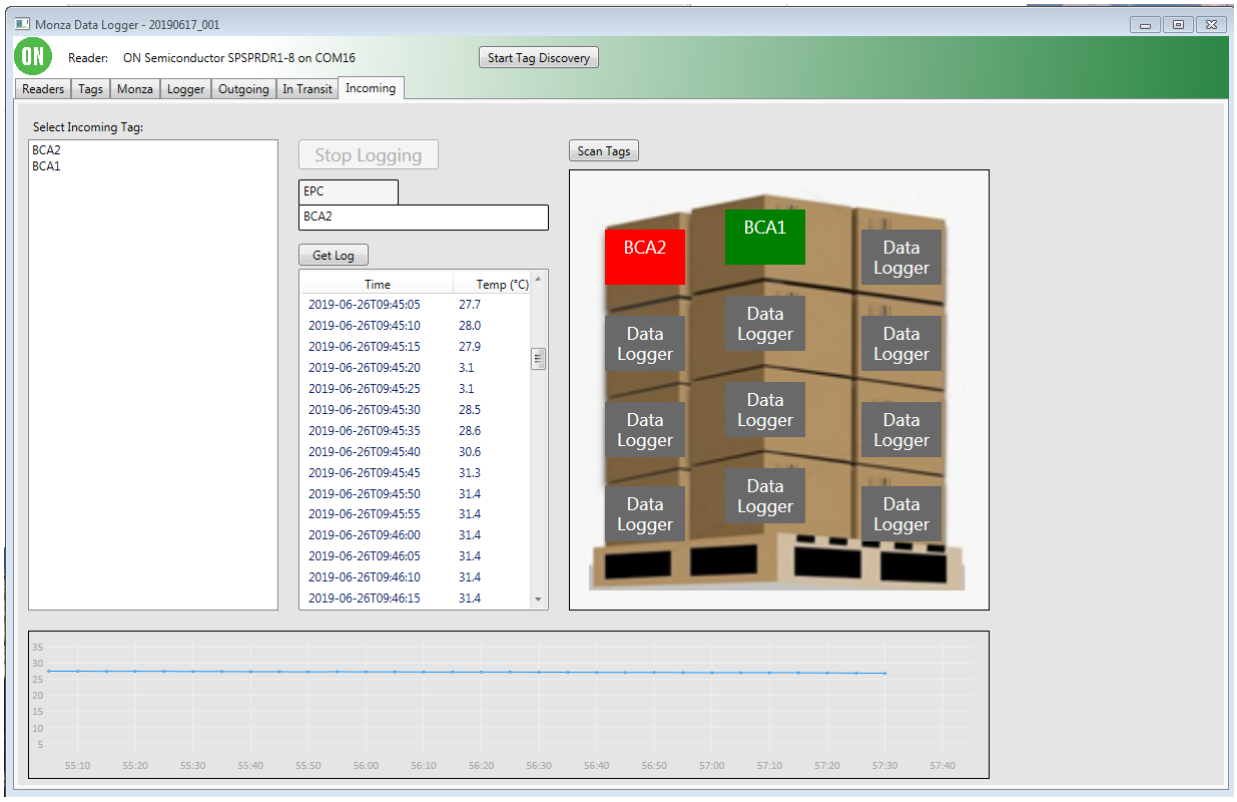

Figure 8.

Pulling the Data Log

For carton BCA2, the temperature threshold was exceeded. The critical question was whether it exceeded the upper threshold by a tenth of a degree for 5 seconds, or whether it got several degrees too hot for a sustained period of time. The QA team can make the determination from the log data which shows the data/time stamp as well as the recorded temperature.

It is also possible to store the data log into a .csv file to be saved to review with the trucking company, or other quality assurance processes. I wrote a macro to provide a more detailed visualization of the data. Please contact me and I will send a copy of the macro.

The output of the macro shows all the original data on the left hand side of the screen. On the right hand, statistics (max, min, total time, time over threshold, time under threshold, and average) as displayed, as well a graph showing the tag temperature with the threshold values displayed.

In this particular case, I took a tag, put it into the refrigerator, and then placed it in the freezer. These changes are clearly visible in the graph. Any data point on the left that is below the lower threshold temperature is turned blue, and any data point above the upper threshold is red.

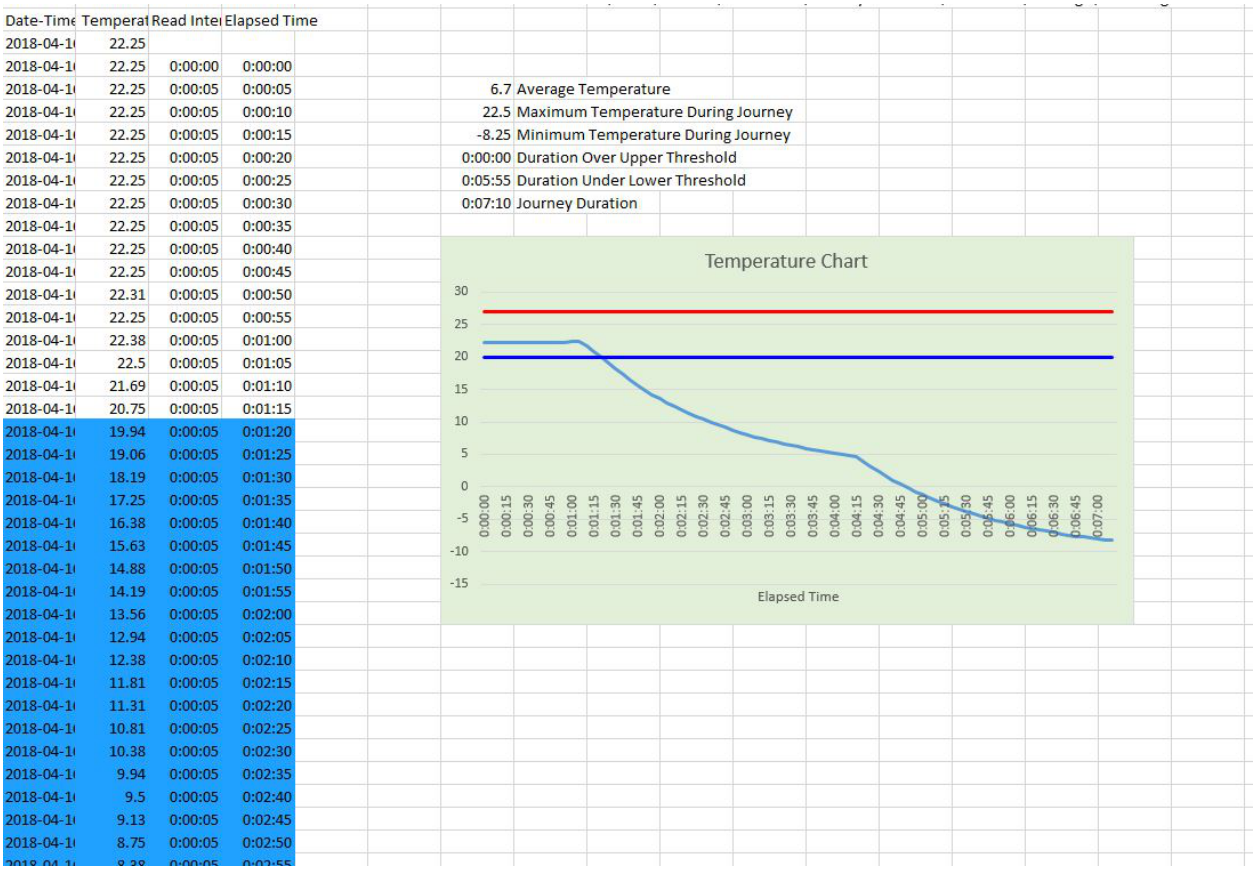

Figure 9.

Capturing the Data Log into a .csv File

To capture the data log from the tag into a .csv file, go to the Logger tab. Select the tag you want to capture the log for. Then press the “Get” button on the Temp Limit section at the bottom of the screen.

Next go to the “Log” section on the right and press “Get”. Once the data has been populated, press the “Save to File” button which will bring up the Windows screen to select a folder and name the file.

Note: This screen can also be used to rename the tag using hex characters. A future update of the demo software will enable using a name with ASCII characters to enable the tag to be tied to a shipment number or other friendly name.

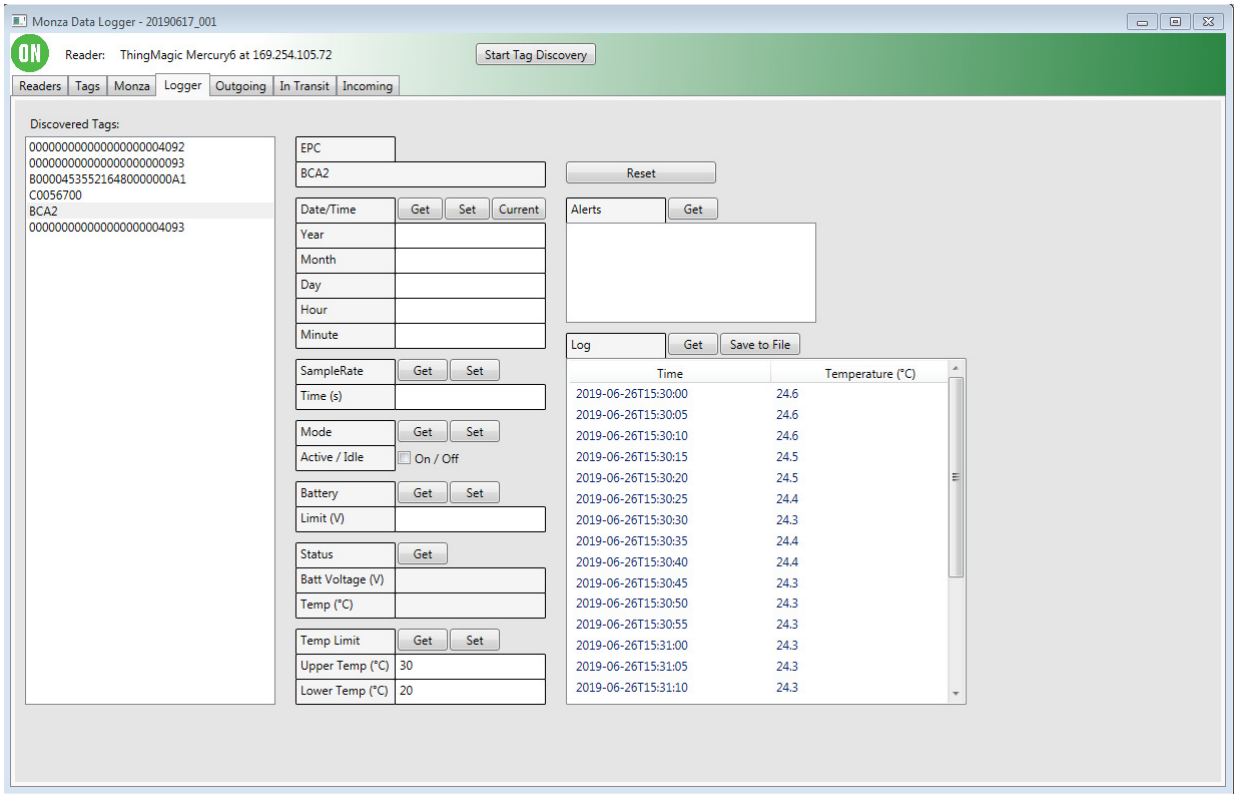

Figure 10.

Summary

This demo is designed to show how easy and fast it is to activate a tag, track it during shipment (if desired), and read the relevant data on the receiving end without handling the tag. This is a fully compliant RFID tag so it can also be used for track−and−trace applications in addition to recording the carton temperature.

Since speed is one of the absolute highlights of the tag, the whole demo can be completed in a couple of minutes, depending on how many different temperature conditions you want to show.

If you have suggestions on how to improve the demo or the demo guide, I would welcome your input. Or if you want the macro that displays the content of the .csv file, please send me a note at douglas.seitz@onsemi.com.

Thank you very much.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Email Requests to: orderlit@onsemi.com

ON Semiconductor Website: www.onsemi.com

TECHNICAL SUPPORT
North American Technical Support:
Voice Mail: 1 800−282−9855 Toll Free USA/Canada
Phone: 011 421 33 790 2910

Europe, Middle East and Africa Technical Support:
Phone: 00421 33 790 2910
For additional information, please contact your local Sales Representative

◊