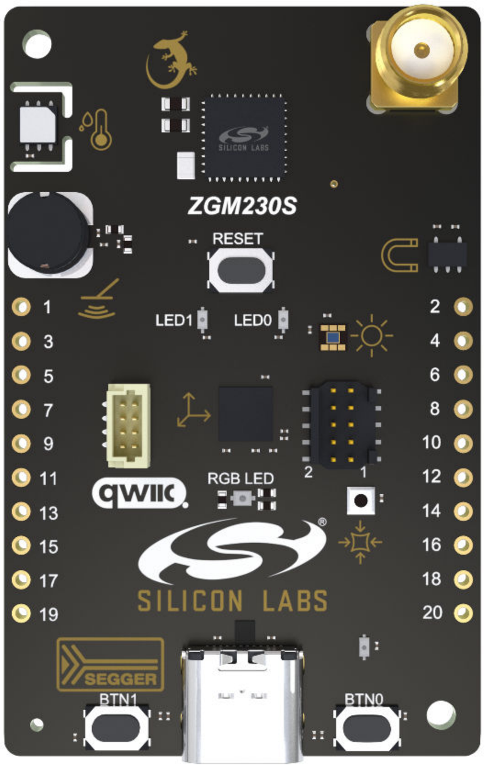
QSG184: Z-Wave 800 Thunderboard Quick Start Guide

A Z-Wave 800 Thunderboard BRD2603A Radio Board is an excellent starting point to get familiar with the ZGM230S Z-Wave® 800 SiP Module. It also provides the necessary tools for developing a Silicon Labs wireless application.

The board is a small and cost-effective, feature-rich prototype and development platform based on the ZGM230S SiP Module.

A built in SEGGER J-Link debugger ensures easy customization and development.



KEY FEATURES OR KEY POINTS

- ZGM230S Z-Wave SiP Module with 512 kB Flash, 64 kB RAM. Integrated RF matching network, crystals, and decoupling capacitors
- +14 dBm TX power
- SMA antenna connector (863-925 MHz)
- Advanced Energy Monitor
- Virtual COM port
- SEGGER J-Link on-board debugger
- RGB LED, two single color LEDs and two push buttons
- CR2032 coin cell battery support
- 20-pin 2.54 mm breakout pads • Mini Simplicity connector for connection to an external Silicon Labs debugger

ON-BOARD SENSORS

- Relative humidity and temperature sensor
- Passive Infrared sensor
- Hall effect sensor
- Ambient light sensor
- Pressure Sensor
- LESENSE LC-Sensor
- 6-axis Inertial Sensor

SOFTWARE SUPPORT

- Simplicity Studio™

Table of Contents

1. Introduction

The ZGM230S Dev Kit (OPN: ZGM230-DK2603A) has been designed to inspire customers to make battery-operated IoT devices with the Silicon Labs ZGM230S Z-Wave SiP Module System-in-Package Module. The highlights of the board include six different environmental sensors accessible to the ZGM230S wireless MCU. The peripherals have been grouped into power domains that can be turned on and off by the application code as needed.

Programming the ZGM230S Dev Kit is easily done using a USB Type-C cable and the on-board J-Link debugger. A USB virtual COM port provides a serial connection to the target application, and the Packet Trace Interface (PTI) offers invaluable debug information about transmitted and received packets in wireless links. Included on the board is an 8 Mbit serial flash that can be used for Over-The Air (OTA) firmware upgrade or as a general purpose non-volatile memory. The ZGM230S Dev Kit is supported in Simplicity Studio™, and a Board Support Package (BSP) is provided to give application developers a flying start.

Energy profiling and advanced wireless network analysis and debugging tools are available through the provided Mini Simplicity Connector using an external Silicon Labs debugger.

Connecting external hardware to the ZGM230S Dev Kit can be done using the 20 breakout pads which present peripherals from the ZGM230S Z-Wave SiP Module such as I^{2}C, SPI, UART, and GPIOs. The breakout pads follow the same pinout as the expansion headers (EXP) on other Silicon Labs Starter Kits. The board also features a Qwiic connector which can be used to connect hardware from the Qwiic Connect System through I^{2}C.

If you would like to know more about the HW features of the ZWave 800 Thunderboard, please refer to **UG532: ZGM230S Dev Kit User's Guide** document.

Please note that a Z-Wave 800 Thunderboard is just an extension kit. If you would like to use it in a Z-Wave network, you need to acquire an additional Thunderboard kit or Z-Wave PK800 kit.

1.1 Kit Contents

The following items are included in the box:

- 1x ZGM230S Dev Kit board (BRD2603A)
- 1x 868-915 MHz antenna (LPRS ANT-SS900)

1.2 Hardware Content

The following key hardware elements are included on the ZGM230S Dev Kit:

- ZGM230S SiP Module with 39 MHz operating frequency, 512 kB kB flash, and 64 kB RAM
- SMA antenna connector for wireless transmission
- Silicon Labs Si7021 relative humidity and temperature sensor
- Silicon Labs Si7210 hall effect sensor
- Vishay VEML6035 ambient light sensor
- TDK InvenSense ICM-20689 6-axis inertial sensor
- Bosch Sensortec BMP384 pressure sensor
- Macronix ultra low power 8 Mbit SPI flash (MX25R8035F)
- LESENSE metal detector LC-sensor
- Two single color LEDs and two push buttons
- RGB LED
- Power enable signals and isolation switches for ultra-low power operation
- On-board SEGGER J-Link debugger for easy programming and debugging, which includes a USB virtual COM port and Packet
- Trace Interface (PTI)
- Mini Simplicity connector for access to energy profiling and advanced wireless network debugging
- Qwiic connector for connecting external hardware from the Qwiic Connect System
- Breakout pads for GPIO access and connection to external hardware
- Reset button
- Automatic switchover between USB and battery power
- CR2032 coin cell holder and external battery connector

1.3 Kit Hardware Layout

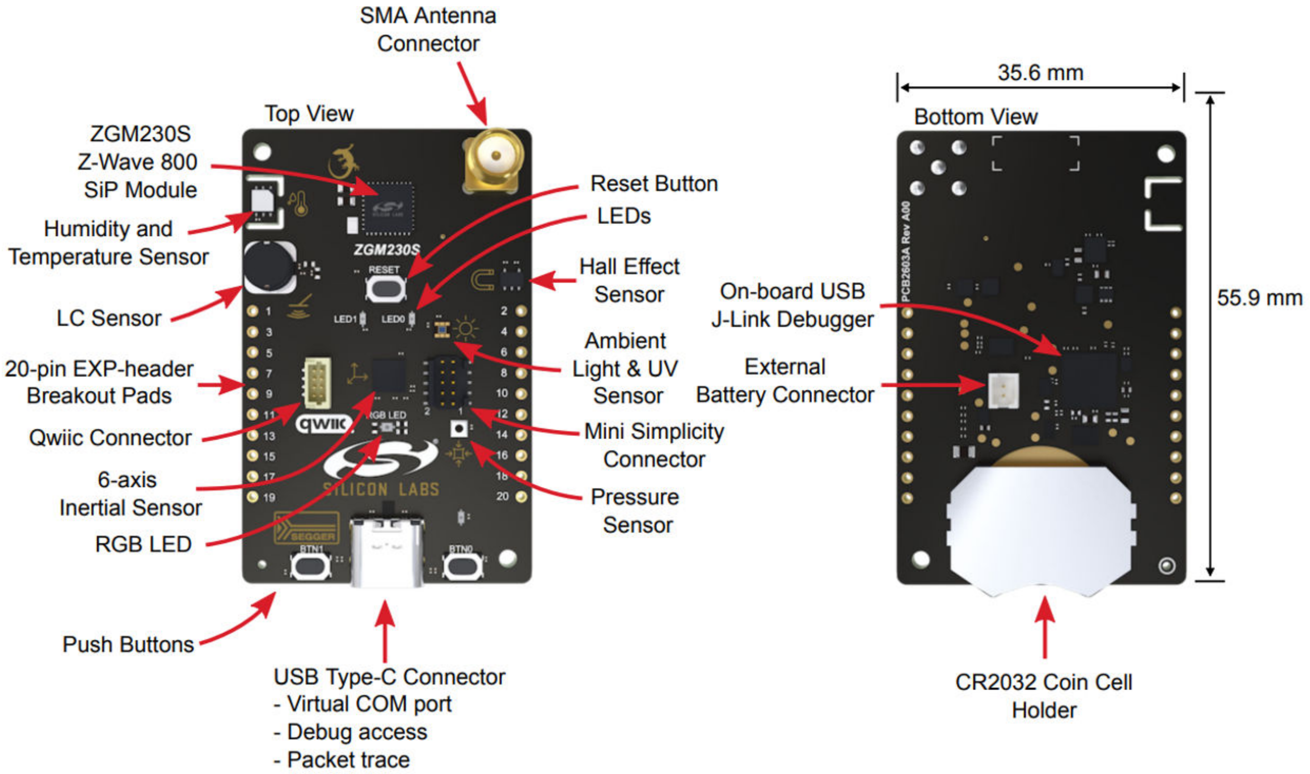


Figure 1.1. Z-Wave 800 Thunderboard HW Layout

2. Getting Started

2.1 About Simplicity Studio

Silicon Labs has enhanced Z-Wave to work with Silicon Labs hardware. The Z-Wave stack library is available as a software development kit (SDK) installed as part of the Gecko SDK (GSDK), the suite of Silicon Labs SDKs. To quickly get started with the GSDK, start by installing Simplicity Studio 5 (SSv5), which will set up your development environment and walk you through the GSDK installation. Simplicity Studio 5 includes everything needed for IoT product development with Silicon Labs devices, including a resource and project launcher, software configuration tools, full IDE with GNU toolchain, and analysis tools. Installation instructions are provided in the Simplicity Studio 5 Online User's Guide.

SSv5 is the core development environment designed to support the Silicon Labs IoT portfolio of system-on-chips (SoCs) and modules. It provides access to target device-specific web and SDK resources; software and hardware configuration tools; an integrated development environment (IDE) featuring industry-standard code editors, compilers and debuggers; and advanced, value-add tools for network analysis and code-correlated energy profiling.

SSv5 is designed to simplify developer workflow. It intelligently recognizes all Silicon Labs evaluation and development kit parts and, based on the selected development target, presents appropriate software development kits (SDKs) and other development resources.

2.2 About the Silicon Labs Z-Wave SDK

The Silicon Labs Z-Wave SDK is composed of the Z-Wave stack and example applications as well as the addition of metadata to allow for the seamless integration into Simplicity Studio 5.

The Silicon Labs Z-Wave SDK is based on the Gecko Platform component-based design, where each component provides a specific function. Components are made up of a collection of source files and properties. The component-based design enables customization by adding, configuring, and removing components. The application developer can use SSv5’s Project Configurator and Component Editor to easily assemble the desired features by including those components that match the required functionality and by configuring the various properties associated with those components.

The Silicon Labs Z-Wave SDK contains the Z-Wave stack in a library format.

For details on the Z-Wave stack version included within the Silicon Labs Z-Wave SDK, refer to the Z-Wave SDK release notes.

2.2.1 Gecko Bootloader

A bootloader is a program stored in reserved flash memory that can initialize a device, update firmware images, and possibly perform some integrity checks. Silicon Labs networking devices use bootloaders that perform firmware updates in two different modes: standalone (also called standalone bootloaders) and application (also called application bootloaders). An application bootloader performs a firmware image update by reprogramming the flash with an update image stored in internal or external memory. The Gecko Bootloader is a code library configurable through Simplicity Studio’s IDE to generate bootloaders that can be used with a variety of Silicon Labs protocol stacks. For more information about bootloaders see UG103.6: Bootloader Fundamentals.

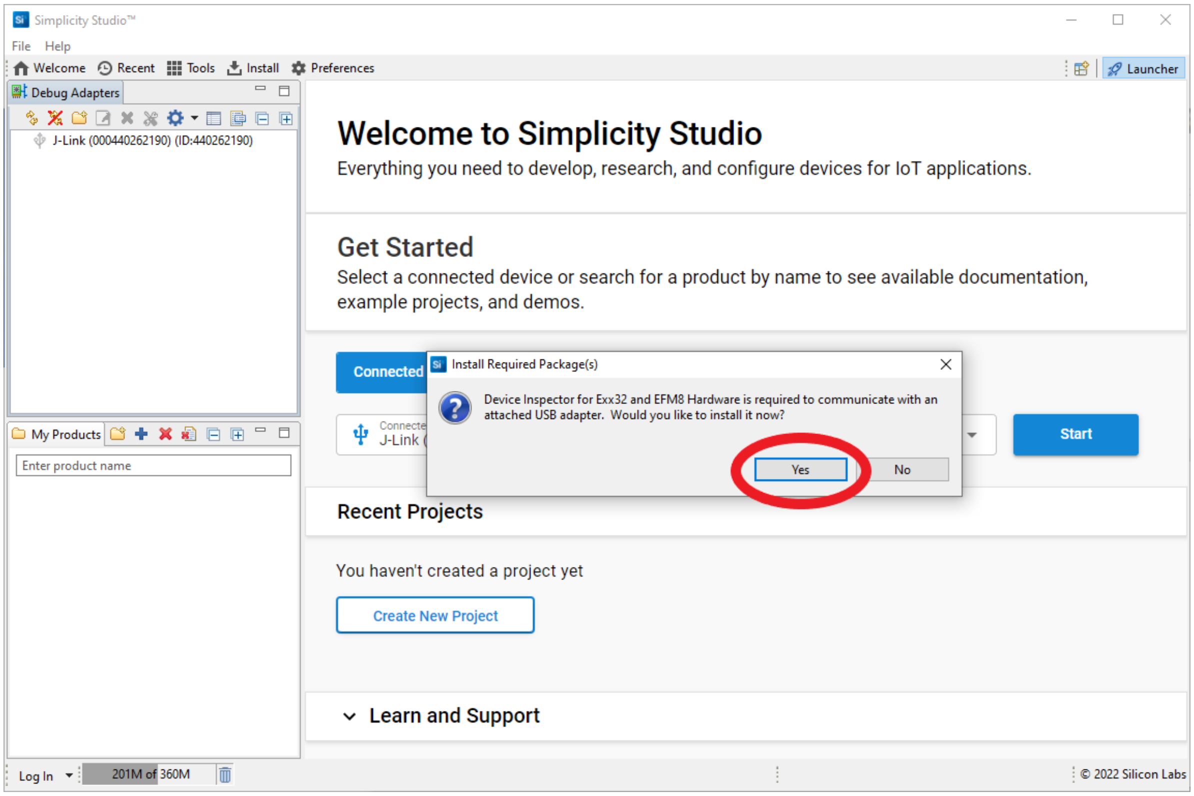
2.2.2 Gecko Platform

The Gecko Platform is a set of drivers and other lower layer features that interact directly with Silicon Labs chips and modules. Gecko Platform components include EMLIB, EMDRV, RAIL Library, NVM3, etc. For more information about Gecko Platform, see release notes that can be found in SSv5’s Documentation tab, as well as online API documentation in https://docs.silabs.com/.

2.3 Connecting to Z-Wave 800 Thunderboard in Simplicity Studio

In just a few click in Simplicity Studio, the board is ready to use. Please follow the steps below:

1. Start Simplicity Studio and connect the device via USB to the PC.
2. Install the required packages by clicking **YES** on the popup dialog in Studio.



Welcome to Simplicity Studio

Everything you need to develop, research, and configure devices for IoT applications.

Get Started

Select a connected device or search for a product by name to see available documentation, example projects, and demos.

Install Required Package(s)

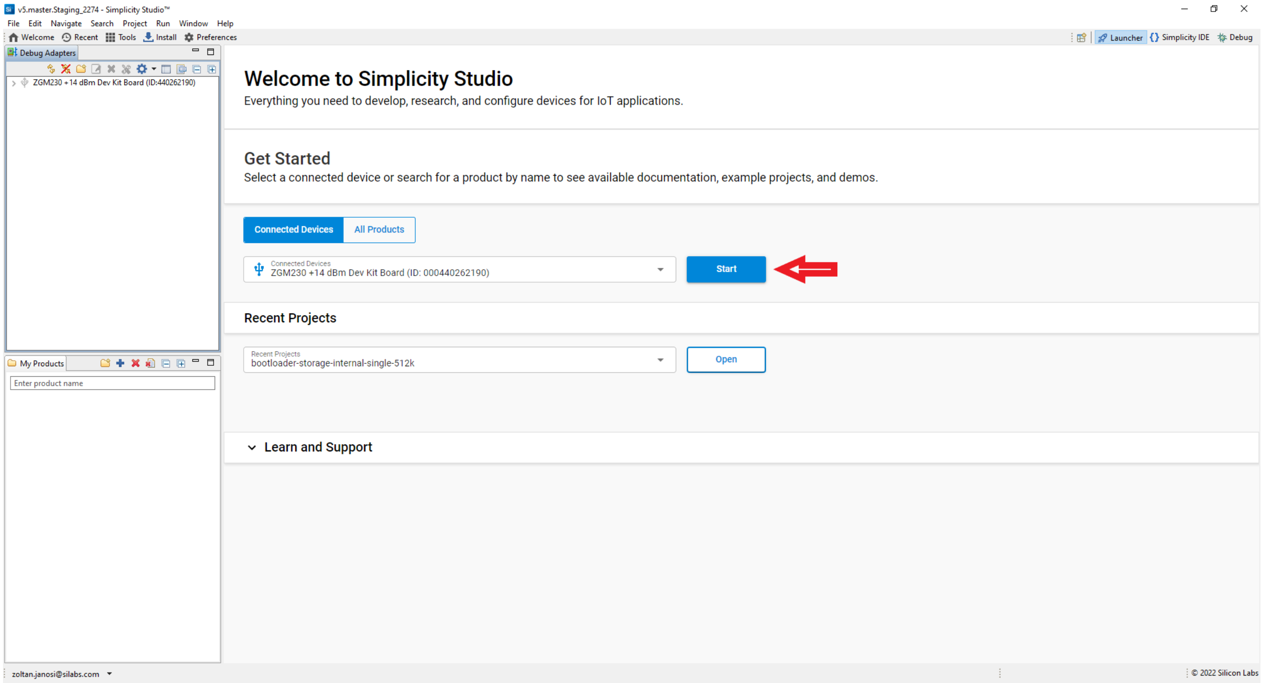
Device Inspector for Exx32 and EFM8 Hardware is required to communicate with an attached USB adapter. Would you like to install it now?

Recent Projects

You haven't created a project yet

Figure 2.1. Installing Additional Packages in Simplicity Studio

3. When it’s finished, select the board from the connected devices and click on **Start**.



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Connected Devices: ZGM230 +14 dBm Dev Kit Board (ID: 000440262190)

Recent Projects: bootloader-storage-internal-single-512k

Figure 2.2. Select Board in Simplicity Studio

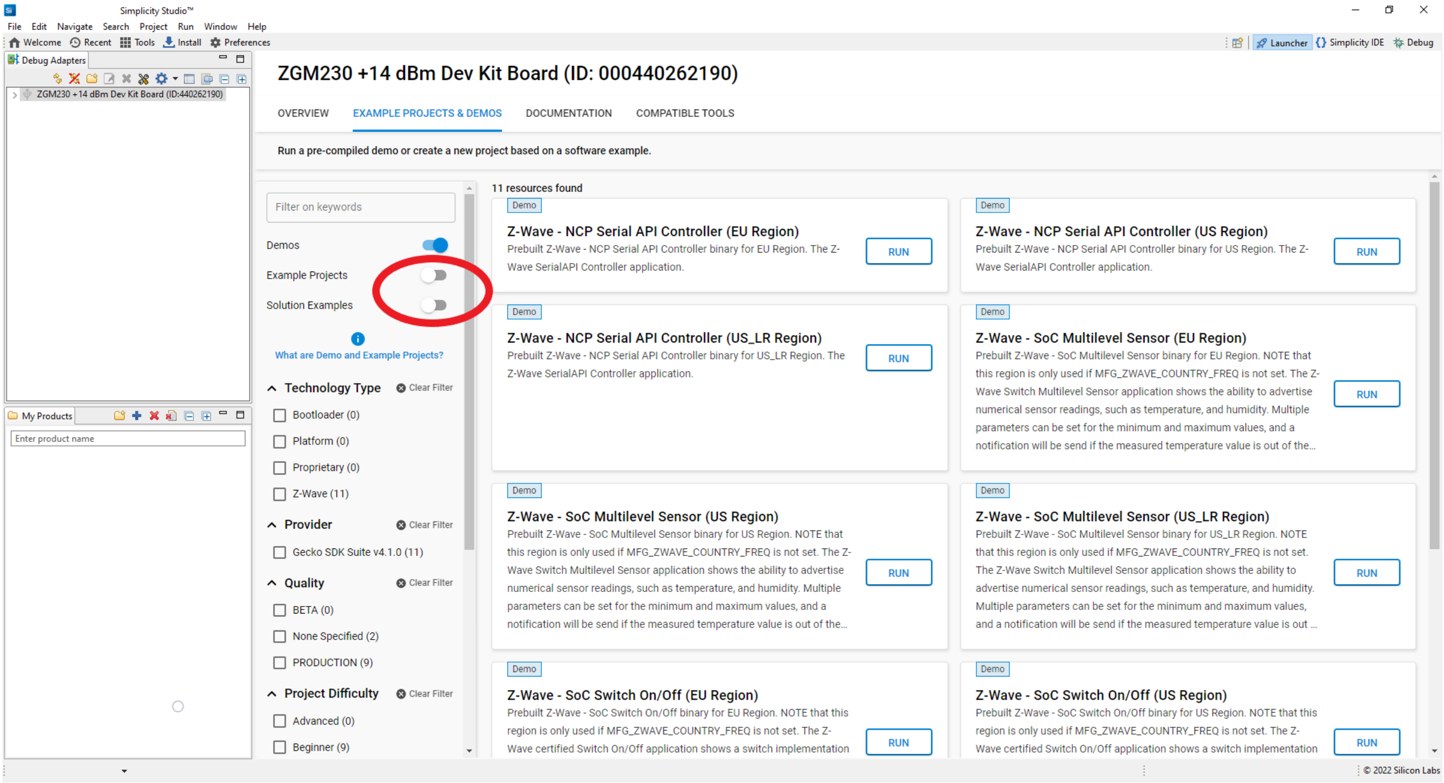
3. About Example Applications and Demos

Because starting application development from scratch is difficult, the Silicon Labs Z-Wave SDK comes with several built-in example applications and demos covering the most frequent use cases designed to illustrate common application functions. Silicon Labs strongly recommends starting development from one of the example applications. Like everything in SSv5, the examples and the demos shown on the **EXAMPLE PROJECTS & DEMOS** tab are filtered based on the part you have connected or selected.

This guide will demonstrate how to use two Z-Wave 800 Thunderboards together to connect them in a Z-Wave network, one as a Z-Wave controller and one as a Z-Wave end-device

3.1 Demos

Demos are prebuilt firmware images that are ready to download to a compatible device. The quickest way to find if a demo is available for your part is by adding the part or board information in the My Products view and then navigating to the **EXAMPLE PROJECTS & DEMOS** tab in the Launcher Perspective. Disable the Example Projects filter.



ZGM230 +14 dBm Dev Kit Board (ID: 000440262190)

Run a pre-compiled demo or create a new project based on a software example.

11 resources found

Z-Wave - NCP Serial API Controller (EU Region)
Prebuilt Z-Wave - NCP Serial API Controller binary for EU Region. The Z-Wave SerialAPI Controller application.

Z-Wave - NCP Serial API Controller (US Region)
Prebuilt Z-Wave - NCP Serial API Controller binary for US Region. The Z-Wave SerialAPI Controller application.

Z-Wave - NCP Serial API Controller (US_LR Region)
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Z-Wave - SoC Multilevel Sensor (EU Region)
Prebuilt Z-Wave - SoC Multilevel Sensor binary for EU Region. NOTE that this region is only used if MFG_ZWAVE_COUNTRY_FREQ is not set. The Z-Wave Switch Multilevel Sensor application shows the ability to advertise numerical sensor readings, such as temperature, and humidity. Multiple parameters can be set for the minimum and maximum values, and a notification will be send if the measured temperature value is out of the...

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Figure 3.1. Demos in Simplicity Studio

Available demos provided by the Z-Wave SDK for Z-Wave 800 Thunderboard are:

- **Z-Wave - NCP Serial API Controller:** The Serial Applications Programming Interface (Serial API) allows a host to communicate with a Z-Wave chip.
- **Z-Wave - SoC Switch On/Off:** Shows a switch implementation to turn on any device that is connected to power.
- **Z-Wave - SoC Multilevel Sensor:** Shows the ability to advertise numerical sensor readings, such as temperature, and humidity.

If you would like to know more about the sample applications, please refer to INS14278 - How to Use Z-Wave Certified Apps or about the Serial API in INS12350-Serial-API-Host-Appl. Prg.Guide.

4. Programming and Executing the Demos, Connecting them in a Z-Wave Network

4.1 Programming the Controller Device

The Z-Wave PC Controller is an application for communicating with Z-Wave and Z-Wave Long Range nodes, like switches and sensors, through a device running Serial API connected to a USB port on the PC.

The PC Controller is often used in the development of a new Z-Wave end-device. The device can be included in the PC Controller, which can then be used to test its functionality by sending it various commands.

This quick start guide will only cover the very basics of this tool. Refer to the manual, INS13114 - Instruction, Z-Wave PC Based Controller v5 User Guide, to learn about all the features of this tool.

To program one of the Thunderboards with the Serial API demo application:

1. Start by connecting the Thunderboard via the USB port to your computer.
2. Start Simplicity Studio and in the Launcher landing page wait until Simplicity Studio detects your device.
3. When it is finished, select the board from the connected devices and click **Start**. (See Section 2.3 Connecting to Z-Wave 800 Thunderboard in Simplicity Studio.)
4. In the device overview page click on the Example Projects & Demos tab, unfilter Examples and Soltions, look for the **Z-Wave - NCP Serial API Controller** demo application, and program the one which corresponds to your region using the **RUN** button.

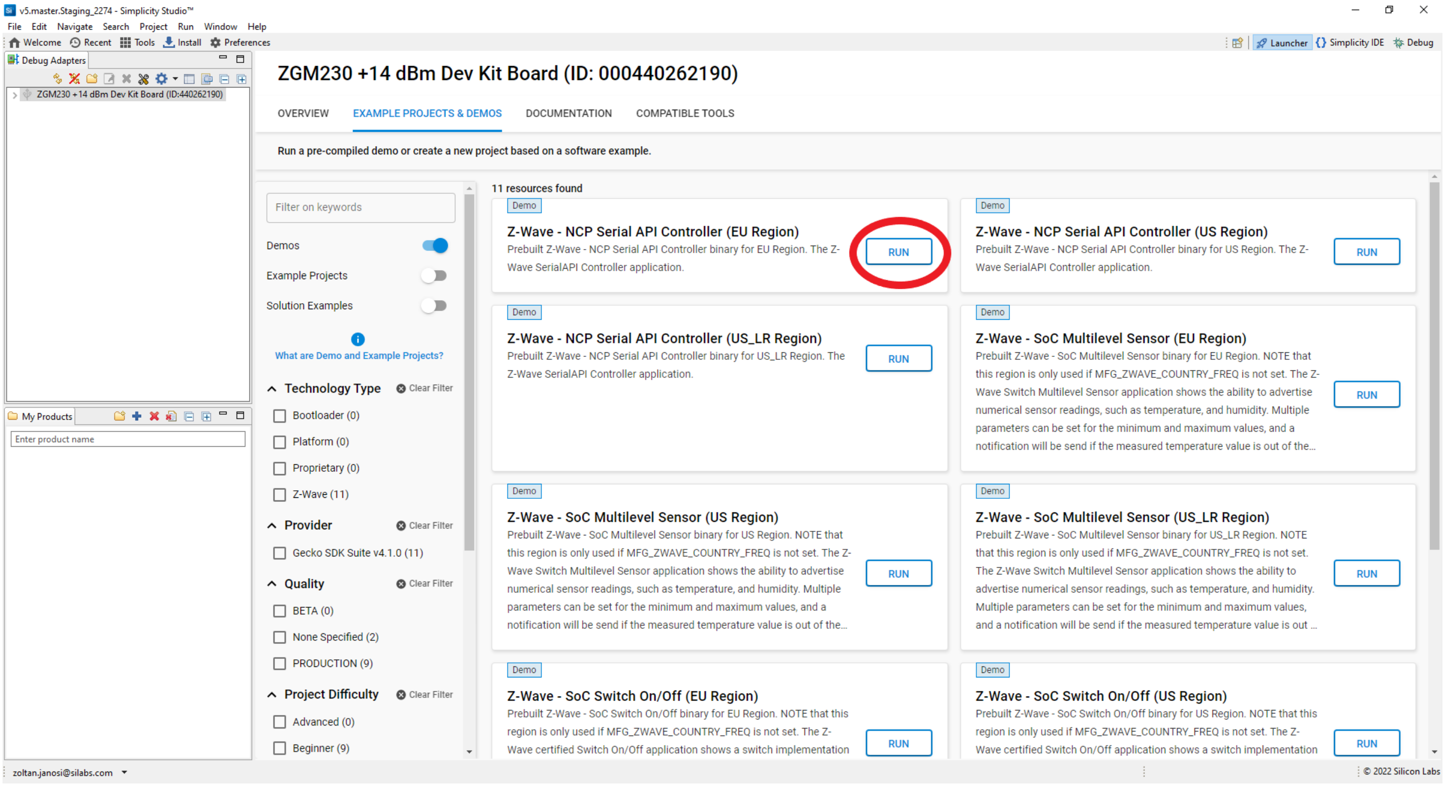

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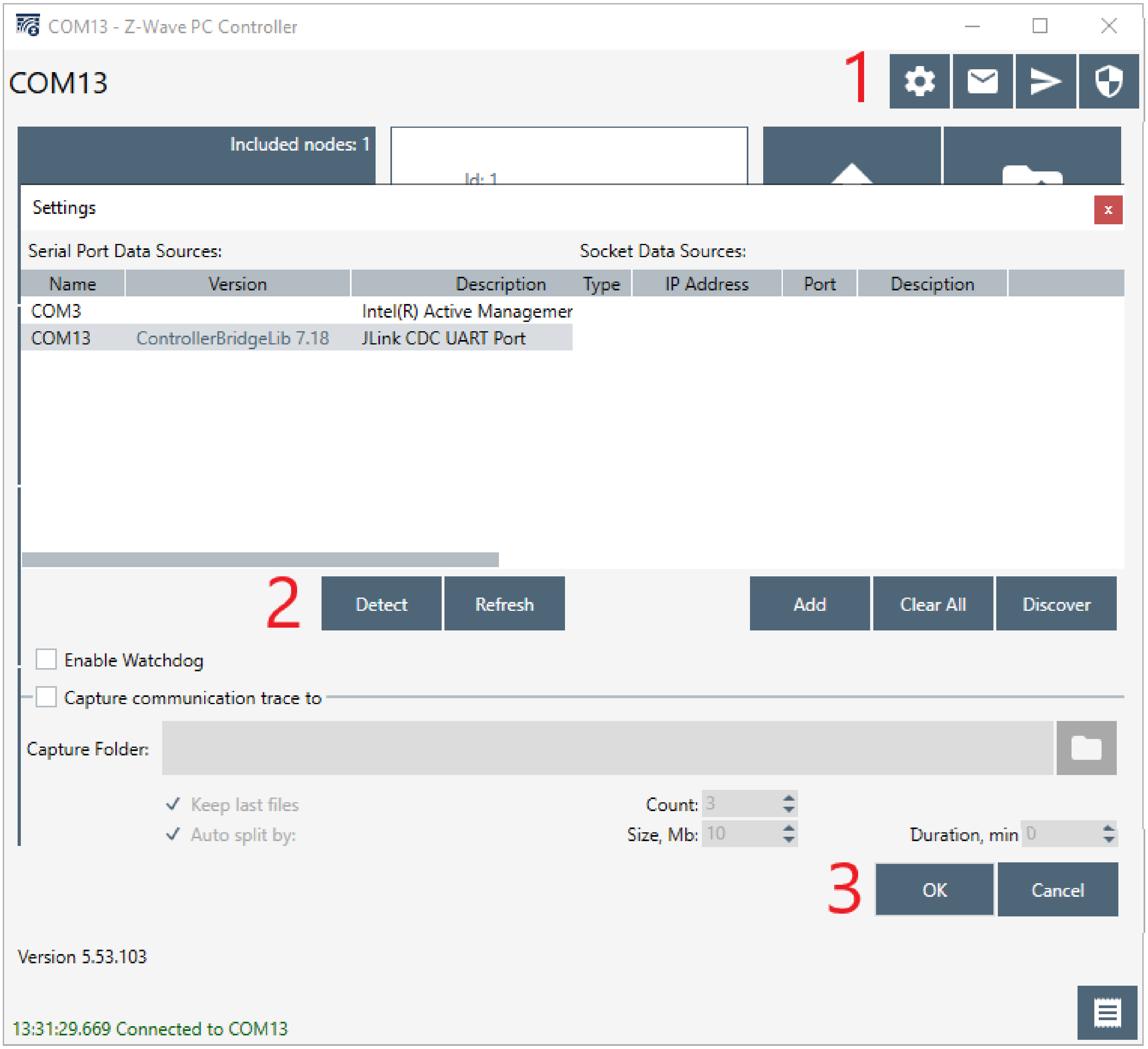
Figure 4.1. Programming Serial API from the Demos Page

5. Tools Run the Z-Wave PC Controller by clicking on the icon on the toolbar, and in the Tools Dialog click on **Z-Wave PC Controller**.

6. To connect to the device, open PC Controller and click on the **'Settings-wheel'** and select the correct COM port. Use the **Detect** button if you are unsure about the correct port.



Settings

Serial Port Data Sources:

Name	Version	Description
COM3		Intel(R) Active Managemer
COM13	ControllerBridgeLib 7.18	JLink CDC UART Port

Socket Data Sources:

Type	IP Address	Port	Desciption

□ Enable Watchdog

□ Capture communication trace to

Capture Folder:

✓ Keep last files Count: 3

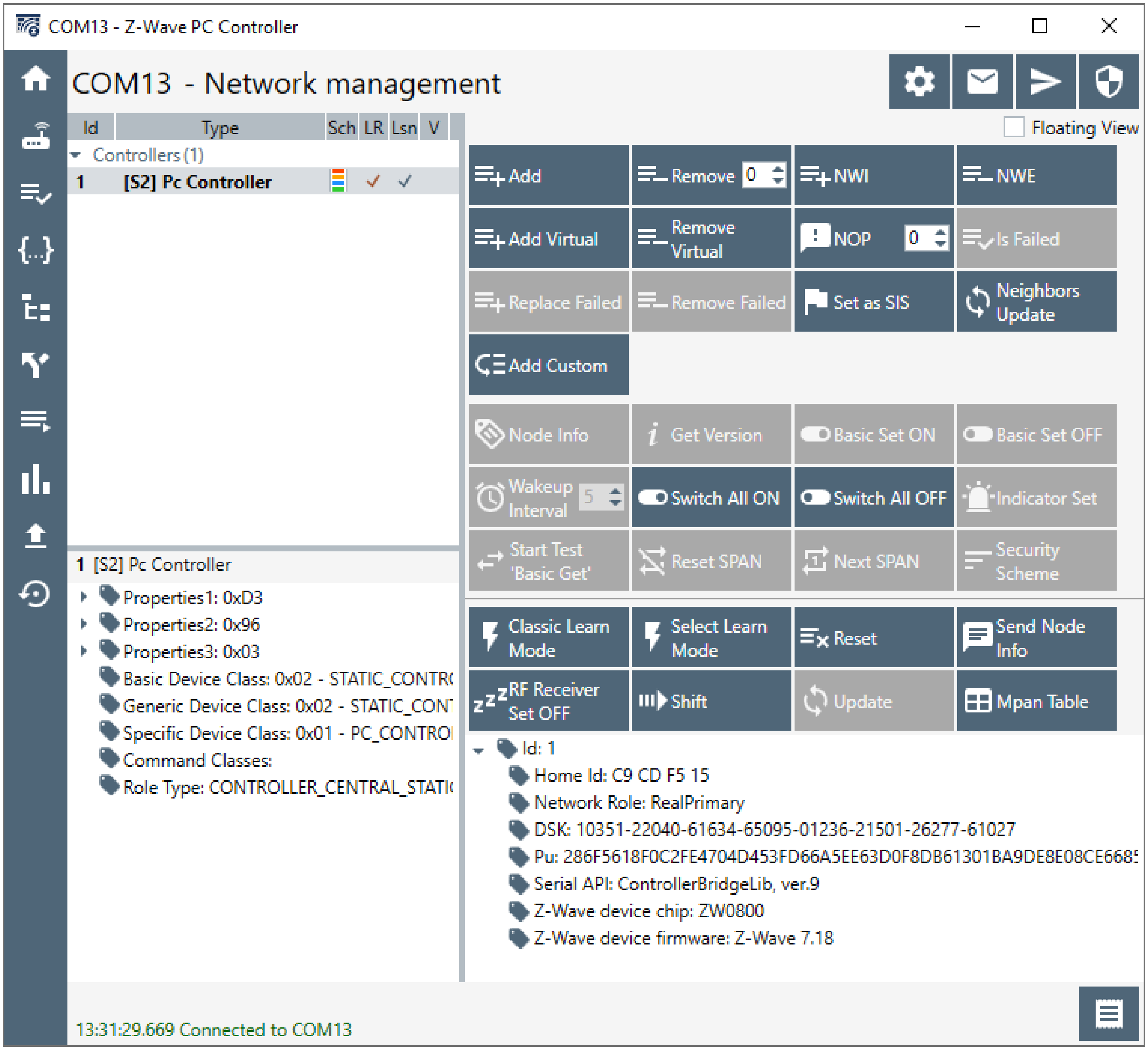
✓ Auto split by: Size, Mb: 10 Duration, min 0

Version 5.53.103

13:31:29.669 Connected to COM13

Figure 4.2. Connect to Serial API Controller in PC Controller

7. In the PC Controller's Network Management menu, you should see the device detected as controller and added to the network.



COM13 - Z-Wave PC Controller

COM13 - Network management

Id	Type	Sch	LR	Lsn	V
Controllers (1)					
1	[S2] Pc Controller			✓	✓

1 [S2] Pc Controller

- Properties1: 0xD3
- Properties2: 0x96
- Properties3: 0x03
- Basic Device Class: 0x02 - STATIC_CONTR
- Generic Device Class: 0x02 - STATIC_CON
- Specific Device Class: 0x01 - PC_CONTRO
- Command Classes:
- Role Type: CONTROLLER_CENTRAL_STATI

Id: 1

- Home Id: C9 CD F5 15
- Network Role: RealPrimary
- DSK: 10351-22040-61634-65095-01236-21501-26277-61027
- Pu: 286F5618F0C2FE4704D453FD66A5EE63D0F8DB61301BA9DE8E08CE668
- Serial API: ControllerBridgeLib, ver.9
- Z-Wave device chip: ZW0800
- Z-Wave device firmware: Z-Wave 7.18

13:31:29.669 Connected to COM13

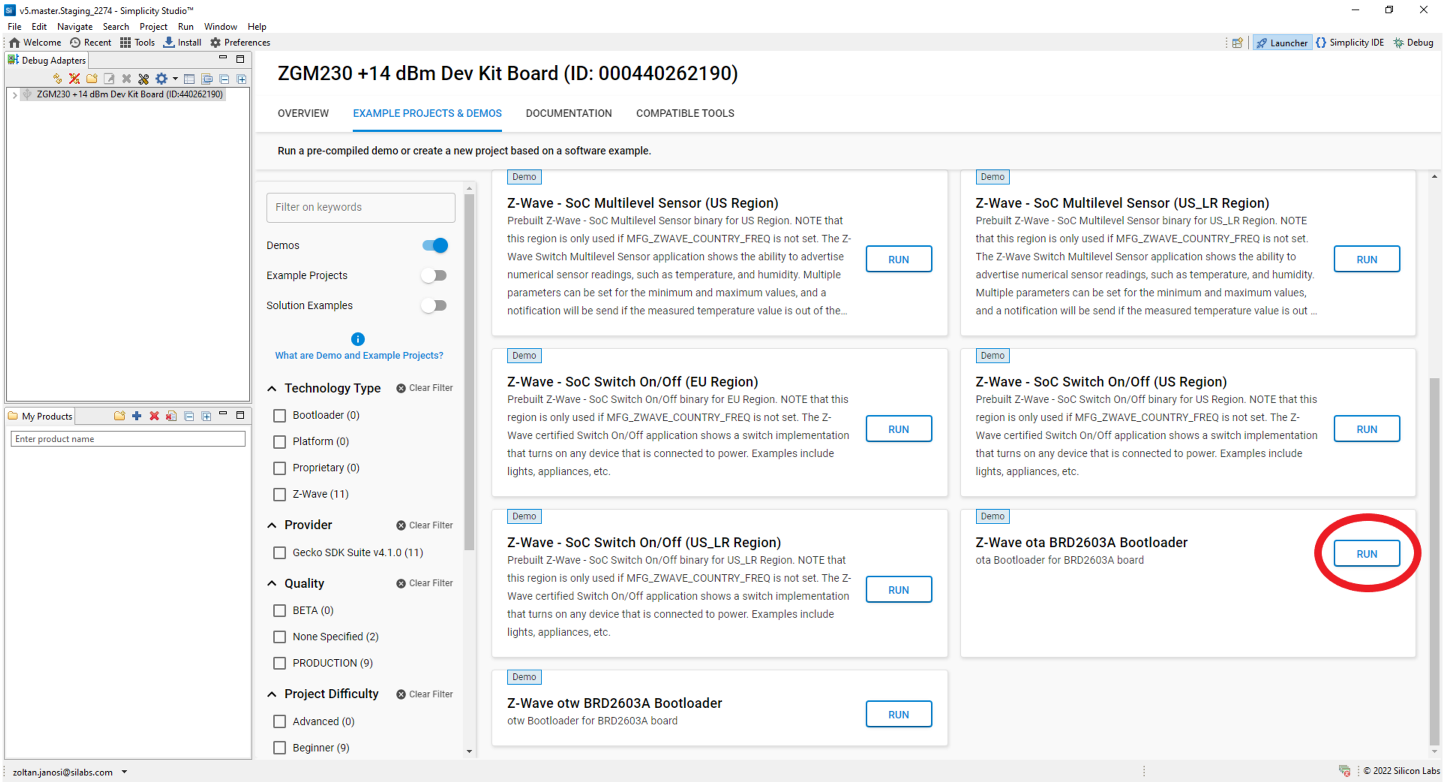
Figure 4.3. PC Controller Network Management Page

4.2 Programming the End-Device

Now that we have a working Z-Wave controller device, we can program a second Thunderboard as an end-device.

4.2.1 Programming the Bootloader

The Z-Wave example applications require the presence of the Gecko Bootloader on the end-device. To program the demo bootloader, look for the **Z-Wave OTA Bootloader** in the Simplicity Studio device overview Example Projects & Demos tab, and click on **RUN**.



ZGM230 +14 dBm Dev Kit Board (ID: 000440262190)

Run a pre-compiled demo or create a new project based on a software example.

Demo
Z-Wave - SoC Multilevel Sensor (US Region)
Prebuilt Z-Wave - SoC Multilevel Sensor binary for US Region. NOTE that this region is only used if MFG_ZWAVE_COUNTRY_FREQ is not set. The Z-Wave Switch Multilevel Sensor application shows the ability to advertise numerical sensor readings, such as temperature, and humidity. Multiple parameters can be set for the minimum and maximum values, and a notification will be send if the measured temperature value is out of the...
RUN

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RUN

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RUN

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RUN

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RUN

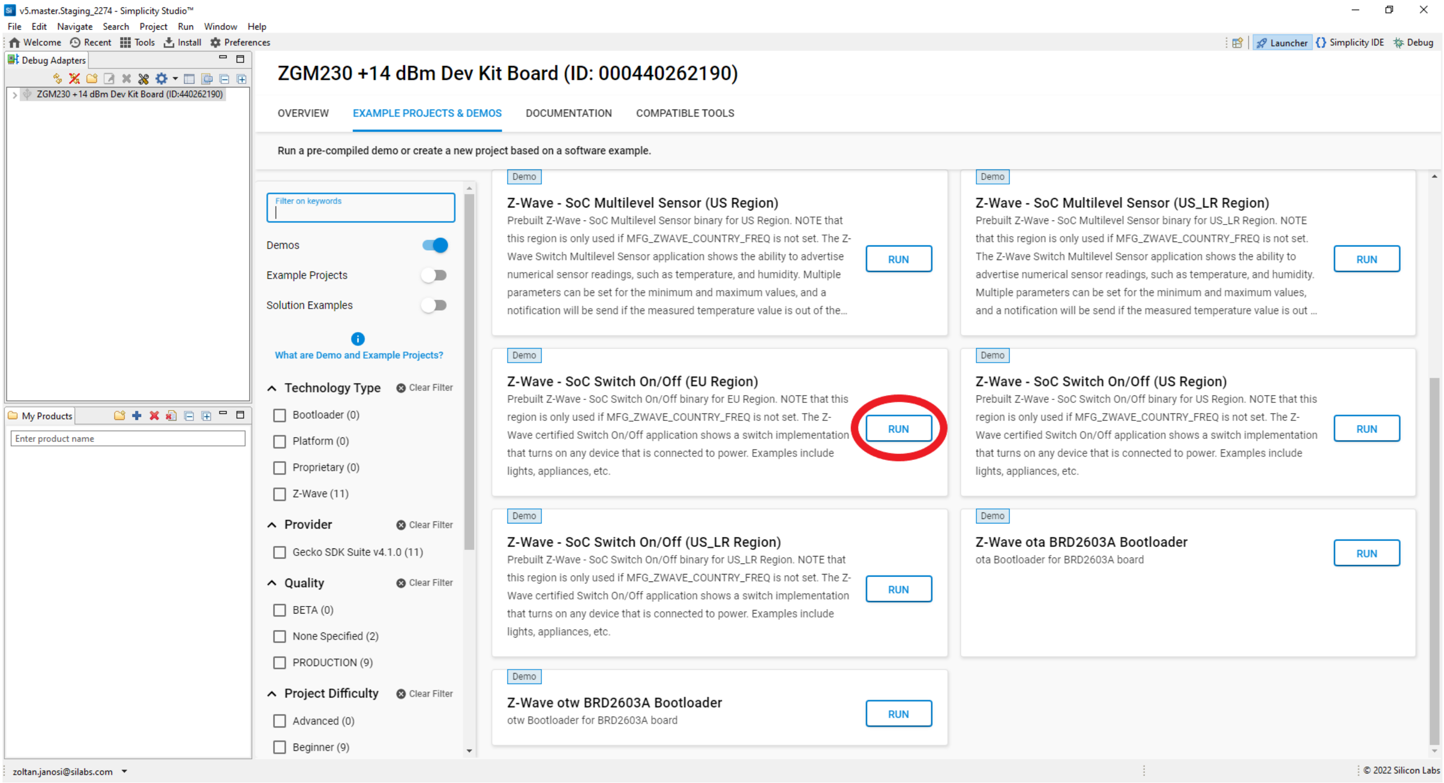
Demo
Z-Wave ota BRD2603A Bootloader
ota Bootloader for BRD2603A board
RUN

Demo
Z-Wave otw BRD2603A Bootloader
otw Bootloader for BRD2603A board
RUN

Figure 4.4. Programming Bootloader from the Demos Page

4.2.2 Programming SwitchOnOff Demo

After programming the Bootloader, using the same user interface in Studio device overview Example Projects & Demos tab, program the SwitchOnOff demo by clicking on **RUN**. Make sure to use the same region variant as the Serial API you selected previously.



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Z-Wave ota BRD2603A Bootloader
ota Bootloader for BRD2603A board

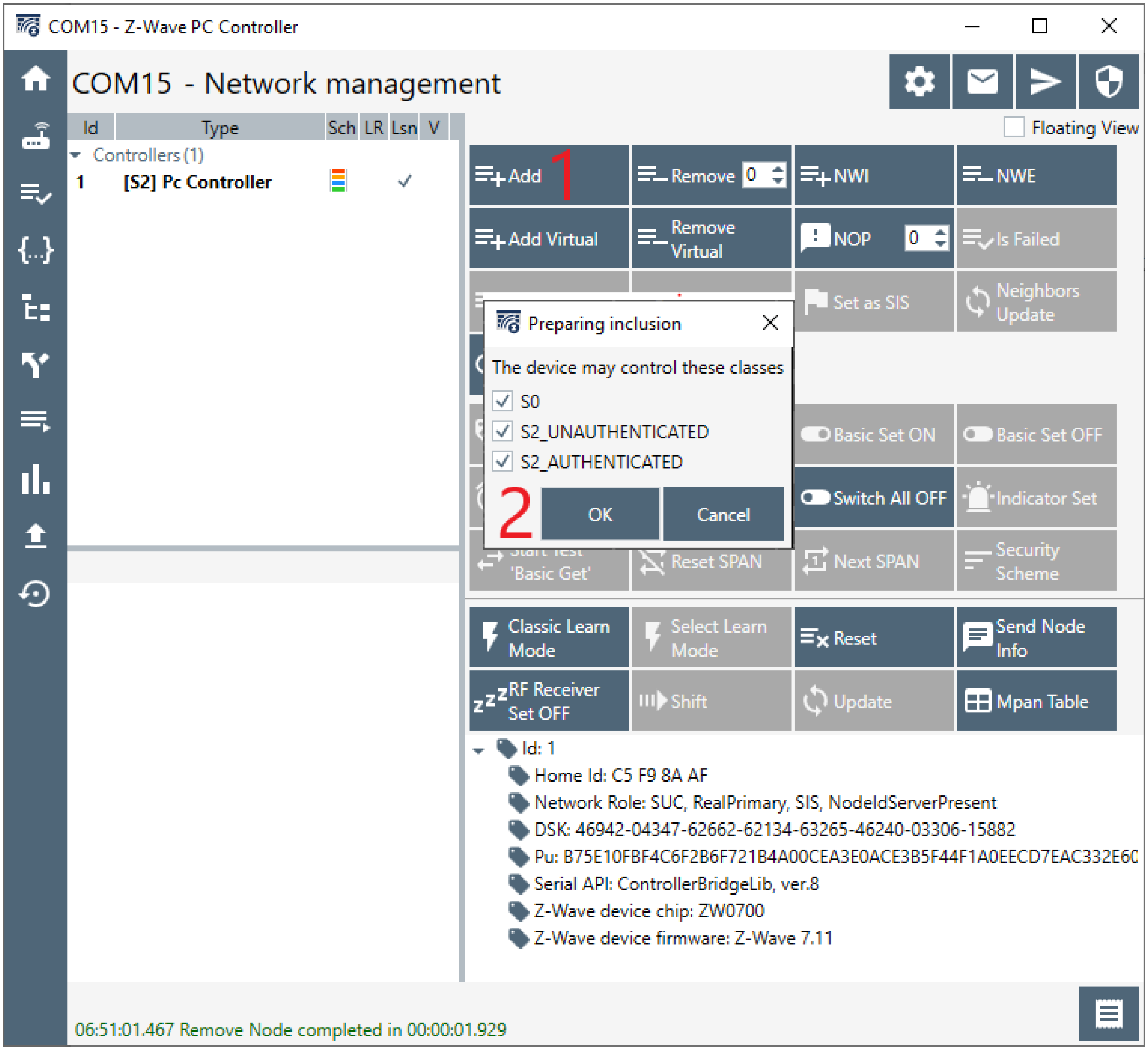
Z-Wave otw BRD2603A Bootloader
otw Bootloader for BRD2603A board

Figure 4.5. Programming SwitchOnOff from the Demos Page

4.3 Network Inclusion

To be able to control the end-device remotely, you have to include it into a Z-Wave network first.

- Connect both programmed boards to the PC via USB.
- Using the controller device in the PC Controller application, on the Network Management view click on **Add**.
- Press **BTN1** on the end-device board to enable Learn Mode.
- In the Preparing Inclusion dialog, click **OK**.



COM15 - Z-Wave PC Controller

COM15 - Network management

Id	Type	Sch	LR	Lsn	V
Controllers (1)					
1	[S2] Pc Controller				✓

Preparing inclusion

The device may control these classes

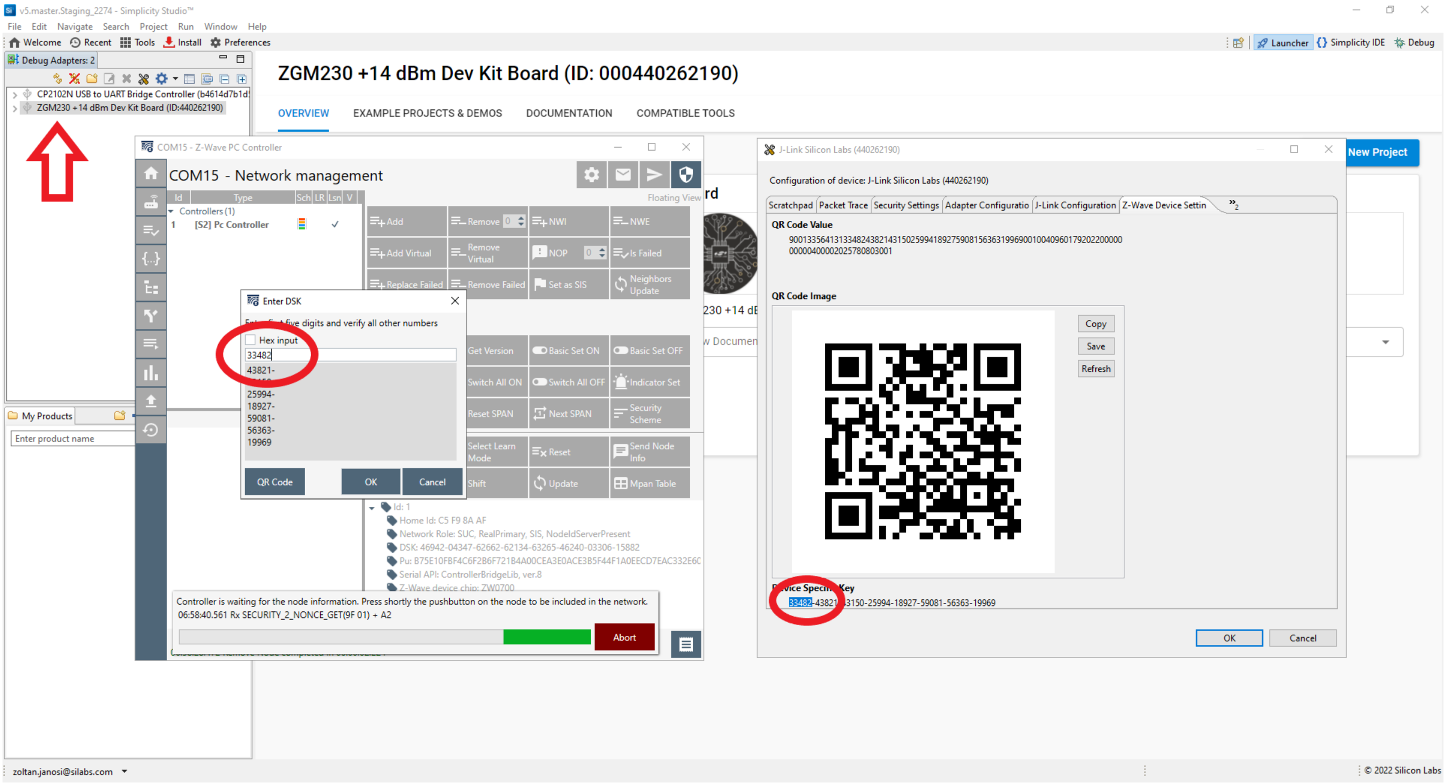
☑ S0
☑ S2_UNAUTHENTICATED
☑ S2_AUTHENTICATED

Id: 1
Home Id: C5 F9 8A AF
Network Role: SUC, RealPrimary, SIS, NodeIdServerPresent
DSK: 46942-04347-62662-62134-63265-46240-03306-15882
Pu: B75E10FBF4C6F2B6F721B4A00CEA3E0ACE3B5F44F1A0EECD7EAC332E6C
Serial API: ControllerBridgeLib, ver.8
Z-Wave device chip: ZW0700
Z-Wave device firmware: Z-Wave 7.11

06:51:01.467 Remove Node completed in 00:00:01.929

Figure 4.6. Initiate End-Device Network Inclusion in PC Controller

- All the demo applications implement Z-Wave S2 security. The S2 DSK (Device Specific Key) is used to authenticate the included device before exchanging the network keys. The PC Controller will require you the enter first five digits of the Device Specific Key. To find the DSK right click on the device in Simplicity Studio **Debug Adapters** list and select **Device Configuration**. Then in the dialog click on the **Z-Wave Device Settings** tab. Enter the DSK and click **OK**.



ZGM230 +14 dBm Dev Kit Board (ID: 000440262190)

COM15 - Network management

Id	Type	Sch	LR	Lsn	V
Controllers (1)					
1	[S2] Pc Controller				✓

Enter DSK

Enter first five digits and verify all other numbers

33482
43821-
25994-
18927-
59081-
56363-
19969

Id: 1
Home Id: C5 F9 8A AF
Network Role: SUC, RealPrimary, SIS, NodeIdServerPresent
DSK: 46942-04347-62662-62134-63265-46240-03306-15882
Pu: B75E10FBF4C6F2B6F721B4A00CEA3E0ACE3B5F44F1A0EECD7EAC332E6C
Serial API: ControllerBridgeLib, ver.8
Z-Wave device chip: ZW0700

Controller is waiting for the node information. Press shortly the pushbutton on the node to be included in the network.
06:58:40.561 Rx SECURITY_2_NONCE_GET(9F 01) + A2

J-Link Silicon Labs (440262190)

Configuration of device: J-Link Silicon Labs (440262190)

QR Code Value
9001335641313348243821431502599418927590815636319969001004096017920220000000000400002025780803001

QR Code Image

Device Specific Key
33482-43821-43150-25994-18927-59081-56363-19969

Figure 4.7. Acquire DSK and Enter During Inclusion

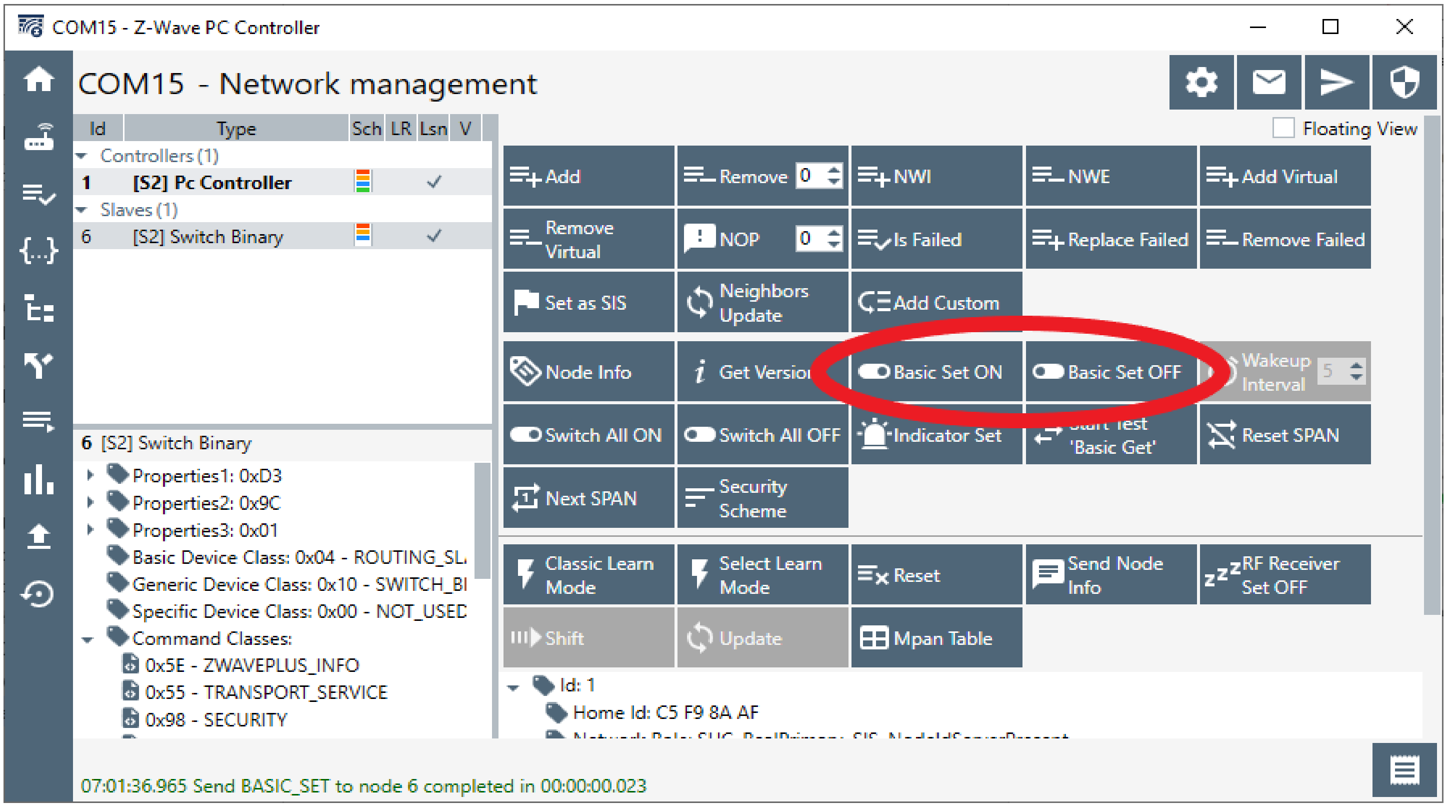
4.4 Using the SwitchOnOff Demo Application

The Z-Wave certified Switch On/Off application shows a switch implementation that turns on any device that is connected to power. Examples include lights, appliances, etc.

Usage of the application:

- Press BTN0 to toggle LED0 On or OFF
- Press BTN1 to enable LEARN mode

You can control the device's Switch functionality from the PC Controller, which will toggle LED0, by using **Basic Set ON and Basic Set OFF** buttons.



COM15 - Z-Wave PC Controller

COM15 - Network management

Id	Type	Sch	LR	Lsn	V
Controllers (1)					
1	**[S2] Pc Controller**			✓	
Slaves (1)					
6	[S2] Switch Binary			✓	

6 [S2] Switch Binary

- Properties1: 0xD3
- Properties2: 0x9C
- Properties3: 0x01
- Basic Device Class: 0x04 - ROUTING_SL
- Generic Device Class: 0x10 - SWITCH_BI
- Specific Device Class: 0x00 - NOT_USED
- Command Classes:
  - 0x5E - ZWAVEPLUS_INFO
  - 0x55 - TRANSPORT_SERVICE
  - 0x98 - SECURITY

- Id: 1
  - Home Id: C5 F9 8A AF

07:01:36.965 Send BASIC_SET to node 6 completed in 00:00:00.023

Figure 4.8. Control SwitchOnOff from PC Controller

5. Next Steps

Congratulations! You successfully completed the first steps of your Z-Wave journey using Z-Wave 800 Thunderboard!

This Quick Start Guide only teaches you the basics. Learn more about the Z-Wave 800 Thunderboard and Z-Wave, refer to the documents below:

Table 5.1. Additional Documentation

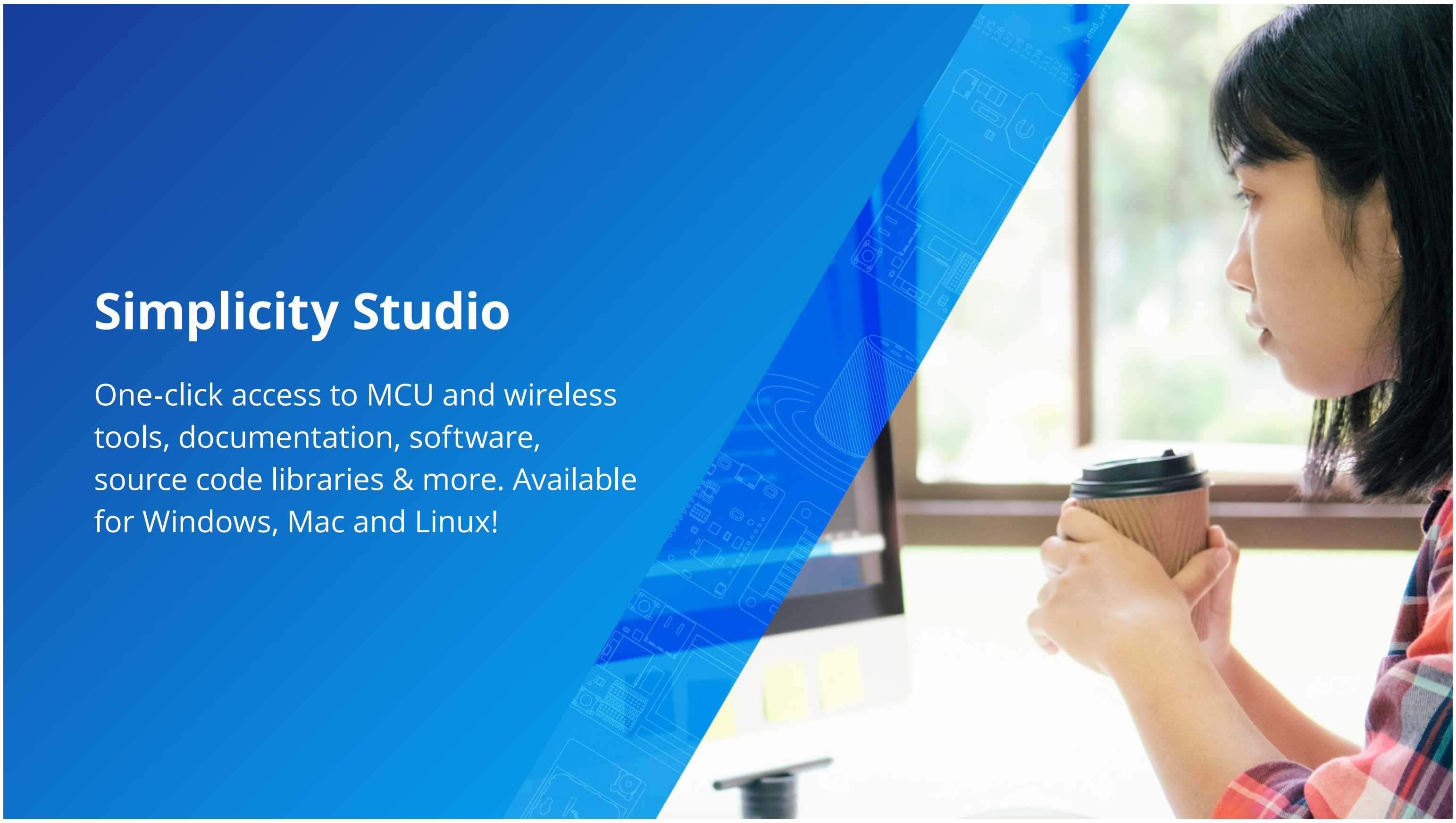
Document number	Title
BRD2603A Z-Wave 800 Thunderboard	
UG532	ZGM230S Dev Kit User's Guide
Z-Wave	
INS14280	Z-Wave Getting Started for End Devices
INS13114	Z-Wave PC Based Controller v5 User Guide
INS10249	Z-Wave Zniffer User Guide
INS14278	How to Use Certified Apps in Z-Wave
INS12350	Serial API Host Appl. Prg. Guide
Bootloader	
UG489	Silicon Labs Gecko Bootloader User’s Guide for GSDK 4.0 and Higher

6. Revision History

Revision 0.1

June 2022

- Initial Release



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