

Harvesting Energy for Smarter IoT with Silicon Labs' xG22E

2025
tech **t**alks
WEBINAR SERIES



BLUETOOTH



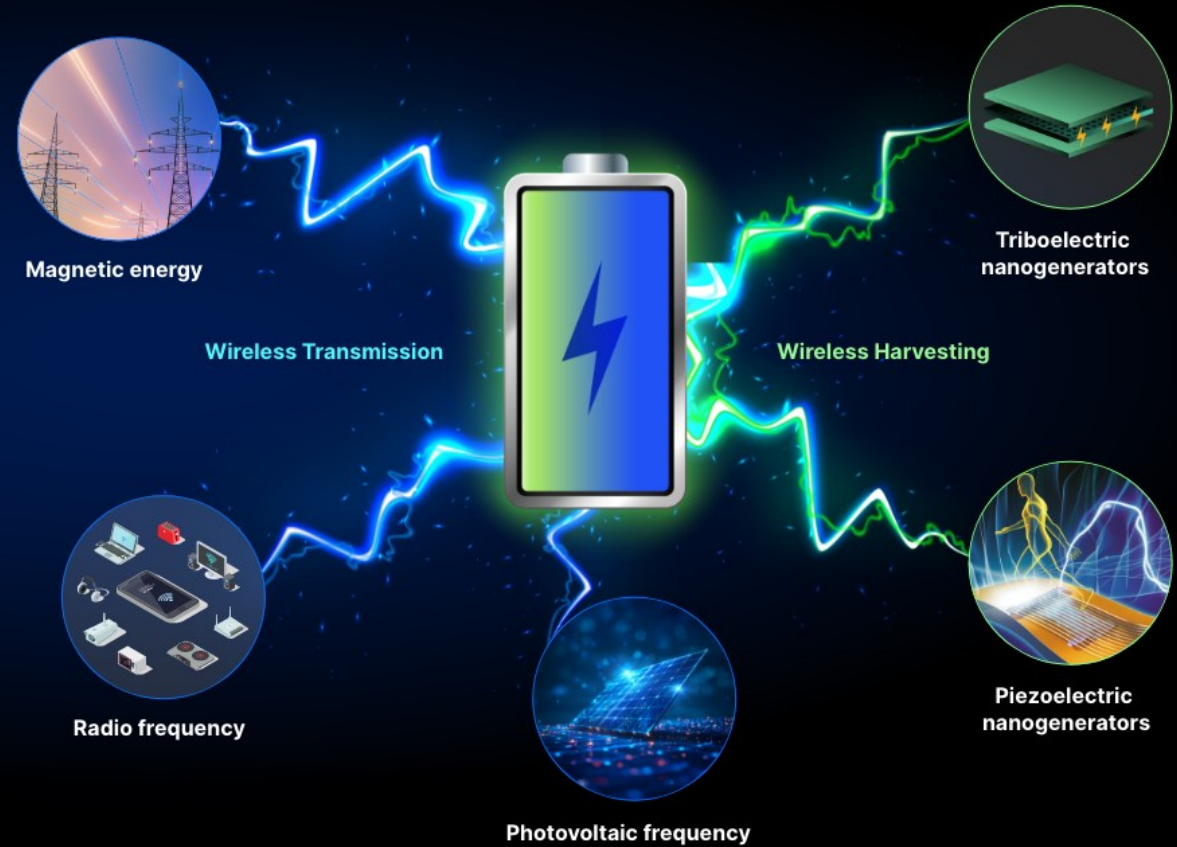
Agenda

- 01** Energy Harvesting - Sources and Applications
- 02** MG22E Explorer Shields - Unboxing!
- 03** MG22E Explorer Shield – Out-of-Box Setup
- 04** MG22E Explorer Shield – Example Setup DEMO
- 05** Going Further



Energy Harvesting – Sources & Applications

- Energy Harvesting sources
- Ambient IoT applications
- Ambient IoT architecture
- Energy Harvesting methodology



Energy Harvesting Sources

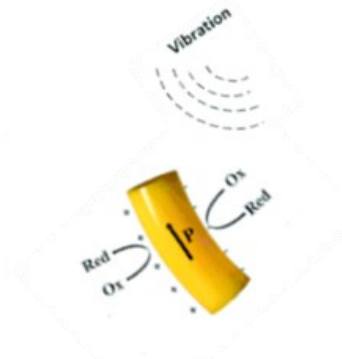


“TRICKLE” ENERGY SOURCES

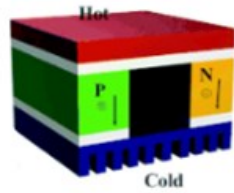
- For applications with nearly *constant energy supplies*
- For applications that are nearly *always-on (rechargeable)*



PHOTOVOLTAIC



VIBRATION
PIEZO



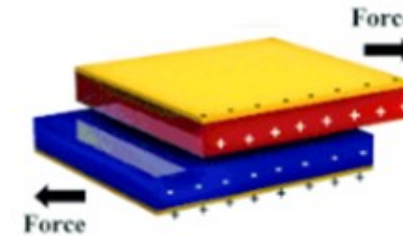
MAGNETIC /
THERMAL
INDUCTION



RF
INDUCTION

“TRANSIENT” ENERGY SOURCES

- For applications with *limited duration energy source*
- For applications that *frequently deep sleep or power off*

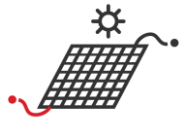


KINETIC

Learn more: [WorksWith 2023](#)

Ambient IoT - Applications

Learn more: [TechTalk 2024](#)



LOGISTICS / LIVESTOCK TRACKING

Bluetooth® Proprietary



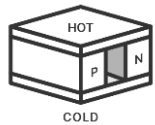
ASSET TRACKING / SMART BUILDING SENSORS

Bluetooth® Proprietary zigbee



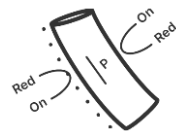
SMART SWITCHES

Bluetooth® zigbee



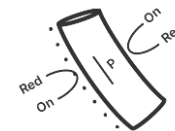
MACHINE MONITORING

Bluetooth® Proprietary zigbee



FACTORY AUTOMATION / AGRICULTURE / TPMS

Bluetooth® Proprietary zigbee

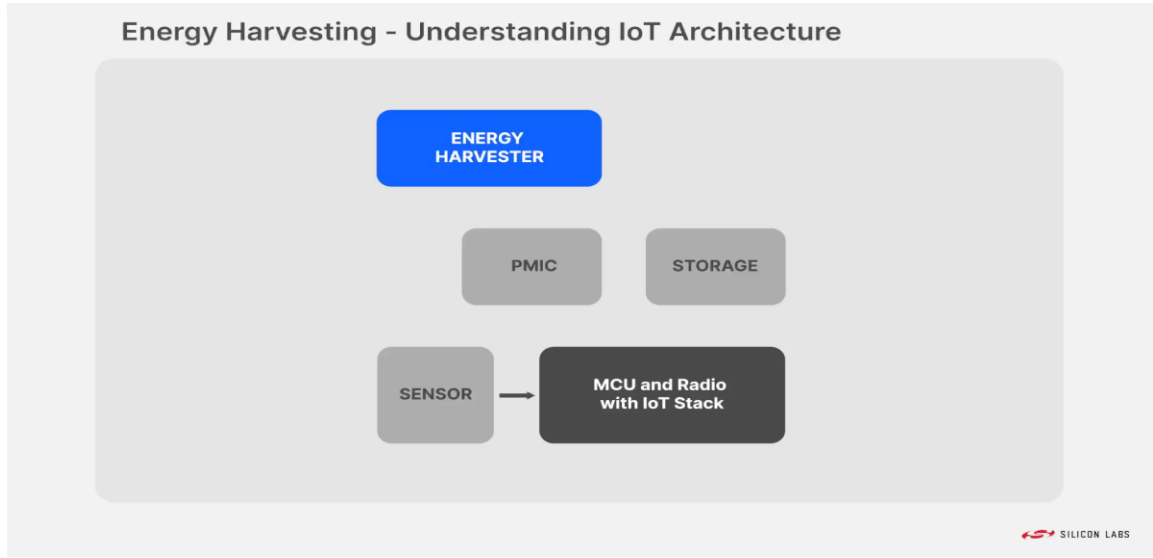


ELECTRIC SUB-METERING

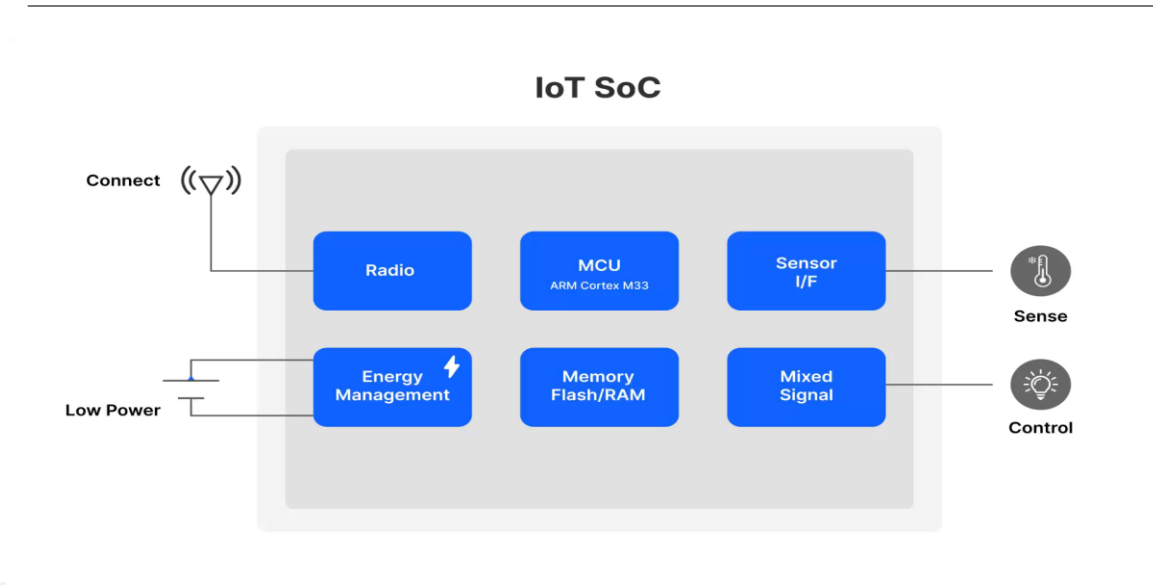
Bluetooth® Proprietary zigbee

Ambient IoT - Methodology

Learn more: [WorksWith 2024](#)



- 1 Understanding your application power budget
- 2 Assess available energy sources
- 3 Energy measurements – PMIC design
- 4 Storage type and size design
- 5 IoT protocol – energy algorithms



Learn more: docs.silabs.com/energy_harvesting

Energy Harvesting Shields for Explorer Kit - EK8200 – Unboxing!

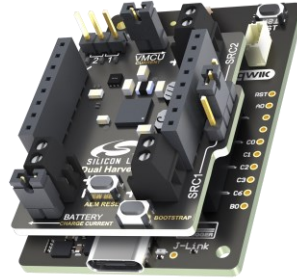
-
- **BRD8200A Kit**
 - BRD8203 – Battery Shield
 - BRD8202 – Kinetic Shield
 - BRD8201 - Dual Source Shield
 - BRD8204/8205 – AC/DC Bricks
 - **Software Examples - [github](#)**
 - **User Guide - [UG591](#)**



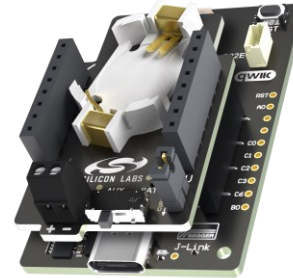
UNBOXING – EK8200A – Energy Harvesting Shields for Explorer Kit



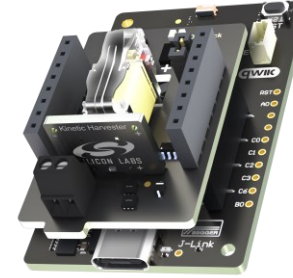
MG22E Explorer Kit



Dual Harvester



Battery Power

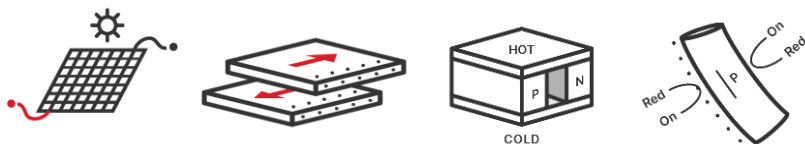


Kinetic Button

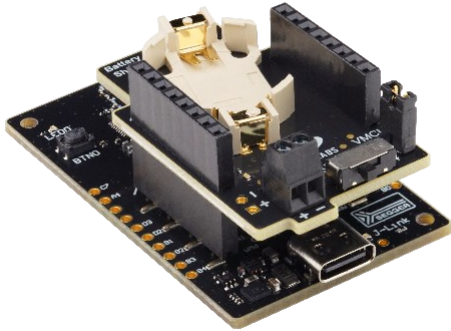


All-in-one multi-application Ambient IoT prototyping kit!

- **co-designed** by *Silicon Labs* and *e-peas*
- **Shield-compatible** with MG22E Explorer Kit (BRD2710A included)
- Includes basic **PV cell** and **capacitor** storage
- Compatible with AC and DC **multiple energy sources** (with rectifier/regulator attachments)
- Compatible with **Bluetooth LE, RAIL, Zigbee (Green Power)** and **Proprietary 2.4GHz** protocols



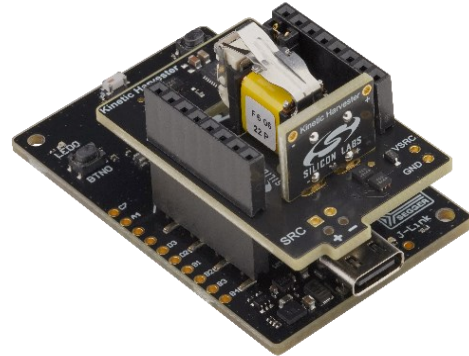
UNBOXING – EK8200A – Energy Harvesting Shields for Explorer Kit



BRD8203

BATTERY BACKPACK

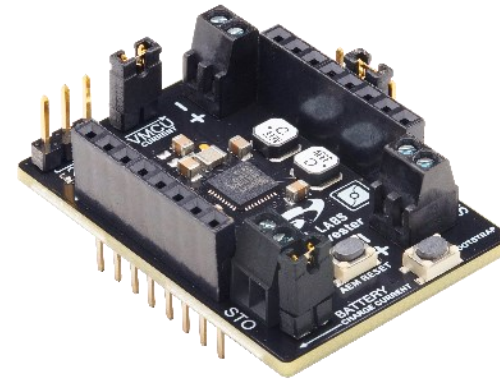
- Coin-cell battery compatible
- Designed with test-points for current and voltage measurements
- USB-power compatible
- Capacitor or alternative-power circuitry adaptable screw terminals



BRD8202

KINETIC SHIELD

- e-peas AEM00300 PMIC
- Battery-less switches and buttons
- Zigbee Green Power ; BLE RAIL examples
- Battery-less Zigbee commissioning



BRD8201

DUAL HARVEST SHIELD

- e-peas AEM13920 PMIC (NEW)
- Simultaneous AC or DC input energy-source
- e-peas i2c 3rd party driver (Github extension for Simplicity Studio)




BRD8204/5


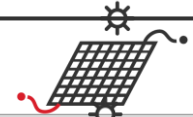

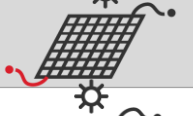







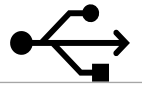

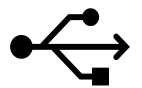
ADAPTER BRICKS

- AC and DC input circuitry
- MOSFET-based rectifier with capacitor wave smoothing
- Over-protection circuitry

UNBOXING – Github– Energy Harvesting Shields for Explorer Kit



github.com/SiliconLabs/energy_harvesting_applications 

#	TYPE	PROTOCOL	ENERGY SOURCE	LINK
1	Energy Harvester <i>Sensor</i>	Bluetooth LE 	Solar 	README
2	Energy Harvester <i>Sensor</i>	Bluetooth RAIL 	Solar 	README
3	Energy Harvester <i>Sensor</i>	Zigbee GreenPower 	Solar 	README
4	Energy Harvester <i>Switch</i>	Bluetooth RAIL 	Kinetic 	README
5	Energy Harvester <i>Switch</i>	Zigbee GreenPower 	Kinetic 	README
6	Observer / <i>Reader</i>	Bluetooth / RAIL 	N/A 	README
7	Coordinator / <i>Reader</i>	Zigbee GreenPower 	N/A 	README



UG591: User's Guide to EFR32xG22E Energy Harvesting Explorer Kit

EFR32xG22E Energy Harvesting Explorer Kit is an excellent starting point to explore and evaluate different Energy Harvesting solutions with Silicon Labs' Multiprotocol Wireless Systems on Chip (SoC).

This unique Energy Harvesting kit selection includes a lightweight board with one of Silicon Labs most popular Multi-protocol Wireless SoCs, based on the Explorer Kit platform, and different shields and adapters which, combined with the Explorer Kit's features enable evaluation of multiple solutions for Energy Harvesting, making use of energy sources like photovoltaic cells, inductive or piezoelectric sources, Thermoelectric Generators (TEG), in different applications, for example pulsed or continuous supply, single or dual source.

- The Dual Harvester Shield is the most flexible shield, that can be used to harvest energy from one or two sources at the same time. Typical use case scenarios are complimentary photovoltaic cells, one photovoltaic cell and one piezoelectric source taking energy from vibrations, etc. Adapters, for interfacing AC and DC sources to the Dual Harvester Shield, are also provided.
- The Kinetic Button Shield is engineered to demonstrate a specific application, using an inductive switch, aka kinetic switch, to temporary power the Wireless SoC and transmit a sequence of packages, for typical interacting with a light bulb or coordinator
- A supplementary Battery Shield is provided for e.g. debugging stand-alone operation scenarios or evaluating battery lifetime

When connected to the Explorer Kit, the shields supplies exclusively the Wireless SoC, while the debugger is left powered off, allowing stand-alone operation and true real-time current measurements.



Dual Harvester

Kinetic Button

Battery Power

FEATURES

- Energy Harvesting
- Self-powered operation
- Flexible PMIC
- Hardware and Software configurable registers
- AC and DC sources
- Automatic power selection (self-powered or debugger)
- Test Points for current and voltage measurements
- Single or Dual source

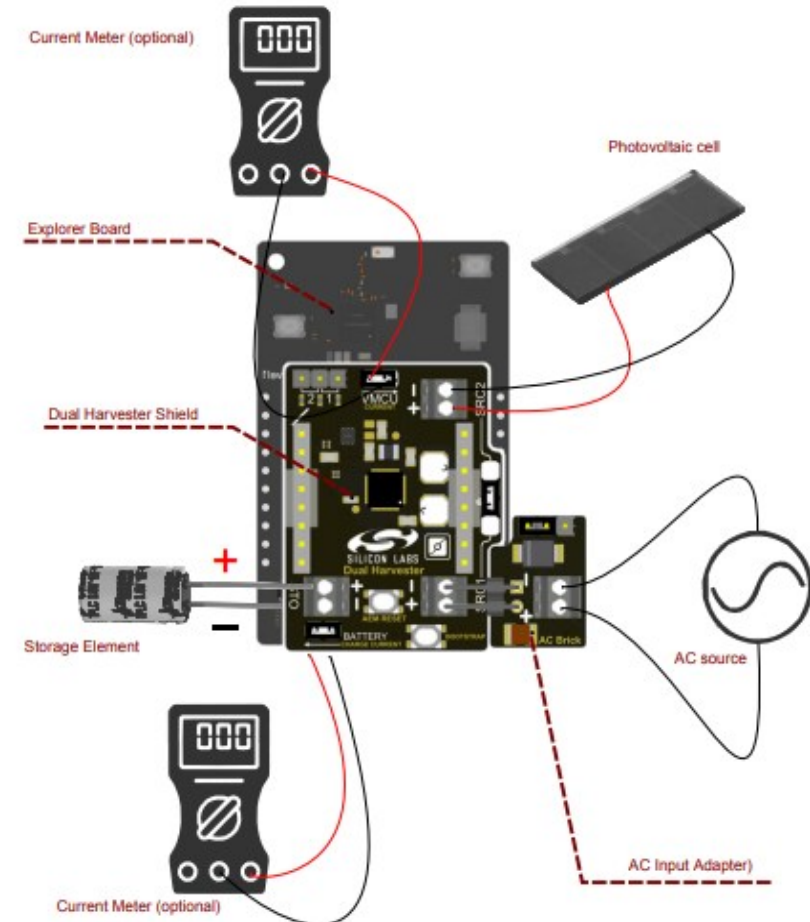
INCLUDED BOARD MODULES IN THIS KIT:

- BRD8201A Dual Harvester Shield
- BRD8202A Kinetic Button Shield, equipped with the BRD8206A Kinetic Switch Adapter
- BRD8203A Battery Shield
- BRD8204A AC Input Adapter
- BRD8205ADC Input Adapter
- BRD2710A Explorer Board
- 1x photovoltaic cell
- 1x lithium capacitor

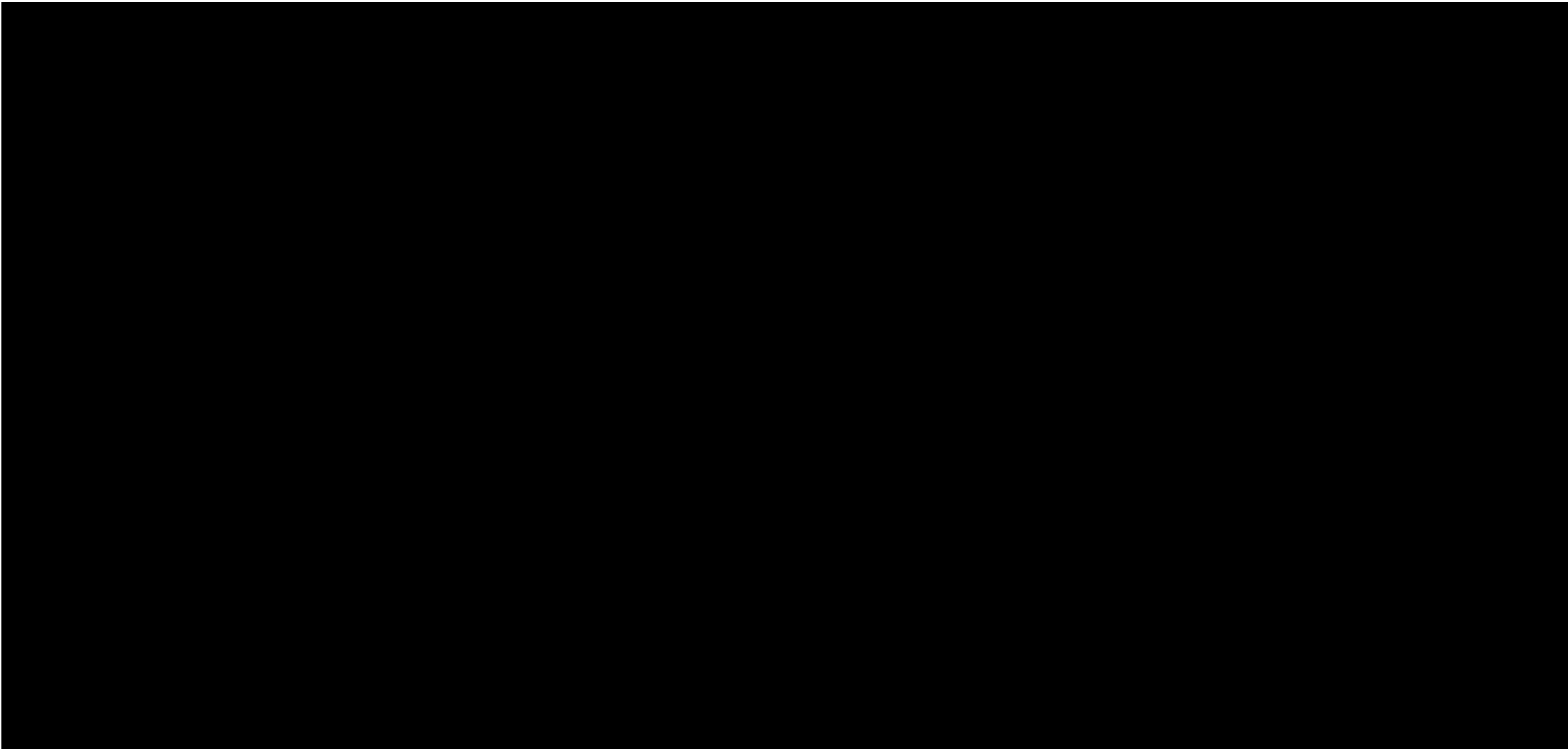
ORDER INFORMATION:

- xG22-EK8200A

docs.silabs.com/energy_harvesting



UNBOXING – User Guide – Energy Harvesting Shields for Explorer Kit



MG22E Explorer Shields - Out-of-the-Box Setup

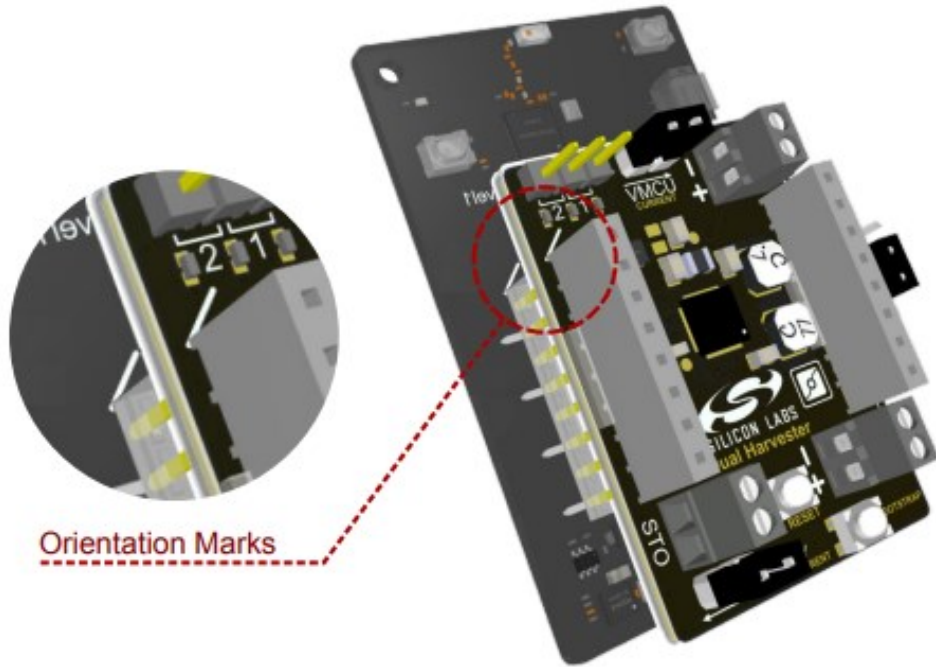
-
- BLE RAIL PV Beacon DEMO (default)
 - Mobile App – *Simplicity Connect*
 - External Reader – *MG21, MG22, MG24, etc.*



HARDWARE– EK8200A – Energy Harvesting Shields for Explorer Kit



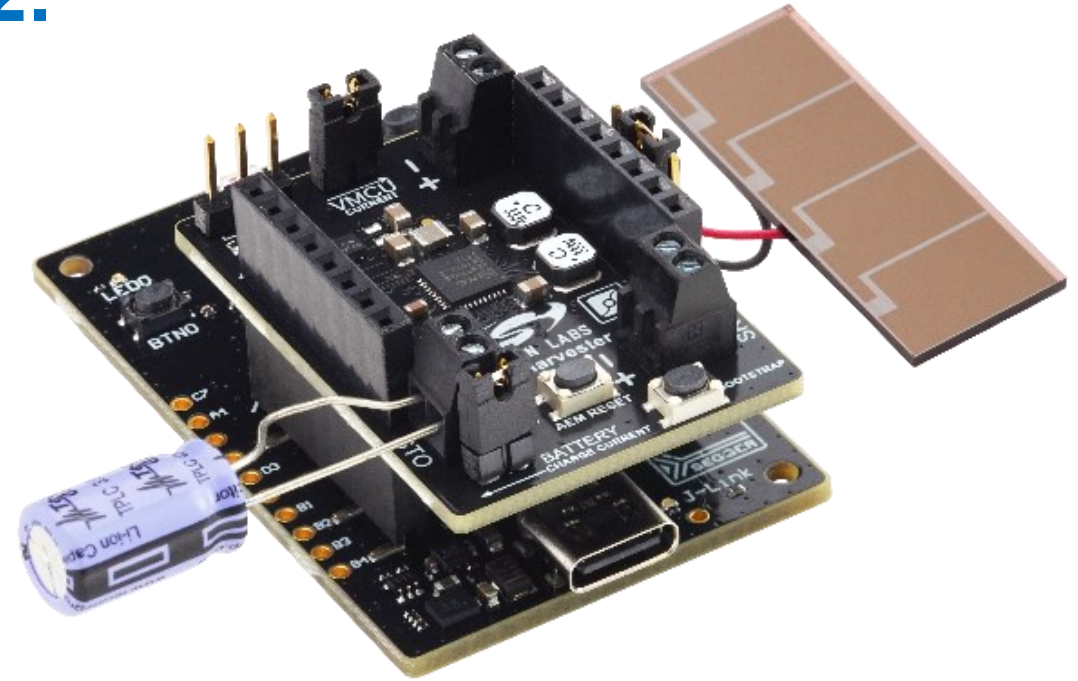
1.



Orientation Marks

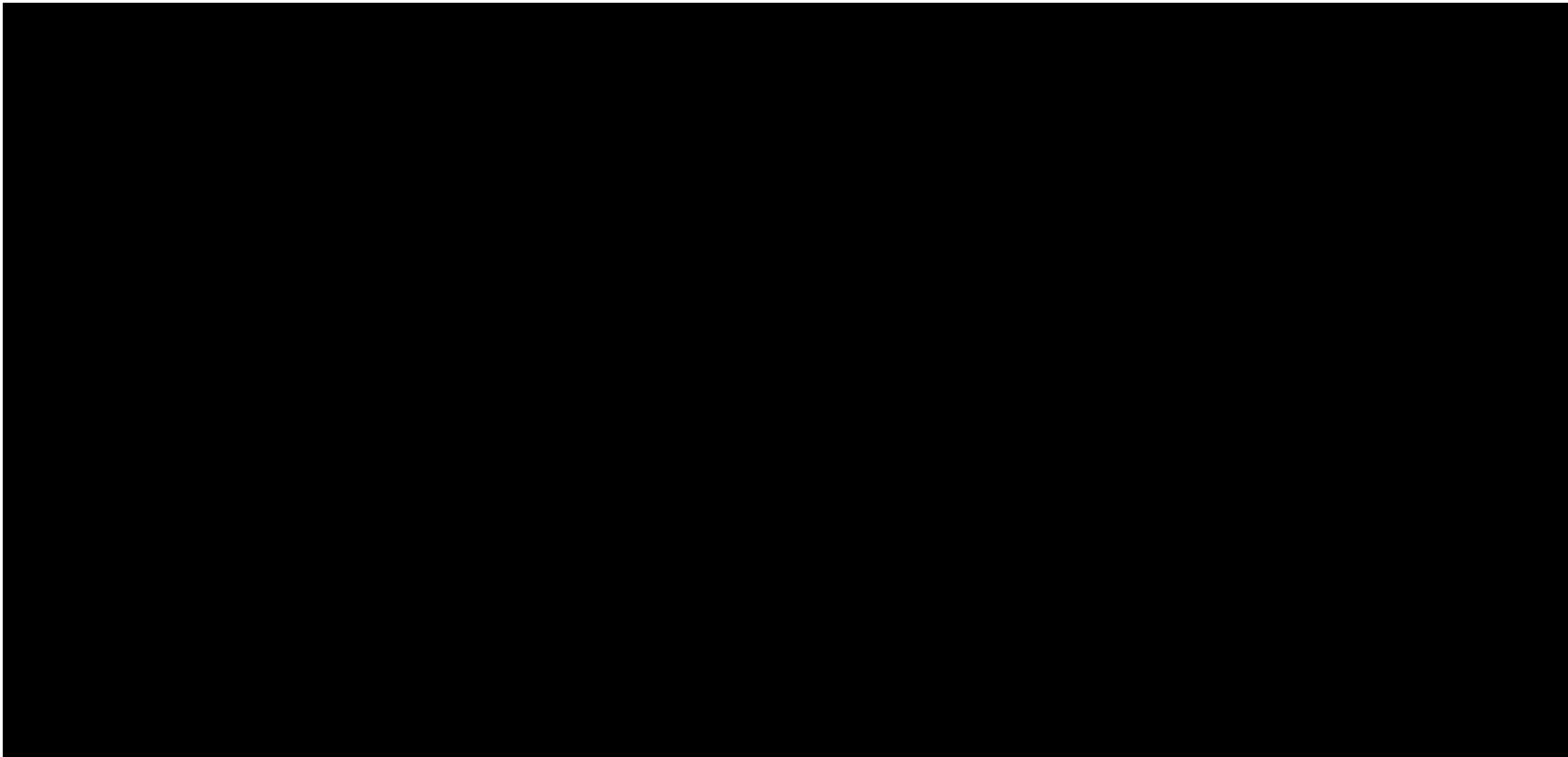
- Install BRD8201 (Dual Harvest) onto BRD2710 Explorer

2.

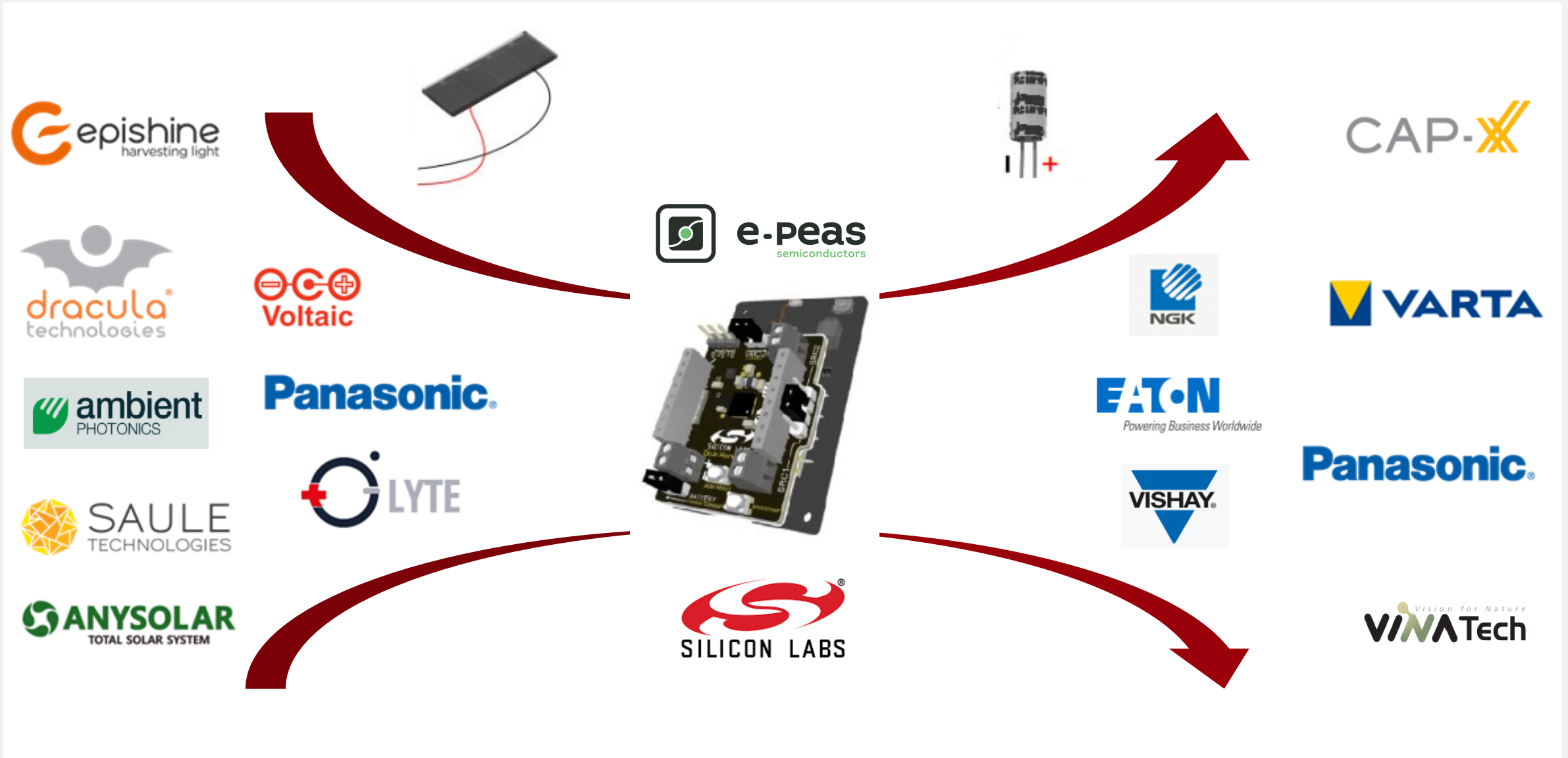


- First step : Screw in Lithium Capacitor
- Second step : Screw in PV cell to SRC2
- *Always dismantle PV first

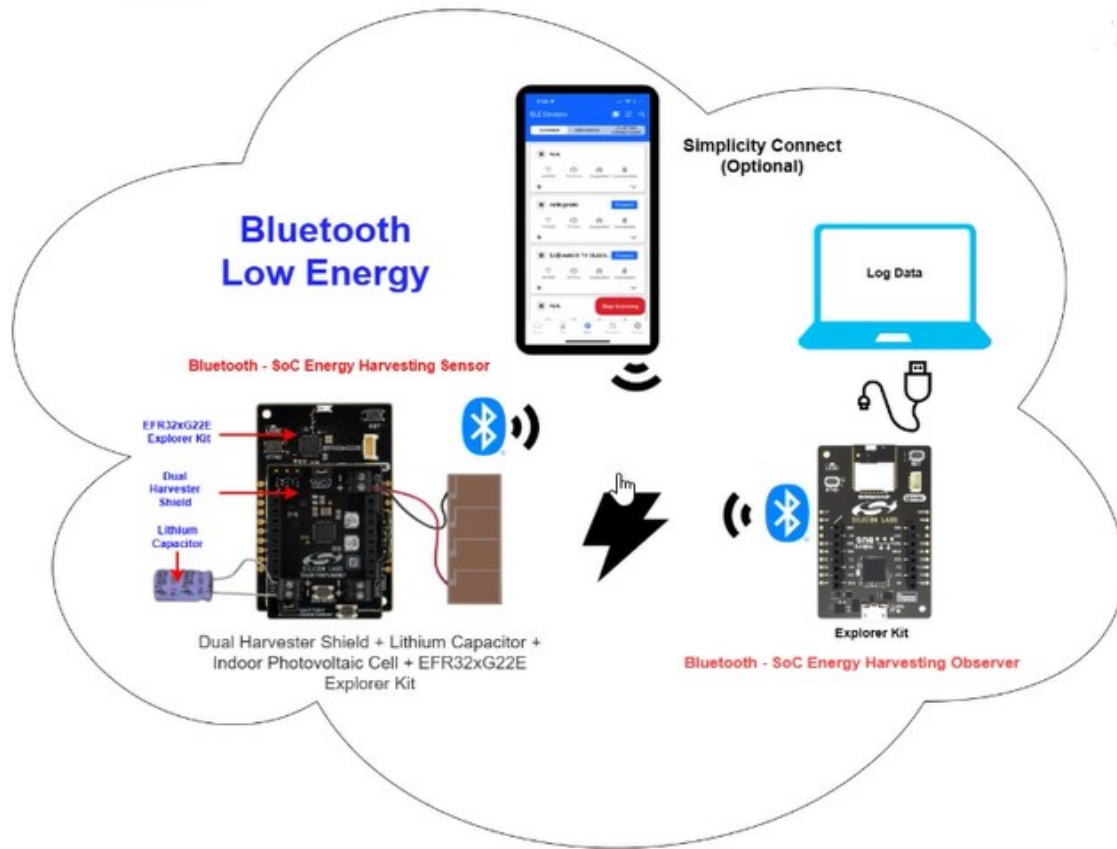
HARDWARE– EK8200A – Energy Harvesting Shields for Explorer Kit



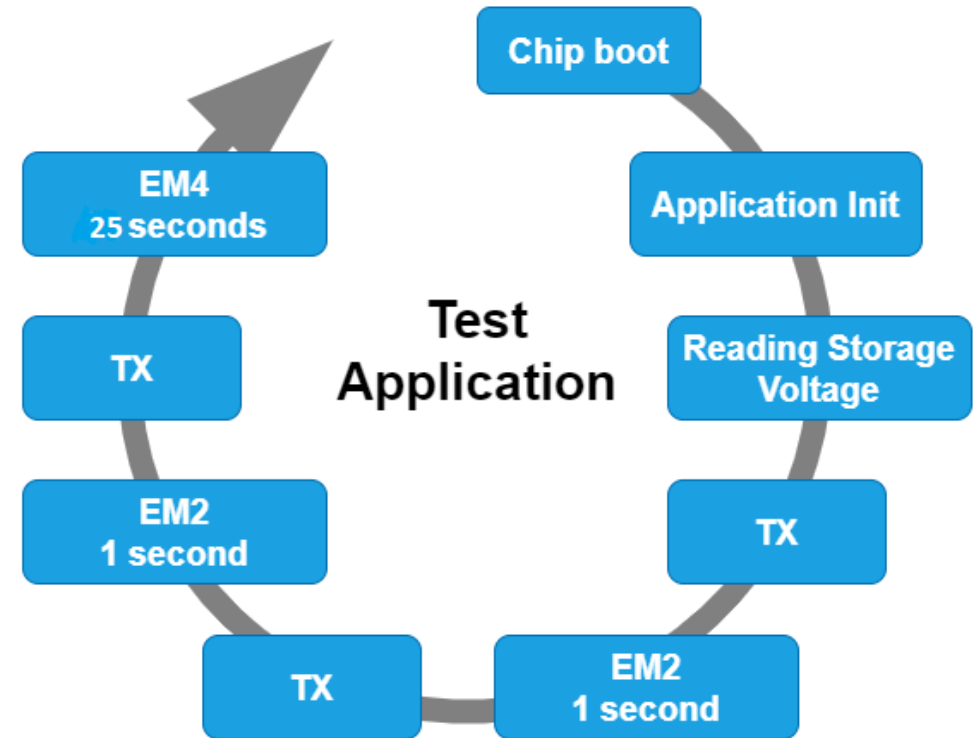
Alternative hardware compatibility – PVs and Storage (Digikey/Mouser)



SOFTWARE – EK8200A – Bluetooth RAIL Sensor



- **Bluetooth packets (RAIL) can be detected:**
 - using Simplicity Connect mobile app
 - using alternative Silicon Labs SoC (example provided)



- **Default application execution – preprogrammed on MG22E Explorer (BRD2710A)**

SOFTWARE – Mobile App – Bluetooth RAIL Sensor



SIMPLICITY CONNECT INSTALLATION

- apps.apple.com/us/app/simplicity-connect
- play.google.com/store/apps/siliconlabs



- Public GitHub repos for Simplicity Connect:

- github.com/SiliconLabs/SimplicityConnect-ios

- github.com/SiliconLabs/SimplicityConnect-android

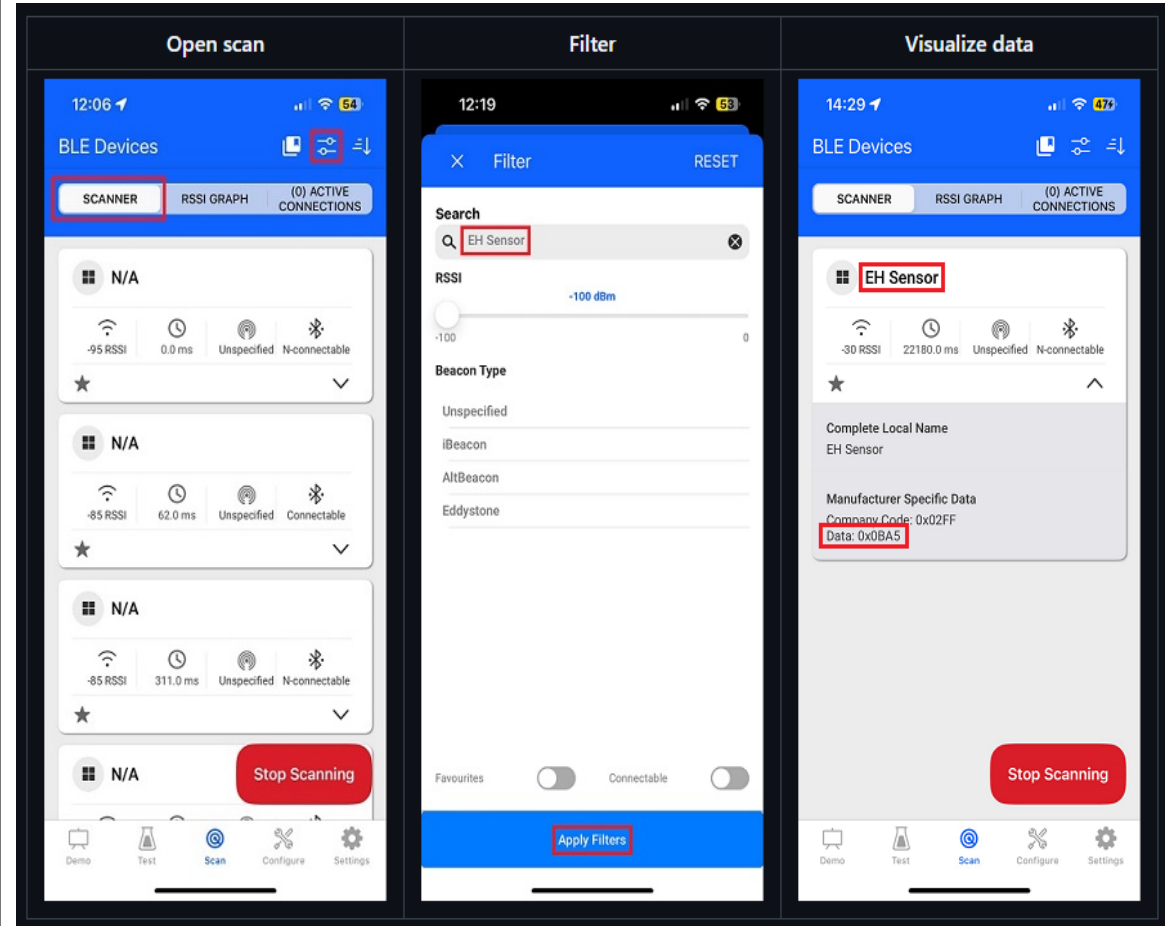


SIMPLICITY CONNECT RESOURCES

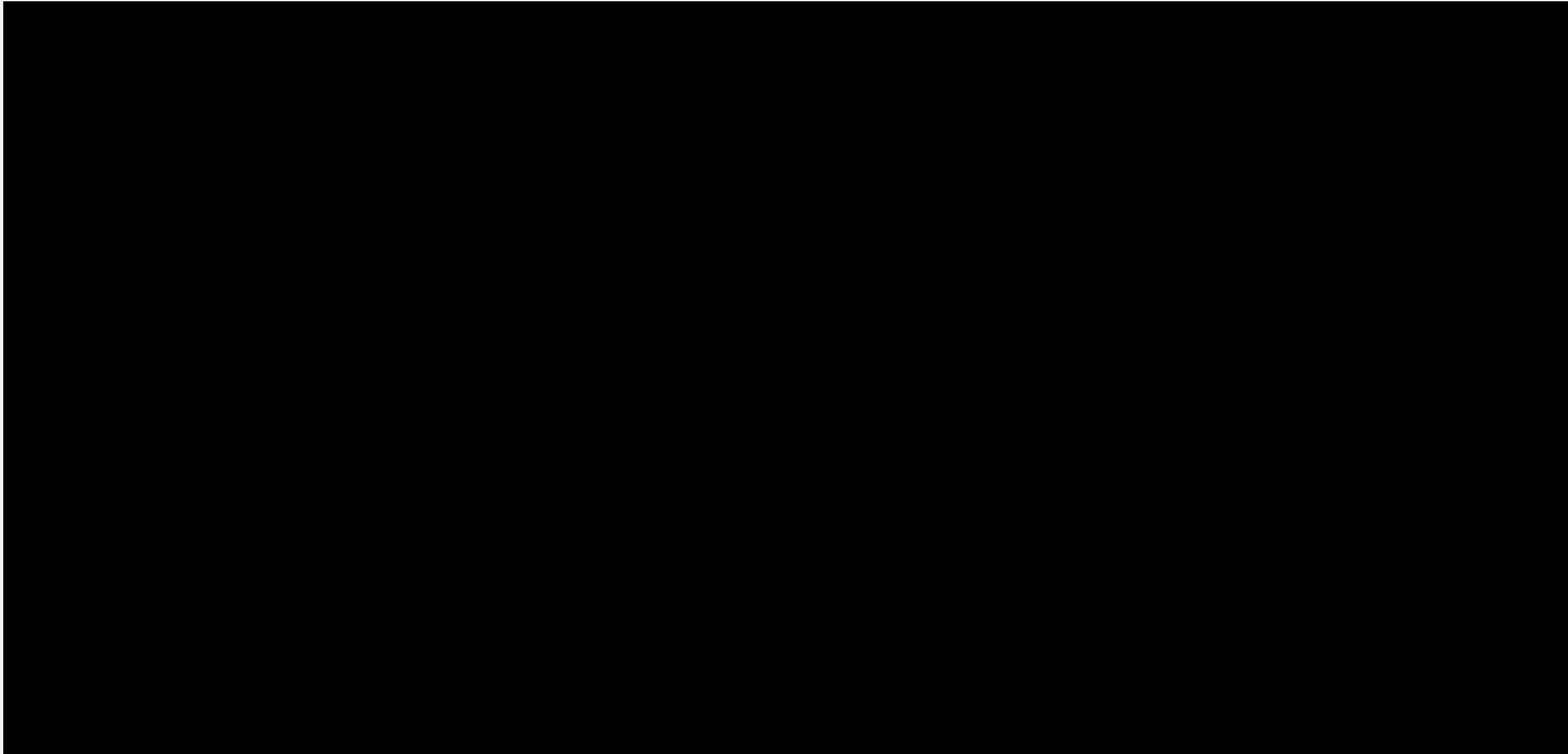
- silabs.com/developer-tools/simplicity-connect-mobile-app
- docs.silabs.com/bluetooth/latest/bluetooth-mobile-applications/efr-connect-mobile-app

Convert '**Data: 0xBA5**' to Decimal to read voltage!
0xBA5 = 2981 mV

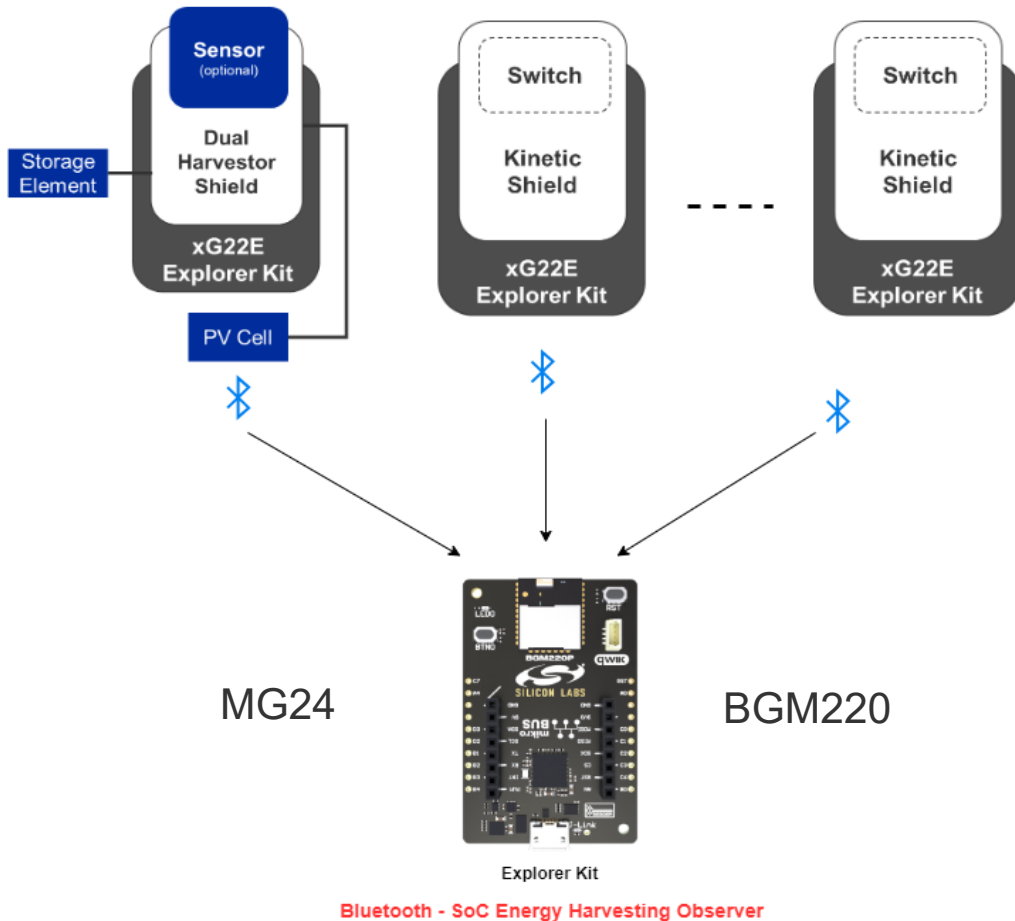
MOBILE INTERFACE



SOFTWARE – EK8200A – Bluetooth RAIL Sensor



SOFTWARE – MG24/BGM220 Explorer – Bluetooth RAIL Observer



- 'Observer' App used on external Silicon Labs Kit can be used to detect Bluetooth LE and BLE RAIL packets (MG24 or BGM220 Explorer) (not incl.)
- 'Observer' App used for both Sensor and Switch BLE/RAIL application

```
>>> [601084] Found an EH Sensor device: 0C:2A:6F:76:F7:8D, channel: 37, rssi: -59, read storage voltage: 3825 mV
-----
From Sensor
>>> [805413] Found an EH Sensor device: 0C:2A:6F:76:F7:8D, channel: 37, rssi: -48, read storage voltage: 3825 mV
-----
>>> [932576] Found an EH Sensor device: 0C:2A:6F:76:F7:8D, channel: 37, rssi: -75, read storage voltage: 3825 mV
-----
```

- Device ID, Channel, RSSI and Storage Voltage in Command Prompt – Simplicity Studio

EFR32xG24 Explorer Kit (ID: 000440277265)

OVERVIEW **EXAMPLE PROJECTS & DEMOS** DOCUMENTATION COMPATIBLE TOOLS

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

Filter on keywords
energy harvesting

2 resources found

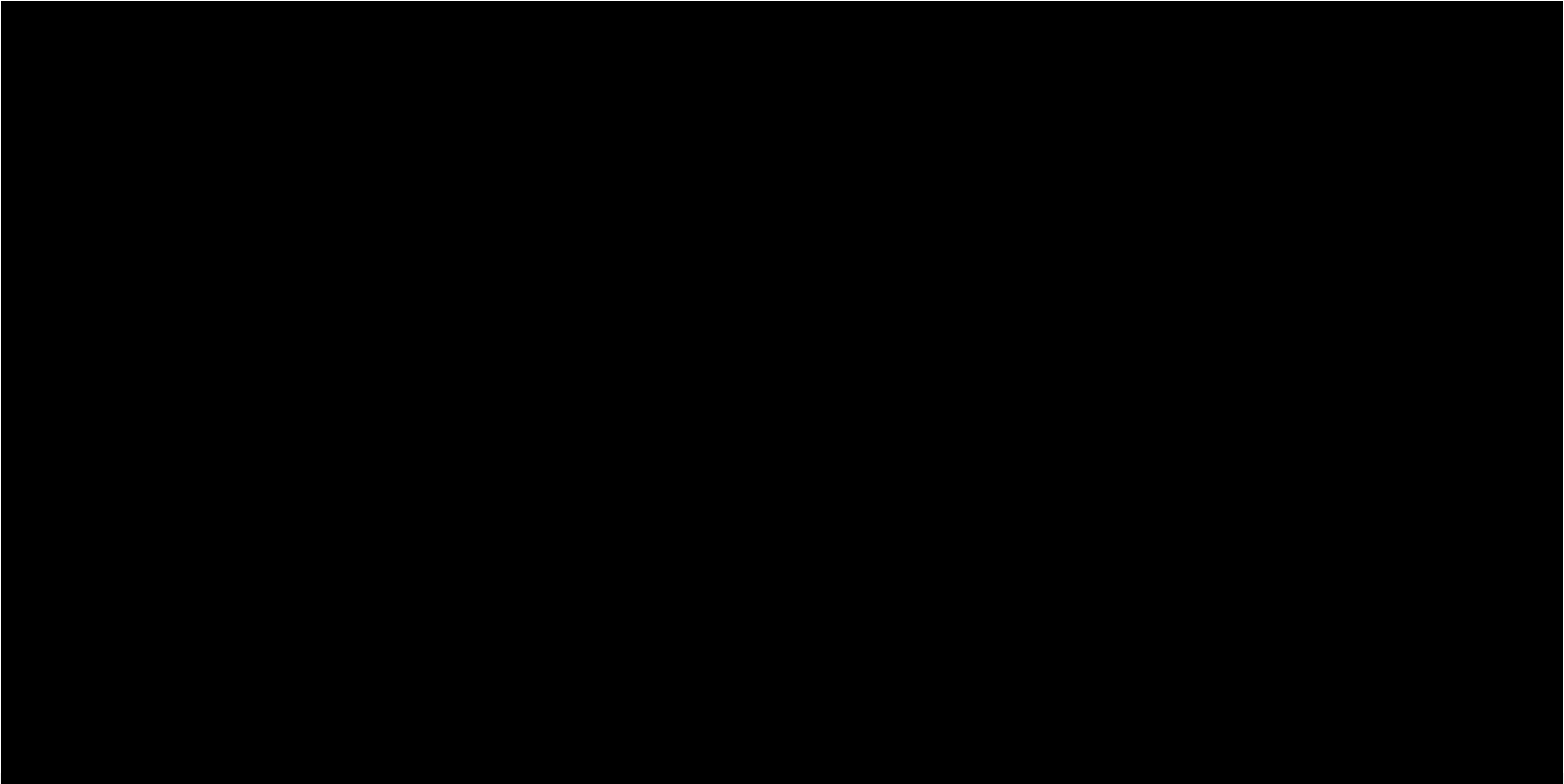
Bluetooth - SoC Energy Harvesting Application Observer

This project aims to implement an Observer device for the Bluetooth Energy Harvesting examples. This device scans and analyzes the advertisement packet of the Energy Harvesting switch/sensor devices, providing information about the sender through a serial port. An LED provides visual feedback when connected to a switch device.

CREATE

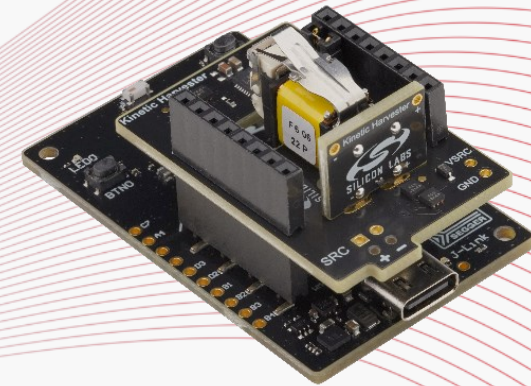
[View Project Documentation](#)

SOFTWARE – EK8200A – Bluetooth RAIL Sensor



EK8200A – Energy Harvesting Shields Example Setup DEMO

- Energy Harvesting SDK Extension installation
- Zigbee Green Power Kinetic Switch & Observer
 - Compiling and Flashing
 - Commissioning DEMO
 - Light DEMO



Energy Harvesting SDK Extension



EXAMPLES AND SDK EXTENSION

- Clone the repository to your PC:
- `git clone`
https://github.com/SiliconLabs/energy_harvesting_applications.git

INSTALL SDK EXTENSION

- **Simplicity Studio Launcher** - Add the SDK extension to the SiSDK:
 - ❑ **Preferences** → **Simplicity Studio** → **SDKs** and select the Simplicity SDK Suite to add extension to
 - ❑ **Browse** → navigate to root folder where we cloned repos → **Select Folder**
 - ❑ Click **OK** and then **Trust** and **Apply and Close**
 - ❑ Restart Simplicity Studio

ENERGY HARVEST SDK EXTENSION

The screenshot shows the Simplicity Studio Preferences dialog box with the 'SDKs' section expanded. The 'Energy Harvesting' SDK is selected, and the 'Add Extension...' button is highlighted. The 'Add Extension...' button is also highlighted in the bottom right corner of the dialog box.

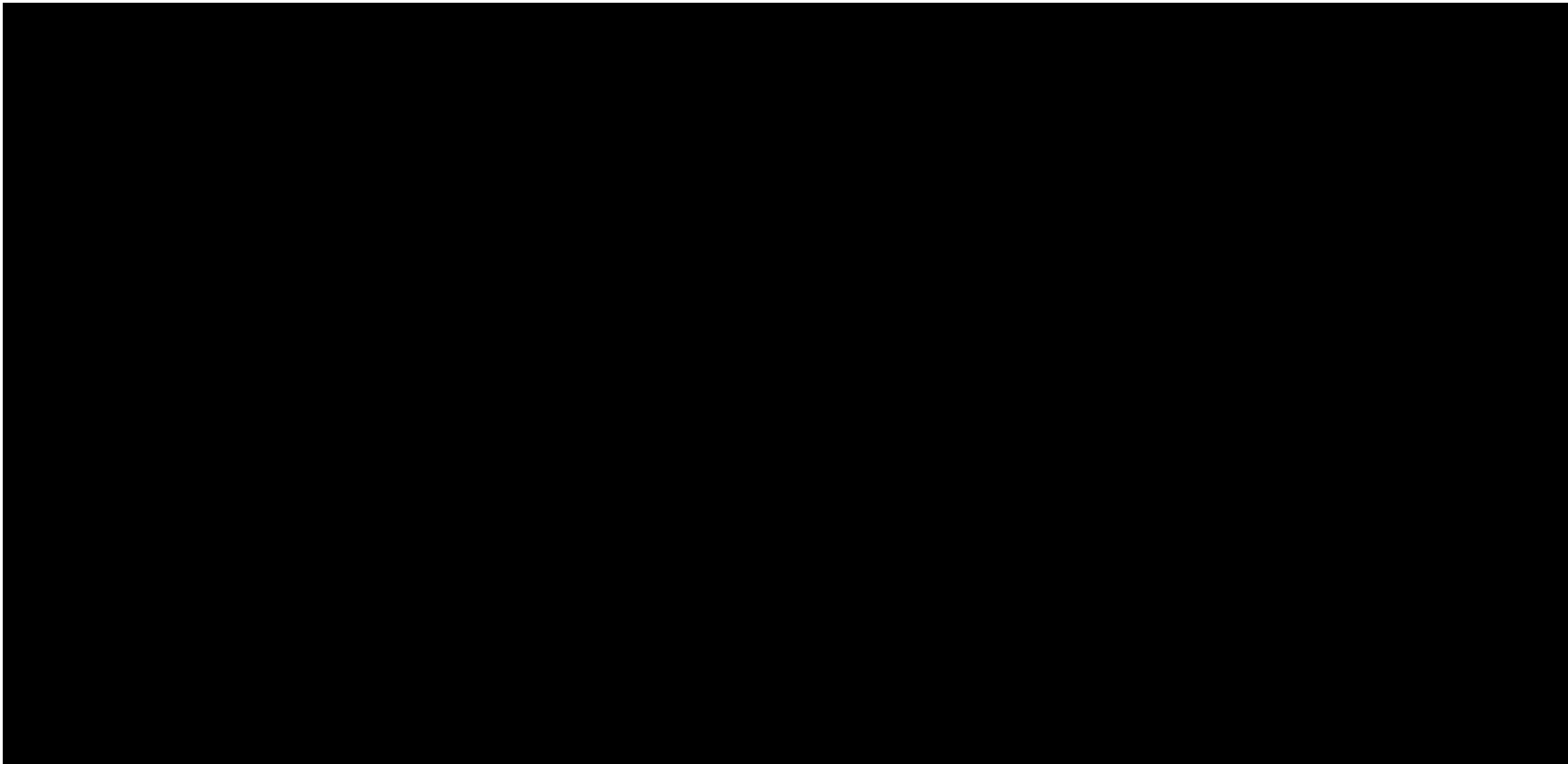
Name	Ver...	Locati...	
<input type="checkbox"/> 8051 SDK v4.3.1.0	4.3...	C:\Silic...	Select All
<input type="checkbox"/> Simplicity Demos v2024.202...	202...	C:\Silic...	Select None
<input checked="" type="checkbox"/> Simplicity SDK Suite v2024.202...	202...	C:\Use...	Add SDK...
<input checked="" type="checkbox"/> WiSeConnect 3	3.3.4	C:\Use...	Remove...
<input checked="" type="checkbox"/> Sidewalk	2.2.1	C:\Use...	Refresh...
<input checked="" type="checkbox"/> Energy Harvesting	0.0.1	C:\Use...	Add Extension...
<input checked="" type="checkbox"/> Silicon Labs Matter	2.4.0	C:\Use...	
<input type="checkbox"/> Stackless applications	1.0.0	(none)	

Description for Simplicity SDK Suite v2024.6.2: Amazon 2020.00. Bluetooth 8.2.0, Bluetooth Mesh 7.0.2, EmberZNet 8.0.2.0, Energy Harvesting 0.0.1, Flex 3.8.2.0, Micrium OS Kernel 5.16.00, OpenThread 2.5.2.0 (GitHub-1fceb225b), Platform 5.0.2.0, Sidewalk 2.2.1, Silicon Labs Matter 2.4.0-1.4, USB 1.3.1.0, Wi-Fi SDK 3.3.4, Wi-SUN 2.2.0.0, Z-Wave SDK 7.22.2.0
Version: 2024.6.2
Location: C:\Users\tfcool\SimplicityStudio\SDKs\simplicity_sdk\

Need more SDKs? [Customize your installation here...](#)

Apply and Close Cancel

Energy Harvesting SDK Extension installation



Zigbee GPD – SoC Energy Harvesting Switch



v5_workspace - Simplicity Studio™

File Edit Navigate Search Project Run Window Help

Welcome Recent Tools Install Preferences

Debug Adapters

My Products

Enter product name

- My Products 1
 - EFR32xG22E Explorer Kit Board (BRD2710A Rev A01)**
 - EFR32MG22E224F512IM40

EFR32xG22E Explorer Kit Board (BRD2710A Rev A01)

OVERVIEW **EXAMPLE PROJECTS & DEMOS** DOCUMENTATION COMPATIBLE TOOLS

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

1 resources found

Filter on keywords
energy harvest

Demos

Example Projects

Solution Examples

[What are Demo and Example Projects?](#)

Wireless Technology Clear

Zigbee GPD - SoC Energy Harvesting Switch

This is a Green Power Sensor Device that pairs with a GP Combo or Sink device and sends gpd toggling GPDF by pushing Kinetic Switch

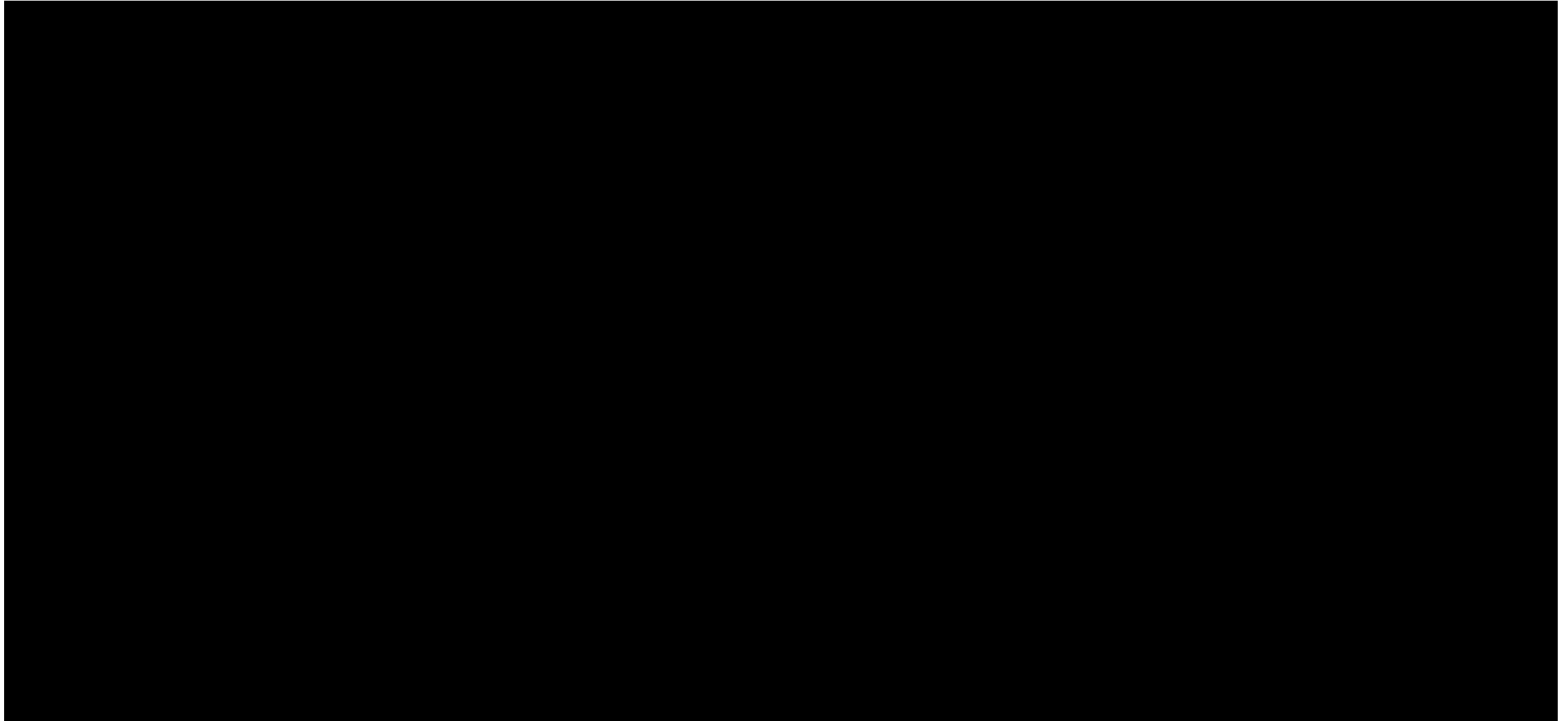
[View Project Documentation](#)

CREATE

- Attach BRD8202 Kinetic Shield to MG22E Explorer BRD2710
- Connect to computer – open Simplicity Studio

- **EXAMPLES PROJECTS & DEMOS** → search for 'energy harvest'
- **CREATE** → Build Project → Flash Project

Zigbee GPD – SoC Energy Harvesting Switch & Observer

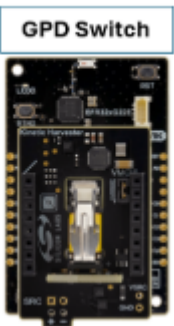


Zigbee Green Power SoC Energy Harvesting GPC Observer (MG24)

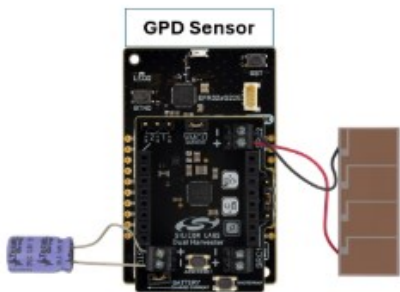


Explorer Kit

BRD2703 (MG24)



BRD2710 (MG22E)



OVERVIEW **EXAMPLE PROJECTS & DEMOS** DOCUMENTATION COMPATIBLE TOOLS

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

Filter on keywords
gpc x observer x

Demos

Example Projects

Solution Examples

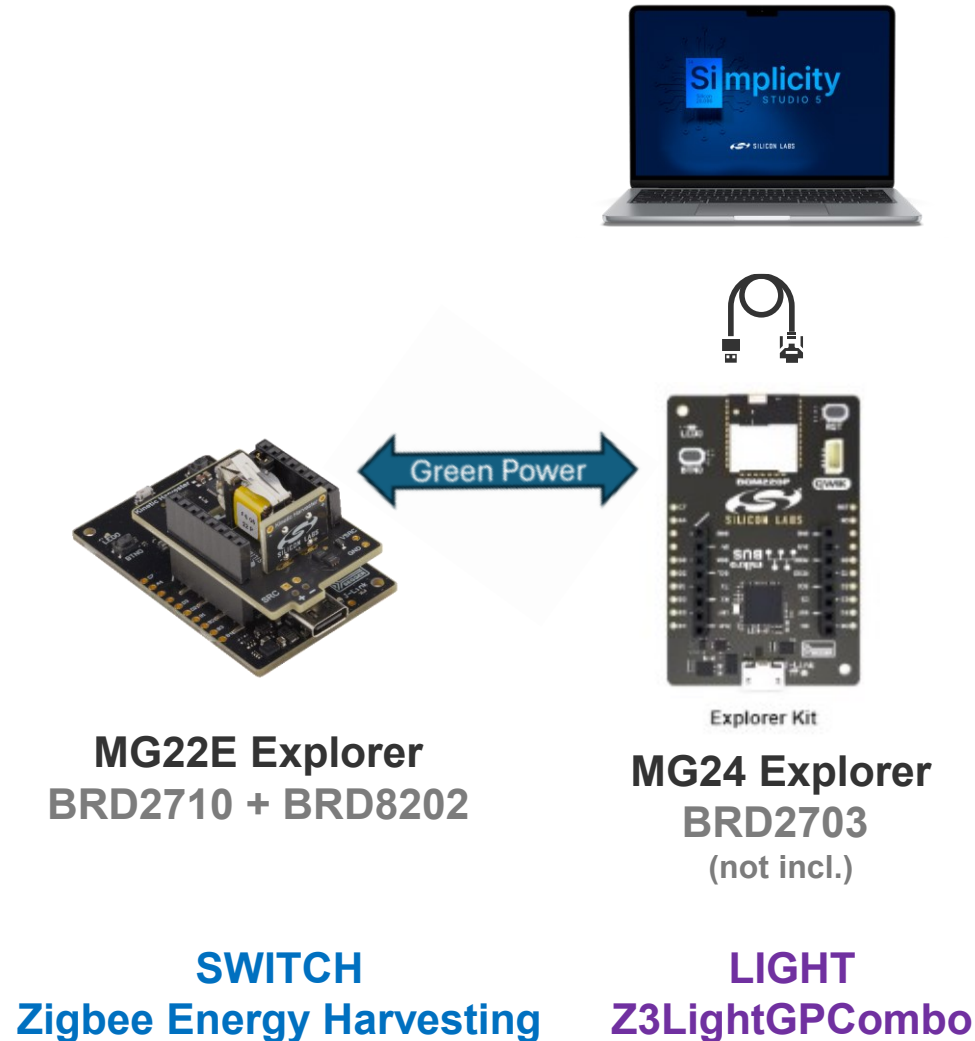
1 resources found

Zigbee GPC - SoC Energy Harvesting Observer
This device is a Zigbee 3.0 light application with Green Power endpoint, Green Power Proxy and Sink functionality design for observing the energy harvesting GPD.

[View Project Documentation](#)

[CREATE](#)

Zigbee Green Power - Energy Harvesting Switch – Commissioning & Light



Commission:

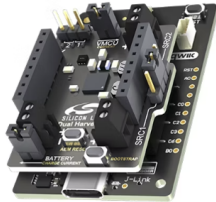
- **MG24:** Connect to computer - Open console log
- **MG24:** LED0 is *blinking* – Zigbee network not ready
- **MG24:** Press **BTN1** to bring up network
- **MG24:** LED0 *ON* – network made – ready
- **MG24:** Press **BTN0** to commission mode

- **MG22E:** Hold **BTN0** and Press Kinetic Button (6x+)
- **MG24:** Console messages confirm commission
- **MG22E:** Push Kinetic Button to toggle LED
- **MG24:** **LED1** toggle state

Decommission:

- **MG22E:** Hold **BTN0** while pressing Kinetic (~6x)
- **MG24:** Hold **BTN1** to leave network --> restart

ORDERING – EK8200A – Energy Harvesting Shields for Explorer Kit



xG22-EK8200A EFR32xG22E Energy Harvesting Explorer Kit

 Buy Now

The EFR32xG22E Energy Harvesting Explorer Kit is an excellent starting point for exploring and evaluating various energy harvesting solutions with Silicon Labs' Multiprotocol Wireless Systems on Chip (SoC). It enables the evaluation of the functionality and performance of energy-harvesting-powered devices with Bluetooth LE and Zigbee Green Power. This comprehensive kit includes the [EFR32xG22E Explorer Kit](#) and multiple energy harvesting shield boards, enabling the evaluation of various energy sources such as photovoltaic cells, inductive or piezoelectric systems, and thermoelectric generators (TEG). It supports [Read More](#)

LAUNCH DATE: 2/19/2025

PURCHASE LINK: <http://www.silabs.com/development-tools/wireless/efr32xg22e-energy-harvesting-explorer-kit.html>

WEB-PAGE: <https://www.silabs.com/wireless/energy-harvesting>

RESOURCES – UG, QSG, AN: <https://docs.silabs.com/energy-harvester/latest/>

Additional Resources



TECH TALK

“Unboxing Silicon Labs' Latest Bluetooth SoC for Energy Harvesting”

[Visit Site](#)



BLOGS

“Ambient IoT – The Future of Sustainable IoT”

“Building a More Sustainable, Connected World with xG22E”

[SiLabs xG22E](#)

[Ambient IoT](#)



WORKSWITH

“**WW23**: Harnessing Ambient IoT: A Leap Towards Sustainable Connectivity”

“WW24: IoT Trends”

[WW23](#)

[WW24](#)



e-peas
semiconductors

OTHER

e-peas AEM datasheets

[AEM13920v1.7](#)

[AEM00300v1.4](#)

e-peas AEM Selector Guide

[Selector Guide](#)

Q&A



Thank you

TOPICS	DATE	TIME
What's new in Matter	25-Jun	AM 10:00 ~ 11:00
The Most Application-Optimized Bluetooth SoCs for Future-Ready Applications	23-Jul	AM 10:00 ~ 11:00
Bringing Bluetooth 6.0 Channel Sounding to Market: Precision Ranging for Secure & Smart Applications	20-Aug	AM 10:00 ~ 11:00
Harvesting Energy for Smart IoT with Silicon Labs xG22e	24-Sep	AM 10:00 ~ 11:00
Introducing MG26, PG26, and BG26: A Highly Flexible SoC Platform for All of Your IoT Needs	22-Oct	AM 10:00 ~ 11:00
Exploring AI/ML Applications on the Ultra-Low-Power SiWx917 Wi-Fi 6 Solution	26-Nov	AM 10:00 ~ 11:00
Exploring Multiprotocol Wireless Techniques	10-Dec	AM 10:00 ~ 11:00

