

# Tech Talks LIVE Schedule – Presentation will begin shortly



## **NEW** Wireless Connectivity Tech Talks



Tuesday, August 10	Quick Start your Bluetooth Designs for Pulse Oximetry and Electric Shelf Labels
Tuesday, August 24	Works With: Make the Most of WW 2021

Respond to the poll to enter to win a  
BG22 Thunderboard

Recording and slides will be posted to:  
[www.silabs.com/training](http://www.silabs.com/training)

We will begin in **0:00**



tech **t▶lks**

# WELCOME

Quick Start your Bluetooth Designs for  
Pulse Oximetry and Electric Shelf Labels

Raman Sharma



# Agenda

- **Introduction to Pulse Oximetry**

- Technical Overview – Hardware & Software
  - BLE Module – BGM220P
  - Biometric Sensor – MAXIM86161 and Measurement basics
  - Embedded Software Architecture
    - Sensor Driver
    - HRM/SpO2 Algorithm
    - BLE Application
- Demonstration

- **Introduction to Electronic Shelf Labels (ESL)**

- Technical Overview of Application
  - EPD operation, current consumption
  - Interaction with EFR
- Demonstration Video

# Pulse Oximeter Example



# Medical Products are Becoming Small, Disposable and Connected

## MINIATURIZATION



- Greater comfort for patients
- Less invasive techniques
- Faster recovery
- Overall cost reduction

## PORTABILITY



- Ensures well-being of active people practicing outdoor sports
- Acceptance of challenging treatments

## CONNECTIVITY



- Reporting of the dosage delivery
- Raising alarms to avoid wrong usage
- Big data management
- Sharing the information

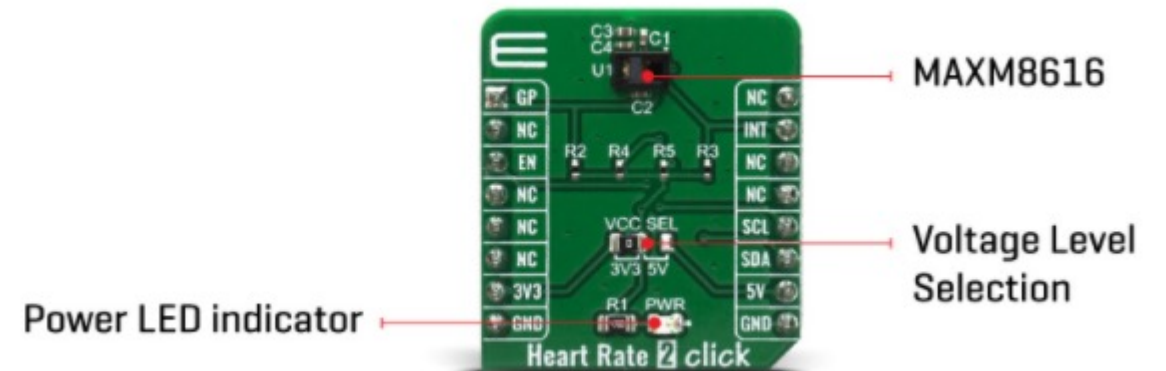
The medical market is focusing on chronic care diseases, elderly care-management and transition care from hospitals to home

# Hardware KIT

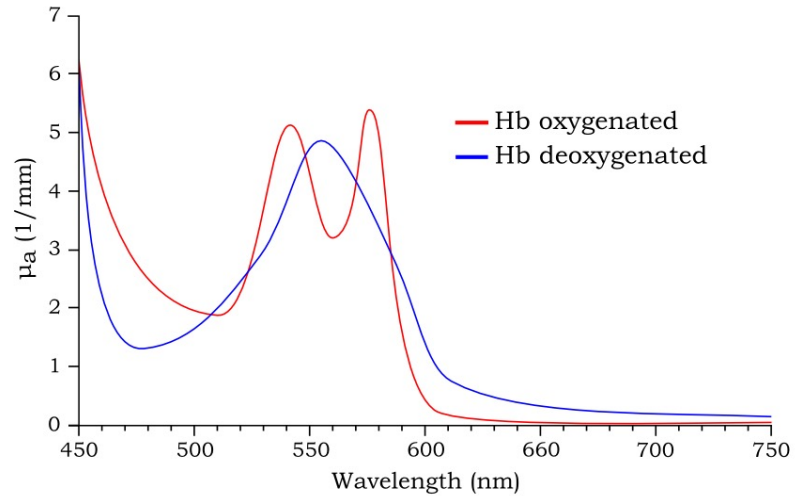
- BGM220 Bluetooth Module Explorer Kit
  - <https://www.silabs.com/development-tools/wireless/bluetooth/bgm220-explorer-kit>



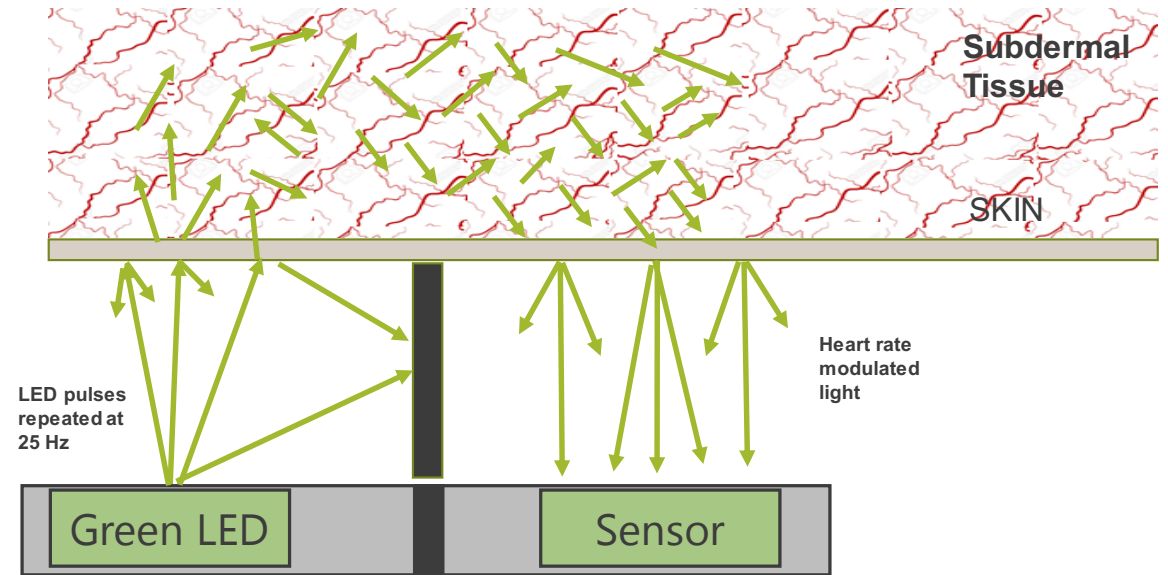
- MikroE Heart Rate 2 Click
  - <https://www.mikroe.com/heart-rate-2-click>



# Heart Rate Sensing Basics

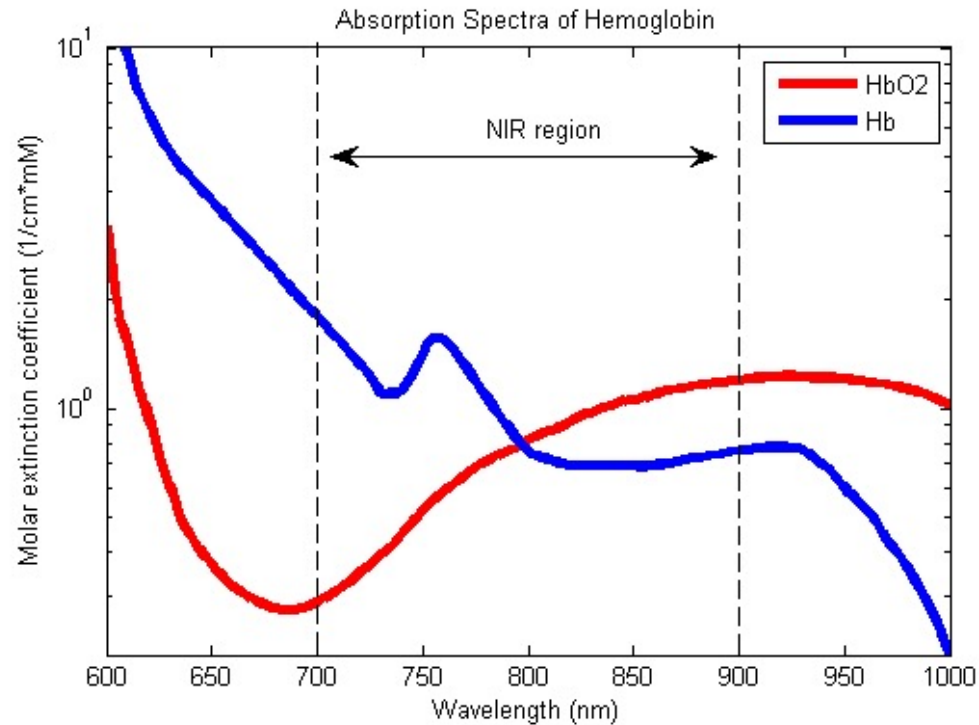


- LED shines light into the skin to a photodiode that is ~1.5-5 mm away.
- The intensity of the light is modulated by expansion and contraction of capillaries during the heart rate cycle.
- The green light is greatly attenuated by tissue.
- Green light works well because of the absorption coefficient being equal for both oxygenated and Deoxygenated blood.



Typical signal on the fingertip, the pulse is clearly visible

# How does SpO2 work?



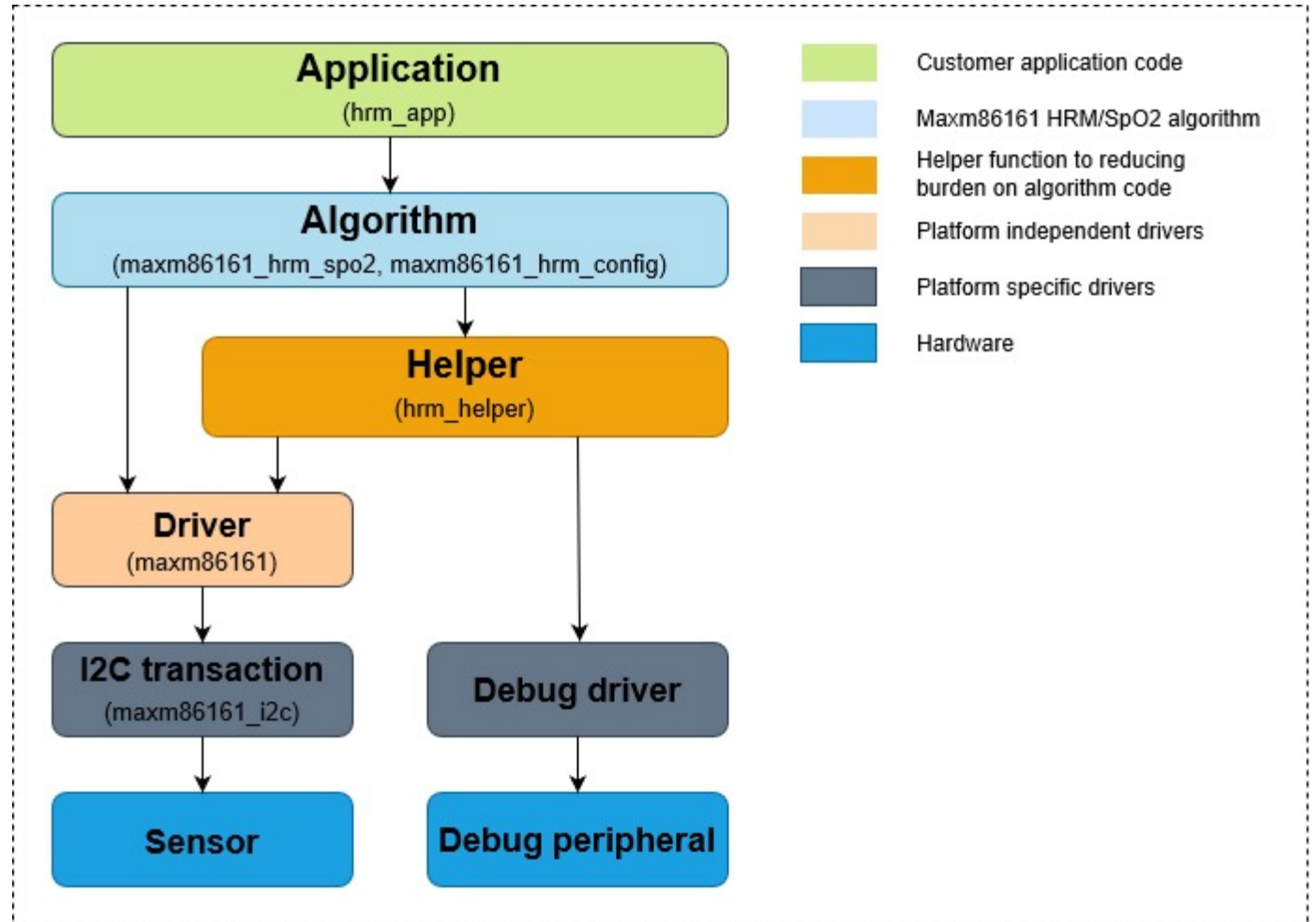
- SpO<sub>2</sub> is the measure of the percentage of Oxygen Saturated blood vs total blood supply. Or Saturation Percentage of Oxygen (SpO<sub>2</sub>).
- Absorption and Scattering in media is governed by the Beer Lambert Law.
- To Calculate SpO<sub>2</sub>, the following formula is used:

$$SpO_2 = \frac{HbO_2}{HbO_2 + Hb}$$



# Technical Overview - Software

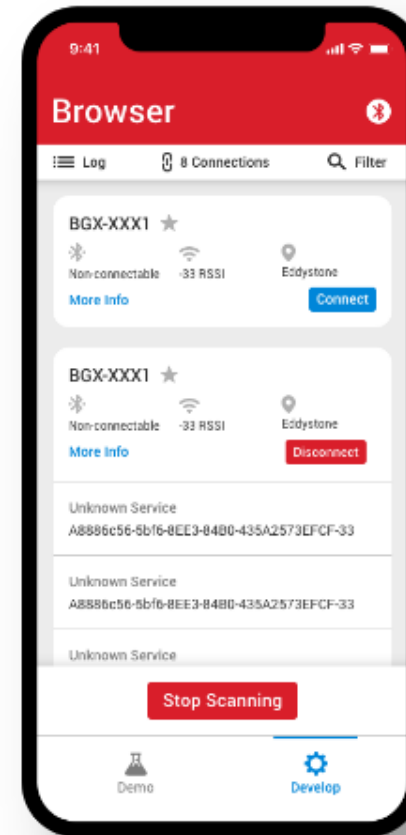
- Embedded Software Architecture
  - Sensor Driver
  - HRM/SpO2 Algorithm
  - BLE Application



# EFR Connect Mobile Application

- Brief overview of Mobile app
- Connect BLE Explorer Kit to Mobile App
- Heart Rate Service
  - Sensor Contact
  - Heart Rate Measurement Value
- Pulse Oximeter Service
  - Heart Rate Value
  - SpO2 value
- Performance
  - Compare results against a commercial Pulse Oximeter
- EFR Connect Source code

<https://github.com/orgs/SiliconLabs/repositories?q=EFRConnect>



# Available Materials

- GitHub Repo - Pulse Oximeter Demo
  - [https://github.com/SiliconLabs/bluetooth\\_applications/tree/master/bluetooth\\_explorer\\_kit\\_i2c\\_biosensor](https://github.com/SiliconLabs/bluetooth_applications/tree/master/bluetooth_explorer_kit_i2c_biosensor)
- Portable Medical Applications
  - AN1242 (<https://www.silabs.com/documents/public/application-notes/an1242-bluetooth-interoperability.pdf>)
  - AN933.2 (<https://www.silabs.com/documents/public/application-notes/an933.2-efr32-series-2-minimal-bom.pdf>)



DEMONSTRATION



## ESL Example – Electronic Shelf Labels

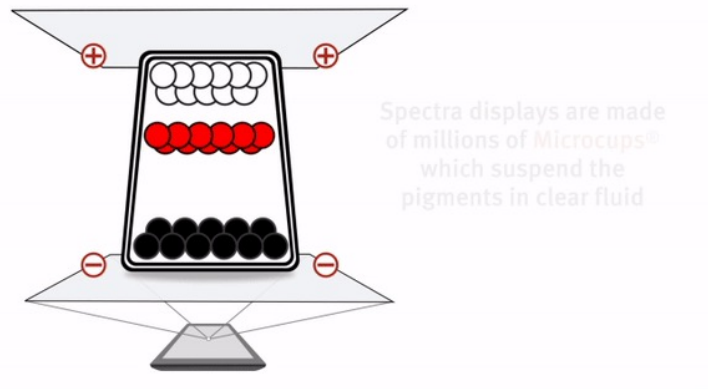


# Retail Business and ESL

- ESL – Electronic Shelf Label
  - Central controller
  - Electronic Display
  - Wireless communication
- Reduce paper usage
- Reduce active human resource
- Many generations:
  - 1st gen: LCD display with Infrared communication
    - LCD constantly consumes current
    - LCD like calculator display, reduced amount of information
  - 2nd gen: E-paper and RF communication
    - No current consumption when static display shown
    - Additional informations, customer experience
  - 3rd gen: Geo-location and product finder
    - Like Bluetooth AOX



# Theory of the EINK operation



- Millions of tiny capsules
- Capsules diameter like human hair
- Filled with colored liquid
- Apply voltage to top and bottom electrodes to issue movement
- Pulse driven

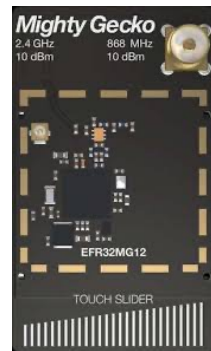
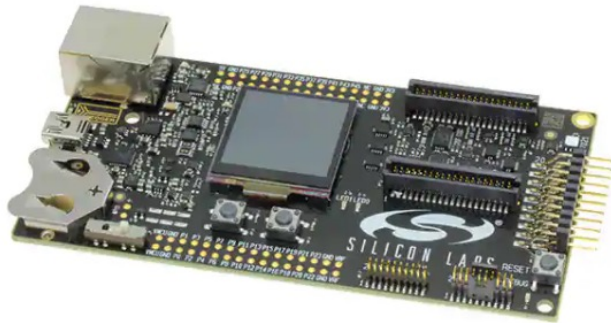
# Hardware accessories



- Eink HULK driving board
  - Includes
    - EPD (display)
    - Driver board
    - 3rd party MCU (not required to this application note)

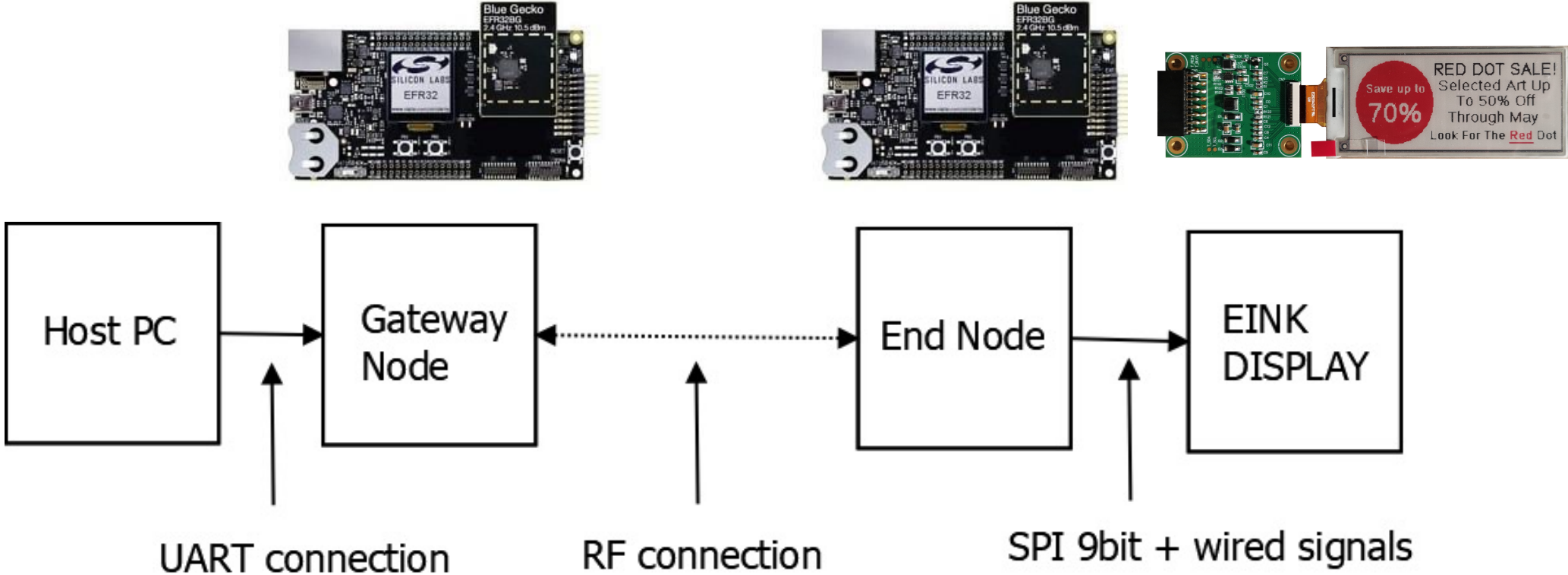


- Jumper cable
  - ~ 10 pieces
  - Male and Female endings
- WSTK (2 pieces)
  - BRD4001A
- BRD4182A (1 piece)
  - EFR32xG22
- BRD4163A (1 piece)
  - EFR32xG12



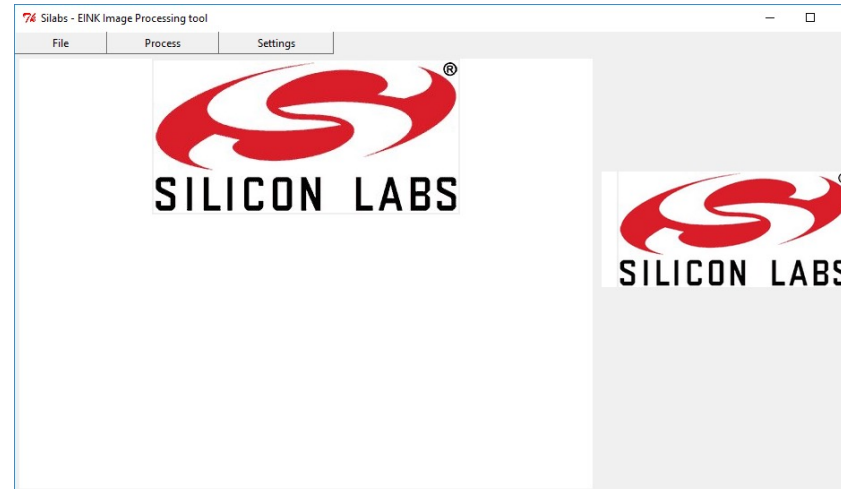
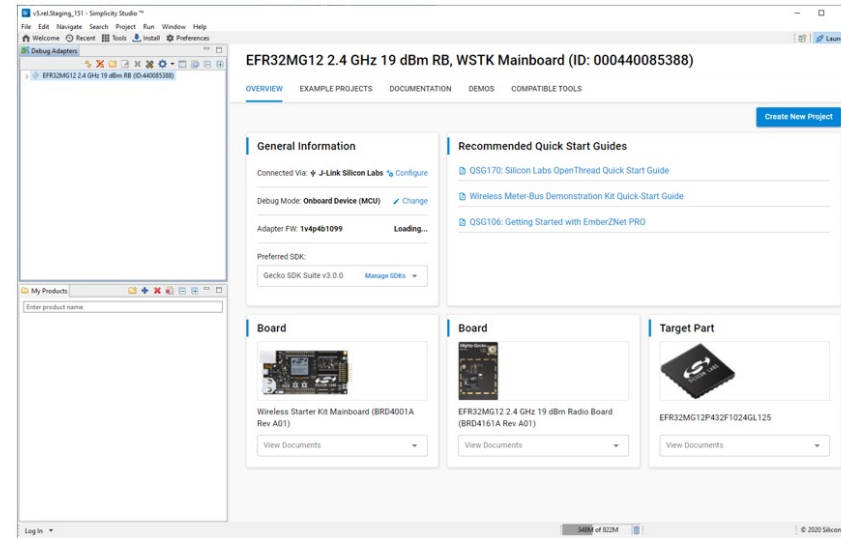


# System overview



# Software requirements

- Tested on Windows 10
- Simplicity Studio V5
  - GSDK3.0
  - Flex SDK
  - 32 bit MCU SDK
  - Gecko Platform
- Python 3.9
  - python Image modul
  - PySerial
  - [https://github.com/silabs-tibor/eink\\_ea2200-bja\\_example/tree/main/pc\\_tool](https://github.com/silabs-tibor/eink_ea2200-bja_example/tree/main/pc_tool)
- Application note source
  - [https://github.com/silabs-tibor/eink\\_ea2200-bja\\_example/](https://github.com/silabs-tibor/eink_ea2200-bja_example/)





DEMONSTRATION VIDEO



# Join our next Tech Talk

The banner features a blue background with a white geometric pattern on the right side. On the right, a person is shown from the chest up, sitting on a blue patterned surface and using a laptop. The laptop screen displays a video conference with three participants. The Silicon Labs logo is in the top left, and the 'tech talks' logo is in the top right. The event date and time are listed below the logo, followed by the main title 'Works With: Make the Most of WW 2021' and a 'w/ works with' logo at the bottom left.

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AUGUST 24TH | 10AM CST

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Q&A





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THANK YOU

