LPWAN SERIES

Presentation Will Begin Shortly

tech talks UPCOMING SESSIONS

NEW

OCT 19TH	Unboxing: Discover the xG28 Wireless SoC Family

ON DEMAND

FEB 16TH	Amazon Sidewalk: Using Battery-Powered Sensors
MAR 16TH	Getting Started with Amazon Sidewalk
APR 13TH	Introducing FG25 for Wi-SUN FAN 1.1
MAY 11TH	Optimizing FG23 for Battery Life & Performance
JUN 8TH	Designing Long Range Devices with Amazon Sidewalk

We will begin in: 4:00

2023 tech talks WEBINAR SERIES

Welcome

xG28 Wireless SoC Unboxing

Chad Steider, Sr. Product Marketing Manager
Matt Maupin, Sr. Product Marketing Manager

SILICON LABS

Agenda

October 19, 2023

- **xG28 Introduction**
- **Differentiating Features**
- **Development Tools**
  - xG28 Hardware Kits
    - Dual Band Range Test Demo
  - Simplicity Studio
    - xG28 and Simplicity Studio Demo
  - Radio Configurator
    - xG28 and Radio Configurator Demo
- **Summary**

Introducing xG28

Dual band support for on Series 2 Platform

- Sub-GHz and 2.4 GHz Bluetooth Low Energy
- Improved performance vs. Series 1 dual band devices

Robust features enable system integration

- Large Flash and RAM
- +20 dBm output power
- Secure Vault
- Rich peripherals including segment LCD and 16-bit ADC
- Multiple package options with up to 51 GPIO

AI/ML Hardware Accelerator

- Lowers reliance on cloud-based inferencing
- Faster and lower power inferencing at edge device

Platform for wireless and MCU development

- FG, SG and ZG for wireless devices
- PG for non-connected devices

Complete Platform for Sub-GHz IoT Development

- **Expand Multi-protocol support to Sub-GHz ecosystems**
  - Multi-protocol support for select Sub-GHz and Sub-GHz + Bluetooth 5.4 use cases
- **Drop-in and/or firmware compatibility between xG28 Wireless SoC families and PG28 standalone MCU**
  - Single hardware design to support multiple wireless and non-connected products
- **Maintain consistent security scheme regardless of wireless needs**
  - Secure Vault™ provides a consistent platform across entire xG28 family
- **AI/ML hardware acceleration support for edge devices**
  - Enables support on 2.4 GHz, Sub-GHz dual band and MCUs

ZG28

- Superset device for ultimate flexibility
- +20 dBm output power option supports up to 1+ mile range with Z-Wave Long Range
- Pin compatible with ZG23 allow migration to larger Flash/RAM

FG28

- Support for low power operation for Sub-GHz mesh networks like Wi-SUN
- Switched and dynamic multi-protocol support for mixed network use cases
- Migration path from older FG1x or FG23 devices

SG28

- Amazon Sidewalk specific SoC to support both Bluetooth and sub-GHz FSK
- Secure Vault™ High to meet current and future network requirements
- Single chip solution for battery powered devices

PG28

- Standalone MCU with firmware compatibility to xG28 wireless SoCs
- First Silicon Labs MCU with AI/ML hardware acceleration
- More GPIOs and larger memory footprint for more complex applications

xG28: Dual-Band SoC for the Next Generation of IoT

Dual-Band

Multi-protocol

More GPIOs

Secure

DEVICE SPECIFICATIONS

High Performance Dual-Band Radio

- Up to +20 dBm Sub-GHz, +10 dBm 2.4 GHz
- -125.8 dBm RX @ 915 MHz 4.8 kbps O-QPSK
- -94.2 dBm @ BLE 1 Mbps

Efficient ARM® Cortex®-M33

- Up to 78 MHz
- Up to 1024kB Flash, 256kB RAM

Low Power

- 82.8 mA TX Current (915 MHz, +20 dBm)
- 26.2 mA Tx Current (915 MHz, +14 dBm)
- 4.6 mA RX (915 MHz 4.8 kbps O-QPSK)
- 22.5 mA TX Current (2.4 GHz +10 dBm)
- 5.2 mA RX (BLE 1 Mbps)
- Active Current: 33 µA/MHz @39 MHz
- 1.3 µA EM2 (16 kB Retained)

Protocol Support

- Proprietary
- Wi-SUN
- Bluetooth LE
- Amazon Sidewalk
- Z-Wave

Package Options

- 6x6 QFN48 (31 GPIO), 8x8 QFN68 (49 GPIO)

DIFFERENTIATED FEATURES

Dual-Band

- Supports Sub-GHz + 2.4 GHz Bluetooth LE

+20 dBm output power

- Eliminates the need for an external power amplifier

Sub-GHz Antenna Diversity

- 6-8 dBm better link budget (Sub-GHz only)

Secure Vault™ Mid and High

- Allows for migration path as security needs change

AI/ML Hardware Accelerator

- Reduces current consumption for AI/ML at the edge

Preamble Sense

- Ultra low power receive mode

High GPIO count

- Supports up to 49 GPIO

16-bit ADC

- Up to 14-bit ENOB for better analog resolution

Segment LCD Controller

- Supports up to 192 segments

Reduced System Cost

- Integrated +20 dBm PA
- Simple RF matching

Pin-compatible with xG23

- 6x6 Pin-compatible for drop-in replacement

Not all specifications, features and protocols are available on all families
See individual data sheets for a complete list of support

xG28 Protocol Support

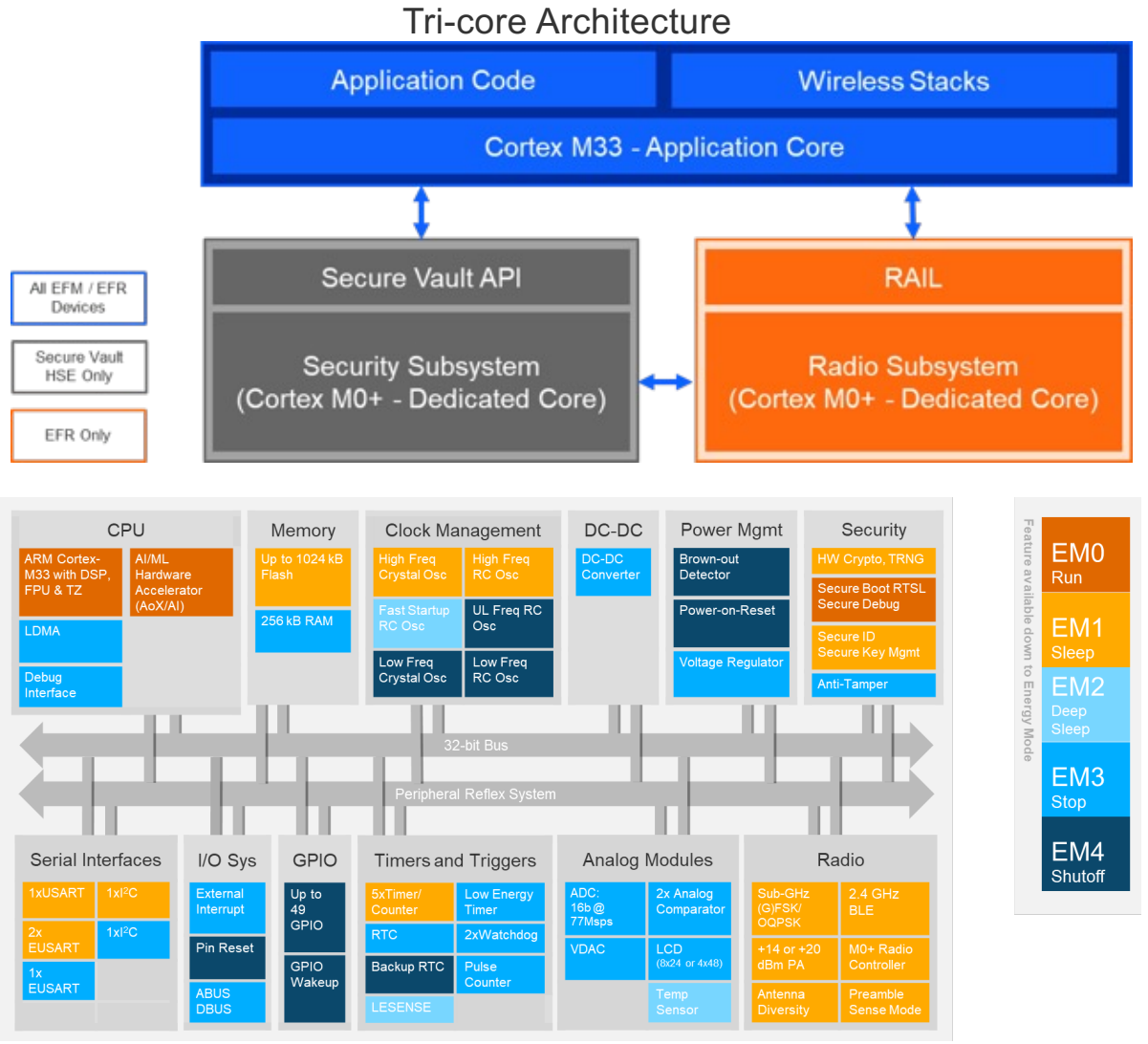
Protocol		ZG28	FG28	SG28
Z-Wave		✓		
Amazon Sidewalk (Bluetooth LE + FSK)		✓	✓	✓
Wi-SUN		✓	✓	
Proprietary		✓	✓	
Bluetooth 5.4		✓	✓	
WM-BUS		3rd Party Partner	3rd Party Partner	
Multi-Protocol Support	Proprietary + Bluetooth LE	✓	✓	
	Sidewalk + Bluetooth LE	✓[1]	✓[1]	✓[1]
	Z-Wave + Bluetooth LE	✓[2]		
	Wi-SUN + Bluetooth LE	✓[3]	✓[3]	

[1]Sidewalk-Wave+BLE DMP Alpha 23Q4, GA 24Q2
[2] Future support for Z-Wave+BLE SMP
[3] Future support for Wi_SUN+BLE DMP, GA 24Q2

Differentiating Features

Tri-Core, Low Power Architecture

- **Tri-core architecture**
  - Cortex M33 Application core
    - Runs wireless stacks and application
  - Dedicated M0+ Radio core
    - Offload radio functionality to free up processor resources
  - Dedicated Security core
    - Isolated security block lowers overall security risk
- **Optimized energy modes and peripherals**
  - Enables key functions and peripherals to run in low power
- **Peripheral Reflex System**
  - Event triggered logic without processor interaction
  - Keep processor core asleep until action is needed
- **AI/ML Hardware accelerator**
  - Offloads AI/ML inferencing

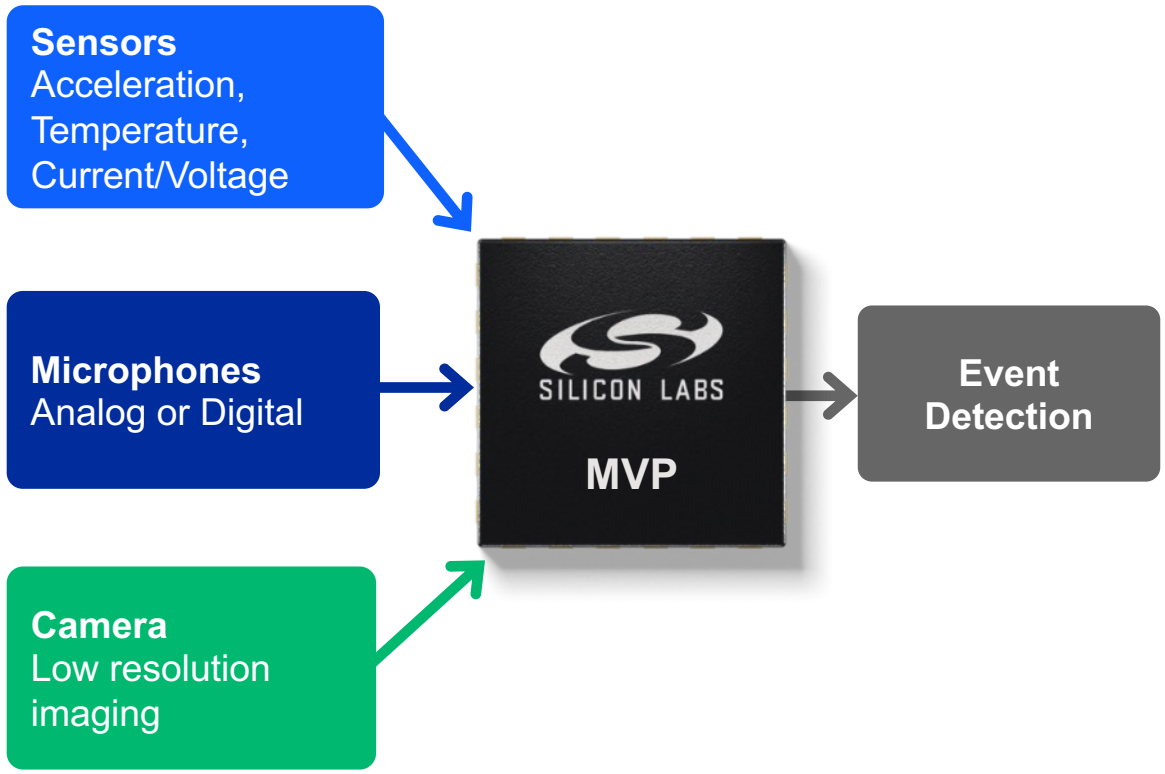


xG28 Block Diagram and Energy Modes

AI/ML Hardware Accelerator

AI/ML Hardware Accelerator Key Features

- **Matrix processor accelerates ML inferencing**
  - Multi-dimensional array operations
  - Handles real and complex data
  - Offloads MCU
- **Up to 8x faster inferencing over Cortex-M**
  - Lower latency
- **Up to 6x lower power for inferencing**
  - Longer battery life
- **MVP Math Library**
  - Can be used for non-ML applications



AI/ML Hardware Accelerator enables efficient Edge ML inferencing

Secure Vault™ Support in xG28: Protecting the IoT Device

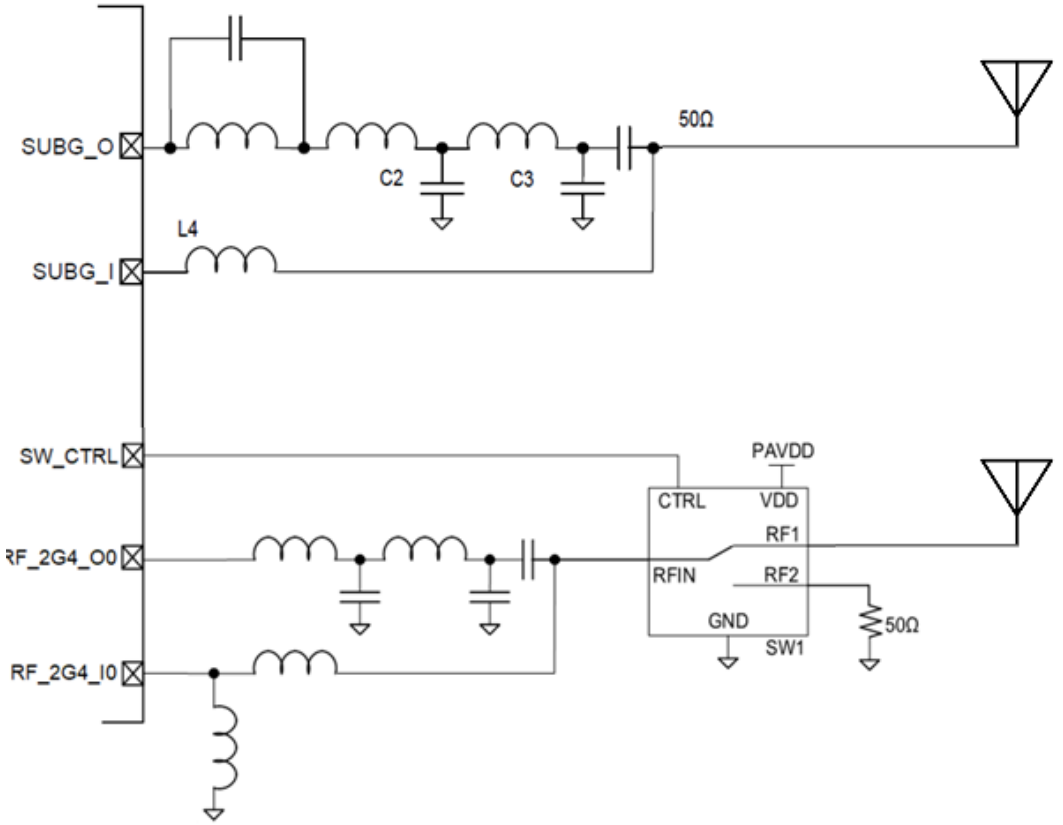
Base	Mid	High	Feature
✓	✓	✓	True Random Number Generator
✓	✓	✓	Crypto Engine
✓	✓	✓	Secure Application Boot
—	HSE	HSE	Secure Engine
—	✓	✓	Secure Boot with RTSL
—	✓	✓	Secure Debug with Lock/Unlock
—	✓	✓	DPA Countermeasures
—	—	✓	Anti-Tamper
—	—	✓	Secure Attestation
—	—	✓	Secure Key Management
—	—	✓	Advanced Crypto

xG28 Supports Secure Vault

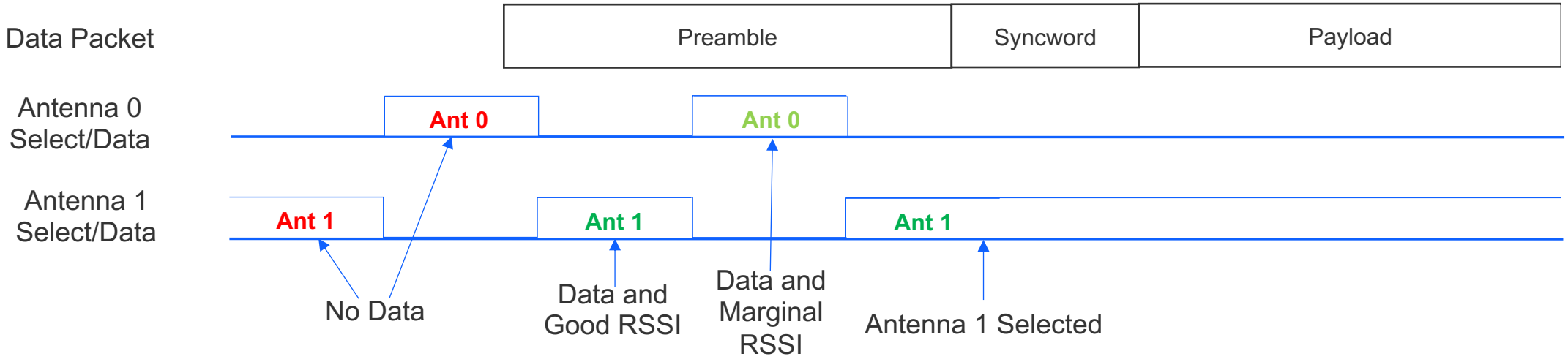
Industry Leading IoT Security

Sub-GHz and 2.4 GHz Bluetooth LE on a single device

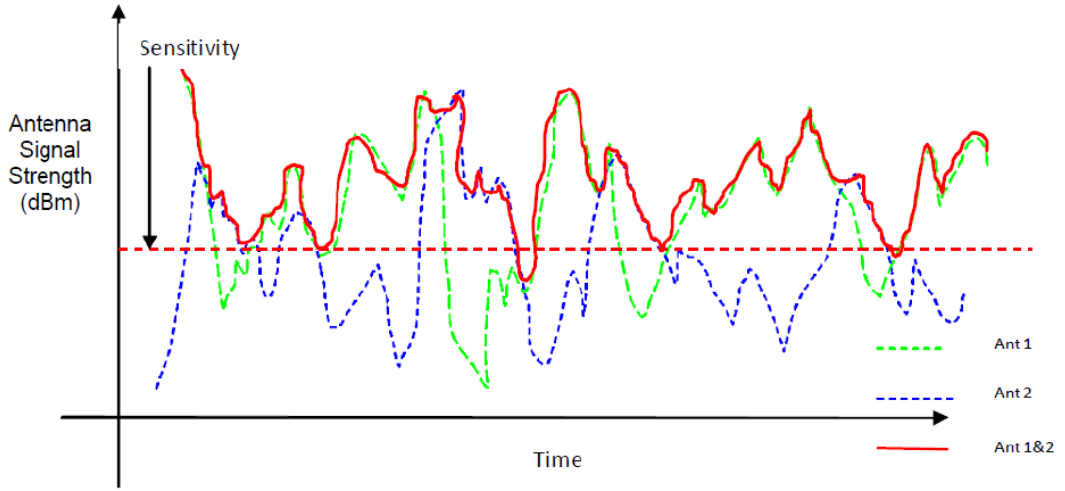
- **Single device with sub-GHz + Bluetooth LE**
  - Up to +20 dBm sub-GHz
  - Up to +10 dBm Bluetooth LE
- **Multiprotocol enables multiple use cases**
  - Bluetooth LE commissioning for sub-GHz networks
  - Dual protocol device for dynamic network selection
  - Bluetooth LE for maintenance and upgrades



xG28 Diversity Example – Select Best



- **Device switches between antenna during receive**
- **During preamble, measures RSSI, correlation, etc.**
- **Compares information from both antenna**
- **Selects best antenna**
- **TX is generally on the same antenna selected for RX**
- **Easily configured through Radio Configurator**



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Hardware and Software Development Tools

IoT Hardware Development Tools – Feature Comparison

	Explorer Kit	Dev Kit	Pro Kit
Debug Speed	1.6MHz	1.6MHz	8MHz
Debug USB	Full Speed	Full Speed	High Speed
Packet Trace Interface (PTI)	✓	✓	✓ 2x
Breakout Pads	✓	✓	✓
Pushbutton s & User LEDs	✓	✓	✓
Virtual COM	✓	✓	✓
Coin cell battery holder	–	✓	✓
On-board Sensors	–	✓	✓
Battery Pack Connector	–	✓	✓
Radio Board Connectors	–	–	✓
EXP Connector	–	–	✓
Display	–	–	✓
Debug OUT	–	–	EFM8/32, EFR32, EZR32
Debug Ethernet	–	–	100 Mbit/s
Energy Monitor (AEM)	–	–	✓
3rd Party Hardware addons	✓	–	–

✓ Supported ✓ Optional or not mounted – Not Supported

Explorer Kit

- Lowest price point
- On-board debugger and signal breakouts
- Minimal on-board features
- 3rd party hardware support

Dev Kit

- Single device development board
- On-board debugger and signal breakouts
- On-board sensors
- Impressive out-of-the-box demos

Pro Kit

- Modular development platform
- Advanced development use cases
- Energy profiling and external device debug
- Ethernet for large network test
- Designed to maximize reuse of EFR32 devices

Getting Started with xG28 (FG28, SG28 and ZG28)

Explorer Kit

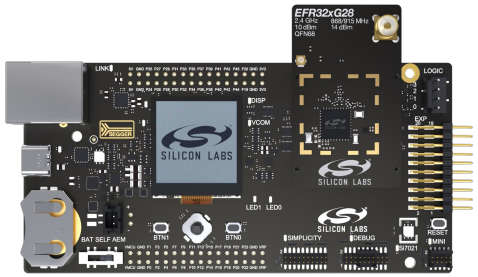
- On-board Debugger
- USB for power and communication
- User Interface
- Breakout pads
- mikroBus socket
- Qwiic connector

xG28-EK2705A - $34

- 1x BRD2705A Explorer Kit Board

Pro Kit

- Advanced debug and development
- USB for power and communication
- User Interface and breakout pads
- RF measurements
- Energy profiling
- Internal/external device debug
- Ethernet for large network test



xG28-PK6024A (+14 dBm) - $179
xG28-PK6025A (+20 dBm) - $179

- 1x BRD4002A Mainboard
- 1x BRD440xC Radio Board
- 1x 868/915 MHz antenna
- 1x Flat Cable
- 1x 2xAA Battery Holder

Radio Board Kits

- Optimized RF layout and performance
- Ideal for RF measurements
- Uses existing Pro Kit main boards

xG28-RB4400C (+14 dBm) - $40
xG28-RB4401C (+20 dBm) - $40

- 1x BRD440xC Radio Board
- 1x 868/915 MHz antenna

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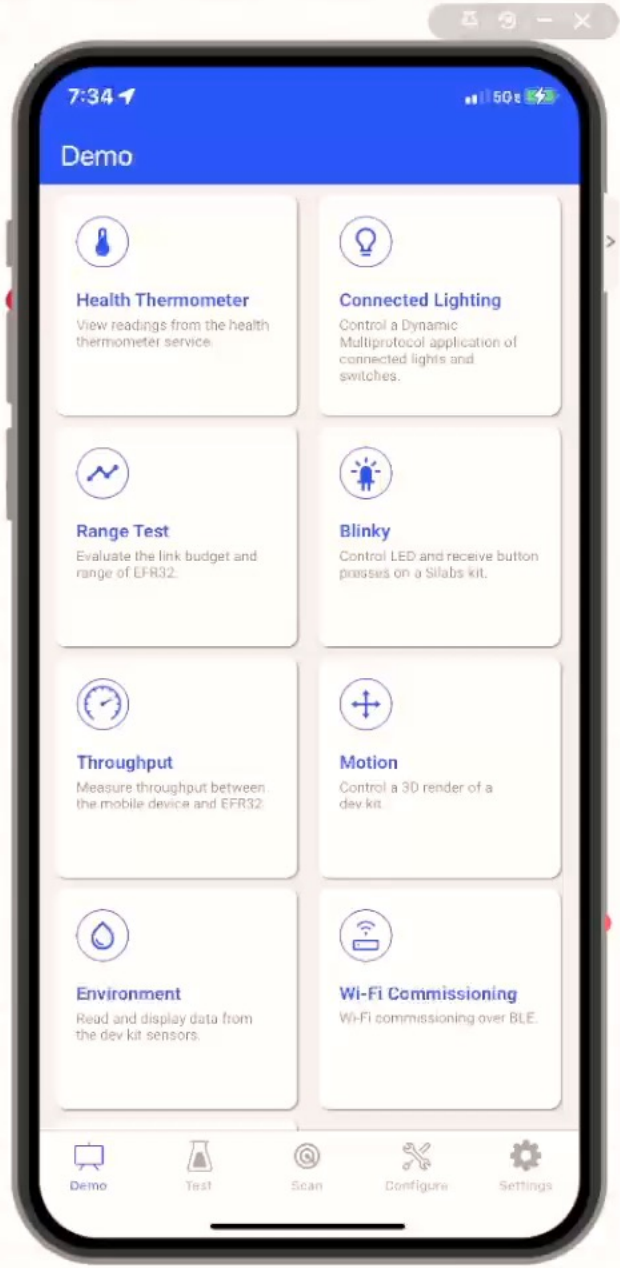
Demo 1

Bluetooth + Sub-GHz DMP Range Test



View recording to watch demo

Live Q&A

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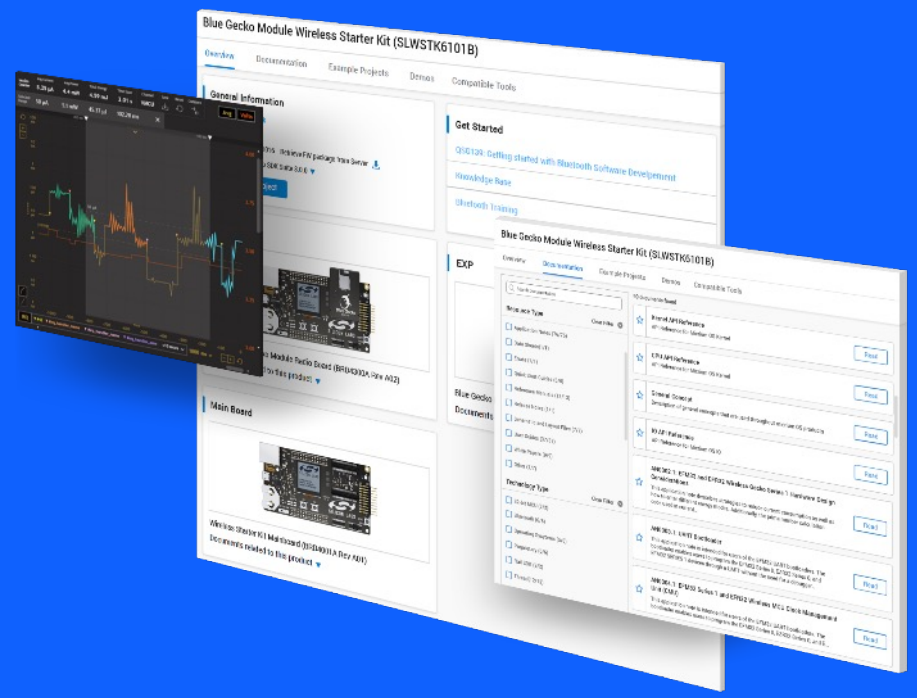
Simplified Developer Experience



Simplicity Studio 5

Simplicity Studio 5

- **Interface**
  - Fresh, new & simplified
  - Intuitive out-of-the-box experience
  - Fast access to developer resources
  - Linux, Mac & Windows
- **Tools**
  - Configuration utilities
  - Compiler
  - Error & validation
  - IDE & command line support
  - Graphical hardware configurator
  - Energy Profiler – visual energy analysis
  - Network Analyzer – packet capture & decode

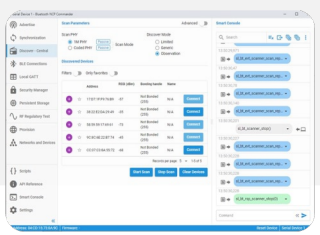
Silicon Labs Tools Code Levels

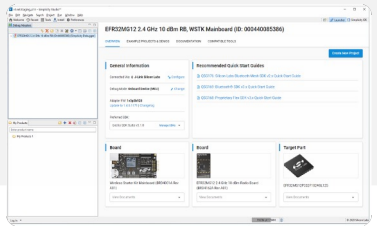
Large variety of customer **expertise levels**:

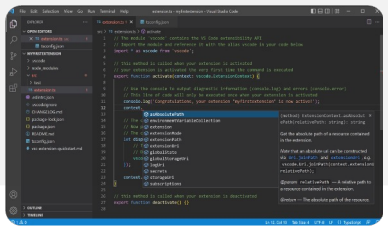
Beginner → Intermediate → Advanced → IoT Expert

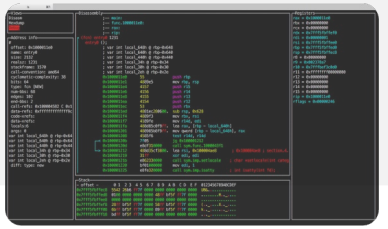
Matching developer flows, the Silicon Labs **Code Levels**:

No-code → Low-code → Custom-code → Pro-code









Typical developer environment and tools:

Silabs GUI Tools → Silabs GUI Tools + Silabs IDE → Silabs IDE or Custom IDE → Custom IDE

SLC (Silicon Labs Configurator) as common foundation

Demo 2

Simplicity Studio

v5_workspace - Simplicity Studio™

File Edit Navigate Search Project Run Window Help

Welcome Recent Tools Install Preferences

Launcher Simplicity IDE Debug Network Analyzer Energy Profiler

Debug Adapters: 2

EFR32xG28 868/915 MHz +20 dBm + 2.4 GHz +10 dBm RB (ID:440231943)

EFR32xG28 Explorer Kit (ID:440306735)

My Products

Enter product name

My Products 1

EFR32BG21A010F1024IM32
EFR32BG21B010F1024IM32
EFR32BG21B010F768IM32
EFR32BG21B020F1024IM32
EFR32BG24A010F1024IM40
EFR32BG24B110F1536IM48
EFR32BG24B210F1024IM48
EFR32BG24B220F1024IM48
EFR32BG27 +8 dBm Dev Kit Board (BRD2602A Rev A02)
EFR32FG28A110F1024GM68
EFR32FG28A122F1024GM68
EFR32MG12 2.4 GHz 19 dBm Radio Board (SLWRB4161A)
EFR32MG24B010F1024IM48
EFR32MG24B010F1536IM40
EFR32MG24B010F1536IM48
EFR32MG24B020F1024IM48
EFR32MG24B220F1536IM48
EFR32MR21A020F512IM32
EFR32SG23B020F512IM40
EFR32SG28B320F1024IM48
EFR32xG21 2.4 GHz 10 dBm Radio Board (BRD4181B)

EFR32xG28 Explorer Kit (ID: 000440306735)

OVERVIEW EXAMPLE PROJECTS & DEMOS DOCUMENTATION COMPATIBLE TOOLS

Create New Project

General Information

Connected Via: J-Link Silicon Labs Configure

Debug Mode: **Onboard Device (MCU)** Change

Adapter FW: **1v4p12b16** **Latest**

Secure FW: **2.2.2** 2.2.2| Changelog

Board

EFR32xG28 Explorer Kit (BRD2705A Rev A01)

View Documents

Target Part

EFR32ZG28B312F1024IM48

View Documents

View recording to watch demo

Live Q&A

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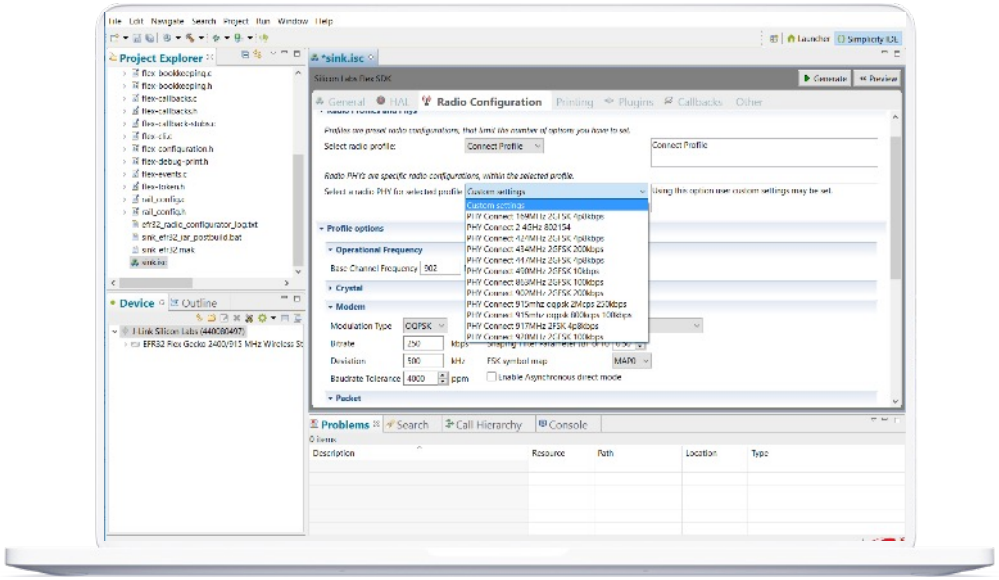
Radio Configurator



Tool to configure and optimize radio performance

Rapid Radio configuration and prototyping

- Predefined PHY settings for most common world regions
- Ability to create custom PHY settings for proprietary wireless applications

Intuitive GUI to configure PHY parameters

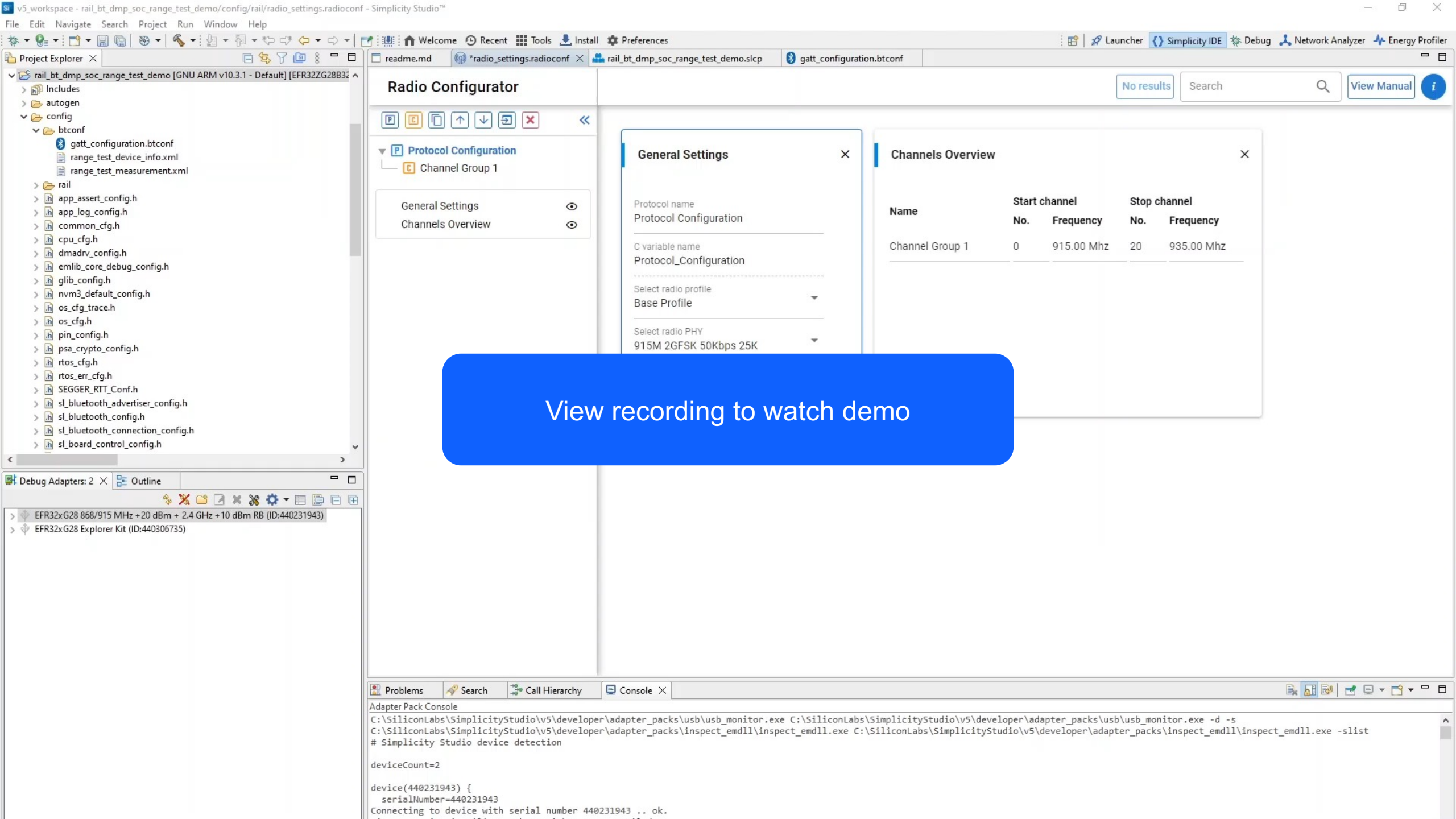
- Frequency bands, channel spacing, modulation
- Bit rate, symbol maps, symbol coding, filtering
- Timing detection, AFC, AGC and many other

Quick learning curve for new radio engineers

- Human readable configurations
- No need to learn specific radio registers and other IC internal information

Demo 3

Radio Configurator


v5_workspace - rail_bt_dmp_soc_range_test_demo/config/rail/radio_settings.radioconf - Simplicity Studio™
File Edit Navigate Search Project Run Window Help
Welcome Recent Tools Install Preferences
Launcher Simplicity IDE Debug Network Analyzer Energy Profiler
Project Explorer
rail_bt_dmp_soc_range_test_demo [GNU ARM v10.3.1 - Default] [EFR32ZG28B32
Includes
autogen
config
btconf
gatt_configuration.btconf
range_test_device_info.xml
range_test_measurement.xml
rail
app_assert_config.h
app_log_config.h
common_cfg.h
cpu_cfg.h
dmadrv_config.h
emlib_core_debug_config.h
glib_config.h
nvm3_default_config.h
os_cfg_trace.h
os_cfg.h
pin_config.h
psa_crypto_config.h
rtos_cfg.h
rtos_err_cfg.h
SEGGER_RTT_Conf.h
sl_bluetooth_advertiser_config.h
sl_bluetooth_config.h
sl_bluetooth_connection_config.h
sl_board_control_config.h
Debug Adapters: 2
Outline
EFR32xG28 868/915 MHz +20 dBm + 2.4 GHz +10 dBm RB (ID:440231943)
EFR32xG28 Explorer Kit (ID:440306735)
readme.md
*radio_settings.radioconf
rail_bt_dmp_soc_range_test_demo.slcp
gatt_configuration.btconf
Radio Configurator
No results
Search
View Manual
Protocol Configuration
Channel Group 1
General Settings
Channels Overview
General Settings
Protocol name
Protocol Configuration
C variable name
Protocol_Configuration
Select radio profile
Base Profile
Select radio PHY
915M 2GFSK 50Kbps 25K
Channels Overview
Name
Start channel
No.
Frequency
Stop channel
No.
Frequency
Channel Group 1
0
915.00 Mhz
20
935.00 Mhz
View recording to watch demo
Problems
Search
Call Hierarchy
Console
Adapter Pack Console
C:\SiliconLabs\SimplicityStudio\v5\developer\adapter_packs\usb\usb_monitor.exe C:\SiliconLabs\SimplicityStudio\v5\developer\adapter_packs\usb\usb_monitor.exe -d -s
C:\SiliconLabs\SimplicityStudio\v5\developer\adapter_packs\inspect_emdll\inspect_emdll.exe C:\SiliconLabs\SimplicityStudio\v5\developer\adapter_packs\inspect_emdll\inspect_emdll.exe -slist
# Simplicity Studio device detection
deviceCount=2
device(440231943) {
serialNumber=440231943
Connecting to device with serial number 440231943 .. ok.

Resources and Links

- **FG28 Web Pages**
  - https://www.silabs.com/wireless/proprietary/efr32fg28-sub-ghz-wireless-socs
- **SG28 Web Pages**
  - https://www.silabs.com/wireless/amazon-sidewalk/efr32sg28-dual-band-wireless-socs
- **ZG28 Web Pages**
  - https://www.silabs.com/wireless/z-wave/efr32zg28-z-wave-800-socs
- **PG28 Web Pages**
  - https://www.silabs.com/mcu/32-bit-microcontrollers/efm32pg28-series-2

- **LPWAN Technology**
  - https://www.silabs.com/wireless/lpwan
- **AI/ML Webpage**
  - https://www.silabs.com/applications/artificial-intelligence-machine-learning
- **Studio 5**
  - https://www.silabs.com/developers/simplicity-studio
- **EFR Connect**
  - https://www.silabs.com/developers/efr-connect-mobile-app
- **Documentation**
  - https://docs.silabs.com/
- **Community**
  - http://community.silabs.com/

xG28: Dual Band Wireless SoC Expanding the Possibilities for IoT Devices

- Dual Band Wireless SoC
  - Sub-GHz + Bluetooth LE Multiprotocol for advanced use cases
- 1024 kB of Flash and 256 kB of RAM
  - Ensures enough Flash and RAM for advanced nodes and future growth
- AI/ML hardware accelerator
  - 8x faster inferencing and 6x lower power consumption vs Cortex-M
- High performance RF
  - +20 dBm Sub-GHz and high sensitivity receiver provide greater range and reliability
- Low active and sleep currents
  - Provides longer battery life
- Robust peripherals and up to 51 GPIOs
  - Enables better system integration
- Secure Vault™
  - Secures the device remote and local cyber-attacks

Arrow Electronics Exclusive!
50% Off xG28 Dev Kits

Visit **www.arrow.com** and enter the xG28 tool part number you are looking for.

Upon checkout, enter code **WORKSWITH2023** to save 50%. This offer is limited to the first 100 customers/companies.

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Live Q&A

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2023 tech talks
WEBINAR SERIES

Thank You

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Watch ON DEMAND

silabs.com/training