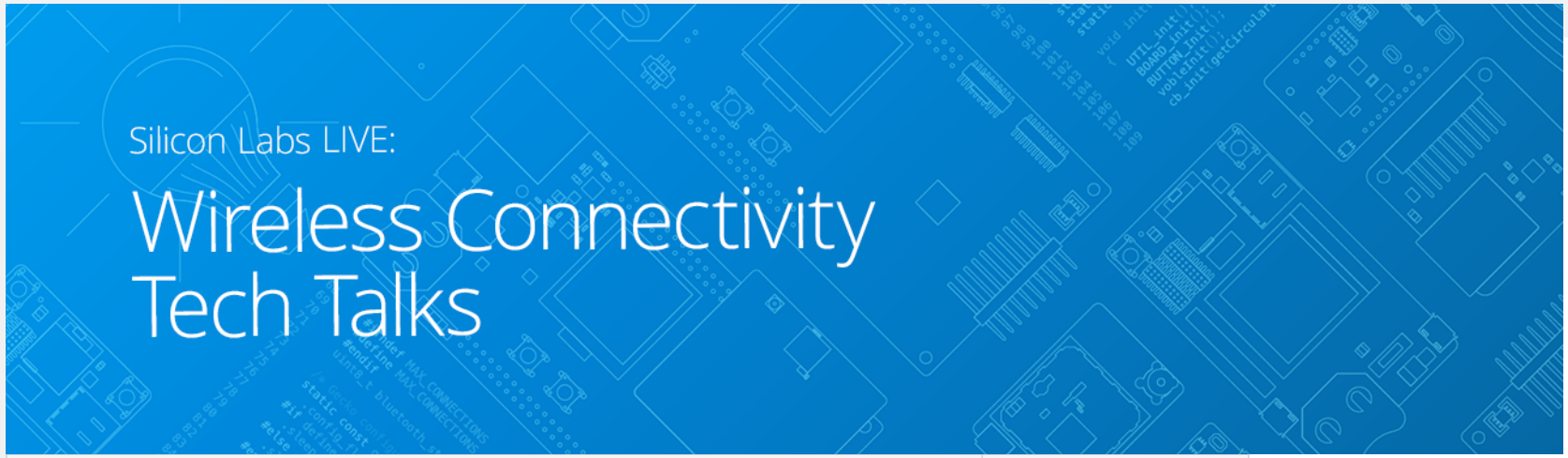
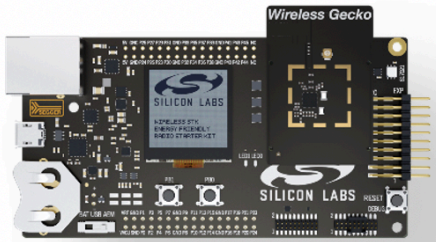
Tech Talks LIVE Schedule – Presentation will begin shortly



How to Measure and Debug Network Performance - Using Silicon Labs Network Analyzer	**Thursday, May 7**
RF Regulatory and Qualification Testing for Bluetooth, Zigbee & Z-Wave	Tuesday, May 12
Simplicity Studio Tips & Tricks: Our FAEs Know All The Tricks - Improve Your Life in Simplicity Studio	Thursday, May 14
Wireless Module vs Wireless SoC Tradeoffs and Decision Making Criteria	Tuesday, May 19
Thunderboard BG22 Unboxing. You Have Our Kit… What Can You Do With It?	Thursday, May 21
Designing in Bluetooth using Bluetooth Xpress Modules with Minimal Code Writing	Tuesday, May 26
Overview of Silicon Labs Wi-Fi Solutions (Including Redpine Signals Wi-Fi Solutions)	Thursday, May 28

Please take the 3 question poll while waiting and be entered to receive a BG22 Starter Kit.



BG22 SoC Starter Kit
SLWSTK6120A

Find Past Recorded Sessions at:
https://www.silabs.com/support/training

WELCOME

Silicon Labs LIVE:

Wireless Connectivity Tech Talks

Simplicity Studio - Network Analyzer

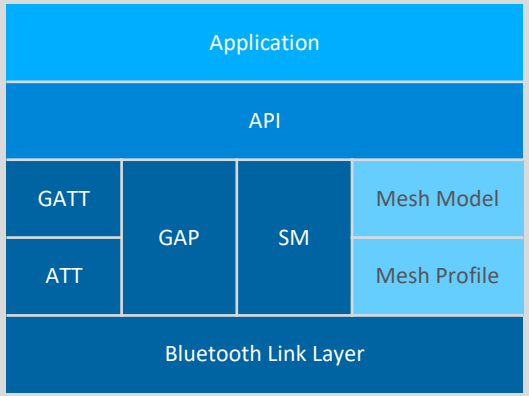
MAY 2020 – JAKE JOHNSON, FIELD APPLICATIONS ENGINEER

A Complete Solution for Enabling Wireless Products

SoCS AND MODULES

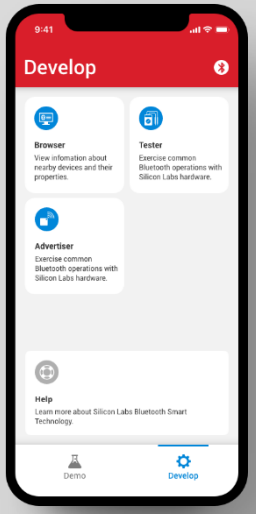
Industry leading Zigbee, Thread, Bluetooth 5.2, and proprietary SoCs and pre-certified modules

STACK SOFTWARE



In-house developed stacks with latest Zigbee, Thread, Bluetooth 5.2 and mesh features

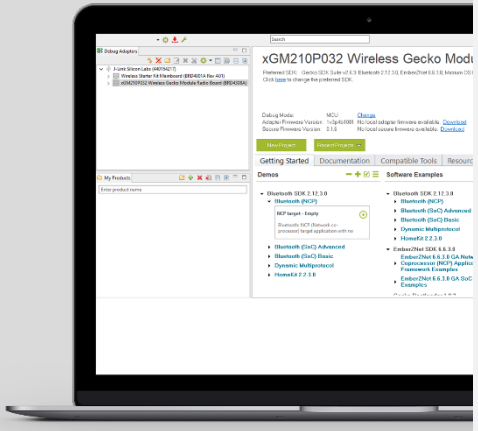
MOBILE APPLICATIONS



Reference applications and source code for iOS and Android

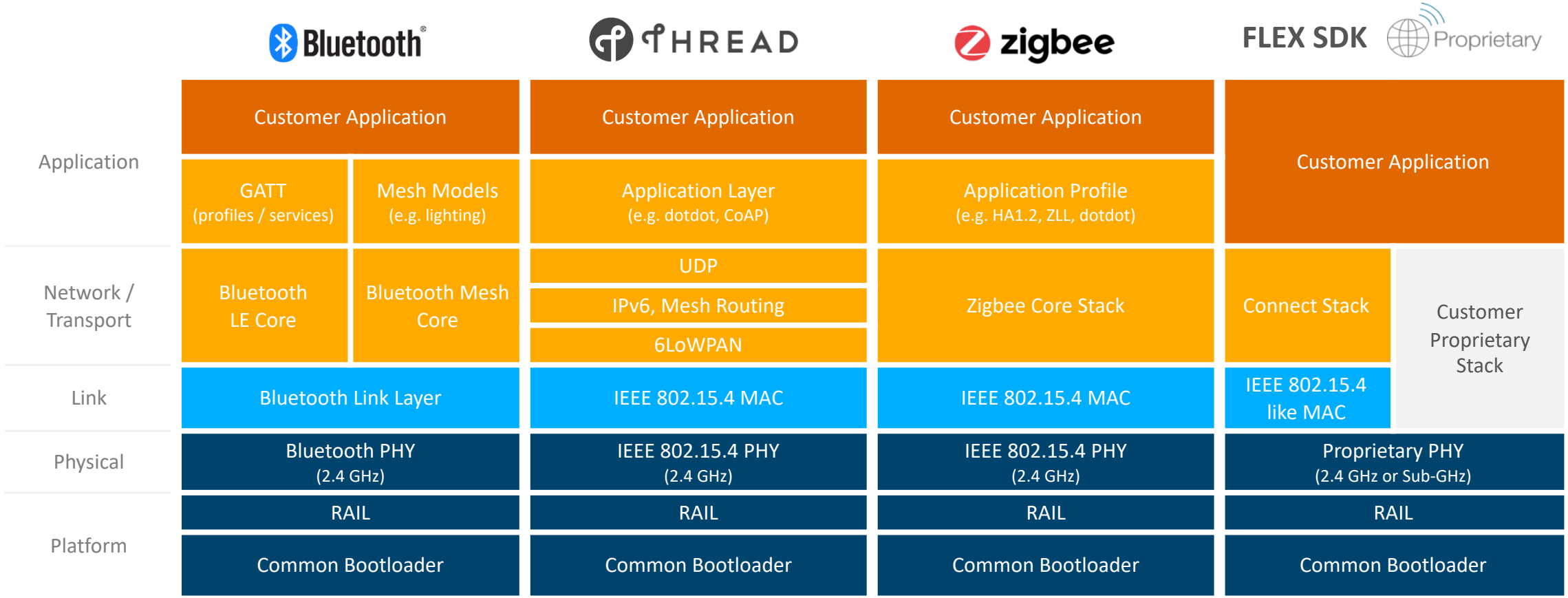
Phone interoperability test program

DEVELOPMENT TOOLS



Free-of-charge development and protocol analysis tools to boost productivity

A Common Platform



The Right Tool Set – Simplicity Studio™

Wireless and MCU design made simple

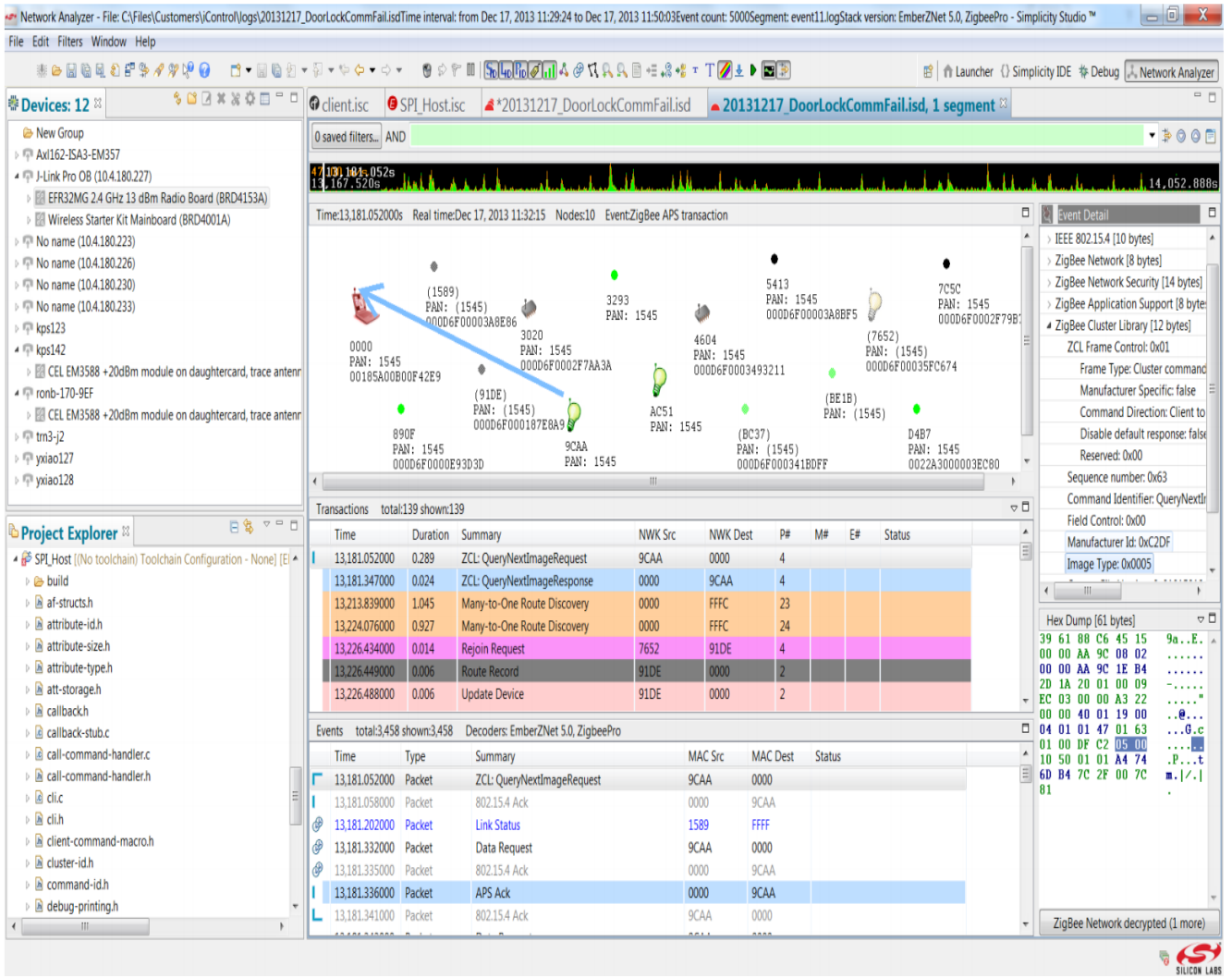
- Cross platform development environment for MCU and Wireless products
- Eclipse-based IDE
- Complete Documentation
- Demos / Software Examples
- Advanced Tools
  - AppBuilder
  - Radio Configurator
  - Commander
  - Energy Profiler
  - Network Analyzer

Single Tool for Development

Overview

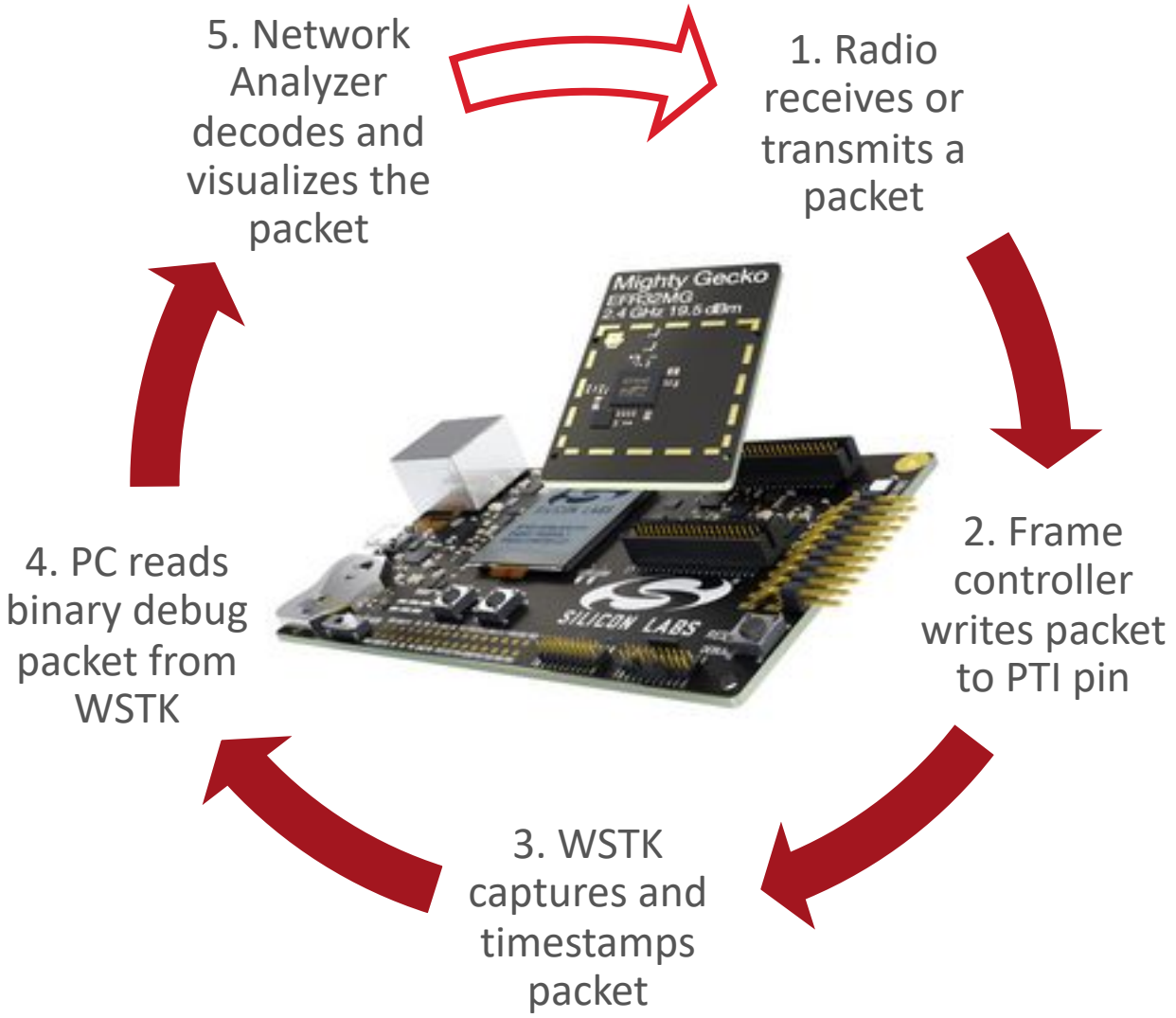
Network Analyzer

- Radio packet tracing in real time
- Simultaneous capture from multiple nodes
- Debug Multiple wireless protocols
- Debug Multiprotocol networks (Zigbee & BLE)
- Developed by our own networking engineers to develop and debug our stacks



Packet Trace Interface (PTI)

- Direct feedback from baseband radio
  - Raw TX and RX packet
  - Timestamp, RSSI, channel, protocol, etc.
- Implemented in hardware and radio sequencer
  - Dedicated UART/SPI interface
  - Zero overhead to Cortex code
- Captured and timestamped by Wireless Starter Kit (WSTK)

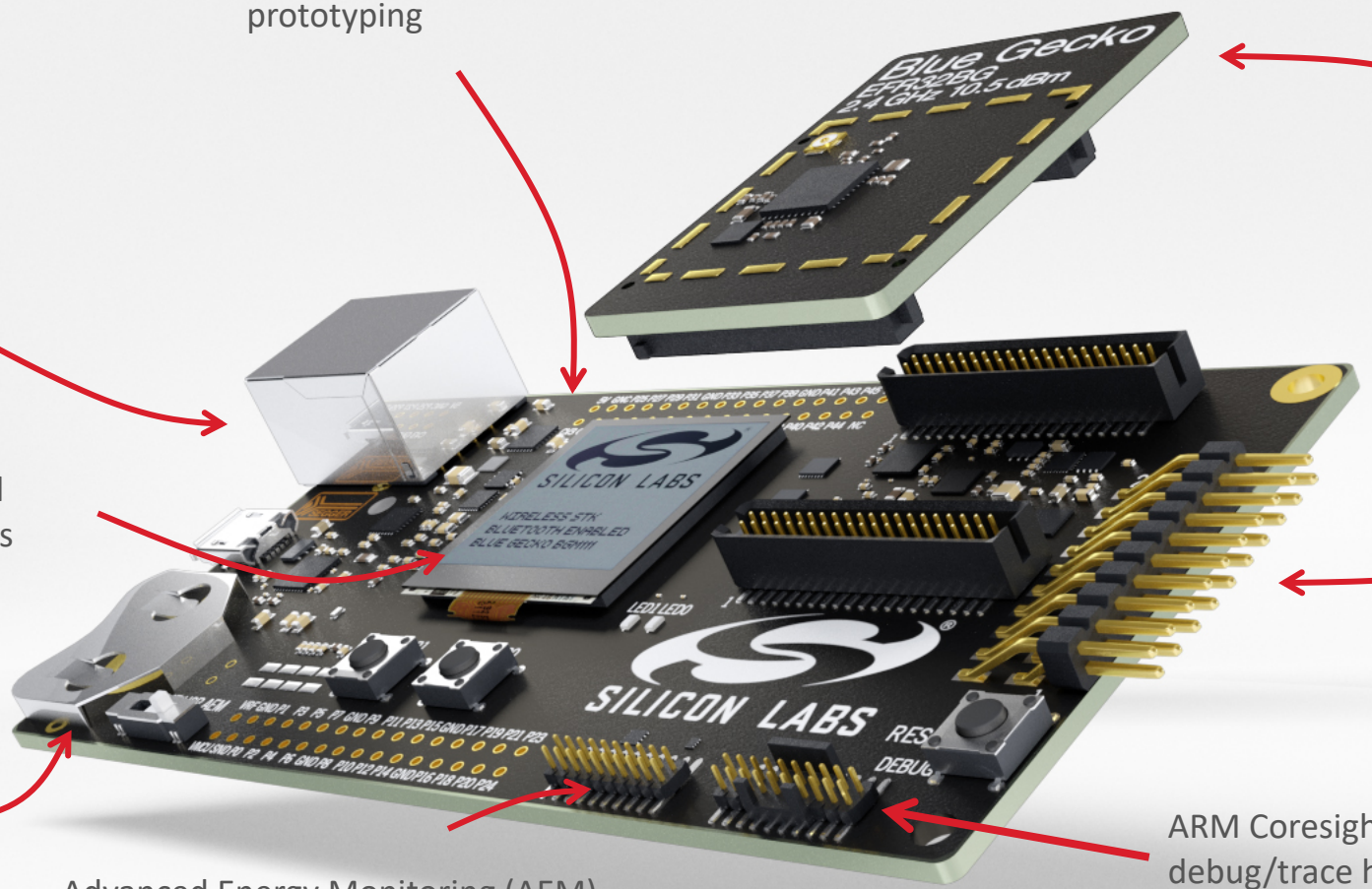


Development Hardware

Radio pin access headers for prototyping

Integrate J-Link debugger
Connect via USB or Ethernet
Virtual Com Port support
Packet Trace
Energy Profiler

Radio card header for easy swapping



Ultra-low power 128x128 pixel memory LCD, buttons and LEDs

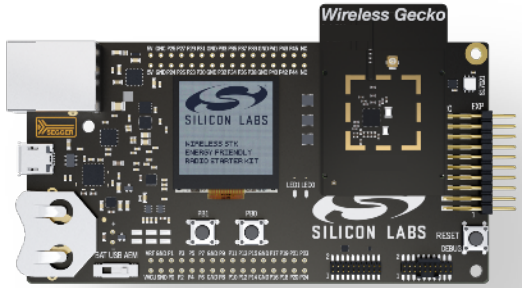
Expansion header for prototyping

USB Power or Battery Power

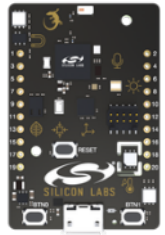
Advanced Energy Monitoring (AEM)
USB Serial Port
Packet Trace Port

ARM Coresight 19-pin debug/trace header

Getting Started with BG22 SoCs



BG22 SoC Starter Kit
SLWSTK6120A

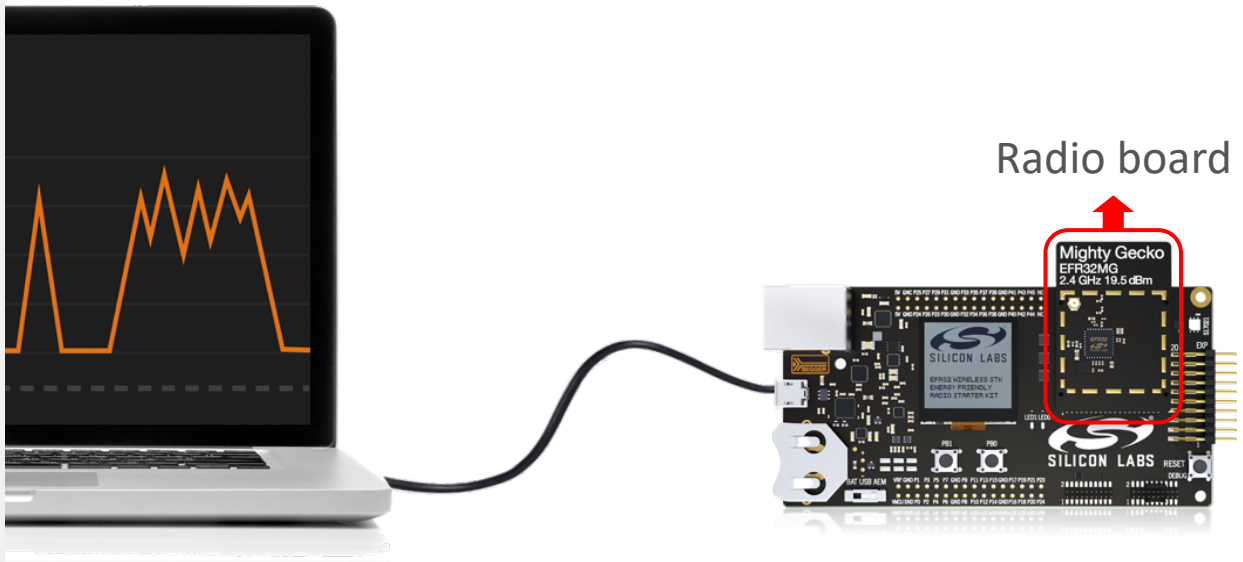


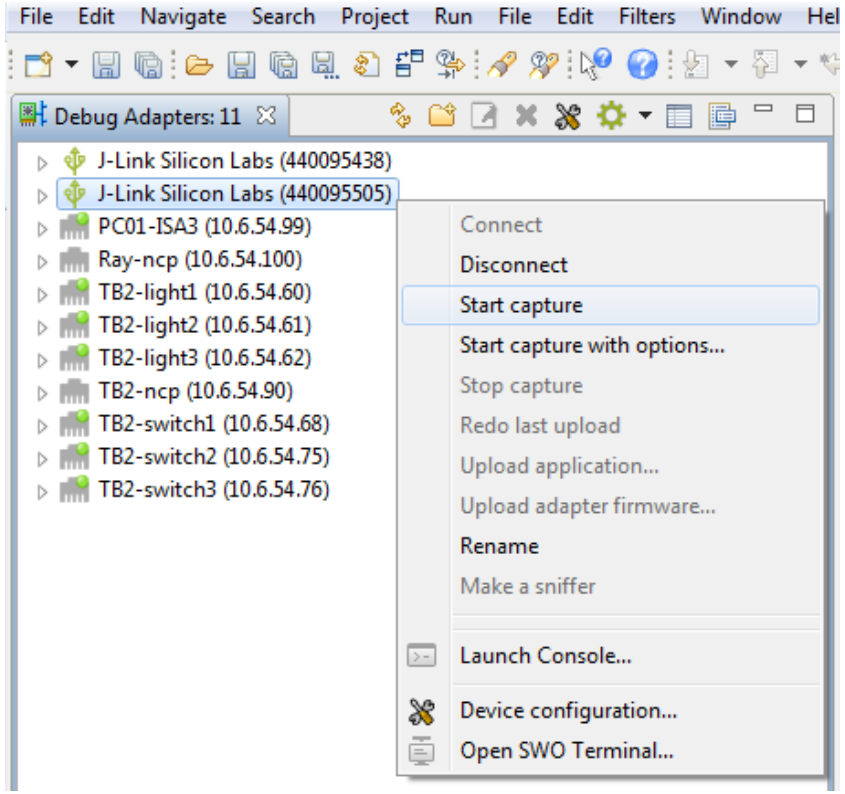
Thunderboard BG22
SLTB010A

SLWSTK6120A	1x WSTK main boards 1x SLWRB4182A radio boards (QFN40) 1x SLWRB4183A radio boards (QFN32)
SLWRB4182A	BG22 +6 dBm radio board (QFN40)
SLWRB4183A	BG22 +6 dBm radio board (QFN32)
SLTB010A	Thunderboard BG22 kit

How to capture packet trace on demo boards - Hardware connection

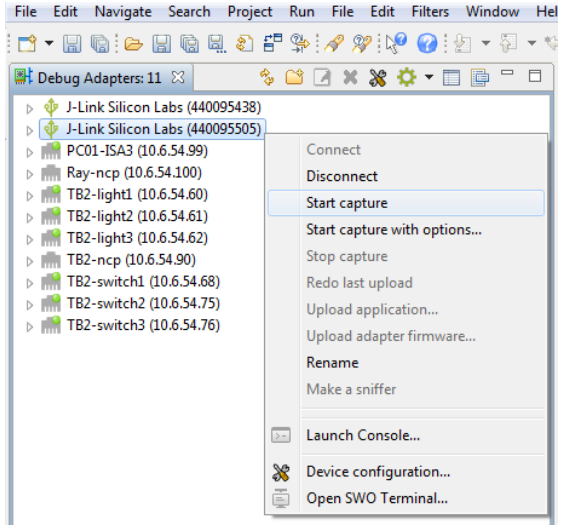
- Capture packet trace on WSTK Kit
  - WSTK main board + Radio board, debug mode set to ‘MCU’
  - USB/Ethernet cable
  - Running Network Analyzer on PC
  - Click “Start capture” on adapter





How to capture packet trace - Hardware connection

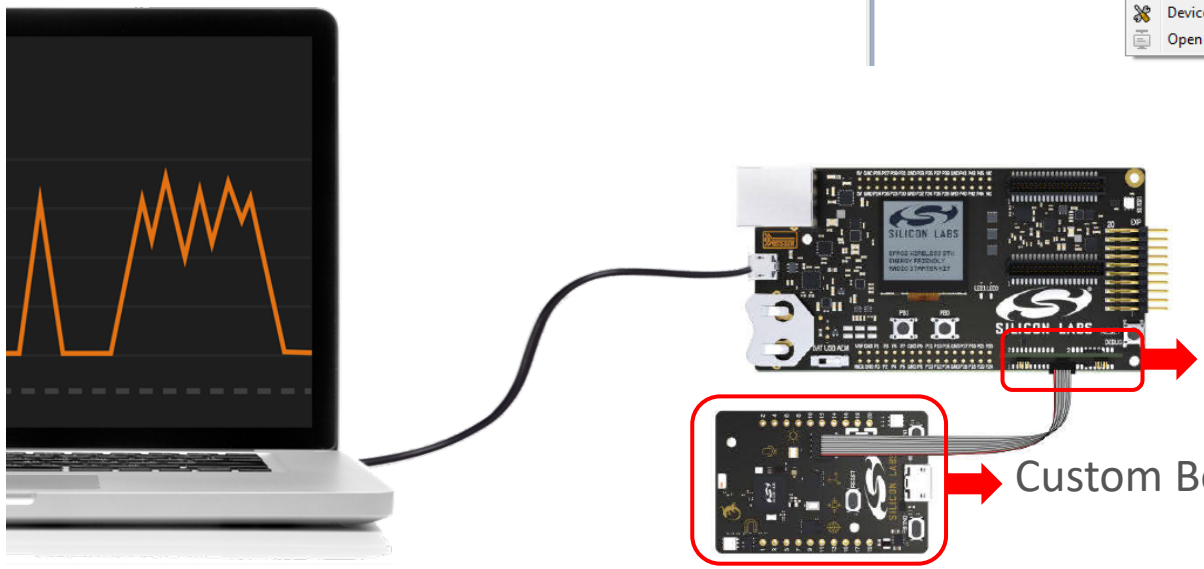
- Capture packet trace on Custom Board
  - WSTK main board, debug mode set to ‘OUT’
  - Simplicity Debug Adapter Board
  - 10-Pin ribbon cable
  - USB/Ethernet cable
  - Running Network Analyzer on PC
  - Click “Start capture” on adapter

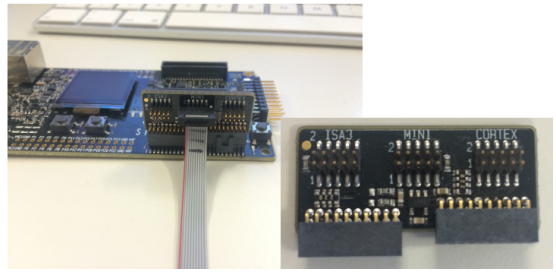


Pin #	Pin Name	Pin Function	EFR32 Functionality
1	VAEM	Target Advanced Energy Monitor Voltage Net	VDD
2	GND	Target Ground	VSS
3	RST	Target Reset (Active Low)	RESETn
4	VCOM_RX	Target Pass-through UART/Virtual COM Port Receive	US0_RX
5	VCOM_TX	Target Pass-through UART/Virtual COM Port Transmit	US0_TX
6	SWO	Target Serial Wire Output	SWO
7	SWDIO	Target Serial Wire Data Input/Output	SWDIO
8	SWCLK	Target Serial Wire Clock	SWCLK
9	PTI_FRAME	Target Packet Trace Interface Frame Signal	FRC_DFRAME
10	PTI_DATA	Target Packet Trace Interface Data Signal	FRC_DOUT

VAEM	1	2	GND
RST	3	4	VCOM_RX
VCOM_TX	5	6	SWO
SWDIO	7	8	SWCLK
PTI_FRAME	9	10	PTI_DATA

We strongly recommend that customers include 10-pin mini simplicity connector pin-out on development hardware

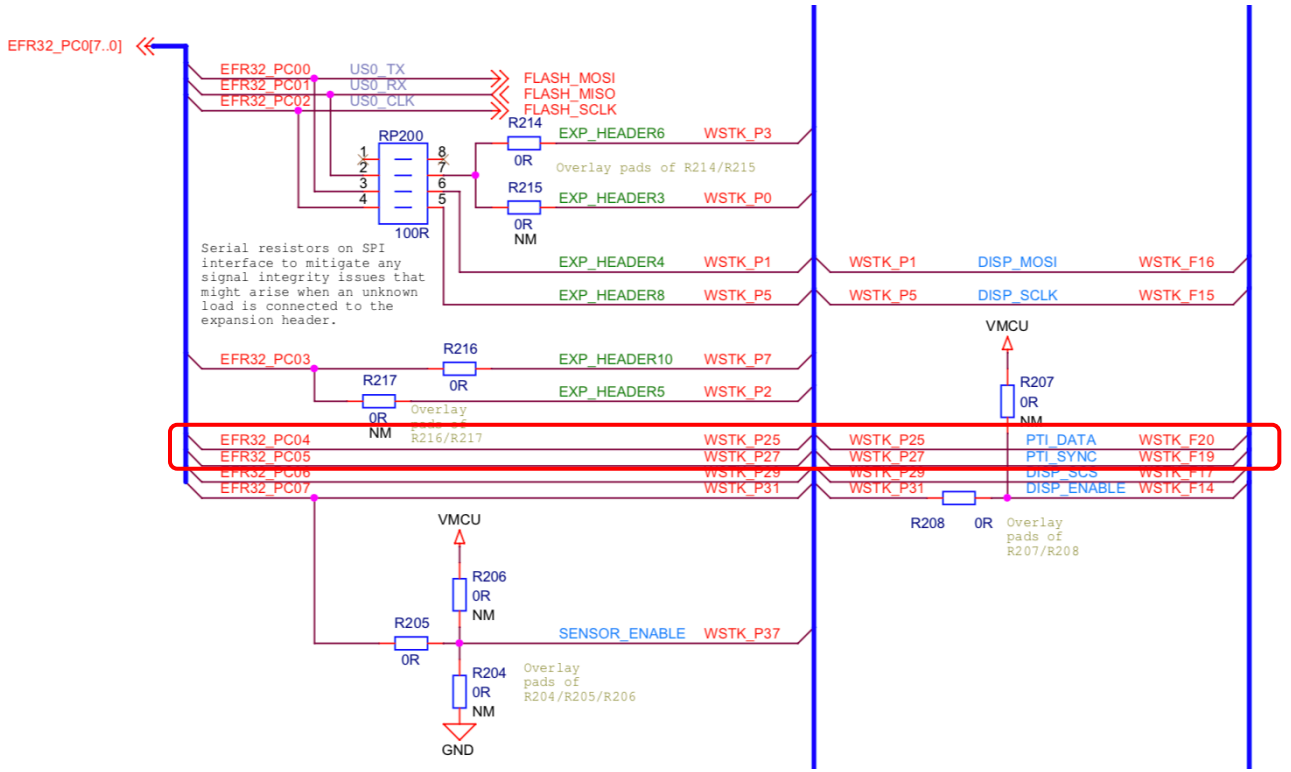




How to capture packet trace – Software configuration for Bluetooth

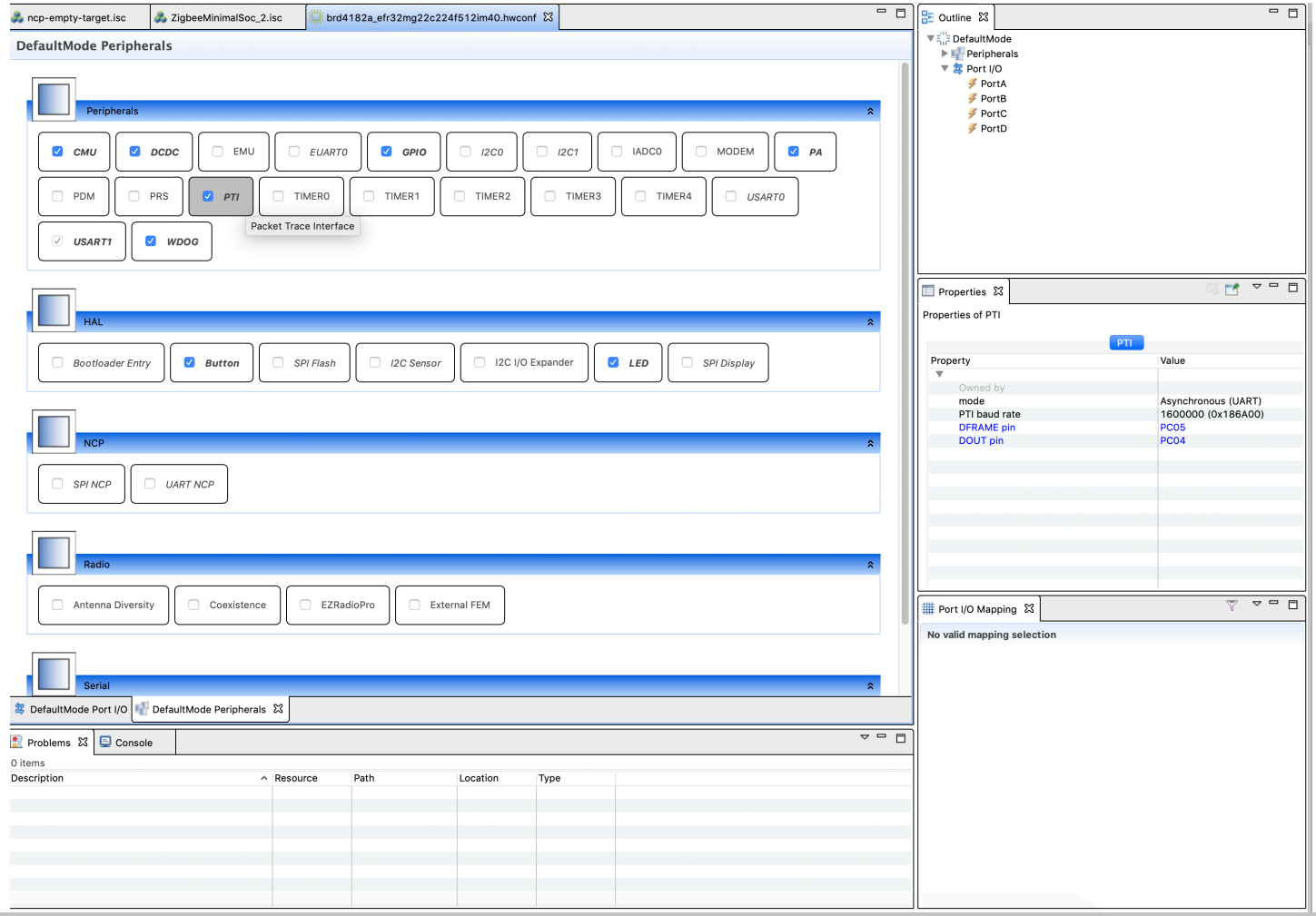
- Bluetooth - Configure PTI in hal-config-app-common.h

```
#define HAL_PTI_ENABLE                  (1)
#define HAL_PTI_MODE                    (HAL_PTI_MODE_UART)
#define HAL_PTI_BAUD_RATE               (1600000)
```



How to capture packet trace – Software configuration in App Builder

- App Builder Projects - Configure PTI in .hwconfig file
  - PTI_FRAME
  - PTI_DATA



How to capture packet trace – Software configuration, peripheral routing

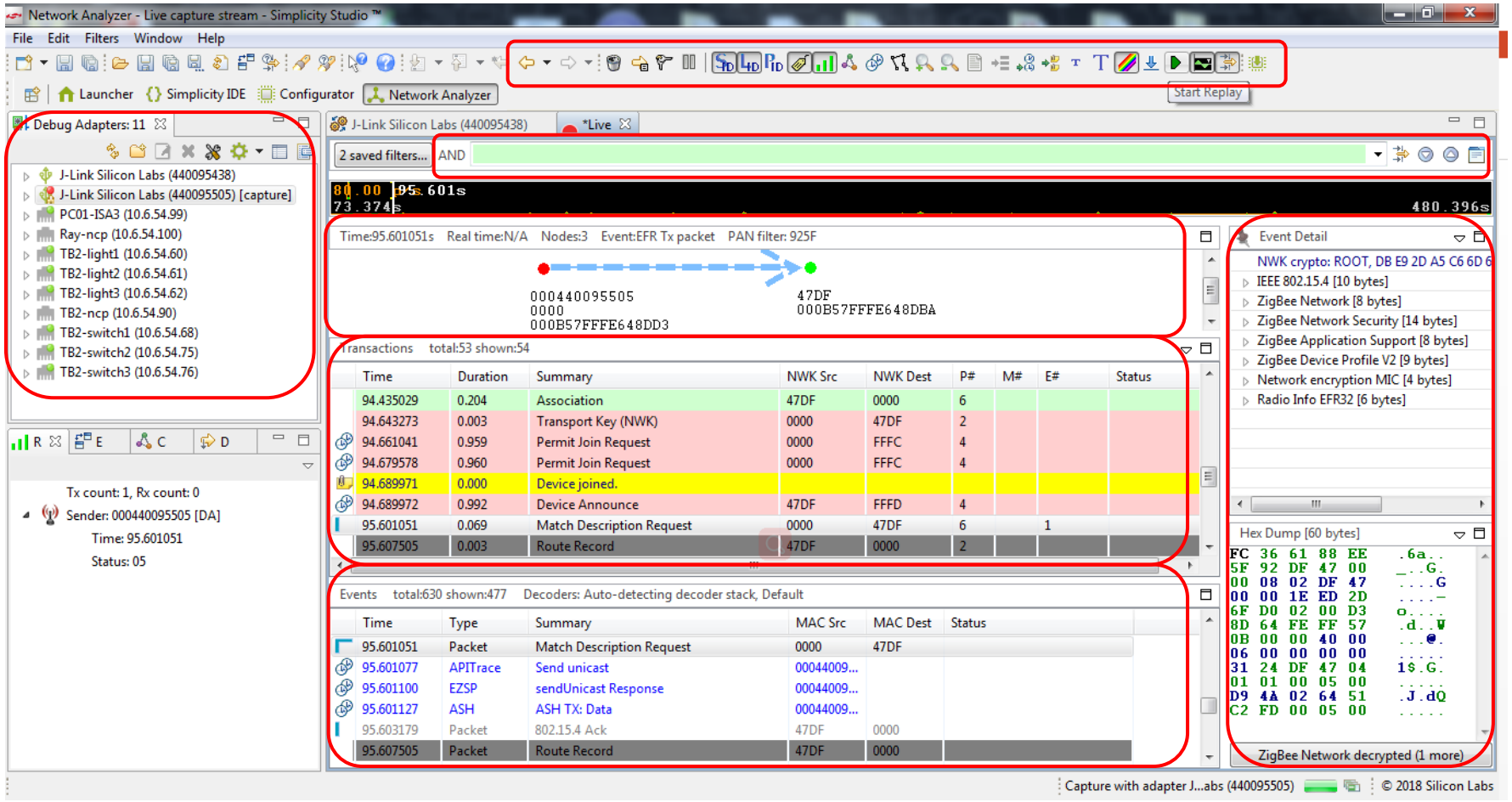
- GPIO LOCATION
  - FRC_DFRAME
  - FRC_DOUT

Table 6.6. DBUS Routing Table

Peripheral.Resource	PORT			
	PA	PB	PC	PD
CMU.CLKIN0			Available	Available
CMU.CLKOUT0			Available	Available
CMU.CLKOUT1			Available	Available
CMU.CLKOUT2	Available	Available		
EUART0.CTS	Available	Available	Available	Available
EUART0.RTS	Available	Available	Available	Available
EUART0.RX	Available	Available	Available	Available
EUART0.TX	Available	Available	Available	Available
FRC.DCLK			Available	Available
FRC.DFRAME			Available	Available
FRC.DOUT			Available	Available

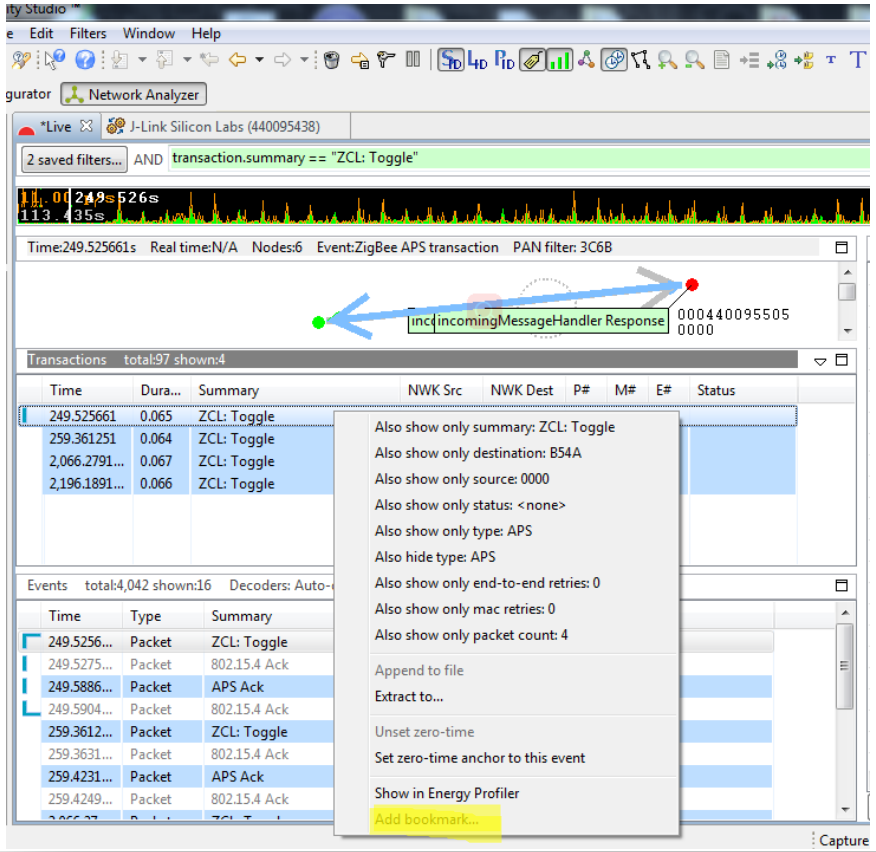
Network Analyzer Perspective

- Editor Panes
  - Adapters
  - Map
  - Transactions
  - Events
  - Event Details
  - Hex Dump
  - Filters
  - Tools

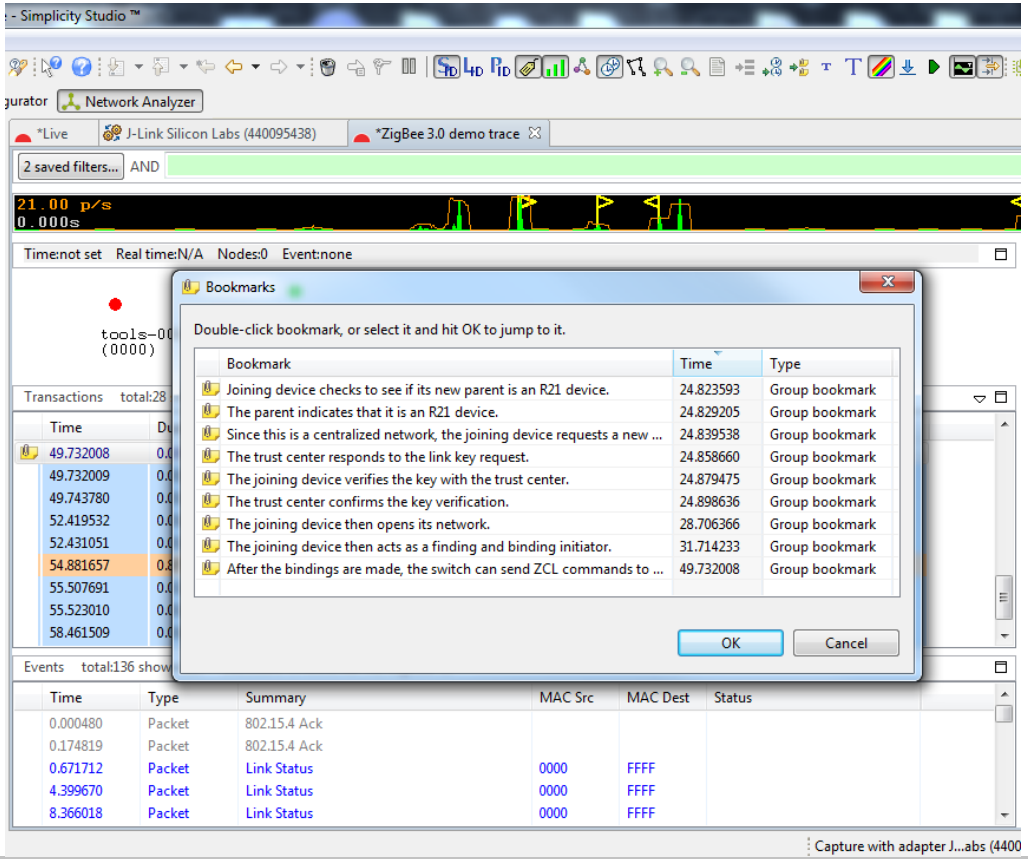


Tools in Network Analyzer - Bookmark

- Add bookmark
  - Right click on the transaction or event
  - Choose “Add bookmark”

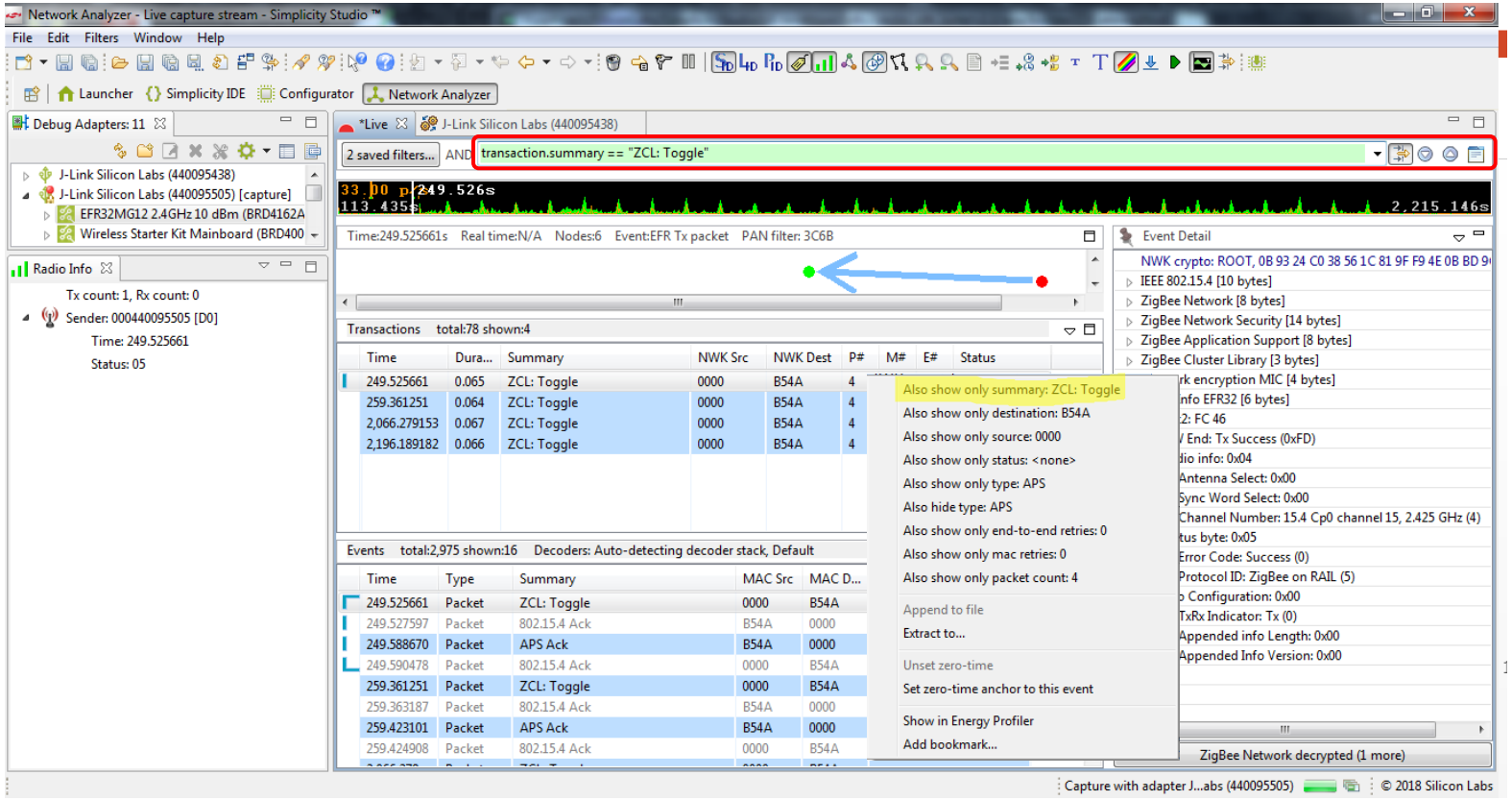


- Go to bookmark
  - Click  on toolbar



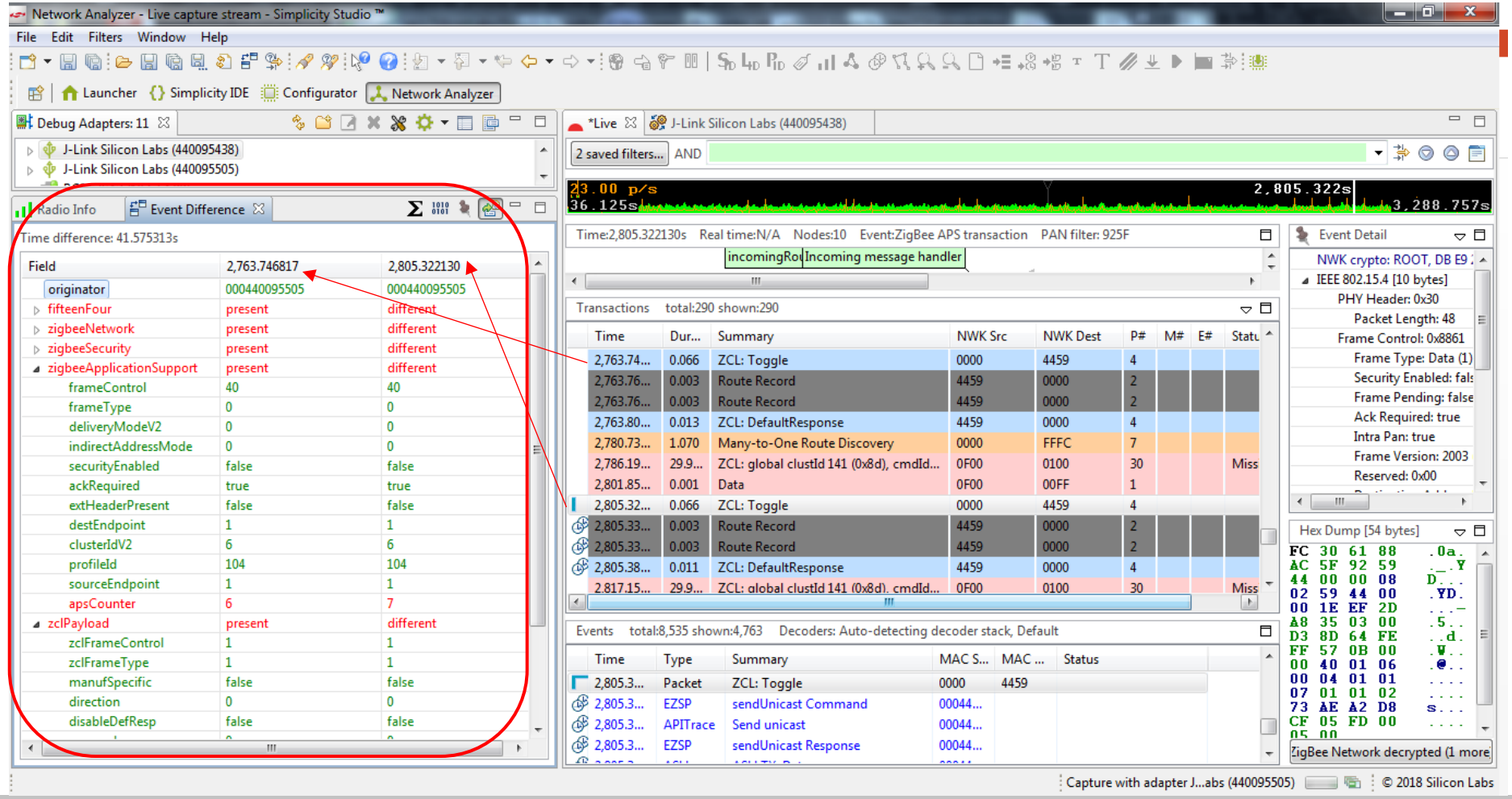
Tools in Network Analyzer - Filters

- Filters
  - Right click on the transaction or event and choose “Also show only xxxx”
  - Edit filters with regular expression (&& or ||)



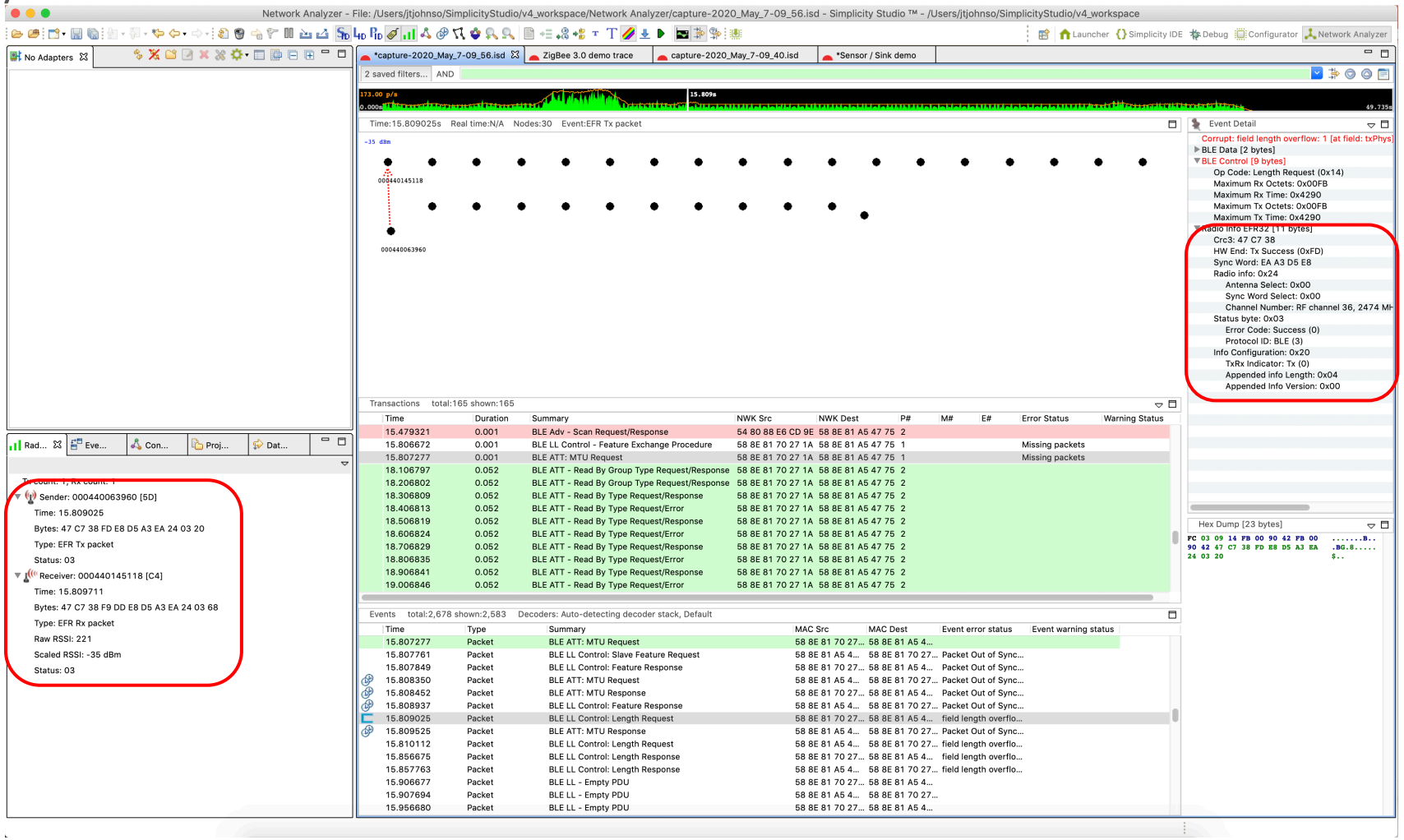
Tools in Network Analyzer - Event difference

- Simplicity Studio->Windows->Show View-> Event Difference



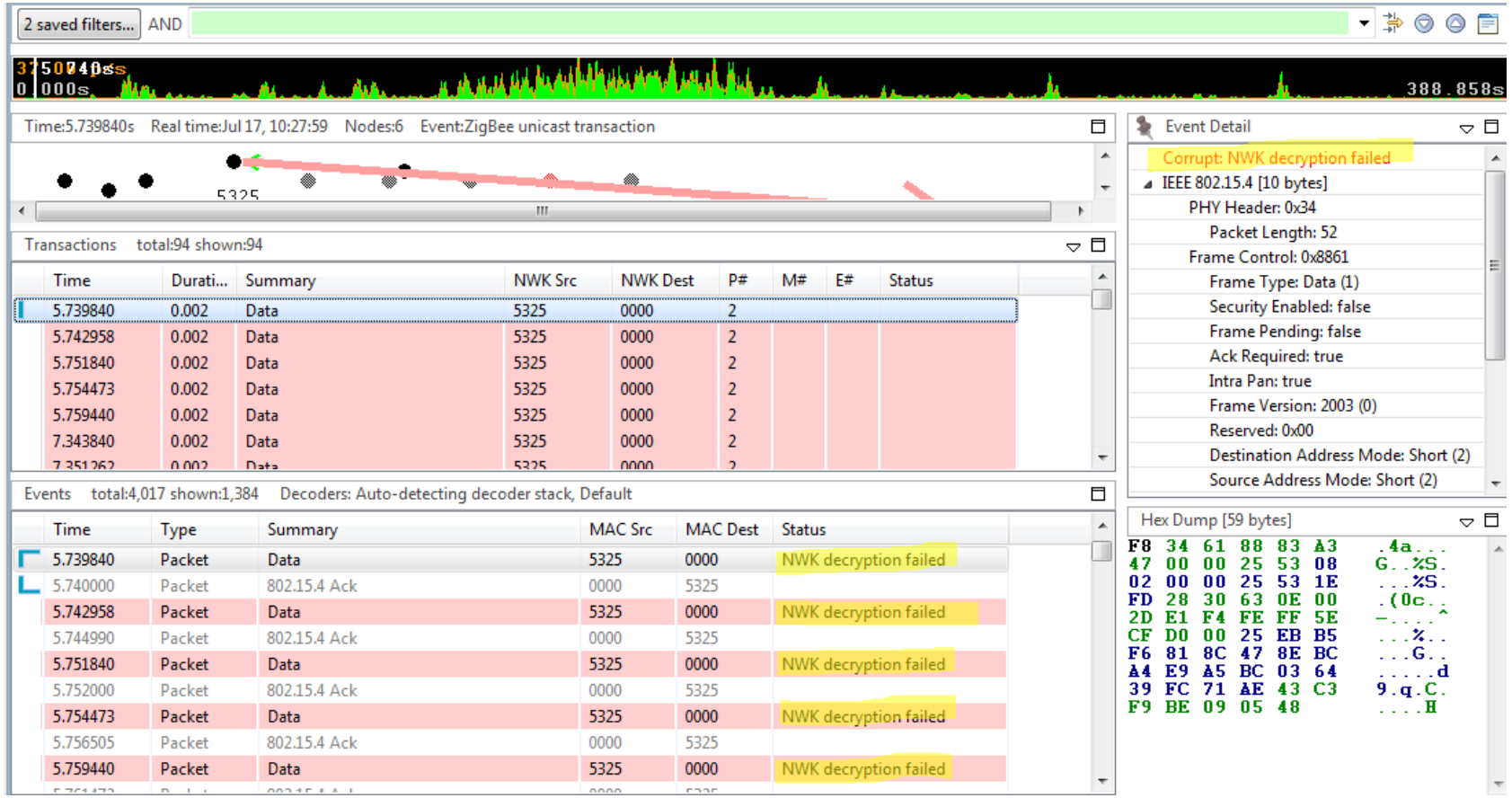
Tools in Network Analyzer - Radio Info

- Simplicity Studio->Windows->Show View-> Radio Info



Tools in Network Analyzer - Network Key

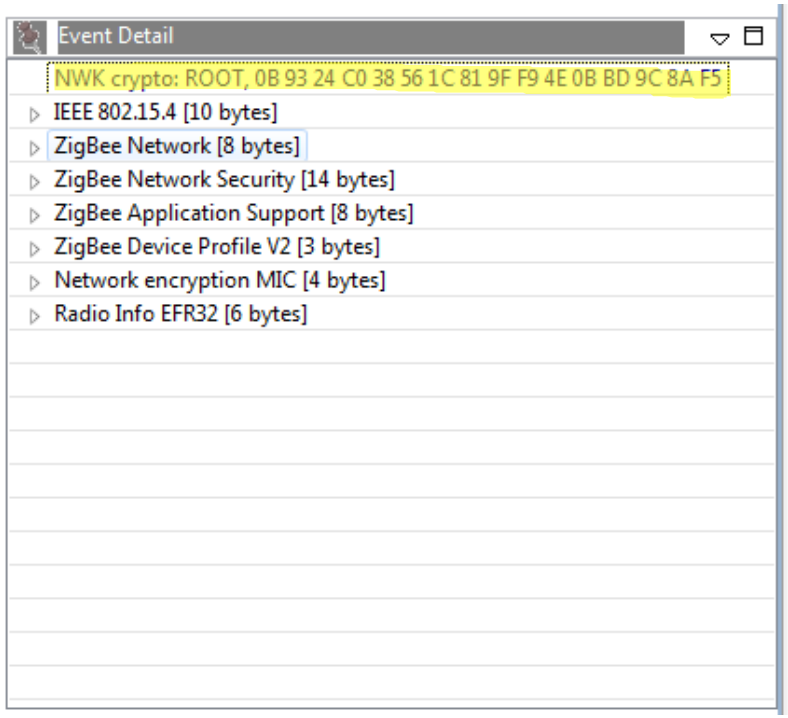
- Corrupt: NWK decryption failed
  - Missing Network Key in packet trace



Tools in Network Analyzer - Get Network Key

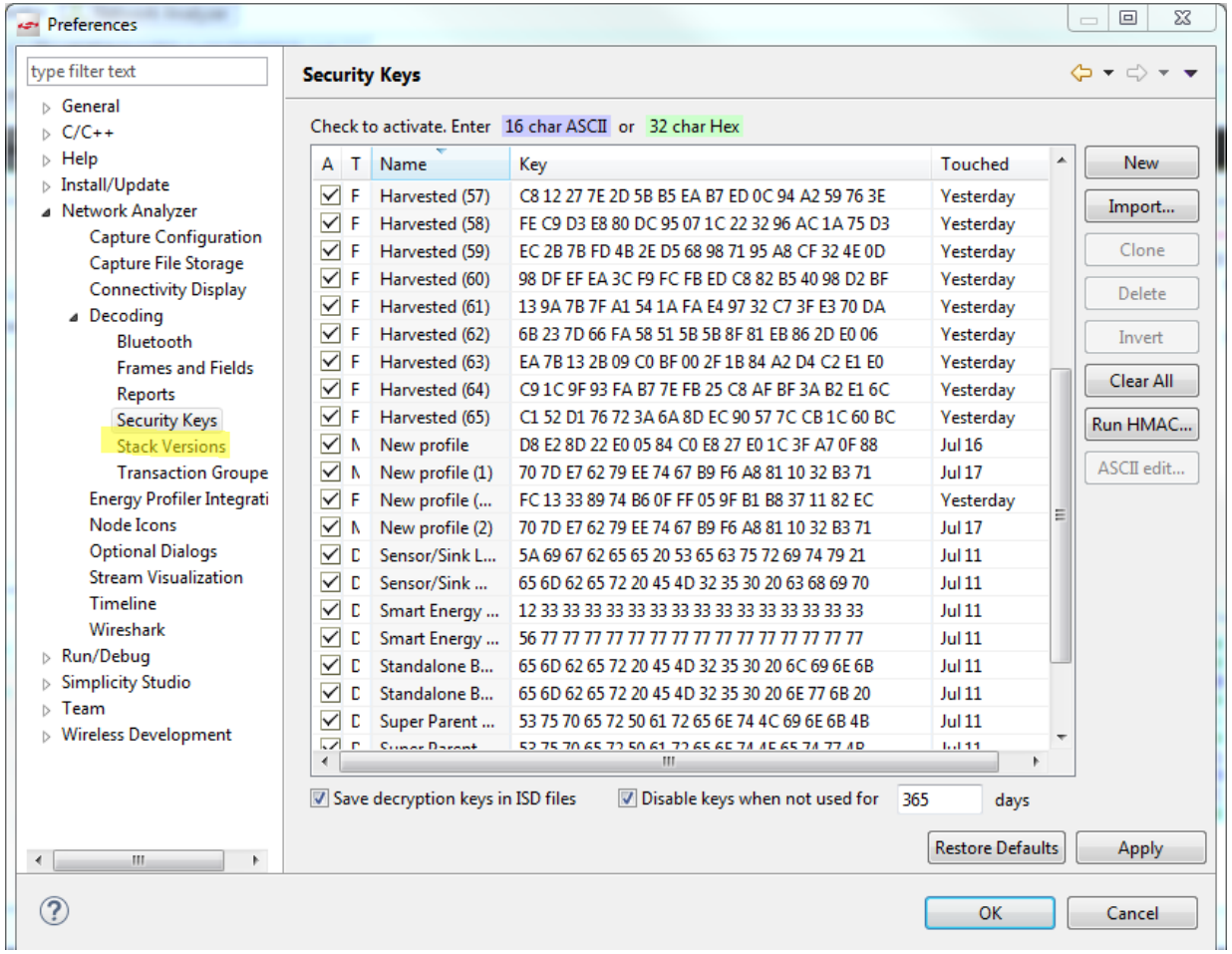
- Get Network Key
  - Print “keys print” CLI on console
  - Read it from packet trace

```
ep 2 [endpoint enabled, device enabled] nwk [0] profile [0x0104] devId [0x010D] ver [0x00]
    in (server) cluster: 0x0000 (Basic)
    in (server) cluster: 0x0003 (Identify)
    in (server) cluster: 0x0004 (Groups)
    in (server) cluster: 0x0005 (Scenes)
    in (server) cluster: 0x0006 (On/off)
    in (server) cluster: 0x0008 (Level Control)
    in (server) cluster: 0x0300 (Color Control)
   out(client) cluster: 0x1000 (ZLL Commissioning)
    in (server) cluster: 0x1000 (ZLL Commissioning)
ep 242 [endpoint enabled, device enabled] nwk [0] profile [0xA1E0] devId [0x0061] ver [0x00]
    out(client) cluster: 0x0021 (Green Power)
Nwk cnt: 1
nwk 0 [Primary (pro)]
  nodeType [0x02]
  securityProfile [0x05]
Z3LightSocZDOTesting>EMBER_SECURITY_LEVEL: 05
NWK Key out FC: 00015B02
NWK Key seq num: 0x00
NWK Key: 0B 93 24 C0 38 56 1C 81  9F F9 4E 0B BD 9C 8A F5
Link Key out FC: 00004002
TC Link Key
-     (>)000B57FFFE648DD3  00025005  L     y     7A 0B AA D5 29 FF 57 5A  06 27 80 B9 78 0F C6 A3
Link Key Table
0/0 entries used.
Z3LightSocZDOTesting>
keys print
```



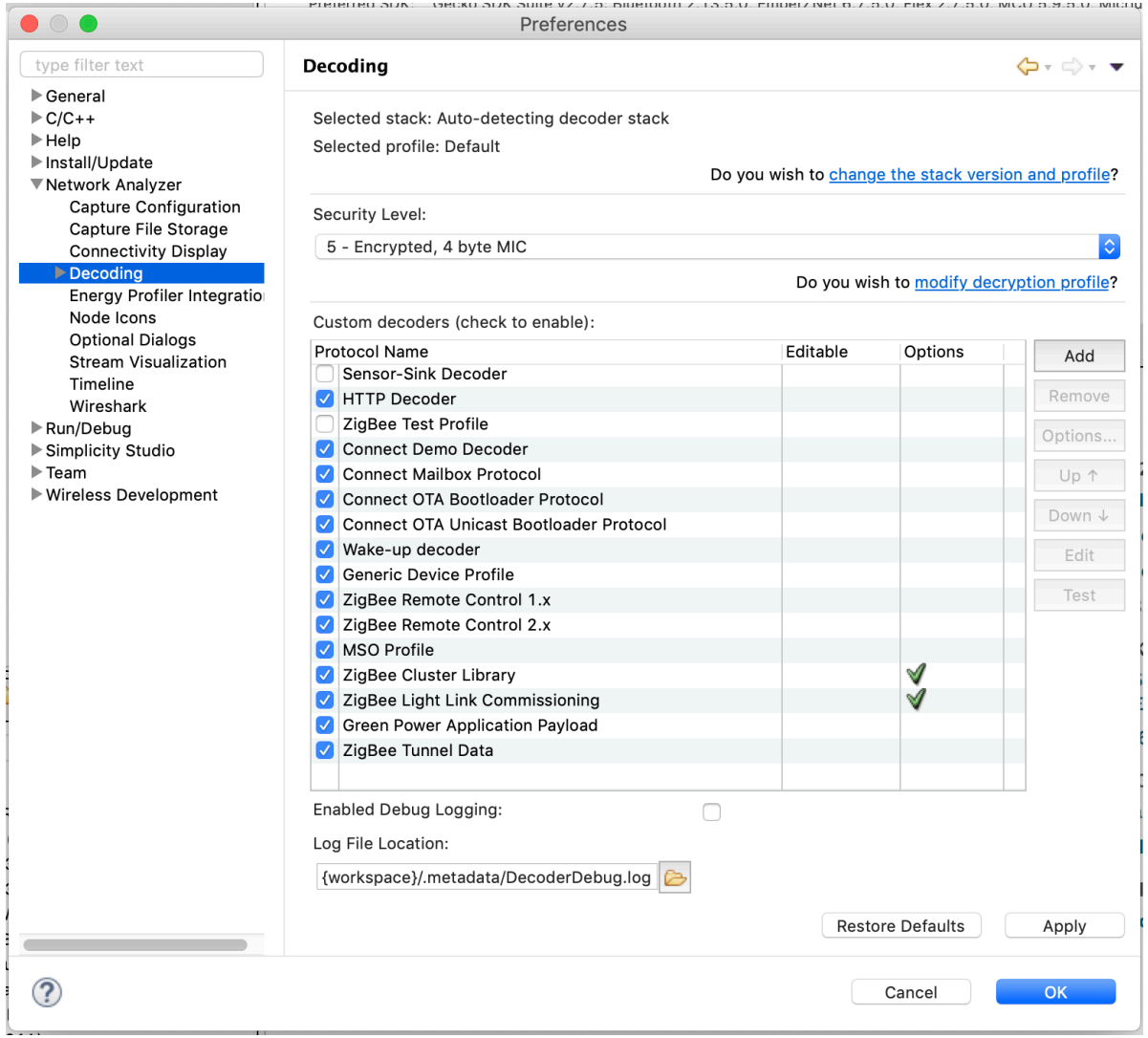
Tools in Network Analyzer - Import Network Key

- Simplicity Studio->Windows->Preferences->Network Analyzer->Decoding->Security keys



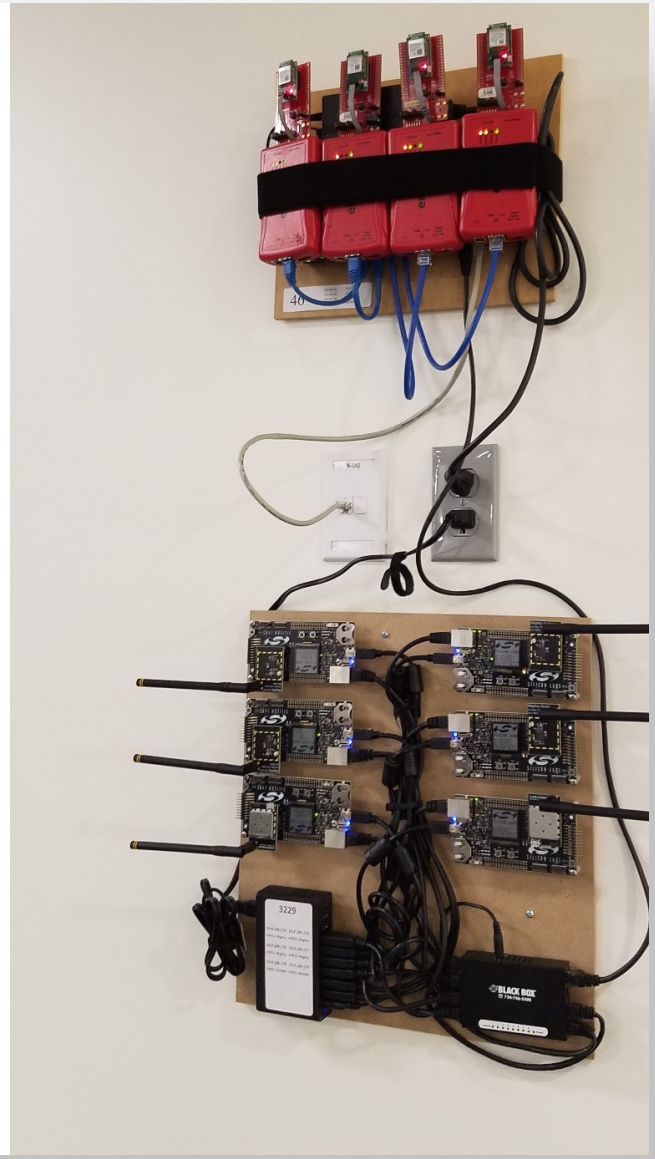
Protocol Decoding

- Usually auto detected but can be manually configured
- Possible to implement your own decoders for proprietary protocols

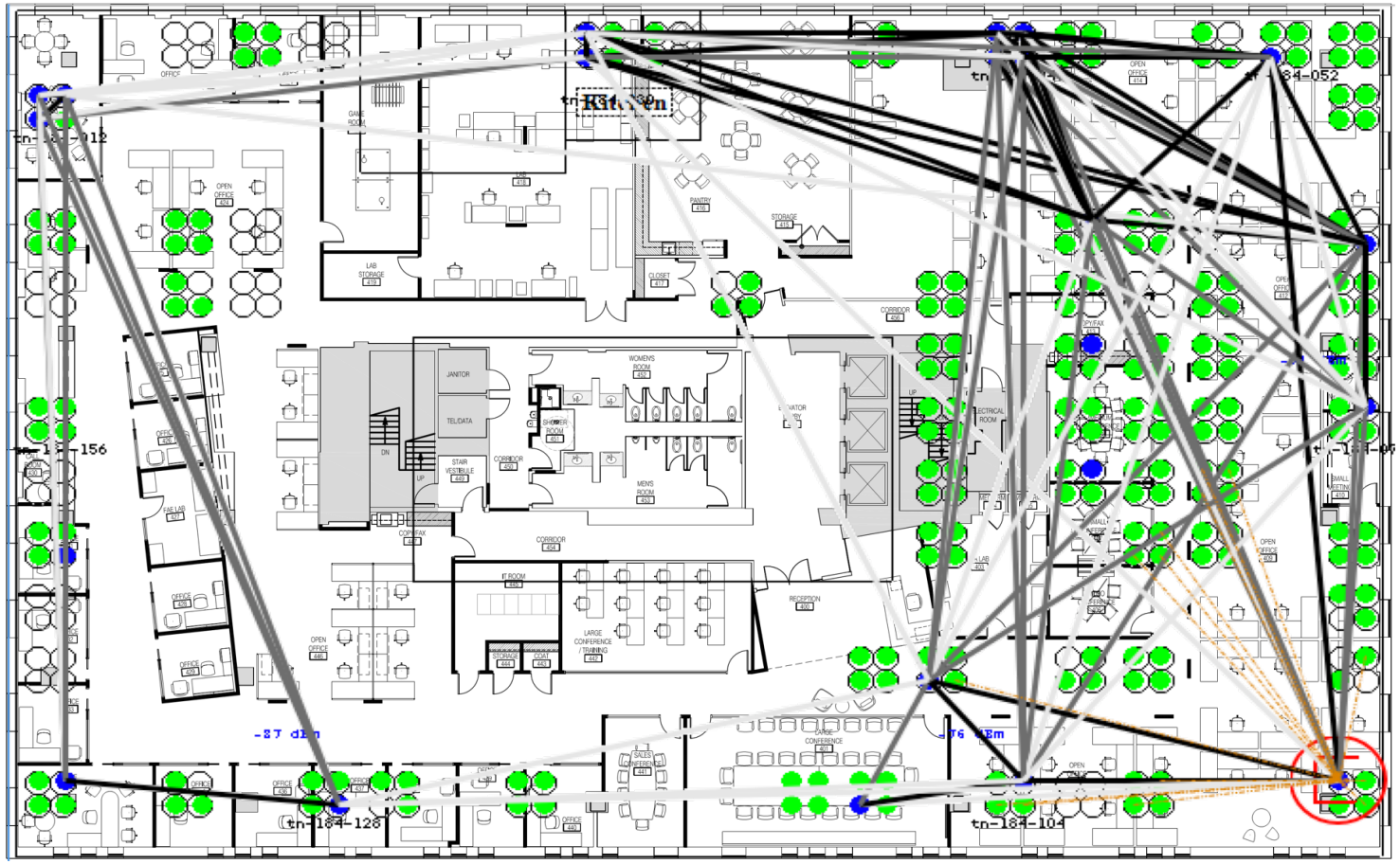


Silicon Labs Test Network

- 500+ node test network for QA and performance testing
- Ability to configure various network topologies
- Consists of device clusters spaced over entire office
- Controlled over Ethernet backchannel to allow
- Learn more at www.silabs.com/mesh-peformance or check out the following application notes:
  - AN1138: Zigbee Mesh Network Performance
  - AN1141: Thread Mesh Network Performance
  - AN1142: Mesh Network Performance Comparison



Silicon Labs Test Network

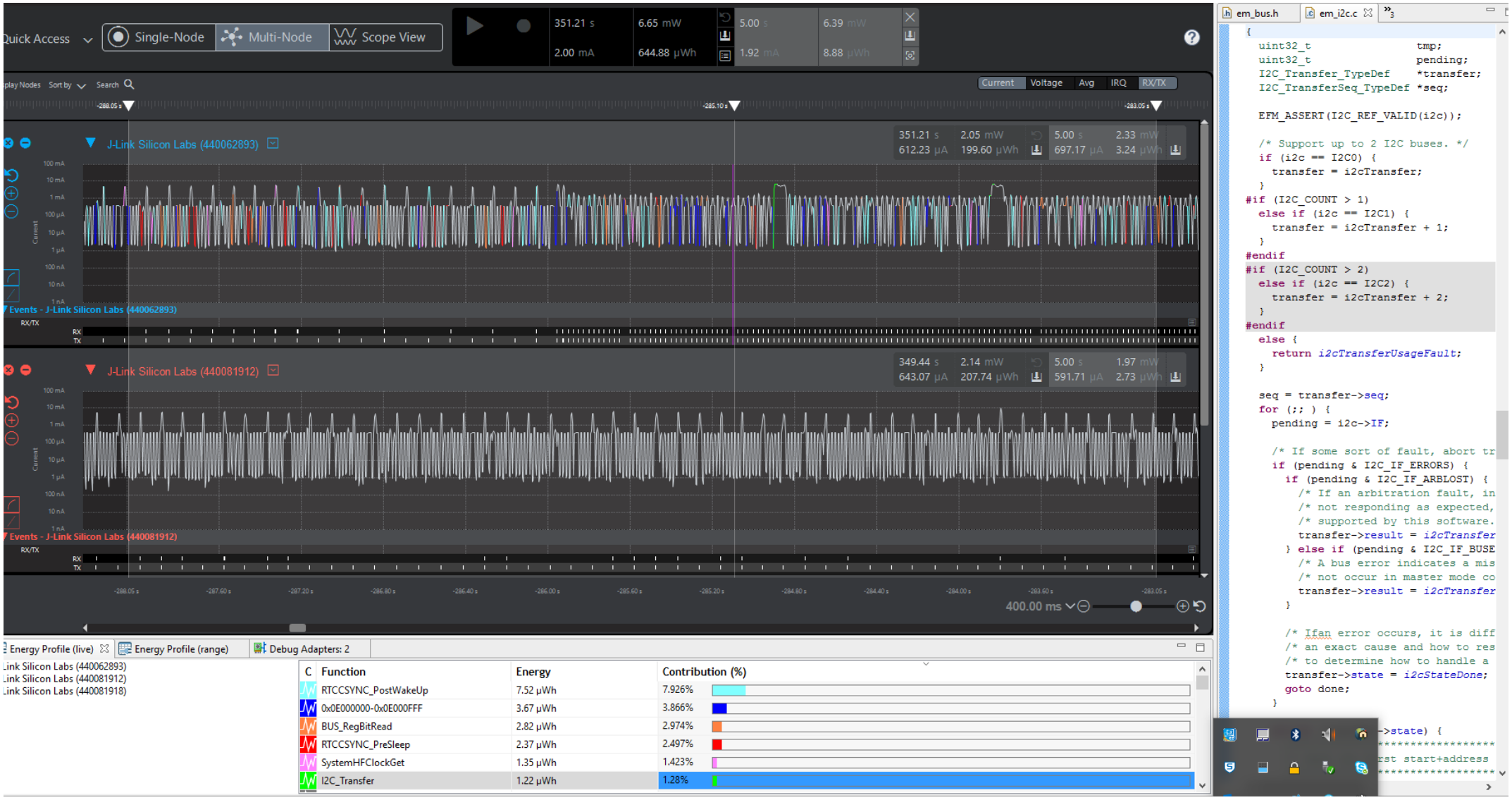


Energy Profiler

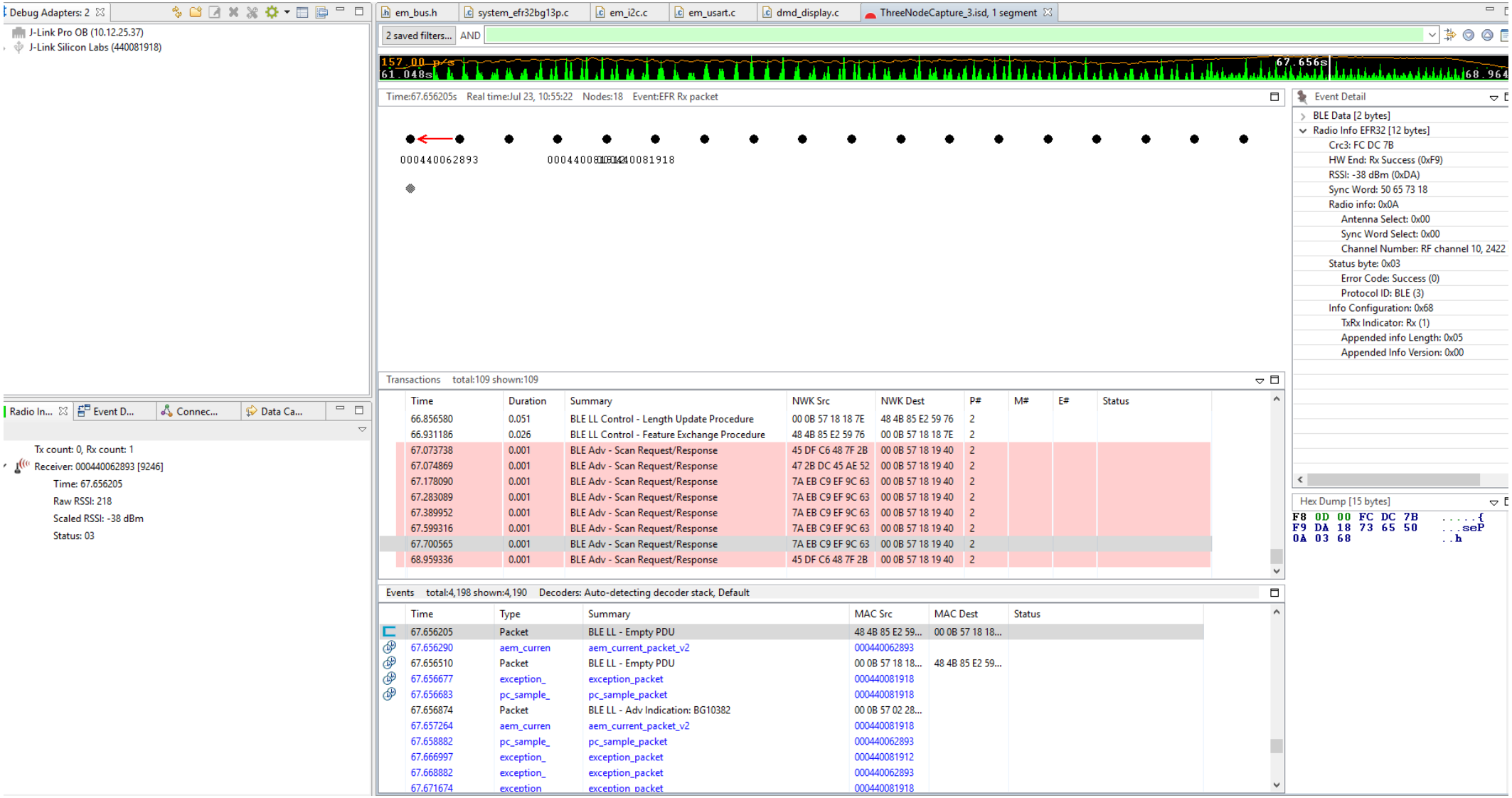
- Key Features
  - Multi-node support allowing analysis of power consumption of entire network
  - Code correlation support for all monitored nodes
  - Integration with Network Analyzer
  - Complex searches are supported
  - Configurable capture triggers
  - Color coding of code sections to highlight relevant areas on graphs

Energy Profiler – Single Node

Energy Profiler – Multi Node

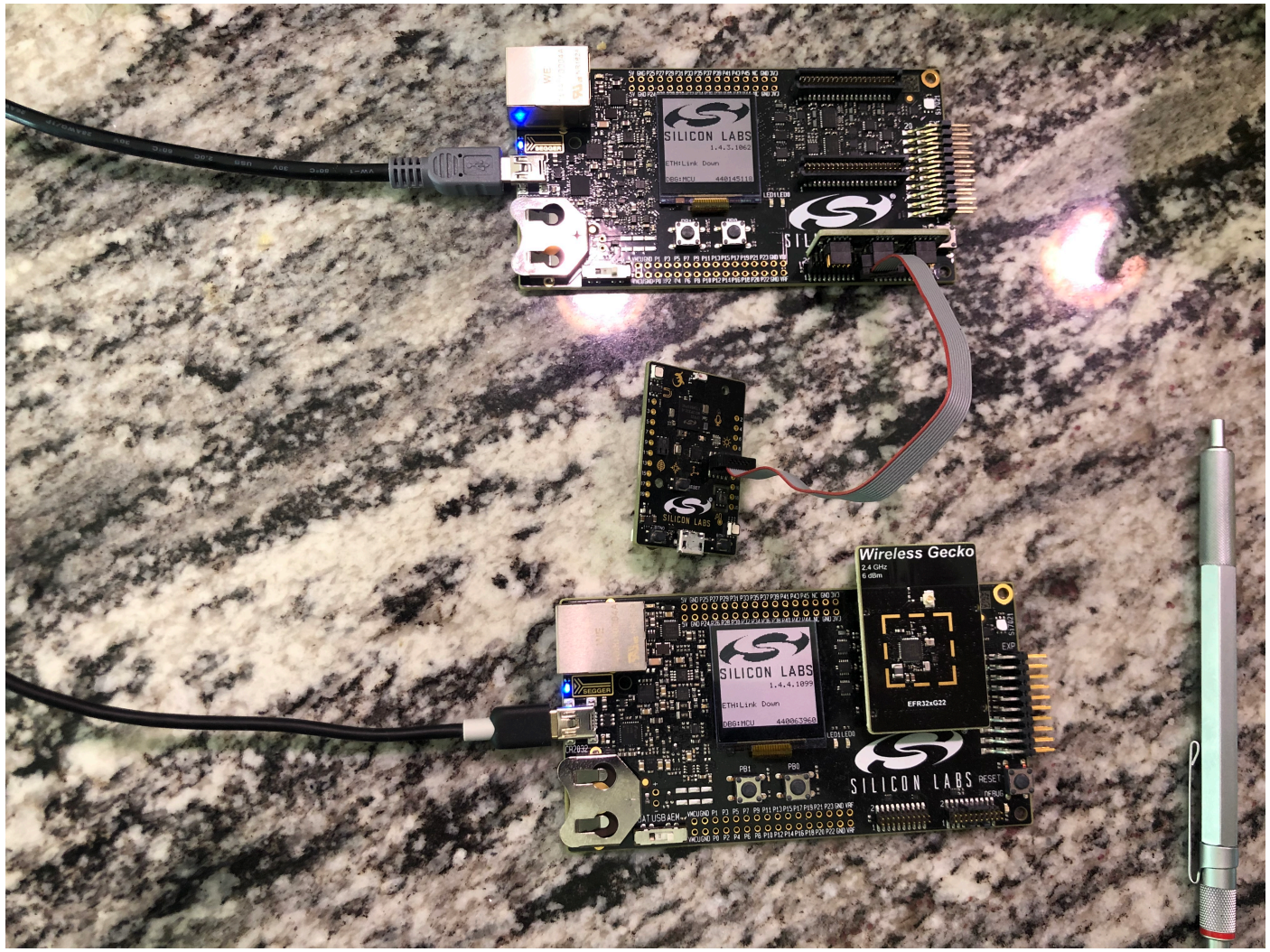


Network Analyzer – Energy Traces



Demo – Bluetooth advertising and connections, Zigbee 3.0

- WSTK with BG22 radio card in NCP mode
  - BGTool used to graphically scan, connect, read attributes, disconnect
- WSTK with BG22 Thunderboard advertising multiple advertising sets
  - One iBeacon
  - One connectable advertisement
  - Simple GATT



Additional documentation

- Main documentation link – docs.silabs.com

- Application Notes
  - AN0822 - Simplicity Studio User Guide.pdf
  - AN958 - Debugging and Programming Interfaces for Custom Designs
  - UG343 - Multi Node Energy Profiler
  - UG104 - Testing and Debugging Applications for the Mighty Gecko

- KBAs
  - Can I examine captured packet/event data outside of Network Analyzer?
  - How to open large *.isd(packet trace) file with Network Analyzer?

BG22 Virtual Workshop

Learn how to develop and deploy more powerful, efficient, and secure IoT products with your own BG22 Thunderboard – free for all registrants!

North America: May 19th–21st, May 12th-14th, 2020

10:00AM –11:30 AM CST

(Other sessions available for Asia Pacific and Europe)

We have added new workshops in AMER for May 26-28, June 2-4, June 9-11, June 23-25 and June 30-July 2. We'll soon be adding new dates for APAC and EMEA.

Register today! https://www.silabs.com/about-us/events/virtual-bluetooth-workshop

Thank You | Questions and Answers

Webinar will be available soon at:

https://www.silabs.com/about-us/events/tech-talks

Previous webinars on CHIP, Bluetooth and Security are already posted